Dietary influence on response to PM: Asthma and COPD

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BRIDGING RESEARCH, LUNG HEALTH & THE ENVIRONMENT

Disclosures

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

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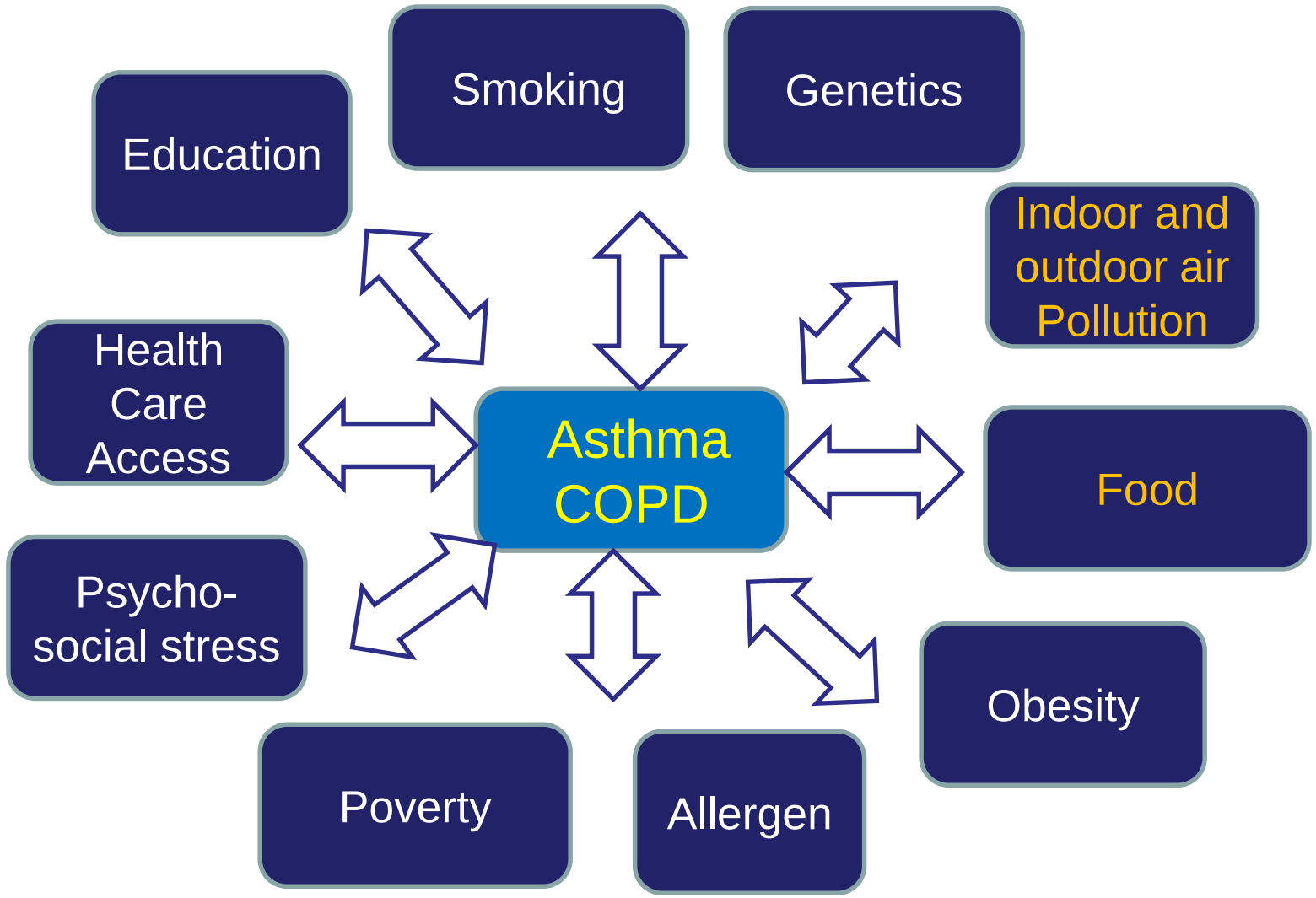
(2) The following personal financial relationships with tobacco industry entities existed during the past 12 months:

None

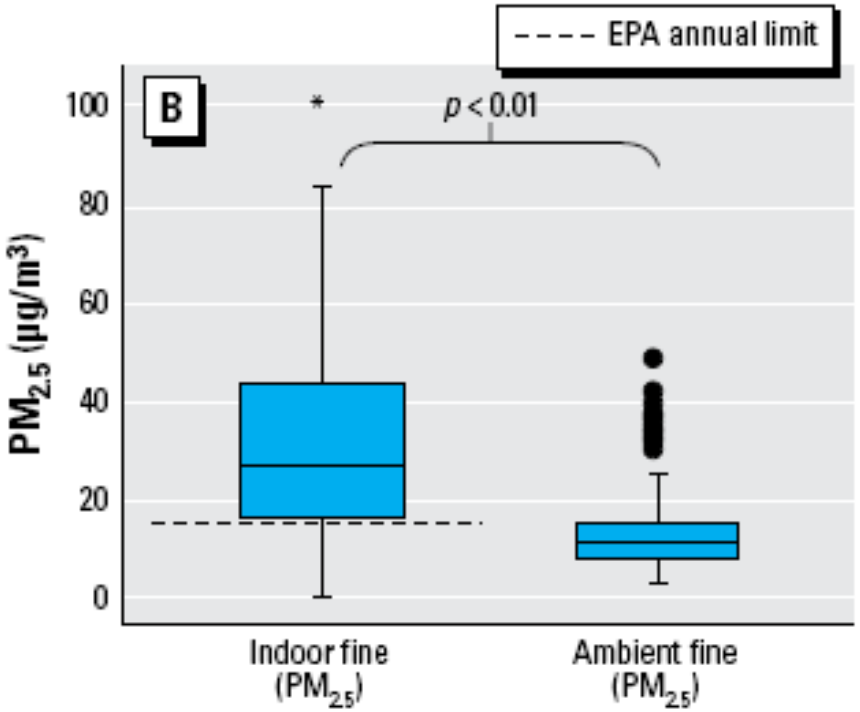
Exposome: Many Factors Coalesce to affect respiratory health

