

Evaluating Symptoms of Parkinson's Disease

ANALYSIS OF CAM LONGITUDINAL STUDY

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About Parkinson's disease

PARKINSON'S DISEASE

"Parkinson's disease is a type of movement disorder that can affect the ability to perform common, daily activities. There are an estimated 1 million Americans living with Parkinson's disease and more than 10 million people worldwide."

- American Parkinson's Disease Association

DISEASE IMPACT

"As the second most common age related neurodegenerative disease after Alzheimer's disease, the health, social and economic impact resulting from Parkinson's disease will continue to increase alongside the longevity of the population. Ageing remains the biggest risk factor for developing idiopathic Parkinson's disease."

- from *Ageing and Parkinson's disease: Why is advancing age the biggest risk factor?* by Amy Reeve, Eve Simcox and Doug Turnbull

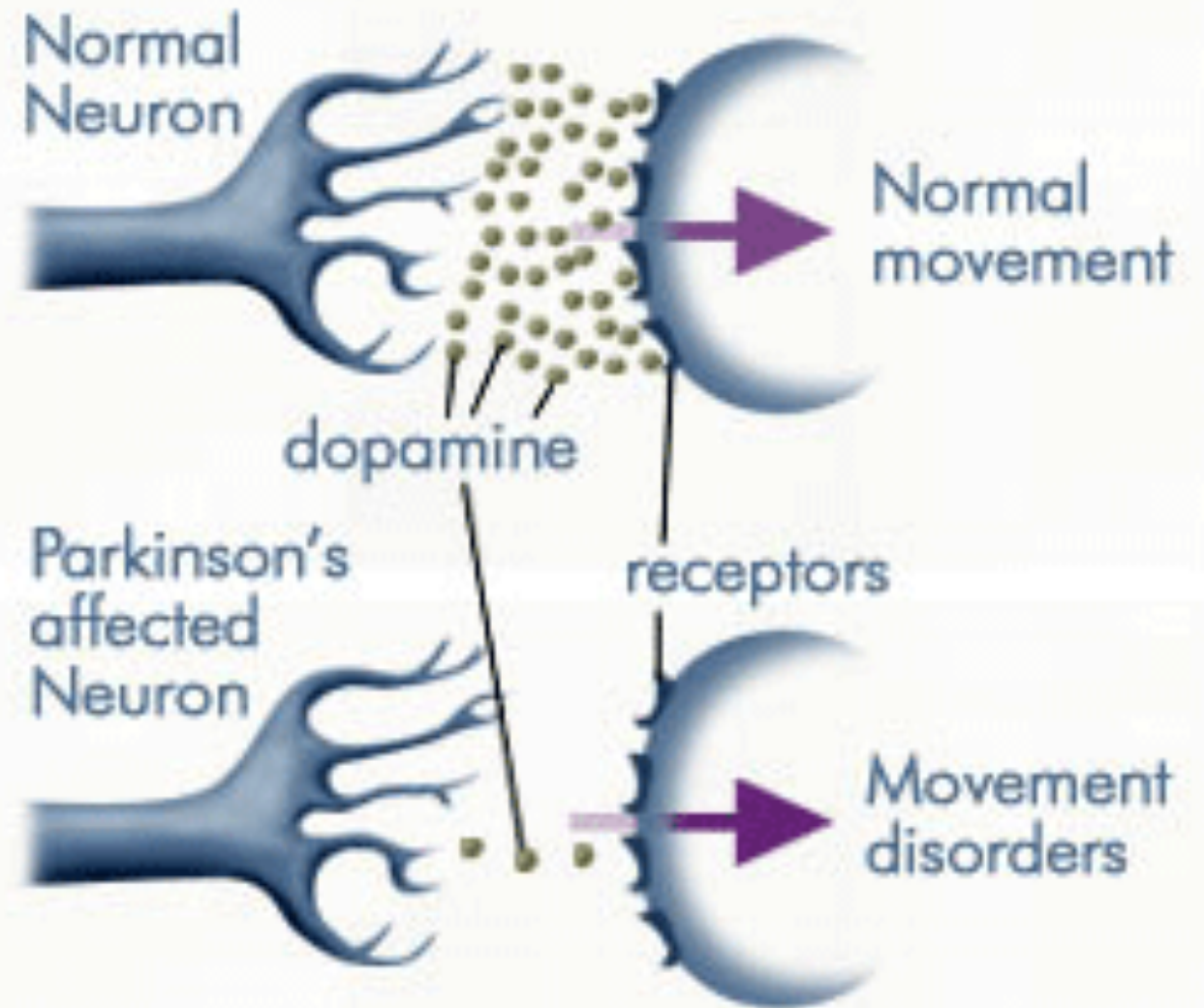
WHAT WE KNOW ABOUT THE CAUSE

Death of dopamine generating cells in area of brain called substantia nigra

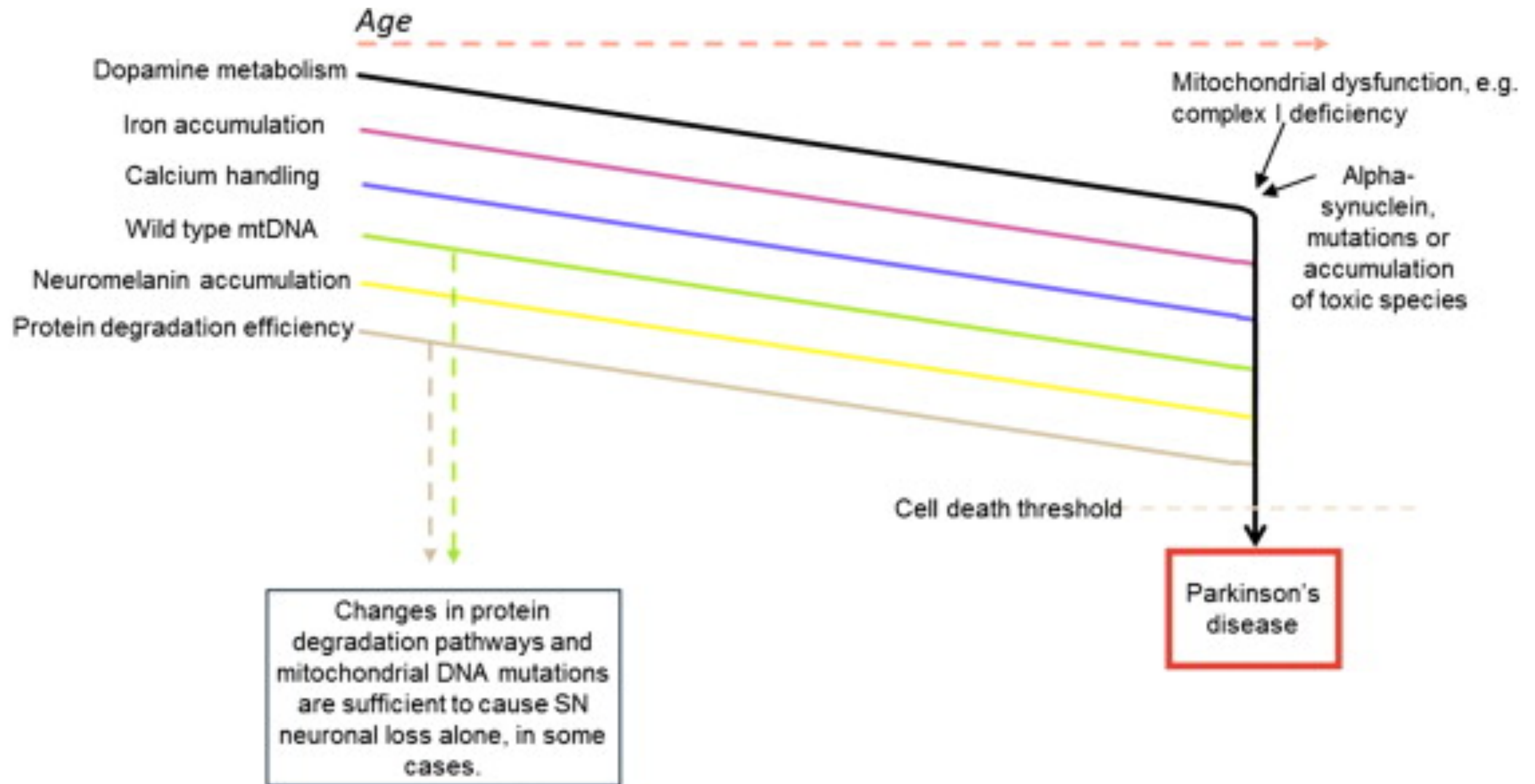
Dopamine is a messenger that tells another part of the brain to move the body

Low dopamine results in loss of movement control

Dopamine levels in a normal and a Parkinson's affected neuron.



DISEASE PROGRESSES WITH AGE



MOTOR AND NON-MOTOR SYMPTOMS

According to the American Parkinson Disease Association (APDA): "There are five primary motor symptoms of Parkinson's disease: tremor, rigidity, bradykinesia (slow movement), postural instability (balance problems), and walking/gait problems. Observing one or more of these symptoms is the main way that physicians diagnose Parkinson's."

"Because Parkinson's disease is a type of movement disorder, the associated non-motor symptoms can often be overlooked. However, there are several common symptoms of Parkinson's disease that do not primarily involve movement: smell, sleep problems, depression and anxiety, psychosis, fatigue, cognitive changes, weight loss, gastrointestinal issues, urinary issues, sexual concerns, sweating, melanoma, personality changes, eye and vision issues."

EARLY DETECTION VS PEACE OF MIND

Knowledge is power

Conventional neurology has limited tools to ameliorate motor symptoms after disease has progressed. Alternative therapies might address symptoms in earlier stages.

But ignorance is bliss

But if there are no real treatments for this progressive disease, would not knowing provide peace of mind?

About the project

PROJECT DESCRIPTION

Project description: Analysis of a Complementary and Alternative Medicine (CAM) longitudinal study from 2006-2018 of 1,700 Parkinson's patients from over 23 countries. Patients completed a survey every six months, totaling 5,149 entries.

CAM definition: *Complementary* means a non-mainstream practice is used together with conventional medicine. *Alternative* means a non-mainstream practice is used in place of conventional medicine.

PROBLEM STATEMENTS

Problem statements:

- ▶ In this longitudinal study, how does a person's symptoms change over time?
- ▶ What are the significant symptoms in each stage of the disease covered in the study?
- ▶ What are any correlations between symptoms and disease progression?
- ▶ Does deep brain stimulation affect symptoms or disease progression?
- ▶ What is impact of loneliness on disease progression?

CLINICIAN ROLE

Clinicians may use motor-based symptoms to make first diagnosis and chart progress of disease, when motor-based symptoms may appear first only in later stages. This could lead to late diagnosis of the disease. It would be better if the patients and clinicians were tracking the same symptoms.

A clinician typically has only 15 minutes to conduct a general screening and would only ask about motor symptoms.

