

# Addressing Chronic Pain in Marginalized Populations Using Nutritional Education Curricula



Ramona Wallace D.O. IFMCP  
Julia Kwapiszewski MPH  
Lisa Graves MD

# DISCLOSURES/CONFLICTS OF INTEREST

*None*

# ABOUT US

## Ramona Wallace DO IFMCP

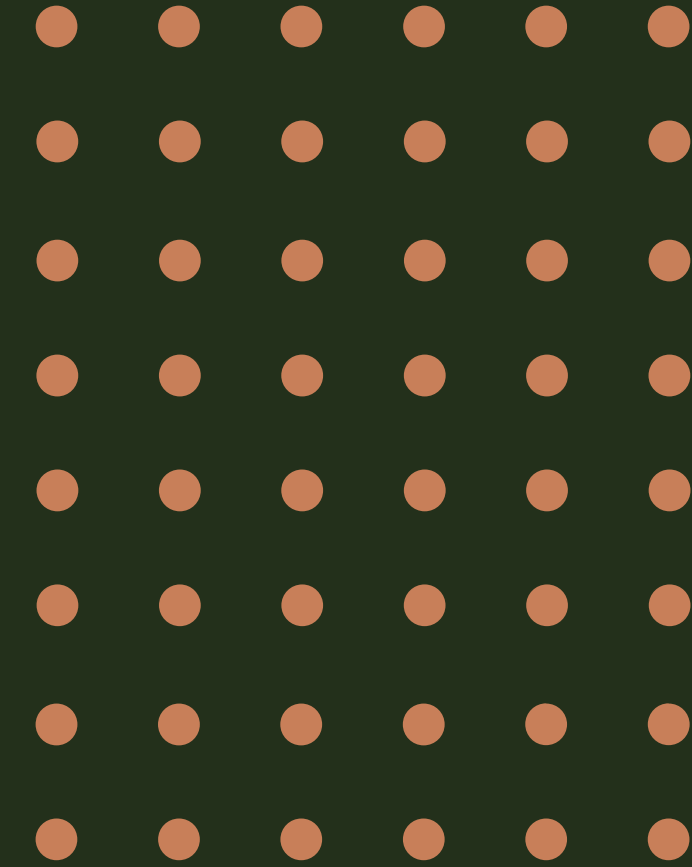
Worked in rural Michigan for 17 years with a focus on Amish populations, then worked in FQHC in Muskegon and Battle Creek since 2009. Peer reviewed publication in childhood obesity, systems biology and nutritional deficiencies. Currently on Faculty at WMED in Family Medicine. Certified Practitioner in Functional Medicine

## Julia Kwapiszewski MPH

Received her Master's in Public Health at Western Michigan University. Is currently a 1st year medical student at CMED serving in leadership positions for Research in Medicine, Street Medicine, and Public Health student groups.

## Lisa Graves MD MCInSc

Professor in the department of Family Medicine and Community Medicine at WMED. Received her Master's in Clinical Sciences at Western Michigan University.



# LAND ACKNOWLEDGEMENT

**"We wish to recognize the Anishinaabe people whose traditional land we are gathered upon today and the land on which the Saginaw Chippewa Indian Tribe have resided for over 200 years. To recognize the land is an expression of gratitude and appreciation to those whose territory you reside on, and a way of honoring the Indigenous people who have been living and working on the land from time immemorial (existing since beyond the reach of memory). It is important to understand the long-standing history that has brought us to reside on the land, and to seek to understand our place within that history."**

# CONFERENCE OBJECTIVES

Provide an opportunity for rural health care workers to share and learn from each other

Provide networking and collaboration opportunities

Provide current and relevant information about rural health

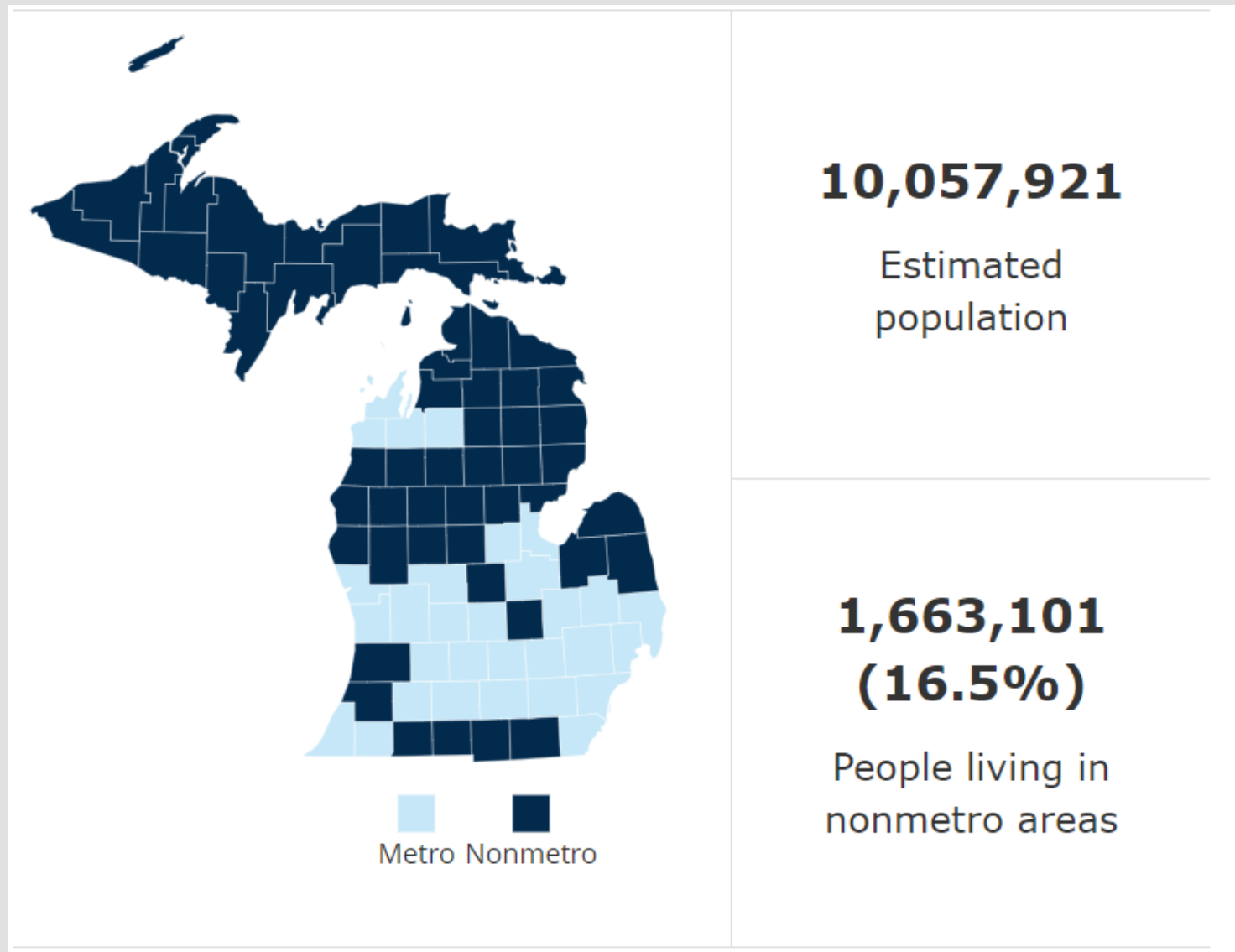
# PRESENTATION OBJECTIVES

Describe, define, identify, and discover the intricate connections between food insecurity, substance use disorder, chronic pain, and malnutrition, particularly in underserved and rural populations.

Compare, discuss, contrast, and apply practical strategies for addressing micronutrient deficiencies within the context of chronic pain and substance use disorders in underserved and rural communities.

Connect, explain, and summarize the significance of comprehensive education and training in nutritional foundations for healthcare professionals, emphasizing the need for policy changes and collaborative efforts to improve the health outcomes of marginalized populations.

# Population Overview



## Michigan Rural Healthcare Facilities

**37**  
Critical Access Hospitals



**221**  
Rural Health Clinics



**126**  
Federally Qualified Health Centers\*



**31**  
Short Term/PPS Hospitals\*

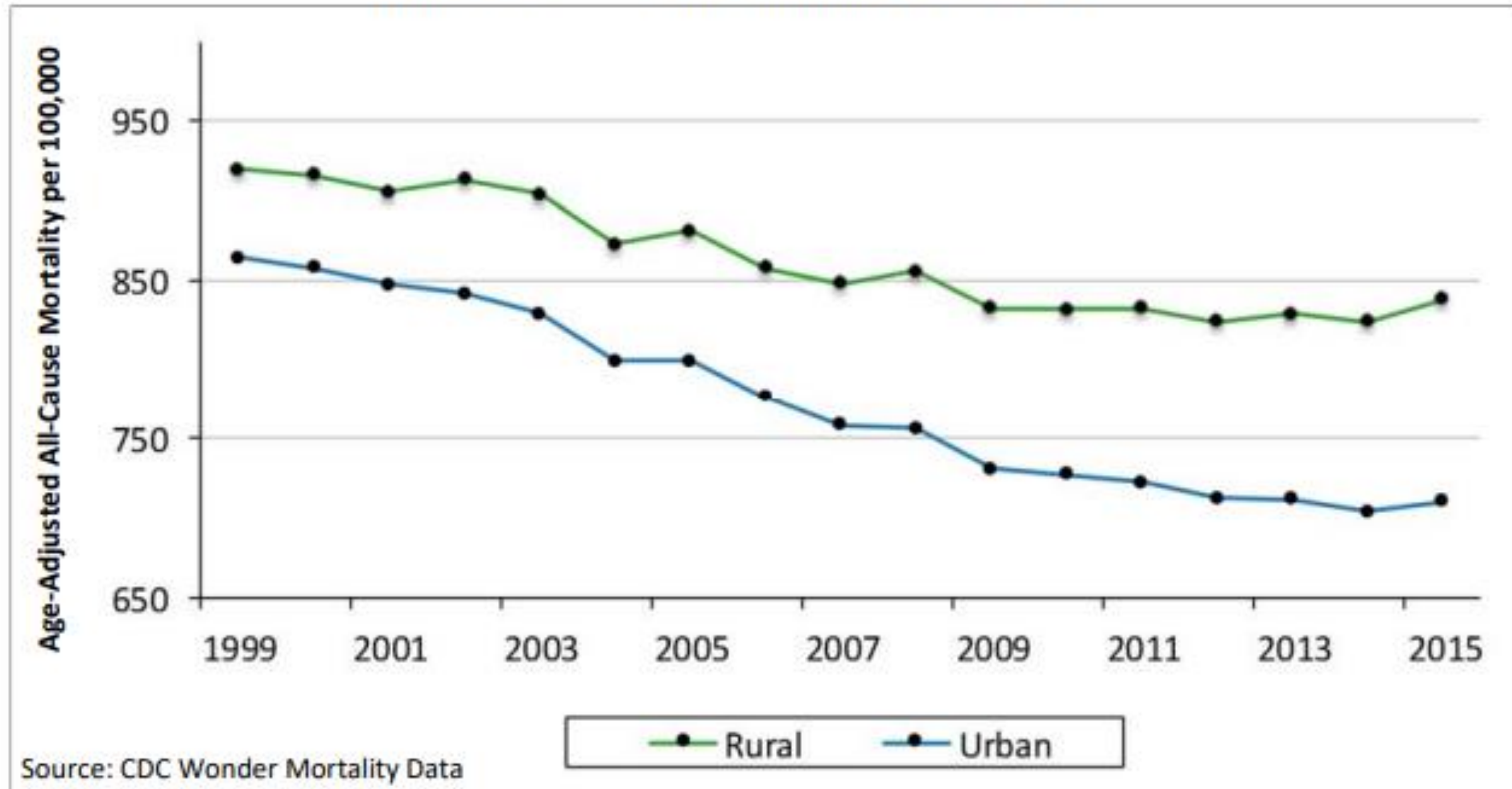


[Rural health for Michigan Overview - Rural Health Information Hub](#)

