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## **Supplemental Material**

# **Cross-Sectional Associations between Exposure to Persistent Organic Pollutants and Leukocyte Telomere Length among U.S. Adults in NHANES, 2001-2002**

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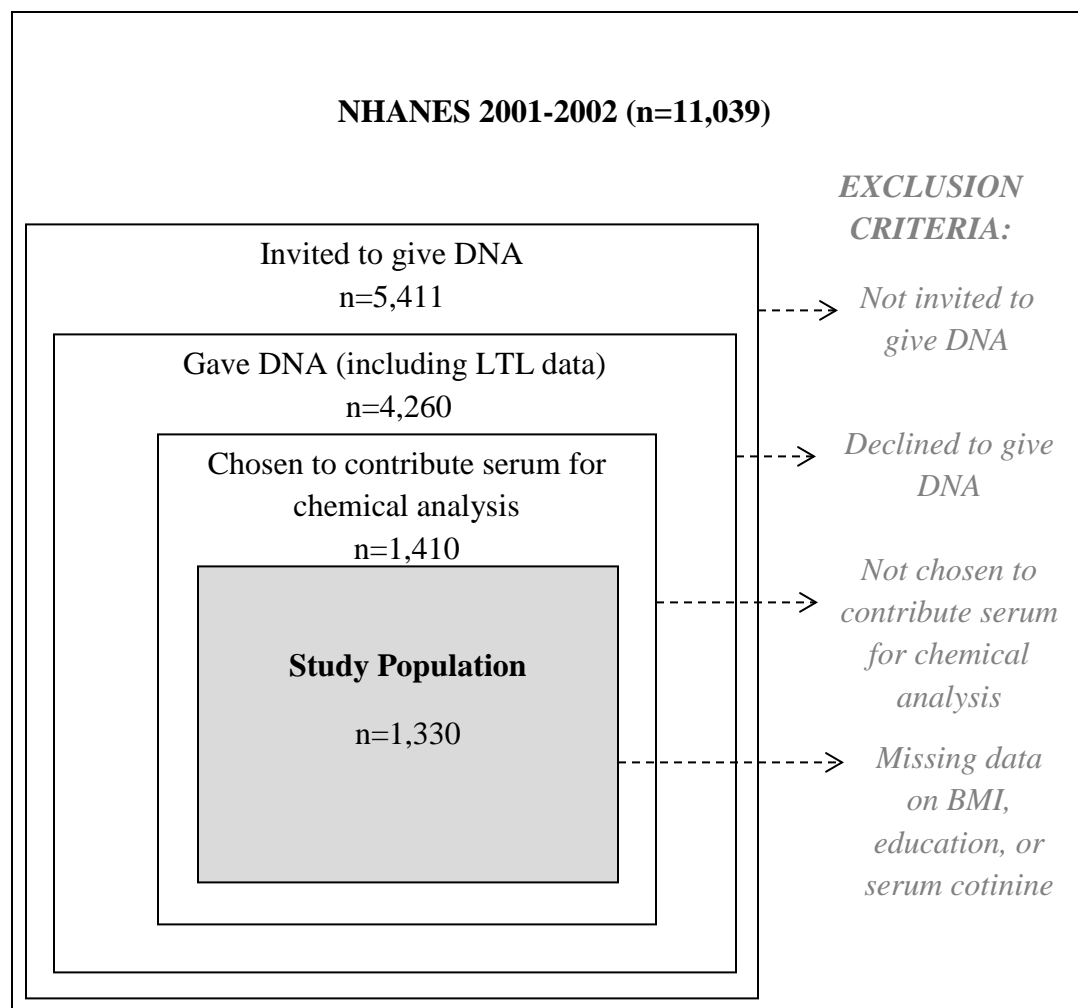
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**References**

**Figure S1.** Exclusion criteria used to form the study population.



**Table S1.** Percent difference (95% CI) in leukocyte telomere length (T/S ratio) by TEQ. Each model treats values below the LOD differently.