Data cleaning

DATA DESCRIPTION AND CLEANING

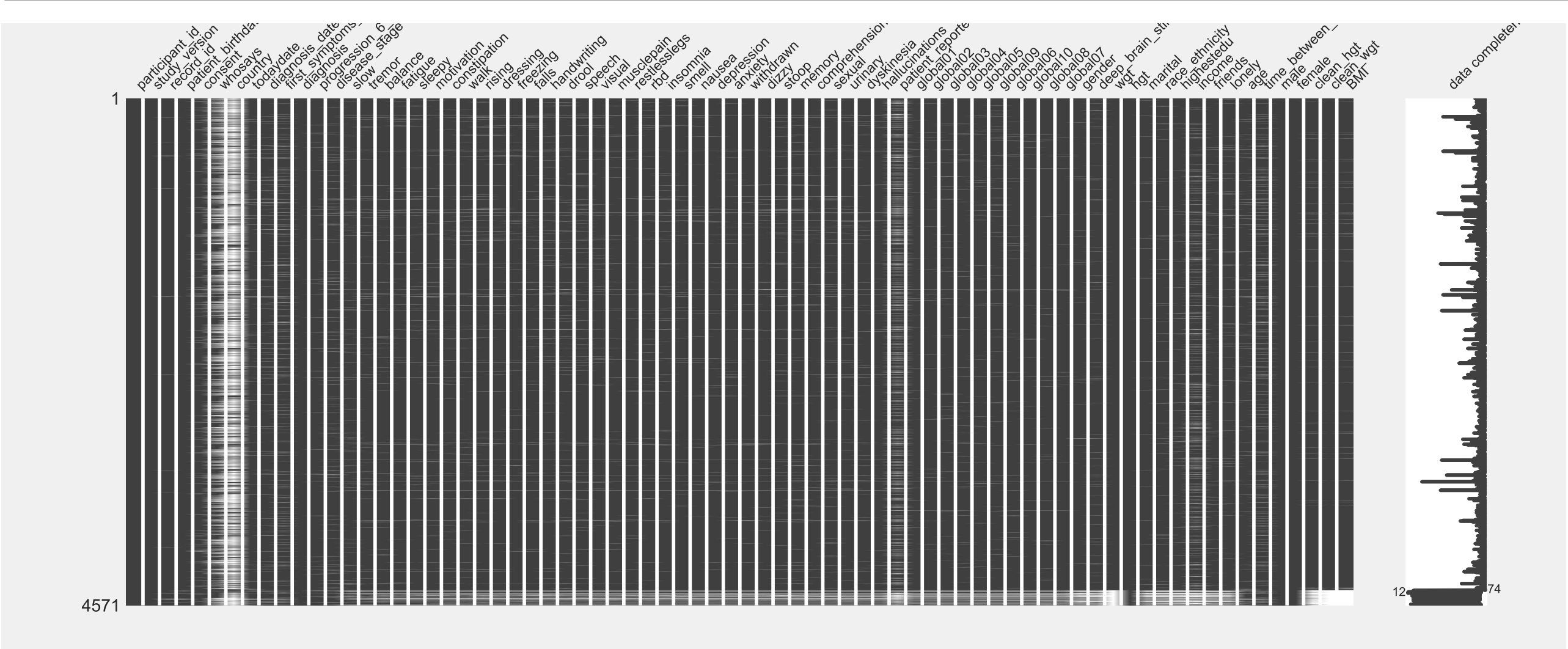
Data description

- ▶ 67 columns, many with incomplete data
- ▶ Data types include floats, objects, integers
- ▶ Significant number of NaNs across dataset
- ▶ Data includes id, demographic info, symptoms, birthdate, education, and income

Data cleaning

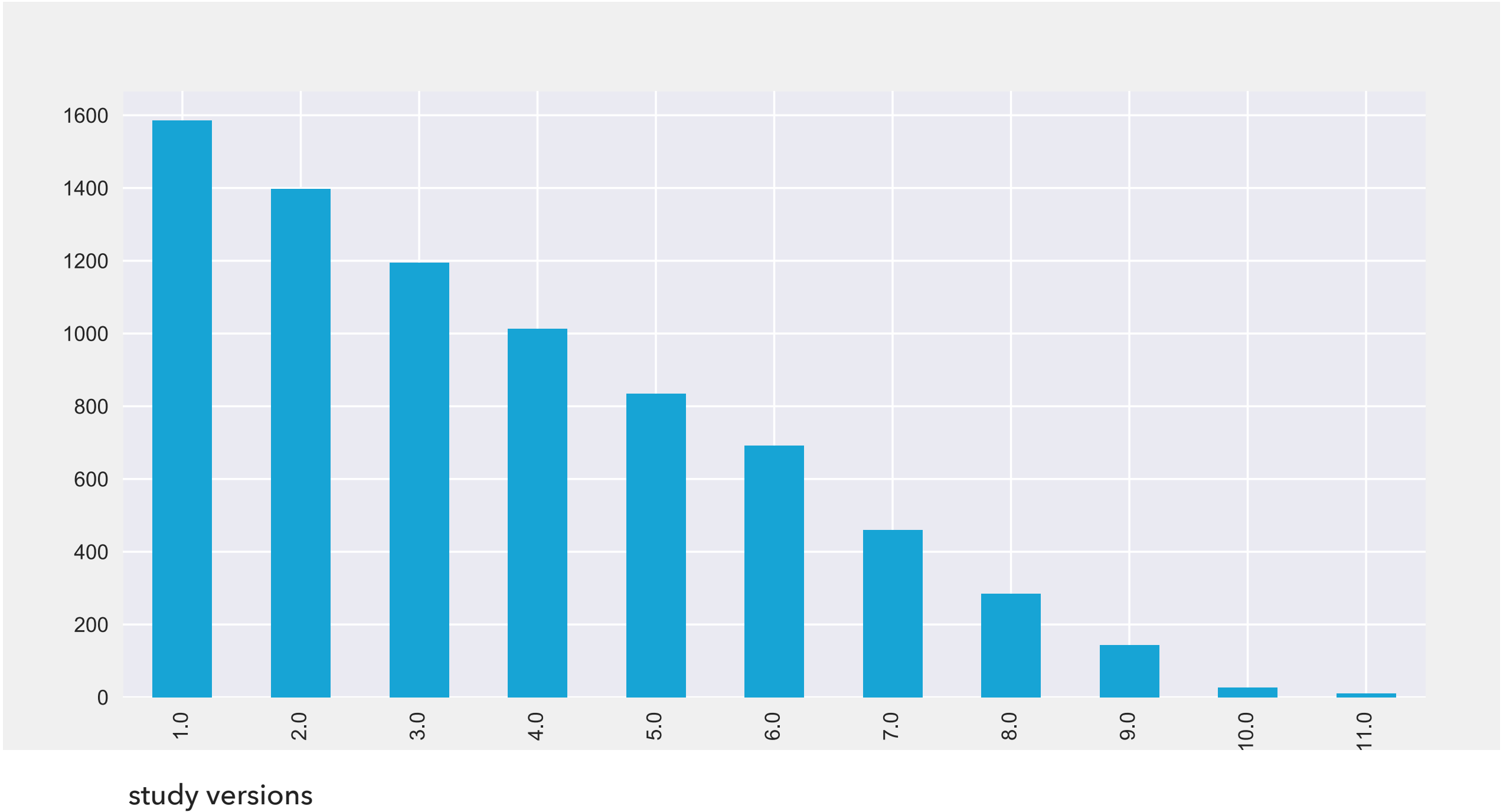
- ▶ Weight and height needed to be standardized
- ▶ Gaps in reporting due to self-reporting
- ▶ As patients' conditions deteriorated over time, surveys were filled out by other people, completion varies
- ▶ Dates were edited to address Y2K issue
- ▶ Dummied columns for categorization