[US Census: 2022](#)

# Population Disparities

Figure 2: All-Cause U.S. Mortality Rate, 1999-2015



Extensive data show persistent health disparities, including: higher mortality and lower life expectancy, decreased or limited access to care, and increased distances to receive care. Rural Michigan Farmers' Health Concerns and Experiences: A Focus Group Study - PMC (nih.gov)

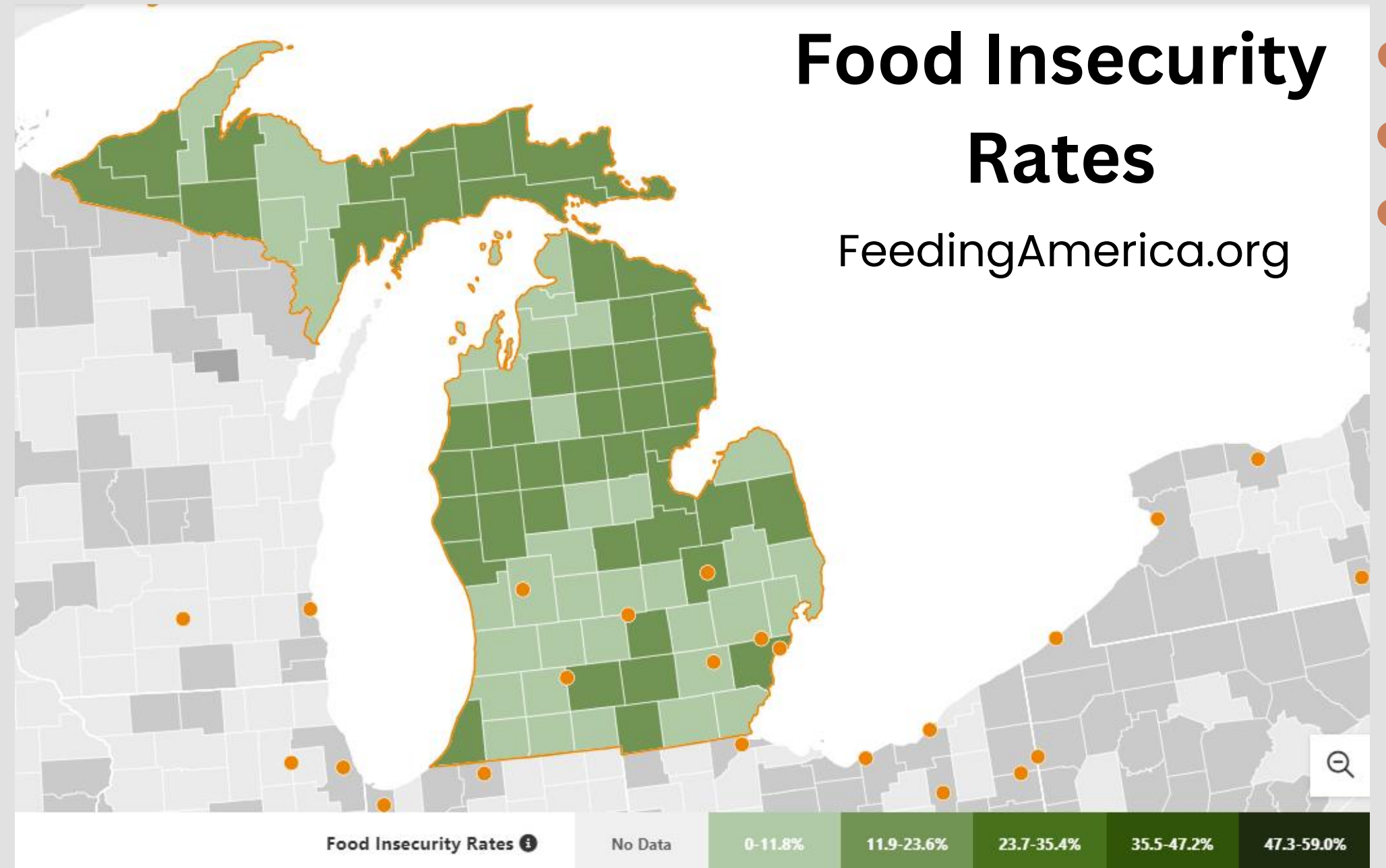


# Michigan Rural Counties



# Food Insecurity Rates

FeedingAmerica.org

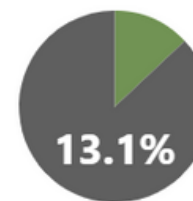


FOOD INSECURE POPULATION (CHILD) IN MICHIGAN

**282,320**



CHILD (<18 YEARS) FOOD INSECURITY RATE IN MICHIGAN



ESTIMATED PROGRAM ELIGIBILITY AMONG FOOD INSECURE CHILDREN IN MICHIGAN



- 22%** Likely ineligible for federal nutrition programs (incomes above 185% of poverty)
- 78%** Income eligible for federal nutrition programs (incomes at or below 185% of poverty)

AVERAGE MEAL COST IN MICHIGAN

**\$3.34**

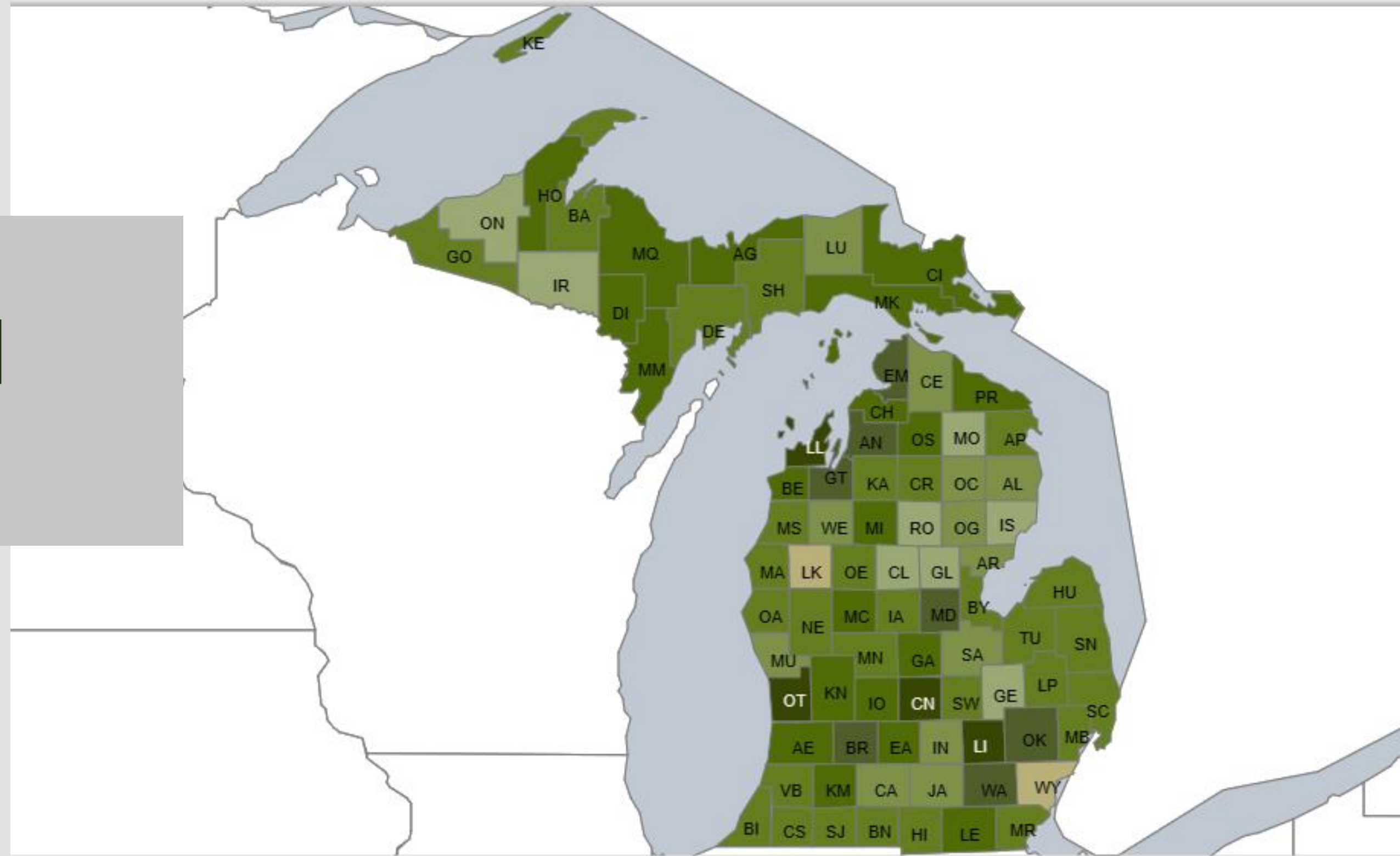
ANNUAL FOOD BUDGET SHORTFALL

**\$696,000,000**

# County Health Rankings & Roadmaps

2024 Health Outcomes - Michigan

## 2024 HEALTH OUTCOMES



MES GROUP    LEAST HEALTHY IN US    HEALTHIEST IN US    NOT GROUPED (NA)

Congressional District Lines ([Learn More](#))

# FOOD INSECURITY

- “In 2022, 14.7 percent of households in rural areas experienced food insecurity compared to 12.5 percent of households in metro areas. Geography: The food insecurity rate is highest in the South (14.5 percent), followed by the Midwest (12.4 percent), the Northeast (11.6 percent), and the West (11.2 percent).”
  - <https://frac.org/hunger-poverty-america>
- “In Michigan, the overall food insecurity rate is 11.5%. In the Upper Peninsula, where 100% of the counties are rural, the food insecurity rate is 14%”
  - <https://www.feedwm.org/2023/01/important-facts-on-rural-hunger-in-michigan/>
- The Food Security Council in 2022 made this summary statement:

**THE SOCIAL DETERMINANTS OF FOOD INSECURITY HAVE THE GREATEST IMPACT ON THE NATURE, SCOPE, AND CAUSES OF FOOD INSECURITY. THERE IS AN INTERCONNECTEDNESS BETWEEN POVERTY, HEALTH, AND FOOD INSECURITY.**

