Effects of Recent Air Pollution Exposure on Cognition, Inflammation, and Neurodegeneration in HIV

Sarah A Cooley[1], Julie Wisch[1], Tricia Burdo[2], Dianne Langford[2], Rajan Chakrabarty[1], Payton Beeler[1], Beau M Ances[1]
[1]Washington University in St. Louis, St. Louis, MO, USA; [2]Temple University, Philadelphia, PA, USA

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BACKGROUND

- Ambient air pollution, even within permissible levels, has been associated with greater risk of illness and mortality[1]
- People with HIV (PWH) may be more vulnerable to worsening climate and pollution-associated outcomes[2]
- Most studies of the effect of air pollution on health outcomes in HV are outside of the United States (US), limiting generalizability to PWH living within the US

METHODS

- 227 PWH and 107 people without HIV (PWoH) living in the St. Louis region
- Participant addresses were used to determine census tract-based location
- Spatial interpolation applied to publicly available EPA pollution monitoring data to calculate average exposure to pollutants in week prior to study visit
  - Fine particulate matter (PM) 2.5
  - PM 10
  - Ozone
  - Lead (Pb)
- NASA satellite data was used to calculate average PM2.5 exposure over past calendar year in a subset of participants
- All participants completed comprehensive neuropsychological battery
- All participants completed a blood draw to get markers of interest:
  - sCD14
  - sCD163
  - CD14CD16 monocytes
  - Neurofilament light protein (NfL)
  - Glial fibrillary acidic protein (GFAP)
- Relationships were assessed using regression models accounting for Area Deprivation Index (ADI)[3]

Recent exposures to common air pollutants were associated with poorer outcomes in cognition, inflammatory markers and monocytes, and markers of neurodegeneration in PWoH and PWH.

RESULTS

- PWH and PWoH did not significantly differ in recent air pollutant exposure (p>.05).
- Cognition:
  - Higher recent exposures to PM2.5, PM10, and Pb were associated with worse learning, delayed recall, executive functioning and global cognition in both PWoH and PWH (p-values <.05) (**Figure 1**)

	PWoH	PWH	P-value
Age (years; M ± SD)	48.1± 14.9	52.3 ± 12.0	.005
Sex (% Male)	56%	74%	<.001
Education (years; M ± SD)	13.9 ± 2.4	13.1 ± 2.5	.007
Race (%AA)	59%	66%	.57
Recent CD4 T-cell count, median (IQR)	N/A	611 (441, 845)	N/A
Duration of HIV infection (months; median [IQR])	N/A	198 (106, 347)	N/A
Recent HIV viral load, median (IQR)	N/A	20 (20, 20)	N/A
Area deprivation index (M ± SD)	66.7 ± 23.8	73.1 ± 24.9	.02

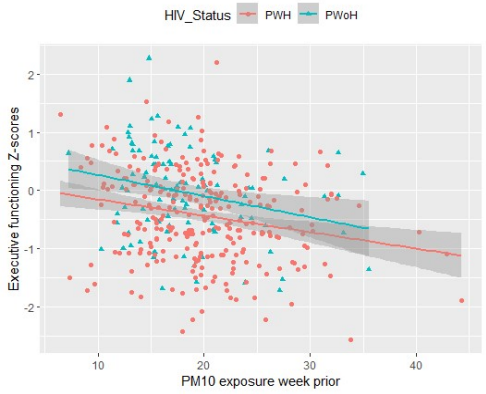


Figure 1. Greater recent PM10 exposure associated with worse executive functioning.

RESULTS continued

- Higher recent ozone and PM2.5 exposure associated with higher levels of inflammation (sCD14, sCD163) in PWH (p-values <.05)
- Higher recent PM2.5 exposure also associated with reduced classical monocytes and greater non-classical monocytes in PWH (p-values <.01; **Figure 2**)

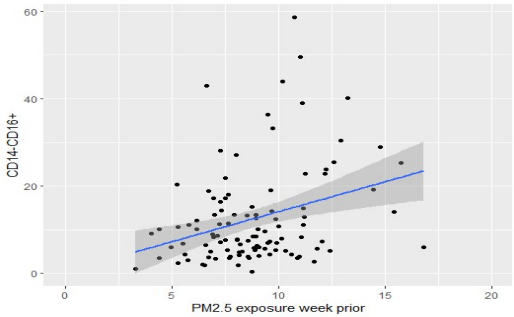


Figure 2. Greater recent PM2.5 exposure associated with higher levels of non-classical monocytes in PWH.

- Higher recent ozone and PM10 exposure associated with higher markers of neurodegeneration (NfL and GFAP) in PWH and PWoH

CONCLUSIONS

- Greater recent exposures to air pollutants associated with worse cognition and changes to plasma markers of inflammation and neurodegeneration in PWH
- Air pollution may trigger immune responses in PWH that may contribute to neurodegeneration and cognitive changes in PWH
- Longitudinal studies of the effects of air pollution are needed in PWH

ADDITIONAL KEY INFORMATION

Author Contact Information:
Sarah Cooley: SCooley22@wustl.edu

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