VILLANOVA UNIVERSITY
M. LOUISE FITZPATRICK COLLEGE OF NURSING
MacDonald
CENTER FOR NUTRITION EDUCATION AND RESEARCH

# MCNER Webinar Series

## Don’t Take My Breath Away: Nutrition and Lung Health

## Wednesday, May 15, 2024

Moderator:
Lisa Diewald, MS, RDN, LDN
Associate Director
MacDonald Center for Nutrition Education and Research
Villanova University M. Louise Fitzpatrick College of Nursing

VILLANOVA NURSING

# Finding Slides for Today's Webinar

- Slides are posted at villanova.edu/cope
- From right menu→ Webinars
- Go to 5/15/24 webinar presented by Corrine Hanson, PhD, RDN, LMNT

# Did you use your phone to access today's webinar?

If you are calling in today rather than using your computer to log on, and need CE credit, please email mcner@villanova.edu and provide your name
and we will send you an online link for an evaluation and CE certificate.

# Continuing Education Credit Details

- Villanova University M. Louise Fitzpatrick College of Nursing is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation.
- This activity awards 1 contact hour for nursing professionals.

- This activity awards 1 CPEU in accordance with the Commission on Dietetic Registration's CPEU Prior Approval Program
  - Level 2 activity
  - Suggested CDR Performance Indicators: 6.1.1, 6.2.3, 8.2.3, 10.3.3

*If you are an RD or RDN and have any questions or concerns about this continuing education activity, you may contact CDR directly at QualityCPE@eatright.org*

VILLANOVA NURSING

# Disclosures

There are no relevant financial relationships with ineligible companies for those involved with the ability to control the content of this activity.

Planners will review participant feedback to evaluate for real or perceived commercial bias in any activity.

CDR members: Any feedback about the quality of the activity can be sent directly to CDR at QualityCPE@eatright.org

# Don’t Take My Breath Away: Nutrition and Lung Health

Corri Hanson, PhD, RD, LMNT, FAND
Director, Medical Nutrition Program
Professor of Nutrition
University of Nebraska Medical Center

# Don’t Take My Breath Away

## The role of diet in the development and progression of lung disease

Corrine Hanson, PhD, RD, LMNT, FAND
Professor and Director, Medical Nutrition Education
University of Nebraska Medical Center

UNMC

# Dietary Intake is Associated with Lung Function in the Eclipse Cohort

Corrine Hanson, PhD, RD[1]; Harlan Sayles, MS[2]; Erica Rutten, PhD[3]; Emiel Wouters, MD[4]; William MacNee, MD[5], Peter Calverley, MD[6]; Jane Meza, PhD[2], Stephen Rennard, MD[7]

*[1]University of Nebraska Medical Center, School of Allied Health Professions, Medical Nutrition Education. [2]University of Nebraska Medical Center, College of Public Health. [3]Program Development Centre, Centre of Expertise for Chronic Organ Failure, the Netherlands. [4]University of Maastricht, Department of Pulmonary Diseases. [5]University of Edinburgh. [6]University of Liverpool, Department of Medicine, Clinical Sciences Centre. [7]University of Nebraska Medical Center, Division of Pulmonary, Critical Care, Allergy and Sleep Medicine*

**Background:** Diet is a potentially modifiable risk factor in the development and progression of many diseases, including COPD.

**Objective:** The objective of this study is to evaluate the relationship between dietary intake and clinical characteristics of COPD in a large and well-characterized population of COPD patients and controls that were part of the Evaluation of COPD Longitudinally to Identify Predictive Surrogate Endpoints study (ECLIPSE).

**Methods:** Limited diet records were available for 2,167 subjects who provided dietary intake information at eight time points over a 3-year period.

- Subjects reported the amount they had consumed over the last 24 hours for four food categories which included grapefruit, fish, fish, bananas, and cheese.
- Intake of each food group was handled as a dichotomous variable (Yes/last 24 hours at any of the eight follow-up points versus No at all eight points). These two groups were then compared using clinical outcome measures at the last available follow-up
- Multivariate models for each food group and each outcome measure were run to adjust for confounding factors of age, sex, BMI, and smoking (SGRQ and 6-min walk were also adjusted for FEV1).

**Results**: Associations between intake of food items and outcome variables are given in the following table. Color legend: Green=The association has a positive impact on lung health. Red=The association has a negative impact on lung health. No color=no significant association

| Outcome | Grapefruit | | Fish | | Bananas | | Cheese | |
|---|---|---|---|---|---|---|---|---|
| | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value |
| FEV1 Post-Dose | 0.06 | 0.02 | 0.07 | 0.04 | 0.09 | 0.001 | 0.2 | 0.0001 |
| FEV1 % Pred Post-Dose | 2.1 | 0.17 | 1.3 | 0.23 | 2.9 | 0.006 | 4.7 | 0.002 |
| FVC Post-Dose | 0.14 | 0.005 | 0.09 | 0.007 | 0.08 | 0.02 | 0.20 | <0.001 |
| FEV$_1$ Post-Dose (annual rate of change in mL) | 6.64 | 0.01 | -1.5 | 0.41 | -2.5 | 0.17 | -4.45 | 0.05 |
| Emphysea: % voxels < -950HU | -0.63 | 0.45 | -1.5 | 0.008 | -0.98 | 0.09 | -1.6 | 0.05 |
| Emphysema: % voxels < -950HU (change over 3 years) | -0.68 | 0.03 | -0.41 | 0.07 | -0.60 | 0.007 | -0.26 | 0.41 |
| 6-Minute Walk | 15.1 | 0.09 | 25.2 | <0.001 | 11.3 | 0.06 | 19.7 | 0.02 |
| SGRQ score | -1.9 | 0.08 | -1.9 | 0.02 | -0.35 | 0.66 | -0.92 | 0.42 |
| Fibrinogen | 0.74 | 0.90 | -2.86 | 0.50 | 1.93 | 0.65 | -3.97 | 0.52 |
| Claracel secretory protein | -0.36 | 0.19 | -0.19 | 0.32 | 0.29 | 0.14 | 0.51 | 0.06 |
| C-reactive protein | -1.9 | 0.05 | 0.08 | 0.90 | -0.47 | 0.50 | -1.15 | 0.24 |
| Total neutrophils | 0.10 | 0.37 | -0.18 | 0.02 | -0.13 | 0.10 | 0.006 | 0.98 |
| Surfactant protein D | -1.98 | 0.66 | -2.82 | 0.37 | -1.68 | 0.59 | -9.91 | 0.03 |
| White Blood Cells | 0.03 | 0.80 | -0.21 | 0.01 | -0.10 | 0.27 | 0.002 | 0.97 |

**Conclusion**: Subjects who demonstrated recent consumption of foods associated with a healthy diet, including fish, fruit, and dairy products, had improved markers of lung function, less emphysema, improved 6-minute walk and SGRQ scores, and a decrease in certain inflammatory markers. The role of diet as a possible modifiable risk factor in COPD continues to warrant investigation

University of Nebraska Medical Center

# Dietary Fiber Intake and Lung Function

UNMC

# Methods

We evaluated 1,929 adults in the NHANES cycle 2009-2010 who had spirometry measurements and information on daily fiber intake available.

