Are we living in a depressive society?*

Trends in symptoms of depressive disorder in the US population from May 2020 to March 2024

Chay Park

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This study explores how socio-cultural factors like age, sex, race/ethnicity, and education level influenced depressive disorder in the U.S. during and after the COVID-19 pandemic, analyzing data from 2020 to 2024. Using statistical methods in R, it uncovered variations in mental health impacts across different demographic groups. The research reveals a complex relationship between socio-cultural factors and mental health, highlighting the increased vulnerability of certain populations during global crises. The findings contribute to the development of targeted public health measures to alleviate mental health issues amid and following pandemics, enhancing our understanding of the impact of socio-cultural factors on mental well-being in times of crisis.

1 Introduction

Depression and anxiety are not only prevalent but escalating issues in the modern world, affecting individuals across the globe regardless of demographic factors (World Health Organization, 2021). These mental health challenges have been further exacerbated by the COVID-19 pandemic, which led to widespread social and economic upheaval (Brooks et al., 2020). While various studies have explored the impact of the pandemic on mental health, there remains a significant gap in understanding the interactions between socio-cultural factors and the prevalence of anxiety and depressive disorders during this period (Pfefferbaum & North, 2020).

This paper addresses this gap by analyzing data from the U.S. Census Bureau's Household Pulse Survey, initiated in response to the pandemic to assess its effects on American households, including mental wellness (U.S. Census Bureau, 2020). Our analysis focuses on the correlation between the prevalence of anxiety or depressive disorders and socio-cultural factors such as age, sex, race/ethnicity, and education level during the pandemic and post pandemic years of

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*Code and data are available at: https://github.com/Chay-HyunminPark/Anxiety_depressive_disorder.

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2020 to 2024. Specifically, the estimand of this study is the difference in the rates of symptom of depressive disorders across individuals, correlated with socio-cultural factors including age, sex, race/ethnicity, and education level.

Employing a quantitative methodology, this paper utilizes R (R Core Team 2020) for analysis. We utilized packages like ggplot2 (Wickham et al., 2016) and gridExtra (Murrell, 2021) for data analysis and visualization. Our findings reveal significant trends and disparities in the rates of anxiety and depressive disorders across different socio-cultural groups, highlighting the intricate relationship between these factors and mental health outcomes during the pandemic.

The importance of this research lies in its potential to inform public health policies and interventions, aiming to mitigate the adverse effects of such global crises on mental health (Xiong et al., 2020). By understanding the specific socio-cultural factors that contribute to increased vulnerability to anxiety and depressive disorders, targeted strategies can be developed to support affected populations more effectively.

The paper is structured to first present the trend analysis of anxiety and depressive disorder rates in the U.S. from 2020 to 2024, followed by an examination of how these rates vary across different demographic groups. Subsequent sections discuss the statistical methods and results for each research question. It opens up the findings and let the world explores their broader implications for mental health research and policy. The conclusion summarizes the key insights, acknowledges the limitations of the study, and suggests avenues for future research.

The study focuses on answering the following research questions:

- What is the trend in US anxiety and depressive disorder rates from 2020 to 2024?
- How do depressive rates vary across different age groups?
- How do depressive rates differ based on race and ethnicity?
- How do depressive rates differ based on sex?
- How do depressive rates differ based on education level?
- Is there codependency of social connection on one's depression level?

Through this analysis, we aim to better understand contributing factors of mental wellness of the US population. Furthermore, we display possible correlation between factors and the mentall wellness states.

2 Data

2.1 Methodology

The U.S. Census Bureau, in collaboration with five federal agencies, launched the Household Pulse Survey to produce data on the social and economic impacts of Covid-19 on American households. The Household Pulse Survey was designed to gauge the impact of the pandemic on employment status, consumer spending, food security, housing, education disruptions, and dimensions of physical and mental wellness (National Center for Health Statistics, 2024). In the paper, we will focus on the impact of the pandemic on mental wellness by analysing the dataset of the indicators of anxiety or depression based on reported frequency of symptoms. The data on the trend in US anxiety and depressive disorder rates, measured from 2020 to 2024, was sourced from the Centers for Disease Control and Prevention (CDC). Alongside with 'National Estimate' group in which covers the whole population trends, trends in anxiety and depressive disorder rates by population subgroup, specifically categorized by age, race and ethnicity, sex, education groups were gathered from the National Center for Health Statistics (NCHS). The data is freely available at https://data.cdc.gov/NCHS/Indicators-of-Anxiety-or-Depression-Based-on-Repor/8pt5-q6wp/about_data, with raw files located in the inputs/data on the GitHub repository.

