STA490 MoveU Project

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Effect of physical activity on mental health

Many studies suggest that exercising can help people deal with mental health issues and boost well-being.

We want to gain a better understanding of how exercise affects a person's mental health, and which types of exercise are best for a mood boost. More importantly, how much exercise is too much or not enough.

Backgrounds

- Current WHO recommendations on physical activity for adults health are as follows: at least 150 min of moderate-intensity aerobic physical activity throughout the week, or 75 min of vigorous-intensity physical activity per week, or any equivalent combination of the two.
- Adults should also perform muscle-strengthening activities of moderate intensity or higher that involve all major muscle groups for 2 or more days per week.

Moderate aerobic: brisk walking, swimming or mowing the lawn …

Vigorous aerobic: running or aerobic dancing …

Your Brain on Exercise Survey

1. U of T Year   1st Ⓐ   2nd Ⓑ   3rd Ⓒ   4th Ⓓ   5th Ⓔ   >5th Ⓕ   graduate Ⓖ

2. Enrolment status   Part-time Ⓐ   Full-time Ⓑ

3. cGPA   0.5-1.5 Ⓐ   >1.5-2.5 Ⓑ   >2.5-3.5 Ⓒ   >3.5-3.9 Ⓓ   >3.9 Ⓔ

4. Gender   Female Ⓐ   Male Ⓑ   Different identity Ⓒ   Prefer not to say Ⓓ

5. Age (years)   <18 Ⓐ   18 Ⓑ   19 Ⓒ   20 Ⓓ   21 Ⓔ   22 Ⓕ   >22 Ⓖ

6. Body Mass Index [Weight (kg)/height (m)^2]   <18.5 Ⓐ   18.5-24.9 Ⓑ   25-29.9 Ⓒ   >29.9 Ⓓ

7. *On an **average day** during the **past week**,* how much **awake** time (hours) did you spend sitting or lying down?

   <1 Ⓐ   1-1.9 Ⓑ   2-3.9 Ⓒ   4-6.9 Ⓓ   7-10.9 Ⓔ   11-16 Ⓕ   >16 Ⓖ   hours

8. *During the **past week**,* how many **times** did you exercise (e.g. run) for more than 10 minutes at a **moderate** or **high** intensity (i.e. breathing noticeably harder or sweating a bit)?

   0 Ⓐ   1 Ⓑ   2 Ⓒ   3-4 Ⓓ   5-7 Ⓔ   8-10 Ⓕ   >10 Ⓖ   times

*During the **past week**,* how much time (minutes) did you spend doing the following exercises:

	0	~10	~30	~60	~75	~120	≥150 min.
9. Light aerobic (e.g. walking)?	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
10. Moderate aerobic (e.g. brisk walking)?	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
11. Vigorous aerobic (e.g. running)?	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
12. Resistance (e.g. lifting weights)?	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
13. Flexibility (e.g. stretching)?	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ

14. *During the past week*, how many major stressors (e.g. moving to a new place, assignments due, tests) did you have?

      0 Ⓐ   1 Ⓑ   2 Ⓒ   3 Ⓓ   4 Ⓔ   >4 Ⓕ

During the past week, did you find that you had,

	All the time	Every day	Nearly every day	More than half the days	Several days	One day	Not at all
15. Trouble concentrating on things, like studying	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
16. Little energy/tiredness	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
17. Unhappy or stressed feelings	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
18. Poor appetite or overeating	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
19. Trouble falling/staying asleep, slept too much	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ

20. *During the past week*, on average, how many hours did you sleep at night?

