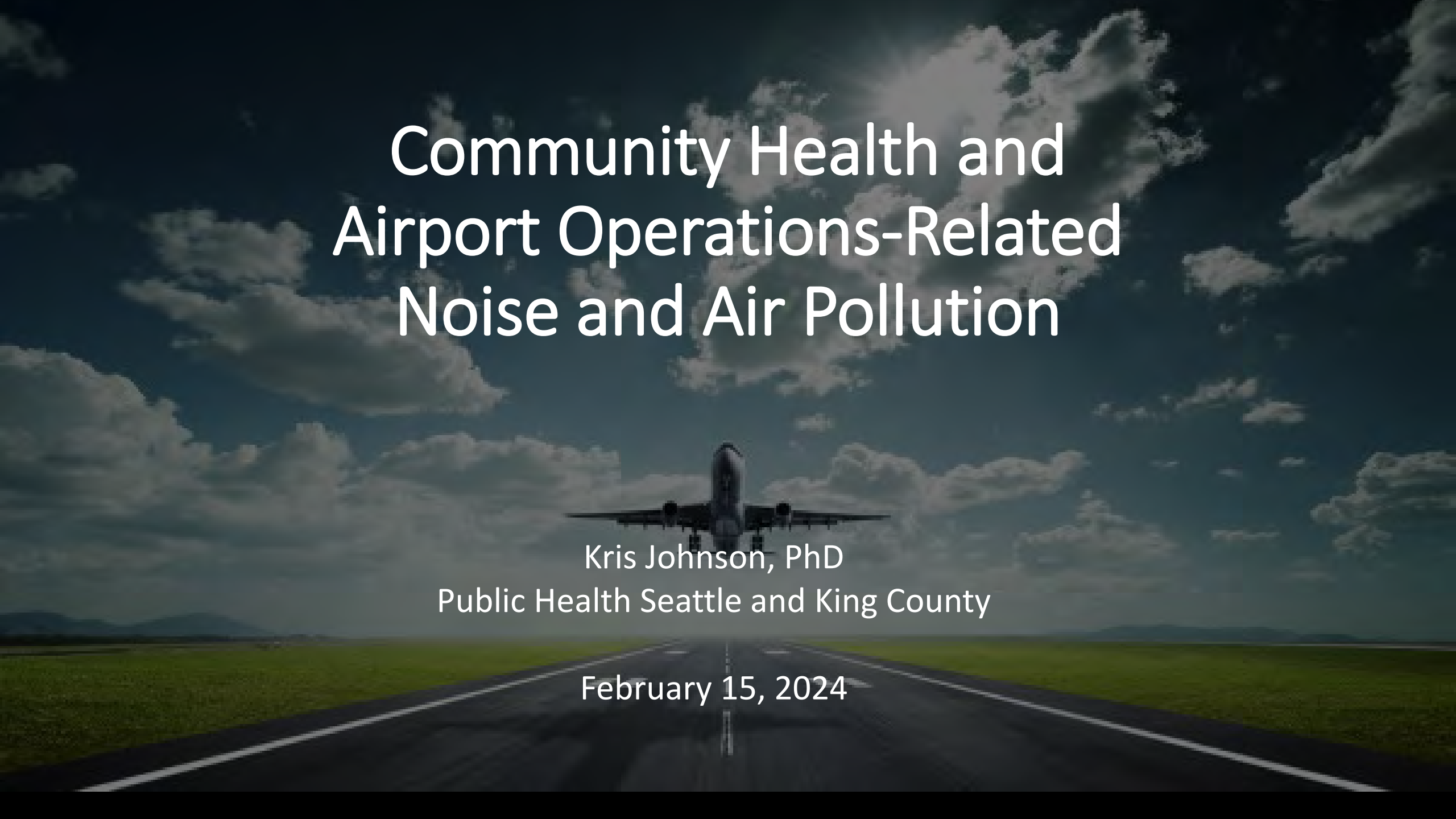
Community Health and Airport Operations-Related Noise and Air Pollution



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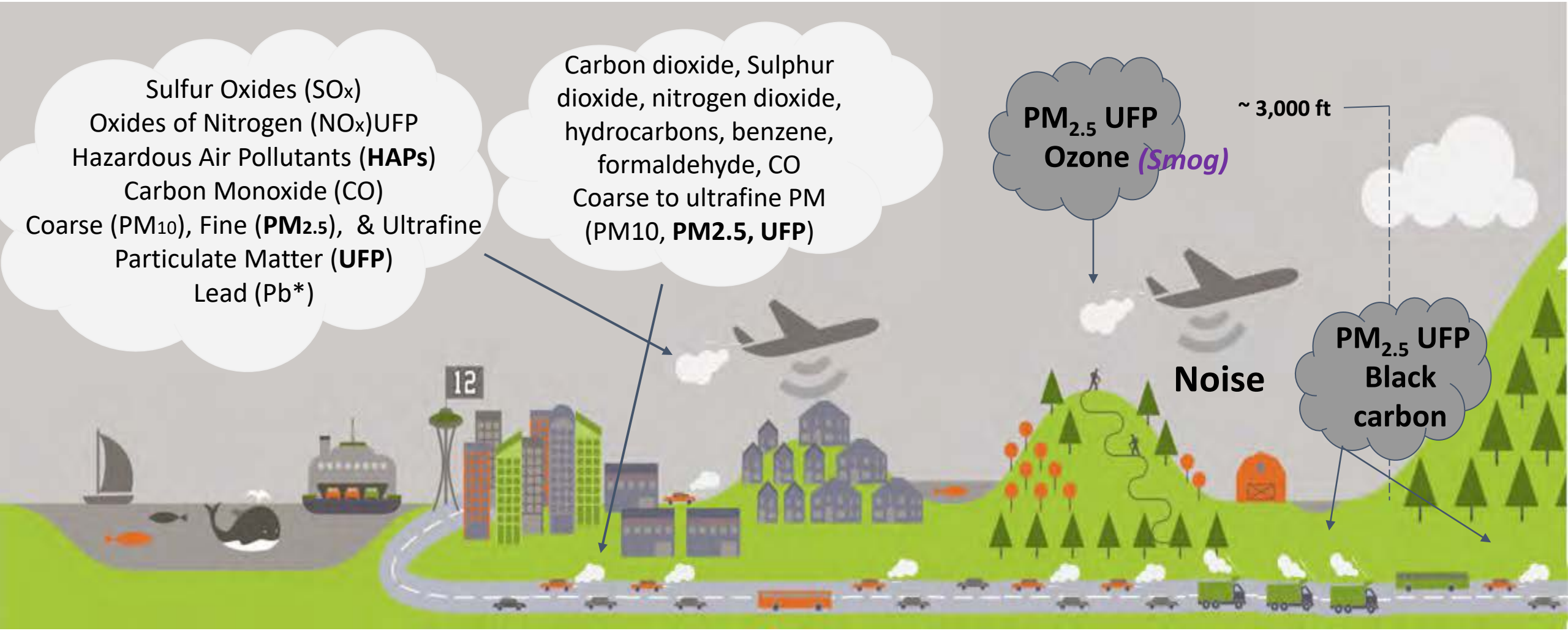
Community Health and Airport Operations-Related Noise and Air Pollution

a) Assess strength of evidence re airport related pollution and community health
b) Examine airport community health
c) Recommend steps to address health issues

What pollution results from airport operations?



