

COVID-19: Is there a Significant Relationship Between Total Symptoms and Population Density or Income Level?

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INTRODUCTION

The pandemic caused by SARS-CoV-2 (COVID-19) is aggressively changing the world. To date, over 63 million cases are confirmed worldwide, and nearly 1.5 million people have died (World Health Organization, 2020). Early study results indicate virus infection rates are higher among less-educated minority groups (Hamidi et al., 2020). We explore early 2020 COVID-19 data, collected from 7,505 individuals who live within 18 American geographic areas (COVID Impact Survey, n.d.).

This study investigates whether there is a significant relationship between COVID-19 symptoms and population density or between symptoms and income level. Connectivity within population is considered more substantial to COVID-19 spread than density (Hamidi et al., 2020). However, due to the early understanding of virus spread, some researchers suspect that highly populated areas are hit harder than others; they also suggest that improved health outcomes are related to increased social distancing—more common among communities where individuals earn higher incomes and have more education (Maroko et al., 2020).

To test for significance, we first tallied the number of COVID-19 symptoms reported by the sample group: Scores range from 0-15. Using symptom scores, we test for significance across four distinct income levels; we also test for symptom significance against urban, suburban, and rural populations. We hypothesize that individuals living in urban areas will experience more total symptoms than those in other population groups; similarly, that people with lower incomes will experience more total symptoms than other earners.

METHODS

The total symptom score (continuous variable) was measured against population density and income level (categorical variables); each variable has multiple groups.

- Population density: three groups (urban, suburban, rural).
- Income level: four groups (Less 30K, 30K-60K, 60K-125K, 125K+).

The sample size was 7,505.

Data were analyzed using descriptive statistics in RStudio

- frequency tables, summary, histograms, bar plots
- bivariate graphs, proportion tables

Data were tested using inferential statistics in RStudio

- one-way analysis of variance, Tukey HSD, 'by command'

Symptom Total Summary

Min.	Q1	Median	Mean	Q3	Max.
0	0	1	1.946	3	15

Symptom Total ~ Population Density

	N	Mean	SD	DF	SS	MS	F-Statistic	P-Value
urban	442	1.91	2.31	2	42	21.056	3.842	0.0215*
suburban	1194	2.11	2.44	7502	41116	5.48		
rural	5869	1.98	2.45					
	7505							

Symptom Total ~ Income Level

	N	Mean	SD	DF	SS	MS	F-Statistic	P-Value
Less 30K	1760	2.30	2.69	3	473	157.75	29.02	<2e-16***
30K-60K	1838	2.10	2.35	7333	39861	5.44		
60K-125K	2496	1.78	2.11					
125K+	1243	1.6	1.95					
NAs	168							
	7505							

CONCLUSIONS

When examining the association between the total number of symptoms and population density, our statistical tests reveal that of individuals reporting symptoms, those within suburban areas had the highest total symptom value ($M = 2.1$, $SD = 2.44$).

