NYU Grossman School of Medicine

Scientific Sessions

CLEANER AIR FOR LOWER CARDIOMETABOLIC RISK

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American Heart Association.

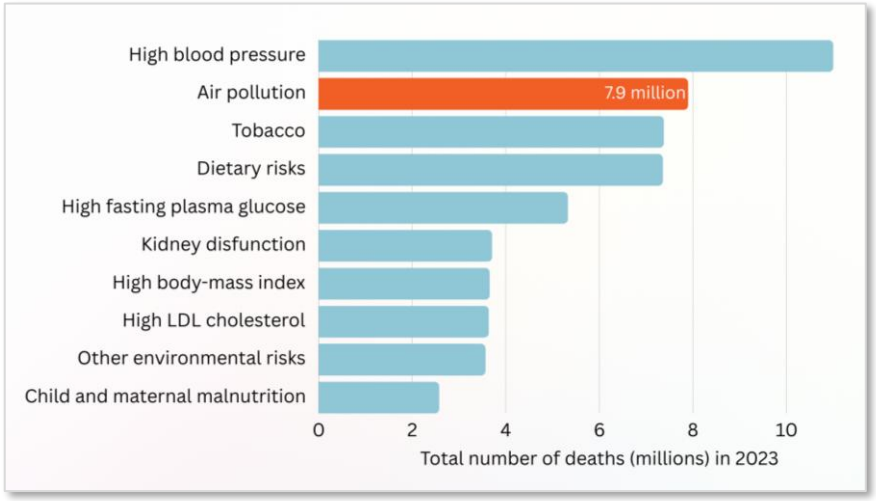
DISCLOSURE SLIDE

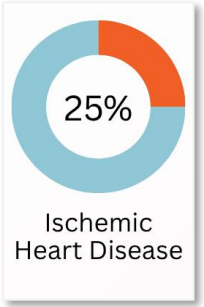
No financial conflicts of interest to disclose

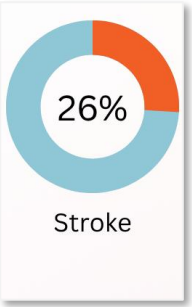
01 BACKGROUND

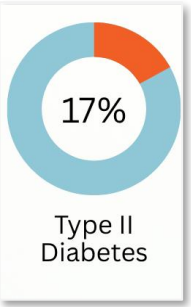
Air pollution is a modifiable cardiometabolic risk factor