What health outcomes are likely caused or caused by airport operations–related pollutants?

Strength-of-Evidence Criteria Applied	
Causal	• Exposure is shown to lead to effect across multiple high-quality studies by multiple research groups. • Plausible alternative explanations for effect have been ruled out. • Biological pathways supported by evidence.
Likely Causal	• Exposure is shown to lead to effect across multiple high-quality studies, but uncertainties remain. • Plausible alternative explanations for effect have been ruled out but ***concerns about possible co-pollutant exposures may remain***. • Biological pathways, while plausible, may be missing evidence.
Suggestive	• Exposure seems to lead to effect in at least one high-quality study, but ***alternative explanations for the effect, such as a third factor, cannot yet be ruled out***. • May have a limited number of studies with modest effects or may have several studies with conflicting results.
Inadequate Evidence	It is unclear if exposure leads to effect or not, because of *a lack of quality studies or because of significant inconsistency* in results across studies.
Not Likely Causal	Exposure consistently does not appear to lead to effect across studies; adequate studies show no effect across different exposure levels and different populations.

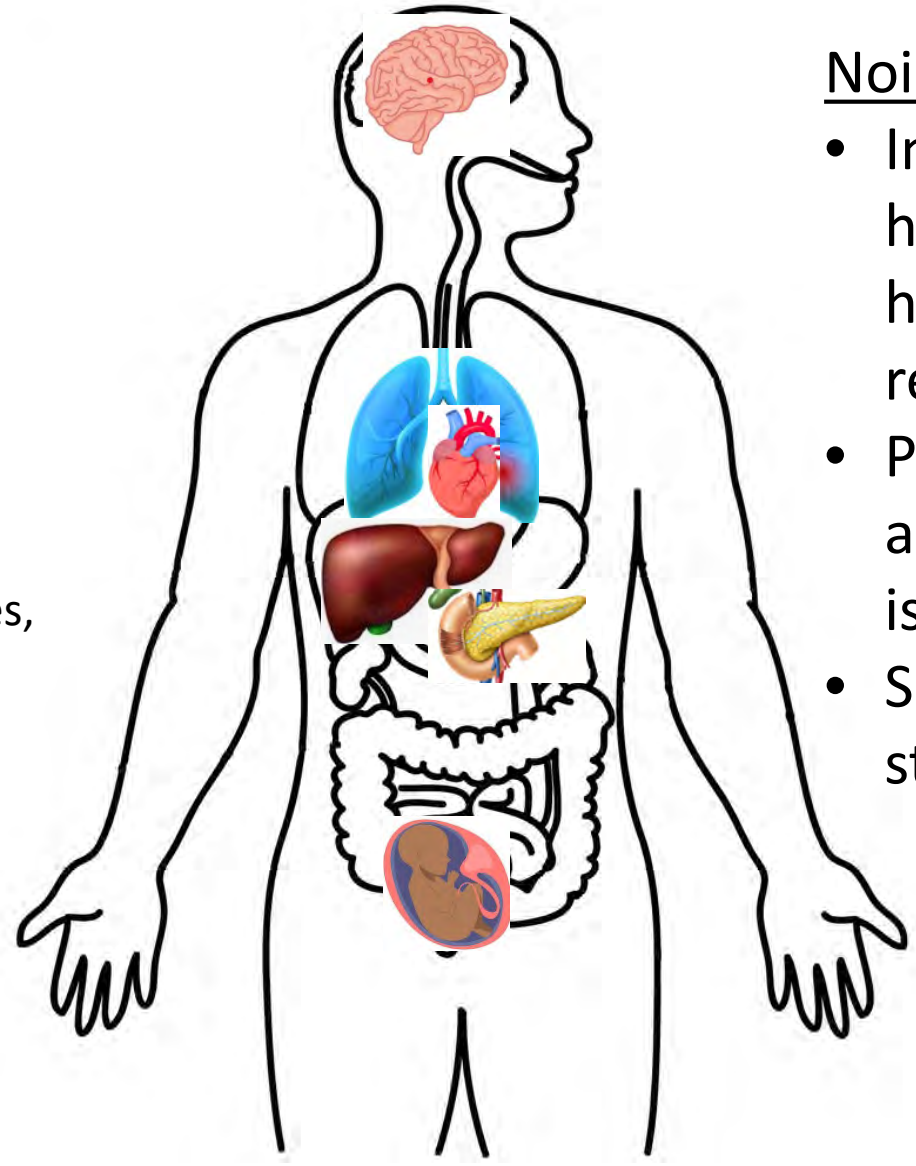
What health outcomes are likely caused or caused by airport operations–related pollutants?

Organ System	Noise Pollution	Air Pollutants	Lead
Cardiovascular	Causal	Causal ($PM_{2.5}$, *UFP*, Ozone, CO)	Causal
Respiratory	Not examined	Causal ($PM_{2.5}$, UFP, *Ozone*, *No_x*, So_x, HAPs)	Not examined
Reproductive & fertility	Not examined	Likely causal (*$PM_{2.5}$*)	Causal
Birth outcomes	Suggestive	Likely causal (*$PM_{2.5}$*, *UFP*)	Suggestive
Cancer	Not examined	Causal (HAPS, *$PM_{2.5}$*)	Likely causal
Brain/Nervous system	Causal	Likely causal (*$PM_{2.5}$*, *UFP*)	Causal
Metabolic system	No causal evidence	Likely causal (*UFP*, *Ozone*, *$PM_{2.5}$*)	Not examined

What are the health impacts of airport-related pollutants?

