The effects of COVID-19 pandemic social isolation on the mental and physical health of the general population

Michael Cinque[1], Karen Kuntz[1]
[1] Chaminade High School, Mineola, New York

SUMMARY

During the early part of 2020, the COVID-19 pandemic began, and continues to affect the lives of millions of people spanning the globe. During the pandemic, local and national governments throughout the world sought to limit the spread of the SARS-CoV-2 virus, which causes the disease known as COVID-19, through the use of mandated lockdowns and social distancing measures. The effects that these unprecedented and hastily implemented measures have had on the mental and physical health of the general population, continues to be an area of intense study. We attempted to measure these effects through an anonymous Google forms survey. A majority of survey respondents lived on Long Island, NY during the period of social isolation. The survey, conducted during April and May of 2020, focused on changes in physical and mental health across various age groups and between sexes. The results of the survey reveal some negative impacts to physical health across all demographic groups, such as decreased physical activity and worsened perceived sleep quality. The survey also reveals significant increases in depressive symptoms and feelings of loneliness across all groups following the period of social isolation, with more significant increases occurring in younger age groups and amongst women. This study illustrates that the social isolation resulting from the COVID-19 lockdowns had negative effects on both the physical and mental health of the general population and provides valuable information that may be used to assist local and national health officials with post-pandemic mental health responses in the future.

INTRODUCTION

On March 20th, 2020 the Governor of New York issued the stay-at-home order in response to the COVID-19 pandemic, altering the lifestyles of millions of New Yorkers (1). In an effort to combat the spread of the SARS-CoV-2 virus, which causes the disease known as COVID-19, health officials enacted strict social distancing rules and guidelines, leaving many people socially isolated. Despite these intentions to safeguard the public's physical health and to prevent the spread of the virus, the mental and physical health of the general population may have been compromised.

Multiple recent studies have shown links between social isolation and symptoms of depression and loneliness amongst different age groups and between sexes (2-5). For example, a 2017 study from Singapore showed an association between social isolation, loneliness, and depressive symptoms, as defined by the Patient Health Questionnaire (PHQ-9) (2). The same study found young people to be the most vulnerable to these effects. Another recent study on the effects of COVID-mandated social isolation on youth predicted that the cancelation of social events due to the pandemic would most strongly negatively affect children and adolescents (3). In addition, another study focusing on older adults and social isolation found this population to be highly susceptible to loneliness and depression during periods of social isolation (4). These studies raise questions about which age group is most susceptible to loneliness and depression resulting from social isolation. In terms of the effects of social isolation on male versus female sex, a study on social isolation during the COVID-19 pandemic have found connections between lockdowns and an increased susceptibility of women to anxiety and insomnia (5). We were interested in determining how different age groups and sexes have been affected by COVID-19 pandemic-induced social isolation. This study attempted to measure the physical and mental ramifications of this mandated isolation across these demographics.

The SARS-CoV-2 virus is a novel coronavirus that was first identified in Wuhan, China. The first case was reported in early December of 2019, but it was not until March 2020 that COVID-19 was declared a pandemic (6). Throughout the spring of 2020, the focus of many state governments in the United States and national governments throughout the world was heavily concentrated on limiting the spread of the virus via social isolation measures (6). Lockdown orders were at the center of the early plans for containment; however, this hastily-implemented solution came with a wealth of concerns. One of these concerns was the effect that large-scale social isolation would have on the public. Such a large exercise in social isolation was completely alien to the world, and the extent of the damage on mental and physical health of individuals, isolated from their normal social lifestyles, were largely unknown. This gap in knowledge led us to our question: to what extent was the mental and physical health of people of differing backgrounds (specifically of different ages and sexes) affected by the social isolation induced by the COVID-19 lockdowns?

Our study measured the physical and mental ramifications of this mandated isolation between sexes and across different

age groups. We hypothesized that there would be a decline in the practice of healthy physical habits (physical activity, healthfulness of diet, sleep quality/insomnia, etc.) across the general population due to increased social isolation. This was based on a previous study done in 2017 in Singapore linking social isolation to poorer physical health, such as decreased physical activity, lack of a healthy diet, and decreased quality of sleep. Interestingly, this study also showed that isolation did not affect all groups (age, sex, location, employment status, etc.) equally, forming the basis for the main question addressed by our study (2).

