BIOSTAT 629 001 WN 2021 Final Presentation: Sleep Quality in Times of Covid-19 Pandemic

Wenjing (Katrina) Zhou

University of Michigan, Department of Statistics

03/18/2021

Background

- Coronavirus disease 2019 (COVID-19) outbreak:
  - social distancing, staying in place order
  - isolation, decrease in exercise time, stress and anxiety
- MIPACT (Michigan Predictive Activity and Clinical Trajectories) Study:
  - electronic health records(EHR). participant survey data, genetic information, blood pressure measurements, and Apple Watch activity and clinical data
- **Goal:**
  - **1. Does sleep quality vary obviously due to COVID-19?**
  - **2. What are the factors influencing sleep quality?**

Data Files

- ActiveEnergyBurned_202004.csv, AppleExerciseTime_202004.csv :
  - all values are equal to one.
- BodyFatPercentage_202004.csv, BMI_202004.csv :
  - missing rates are 97.797% and 96.843%.

Data Files

- BloodPressureDiastolic_202004.csv, BloodPressureSystolic_202004.csv:
  - ParticipantResearchID, StartDate, Value
- EHR_Demographic_202010.csv :
  - ParticipantResearchID, EnrollmentDate, AgeAtEnrollment, GenderName, MaritalStatusName, RaceName
- Surveys_202004.csv :
  - Sleep quality, stress, mood
  - For question "In the past 7 days:My sleep quality was", each person only answers this question once.
  - ParticipantResearchID, SurveyName, SurveyStartDate, SurveyQuestion, SurveyAnswer

Data Exploratory

Mean and 95% confidence interval of people's answers to the questions: Over the last 2 weeks, how often have you been bothered by the following problems?

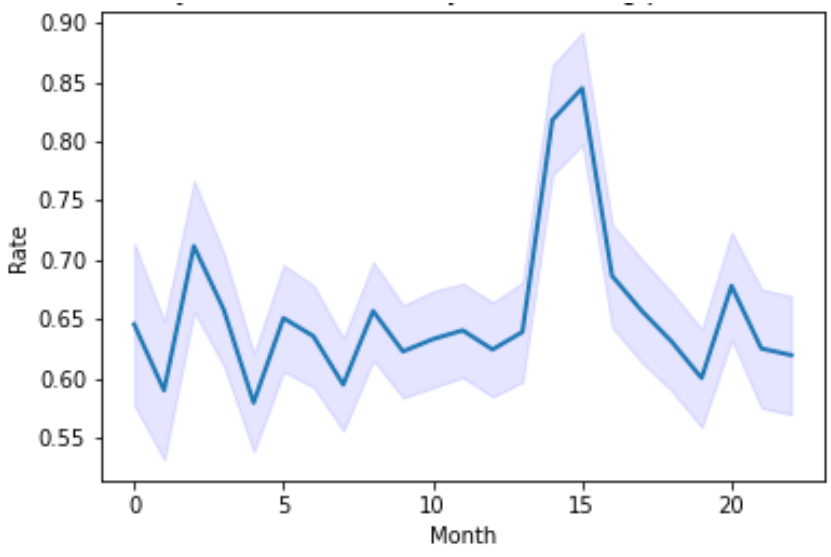

Figure 1: Feeling nervous, anxious, or on edge.

