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Miscarriage but not stillbirth rates are higher among younger nulliparas in rural Southern Nepal

J. Katz[1], **S.K. Khatry**[2], **S.C. LeClerq**[1], **S.R. Shrestha**[2], **K.P. West Jr**[1], and **P. Christian**[1]

1*Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205, USA*

2*The Nepal Nutrition Intervention Project Sarlahi, Kathmandu, Nepal*

Abstract

Objectives—To examine the impact of young maternal age on miscarriages and stillbirths in rural Southern Nepal.

Methods—Pregnancies, miscarriages and stillbirths were prospectively identified in two randomized trials of maternal micronutrient supplementation. This analysis included 5861 women of parity 0 (nulliparas) and 4459 of parity 1 (primiparas) who were under 26 years of age.

Results—Among nulliparous women, 5.6% and 4.6% of pregnancies ended in miscarriage and stillbirth. The adjusted relative risk of miscarriage was 2.07 for girls under 15 (95% confidence interval: 1.34, 3.66) compared to those 18 and 19 years, and 1.40 (95% CI: 1.06, 1.84) among those 15-17 years. Stillbirth rates did not differ significantly by maternal age. There were no differences in miscarriage or stillbirth rates by maternal age among primiparas.

Conclusion—Young maternal age increased the risk of miscarriages but not stillbirths for nulliparas. Miscarriages and stillbirths did not differ by maternal age for primiparous women.

Introduction

Adolescent pregnancy is common world-wide, but is especially prevalent in developing countries [1]. In developed countries, adolescents are more likely to deliver low birth weight and preterm infants than older women [2]. In some developing countries, where the nutritional status of young women is often poor, menarche can be delayed by about 3 years, and growth can continue until age 20 [3]. Short stature and low body mass index (BMI) are known risk factors for adverse pregnancy outcomes, and women who become pregnant before they have achieved their full height and reproductive maturity may be less likely to deliver a viable fetus. We have previously shown that in rural Nepal, a higher rate of low birth weight occurs among nulliparous adolescent pregnancies, but this is driven primarily by a higher prevalence of preterm deliveries rather than intrauterine growth retardation [4]. Few studies have examined adverse pregnancy outcomes in very young women in nutritionally deprived populations in South or South East Asia [5-9]. Most of these studies have been hospital based [5-9]. Even fewer studies have been population-based [10], and none of these studies ascertained pregnancies prospectively. Hence, such studies have been able to examine rates of stillbirth but not miscarriage. Very few studies, whether hospital or population-based, have examined whether reproductive risks are different for nulliparous and parous women among adolescents [8]. If there is evidence of an increased risk of adverse pregnancy outcomes for adolescents,

Corresponding Author: Joanne Katz, Sc.D., Professor and Associate Chair, Department of International Health, Director, Program in Disease Prevention and Control, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe Street, Room W5009, Baltimore, MD 21205-2103 USA, Ph: 410-955-7016, Fax: 410-955-2029, Email: jkatz@jhsph.edu.

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then this would provide further support for policies to increase the minimum age at first marriage, encourage continued education for girls, targeting of adolescents for contraceptive advice and products, and provision of special antenatal and intrapartum care for pregnant adolescents.

In rural Nepal, very young age at first marriage and pregnancy is common, making this an appropriate place in which to examine the impact of maternal age on pregnancy outcomes [11]. In addition, this is an environment where there are virtually no teenage pregnancies outside of marriage, and no social stigma associated with teen pregnancy [12]. Factors associated with early marriage and teen pregnancies are primarily ethnicity and literacy, rather than socioeconomic status [4,13,14]. In this paper, we compare the prevalence of spontaneous miscarriages, stillbirths, and fetal deaths among adolescents aged 12-19 years and adult women aged 20-25 years of parity 0 (nullliparous) and 1 (primiparous) by combining data from two large population-based, randomized trials of micronutrient supplementation in Sarlahi district, Nepal.

Materials and Methods

Sarlahi District is located in the southeastern low lying terai (plains) region of Nepal, bordering the Indian state of Bihar. Sarlahi district was selected for these studies because it is representative, in terms of many health indicators such as infant and child mortality, of other such districts in the plains of Nepal, although not necessarily of all of Nepal. In this rural area, the population consists primarily of subsistence farmers, and literacy is low for both men and women. Women marry young an nutritional status of pregnant women in this area is poor, with 54% having a mid upper arm circumference below 21.5 cm [15]. Hence, this was an appropriate population in which to address the issue of the impact of adolescence on pregnancy outcomes.