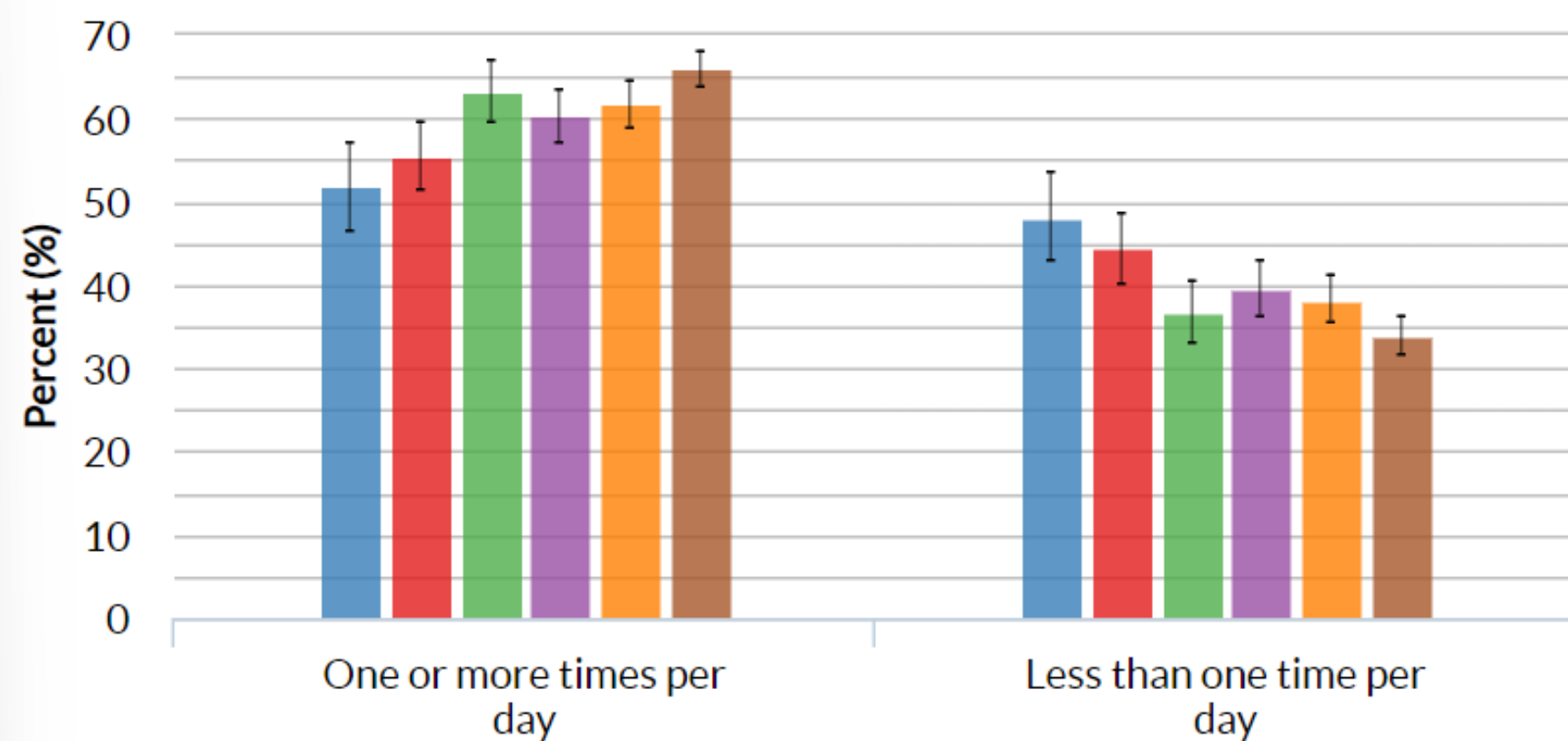
These social determinants include racial and ethnic inequality; health, age, and disability status; and poverty, income, and unemployment status. There is often a perpetual cycle of income restriction, food insecurity, and adverse health outcomes which is incredibly difficult to break independently and highlights the necessity of federal, state, and charitable food assistance programs. The COVID-19 pandemic has exacerbated these challenges for those disparately vulnerable to food insecurity.

### Michigan - 2021

Consumed fruit less than one time per day (variable calculated from one or more BRFSS questions) (Crude Prevalence)

View by: Age Group

Response: ( All )



#### Age Group

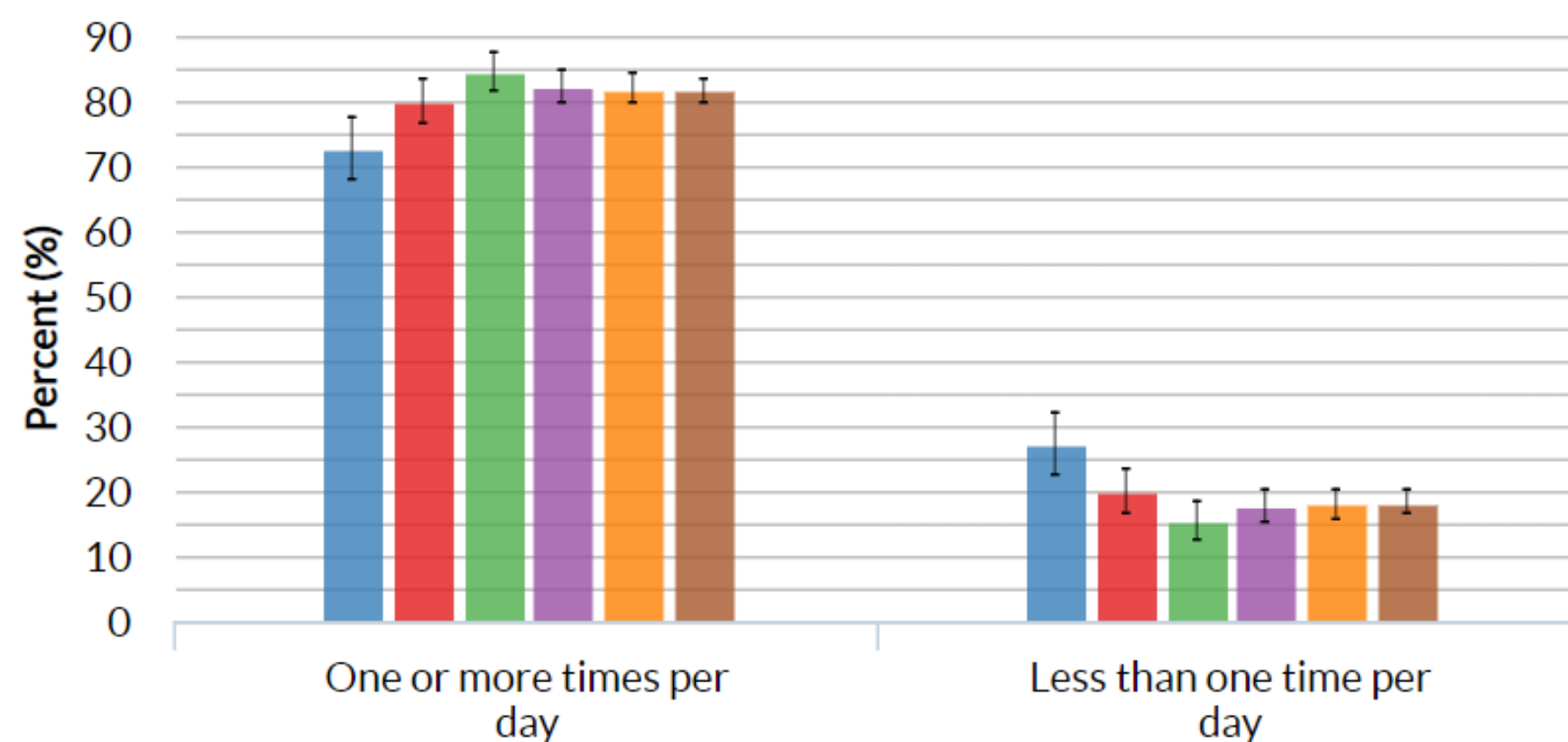
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

### Michigan - 2021

Consumed vegetables less than one time per day (variable calculated from one or more BRFSS questions) (Crude Prevalence)

View by: Age Group

Response: ( All )



#### Age Group

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

# SCURVY

***“They lived mainly on dried meat and grains which could be stored without refrigeration, their gums turn black and their teeth fall out. It often killed them.” ~ James Lind 1747***

According to *Feeding America.org*, **“Poverty, unemployment and low wages lead to food insecurity.** It's why Feeding America helps people experiencing food insecurity get the food and resources they need by increasing access to food in their communities.”



# STUDY DESIGN

- Looked at patients who were at risk for nutritional deficiencies with chronic comorbidities that were not responding to conventional treatment
- Took levels for A, B1, B2, B3, B5, B6, B9, C, D, Magnesium, Selenium, Iron, Ferritin when the symptoms and risk factors warranted
- Pulled out the data with populations with deficiencies with a sample size >50
- Compared deficiency with comorbidities and identified patterns and correlations, observational data

# A LOOK AT THE DATA



## **BMI**

- Range (13–66)
- Average – 29.4

## **Sex at Birth**

- Female – 49%
- Male – 51%

## **Age**

- Age range (18–86): average – 49

## **Race – by patient identification**

- White – 78%
- Black/African American – 12%
- American Indian/Alaska Native – 2%
- Hispanic or Latino – 2%
- Unreported – 2%
- Other 4%

# A LOOK AT THE DATA

## Vitamin C test (Normal: 0.4 – 2.0 mg/dL)

- 362 people tested
- 171 with low vitamin C levels (<0.4 mg/dL)
- 191 with normal vitamin C levels

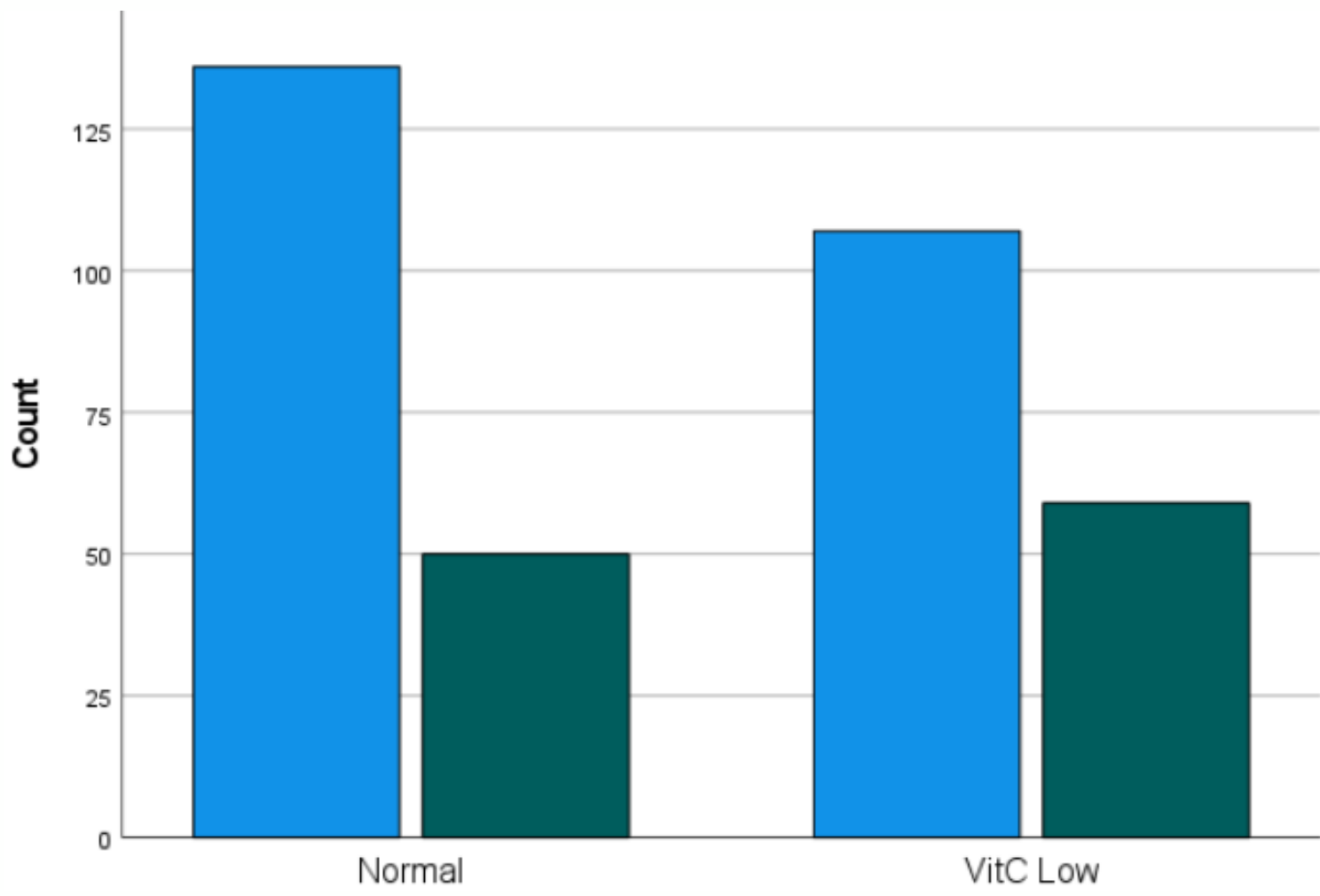
## Of the individuals with Low Vitamin C levels:

