

How Ya Doin'? with COVID-19

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SUMMARY

COVID-19 has had a profound negative impact on individuals, communities, and society. The purpose of this study was to investigate the impact of COVID-19 restrictions on sleep patterns, eating, mood, physical activity, and screen time of students and adults. We hypothesized that participants experienced fewer sleeping hours, more unhealthy eating habits, a severe change in mood and physical activity, and increased screen time hours after COVID-19 restrictions were implemented compared to before COVID-19. Participants were given an online survey with 10 questions about sleep patterns, eating habits, mood, physical activity, and screen time and asked to rate each item based on their experience before and during COVID-19 restrictions. Results were summarized and compared between the timepoints of “before” and “during” COVID-19 restrictions. For the 227 participants, quality of sleep, eating habits, mood, and physical activity mostly decreased, whereas screen time increased. These changes were statistically significant in middle and high school students but not adults. Each area of question had slightly different results when looking at different ages and gender. For example, sleep was significantly worse in middle school students and significantly improved in high school students, but the worsening in adults was not statistically significant. Based on these results, we concluded that COVID-19 has overall negatively affected daily life with worse sleep, eating, mood, physical activity, and screen time.

INTRODUCTION

The coronavirus 2019 (COVID-19) pandemic caused by the novel coronavirus (SARS-CoV-2) has had a negative impact on individuals, communities, and society. Severe restrictions, which have been necessary to contain the pandemic, have adversely affected people’s health and lifestyle. Research shows that students from grade school to college are vulnerable to decreases in physical and mental health due to schools closing, distance learning, isolation, and other unexpected changes to their lives (1).

Sleep difficulties have been exacerbated by disruptions in home, family, and work lives due to COVID-19 (2). Stress from being isolated, staying at home all day, and/or having the illness, as well as the economic, financial and psychosocial impacts of the pandemic, contribute to sleep disruptions (2). A survey study in China captured the acute negative

impact during the peak of COVID-19 on sleep (insomnia) and psychological symptoms (acute stress, anxiety, and depression), finding insomnia worse in female, young, living in the epicenter, and closer to others with COVID-19 (3). An Italian survey study examined the impact of home confinement on sleep patterns and sleep disturbances among Italian children and adolescents during the COVID-19 pandemic, and reported a significant change in the sleep/wake schedule of children across all age groups, with delays in bedtime and rise time, which could limit access to outdoor activities and reduce interactions with other people (4).

Eating habits and weight have also incurred pandemic-related changes in patterns of physical activity, diets, sleeping, and psychological functioning. A study assessed the impact of the pandemic on eating behaviors and discovered that every 1-unit increase in depressive symptoms was associated with a 13% greater odds of binge eating (5). In addition, people with food insecurity pre-pandemic have experienced more hardships and limited access to fresh food since COVID-19 (6). The pandemic weight gain has become a significant problem. A study of self-reported weight measurements of middle-aged men and women across the country showed a 1.5-pound weight gain per month (7). Children are also gaining weight in an unhealthy way; in a study of pediatric patients, the prevalence of pediatric obesity was reported to increase from 13.7% pre-pandemic to 15.4% during the pandemic (8). There was a disparity seen in that these increases were more pronounced among children who were Hispanic or Black, from a lower-income group, or publicly insured (8). The unhealthy eating behaviors correlated with a negative impact during the pandemic include mindless eating and snacking, increased food consumption, generalized decrease in appetite or dietary intake, eating to cope, pandemic-related reductions in dietary intake, and re-emergence of eating disorder symptoms (5).

Mood and mental health are both directly and indirectly affected by COVID-19. A systematic review to assess psychiatric and neuropsychiatric presentations of severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and COVID-19, including depression, anxiety, fatigue, post-traumatic stress disorder, and rarer neuropsychiatric syndromes, reported that most people recover without experiencing mental illness (9). However, the emotional responses due to the prolonged COVID-19 pandemic and subsequent restrictions can lead to psychological impacts such as stress, feelings of powerlessness, loss of identity, isolation, loneliness, fear, and anxiety (10). These mental health effects could potentially be long-term and therefore should not be ignored (11). A study investigating mood responses of 1,062 participants during the period of COVID-19 restrictions in Australia found a profile of

increased risk of mental health issues characterized by high scores on tension, depression, anger, fatigue, and confusion (12). In children in the United States (US), the proportion of mental health–related emergency department visits increased beginning in April 2020 and remained elevated through October 2020 (13).

