

Research

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Chronic Diseases during Pregnancy and Birth Outcome: A Study Based on Tertiary Hospital of Mumbai

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ABSTRACT

Background/Objective: Chronic disease has emerged as one of the most serious public health problems while disease prevalence during pregnancy had a greater risk of premature death and long-term illness. However, it is an important determinant of an adverse birth outcome like pre-term delivery, low birth-weight, premature delivery, stillbirths, perinatal morbidity and mortality. Hence, the study examines the chronic disease prevalence among women and its association with adverse birth outcome.

Methods: The study was conducted on inpatients' that came for delivery in a tertiary hospital of Mumbai from 20th January to 31st May 2013, by using semi-structured questionnaire. Questions were asked about chronic disease prevalence before and during pregnancy and the outcome of pregnancy.

Result: About 50% of women were reported of having some sort of chronic disease during pregnancy while severe anemia was the most common complication irrespective of pregnancy status. Women with any chronic disease during pregnancy have a higher risk of adverse birth outcome such as low birth-weight and pre-mature delivery, etc. Where a significant difference was found between women with chronic disease during pregnancy and without disease in delivering premature and low weight at birth baby.

Conclusion: Obstetric health complications are one of the major health issues that result in adverse maternal and perinatal outcomes, and it is very important to know about the complications and its consequences on birth outcomes. This will help to improve the health status of the mother and the newborn.

KEY WORDS: Chronic disease; Birth outcome; Low birth weight; Stillbirth; Mumbai.

INTRODUCTION

Disease prevalence during pregnancy has a particular importance in the study of maternal well-being and neonatal outcomes. Women in their reproductive age and with chronic medical conditions have a greater risk of not only pre-mature death and long-term illnesses but also for pregnancy complications. Therefore, it is not surprising that women with chronic diseases are often anxious about pregnancy.¹ Smoking, diabetes and hypertension increase the risk of pre-term delivery,² whereas, smoking and obesity has led to the risk of infant birth defects.^{3,4}

Chronic diseases and risk factors have been associated with maternal complications such as gestational diabetes, gestational hypertension and pre-eclampsia during pregnancy.⁵ Such previously existing complications or those developed during the pregnancy tend to get further aggravated by the physiological effects of pregnancy which may indirectly lead to maternal deaths.⁶ These include anemia, hypertension, diabetes, as well as infectious conditions of HIV and malaria. In developing countries, about 30% of maternal deaths occur due to indirect

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causes.⁷ The growing prevalence of lifestyle-related conditions contribute to the increased commonness of obesity. This also contributes to the growing list of health problems as obesity, diabetes mellitus, heart disease and hypertensive disorders.⁸ Women have also experienced increase in the prevalence of chronic disease related risk factors such as obesity, diabetes, high cholesterol, and asthma during the reproductive ages.⁹ Therefore, approaching women's health from a life course perspective offers an opportunity to reduce the pregnancy-related complications and deaths and to eliminate disparities through enhanced health promotion and disease prevention.¹⁰

Diabetes has become a global pandemic because of the sedentary lifestyle, urbanization and has lead to increased commonness of obesity.¹¹ In fact, a high prevalence of gestational diabetes mellitus (GDM) of the order of 18% has been reported in India.¹² Similarly, hypertension/high blood pressure has been found to be the most common chronic disease during pregnancy. It reduces the supply of oxygen and nutrients to the uterus, potentially slowing the child's growth and increasing the risk of low-birth weight.¹³

However, nutritional deficiency like anemia is not only leads to poor outcomes in pregnancy and reduced work productivity among adults, but also contributes to deaths among pregnant women. Levy et al¹⁴ in their retrospective study evaluated the pre-term birth and birth weights of the anemic pregnant women which has determined maternal anemia as an independent risk factor for poor birth outcome. However, severe anemia during pregnancy may also have adverse effects on the mother and the fetus.¹⁵

With an epidemiological transition started in India, the burden of chronic disease and non-communicable diseases is on the rise.¹⁶ It has been predicted that there will be a rise of 67% death among all deaths by chronic diseases in 2020, which was 53% in 2005.¹⁷ However, there is a dearth of literature on maternal chronic disease and adverse birth outcome among women from lower socio-economic strata in India. Hence, our study tries to examine the chronic disease prevalence among women and its association with adverse birth outcomes that belong to lower socio-economic strata of the population in Mumbai city.