The primary outcomes were lung function measurements ($FEV_1$, FVC, percent predicted $FEV_1$ and FVC)

We also conducted a categorical analysis of fiber intake and airflow restriction and obstruction based on GOLD and Spirometry Grade (SG) classifications

Multivariate regression models were used to look at the association of lung function measurements and COPD with dietary fiber intake

| | Fiber Intake Quartile Mean (SE) | | | | |
|---|---|---|---|---|---|
| **Characteristic:** | <10.75 grams/day (n=360) | 10.75-<13.46 grams/day (n=461) | 13.46-17.5 grams/day (n=529) | >17.5 grams/day (n=571) | P-value |
| **Continuous variables Mean (SD)** | | | | | |
| **Age, yr** | 52.9 (0.5) | 53.1 (0.5) | 52.8 (0.5) | 52.5 (0.3) | 0.76 |
| **$FEV_1$ (L)** | 2.6 (0.04) | 3.0 (0.04) | 3.1 (0.05) | 3.2 (0.05) | <0.0001 |
| **$FEV_1$, %pred** | 80.9 (0.8) | 86.6 (0.8) | 89.0 (1.0) | 90.6 (0.5) | <0.0001 |
| **FVC (L)** | 3.3 (0.04) | 3.9 (0.05) | 4.1 (0.06) | 4.3 (0.06) | <0.0001 |
| **FVC, %pred** | 82.3 (0.7) | 87.2 (0.8) | 90.0 (0.9) | 92.7 (0.6) | <0.0001 |
| **$FEV_1$/FVC ratio** | 0.76 (0.005) | 0.77 (0.005) | 0.76 (0.003) | 0.76 (0.003) | 0.079 |
| **Socioeconomic Status (income:poverty status ratio)** | 2.96 | 3.55 | 3.56 | 3.68 | 0.007 |
| **C-Reactive protein (mg/dL)** | 0.47 (0.5) | 0.41 (0.06) | 0.31 (0.04) | 0.31 (0.05) | 0.01 |
| **Energy intake (kcals/day)** | 1868.4 (48.8) | 2076.7 (46.6) | 2224.9 (48.5) | 2368.9 (42.3) | <0.0001 |
| **BMI** | 29.8 (0.5) | 29.8 (0.4) | 28.9 (0.3) | 28.4 (0.04) | 0.035 |
| **Discrete variables** | N (%) | | | | |
| **Gender** | | | | | |
| **Male** | 79 (18.4) | 215 (45.2) | 300 (54.9) | 376 (64.9) | <0.0001 |
| **Female** | 283 (81.6) | 246 (54.8) | 232 (45.1) | 198 (35.1) | |
| **Smoking** | | | | | |
| **Never** | 162 (45.6) | 239 (55.7) | 275 (52.8) | 313 (57.0) | 0.0031 |
| **Former** | 97 (27.6) | 125 (29.7) | 154 (30.7) | 163 (28.5) | |
| **Current** | 103 (26.8) | 97 (14.6) | 103 (16.5) | 98 (14.5) | |
| **Spirometry Grade Classificaitons:** | | | | | |
| **Normal airflow** | 183 (50.1) | 269 (50.1) | 354 (67.0) | 390 (68.3) | |
| **Airflow restriction** | 122 (29.8) | 125 (29.7) | 85 (14.1) | 95 (14.8) | <0.0001 |
| **Airway obstruction** | 55 (20.1) | 67 (16.9) | 90 (18.9) | 86 (17.0) | |
| **GOLD:** | | | | | |
| **Normal** | 305 (80.0) | 394 (85.9) | 444 (81.1) | 485 (83.1) | 0.35 |
| **Airflow obstruction** | 55 (20.1) | 67 (14.1) | 85 (18.9) | 86 (16.9) | |

# Subjects in the highest quartile intake of fiber had:

Mean $FEV_1$ and FVC measurements that were 82 mL and 129 mL higher that the lowest quartile of intake (p=0.04 and 0.01)

Mean percent predicted $FEV_1$ and FVC values that were 2.4 and 2.8 percentage points higher (p=0.07 and 0.02).

In the categorical analysis, higher fiber intake was associated with:

A higher percentage of those with normal lung function (p=0.001)

