Time spent with family, self-rated health, workload management seriously affects the stress level of young Canadians

Yifan Xu

December 9, 2020

Abstract

There are multiple factors that affect the stress level of young Canadians. In this paper, we explored the Canadian General Social Survey (GSS), Cycle 30, 2016: Canadians at work and at home, and fitted a logistic regression model based on factors related to the stress level with R. We found that the self-rated health, time spent with family and workload management seriously affect Canadians' stress level. This can not only roughly predict the young adults' stress level, but also provide people with a way to relieve stress, especially during the COVID-19 pandemic.

Keywords: Canadian well being; stress level; Sample survey without replacement ; Self-rated health ; logistic Regression analysis with R.

Introduction

Stress has always been a common problem among modern people, and different stress occurs at all stages of people's life. According to a survey of Canadians by Ipsos, almost half of Canadians said they feel severely stressed at least once a week, and more than 15% of them said they feel pretty stressed nearly every day. Compared with the information five years ago, it suggests that young adults undergo greater pressure in life than middle-aged and elderly people. (Ipsos (2020)) Their pressure may come from family, work and job, close relationships, or related to themselves.The present condition of young people's stress is worthy of attention. Especially in the current COVID-19 epidemic, new diseases have caused people to panic to a certain extent. At the same time, many measures taken to prevent the spread of the virus, such as keeping a safe distance during isolation and the closing of public entertainment, making them isolated and lonely, thereby increasing stress and anxiety. (Disease Control and Prevention (2020)) Therefore, we intend to find the main causes of stress among young adults, the approach to relieve their stress, and how to predict their stress level.

We utilized the dataset about Canadian General social survey(GSS), Cycle 30, 2016: Canadians at work and home, which was conducted from August 2 to December 23, 2016. It was a sample survey with a cross-sectional design and covered 10 provinces of Canada. Non-institutionalized personnel aged 15 and above were the target population. This survey provided information on social trends about working conditions, family status, time utilization, and how these factors affect the well beings of Canadians. (GSS (2016)) This report mainly examined which of these factors can strongly affect young adults' stress level and how to predict it. The main method we used is building a logistic regression model GLM (Hadley Wickham (2020) Wickham et al. (2019)) in R (R Core Team (2020)) to measure the relationship between the young adults' stress level and exploratory variables related to induce or reduce the stress. We find that the time spent with family, self-rated health, workload management seriously affects the stress level of young Canadians.

Below is the data section, we will introduce the data set and focus on several variables we choose, then conduct the logistic regression analysis with R (R Core Team (2020)) and obtain the logistic regression model, which followed by multiple figures and tables in the result section. Finally in the discussion section, we will discuss our findings based on the model results as well as some weaknesses and opportunities for future work.

We used R markdown to produce this paper. (JJ Allaire (2020) Yihui Xie (2018))

Data

In this paper, we utilized the dataset about Canadian General social survey(GSS), Cycle 30, 2016: Canadians at work and home. The data, user guide and code book can be found at:https://sda-artsci-utoronto-ca.myaccess.library.utoronto.ca/sdaweb/dli2/gss/gss30/gss30/more_doc/index.htm (It can be accessed by faculty, students, and staff member at University of Toronto only.) We also used the haven (Wickham and Miller (2020)) and janitor packages (Firke (2020)) in the data cleaning.

The 2016 GSS was conducted from the beginning of August to the end of December, 2016, and it is a sample survey using a cross-sectional design. Its target population contains all non-institutionalized people over the age of 15 who live in 10 Canadian provinces, except residents from Yukon, Northwest Territories, and Nunavut and full-time institution residents. The frame of this survey was conducted with 2 different components: 1) lists of telephone numbers in use from Statistics Canada and 2) list of all houses in ten provinces from the Address Register (AR). The two main methods of this survey are stratified sampling and simple random sampling without replacement (SRSWOR). First of all, every record from the survey frame was assigned to one stratum in its province. Next, the SRSWOR of these records was selected in each stratum. For each family, one person was chosen to complete the online survey or a telephone interview.(GSS (2016))

There were non-response cases in this survey, mainly because the respondents could not be connected, could not provide information, or refused to participate in the survey. In 2016, the response rate of GSS was approximately 50.8%. (GSS (2016)) During records processing, there are mainly three ways to deal with a small number of incorrect records or records lacking information, which are completing them, make corrections, or calculated from other information in the questionnaire. To be specific, according to whether there is some auxiliary information used to model response tendency for each household, there are three types of unresponsive telephone numbers: phone numbers without auxiliary information, phone numbers with some available auxiliary information, and phone numbers with auxiliary information available from Statistics Canada. The approach to deal with non-response is to compensate the non-responders by adjusting the weight of the households responding to the survey. For the first type of non-response, those unresponsive phone numbers were ignored and dropped. Such adjustment was made independently in each stratum. Then for the last 2 types, non-responses adjustments were made independently in their regions. (GSS (2016))

Since SRSWOR was chosen in this survey, it is inevitable that the estimates of the sampling survey would be affected by sampling errors, probably causing certain biases in the final results. In order to reduce such errors as much as possible, the researchers used sample data to estimate a statistical measure of the standard error and the sampling error. (GSS (2016))

Among the hundreds of variables in this data set, we noticed the variable " SMG_Q01", which is to measure the stress level of Canadians. Therefore, it is treated as the response variable in our research. Moreover, since we are concerned about the stress of young adults, we choose people 15 to 44 years old as the observations. And we choose the exploratory variables mostly from three aspects: life, work and personal situation, they are:

- TTLINCG2 Income - Personal income group (before tax)
- DOS_Q05 Level of satisfaction - Personal appearance
- SRH_110 Self rated health in general
- FAM_Q03 Level of satisfaction - Amount of time spent as a family
- WIR_Q01 Management of workload
- STJ_Q05 Match between current job and field of education or training

Figures will show below: (we used the ggplot2 package (Wickham (2016)))

