

# **Age and Medical Conditions**

## **Analysis Report**

HPP 10K Dataset

Ages 40-70 | N = 23,473

Conditions with  $n \geq 100$  cases

**37 significant associations**

22 increase with age | 15 decrease with age

# EXECUTIVE SUMMARY

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## STUDY DESIGN

- Cross-sectional analysis of HPP 10K cohort
- Age range: 40-70 years (94% of cohort)
- Sample size: 23,473 subjects
- Minimum cases per condition: 100

## KEY FINDINGS

37 conditions show significant age associations ( $p < 0.05$ ):

- 22 conditions INCREASE with age
- 15 conditions DECREASE with age

### TOP 5 CONDITIONS INCREASING WITH AGE:

- Osteoarthritis: 2.50x odds per decade (n=611)
- Glaucoma: 2.42x odds per decade (n=161)
- Ischemic Heart Disease: 2.39x odds per decade (n=285)
- Hypertension: 2.36x odds per decade (n=2494)
- Retinal detachment: 2.23x odds per decade (n=200)

### TOP 5 CONDITIONS DECREASING WITH AGE:

- Polycystic Ovary Disease: 0.53x odds per decade (n=582)
- Endometriosis and Adenomyosis: 0.67x odds per decade (n=278)
- Allergy: 0.71x odds per decade (n=4220)
- Sinusitis: 0.79x odds per decade (n=752)
- B12 Deficiency: 0.79x odds per decade (n=1110)

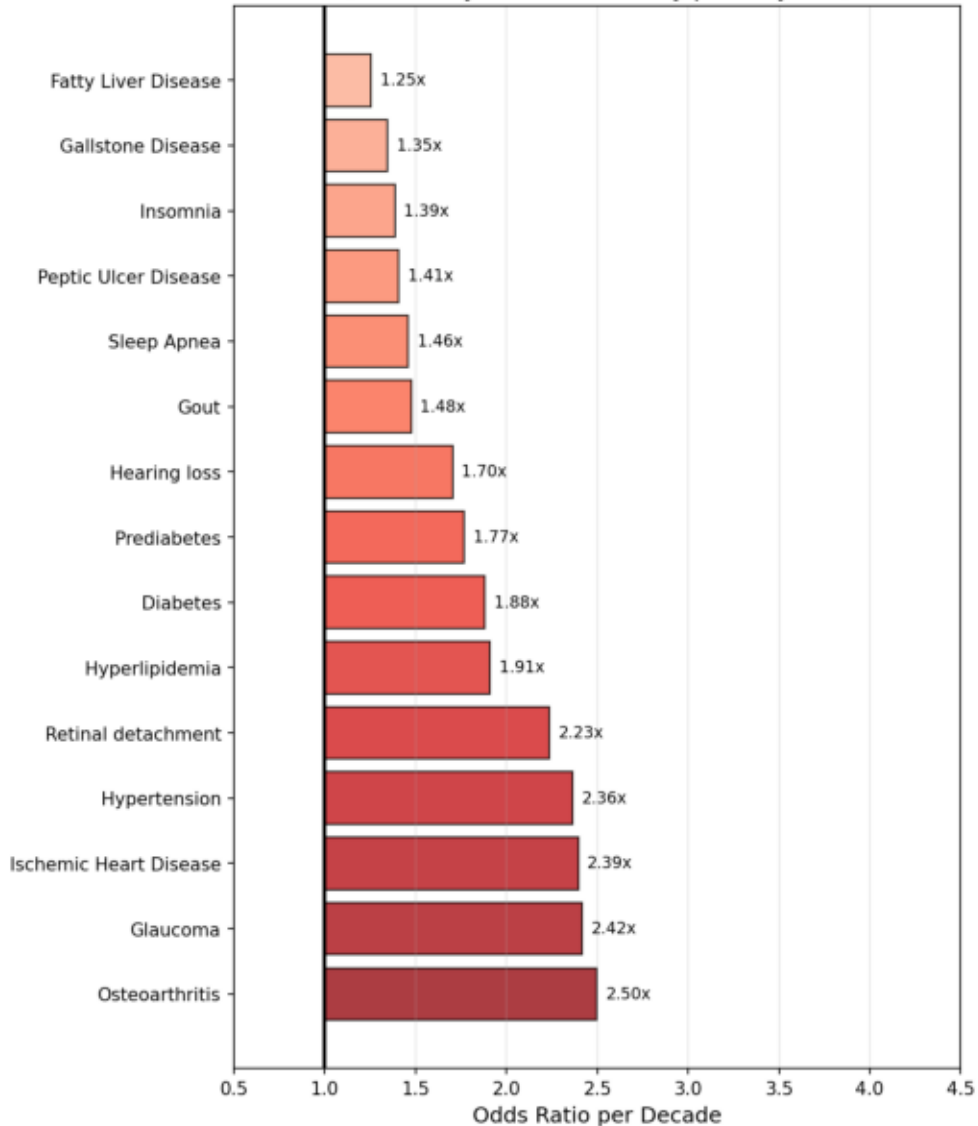
## INTERPRETATION

Cardiovascular conditions (AF, IHD, hypertension) and sensory conditions (glaucoma, hearing loss) show expected age-related increases. Mental health conditions show decreasing prevalence, likely due to cohort effects and survival bias.

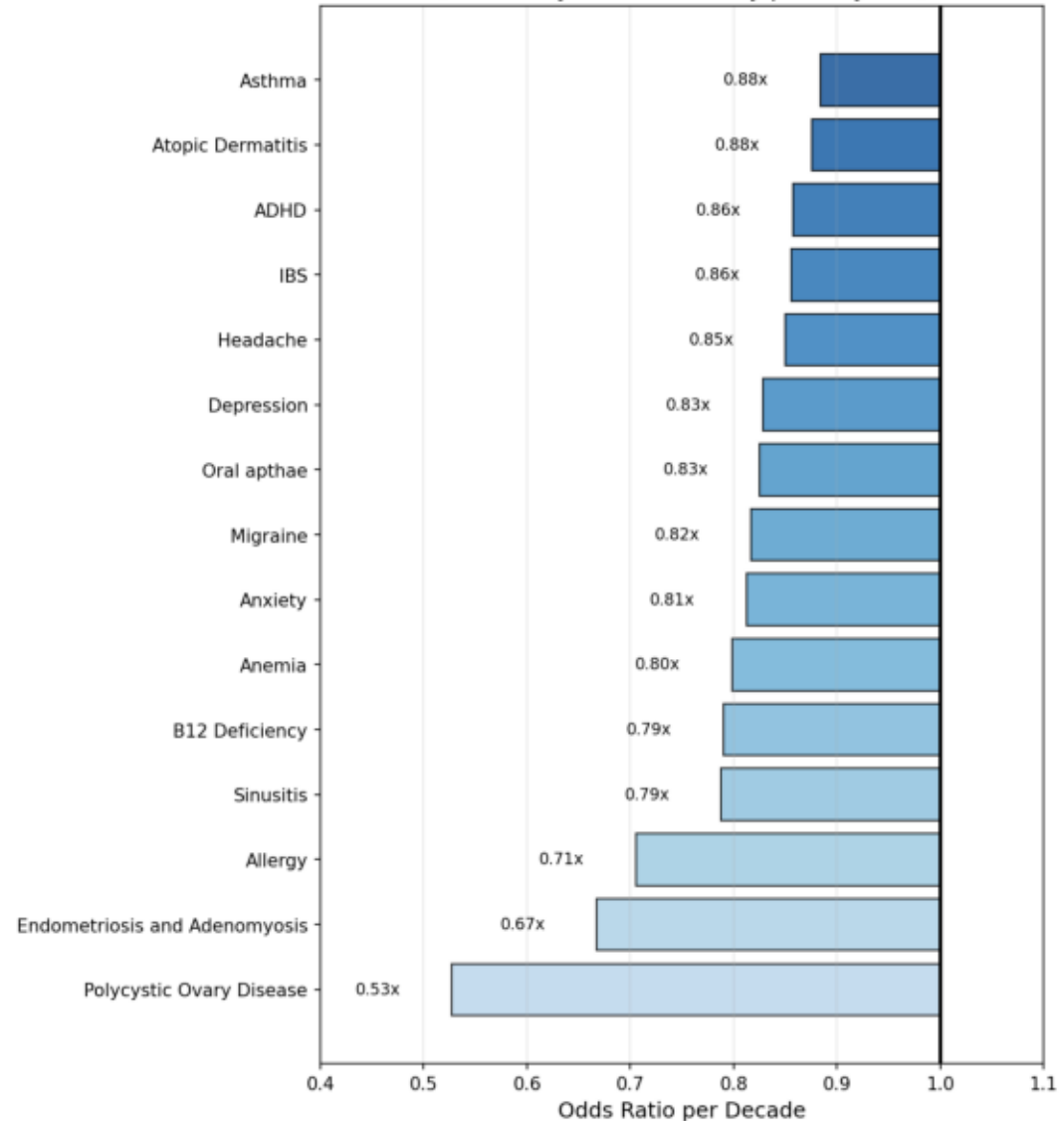
# Summary: Odds Ratio per Decade of Age

**Age Effect on Medical Conditions: Summary**  
(Odds Ratio = 2.0 means twice as likely per decade of age)

Conditions that INCREASE with Age  
(How many times more likely per 10 years)



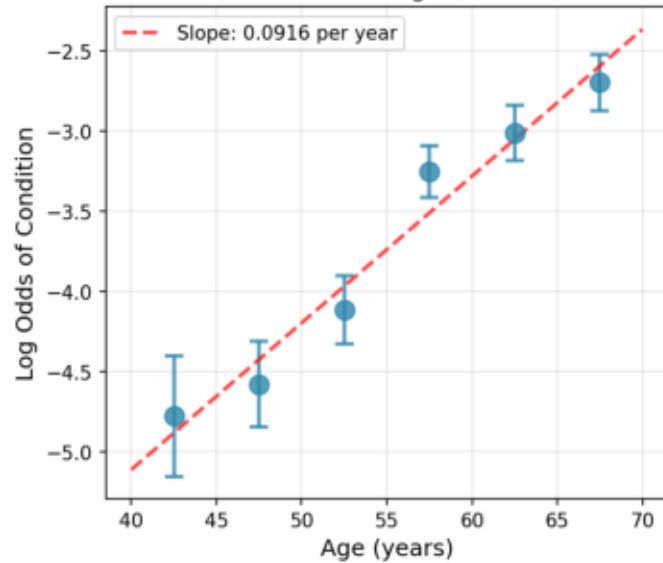
Conditions that DECREASE with Age  
(How many times less likely per 10 years)



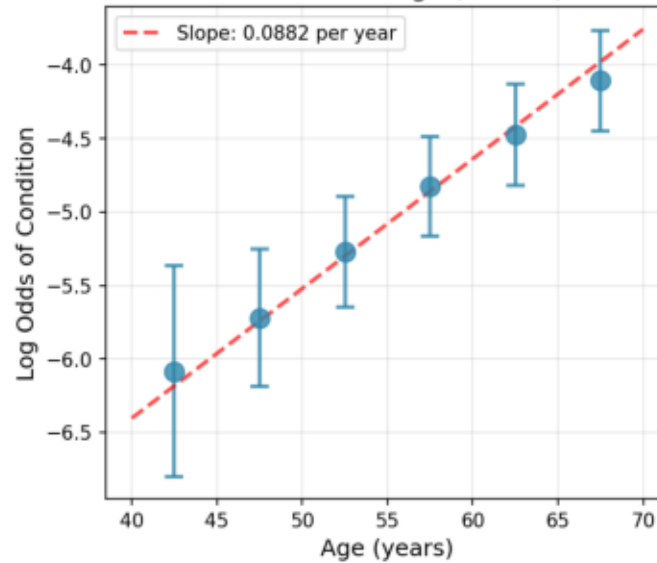
# Top Conditions Increasing with Age (Log Odds)

Top 6 Conditions INCREASING with Age  
(Log Odds vs Age)

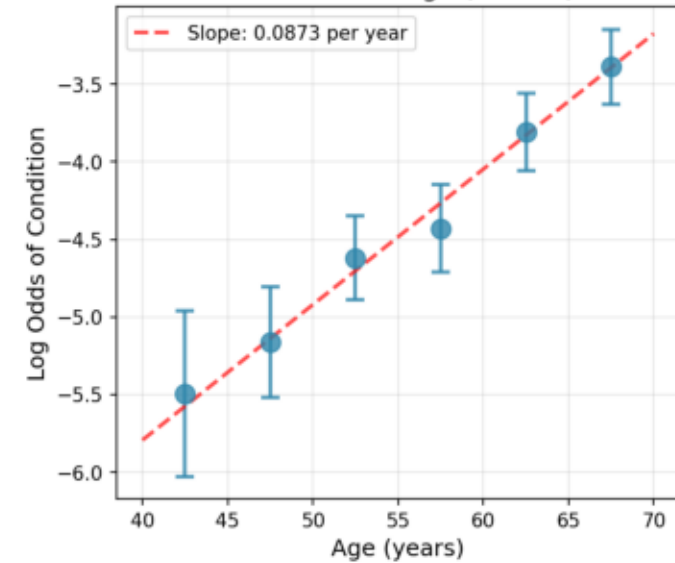
Osteoarthritis  
↑ increases with age (n=611) \*\*\*



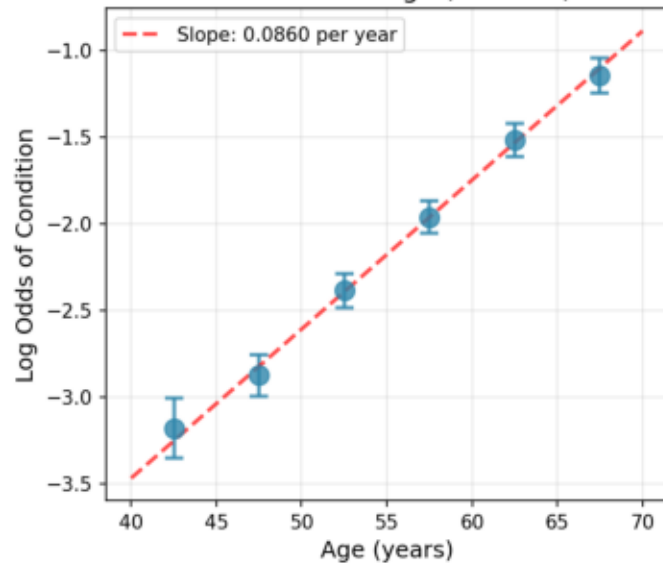
Glaucoma  
↑ increases with age (n=161) \*\*\*



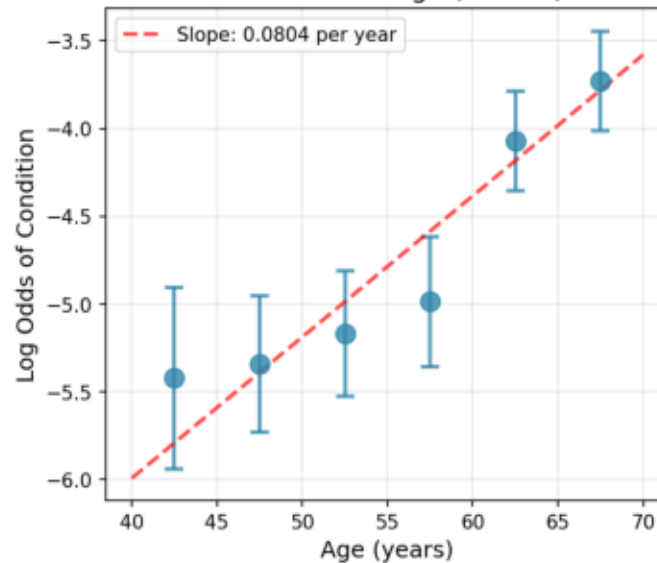
Ischemic Heart Disease  
↑ increases with age (n=285) \*\*\*



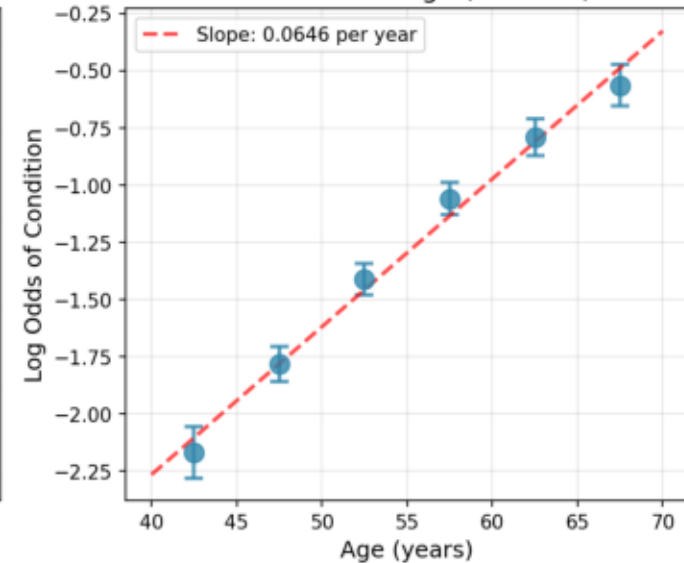
Hypertension  
↑ increases with age (n=2494) \*\*\*



Retinal detachment  
↑ increases with age (n=200) \*\*\*



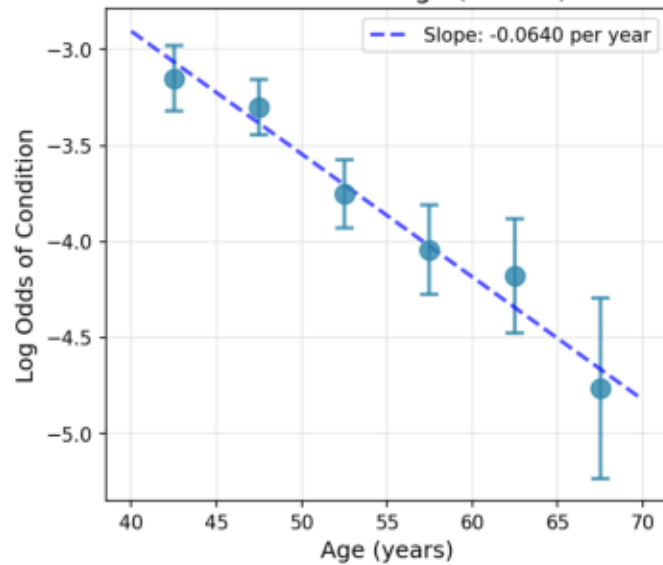
Hyperlipidemia  
↑ increases with age (n=5013) \*\*\*