Study Area

The population of Mumbai has significantly increased over the past few years leading to an alarming population amongst the slum dwellers too. According to census 2011,¹⁸ the population of Mumbai was 12 million and the number of people living in slum areas has also grown up by a staggering 3 million. Being a metropolitan city, the situation in Mumbai is different from other cities and a large percentage of population lives in the slum areas. Hence, the main aim of the study is to bring out the prevalence of chronic health complications among women and its adverse impact on birth outcome. Mainly among those from low-income households, living in slum areas, poor and not willing to utilize

the health facilities provided by the private health sector. In this context, a tertiary hospital was selected which is situated nearby the slum areas of Mumbai.

MATERIALS AND METHODS

Self-reported reproductive health complications of inpatients were collected through personal interviews in a tertiary hospital of Mumbai. A total of 300 inpatients were selected based on their consent for participation in the interview from 20th January to 31st May 2013. The interview was conducted on women (inpatients) that came for delivery at the selected hospital and are from the lower socio-economic strata of the population. The main focus was to access the prevalence of chronic diseases among women in the surveyed hospital. The patients were enquired whether they suffered from any chronic diseases at any time of their life, especially before or during pregnancy. Specific type of chronic diseases such as, diabetes, hypertension, anaemia, any cardiovascular diseases etc. are included in the questionnaire. Women were also asked about the treatment they received for their chronic illnesses. The self-reported chronic disease status was also cross verified with the hospital case sheets to know the disease status. Among the selected population 151 were having any disease during pregnancy while 149 does not reported of any disease status during pregnancy. Reporting of any chronic disease during and before pregnancy was taken as the dependent variable for the analysis where, 'having any chronic disease was taken as '1' if 'yes' and '0' if otherwise. For further analysis, all the reported diseases were grouped into three different categories, like women having at least one chronic disease, one to two chronic diseases and more than two chronic diseases during pregnancy.

The outcome variables of the study were low birth weight, prematurity, birth defects and other neonatal complications. However, to compare the pre-natal and perinatal outcomes, participants were categorized into groups according to the number of live births and previous pregnancies. So the participants were categorized into two groups; Primiparous and multiparous with chronic disease during pregnancy and primiparous and multiparous without chronic disease. Socio-economic and demographic characteristics of women were considered as independent variables for analysis to see the impact on health of the women and new-born. Both descriptive and analytic statistical methods were used. Frequencies and bi-variate analysis was performed to see the disease prevalence. Whereas, inference statistics was calculated using chi-square tests according to Pearson's coefficient.

Chi-square test was performed to explore the significance difference between the selected women and new-born health indicators. As Chi-square test is used to see the association between two classifications (classifier variable) of a set of counts or frequencies and compares the observed and expected frequencies in each category. Results are presented in terms of odd ratios and associated *p*-values. All the analysis was done using SPSS 20.

Ethical Approval

The International Institute for Population Sciences-Students Research Ethics Committee (IIPS-SREC) approved the study, and it was explained to the participants that the information collected was solely for the purpose of research and the confidentiality of their names would be maintained. The participants' verbal consent was obtained and recorded on paper. .

