The EtO Effect

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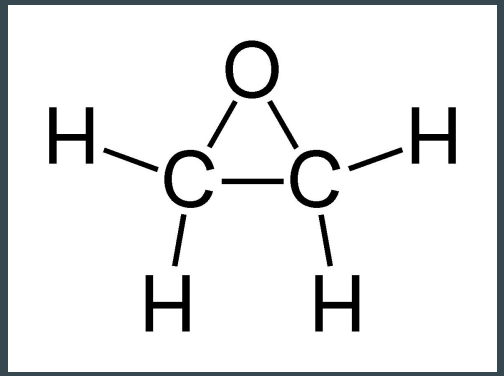
Introduction

- Pre-health and environment
- National Health and Examination Survey (CDC)
- Ethylene oxide
  - Colorless, flammable gas
  - Industrial chemicals and medical sterilizer
  - Inhaled or absorbed into bloodstream
- Public health implications
  - Diabetes, asthma, thyroid issues, chronic bronchitis, stroke



en participants with and without these conditions?

Which common medical conditions are associated with ethylene oxide exposure, and how do ethylene oxide levels differ between participants with and without these conditions?

Data

```
```{r}
#| label: join-data
conditions_ethylene_oxide <- ethylene_oxide |>
    left_join(medical_conditions, by = "id")

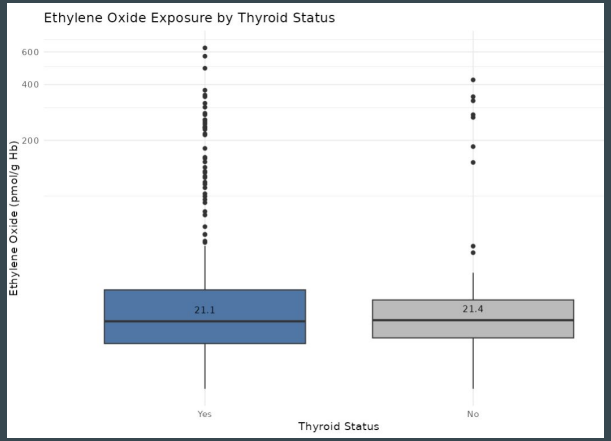
joined_ethylene_oxide <- conditions_ethylene_oxide |>
    left_join(cotinine, by = "id")

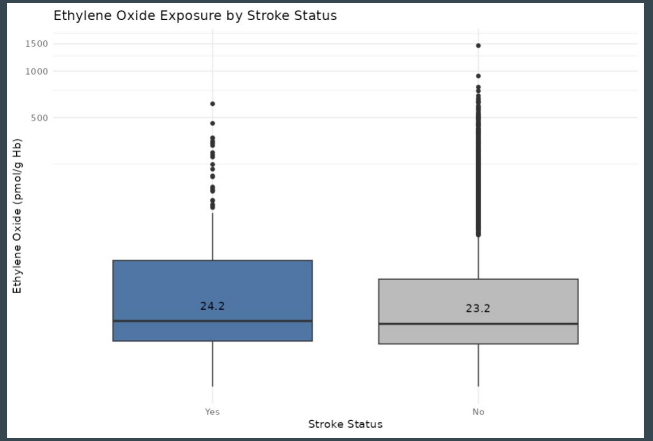
more_joined_ethylene_oxide <- joined_ethylene_oxide |>
    left_join(diabetes, by = "id")
```
```

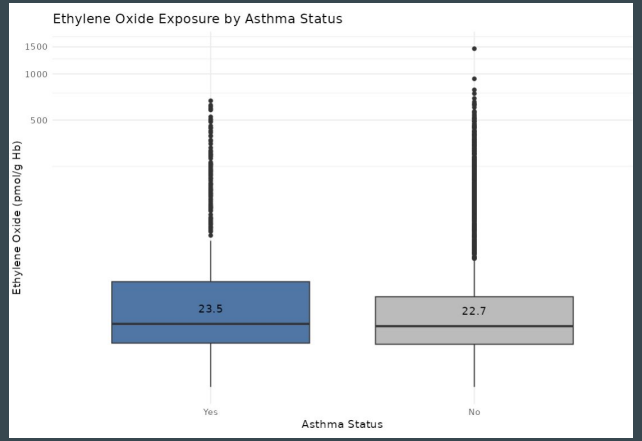
- Ethylene oxide
- Medical conditions
- Diabetes
- Cotinine serum