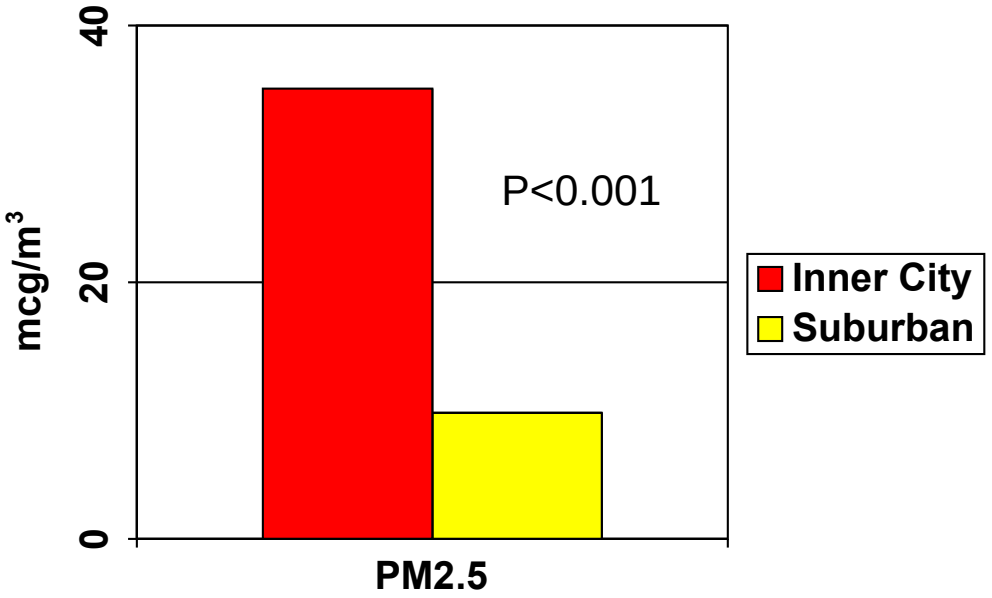


Sources of Indoor Pollution

Hansel et al. EHP 2009
McCormack et al EHP 2009
Paulin et al. J of Env Protection. 2013
Paulin et al. Env Research 2017

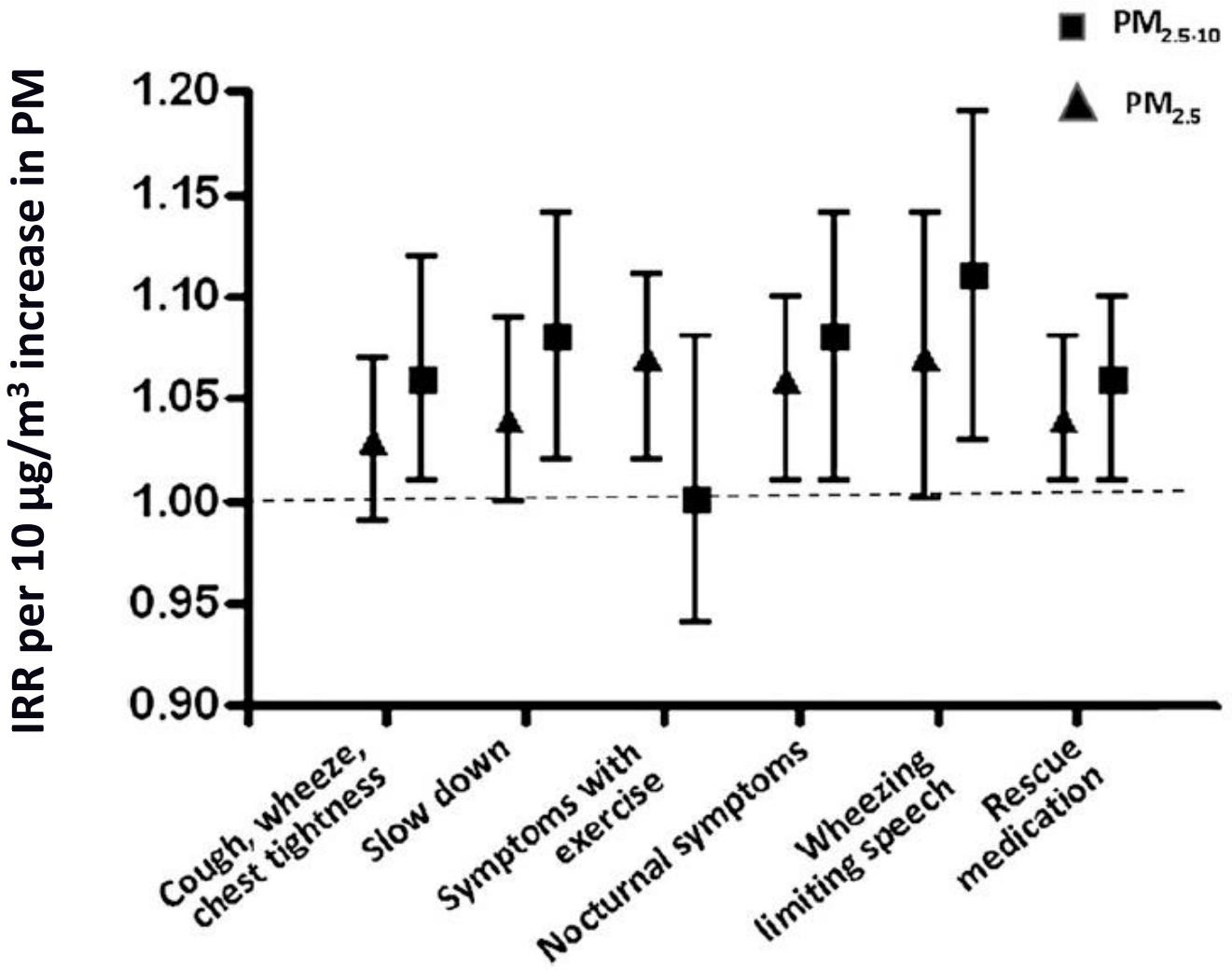
Low SES and pollutant burden in US Homes: PM levels in inner city Baltimore