From 1992 through 1997, a trial known as NNIPS-2 (Nepal Nutrition Intervention Project Sarlahi) was conducted in 426 communities of Sarlahi district, Nepal. These communities comprise about a third of the district and were selected to be a certain distance from the Indian border, to reduce loss to follow up due to the increased migration along the border. These communities, in which ~45,000 women of child-bearing age resided, were randomized to receive weekly supplements of vitamin A, beta-carotene or placebo [15,16]. The women were visited each week and asked about menses in the past 7 days and whether they were pregnant or not. On average, women were identified as pregnant through these visits at about 16 weeks of gestation. At this time, they were interviewed about demographics, socio-economic status, pregnancy history, date of last menstrual period, diet and morbidity. Mid-upper arm circumference was measured to assess nutritional status. Pregnancy outcomes were recorded and all women were followed until 1997 when the trial ended. Newly married women residing in the study area were prospectively enrolled and followed as previously described [15,16]. Hence, this study continued to add newly eligible women to the cohort. Vitamin A or beta carotene reduced maternal mortality by 44% and hence all pregnant women received weekly vitamin A thereafter.

From 1998 to 2000, a trial (NNIPS-3) of daily antenatal micronutrient supplements was conducted in these same 426 communities [17,18]. In this study, communities were randomized for pregnant women to receive one of five different micronutrient supplements (vitamin A alone as the control group, vitamin A and folic acid, vitamin A, folic acid and iron, vitamin A, folic acid, iron and zinc, and the fifth group received a multiple micronutrient supplement containing all the prior listed supplements along with additional ones). All married women of childbearing age who were not menopausal, pregnant or breastfeeding an infant at the time the study started, were visited every 5 weeks to ascertain whether menses had occurred in the past 30 days. If not, a urine-based pregnancy test was performed. This approach identified women

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as pregnant around 9 weeks of gestation. Those found to be pregnant were interviewed using the same questionnaire as in the previous trial. Pregnancies were followed until their outcomes were ascertained. Pregnant women were given a clean birth kit, administered tetanus toxoid vaccine and deworming twice in pregnancy.

In both trials, eligible women were identified through a house to house survey, and refusal to participate was less than 2%. Village-based women visited participants weekly (NNIPS-2) and bi-weekly (NNIPS-3). Because of the frequency of visits, details of the pregnancy outcome were ascertained soon after the event. Very few women migrated during the study. Hence the loss to follow up was low. About 95% of women in each trial delivered their infants at home, without the aid of a trained birth attendant.

Pregnancy outcomes examined were miscarriages, stillbirths and fetal deaths. Miscarriages were defined as pregnancies where the gestational age at the time of delivery was less than 28 weeks and the infant did not survive. Stillbirths were defined as deliveries occurring from 28 weeks of gestation onwards but where the infant did not move or cry after delivery as ascertained from a questionnaire with the mother and family members soon after birth. Stillbirth is defined as a late fetal death, but the cut point for gestational or fetal weight that determines late pregnancy varies in the literature. We selected a cut point of 28 weeks because this has been used in many studies internationally, thus providing comparability with these studies. It was also unlikely that an infant born before 28 weeks gestation would be viable in this environment, and we did not have weights of stillborn infants. This definition was used for fetal deaths where the mother survived and for those where she did not. Gestational age was calculated using the date of last menstrual period (LMP) provided by women at the time of the early to mid pregnancy enrolment interview (9 to 16 weeks gestation depending on which trial). If the LMP date was not available, gestational age was based on the prospective reporting of menses (NNIPS-2), or the date of a positive pregnancy (NNIPS-3). Fetal deaths were defined as the sum of miscarriages, stillbirths and maternal deaths during pregnancy.