2.2 Features

In this paper, data validation is conducted using an R script file named '03-test_data' to ensure the accuracy of the dataset obtained directly from the source. The paper utilizes both 'Indicators_of_Anxiety_or_Depression_Based_on_Reported_Frequency_of_Symptoms_During_Last_7_Days_20240401' and 'Lack_of_Social_Connection' CSV files. Then by the characteristics of the group, the data sets are separately saved as 'Age_subgroup_trends' where it only saves the rows with 'By Age' under the 'Group' column, irrespective of race and ethnicity. Similarly, 'Educ_subgroup_trends' are the dataset only with the rows 'By Education' under the 'Group' column to identify the patterns of each population subgroup with classification of highest educational attainment, regardless of race and ethnicity. All CSV files are saved as parquet file. Due to its functionality, as opposed to row-based formats like CSV or Excel, Parquet allows it to efficiently handle analytical queries by accessing only the necessary columns of data, which reduces storage reads, improves query performance, and lowers storage costs. The column 'Value' is used to denote the symptom rate on the y-axis. Column 'Time Period End Date' is used to denote the range of the period, a date for the x-axis.
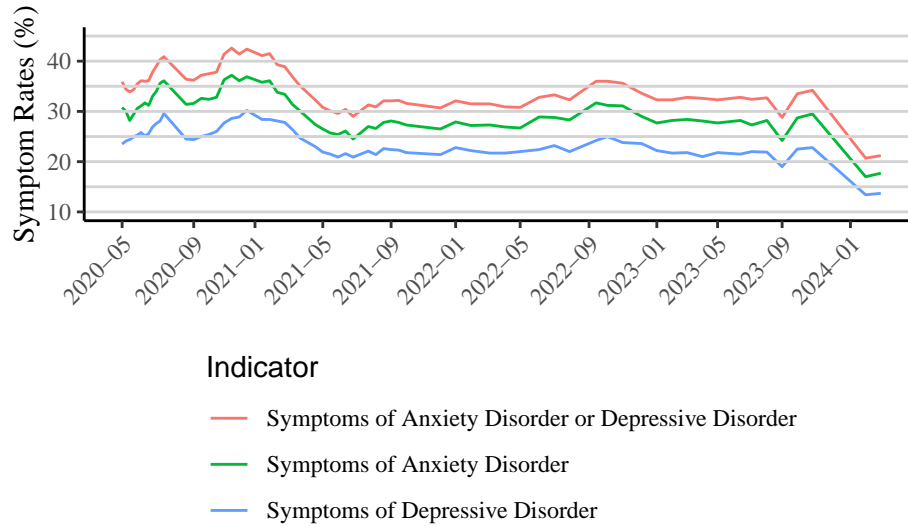
Figure 1: Trend in US Anxiety and Depressive Disorder Rates

3 Results

3.1 Trend in US Anxiety and Depressive Disorder Rates

The overall trend in US anxiety and depressive disorder rates Figure 1 shows significant fluctuations over the observed period, with several notable peaks indicating heightened rates of reported symptoms. For instance, one of the highest peaks occurs in early 2021, where the rate of symptoms for combined anxiety and depressive disorders reaches approximately 45%. This peak reflects a substantial increase compared to earlier peeriods. Another significant peak, observed in mid-2022, sees rates approaching closer to 36-37%, illustrating another period of notable increases in symptoms among the population.

These peaks are interspersed with valleys, such as in late 2020, where rates temporarily din to around 25%, demonstrating the episodic nature of these conditions. The plot also highlights a general trend of increasing rates from the onset of the data in 2020 through to peaks in 2021, followed by some fluctutation but maintaining relatively high levels overall.

In late 2023, there is a notable decline in the symptom rates for both anxiety and depressive disorders, suggesting a potential easing of these mental health challenges or the effectiveness of interventions and strategies implemented over the period. This decrease is significant as it may indicate periods of relief amidst the prevailing trends of increasing disorder rates, which could be crucial for future public health planning and policymaking.

The Figure 1 provides a line graph visualization of these rates over time. This visual representation allows for clear observation of trends and seasonal variations, with specific dates marked on the x-axis to aid in pinpointing changes.

