

# Prevalence of Periconception Risk Factors for Adverse Pregnancy Outcomes in a Cohort of Urban Indian Women: Implications for Preconception Health Education

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## Abstract

**Objective:** This study aimed at determining the prevalence of selected periconception (pre- and early-post conception) risk factors for adverse pregnancy outcomes among urban Indian women, in order to identify the targets of a preconception education programme.

**Methods:** Data on selected risk factors for adverse pregnancy outcomes was collected through face to face interview of 2107 pregnant women. Odds ratios (OR) were computed in order to identify the characteristics of women with higher numbers of risk factors.

**Results:** The most prevalent risk factors were nutritional (lack of preconception folic acid supplement use 99.7%, anaemia 61% and malnutrition 41%), followed by social factors (low education levels 62%, low socioeconomic status 68%). There was high prevalence of chemical exposures in the household environment (household cleaners 76%, use of indoor insect repellents 64%). Women from families below the poverty line (OR 1.3, 95% CI 1.0-1.6) and with low education levels (OR 1.4, 95% CI 1.1-1.6) were more likely to report five or more risk factors.

**Conclusions:** The high prevalence of risk factors for adverse pregnancy outcomes identifies the need for health promotion messages targeted at women in the preconception period with emphasis on pre pregnancy nutrition, and on limiting risk exposures within the household environment. The study identified a need to specially focus on poorly educated women from families below the poverty line.

**Keywords:** Preconception risk factors; Adverse pregnancy outcome; Preconception folate; India; Low and middle income countries

## Introduction

The risk factors for adverse pregnancy outcomes (APOs) such as spontaneous abortions, restricted foetal growth, preterm delivery, low birth weight, stillbirths and birth defects encompass a spectrum of modifiable and non-modifiable exposures. These include maternal age, education, socioeconomic and health status, smoking, alcohol consumption and obesity [1,2]. Several of these risks require interventions in the preconception period [3]. Preconception risk factors are addressed through screening and management of high risk women, and through health promotion which includes education on nutritional factors (preconception folic acid supplementation, appropriate body mass index), limiting environmental exposures and lifestyle modification (advice regarding caffeine, smoking, alcohol and recreational drugs) [4]. The prevalence of preconception risk factors has been reported from studies, and ongoing surveillance [5-8]. Most of these reports are however from women in high income countries (HICs), where the general health status, awareness and education levels are higher than those from low and middle-income countries (LMICs) [9-11]. Data on risk exposures of women in low income settings are needed, as these exposures are likely to be dissimilar due to differences in socio-economic, demographic, cultural, dietary, lifestyle, environmental, regulatory and health systems characteristics. As an example, obesity is a major risk factor for adverse pregnancy outcomes in HICs [8], while under nutrition and micronutrient deficiencies have a higher prevalence among pregnant women in LMICs [12]. Pregnant women in LMICs may be exposed to agrochemicals due to predominantly agricultural lifestyles, or chemicals in the household environment from cleaners, insect repellents and indoor exterminator services. Lifestyle risk exposures include smokeless tobacco (SLT) use

rather than smoking. SLT use has been associated with low birth weight and decreased gestational age at birth [13]. Self-prescription is also reported in low income countries like India. The prevalence and types of maternal illnesses are also likely to differ, with a higher prevalence of infections such as tuberculosis, syphilis and HIV in women from LMICs. Consanguinity, another risk factor for adverse pregnancy outcomes, is known to be high in certain parts of the developing world, including India [14]. Other risk factors predisposing women to adverse pregnancy outcomes include poverty, low education levels and gender-related issues, which may result in low empowerment and decision making by women.

In this study, we measured the prevalence of 22 risk factors among urban pregnant women accessing four government hospitals in the Western Indian city of Pune. We collected data on a number of well-established risk factors such as those being used in the Pregnancy Risk Assessment and Monitoring System (PRAMS) surveillance [8] in order to identify the contents of preconception counselling for women intending a pregnancy.

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## Methods

### Study design and settings

This study presents baseline data of the Pune Urban Birth Outcome study (PUBOS), which aims at measuring the birth prevalence of congenital anomalies in a pregnancy cohort. The study recruited 2107 pregnant women presenting for the first antenatal check-up at four government hospitals in Pune, the eighth largest Indian city. Mean gestational age at recruitment was  $11 \pm 3$  weeks. Baseline data on selected risk factors for APOs were collected through face-to-face interview at the time of enrolment in the study, after obtaining informed consent. The study was approved by the Institutional Ethics Committee.

### Study participants

The eligibility criteria were Indian women reporting for antenatal check-up within 16 weeks of pregnancy, and providing consent to access medical records. Women who were not conversant in the local language were excluded from the study.

