# Systematic Literature Review of Indoor School Exposure to $PM_{2.5}$ in Children

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## STUDY QUESTION

*Does exposure to indoor PM 2.5 in school children increase the risk of asthma or worsen existing asthma in children already diagnosed?*

## PECO STATEMENT

**Population:** School aged Children 5-18

**Exposure:** Indoor $PM_{2.5}$ air pollution in schools

**Comparator:** Children in schools with less indoor $PM_{2.5}$ exposure

**Outcome:** Asthma

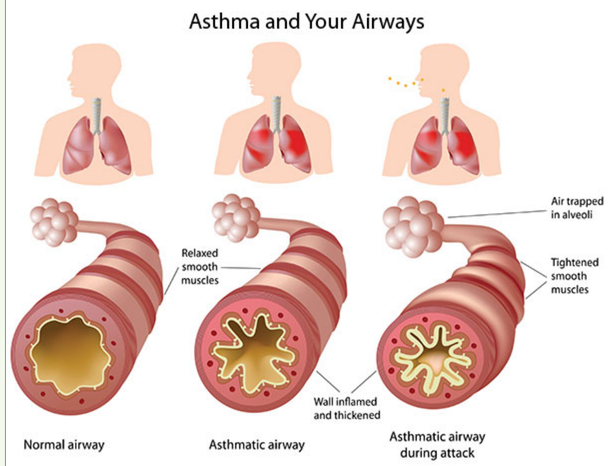
## BACKGROUND, OBJECTIVES & METHODS

**BACKGROUND:** Air pollution in schools effects a vulnerable population who are indoors for large amounts of their daily schedule.

**OBJECTIVES:** I conducted a systematic literature review regarding indoor school exposure to indoor PM2.5 (Particulate Matter) and asthma prevalence in children.

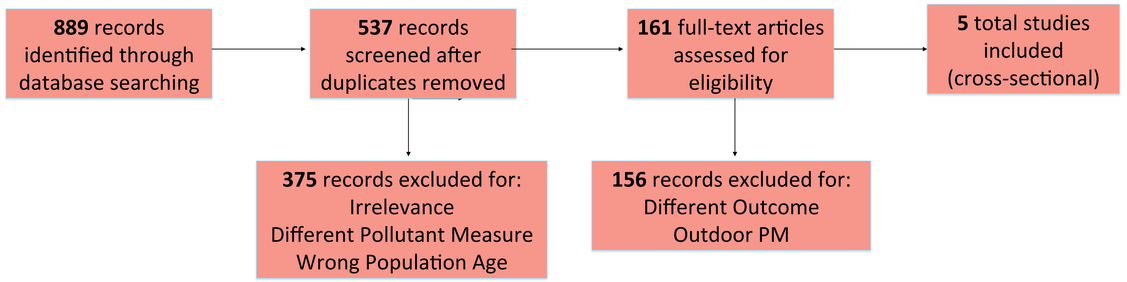
**METHODS**: I searched articles published between 1 January 2002 and 15 September 2017, and included original studies that assessed indoor school exposure $PM_{2.5}$ in school children. I evaluated the risk of bias of individual studies and the overall quality and strength of the evidence according to the Navigation Guide systematic review methodology. I established criteria a priori to identify studies that could be included for synthesis.

## Pathology of Asthma



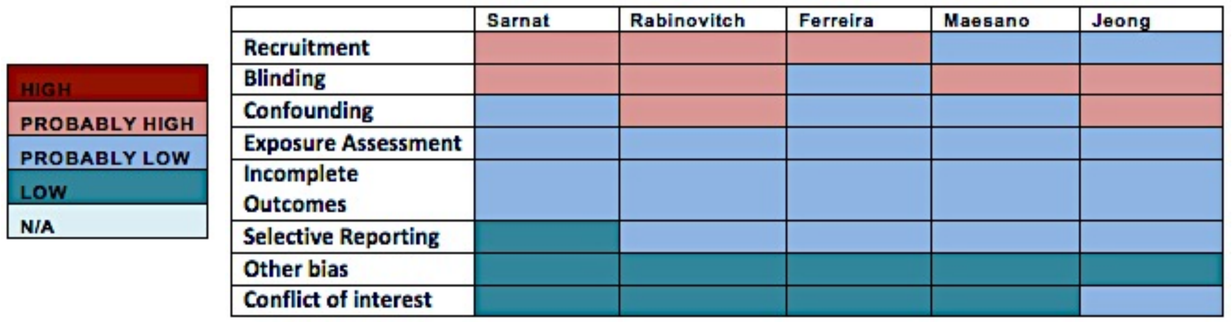

## METHODS

**Systematic Search and Study Selection Process using the Navigation Guide**




## RESULTS

**Risk of Bias Heat Map**




*Generally **Probably Low Risk of Bias** for each individual study and across studies as a whole