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3.2 Trends in Depressive Disorder Rates by Population Subgroup
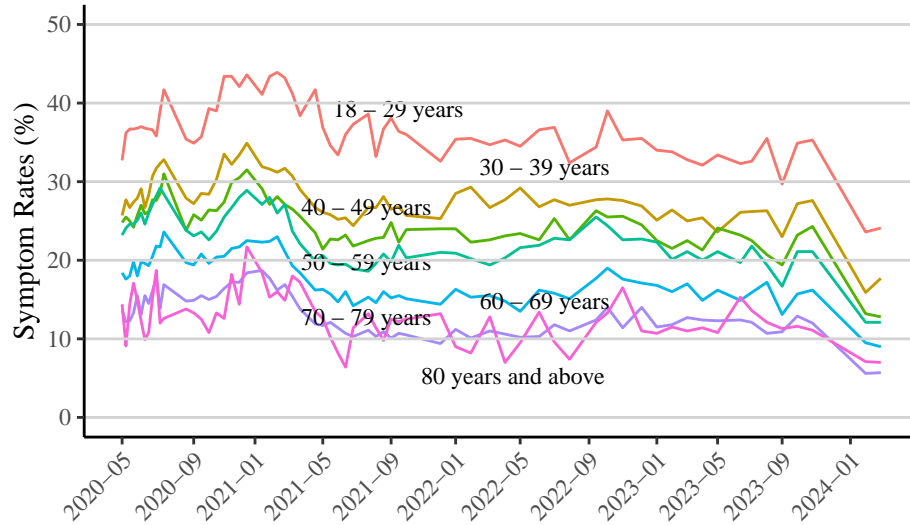
3.2.1 Population subgroup by age

Figure 2: Depressive Disorder Trend by Population Subgroup by Age

Figure 2 illustrates the trends in depressive disorder rates by population subgroup segmented by age, covering the period from May 2020 to March 2024. This graph reveals several key insights about how depressive symptoms have fluctuated across different age groups during and potentially influenced by the ongoing global and societal changes. The line graph distinguishes each age group with a separate line, showing the trend of depressive disorder rates for each demographic:

1. **Young Adults (18-29 years):** This group shows relatively higher rates of depressive symptoms throughout the period, with peaks that suggest increased vulnerability during certain times. Notable spikes might correlate with specific events or seasons, indicating external impacts on mental health. During the period, the symptom rates of this group are generally 10% higher than the second highest age group. Moreover, it is observed that there is 20% difference gap with the lowest symptom rates age group, 80 years and above.

2. **Middle-aged Groups (40-59 years):**This line show moderate fluctuation but generally less variance compared to younger adults or older adults. Middle-aged groups generally locate in between 30 -39 years young adult group and 60 - 69 years old adults group. However, on 2023 May, middle-aged group 40 - 49 years exceeds 30 - 39 years young adults group by a few percentage of symptom rates. Overall, both 40 - 49 years age group and 50 - 59 years age group demonstrate similar trends with some points

where symptom rates of 50 - 59 years age group surpassed 40 - 49 years age group. For instance, 2021 March and 2022 September.

3. **Old Adults (80 years and above):** Most fluctuating age groups, with a peak in 2021 January and multiple lowest peaks including 2021 July, 2022 March, and 2022 August. This group still score below than majority of the age groups but
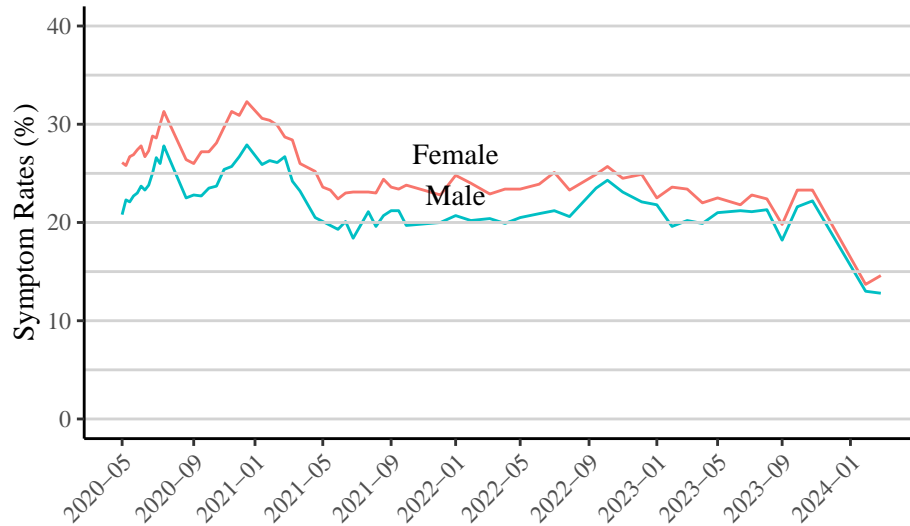
3.2.2 Population subgroup by sex