EPIDEMIOLOGICAL STUDIES SHOW AIR POLLUTION DRIVES MORTALITY



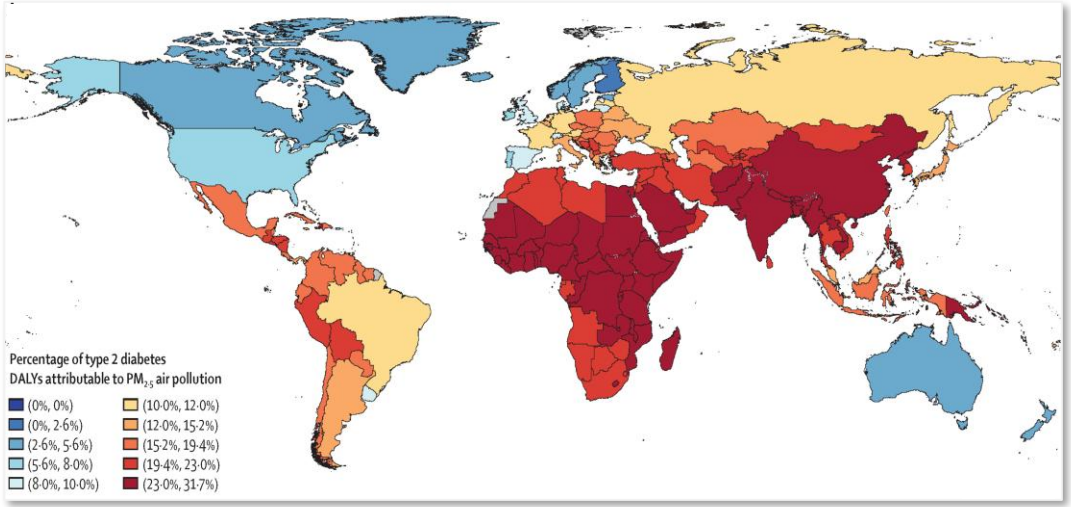


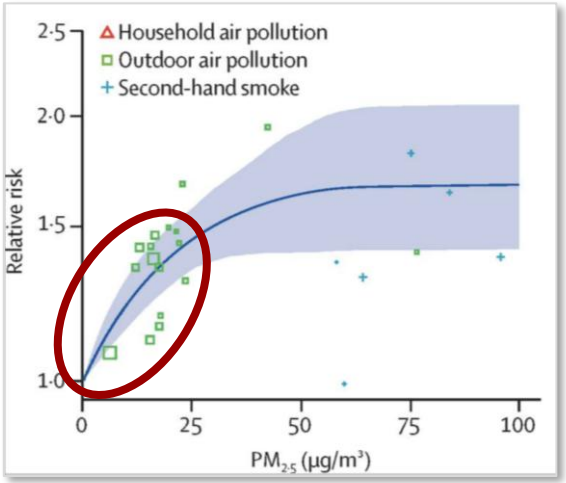




EPIDEMIOLOGICAL STUDIES SHOW AIR POLLUTION DRIVES DIABETES

- 3rd highest global risk factor for type 2 diabetes



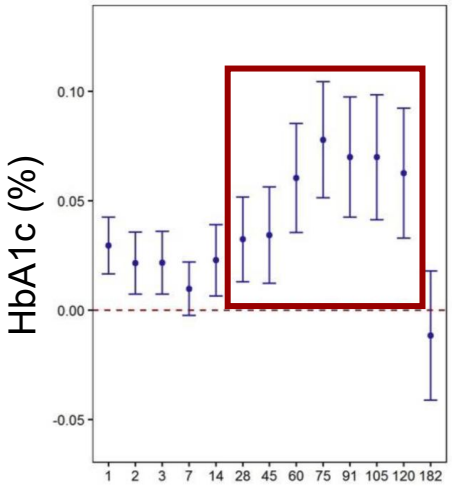


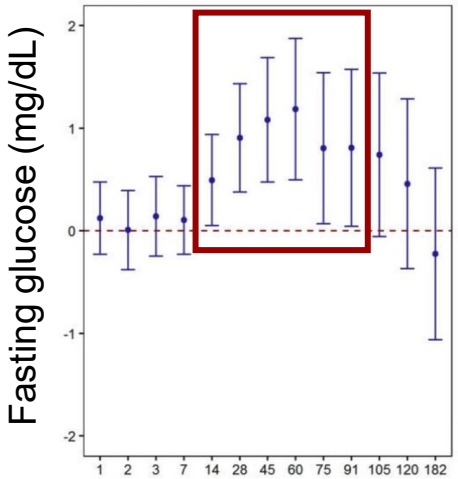
Adapted from GBD 2019 Diabetes and Air Pollution Collaborators. Lancet Planetary Health 2022;6(7):e586

EPIDEMIOLOGICAL STUDIES SHOW AIR POLLUTION INCREASES BLOOD SUGAR

For adults without diabetes ↑ exposure is associated with:

- ↑ HbA1c
- ↑ fasting glucose



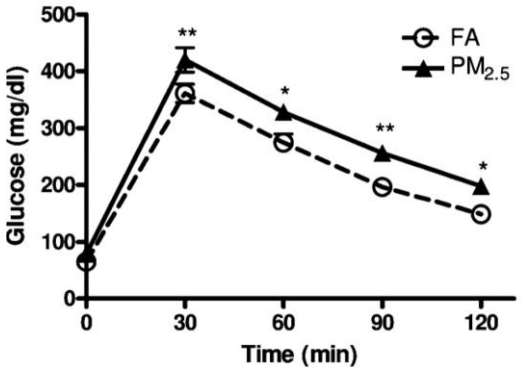


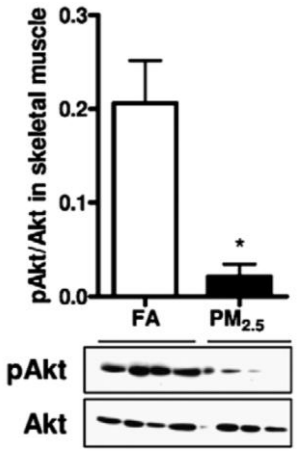
Lucht et al. EHP. 2018;126:047001

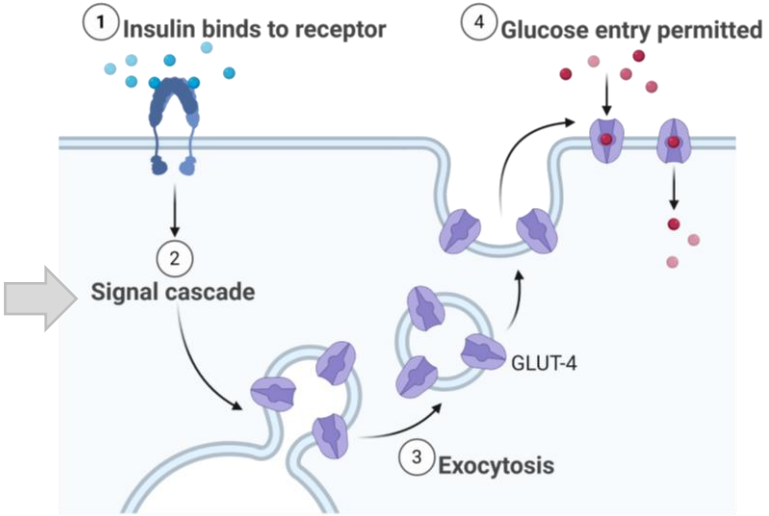
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EXPERIMENTAL STUDIES SHOW AIR POLLUTION INCREASES BLOOD SUGAR