<u>Air pollution</u>

- Respiratory problems (asthma, respiratory diseases)
- Cardiovascular issues (Hypertension, heart disease/attack, stroke)
- Brain/Nervous system (dementia, oxidative stress)
- Metabolic issues (Diabetes, metabolic syndrome)
- Reproductive health (preterm, low birthweight)



<u>Noise pollution</u>

- Increased blood pressure, hypertension, heart disease, heart attack, stroke, heart-related death
- Poor school performance among children; memory issues
- Sleep disruption, chronic stress and annoyance

A LOOK AT CONTEXT: WHAT IS THE HEALTH OF AIRPORT COMMUNITIES COMPARED TO THE REST OF KING COUNTY?

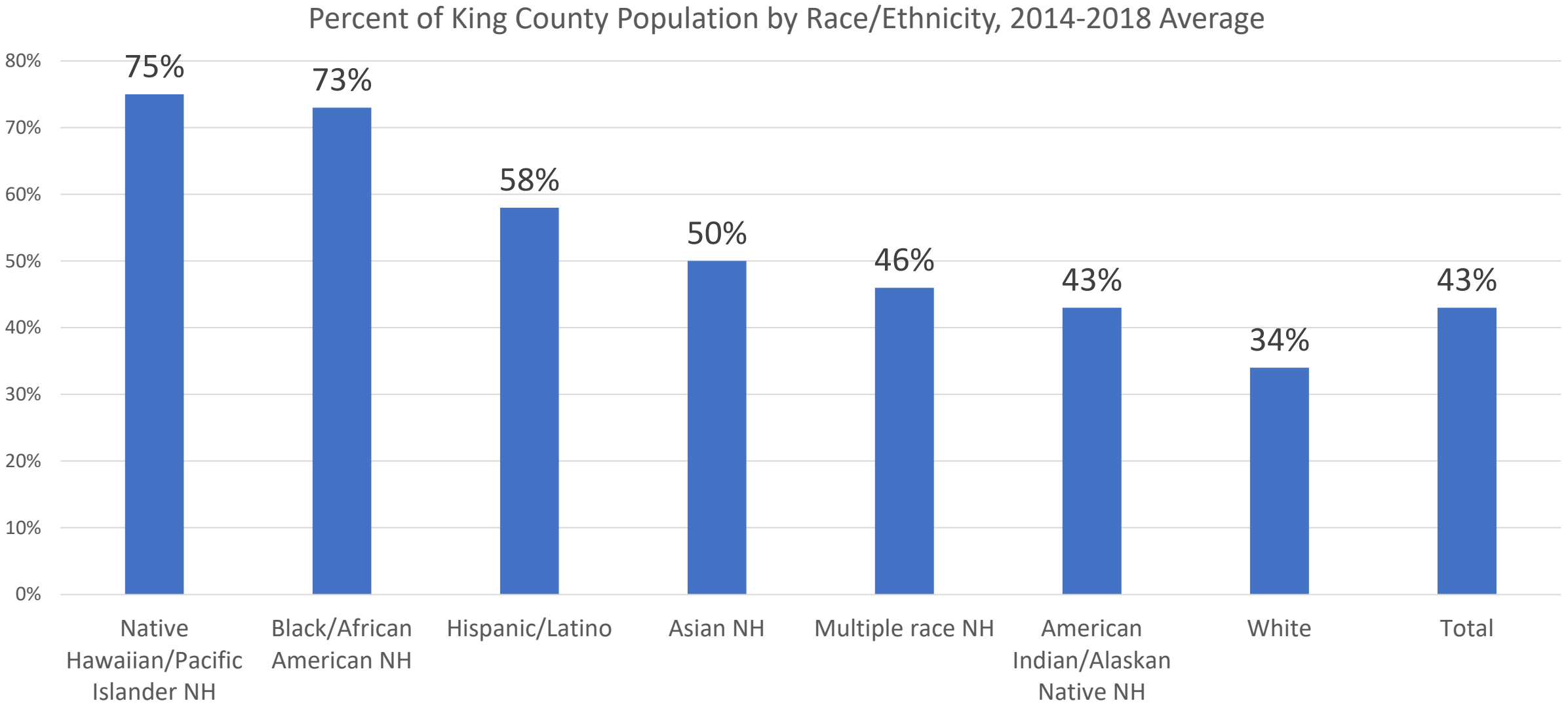
People in airport communities face disparities in

- Health throughout the life course
- Health risk factors (asthma, diabetes)
- Resources (twice as many children in poverty, adults more likely to be uninsured, higher rates of food insecurity)

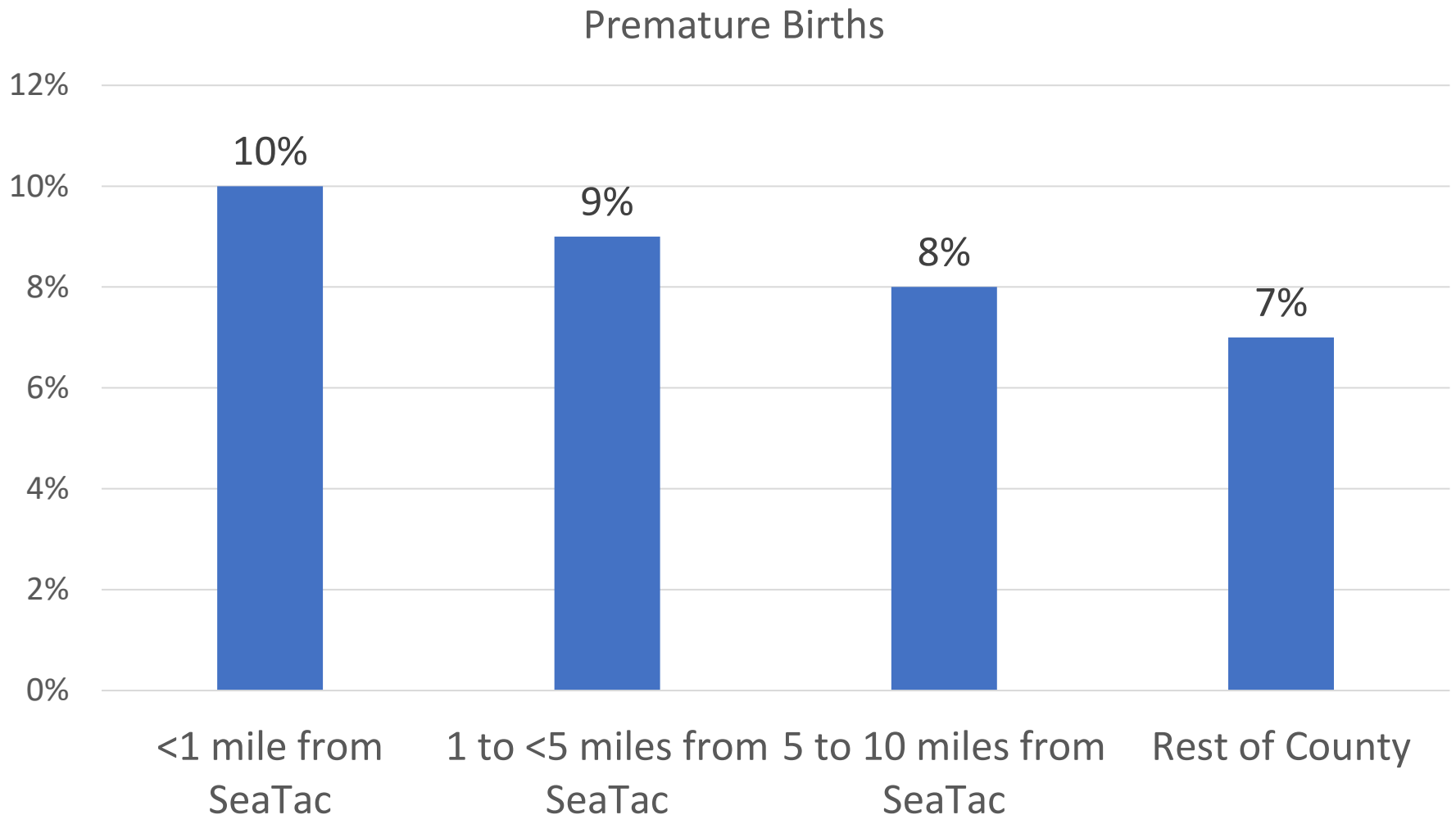
For some measures, health outcomes worsened with proximity to airport