Ethylene Oxide Exposure by Health Condition

Visualizing the distribution of exposure for thyroid, stroke, and asthma

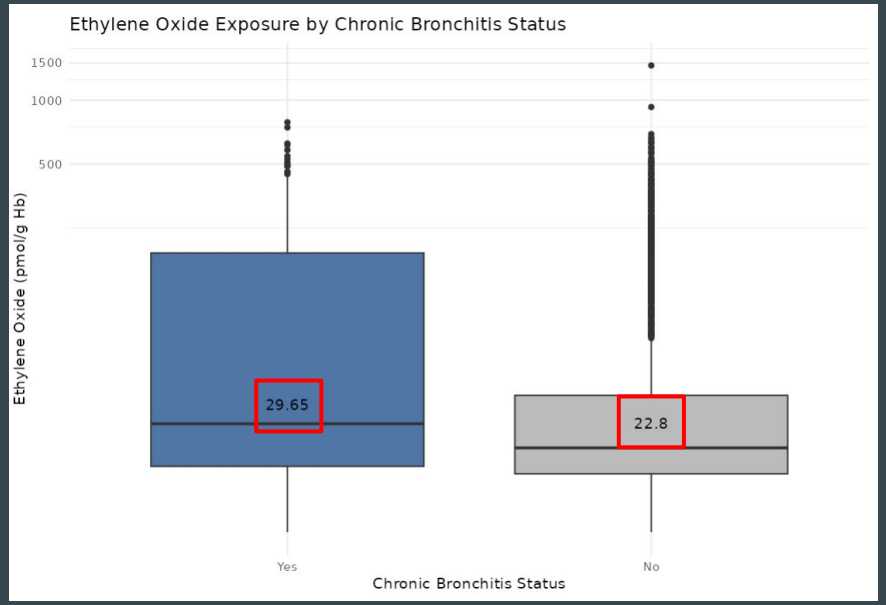


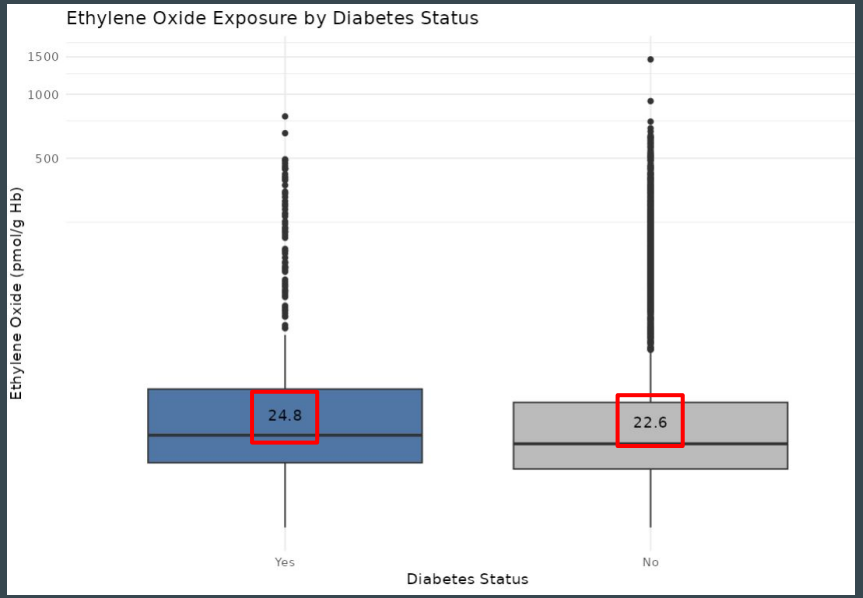




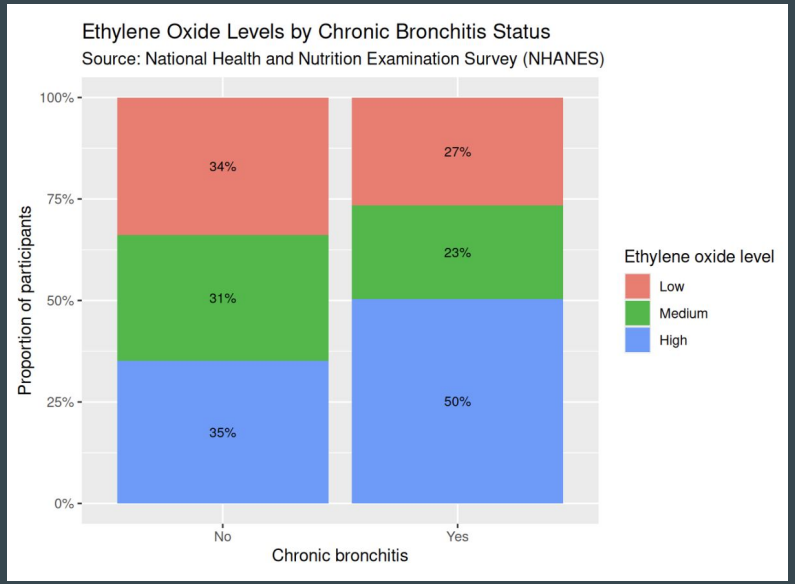