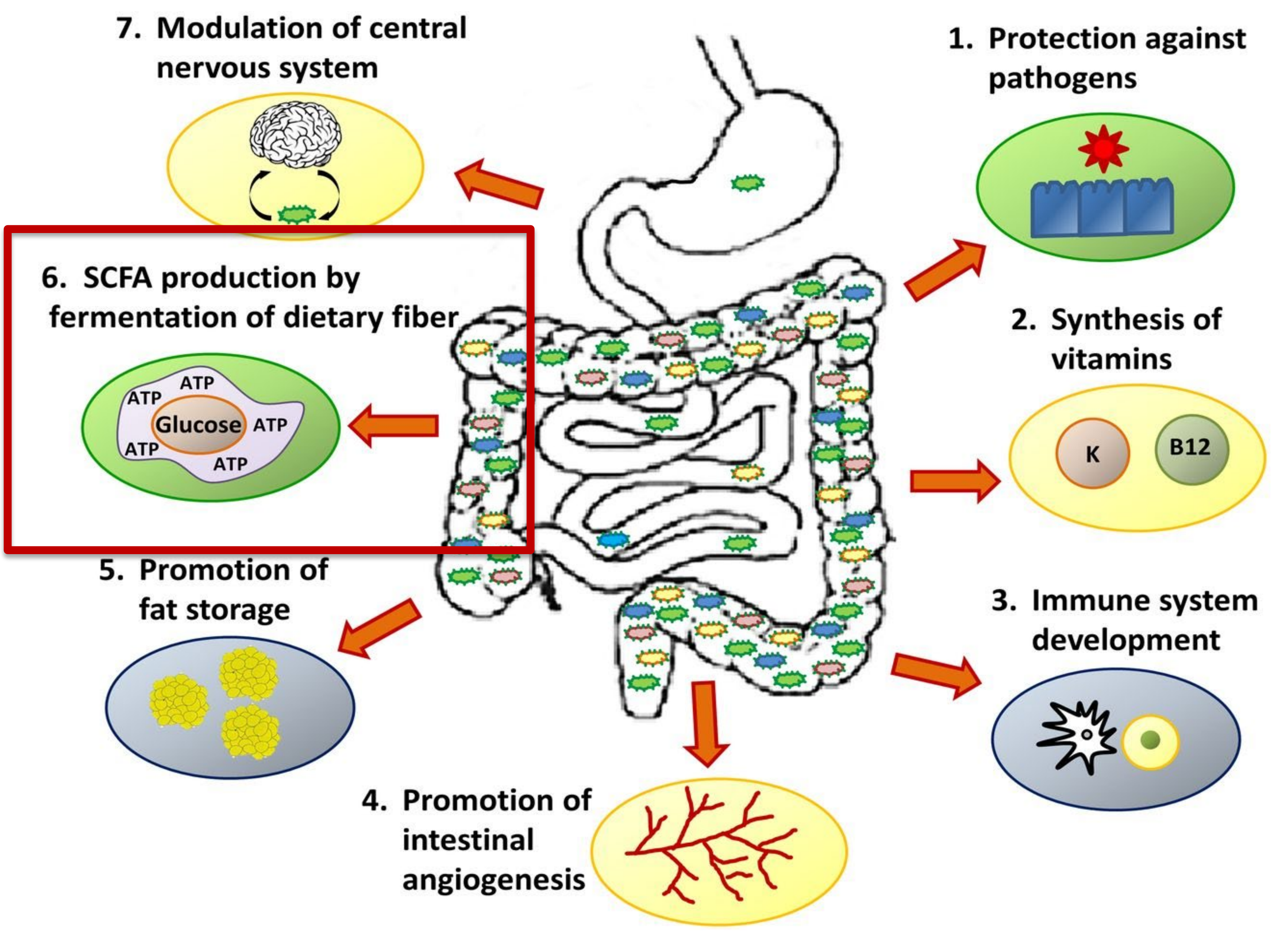
A significant decline in the proportion of participants with airflow restriction (p=0.001).

Table 3. Low fiber is associated with higher odds of respiratory morbidity (NHANES)

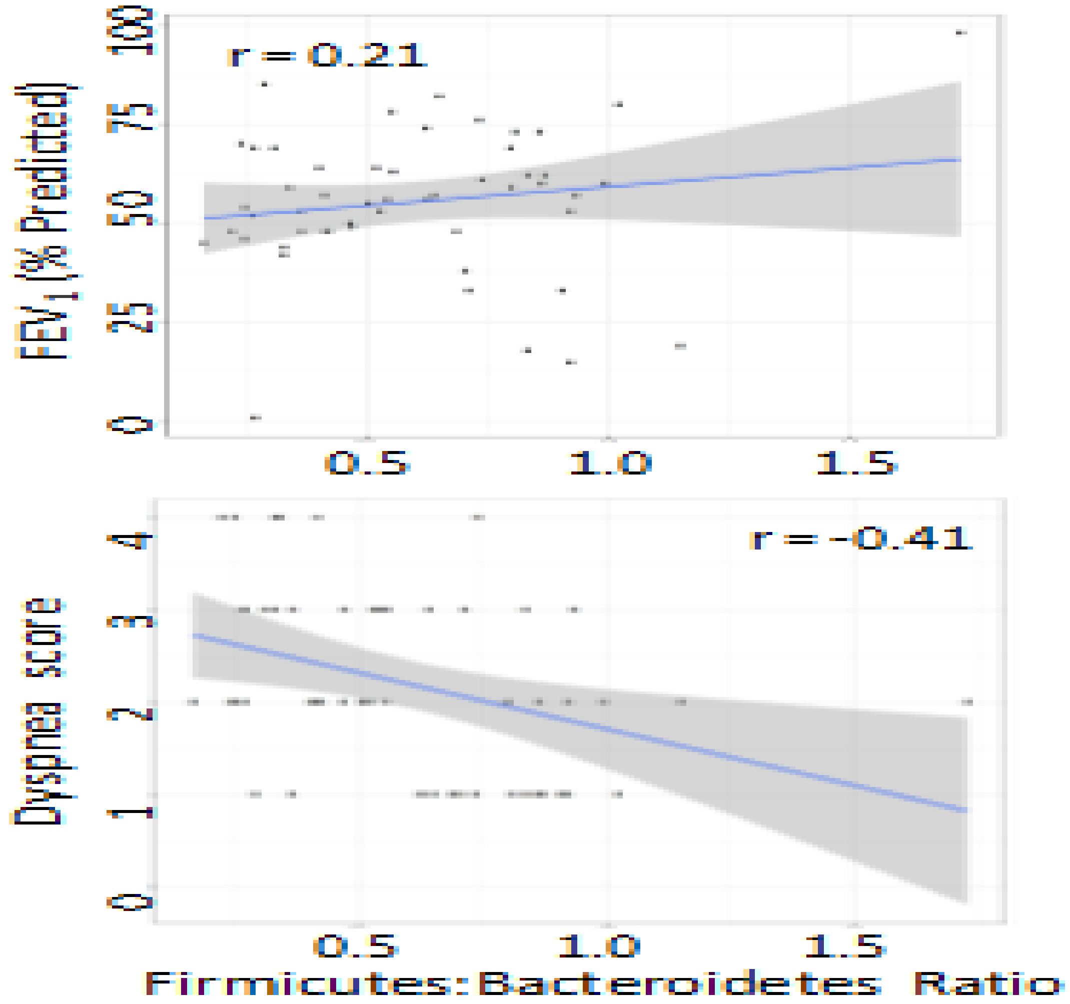
| | Quartile Fiber Intake | | | | |
|---|---|---|---|---|---|
| | Q1 (low) < 10.45 gm/day | Q2 10.5-15 gm/day | Q3 15.1-21.2 gm/day | Q4 (high) > 21.2 gm/day | Q1 vs. Q4 *p-value* |
| Asthma, n = 13095 | 1.3 (1.0-1.8) | 0.9 (0.7-1.2) | 0.9 (0.7-1.1) | 1 | 0.043 |
| Wheeze, n = 13137 | 1.2 (1.0-1.5) | 1.1 (0.9-1.4) | 1.0 (0.9-1.2) | 1 | 0.024 |
| Cough, n = 8407 | 1.8 (1.3-2.5) | 1.6 (1.2-2.1) | 1.4 (1.0-1.8) | 1 | 0.0005 |
| Phlegm, n = 8410 | 1.6 (1.1-2.2) | 1.4(1.0-1.9) | 1.3 (0.9-1.9) | 1 | 0.008 |