- Hospitalization rates for heart disease
- Rate of death from all causes, heart disease
- Life expectancy (2-5 years lower for airport communities)

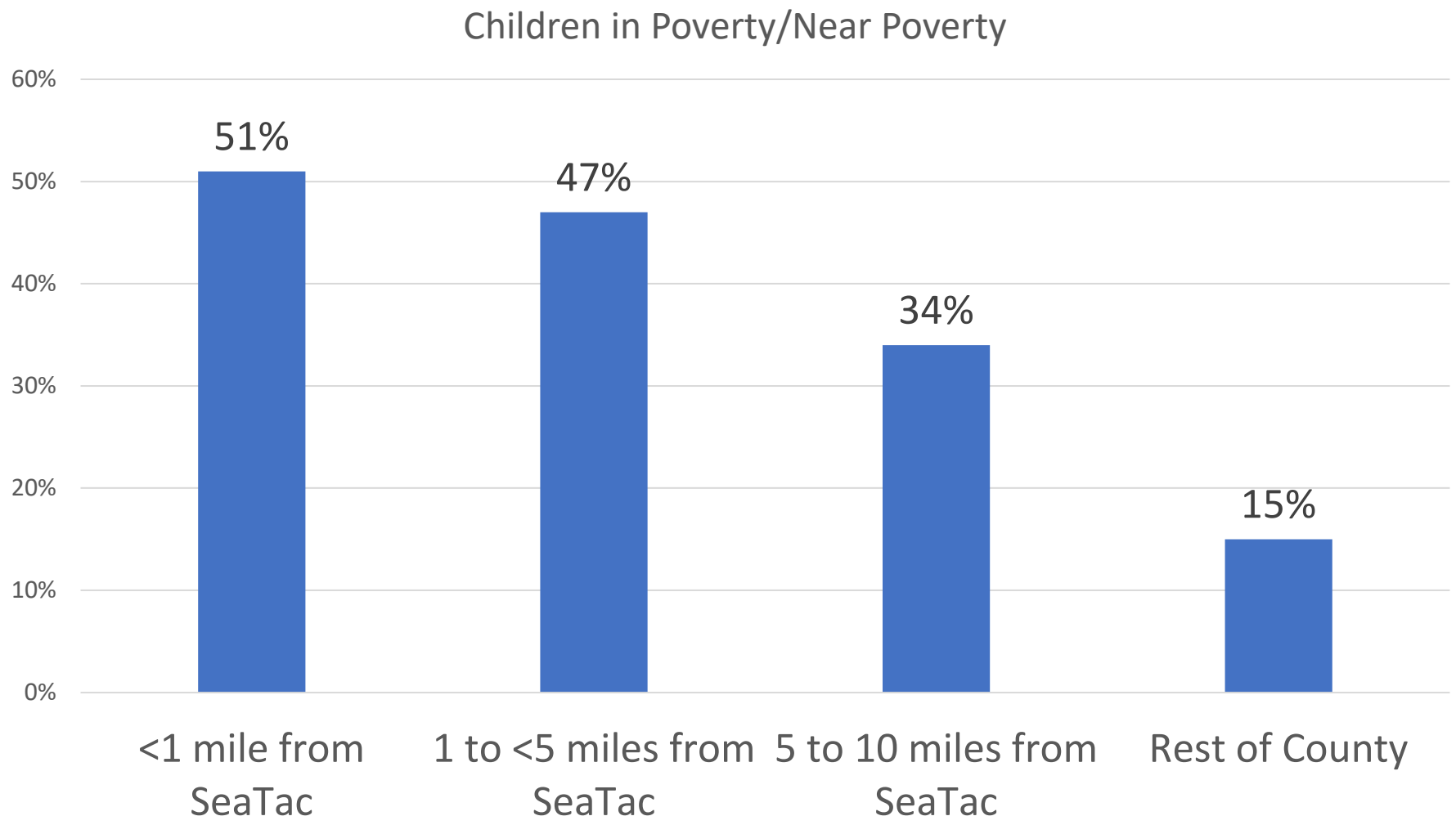
The airport communities are home to a majority of King County's people of color



