

Stress in early pregnancy can lead to shorter pregnancies, more pre-term births and fewer baby boys

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Stress in the second and third months of pregnancy can shorten pregnancies, increase the risk of pre-term births and may affect the ratio of boys to girls being born, leading to a decline in male babies. These are the conclusions of a study that investigated the effect on pregnant women of the stress caused by the 2005 Tarapaca earthquake in Chile.

Although it has been known for a while that stress may affect the duration of pregnancy, until now, no study has looked at the impact of both the timing of the stress and the effect that stress might have on the ratio of male-to-female births. The research published online in Europe's leading [reproductive medicine](#) journal [Human Reproduction](#) [1] today (Thursday), provides answers to these questions and also suggests that it is exposure to stress itself rather than other factors that can often accompany or cause stress, such as poverty, that appears to affect pregnancy.

Professors Florencia Torche (PhD) and Karine Kleinhaus (MD, MPH), of New York University (New York, USA), analysed birth certificates of all babies born between 2004-2006 in Chile; there were over 200,000 births a year. The birth records provided information on [gestational age](#) at delivery, sex, weight and height of the baby and whether any medical attention was required. They also included information on the mother's age, marital status, whether or not she had been pregnant before and in which of the 350 counties in Chile she lived. This information gave the

researchers very specific information about how exposed the mothers were to the effects of the earthquake, based on how close they lived to the epicentre.

"Looking at information on gestational age at the time of the earthquake in a large, unselected group of women, enabled us to determine the risk for specific [birth outcomes](#) by gestational age of exposure to a [stressor](#), which, because it was a natural disaster, was experienced by all at the same time, although in varying degrees of severity, depending on how close they lived to the epicentre," said Prof Torche who is Associate Professor of Sociology. "We were able to capture the developmental periods in which exposure to stress was most detrimental for either sex."

The earthquake measured 7.9 on the moment-magnitude scale (the successor to the Richter scale), which is classified as "disastrous". The areas most affected were the cities of Iquique and Alto Hospicio, and the surrounding towns. The researchers found that women who experienced a severe quake (because they lived closest) during their second and third months of pregnancy had shorter pregnancies and were at higher risk of delivering pre-term (before 37 weeks gestation). The pregnancies of women exposed to the earthquake in the second month of pregnancy were on average 0.17 weeks (1.3 days) shorter than those in the unaffected areas of Chile. The pregnancies of those exposed in the third month were 0.27 weeks (1.9 days) shorter. Normally, about six in 100 women had a pre-term birth, but among women exposed to the earthquake in the third month of pregnancy, this rose by 3.4%, meaning more than nine women in 100 delivered their babies early.

The effect was most pronounced for female births; the probability of pre-term [birth](#) increased by 3.8% if exposure to the quake occurred in the third month, and 3.9% if it occurred in the second month. In contrast there was no statistically significant effect seen in male births.

As the stress of the earthquake had greater effect on pre-term births in girls rather than boys, the researchers had to make adjustments for this when calculating the effect of stress on the sex ratio: the ratio of male to female live births. They found that there was a decline in the sex ratio among those exposed to the earthquake in the third month of gestation of 5.8%.

Prof Kleinhaus, who is Assistant Professor of Psychiatry, Obstetrics & Gynecology, and Environmental Medicine, explained: "Generally, there are more male than female live births. The ratio of male to [female births](#) is approximately 51:49 – in other words, out of every 100 births, 51 will be boys. Our findings indicate a 5.8% decline in this proportion, which would translate into a ratio of 45 male births per 100 births, so that there are now more female than male births. This is a significant change for this type of measure."

Previous research has suggested that in times of stress women are more likely to miscarry male foetuses because they grow larger than females and therefore require greater investment of resources by the mother; they may also be less robust than females and may not adapt their development to a stressful environment in the womb. "Our findings on a decreased sex ratio support this hypothesis and suggest that stress may affect the viability of male births," said Prof Torche. "In contrast, among female conceptions, stress exposure appears not to affect the viability of the conception but rather, the length of gestation."

The researchers suggest that possible mechanisms to explain their findings could involve the placenta, which sets the duration of the pregnancy, and the effect of the stress hormone cortisol on the placenta's function.

Prof Torche concluded: "In terms of implications, it is clearly unrealistic to recommend avoiding [natural disasters](#). However, this research

suggests the need to improve access to healthcare for women from the onset of pregnancy and even before conception. Obviously this will not reduce the exposure to stress, but it may provide care, advice, and tools that would allow women to cope with stressful circumstances.

"A separate implication has to do with our ability to use a 'natural experiment' (the earthquake) to isolate the effect of stress from factors that commonly go with it. In particular, researchers have long suggested that poverty is bad for health outcomes because of the stress it elicits. This is very plausible, but it is difficult to disentangle the effect of stress alone from the effect of other factors associated with poverty, such as nutritional deprivation and poor housing, which could also have an independent impact on women's health and the outcome of their pregnancies. This makes it difficult to ascertain whether [stress](#) itself does, indeed, matter. Our research provides strong evidence that it does."

More information: [1] "Prenatal stress, gestational age and secondary sex ratio: the sex-specific effects of exposure to a natural disaster in early pregnancy", by Florencia Torche and Karine Kleinhaus. Human Reproduction journal. [doi:10.1093/humrep/der390](https://doi.org/10.1093/humrep/der390)

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