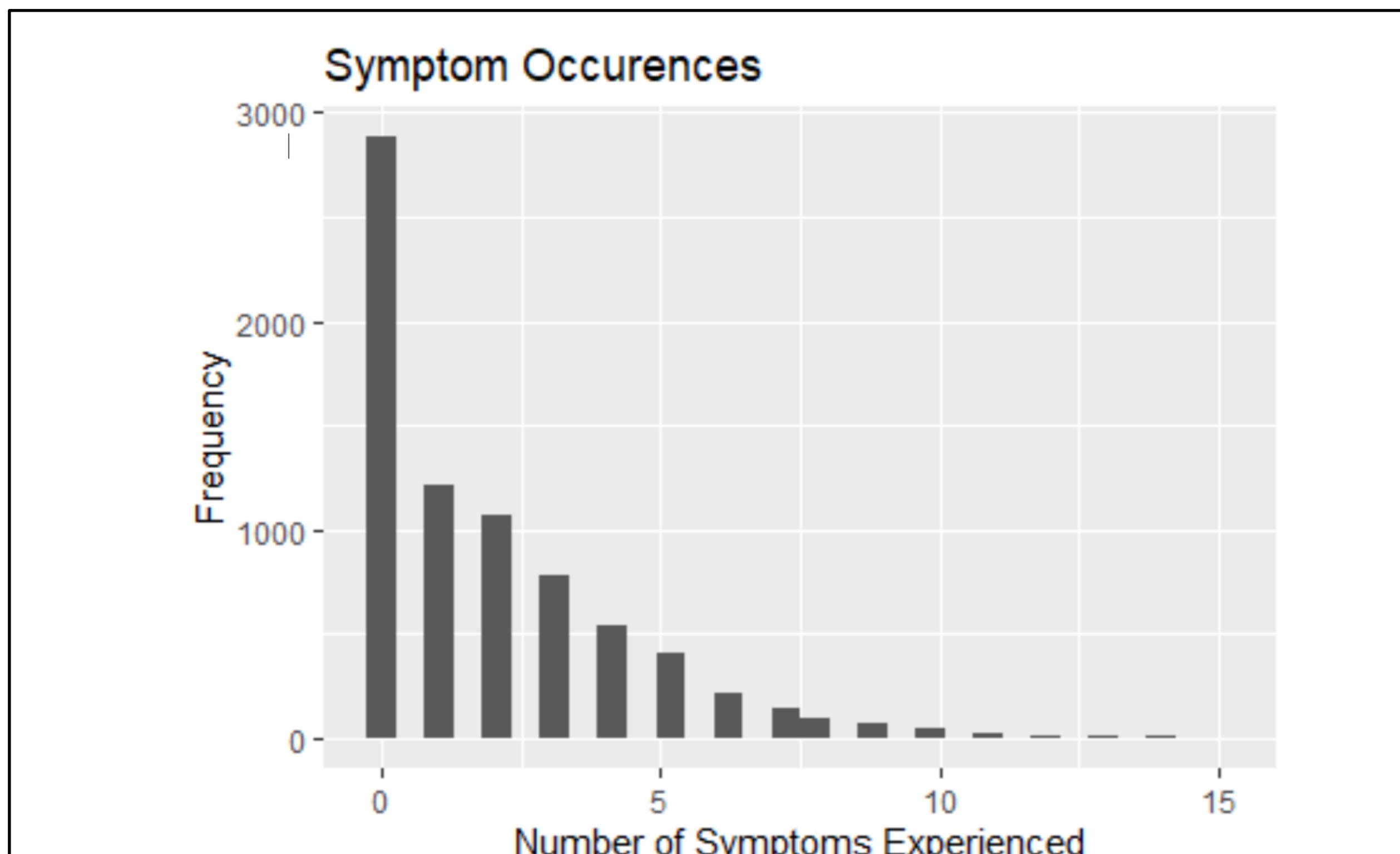
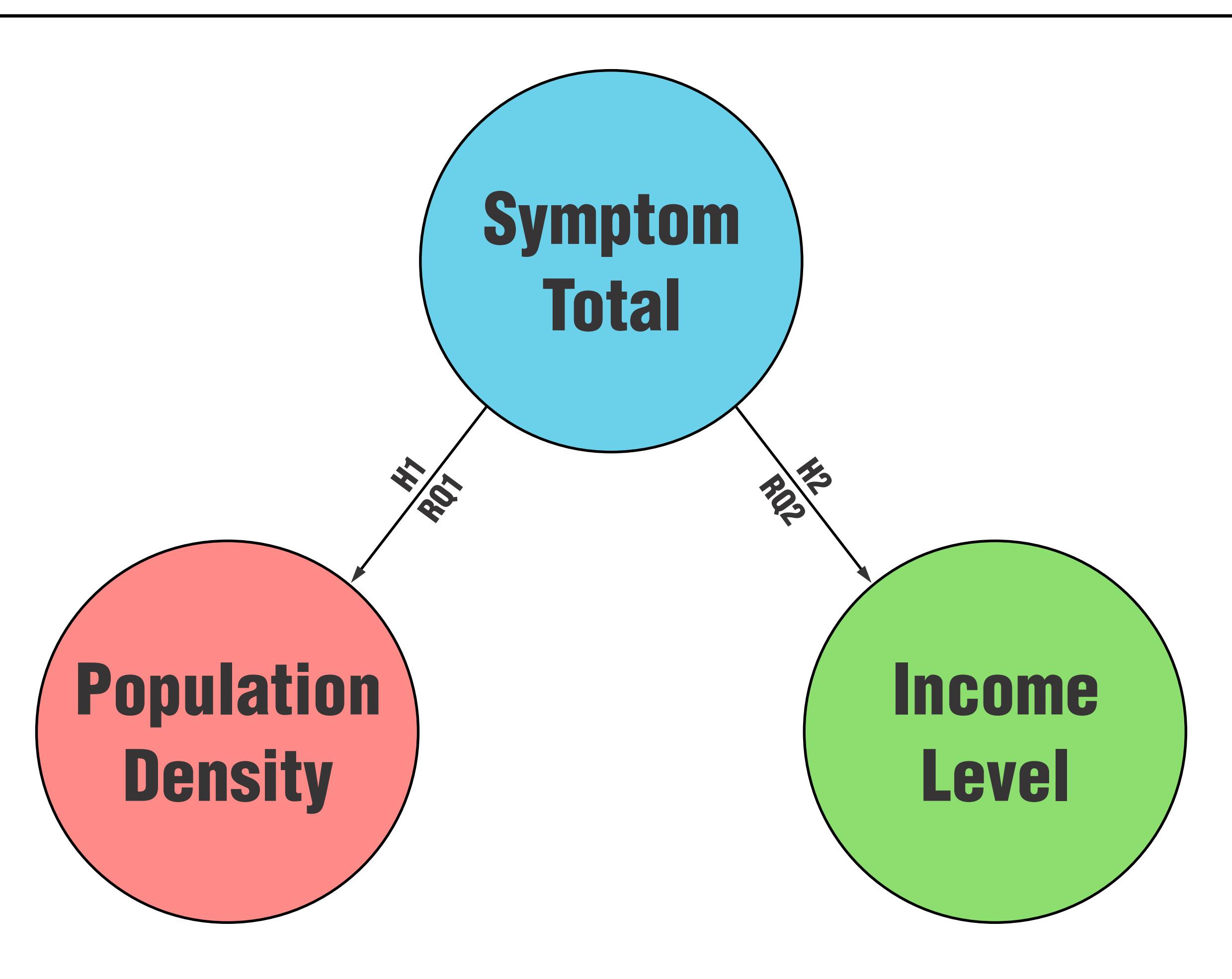
Though mean values do vary, they are quite close, so symptoms and population may not be closely related. Findings indicate that the average number of symptoms are not highest in urban areas, proving H1 incorrect.

When examining the association between the total number of symptoms and income category, our statistical tests reveal that of individuals with symptoms, those in the lowest income category had the highest total symptom value ($M = 2.3$, $SD = 2.69$).

Findings indicate that the average number of symptoms decreases as income increases, proving H2 correct.

REFERENCES

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RESULTS

Symptom Total ~ Population Density

- returned a p -value = < 0.05
- all means are not equal, we accept significance and reject the Null Hypothesis
- only suburban~urban shows significance in Tukey HSD

Symptom Total ~ Income Level

- returned a p -value = < 0.0215
- all means are not equal, we accept significance and reject the Null Hypothesis
- of lines 1-6, only 2-5 show significance in Tukey HSD