AGE AT INCIDENT ANALYSIS

Study Design
• Analysis of age at diagnosis for medical conditions
• Data source: HPP 10K Dataset with diagnosis dates
• Sample: N = 31,146 subjects with valid year of birth

Key Calculation
• Age at diagnosis = Year of diagnosis - Year of birth
• Incidence proportion = Count diagnosed at age / Total diagnosed
• $-\log_{10}$(incidence) = Higher values = Rarer at that age

Data Quality Notes
• Excluded dates = "2000-01-01" (placeholder for unknown date)
• ~30% of diagnosis dates are placeholders (excluded)
• Minimum 20 valid cases required per condition
• 66 conditions met inclusion criteria

How to Interpret -log(Incidence) Plots
• Lower -log values (warmer colors) = More common at that age
• Higher -log values (cooler colors) = Less common at that age
• The curve shows WHEN in life conditions typically develop
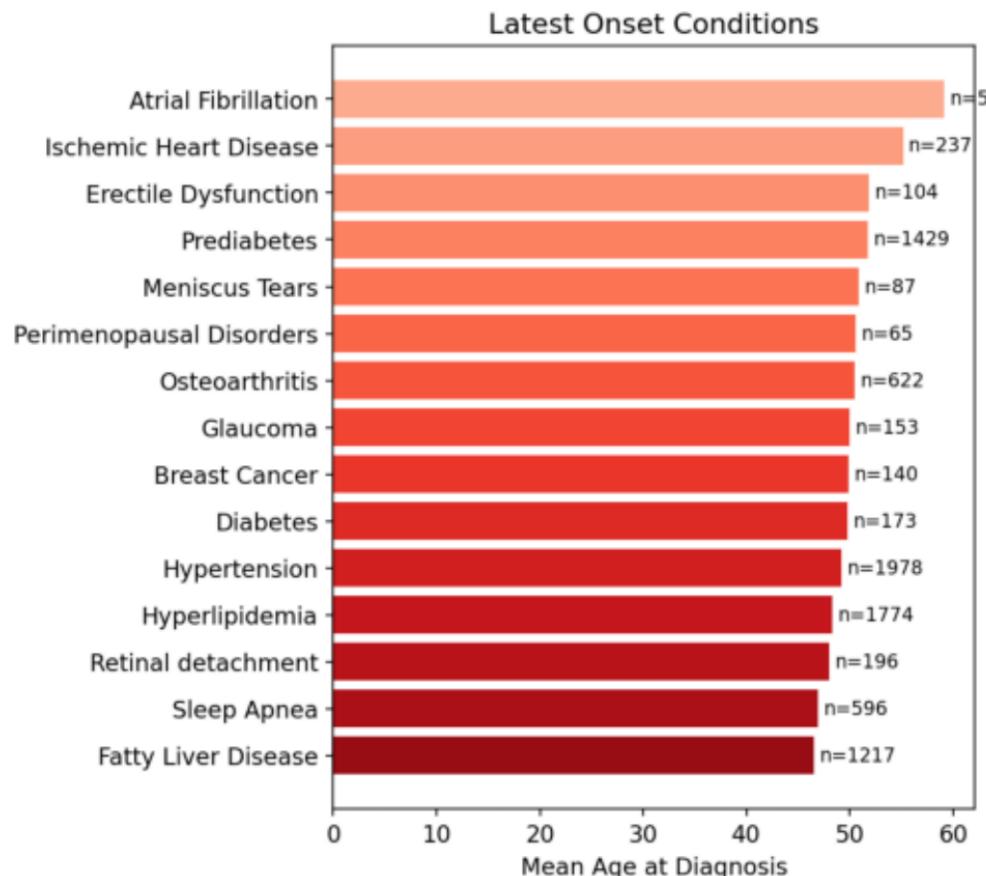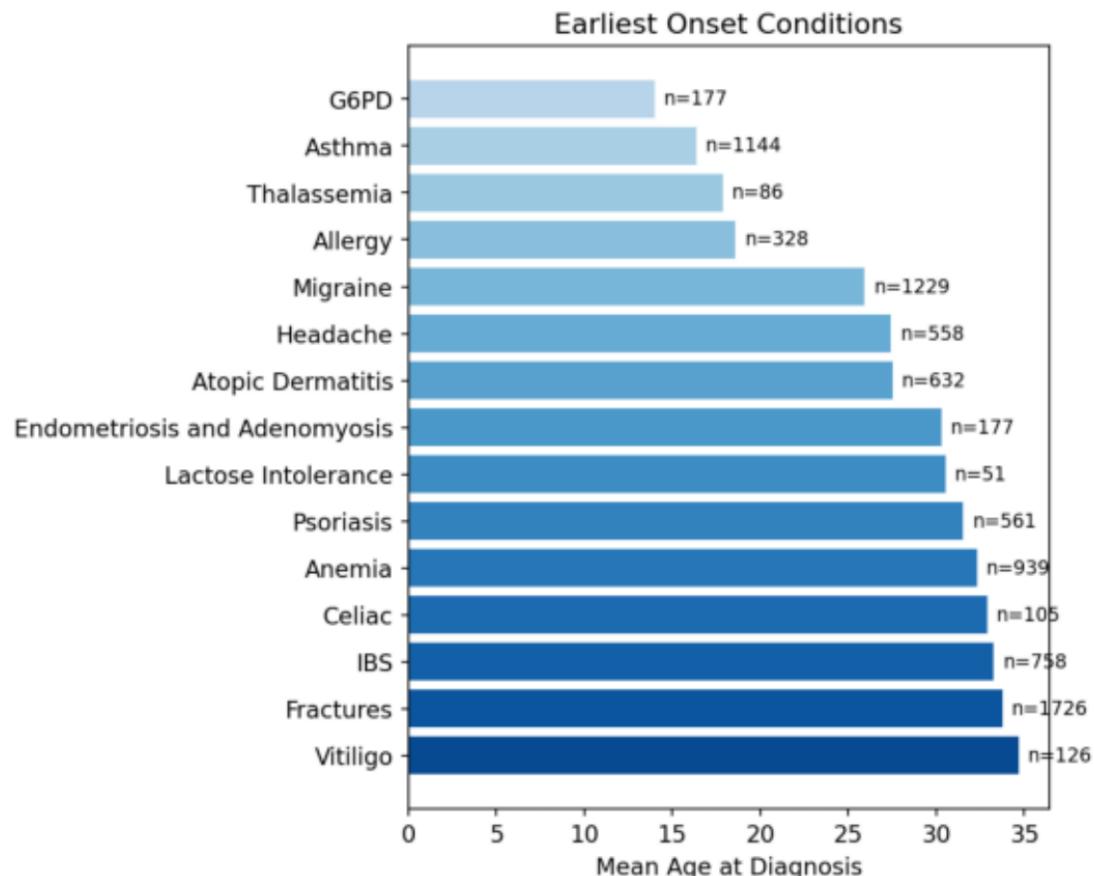
Key Patterns
• EARLY ONSET: Asthma, Allergies, ADHD, Migraine
   - These conditions peak in childhood/young adulthood