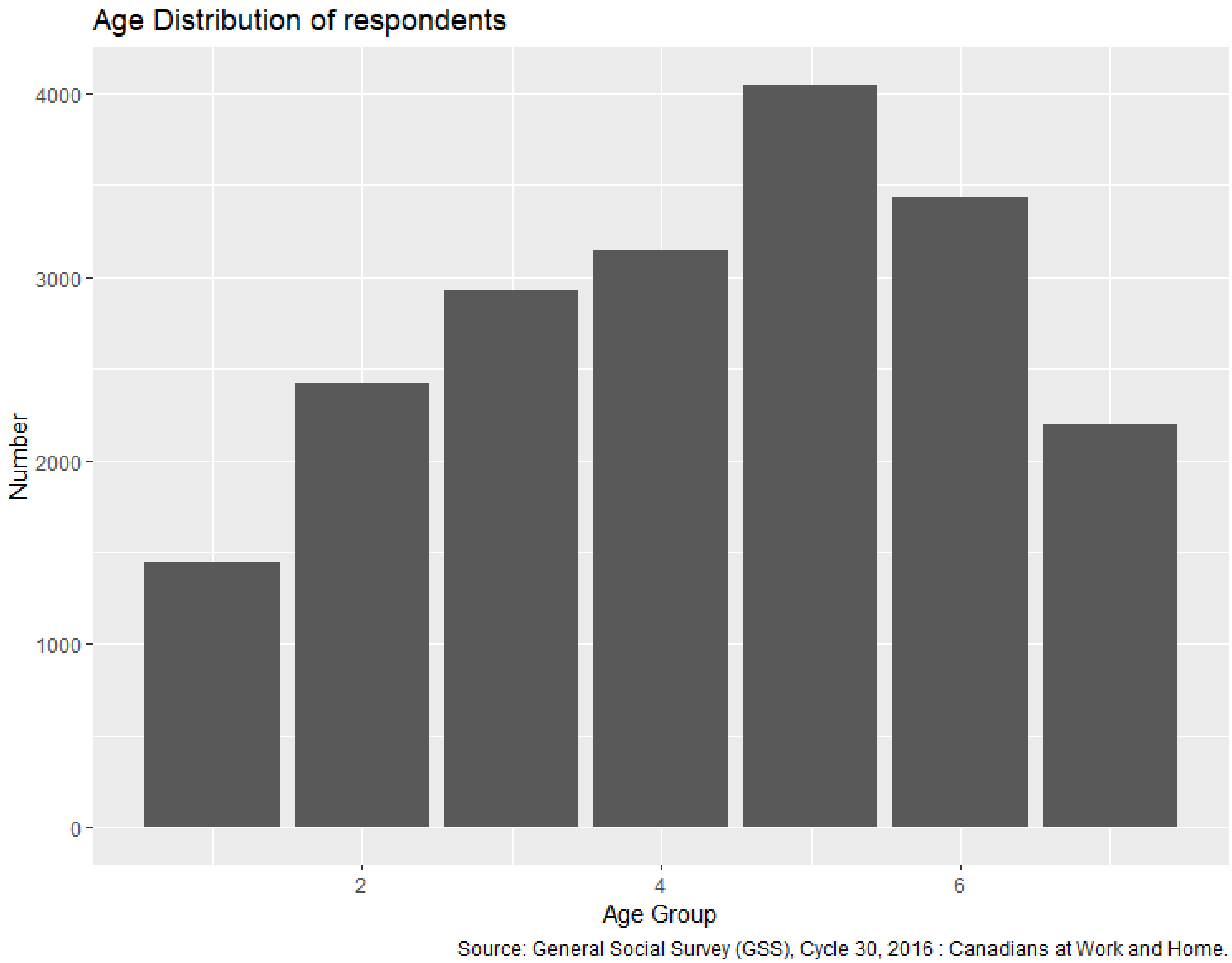
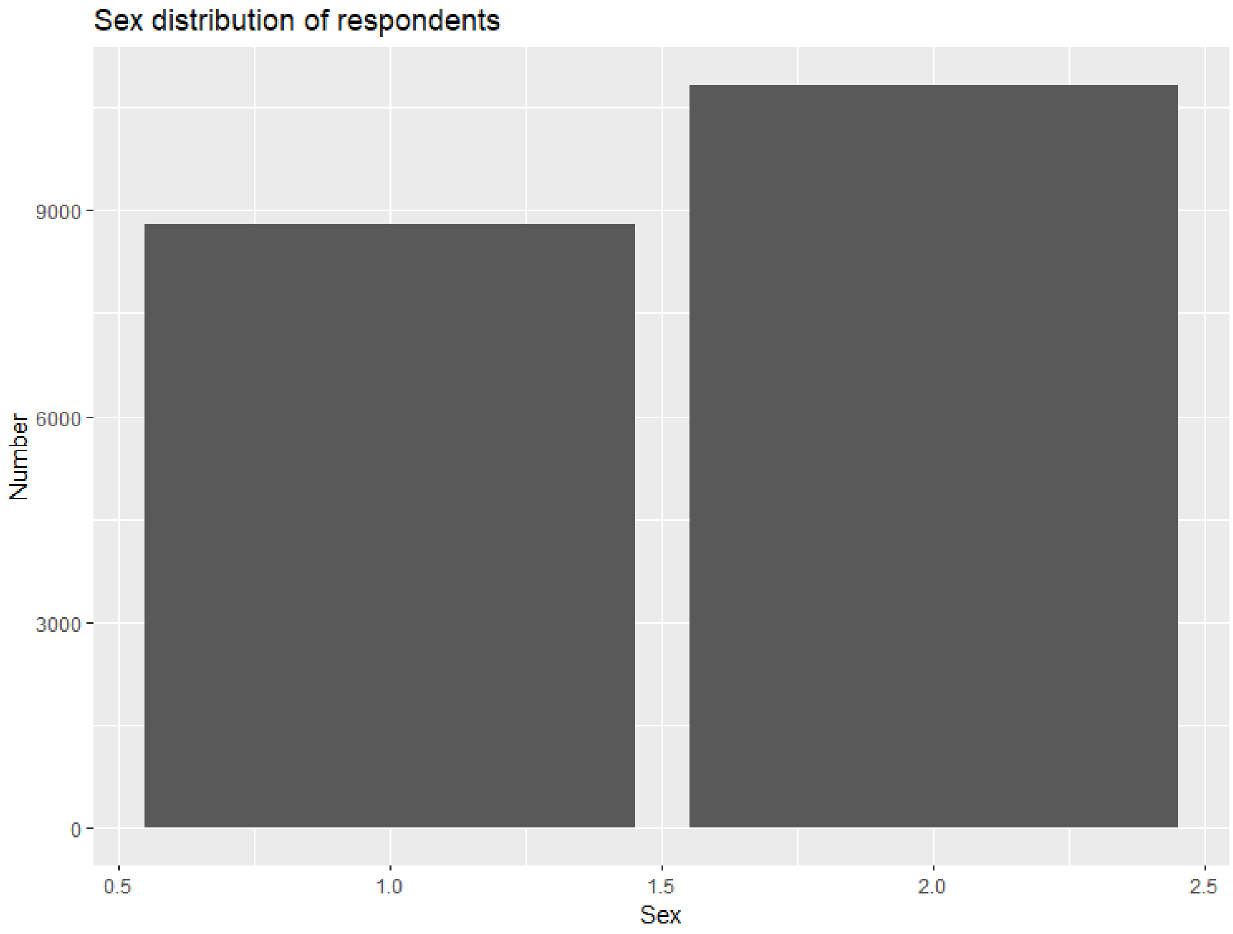


Figure 1

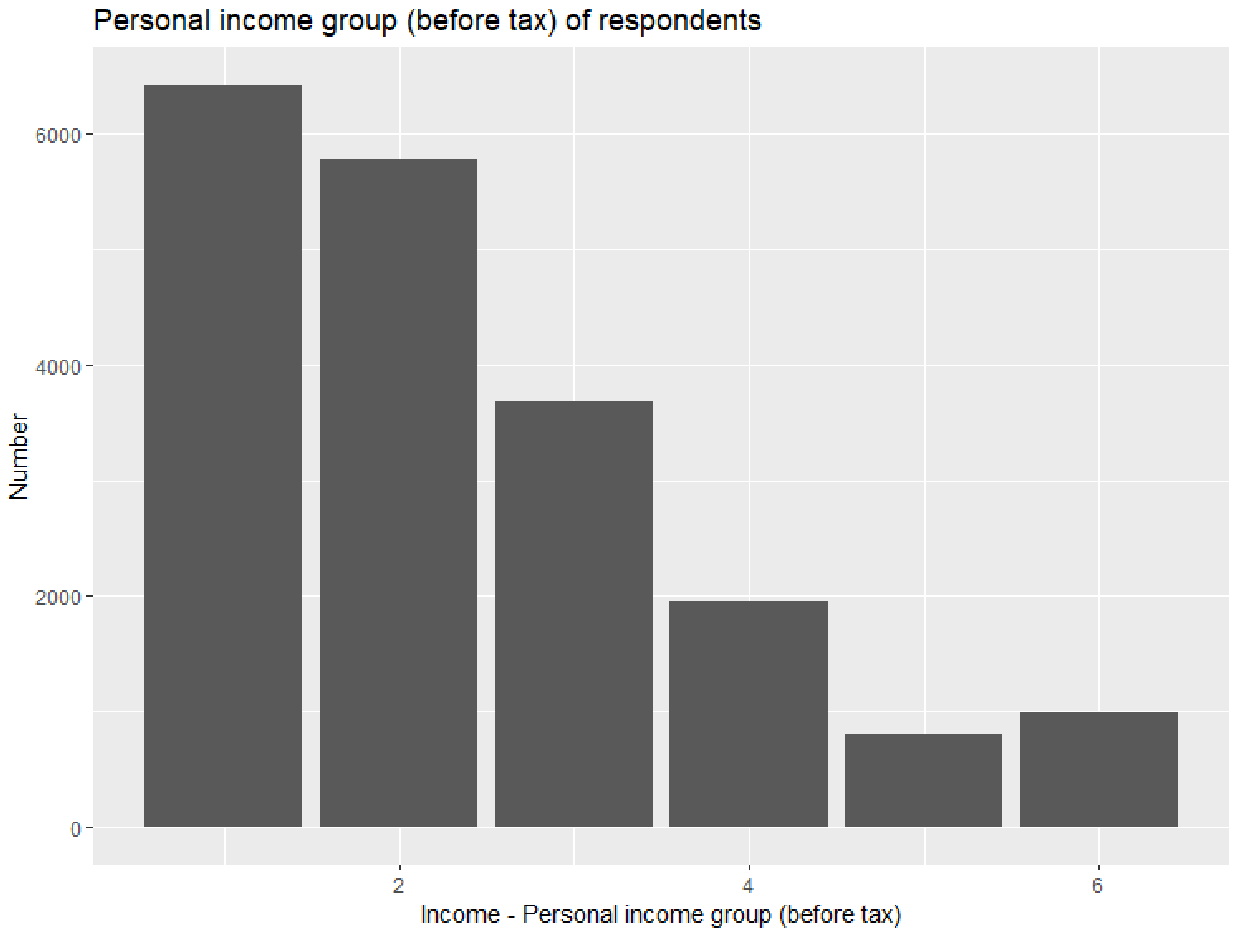
The x-axis is expressed as 15 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, 65 to 74 years, 75 years and over, Valid skip, Don't know, Refusal, and Not stated.