Simons et al. 2007
McCormack et al. EHP. 2009

Indoor PM and Asthma Morbidity



McCormack et al. EHP 2009

In-Home Air Pollution Is Linked to Respiratory Morbidity in Former Smokers with Chronic Obstructive Pulmonary Disease

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- Non-smoking homes. Indoor PM was relatively low
  - ~11 ug/m^3
- Indoor $PM_{2.5}$ was associated with increases in
  - Severe COPD exacerbations
  - Respiratory Symptoms (MMRC)
  - Respiratory Health Status (SGRQ)
  - Rescue Medication use

Hansel et al. AJRCCM 2013

Omega-3 and 6 polyunsaturated fatty acids

- Omega-3 fatty acid
  1. α-linolenic **acid** (ALA) (found in plant oils)
  2. Eicosapentaenoic **acid** (EPA), (found in marine oils)
  3. Docosahexaenoic **acid** (DHA), (found in marine oils)
- Omega-6 fatty acid:

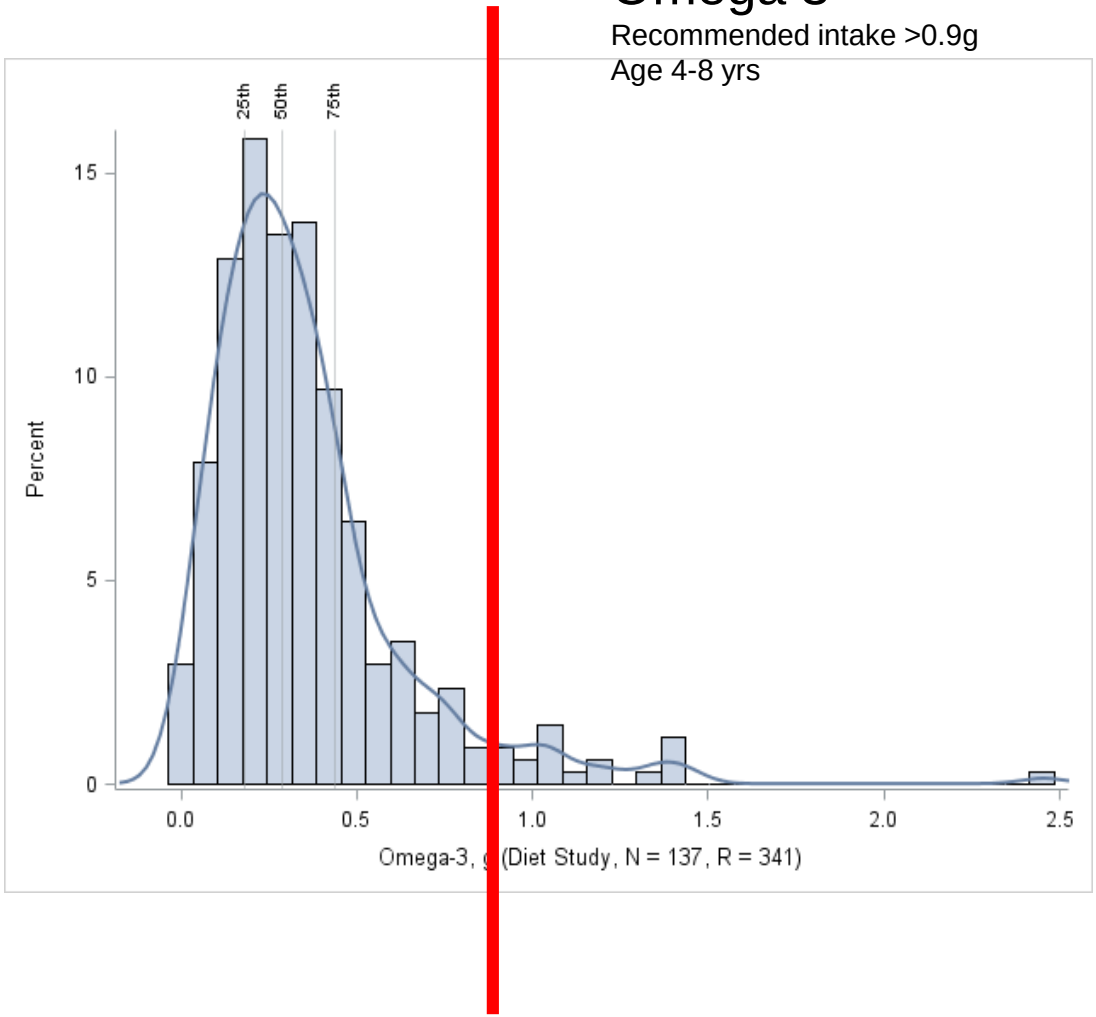
  Necessary for human health, but too much associated with disease
  a. Coronary heart disease and stroke
  b. Autoimmune disorders
  c. Cancers of the breast, colon, and prostate etc.