- 68% have current periodontal disease
- 13% have previously reported periodontal disease
- 80% currently smoke



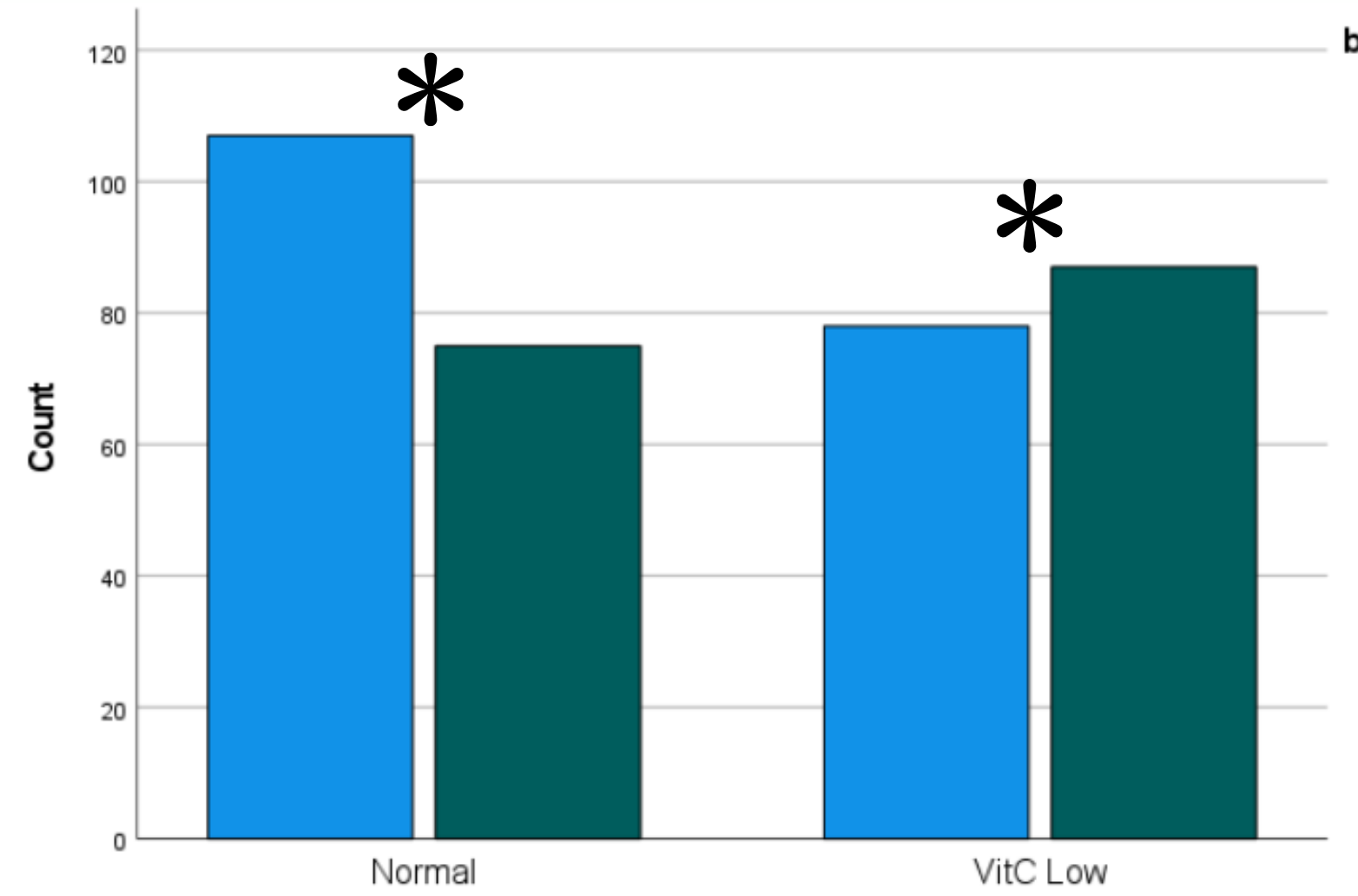
crps\_regional\_pain

No  
Yes



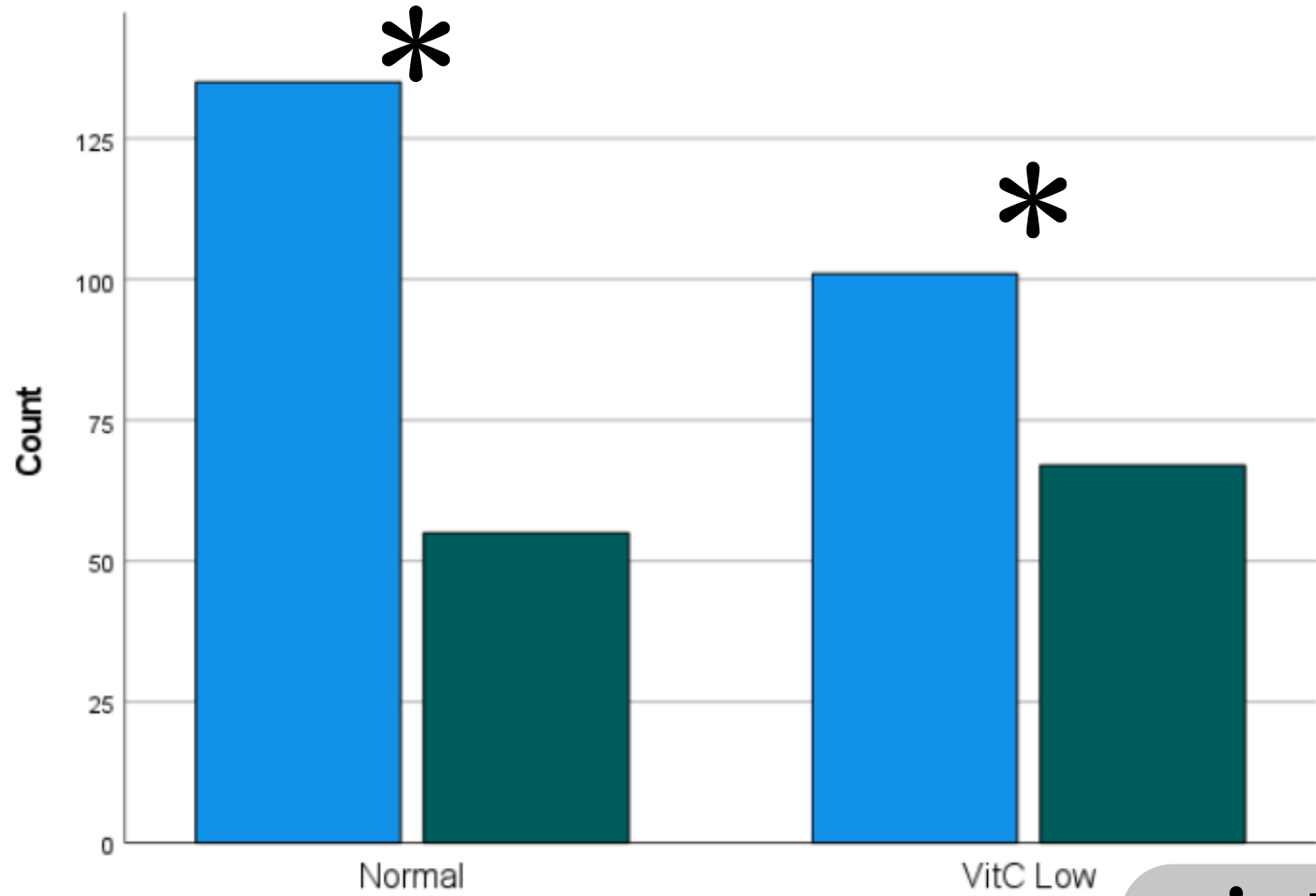
back\_pain

No  
Yes



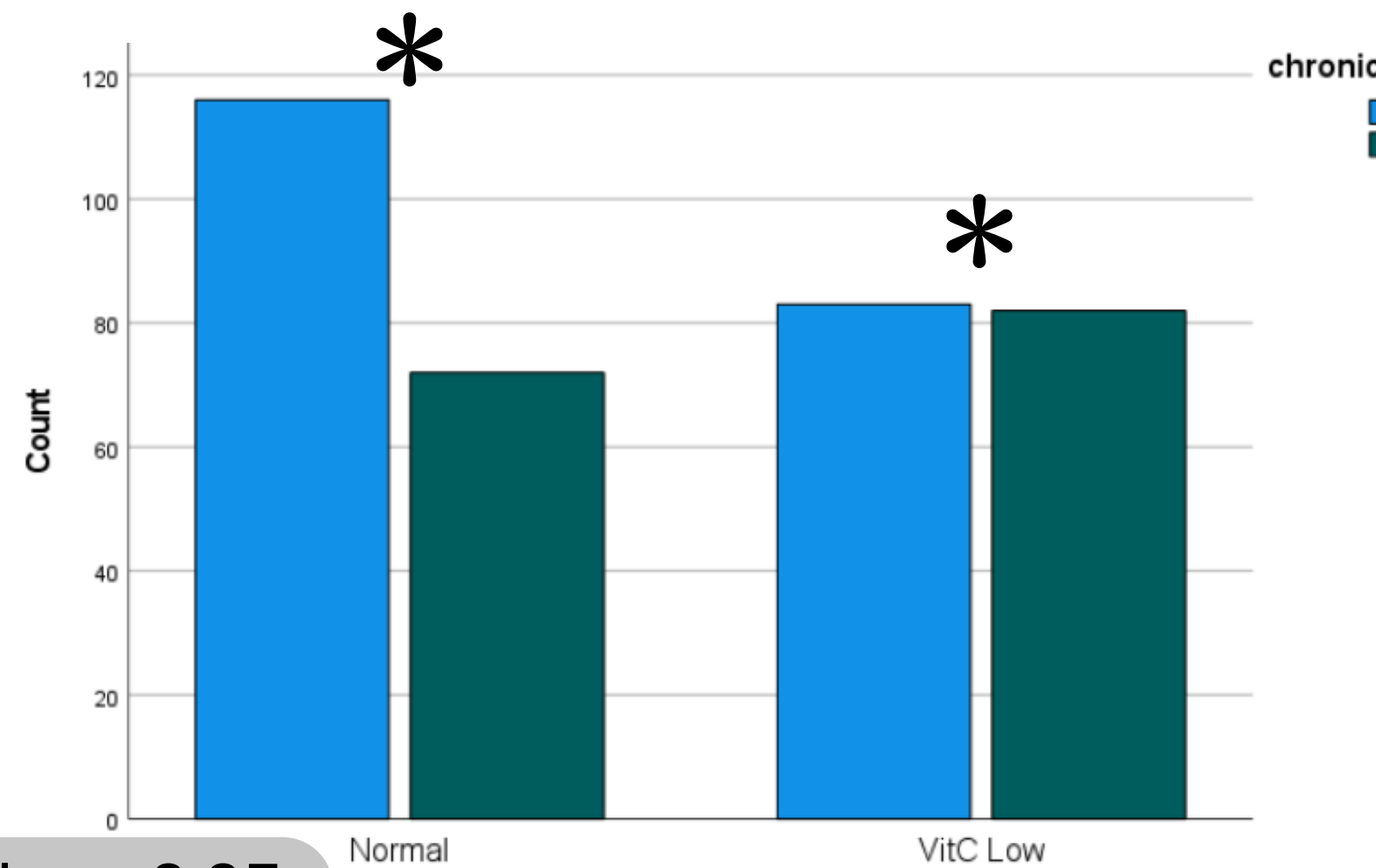
chronic\_pain\_med

No  
Yes



chronic\_joint\_pain

No  
Yes



\* Indicates p-value < 0.05

# CHRONIC PAIN AND MALNUTRITION

- **Elma Ö, Brain K, Dong HJ. The Importance of Nutrition as a Lifestyle Factor in Chronic Pain Management: A Narrative Review.**

