



A Comprehensive Study on Environmental Pollution and Pregnancy Outcomes

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Vehicular traffic contributes significantly to the pollution of air and neighborhood noise. Since there is increasing affirmation that ambient air pollution hurts reproductive health, which is less known regarding the relationship between traffic noise and pregnancy outcomes. Many researchers have investigated all the possible adverse effects of ambient air pollution on birth outcomes during the last decade or so. We examined these studies, which were discovered by thoroughly searching the major scientific databases. Overall, research suggests that air pollution and noise pollution significantly impact birth outcomes, while the quality of the deposition varies. Researchers utilized 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. Using the deterministic model (CadnaA) and air pollutants exposure, they assessed noise exposure during pregnancy by assessing temporally adjusted land-use regression. Noise exposure is related to reduced birth weight. We also looked into various processes to prevent air pollution and noise. As a result of the policy change and technical innovation, the government, authorities, and industry have been at the forefront of combating pollution. Pollution levels in and around people's homes and workplaces are typically beyond their control. However, few things may be done to mitigate the impacts of contaminated air.

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1. INTRODUCTION

Vehicular traffic contributes to air pollution but also residential noise [1]. Various studies have discovered connections between 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 adversely affect noise exposure [3]. Stress has been suggested to impact embryonic development via the endocrine system, a theory backed up by both human [4] and animal research. Sleep disruption has been attributed to lower pregnancy outcomes [5]. In addition, there are proof of an increased chance of hypertension in noise-exposed subjects [6], which might raise the chance of a poor pregnancy outcome. Outcomes [7]. Cross-sectional occupational studies provide the most evidence indicating a negative impact of noise on pregnancy outcomes. In various studies, eight occupational noise composure has been linked to gestational length and fetal growth. Nine data suggest this is a possibility. There has been no data that prove the relation between residential airplane 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 air pollution and noise impact reproductive outcomes, they should be minor [8,9]. Because of the broad scope of exposure and potential health implications of premature birth and LBW, their public haleness effect may be significant if proved to be causative [10]. In a study of over 70,000 live deliveries in Vancouver, British Columbia, Canada, they have documented correlations between traffic-related exposure of air pollute mother during pregnancy and preterm delivery, small for gestational age, and low birth weight at full term [11]. In the same study, further research revealed correlations with term birth weight [12]. Because transportation is a significant source of air pollution and noise too, the question emerges that whether there is a link between pregnancy and noise in this population, and if a portion of the effects caused by pollution of air is actually because of noise exposure [13,14].

Although there is a powerful affirmation that exposure to ambient air pollution during pregnancy is related to 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, ants generate noise. Hypertension and cardiovascular outcomes are two adverse health consequences of road traffic noise independent of air pollution. As a result, noise may impact Preterm birth and stillbirth. Oxidative stress and systemic inflammatory responses to air pollution and 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 the traffic-related air pollution because O₃ is titrated out by nitrogen oxide sources such as road traffic and thus reduced.

1.1 Objectives

- To provide general information about harmful effects of air pollution during pregnancy
- To provide general information about harmful 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

2. AIR POLLUTION EXPOSURE ASSESSMENT

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

The specific impacts of air pollution depend 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 healthy food

supply, 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 mold,
- hazardous substances, like some cleaning liquids and paint

Various methods are used to estimate air pollution exposure by researchers [11]. 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, utilization 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 kilometers, can be done [11,15]. This method offers a higher temporal resolution (daily observations for most days) but lower geographical resolution. After that, road classifications are carried out by computing road accessibility for residential postal codes to assess if a postal house code was within 50 meters of an expressway or major highway.

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 the body, or changes in autonomic nervous system function." Low birth weight can be caused by direct harmful effects from fetal exposure, impaired maternal cardiovascular or respiratory function, and generalized inflammation due to oxidative stress, whereas stillbirths can be affected by variations in oxygen distribution, DNA damage, or injury to the placenta [16].

Pregnant women living in polluted regions may have an elevated risk of preterm labor. Preterm

labor raises the chance of additional complications, such as low birth weight, a baby's lungs being undeveloped, and infant death during or shortly after birth [17]. The investigations conducted by the researchers have revealed a correlation between air pollution and stillbirth [18].