- Balanced omega-3 and omega-6 fatty acids diet

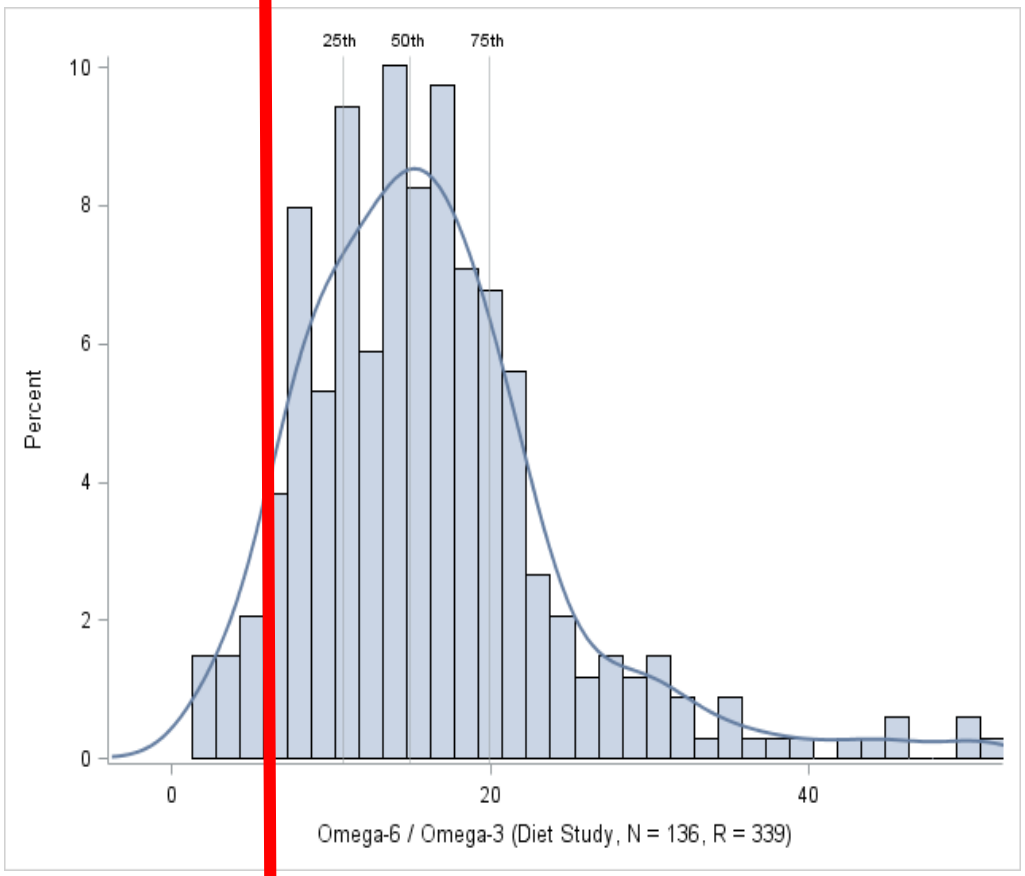
Dietary intake of Omega 3 and 6 PUFAs in Baltimore inner city children with asthma

Omega 3

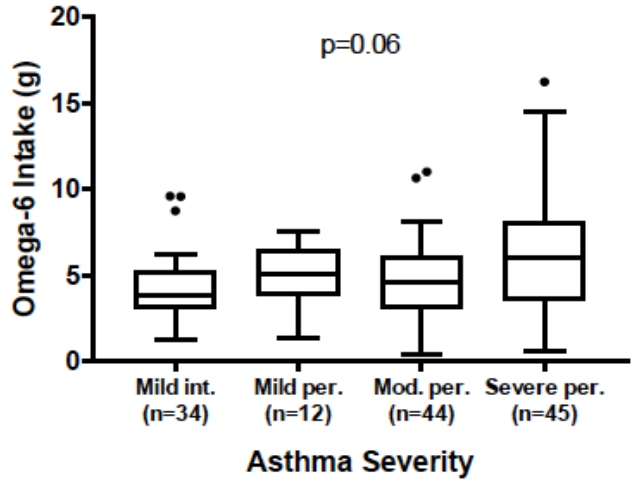
Recommended intake >0.9g
Age 4-8 yrs



Omega 6:3



Omega-6 intake linked with increased risk of severe asthma



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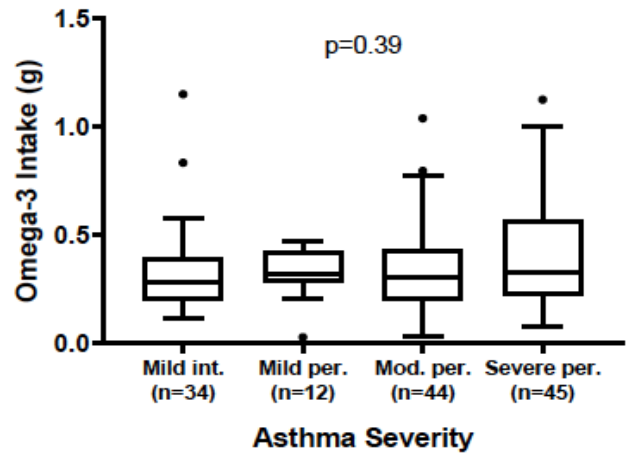

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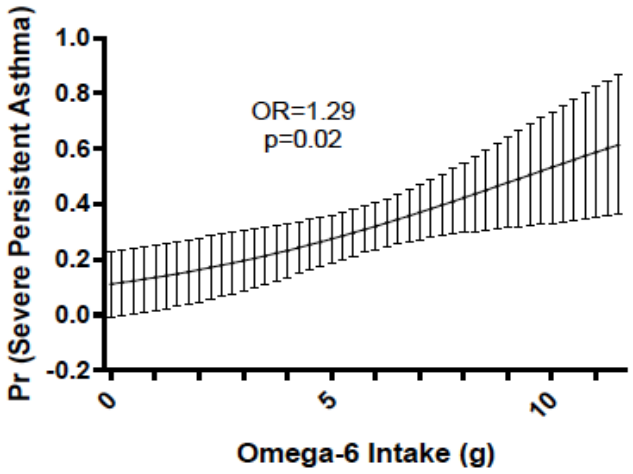