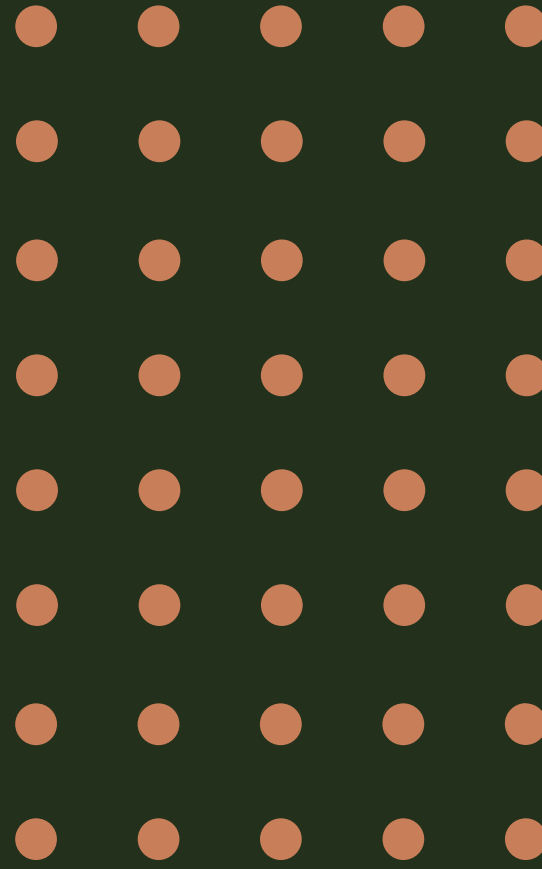
J Clin Med. 2022 Oct 9;11(19):5950. doi: 10.3390/jcm11195950. PMID: 36233817; PMCID: PMC9571356.

- **“An accumulating body of evidence suggests that poor nutrition, such as malnutrition, unhealthy dietary behaviors, and a poor dietary intake can play a significant role in the occurrence, prognosis, and maintenance of chronic non-cancer pain, hereafter described as chronic pain”**


{<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9571356/>}

- **“Unhealthy dietary behaviors and a poor dietary intake is characterized by the limited intake of core nutrient-rich foods and an excessive intake of energy-dense nutrient poor foods”**

{<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9571356/>}



# Vitamin C prevents cigarette smoke-induced oxidative damage in vivo.

Panda K <sup>1</sup> , Chattopadhyay R, Chattopadhyay DJ, Chatterjee IB

[Author information](#) ▶

Free Radical Biology & Medicine, 01 Jul 2000, 29(2):115-124

[https://doi.org/10.1016/s0891-5849\(00\)00297-5](https://doi.org/10.1016/s0891-5849(00)00297-5) PMID: 10980400

[Integr Med \(Encinitas\)](#). 2020 Jun; 19(3): 18–29.

PMCID: PMC7572147 | PMID: [33132774](#)

# Vitamin C, Pain and Opioid Use Disorder

[Erica Zelfand](#), ND

[Nutrients](#). 2020 Jul; 12(7): 1963. Published online 2020 Jul 1.

doi: [10.3390/nu12071963](https://doi.org/10.3390/nu12071963)

PMCID: PMC7400679 | PMID: [32630245](#)

# Factors Affecting Vitamin C Status and Prevalence of Deficiency: A Global Health Perspective

[Anitra C. Carr](#)<sup>1,\*</sup> and [Sam Rowe](#)<sup>2</sup>

Review > [J Transl Med](#). 2017 Apr 14;15(1):77.

doi: [10.1186/s12967-017-1179-7](https://doi.org/10.1186/s12967-017-1179-7).

# The role of vitamin C in the treatment of pain: new insights

[Anitra C Carr](#)<sup>1</sup>, [Cate McCall](#)<sup>2</sup>

Affiliations + expand

PMID: 28410599

PMCID: [PMC5391567](#)

DOI: [10.1186/s12967-017-1179-7](https://doi.org/10.1186/s12967-017-1179-7)

> [BMJ Open](#). 2023 May 24;13(5):e069230.

doi: [10.1136/bmjopen-2022-069230](https://doi.org/10.1136/bmjopen-2022-069230).

# Impact of vitamin C on the reduction of opioid consumption after an emergency department visit for acute musculoskeletal pain: a double-blind randomised control trial protocol

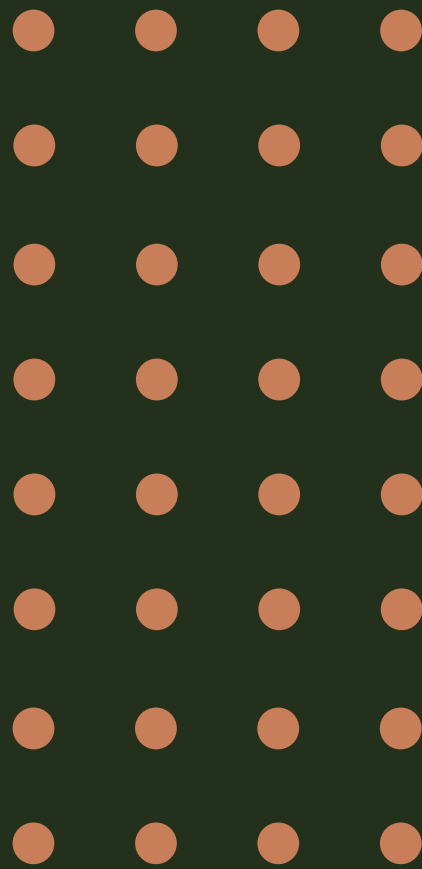
[Raoul Daoust](#)<sup>1 2 3</sup>, [Jean Paquet](#)<sup>2</sup>, [Jean-Marc Chauny](#)<sup>4 2</sup>,  
[David Williamson](#)<sup>3 5</sup>, [Vérilibe Huard](#)<sup>4 2 3</sup>, [Caroline Arbour](#)<sup>3 6</sup>,  
[Marcel Emond](#)<sup>7</sup>, [Dominique Rouleau](#)<sup>3</sup>, [Alexis Cournoyer](#)<sup>4 2 3</sup>

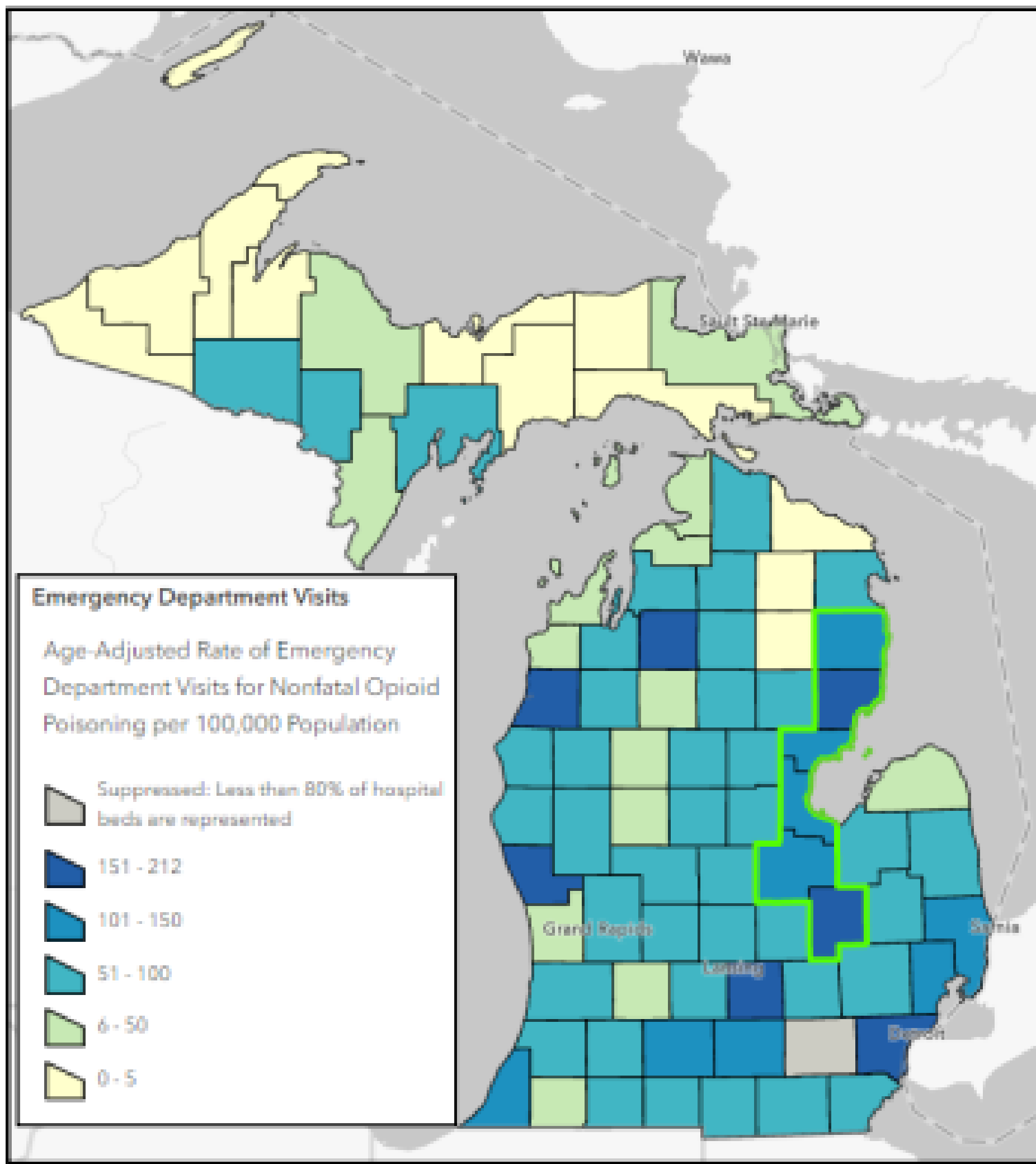
Affiliations + expand

PMID: 37225265

PMCID: [PMC10230879](#)

