The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

Excellence in Women's Health

Air Pollution and Pregnancy

Most places in Australia and New Zealand have very good air quality most of the time. Important causes of air pollution include smoking, home heating, bushfires, traffic and industrial pollution, amongst others. While it is not always possible to avoid air pollution, it is sensible to minimise your exposure when you can. This is especially important if you have a chronic illness, like asthma, or are at higher risk of developing a complication of pregnancy, like diabetes.

There are many ways to reduce risks associated with air pollution, such as:

- Avoid frequent exposure to indoor smoke from tobacco, incense, mosquito coils, candles, unflued (without a chimney) gas appliances, or anything else that burns.
- When you can, go along roads with less traffic when driving, walking, or bike riding.
- If you are living in persistently smoky conditions, consider using a High-Efficiency Particulate Air (HEPA) cleaner inside – check it's the right size for your room.
- Look after your overall health. The positive effects of getting regular exercise and having a healthy diet will help counter some of the negative effects of air pollution.
- If you smoke tobacco – try to quit. Cigarette smoke is the single most important source of harmful air pollution for pregnant women.
- Bushfires can sometimes cause widespread air pollution. See below for ways to protect yourself when it is smoky.

Air pollution occurs when air contains chemicals or particles that are harmful to our health. Although Australia and New Zealand have some of the cleanest air in the world, there are times or places where air pollution can rise to harmful levels, for example during bushfires, or in towns where wood burners are used for home heating. This pamphlet discusses the effects of air pollution on women who are pregnant or planning pregnancy, and ways in which women can protect themselves and their babies.

Air Pollution and its effects

Air can be polluted by gases and small suspended particles (particulate matter).

Gases include ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide. Some (eg ozone), are mainly irritants while others (eg carbon monoxide) are poisonous.

Particulate matter is divided up according to its size. Larger, 'coarse' particles (PM_{10}), can be up to 10 micrometres in diameter, smaller 'fine' particles ($PM_{2.5}$), are up to 2.5 micrometers in size, while 'ultrafine' particles (PM_1), are less than one micrometre (see illustration). All particles can be irritating to the eyes and airways, and make any lung problems, like asthma, get worse. Smaller particles like $PM_{2.5}$ and PM_1 can have further impacts on health because they get further into the lungs and can enter the blood stream.

Most airborne particles are not directly poisonous but can be harmful because they provoke low grade immune and stress responses in the body. These include increased inflammation, increased blood glucose, changes to regulation of heart rhythms, blood vessel function, and blood clotting regulation. The changes themselves are generally very small, but can potentially contribute to problems in women or babies who are already at higher risk for other reasons.

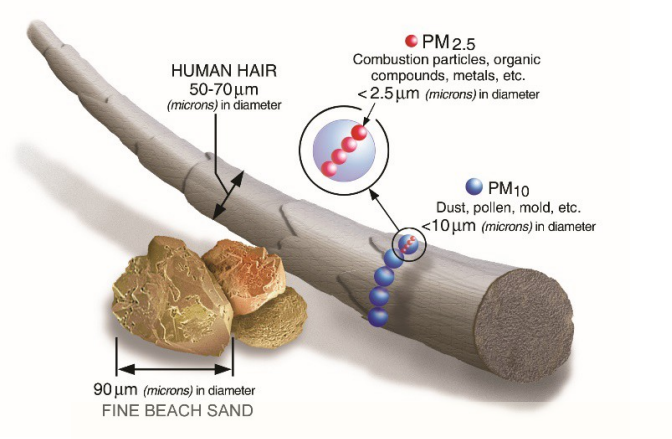

Illustration comparing size of particulate matter with human hair and fine beach sand. Source:https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

Sources of Air Pollution

In Australia and New Zealand, the most important cause of air pollution is combustion. The burning of any material including petrol, plastic, grass, wood, tobacco and incense always releases hundreds of different compounds including many different gases and large numbers of aerosolised particles.

Sources of serious and widespread outdoor (ambient) air pollution in Australia and New Zealand include:

- Wood heaters (wood burners) for home heating
- Bushfires or planned burning
- Dust storms, volcanic smog although these are rare.