Ethylene Oxide Exposure by Health Condition

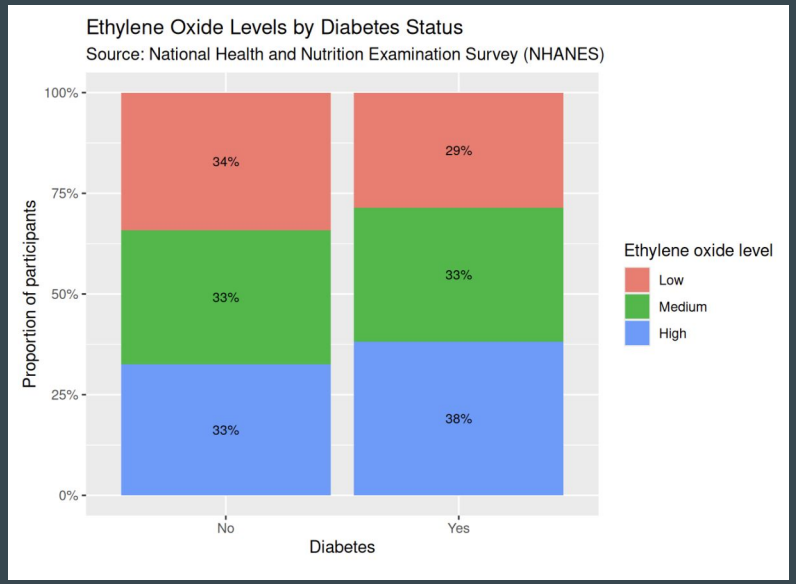
The distribution of exposure for chronic bronchitis and diabetes





Higher ethylene oxide levels are more common among those with chronic bronchitis and diabetes