Source: General Social Survey (GSS), Cycle 30, 2016 : Canadians at Work and Home.

Figure 2

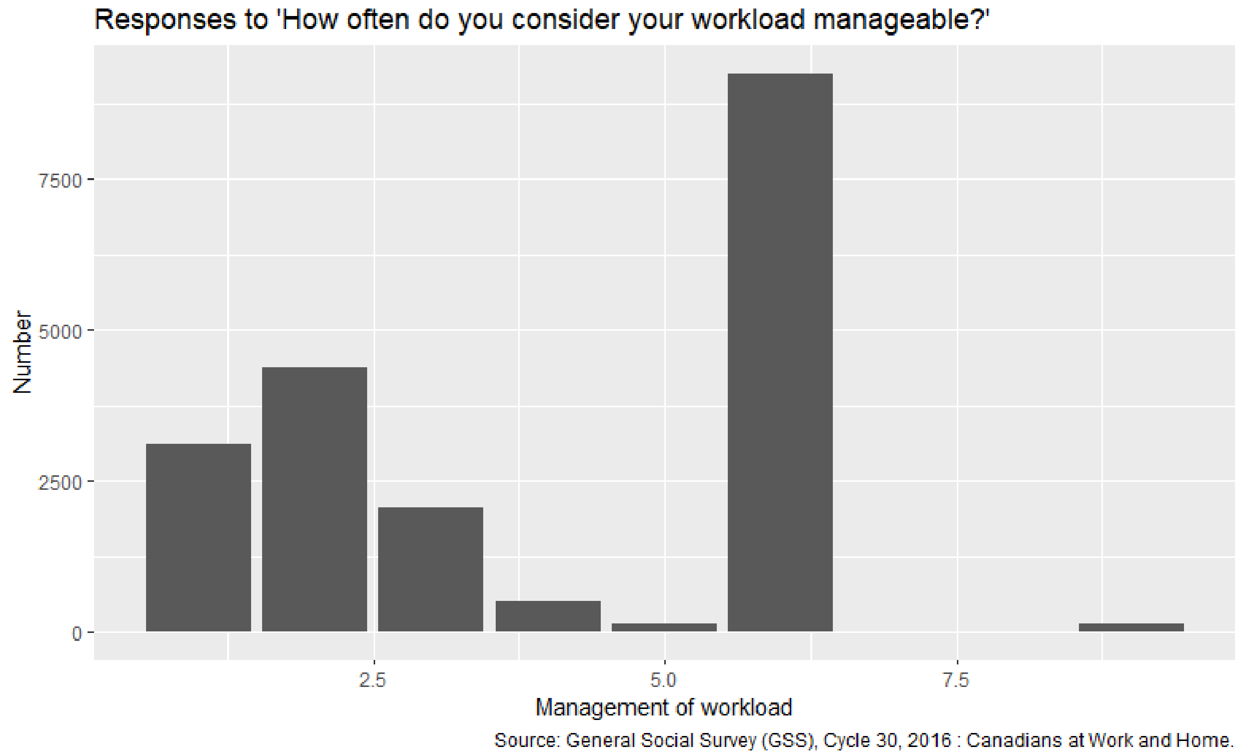
The x-axis is expressed as Male and Female.



Source: General Social Survey (GSS), Cycle 30, 2016 : Canadians at Work and Home.

Figure 3

The x-axis is expressed as: Less than 25,000, 25,000 to 49,999, 50,000 to 74,999, 75,000 to 99,999, 100,000 to 124,999, 125,000 or more, Valid skip, Don't know, Refusal and Not stated.

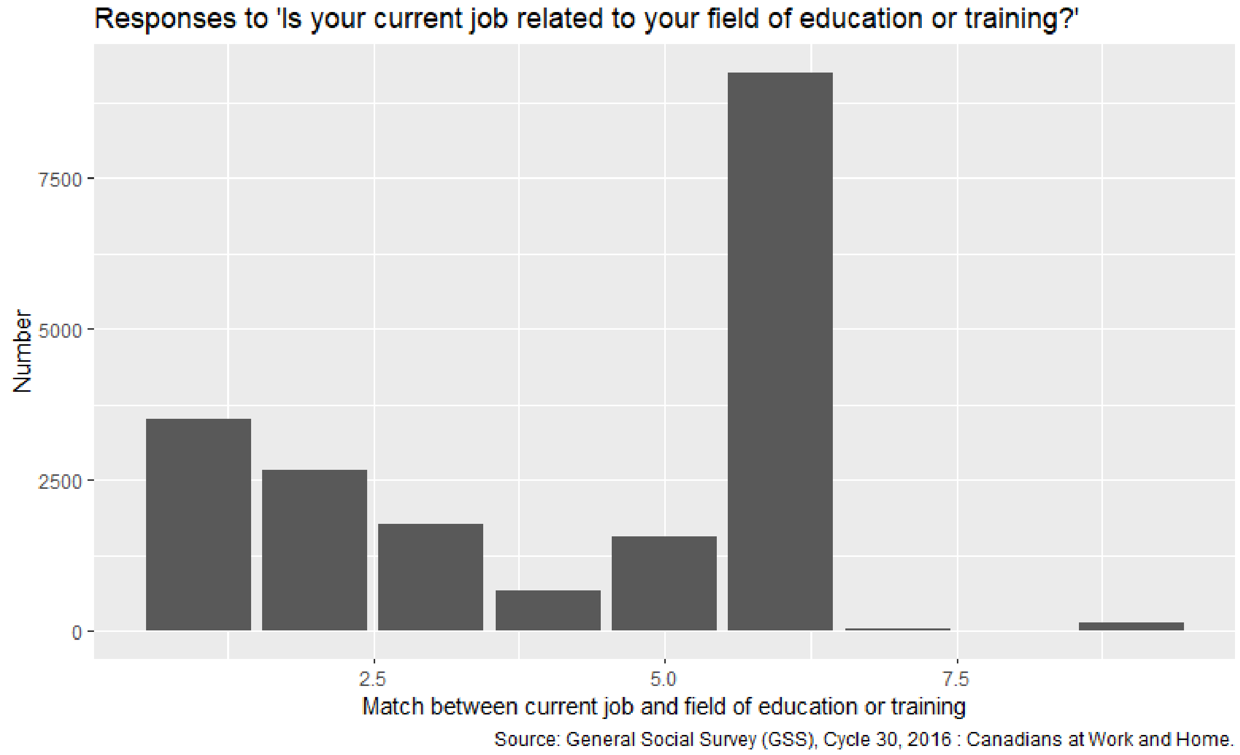


Responses to 'How often do you consider your workload manageable?'

