CARE-LA: Initial Results on Diesel Exhaust Exposures

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Scientific Guidance Panel Meeting

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Background

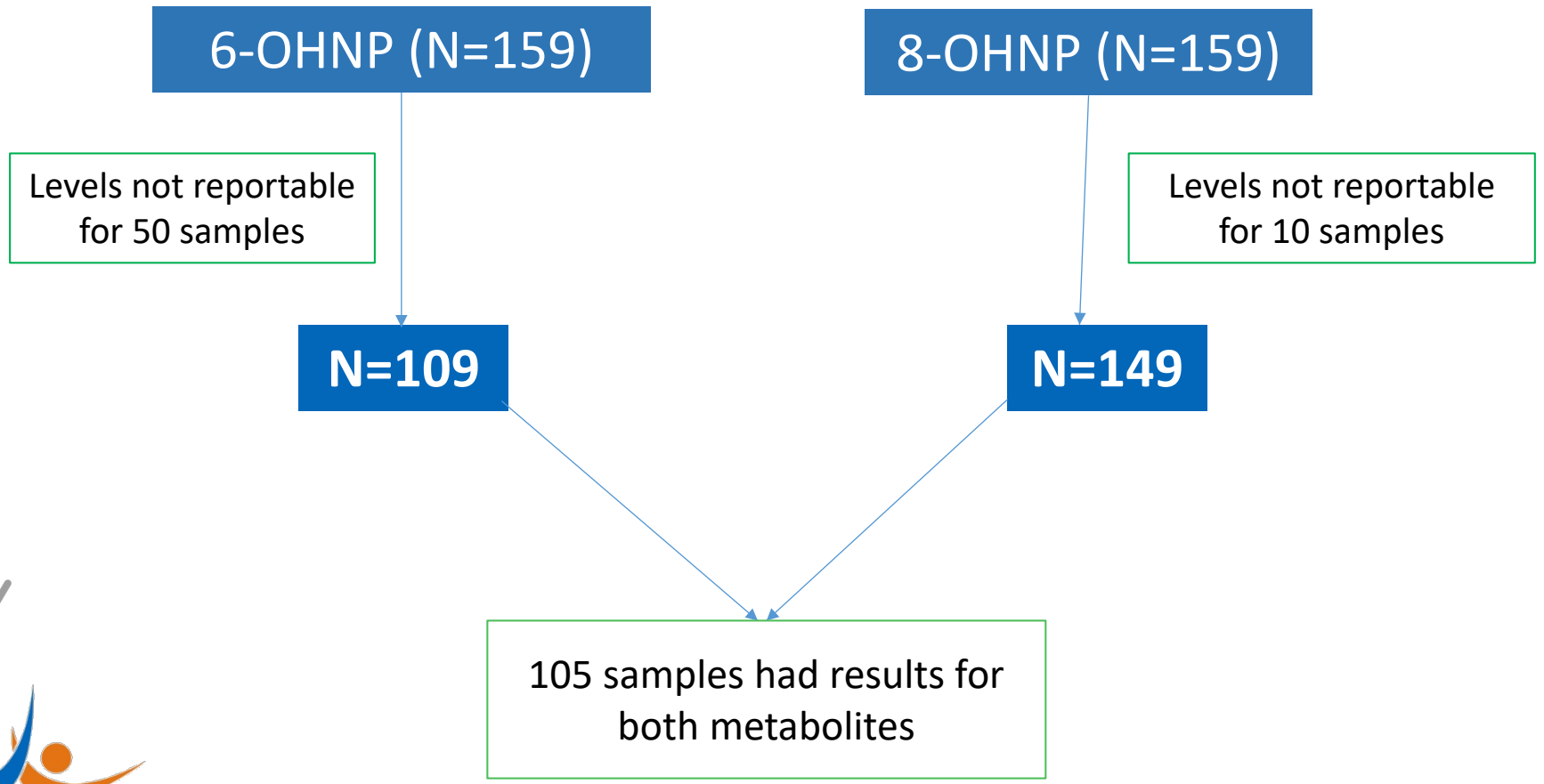
- SGP recommendation of diesel exhaust as a priority for biomonitoring
  - Strong community and stakeholder support
- Identification of 1-nitropyrene (1-NP) as a biomarker
- Launch of East Bay Diesel Exposure Project (EBDEP)
  - Lab analyses conducted by Chris Simpson's laboratory at University of Washington
- 1-NP added to the California Regional Exposure (CARE) Study