### Variables

Periconception period was defined as the period extending from three months before (preconception) to three months after conception. The 22 risk factors were grouped into eight domains. Demographic risk factors for APOs included young (age less than 19 years) and old maternal age (age >35 years), and consanguinity. Social domain included data on education ( $\leq 10$  years of education or >10 years of education) and economic status. As women were unaware of the family income, economic categorization was done using the criteria used by government agencies [15]. By this classification, families below poverty line (BPL) are issued yellow coloured cards, families just above the poverty line (APL) are issued orange coloured cards, while families from economically higher strata are issued white coloured cards. Reproductive health and family planning domain included data on whether the pregnancy was planned or not and bad obstetric history (unfavourable foetal outcomes in terms of two or more consecutive spontaneous abortions, neonatal death, intrauterine foetal death and congenital anomaly affected birth). Lifestyle domain explored data on alcohol and tobacco use. Nutrition and anthropometric domain included data on height, weight, haemoglobin levels, and preconception use of folic acid supplements. Height and weight data at first antenatal care visit was used for calculation of early pregnancy body mass index (BMI) which is a proxy for preconception BMI [16]. BMI and anaemia classification was based on World Health Organisation categorisation [17,18]. Maternal morbidity and illness variables were categorized into underlying chronic conditions (any clinically diagnosed existing non-communicable condition), acute illness and infections during the periconception period. The domain of maternal medication use included prescribed medications and self-prescribed medications during the periconception period. Environmental risk exposures included report of periconception exposure to household cleaners and detergents, exposure to solid or aerosolized insect repellents inside the house, use of exterminator services, exposure to paints (that is painting work in the house), exposure to X-rays, and exposure to second hand smoke during the periconception period. Report of agricultural work (that is exposure to agrochemicals and pesticides ever in the lifetime) was also included in environmental exposures.

### Data collection

Data was collected using a structured questionnaire. The data on exposures was based on recall, except for medication use, which was

verified from prescriptions present with the woman. Weight and height measurements were recorded for each participant. Data on haemoglobin levels were collected from hospital laboratory reports.

### Statistical analysis

Data was analysed using Statistical Package for Social Sciences (SPSS) Version 17.0. Prevalence of selected risk factors was represented as proportions. The number of risk factors per woman was calculated for all 2107 women. As 70% of women had five or more risk factors, women were categorized into two groups, those with less than five risk factors and those with five or more risk factors. Odds ratios were computed in order to determine whether there was any relationship between number of risk factors for APOs and maternal characteristics that is education levels, economic status and parity.

## Results

### Demographic and social

The mean age of pregnant women was  $22 \pm 3$  years. Nearly one-fifth of women (390, 18%) were below 19 years of age, while only 13 women (0.6%) were above the age of 35 years. Twenty percent women (422) reported consanguineous marriage. Majority (1305, 62%) of women had less than 10 years of education. In terms of economic categorization, 68% of women were around the poverty level, out of which 17% (356) belonged to households that were below the poverty line, and 51% (1085) belonged to families that were just above the poverty line (Table 1).

### Reproductive health and family planning

Most pregnancies were unplanned. Contraceptive use was low (252, 12%), being only 1% among primigravidae and 11% among multigravidae. Among 1249 multi-gravid women, 12% (149) reported bad obstetric history.

### Tobacco and alcohol use

None of the women reported smoking or using alcohol. Smokeless tobacco use was 7% (145) in the preconception period, of which 4% (44) continued SLT use into pregnancy.

### Nutritional and anthropometric

In terms of nutritional risk factors, 27% (557 women) were underweight, while 14% (288 women) were overweight or obese. Sixty one percent of women had some form of anaemia, among whom 0.5% (9 women) had severe anaemia and 19% (333) had moderate anaemia. Only seven (0.3%) women reported using preconception folic acid. These were prescribed by doctors when the women had presented for some other complaint. Fourteen percent of women had short maternal stature (height <145 cm).

### Maternal morbidity and medication use

Prevalence of any maternal acute illness during the periconception period was 8% (162). Only 2% (45 women) reported chronic conditions, of which thyroid disorders were the highest, affecting 26 women. Other chronic conditions included five women with clinically diagnosed epilepsy and two women with psychiatric disorders. Three women reported a congenital condition (two women with congenital heart disease, while one woman had a diagnosis of spina bifida). In addition to this, three women were beta thalassemia carriers. Of 28 women who reported using non-allopathic medicines, 26 reported using ayurvedic "tonics". Two percent of the women reported using over-the-counter analgesics.