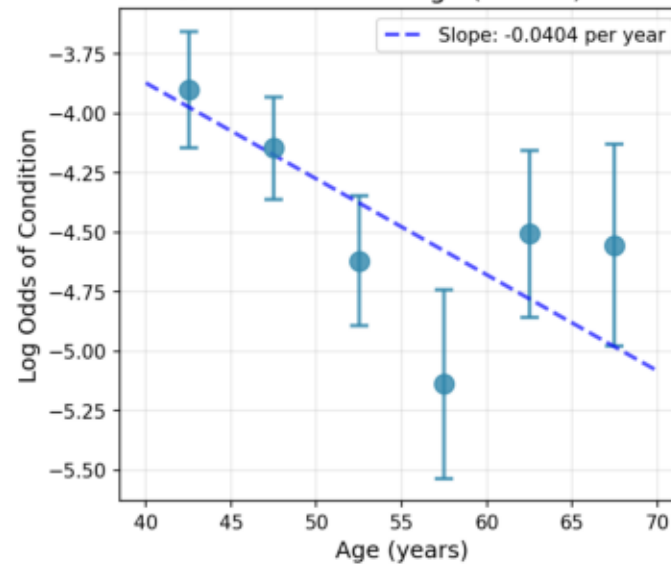
# Top Conditions Decreasing with Age (Log Odds)

Top 6 Conditions DECREASING with Age  
(Log Odds vs Age)

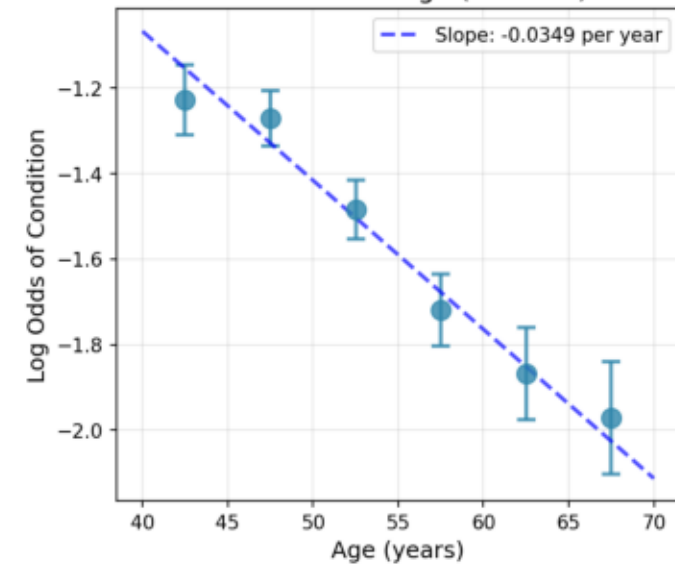
Polycystic Ovary Disease  
↓ decreases with age (n=582) \*\*\*



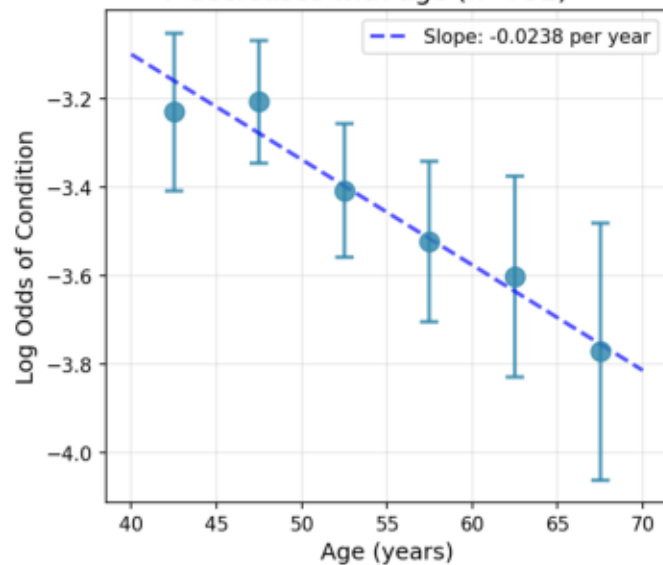
Endometriosis and Adenomyosis  
↓ decreases with age (n=278) \*\*\*



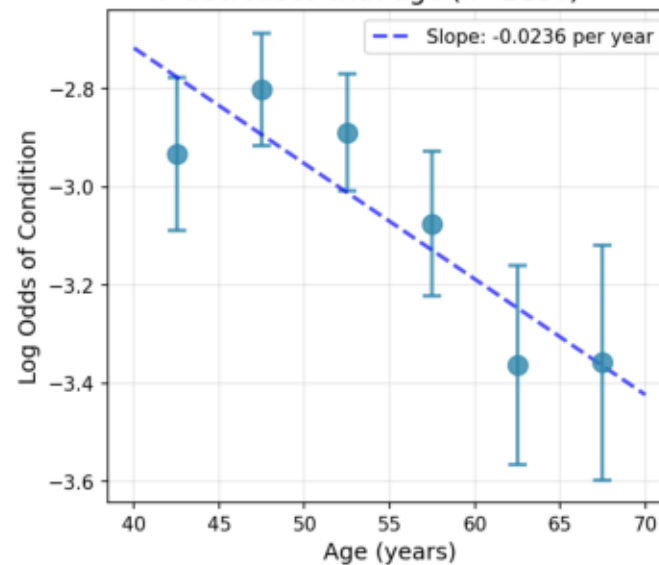
Allergy  
↓ decreases with age (n=4220) \*\*\*



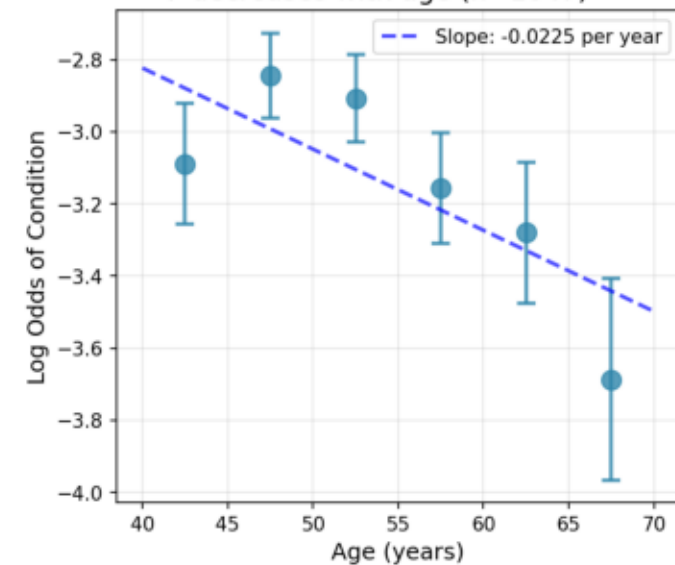
Sinusitis  
↓ decreases with age (n=752) \*\*\*



B12 Deficiency  
↓ decreases with age (n=1110) \*\*\*

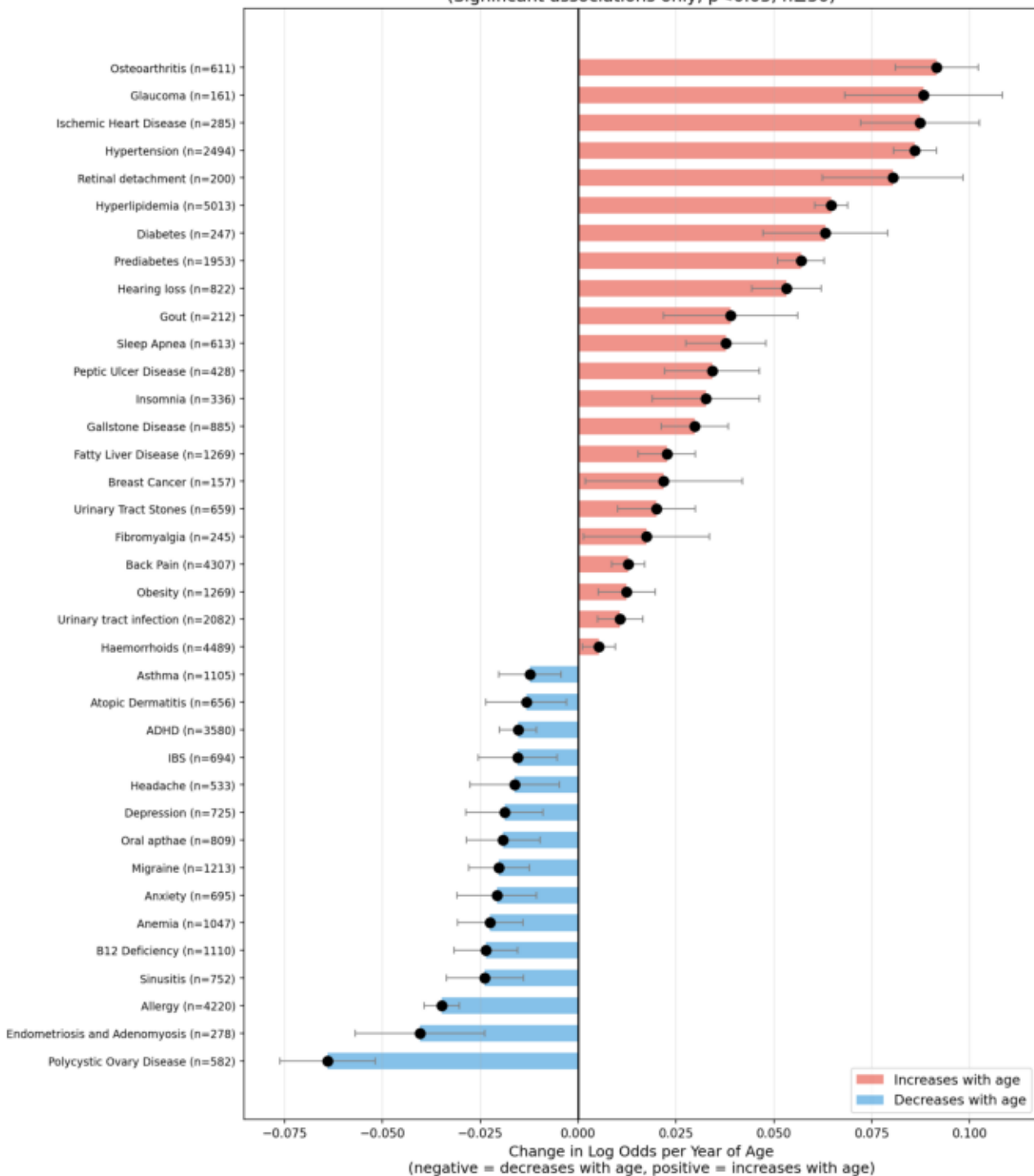


Anemia  
↓ decreases with age (n=1047) \*\*\*



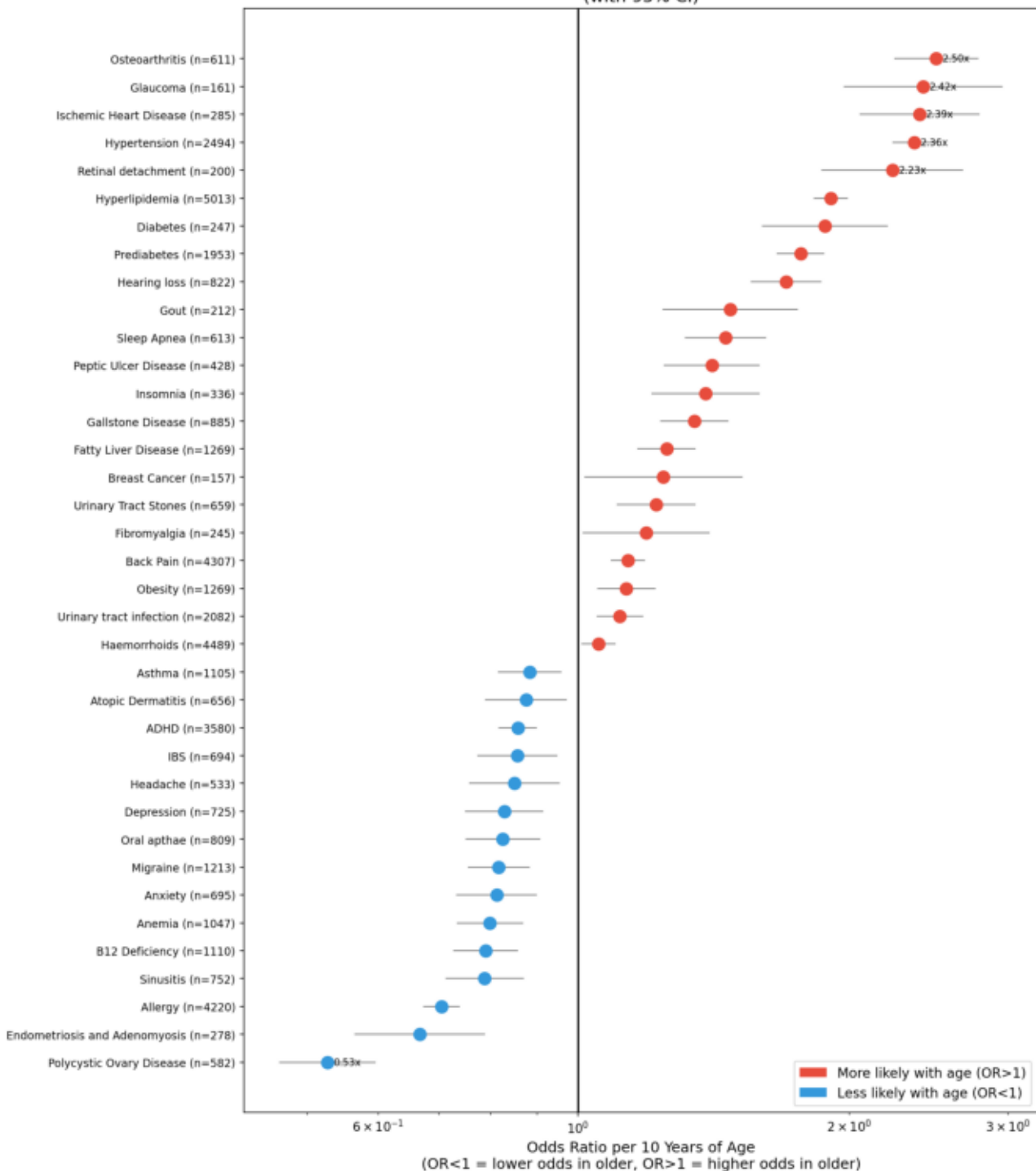
# Forest Plot: Age Effect on All Significant Conditions

Age Effect on Medical Conditions  
(Significant associations only,  $p < 0.05$ ,  $n \geq 50$ )



# Odds Ratio per Decade with 95% Confidence Intervals

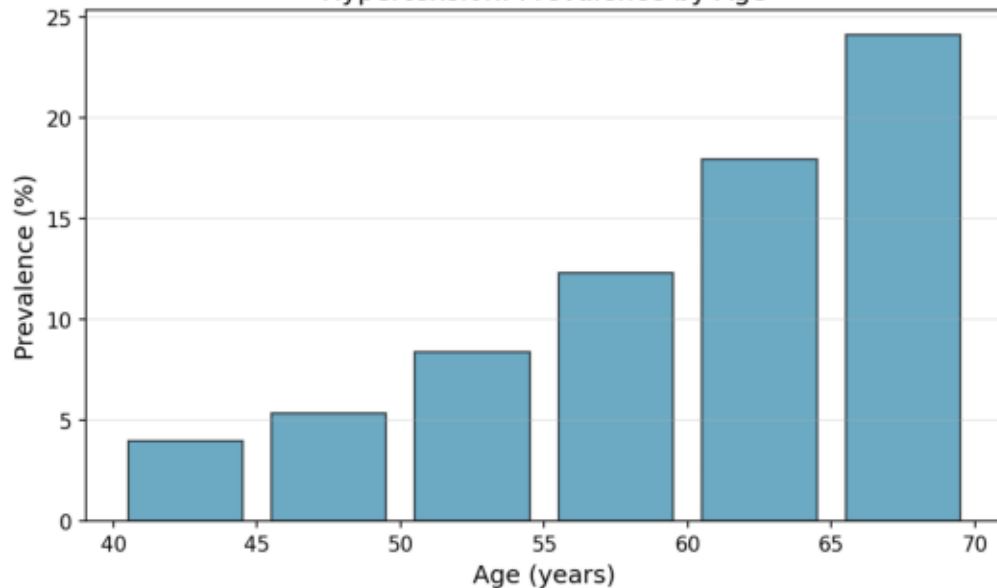
How Much More/Less Likely is Each Condition per Decade of Age?  
(with 95% CI)