MANY MISSING VALUES

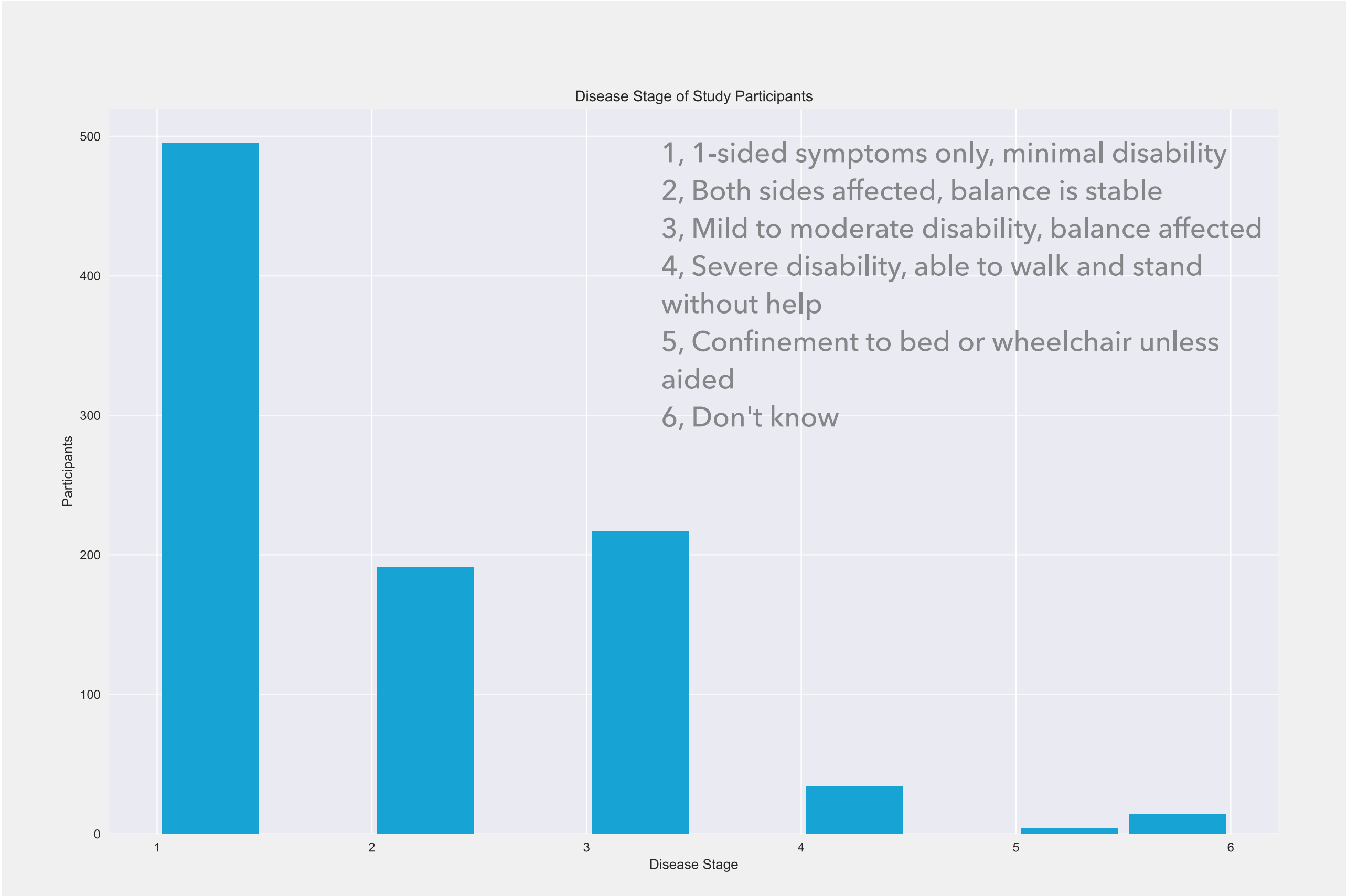


Study population

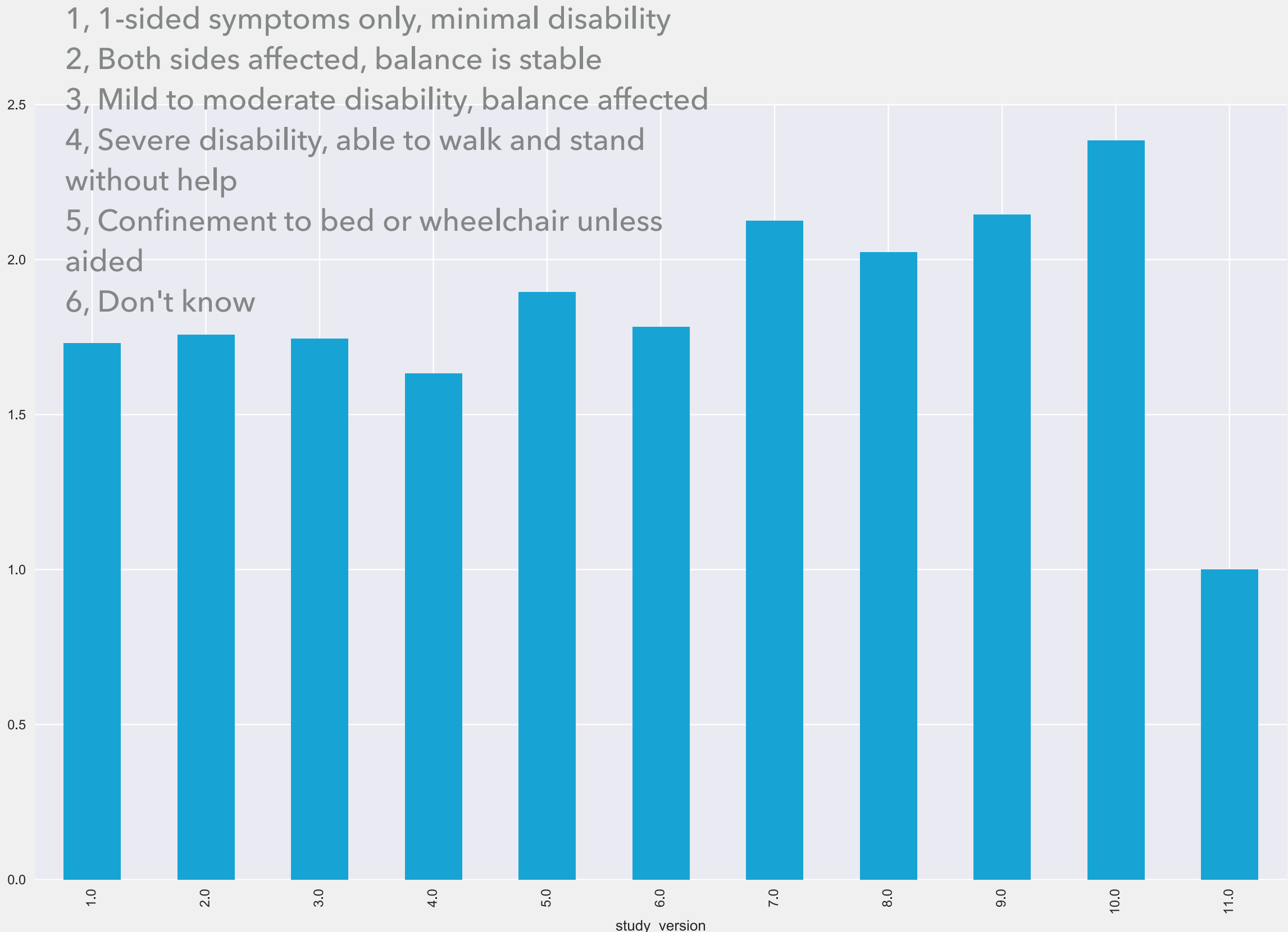
NUMBER OF PARTICIPANTS DECREASES ACROSS STUDY VERSIONS



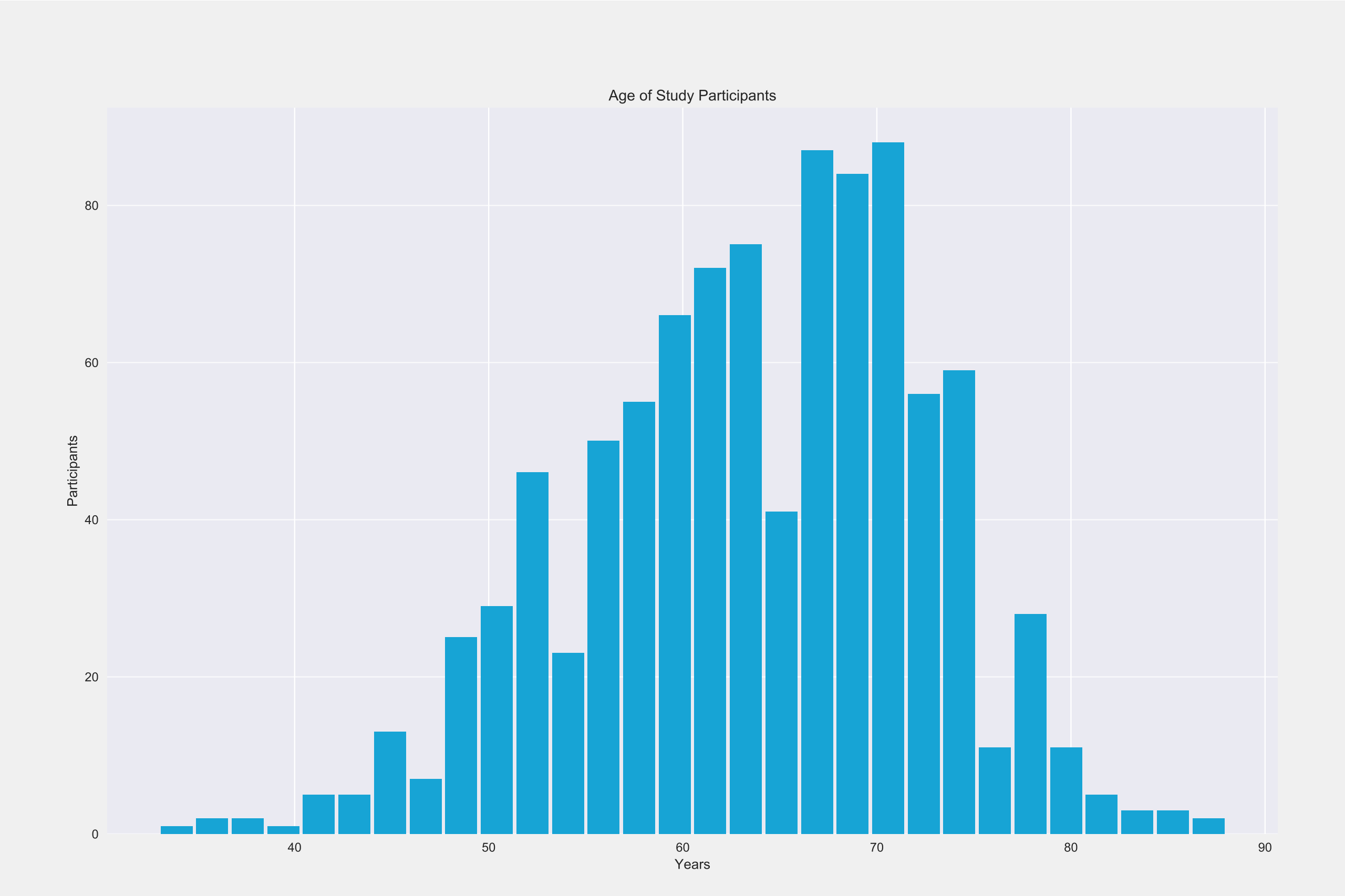
MOST IN EARLY DISEASE STAGE



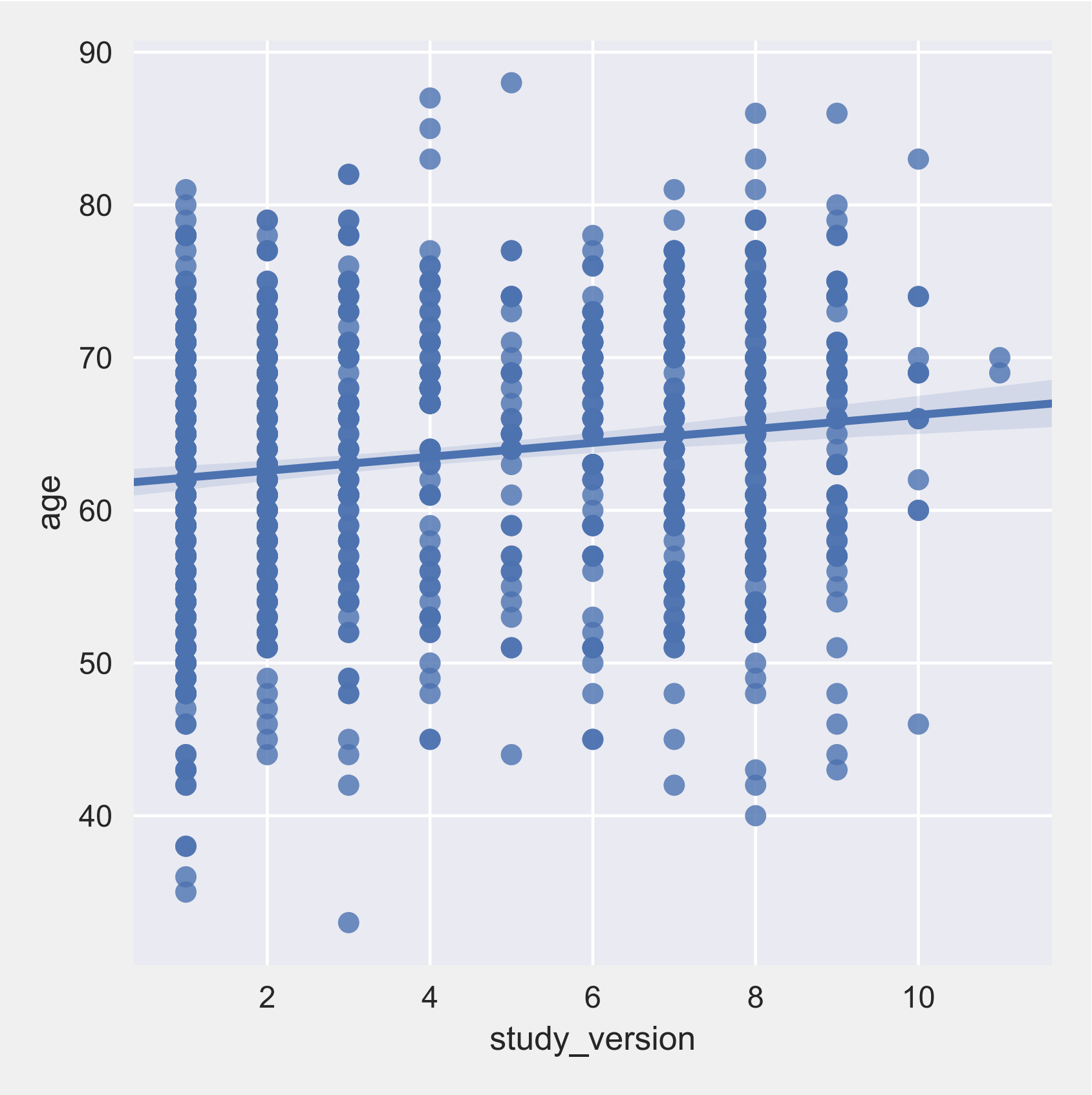
DISEASE STAGES IS MILD ACROSS STUDY VERSIONS



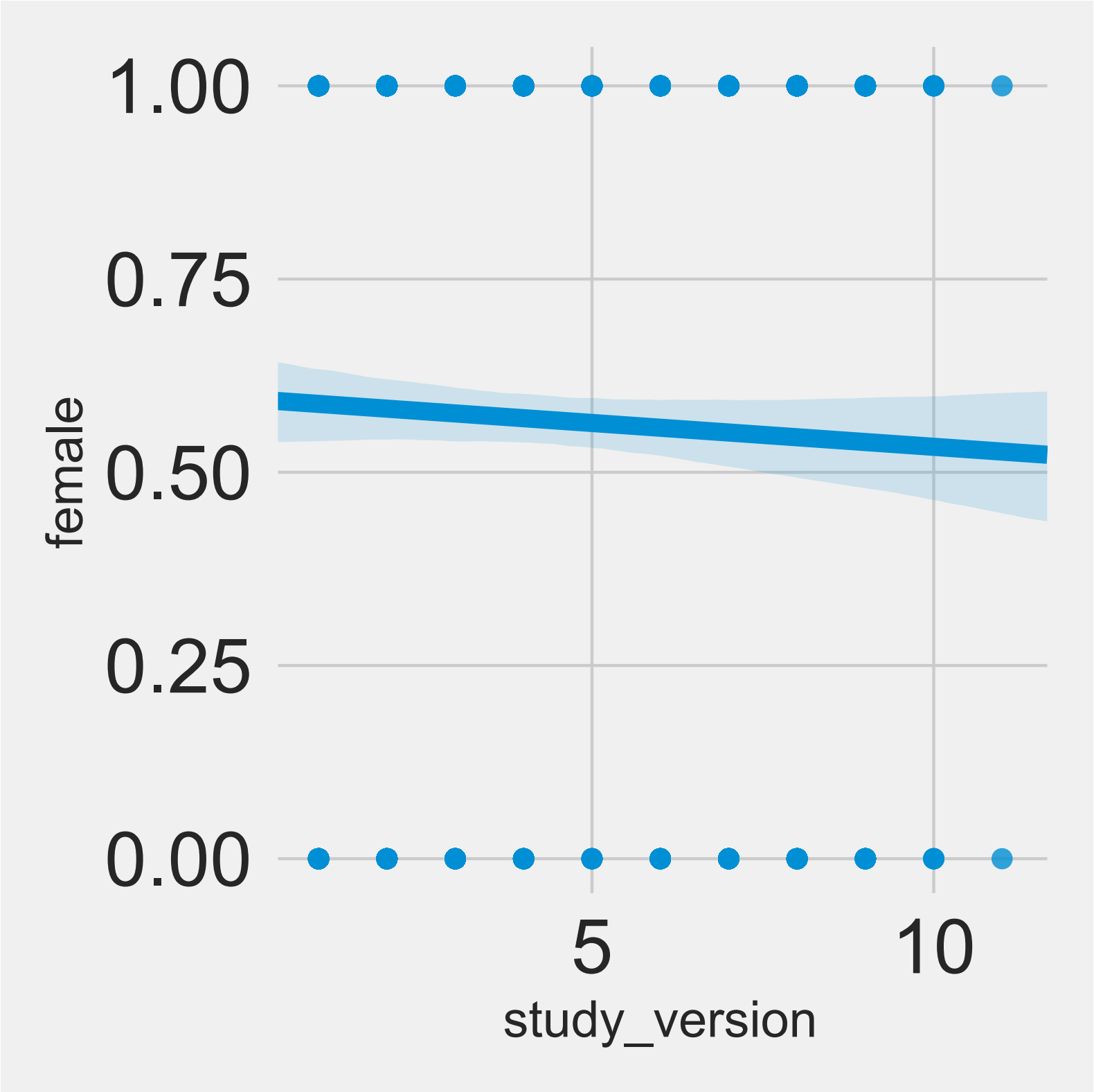