$PM_{2.5}$ blunts insulin signaling → glucose intolerance







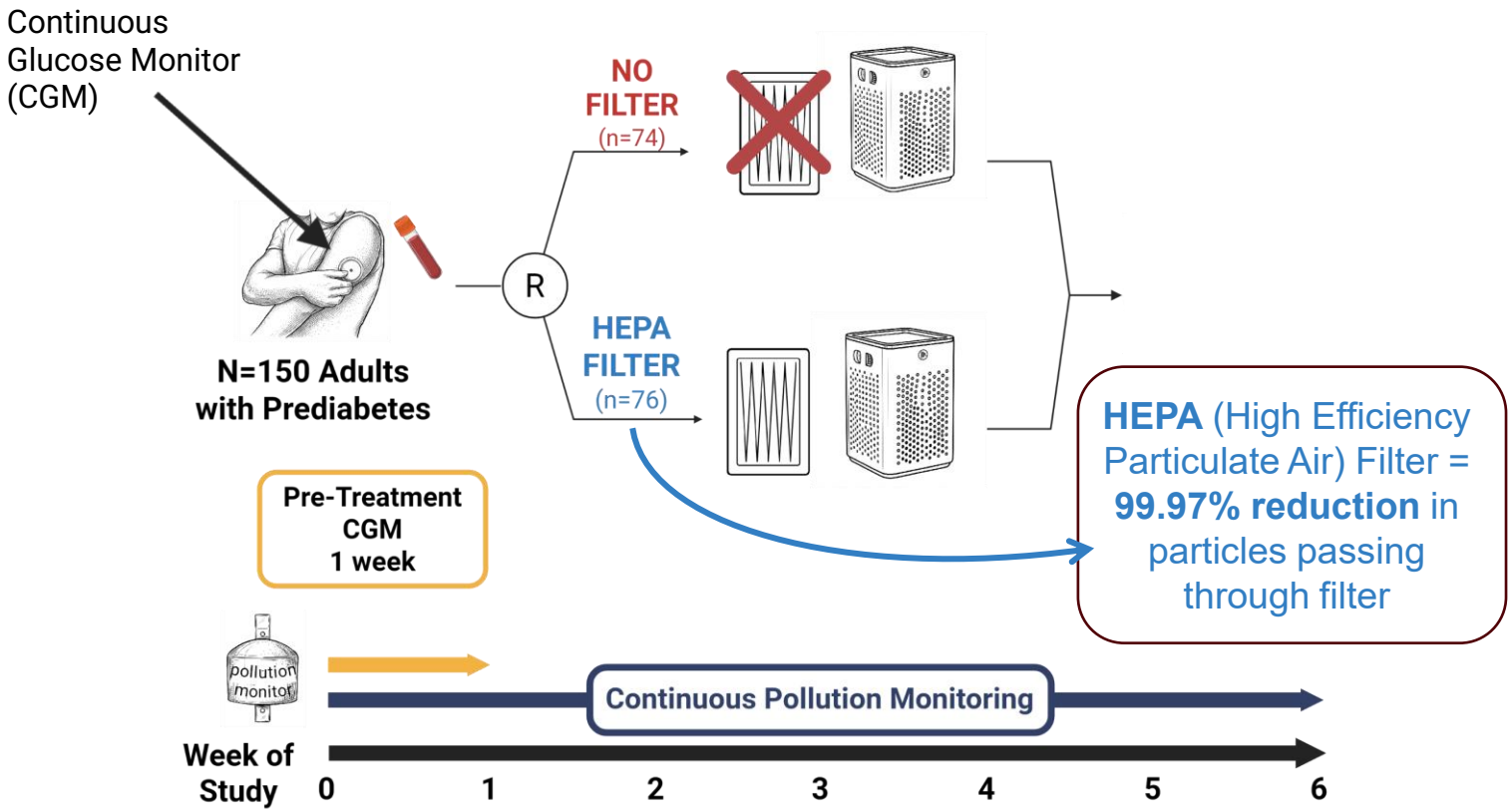
Xu, Toxicol Sci. 2011;124(1):88;
Rajagopalan, J Clin Invest. 2020 Nov 2;130(11):6034