RESULTS

Demographic Profile of the Respondent

The mean age of the respondent is 25 years ($SD\pm 4.06$). The highest numbers of respondent (inpatients) were in the age group of 20-24 years (45.7%) whereas only 3.3% of respondent is in age below 20 years. The mean age at marriage of the respondent is about 20 years ($SD\pm 2.71$). More than half of the total respondents were married before completion of 20 years of

age (56.6%). The mean duration of marriage is around 6 years ($SD\pm 4.03$). Half of the respondents were married for less than 10 years. About 66% of women reported of having their first child at the age group of 20-24 years and the mean age at first birth was 21 years, whereas 32% of the births are of first ordered birth. Forty-nine percent are second ordered and 19% births are third or higher ordered birth. Out of the total births 52% were male and 48% were female child. Some preference was seen among the women as many of them reported that they gave birth of more than two or three children because they wanted a male child (Table 1).

Prevalence of Chronic Disease among Women

About half of the women reported having a chronic disease during pregnancy. Amongst all the diseases, anaemia (40.7%), respiratory disease (39.0%), hypertension (11%) and diabetes (9%) (Table 2) were found to be the most severe.

Table 1: Demographic Characteristics of Participants.		
Background Characteristics	N	%
Age of women (mean 25.25±4.06)		
Less than 20 years	10	3.3
20-24 years	137	45.7
25-29 years	100	33.3
More than 30 years	53	17.7
Husband's age (mean 29.61±4.84)		
Less than 25 years	27	9.0
25-30 years	175	58.3
30-35 years	64	21.4
More than 35 years	34	11.3
Age at marriage (mean 19.50±2.71)		
Less than 20 years	170	56.6
20-25 years	119	39.7
More than 25 years	11	3.7
Marriage Duration (Mean 5.73±4.03)		
Less than 5 years	132	44.0
5-10 years	135	45.0
More than 10 years	33	11.0
Age at first birth (mean 21.48±2.95)		
Less than 20 years	49	23.9
21-24 years	135	65.9
More than 25 years	29	10.2
Birth order		
One	96	32.0
Two	146	48.7
Three and more	58	19.3
Sex of the child		
Male	156	52.0
Female	144	48.0

Table 3 shows the socio-economic and demographic characteristics and its association with chronic disease prevalence among women. A negligible difference was found in reporting of having any chronic disease during pregnancy by age of the women. However, women in age group above 30 years reported more of having any chronic disease during pregnancy. Reporting of having any chronic disease, was found more among women with her second parity (52.1%). Meanwhile, more than three fifth of women reportedly underwent a C-section (Caesarean section) and about three-fourth had forceps delivery those were

having any chronic disease during pregnancy.

Women with any chronic disease during pregnancy reported to have had more antenatal check-ups compared to women without any disease. It is about half of the women who received proper antenatal check-ups during pregnancy as they needed more care and treatment with a disease. Similarly, highly educated women reported having more disease prevalence because they were aware of the symptoms of the diseases and its consequences compared to their counterparts. Ninety-eight

Table 2: Prevalence of Chronic Disease before and during Index Pregnancy.

Type of Chronic diseases	Disease prevalence among women			
	During pregnancy ¹		Anytime before pregnancy ²	
	N	%	N	%
No disease	149	49.7	90	30.0
Any chronic disease	151	50.3	210	70.0
Diabetes	14	9.3	4	1.9
Hypertension	16	10.6	77	36.7
Severe anemia	61	40.7	120	57.1
Tuberculosis	21	13.9	109	51.9
Cardiovascular disease	3	2.0	0	0.0
Respiratory disease	59	39.0	33	15.7
Malaria	5	3.3	88	41.9

Note: ¹Reported chronic disease by women were cross-checked with case-sheets
²Self-reported disease prevalence

Table 3: Type of Chronic Disease Prevalence among Women during Pregnancy (most Recent Birth) by Socio-Demographic Characteristics.