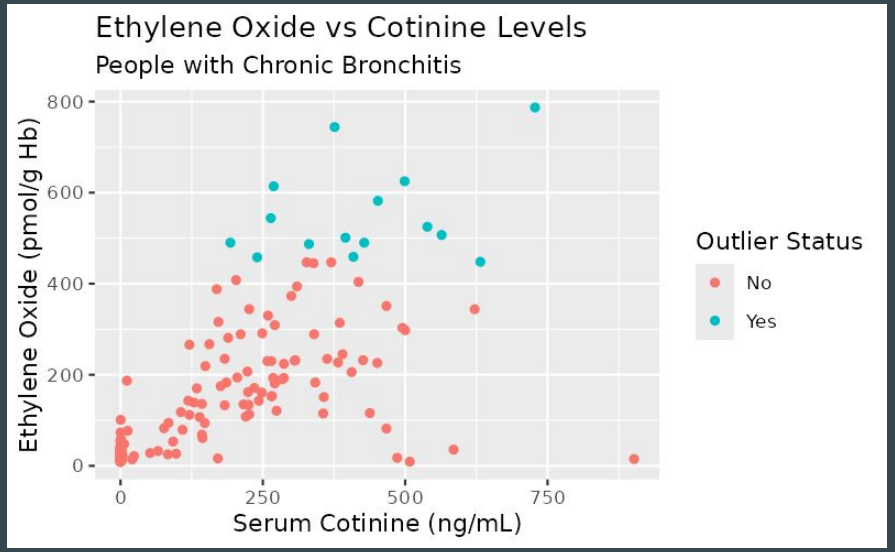


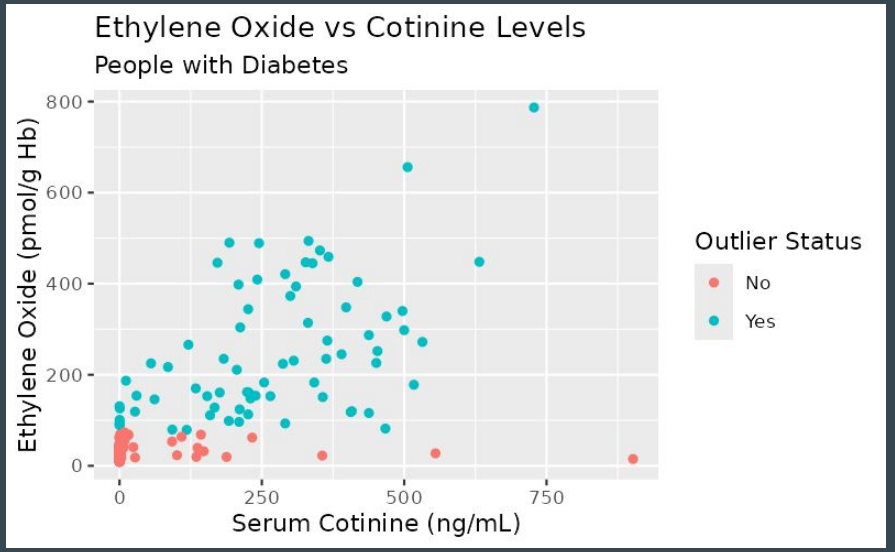


- Half of participants with chronic bronchitis (50%) are in the high ethylene oxide group, compared with 35% of those without it.
- Participants with chronic bronchitis are less likely to be in the low (27% vs 34%) and medium (23% vs 31%) groups → Distribution is shifted toward higher exposure

- Participants with diabetes are more likely to be in the high exposure group (38% vs 33%)
- For medium and low ethylene oxide level groups, difference is smaller or similar

Outlier Investigation





Median cotinine level for non-outliers: 0.240 ng/mL

Median cotinine level for outliers: 409 ng/mL

Median cotinine level for non-outliers: 0.02 ng/mL

Median cotinine level for outliers: 245 ng/mL

Discussion & Conclusion & Critique

Conclusion: Answering our research question

- EtO significantly higher in participants with chronic bronchitis and diabetes. Asthma, stroke, and thyroid issues no significant difference.
- Participants with chronic bronchitis more likely to be in high exposure tertile (50% vs 35%); shift was smaller for diabetes (38% vs 33%).

Discussion

- High EtO outliers had far higher cotinine than non-outliers (median 409 vs 0.24 ng/mL for bronchitis; 245 vs 0.02 for diabetes), suggesting smoking likely drives extreme values.
- Real-world applications: Public awareness of this association and limiting exposure, especially to tobacco smoke, the largest source in our data.

Critique

- These medical conditions have many causes, and smoking, age, and sociodemographic factors could **confound** the results.
- Self-reported, cross-sectional data can't show cause and effect
- Our body produces some ethylene oxide on its own (endogenous sources) and also clears it, so levels vary between people regardless of outside exposure.
- Next steps: Use data that separates endogenous from exogenous (outside) sources of ethylene oxide to see whether the trends hold.