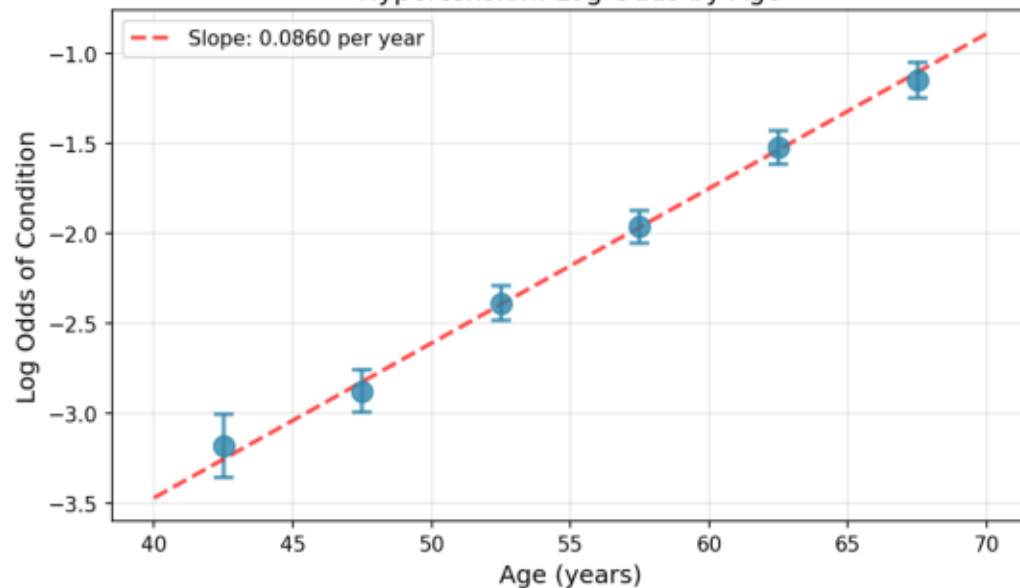
# Hypertension: Prevalence vs Log Odds

**Hypertension INCREASES with age**  
**Odds Ratio per decade: 2.36x**

Hypertension: Prevalence by Age



Hypertension: Log Odds by Age

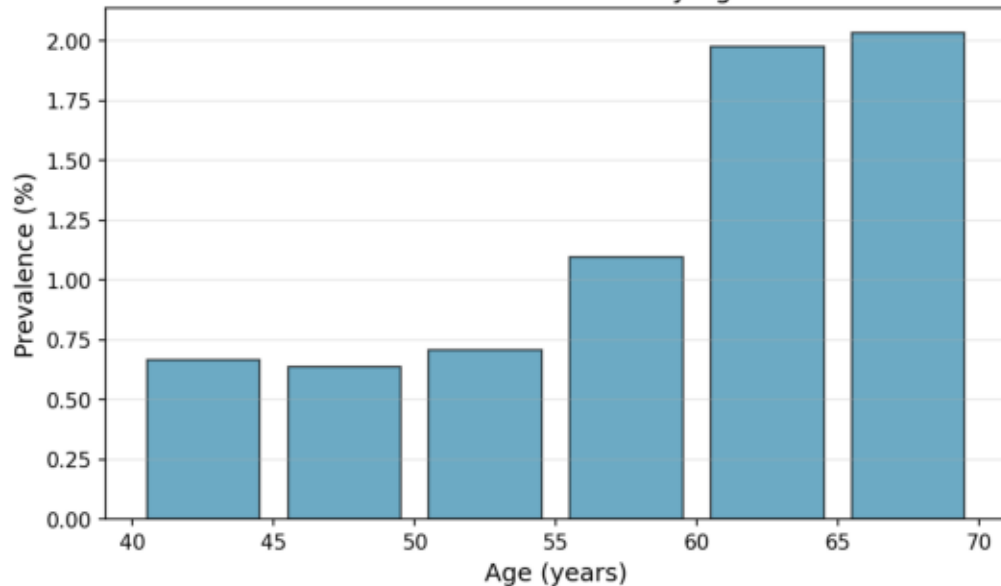




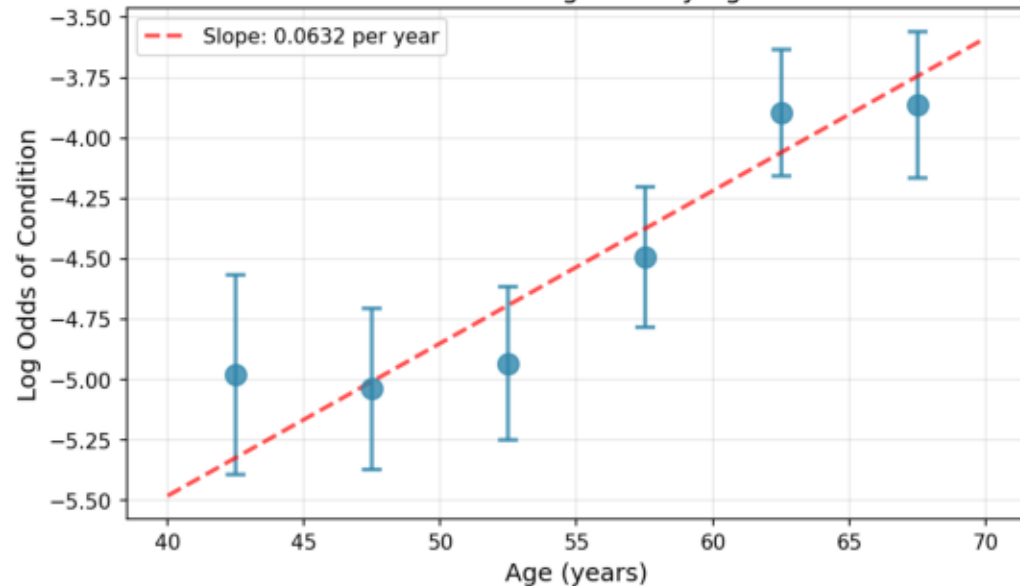
# Diabetes: Prevalence vs Log Odds

**Diabetes INCREASES with age**  
**Odds Ratio per decade: 1.88x**

Diabetes: Prevalence by Age



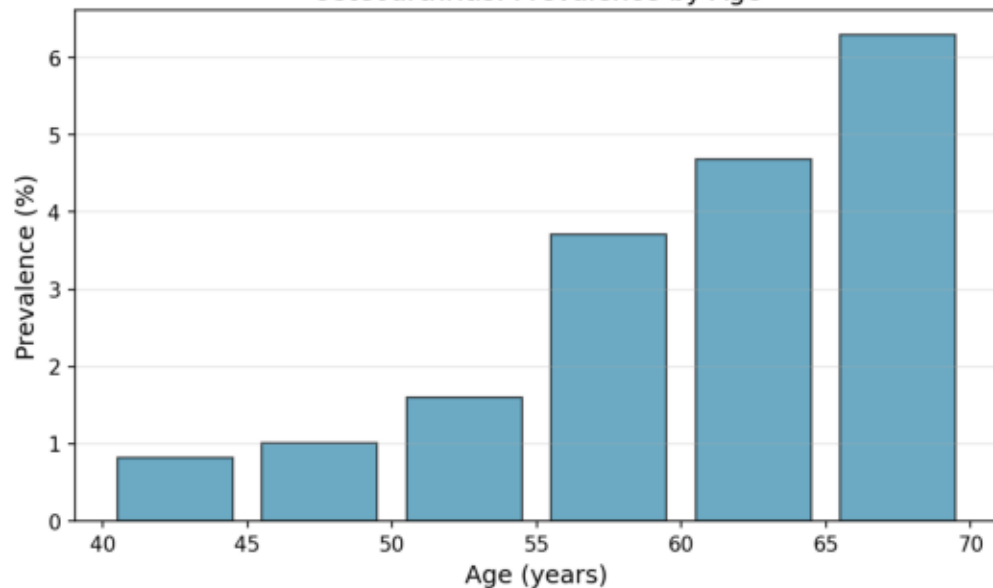
Diabetes: Log Odds by Age



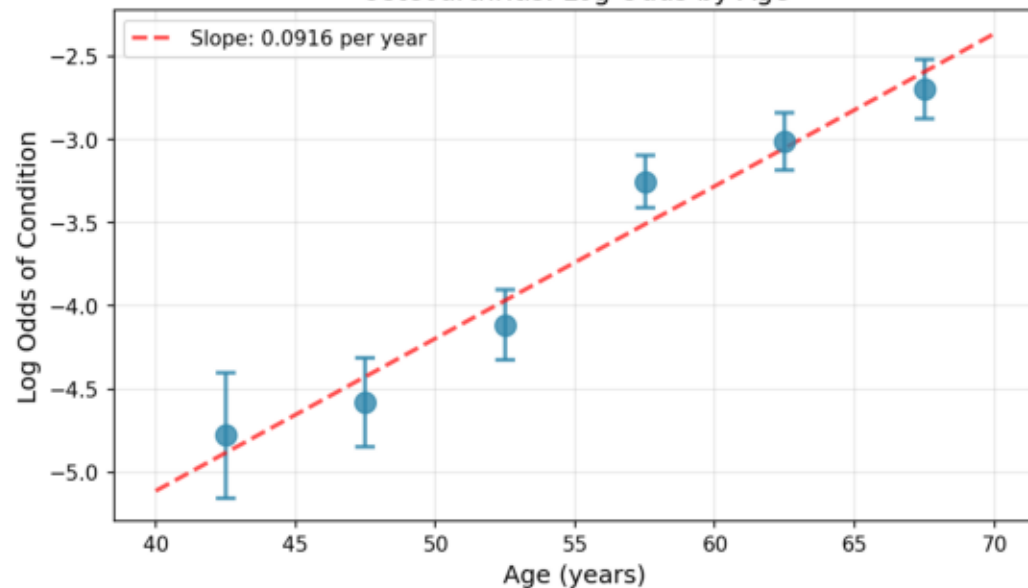
# Osteoarthritis: Prevalence vs Log Odds