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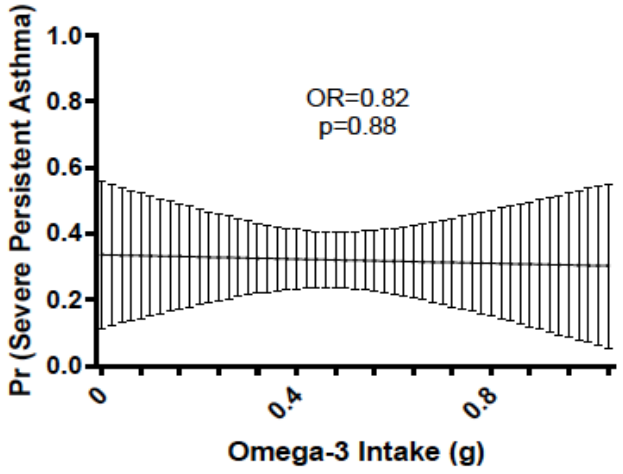
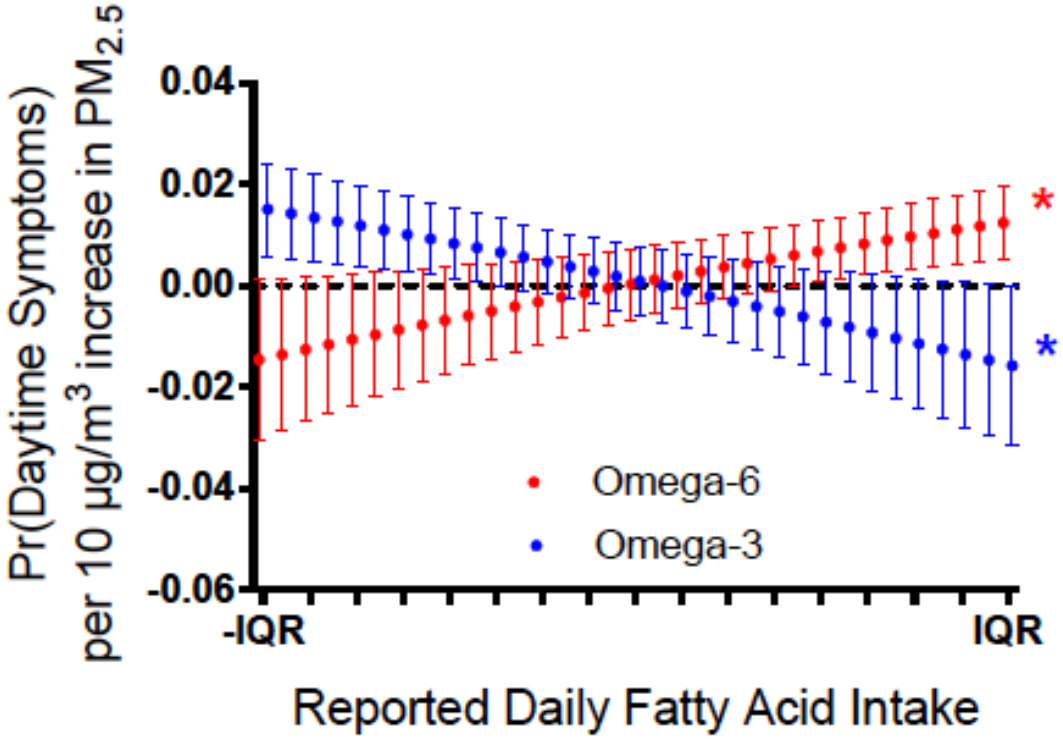


D.

Brigham et al AJRCCM.2019

Omega fatty acid intake modifies susceptibility to PM in kids with asthma



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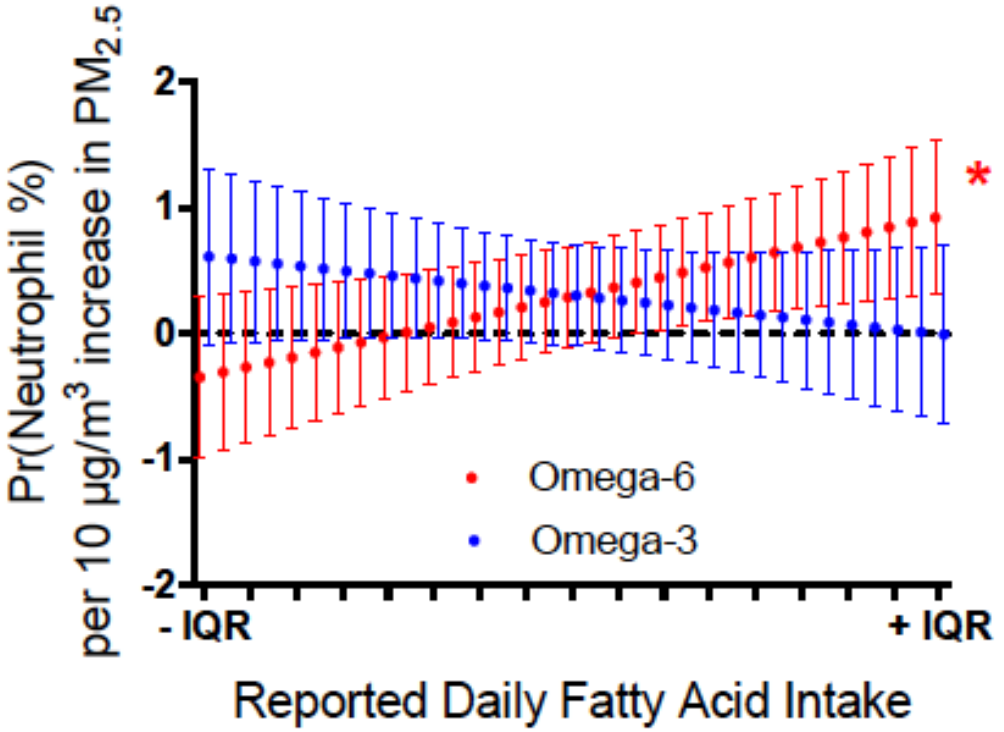


B.