The second hypothesis was that we would see that younger people, particularly those under 18, are more strongly negatively affected in terms of mental health than older people. This is based on another recent study on pandemic social isolation and its effects on youth, which revealed that children and adolescents are at particular risk for suffering from the negative mental effects of social isolation (3). One possible reason for this is that young people utilize social media more than those in older age groups, and it is highly likely that social media usage is increased during periods of social isolation. A study conducted in China showed a direct link between social media usage and depression during the COVID-19 pandemic (7). Thus, we expected to see that young people experienced a measurable increase in self-reported feelings of loneliness and depressive symptoms due to the lack of physical social interactions from their typical social engagements, such as school or other social gatherings. We also expected to see that survey participants between 40 and 55 suffered the least from increases in self-reported feelings of loneliness and depressive symptoms as a 2018 study found that middle-aged adults (40–59 years old) are the least reliant on daily social interactions (8).

We expected that the older demographics (over 70 years of age) would have an increase in self-reported feelings of loneliness, due to the fact that individuals, living in nursing homes and assisted living facilities, where 14% of this population reside, tended to suffer from more severe lockdown rules and many residents were left isolated from family members (9). We also expected to see that this had a negative impact on the physical health of this older population since a 2019 study on older adults experiencing social isolation linked social isolation to a more sedentary lifestyle and greater health risks among older adults to a noticeable degree (10). It is important to note that while some age groups will suffer more than others, no age group will likely be unaffected. Two studies from 2002 and 2012, respectively, reported that social isolation leads to both loneliness and depression across all age groups (11,12).

Beyond differences in individuals of varying age groups, we predicted that individuals of different sexes would report different levels of mental health decline since the start of the pandemics. We hypothesized that more women would report feelings of loneliness due to social isolation compared to men One study also revealed that, compared to men more women suffer from loneliness as a result of social isolation (13). Another study comparing the amount of loneliness experienced by men and women in January of 2020 to April/May of 2020 (during the lockdown periods) likewise found that women suffered a steeper increase in feeling lonely compared to men (14).

RESULTS

We used an anonymous Google Forms survey to ask questions about participants' daily habits, physical health, mental health, social health, and other general information (age, gender, location, employment status, living situation, etc.). In total, 456 individuals participated in our survey from
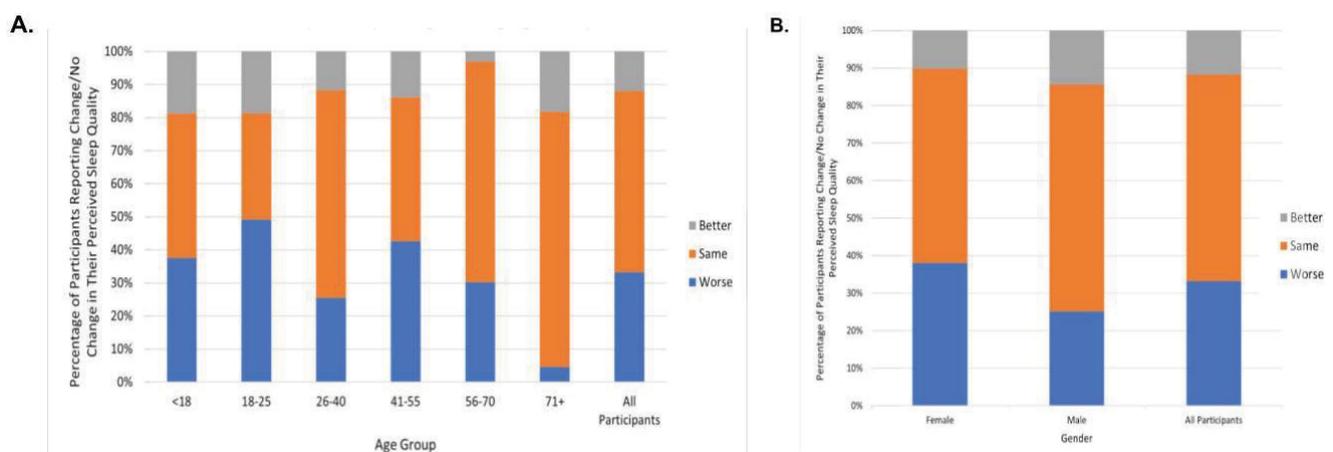

