



Association of outdoor air pollution and indoor renovation with early childhood ear infection in China



Qihong Deng ^{a, b, *}, Chan Lu ^a, Wei Jiang ^a, Jinping Zhao ^a, Linjing Deng ^a, Yuguang Xiang ^a

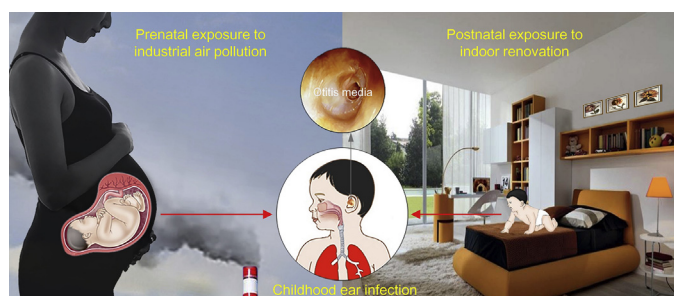
^a School of Energy Science and Engineering, Central South University, Changsha, Hunan, China

^b XiangYa School of Public Health, Central South University, Changsha, Hunan, China

HIGHLIGHTS

- Otitis media (OM) is a common infection in children but its risk factors still remain unclear.
- We examined key air pollutants and critical exposure windows in the development of OM.
- Both outdoor and indoor air pollutants were significantly associated with OM onset.
- Prenatal outdoor exposure and postnatal indoor exposure were associated with childhood OM.
- Combined exposure to indoor and outdoor air pollution significantly increased OM risk.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 31 October 2016

Received in revised form

13 November 2016

Accepted 15 November 2016

Handling Editor: Shane Snyder

Keywords:

Ambient air pollution

Home renovation

Indoor air pollution

Otitis media

Postnatal

Prenatal

ABSTRACT

Background: Otitis media (OM) is a common infection in early childhood with repeated attacks that lead to long-term complications and sequelae, but its risk factors still remain unclear.

Objective: To examine the risk of childhood OM for different indoor and outdoor air pollutants during different timing windows, with a purpose to identify critical windows of exposure and key components of air pollution in the development of OM.

Methods: We conducted a retrospective cohort study of 1617 children aged 3–4 years in Changsha, China (2011–2012). Children's life-time prevalence of OM and exposure to indoor air pollution related to home renovation activities were surveyed by a questionnaire administered by the parents. Children's exposure to outdoor air pollution, including nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and particulate matter with an aerodynamic diameter ≤ 10 μm (PM₁₀), was estimated using the measured concentrations at municipal monitoring stations. The odds ratio (OR) and 95% confidence interval (CI) of childhood OM for prenatal and postnatal exposure to indoor and outdoor air pollution were examined by using logistic regression model.

Results: Life-time prevalence of OM in preschool children (7.3%) was associated not only with prenatal exposure to industrial air pollutant with adjusted OR (95% CI) = 1.44 (1.09–1.88) for a 27 μg/m³ increase in SO₂ but also with postnatal exposure to indoor renovations with OR (95% CI) = 1.62 (1.05–2.49) for new furniture and 1.81 (1.12–2.91) for redecoration, particularly in girls. Combined exposure to outdoor SO₂ and indoor renovation significantly increased OM risk. Furthermore, we found that exposure to

* Corresponding author. School of Energy Science and Engineering, Central South University, Changsha, Hunan, China.

E-mail address: qhding@csu.edu.cn (Q. Deng).

outdoor SO₂ and indoor renovation were significantly associated with the onset but not repeated attacks of OM.

Conclusion: Prenatal exposure to outdoor industrial air pollution and postnatal exposure to indoor renovation are independently associated with early childhood OM in China and may cause the OM onset.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Otitis media (OM), commonly called air infection, ranked fifth on the global burden of disease and affected 1.23 billion people in 2013 (Vos et al., 2015). It is one of the most common causes of physician visits among preschool children: More than 80% of children will develop acute OM at least once before 3 years of age and 40% will have six or more recurrences by age 7 (Vergison et al., 2010). OM is a frequent respiratory infection in early childhood and has long-term complications and sequelae, such as hearing loss, development of atopic diseases, and impairment of language and cognitive abilities in later life (Bennett et al., 2001; Niclasen et al., 2016), that not only have a crippling effect on child's development and quality of life but also significant economic and social burdens on child's family and the healthcare (Grindler et al., 2014; Rovers et al., 2004). Therefore, there is a critical need to investigate the main risk factors of OM so as to provide more effective preventative and treatment strategies for OM and its complications and sequelae.