Characteristics	Any chronic disease during pregnancy
Age of women	
Less than 20 years	50.0
20-24 years	47.7
25-29 years	52.2
More than 30 years	54.7
Parity of women	
One	49.0
Two	52.1
Three and more	48.3
Type of delivery	
Normal	49.8
C-section	61.5
Forceps	71.4
Number of ANC visit	
Only once	43.8
2-3 times	43.4
More than 3 times	53.1
Women's education	
Primary	57.1
Secondary	49.2
Higher	58.6
Working status	
Working	30.0
Not working	51.0
Religion	
Hindu	48.1
Muslim	52.9
Treatment received	
Yes	98.0
Total	50.3 (151)

percent of women received treatment for their chronic diseases during pregnancy and most of them were treated in public hospitals.

Association of Chronic Diseases and Birth Outcome

Result demonstrates that most of the newborns with low birth-weight were delivered by women with who suffered from a chronic disease during pregnancy (33.4%), than women without any disease (26.4%) ($c^2=0.71$; $p<0.10$). Similarly, smaller size at birth (14.4%) and pre-mature delivery (10.6%) was also found to be high among women with any chronic disease during pregnancy ($c^2=0.84$; $p<0.05$). However, the result clearly shows that women having any disease during pregnancy have higher chances of delivery in C-section (11.3%) and with the help of forceps (13.2%) compared to women not exposure to any disease during pregnancy, which is 3% and 5% respectively.

But, newborns with birth defects were found to be higher among women without disease during pregnancy. The study results did not show any differentials in reporting of still-birth among women with any chronic disease during pregnancy

or not (Table 4).

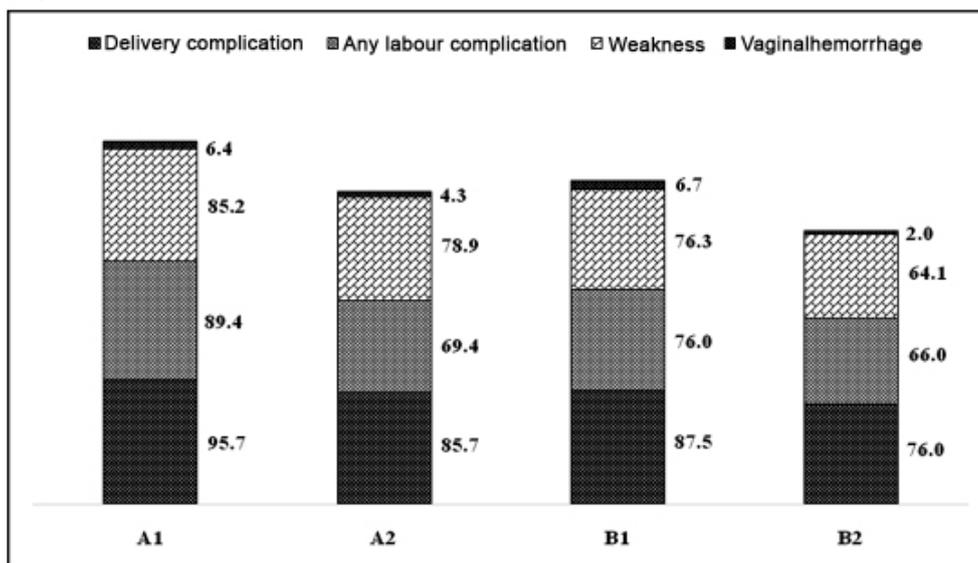
The gestational month of delivery was also seen less among women who had any chronic disease during her pregnancy (i.e., delivered before completion of nine months). About 11% of the women delivered within seven months of gestational period and with chronic disease during pregnancy ($c^2=0.84$; $p<0.05$). However, no significant differential was observed in reporting of experiencing stillbirth and neonatal mortality. The study shows that women with any chronic disease during pregnancy had a poor health status of the newborn.

