ABSTRACT

Background: Low birth weight has been associated with many negative health outcomes which pose a burden on the infant, the family of the infant, and the healthcare system. Identifying possible exposures and risk factors is a crucial step in helping to establish preventative measures.

Objective: The objective of this literature review was to determine if there is an association between prenatal exposure to air pollution and decreased birth weight (LBW) or low birth weight (DBW).

METHODS: This literature review utilized several online databases to collect research articles. After applying exclusion criteria and removing duplicates, only 30 articles were reviewed.

RESULTS: A majority of the 30 articles reviewed supported the positive relationship of prenatal exposure to air pollution with LBW and DBW. Most of the pollutants studied have shown a positive association to both LBW and DBW across multiple studies. These studies include PM₂.₅, PM₁₀, CO, NOₓ, SO₂, and NOₓ. Other studies found an insignificant relationship or no relationship between prenatal exposure to air pollution and LBW or DBW.

Conclusions: There is a general consensus in the literature that prenatal exposure to air pollution is associated with both LBW and DBW. This is a finding that should fuel future interventions and policy development.

INTRODUCTION

Research Question

What is the relationship between exposure to air pollution and low birth weight? Specifically, are there certain pollutants that are linked to an increased likelihood of low birth weight?

Background and Rationale

Many recent studies have shown a link between exposure to air pollution and likelihood of decreased or low birth weight (LBW). LBW has been associated with negative outcomes. For instance, low and very low birth weight has been associated with many complicating conditions such as central policy (Stanski, 2003; Cristiano & Ogilvie, 2008) respectively. LBW infants have more difficulty reaching developmental milestones which was concluded to be a predictor of emotional and behavioral problems in childhood and adolescence (Lu, Sun, Nederbitzer, Uchiyama, & Chen, 2002). The incidence of LBW babies is increasing. In 2004, 8.1% of all newborns in the U.S were LBW, the highest rate reported since 1989. This was also a 16% increase from 1990 (Martin et al., 2000). This increasing rate is important to consider when examining the cost of LBW. The costs associated with LBW create a large burden on the healthcare system. LBW infants average $15100, with an average length of stay of 12.9 days compared to $600 and 1.9 days for uncomplicated newborns (Letz et al., 2007). This can pose many problems for the healthcare system.

Study Design

A structured literature review was carried out to assess the relationship between prenatal exposure to air pollution and LBW and DBW. The study focused on the databases that were “prenatal exposure air pollution” and “low birth weight”.

Search Strategy

Four major databases were searched to collect the relevant literature addressing this relationship. These databases include: PubMed, CINAHL (Ebsco), Scopus and Web of Science. The search terms used to locate articles in the databases were “prenatal exposure air pollution” and “low birth weight.”

Exclusion Criteria

The first set of exclusion criteria was as follows:

- Studies not published in English, qualitative studies, editorials, expert opinions, and articles not accessible online.
- The second set of exclusion criteria:
  - Concerning smoking or tobacco exposure, articles concerning indoor air pollution, and articles concerning preterm birth or adverse birth outcomes without specifically evaluating LBW or DBW.

RESULTS

Among the 30 articles, there were 12 air pollutant categories that were assessed for each article. The 12 categories were PM₂.₅, (particulate matter 2.5 microns in diameter or less), PM₁₀, (particulate matter 10 microns in diameter or less), CO, NOₓ, SO₂, Hydrocarbons, NOₓ, NO₂, O₃, TAP (traffic air pollution), PWF (pollution from wildfires), and BC (black carbon). These are pollutants that appeared in the selected 30 articles. For each article and pollutant, the relationship was assessed as POS (positive association between exposure and LBW/DBW). NOD (no association between exposure and LBW/DBW) or NUA (not applicable) if there was no indication of the specific pollutant or air pollution in that particular study.) In total, 16 articles assessed LBW as an outcome and 14 articles focused on DBW.

- Since 12 pollutants were evaluated for all 30 studies a total of 360 relationships were assessed. 192 of these relationships were assessed for LBW (16 articles x 12 pollutants)
- 168 relationships were assessed for DBW (14 articles x 12 pollutants)

Figure 1 illustrates the positive association between LBW and exposure to the five significant pollutants previously mentioned (PM₂.₅, PM₁₀, NOₓ, SO₂, and CO) and the most frequently assessed pollutants that had an association to LBW and DBW.

As shown in Figure 3, there were many positive associations between exposure to the five significant pollutants previously mentioned (PM₂.₅, PM₁₀, NOₓ, SO₂, and CO) and DBW. Additionally, there was a moderate positive association with both O₃ and DBW.

CONCLUSION

- There were few instances in where a negative association between LBW/DBW and pollutant exposure was observed. These outliers were often contradicted by other studies.
- A common limitation between most studies was the assumption that maternal residence did not change during pregnancy. Data on residential mobility for most study subjects was not available to assess the extent to which this assumption is true.
- In the case of air pollution, a clear and understandable description of exposure creates some particular difficulties as the data collected depends exclusively on outdoor measurements of pollutants. But, such measurements are subject to biases because most people spend much more of their time indoors than out, and air pollutant concentrations are much higher outside than indoors (Sperling, Letz, & Sexton 1983). In addition, available evidence indicates that personal exposure to many pollutants is not adequately characterized because the time people spend in different locations and their activities vary dramatically with age, gender, occupation, and socioeconomic status (Sperling, Letz, & Sexton 1983). Accurate estimates of human exposure to inhaled air pollutants are necessary for a realistic assessment of the risks of these pollutants, and for the design and implementation of effective strategies to control and limit these risks. Except in occupational settings, such estimates are usually based on measurements of pollutants concentrations in outside (ambient) air, recorded with outdoor fixed-site monitors (Watanabe, Bales & Kennedy, 1988).
- Lastly, limitations of our literature review limited resources (ex. Time), generalization (if the pollutants affected any specific trimester, it was not specified, just categorized as positive association).

- After looking at studies on improving air pollution control policies, recycling, composting and landfilling, seems to be an effective solution for dealing with municipal solid waste (MSW). A major environmental problem globally in Vietnam is to decrease air pollution. It is also environmentally friendly (Bai & Vlajouy, 2015).

- Similarly, to mitigate serious air pollution, the State Council of China propagated the cost-effective Air Pollution Prevention and Control Action Plan in 2013 (Central Government of China, 2016). First, an evaluation of air pollution and the emissions of multiple pollutants. Second, adjusting and optimizing industrial structure and promoting upgrade of economic transition. Third, speeding up technological reform of enterprises and improving the capability of scientific and technological innovation. Finally, quickening the step to adjust energy structure and increase the supply of clean energy. These findings may have significant implications for improving China’s air pollution control policy. By using these methods and implementing them all over the world, overall air quality can be improved.

- Likewise, local initiatives can be taken. This may include setting tolls throughout cities to encourage car pooling or the use of public transportation. This can help decrease motor vehicle emissions. Similarly, as previously mentioned, recycling is also a very easy and cost-effective method in decreasing air pollution and municipal solid waste.

REFERENCES