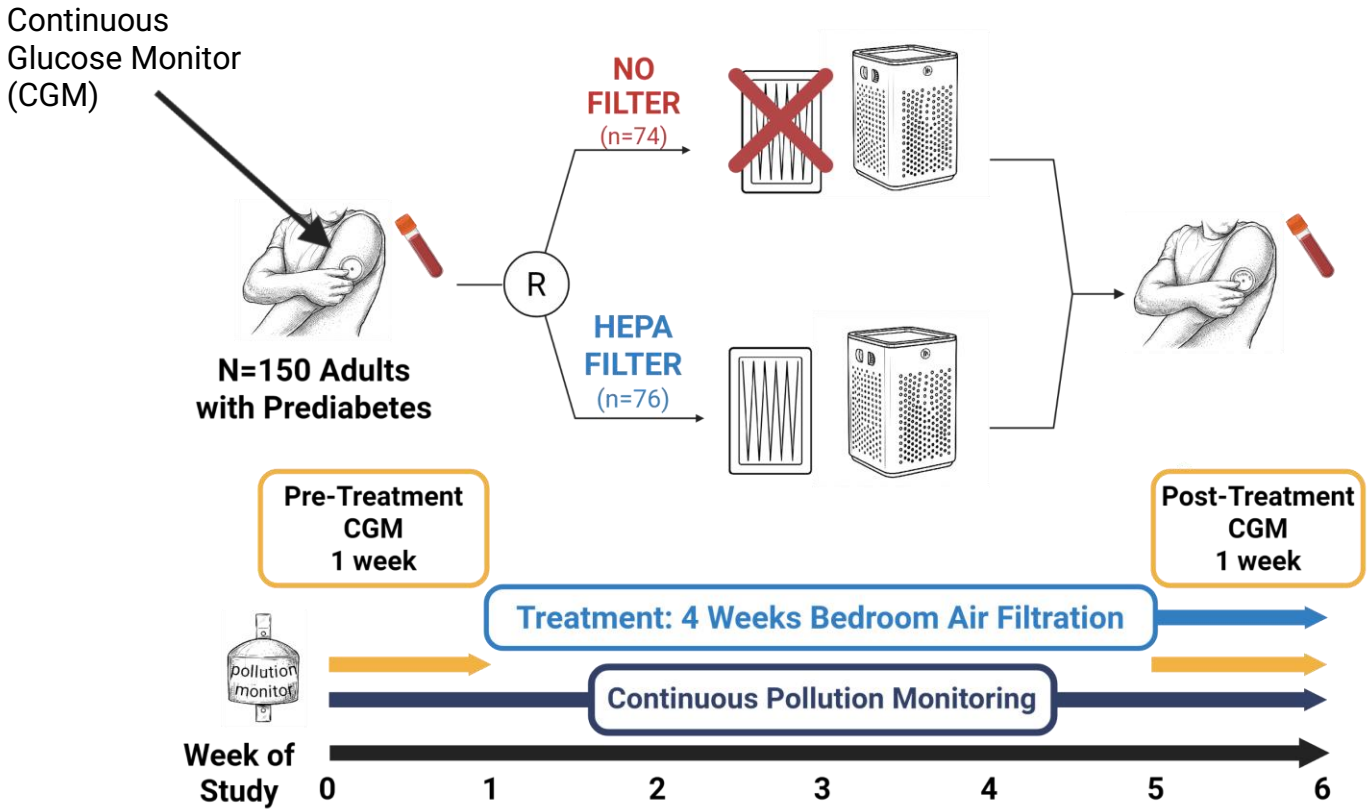
HYPOTHESIS

Lowering particulate matter pollution exposure
over 4 weeks will improve glucose homeostasis
in a primary prevention cohort of adults with prediabetes

02 STUDY DESIGN:

Randomized, double-blind, sham-controlled trial


Continuous
Glucose Monitor
(CGM)
N=150 Adults
with Prediabetes
R
NO
FILTER
(n=74)
HEPA
FILTER
(n=76)
HEPA (High Efficiency Particulate Air) Filter = 99.97% reduction in particles passing through filter
Pre-Treatment
CGM
1 week
Pollution monitor
Continuous Pollution Monitoring
Week of
Study
0
1
2
3
4
5
6

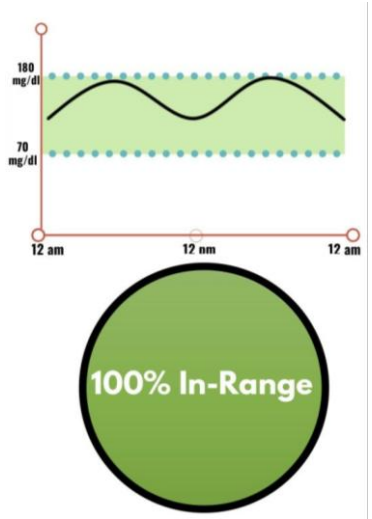

Continuous
Glucose Monitor
(CGM)
N=150 Adults
with Prediabetes
R
NO
FILTER
(n=74)
HEPA
FILTER
(n=76)
Pre-Treatment
CGM
1 week
Post-Treatment
CGM
1 week
Treatment: 4 Weeks Bedroom Air Filtration
Pollution
monitor
Continuous Pollution Monitoring
Week of
Study
0
1
2
3
4
5
6

