Air Pollution Exposure and Head and Neck Cancer Incidence

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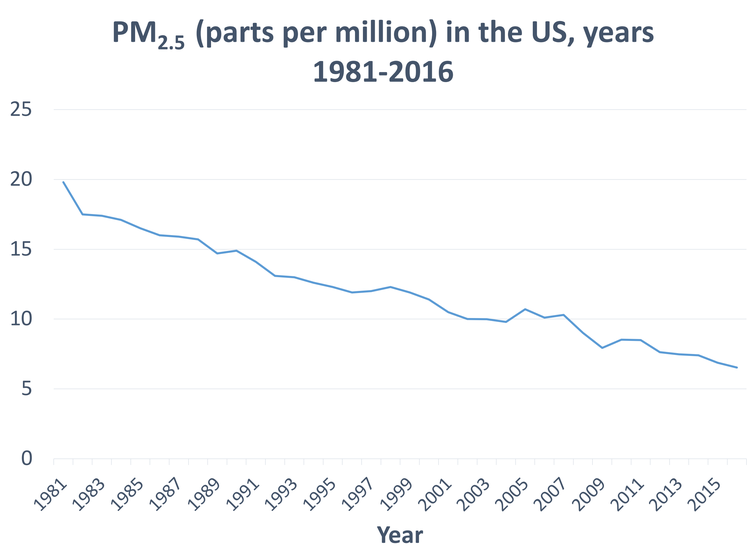
OBJECTIVES

- Identify the association between air pollution as measured by $PM_{2.5}$ and the incidence of head and neck cancers.
- Delineate subsites of the upper aerodigestive tract affected by $PM_{2.5}$
- Analyze the time dependent relationship of air pollution on head and neck cancer incidence using lag models.

INTRODUCTION

- It is well-documented that compounds present in air pollution with a particle diameter less than 2.5 microns ($PM_{2.5}$) have carcinogenic properties.[1,2] Long-term exposure to $PM_{2.5}$ has been linked to higher incidence and mortality rates of lung cancer, particularly in non-smokers. [1,3-6] Therefore, it is not surprising that the International Agency for Research on Cancer (IARC) has classified air pollution, particularly $PM_{2.5}$, as a causal agent (Group 1 carcinogen) for lung cancer.[1]
- Data linking air pollution and head and neck cancer incidence are more limited. Recent studies have associated $PM_{2.5}$ exposure with selected cancer incidence including oral cancer, on a United States (US) county level with various lag models up to 15 years.[7] However, site-specific incidence relationships to air pollution are still lacking.
- This work seeks to identify the association between air pollution as measured by $PM_{2.5}$ and the incidence of head and neck cancers. We use cancer registry data focusing on overall and site-specific incidences of head and neck cancer and appropriate lag models.



METHODS

- The relationship between US county mean $PM_{2.5}$ levels and head and neck cancer incidence rate was examined using an additive mixed model. Lagged effect of the pollutant's effect on head and neck cancer incidence was analyzed.

RESULTS

Variable	Statistics
PM $_{2.5}$ average concentration ($\mu g/m^3$), median (IQR)	9.51 (7.85-11.4)
Female%, median (IQR)	50.6% (49.9% - 51.3%)
Age	
% over 65 years old, median (IQR)	23.1% (21.5% - 25.0%)
% under 18 years old, median (IQR)	16.0% (13.7% - 18.6%)
Race	
White (%), median (IQR)	91.2% (72.5% - 97.2%)
Black (%), median (IQR)	4.1% (1.0% - 22.7%)
Hispanic (%), median (IQR)	3.2% (1.6% - 8.5%)
Smoker%, median (IQR)	19.8% (16.5% - 22.8%)
Binge Drinking, median (IQR)	14.5% (11.6% - 18.7%)
Median Income, median (IQR)	55,500 (46,800 - 66,000)
Population, median (IQR)	24,100 (12,900 - 73,500)