DOI: [10.1136/bmjopen-2022-069230](https://doi.org/10.1136/bmjopen-2022-069230)

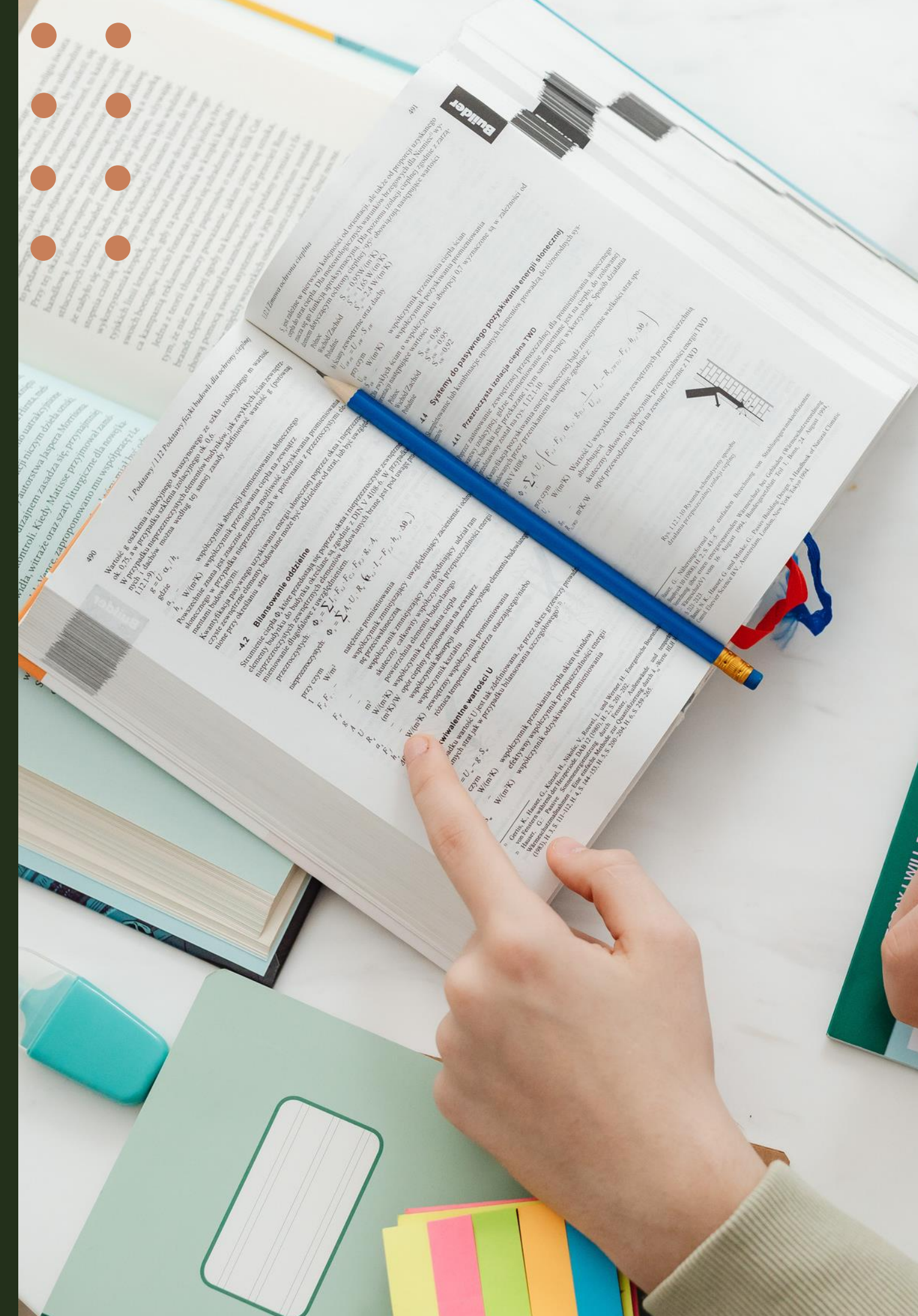


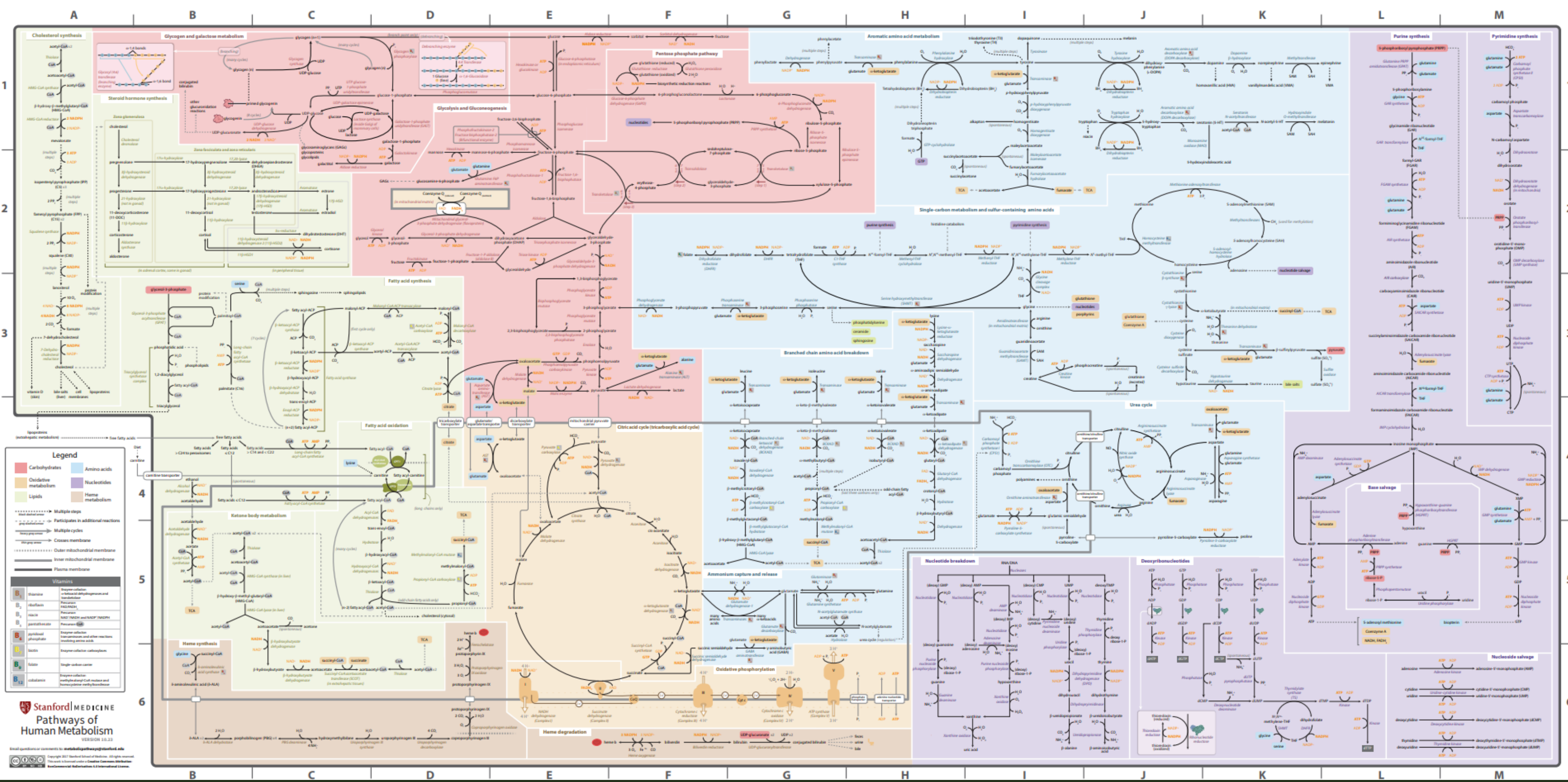


# MICHIGAN LANDSCAPE MAP HIGHLIGHTS COUNTIES AFFECTED HARDEST BY OPIOID EPIDEMIC (2019)

[https://michigan-open.org/wp-content/uploads/2023/11/OPEN\\_WhitePaper\\_Nov2023-1.pdf](https://michigan-open.org/wp-content/uploads/2023/11/OPEN_WhitePaper_Nov2023-1.pdf)

# BACK TO YEAR 1 OF MEDICAL SCHOOL





**Legend**

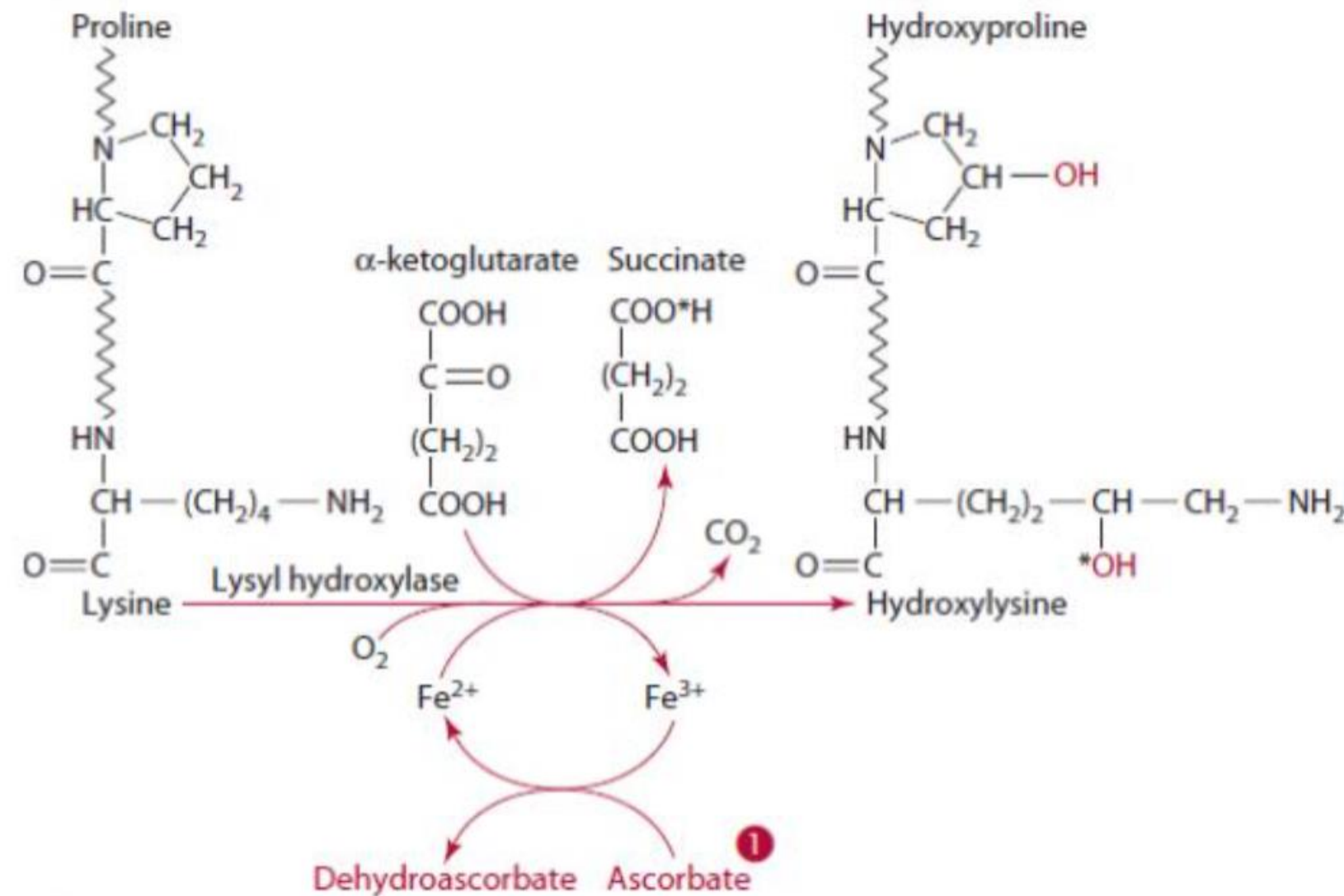
- Carbohydrates (Red)
- Amino acids (Blue)
- Oxidative metabolism (Orange)
- Lipids (Green)
- Nucleotides (Purple)
- Heme metabolism (Yellow)