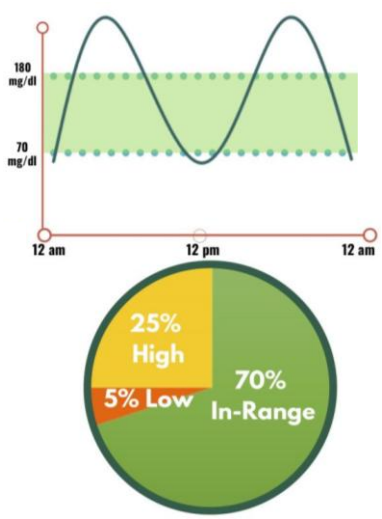
CGM CAPTURES GLYCEMIC CONTROL

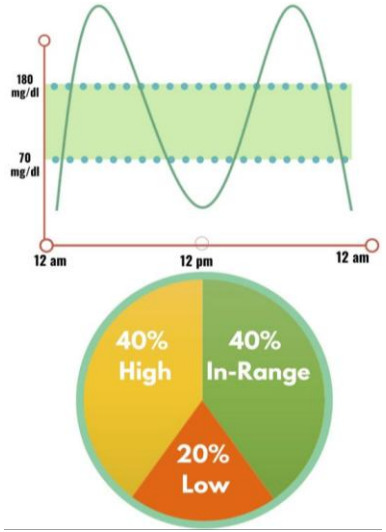
AS MEASURED BY CGM COEFFICIENT OF VARIATION %CV

Average glucose 154 mg/dL

HbA1c 7%



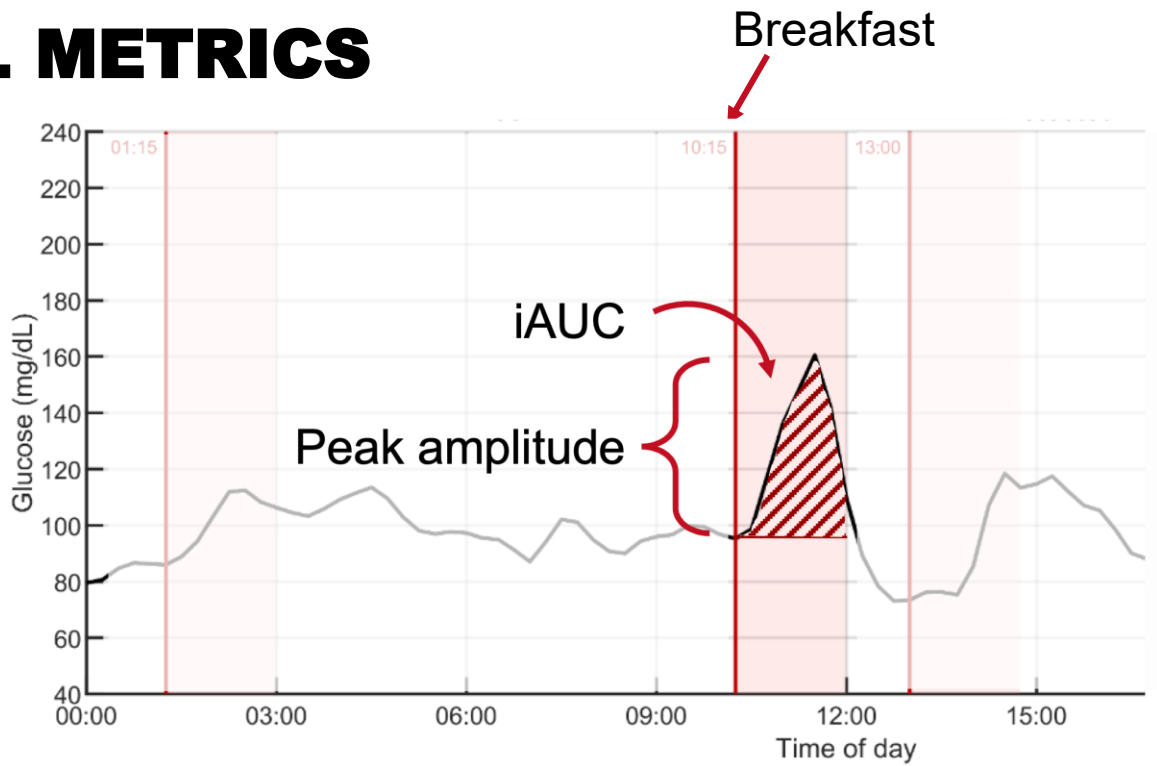




adapted from: https://www.diabetesnet.com

EXPLORATORY OUTCOMES: POST-PRANDIAL METRICS

- Peak Amplitude
- Incremental Area Under the Curve (iAUC)



EXPLORATORY OUTCOMES: POST-PRANDIAL METRICS

- Peak Amplitude
- Incremental Area Under the Curve (iAUC)
- Homeostasis Model Assessment of Insulin Resistance (HOMA-IR)

$$\text{HOMA-IR} = \frac{fasting\ insulin \ x \ fasting\ glucose}{405}$$

STATISTICAL CONSIDERATIONS

- Sample size: 150
  - 80% power
  - 10% reduction in the primary endpoint
  - $\alpha = 0.05$
  - ~ 25% missingness
- ANCOVA: Treatment Arm