Figure 1: Changes in perceived sleep quality. (A) Perceived sleep quality change by age group. Percentage bar graph showing perceived sleep quality among age groups during the period of social isolation as compared to before the pandemic began. Survey participants were asked to report if their sleep quality was better, the same, or worse than before the lockdown period began. **(B)** Perceived sleep quality change by gender. Percentage bar graph showing perceived sleep quality as reported by males and females during the period of social isolation as compared to before the pandemic began. Survey participants were asked to report if their sleep quality was better, the same, or worse than before the lockdown period began.
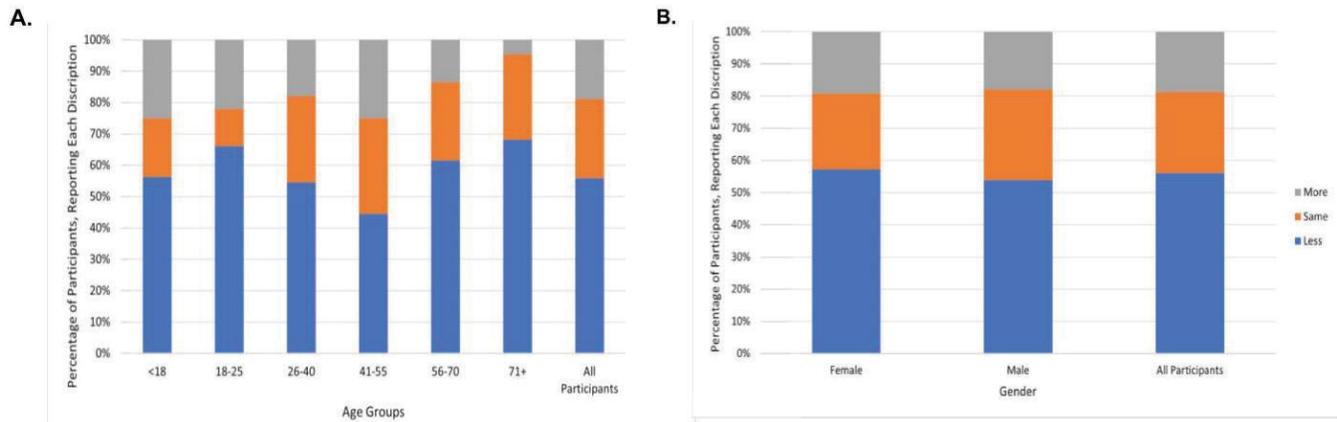
Figure 2: Changes in amount of physical activity. (A) Change in amount of physical activity by age group. Percentage bar graph showing change in physical activity among age groups during the period of social isolation as compared to before the pandemic began. Survey participants were asked to report if their amount of physical activity was less than, the same, or more than before the lockdown period began. **(B)** Change in amount of physical activity by gender. Percentage bar graph showing change in physical activity in males and females during the period of social isolation as compared to before the pandemic began. Survey participants were asked to report if their amount of physical activity was less than, the same, or more than before the lockdown period began.
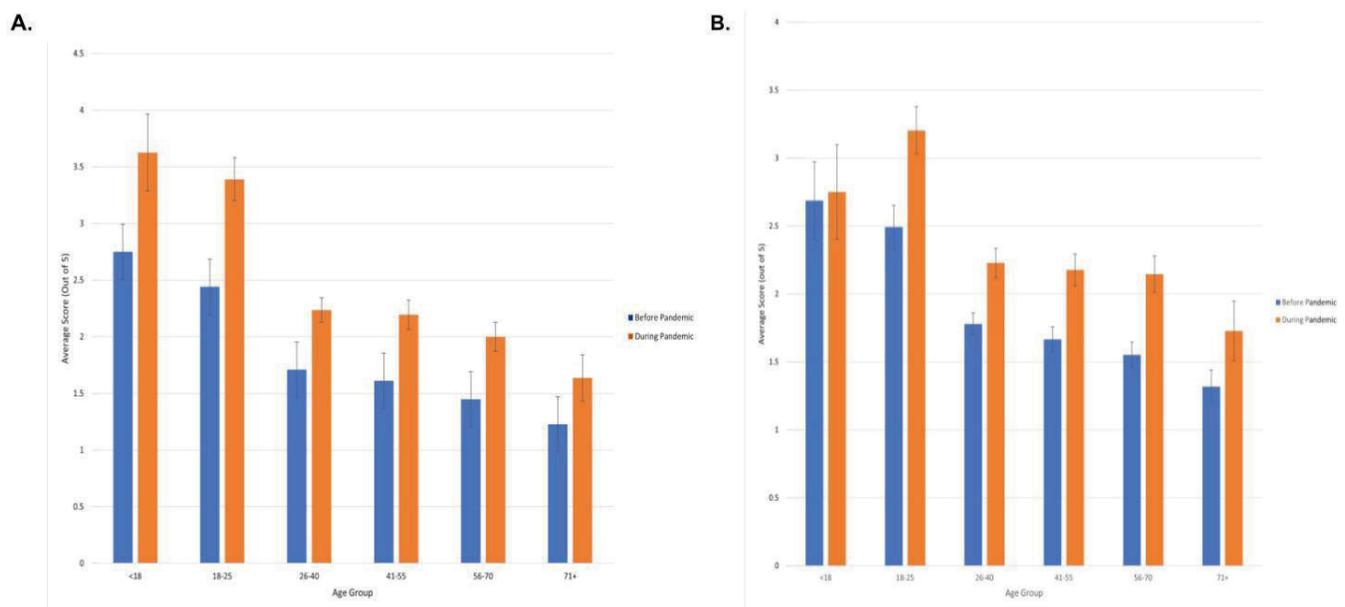