The calculation of rates of miscarriage, stillbirth and fetal death used the number of pregnancies as the denominator. This denominator was selected because it allowed us to use common denominator for both types of fetal deaths and to create rates rather than ratios. Maternal age in years was ascertained by interview at the time of enrolment in both studies, using local events calendars as needed. A parity of zero (nulliparous status) was assigned to women who reported no prior pregnancies that resulted in a live birth. A parity of one (primparous status) was assigned to women who reported having had one previous live born child. For this analysis, gravidity was defined as the number of pregnancies (including the current one) reported during the interview, whether or not they resulted in a live birth (19) Parity was used because we could not distinguish between prior stillbirths and miscarriages, and there was likely to be a difference in risk associated with women who had a prior live birth or stillbirth, and those who had an early miscarriage. By separating women by parity and gravidity, we could assessed the risk of fetal loss separately for those who had never been pregnant, and those who had been pregnant but not ever had a live birth.

To examine the impact of maternal age on pregnancy outcomes, women who contributed a pregnancy to either study, were 25 years of age or younger at the time of their enrolment interview in early to mid pregnancy, and who gave a history of either no prior live births, or one prior live birth, were included. Older women were excluded because very few of them were of parity 0 or 1. Married women of parity 0 or 1 who were older than 25 in this environment were unusual and more likely to have reproductive health problems than those of the same age but with live born children. Women of parity higher than 1 were excluded because there were too few adolescent pregnancies in this group.

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Analyses were stratified by parity because the risks of adverse outcomes differed between parity 0 and 1. Age was categorized as < 15, 15-17, 18-19 and 20-25 years among women of parity 0. For those of parity 1, age was categorized as < 20 and 20-25 years because the rates of adverse outcomes were lower and there were too few women of parity 1 who were under 18 to make appropriate statistical inferences (204 or 4.6% of parity 1 women). Age was categorized rather than used as a continuous variable because the risks of fetal loss were not linear with age. While the stratified analysis could be presented as one regression with parity as a covariate and with interactions between parity and the other covariates, we chose to present them separately because the age distribution was different for parity 0 and parity 1 women and because a stratified analysis made the interaction between parity and maternal age clearer than in a unified regression model. The age-parity interaction was statistically significant in the unifed model, but only when age was treated as a continuous variable, since the estimates were too unstable in categories. The rates of miscarriage, stillbirth and fetal death were calculated stratified by parity and age. Crude relative risks were estimated using 18-19 year old women as the reference. Potential covariates examined were maternal literacy (ability to read and write), Hindu caste, gravidity, supplementation treatment group, study (NNIPS-2 or NNIPS-3), mid-upper arm circumference, and night blindness during pregnancy. Literacy rather than years of education was used because the literacy rate was low and the years of education of women who did attend school were so few. Poisson regression was used to calculate adjusted relative risks. Covariates were included in the multivariate model based on statistically significant bivariate associations with the outcomes($p<0.05$). All statistical analyses were done using SAS version 9.0.

Results

There were 10,320 women of parity zero or one who were below 26 years of age at the time of the enrolment interview in early to mid-pregnancy. The mean (SD) age of the nulliparas was 18.6 (2.2) years, range 10-25 years, and 20.8 (2.2) years, range 13-25 years for primiparous women. There was a total of 5861 nulliparous women 25 years of age or younger. Of these, 4614 (79%) were from the NNIPS-2 study and 1247 (21%) were from NNIPS-3. Sixty-two (1.1%) of these were missing a pregnancy outcome due to loss to follow up. Of the remaining 5799, 28 (0.5%) were missing gestational age. This left 5771 for whom an outcome could be defined (5178 live births, 325 miscarriages, 258 stillbirths, 5 maternal deaths occurring at less than 28 weeks and 7 maternal deaths after 28 weeks gestation) (Figure 1).

There were 4459 primiparous women 25 years of age or younger, with 3351 (75%) from NNIPS-2 and 908 (25%) from NNIPS-3. Fifty-one (1.1%) of these were missing a pregnancy outcome. This left 4408 pregnancies, 8 (0.2%) of which were missing gestational age. Hence, there were 4400 pregnancies where outcomes could be defined (4072 live births, 210 miscarriages, 116 still births, 1 maternal death occurring less than 28 weeks and 1 maternal death from 28 weeks gestation) (Figure 1).

The crude rates of miscarriage and stillbirths by maternal age in years are shown in Table 1. Although the numbers are small in lower and higher age categories, there is evidence of a high and consistent risk of miscarriage below 15 years, an intermediate risk between 15 and 17 years, the lowest risk between 18 and 23 years, and an intermediate risk for 24 and 25 year olds among nulliparous women. There was some evidence for an increasing risk of stillbirth with increasing maternal age among nulliparous women. No consistent trend in risk of miscarriage or stillbirths by maternal age was evident for primiparas.