Source: General Social Survey (GSS), Cycle 30, 2016 : Canadians at Work and Home.

Figure 4

The x-axis is expressed as Always, Often, Sometimes, Rarely, Never Valid skip, Don't know, Refusal, and Not stated.

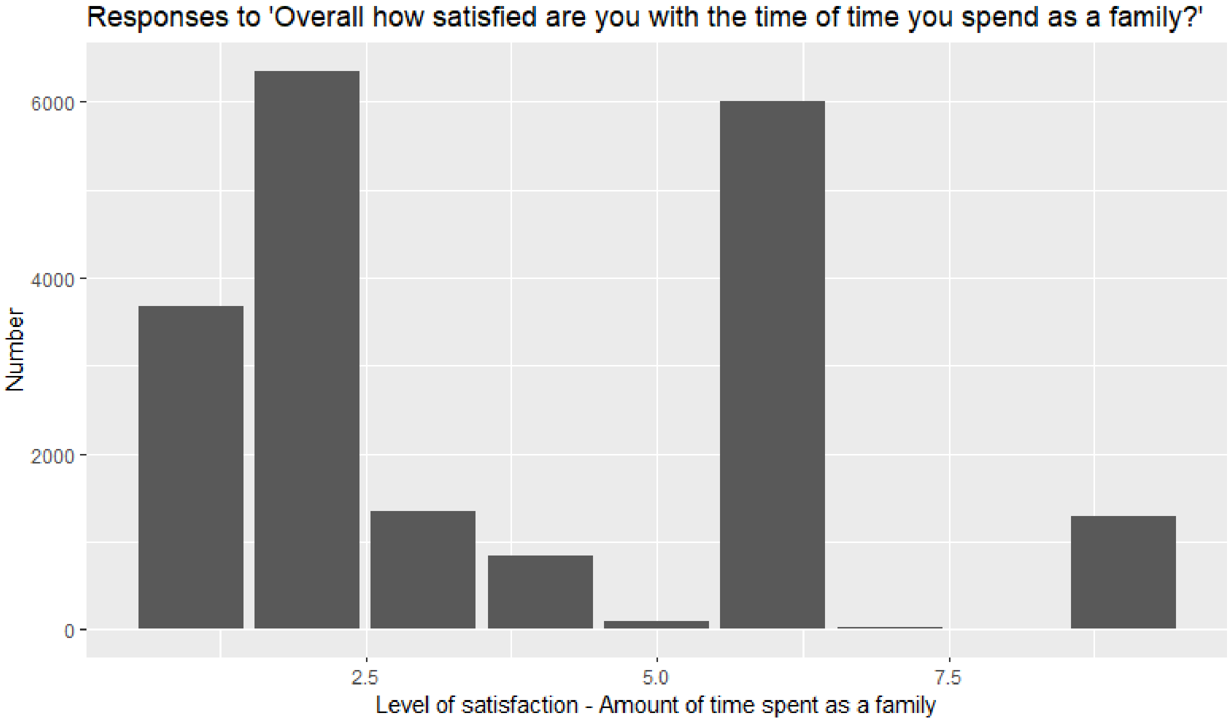


Responses to 'Is your current job related to your field of education or training?'

Source: General Social Survey (GSS), Cycle 30, 2016 : Canadians at Work and Home.

Figure 5

The x-axis is expressed as Completely, Mostly, Somewhat, Mostly not, Not at all, Valid skip, Don't know, Refusal, and Not stated.



Source: General Social Survey (GSS), Cycle 30, 2016 : Canadians at Work and Home.

Figure 6

The x-axis is expressed as Very satisfied, Satisfied, Neither satisfied nor dissatisfied, Dissatisfied, Very dissatisfied, Valid skip, Don't know, Refusal, and Not stated.

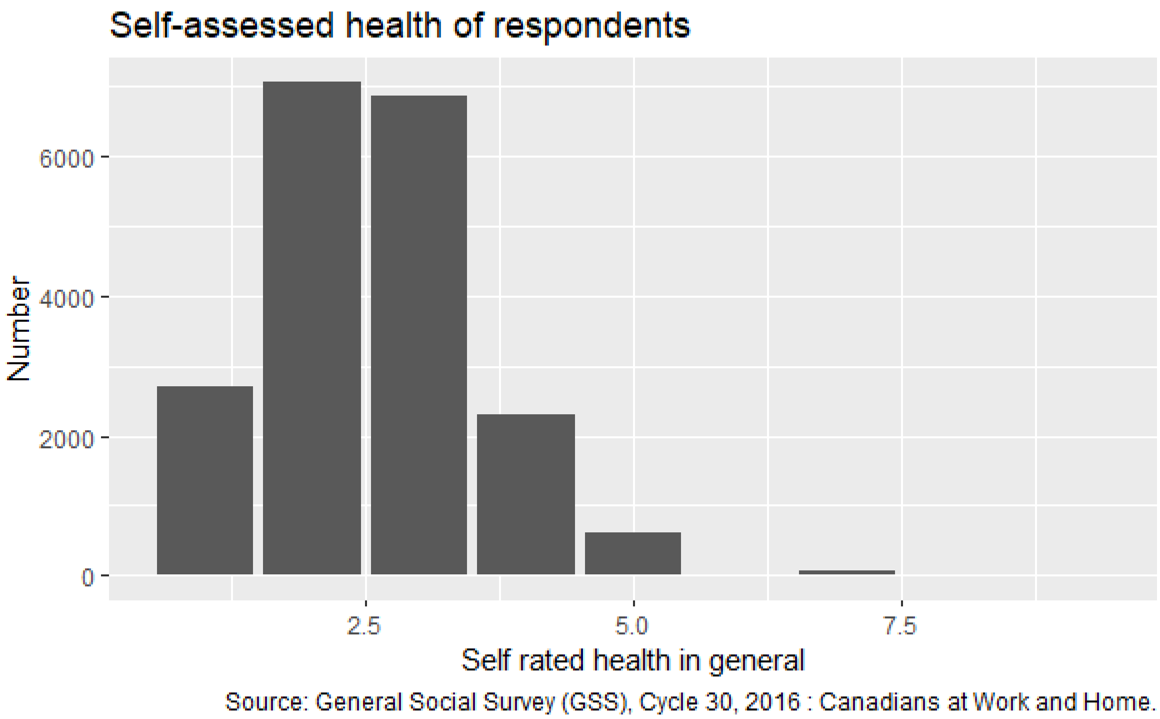


Figure 7

The x-axis is expressed as Excellent, Very good, Good, Fair, Valid skip, Don't know, Refusal, and Not stated.