Figure 3: Prevalence of feelings of loneliness and depressive symptoms by age group before and during the pandemic. (A) Prevalence of feelings of loneliness by age group before and during the pandemic. Bar graph displaying the mean Likert score ranking feelings of loneliness of varying age groups before and during the start of the period of social isolation. Survey respondents were asked to rank their feelings of loneliness on a scale of 1 to 5, with 1 representing never feeling lonely and 5 representing feelings of loneliness being present every day. Error bars represent Standard Error of the Mean. The following are the p-values for the t-tests (prevalence of feelings of loneliness before and during the pandemic) of each age group: $p = 0.097$ (<18), $p < 0.001$ (18-25, 26-40, 41-55, and 56-70) and $p = 0.088$ (71+). **(B)** Prevalence of depressive symptoms by age group before and during the pandemic. Bar graph displaying the mean Likert score ranking the prevalence of depressive symptoms of varying age groups before and after the start of the period of social isolation. Survey respondents were asked to rank the prevalence of their depressive symptoms on a scale of 1 to 5, with 1 representing never feeling depressed and 5 representing symptoms of depression being present every day. Error bars represent Standard Error of the Mean. The following are the p-values for the t-tests (prevalence of feelings of depressive symptoms before and during the pandemic) of each age group: $p = 0.890$ (<18), $p = 0.00328$ (18-25), $p < 0.001$ (26-40, 41-55, and 56-70) and $p = 0.113$ (71+).