**Osteoarthritis INCREASES with age**  
**Odds Ratio per decade: 2.50x**

Osteoarthritis: Prevalence by Age



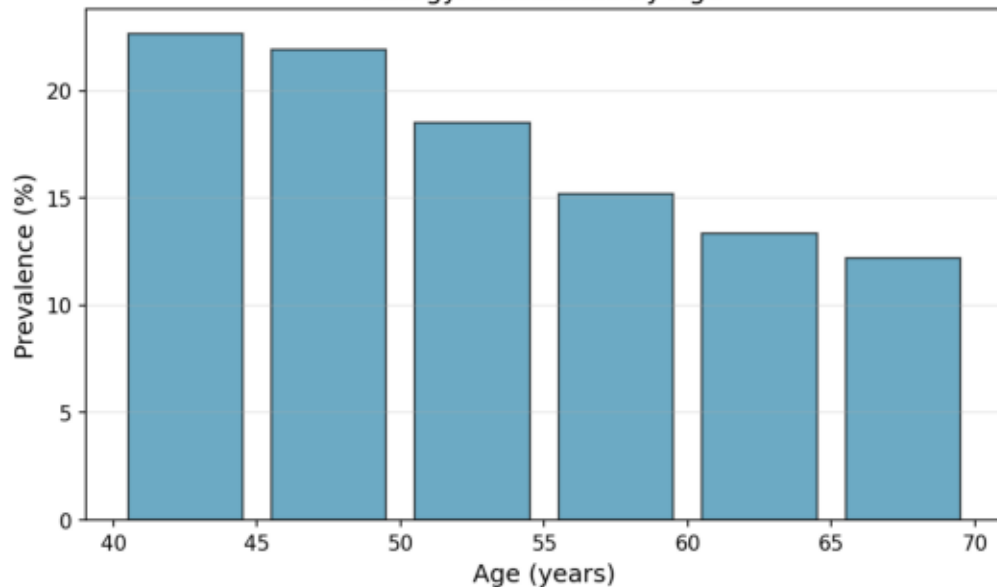
Osteoarthritis: Log Odds by Age



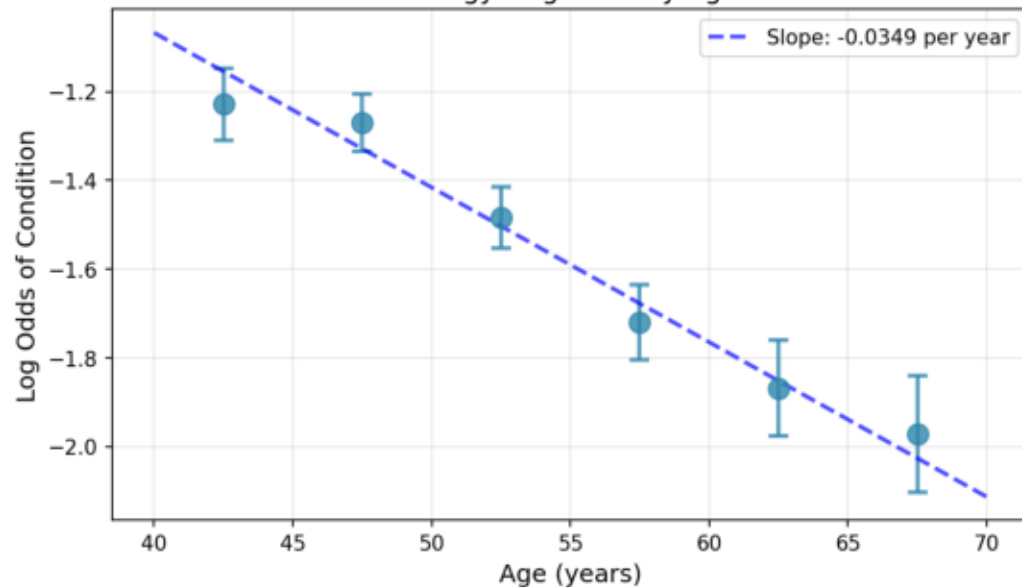
# Allergy: Prevalence vs Log Odds

**Allergy DECREASES with age**  
**Odds Ratio per decade: 0.71x**

Allergy: Prevalence by Age



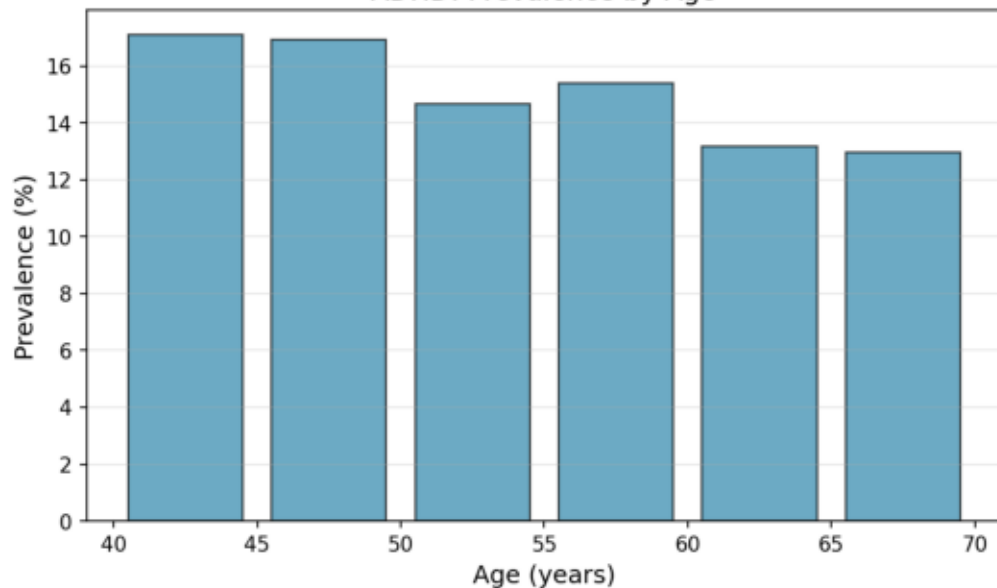
Allergy: Log Odds by Age



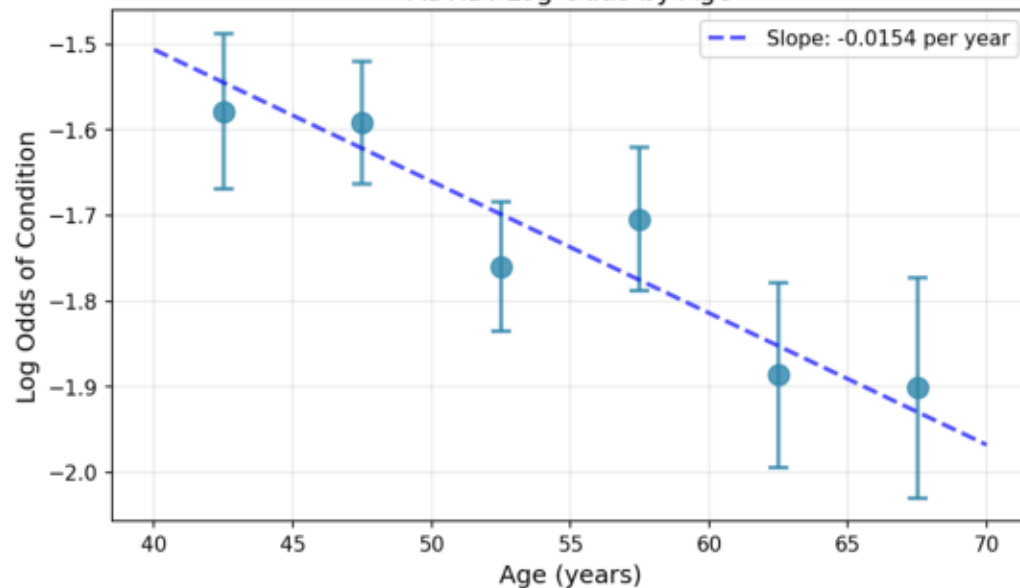
# ADHD: Prevalence vs Log Odds

**ADHD DECREASES with age**  
**Odds Ratio per decade: 0.86x**

ADHD: Prevalence by Age



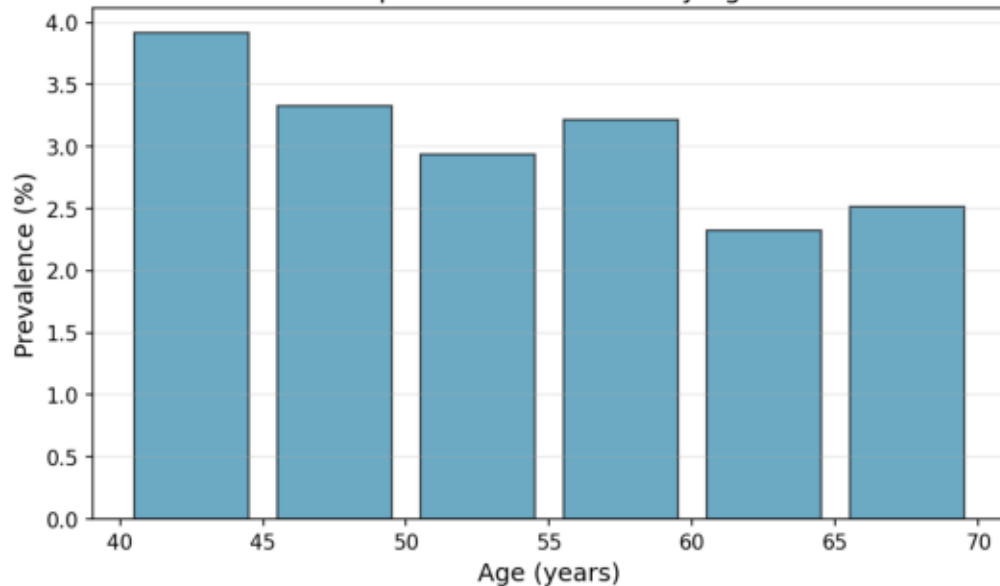
ADHD: Log Odds by Age