• MID-LIFE ONSET: Depression, Anxiety, Back Pain, Obesity
   - These conditions peak around ages 35-50

• LATE ONSET: Hypertension, Diabetes, Osteoarthritis
   - These conditions peak after age 50
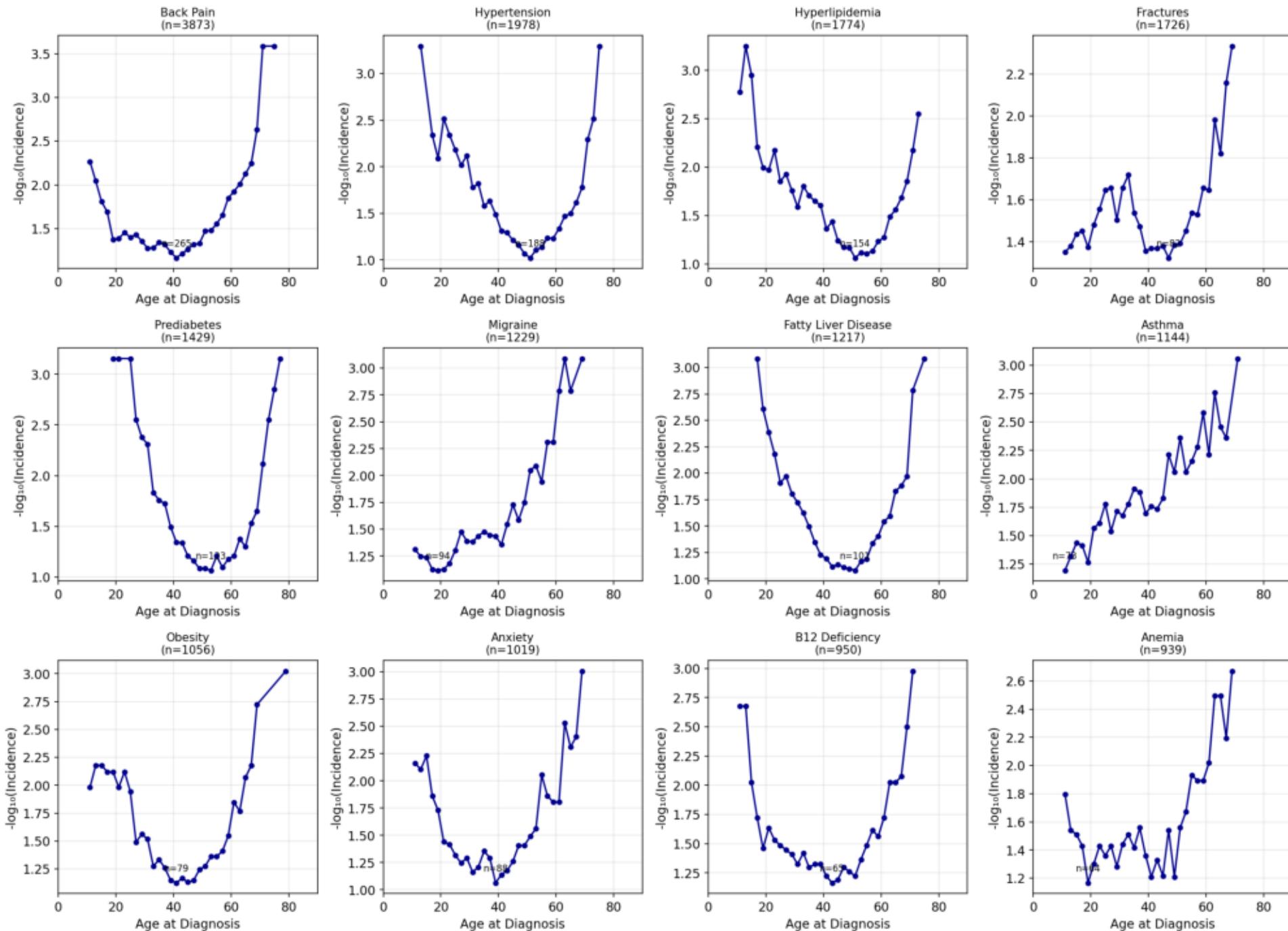
Important Caveats
• Age at diagnosis ≠ Age at onset (diagnosis may lag years)
• Cohort effects may bias older generations
• Survival bias may affect late-onset conditions

When Do Conditions Develop? Early vs Late Onset

Earliest Onset Conditions

Condition	Mean Age at Diagnosis	n
G6PD	~14	n=177
Asthma	~16	n=1144
Thalassemia	~18	n=86
Allergy	~18	n=328
Migraine	~26	n=1229
Headache	~27	n=558
Atopic Dermatitis	~27	n=632
Endometriosis and Adenomyosis	~30	n=177
Lactose Intolerance	~30	n=51
Psoriasis	~31	n=561
Anemia	~32	n=939
Celiac	~33	n=105
IBS	~33	n=758
Fractures	~34	n=1726
Vitiligo	~35	n=126

Latest Onset Conditions

Condition	Mean Age at Diagnosis	n
Atrial Fibrillation	~59	n=55
Ischemic Heart Disease	~55	n=237
Erectile Dysfunction	~52	n=104
Prediabetes	~52	n=1429
Meniscus Tears	~51	n=87
Perimenopausal Disorders	~50	n=65
Osteoarthritis	~50	n=622
Glaucoma	~50	n=153
Breast Cancer	~50	n=140
Diabetes	~50	n=173
Hypertension	~49	n=1978
Hyperlipidemia	~49	n=1774
Retinal detachment	~48	n=196
Sleep Apnea	~47	n=596
Fatty Liver Disease	~47	n=1217