Odds ratios (95% confidence intervals), adjusted for covariates


WHY
WHY WHY WHY
WHY
WHY
WHY
WHY



7. Modulation of central nervous system
1. Protection against pathogens
6. SCFA production by fermentation of dietary fiber
ATP
ATP
Glucose
ATP
ATP
ATP
2. Synthesis of vitamins
K
B12
5. Promotion of fat storage
3. Immune system development
4. Promotion of intestinal angiogenesis




Figures 3 & 4. Worse % predicted $FEV_1$ and dyspnea is associated with lower Firmicutes:Bacteroidetes ratio in CURE COPD (former smokers, cross sectional analysis at baseline, 3 months and 6 months, n = 18.

# Saturated Fat

Among subjects with spirometry-defined COPD: Subjects in the lowest quartile intake of saturated fat intake had:

- Mean $FEV_1$ and FVC measurements that were 126 mL and 166 mL lower that the highest quartile of intake (p=0.04 and 0.01)

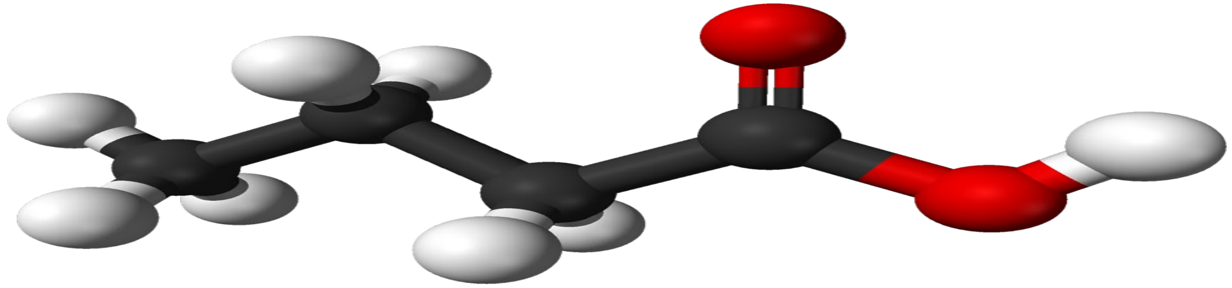
- Mean percent predicted FVC values that were 3.3 percentage points lower (p=0.03).

- We evaluated intakes of individual fatty acids to attempt to determine if specific fatty acids were driving the observed association between saturated fat intake and lung function parameters in individuals with COPD.

- The relationships appear to be driven by butanoic, hexanoic, decanoic, dodecanoic and tetradecanoic acid.

    - **Butanoic: C4**
    - **Hexanoic: C6**
    - Decanoic: C10
    - Dodecanoic (lauric): C12

- These would be classified as SCFA (C4) and medium chain fatty acids (C6-12)



# Associations of Prenatal Dietary Inflammatory Potential with Wheeze Trajectory in Project Viva

Corrine Hanson, Sheryl Rifas-Shiman, N. Shivappa, M.D. Wirth, J. R. Hebert, Diane Gold, Carlos Camargo, M.W. Gillman, S. Sen, J. Sordillo, E. Oken, A. Litonjua

UNMC

# Our Goal:

- Determine the extent to which diets with a higher inflammatory potential during the first and second trimester of pregnancy (as measured by the DII) is independently associated with respiratory/allergy outcomes (asthma, wheeze, lung function) in the offspring in early and mid-childhood.

