Environmental Exposures and Inflammatory Bowel Disease in Childhood

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Background

- Inflammatory bowel diseases (IBD) affect >1.4 million individuals in the United States and often present in adolescence.
- The pathophysiology of IBD involves individual, genetic, and environmental factors.
- Environmental exposures, notably air pollution and weather, have been suggested to contribute to IBD disease activity.
- There is increasing access to health-related data sources to enable data sharing and integration to learn new perspectives on health.

Objective

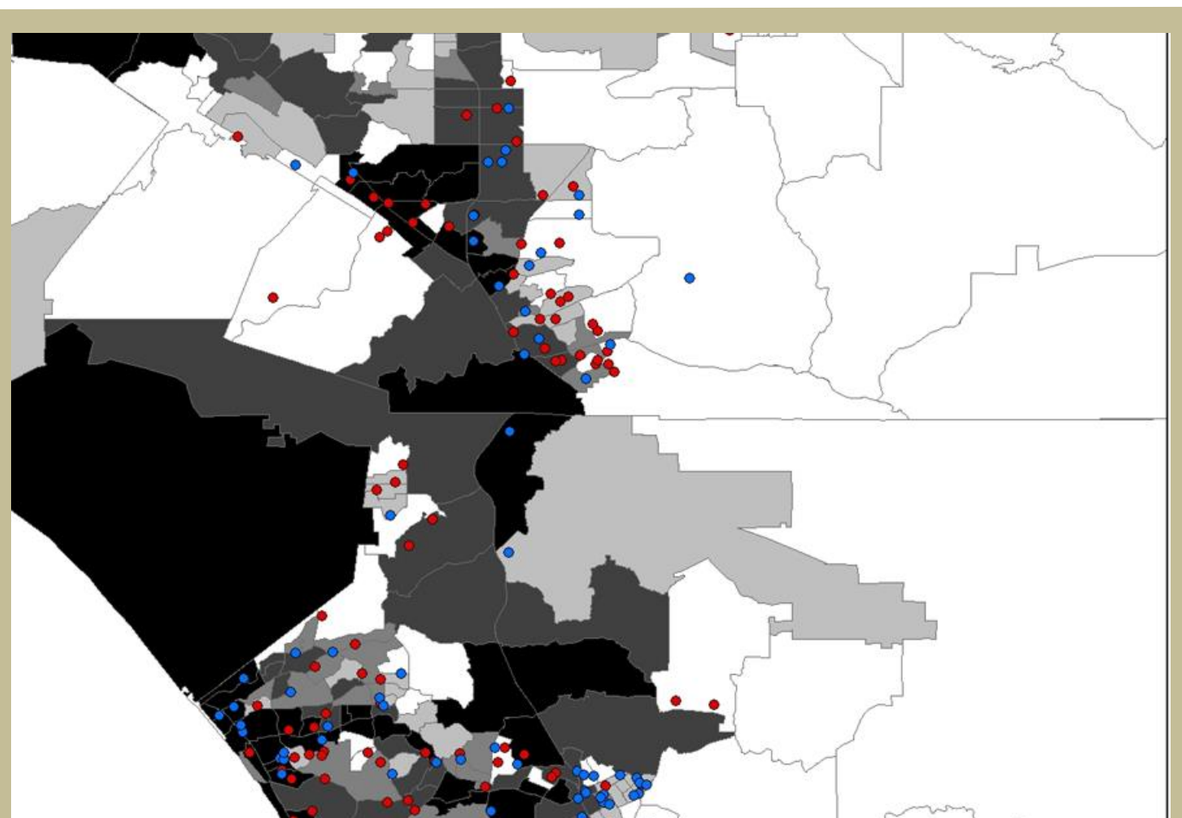
- To evaluate relationships between environmental exposures and the prevalence and disease activity of pediatric IBD using novel data sources that take into account geographic location.

Methods

- Youth diagnosed with IBD from 1999-2015 with >= 6 months follow-up were identified at a pediatric medical center serving a catchment area of >1 million children.
- Healthy controls (HC) were EHR-identified and matched to IBD youth by age and gender. Home addresses at each clinical encounter for all patients were recorded and distance calculated from homes to the nearest major road and freeway using the ArcGIS proximity toolset.
- Group comparisons (IBD vs. HC and IBD who did v. did not have a disease flare following diagnosis) of distances between home and major road and home and freeway were performed using Wilcoxon rank sum test.
- Weather data (temperature, humidity, wind speed and direction, atmospheric pressure, and solar radiation) were extracted according to home location over time from WiFire Data Services.
- Mutual information analyses (MIA) were conducted and models were trained/cross-validated using machine learning to determine whether weather data was predictive of IBD diagnosis and/or IBD disease activity.

Results

- 320 youth with IBD (161 M: 159 F; mean (SD) age: 11 (4) y) were identified with 320 age-and-sex matched HC.
- IBD youth lived statistically significantly further away from freeways (median (IQR): 5,286 (2,406, 11,281) v. 3,914 (1,682, 7,161) ft, IBD v. HC, p=0.0006) and major roads (844 (360, 1,805) v. 610 (181, 1,083) ft, IBD v. HC, p<0.0001) than HC.
- On average, youth with IBD who flared (N=133) lived closer to freeways (5,017 (2,207, 11,146) v. 5,800 (2,516, 11,977) ft, flare v. non flare, p=0.52) and major roads (718 (386, 2,034) v. 932 (329, 1.775) ft, flare v. non flare, p=0.82) than youth with IBD who did not flare (N=187), but this did not reach statistical significance.
- Models created using weather data in cross-validation did not demonstrate accuracy greater than chance (average AUC 0.58 - 0.60) in predicting presence of IBD and whether an IBD disease flare occurred.



Conclusion

- Traffic pollution may play a role in the development of IBD in children.
- Reduced exposure to antigens (i.e., traffic pollution) may lead to underdevelopment of the control pathways of the immune system leading to dysregulation with subsequent antigen exposures (Hygiene hypothesis).

References

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