AGE OF POPULATION



AGE IS CONSISTENT ACROSS STUDY VERSIONS

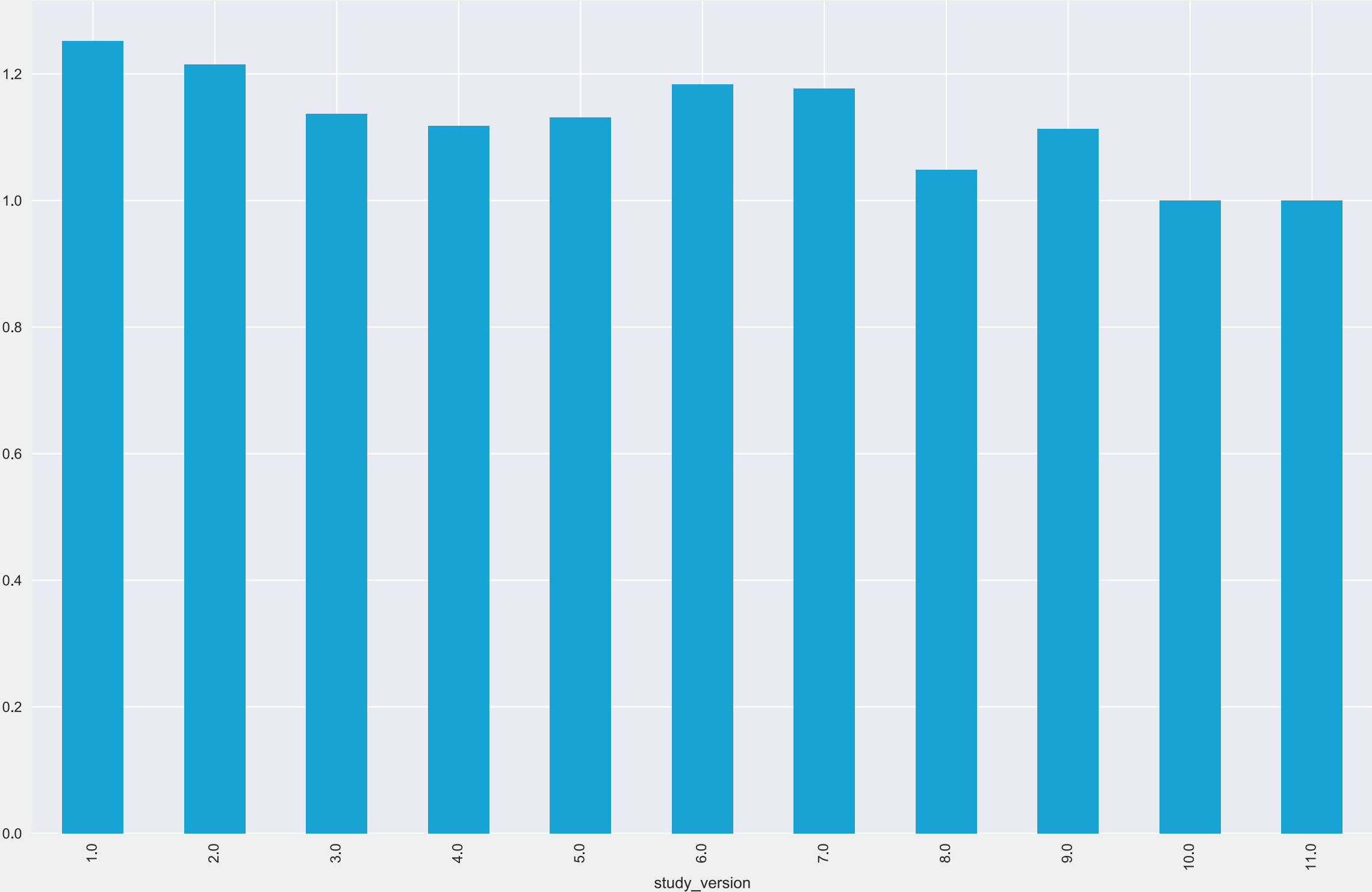


GENDER IS CONSISTENT ACROSS STUDY VERSIONS



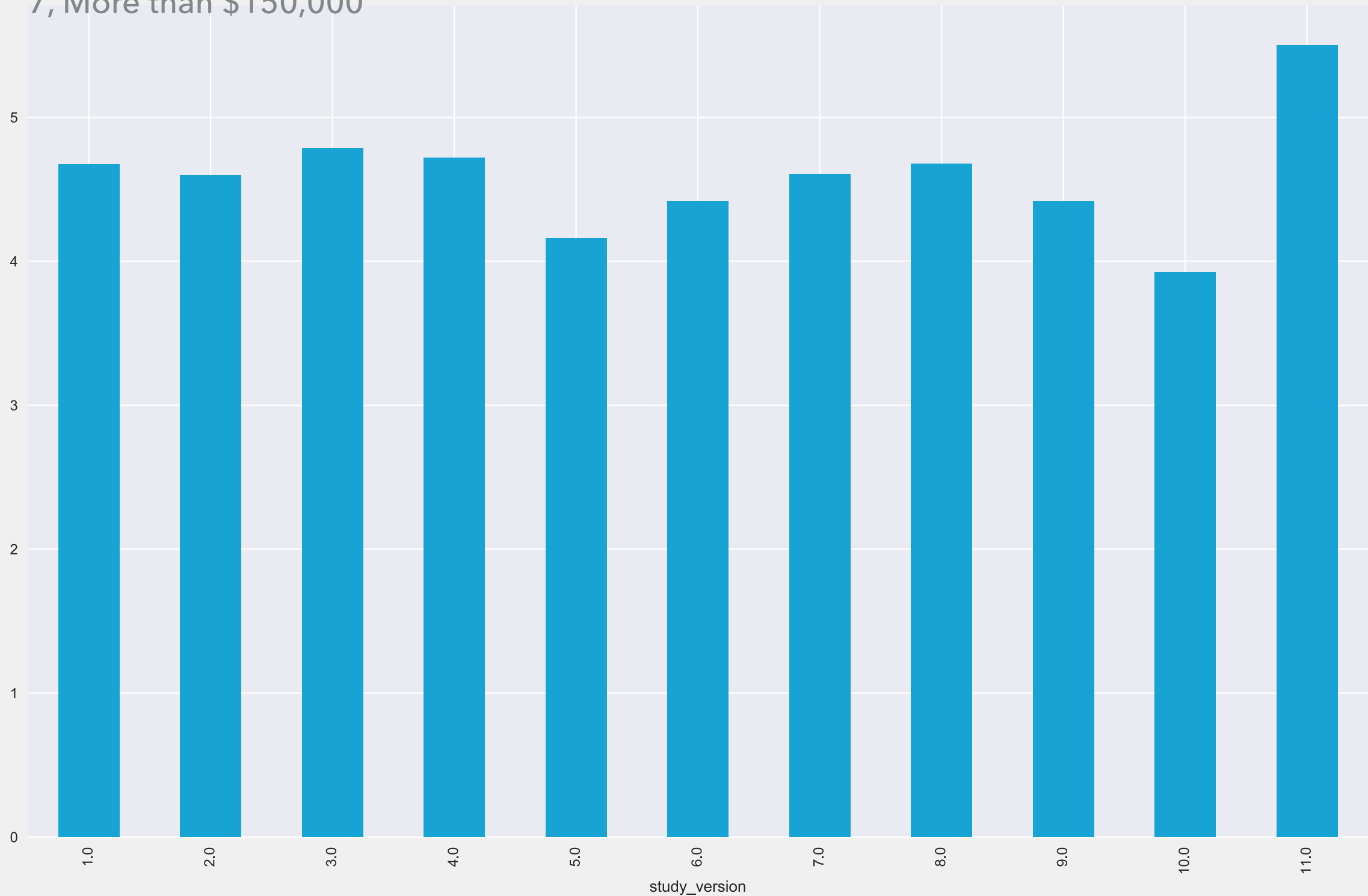
RACE / ETHNICITY IS CONSISTENT ACROSS STUDY VERSIONS

1, Caucasian | 2, Black | 3, Hispanic | 4, Native American | 5, Asian / Pacific Islander | 6, Other