A cross-sectional study to investigate the impact of the COVID-19 shutdown on the physical activity of 1,802 Danish citizens ages 15–18, 19–29, 30–59, and 60+ years reported alarming decreases in physical activity among all age groups (14). A Canadian survey study to assess the impact of COVID-19 restrictions on physical activity, behavior, and well-being found significant differences between those who were inactive versus active (15). People who were inactive with less physical activity became more inactive, but those who were more physically active had better mental health scores. Also, those inactive participants who became more active had lower anxiety levels (15). A US study to examine the early effects of the COVID-19 pandemic on physical activity and sedentary behavior of children during school closures and sports cancellations found short-term changes of decreased physical activity and increased sedentary behavior, which if continued could lead to inactivity and increased risk of obesity and other conditions such as diabetes and heart disease (16). Screen time for all purposes -- including school, work, and leisure -- has increased with COVID-19 restrictions. The pandemic-imposed shift to remote work and distance learning have led to increases in digital screen time for adults and children. About 4 in 10 workers feel their jobs can be done from home most of the time (17). Accordingly, about 42% of the labor force in the US now work from home full-time and therefore spend several hours in front of computer screens for work (18). A study of 2,426 children and adolescents in Shanghai during the COVID-19 pandemic showed a substantial decrease in physical activity and increase in screen time (19).

The purpose of this survey study was to investigate the impact of COVID-19 restrictions on sleep, eating, mood, physical activity, and screen time of students (from grade school to college) and adults via an internet survey which could be forwarded to as many people as possible, and without geographic boundaries. We hypothesized that participants experienced fewer sleeping hours, more unhealthy eating habits, a significant change in mood and physical activity, and increased screen time hours due to COVID-19 restrictions. This is an important question given the continued impact of COVID-19 and restrictions on our daily lives, and the potential to better understand what lifestyle aspects could be changed and improved to lessen its negative impact.

RESULTS

A total of 227 people responded to the survey (Table 1). One-third of the respondents were middle schoolers, one-fourth were high school students, and the rest were adults (19 years and older). The majority of the respondents were female (78.9%), and from the US.

The survey asked participants to rate 5 pairs of lifestyle item (sleep, eating, mood, physical activity, and screen time) before and after COVID restrictions on a 1-10 scale. For the first three items, the scales were described as 1 = worst and 10 = best. For physical activity, the scale was 1 = "not at all" to 10 = "frequently." For screen time usage per day, the

N=227		Number of responses (percentage)
Age group		
	11-14	65 (30.1)
	15-18	58 (25.6)
	19-25	15 (6.7)
	26-35	5 (2.2)
	36-45	6 (2.6)
	46-55	47 (20.7)
	56-65	21 (9.3)
	65+	9 (4)
Gender		
	Female	179 (78.9)
	Male	45 (19.8)
	Prefer not to say	3 (1.3)
Location		
	US	183 (80.6)
	Non-US	44 (19.4)

Table 1: Characteristics of participants.

number of hours was asked, with 1 = "1 hour or less" and 10 = "10 hours or more." For all ages, scores for eating, mood, physical activity, and screen time were significantly worse ($p < 0.0001$) during COVID-19 restrictions compared to before, and sleep scores were lower during restrictions than before but not statistically significant (Figure 1).

We also analyzed these changes broken down by age groups (Figure 2). The middle school group, ages 11-14, showed significantly worse scores for sleep ($p = 0.004$), eating, mood, physical activity, and screen time ($p < 0.0001$) during COVID-19 restrictions compared to before. The high school group, ages 15-18, scored significantly worse on eating ($p = 0.01$), mood, physical activity, and screen time ($p < 0.0001$) during COVID-19 restrictions compared to before; sleep scores were improved after restrictions, but this change was not statistically significant. Participants aged 46-65 had