Figure 3: Depressive Disorder Trend by Population Subgroup by Sex

Figure 3 differentiates between the two sex subgroups, highlighting the trends in depressive disorder rates for each:

1. **Female Subgroup:** This line consistently shows higher rates of depressive symptoms compared to the male subgroup. The trend line for females exhibits several pronounced peaks which suggest periods of increased stress or exacerbation of symptoms. The higher overall symptom rates in this subgroup might reflect the broader social, economic, and perhaps biological factors that influence mental health disparities between sexes.

2. **Male Subgroup:** Although the rates for the male subgroup are generally lower than those for females, the trend line still shows significant fluctuation with similar peaks and troughs, indicating that males are also significantly affected by the same factors that increase depressive symptoms.
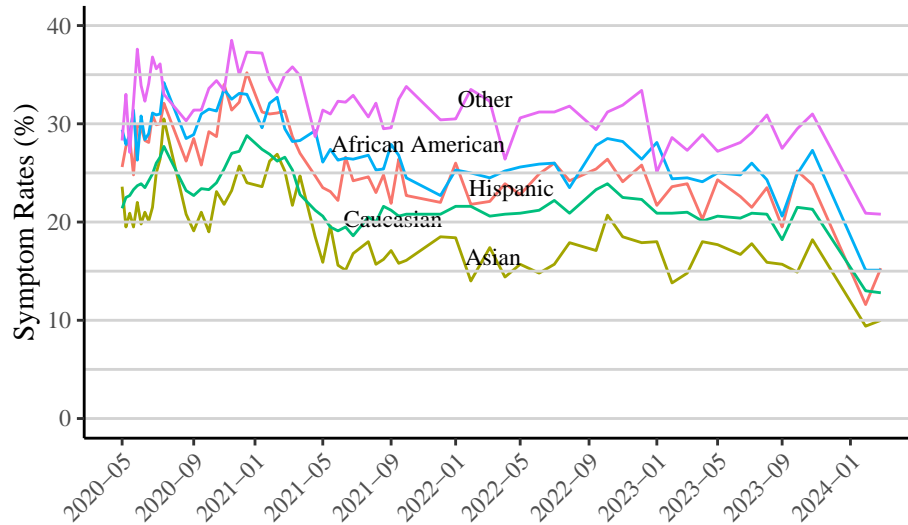
Figure 4: Depressive Disorder Trend by Population Subgroup by Race

3.2.3 Trends in Depressive Disorder Rates by Population Subgroup by Race and Ethnicity

The line graph in Figure 4 shows the depressive disorder rates for several race and ethnicity subgroups, including Hispanic, Caucasian, African American, Asian, and Other (Non-Hispanic, other races and multiple races). Each line represents the trend within a specific subgroup, providing a visual representation of how symptom rates have evolved over the specified period.

1. **Hispanic and African American Subgroups:** These lines indicate relatively higher rates of depressive symptoms compared to other groups.

2. **Caucasian Subgroup:** This group generally shows lower symptom rates than the Hispanic and African American subgroups but follows a similar trend of fluctuations.

3. **Asian Subgroup:** Typically, this line shows the lowest symptom rates among the subgroups.

4. **Other (Non-Hispanic, Other Races and Multiple Races):** This category shows a unique trend with variability.