03 RESULTS

WELL-BALANCED COHORT

- Young, diverse
  - 47 ± 13y
  - 44% female

	Filter (N = 76)	No Filter (N = 74)
Race, n (%)		
Asian	18 (24%)	14 (19%)
Black/African American	24 (32%)	27 (36%)
White	24 (32%)	25 (34%)
MENA / NHPI / Other	14 (18%)	17 (23%)
Hispanic/Latinx ethnicity, n (%)	11 (14%)	16 (22%)

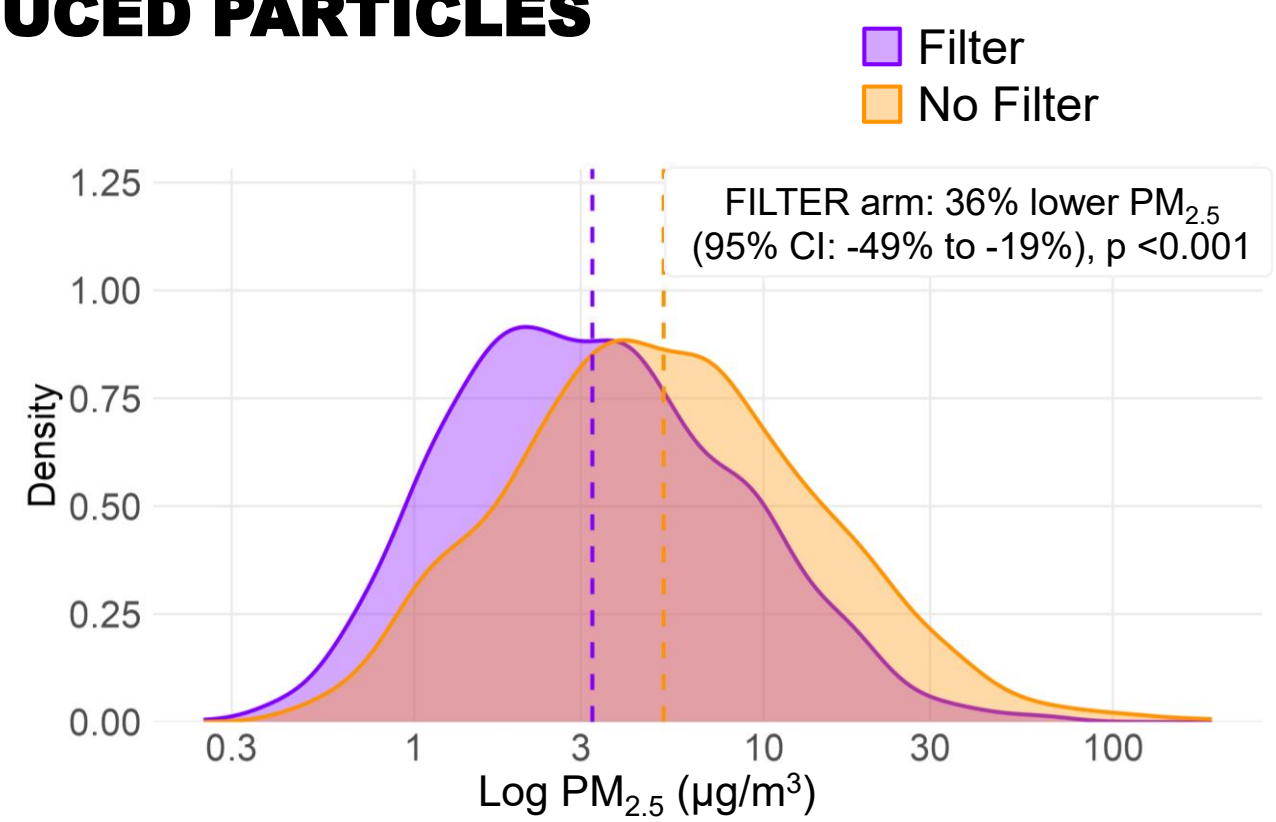
WELL-BALANCED COHORT

- Young, diverse
  - 47 ± 13y
  - 44% female
- Similar BMI, HbA1c, prediabetes history

	Filter (N = 76)	No Filter (N = 74)
Clinical / Anthropometric		
BMI, kg/m², mean (SD)	29.4 (6.2)	28.4 (5.5)
HbA1c, %, mean (SD)	5.9 (0.2)	5.8 (0.2)
Prediabetes duration, n (%)		
0-2 years	46 (61%)	45 (61%)
2-5 years	20 (26%)	13 (18%)
5-10 years	4 (5%)	9 (12%)
>10 years	4 (5%)	5 (7%)