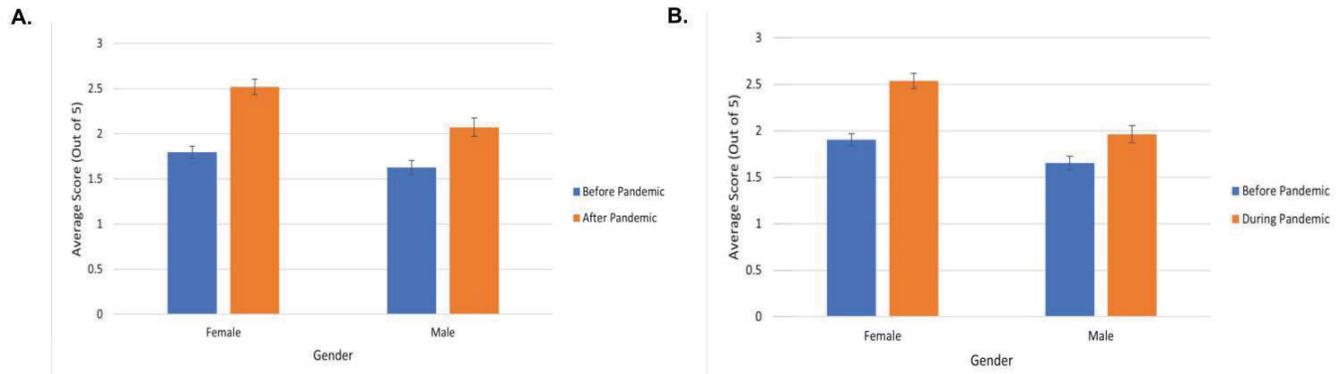
Figure 4: Prevalence of feelings of loneliness and depressive symptoms by gender before and during the pandemic. (A) Prevalence of feelings of loneliness by gender before and during the pandemic. Bar graph displaying the mean Likert score ranking feelings of loneliness of males and females before and after the start of the period of social isolation. Survey respondents were asked to rank their feelings of loneliness on a scale of 1 to 5, with 1 representing never feeling lonely and 5 representing feelings of loneliness being present every day. Error bars represent Standard Error of the Mean. The *p*-values for the *t*-tests (prevalence of feelings of loneliness before and during the pandemic) of male and females are, respectively, *p* = 0.00105 and *p* < 0.001. **(B)** Prevalence of depressive symptoms by gender before and during the pandemic. Bar graph displaying the mean Likert score ranking the prevalence of depressive symptoms of males and females before and after the start of the period of social isolation. Survey respondents were asked to rank the prevalence of their depressive symptoms on a scale of 1 to 5, with 1 representing never feeling depressed and 5 representing symptoms of depression being present every day. Error bars represent Standard Error of the Mean. The *p*-values for the *t*-tests (prevalence of feelings of depressive symptoms before and during the pandemic) of male and females are, respectively, (*p* = 0.00887 and *p* < 0.001).