3.2.4 Trends in Depressive Disorder Rates by Population Subgroup by Education

This analysis highlights the variations in depressive disorder rates across different educational subgroups in the US, utilizing data from mid 2020 up to early 2024. The visualization provided in the **?@fig-educationandtrend-graph** reveals distinct temporal trends across various education demographics, illustrating how depressive symptoms fluctuate over time among these groups.
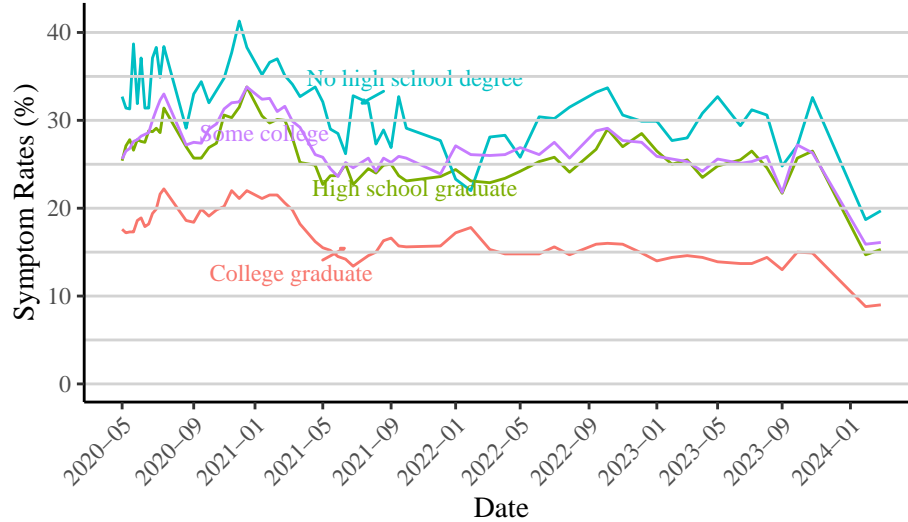
Figure 5: Depressive Disorder Trend by Population Subgroup by Education

Detailed Analysis of Trends by Education Level Figure 5 presents the depressive disorder rates for several educational subgroups, including those with a college degree or higher, some college or an associate's degree, a high school diploma or GED, and less than a high school diploma. Each line represents the trend within a specific educational subgroup, offering a visual representation of how mental health issues vary based on educational attainment.

1. **College Graduate or Higher:** This subgroup typically shows the lowest rates of depressive symptoms, which might indicate better access to resources, stronger economic stability, or higher awareness and utilization of mental health services.

2. **Some College/Associate's Degree:** Individuals in this group exhibit slightly higher rates than those with higher education but still lower than the less educated groups. This might reflect a mid-level access to resources and varying levels of stress related to educational and career expectations.

3. **High School Diploma or GED:** This subgroup shows higher rates of depressive symptoms compared to those with more education. The increased rates could be linked to economic challenges, job market limitations, or the stress associated with lower social mobility.

4. **Less Than a High School Diploma:** This group consistently shows the highest rates of depressive symptoms, indicating significant vulnerabilities. Factors such as lower economic stability, limited access to healthcare, and higher life stressors likely contribute to these higher rates.
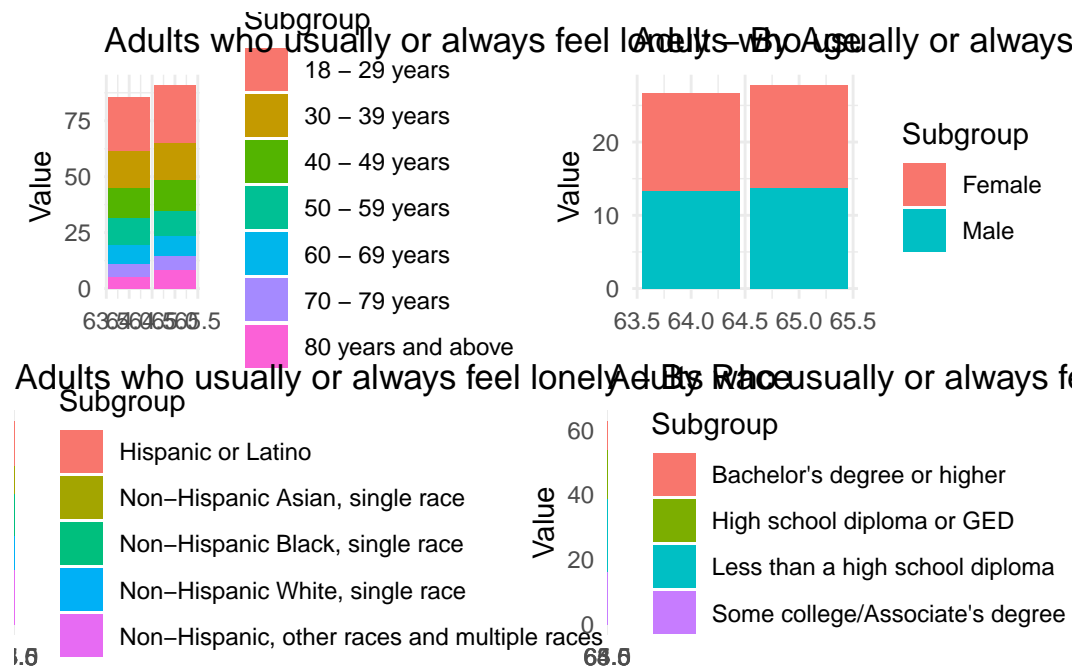
Figure 6: Adults who usually or always feel lonely

4 Model

4.1 Model set-up

4.1.1 Model justification

5 Discussion

What is done in this paper? What is something that we learn about the world? What is another thing that we learn about the world?