CARE-LA measurements

- Sub-sample of 159 participants
- Two 1-NP metabolites measured:
  - 6-OHNP and 8-OHNP
- Urinary results adjusted for specific gravity*
  - One approach to account for participant hydration status
  - Improves comparison within and between studies
- Metabolites reflect recent exposure

*Reference value of 1.017, NHANES 2007-8

Summary of sample analysis



Summary statistics

Metabolite (pg/L)	N	Geometric Mean (95% CI)	Median	MDL	Detection Frequency
6-OHNP	109	108 (88.9-132)	119	9.4	90.8%
8-OHNP	149	87.9 (76.0-102)	90.7	11.4	87.2%

Correlation of 6- and 8-OHNP

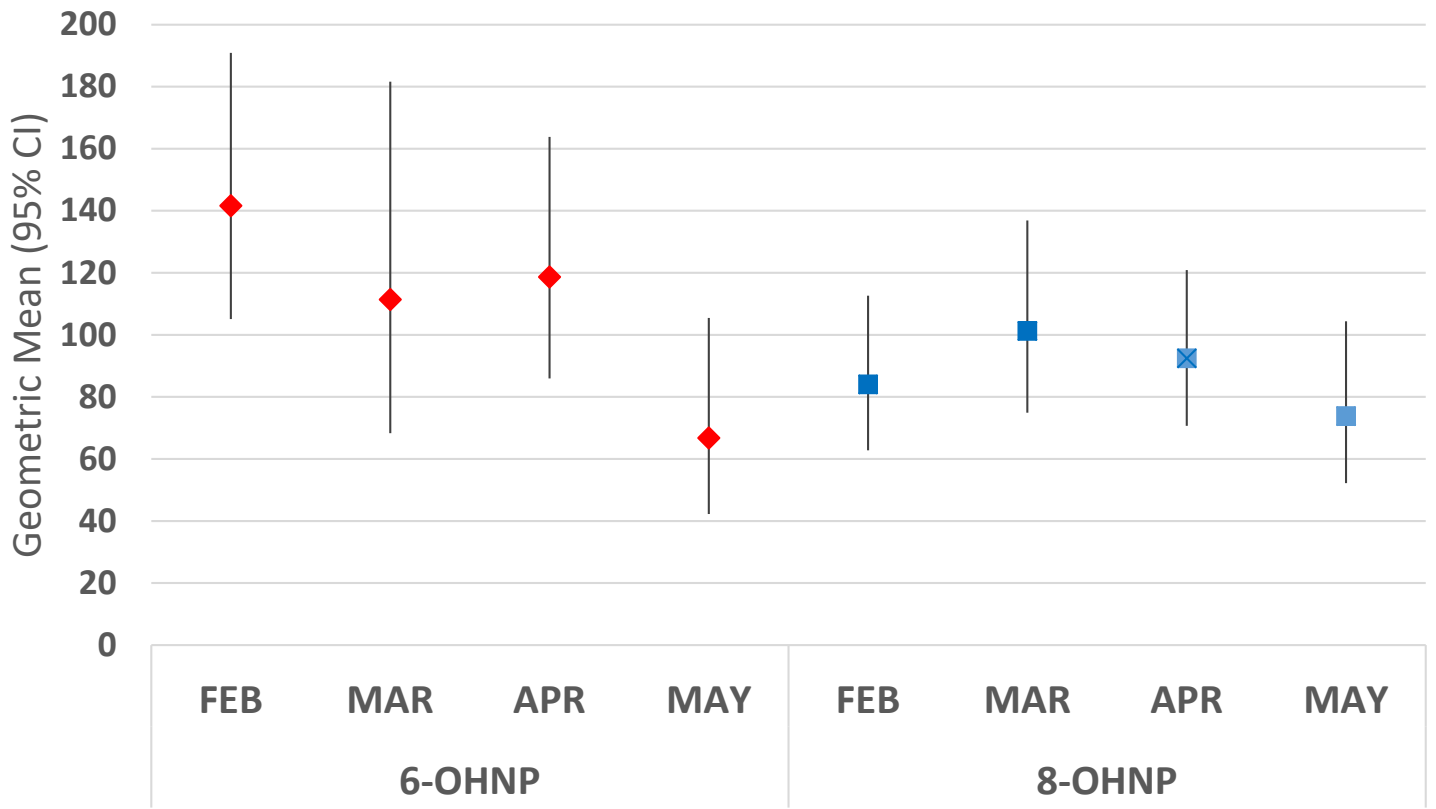
Race/Ethnicity	N	Correlation
Overall	105	0.70*
Hispanic	35	0.78*
White	36	0.27
Asian	15	0.90*
African American	11	0.97*