      <4 Ⓐ   5 Ⓑ   6 Ⓒ   7 Ⓓ   8 Ⓔ   9 Ⓕ   >9 Ⓖ   hours

21. *During the past week*, how many nights did you go to sleep within an hour of the same time? (e.g. 11:30 pm week nights, 1:30 am weekends = 5 nights)

      0 Ⓐ   1 Ⓑ   2 Ⓒ   3 Ⓓ   4 Ⓔ   5 Ⓕ   6-7 Ⓖ   nights

Variable Category (Categorical)

We have explanatory variables:

- U of T years
- Enrolment status
- cGPA
- Gender
- Age
- Body Mass Index
- Average hours sitting or lying
- Moderate or High exercise

- **Light aerobic**
- **Moderate aerobic**
- **Vigorous aerobic**
- **Resistance**
- **Flexibility**
- **Number of Stressors**
- Health
- **Average hours of sleep**
- Consistent bedtime

Type of Variable

We considered the average score of the following 5 mental health questions as the response variable:

1. Troubles concentrating on things
2. Little energy or tiredness
3. Unhappiness or stress feeling
4. poor appetite or overeating
5. Trouble sleeping.

Missing Value Treatment

Exercise1	Exercise2	Exercise3	Exercise4	Exercise5	NumStressors	Health1	Health2	Health3	Health4	Health5
150	60	120	0	10	2	(E,F)	F	E	F	F
60	10	10	0	10	2	G	G	E	G	G
150	0	0	10	0	2	E	D	E	F	G
150	10	60	60	0	2	E	D	F	G	G
30	75	120	0	30	1	B	E	F	G	E
150	150	30	120	120	2	F	F	F	G	G
75	10	0	0	0	>4	E	C	C	C	G