The rates of fetal death were 10.3% among women of parity 0, and 7.5% among those of parity 1 (Tables 2 and 3). Miscarriage rates were higher than stillbirth rates within parity categories. Among nulliparas, the miscarriage rates declined from 16.7% among those under 15 to 5.4%

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among those 20-25 years of age. The lowest rates were among 18 and 19 year olds (4.2%), with a slight increase among those 20 years of age and older.

The rates of stillbirth increased with increasing maternal age among nulliparas, from 2.8% among those under 15 to 5.4% among those 20 and older. Characteristics associated with both maternal age and pregnancy outcomes among nulliparas were literacy, caste, gravidity, and study (NNIPS-2 women were slightly older and had lower rates of miscarriage than those in NNIPS-3 (4.3% versus 10.8%). In the multivariate model, literacy was statistically significantly protective against miscarriage and fetal death. The literacy rate ranged from 16% among under 15 year olds to 30% among those 20 and older. Lower caste increased the risk of all outcomes, with higher caste Brahmins and Chetris having the lowest risk. Women with prior pregnancies that did not result in a live birth were at higher risk of stillbirth and fetal deaths than those who had never been pregnant previously. Fewer women from NNIPS-3 contributed pregnancies to the combined data set, their miscarriage rates were higher, and these women were also younger than those in NNIPS-2. Hence, study membership was an important covariate in the multivariate regression model. Among nulliparous women in NNIPS-3, the adjusted relative risk of miscarriage was 2.51 (95% CI: 1.99, 3.17), relative to NNIPS-2 (Table 2). Although the miscarriage rates were higher in NNIPS-3 than NNIPS-2, the pattern of declining rates with increasing age was the same in both studies. Using dates of delivery in months, we did not find any secular trends in miscarriage or stillbirth rates within each of the studies. Micronutrient supplements did not affect miscarriages, stillbirths or overall fetal losses in either NNIPS-2 or NNIPS-3 (21,22), and therefore were not included as covariates in the regression models. Similarly, mid-upper arm circumference and night blindness did not predict either type of fetal loss, and were therefore not included in the multivariate models. Sexually transmitted infections were identified only in NNIPS-3 but were uncommon, and therefore not included as a predictor of fetal loss [20].

After adjusting for maternal literacy, caste, gravidity and study, the relative risks of adverse pregnancy outcomes by maternal age were attenuated, but retained their same patterns. Miscarriage rates were still statistically significantly higher for those under 15 and 15-17 years of age than for those 18-19 years (adjusted RR 2.07, 95% CI: 1.17, 3.66, and 1.40 (1.06, 1.84)). Stillbirth rates increased with age but none of the relative risks were statistically different from one.

Among primiparas, the overall rates of miscarriage and stillbirths were 4.8% and 2.7%, respectively (Table 3). The miscarriage rates were comparable to those of nulliparas, but stillbirths were higher among parity 0 than parity 1 women. There was no evidence that the pregnancies of women under 20 years of age were at higher risk for miscarriage, stillbirth or fetal death than those 20 and older, before or after adjustment for literacy, caste, gravidity and study. There were only 204 pregnancies among women < 18 years of age of parity 1, and only 10 miscarriages (4.9%) and 1 still birth (0.5%) among these. With age categorized as < 20 versus 20 -25 years among primiparas, literacy was not associated with any of the pregnancy outcomes. Lower caste was associated with significantly higher miscarriage rates. A history of prior pregnancies regardless of their outcomes (“gravidity”) was associated with an increased risk of stillbirths but not miscarriages. As seen among nulliparas, the rate was significantly higher for miscarriages but not stillbirths in the NNIPS-3 than NNIPS-2 study.