* $p<0.05$

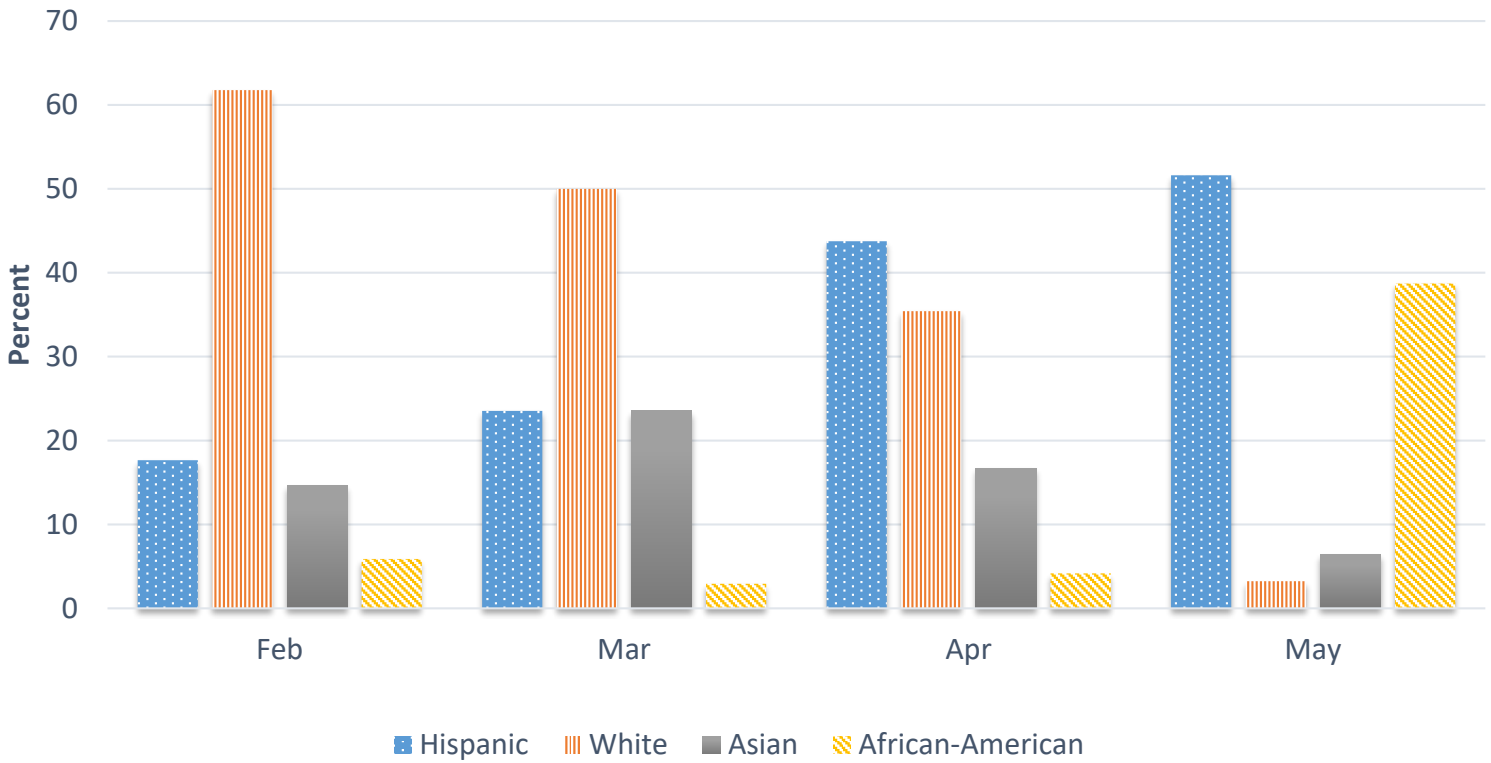
Seasonality of winter-time pollutants

- PAHs in air including 1-nitropyrene tend to be much higher between November and February
  - Inversions increase concentrations
  - Rain leads to sharp declines in concentrations
- Both timing and level of peak concentrations can vary from year to year