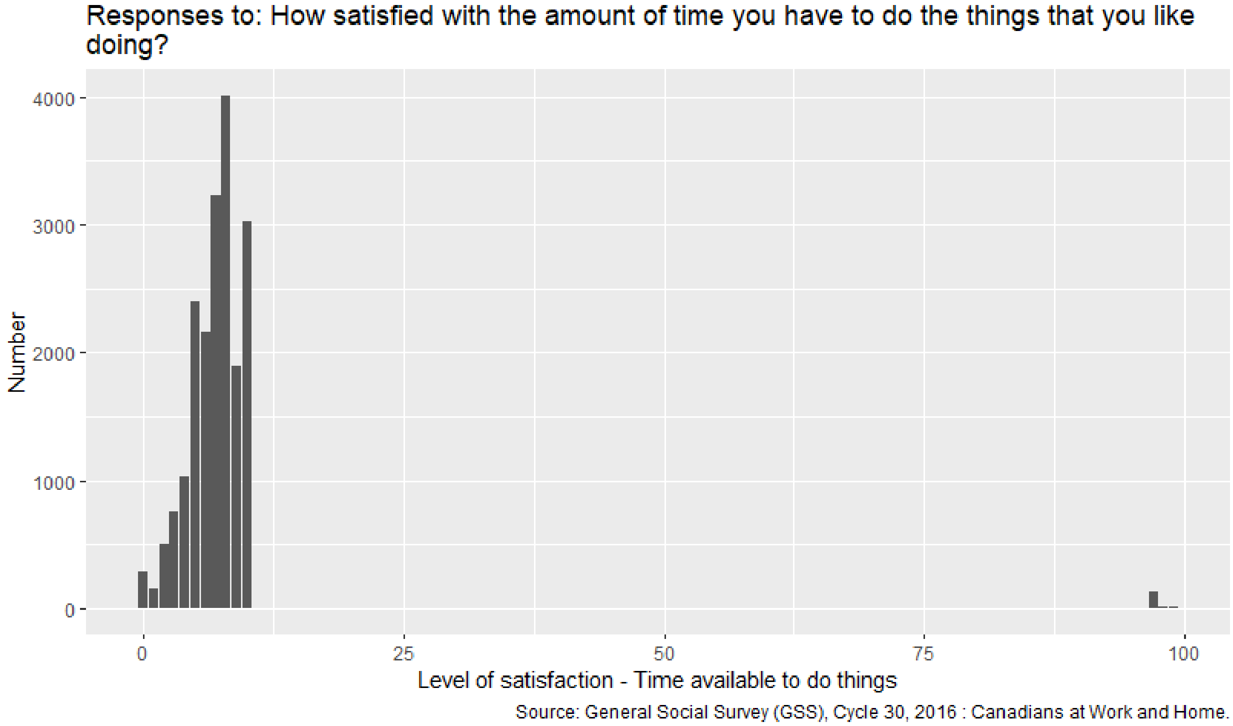


Figure 8

As the x-axis increases, satisfaction of respondents' increases.

From Figure 1 and Figure 2, we can see that the 15-44 year-olds account for about half of the respondents. Also, there are nearly 1,500 more women than men among these respondents.

Figure 3 indicates that the distribution of income is right-skewed. Most people earn less than 25,000 CAD, and the high-income group only accounts for a small part. Regarding the question of whether the workload is manageable, the vast majority of people skipped it. Among those who answered it, most often believed that the workload was manageable (shown in figure 4). In the self-assessment of general health, most respondents felt that their health state is very good (shown in figure 7). Besides, most of the respondents are also satisfied with the time spent as a family (shown in figure 6).

Since GSS intends to protect respondent privacy, the options for each survey question include "Valid skip", "Don't know", "Refusal", "Not stated", we deleted them using na.omit() function in R for better analysis. Moreover, as the answer options for multiple survey questions are somewhat similar, we merged these options. For example, regarding the question "how satisfied are you with the amount of time you spend as a family?", the options "Very satisfied" and "satisfied" are combined, and "dissatisfied" and "Very dissatisfied" are combined.

In the next section of modeling, we analyzed these variables and how they affected the stress level among young adults. Meanwhile, we used R (R Core Team (2020)) to obtain a proper logistic regression model with good predictions on stress level in young adults.

Model

Logistic regression distinguishes two types, and the output result is the probability of an event. Thereby, if a logistic regression model is applied, the final result can indicate the possibility that a person is under high pressure. This matches what we want to study, so we plan to build a logistic regression model.

Among all these 7 predictors, we find that the time spent with family, self-rated health, workload management have the most predictive effect. Therefore, we obtain a logistic regression model with these predictors using the function glm (we used the dplyr and tidyverse packages (Hadley Wickham (2020) Wickham et al. (2019)) in R (R Core Team (2020)).)

Before building the model, we randomly used 60% of the survey data as a training set and 40% as a test set for the model validation. The training set was used to build the model while the test set was to check the model performance, such as whether each predictor is still significant, and whether two estimated coefficients are similar.

Next, we build a full model with all the selected variables above, and then through deleting and selecting, we find 3 variables strongly related to the stress level of young adults with effective predictive ability. They are:

- Health.rated: In general, would you say your health is…? (Excellent/ Very good / Good / Fair / Poor)
- Workload.manage: How often do you consider your workload manageable? (Always / Sometimes / Rarely)
- Family time: Overall, how satisfied are you with the amount of time you spend as a family?" (Satisfied / General / Dissatisfied)

The final logistic regression model we obtain is:

$$log(\frac{p}{1-p}) = -1.3285 + 0.6635x_{family.time_{general}} + 1.2838x_{family.time_{dissatisfied}} + 0.2041x_{health.rated_{Verygood}}$$

$$+0.5896x_{health.rated_{good}} + 1.4144x_{health.rated_{fair}} + 2.2444x_{health.rated_{poor}}$$

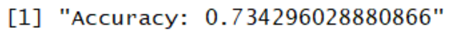
$$+1.3616x_{workload.manage_{sometimes}} + 2.2479x_{workload.manage_{rarely}}$$

Model Interpretation

For the right side of the model, -1.3285 is the intersection. There are three exploratory variables. Each variable takes three to five different levels, and these x values can be taken as 0 or 1.

For example, for the variable: "Family time: Overall, how satisfied are you with the amount of time you spend as a family?", there are three different levels: "satisfied", "general", and "dissatisfied". If a person is generally satisfied with the family time, then the coefficient should be set to 1, and the others to 0. If a person is satisfied with the family time, then all other coefficients should be set to 0.

For the left side of the model, P represents the possibility that an individual is under high stress. After getting the result on the right side of the model, we can obtain this probability by taking the exponent and a few steps of calculation.



```
[1] "Accuracy: 0.734296028880866"
```

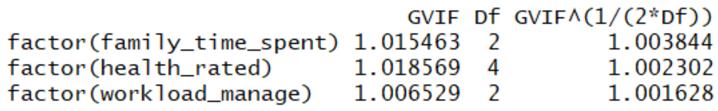
Figure 8: Accuracy of the model

When our model is applied to an independent new data set (test data set), the prediction accuracy of the model is nearly 73.43%. (Assuming the prediction is correct when the predicted probability is greater than 50%)

Multi-collinearity check will be discussed in the results session and model diagnostic will be performed in the discussion section.

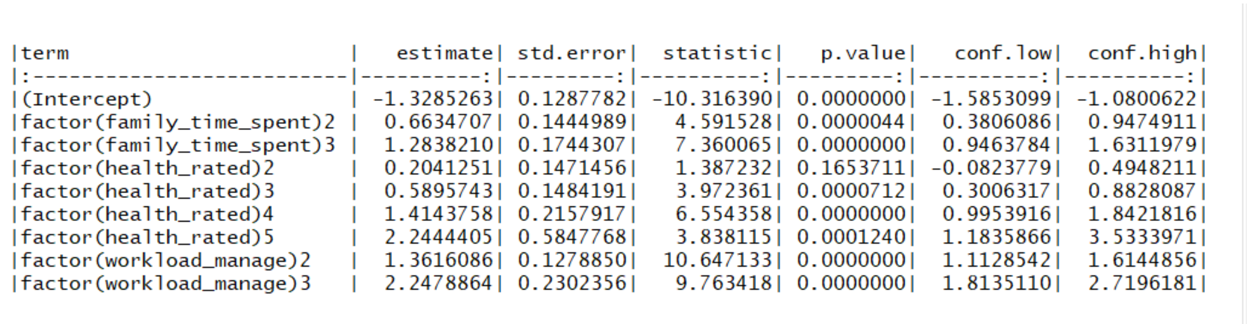
Results

To ensure that there is no strong correlation between the predictor variables, we check the multicollinearity of each variable by their VIF values. (we used the Car package (Fox and Weisberg (2019))) Bigger than 5 indicates some collinearity in predictors.



```
                             GVIF Df GVIF^(1/(2*Df))
factor(family_time_spent) 1.015463  2        1.003844
factor(health_rated)      1.018569  4        1.002302
factor(workload_manage)   1.006529  2        1.001628
```

