Covid-19 Pandemic, Demographic Factors and Time Spent Outside of the Home

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Background

The Covid-19 pandemic, and the subsequent nationwide quarantine, greatly impacted the amount of time people spend outside of their home. Previous research has shown that there are demographic, socioeconomic, and geographic differences in the amount of time people spent outside of the home during the pandemic. In this project I investigate the impact of the Covid-19 pandemic and other factors on the amount of time people in the U.S. spend outside of their home.

Research Question

- To what extent has the amount of time adults and children in the U.S. spend outside of their home returned to pre-March 13th 2020 levels in 2023?
- What factors are related to the amount of time a person spends outside of their home?

Note: "Outside" means outside of the person's own home or yard.

Data

Source: The data is from The Bureau of Labor Statistics' American Time Use Survey (ATUS), which measures the amount of time people spend doing various activities.

Population: The population for the study is the civilian noninstitutional population, aged 15 and older, and residing in households in the U.S.

Sample: The sampling method is a stratified three-stage sample.

Data Collection: An eligible person from each household is randomly selected to be the designated person for ATUS and is randomly assigned a day of the week about which to report. The data is collected through phone interviews.

Time Range: The data collected is from January 1, 2003 to December 31, 2023. Note: due to the Covid-19 pandemic, there was no data collected from March 18 to May 9, 2020.

Missing Values: A total of 880,047 observations have missing values for the location of the activity. After exploring the missing values, I concluded they are not different than the rest of the data, so I assume they are missing completely at random and drop them.

Return to Pre-Pandemic Levels?

- Subsetted data so it doesn't include any values from March 2020 - November 2023. Trained two models: one that includes predictors related to Covid, one that doesn't.
- ANOVA test comparing the two models: p-value = 0.001. Indicates that in December 2023, the amount of time spent outside has not returned to pre-pandemic levels.

Modeling and Analysis

Used linear regression models to analyze the relationship of the Covid-19 pandemic and individual characteristics of respondents on the total hours people spend outside.

- **Model 1:** Only predictors related to time.
- **Model 2:** All predictors, as well as the interactions of every predictor with the Post-Covid predictor.
- **Model 3:** Used the stepwise procedure to create a model with only the predictors that lead to the best BIC.
  - Selected as the final model after comparing diagnostic criteria.
- **Model 4:** Identical to final model, except no predictors related to Covid.

Variables	Model 1	Model 2	Model 3	Model 4
Post-Covid	X*	X*	X*	
Days	X**	X**	X**	X*
Days^2	X*	X*	X*	X*
Month	X*	X*	X*	X*
Year	X*	X*		
Season	X*	X*	X*	X*
Day of Week	X*	X*	X*	X*
Weekend	X	X		
Region		X	X*	X*
State		X*		
Household Income		X*	X*	X*
Age		X**	X**	X*
Sex		X**	X*	X*
Race		X*		
Married		X**	X*	X*
School		X**	X*	X*
Employment Status		X*	X*	X*
Job category		X*	X*	X*
H. Under 13		X*	X*	X*
H. Under 18		X*	X*	X*
H. Over 65		X*	X*	X*
H. Num. People		X*	X*	X
R^2	0.0572	0.2207	0.2192	0.2143
Adjusted R^2	0.0571	0.2197	0.2188	0.214
BIC	1195780	1159057	1157216	1158123
RMSE	4.241	3.861	3.861	3.872

Note: Marked in red if the model includes that predictor's interaction with the Post-Covid predictor.
Marked with * if the predictor is significant at the 0.05 level.
Marked with * if the interaction of that predictor with Post-Covid is significant.