Brigham et al AJRCCM.2019

Omega intake in NHANES 2007-2012 COPD population

Association between PUFAs and COPD controversial

Fulton et al. Nutrition Reviews. 2015

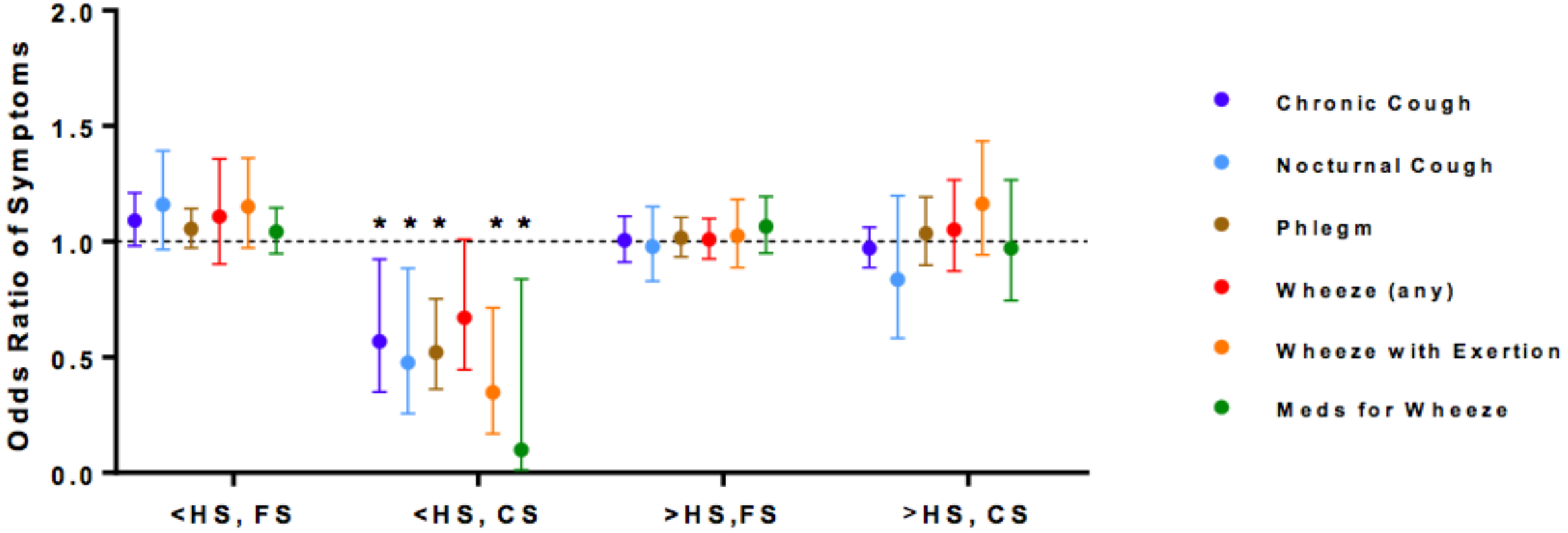
NHANES 2007-2102

- Age >40 years
- >100 cigs
- $FEV_1/FVC < 0.7$
- No asthma diagnosis
- N=878 of 27,528

Table 1 Characteristics of U.S. Adults with COPD, NHANES 2007–2012

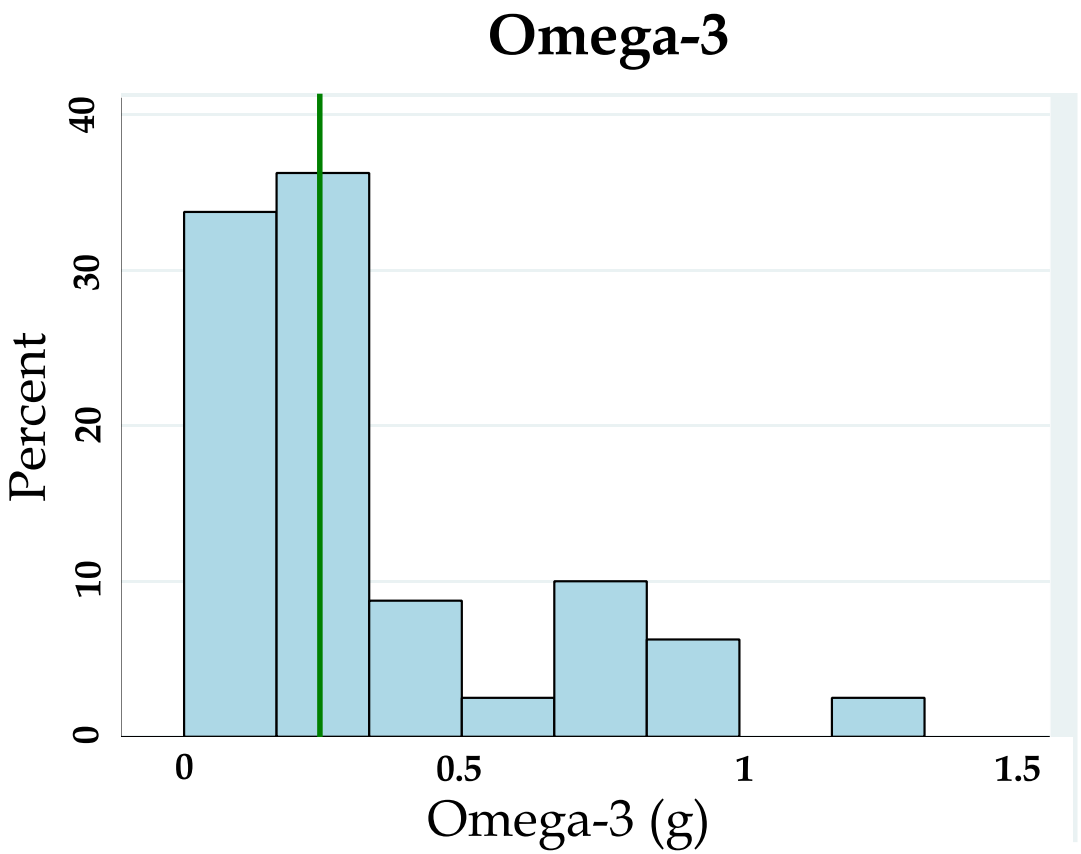
Demographics	
Age (years)	60.6 ± 8.4
Male (%)	63.5
Ethnicity (%)	
Non-hispanic White	85.1
Others	14.8
Pack-Years	30.4 ± 23.8
BMI, kg/m2	27.3 ± 4.9
Dietary Intake	
Energy (kcal)	2112 ± 680
Omega-3	
EPA + DHA (g)	0.11 ± 0.21
ALA (g)	1.71 ± 0.89

Beneficial effect of EPA + DHA intake on respiratory symptoms among current smokers with low education