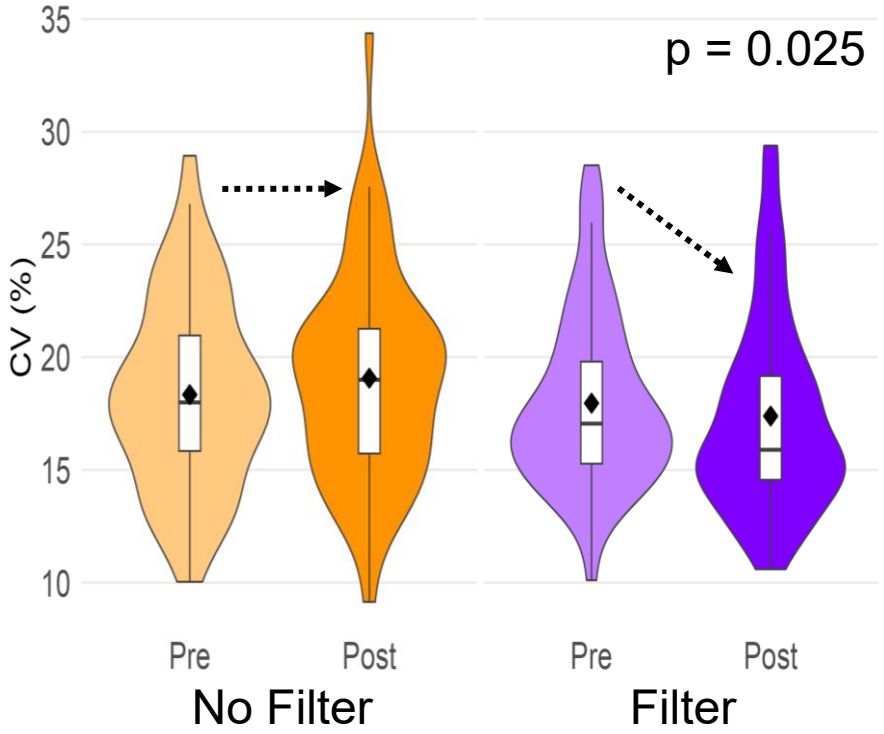
FILTERS REDUCED PARTICLES

Baseline $PM_{2.5}$, $\mu g/m^3$ mean (SD)	
Filter	7.51 (6.35)
No Filter	7.86 (10.83)