# Overall DII score

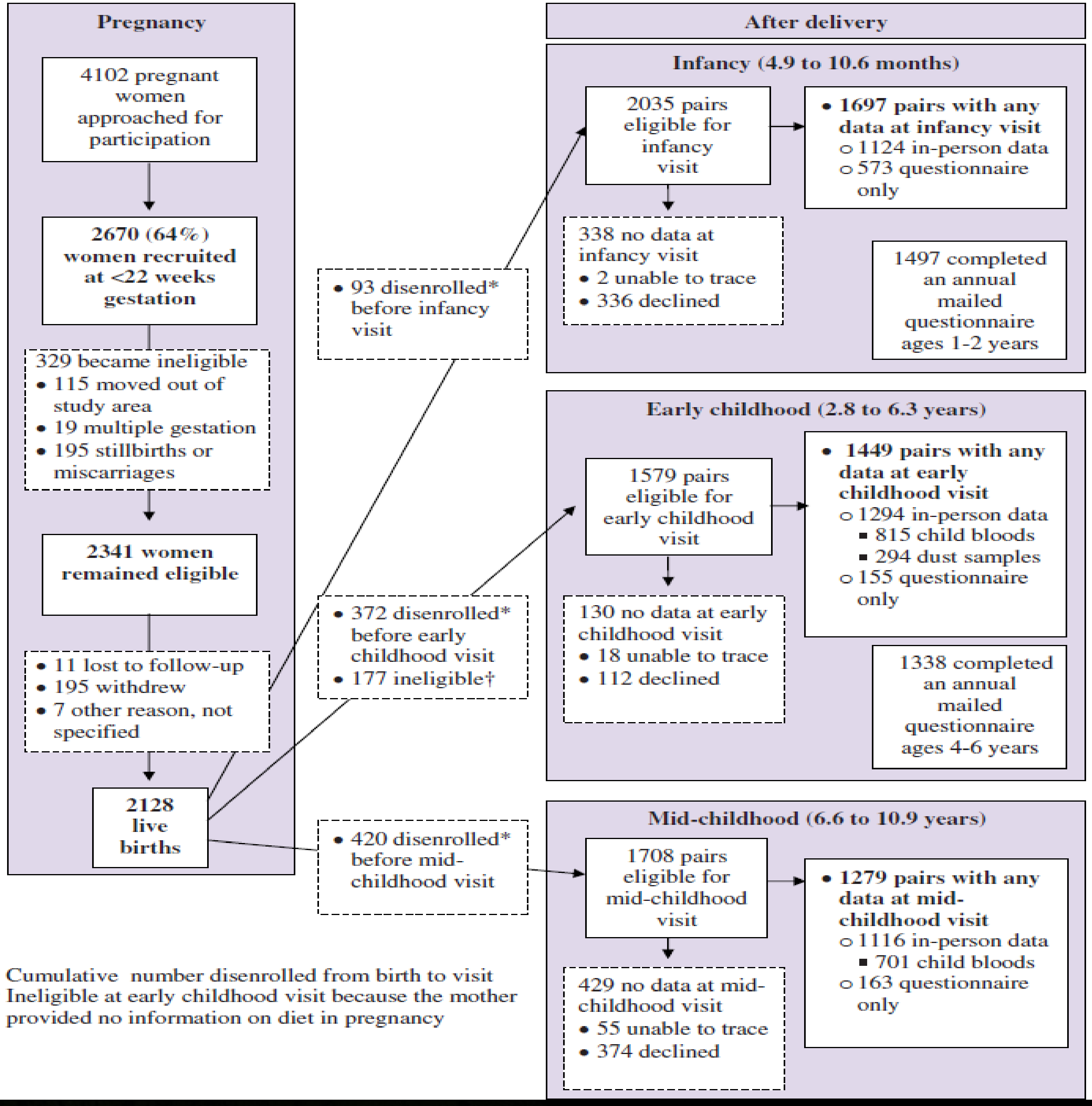
- More negative scores represent anti-inflammatory diet potential while more positive scores represent pro-inflammatory diet
- Approximate range is -10 to 10
- The DII is not a dietary pattern in itself, but a way to assess the pro- or anti-inflammatory potential of any diet.
    - Thus, it differs from other dietary patterns studied in relation to respiratory outcomes.

HOME | HISTORY | RESEARCH | THE TEAM | FOR PARTICIPANTS | FOR INVESTIGATORS

PROJECT Viva

## A Study of Health for The Next Generation

Project Viva is a ground breaking longitudinal research study of women and children. The goal of Project Viva is to find ways to improve the health of mothers and their children by looking at the effects of mother's diet as well as other factors during pregnancy and after birth.




* Cumulative number disenrolled from birth to visit
† Ineligible at early childhood visit because the mother provided no information on diet in pregnancy

# Methods

Project Viva mothers who completed 1st or 2nd trimester dietary questionnaires whose children have been seen at least once in follow-up.

↓

Dietary inflammatory index during pregnancy, calculated from FFQs administered during the first and second trimester of pregnancy

# Outcomes

- Diagnosis of ever asthma (measured at early childhood and mid-childhood)
- Wheezing (measured at early childhood and mid-childhood)
- Wheeze Trajector
- Lung function ($FEV_1$, FVC, $FEV_1$/FVC ratio, $FEF_{25-75}$, % predicted $FEV_1$ and FVC measured at mid-childhood)

- Confounders include maternal age, education, household income, race/ethnicity, parity, smoking history, pre-pregnancy BMI,
- Effect modifiers include sex of child, maternal BMI and maternal smoking status

# Results

- For wheeze trajectory, in the unadjusted analysis, 1st trimester DII scores and average (1st and 2nd semester) DII scores were significantly associated with early wheeze when compared to never wheeze (OR=1.83; 95% CI: 1.10, 3.04; and OR=1.66; 95% CI: 1.04, 2.65 for 1st trimester and average DII scores, respectively).

- **This relationship remained significant after adjustment for confounders, with the odds of the *child having early wheeze compared to never wheeze for mothers in the first vs. fourth quartile (i.e., more pro-inflammatory) of DII increasing by 1.84 (95% CI: 1.08, 3.14).***

- A similar relationship was seen for average 1st and 2nd trimester DII scores for early wheeze vs. never wheeze (OR=1.87, 95% CI: 1.12, 3.11).

# Results

**After adjustment for confounders, those in quartile 4 had $FEF_{25\text{-}75}$ values that were 136 ml lower when compared to those in quartile 1 (95% CI: -256, -15.8).**

Similar results were seen for the average of the 1st and 2nd semester DII (β =-133, 95% CI: -251, -15.8 for the fourth DII quartile compared to the first)

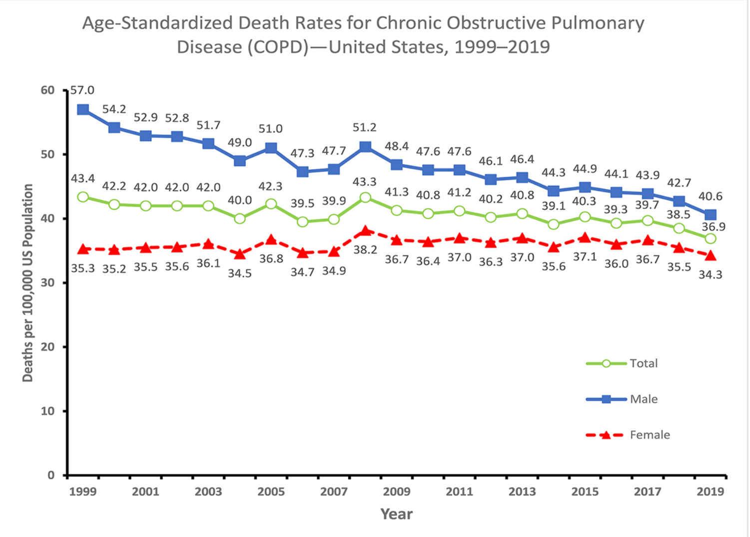
# Association Between A Plant Centered Diet, Incident Emphysema, and Lung Function Trajectory Among Smokers: Findings from the CARDIA Lung Study