Exercise1: Light aerobic

Exercise2: Moderate aerobic
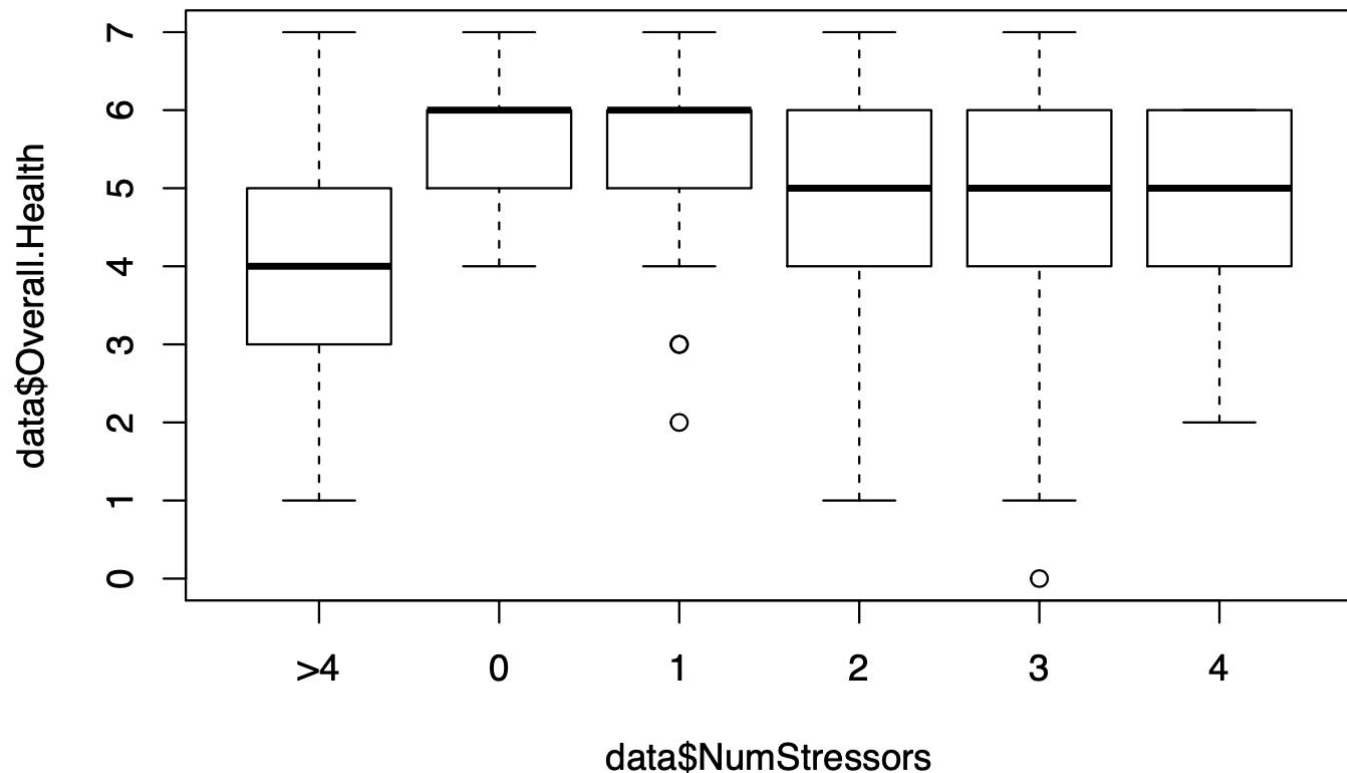