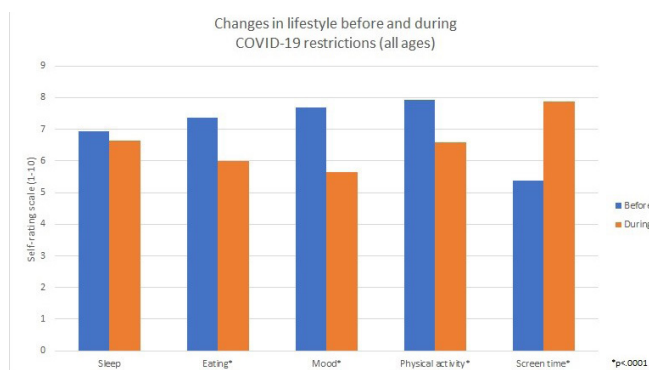


Figure 1: Changes in lifestyle before and during COVID-19 restrictions for all age groups combined. Participants rated their sleep, eating, mood, physical activity, and screen time on a 10-point scale. Responses were averaged and compared before and during COVID-19 restrictions. Scores (mean ± SD) before and during restrictions: Sleep - before 6.96 ± 1.82, during 6.64 ± 2.00; Eating - before 7.39 ± 1.73, during 5.99 ± 2.14; Mood - before 7.68 ± 1.71, during 5.66 ± 2.13; Physical Activity - before 7.97 ± 2.15, during 5.63 ± 2.49; Screen Time - before 5.4 ± 2.3, during 7.86 ± 2.08. Significant decreases were found in eating, mood, and physical activity, while there was a significant increase in screen time ($p < 0.0001$). Higher scores for sleep, eating, mood, and physical activity indicate positive changes. Higher scores for screen time indicate longer time spent on the screen, which may or may not be a positive change.