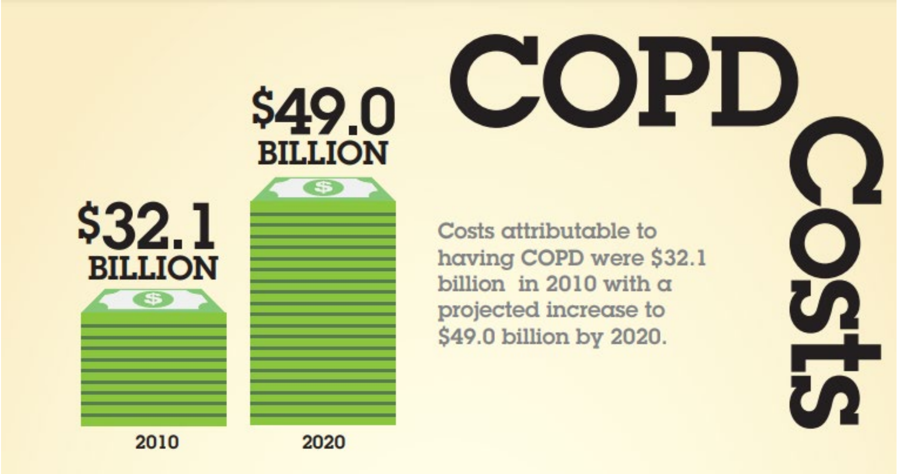
E. Eisenberg*, Y. Choi, M. Jackson*, A. Wang, C. Hanson, J. G. Wang, G. R. Washko, G. Y. Liu, J. Shikany, L. Steffen, R. Kalhan, D. Jacobs, S. Bose

UNMC

# COPD causes major morbidity and mortality

- 6.4% of US adults report a diagnosis of COPD
- Third overall disease related cause of death
- Among the chronic respiratory diseases, accounts for the majority of DALYs (Disability Adjusted Life Years)

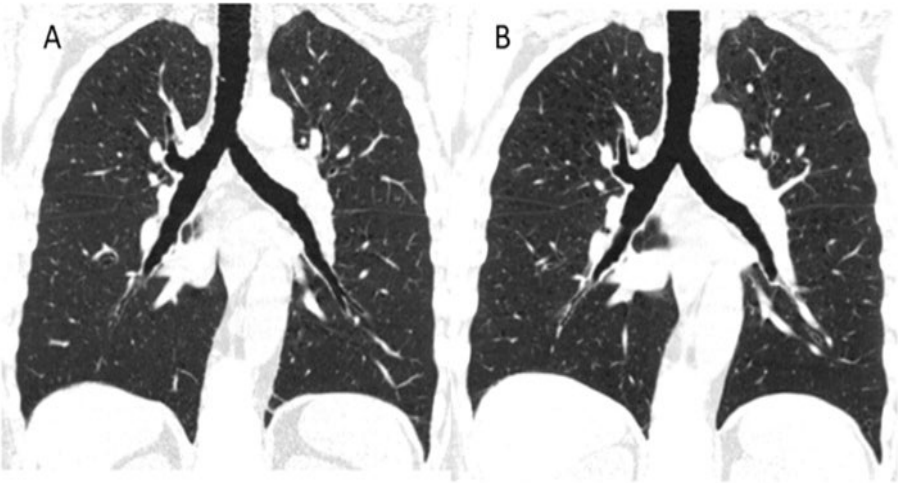



CDC.gov

# Emphysema predicts disease progression

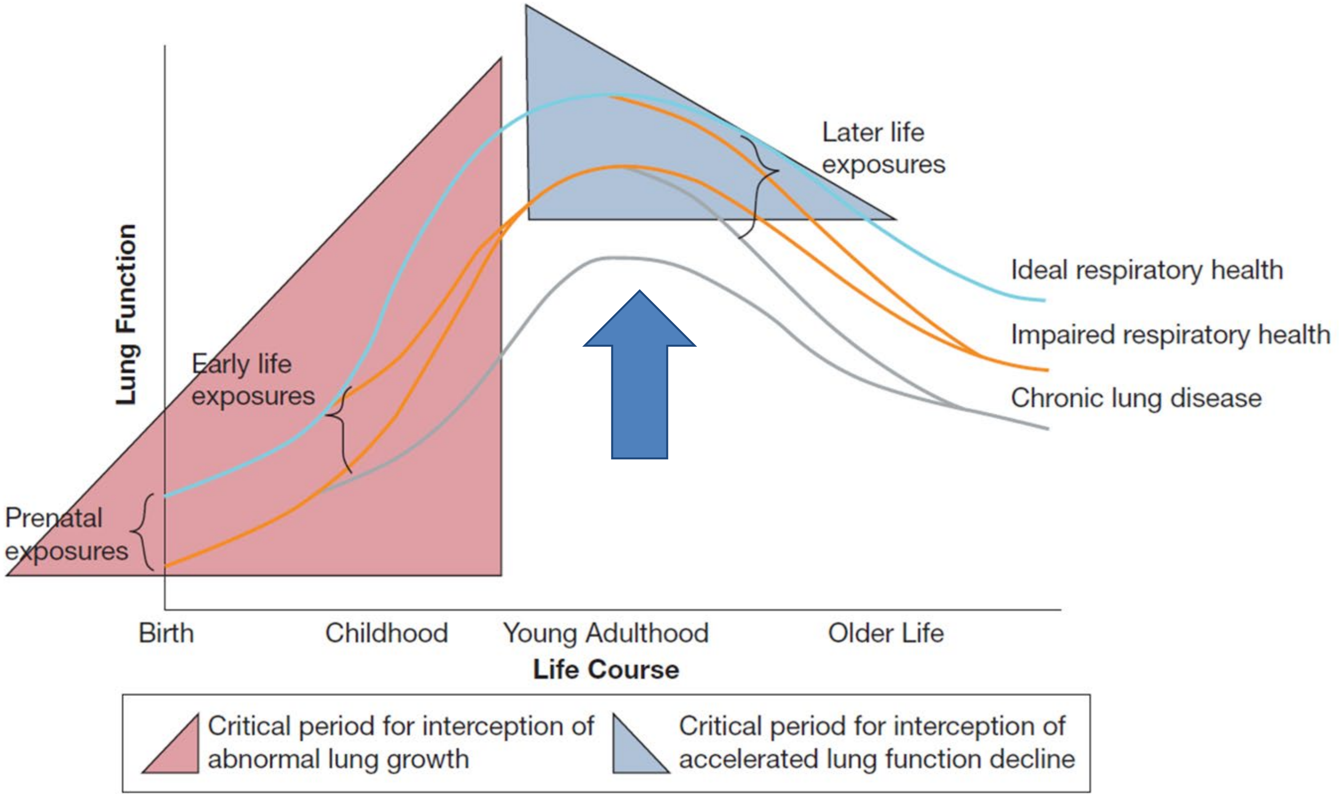
- Ever smokers, w/ emphysema & normal spirometry (GOLD 0)
- At baseline:
  - Lower baseline PFTs
  - Greater dyspnea
  - Worse QOL
- At 5 years:
  - Increased airflow obstruction
  - Greater progression of emphysema