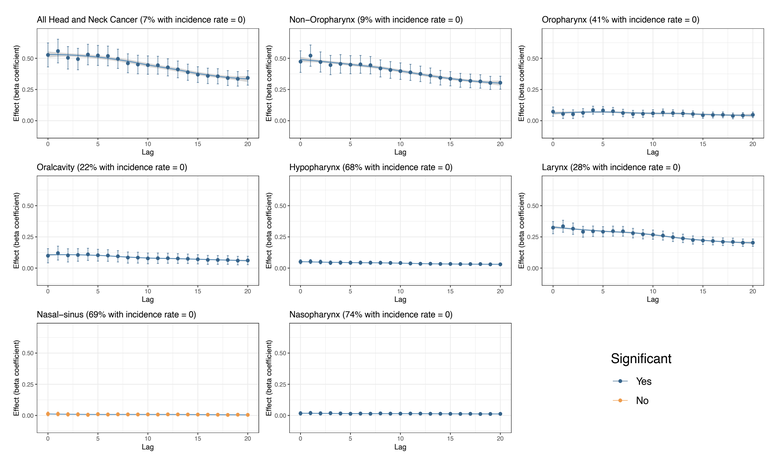


Figure 1. **PM2.5 pollution effect on Head and Neck Cancer incidence and by subsite, unadjusted for covariates.** Lag: years. Blue denotes statistical significance and orange denotes insignificant effect.

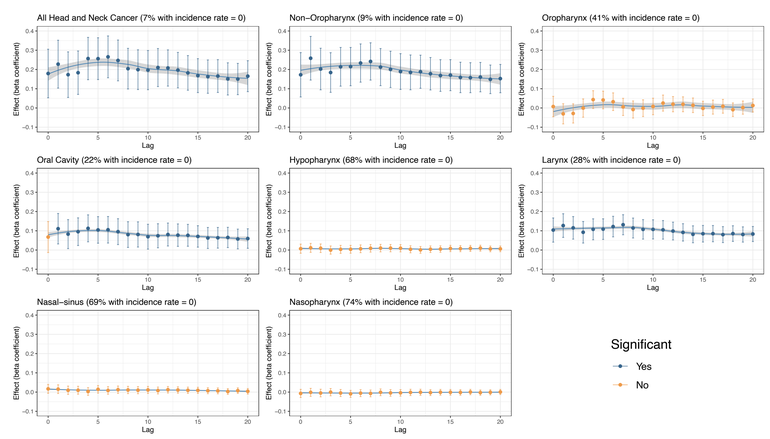
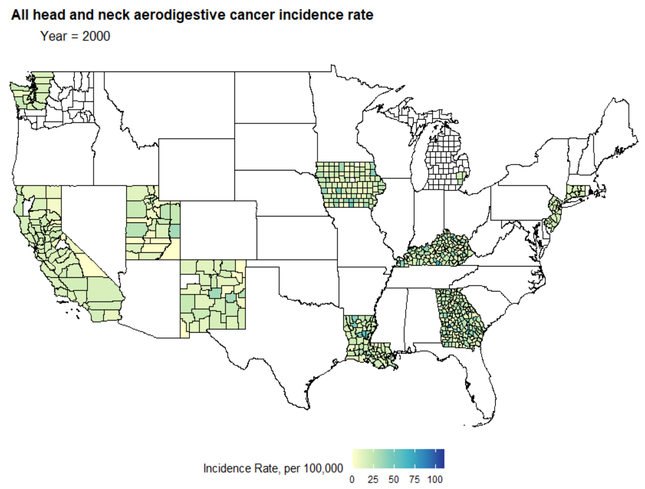


Figure 2. **PM2.5 pollution effect on Head and Neck Cancer incidence and by subsite, adjusted for covariates.** Lag: years. Blue denotes statistical significance and orange denotes insignificant effect.



CONCLUSIONS

- There is a significant associated between $PM_{2.5}$ levels and the incidence of head and neck cancer, with the strongest correlation at a 5-year lag period ($\beta = 0.25$, p-value < 0.01). The association was also significant at no lag ($\beta = 0.18$, p-value <0.01) and up to a 20-year lag period ($\beta = 0.16$, p-value <0.01).
- Head and neck cancer incidence overall and by subsite including combined non-oropharyngeal sites, oral cavity, and laryngeal cancer incidence are associated with increased exposure to PM2.5 pollution at various time intervals.
- The effects were most pronounced 5 years after exposure to PM2.5.
- This study supports the increasing body of literature on environmental health and the importance of strong air quality standards in decreasing the risk of various cancers, including head and neck cancer.

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