- Multiple steps  
 - Participates in additional reactions  
 - Multiple cycles  
 - Crosses membrane  
 - Outer mitochondrial membrane  
 - Inner mitochondrial membrane  
 - Plasma membrane

**Vitamins**

B <sub>1</sub>	Thiamine	Keyner cofactor in several decarboxylation and transamination reactions
B <sub>2</sub>	Riboflavin	Keyner cofactor in several redox reactions
B <sub>3</sub>	Niacin	Keyner cofactor in several redox reactions
B <sub>5</sub>	Pantoic acid	Keyner cofactor in several transamination reactions
B <sub>6</sub>	Pyridoxal phosphate	Keyner cofactor in several transamination reactions and other reactions involving amino acids
B <sub>7</sub>	Biotin	Keyner cofactor in several carboxylation reactions
B <sub>9</sub>	Folate	Single-carbon carrier
B <sub>12</sub>	Cobalamin	Keyner cofactor in several methyltransferase reactions and other reactions involving amino acids

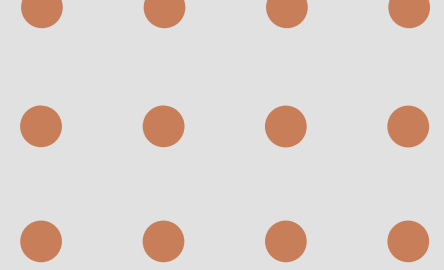
# Collagen Synthesis



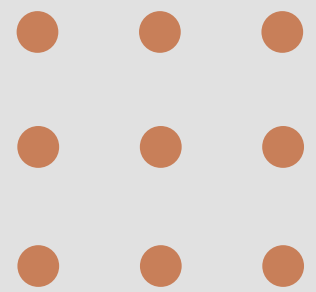
① Ascorbate acts as a reducing agent to convert the oxidized iron atom ( $\text{Fe}^{3+}$ ) back to its reduced state ( $\text{Fe}^{2+}$ ) in the enzymes lysyl hydroxylase and prolyl hydroxylase.

**Take Away:  
Vitamin C is  
important for  
wound healing**

**Figure 9.4** Ascorbate functions in the hydroxylation of peptide-bound proline and lysine in procollagen. One atom of oxygen (\*) appears in the hydroxyl group of the product and the other in succinate.



# WHY ARE PEOPLE NOT BEING TESTED?





**Table 4. Laboratory components: National Health and Nutrition Examination Survey, 1999–2022—Con.**



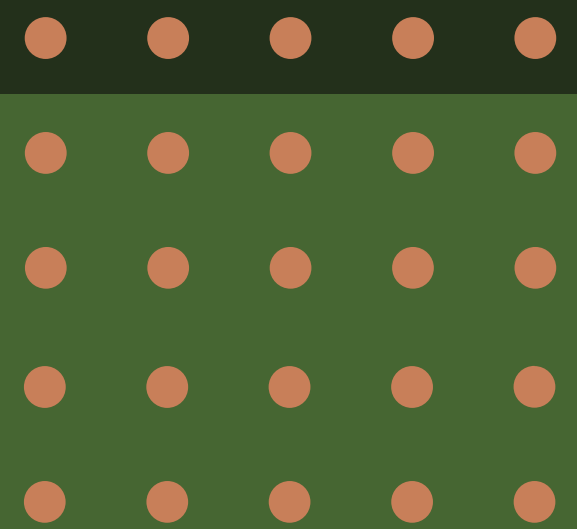
Component	Sample description	<span style="color: blue;">■</span> Component or laboratory test conducted on original sample description <span style="color: green;">■</span> Change from original sample description <span style="color: white;">■</span> Component or laboratory test not conducted											
		1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	2015–2016	2017–2018	2019–2020	2021–2022
Vitamin A/E/carotenoids (blood)	3 years and over	■	■	■	■						■		
Vitamin B6 (blood)	1 year and over			■	■	■	■	■					
Vitamin B12 (blood)	3 years and over	■	■	■	■			■					
<b>Vitamin C (blood)</b>	6 years and over			■	■						■		
Vitamin D (blood)	6 years and over		■	■	■	■	■	■	■	■		■	
Volatile N-nitrosamines (urine)	1/3 sample (6 years and over) and all smokers 18 and over								■				
Volatile organic compounds (VOC) (blood)	Subsample 20–59 years	■	■	■	■	■	■	■	■	■	■	■	■
Volatile organic compounds (VOC) exposure monitor (blood)	Subsample 20–59 years	■	■										
Volatile organic compounds (VOC) (urine)	Subsample (6 years and over) and all adult smokers								■	■	■	■	■
Volatile organic compounds (VOC) (water)	Subsample 20–59 years	■	■	■	■								
White blood cells/deoxyribonucleic acid (WBC/DNA) (blood)	20 years and over	■	■				■	■					



## Sample Size - 6740

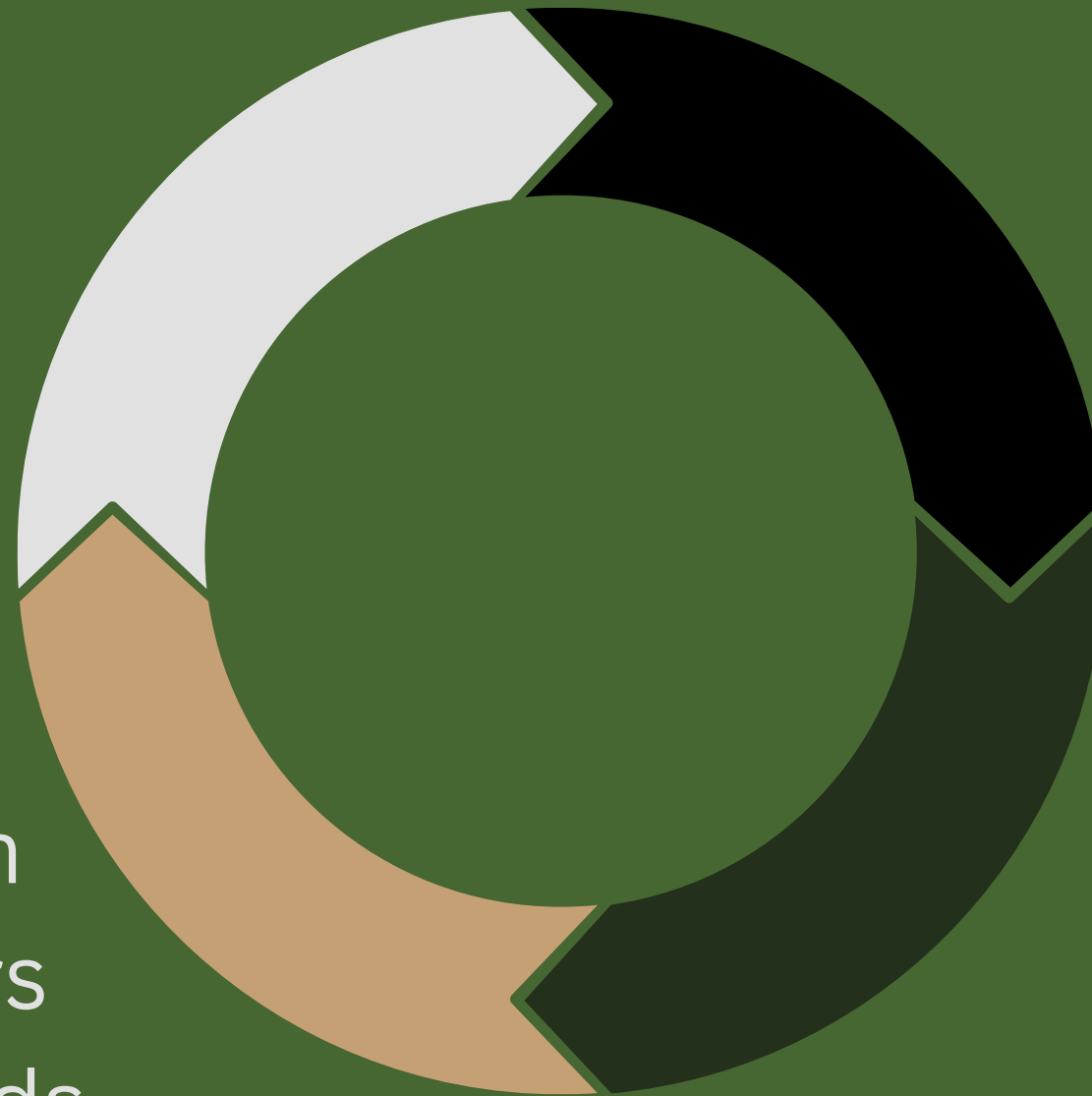
- Vitamin C Normal- 5738 (77.2%)
- Vitamin C Low - 1002 (**13.5%**)
- Missing Data - 695 (9.3%)