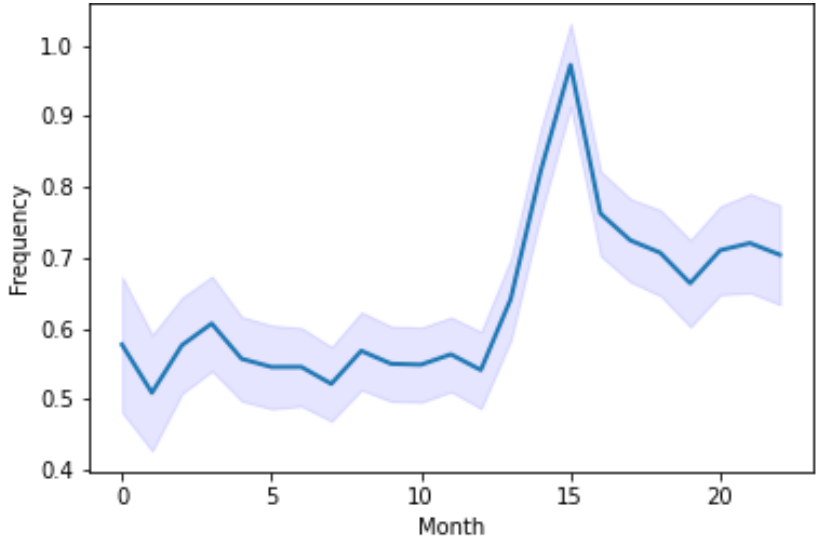

Figure 2: Feeling afraid as if something awful might happen

Data Exploratory

Mean and 95% confidence interval of people's answers to the questions:

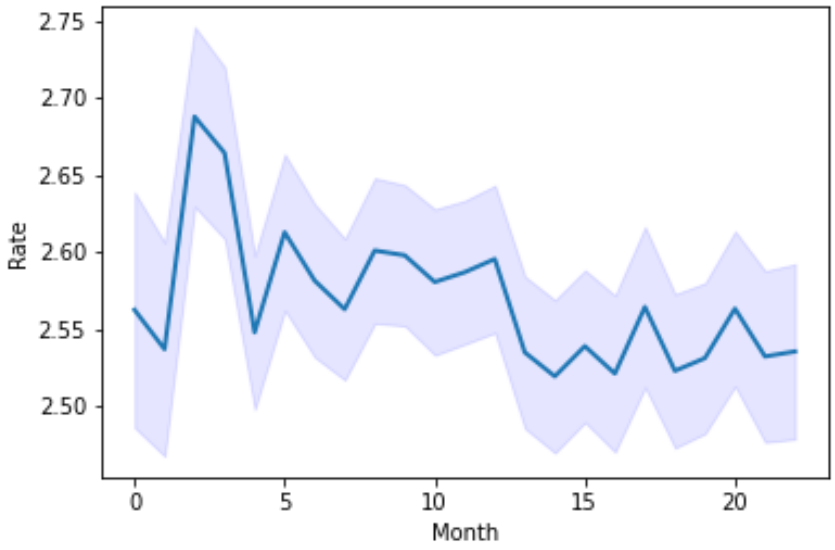

Figure 3: In the past 7 days: My sleep quality was: 1 - very good 2 - good 3 - fair 4 - poor 5 - very poor

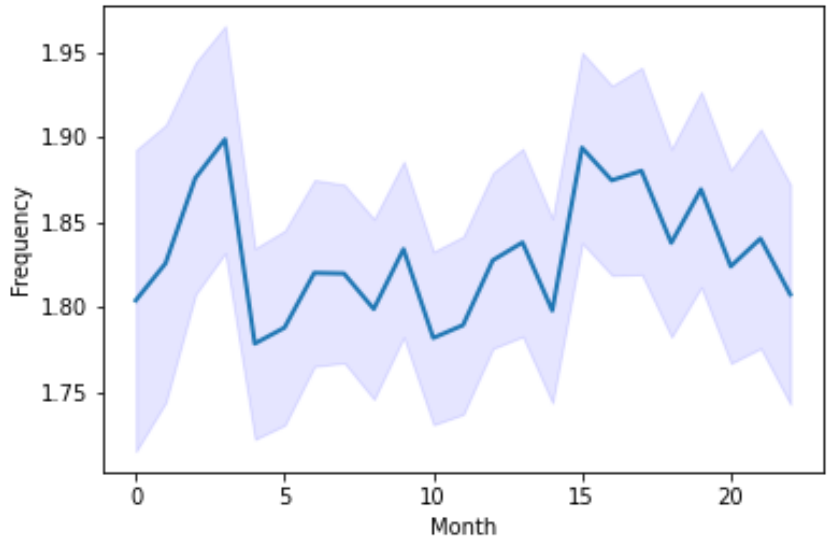

Figure 4: In the past 7 days: I had difficulty falling asleep. 1 - Not at all, 2 - A little bit, 3 - Somewhat, 4 - Quite a bit, 5 - Very much