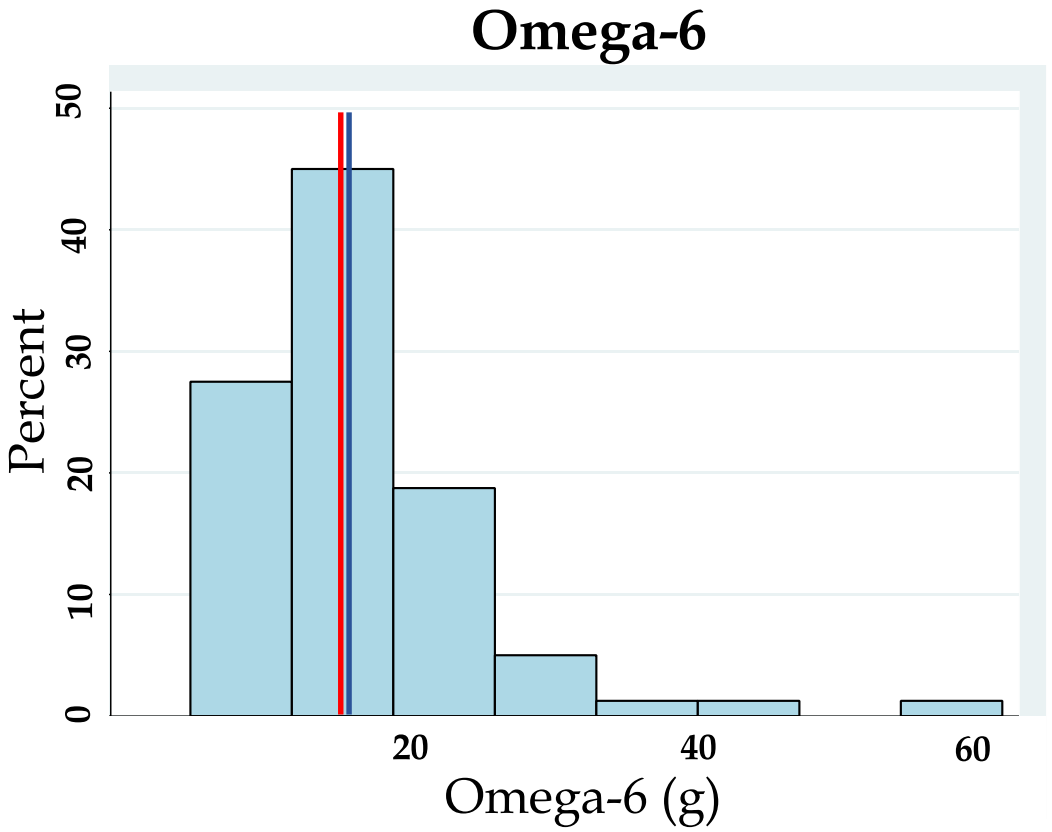


Lemoine et al. BMC Pulm. In press

Dietary intake of Omega 3 and 6 PUFAs in adults with COPD



Recommended intake: >0.25 g/day



Recommended intake: 11-13 g/day (women)
15-16 g/day (men)

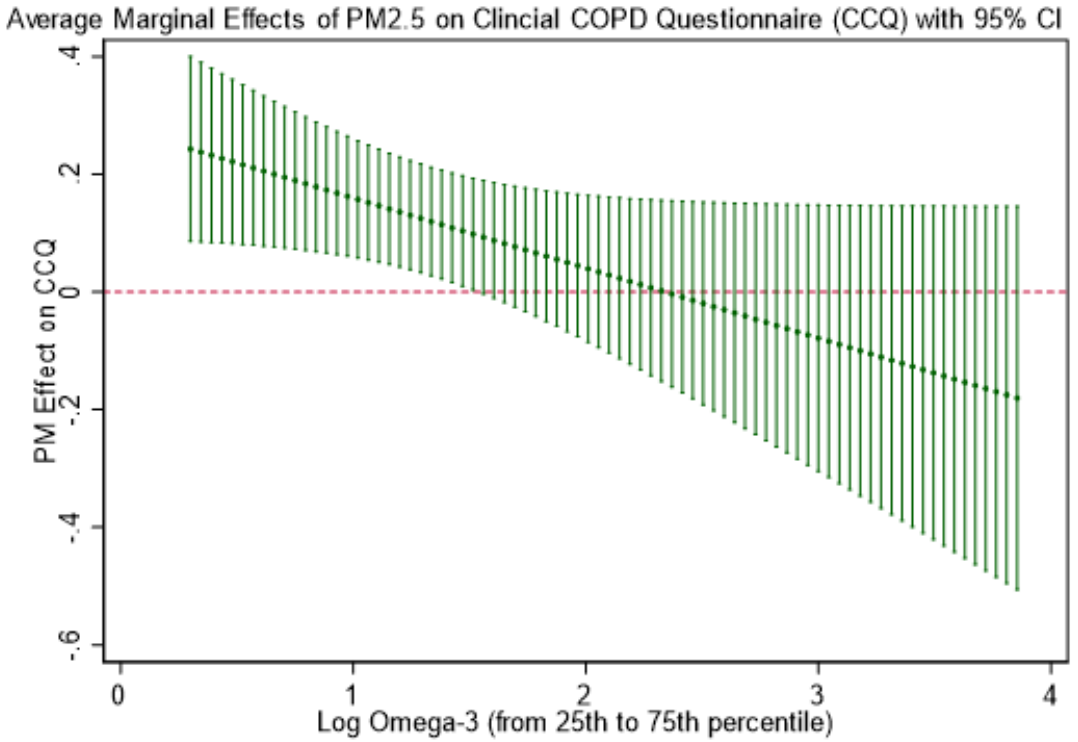
Omega 3 intake linked with COPD symptoms

	Omega-3 (EPA + DHA)	
	β	**p**
FEV_1 % Predicted	0.31	0.66
mMRC (OR)	**0.80**	**0.03**
CAT	**-0.96**	**0.00**
SGRQ	**-1.88**	**0.01**
CCQ	**-0.11**	**0.01**
6MWD	**64.27**	**0.00**
ECSS	-0.26	0.08
Exacerbations (OR)	0.90	0.38
ED visit/Hosp (OR)	0.86	0.18

Adjusted for age, gender, race (white vs. others), education (high school or less vs. more than high school), BMI, total calories, pack-years, FEV_1 % predicted (except when FE_1% predicted is the outcome), omega 6 (ARA). Results represent 0.1g increase in omega-3.