| Risk factor domains   | N (%)       |
|---|-------------|
| <b>Demographic</b>  |             |
| Maternal age ≤ 19 yrs (n =2098)   | 390 (18)    |
| Maternal age ≥ 35yrs (n =2098)  | 13 (0.6)    |
| Consanguinity (n =2104)   | 422 (20)    |
| <b>Social</b>   |             |
| Maternal education ≤ 10 yrs (n=2104)  | 1305 (62)   |
| <b>Economic status (n=2107)</b>   |             |
| Below poverty line (possess yellow ration card)                                 | 356 (17)    |
| Above poverty line (possess orange ration card)                                 | 1085 (51)   |
| Possess white ration card (ineligible for subsidized staples)                   | 122 (6)     |
| Do not possess a ration card  | 544 (26)    |
| <b>Reproductive health and family planning</b>                                  |             |
| Unplanned pregnancy (n=2099)  | 1847 (88)   |
| Bad obstetric history (n=1249)  | 149 (12)    |
| <b>Tobacco and alcohol use</b>  |             |
| Smokeless tobacco use (n=2106)  | 145 (7)     |
| Continued after pregnancy confirmation  | 44 (4)      |
| <b>Nutritional and anthropometric</b>   |             |
| Underweight (n=2066)  | 557 (27)    |
| Overweight and obese (n=2066)   | 288 (14)    |
| <b>Anaemia (n=1812)</b>   |             |
| Severe anaemia  | 9 (0.5)     |
| Moderate anaemia  | 333 (18.4)  |
| Mild anaemia  | 755 (41.7)  |
| Lack of preconception folic acid supplement use (n=2105)                        | 2098 (99.7) |
| Short maternal stature (n=2070)   | 293 (14)    |
| <b>Maternal morbidity and medication use</b>                                    |             |
| Underlying Chronic illness (n=2100)   | 45 (2)      |
| Thyroid disorders   | 26          |
| Cardiovascular diseases   | 6           |
| Asthma  | 6           |
| Epilepsy  | 5           |
| Psychiatric illness   | 2           |
| <b>Maternal acute infections and illness (n=2106)</b>                           |             |
| Fever   | 65          |
| Upper respiratory tract infection   | 43          |
| Vaginal infections  | 24          |
| Urinary tract infections  | 20          |
| Gastrointestinal ailments   | 8           |
| Systemic infections   | 2           |
| Over-the-counter non-prescription medication use (n =2105)                      | 46 (2)      |
| <b>Prescription medication use</b>  |             |
| Category B drugs (Lacilactone, Penicillin)                                      | 7           |
| Category C (Escitalopram, Risperidone, Fluoxetine hydrochloride, Levetiracetam) | 2           |
| Category D (Phenytoin)  | 3           |
| <b>Environmental exposures</b>  |             |
| Exposure to household cleaners (n=2097)   | 1544 (76)   |
| Exposure to insect repellants (n=2102)  | 1343 (64)   |
| Exterminator service use (n=2106)   | 148 (7)     |
| Report of agricultural work (n=2097)  | 363 (17)    |
| Exposure to paints (n=2097)   | 343 (16)    |
| Exposure to second hand smoke (n=2101)  | 98 (5)      |
| Exposure to X rays (n=2101)   | 64 (3)      |

**Table 1:** Prevalence of periconception risk factors in an urban Indian cohort of pregnant women.

### Environmental exposures

Nearly 5% of women reported second hand smoke exposure at home. Seventeen percent (363 women) reported participating in agricultural work prior to marriage, involving direct contact with pesticides and fertilizers. Seventy six percent (1544 women) reported exposure to household cleaners and detergents nearly every day. Use of indoor insect repellents was high at (64%, 1343), with three-fourth of women (1007) reporting daily use of insect repellents. Use

of exterminator services during the periconception period, followed by cleaning of the pesticide sprayed areas without any protection was reported by 7% (148) women. Three percent women reported exposure to X-rays during the periconception period, either because of injury or during dental surgery. Sixteen percent women (343) reported exposure to paints at home during the periconception period.

### Distribution of risk factors

All women in the cohort reported at least one risk factor. Seventy percent (1481 women) reported five or more risk factors (Figure 1). Pregnant women with low education (≤ 10 years) were more likely to possess ≥ 5 risk factors as compared to women with >10 years of education (OR 1.4, 95% CI 1.1-1.6). Women belonging to BPL families possessed ≥ 5 risk factors as compared to women belonging to above poverty line (APL) families and families with no ration card (OR, 1.3, 95% CI 1.0-1.6). There was no association between number of risk factors and parity (Table 2).