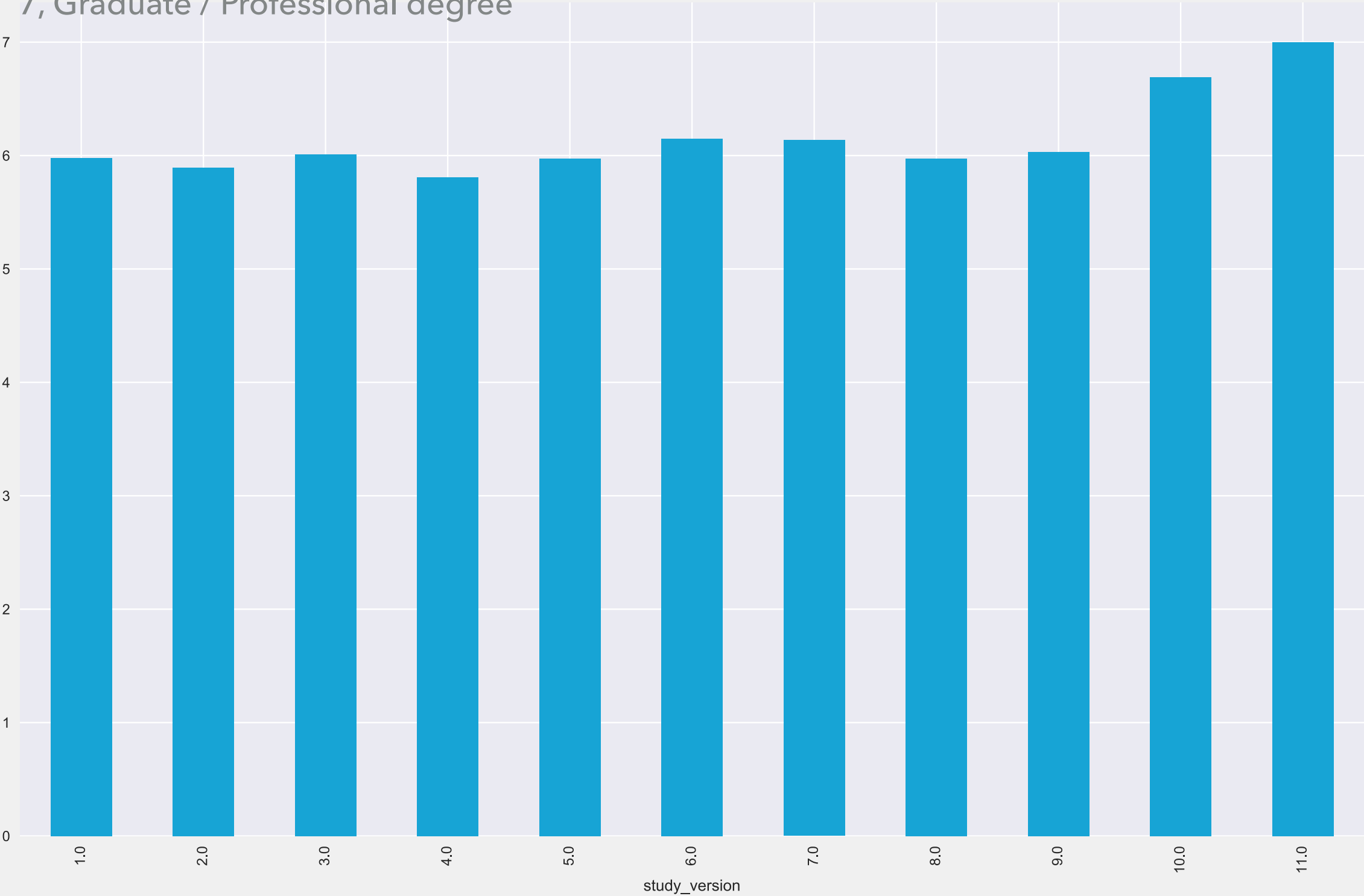
INCOME IS CONSISTENT ACROSS STUDY VERSIONS

1, Less than \$20,000 | 2, Between \$20-40,000 | 3, Between \$40-60,000 |
4, Between \$60-80,000 | 5, Between \$80-100,000 | 6, Between \$100-150,000
7, More than \$150,000



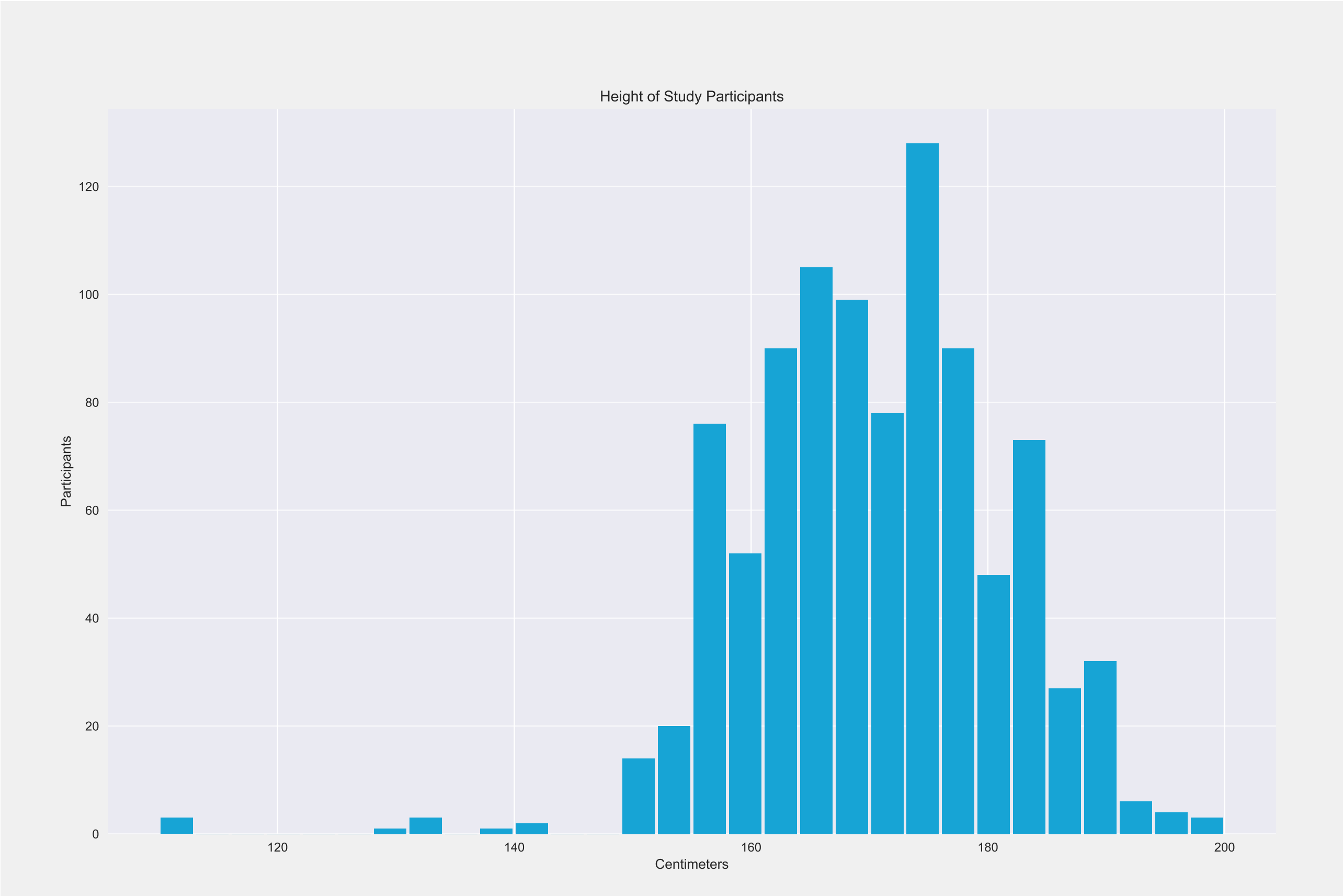
HIGHEST EDUCATION LEVEL IS CONSISTENT ACROSS STUDY VERSIONS

1, Less than 8th grade | 2, Grades 9-11 | 3, Completed High School/GED
4, Technical school certification | 5, Associate Degree | 6, Bachelors Degree
7, Graduate / Professional degree