TEQ metric	Model 3 <sup>a</sup>		Treatment of values below the LOD
	n	% difference (95% CI)	
<b>Final model</b>			
Per doubling of exposure	976	5.29 (1.66, 9.05)**	All congeners included; values <LOD modeled as LOD/√2
<b>Excluding &lt;33% detected</b>			
Per doubling of exposure	995	4.84 (1.58, 8.20)**	Congenens with <33% of values detected are excluded
<b>Excluding &lt;50% detected</b>			
Per doubling of exposure	996	4.93 (1.53, 8.44)**	Congenens with <50% of values detected are excluded
<b>Multiple imputation</b>			
Per doubling of exposure	976	4.30 (1.09, 7.61)*	All congeners included; values <LOD were imputed <sup>b</sup>

*Abbreviations:* TEQ: toxic equivalent; CI: confidence interval; LOD: Limit of detection

<sup>a</sup>Model 3 is adjusted for age, age<sup>2</sup>, sex, race/ethnicity, BMI, (log)cotinine, white blood cells, percent lymphocytes, percent monocytes, percent neutrophils, percent eosinophils, percent basophils, serum lipids, and non-dioxin-like PCBs.

<sup>b</sup>We averaged 5 runs of the SAS lifereg model, assuming that the values fell between zero and LOD/√2 for each congener and that the congeners were log-normally distributed, to generate the imputed values. Only congeners with at least 10% of values detected were imputed to ensure valid imputation; for congeners with less than 10% of values detected, the sample-specific LOD/√2 was used for <LOD values.

\**P* < 0.05; \*\* *P* < 0.01

**Table S2.** Percent difference (95% CI) in leukocyte telomere length (T/S ratio) by non-dioxin-like PCBs, non-ortho PCBs, and TEQ (modeled as wet weights (ng/g or pg/g)).

Metric	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>		Model 3 <sup>c</sup>	
	n	% difference (95% CI)	n	% difference (95% CI)	n	% difference (95% CI)
<b>Non-dioxin-like PCBs</b>						
Per doubling of exposure	1265	3.89 (1.24, 6.61)**	1259	3.62 (0.93, 6.38)*	1093	0.32 (-2.34, 3.06)
Quartile 1 ( $\leq 0.45$ ng/g)		Ref		Ref		Ref
Quartile 2 (0.46 – 0.87 ng/g)		6.37 (0.34, 12.76)*		7.04 (2.05, 12.26)**		4.36 (-0.12, 9.03)
Quartile 3 (0.88 – 1.62 ng/g)		10.87 (3.84, 18.38)**		10.88 (4.30, 17.87)**		5.49 (-0.97, 12.37)
Quartile 4 ( $> 1.62$ ng/g)		12.35 (2.91, 22.66)*		11.84 (2.61, 21.90)*		3.02 (-5.49, 12.31)
<i>P trend</i>		0.013*		0.022*		0.61
<b>Non-ortho PCBs</b>						
Per doubling of exposure	1134	4.21 (2.44, 6.01)**	1128	4.22 (2.75, 5.72)**	1093	3.68 (2.08, 5.31)**
Quartile 1 ( $\leq 0.17$ pg/g)		Ref		Ref		Ref
Quartile 2 (0.18 – 0.29 pg/g)		3.51 (-1.93, 9.26)		4.27 (-0.82, 9.61)		4.30 (-0.89, 9.75)
Quartile 3 (0.30 – 0.48 pg/g)		6.10 (-0.18, 12.77)		6.55 (0.87, 12.55)*		5.31 (0.58, 10.26)*
Quartile 4 ( $> 0.48$ pg/g)		11.54 (4.31, 19.27)**		11.66 (5.04, 18.71)**		8.78 (2.08, 15.93)*
<i>P trend</i>		0.002**		0.001**		0.0099**
<b>TEQ</b>						
Per doubling of exposure	1002	5.58 (2.36, 8.90)**	998	5.70 (2.40, 9.10)**	975	5.20 (1.74, 8.79)**
Quartile 1 ( $\leq 0.08$ pg/g)		Ref		Ref		Ref
Quartile 2 (0.09 – 0.11 pg/g)		3.97 (-2.48, 10.85)		4.68 (-0.78, 10.43)		4.30 (-1.07, 9.96)
Quartile 3 (0.12 – 0.18 pg/g)		6.97 (-0.34, 14.83)		7.94 (1.48, 14.82)*		6.91 (0.37, 13.88)*
Quartile 4 ( $> 0.18$ pg/g)		9.22 (0.04, 19.25)*		9.29 (0.51, 18.83)*		6.95 (-1.41, 16.02)
<i>P trend</i>		0.044*		0.029*		0.073

Abbreviations: PCB: polychlorinated biphenyl; TEQ: toxic equivalent; CI: confidence interval; Ref: reference category

<sup>a</sup>Model 1 is adjusted for age, age<sup>2</sup>, serum lipids

<sup>b</sup>Model 2 is adjusted for age, age<sup>2</sup>, sex, race/ethnicity, BMI, (log)cotinine, white blood cells, percent lymphocytes, percent monocytes, percent neutrophils, percent eosinophils, percent basophils, serum lipids.

