

Wildfires, air pollution and alteration of sex ratios – can perinatal outcomes be affected?

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Abstract

Environmental disasters such as wildfires and air pollution appear to be occurring more frequently. Studies have shown that they can have significant impact on pregnancy outcomes and more studies need to be conducted to fully understand the impact on reproductive health.

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The United Nations Environmental Programme (UNEP 2022) has declared wildfires more numerous & intense than ever before. The effect of climate change on the rate of bushfires is intuitive – rising earth temperatures & extreme weather combine dry vegetation with stronger low-humidity winds to create a perfect fire storm. Eastern Australia & the West Coast of the United States of America regularly experience summer fires but the 2019-2020 fire seasons saw record-breaking numbers and extent of wildfires with devastating consequences.

Exposure to wildfire smoke during pregnancy has been associated with increased maternal stress, higher rates of gestational diabetes & hypertension, preterm birth & birthweight reduction. A systematic review regarding wildfire exposure in pregnancy & adverse birth outcomes determined higher incidence of preterm birth due to wildfire exposure particularly during the second trimester. The release of PM_{2.5} (particulate matter smaller than 2.5 µm in aerometric diameter) by wildfire is a known risk factor for preterm birth. Ambient PM_{2.5} for entire gestation has been shown to induce birthweight reduction (Amjad S. Environ Int.,2021:156:106644). Data from the Canberra, Australia fires of 2003 showed that male infants born in the most severely fire-affected area had significantly higher average birth weights than their less exposed peers and were also heavier than males born in the same areas in non-fire years (O'Donnell M. Evolution, Medicine, and Public Health 2015:344–354)

Historically, environmental climate conditions have been shown to alter sex ratio in human births. Sex ratio (the ratio of males to females in a population), can be observed at conception (primary sex ratio, PSR) or at birth (secondary sex ratio, SSR). Lyster first described a significant reduction in SSR (109 compared to 144), approximately 320 days following the London smog from 5th to 9th December in 1952, in an otherwise masculine sex ratio period (733 vs 623) (J Obstet Gynaecol Br Commonw., 1965:81:626-631). Male frailty, maternal stress, air pollution and ambient PM exposure, & radiation exposure have all been implicated as causes.

In 1984, O. Lloyd suggested “changes in the sex ratios . . . may be an early indication of changes of general mortality or morbidity resulting from chemical or biological stresses in the environment” after discovering the highest sex ratio of births in Armidale, Scotland in 1967 coincided with an acute increase in mortality from non-malignant respiratory disease, respiratory cancer & non-respiratory cancer. They hypothesised this was due to air pollution, namely high concentrations of airborne carcinogenic ‘trigger factors’ from local foundries (BJOG, 1984: 91:901-907) (Fig. 1). Interestingly, only one natural disaster has been associated with a subsequent rise in sex ratio following it - Hurricane Katrina in 2005 (Med Princ Pract. 2015. 24:5: 477–485).

The data for wildfires is limited but consistent. O’Donnell’s analysis of the 2009 Black Saturday bushfires in Victoria, Australia found a significant decrease in the secondary sex ratio of births conceived after the fires, with a male birth rate of 46.6% in the severely affected regions, in comparison with a male birth rate of 51.1% in the remainder of Victoria (O’Donnell, 2017. p172-173).

With natural disasters becoming reportedly more frequent and more extensive, the impact on birth outcomes needs to be better researched to assist with planning for health care in order to reduce the risks of perinatal morbidity and mortality.

Figure 1.

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An unusual sex ratio of births in an industrial town with mortality problems

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