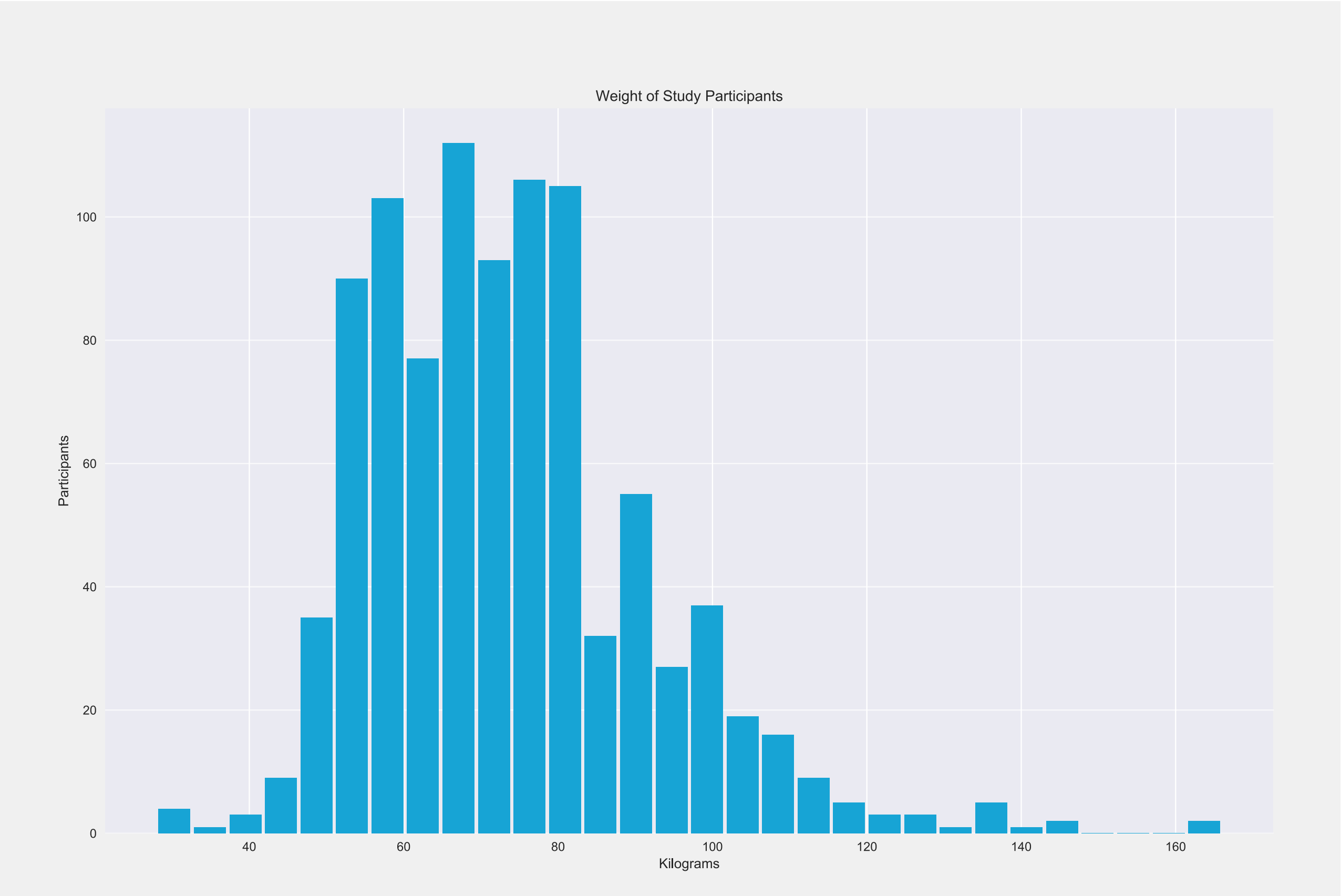


Height, Weight, BMI

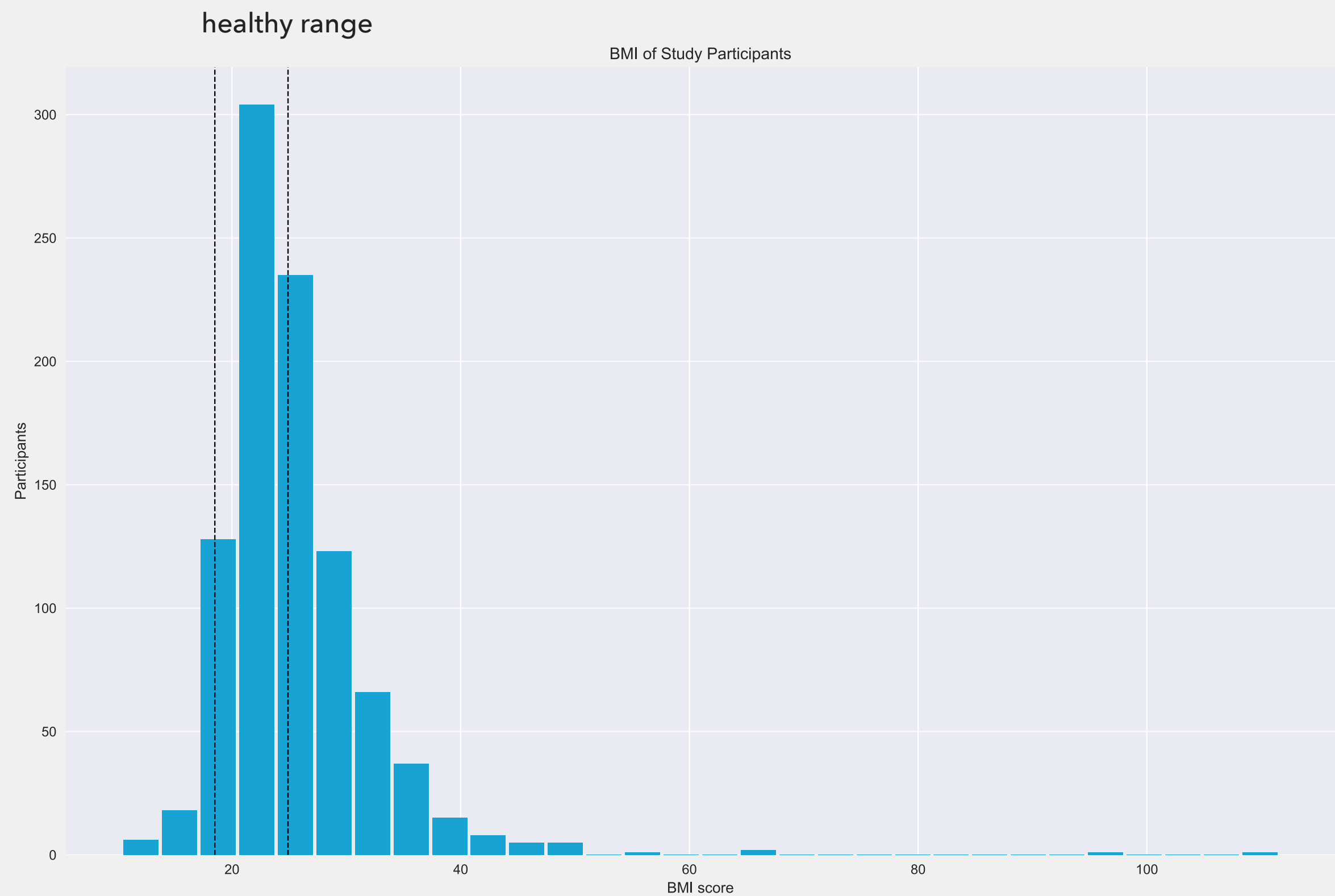
HEIGHT OF POPULATION



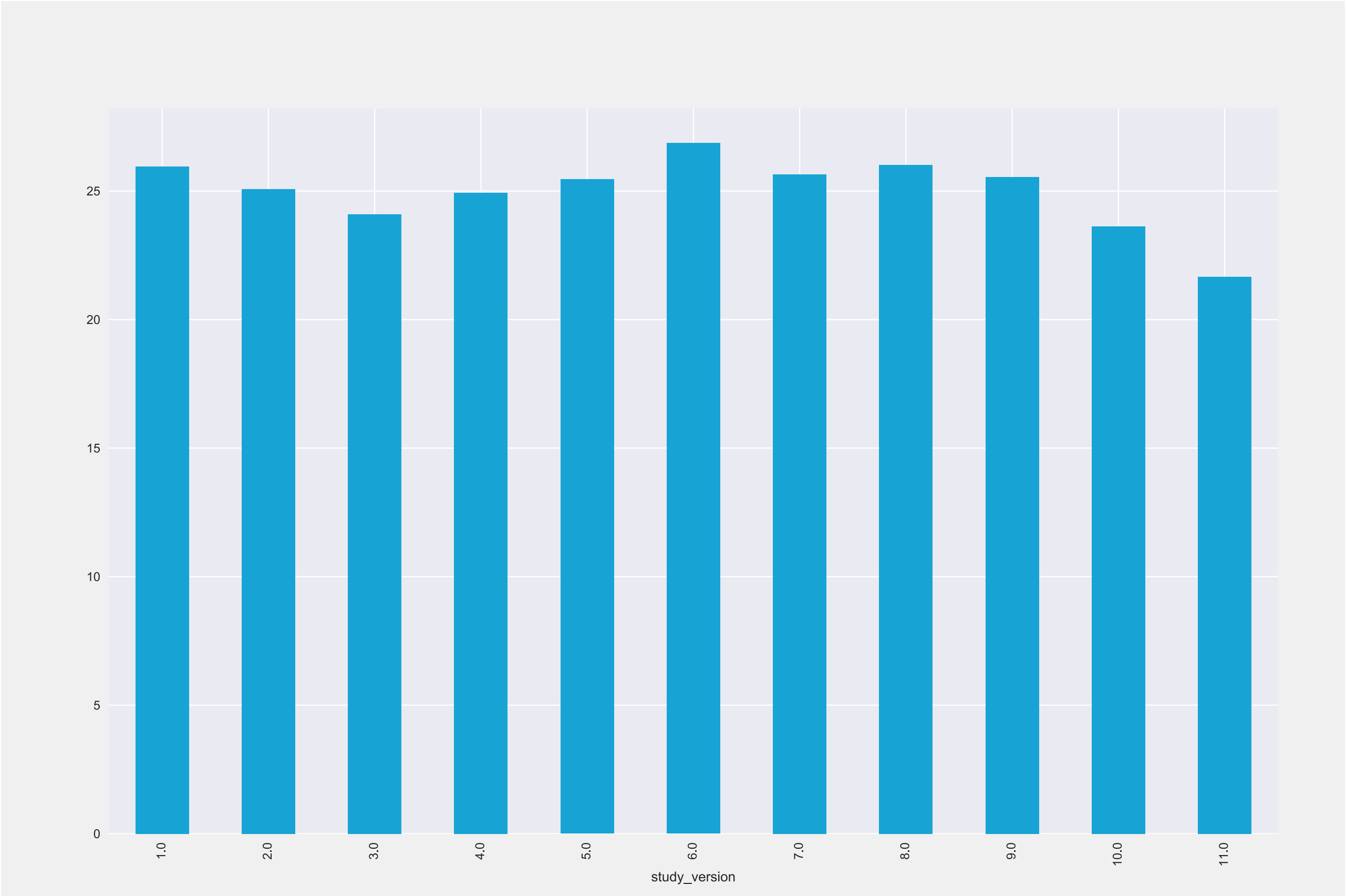
WEIGHT OF POPULATION



BMI OF POPULATION IS WITHIN HEALTHY RANGE

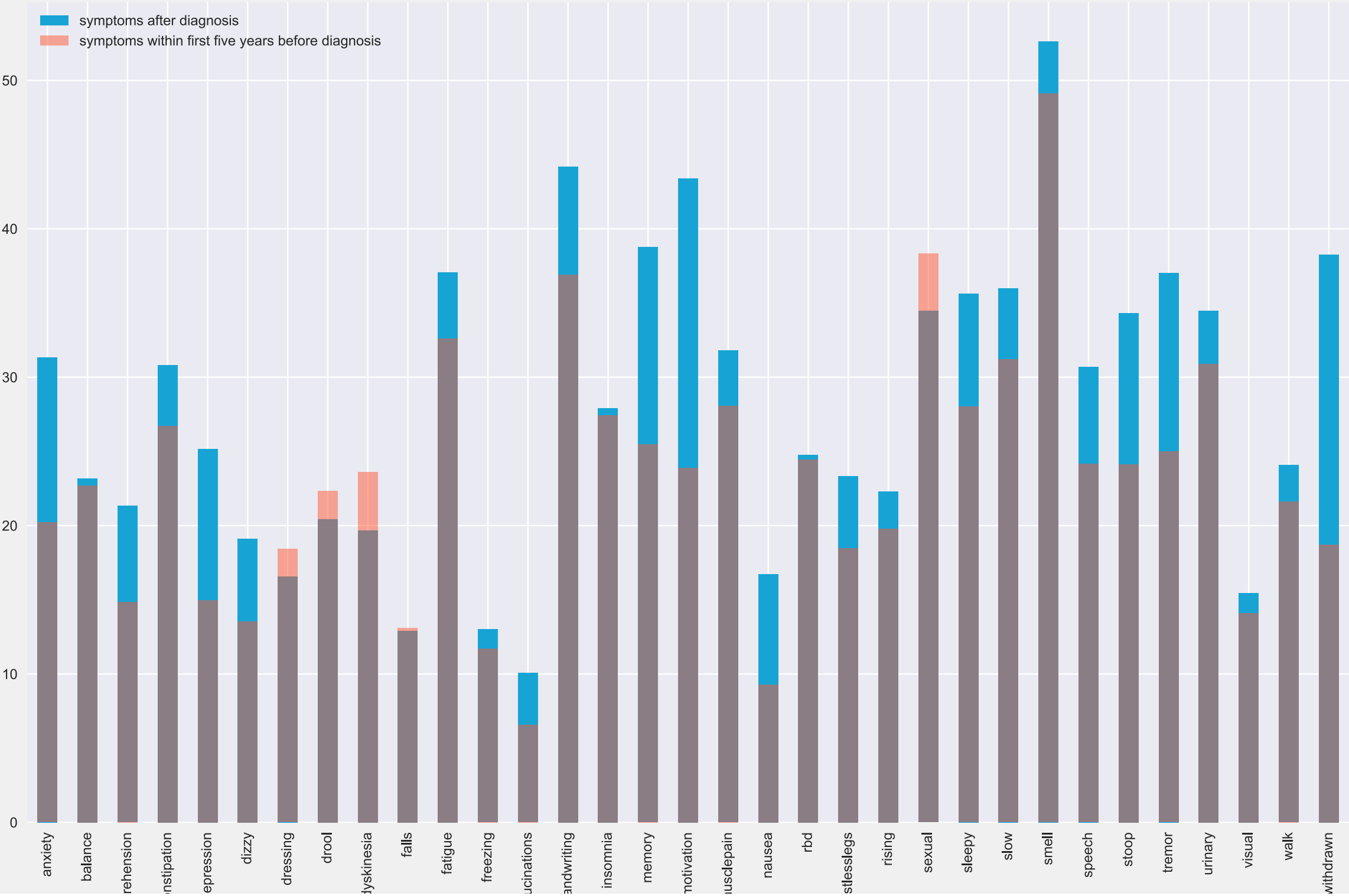


BODY MASS INDEX (BMI) IS CONSISTENT ACROSS STUDY VERSIONS

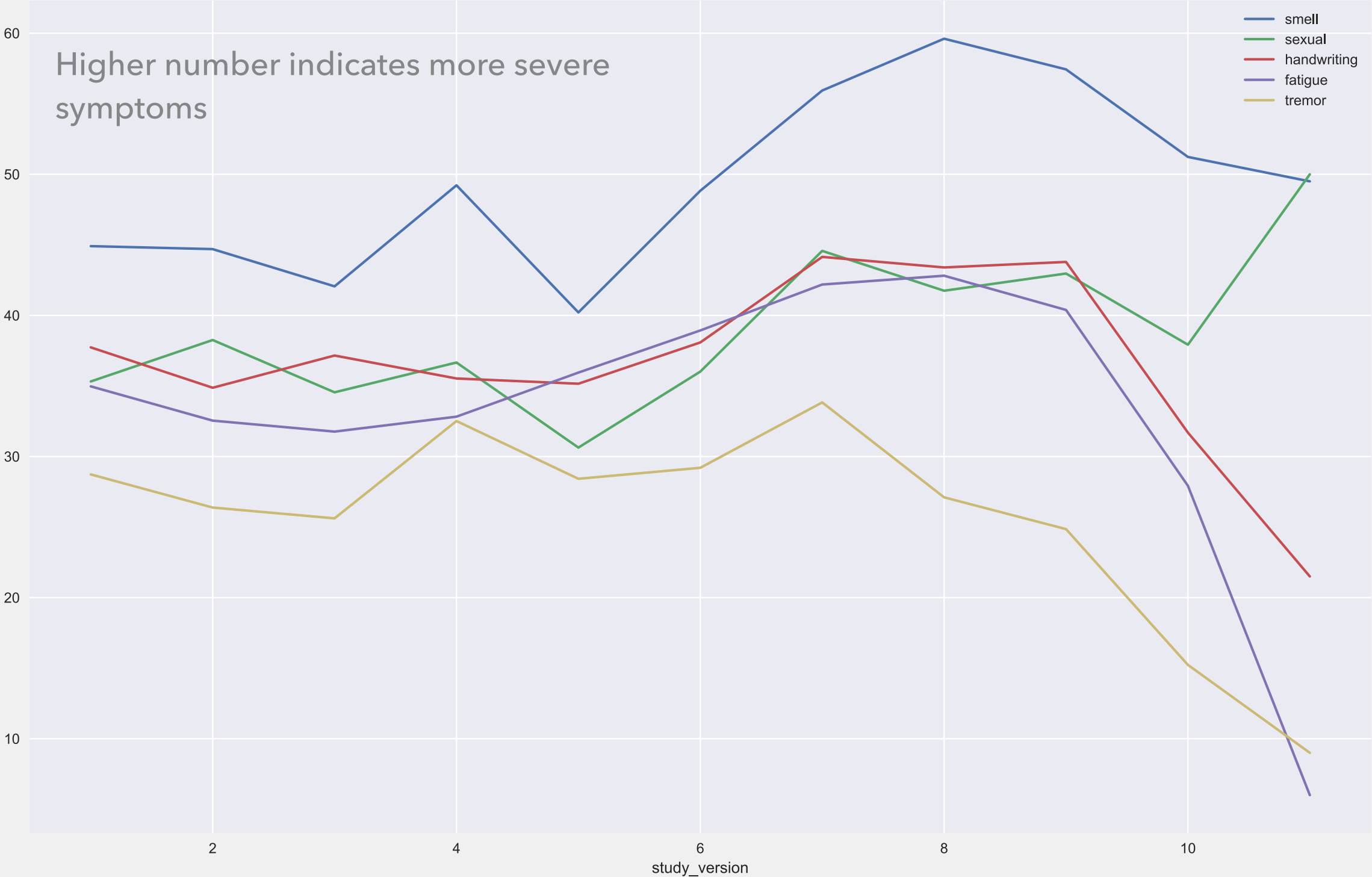


Key symptoms

COMPARISON OF SYMPTOMS BEFORE AND AFTER DIAGNOSIS