OM is a complex disease involving multiple genetic and environmental factors (Daly et al., 2010). Although genetic predisposition strongly influences the risk of OM (Casselbrant et al., 1999), air pollution has been shown to be a significant risk factor for the development of OM (Heinrich and Raghuyamshi, 2004). Outdoor air pollution has been observed to be linked with childhood OM incidence (Brauer et al., 2006; Heinrich and Raghuyamshi, 2004; Zemek et al., 2010). Recent epidemiologic studies in developed countries have reported significant associations of the prevailing traffic-related air pollution (TRAP) with childhood OM, either between short-term exposure and emergency department visits for ear infections or between long-term exposure and physician diagnosis of OM (Brauer et al., 2002, 2006, 2007; Kousha and Castner, 2016; MacIntyre et al., 2014; Zemek et al., 2010). With the rapid economic growth and accelerating urbanization in the past decades, China has experienced increasingly severe level and complicated structure of ambient air pollution, combining the world worst classic industry-related air pollution (IRAP) and the rapid worsening TRAP (Kan et al., 2012). However, there is a lack of studies in China whether the strikingly high level and complex mixture of air pollution is associated with childhood OM. Only one recent time-series study in Beijing (Zhang et al., 2015) found that daily concentrations of ambient air pollutants, both NO₂ (a marker of TRAP) and sulphur dioxide (SO₂, a marker of IRAP), were associated with numbers of outpatient visits for otolaryngology including ear infections. Difference in the level and type of ambient air pollution between China and developed countries prompts the need for further investigation into the role of outdoor air pollution in the development of childhood OM.

Indoor air pollution may have a greater impact than outdoor air pollution because children spend 90% of their time indoors (Nazaroff and Goldstein, 2015; Zhang and Smith, 2003). With the rapid economic growth and accelerating urbanization in recent years, a huge amount of Chinese people have moved into new houses with redecoration and new furniture, particularly for the new couples and expected parents. The new house and home

renovation have become a major source of indoor air pollution and their impact on the health of children who was born or will be born is an increasing concern in China (Gao et al., 2014). However, the childhood OM risk of indoor air pollution generated by renovation has never been investigated. So far, of particular relevance to a possible association between indoor environmental factors and childhood OM is the environmental tobacco smoke (ETS) exposure as a risk factor (Håberg et al., 2010; Ilicali et al., 2001; Jones et al., 2012).

Of particular note, it still remains unclear the critical timing window for the effect of exposure to environmental factors on childhood OM. Although early postnatal exposure to air pollution has been found to be associated with the increased risk of childhood OM (Brauer et al., 2002, 2006, 2007; MacIntyre et al., 2014), early life exposure to air pollution during pregnancy has recently attracted considerable attention (Backes et al., 2013; Deng et al., 2015, 2016a,b), as it may influence developmental plasticity and result in altered fetal programming that leads to later development of a variety of diseases (Gluckman et al., 2008). However, the effect of prenatal exposure to air pollution on childhood OM has been scarcely addressed (Aguilera et al., 2013; Jedrychowski et al., 2005).

In this study, we comprehensively examined the early childhood OM risk effect of different air pollutants during different exposure timing windows, so as to identify the susceptible windows of exposure and key components of air pollution in the development of OM. Accordingly, we hypothesized that childhood OM was associated with exposure to both outdoor and indoor air pollutants during prenatal and postnatal periods. To test the hypothesis, we carried out an investigation in a retrospective cohort study in Changsha, a part of nationwide multi-center "China-Children-Homes-Health (CCHH)" study (Deng et al., 2015; Zhang et al., 2013).

2. Methods

2.1. Study population

Between September 2011 and January 2012, we conducted a survey for childhood respiratory health in the kindergartens in Changsha, the capital city of Hunan Province in south-central China, having a population of 7.22 million and covering an area of 1909 km² (Fig. 1). The study protocol was approved by the Ethics Committee of Central South University and also by the health department of each kindergarten. We used a self-administered Chinese questionnaire that combined the standard questionnaire designed by the International Study of Asthma and Allergies in Childhood (ISAAC) (Asher et al., 2006) and a Swedish questionnaire about dampness in buildings and health (DBH) (Bornehag et al., 2004) to collect information on health status, exposure to indoor environment risk factors, and lifestyles of the children and their family members. A total of 4988 questionnaires were randomly distributed to the children at 36 participating kindergartens (Fig. 1). Children were instructed to have the questionnaire completed by their parents and to return it to kindergartens within one week.

We received 3897 completed questionnaires and the overall

Download English Version:

<https://daneshyari.com/en/article/5747016>

Download Persian Version:

<https://daneshyari.com/article/5747016>

[Daneshyari.com](https://daneshyari.com)