Figure 1 represents some of the specific complications during the time of delivery and after delivery among women who had developed any chronic disease during pregnancy. It also provides information by parity of women such as women having chronic disease or not with first parity and having chronic disease or not with her second and more parity in the studied area. It clearly shows that women having any chronic disease irrespective of first or second and more parity are more prone to having any complication at delivery as compared to women without chronic disease during pregnancy and about 96% with

Table 4: Outcome of Pregnancy by Chronic Disease Status of Women during Pregnancy			
Birth outcomes	Disease prevalence among women during pregnancy		c²
	With any Chronic disease	Without any Chronic disease	
Weight at birth			
Less than 2.5kg	33.4	26.4	
2.5 kg to 3.5kg	16.8	14.9	0.71*
More than equal to 3.5 kg	49.8	58.7	
Size at birth			
Smaller than average	14.4	12.2	
Average	84.1	87.8	3.48
More than average	1.5	0.0	
Type of delivery			
Normal	75.5	91.2	
C-section	11.3	3.4	4.86*
Forceps	13.2	5.4	
Gestation month at delivery			
Seventh month	10.6	7.4	
Eight month	14.3	14.1	0.84**
Nine month	75.1	78.5	
Any birth defects			
Yes	2.9	3.4	
No	97.1	96.6	0.50
Birth outcome			
Live birth	98.7	98.6	
Stillbirth/Neonatal death	1.3	1.4	1.33*
N	151	149	

Note: p values ***<0.01, **<0.05, *<0.10

Figure 1: Complications during Delivery and after Delivery Plot Against having Chronic Diseases or not during Pregnancy by Parity of Women.



Note: A- women with any chronic disease, B- women without chronic disease, 1- women with first parity, 2- women with second and third parity.

first parity and 88% with second or more parity respectively.

Women with their first parity were observed to have experienced more complications like labor complication and weakness during and after delivery compared to their counterparts. However, chronic disease prevalence was another most important cause of health complications among women as reported by them. It was also observed that, any health complication during pregnancy was highly reported by women those who were not suffering from any chronic disease during pregnancy. Whereas in both the groups, vaginal hemorrhage was found to be higher among women having chronic diseases.

Table 5 represents the groups of chronic disease prevalence before and during pregnancy and its relation to the newborn health complications. Difficulty in breast feeding among newborn was highly reported by women with any chronic disease at any time before and during pregnancy. While it was seen more among those having any chronic disease any time before pregnancy (58.4%) than others. Breathing problem was found to be high (16.9%) among newborns whose mothers developed chronic diseases during pregnancy, while about 4 point less (13%) among those had chronic diseases at any time before pregnancy. Low weight at birth and baby develop yellow staining on palm and soles were also found high among women

Newborn health complications	Prevalence of any chronic disease among women	
	During pregnancy ¹	Any time before pregnancy ²
Low weight	22.0	20.8
Feeding problem/Poor sucking	56.8	58.4
Problem in breathing	16.9	13.0
Dull and inactive	5.1	5.8
Yellow staining on palm and soles on body	13.6	11.1
Cold/cough	16.9	16.3
Ulcers in mouth	12.7	7.8
Any other problem	55.1	58.8

Note: ¹Reported chronic disease by women were cross checked with case-sheets
²Self-reported disease prevalence

with disease prevalence during pregnancy compared to their counterpart.

DISCUSSION

The main aim of the study is to bring out a brief overview of chronic disease prevalence during pregnancy and its association with the health of women and the health of the new-born. Half of the women were suffering from a type of chronic disease during pregnancy whereas about three-fourth of them reported having any chronic disease at any time in lifetime. Severe anaemia (40.7%) and chronic respiratory illness (39.0%) were the most common diseases found among women. Study by Kersten et al¹ has found that every fifth pregnant woman suffers from at least one chronic disease, and higher prevalence rates have reported in the literature. In an American study analyzing 6294 women of childbearing age, 26.6% of the participants had one of the most prevalent chronic diseases. In contrast, 39.1% of all women who were not pregnant reported that they were chronically ill.¹⁹ While our study shows that about half of the women reported of developing any chronic disease during her pregnancy.