-log₁₀(Incidence) by Age for Top 12 Conditions

$$-\log_{10}(\text{Incidence Rate}) \text{ by Age at Diagnosis}$$
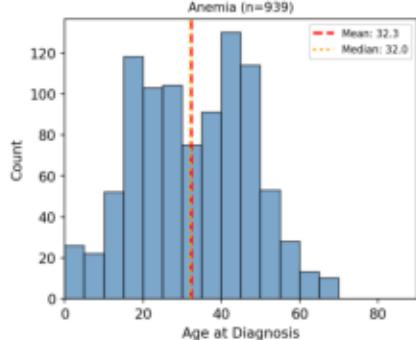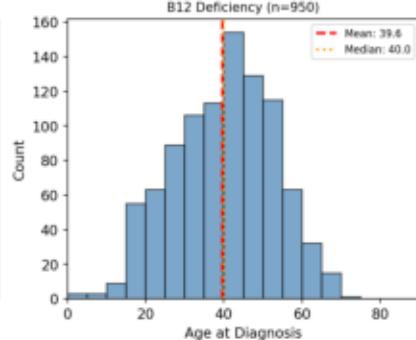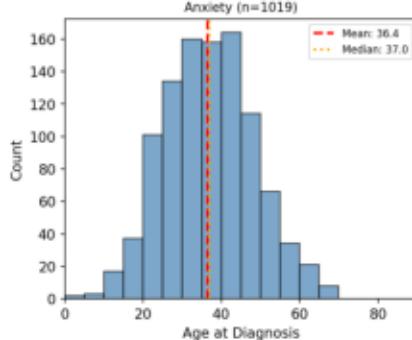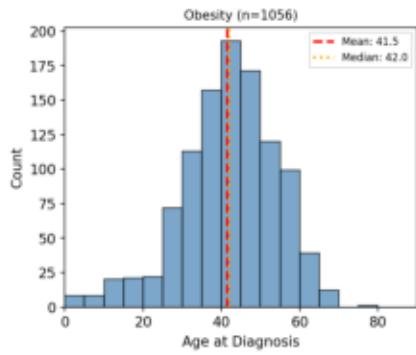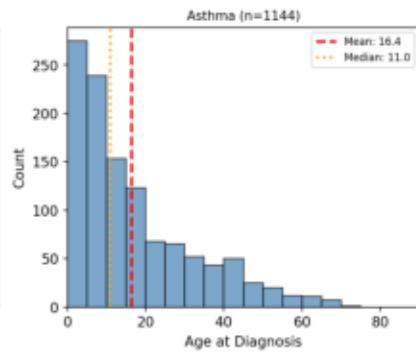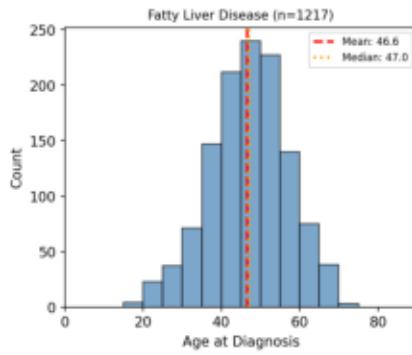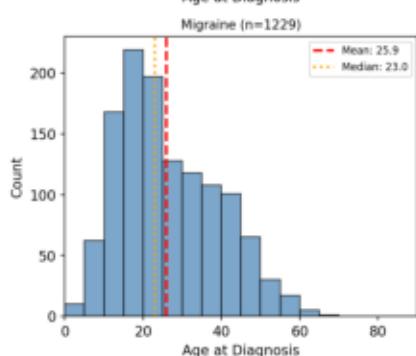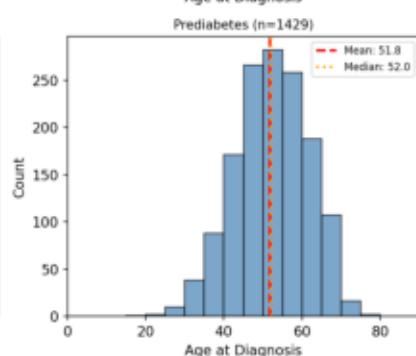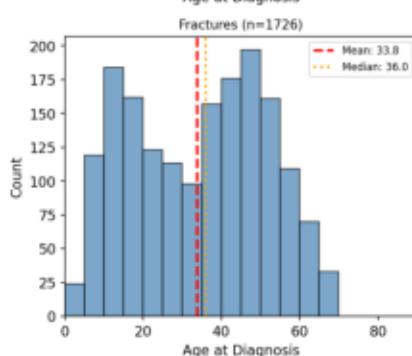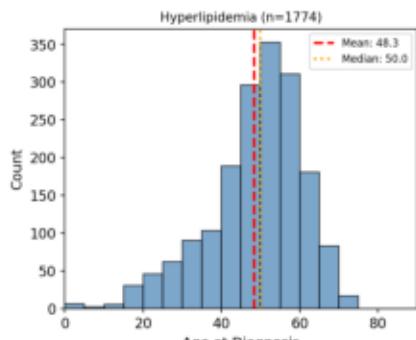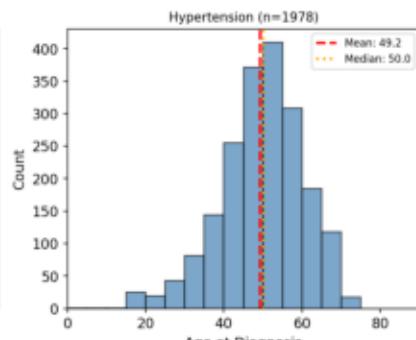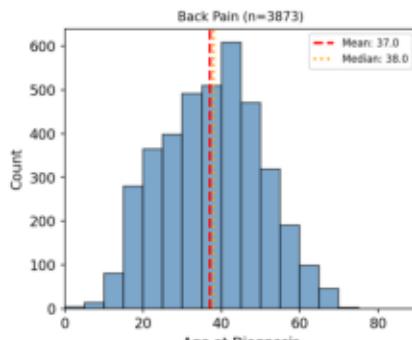
Incidence Heatmap Across Age and Conditions

