

Review Article

A comprehensive study on Environmental Pollution and Pregnancy Outcomes

Abstract:

Vehicular traffic contributes significantly to pollution of air and the neighbourhood noise too. Since there is increasing affirmation that ambient air pollution has a negative impact on the reproductive health, which is less known regarding the relation between traffic noise and pregnancy outcomes. Vast number of researchers have investigated all the possible negative effects of ambient air pollution on birth outcomes during the last decade or so. We examined these studies, which were discovered by a thorough search of the major scientific databases. Overall, research suggests that air pollution and noise pollution have significant impact on the birth outcomes, while the quality of the deposition varies. Researchers utilised connected administrative health data sources to discover pregnancy outcomes with detailed covariate data (gender, contemporary lifestyle, total no of pregnancies, birth month and year, and so on), earnings and education, and mother housing history. They assessed noise exposure during pregnancy using neterministic model (CadnaA) and air pollutants exposure by assessing temporally adjusted land-use regression. Noise exposure is related to a reduced birth weight. We also looked into various processes for prevention of air Pollution as well as noise. As a result of policy change and technical innovation, the government, authorities, and industry have been in the forefront of combating pollution. Pollution levels in and around people's homes and workplaces are typically beyond their control. However, there are few things that may be done to mitigate the impacts of contaminated air.

Keywords: Air pollution, Noise pollution, Pregnancy, Public health challenges , preventive measures

Introduction:

Not only the vehicular traffic contribute to pollution of air, but it also contributes to residential noise.¹ Various studies have discovered connections in the air pollution and poor pregnancy outcomes in the previous decade. IUGR, low birth weight, early maturity, and congenital anomalies are all enhanced by maternal exposure to air pollutants during pregnancy.² An increase in stress and sleep disruption can be turn out as an adverse effect of noise exposure.³ Stress has been suggested to impact embryonic development via the endocrine system, a theory backed up both human⁴ and animal research. Sleep disruption has been attributed to lower pregnancy outcomes.⁵ In addition, there is a proof of an increased chance of hypertension in noise-exposed subjects⁶, which might raise the chance of a poor pregnancy outcome. outcomes.⁷ Cross-sectional occupational studies provide the majority of the evidence indicating a negative impact of noise on pregnancy outcomes.⁸ Occupational exposure of noise has been linked to gestational length and foetal growth in various studies.⁹ There is some data that suggests this is a possibility. There has been no data that proves a relation between residential aeroplane noise exposure and gestational length or birth weight, but there has been evidence that shows a relation between residential traffic noise exposure and birth weight.¹⁰ If there are any impacts of air pollution and noise on reproductive outcomes, they should be minor. Because of the broad scope of exposure and potential health implications of premature birth and LBW, if proved to be causative, their public health effect may be significant.¹¹ In a study of over 70,000 live deliveries in Vancouver, British Columbia, Canada, they have documented correlations between traffic-related exposure of air pollutants on mother during pregnancy and preterm delivery, small for gestational age, and low birth weight at fullterm.¹² In the same study, further research revealed correlations with term birth weight.¹³ Because transportation is a major source of air pollution and the noise too, the question emerges that whether there is a link between pregnancy and noise in this population, and if portion of the effects caused by pollution of air are actually because of noise exposure.

Although there is substantial affirmation that exposure to ambient air pollution during pregnancy is related with an elevated risk of intrauterine death and low birth weight, there is less evidence for links to preterm birth and stillbirth. Road traffic is responsible for air pollution, particularly in metropolitan areas and it also generates noise. Hypertension and cardiovascular outcomes are two adverse health consequences associated with road traffic noise that are independent of air pollution. As a result, noise may have an impact on preterm birth and stillbirth. Oxidative stress and systemic inflammatory responses to air

pollution, as well as stress responses to noise, are potential biological mechanistic pathways, leading to disrupted placental function and thus adverse birth outcomes. Ozone (O₃) is a secondary hazardous air pollutant whose distribution in urban areas is heavily impacted by traffic-related air pollution, because O₃ is titrated out by nitrogen oxide sources such as road traffic, and thus reduced.

Objectives:

- To provide general information about bad effects of air pollution during pregnancy
- To provide general information about bad effects of noise exposure during pregnancy
- To understand effects of noise and air pollution on the baby as well as on the mother
- To provide information about prevention of effect of air pollutants and noise pollution during pregnancy

Air Pollution Exposure Assessment:

Air pollution may influence health of both mother and the developing fetus. Contaminants present in the air can cross placenta, overwhelm the health of placenta and disrupting the fetus's development.

The specific impacts of air pollution which depends on several important factors, including:

- time and composition of exposure
- duration and quantity of pollutant exposure
- the type of the pollutant

Other variables may interfere with pollution to reduce or raise the danger. The majority of the studies concluded that those who are likely to be prone to congenital anomalies are also prone to reside in polluted regions. Other risk factors, including racism and a lack of supply of healthy food, secure housing and prenatal care, may exacerbate the consequences of exposure to air pollution for low-income or minority-group parents.