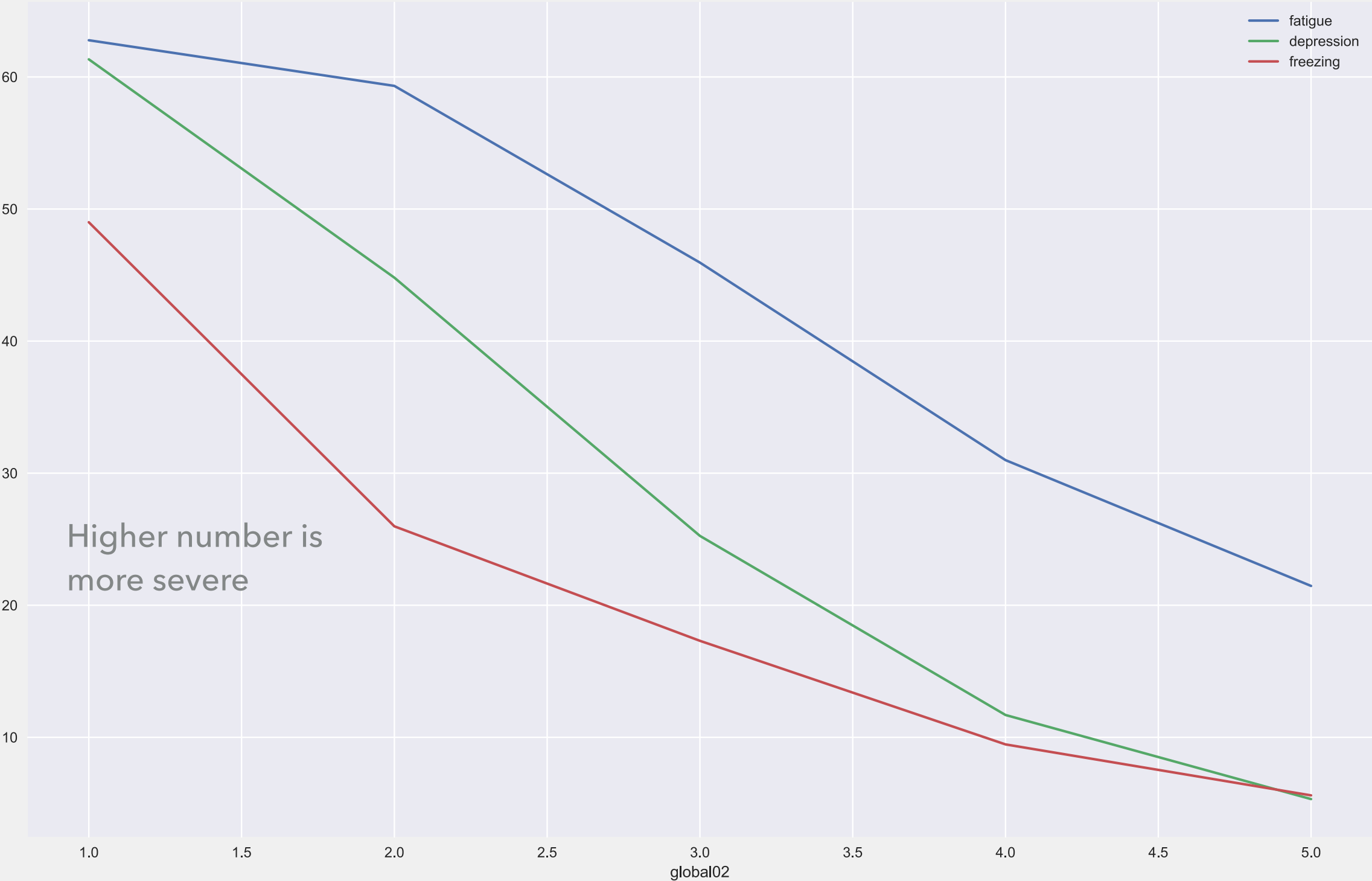


SMELL LEADS KEY SYMPTOMS ACROSS STUDY VERSIONS



FATIGUE, DEPRESSION, FREEZING PREDICT POOR QUALITY OF LIFE

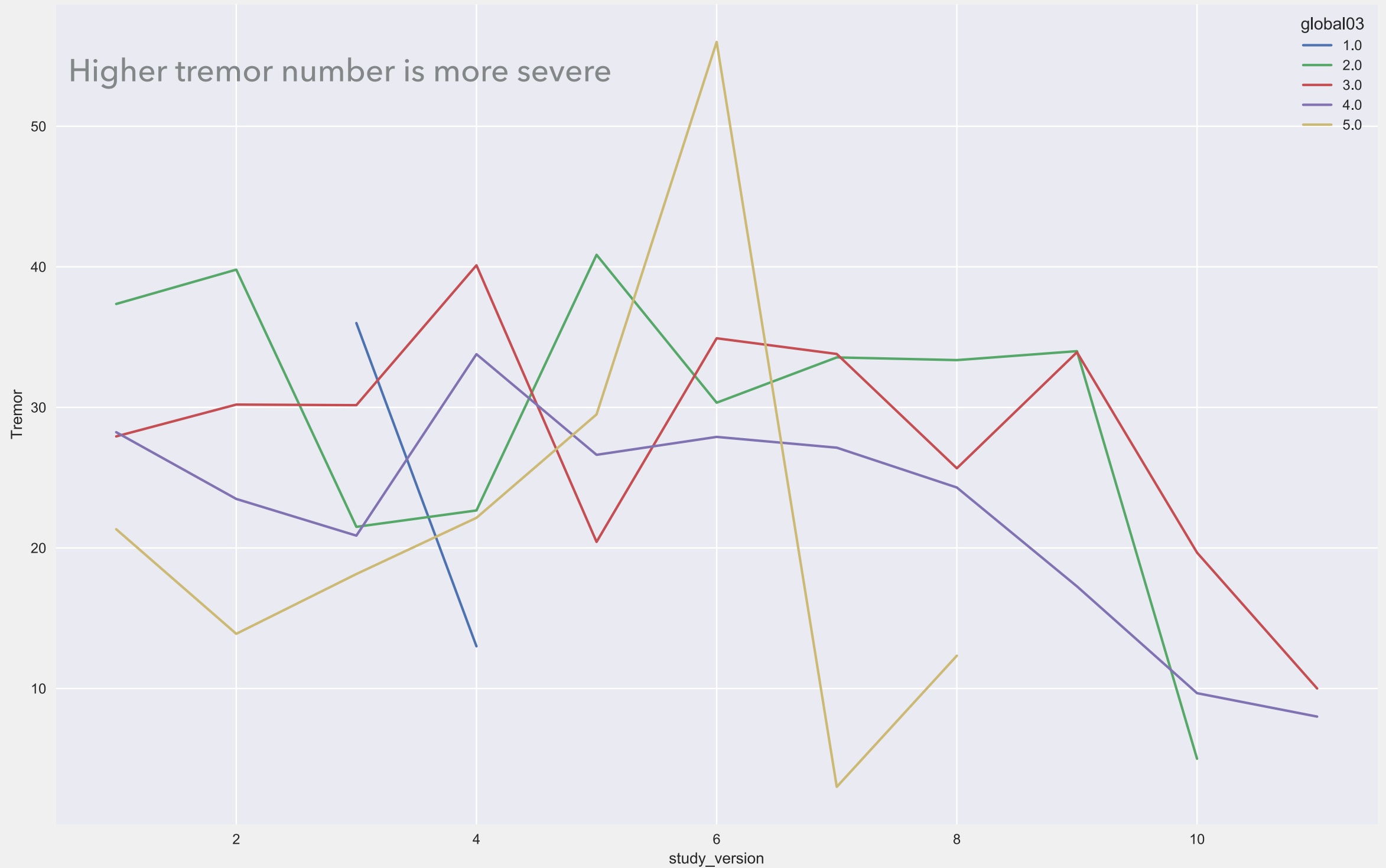
In general, would you say your quality of life is ...
5, Excellent | 4, Very good | 3, Good | 2, Fair | 1, Poor



TREMOR IS NOT A CLEAR INDICATOR OF POOR PHYSICAL HEALTH

In general, how would you rate your physical health?
5, Excellent | 4, Very good | 3, Good | 2, Fair | 1, Poor