-log₁₀(Incidence) Heatmap
(Blue = Higher -log = Lower Incidence, Red = Lower -log = Higher Incidence)
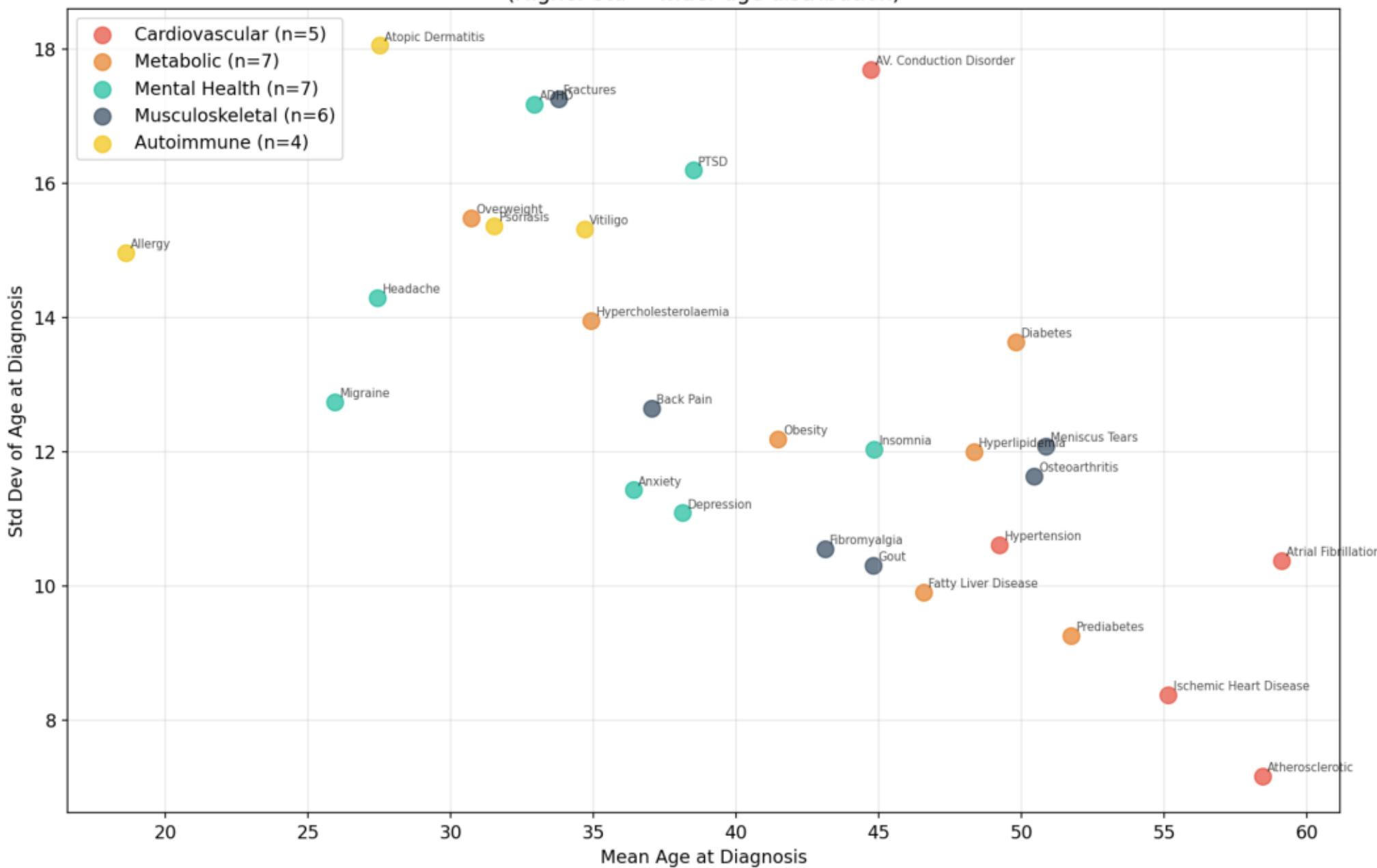
Age at Diagnosis Distributions