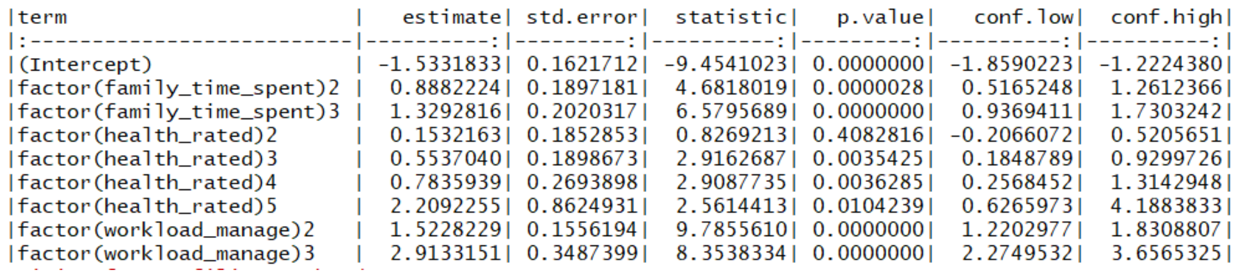
Figure 9: VIF values of each predictor



```
|term                        |   estimate| std.error|  statistic|   p.value|   conf.low|  conf.high|
|:---------------------------|----------:|---------:|----------:|---------:|----------:|----------:|
|(Intercept)                 | -1.3285263| 0.1287782| -10.316390| 0.0000000| -1.5853099| -1.0800622|
|factor(family_time_spent)2  |  0.6634707| 0.1444989|   4.591528| 0.0000044|  0.3806086|  0.9474911|
|factor(family_time_spent)3  |  1.2838210| 0.1744307|   7.360065| 0.0000000|  0.9463784|  1.6311979|
|factor(health_rated)2       |  0.2041251| 0.1471456|   1.387232| 0.1653711| -0.0823779|  0.4948211|
|factor(health_rated)3       |  0.5895743| 0.1484191|   3.972361| 0.0000712|  0.3006317|  0.8828087|
|factor(health_rated)4       |  1.4143758| 0.2157917|   6.554358| 0.0000000|  0.9953916|  1.8421816|
|factor(health_rated)5       |  2.2444405| 0.5847768|   3.838115| 0.0001240|  1.1835866|  3.5333971|
|factor(workload_manage)2    |  1.3616086| 0.1278850|  10.647133| 0.0000000|  1.1128542|  1.6144856|
|factor(workload_manage)3    |  2.2478864| 0.2302356|   9.763418| 0.0000000|  1.8135110|  2.7196181|
```

Figure 10: Model summary built with the training data

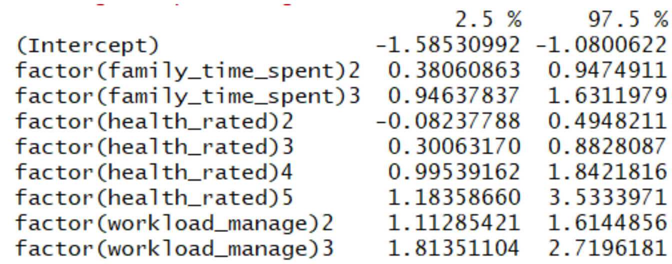
(We used the knitr package (Xie (2014) Xie (2015) Xie (2020).))



```
|term                        |   estimate| std.error|  statistic|   p.value|   conf.low|  conf.high|
|:---------------------------|----------:|---------:|----------:|---------:|----------:|----------:|
|(Intercept)                 | -1.5331833| 0.1621712| -9.4541023| 0.0000000| -1.8590223| -1.2224380|
|factor(family_time_spent)2  |  0.8882224| 0.1897181|  4.6818019| 0.0000028|  0.5165248|  1.2612366|
|factor(family_time_spent)3  |  1.3292816| 0.2020317|  6.5795689| 0.0000000|  0.9369411|  1.7303242|
|factor(health_rated)2       |  0.1532163| 0.1852853|  0.8269213| 0.4082816| -0.2066072|  0.5205651|
|factor(health_rated)3       |  0.5537040| 0.1898673|  2.9162687| 0.0035425|  0.1848789|  0.9299726|
|factor(health_rated)4       |  0.7835939| 0.2693898|  2.9087735| 0.0036285|  0.2568452|  1.3142948|
|factor(health_rated)5       |  2.2092255| 0.8624931|  2.5614413| 0.0104239|  0.6265973|  4.1883833|
|factor(workload_manage)2    |  1.5228229| 0.1556194|  9.7855610| 0.0000000|  1.2202977|  1.8308807|
|factor(workload_manage)3    |  2.9133151| 0.3487399|  8.3538334| 0.0000000|  2.2749532|  3.6565325|
```

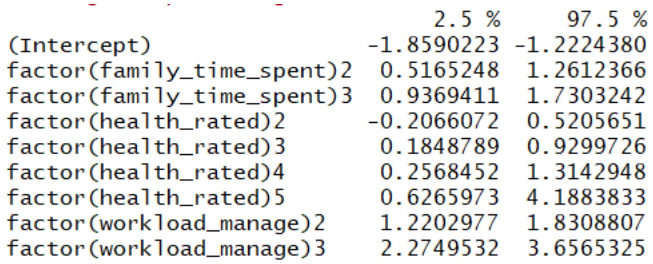
Figure 11: Model summary built with the test data

(We used the knitr package (Xie (2014) Xie (2015) Xie (2020)))



```
                                 2.5 %     97.5 %
(Intercept)                 -1.58530992 -1.0800622
factor(family_time_spent)2   0.38060863  0.9474911
factor(family_time_spent)3   0.94637837  1.6311979
factor(health_rated)2       -0.08237788  0.4948211
factor(health_rated)3        0.30063170  0.8828087
factor(health_rated)4        0.99539162  1.8421816
factor(health_rated)5        1.18358660  3.5333971
factor(workload_manage)2     1.11285421  1.6144856
factor(workload_manage)3     1.81351104  2.7196181
```

Figure 12: Confidence interval of model coefficients built with the training data



```
                                2.5 %     97.5 %
(Intercept)                -1.8590223 -1.2224380
factor(family_time_spent)2  0.5165248  1.2612366
factor(family_time_spent)3  0.9369411  1.7303242
factor(health_rated)2      -0.2066072  0.5205651
factor(health_rated)3       0.1848789  0.9299726
factor(health_rated)4       0.2568452  1.3142948
factor(health_rated)5       0.6265973  4.1883833
factor(workload_manage)2    1.2202977  1.8308807
factor(workload_manage)3    2.2749532  3.6565325
```