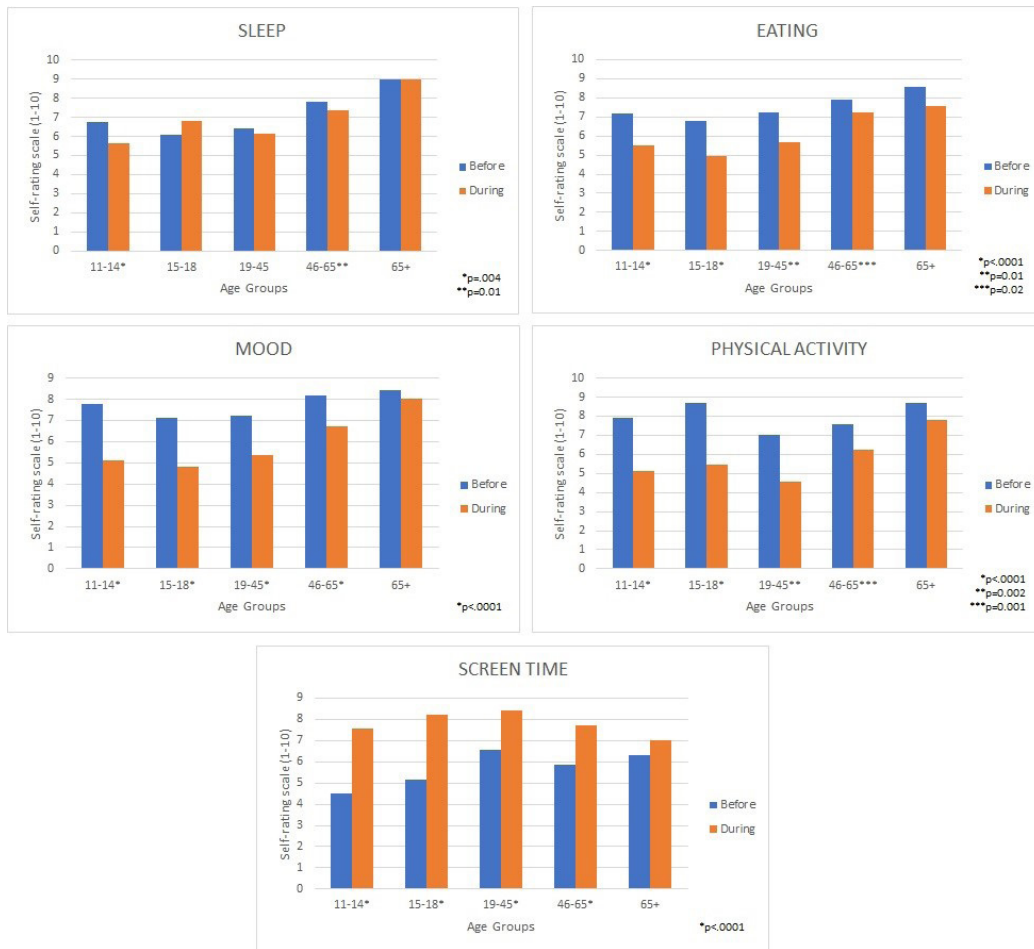


Figure 2: Changes in lifestyle before and during COVID-19 restrictions by age group. Participants rated their sleep, eating, mood, physical activity, and screen time on a 10-point scale. Responses were averaged and compared before and during COVID-19 restrictions. For middle schoolers (ages 11-14), significant decreases were found in sleep ($p = 0.004$) and eating, mood, and physical activity ($p < 0.0001$), while there was a significant increase in screen time ($p < 0.0001$). For high schoolers (ages 15-18), significant decreases were found in eating ($p = 0.01$) and mood and physical activity ($p < 0.0001$), while there was a significant increase in screen time ($p < 0.0001$). For adults (ages 46-65), significant decreases were found in sleep ($p = 0.01$), eating ($p = 0.02$), mood ($p < 0.0001$), and physical activity ($p = 0.001$), while there was a significant increase in screen time ($p < 0.0001$). Older adults (age 65 and older) had no significant change in scores. Higher scores for sleep, eating, mood, and physical activity indicate positive changes. Higher scores for screen time indicate longer time spent on the screen, which may or may not be a positive change.

significantly worse scores across all measures: sleep ($p = 0.01$), eating ($p = 0.02$), mood ($p < 0.0001$), physical activity ($p = 0.001$), screen time ($p < 0.0001$). The group aged 65 years and older had no significant change in scores.

The changes in lifestyle items were also analyzed by gender (Figure 3). All parameters significantly declined after COVID restrictions compared to before for both males and females, with the exception being that males had no significant changes in sleep scores.

The changes in scores before and during COVID-19 restrictions by age group and gender were also analyzed (Table 2). Middle school males and females had similar changes in sleep, eating, and mood, but not physical activity and screen time. Middle school females had less physical activity and significantly increased screen time compared to males. High school males had greater changes in sleep, eating, mood, and screen time than females, but not in physical activity. High school males had significantly increased screen time compared to females. Adult females had greater changes in

sleep, eating, and screen time compared to males, and adult males had greater changes in mood and physical activity compared to females. The differences between males and females in eating and screen time are statistically significant.

When looking at the changes for screen time between males and females, the scores are more than a one point difference compared to the other lifestyle topics, in which the difference between males and females are less than one point. The results of T-test comparisons between the two genders are shown in the "Gender difference (yes/no)" column, with Y indicating a statistically significant difference in the change between males and females. Screen time use between males and females in each group of middle school, high school, and adults are statistically different. For high school students, there is a change in score that is more than one point for sleep and screen time. For adults, only screen time changed by more than one point. The trend is that females have noticeably bigger changes than males for screen time in all age categories.

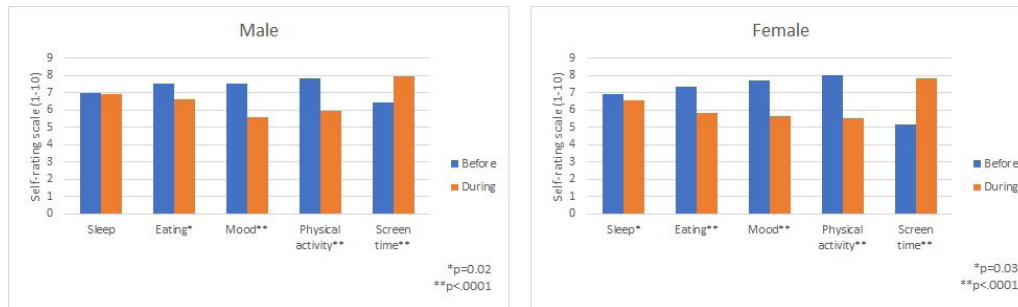


Figure 3: Changes in lifestyle before and during COVID-19 restrictions by gender. Participants rated their sleep, eating, mood, physical activity, and screen time on a 10-point scale. Responses were averaged and compared before and during COVID-19 restrictions. For males, significant decreases were found in eating ($p = 0.02$), mood and physical activity ($p < 0.0001$), while there was a significant increase in screen time ($p < 0.0001$). For females, significant decreases were found in sleep ($p = 0.03$), eating, mood and physical activity ($p < 0.0001$), while there was a significant increase in screen time ($p < 0.0001$). Higher scores for sleep, eating, mood, and physical activity indicate positive changes. Higher scores for screen time indicate longer time spent on the screen, which may or may not be a positive change.

DISCUSSION

The goal of this survey study was to find out how sleep, eating, mood, physical activity, and screen time have been affected by COVID-19 and its restrictions. Overall, the results of this survey of 227 people show there was a significant negative impact on sleep, eating, mood, physical activity, and screen time during COVID-19 restrictions compared to before COVID-19 restrictions. These findings support our hypothesis that COVID-19 and the restrictions related to the pandemic have negatively impacted participants’ lifestyles.