Discussion

Very young maternal age (<15 y) was found to be an important contributor to miscarriages but not to stillbirths in an undernourished population of rural Nepali women who had not experienced a prior live birth. Among women of parity 1, there were too few who were of similarly young age to address this question, but those who were under 20 years were not at

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higher risk than those 20 years and older. If the nulliparas were grouped into those under 20 and 20 years and older, the younger women were at no increased risk of miscarriage or stillbirth. Hence, it is the very young women (those below 18 years, and especially those below 15 years) who are at greatest risk of miscarriage, and women of this age are almost all nulliparous. Although only 1.2% of nulliparas were < 15 years of age, 30.2% were < 18 years, a figure similar to that of Nepal as a whole, and among those < 18 years, one in 12 nulliparous women will miscarry this pregnancy. This is likely an underestimate of the risk since it does not include very early miscarriages. This increased risk with young maternal age did not extend to stillbirths, perhaps because those pregnancies destined for an adverse outcome ended early rather than late in pregnancy for these youngest women. Our data are supportive of this being the case since the mean gestational age at miscarriage increased with increasing maternal age among nulliparous women (data not shown). For women under 15 years of age the mean gestational age at miscarriage was 12.2 weeks, and 16.5 weeks among those 20 and older. However, these differences may reflect a bias in self reporting of pregnancy by maternal age (perhaps younger women were less able to provide accurate dates of last menstrual period). It should be noted that abortion was not legal in Nepal during the time of these studies, and access to illegal abortion was limited. Information about whether the abortion was induced was obtained in NNIPS-3, but not NNIPS-2. In NNIPS-3, 8.6% of all abortions were reported to be induced. However, there was only one report of an induced abortion (0.7%) among women of parity 0, and two (1.9%) among women of parity 1. All women enrolled in these trials were married (an inclusion criterion) and of parity 0 or 1, hence it is likely that a high proportion of these miscarriages were spontaneous rather than induced.

In this population, the factors found to be associated with young age in pregnancy were literacy and ethnicity, but not other measures of socioeconomic status [4]. Similar associations have been found in analysis of the DHS surveys in Nepal [13,14]. These characteristics were also associated with adverse pregnancy outcomes and were thus included in the multivariate model, along with gravidity (number of previous pregnancies), which was associated with an increased risk of adverse outcomes and with maternal age) and study (because of the increased rates of miscarriage in NNIPS-3 due to earlier pregnancy ascertainment in that study). Even after adjustment, nulliparous women < 18 years of age were at a significantly higher risk of miscarriage than 18-19 year old women, who experienced the lowest risk. This may be because women who have not yet had their first live birth by age 20 are unusual in this population. They may be women who have had difficulty conceiving (implying poorer reproductive health) and therefore may have had worse pregnancy outcomes than those slightly but not too much younger. Alternatively, the optimal age of reproduction may be 18-19 as shown by Allal et al. [21].

The few studies from South Asia that have examined adverse pregnancy outcomes by maternal age have shown much higher rates of adverse outcomes among adolescents than older women, but only a few of these studies stratified by parity, and many did not exclude older grand multiparas, who are also at higher risk. In addition, hospital-based studies may not be representative of population-based ones, as younger women who come to hospitals for deliveries may be those at highest risk. The more modest impact of young age at first live birth found in this study may be due to stratification by parity and to focusing on a population-based sample of women 25 years of age and younger. Specifically, in our data, only very young adolescents who had never had a prior live birth were at higher risk for miscarriages, and this younger age group was not at any higher risk for stillbirths. This finding is in contrast to hospital-based studies in South Asia and elsewhere [6,22-23], which found higher rates of stillbirth among adolescents. Others have found no differences in stillbirth rates by maternal age [24].

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The strengths of our study were that it included ~10,000 pregnancies, was population-based, and ascertained pregnancies, miscarriages and stillbirths prospectively. Another strength was that this population may represent demographic and health characteristics of other rural populations of the northern Gangetic plains of South Asia based on health statistics such neonatal, infant and child mortality. In addition, the 4.6% stillbirth rate seen here among nulliparous women and the 2.7% among primiparas are not out of line with the estimate of 3.2% for South Asia [25]. Most of the observed miscarriages were spontaneous, since there was no legal access to induced abortion and no social stigma associated with pregnancy in adolescence (in fact, the opposite), although induced abortions cannot be completely ruled out. Hence, the social and behavioral contribution to the association between maternal age and miscarriage is largely removed. Limitations included not knowing the age at menarche, and hence being unable to use gynecologic rather than chronologic age, inability to identify very early miscarriages, especially in the study where prospective urine based testing was not done, possible misclassification of maternal age (although this was minimized by use of local event calendars and categorization of ages), miscarriages and stillbirths, due to the difficulty of estimating gestational age in this population. Although the association between maternal age and fetal loss was adjusted for confounders, several risk factors for fetal loss identified in the literature were not available for adjustment.