Figure 13: Confidence interval of model coefficients built with the test data

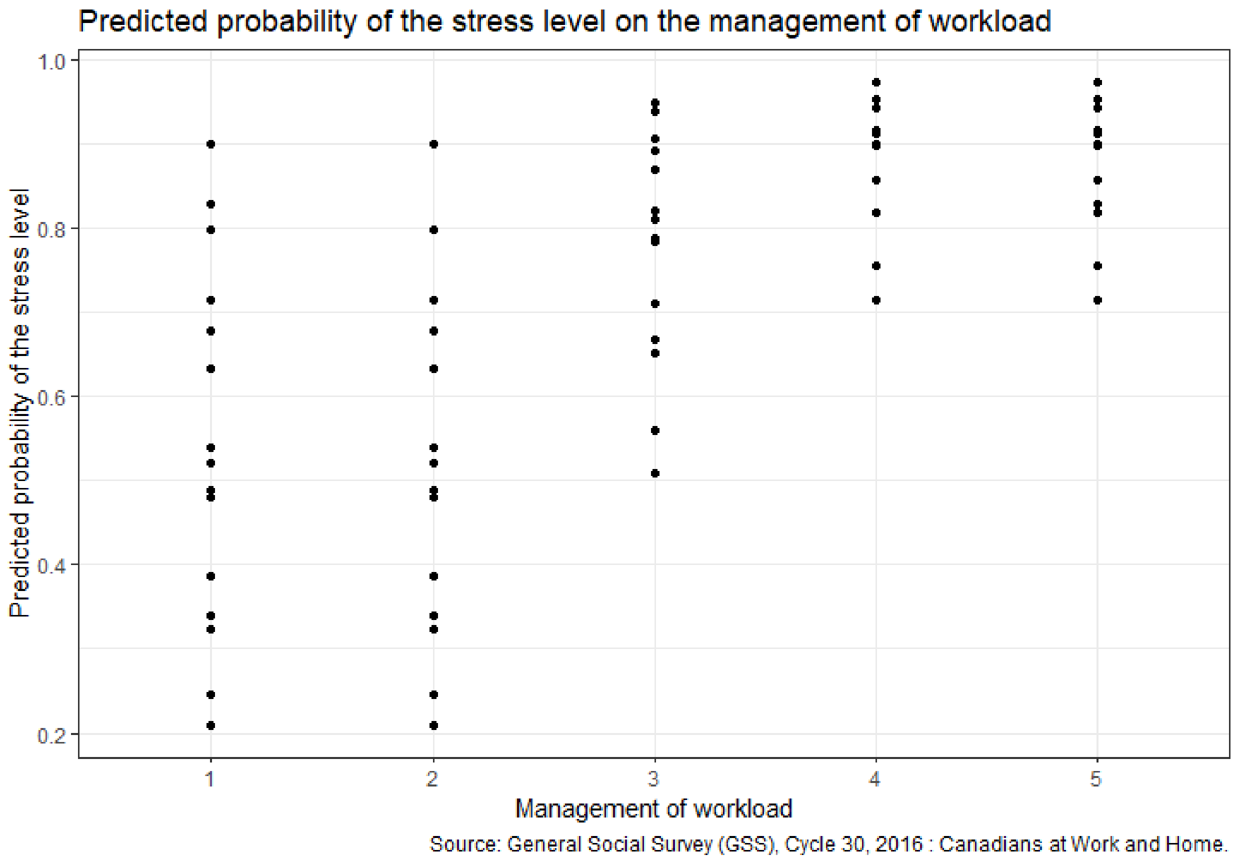


Figure 14: Predicted probability of the stress level on the workload manage

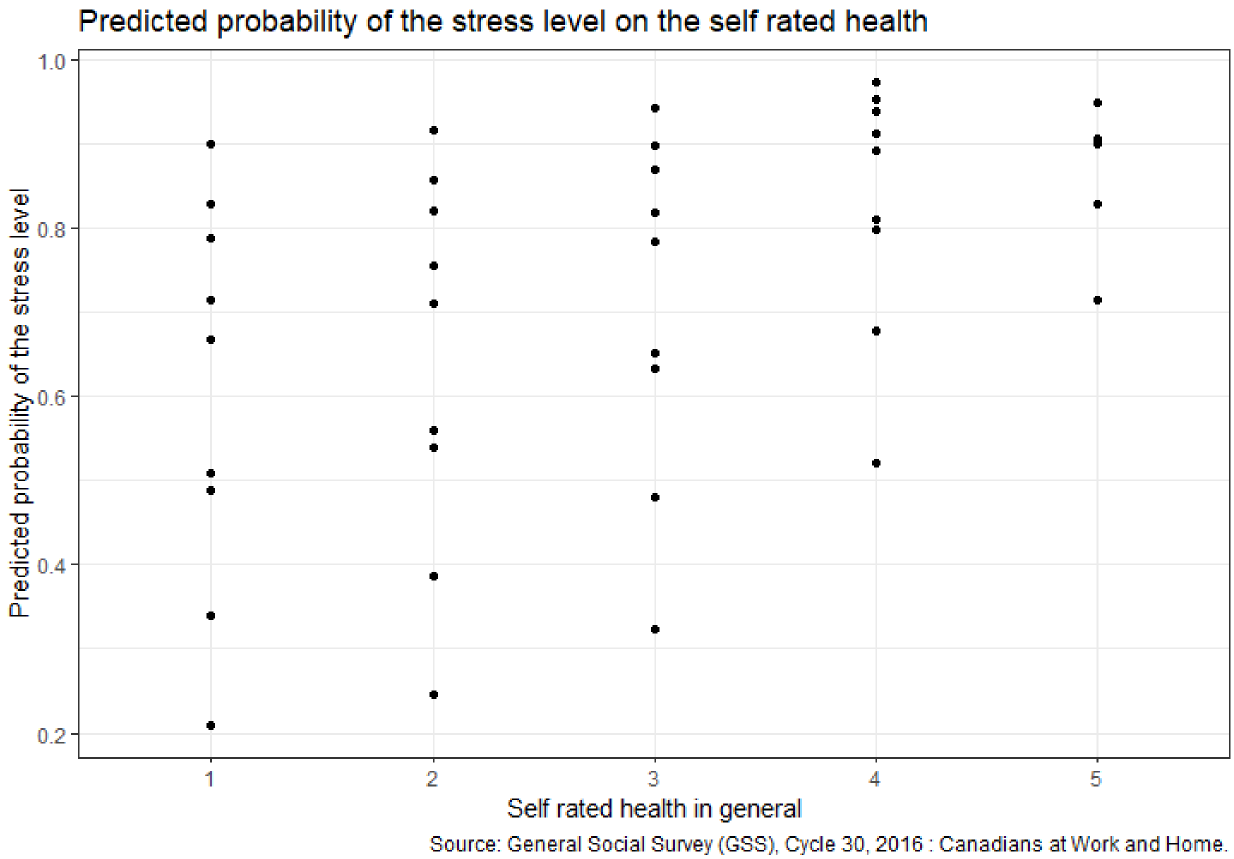


Figure 15: Predicted probability of the stress level on the self rated health

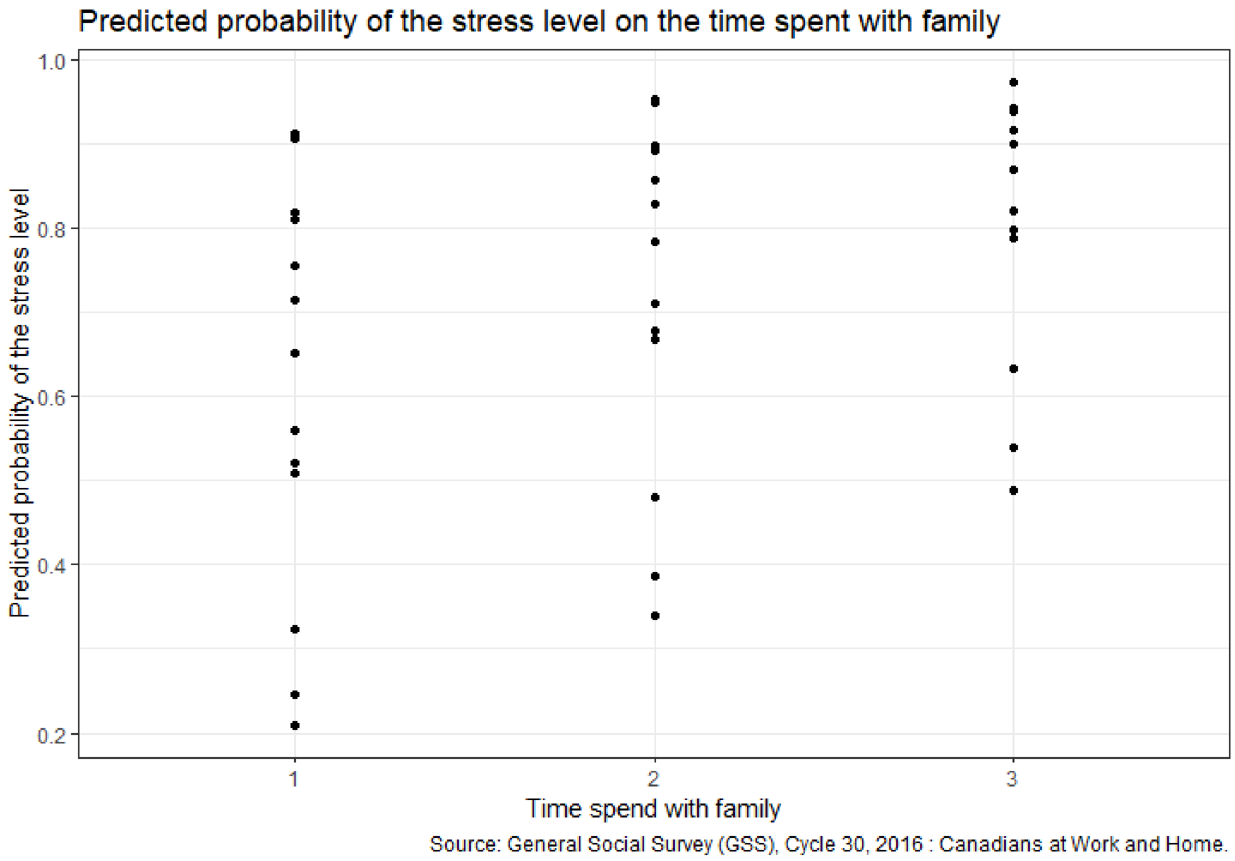


Figure 16: Predicted probability of the stress level on the time spent with a family

Figure 9 shows that their VIF values are less than 5, indicating that no multicollinearity occurs in predictors.

Figure 10,11 and 14-16 will be discussed in the next section.

Discussion

To explore the relationship between each predictor variable and the stress level, we look at the fourth column of Figure 10, which contains the p-value of each predictor. P-value means the probability at least or more extreme than the observed values. When the P-value is less than 0.05, it means that we have enough evidence to reject the null hypothesis. Otherwise, we fail to reject the null hypothesis. In this case, the null hypothesis was set as "there is no strong relationship between the stress level and that predictor". Through the fourth column in Figure 10, we find that the P-value of all predictors is less than 0.05, indicating that self-rated health, amount of time spent as a family, workload management are strongly related to the stress level.

From Figure 10 and 11, we compare the two models. By looking at P-values in figures 11, just one significant variable was lost (with P-value > 0.05), and the estimated coefficients of predictors for two models are similar.

Next, we will explain how each predictor affects the stress level and apply our model results to a big world.

Figure 14-16 shows the predictive probability of each predictor.

Figure 15 shows the impact of people's general health self-assessment on stress. Here, 1 in the x-axis means that people are very satisfied with their health assessment, and 5 means that people are very poor with their health assessment. We can see that the better respondents rated their health, the lower their stress level would be. Figure 14 shows the effect of people's workload management on stress levels. As the x-axis increases, the workload is rarely manageable to the respondents. For those respondents who are not able to manage their workload, their stress levels would be higher. And these predictions for the possibility are concentrated between 0.7-1, which is pretty high. The 2019 Workplace Health Report, released by Zhaopin Recruitment, surveyed more than 6,000 workplace people about their health and lifestyle. Among these 6000 young adults, only one-fifth of them believed that they are in good health, and more than 30% feel their health is very poor. They are mostly worried about cervical and lumbar problems caused by long-term work, which exacerbating their anxiety and stress.(WHB.cn (2019))

Figure 16 shows how satisfied people are with the amount of time spent as a family. 1 in the x-axis means respondents are satisfied, 2 means they feel general, and 3 means they are not satisfied with the amount of time. From this picture, we can see that respondents who are more satisfied with the amount of time spent with families are under lower stress. It's obvious that modern life is very busy. Especially for young adults, they spend most of their time at work and spend less time with their families. According to the findings of Gallup Healthways, social time is one of the main reasons for the fluctuation of the daily happiness-stress levels. Likewise, it's happiest when spending about 6 hours with family and friends (Jin Harter (2008)). Therefore, try to be with family. It could be eating together, or chatting in the yard to relax and relieve stress (Avenson (n.d.)).

Weakness and Next Step