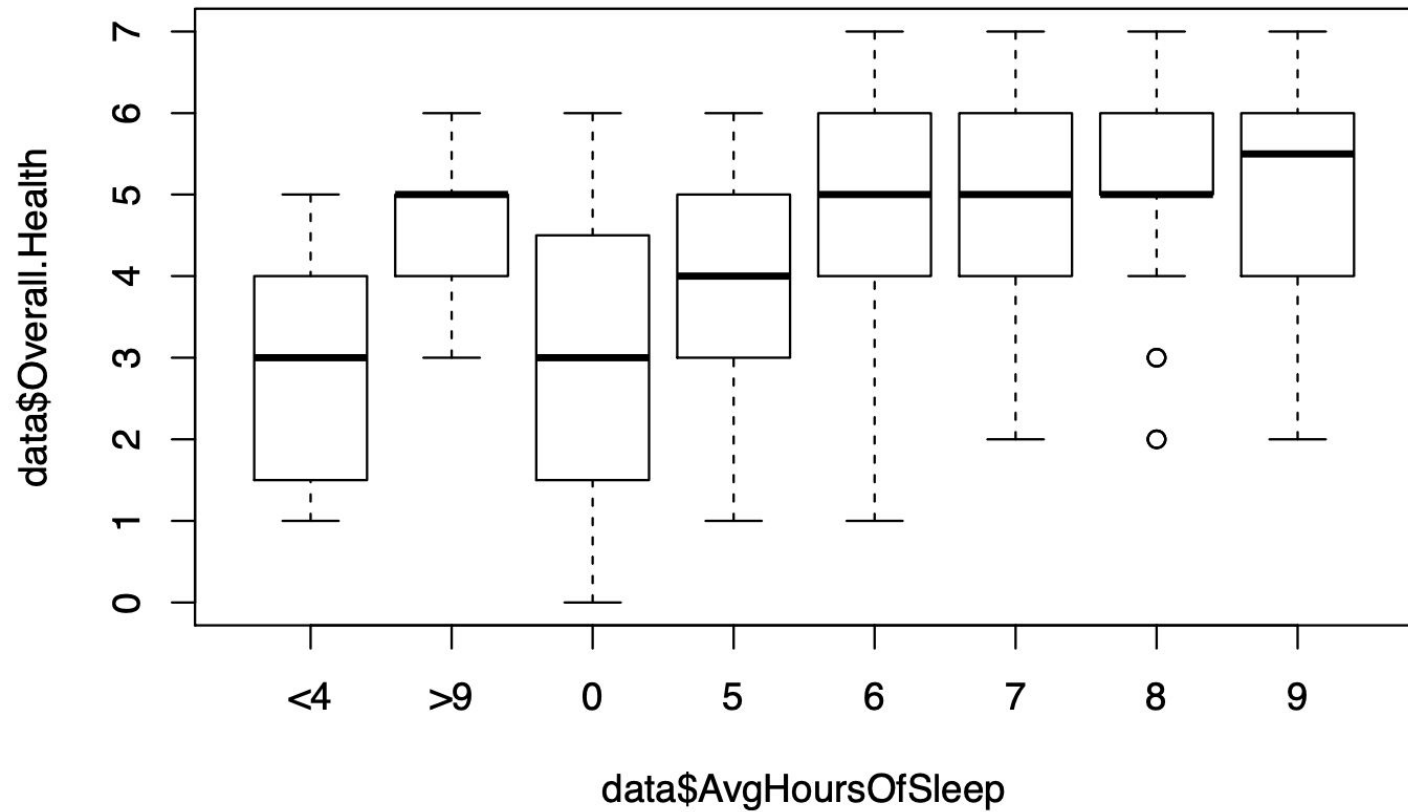Exercise3: Vigorous aerobic