<sup>c</sup>Model 3 is additionally adjusted for a second exposure metric. Non-dioxin-like PCBs are adjusted for non-ortho PCBs, serum lipids. Non-ortho PCBs and TEQ are adjusted for non-dioxin-like PCBs. \* $P < 0.05$ ; \*\*  $P < 0.01$

**Table S3.** LTL and risk/odds of dioxin- or PCB-associated cancers.

Reference	Cases	Cancer Type	Study design	Association between LTL and cancer risk/odds
(Fu et al. 2012)	140	Liver	Retrospective, Case-control	Positive (quartile $P_{\text{trend}}=0.079$ )
(Liu et al. 2011)	240	Liver	Retrospective, Case-control	Positive (quartile $P_{\text{trend}} < 0.001$ )
(Anic et al. 2013)	198	Melanoma	Retrospective, Case-control	Positive (tertile $P_{\text{trend}} < 0.0001$ )
(Burke et al. 2013)	119	Melanoma	Retrospective, Case-control	Positive (short LTL OR: 2.81 (95% CI: 1.02–7.72), $P = 0.04$ )
(Han et al. 2009)	218	Melanoma	Prospective, Case-control	Positive (quartile $P_{\text{trend}} = 0.09$ )
(Nan et al. 2011)	557	Melanoma	Prospective, Case-control	Positive (quartile $P_{\text{trend}} = 0.0003$ )
(Sun et al. 2015)	191	Lung	Retrospective, Case-control	Positive among participants > 60 years (long LTL OR: 0.52 (95% CI: 0.29–0.94), $P = 0.031$ )
(Kim et al. 2015)	151	Lung	Prospective, Longitudinal	LTL positively associated with recurrence in women (long LTL hazard ratio: 2.25 (1.02–4.96; $P = 0.044$ ))
(Seow et al. 2014)	847	Lung	Prospective, Case-control	Positive (quartile $P_{\text{trend}} < 0.0001$ )
(Sanchez-Espiridion et al. 2014)	1385	Lung	Retrospective, Case-control	Positive for adenocarcinoma (quartile $P_{\text{trend}} < 0.001$ )
(Lan et al. 2013)	215	Lung	Prospective, Case-control	Positive (tertile $P_{\text{trend}} = 0.003$ )
(Shen et al. 2011)	229	Lung	Prospective, Case-control	Positive (quartile $P_{\text{trend}} = 0.05$ )
(Hosgood et al. 2009)	120	Lung	Retrospective, Case-control	No association (Shortest vs longest quartile OR: 1.58 (95% CI: 0.79–3.18))

(Jang et al. 2008)	243	Lung	Retrospective, Case-control	Inverse (quartile $P_{\text{trend}} < 0.0001$ )
(Wu et al. 2003)	54	Lung	Retrospective, Case-control	Inverse (quartile $P_{\text{trend}} = 0.002$ )
(Hosnijeh et al. 2014)	235	NHL	Prospective, Case-control	Positive for follicular lymphoma and diffuse large B-cell lymphoma (quartile $P_{\text{trends}} = 0.02, 0.03$ respectively)
(Lan et al. 2009)	107	NHL	Prospective, Case-control	Positive (quartile $P_{\text{trend}} = 0.003$ )
(Widmann et al. 2007)	40	NHL	Retrospective, Case-control	Inverse (shortest vs longest quartile OR: 19.0 (95% CI: 2.1-170.4))
(Lee et al. 2003)	15	NHL	Retrospective, Case-control	Inverse (Wilcoxon test $P < 0.001$ )
(Xie et al. 2013)	137	Soft tissue sarcoma	Retrospective, Case-control	Positive (quartile $P_{\text{trend}} < 0.001$ )

*Abbreviations:* PCB: polychlorinated biphenyl; Prospective study (LTL measured before outcome had developed); Retrospective study (LTL measured after outcome had developed); NHL: Non-Hodgkin's lymphoma; LTL: Leukocyte telomere length; OR: Odds ratio

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