Severe anemia is not only concentrated among women at pregnancy but also before pregnancy that continues to be a major public health problem. It has been estimated that more than one-third of the world's women are anemic; the vast majority of this being in developing countries.^{20,21} It is generally agreed that the prevalence of malaria is higher among pregnant women than other groups, and that can lead to abortion, intrauterine fetal death, pre-mature delivery and even maternal death.²² Whereas, the prevalence of malaria was found to be most common among women, although, not particularly during pregnancy. Study shows that women having more than one or more than two chronic disease at the time of pregnancy has a higher chance of experiencing complications like labour related complications, convulsion (not from fever) during delivery. Where the educational status of women and receiving any antenatal check-ups has no positive association with developing any chronic disease during pregnancy as disease prevalence is quite hazardous to the weak immune health.

The study also highlights the women's chronic ill status and its association with the health of the new-born. A positive correlation was found between the mother's ill health status and adverse health outcome of new-born. While women with severe anaemia and severe respiratory illness also reported of delivering new-born with poor health status. Similarly, low weight at birth (54.1%), small sized baby (55.0%) and premature baby (66.7%) were delivered by the women who developed any chronic disease during her pregnancy compared to women without disease. So, it can be summarized that there is a positive association between mother's chronic ill health during pregnancy and adverse health outcome of the new-born. Chronic disease among pregnant women such as severe anemia has a significant influence on adverse pregnancy outcome.¹ Similarly, in our study we have found that a newborn with low birth weight, small size at birth

and premature birth were delivered by women who developed any chronic disease during pregnancy.

CONCLUSION

This analysis was done on hospital-based study in which the prevalence of all major chronic diseases during and before pregnancy was included as reported by the inpatients. Half of the women suffered from at least one chronic disease during pregnancy. In addition to this, the perinatal outcome appears to be less favourable for newborns of women with chronic diseases.

LIMITATION

The previous chronic history was taken based on the women's self-reported response. There were no clinical records to verify the previous history.

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CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

1. Kersten I, Lange AE, Haas JP, et al. Chronic diseases in pregnant women: Prevalence and birth outcomes based on the SNIp-study. *BMC Pregnancy Childbirth*. 2014; 14: 75. doi: [10.1186/1471-2393-14-75](https://doi.org/10.1186/1471-2393-14-75)
2. US Department of Health and Human Services. The health consequences of smoking: A report of the Surgeon General., Atlanta (GA): Centres for Disease Control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2004.
3. Balsells M, Garcia-Patterson A, Gich I, Corcoy R. Maternal and foetal outcome in women with type 2 versus type 1 diabetes mellitus: A systematic review and meta-analysis. *J Clin Endocrinol Metab*. 2009; 94(11): 4284-4291. doi: [10.1210/jc.2009-1231](https://doi.org/10.1210/jc.2009-1231)
4. Taylor R, Davison JM. Type 1 diabetes and pregnancy. *British Medical J*. 2007; 334 (7596): 742. doi: [10.1136/bmj.39154.700417.BE](https://doi.org/10.1136/bmj.39154.700417.BE)
5. Chu SY, Callaghan WM, Kim SY, et al. Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care*. 2007; 30(8): 2070-2076. doi: [10.2337/dc06-2559a](https://doi.org/10.2337/dc06-2559a)

