Reducing the health burden of air pollution through electronic medical record risk prediction

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Introduction

- Air pollution has well documented adverse effects on individual health, with both acute (e.g. heart attacks, asthma exacerbations) and chronic (e.g. coronary artery disease, child lung development) health manifestations
- A particularly well documented phenomenon is the rise in emergency room visits and hospitalizations during high air pollution days, such as from wildfires or ambient air pollution
- Currently, risk communication about high pollution days is executed through broad, public announcements in the form of AQI alerts
- There is an opportunity for more targeted outreach about high air pollution days to those individuals at highest risk of the adverse health effects of air pollution
- Electronic medical record (EMR) systems and artificial intelligence (AI) technology provide tools to better identify individuals at highest risk of health sequelae
- Identifying such individuals may facilitate tailored messaging, such as reinforcing the need to fill medication prescriptions or avoid high exposure activities, as well as possible interventions, such as providing air filters and home environmental assessments

Project Goals

1) Literature review: assess and summarize the current evidence on:
    1) The relationship between air pollution and health outcomes
    2) Study designs and methods to identify individuals at highest risk of adverse health events from air pollution
    3) Individual level interventions to mitigate the adverse health effects of air pollution
2) Assess patient and health care provider perspective and needs in relation to air pollution and its effects on health with a human centered design approach
3) Contribute to a multi-disciplinary effort to establish an EMR-based risk prediction model at UCLA Health

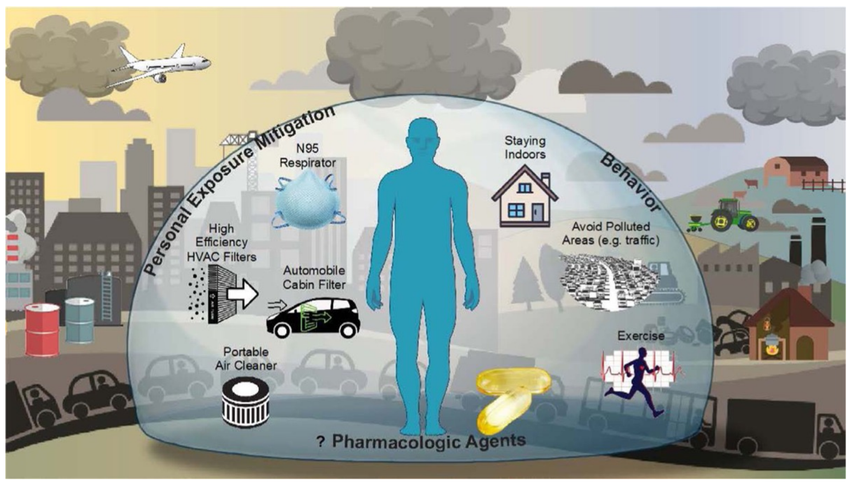

Figure 1: Individual exposure mitigation strategies

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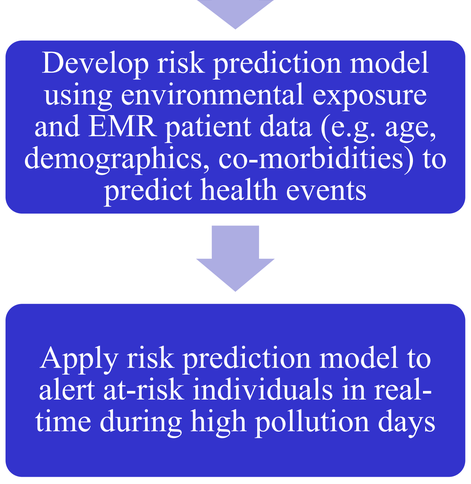
Materials and Methods

Figure 2: Project schema for developing and implementing an EMR-based risk prediction model for air pollution related health outcomes



Results and Outcomes

- A range of methods have been used to study the association between air pollution and health events
    - Case-crossover studies are most common study design
    - Exposures are variably measured by individual pollutants (PM 2.5, ozone), smoke exposure (binary variable by smoke column), or combinations of above
    - Relevant health outcomes (e.g. asthma exacerbation) are variably assessed by ICD codes, key word searches, or more stringent criteria (e.g. inhaler and steroids administered)
- There have been limited system-level efforts to intervene on the adverse individual health effects of air pollution
- Tools and interventions to mitigate the health impacts of air pollution have primarily been studied at the mechanistic level, without robust evidence evaluating medium- to long-term effects with clinical significance

Conclusions

- There are clear and strong associations between air pollution levels, particularly PM2.5, and respiratory health events
- EMR data can be used to identify pollution-related health events and inform a risk prediction model
- There have been limited efforts to implement system-level initiatives to better target messaging and interventions at high-risk individuals
- Human centered design practices with input from both patients and health care providers may inform more effective and equitable interventions

Future Goals

- Using input from patient and health care provider interviews and through iterative human centered design practices, develop messaging and possible interventions
- Pending approval at the health care system level, the EMR AI risk prediction model will be used to identify individuals at highest risk of health events from air pollution. This model will be monitored and iterated upon to ensure accuracy, equity, and patient protection
- Implement a health care system intervention using messaging and interventions developed above to intervene on
- Upon demonstration of a successful model of advanced risk prediction and intervention to mitigate the risk of air pollution on health, eventually the model may be expanded to other disease processes and environmental risks`

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