Data Cleaning

- Use package dplyr to extract **BMI, bodyfat, age at enrollment, gender, marital status, race, mood, stress, sleep quality, systolic and diastolic blood pressure**.
- Change the age at enrollment to the actual age.
- Found each individual only has one response of sleep quality. Then average predictors, BMI, bodyfat, mood, stress and blood. pressure by individual
- Left join the sleep quality with predictors on ID.
  The shape of the data frame is (1362, 12) at this step.

Data Cleaning

- Check the proportion of missing in each column. See Table 1.
- Drop the columns of BMI and bodyfat.
- Drop all rows still containing NA's, accounting for about 10% of the total.
- The data is ready for analysis with the shape (1196, 10).

Variable	**Missing Proportion (%)**
bodyfat	97.797
BMI	96.843
marital status	7.048
mood	5.14
stree	5.14
diastolic	4.993
systolic	4.993
race	0.367
sleep quality	0
age	0
gender	0

Table 1: Missing proportion of variables

Data Exploratory

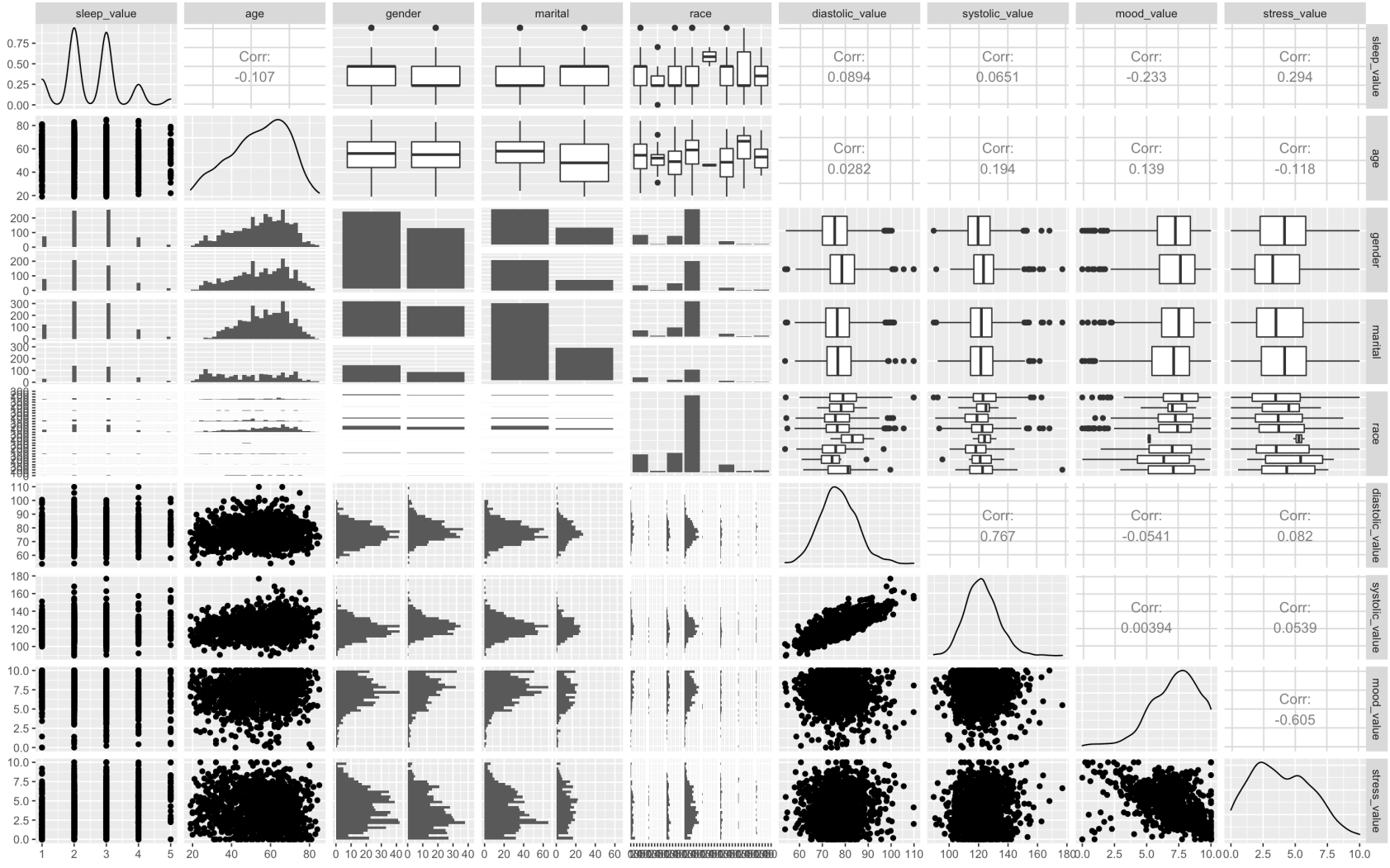

Figure 5: Visualization of covariates. (Left part: scatterplots of each pair of variables; Right: Pearson correlation; diagonal: variable distribution.)

Methods: simple Linear Model

$$sleepquality = \beta_0 + mood * \beta_1 + stress * \beta_2 + gender * \beta_3 + age * \beta_4$$

$$+ \text{ race * } \beta_5 + marital * \beta_6 + diastolic * \beta_7$$

Predictors	Coefficients	P Value
age	-0.00543	0.0060 **
raceAsian	-0.31586	0.0012 **
mood	-0.03920	0.0201 *
stress	0.08932	1.8e-10 ***

Table 2: Summary of the first model

Methods: Linear Model with Interactions

$$sleepquality = \beta_0 + mood * \beta_1 + stress * \beta_2 + gender * \beta_3 + age * \beta_4$$