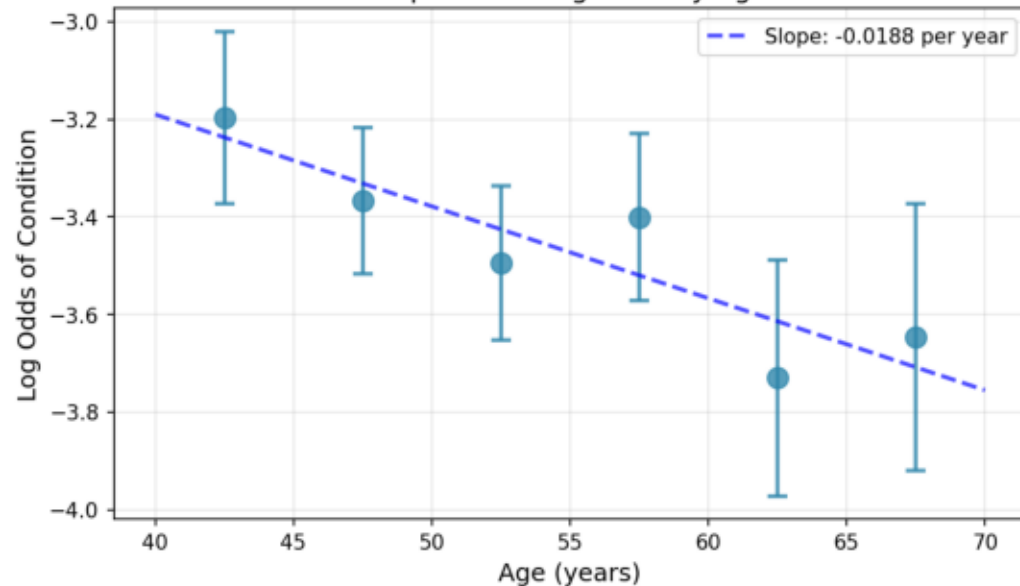
# Depression: Prevalence vs Log Odds

**Depression DECREASES with age**  
**Odds Ratio per decade: 0.83x**

Depression: Prevalence by Age

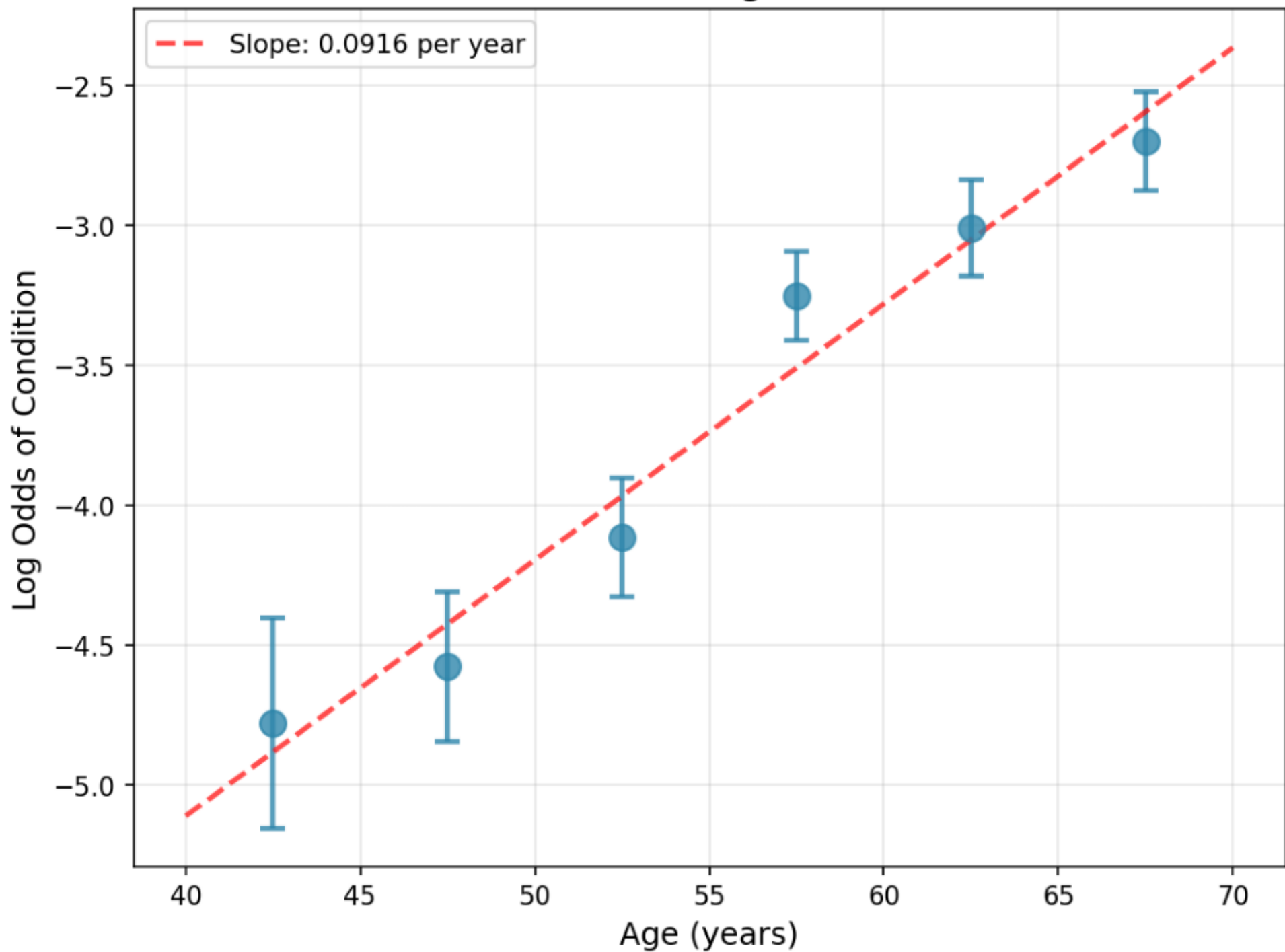


Depression: Log Odds by Age



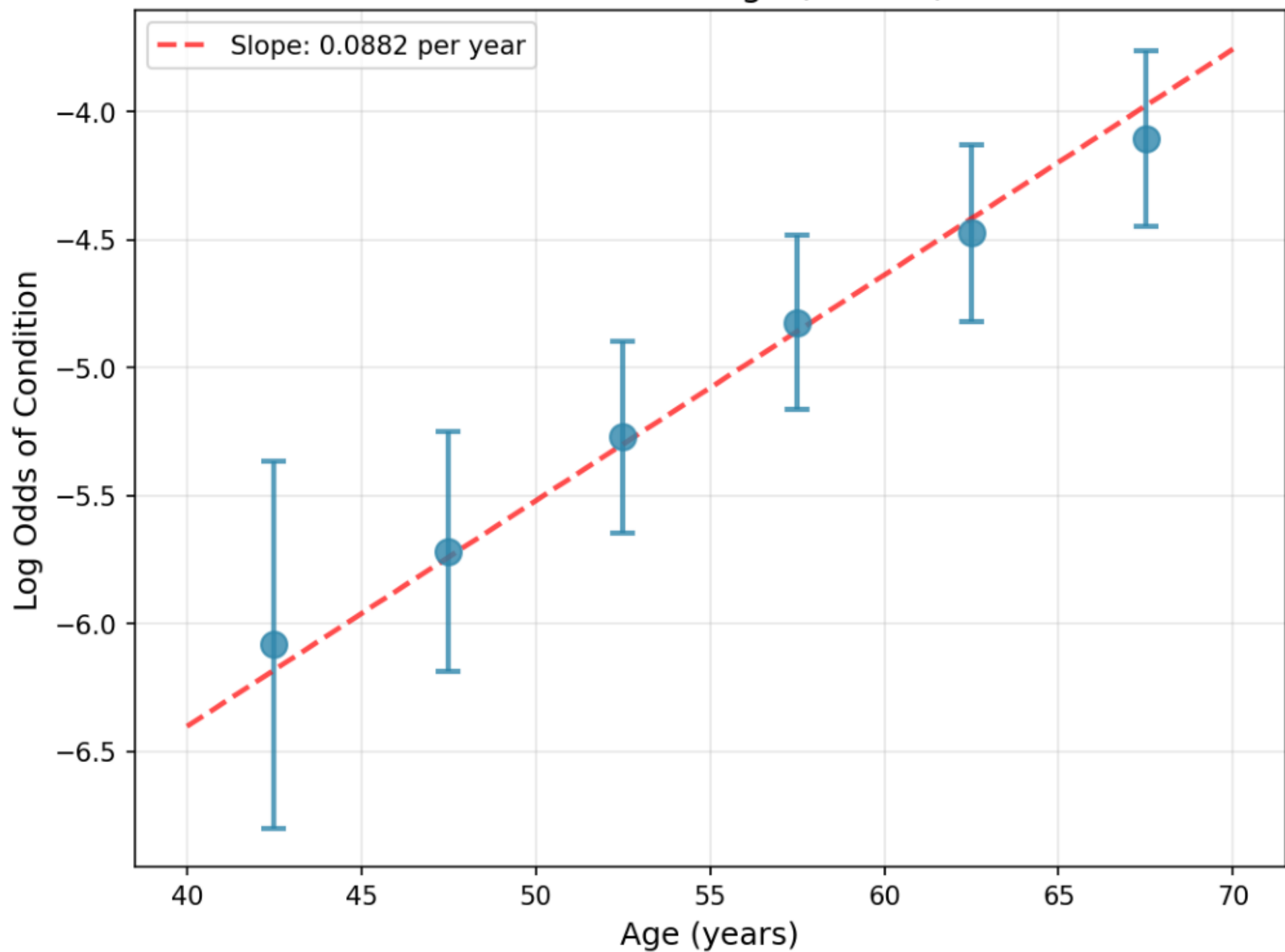
# Osteoarthritis

↑ increases with age (n=611) \*\*\*



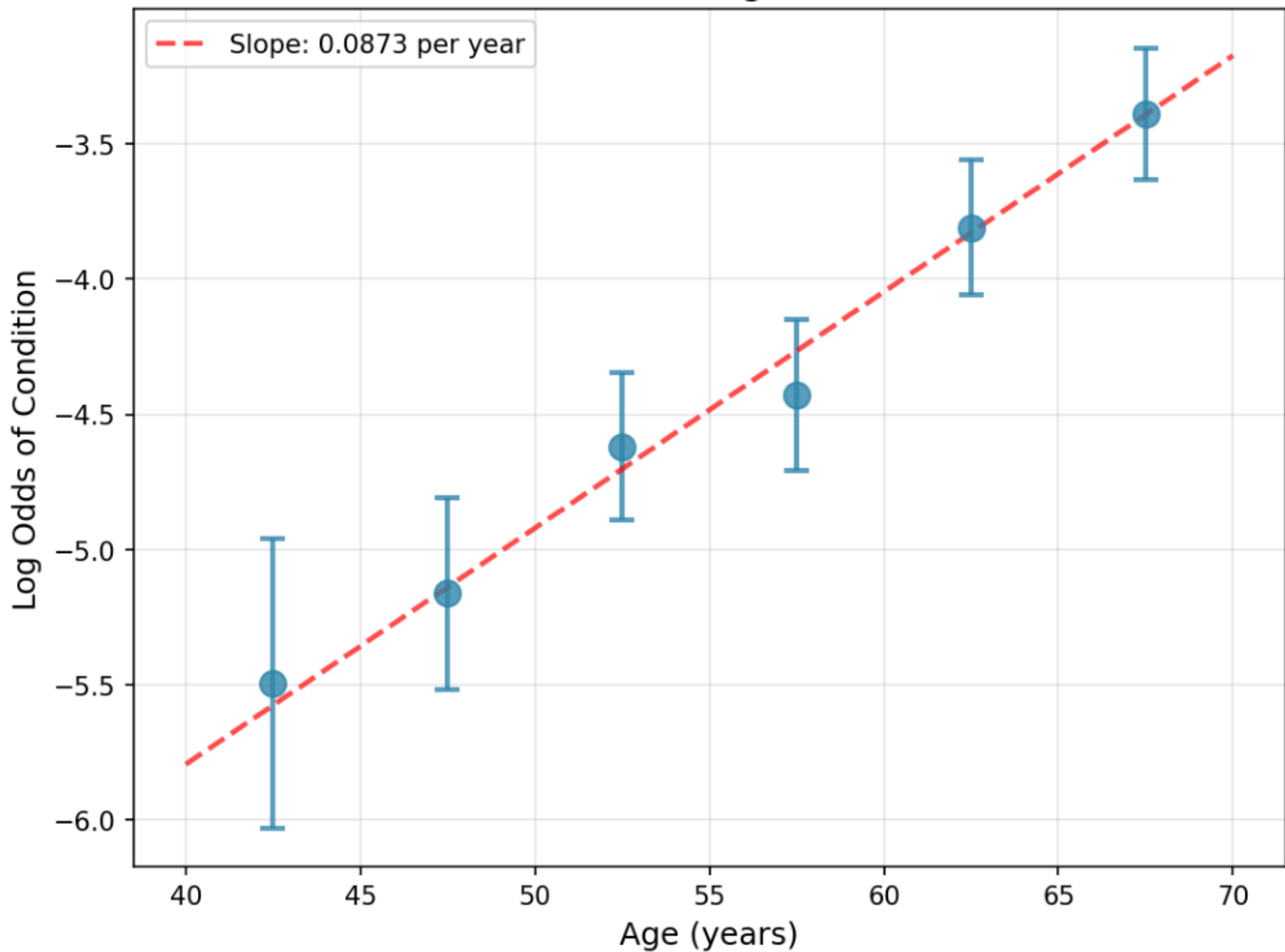
## Glaucoma

↑ increases with age (n=161) \*\*\*



# Ischemic Heart Disease

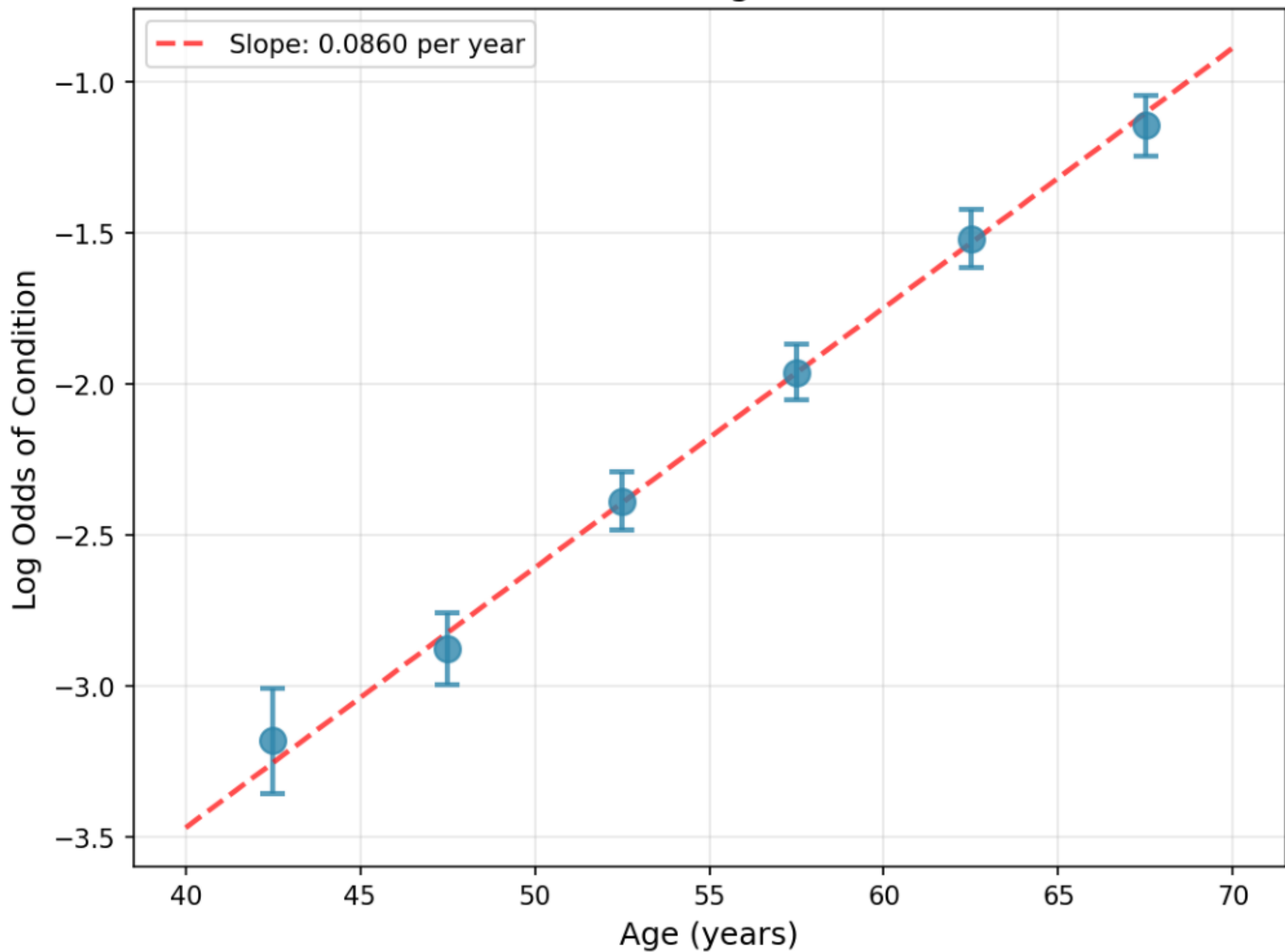
↑ increases with age (n=285) \*\*\*





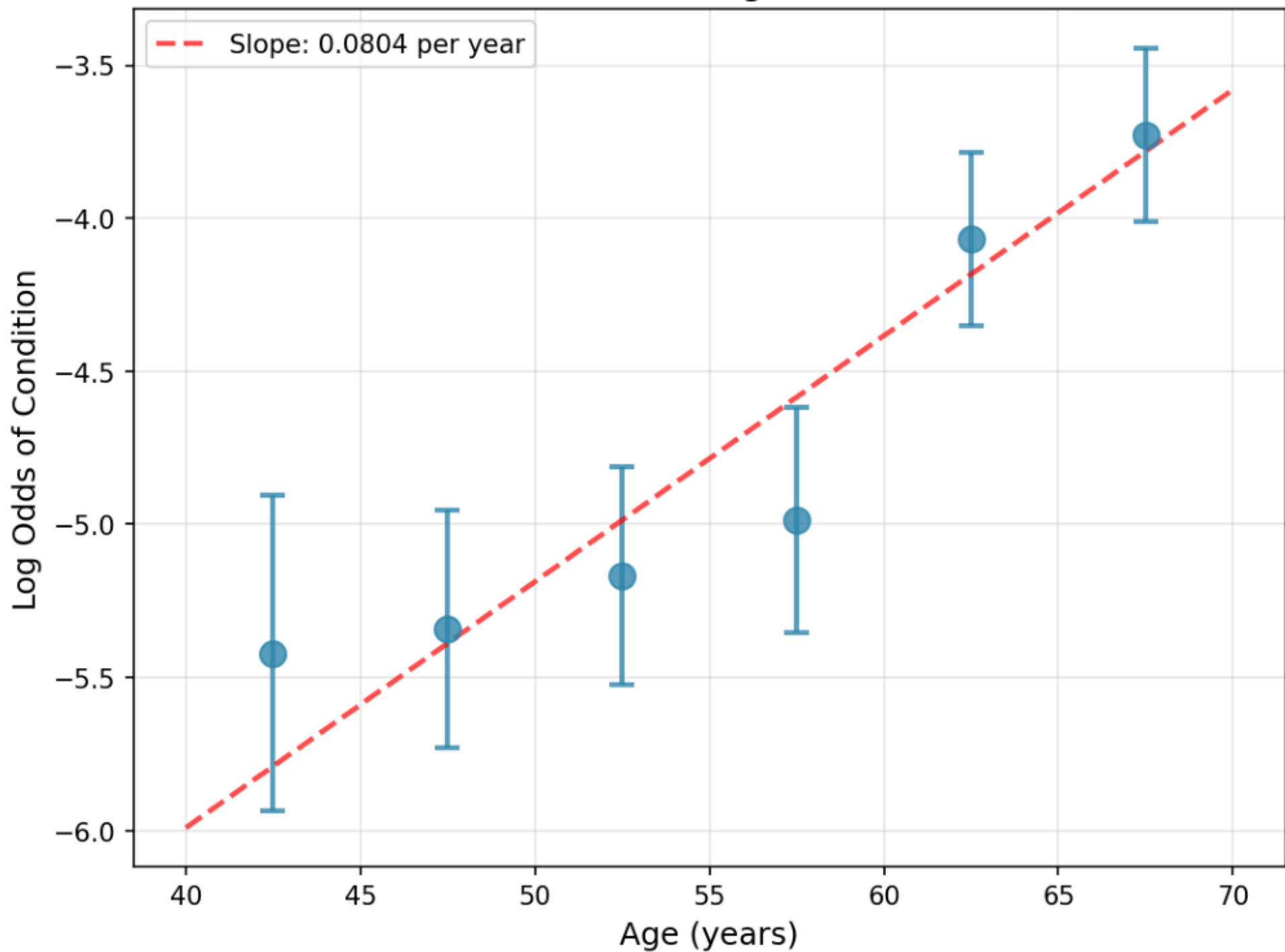
# Hypertension

↑ increases with age (n=2494) \*\*\*



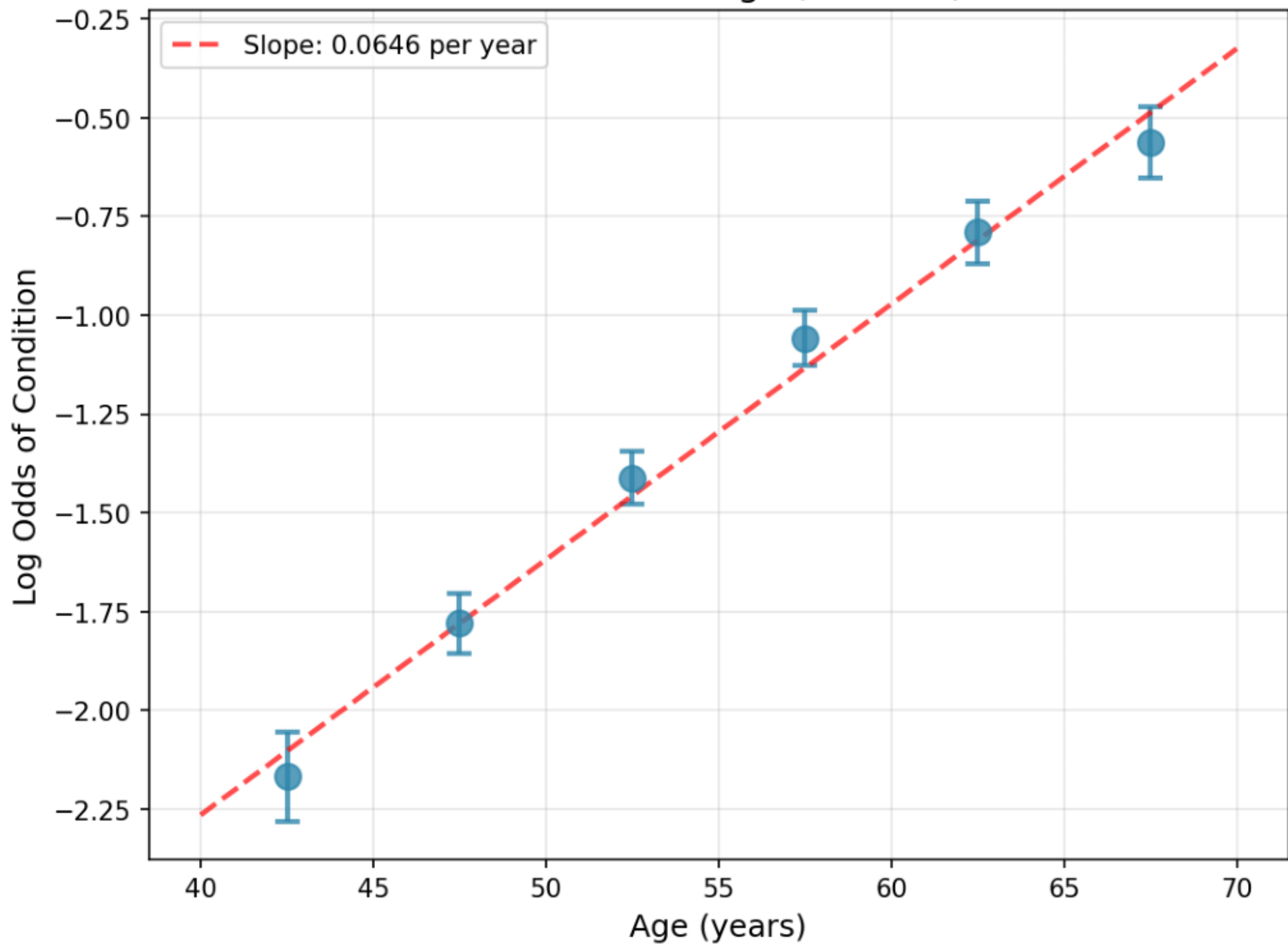