Exercise4: Resistance

Exercise5: Flexibility
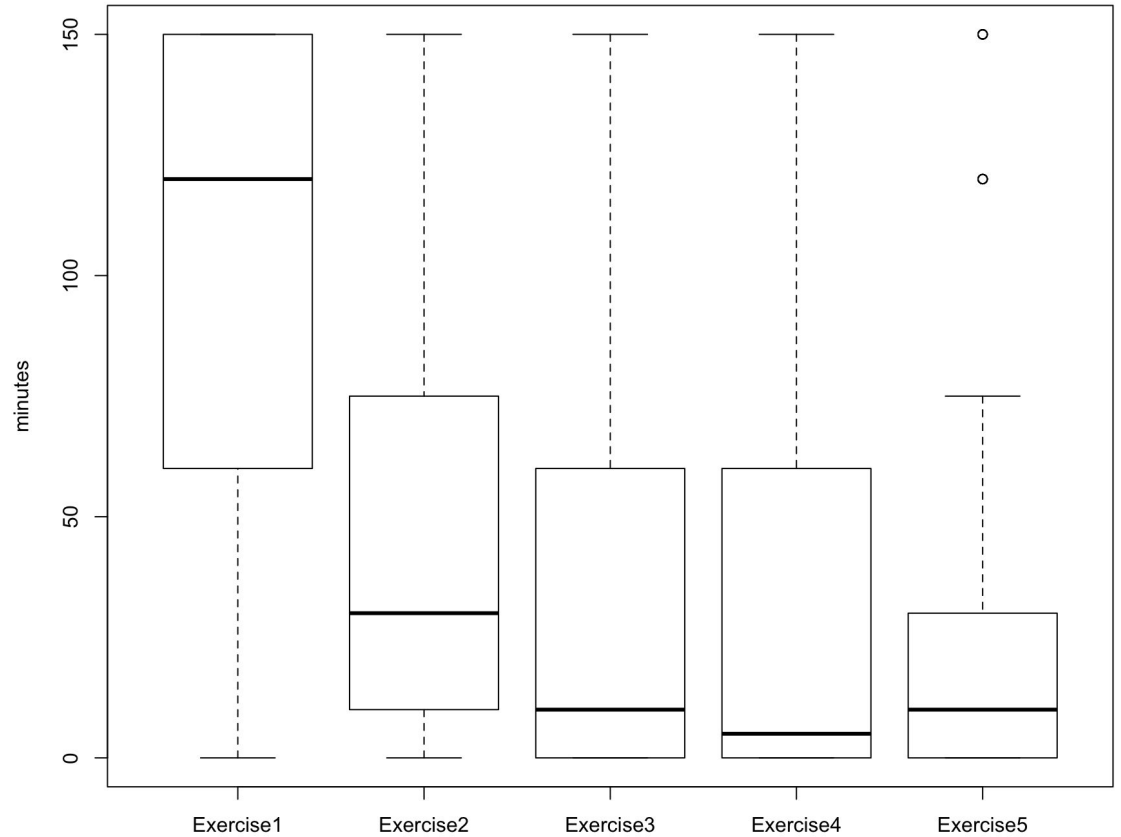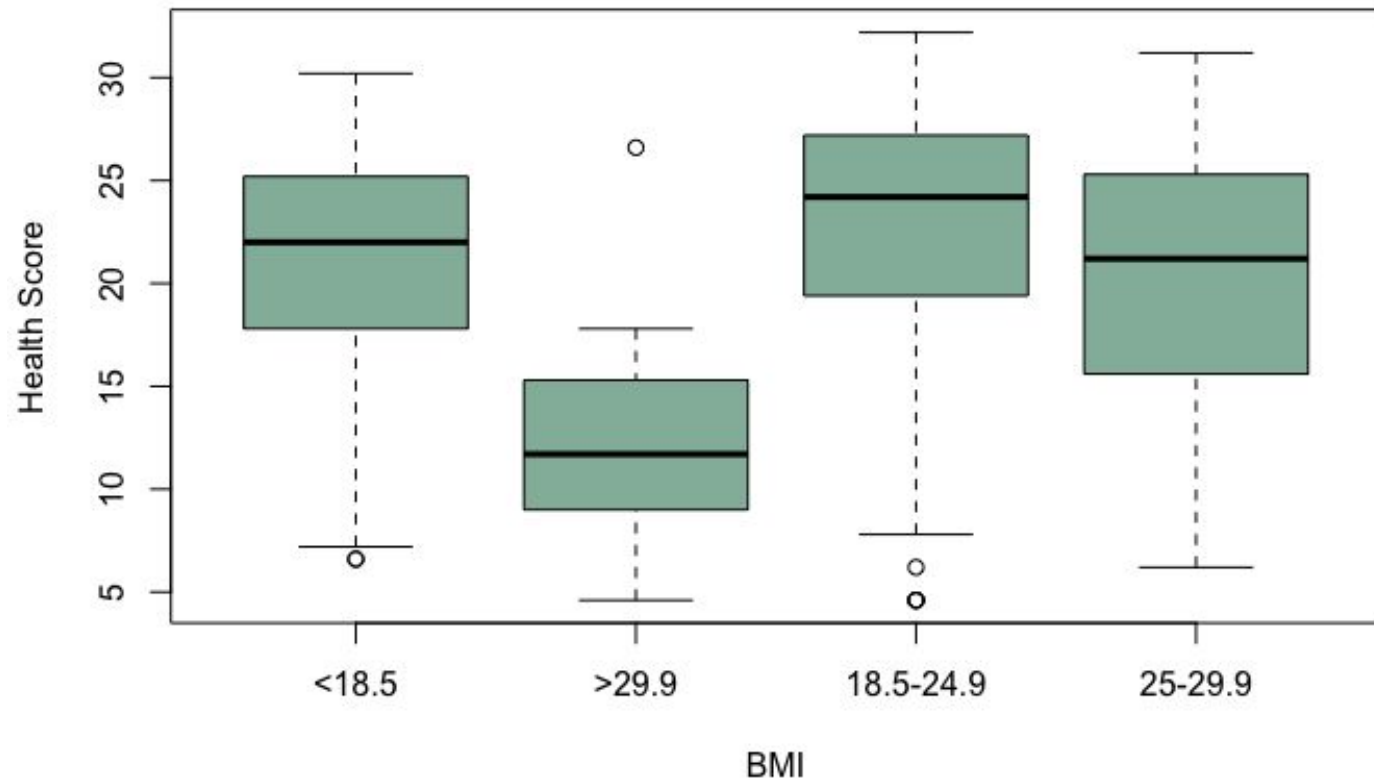
Observations From Data