3. NOISE EXPOSURE ASSESSMENT

Westman defined noise as "sound of high power and extreme frequency levels that are considered 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 are harmful.

Because noise can negatively affect fetal development, human pregnancy research in a controlled laboratory environment is not viable. Pregnant women who are manifest 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 focused on plasma levels of placental lactogen in the mother's placenta [19]. The researchers analyzed the levels of HPL in women residing in a noisy environment to those who reside in a quiet environment. The women were in their 22nd to 41st wk of gestation. 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 the quiet area had HPL levels that were within normal limits, whereas women who lived in the noisy area had lower levels, especially after the 30th wk of pregnancy; additionally, significant dissimilarities were found after the 36th week, with lower intensities enough to consider as a danger to fetal 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 [20].

Researchers utilized the first-order noise modeling program 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. Based on these data, Day-evening-night noise level (24-hour assessment, with evening and night manifestation penalized 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 was used to connect exposures to individuals via their six-character residence postal code. Because Vancouver is densely populated, most postal codes correspond to limited geographic regions. A six-character postal code in an urban region generally symbolizes high-rise constructions or a small part of a city block; it typically denotes a broader area in rural areas. 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 manifestation statistics were computed as time-weighted averages for all places they resided for participants who changed residences throughout a particular period. Several individuals partly missed manifestation noise data because they moved from or to places outside of the noise exposure assessment area. Noise levels were strongly linked across pregnancy periods (entire gestational period and trimesters) for every individual, as well as for those who altered.

The risk for having an 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 the gestational period. The effect was insignificant for preeclampsia, fetal death, neonatal death, spontaneous abortion, and premature birth.

4. HEALTH OUTCOMES

The birth weight and gestation period were calculated using vital statistics birth records. Information on the period of pregnancy is taken from the Birth certificate, which depends on ultrasound at 20 weeks, in uncommon conditions (5 percent of pregnancies), as 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 depends on ultrasound at 20 weeks; To assess the age of conception using ultrasonography, the most recent menstrual cycle was used. The critical 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 fetal weight (in grams), underweight at birth (< 2,500 g), and fetal weight at delivery (in grams) (in grams). Small size for gestational age characterizes growth.

5. HOW TO PREVENT?

5.1 Air Pollution

- When air quality is hazardous, such as at the time of wildfire, evacuate to a safer location.
- Inspect the house for asbestos and then consult with an asbestos adviser to design a strategy to minimize the risk if required.
- To prevent carbon monoxide toxicity, the installation of a carbon monoxide detector.
- Examination of the house for mold and, if required, employment of a professional mold 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 are indicated. Many regional weather stations, particularly in polluted areas, report daily air quality.
- Consult a medical practitioner for more advice on lowering the overall risk of pregnancy problems caused by air pollution [22-28].

5.2 Noise Pollution

→Protect yourself from loud noise:

- If there is exposure to loud noise, use hearing protection (such as earplugs)
- Adults' hearing can be damaged by 85 decibels (dBA) or higher noise levels. 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 the fetus from loud noises, too much noise might stress pregnant women. Stress might induce physiological changes in pregnant women's bodies, impacting fetus
- awareness about the noise level at the workplace.

→Protection of fetus from deafening noise:

- Hearing protection will not wholly shield the developing fetus's growing ears from the noise. By the 20th week of pregnancy, a baby's ears are mainly formed, and the fetus begins to respond to noises around the 24th week.
- Experts believe that noise levels of 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 like a rumble or vibration. We don't know if this noise affects the developing fetus, but these noises travel readily through mothers' bodies and can create changes in her body that may impact the 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 work in a calmer environment while pregnant.

6. CONCLUSION

There is sufficient data to link to relating particle pollution of air and pulmonary mortality in the postnatal period. The evidence suggests a relationship between pollution of air and weight of newborns; 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 potential physiological pathways for effects on newborn weight, preterm delivery, and Intra-Uterine Growth Retardation, bolstering the case for an actual link between pollution and these birth

outcomes. Database 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 emphasize the importance of noise manifestation in the home and at work for developing 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 valid 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 biological processes need to be clarified further Fifth, with more attention being paid to the 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.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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