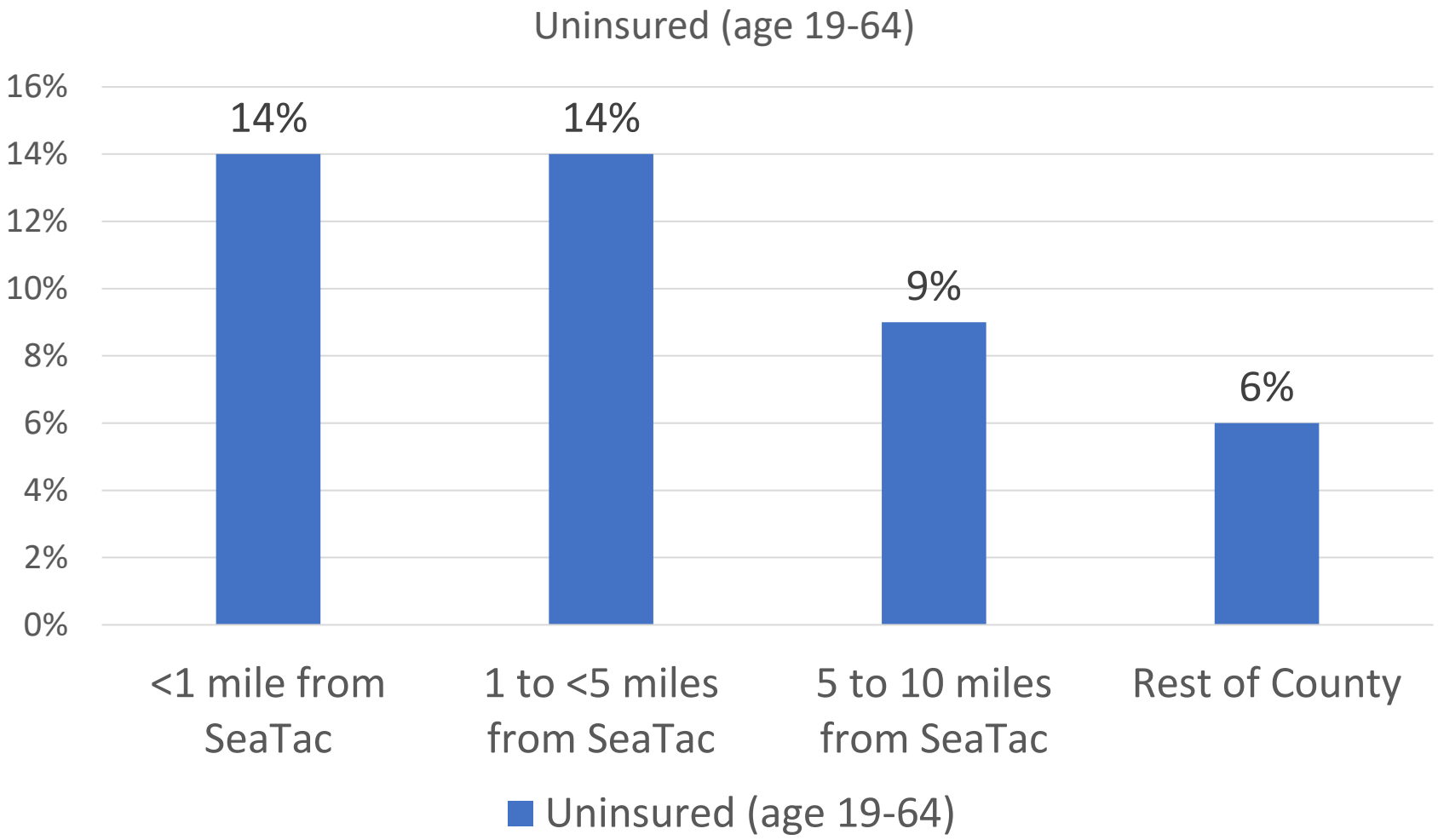
Mothers in airport communities were 43% more likely to have a premature birth than the rest of King County



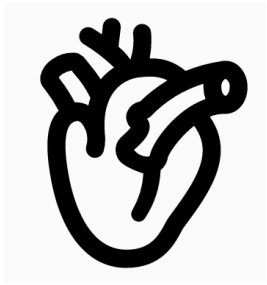
Airport communities had twice as many children living in poverty or near poverty than the rest of King County

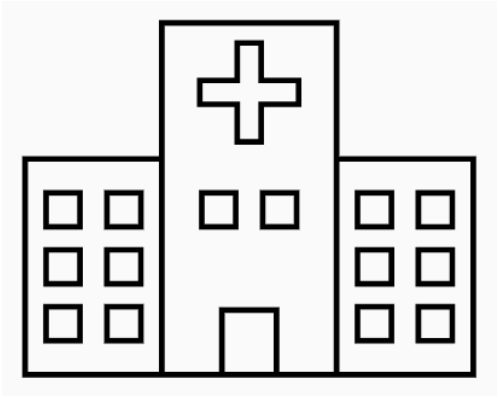


Adults were more likely to be uninsured in airport communities than in the rest of King County