Sources of outdoor air pollution that can be important in more localised areas include:

- Emissions from industry or power generation
- Traffic, especially on or near major roads
- Crop spraying.

Important sources of indoor air pollution are:

- Cigarette smoke
- Gas heating or cooking (frying or grilling), especially if there is no flue (chimney) or range hood
- Wood heaters, incense sticks, mosquito coils and candles
- Indoor use of unflued outdoor appliances like camping stoves or outdoor gas heaters is very risky because the toxic gases that are produced can build up to dangerous and deadly levels.

Outdoor pollution can rapidly enter a home, although this can be slowed if the house is well sealed.

Other indoor pollution sources that can be important, especially for people with particular sensitivities, include:

- Cleaning products
- Mould and dust mites
- Newly installed furnishings or carpet.

Air Quality Measures

Government agencies measure and report important air pollutants in all major cities, and increasingly in smaller communities. The information is displayed on the web pages of each state and territory of Australia by environment agencies, environment protection authorities, or health departments. In New Zealand air quality is reported by Land Air and Water Aotearoa (LAWA).

In Australia, you can also check air quality where you live, through an app such as *AirRater*. Some global app providers display an air quality 'index' which can be confusing because the calculation of the index varies between countries and might not correspond with information from local authorities. Air pollution monitors do not usually capture localised areas of higher pollution like busy road intersections.

Air Pollution in Pregnancy

Air pollution affects people differently. If you are usually well with no underlying health issues, then occasionally being in areas with increased air pollution is not likely to harm you or your baby.

Short term increases in air pollution, lasting from a few hours to a few days, can cause headache, and irritation of eyes, nose and throat. It can worsen symptoms of existing lung and heart diseases, including asthma, and make blood glucose harder to control for those with diabetes. In some people, especially those at higher risk, health impacts can be noticeable even with relatively small increases in air pollution.

Exposure to polluted air over years increases the risk of developing lung diseases, heart disease, stroke, diabetes and cancer. The higher the pollution, the higher the risk. Any reduction in exposure to air pollution will lower the risk.

Pregnant women can be more vulnerable than others to the effects of air pollution because of pregnancy-related changes to the function of their lungs, heart, and immune system. Unborn babies and children in their first years of life can be more vulnerable to air pollution because their organ systems like their heart, lungs and brain are all still developing. Air pollution is one of very many factors that can influence developmental processes. Some studies have found that persistently increased air pollution in early life is linked with an increased risk of chest infections, obesity, and possibly learning and behavioral difficulties - but the influence is small. Other factors like genetic makeup, social influences, and other aspects of the environment all play important roles.

Compared to our understanding of the impacts of day-to-day air quality, we know less about the effects of air pollution events such as bushfires or dust storms during pregnancy. The existing studies suggest that the risk of gestational diabetes, preterm birth and growth restriction in the developing baby are increased after short-term exposure to severe air pollution in pregnancy. Air pollution during pregnancy has less conclusively been linked to an increased risk of high blood pressure in pregnancy, miscarriage[1], and effects on fertility[2].

Most of the studies that have looked at effects of air pollution in pregnancy were done in places where there are high levels of polluted air year-round, such as China or large cities in the United States of America. These settings are different to air quality in Australia and New Zealand, so translating these findings to the Australian and New Zealand setting is challenging. However, limited studies in Australia suggest that low-level day-to-day exposure to air pollution may influence fetal growth[3].

Not all research studies have found a link between air pollution and these outcomes. Air pollution is one of many genetic and environmental factors that might contribute to fertility and pregnancy health. When pollution-related associations are identified, they are usually small. For example, a study following severe wildfire smoke impacts in the United States of America found that infants of mothers who were pregnant during the fire had, on average, a lower birthweight of 7 grams[4].

How to protect yourself and your pregnancy from air pollution?

• If the outdoor air quality is poor, try to stay inside as much as possible, with doors and windows shut. Use air conditioners on recycle mode.

• No building can keep outdoor air pollution out completely, so remember to open the doors and windows again once the outdoor air quality has improved. Except in times of poor outdoor air quality, make sure you get lots of fresh air into your home.

• Visit air-conditioned indoor buildings as an alternative to outdoor activities. Many public buildings such as libraries or cinemas are air conditioned and provide some protection from outdoor air pollution.