These analyses provide evidence of a higher risk of miscarriage but not stillbirths, among nulliparous adolescents below 18 years of age. These miscarriages were not early ones, but those that occurred in mid to late pregnancy because we identified pregnancies no earlier than about 9 weeks gestation and most were later than this. Therefore the maternal health consequences of these miscarriages may be greater than if they occurred very early. While prior pregnancies that did not result in a live birth put women at higher risk for miscarriage and stillbirths in the subsequent pregnancy, this was true at all ages. From a public health perspective, it would be important to target these very young women for programs that reduce teen marriages, and for those who are married, to improve demand and access to contraceptives to delay first pregnancies, preferably until at least age 18 years.

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TABLE 1

Numbers and rates of miscarriage and stillbirths by year of maternal age among nulliparous (parity=0) and primiparous (parity =1) pregnant women in rural Nepal

	Parity 0			Parity 1		
Maternal Age (yrs)	Pregnancies N	Miscarriage n (%)	Stillbirth n (%)	Pregnancies N	Miscarriage n (%)	Stillbirth n (%)
10	2	1 (50.0)	0 (0.0)	0		
12	8	1 (12.5)	0 (0.0)	0		
13	14	2 (14.3)	0 (0.0)	2	0 (0.0)	0 (0.0)
14	48	8 (16.7)	2 (4.2)	3	0 (0.0)	0 (0.0)
15	181	14 (7.7)	6 (3.3)	15	0 (0.0)	0 (0.0)
16	611	48 (7.9)	25 (4.1)	47	3 (6.4)	0 (0.0)
17	877	64 (7.3)	37 (4.2)	137	7 (5.1)	1 (0.7)
18	1389	59 (4.3)	59 (4.3)	452	19 (4.2)	11 (2.4)
19	845	34 (4.0)	39 (4.6)	576	36 (6.3)	22 (3.8)
20	845	50 (5.9)	39 (4.6)	901	44 (4.9)	27 (3.0)
21	328	16 (4.9)	14 (4.3)	548	22 (4.0)	14 (2.6)
22	310	13 (4.2)	20 (6.5)	749	29 (3.9)	23 (3.1)
23	125	4 (3.2)	7 (5.6)	401	21 (5.2)	5 (1.3)
24	97	7 (7.2)	7 (7.2)	301	14 (4.7)	6 (2.0)
25	91	7 (7.7)	10 (11.0)	268	16 (6.0)	8 (3.0)
Total	5771	328 (5.7)	265 (4.6)	4400	211 (4.8)	117 (2.7)

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TABLE 2

Risk of miscarriages, still births and fetal deaths among nulliparous pregnant women in rural Nepal by maternal age and other characteristics

	Pregs	Miscarriage					Stillbirth					Fetal Death				
	N	n	%	Crude	Adjusted*		n	%	Crude	Adjusted*		n	%	Crude	Adjusted*	
Total	**5771**	**328**	**5.7**	**RR**	**RR**	**95% CI**	**265**	**4.6**	**RR**	**RR**	**95% CI**	**593**	**10.3**	**RR**	**RR**	**95% CI**
Maternal Age (yrs)																
< 15	72	12	16.7	**4.00**	**2.07**	**1.34, 3.66**	2	2.8	0.63	0.72	0.18, 2.94	14	19.4	**2.27**	1.58	0.96, 2.60
15-17	1669	126	7.6	**1.81**	**1.40**	**1.06, 1.84**	68	4.1	0.93	0.94	0.68, 1.31	194	11.6	**1.36**	1.18	0.97, 1.45
18-19	2234	93	4.2	1.00	1.00		98	4.4	1.00	1.00		191	8.6	1.00	1.00	
20-25	1796	97	5.4	1.30	1.25	0.93, 1.68	97	5.4	1.23	1.15	0.85, 2.94	194	10.8	**1.26**	1.20	0.98, 1.47
Literacy**																
No	3706	232	6.3		1.00		184	5.0		1.00		416	11.2		1.00	
Yes	1466	63	4.3		**0.73**	**0.53, 0.99**	47	3.2		0.75	0.51, 1.08	110	7.5		**0.73**	**0.58, 0.93**
Caste**																
High	993	39	3.9		1.00		35	3.5		1.00		74	7.5		1.00	
Middle	3254	191	5.9		1.25	0.86, 1.82	137	4.2		0.99	0.65, 1.51	328	10.1		1.13	0.86, 3.52
Low	626	48	7.7		1.56	0.99, 2.46	45	7.2		**1.64**	**1.01, 2.68**	93	14.9		**1.59**	**1.15, 2.20**
Other	301	17	5.7		1.21	0.67, 2.16	16	5.3		1.16	0.62, 2.15	33	11.0		1.19	0.79, 1.81
Gravidity																
1	5281	286	5.4		1.00		226	4.3		1.00		512	9.7		1.00	
2 or more	490	42	8.6		1.41	0.97, 2.04	39	8.0		**1.97**	**1.35, 3.00**	81	16.5		**1.62**	**1.27, 2.10**
Study																
NNIPS-2	4525	193	4.3		1.00		219	4.8		1.00		412	9.1		1.00	
NNIPS-3	1246	135	10.8		**2.51**	**1.99, 3.17**	46	3.7		0.83	0.60, 1.15	181	14.5		**1.61**	**1.35, 1.93**