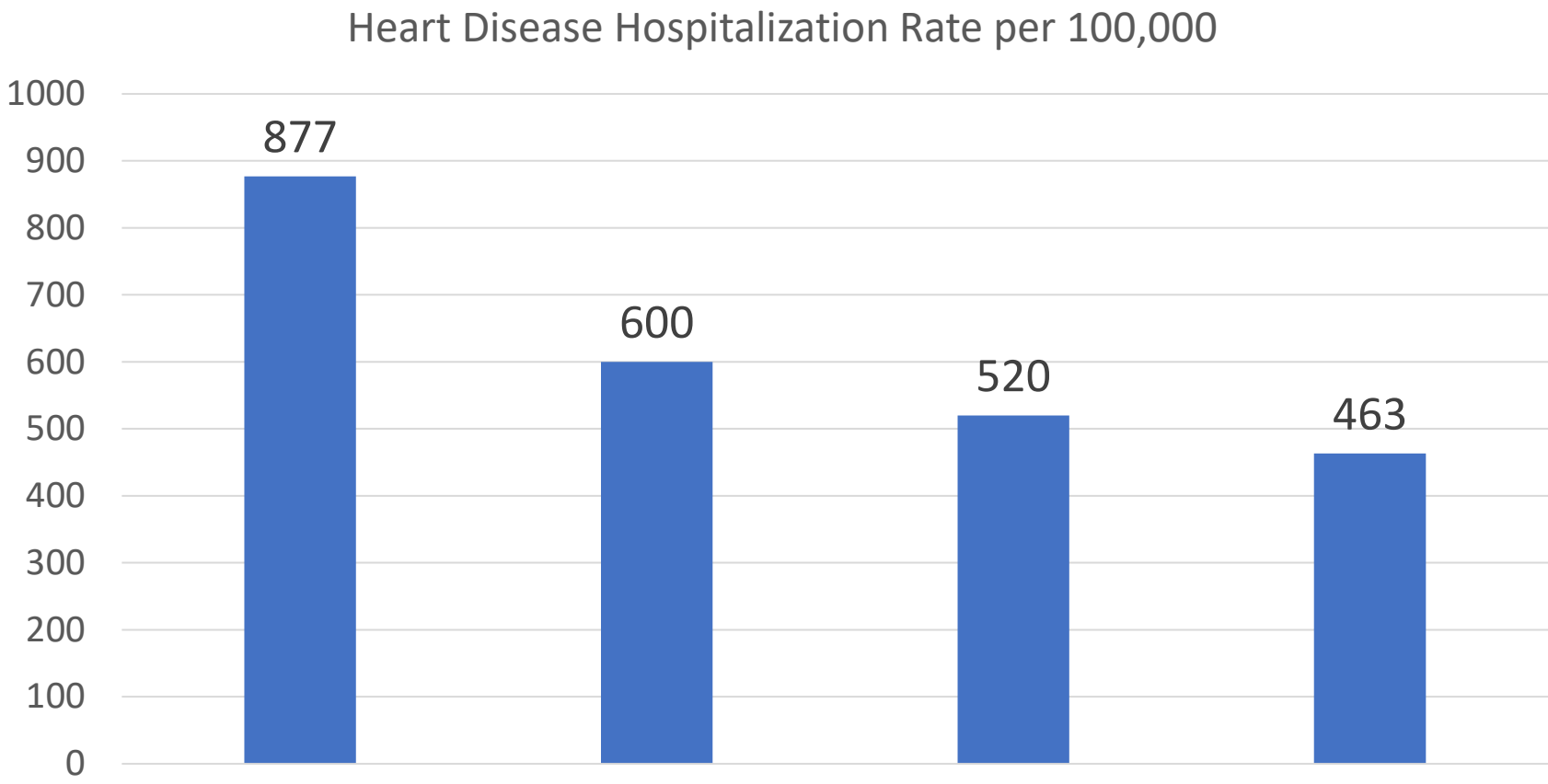


Airport communities had a higher rate of hospitalization from heart disease than the rest of King County

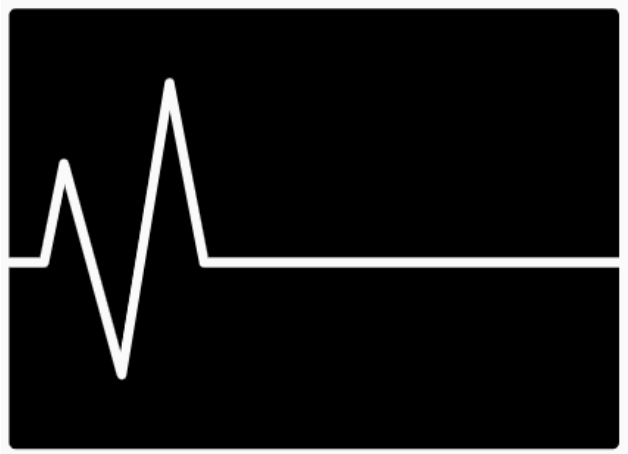


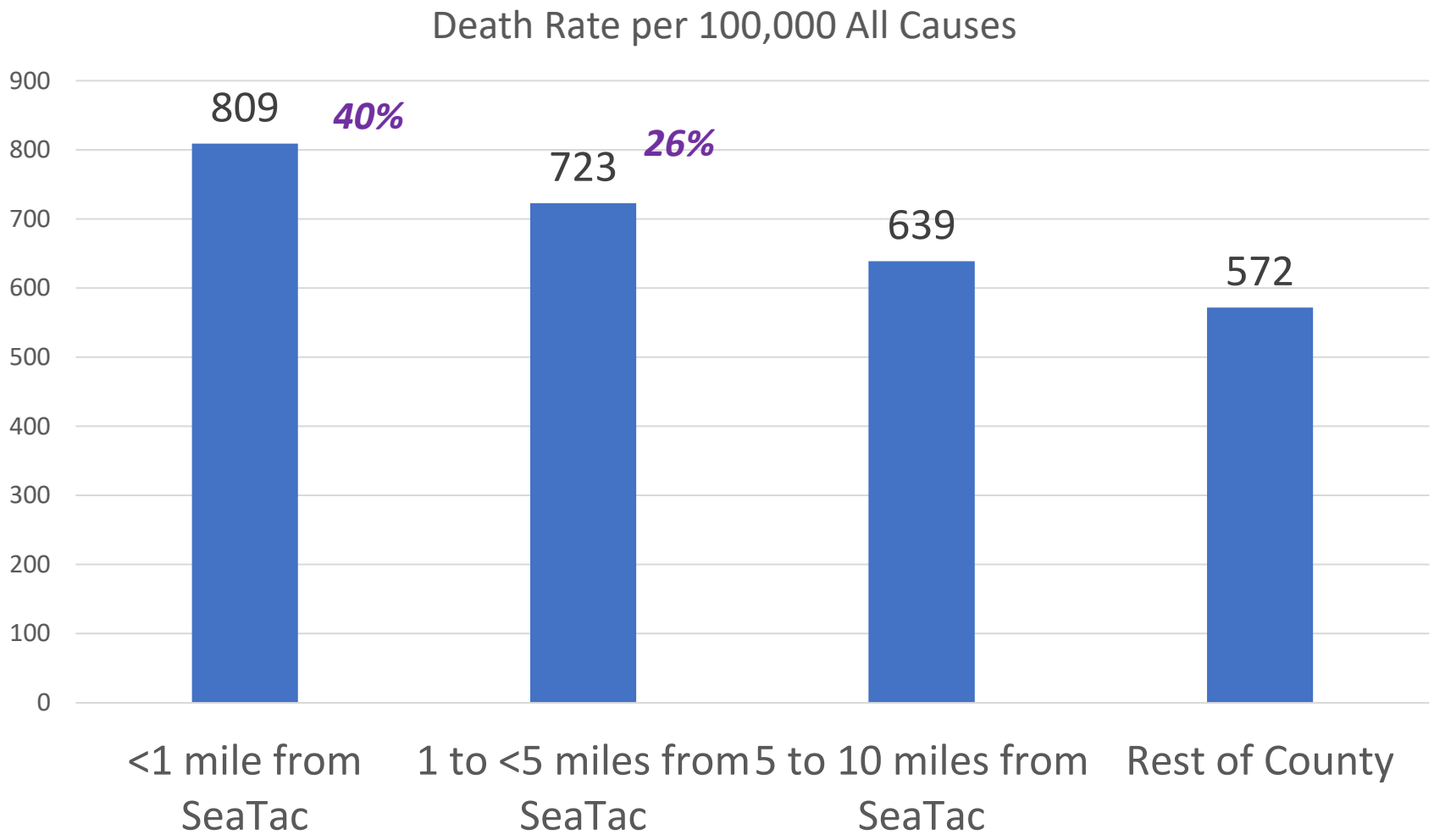


Also
stroke, diabetes, asthma, COPD



Airport communities had a higher rate of death than the rest of King County





ARE COMMUNITIES NEAR AIRPORTS EXPOSED TO NOISE AND AIR POLLUTION FROM AIRPORT OPERATIONS?