# THE CYCLE OF CHRONIC PAIN: WHERE WE INTERVENE



Decreased ability to  
recover

Chronic Pain

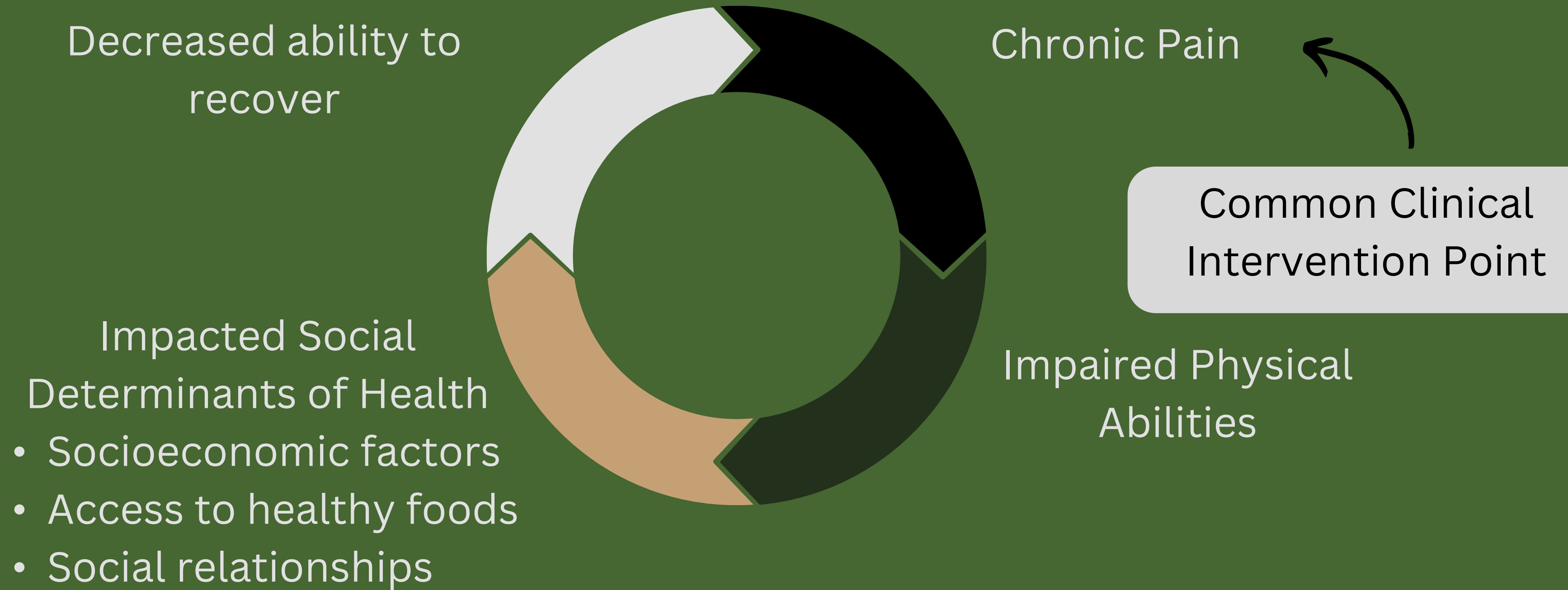


Impaired Physical  
Abilities

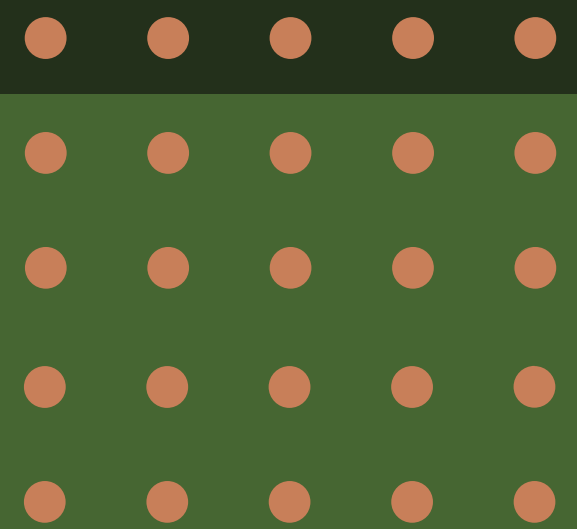
Impacted Social  
Determinants of Health

- Socioeconomic factors
- Access to healthy foods
- Social relationships

# THE CYCLE OF CHRONIC PAIN: WHERE WE INTERVENE



# THE CYCLE OF CHRONIC PAIN: WHERE WE INTERVENE

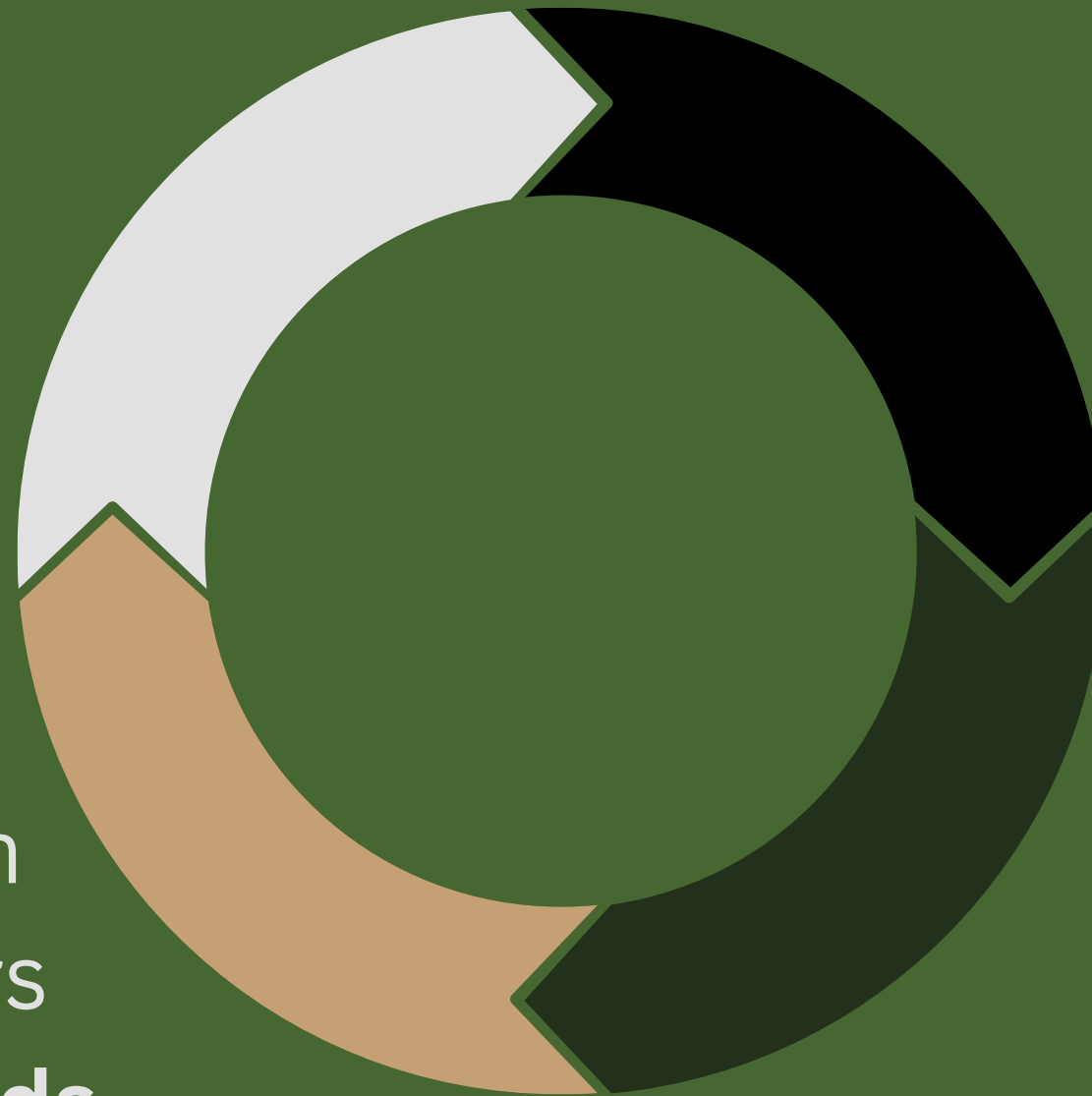


Decreased ability to  
recover

Rethinking the  
Intervention



- Impacted Social  
Determinants of Health
- Socioeconomic factors
  - **Access to healthy foods**
  - Social relationships



Chronic Pain

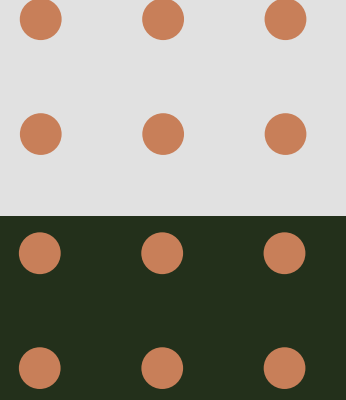
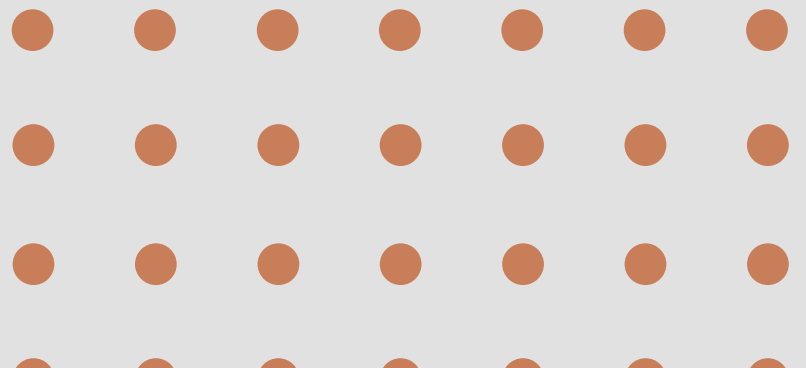
Impaired Physical  
Abilities



# BACK TO RURAL HEALTH

Each one of these problems is exacerbated by unique challenges faced in rural health

- Smoking** ●
- Drinking** ●
- Nutrition** ●
- Health Care** ●
- SUD** ●



# IDEAS INTO ACTION

Eating  
Patterns

Metabolic  
Patterns

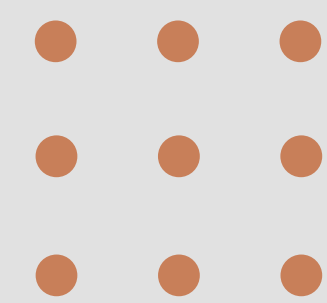
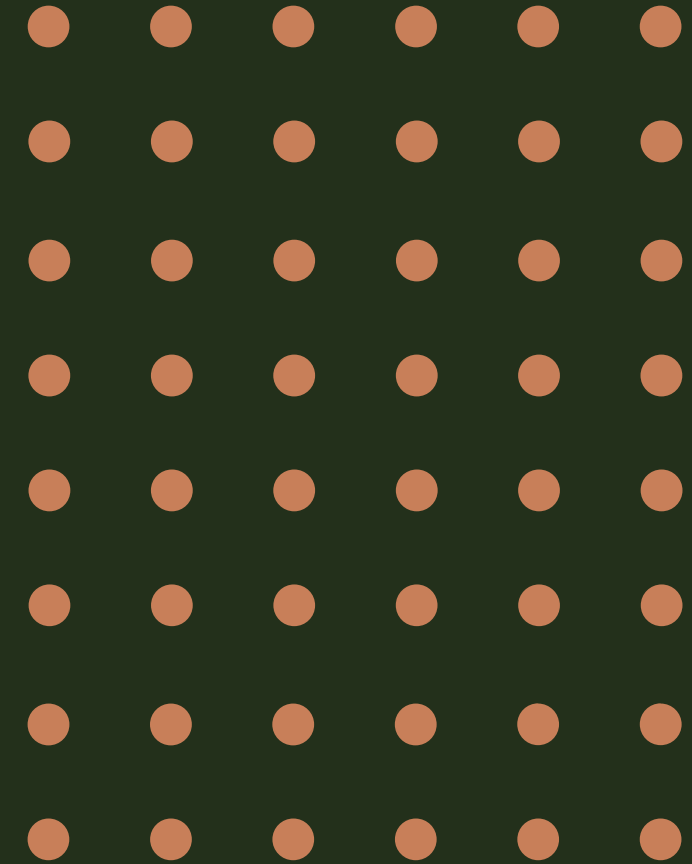
Genetic Pre-  
dispositions

Metabolic  
Memory

Microbiome?

# **SPECIAL THANKS TO**

- **Nate Brookshire**
- **Tessa Mlinar**
- **Dr. Neli Ragina**
- **Dr. Jesse Bakke**
- **Janet Mindes**
- **Nate Dickman**



# HOW TO CONTACT

**Ramona Wallace DO IFMCP**

ramona.wallace@wmed.edu



**Julia Kwapiszewski MPH**

kwapiljt@cmich.edu



**Lisa Graves MD MCIInSc**

lisa.graves@wmed.edu