# Retinal detachment

↑ increases with age (n=200) \*\*\*



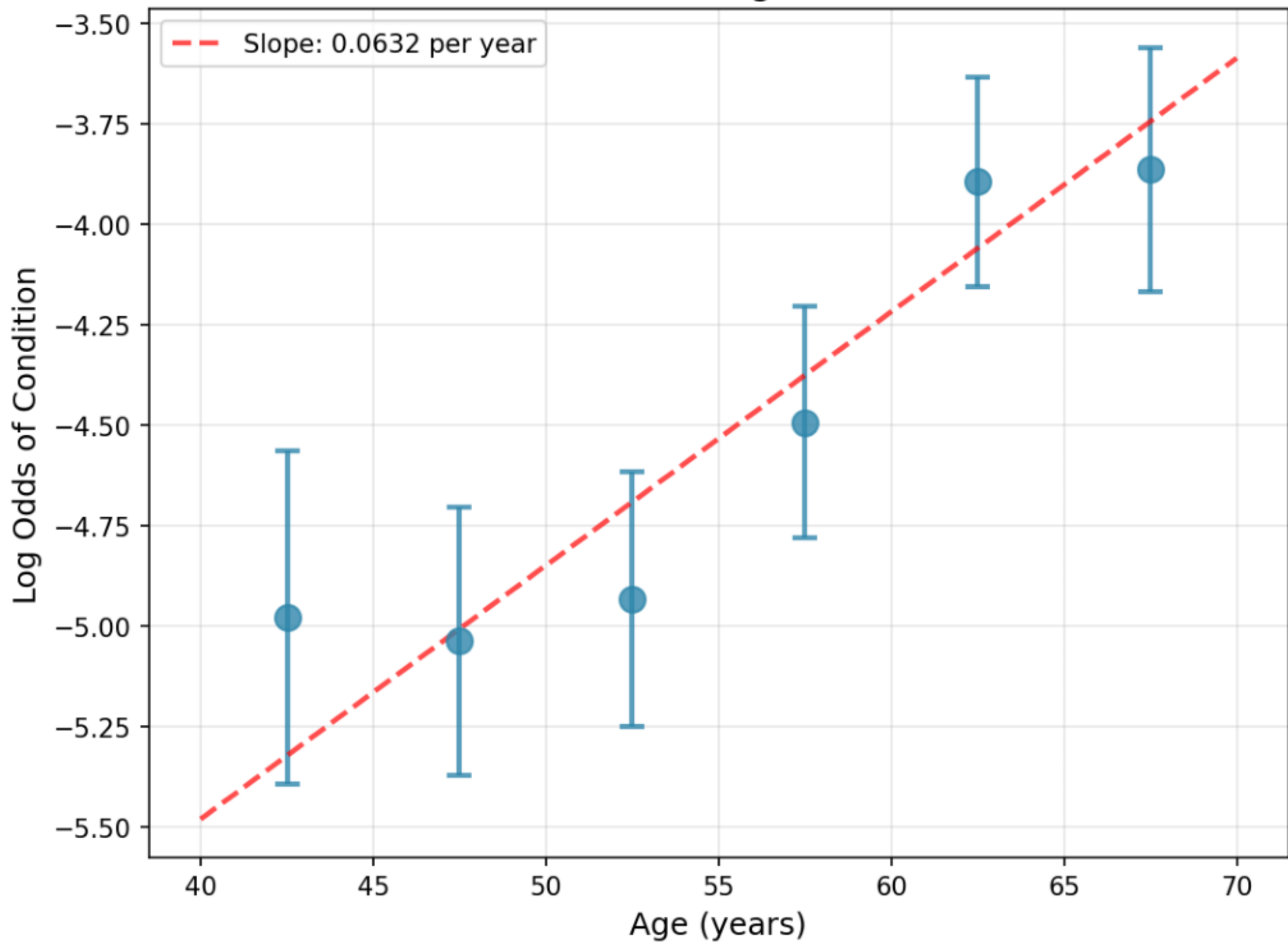
# Hyperlipidemia

↑ increases with age (n=5013) \*\*\*



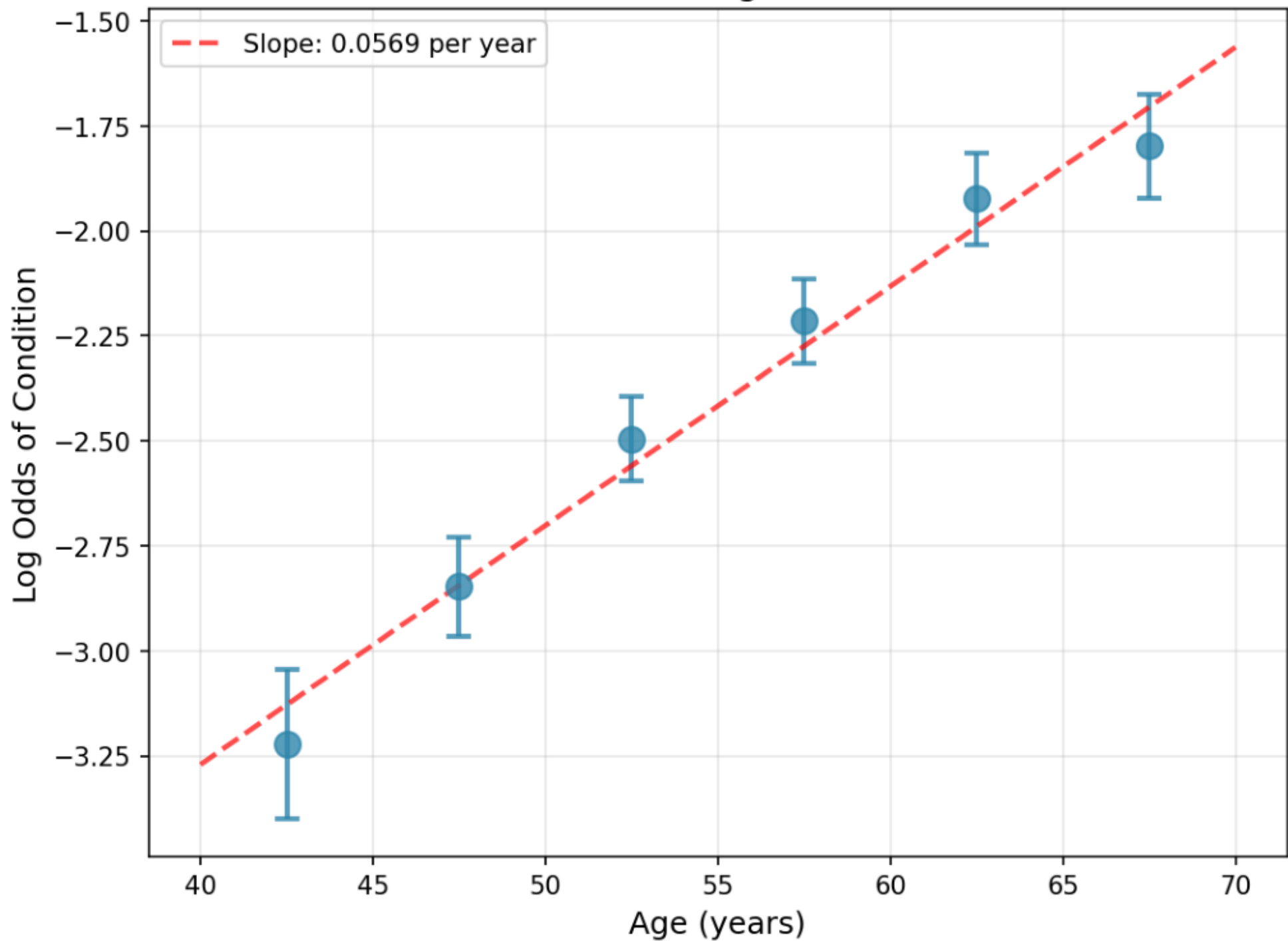
## Diabetes

↑ increases with age (n=247) \*\*\*



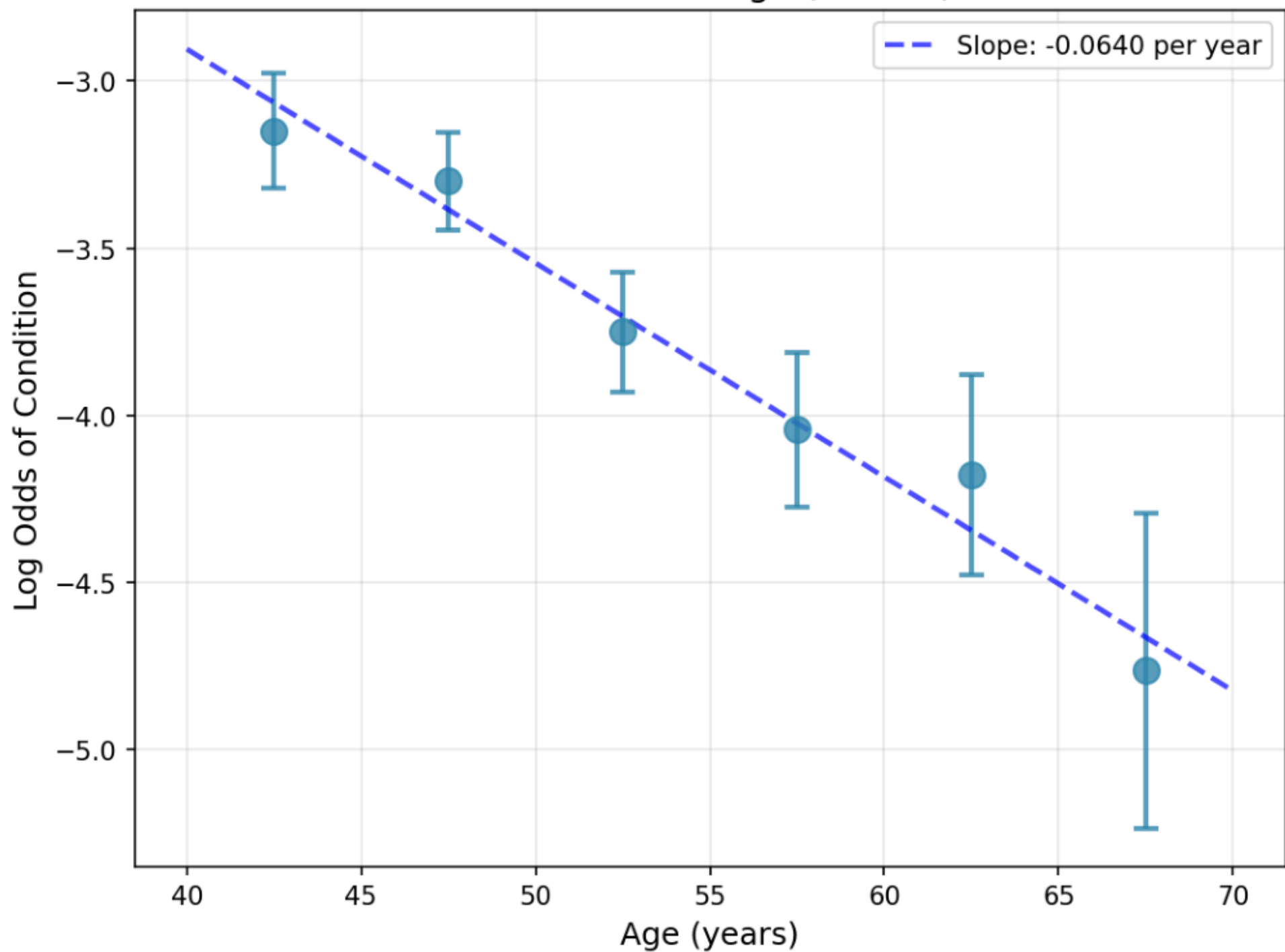
## Prediabetes

↑ increases with age (n=1953) \*\*\*



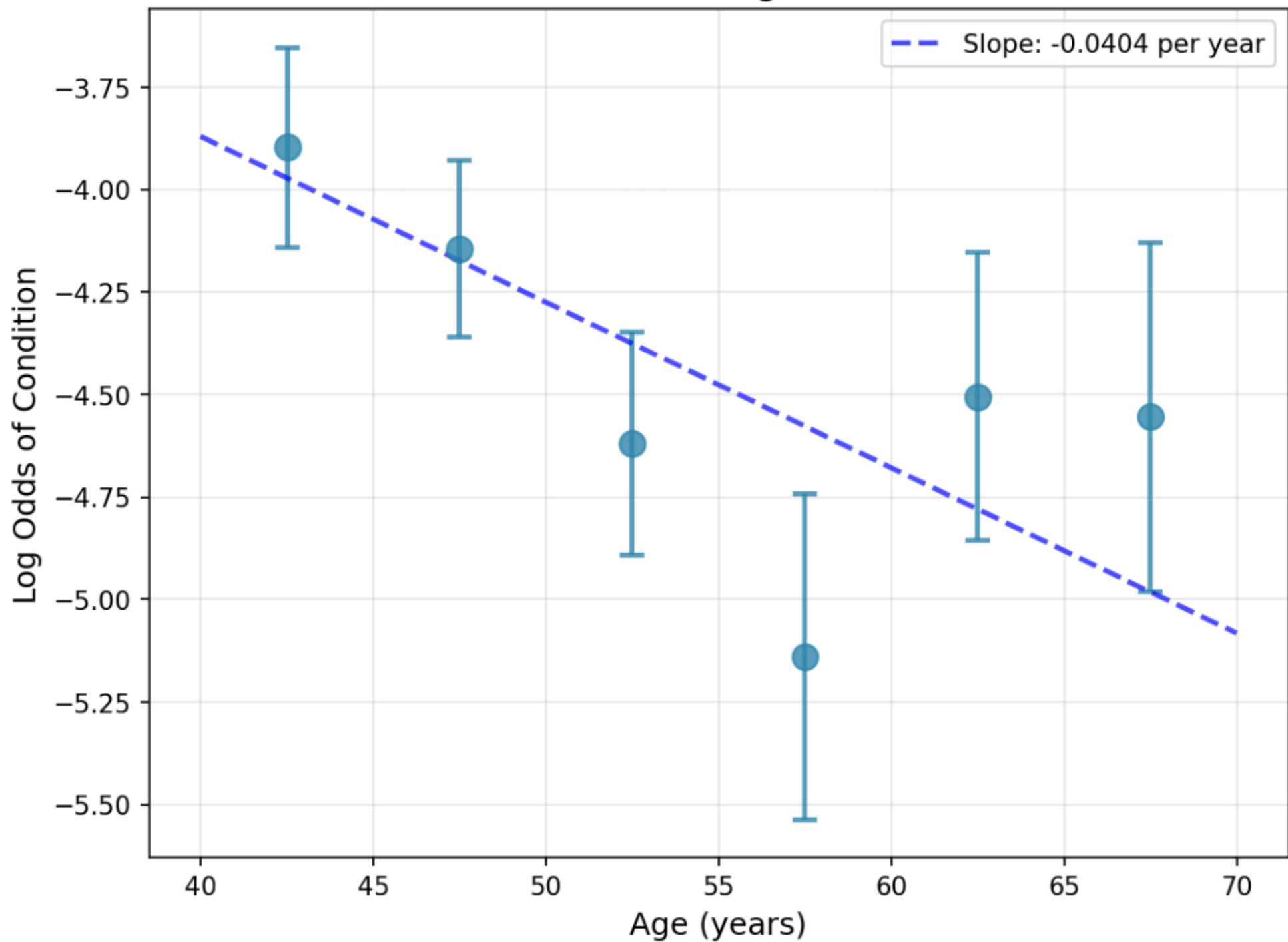
# Polycystic Ovary Disease

↓ decreases with age (n=582) \*\*\*

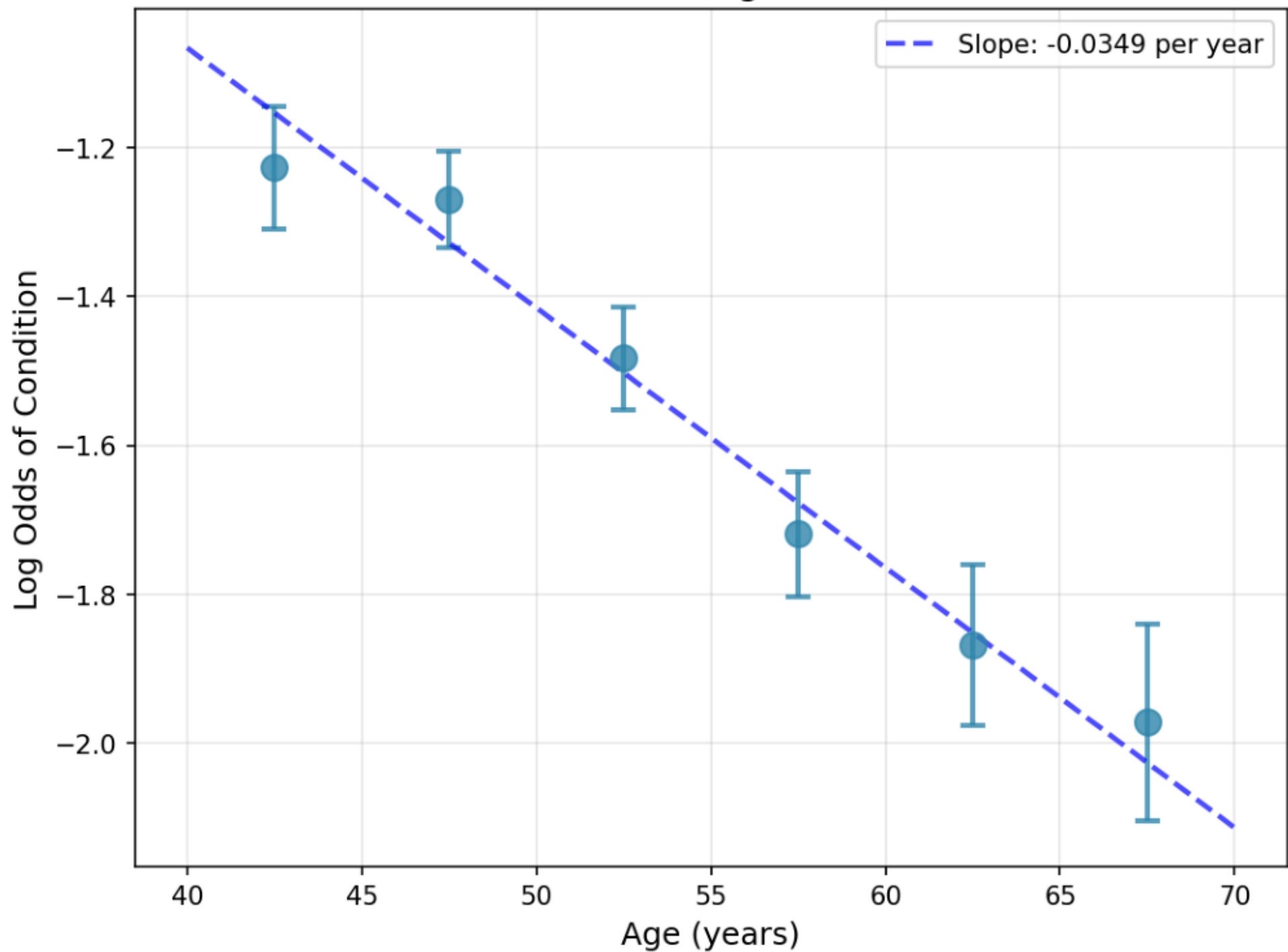


# Endometriosis and Adenomyosis

↓ decreases with age (n=278) \*\*\*



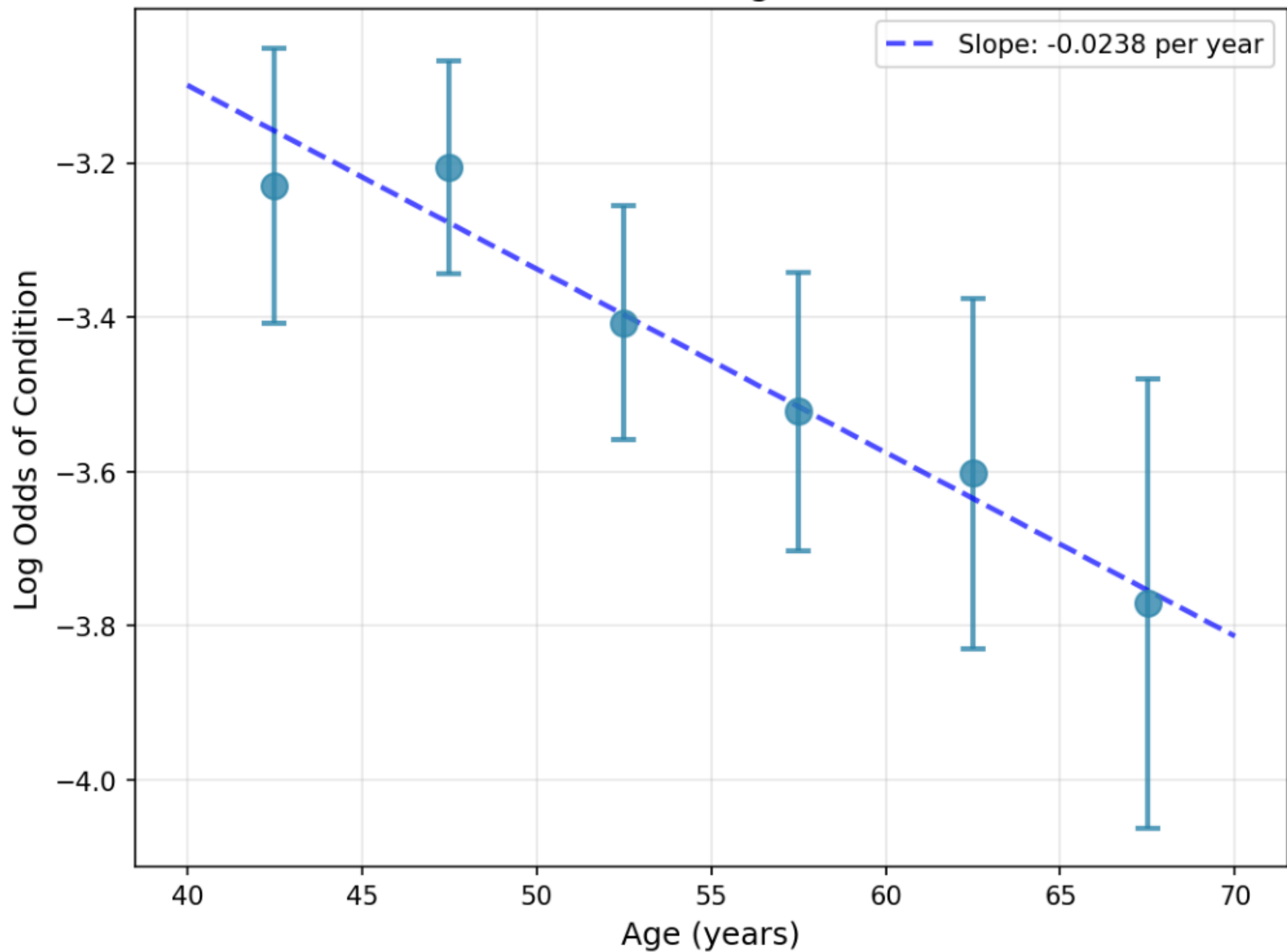
Allergy  
↓ decreases with age (n=4220) \*\*\*