Yes, and we need to know more about exposure levels.

- Several studies in urban areas identified noise and air pollution related to airports and adverse health effects
- 2018 Beacon Hill study showed that >50% of 24-hour day-night avg noise levels over 65 dB (WHO recommends 45 dB).
- 2019 Puget Sound Clean Air Agency report shows particulate matter levels over EPA-recommended levels 22 days in winter

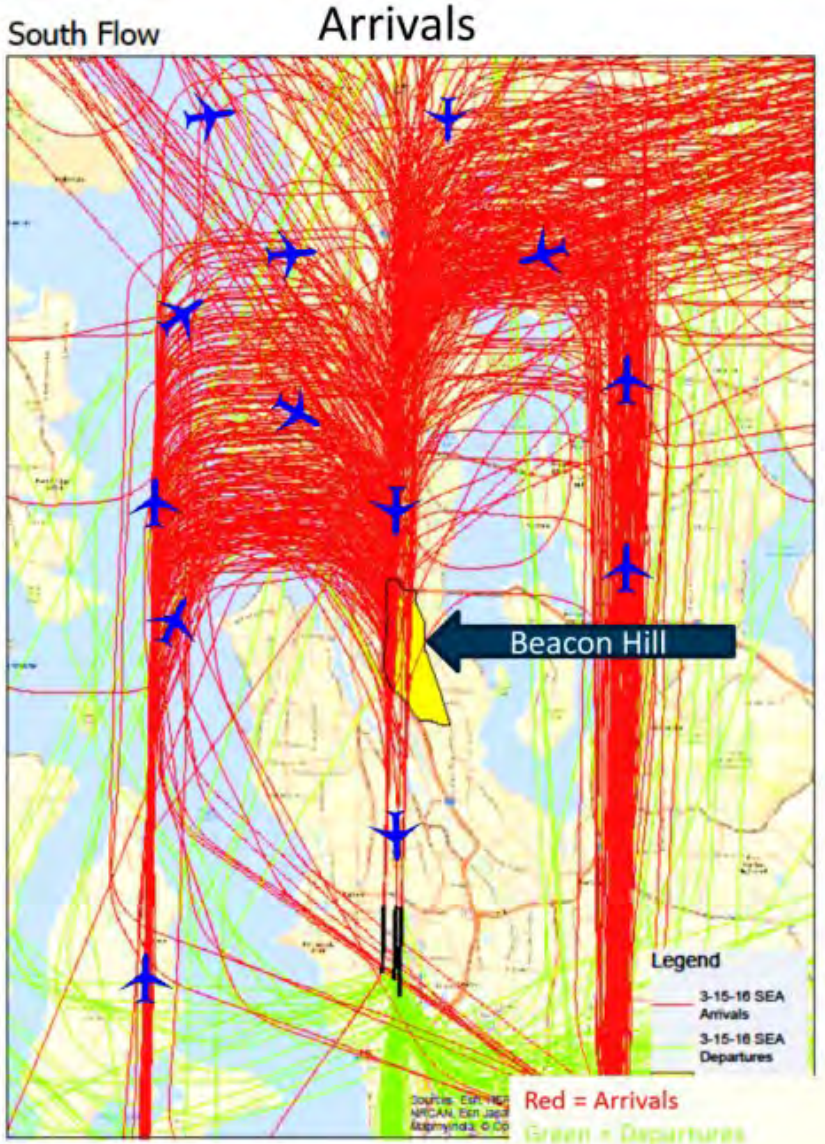


Figure 3. Arrival flight paths for Seattle-Tacoma International Airport. Beacon Hill neighborhood in yellow. Airport runways shown as two black lines center-bottom of image.