Health Score of
Mental Problem

1: all the time
2: every day
3: nearly every day
4: more than half days
5: several days
6: one day
7: not at all

Boxplot of Health score by BMI

Statistical Approaches

- Generalized Linear Mixed Model
  - 140 subjects * 3 surveys = 420 observations
  - Pseudoreplication
  - Treat Subject ID as a random effect

- Response variable:
  - Mental Health Indicator (Scale 1-7)
  - Gamma or Beta Distribution
    - Left-skewed distribution
   - Positive and continuous

Distribution of Response Variable "Mental Health"
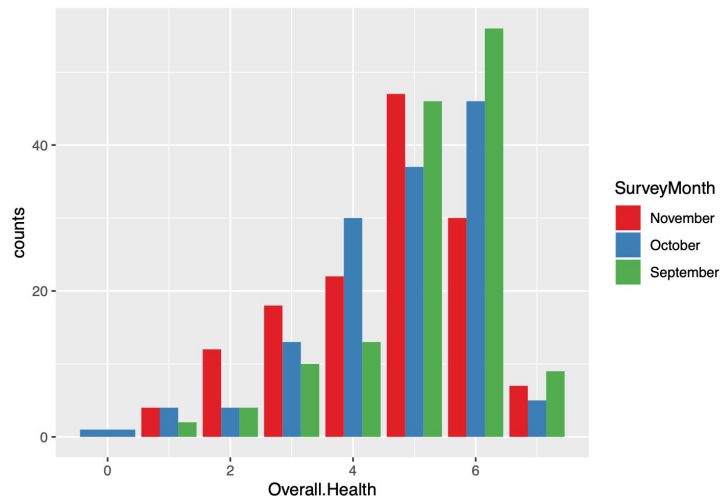
Statistical Approaches

- Predictor Variable (Two approaches):
  a. Continuous (Total Minutes of Exercises)
  b. Dummy (Treatment/Control Group)
    - Treatment Group (Referring to WHO)
      - Moderate-aerobic >= 150 OR
      - Vigorous-aerobic >= 75 OR
      - Any equivalent comb of the two

- Confounders
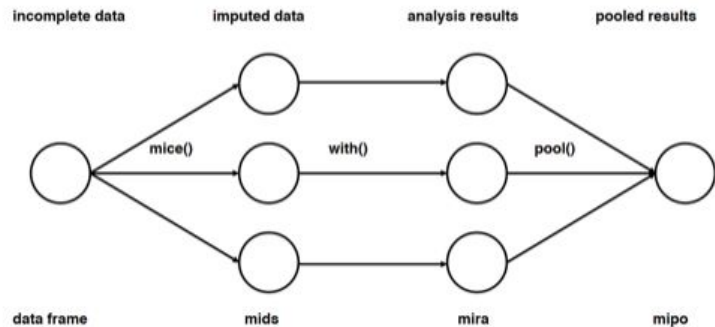 - Number of Stressors
  - Average Hours of Sleep
  - BMI

a. Distribution of Predictor Variable "Total Minutes of Exercises"
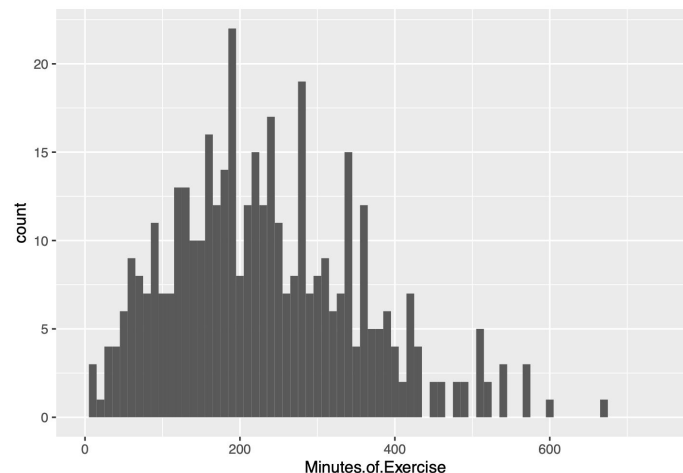
Questions and Challenges

Missing data

1. Last data observations: most convenient but less recommended
2. Simple imputation: mean
3. Multiple imputations: complicated but accurate

Measurements of the response variables

	All the time	Every day	Nearly every day	More than half the days	Several days	One day	Not at all
15. Trouble concentrating on things, like studying	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
16. Little energy/tiredness	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
17. Unhappy or stressed feelings	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
18. Poor appetite or overeating	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
19. Trouble falling/staying asleep, slept too much	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ

	All the time	Every day	Nearly every day	More than half the days	Several days	One day	Not at all
Q15	1	2	3	4	5	6	7
Q16	0.8	1.6	2.4	3.2	4.0	4.8	5.6
Q17	1	2	3	4	5	6	7
Q18	0.8	1.6	2.4	3.2	4.0	4.8	5.6
Q19	1	2	3	4	5	6	7

Limitation of the survey