Hours spent outside for an average person, with prediction interval
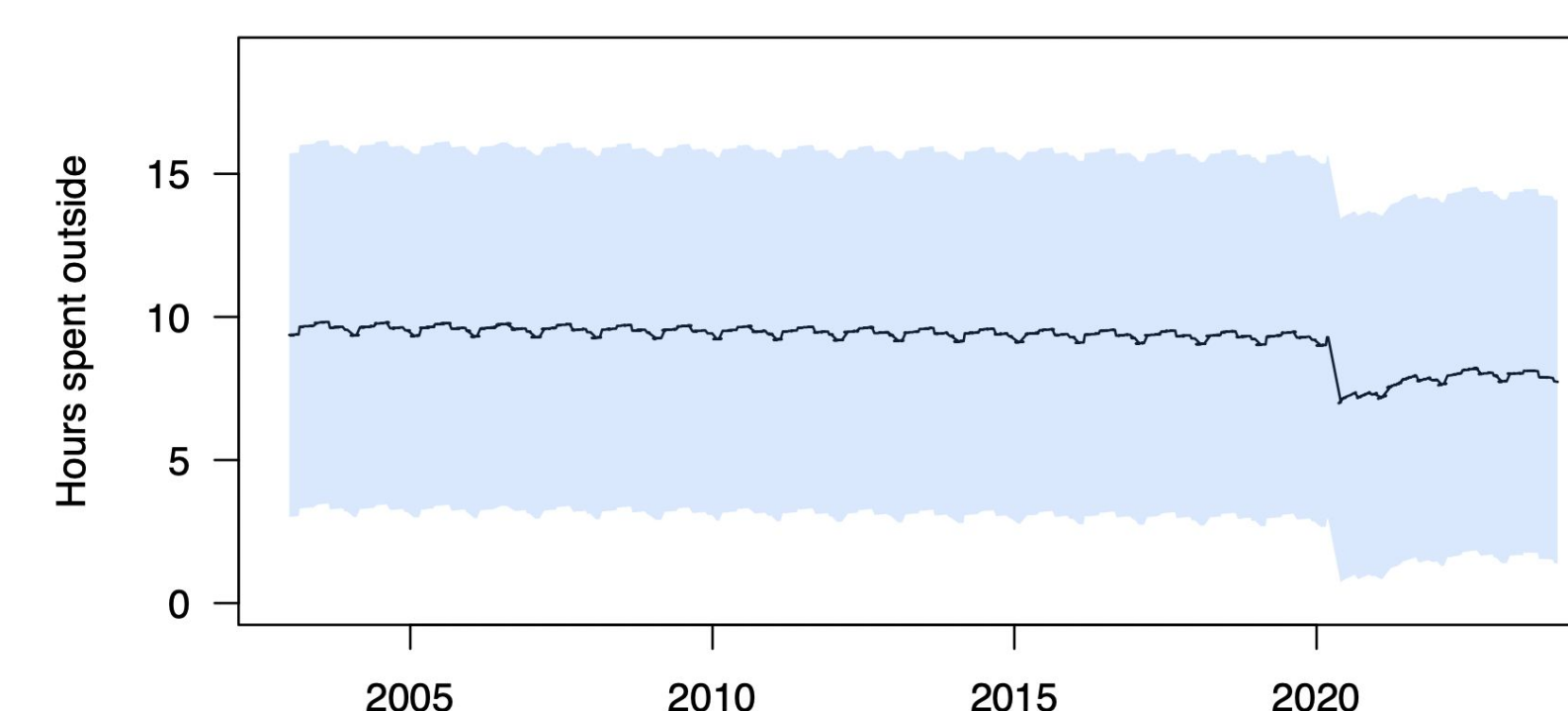
"Average person": 46 year old woman, living in the West, married, 3 person household with no kids or elders in the home, avg. family income of $75,000 to $99,999, working in management occupations.
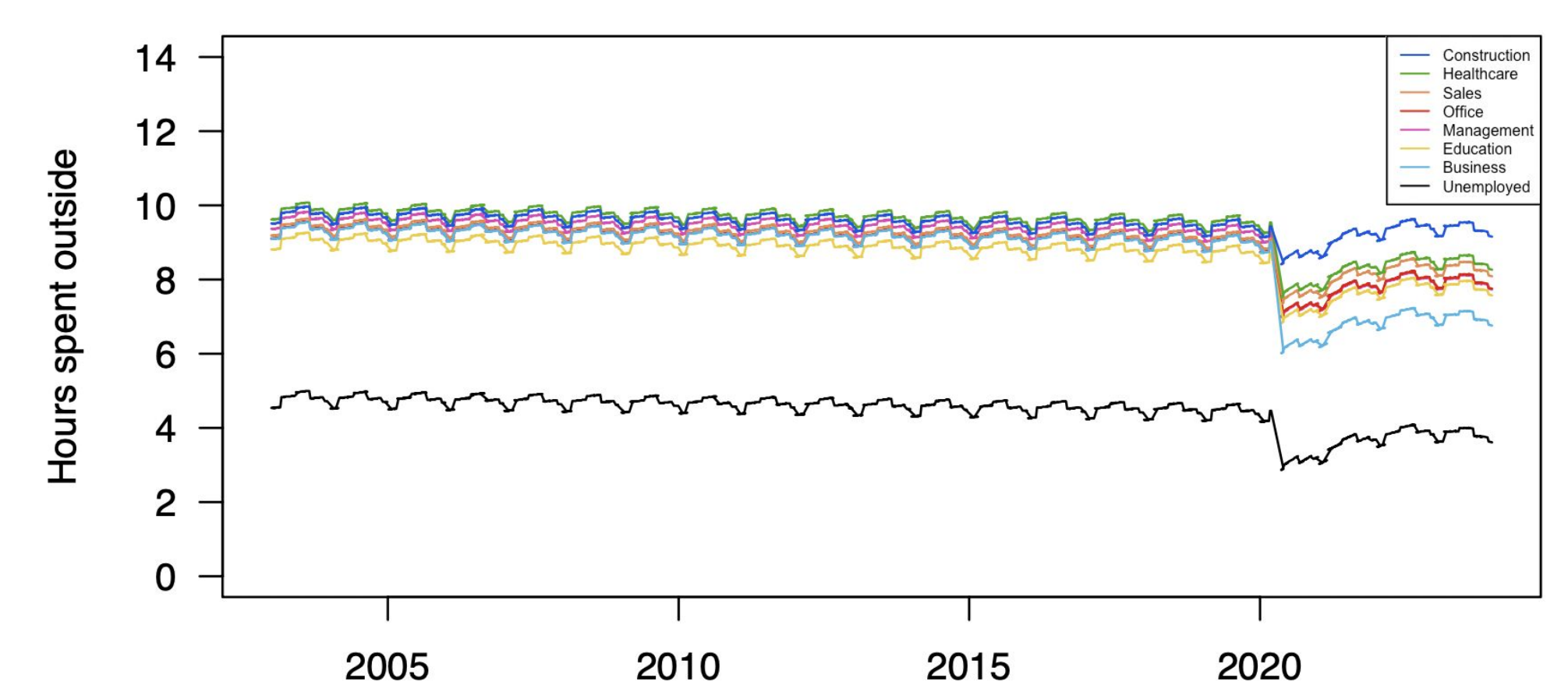
Model Predictions