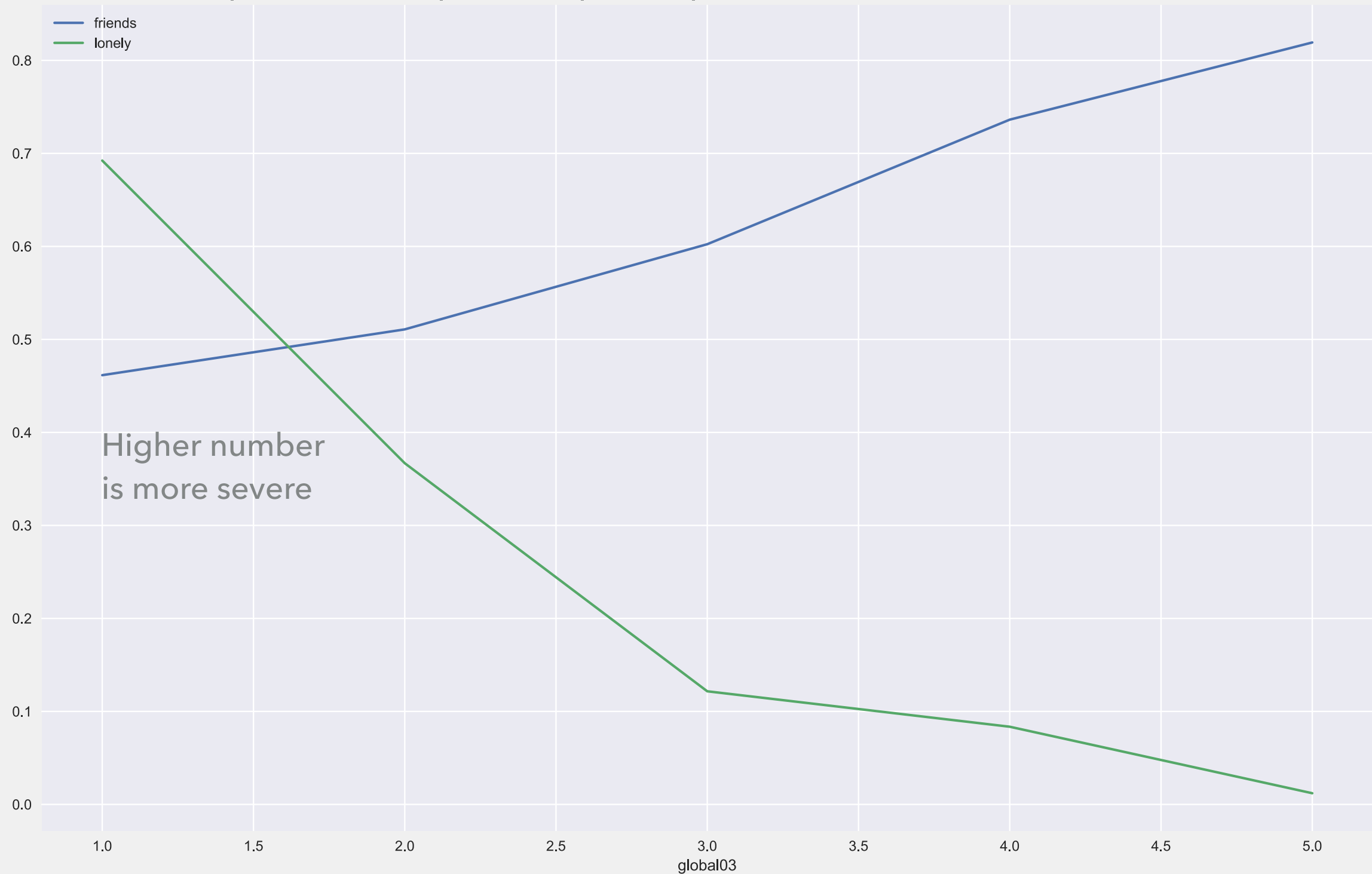
Higher tremor number is more severe



Impact of loneliness

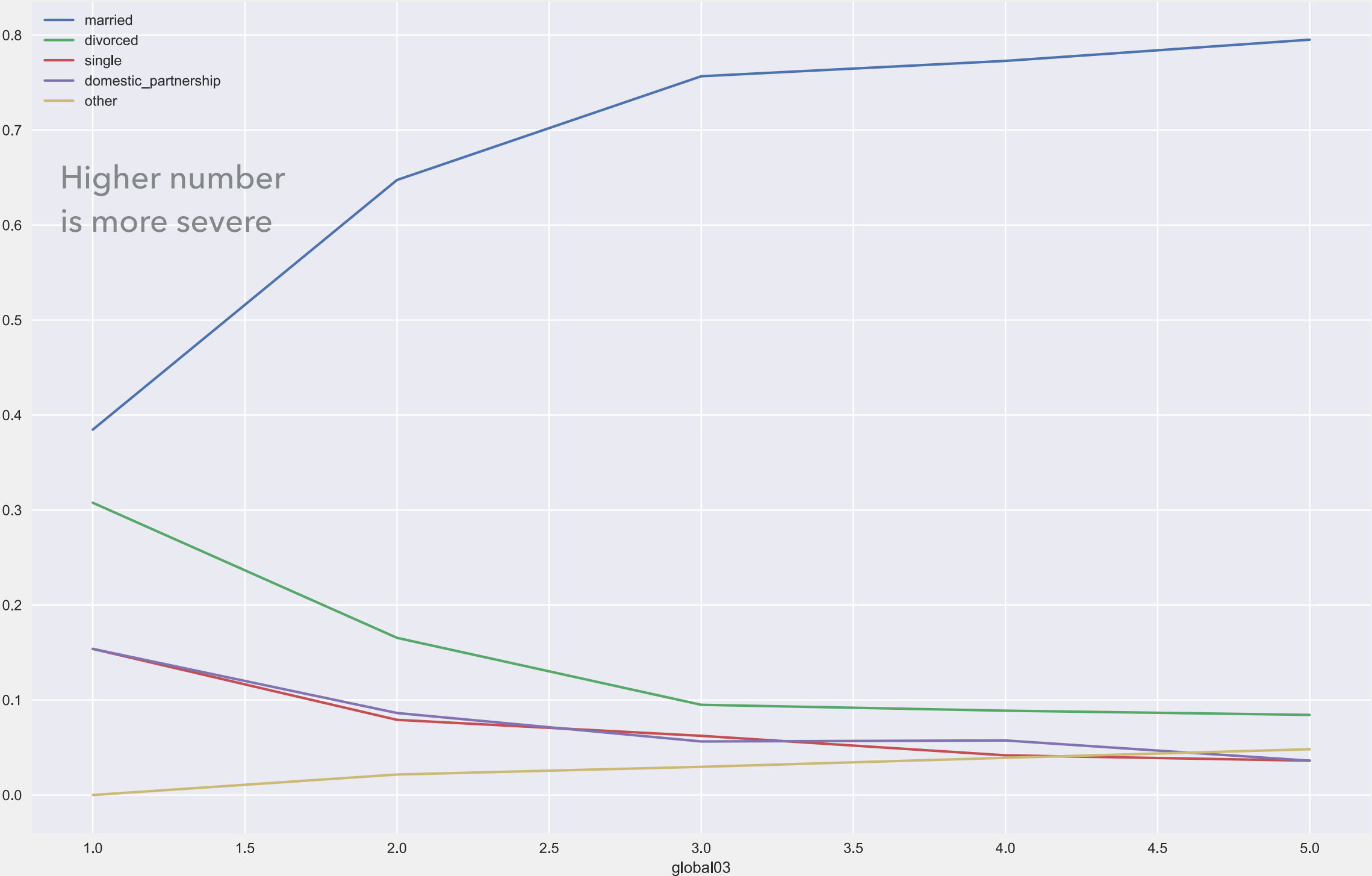
LONELINESS AND FRIENDS IMPACT PHYSICAL HEALTH

In general, how would you rate your physical health?
5, Excellent | 4, Very good | 3, Good | 2, Fair | 1, Poor



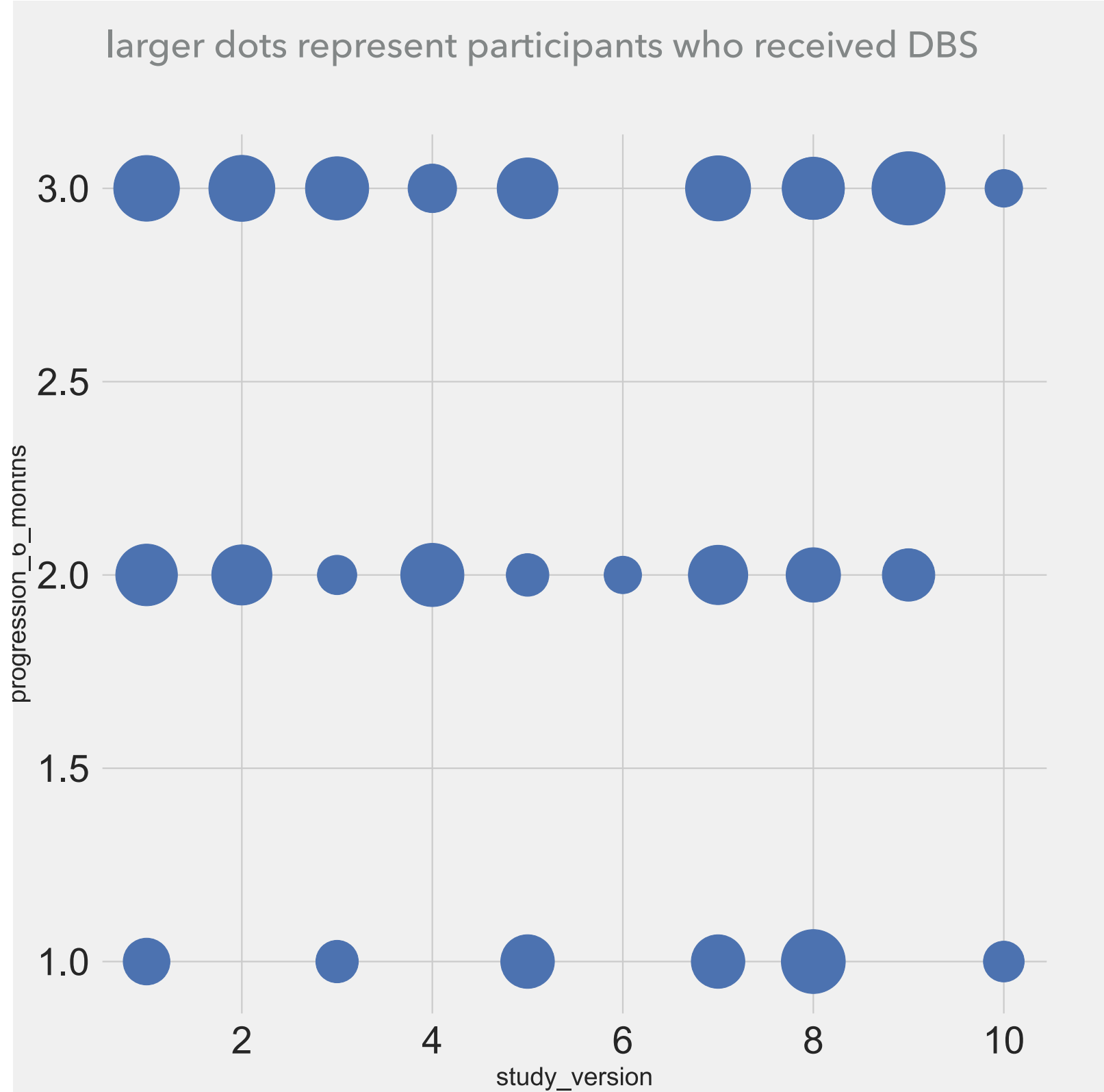
MARITAL STATUS POSITIVELY IMPACTS PHYSICAL HEALTH

In general, how would you rate your physical health?
5, Excellent | 4, Very good | 3, Good | 2, Fair | 1, Poor



Deep Brain Stimulation (DBS)

DEEP BRAIN STIMULATION DOES NOT FORESTALL DISEASE PROGRESSION



Over the past 6 months, would you say your disease has:

- 1, Improved
- 2, Been stable
- 3, Worsened

Deep Brain Stimulation

Electrodes are placed on the brain, then connected to a battery-operated device placed under the skin below the collarbone. This neurostimulator delivers continuous electrical pulses through the electrodes to decrease Parkinson's symptoms.

Conclusions

CONCLUSIONS

- ▶ Non-motor symptoms such as loss of smell and sexual dysfunction are earlier indicators of Parkinson's than motor symptoms
- ▶ Fatigue, depression and feeling of freezing are predictors of poor quality of life
- ▶ Tremor is not a good indicator of poor health
- ▶ Loneliness and having few friends negatively affect physical health, while married status positively affects it
- ▶ Deep brain stimulation seems to be connected with worsened disease conditions, more analysis is needed

NEXT STEPS

- ▶ Review analysis with researcher to inform next iteration of study
- ▶ Consider rate of change of symptoms across study versions, and with deep brain stimulation
- ▶ Dummy out more columns to better evaluate study population