6. AbouZahr C. Global burden of maternal death and disability. *Br Med Bull.* 2003; 67(1): 1-11. doi: [10.1093/bmb/ldg015](https://doi.org/10.1093/bmb/ldg015)
7. Khan KS, Wojdyla D, Say L, Gulmezoglu AM, Van Look PFA. WHO analysis of causes of maternal death: A systematic review. *Lancet.* 2006; 367(9516): 1066-1074. doi: [10.1016/S0140-6736\(06\)68397-9](https://doi.org/10.1016/S0140-6736(06)68397-9)
8. Hussein J, McCaw-Binns A, Webber R. Perinatal and maternal mortality in developing countries. 2012.
9. Centres for Disease Control and Prevention Health. United States, 2008. Hyattsville (MD): National Centre for Health Statistics. 2008.
10. Collins J, Lehnerr J, Posner S, Toomey KE. The ties that bind: maternal and child health and chronic disease at the Centres for Disease Control and Prevention. *Prev Chronic Dis.* 2009; 6(1): A01. Web site. https://www.cdc.gov/pcd/issues/2009/Jan/08_0233.htm. Accessed February 12, 2017.
11. Saxena P, Tyagi S, Prakash A, Nigam A, Trivedi SS. Pregnancy outcome of women with gestational diabetes in a tertiary level hospital of North India. *Indian J Community Med.* 2011; 36(2): 120-123. doi: [10.4103/0970-0218.84130](https://doi.org/10.4103/0970-0218.84130)
12. Seshiah V, Balaji V, Balaji MS, Sanjeevi CB, Green A. Gestational diabetes mellitus in India. *J Assoc Physicians India.* 2004; 52: 707-711. Website. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.623.3983&rep=rep1&type=pdf>. Accessed February 12, 2017.
13. Mayo Clinic staff. High blood Pressure in Pregnancy: Know the fact. 2011. Web site. <http://www.mayoclinic.com/health/pregnancy/PR00125>. Accessed February 12, 2017.
14. Levy A, Fraser D, Katz M, Mazor M, Sheiner E. Maternal anemia during pregnancy is an independent risk factor for low birth weight and preterm delivery. *Eur J Obstet Gynecol Reprod Biol.* 2005; 122(2): 182-186. doi: [10.1016/j.ejogrb.2005.02.015](https://doi.org/10.1016/j.ejogrb.2005.02.015)
15. Sifakis S, Pharmakides G. Anemia in pregnancy. *Ann N Y Acad Sci.* 2000; 900: 125-136. doi: [10.1111/j.1749-6632.2000.tb06223.x](https://doi.org/10.1111/j.1749-6632.2000.tb06223.x)
16. Bhojani U, Thriveni BS, Devadasan R, et al. Out-of-pocket healthcare payments on chronic conditions impoverish urban poor in Bangalore, India. *BMC Public Health.* 2012; 12: 990. doi: [10.1186/1471-2458-12-990](https://doi.org/10.1186/1471-2458-12-990)
17. Reddy KS, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. *Lancet.* 2005; 366(9498): 1744-1749. doi: [10.1016/S0140-6736\(05\)67343-6](https://doi.org/10.1016/S0140-6736(05)67343-6)
18. Census of India. Provisional population tables, Vol. 1. Registrar General and Census Commissioner, New Delhi, India: 2011.
19. Chatterjee S, Kotelchuck M, Sambamoorthi U. Prevalence of chronic illness in pregnancy, access to care, and health care costs implications for inter conception care. *Women's Health Issues.* 2008; 18(6): 107-116. doi: [10.1016/j.whi.2008.06.003](https://doi.org/10.1016/j.whi.2008.06.003)
20. World Health Organization. The prevalence of anaemia in women: A tabulation of available information. WHO, Geneva Switzerland: 1992.
21. Dangour AD, Hill HL, Ismail SJ. Haemoglobin status of adult non-pregnant Kazakh women living in Kzyl-Orda region, Kazakhstan. *Eur J Clin Nutr.* 2001; 55: 1068-1075. Web site. <http://www.nature.com/ejcn/journal/v55/n12/abs/1601267a.html>. Accessed February 12, 2017.
22. Mvondo JL, James MA, Cambell CC. Malaria and pregnancy in cameroonian women. effect of pregnancy on plasmodium falciparum parasitaemia and the response to chloroquine. *Tropical medicine parasitology.* 1992; 43(1): 1-5. Web site. <http://europepmc.org/abstract/med/1598501>. Accessed February 12, 2017.