**Summary & Comparison of Methods/ Results**

| Source | Location | (n) | Age | Exposure measure | Outcome measure | Results |
|---|---|---|---|---|---|---|
| Sarnat | Texas, USA & Mexico | 58 | 6-12 y/o | 48 hour samplings via Harvard cascade impactors | eNO- exhaled nitric oxide (biomarker or airway inflammation) | With increased $PM_{2.5,}$ there was a 2.7% (CI 1.4, 3.9) change in eNO |
| Rabinovitch | Colorado, USA | 30 | 7-13 y/o | Continuous active personal aerosol nephelometer monitor, 4 day intervals | uLTE-urine samples to measure outcome, Doser-albuterol usage monitor and surveys | Increase of 5 µg/ m3 of $PM_{2.5}$ resulted in 13.3% (CI -5.7, 36.0) increase in albuterol use and LTE4 levels by 10.6 -9.0, 34.4) on lag day 0 |
| Ferreira | Portugal | 1019 | 6-10 y/o | 30 minutes VelociCalc 9555-P | Questionnaire | Prevalence of asthma was 11.8% in study population; no significant association with exposure |
| Maesano | France | 4643 | 9-10 y/o | 5 day intervals using filter-based samples | Skin prick test, exercise-induced asthma and questionnaire | OR 1.28 (CI 1.00, 1.65) $PM_{2.5}$ and asthma; OR 1.41 (CI 1.16, 1.73) $PM_{2.5}$ and allergic asthma |
| Jeong | Korea | 1226 | 8-10 y/o | GT-331 monitor | Skin prick test, questionnaire | Prevalence of asthma not significant (13.13% Incheon, 13.38% in Jeju); Prevalence of wheezing in Incheon 24.96 and Jeju 18.80 which was significant (higher PM2.5 in Incheon) |

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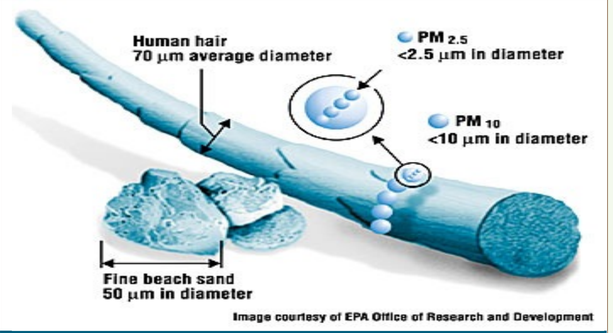
## Particulate Matter




## DISCUSSION

**DISCUSSION**: Five studies met the complete inclusion criteria. I rated studies generally with probably low risk of bias and rated the overall body of evidence as moderate quality with limited evidence. I concluded the body of evidence was of moderate quality for asthma with limited evidence for an association of asthma with $PM_{2.5}$. Chance, bias, and confounding could not be ruled out with reasonable confidence (Lam et al 2017).

**CONCLUSIONS**: I concluded there was limited evidence supporting an association between indoor school $PM_{2.5}$ exposure and increased prevalence of asthma. Preventing childhood asthma could help prevent loss of missed school and increased respiratory health over a lifetime.

## NEXT STEPS

Future research focusing on the indoor environments, particularly schools, in Industrialized nations. Further exploration of asthma as an outcome of poor indoor air quality needs to be better understood and documented.

## REFERENCES

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2. Jeong, S. H., et al. (2011). Comparison of air pollution and the prevalence of allergy-related diseases in Incheon and Jeju city. *Korean Journal of Pediatrics, 54*(12), 501-506. Retrieved from SCOPUS database.
3. Maesano, I., et al. (2012). Poor air quality in classrooms related to asthma and rhinitis in primary schoolchildren of the French 6 cities study. *Thorax, 67*(8), 682-688.
4. Rabinovitch, N. et al., (2016). Within-microenvironment exposure to particulate matter and health effects in children with asthma: A pilot study utilizing real-time personal monitoring with GPS interface. *Environmental Health: A Global Access Science Source, 15*(1), 1-10.
5. Sarnat, S. E., et al. (2012). Air pollution and acute respiratory response in a panel of asthmatic children along the U.S.-Mexico border. *Environmental Health Perspectives, 120*(3), 437-444.
6. Pic 1: http://pedilung.com/pediatric-lung-diseases-disorders/asthma/
7. Pic 2: ttps://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM

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