1-NP metabolites by month of study



Race/ethnicity by month of study



Statistical analysis

- Analyzed demographics (e.g., race, gender, age) associated with each metabolite ($p<0.10$)
- Considered those factors in multiple regression models with:
  - Self-reported exposure to diesel exhaust, last 3 days
  - Diesel traffic within 500 meters of residence
  - Tobacco use

Participant characteristics and metabolite levels

Characteristic	6-OHNP	8-OHNP
Race/ethnicity	NS	NS
Gender	NS	NS
Age (years)	NS	YES*
Education	NS	NS
Income	NS	NS
Place of birth	NS	NS
Language of survey	NS	NS
Month of sample collection	YES*	NS

NS=Association with metabolite levels was not significant (p>0.05)
YES*=Characteristic was significantly associated with metabolite level (p<=0.05)

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Traffic near participant residence

- Collaboration with EBDEP team
- 2017 daily traffic counts for LA County*
  - primary highways and secondary roads
- Determined daily vehicle-kilometers-traveled (VKT) within a 500 meter buffer area surrounding each participant address
- Types of vehicles
  - All vehicles (commercial and passenger)
  - Buses and commercial trucks
  - Tractor-trailers (e.g. 18-wheelers)

*Source: US Department of Transportation, Federal Highway Administration, Highway Performance Monitoring System

Traffic and metabolite levels

Traffic w/in 500M of residence (VKT)	% Change 6-OHNP	% Change 8-OHNP
All vehicles	27.0*	10.1^
Buses/commercial trucks	34.1*	16.1
Tractor-trailers	23.7*	18.4^

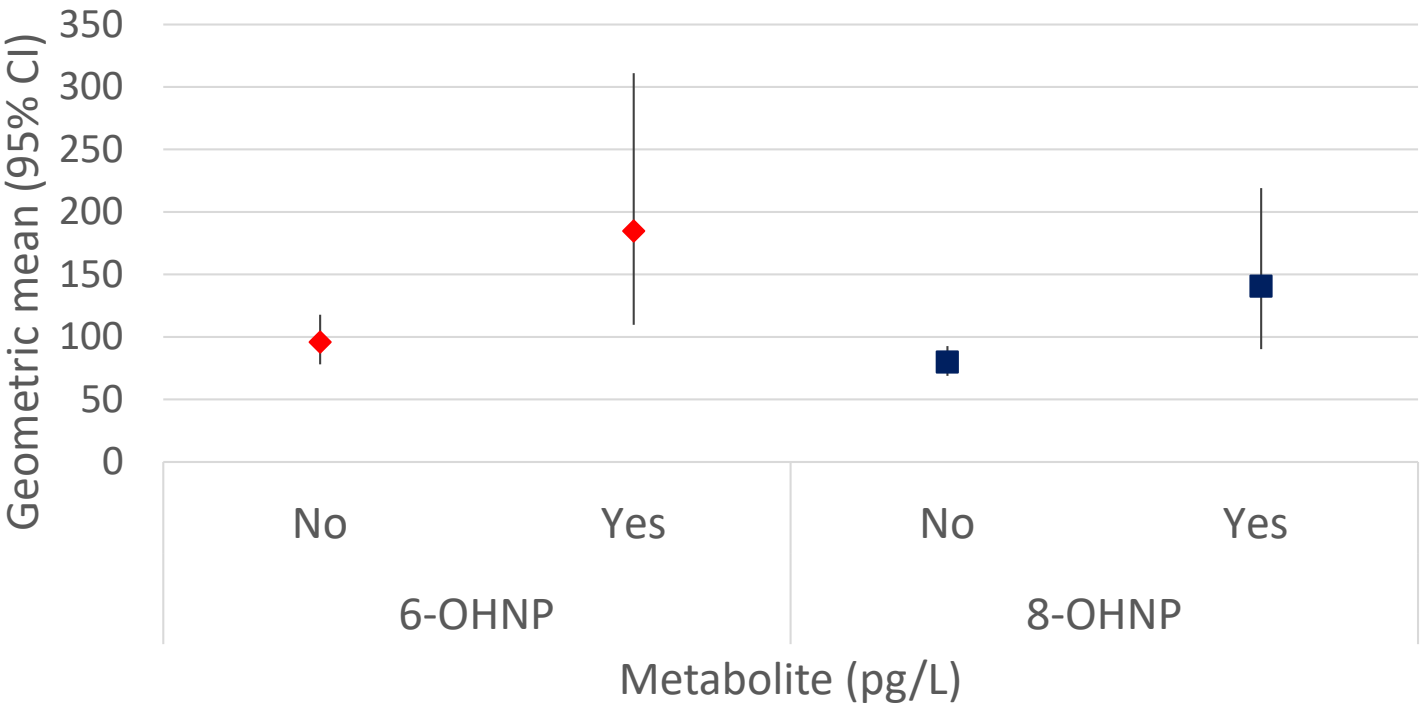
Percent change for an interquartile range change in VKT: all vehicles= 89,211; buses/small trucks=3025; tractor-trailers=1800; all heavy duty=4935; 6-OHNP adjusted for month of sample collection; 8-OHNP adjusted for age in years. * = $p<0.05$; ^ = $0.05<p<0.10$