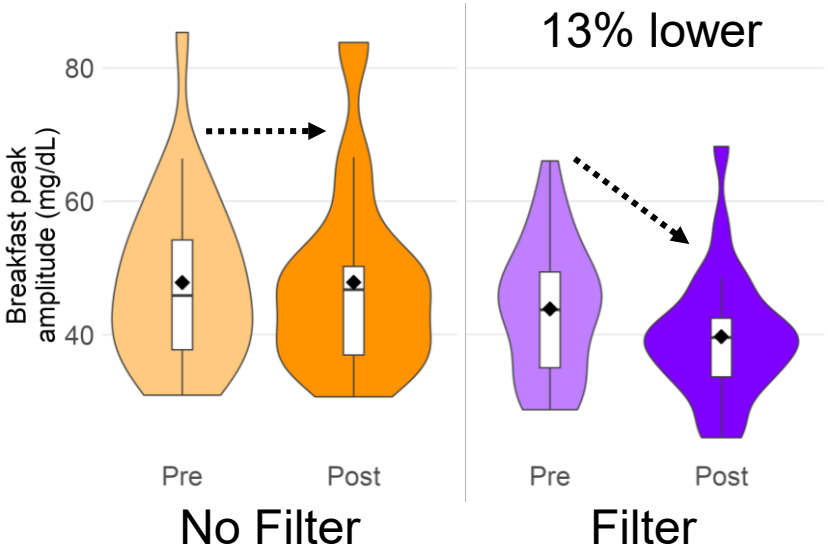


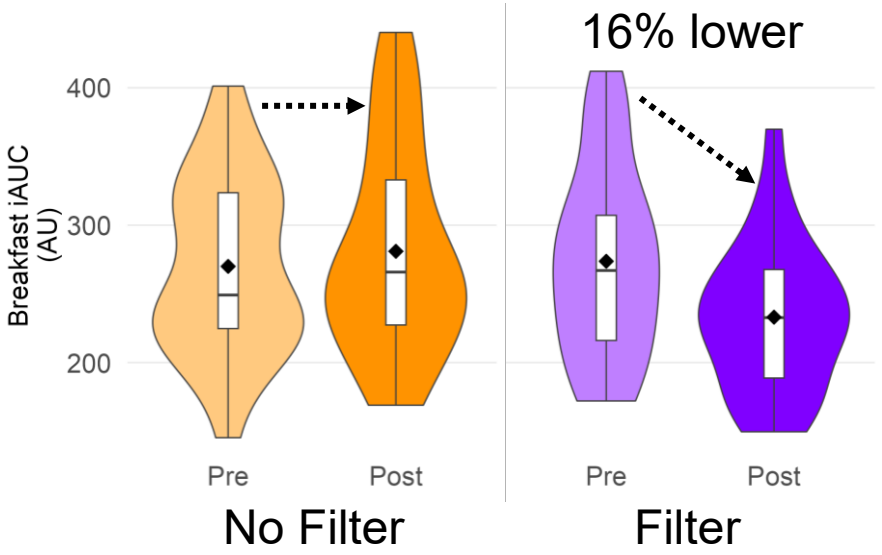
FILTERS LOWER COEFFICIENT OF VARIATION

7% lower after Filtration vs No Filtration



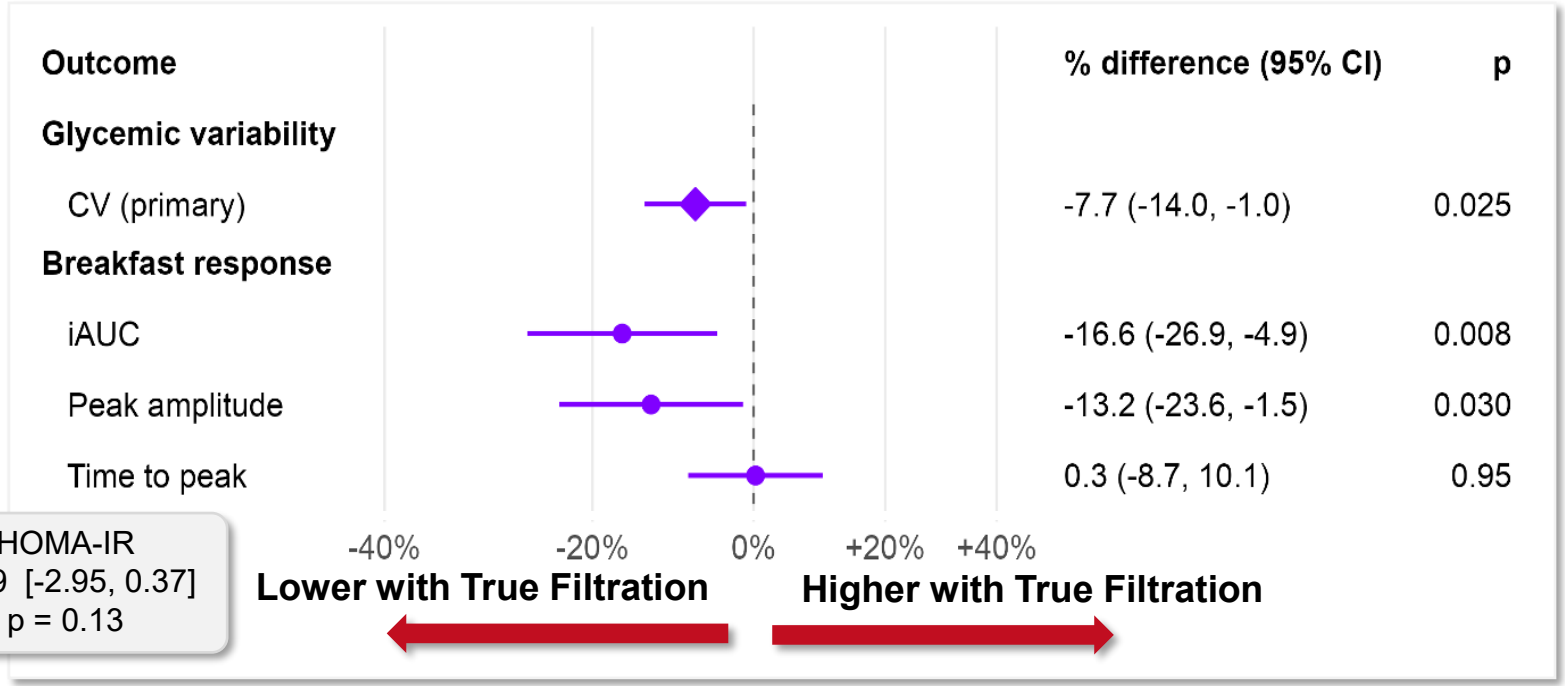
FILTERS IMPROVED NOVEL CGM METRICS





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CONSISTENT RESULTS ACROSS CGM OUTCOMES



HOMA-IR
-1.29 [-2.95, 0.37]
p = 0.13

04 DISCUSSION

The meaning of 16% lower iAUC…

REDUCTIONS COMPARABLE TO DIETARY CHANGE

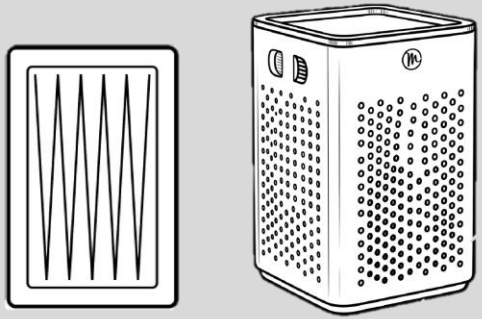
~7g of Carbohydrates (~2 tsp sugar)



LIMITATIONS, CONSIDERATIONS

- Small effect → Cumulative benefit over time
- No food logging → Future research needed
- Low pollution area → Effects detectable

Clinical utility?



BENEFITS > RISKS

Overnight exposure to HEPA filtration for 4 weeks improved blood sugar metabolism for adults with prediabetes

THANK YOU

Scientific Sessions

#ScientificSessions26

ACKNOWLEDGEMENTS

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- Dr. Jiyuan Hu

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