Age at Diagnosis Distribution

Age at Diagnosis by Disease Category

Age at Diagnosis by Disease Category
(Higher std = wider age distribution)

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TOP 30 CONDITIONS BY SAMPLE SIZE
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Condition                         N    Mean   Median    Std
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Back Pain                       3873    37.0    38.0    12.6
Hypertension                    1978    49.2    50.0    10.6
Hyperlipidemia                  1774    48.3    50.0    12.0
Fractures                       1726    33.8    36.0    17.3
Prediabetes                     1429    51.8    52.0     9.3
Migraine                        1229    25.9    23.0    12.7
Fatty Liver Disease             1217    46.6    47.0     9.9
Asthma                          1144    16.4    11.0    15.4
Obesity                         1056    41.5    42.0    12.2
Anxiety                         1019    36.4    37.0    11.4
B12 Deficiency                   950    39.6    40.0    12.7
Anemia                           939    32.3    32.0    14.7
Depression                       869    38.1    38.0    11.1
Hearing loss                     761    40.0    44.0    18.6
IBS                              758    33.3    33.0    13.2
Gallstone Disease                718    41.7    42.0    10.9
Atopic Dermatitis                632    27.5    26.0    18.1
Osteoarthritis                   622    50.4    52.5    11.6
Sleep Apnea                      596    46.9    47.0    10.7
Psoriasis                        561    31.5    32.0    15.4
Headache                         558    27.4    24.0    14.3
Urinary Tract Stones             500    39.8    40.0    12.6
Insomnia                         422    44.8    46.0    12.0
Fibromyalgia                     387    43.1    44.0    10.5
Allergy                          328    18.6    15.5    15.0
Ischemic Heart Disease           237    55.2    54.0     8.4
Retinal detachment               196    48.0    52.0    13.7
Gout                             185    44.8    44.0    10.3
G6PD                             177    14.0     5.0    16.7
Endometriosis and Adenomyosi     177    30.3    29.0     9.3
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KEY FINDINGS

1. EARLIEST ONSET CONDITIONS (Mean Age < 30 years)
These conditions typically develop in childhood or young adulthood:

- Migraine: Mean age 26 years (n=1229)
- Asthma: Mean age 16 years (n=1144)
- Atopic Dermatitis: Mean age 28 years (n=632)
- Headache: Mean age 27 years (n=558)
- Allergy: Mean age 19 years (n=328)
- G6PD: Mean age 14 years (n=177)
- Thalassemia: Mean age 18 years (n=86)
- FMF: Mean age 29 years (n=42)

2. LATEST ONSET CONDITIONS (Mean Age > 50 years)
These conditions typically develop in middle age or later:

- Prediabetes: Mean age 52 years (n=1429)
- Osteoarthritis: Mean age 50 years (n=622)
- Ischemic Heart Disease: Mean age 55 years (n=237)
- Erectile Dysfunction: Mean age 52 years (n=104)
- Meniscus Tears: Mean age 51 years (n=87)
- Perimenopausal Disorders: Mean age 51 years (n=65)
- Atrial Fibrillation: Mean age 59 years (n=55)
- Hyperparathyroidism: Mean age 51 years (n=41)

3. WIDEST AGE DISTRIBUTIONS
Some conditions span a wide range of ages at diagnosis:

- Sinusitis: Std = 20.0 years
- COPD: Std = 19.3 years
- Hearing loss: Std = 18.6 years
- Atopic Dermatitis: Std = 18.1 years
- AV. Conduction Disorder: Std = 17.7 years

4. NARROWEST AGE DISTRIBUTIONS
Some conditions cluster tightly around a specific age:

- Perimenopausal Disorders: Std = 4.6 years
- Polycystic Ovary Disease: Std = 5.6 years
- Atherosclerotic: Std = 7.2 years
- Gallbladder Polyp: Std = 7.6 years
- Ischemic Heart Disease: Std = 8.4 years