late-April through mid-May 2020. We first measured changes in quality of sleep during the period of social isolation. We found that all age groups (with the exception of the over 71 age group) revealed participants reporting worse sleep **(Figure 1A)**. Only 5% of the 71+ age group reported worse sleep during the period of social isolation. The percentages of male and female participants who reported worse sleep during the lockdown as compared to before were 38% and 25%, respectively **(Figure 1B)**.

In terms of physical activity, all age groups showed a portion of participants reporting less physical activity ranging between 43% and 69% **(Figure 2A)**. The percentages of female and male participants who reported less physical activity since the lockdown's start were 57% and 54% respectively **(Figure 2B)**.

When we compared the prevalence of feelings of loneliness before and during the period of social isolation for the various age groups surveyed **(Figure 3A)**, all age groups reported an increase in feelings of loneliness during the period of social isolation as compared to before. Significant increases (*p* < 0.001) were seen for the 18–25 age group, the 26–40 age group, the 41–55 age group, and 56–70 age group. While the under 18 and the over 71 age groups did report an increase in feelings of loneliness during the period of social isolation as compared to before, these increases were not statistically significant (*p* = 0.097 and *p* = 0.088, respectively).

When we compared the prevalence of depressive symptoms before and during the period of social isolation for the various age groups surveyed **(Figure 3B)**, significant increases (*p* < 0.001) were seen for the 18–25 age group, the 26–40 age group, the 41–55 age group, and the 56–70 age group. Any increases in the prevalence of depressive

symptoms during the period of social isolation in the under 18 and the over 71 age groups were not statistically significant (*p* = 0.890 and *p* = 0.113, respectively).

When examining the differing experiences of males and females during the period of social isolation **(Figures 4A and 4B)** we found that the lockdowns had a more negative effect on the mental health of females in terms of depressive symptoms and feelings of loneliness. A comparison of the prevalence of feelings of loneliness between the period of time before the pandemic to the period of social isolation in both males and females revealed a statistically significant increase (*p* < 0.05 and *p* < 0.001, respectively). Following an examination of the prevalence of depressive symptoms, a statistically significant increase was seen when comparing the period of time before the pandemic to the period of social isolation in both males and females (*p* < 0.05 and *p* < 0.001, respectively).

We observed an inverse correlation between age and both feelings of loneliness and depressive symptoms **(Figures 3A and 3B)**. A strong negative correlation between age and loneliness was seen both before (r = -0.96) and during the period of social isolation (r = -0.94). There was also a strong negative correlation between age and depressive symptoms both before (r = -0.96) and during (r = -0.85) the period of social isolation.

DISCUSSION

Following the analysis of the results of the survey, all age groups and both sexes were found to have an overall increase in feelings of loneliness and depressive symptoms before and after the onset of the pandemic, likely due to the stress of social isolation resulting from the COVID-19 pandemic. A portion (between 25%–50%) of each age group surveyed reported a

decrease in the perceived quality of their sleep with the 71+ age group reporting the smallest decrease in sleep quality. Each group also reported a decrease in physical activity, with the reported decrease in physical activity appearing to be more consistent among groups and affecting larger portions of the groups than reported decrease in sleep quality. Poor sleep quality is known to be both a cause and a result of decreased physical activity and poor mental health (15). Indeed, 33% of total survey participants reported a decrease in sleep quality during social isolation. Most age groups fell relatively near this average except for the 71+ age group, where only a small portion of the group reported worse sleep quality. This age group most likely did not have any major interruptions to their usual routines, as many people in this age group are retired and may not have had school or work that would have been affected by the lockdowns. The relatively greater stability in schedule and sleep routines could possibly be one cause for the lower prevalence of depressive symptoms and feelings of loneliness seen in this age group during the period of social isolation as compared to other age groups. In terms of physical activity, the only general trend was a decrease in reported physical activity during the pandemic as compared to before for all groups (both age and sex). The data collected on sleep and physical activity provide insight into the effects of the pandemic on the general population. Further study is needed to determine if worsened sleep quality and decreased physical activity definitively played a causative role in the increase in depressive symptoms and feelings of loneliness observed amongst all age groups and sexes during the period of social isolation resulting from the onset of the pandemic.

In general, our survey revealed an inverse relationship between age and both depressive symptoms and feelings of loneliness both before and during the period of social isolation. Our data reveals a strong negative correlation between age and feelings of loneliness, seen both before and during the period of social isolation. There was also a strong negative correlation between age and depressive symptoms both before and during the period of social isolation. In support of this result, another recent study on mental illness in youth found that within the last decade young adults (aged 18–25) have seen a dramatic increase in the prevalence of these symptoms. The study claims that social media and fewer face-to-face interactions, associated with high usage of social media, has led to social isolation and thus an unusually high mental illness rate in young adults compared to other age groups before the start of the pandemic (16). Our data corroborates these findings, illustrating that before the pandemic began, the younger a participant was, the more likely he or she was to suffer from self-defined depression and loneliness as compared to other age groups.

In terms of the prevalence of depressive symptoms and feelings of loneliness within each age group, increases in these symptoms and feelings were generally seen to a similar extent for all age groups following the beginning of the social isolation period. In particular, the 18–25 age group reported a significantly larger increase in depressive symptoms and feelings of loneliness than all other groups during the period of social isolation. One review of other studies done on the impact of social isolation due to COVID-19 on the mental health of young adults also found youth and adolescents to be the age groups most vulnerable to the mental health effects of the pandemic (17). The authors credit the break in routine from both education and work as being responsible for this vulnerability. Our study, however, showed the negative effects of social isolation due to the pandemic on mental health status were generally consistent across all age groups.