In a GOLD stage 0 participant, *A*, baseline inspiratory CT showed trace emphysema and, *B*, 5-year follow-up CT showed moderate emphysema. $FEV_1$ decreased by 780 mL between visits.

Oh Radiology 2020

# Can earlier interventions alter lung function trajectory?




Liu et al.,
Chest 2021

# Study Objectives

Among **Young Adults** who are **Ever Smokers,** we evaluated the association between a healthy plant-based diet and:

a. development of ***radiographic emphysema***
b. longitudinal ***lung function decline***
c. ***spirometric obstruction***

## Coronary Artery Risk Development in Young Adults (CARDIA)

- Enrolled 5115 young adult (18-30) black and white men and women
- Followed prospectively for 30 years
- Variables: dietary intake, repeat measures of spirometry, lung CT (many more)

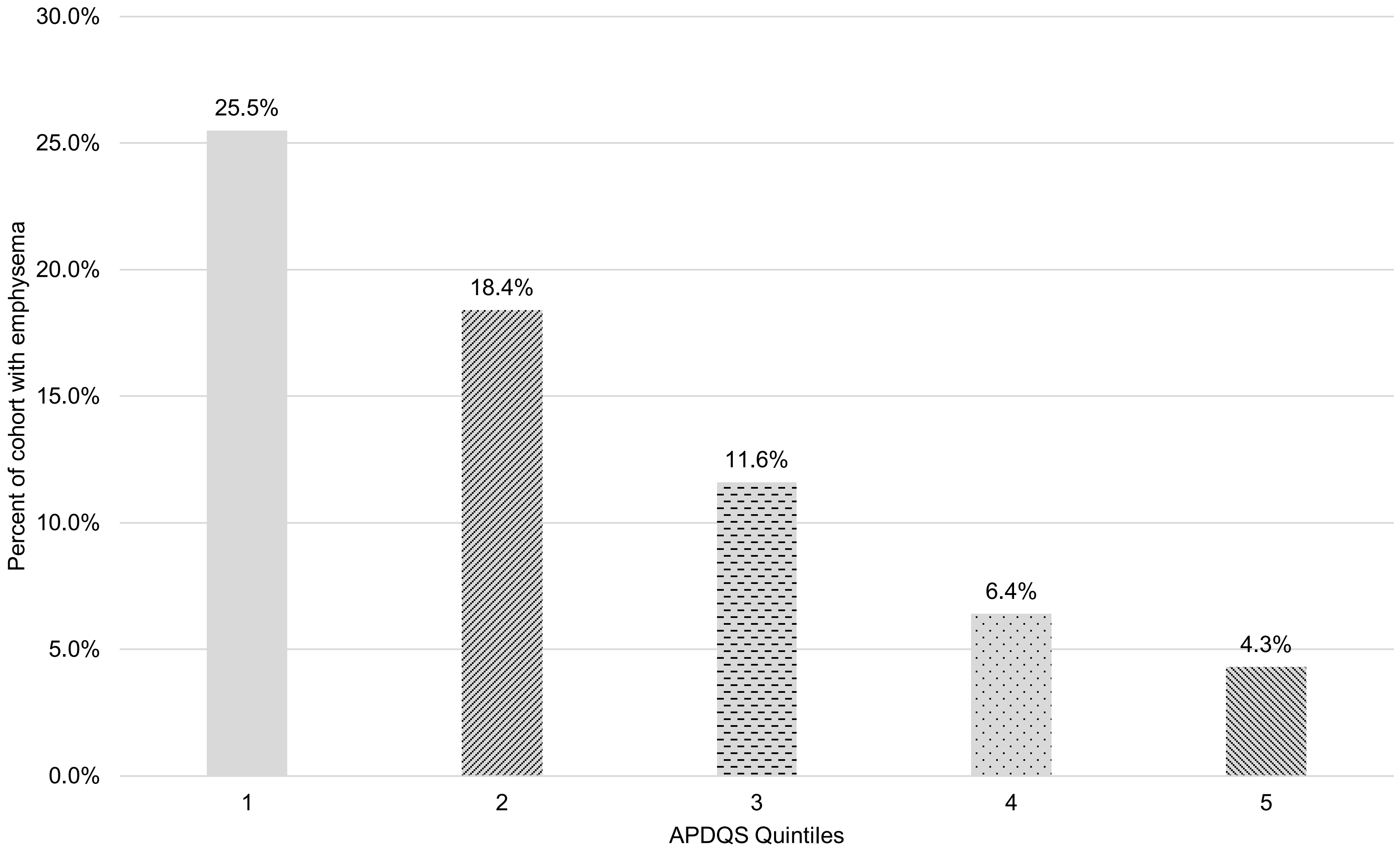
# Exposure: Plant Based Diet

- Utilized the A Priori Diet Quality Score (APDQS) to determine adherence to a plant centered diet
  - higher score = better adherence