* Adjusted for literacy, caste, gravidity and study

** 599 missing literacy, 597 missing caste (high=Brahmin or Chhetri, middle= Vaiysha, low=Sudhra, other=Muslim, Buddhist, Christian or other religions). Relative risks in bold are statistically significantly different from 1.

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TABLE 3

Risk of miscarriages, still births and fetal deaths among primiparous pregnant women in rural Nepal by maternal age and other characteristics

	Pregs	Miscarriage					Stillbirth					Fetal Death				
	N	n	%				n	%				n	%			
Total	**4400**	**211**	**4.8**				**117**	**2.7**				**328**	**7.5**			
				Crude	**Adjusted***				**Crude**	**Adjusted***				**Crude**	**Adjusted***	
Maternal Age (yrs)				**RR**	**RR**	**95% CI**			**RR**	**RR**	**95% CI**			**RR**	**RR**	**95% CI**
< 20	1232	65	5.3	1.14	0.77	0.56, 1.06	34	2.8	1.05	1.18	0.77, 1.81	99	8.0	1.11	0.90	0.70, 1.16
20-25	3168	146	4.6	1.00	1.00		83	2.6	1.00	1.00		229	7.2	1.00	1.00	
Literacy**																
No	2860	146	5.1		1.00		76	2.7		1.00		223	7.8		1.00	
Yes	754	26	3.5		0.79	0.51, 1.23	21	2.8		1.33	0.78, 2.28	47	6.2		0.96	0.69, 1.34
Caste**																
High	564	13	2.3		1.00		11	2.0		1.00		24	4.3		1.00	
Middle	2376	117	4.9		1.79	0.97, 3.28	63	2.7		1.53	0.76, 3.08	180	7.6		**1.66**	**1.06, 2.60**
Low	440	33	7.5		**2.70**	**1.38, 5.28**	17	3.9		2.24	0.98, 5.11	50	11.4		**2.46**	**1.48, 4.08**
Other	236	10	4.2		1.48	0.64, 3.46	6	2.5		1.54	0.54, 4.42	16	6.8		1.46	0.76, 2.78
Gravidity**																
2	3866	172	4.5		1.00		92	2.4		1.00		264	6.8		1.00	
3 or more	533	39	7.3		1.26	0.86, 1.84	25	4.7		**1.89**	**1.15, 3.10**	64	12.0		**1.45**	**1.08, 1.94**
Study																
NNIPS-2	3493	107	3.1		1.00		89	2.6		1.00		196	5.6		1.00	
NNIPS-3	907	104	11.5		**4.69**	**3.47, 6.33**	28	3.1		1.12	0.72, 1.70	132	14.6		**2.84**	**2.25, 3.59**

Relative risks in bold are statistically significantly different from 1.

* Adjusted for literacy, caste, gravidity and study

** 786 missing literacy, 784 missing caste (high=Brahmin or Chhetri, middle= Vaiysha, low=Sudhra, other=Muslim, Buddhist, Christian or other religions), 1 missing gravidity.