The pandemic also appears to have caused more negative effects on physical activity and mental health in women as compared to men. In our survey, 38% of women reported worse sleep quality compared to 25% of men. Female participants also reported a significantly larger increase in feelings of loneliness following the start of the lockdown period, as compared to men during the same period. Increased social isolation is likely the reason for the worsened mental and physical health effects seen in both sexes surveyed, while a difference in physiology between the two sexes may play an important role in the slightly worsened mental health of women following the start of lockdown as compared to men. A study from 2018 found that oxytocin receptors in women tend to be more sensitive than those in men (18). Oxytocin receptors are important for social behavior and bonding; the under-stimulation of these receptors is connected with the development of depression and anxiety. Consistent with our results, this study concluded that women, who tend to be more social than men, are more susceptible to the negative effects of social isolation including sleep issues, depression, and loneliness (18).

There are some limitations to our study that may prevent the results from being extrapolated to the general population. First, the survey was done electronically through the internet and thus, relied on participants to self-select themselves creating a self-selection bias in the results. This self-selection bias includes the exclusion of individuals without internet access. Despite 87.1% of households in the Northeastern United States claiming access to the internet, that percentage is lower among certain groups, such as low-income households (19). Individuals from low-income households may have provided valuable data on the mental health of individuals who lack an ability to connect with others through the internet. In addition, the state of residence was not accounted for. During the pandemic, travel and social interaction restriction varied by state, and thus individuals from different states may have faced differing levels of social isolation. The study is also limited in that it mainly represents the effects of the pandemic in the Northeastern region of the United States during the months of April and May 2020. Other regions may have faced differing levels of strictness during their lockdown periods and may have been locked down for differing periods of time. Another limitation of our study is the use of wording like "depressive symptoms" and

"feelings of loneliness" in the survey questions **(Appendix A, questions 32 and 33)**. Different degrees of loneliness and depressive symptoms may mean different things depending on the individual; however, objective frequencies ("*I don't often feel this emotion*," "*Less than once per week*," "*Once per week*," "*Regularly, but not every day*," and "*Every day*") were presented as options in order to help capture the relative strength of these emotions at the time of responding to the survey as compared with the emotions during the pre-pandemic period.

It also should be noted that during data analysis, the focus of the analysis was shifted from an overall survey of the general effects of social isolation to the significant effects that were seen in terms of the impact on mental health, especially between age groups and sexes. The survey was not built to reduce the complex effects of social isolation to individual measures of mental, physical, or social health. Rather, it was built to test the hypothesis that unprecedented social isolation negatively affects individuals of differing circumstances by examining all of these factors together. We focused on the prevalence of loneliness and depressive symptoms because focusing on these aspects of mental health allowed us to make more confident and concise conclusions from the results of the survey. One final limitation is the use of male and female as the only two sexes surveyed. The survey contained a "prefer not to answer" option when asking for a respondent's sex. This may have prevented a portion of the population who do not identify as male or female from being included in some of the analyses. Despite these limitations, the survey was able to capture a snapshot of the self-reported mental and physical health of a portion of the general population both before and during the periods of social isolation.

Any type of mental health crisis within the general population should be a cause for concern for local, national, and international health organizations. In order to deal with mental health crises such as the most recent crisis caused by the social isolation measures put in place during the COVID-19 pandemic, government-sponsored mental health care programs are being created. For example, in New York, the formation of organizations such as Project Hope, aimed at helping New Yorkers with mental health struggles directly related to COVID-19, can be a key first step to tackle the damage caused by the pandemic (20). The information gained from our study, and studies similar to ours, can help by providing information to these organizations about the negative mental health effects resulting from social isolation during the COVID-19 pandemic and to assist in identifying certain groups within the general population that are most at risk for suffering from these negative effects.