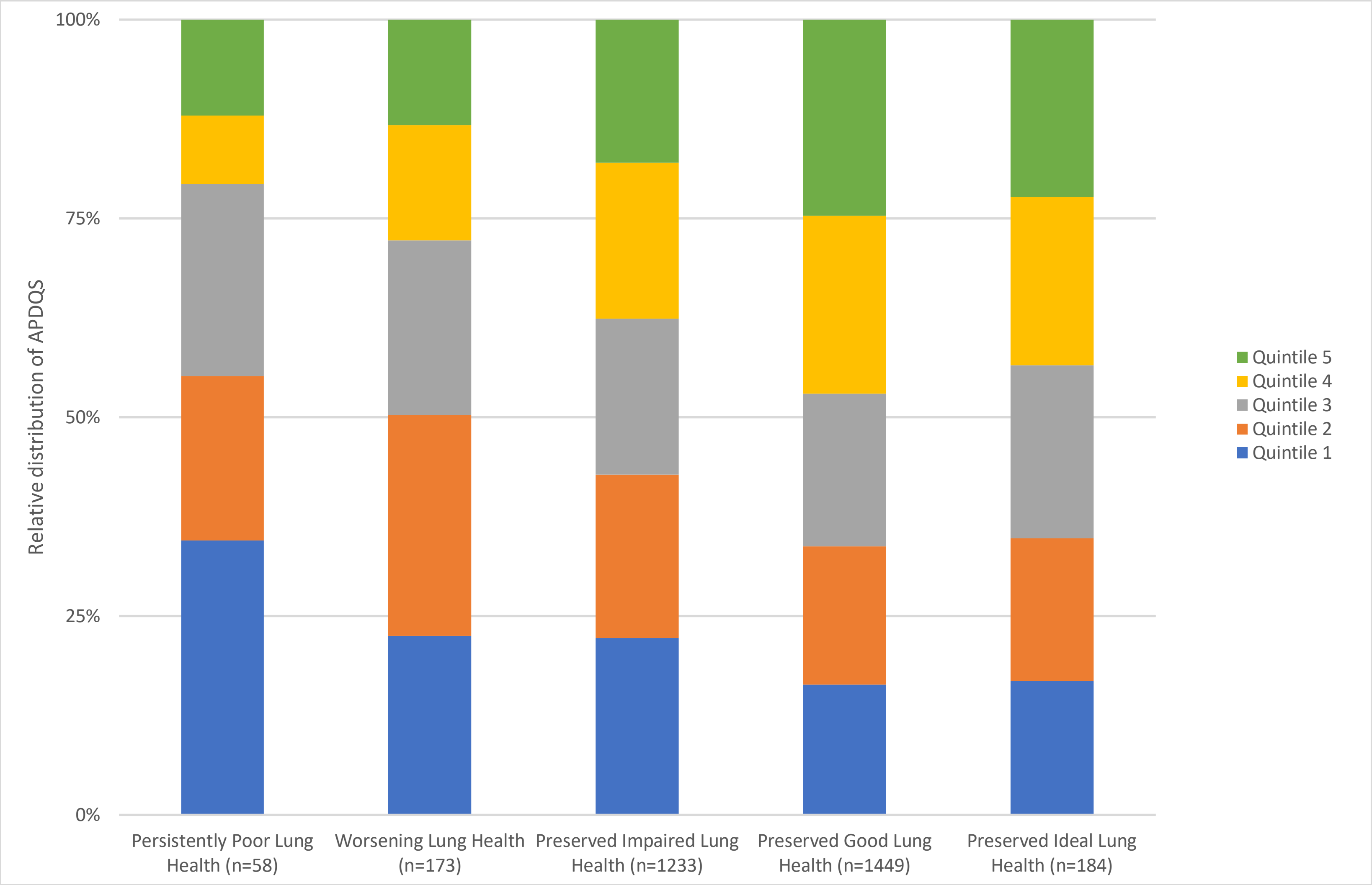
Choi, AHA. 2021

| Multivariable-adjusted ORs (95% CIs) of incident emphysema (Year 25) according to quintiles of the APDQS among ever smokers, N=1351 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | APDQS | | | | | Per 1 SD higher APDQS | P for trend |
| | Quintile 1 | Quintile 2 | Quintile 3 | Quintile 4 | Quintile 5 | | |
| **APDQS median** | 53.3 | 60.5 | 66.7 | 73.3 | 82.5 | | |
| **Unadjusted cumulative incidence % (n/N)** | 25.5 (63/247) | 18.4 (51/278) | 11.6 (31/268) | 6.4 (18/280) | 4.3 (12/278) | | |
| **Unadjusted OR** | 1 (ref) | 0.66 (0.43−1.00) | 0.38 (0.24−0.61) | 0.20 (0.12−0.35) | 0.13 (0.07−0.25) | **0.42 (0.34−0.52)** | **<0.001** |
| **MV model OR** | 1 (ref) | 0.61 (0.37−1.01) | 0.61 (0.34−1.09) | 0.40 (0.20−0.80) | 0.40 (0.18−0.91) | **0.66 (0.49−0.90)** | **0.008** |

# APDQS and lung disease



**Relative distribution of APDQS quintiles among different lung function trajectories ($FEV_1$ % predicted). Only participants with year 30 data and at least one other timepoint (n=3097) were included to ensure that trajectories reflected lung function changes into middle age. Quintile 5 APDQS was more represented in participants with preserved ideal and preserved good lung health, whereas participants with persistently poor lung health were more likely to have scores in quintile 1. The median APDQS scores were 52, 59.7, 66, 72.5, and 82 for quintiles 1, 2, 3, 4, and 5 respectively.**



UNMC

BREAKTHROUGHS FOR LIFE.®


University of Nebraska Medical Center

# To Receive Your CE Certificate

- A link to an evaluation will be sent within a day or two.
- RNs must complete the evaluation to receive CE certificate.
- RD/RDNs: Although completing an evaluation is not required, we truly appreciate your feedback.

  **If you do not see the evaluation, look in your spam folder.**
- CE certificates for RDs/RDNs/DTRs will be emailed to you within 1-2 days after the program.

# Join us for the final session of Cutting-Edge Nutrition!


For more information and to register:
Visit MacDonald Center for Nutrition Education and Research Website

https://bit.ly/MCNERCuttingEdge

VILLANOVA NURSING

# Q&A

VILLANOVA UNIVERSITY
M. LOUISE FITZPATRICK COLLEGE OF NURSING
MacDonald
CENTER FOR NUTRITION EDUCATION AND RESEARCH

Moderator:
Lisa Diewald, MS, RDN, LDN
mcner@villanova.edu



*If you are an RD or RDN and have any questions or concerns about this continuing education activity, you may contact CDR directly at QualityCPE@eatright.org.*

VILLANOVA NURSING