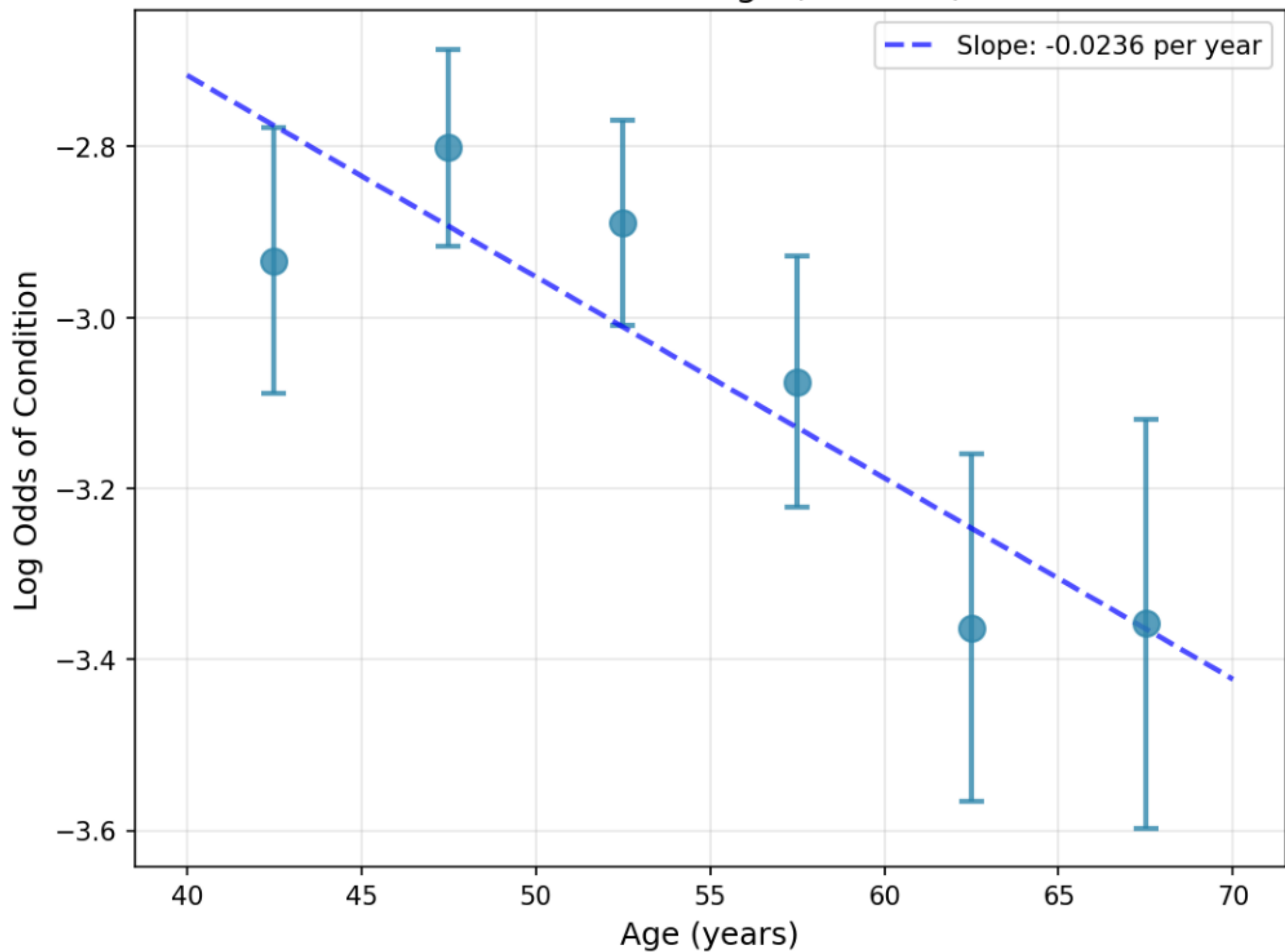
## Sinusitis

↓ decreases with age (n=752) \*\*\*



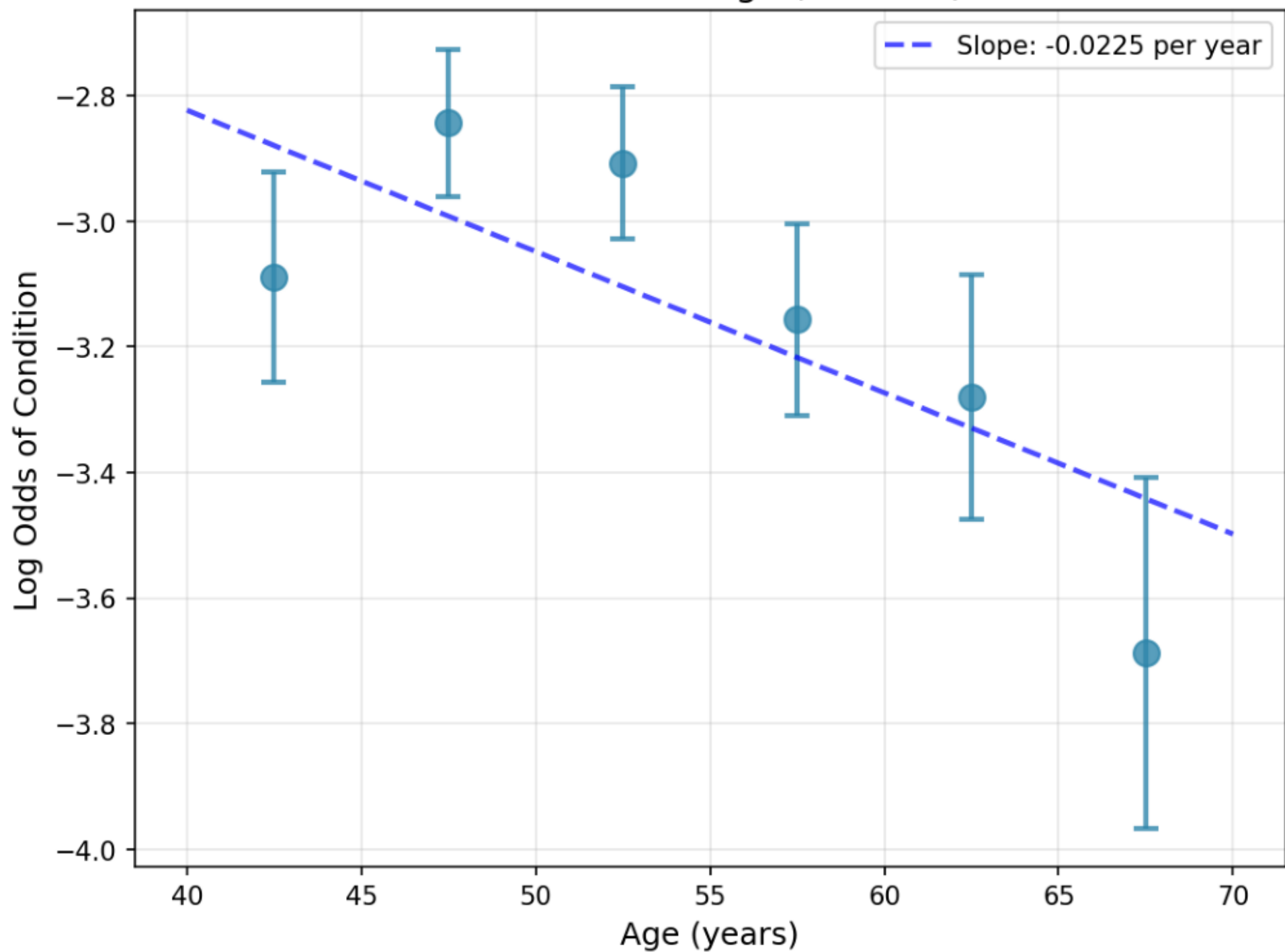
# B12 Deficiency

↓ decreases with age (n=1110) \*\*\*

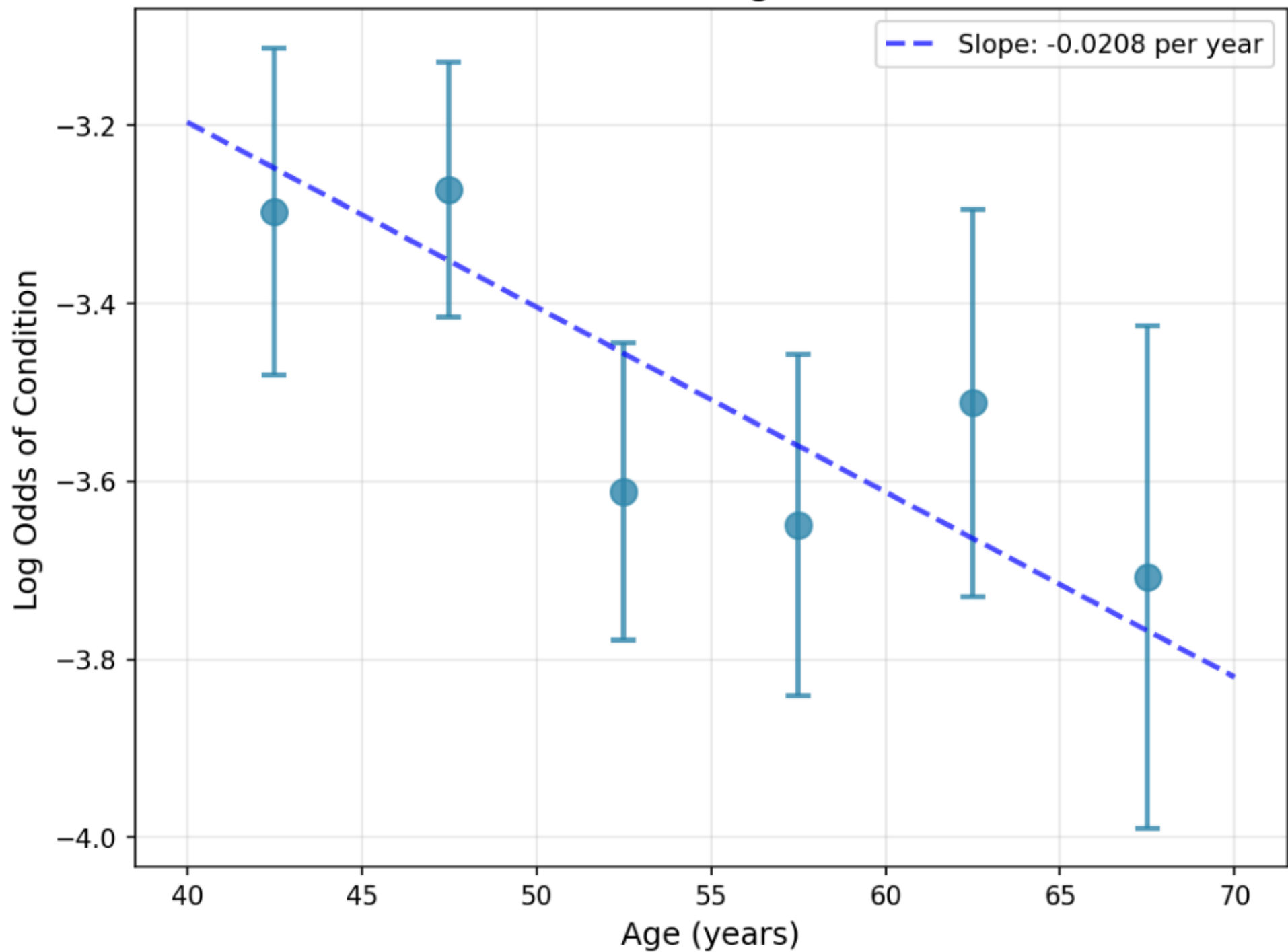


## Anemia

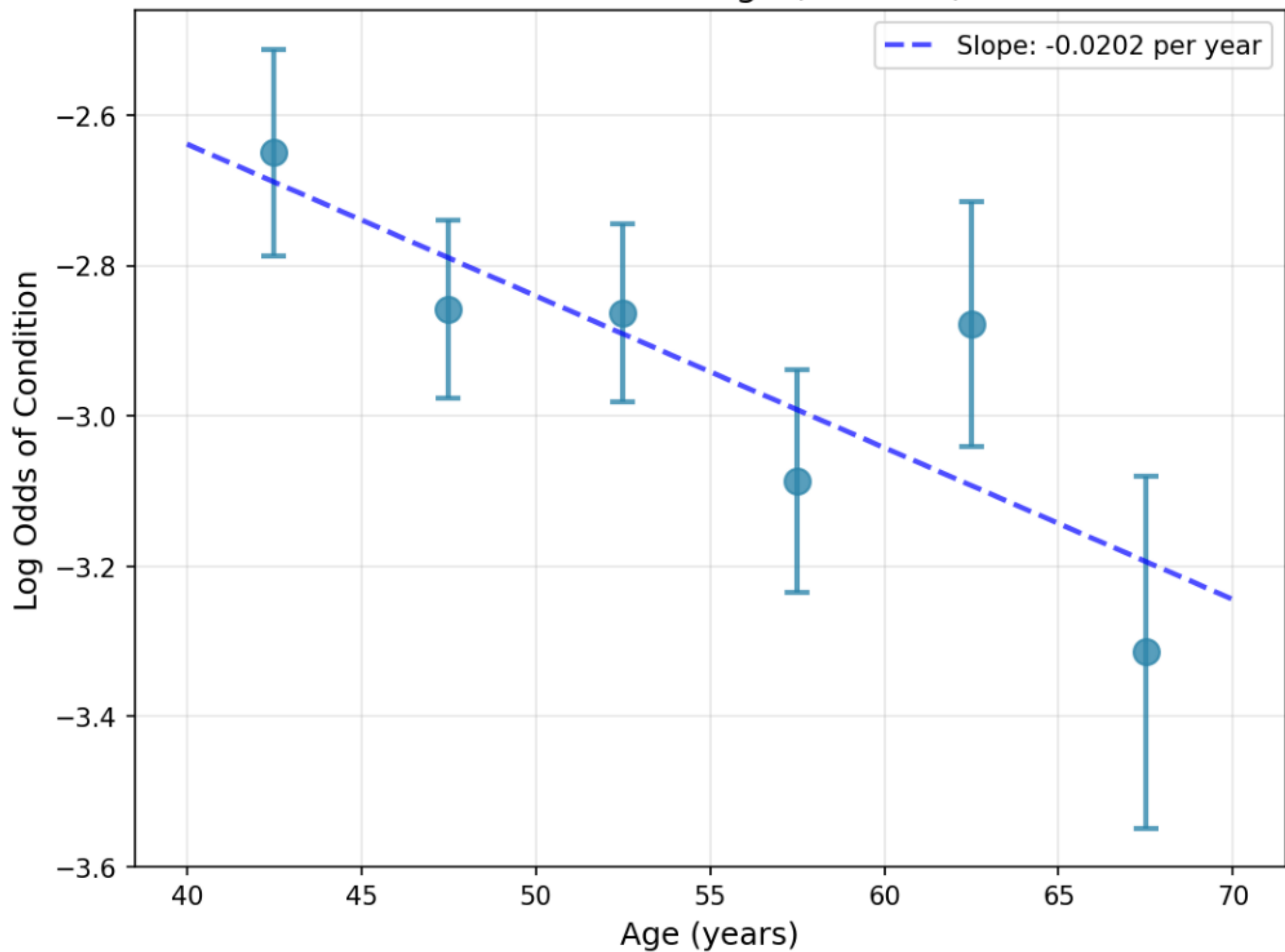
↓ decreases with age (n=1047) \*\*\*



Anxiety  
↓ decreases with age (n=695) \*\*\*



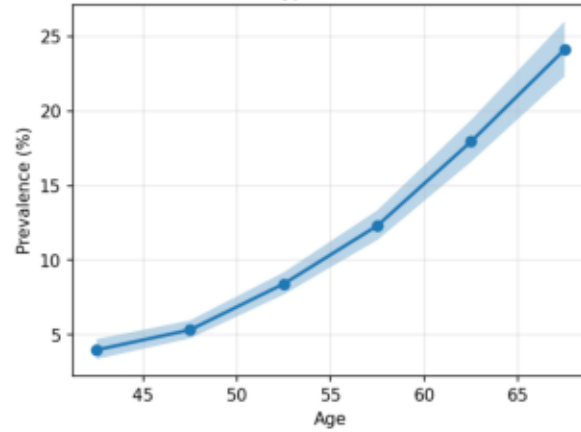
Migraine  
↓ decreases with age (n=1213) \*\*\*