5.1 Findings

5.1.1 Discussion of Results

Figure 2 indicates that while all age groups experienced fluctuations in depressive disorder rates, younger adults consistently reported higher rates. This could be due to a variety of factors including economic instability, career pressures, or social isolation, particularly accentuated by the pandemic. Trends of older adults, age 50 or more, might reflect accumulating stresses or health-related issues as they age, especially during challenging times like the pandemic. The

peaks and valleys in the Figure 2 correlate with the unfolding of global events, particularly the COVID-19 pandemic, which has been a significant stressor impacting mental health across all demographics. The data shows how these impacts vary significantly with age, suggesting that age-specific interventions might be necessary to address the mental health needs of different populations effectively.

Figure 3 suggests that both subgroups follow fairly similar trends over time, with both lines rising and falling in tandem. However, the female population consistently reports higher symptom rates than the male population. This persistent disparity can be indicative of the different ways in which depressive disorders manifest and are reported across genders, possibly influenced by societal roles, expectations, and differing stressors.

African American and Hispanic group, Peaks within these subgroups from Figure 4 might correspond to specific social or economic stressors that disproportionately affect these communities. Caucasian group, The graph points to underlying factors that may influence mental health across different community settings.

Trends of the other group might reflect the diverse socio-economic and cultural backgrounds within this subgroup.

Discussion of Results of the education subgroup The trends across educational subgroups underscore the strong correlation between educational attainment and mental health outcomes. Higher education often provides better opportunities for employment and income, which are crucial determinants of mental health. Conversely, lower educational attainment is closely associated with various life stressors that exacerbate mental health issues.

5.2 Ethical Implication

5.2.1 Implications

The data underscores the need for targeted mental health services and interventions that cater specifically to the unique needs of different age groups. Understanding these trends helps in planning public health strategies and allocating resources more effectively to manage and mitigate depressive disorders among the population.

In conclusion, the depressive disorder rates among different age groups provide crucial insights into the mental health landscape during and following significant global crises. These trends highlight the importance of continuous monitoring and responsive public health strategies to support mental wellness across the lifespan.

The depressive disorder rates among different educational groups emphasize the need for policy interventions that consider the intersection of education, economic stability, and mental

health. Tailoring mental health services to meet the needs of people across different educational backgrounds can lead to more effective prevention and treatment strategies, ultimately reducing the overall burden of depressive disorders in society. _____

5.3 Limitation

– What are some weaknesses of what was done? – The survey was designed to meet the goal of accurate and timely weekly estimates. Hence, it was conducted by an internet questionnaire, with invitations to participate sent by email and text message (National Center for Health Statistics, 2024). Internet questionnaires face several significant challenges. One of the primary concerns is self-selection bias, where the survey tends to attract respondents who are particularly interested in the topic, which can skew the results and limit their generalizability. Additionally, these surveys may not reach a diverse demographic due to varying levels of internet access across different population segments, thus excluding certain groups, such as older adults or lower-income individuals, and potentially leading to a lack of representativeness. Respondents might also misunderstand or misinterpret questions without the opportunity for real-time clarification, compromising the accuracy of the data collected. Privacy and security concerns are prevalent too, as individuals may be hesitant to share personal or sensitive information online for fear of data breaches or doubts about the survey platform's security measures. Lastly, the validity and honesty of responses are at risk; while the anonymity of online surveys can encourage candidness, it might also lead to less thoughtful or dishonest answers, affecting the reliability of the survey outcomes (Dillman, Smyth, & Christian, 2014; Morling, 2018).

5.4 Future Research

– What is left to learn or how should we proceed in the future? – For future research, survey can further ask what are the factors that affect their mood.

Appendix

A Additional data details

B Model details

B.1 Posterior predictive check

B.2 Diagnostics

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