First of all, we have a bit of concern about the model selection. We excluded the linear regression model first, and this is because the variables we focus on are categories, it is hard to fit a linear line. Besides, the final model we selected is the logistic regression model, which is often used in two classifications. However, the stress level cannot be answered simply with "yes" or "no". When we extracted the data, we considered "high-stress level" as "yes", and "low-stress level" as "no". In this way, we lost the data on "moderate-stress level".

Moreover, we selected young adults aged 15-44 at once, but the main sources of stress for different age groups will also be different. For instance, for adolescents in their 20s, the stress from the study is more intense. For people in their 30s, the main sources of stress probably are work or intimacy. Therefore, the 15-44 age group we choose is somewhat broad. In future research, we can subdivide the age by ten years, and then conduct analysis separately. For example, to increase the accuracy in prediction, three age groups of 15-24 years, 25-34, 35-44 years can be modeled separately.

Furthermore, inducing or reducing stress is related to multiple factors, such as study, regular exercise. However, these aspects were not included in the survey. Therefore, it is not been considered in our analysis and model building. In the next step, we intend to find a different data set that covers these aspects. Thus, we could explore the relationship between exercise and stress. If there is a strong relationship, it can better provide people with new approaches to relieve stress.

Appendix

Code for this analysis is available at: https://github.com/cici889/finalpaper

Reference

Avenson, Bob. n.d. "Why Spending Time with Friends Will Lower Your Stress." https://www.ornish.com/zine/why-spending-time-with-friends-will-lower-your-stress/.

Disease Control, Centers for, and Prevention. 2020. "Coping with Stress." https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html.

Firke, Sam. 2020. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

Fox, John, and Sanford Weisberg. 2019. *An R Companion to Applied Regression*. Third. Thousand Oaks CA: Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/.

GSS. 2016. *General Social Survey (Gss), Cycle 30, 2016 : Canadians at Work and Home*. https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5221.

Hadley Wickham, Lionel Henry, Romain François. 2020. *Dplyr: A Grammar of Data Manipulation a Fast, Consistent Tool for Working with Data Frame Like Objects, Both in Memory and Out of Memory*. https://dplyr.tidyverse.org,%20https://github.com/tidyverse/dplyr.

Ipsos. 2020. "Stress Becoming a Way of Life for Canadian." https://www.ipsos.com/en-ca/stress-becoming-way-life-canadians.

Jin Harter, Raksha Arora. 2008. "Social Time Crucial to Daily Emotional Well-Being in U.s." https://news.gallup.com/poll/107692/social-time-crucial-daily-emotional-wellbeing.aspx.

JJ Allaire, Jonathan McPherson, Yihui Xie. 2020. *Rmarkdown: Dynamic Documents for R. R Package Version 2.3*. https://rmarkdown.rstudio.com.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

WHB.cn. 2019. "In the 2019 Workplace Health Report, Only 20." https://wenhui.whb.cn/third/QQ/201908/02/280639.html.

Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Wickham, Hadley, and Evan Miller. 2020. *Haven: Import and Export 'Spss', 'Stata' and 'Sas' Files*.

Xie, Yihui. 2014. "Knitr: A Comprehensive Tool for Reproducible Research in R." In *Implementing Reproducible Computational Research*, edited by Victoria Stodden, Friedrich Leisch, and Roger D. Peng. Chapman; Hall/CRC. http://www.crcpress.com/product/isbn/9781466561595.

———. 2015. *Dynamic Documents with R and Knitr*. 2nd ed. Boca Raton, Florida: Chapman; Hall/CRC. https://yihui.org/knitr/.

———. 2020. *Knitr: A General-Purpose Package for Dynamic Report Generation in R*. https://yihui.org/knitr/.

Yihui Xie, Garrett Grolemund, J. J. Allaire. 2018. *R Markdown: The Definitive Guide. Chapman and Hall/Crc*. https://bookdown.org/yihui/rmarkdown.