$$+ \text{ race } * \beta_5 + marital * \beta_6 + diastolic * \beta_7 + marital :$$
$$age * \beta_8 + marital : mood * \beta_9 + marital : stress * \beta_10 + marital :$$
$$diastolic * \beta_11 + gender : diastolic * \beta_12$$

Predictors	Coefficients	P Value
stress	0.09201	5.7e-08 ***
age	-0.00974	0.00016 ***
raceAsian	-0.31854	0.00110 **
maritalUnmarried	-1.72704	0.00775 **
age:maritalUnmarried	0.00938	0.01172 *
maritalUnmarried:diastolic	0.01581	0.02118 *

Table 3: Summary of the second model

Results

- From 2019 to 2020, people's mental states were relatively stable.
- In April 2020, the population's anxiety increased significantly.
- From 2019 to 2020, overall, participants' sleep quality were getting better.
- From April 2020 to November 2020, people found falling asleep easier and easier, probably because they gradually got used to the new life style.
- Influencing Factors: stress, age, race, marital status, blood pressure.
- Interactions between marital status and other predictors are useful.

Discussion

- Limitation 1: not being able to include information about physical exercise.
- Limitation 2: only focus on April 2020.
- Next step: build two mixed effect models before April 2020, and after April 2020, to compare the different factors to sleep quality before and after COVID-19 started.

References

[1]Desana Kocevska, Tessa F Blanken, Eus JW Van Someren, and Lara Rösler.Sleep quality during the covid-19 pandemic: not one size fits all.Sleepmedicine, 76:86–88, 2020.
[2]Markku Partinen. Sleep research in 2020: Covid-19-related sleep disorders.The Lancet Neurology, 20(1):15–17, 2021.
[3]Jane F Reckelhoff. Gender differences in the regulation of blood pressure.Hypertension, 37(5):1199–1208, 2001.


Q&A