Hours spent outside for Employed vs Unemployed & Female vs Male
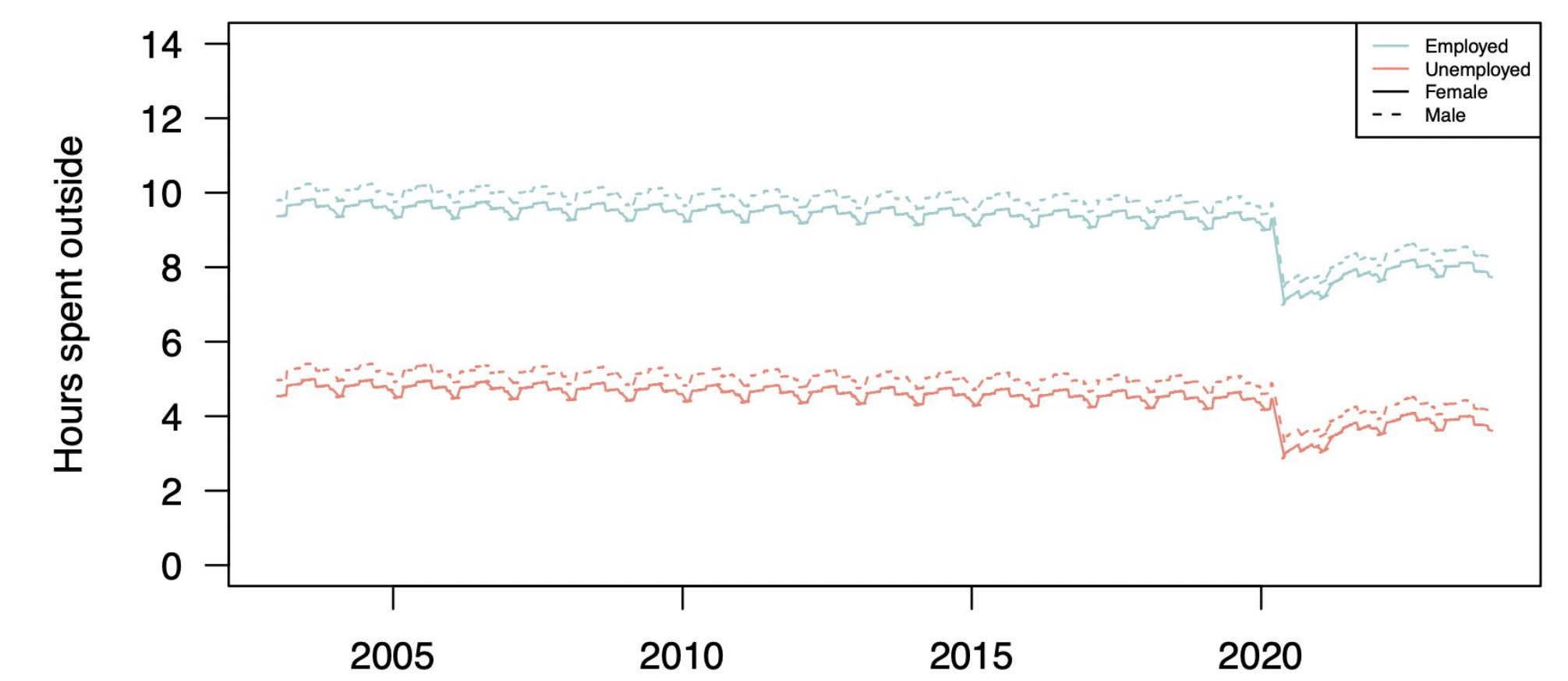
Hours spent outside for Different Ages
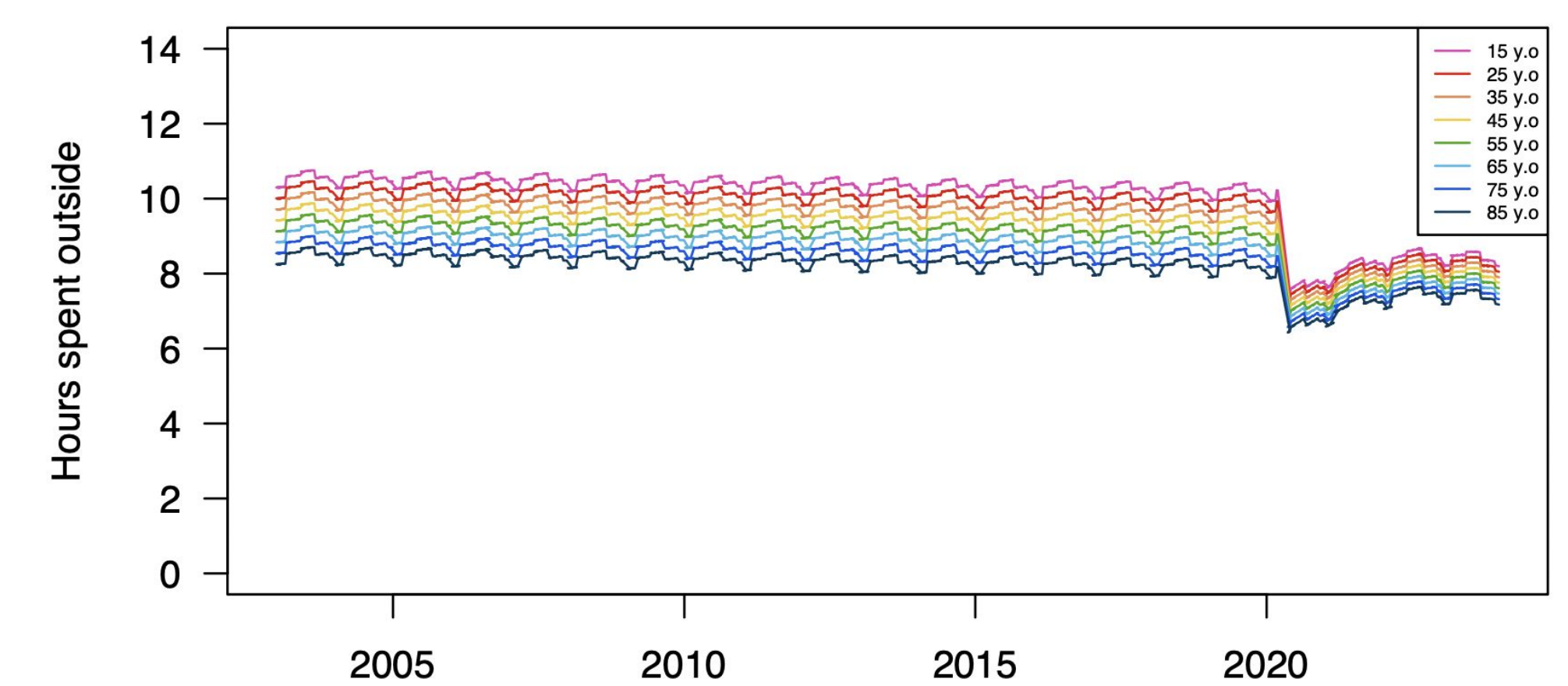
Hours spent outside for Different Job Categories

Conclusion

- The Covid-19 pandemic has a significant relationship with the amount of time people spend outside of their home, and in 2023 time spent outside has not returned to pre-pandemic levels.
- Factors such as sex, age, employment, marital status, school enrollment, household characteristics, and region have a significant relationship with the amount of time people spend outside of their home or yard.

Limitations: Assuming that the model has independent residuals given that these time predictors are being included.

References

U.S. Bureau of Labor Statistics. (2021, September 17). *American Time Use Survey: Data sources.* https://www.bls.gov/opub/hom/atus/data.htm

Hanibuchi, T., Yabe, N., & Nakaya, T. (2021). Who is staying home and who is not? Demographic, socioeconomic, and geographic differences in time spent outside the home during the COVID-19 outbreak in Japan. *Preventive Medicine Reports, 21*, 101306. https://doi.org/10.1016/j.pmedr.2020.101306