• Using High-Efficiency Particulate Air (HEPA) filters has been shown to improve indoor air quality and improve health outcomes in neighbourhoods affected by outdoor air pollution[5]. Check that the HEPA filter is appropriate for the size of the room. HEPA filters are especially useful for persistently smoky conditions associated with bushfires or winter woodsmoke. They enable you to create a clean air room in your home.

• Avoid indoor smoking and minimise the use of cleaning products, candles, frying and grilling, and wood heating. Regularly service gas appliances to ensure they are not leaking.

• Never use camping stoves or outdoor heaters indoors.

• If walking or cycling, select your route away from busy roads especially in rush hour. Being one or two streets back from the main road significantly reduces exposure to air pollution.

• Paper and cloth face masks do not protect against air pollution. The exception is a properly fitted respirator (also known as a P2 or N95 mask)[6]. However, all face masks make breathing harder, and you should consult your doctor or midwife before using one in pregnancy.

• Eat a healthy diet focusing on fresh fruit and vegetables and avoiding sugar and highly processed food. Unhealthy diets increase the risk of heart disease and inflammation, thus worsening the inflammatory effects of air pollution. For infants, breastfeeding has a protective anti-inflammatory effect[7].

• If you are otherwise healthy, the benefits of exercise outweigh potential harms except in extreme air pollution events.

• If you have asthma, or any chronic heart or lung diseases, pay close attention to your symptoms during periods of increased air pollution, and follow your management plan.

• If you have any kind of diabetes, you should pay closer attention to your blood glucose control during periods of increased air pollution.

• If you are in an area persistently affected by smoke from bushfires, consider the possibility of moving to a location less impacted. However, any reduction in exposure is helpful even if you cannot completely avoid the smoke[5]. For further information refer to CAR fact sheet listed in additional resources below.

• If you are worried about exposure to air pollution during pregnancy, talk to your doctor or midwife.

While it is not always possible to avoid a short-term peak in air pollution, remember that it is the cumulative exposure throughout pregnancy that matters the most for your and your baby's health.

Additional resources

Smoke and air quality information (Bureau of Meterology, Australian Government) - http://www.bom.gov.au/catalogue/warnings/air-pollution.shtml

Land Air Water Aotearoa - https://www.lawa.org.nz/explore-data/air-quality/

Article (The Conversation) Pregnant women should take extra care to minimise their exposure to bushfire smoke

Centre for Air pollution, energy and health Research (CAR) fact sheets on bushfire smoke https://www.car-cre.org.au/factsheets

For more about indoor air pollution, see https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality

RANZCOG Best Practice statement: C-Obs 53 Smoking and pregnancy

Quit Australia: Pregnancy and Smoking resource

Smoke Free New Zealand: Health effects

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6. Howard J, Huang A, Li Z, Tufekci Z, Zdimal V, van der WesthuizenH-M, et al. An evidence review of face masks against COVID-19.Proceedings of the National Academy of Sciences. 2021;118(4):e2014564118.
7. Zielinska MA, Hamulka J. Protective Effect of Breastfeeding on the Adverse Health Effects Induced by Air Pollution: Current Evidence and Possible Mechanisms. Int J Environ Res Public Health. 2019;16(21).

Bushfire Resources

HealthDirect
https://www.healthdirect.gov.au/bushfires-and-your-health

South Australia
https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+inter net/public+health/bushfires/bushfire+smoke+and+your+health

Australian Capital Territory
https://health.act.gov.au/sites/default/files/2020-01/Outdoor%20Smoke%20-%20Health%20Impacts%20Factsheet%20-%20January%202020.pdf

New South Wales
https://www.health.nsw.gov.au/environment/air/Pages/bushfire-protection.aspx

Victoria
https://www.epa.vic.gov.au/for-community/environmental-information/air-quality/smoke

Queensland
https://www.qld.gov.au/health/staying-healthy/environmental/after-a-disaster/bushfires/bushfire-smoke-and-your-health

Tasmania
http://www.dhhs.tas.gov.au/publichealth/alerts/air/bushfire_smoke

West Australia
https://www.healthywa.wa.gov.au/Articles/S_T/Smoke-hazard-from-bushfires

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