Ultrafine particles (UFP) emitted from traffic and aircraft sources

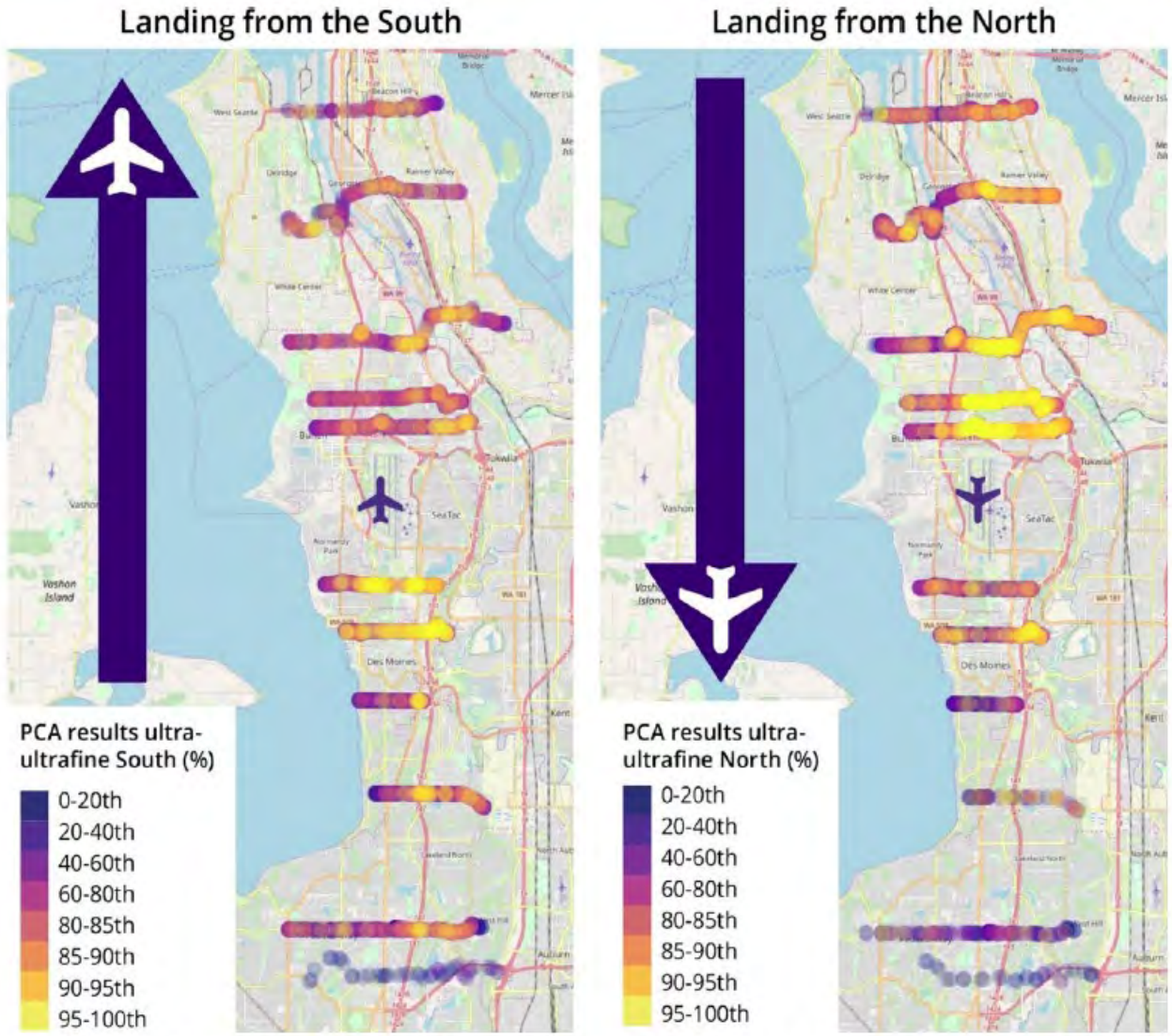


Figure 4. Spatial distribution of the "Ultra-UF" PCA feature, separated by the landing direction. Colors correspond to percentile values for the Ultra-UF factor score. Map layer OpenStreetMap contributors.

- 2018-19 study drove monitors in cars & measured plumes under aircraft landing at SeaTac enriched with small "Ultra-ultrafine" (10-20 nm sized) particles.
- Particle size distribution & black carbon concentration distinguish source
- Introduces additional equity considerations for policy/planning and environmental justice:
  - Who lives downwind of major roads?
  - Who lives under the flight paths near major airports?

Image courtesy of Dr. Edmund Seto, 2023

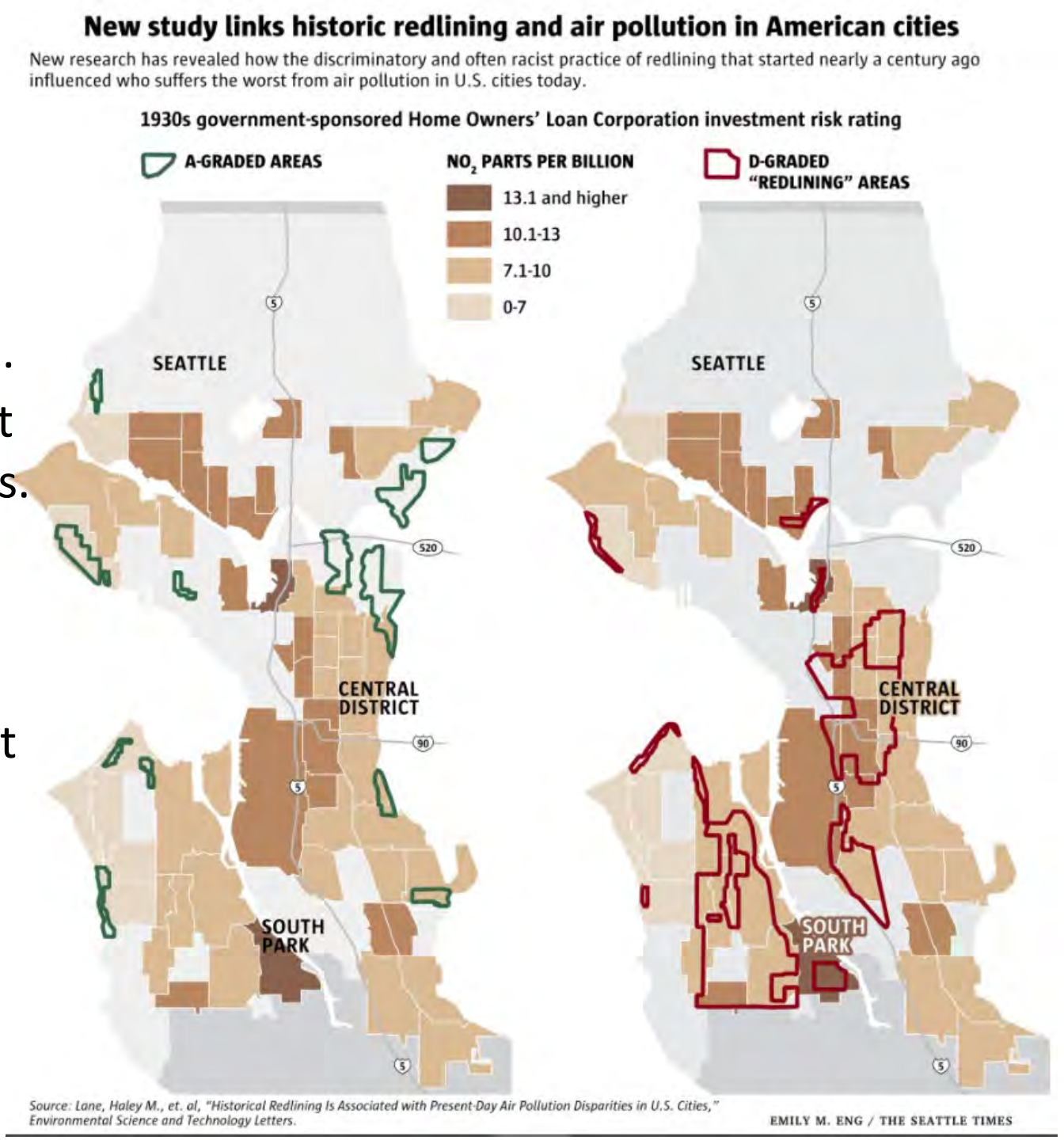
Austin, Xiang, Gould, Shirai, Yun, Yost, Larson, and Seto
Environmental Science & Technology **2021** *55* (5), 2847-2858

Cumulative effects have systemic roots

People in airport communities are:

- More likely to be exposed to air pollution.
- More likely to have health conditions that increase risk of pollutants' adverse effects.
- More likely to face health and resource disparities.

Historical practices and systemic racism underlie the disparities. Historic and current oppression/trauma often result in chronic stress which can lead to adverse health effects like hypertension, other heart conditions, and mental health concerns.



RECOMMENDATIONS

- Address the health disparities of airport communities
- Mitigate the health impacts of airport operations
- Continue development and implementation of strategies to mitigate airport-related air and noise pollution
- Implement new technologies to improve measurement of exposures indoors and outdoors
- Expand the systematic monitoring of pollutants (both outdoor and indoor exposures) in residences, schools, childcare settings, and long-term care facilities
- Support research to address gaps in knowledge