Sleep worsened for some but not all respondents. Both age groups 11-14 and 45-64 showed decreases in sleep, as well as the female (regardless of age) subgroup. All other age groups and the male subgroup did not show worsening of sleep. Sleep is a key component to a normal and healthy lifestyle, and the COVID-19 pandemic has altered many regular sleeping patterns (20). Changes in sleep can affect mood and eating habits, and lack of sleep can lead to more depression, or higher risk of obesity and high blood pressure. Adequate sleep is linked to better performance in school (21). It was interesting to note that high schoolers had better sleep scores during COVID-19 restrictions. One possible explanation from a small study of 45 adolescents interviewed by phone is that the delayed start times from school closures or transition to remote learning led to a 2-hour shift in sleep, longer duration of sleep, and better quality of sleep (22).

Eating habits were perceived as worse during the pandemic and lockdown. Children typically gain weight over the summer, but it is anticipated that they now will gain even more weight during lockdown, which can lead to obesity and increases in health risk (23).

Respondents perceived a significant worsening of mood

during COVID restrictions compared to before. In a study in the UK of 168 children ages 8-12, researchers assessed symptoms of depression and anxiety before and during lockdown, finding a significant increase in depression symptoms but no significant change in anxiety (24). For our survey, we simply asked about mood and not specific emotions, although mood can be an indicator for depression and anxiety. Being depressed can also worsen overall physical and mental health, so it’s important to pay attention to mood during lockdown. Depression and lowered mood may also affect other aspects of this study, as it can lead to students having problems focusing and paying attention in school, as well as worsening their sleeping/eating patterns and making them not want to get out of bed and exercise.

In a study in New York that looked at parents with young children aged 2-7, it was reported that the extent of hardships and consequences the parents and children faced during the crisis (financial issues, job loss, etc.) was correlated with worse mental health (25). This finding is important because it could be that more attention is needed to families who are suffering hardships, especially with those with young children.

Physical activity was significantly decreased during COVID restrictions compared to before among our survey participants. In a study of 2,426 children and adolescents ages 6-17 in 5 different schools in Shanghai, China, researchers found a significant decrease in physical activity (435-minute reduction per week) and increase in screen time (+1,730 minutes per week) when comparing pre-COVID (first survey between January 3-21, 2020, shortly before public health emergency activated January 24, 2020) and during pandemic (second survey between March 13-23, 2020) (19). Our survey results are consistent with the findings of this

	Ages 11-14				Ages 15-18				Ages 19+			
	All n=64	Male n=10	Female n=54	Gender difference (Y/N)	All n=58	Male n=7	Female n=51	Gender difference (Y/N)	All n=102	Male n=28	Female n=74	Gender difference (Y/N)
Sleep	-1.09*	-1.10*	-1.11*	N	0.67*	1.57	0.55	N	-0.38	-0.07	-0.5*	N
Eating	-1.67*	-1.60	-1.81*	N	-1.86*	-2.57	-1.76*	N	-0.90	-0.29	-1.15*	Y
Mood	-2.70*	-2.70*	-2.63*	N	-2.29*	-2.71	-2.24*	N	-1.47	-1.5*	-1.46*	N
Physical Activity	-2.76*	-1.20	-3.07*	N	-3.21*	-3.14*	-3.22*	N	-1.56	-1.75*	-1.49*	N
Screen Time	3.06*	1.50*	3.26*	Y	3.09*	4.00*	2.96*	Y	1.77	0.93*	2.08*	Y

Table 2: Change in scores before and during COVID-19 restrictions by age group and gender. Negative scores indicate a decrease in score, positive scores indicate an increase in score. If the difference between the change in score of the male and female was statistically significant, then the diff column shows Y, otherwise it is N. * $p < .05$ means statistically significant.

study. A lack of physical activity and increase in screen time will negatively impact someone's physical and mental health. Without physical activity, it could weaken one's immunity and provide less immunity for viral infections (26).

The age 65 years and older group had no change in any of the measures, but there were only nine people who were this age, so it was a smaller group. This is interesting and consistent with evidence that older adults may be more resilient to anxiety, depression, and stress than younger populations in the initial phases of the pandemic (27). Results can also depend on how well certain people and their mental health were doing before COVID-19, and it can also tie into whether the people surveyed had jobs or not, plus what their lifestyle was like; the circumstances are also important to these results.