Recent diesel exhaust exposures and metabolite levels

Recent diesel exhaust exposure	% Change 6-OHNP	% Change 8-OHNP
Worked with or around diesel equipment	122*	19
Time spent on freeway	-20^	5
Diesel exhaust exposures other than at work or on freeway	-34	-34^

6-OHNP adjusted for study month; 8-OHNP adjusted for age in years; * = $p<0.05$ | ^ = $0.05<p<0.10$.

Metabolite levels by tobacco use*



*Tobacco use defined as current cigarette smoker or current use of tobacco products other than cigarettes.

6-OHNP multivariable model

Variable	% Change 6-OHNP
Recent work-related diesel exposure	92.6^
Hours on freeway	-18.5^
Tractor-trailer traffic (VKT)#	20.1*
Current tobacco use	74.3*

Also includes factor term for month of sample collection; # Percent change for an interquartile range change in tractor-trailer traffic volume (1800 VKT); * = $p<0.05$; ^ = $0.05<p<0.10$

8-OHNP multivariable model

Variable	% Change 8-OHNP
Age (10 years)	-11.5*
Recent diesel exposure not on freeway or at work	-39.7^
Tractor-trailer traffic (VKT) #	12.5*
Current tobacco user	53.0*

#Percent change for an interquartile range change in tractor-trailer traffic volume (1800 vehicles); * = $p<0.05$; ^ = $0.05<p<0.10$

Preliminary conclusions

- Month of sample collection (6-OHNP) and age (8-OHNP) were the only participant characteristics associated with metabolite levels
- In multivariable models, both 6-OHNP and 8-OHNP levels were associated with tractor-trailer traffic volume and tobacco use
- Reported recent exposure to diesel was marginally associated with metabolite levels but direction of effect varied

Issues for 1-NP surveillance in CARE

- Seasonality of air pollutants might obscure groups with higher levels of exposure
  - Air pollutants vary by month
  - The characteristics of participants can vary by month of sample collection
- Should we restrict analysis of 1-NP to non-smokers?
  - Tobacco users have higher levels of both metabolites
  - Associations are independent of recent diesel exposures and traffic volume

Next Steps

- Continue traffic analyses
  - Heavy-duty traffic
  - Consider other buffer sizes around residence
  - Bus stops, bottlenecks
- Comparison with results from EBDEP
- Comparison with CARE 2 results (N=160 samples)

Thank you!

- University of Washington
  - Chris Simpson
  - Mike Paulsen
- EBDEP team – UC Berkeley and OEHHA
- Other Biomonitoring California staff