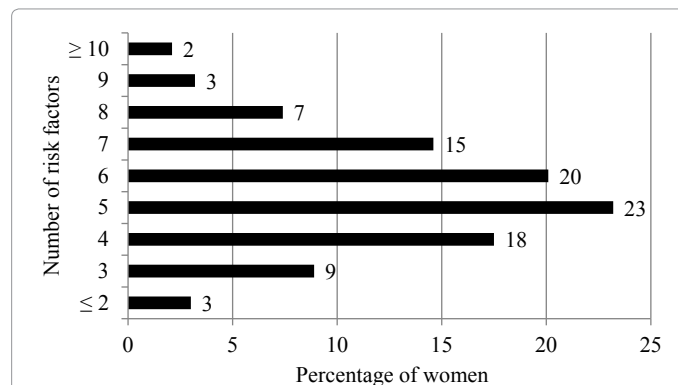
### Discussion

This study explored the prevalent risk factors among women in early pregnancy in a low income setting in order to identify the content of preconception counselling. At present, preconception interventions are not included in the maternal and child health services in India. The study yielded two significant findings. The study identified that over 70% of the 2107 women enrolled in the study reported five or more risk factors for APO. Poorly educated women and those belonging to families below the poverty line had higher odds of having higher number of risk factors. This data suggested that while preconception

| Maternal characteristics | <5 risk factors N (%) | ≥5 risk factors N (%) | Odds ratio (OR) | 95% Interval (CI) | P value |
|--------------------------|-----------------------|-----------------------|-----------------|-------------------|---------|
| Education (n=2107)       |                       |                       |                 |                   |         |
| >10yrs                   | 391 (49)              | 411 (51)              | 1.0             |                   |         |
| ≤ 10 yrs                 | 526 (40)              | 779 (60)              | 1.4             | 1.1-1.6           | 0.00*   |
| BPL card holder (n=2107) |                       |                       |                 |                   |         |
| No                       | 590(34)               | 1161(66)              | 1.0             |                   |         |
| Yes                      | 99(28)                | 257 (72)              | 1.3             | 1.0-1.6           | 0.03*   |
| Parity (n=2105)          |                       |                       |                 |                   |         |
| Multiparous              | 300 (28)              | 762 (72)              | 1.0             |                   |         |
| Nulliparous              | 324 (31)              | 719 (69)              | 0.8             | 0.7-1.1           | 0.15    |

\*p< 0.05

**Table 2:** Odds ratio for number of risk factors and maternal education, economic status and parity.



**Figure 1:** Distribution of risk factors (n=2107).

risk screening and health promotion messages are needed for all women intending a pregnancy, a targeted focus is needed for women from the most vulnerable strata of society.

Secondly, the study identified the need to target education messages on certain domains. The emphasis of education messages for nutritional risk factors, would include advice on intake of preconception folic acid supplements, correction of anaemia and optimization of body mass index prior to conception. Preconception folic acid supplementation is one of the known strategies for preventing neural tube defects [19]. The benefits of correction of anaemia on pregnancy outcomes have been well documented [20]. There is unequivocal data on the effect of optimization of maternal body mass index on pregnancy outcome [21]. Data from this study suggested that preconception health promotion messages should combine advice on preconception folic acid supplementation, correction of anaemia and correction of body weight prior to conception. These messages would also be applicable to women in other LMIC settings as similar high prevalence of undernutrition and anaemia have been reported in Vietnam and Bangladesh [9,10]. That obesity is also an emerging risk in other low income settings has been reported for women in Nepal and Bangladesh [22].

The other prevalent modifiable risk characteristics were behavioural factors, which were smokeless tobacco use and chemical exposures in the household environment. In contrast to most risk exposures occurring in the occupational environment of women from HICs [23], for women in this study, most exposures occurred within the home environment. Other key observations were the low contraceptive use among women in this study, as well as young maternal age. Taken together, these data suggest that in terms of the content of preconception education, health promotion messages should address appropriate age at marriage, planned pregnancy, prevention of teenage pregnancy, correction of macro and micronutrient deficiencies, behavioural modifications and limiting exposure to household chemicals. It is noteworthy that several of these messages are an integral component of reproductive and child health services of low and middle-income countries. However, these messages are usually targeted at married women in the antenatal or interconception period, rather than at nulliparous women, prior to conception. The data from the study also suggests that preconception care messages can target adolescent girls, through life skills education programmes. A key approach to the success of preconception interventions would be the need to train community health workers to expand the focus from antenatal care to providing preconception education to prepare women for pregnancy.

## Conclusions

The high prevalence of periconception risk factors observed among the cohort of urban Indian women underlined the need for preconception education, as most women were unprepared for pregnancy. The most prevalent risk factors for APOs were predominantly modifiable as they were in the nutritional and environmental risk exposure domains. The study identified the need to particularly focus on poorly educated women and women belonging to families below the poverty line.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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