Another interesting finding occurred when comparing the change in lifestyle questions between males and females in the different age groups. Most of the changes for the females were worse than the changes for males; however, few of these differences were statistically significant. In the end, only the change in screen time between males and females was statistically significant across all age groups, and changes in eating were statistically significant for adults. The increased screen time finding seems to make sense because many people are forced to use mobile devices these days (such as for school or work), and it is easy to keep using them.

This survey study is unique from other studies because it ties into what is currently happening in our world today and is socially relevant in the context of the ongoing COVID-19 pandemic. Also, this is a social/behavioral study in which people easily understand and relate to the questions on lifestyle changes.

This study had limitations. Because it is a survey, the results depend on a person's memory of the past. The Bignardi study method was more accurate than our study method, because they obtained the survey twice (before and during COVID-19), whereas our survey was sent only once, thus relying on participants to accurately remember how they were doing months ago (24). We did not analyze by whether people lived in the U.S. or not, as 44 people who completed the survey lived outside of the U.S., but it is clear that the negative impact on peoples' can be felt around the world. It is also possible that there was a sampling bias since the participants were recruited through the students in the school and their families, which may make the results not generalizable to a general population in the community.

Lifestyle changes in response to stress can be complex. Even though the scores for sleep, eating, mood, physical activity and screen time changed for the group in general, some of the "positive" changes in scores could still indicate worsening of behaviors. For example, for the sleep and eating questions, respondents may have reported an increase in scores to refer to sleeping or eating more than usual, instead of the intention of the question to capture whether the behaviors were better, the same, or worse compared to the time before COVID-19 restrictions were in place.

Lastly, we did not ask directly about how well people were doing in terms of mental health (that is, we asked about lifestyle changes), and their responses may depend on many other factors, such as their life circumstances before COVID-19. For example, if they were in a difficult situation where their mental health was already not good, and that affected their sleep and

eating behaviors. Despite these limitations, our study was strong in its large sample size ($n = 227$) and wide age range (11-65+), which allowed us to break down and examine our sample by age and gender.

In summary, we surveyed 227 people about how their lifestyle had changed due to COVID-19 based on these five aspects: sleep, eating, mood, physical activity, and screen time. The purpose of this experiment was to investigate how COVID-19 had affected everyone's day-to-day lifestyle. We found that COVID-19 negatively impacted sleep, eating, mood, and physical activity, and increased screen time significantly. To improve these, we can teach people methods on how to sleep more, eat better, take care of themselves mentally and physically, and spend less time on screens so they can engage with people more. Future studies are needed to more closely examine the impact of pandemic restrictions on the mental and physical health of individuals, identify those at risk of negative outcomes, and develop psychosocial and behavioral strategies to effectively mitigate the negative consequences of the necessary restrictions in a pandemic setting.

MATERIALS AND METHODS

Research involving human subjects was conducted under the supervision of experienced adult sponsors and qualified scientists and followed state and federal regulatory guidance applicable to the humane and ethical conduct of research involving human participants. Prior to data collection, ethical approval was obtained from the Rochester Regional Science and Engineering Fair (RRSEF) Scientific Review Committee.

We researched questions to assess relevant changes in the areas of sleep, eating, mood, physical activity, and screen time before and during COVID-19 restrictions. We then used those questions to create an online survey in Google Forms. We sent out the survey link to approximately 50 people (classmates, family, and friends) over the age of 11, who were asked to forward it to other people they knew. If the person was aged 14 years or under, their parents' approval was required. The survey was only distributed once.

The survey consisted of questions about age, gender, and whether they lived in the United States. Five pairs of questions were asked to rank their lifestyle on a scale of 1-10 (1 being the worst it could/can be, 10 being the best it could/can be) before COVID-19 restrictions and during COVID-19 restrictions. The first pair was about sleep, the second about eating habits, the third about mood, the fourth about physical activity, and the fifth about screen time (**Appendix**). The method of assigning 1 for "the worst it can be" and 10 for "the best it can be" was patterned after survey questions used in the Linear Analog Self-Assessment (LASA), a validated scale to measure quality of life domains of physical, functional, emotional, and social functioning (27).

Data Analysis

From the responses, the average score for each question was calculated, and then matched pairs t-tests with a significance level of $p < 0.05$ were used to compare the responses before and during COVID-19 restrictions. We also performed matched pairs t-tests based on age and gender and looked at negative and positive changes. JMP Pro 14.1.0 (SAS Institute, Cary, NC) was used for statistical analysis.

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