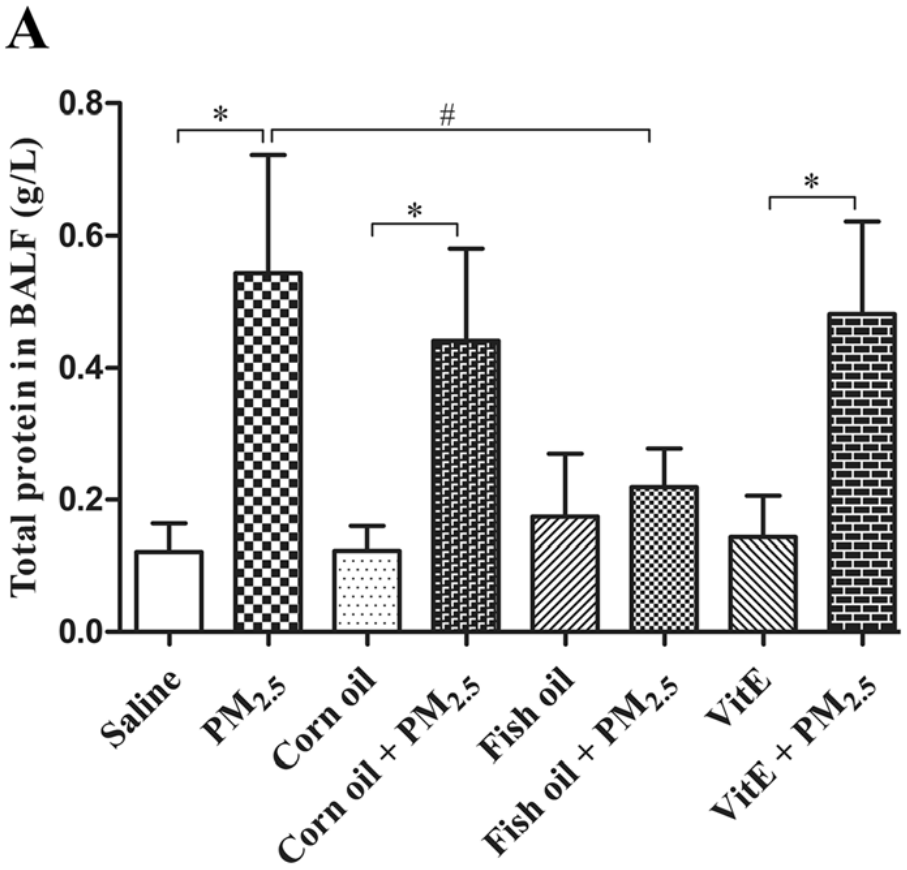
$PM_{2.5}$ effect accentuated with low omega-3 in COPD

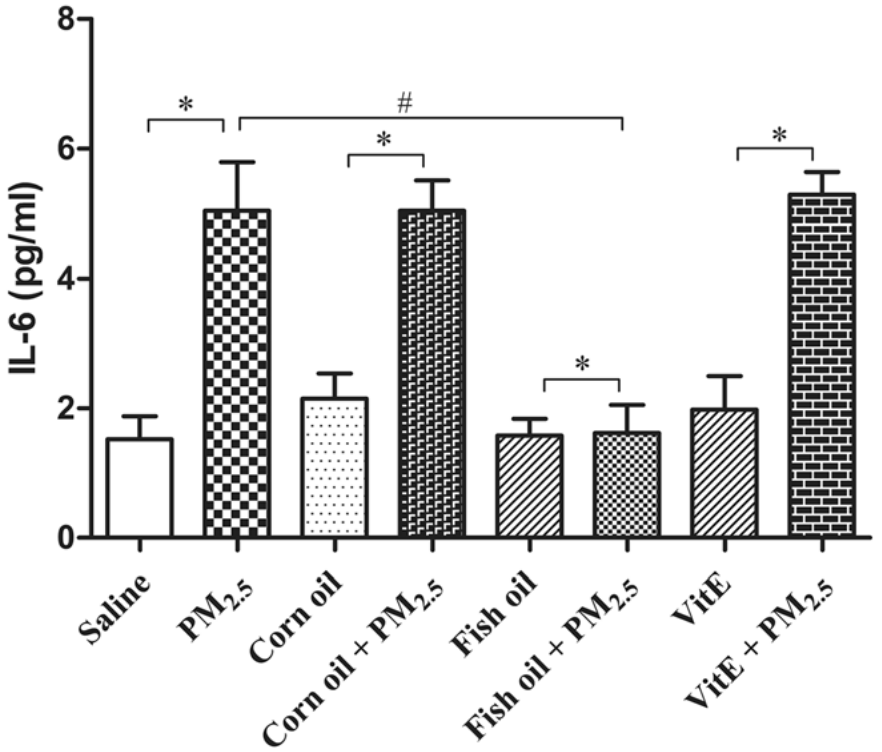
	Low Omega-3		High Omega-3		Interact
	β	p	β	p	p
mMRC	**0.43**	**0.002**	-0.10	0.498	0.039
Clinical COPD Q (CCQ)	**0.46**	**0.004**	0.05	0.413	0.038
FEV1 Post Pct Pred	-3.14	0.175	1.14	0.350	0.136



Model adjusted by race, education, BMI, calories, and packyears, n=77

Fish oil attenuates PM-induced airway and systemic inflammation in rat lungs





Li et al. Respiratory Research. 2019

Conclusions

- PUFA intake may have direct associations with airway disease outcomes, however, relationship may need to be taken in context of other exposures

- Omega 3 intake (EPA + DHA) may be protective against the adverse effects of particulate exposure on both asthma and COPD outcomes

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