Air pollution comes in many forms and can be indoors or outdoors. Some types of air pollution include:

- smog pollution in the outdoors
- indoor and outdoor pollution from fire and smoke, such as cigarette smoke
- Dealing with hazardous substances, interacting with animals, and living/working in industrial environments are all examples of occupational risks.
- Asbestos and other household hazardous chemicals
- allergens, like mould,
- hazardous substances, like some cleaning liquids and paint

Various methods are used to estimate air pollution exposure by researchers.¹² Estimation of participants' home exposures to air pollutants related to traffic, such as black carbon, tiny particulate matter, nitrogen dioxide, and nitric oxide, using high-spatial-resolution land-use regression models can be done. Also, utilisation of regulatory monitoring network data for CO, PM, NO₂, and NO and assigned postal codes i.e. inverse distance (1/distance) average of 3 nearest monitors in 50 kilometres can be done.^{12,14} This method offers a higher temporal resolution (daily observations for the majority of days) but lower geographical resolution. After that, computing of road accessibility for residential postal codes to assess if a house postal code was within 50 metres of an expressway or major highway, road classifications is carried out.

The root of pollution-related preterm labor, according to some studies, might be mechanisms involving hazardous fine particles, such as "maternal hematologic distribution of inhaled hazardous chemicals, the activation of inflammatory action in the body, or changes in

autonomic nervous system function."Low birth weight can be caused by direct noxious effects from foetal exposure, impaired maternal cardiovascular or respiratory function, and generalised inflammation due to oxidative stress, whereas stillbirths can be affected by variations in oxygen distribution, DNA damage, or injury to placenta.¹⁵

Pregnant women who reside in polluted regions may have an elevated risk of preterm labour. Preterm labour raises the chance of additional complications, such as low birth weight, a baby's lungs being undeveloped, and the infant death during or shortly after birth.¹⁶ The investigations conducted by the researchers have revealed a correlation between air pollution and stillbirth.¹⁷

Noise Exposure Assessment:

Westman defined noise as "sound of high power and extreme frequency levels that is considered as annoying and can cause stress responses" in testimony before a government subcommittee on industrial noise. Furthermore, noise ranging in 60DB and 80DB is stressful, while noise levels above 80 decibels is harmful .

Because noise has the potential to have teratogenic effects on foetal development, human pregnancy research in a controlled laboratory environment is not viable. Pregnant women who are manifest to high amounts of sound in the surrounding area of their residency can be studied . Two of these investigations have been completed. Ando and Hattori's initial investigation was focused with plasma levels of placental lactogen in mother's placenta.¹⁸ The researchers analyzed the levels of HPL in women residing in a noisy environment to those who reside at a quiet environment. The women were in their 22nd to 41st wk of gestation at the time. The two populations had similar environmental circumstances, level of life, weather, and traffic conditions. The noise level near the airport ranged from 75 to 95 decibels, depending on the average highest noise level and the number of aircraft per day. Women residing in quiet area had HPL levels that were within normal limits, whereas women who lives in the noisy area had lower levels, especially after 30th wk of pregnancy; additionally, significant dissimilarities were found after 36th week, with lower intensities enough to consider as a danger to foetal support. Decreased birth weight babies were linked to lower HPL levels. These findings were in line with Ishii and Yokobori's animal research on low birth weight.¹⁹

Researchers utilised the first order noise modelling programme CadnaA to study community noise intensity levels at dwelling during all the trimesters of the pregnancy.²⁰ Road traffic information (e.g., road layout, traffic volume, speed restrictions, and road dimensions), railway data (e.g., kind of train, speed, and frequency), and building heights and footprints were used to determine noise exposure. Aircraft noise data was acquired from the Vancouver International Airport Authority's aircraft noise exposure predictions. On the basis of these data, Day-evening-night noise level (24-hour assessment, with evening and night manifestation penalised by 5db and 10 dB) was calculated for the gestational period and trimester normal noise levels (equivalent continuous noise) study is done.²¹ The average of all the 10 *10 meter grid values within the postal code borders (noise) and centroids of postal code were used to connect exposures to individuals via their six-character residence postal code. Because Vancouver is such a densely populated location, the great majority of postal codes correspond to limited geographic regions. A six-character postal code in an urban region generally symbolises high-rise constructions or one small part of a city block; in rural areas, it typically denotes a wider area. A postal code has around 35 people on average for this study. Researchers did not individually examine the impacts of noise manifestation at airports and railway stations, since railway stations and airports were small participants to total noise in this location. Gestational age and trimester wise average manifestations were computed as time-weighted values of averages for all places they resided throughout particular period for participants who changed residences. Because they moved from or to places outside of the noise exposure assessment area, several individuals had partly missing noise manifestation data. Noise levels were strongly linked across pregnancy periods (entire gestational period and trimesters) for every individual, as well as for those who altered.