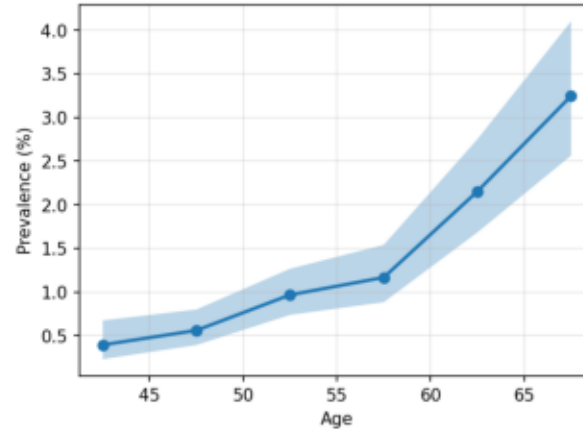
# Cardiovascular: Prevalence by Age

Cardiovascular - Prevalence by Age

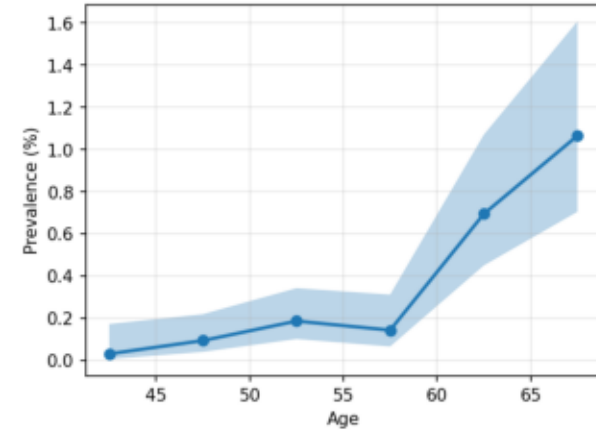
Hypertension



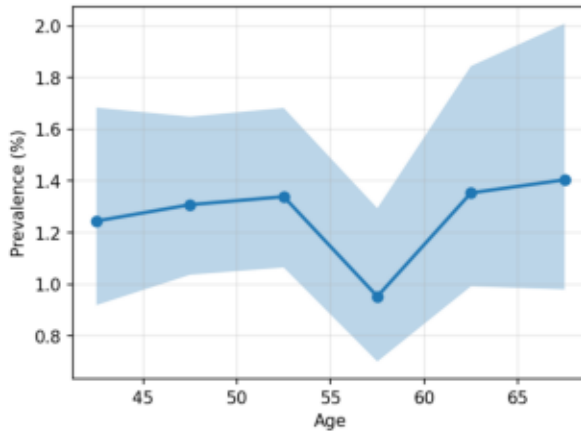
Ischemic Heart Disease



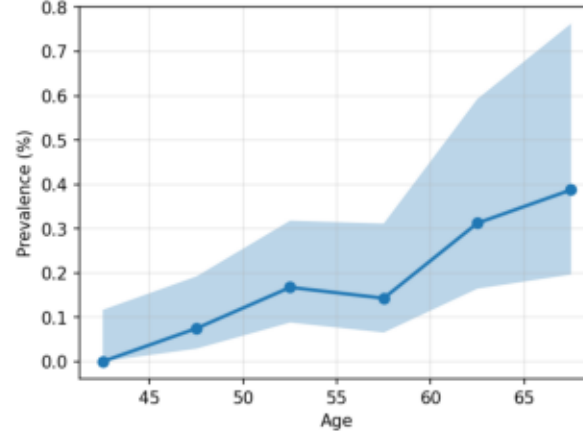
Atrial Fibrillation



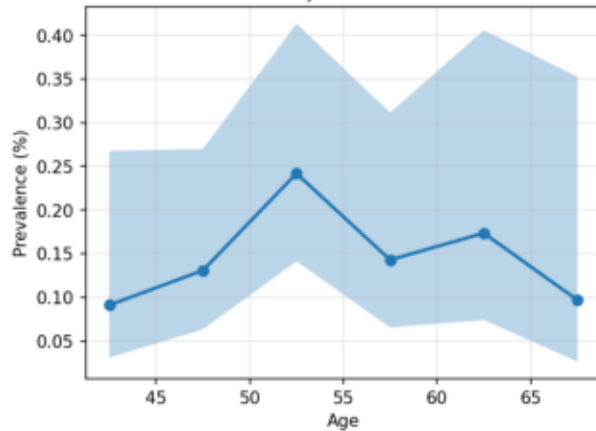
Heart valve disease



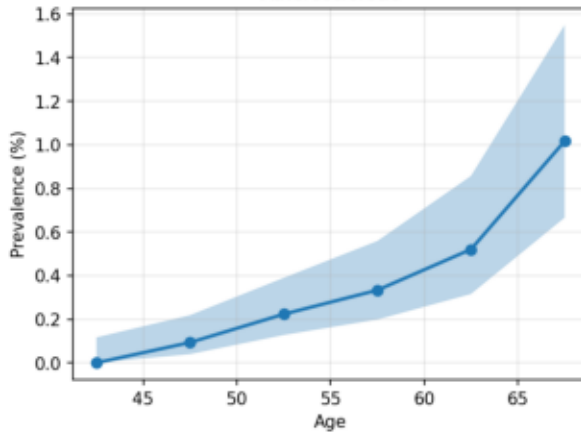
AV. Conduction Disorder



Myocarditis

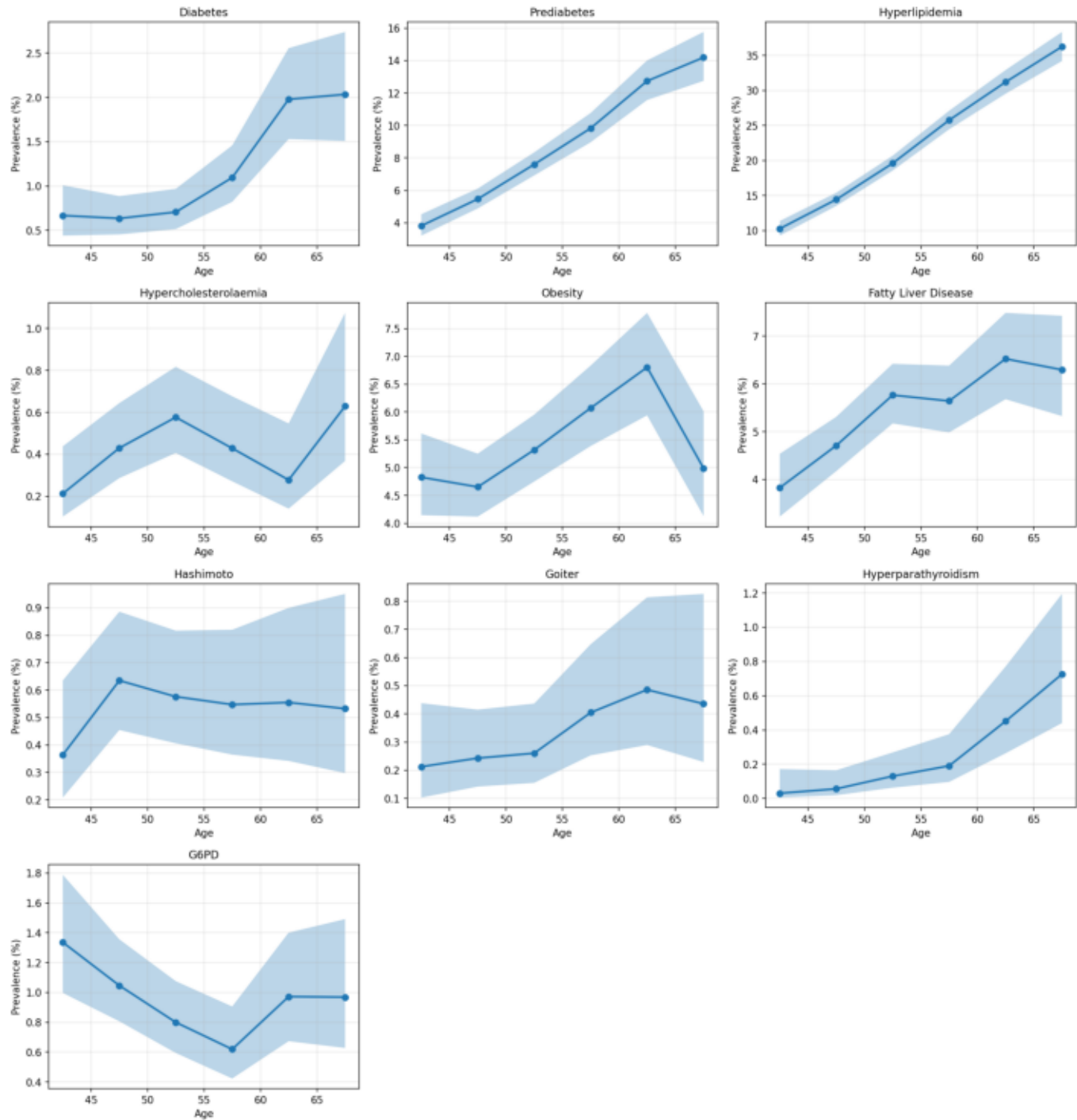


Atherosclerotic



# Metabolic\_Endocrine: Prevalence by Age

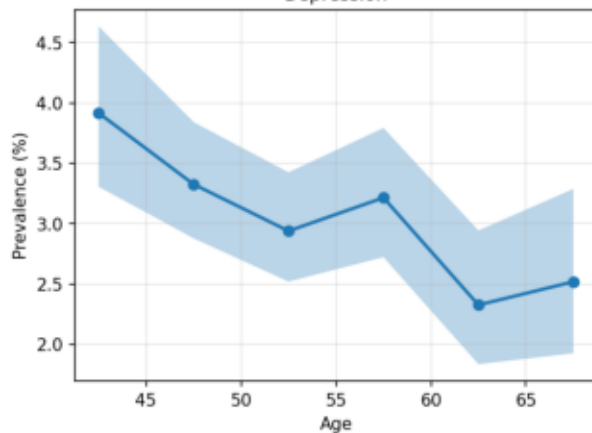
Metabolic/Endocrine - Prevalence by Age



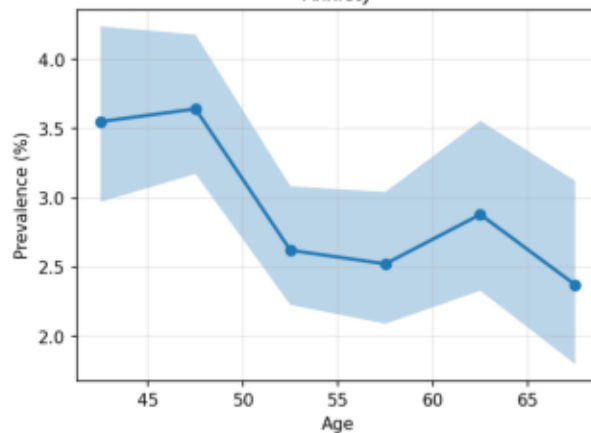
# Mental Health: Prevalence by Age

Mental Health - Prevalence by Age

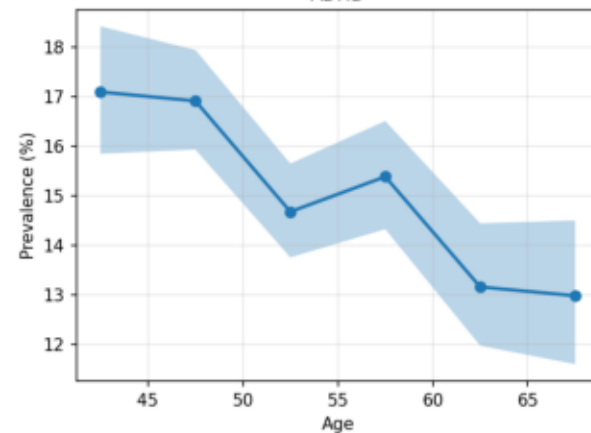
Depression



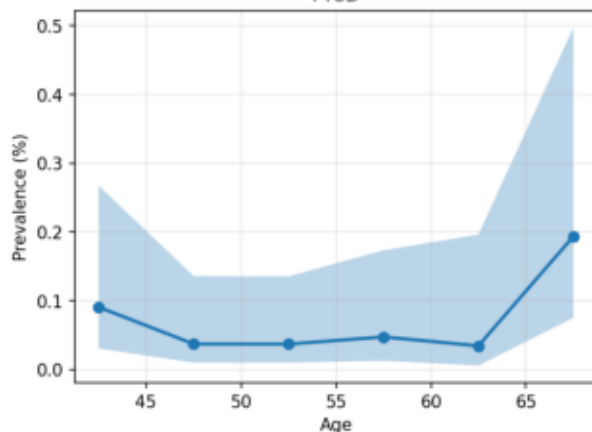
Anxiety



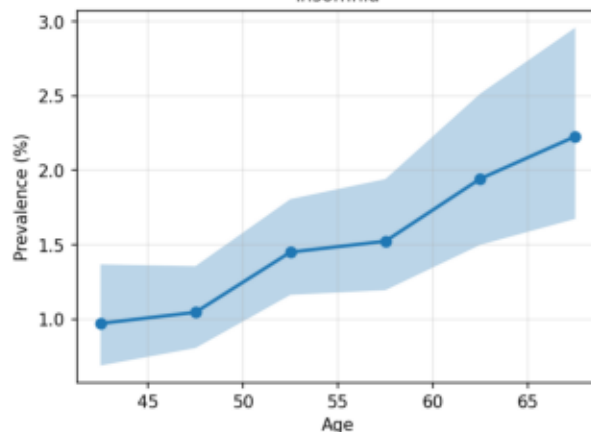
ADHD



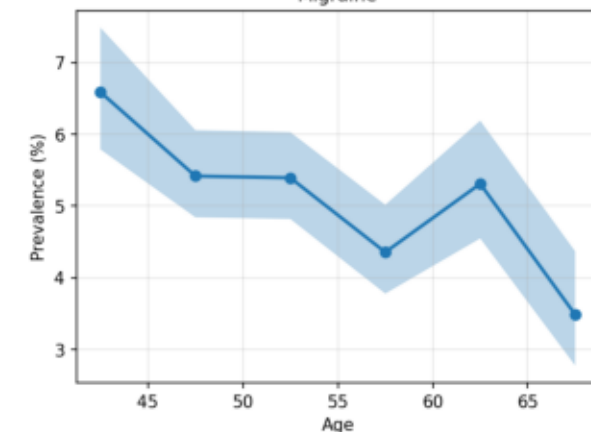
PTSD



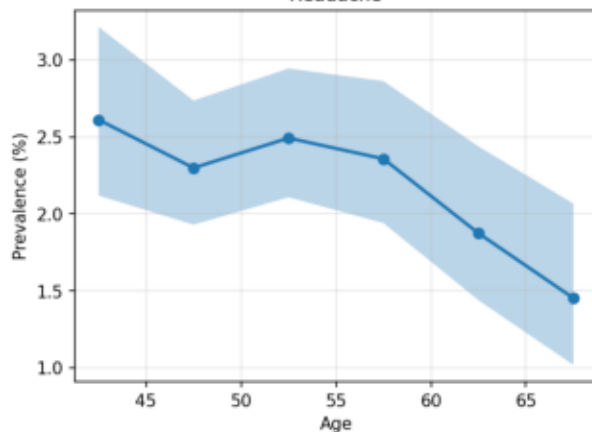
Insomnia



Migraine



Headache

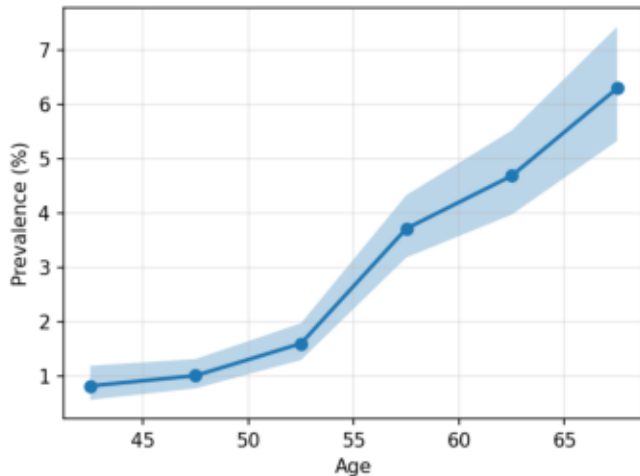




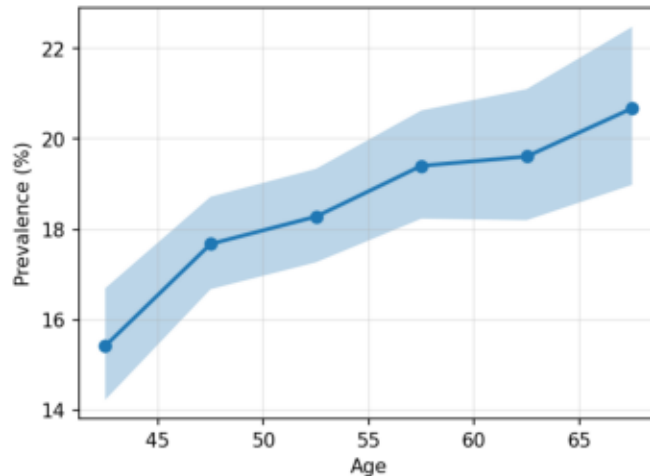
# Musculoskeletal: Prevalence by Age

Musculoskeletal - Prevalence by Age

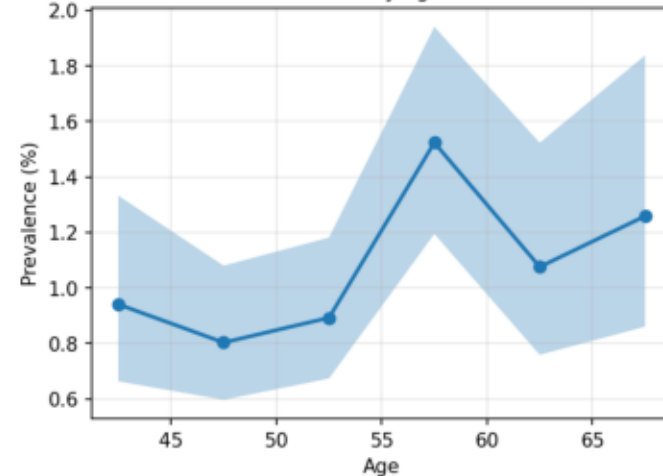
Osteoarthritis



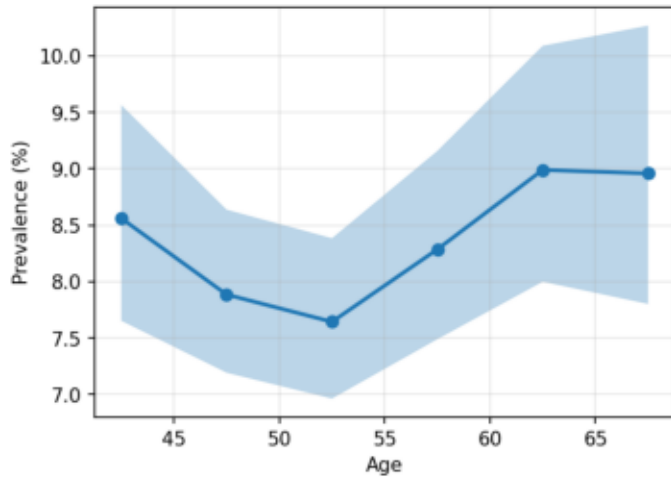
Back Pain



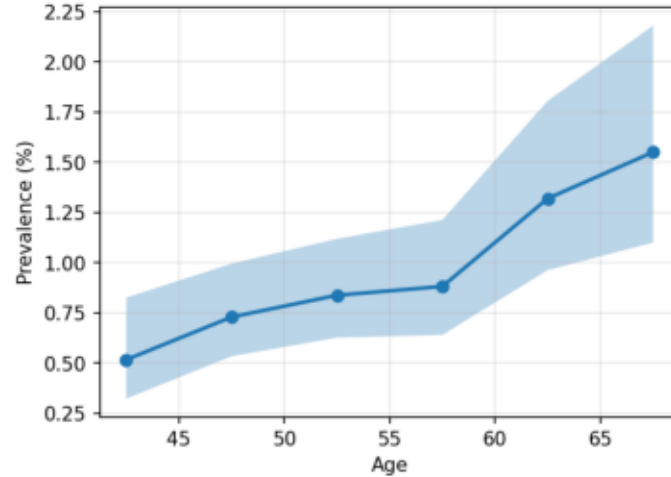
Fibromyalgia



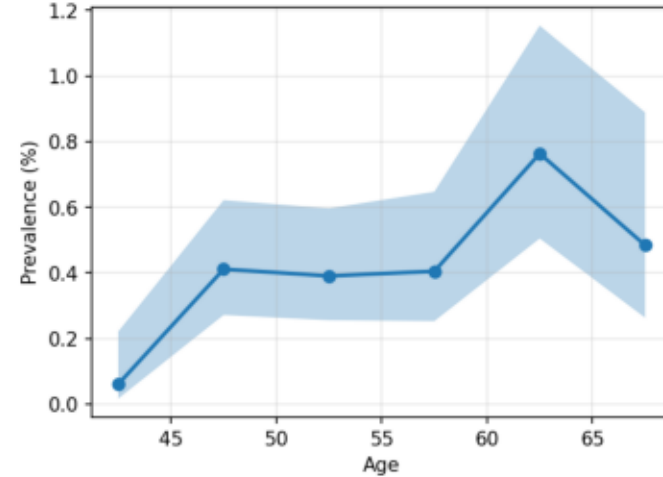
Fractures



Gout



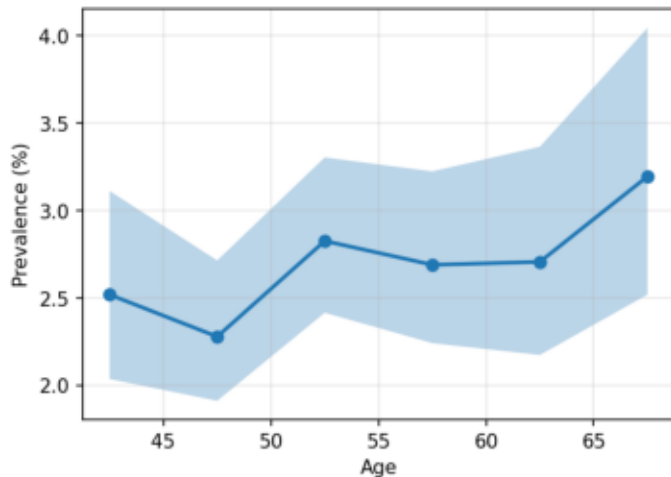
Meniscus Tears



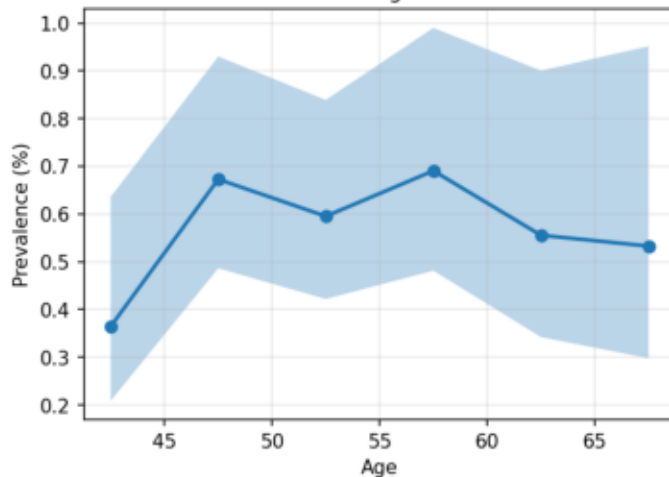
# Autoimmune: Prevalence by Age

Autoimmune - Prevalence by Age

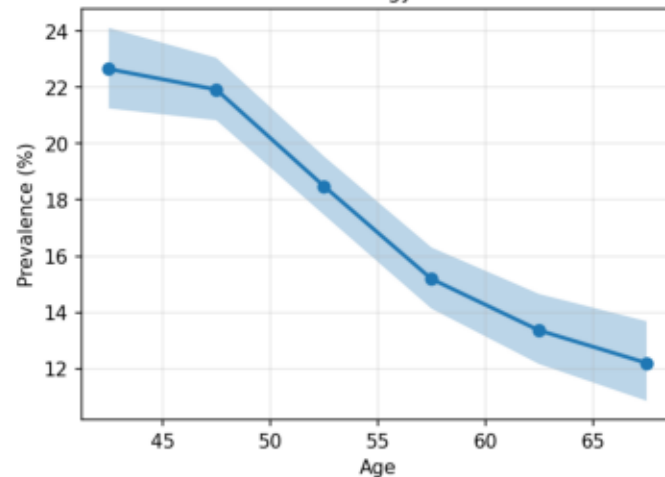
Psoriasis



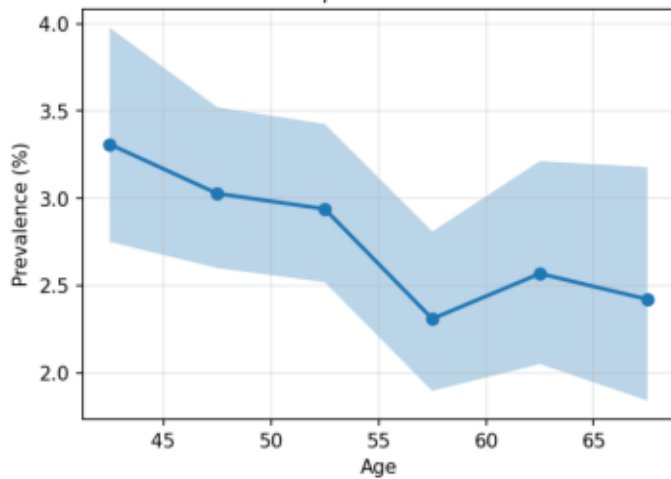
Vitiligo



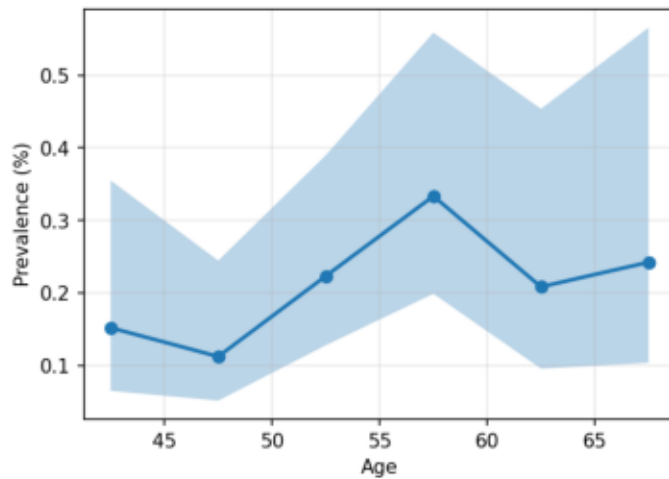
Allergy



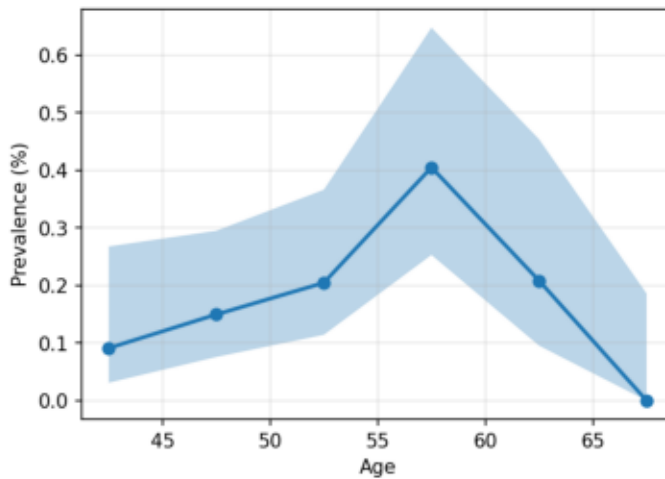
Atopic Dermatitis



Uveitis



FMF



LIMITATIONS AND CRITICAL ANALYSIS  
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1. SURVIVAL BIAS  
Severe conditions may cause earlier death, reducing apparent prevalence in older age groups. This biases results toward finding conditions that "decrease" with age.
2. COHORT/GENERATION EFFECTS  
Different generations have different diagnosis rates:
  - ADHD was not diagnosed in older generations as children
  - Allergies may reflect increased environmental allergensThese are NOT true age effects but generational differences.
3. DETECTION BIAS  
Older adults may seek more medical care, leading to more diagnoses. Younger adults may underreport symptoms.
4. CROSS-SECTIONAL DESIGN  
Cannot establish causality or track individual trajectories. We observe associations, not causes.
5. CONFOUNDERS NOT CONTROLLED  
This analysis did NOT adjust for:
  - Gender (many conditions are sex-specific)
  - BMI (major metabolic confounder)
  - Socioeconomic status
  - Smoking, alcohol, medications
6. SAMPLE SIZE CONSIDERATIONS  
Analysis limited to conditions with  $n \geq 100$  cases to ensure stable estimates.

- RECOMMENDATIONS FOR INTERPRETATION
- Cardiovascular findings (↑) align with known epidemiology
  - Mental health findings (↓) likely reflect cohort effects
  - Reproductive conditions (↓) reflect natural resolution
  - Consider these results as hypothesis-generating

## METHODOLOGY

{'='\*50}

## STATISTICAL MODEL

- Logistic regression:  $\log(p/(1-p)) = \beta_0 + \beta_1 \times \text{Age}$
- $\beta_1$  = change in log odds per year of age
- Odds Ratio per decade =  $\exp(\beta_1 \times 10)$

## INTERPRETATION GUIDE

- OR = 2.0: Condition is 2x more likely per decade of age
- OR = 0.5: Condition is 2x less likely per decade of age
- OR = 1.0: No association with age

## INCLUSION CRITERIA

- Age: 40-70 years
- Minimum positive cases: 100
- Complete data for condition

## WHAT THE PLOTS SHOW

### Log Odds Plot:

- Y-axis: Log odds of having condition at each age
- Points: Observed log odds per age bin
- Line: Fitted regression trend
- Upward slope = increases with age

### Prevalence Plot:

- Y-axis: Percentage with condition
- Shows raw proportions (easier to understand)
- Does not show statistical uncertainty

### Odds Ratio Plot:

- Shows multiplicative change per decade
- $OR > 1$  = more likely with age
- $OR < 1$  = less likely with age
- Error bars = 95% confidence interval

## DATA SOURCE

Human Phenotype Project (HPP) 10K Dataset  
Medical conditions from clinical records

## Top 20 Conditions Increasing with Age

Condition	N	OR/Decade	Log OR/Year	P-value
Osteoarthritis	611	2.5	0.0916	1.25e-64
Glaucoma	161	2.42	0.0882	1.12e-17
Ischemic Heart Disease	285	2.39	0.0873	2.57e-29
Hypertension	2494	2.36	0.086	4.07e-204
Retinal detachment	200	2.23	0.0804	1.84e-18
Hyperlipidemia	5013	1.91	0.0646	4.08e-206
Diabetes	247	1.88	0.0632	8.70e-15
Prediabetes	1953	1.77	0.0569	2.13e-78
Hearing loss	822	1.7	0.0532	4.98e-32
Gout	212	1.48	0.0389	8.40e-06
Sleep Apnea	613	1.46	0.0378	3.60e-13
Peptic Ulcer Disease	428	1.41	0.0342	3.21e-08
Insomnia	336	1.39	0.0326	2.83e-06
Gallstone Disease	885	1.35	0.0297	9.15e-12
Fatty Liver Disease	1269	1.25	0.0226	8.43e-10
Breast Cancer	157	1.24	0.0219	0.0322
Urinary Tract Stones	659	1.22	0.0199	7.83e-05
Fibromyalgia	245	1.19	0.0175	0.0333
Back Pain	4307	1.14	0.0128	4.56e-09
Obesity	1269	1.13	0.0124	8.72e-04

## Top 15 Conditions Decreasing with Age

Condition	N	OR/Decade	Log OR/Year	P-value
Polycystic Ovary Disease	582	0.53	-0.064	6.46e-25
Endometriosis and Adenomyosis	278	0.67	-0.0404	1.72e-06
Allergy	4220	0.71	-0.0349	4.88e-51
Sinusitis	752	0.79	-0.0238	1.98e-06
B12 Deficiency	1110	0.79	-0.0236	1.39e-08
Anemia	1047	0.8	-0.0225	1.30e-07
Anxiety	695	0.81	-0.0208	5.99e-05
Migraine	1213	0.82	-0.0202	3.28e-07
Oral apthae	809	0.83	-0.0192	6.27e-05
Depression	725	0.83	-0.0188	1.93e-04
Headache	533	0.85	-0.0162	0.0055
IBS	694	0.86	-0.0155	0.0025
ADHD	3580	0.86	-0.0154	1.69e-10
Atopic Dermatitis	656	0.88	-0.0133	0.0115
Asthma	1105	0.88	-0.0123	0.0025