Risk for having a SGA small for gestational age baby, gestational hypertension, and a newborn with congenital anomalies are all significantly increased in women manifested to high intensity noise levels during gestational period. For preeclampsia, fetal death, neonatal death, spontaneous abortion, and premature birth, the effect was not significant.

Health Outcomes:

Using vital statistics birth records, the birth weight and gestation period were calculated. Information on period of pregnancy is taken from the Birth certificate, which is depend on ultrasound at 20 weeks, in uncommon conditions (5 percent of pregnancies), like entry to

antenatal care after 20 weeks or ignorance to prenatal care; in uncommon conditions (5 percent of pregnancies), like entry to antenatal care after 20 weeks or ignorance to antenatal care, Information on period of pregnancy is taken from the Birth certificate, which is depend on ultrasound at 20 weeks; To assess the age of conception using ultrasonography, the most recent menstrual cycle was used. The key outcome factors in this study were premature birth (37 weeks pregnancy), moderately premature birth (30–36 weeks), and extremely preterm birth (30 weeks pregnancy). Full-term pregnant foetal weight (in grammes), underweight at birth (< 2,500 g), and foetal weight at delivery (in grammes) (in grammes) Growth is characterised by a small size for gestational age.

How To Prevent?

1. Air Pollution :

- When the quality of air is hazardous, such as at the time of wildfire, evacuate to a safer location.
- inspection of house for asbestos, and then consultation with an asbestos adviser to design a strategy to minimise the risk if required.
- To prevent carbon monoxide toxicity, installation of a carbon monoxide detector.
- examination of house for mould and, if required, employment of a professional mould remover.
- protection of face, When using cleaning chemicals or paint .
- not smoking indoors, and not allowing others to do so. Requesting smokers to change their clothes before entering the residence.
- To decrease indoor air pollution, install a highly-effective particle air filter.
- Avoid going out whenever high levels of air pollution is indicated. Many of the regional weather stations, particularly in polluted areas, report on daily air quality.
- Consult a medical practitioner for more advice on lowering the overall risk of pregnancy problems caused by air pollution.²²⁻²⁸

2. Noise pollution:

→Protect yourself from loud noise:

- If there is exposure to loud noise, use hearing protection (such as ear plugs)
- Adults' hearing can be damaged by noise levels of 85 decibels (dBA) or higher. To be heard by someone next to you at this volume, you'd have to raise your voice. The average workplace noise level is less than 95 decibels.
- While hearing protection will not protect fetus from loud noises, too much noise might stress out the pregnant woman . stress might induce physiological changes in pregnant women's body, which can have an impact on fetus
- awareness about the noise level at workplace.

→Protection of fetus from very loud noise:

- Hearing protection will not completely shield developing fetus's growing ears from noise. By the 20th week of pregnancy, a baby's ears are mostly formed, and fetus begin to respond to noises around the 24th week.
- experts believe that noise levels more than 115 dBA should not be frequently exposed to pregnant women. This is about the same decibel level as a chainsaw. Extremely loud environments (above 115 dBA) should be avoided as much as possible during pregnancy, even if hearing protection is worn.
- Very low frequency noises are those that pregnant women may feel as a rumble or vibration. We don't know if this noise affects developing fetus, but these noises travel readily through mothers body and can create changes in her body that may impact developing fetus. If at all possible, avoid this type of noise.
- Sudden loud noises (impact or impulse noise) should be avoided during pregnancy if they are loud enough to require hearing protection.
- Moving away from the noise , or ensuring to work in a calmer environment while pregnant.

Conclusion :

There is sufficient data to establish a link to relating particle pollution of air and pulmonary mortality in postnatal period. The evidence suggests a relationship in between pollution of air and weight of newborn, however further study is required. Although the data for preterm births and IUGR is inadequate to conclude causality, the current evidence supports additional research. Molecular epidemiology studies point to probable physiological pathways for effects on weight of newborn, preterm delivery, and Intra Uterine Growth Retardation, bolstering the case for a real link between pollution and these birth outcomes. Data base for birth abnormalities is still inadequate to suggest judgments. The findings for noise exposure match those for a greater risk of small for gestational age babies. They emphasise importance of noise manifestation in the home and at work for the development of gestational hypertension and, in particular, congenital abnormalities.

We recommend some study objectives based on the findings of this review. First, the effects on birth weight, preterm, and IUGR must be established as true and causative. Second, determining the most susceptible time of exposure during pregnancy is critical. Third, the contribution of various contaminants must be determined. Fourth, the biologic processes need to be clarified further. Fifth, with more attention being paid to entire human cycle, it will be fascinating to see if early manifestation and poor reproductive outcomes have any durable repercussions later in life. Finally, finding the most effective and cost effective equipment or procedures for avoiding adverse impacts of air pollutants and noise during gestational is critical.

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