Overall, we showed that the social isolation resulting from the COVID-19 lockdowns was detrimental to both the physical and mental health of a very large proportion of our survey participants, which may be considered somewhat representative of the general population. Across the categories of age and sex, each of these various groups was affected differently by social isolation. In particular, young people and females appear to be the most negatively affected by this social isolation in their respective categories, age and sex. The susceptibility of the general population, and these groups in particular, to worsened mental health following periods of social isolation should be taken into account if mass lockdowns are considered as a preventive measure should another pandemic occur in the future.

MATERIALS AND METHODS
Data Collection

In order to examine the effects of social isolation on the general population, we conducted an anonymous survey using Google Forms **(Appendix A)**. The framework and the questions of the survey were original to the survey, created by the authors, but they were inspired by a few other studies (2, 21). The survey was broken up into five sections: consent, general information, physical health, mental health, and social health. All participants gave their consent to participate in the survey via an initial series of three questions. These questions established that the participants were aware of their anonymity, their ability to leave the survey at any point, and the completely voluntary nature of the survey.

The general information section (14 questions) served to receive demographic information from participants (age, sex, location, employment status before and during the pandemic, current living situation, etc.). The physical health section (13 questions) of the survey served to collect data from participants on changes in physical activity, sleep quality, and dietary habits resulting from social isolation. The mental health section (5 questions) served to collect data from participants on changes in emotions (loneliness, depression) and overall mental status resulting from social isolation. A section on social health (7 questions) served to collect data on how connected participants felt with friends and family socially and if they felt that their social needs were satisfied. All 32 questions were multiple choice. For some questions, multiple answers could be selected, while some utilized a 10-point linear scale, and others utilized a 5-point Likert-style scale.

The survey was reviewed by two PhD-level biologists before being sent out. The survey was distributed to the teachers and students of Chaminade High School, located in Mineola, New York, as well as people in the local community via email, and it was also shared via social media. Survey participants were encouraged to share the survey with others, making it hard to track precisely how many individuals took the survey out of everyone who received it. However, if an individual did take the survey, they were required to answer all questions before submission. The survey was open to responses from April 22nd, 2020 until May 14th, 2020 and took participants five to ten minutes to complete. In total, 456 responses were received.

Data Analysis

The responses were converted from a Google Sheets file into a .csv file, which was then interpreted by the IBM SPSS program. Using SPSS, we separated the data into two categories: age and sex. Based on information from previous studies, which found that psychological stress affects individuals of different ages and sexes differently, the age intervals (<18, 18–25, 26–40, 41–55, 56–70, 71+) were chosen at 15-year intervals to sample a variety of age cohorts with the exceptions of the under 18 and 18–25 groups (11, 13). A 15-year interval was chosen based on how generations—cohorts of individuals born over a 15–20 year span—are usually grouped. Our age group model is similar to another 2020 COVID-19 mental health study that also categorized ages by generations defined approximately by 15-year age intervals (22).

Survey question response data was analyzed based on the responses given by different sexes and the various age groups as to the changes in the following both before and during the period of social isolation: perceived sleep quality, physical activity, overall mental health change, social personality, prevalence of symptoms of depression before and during the lockdown (as defined by the participant), prevalence of feelings of loneliness before and during the lockdown (as defined by the participant), caloric intake, healthy eating choices, alcohol consumption, routine, prevalence of domestic arguing, and the amount of virtual contact with friends and family. To better evaluate responses for questions regarding the prevalence of participant-defined feelings of loneliness and depressive symptoms, we used a five-point Likert scale, allowing the participants to answer in degrees of prevalence and allows statistical analyses of the responses to be performed (23). The scale began with "little to no" prevalence of participant-defined emotions, assigned a value of 1, and ended with "regular everyday" prevalence of participant-defined emotions, assigned a value of 5. Inspiration for this scale was taken from a 2017 Singapore study, which also assigned numbers to levels of prevalence of loneliness and depression (1). For example, one of the study's questions, "How often do you feel isolated from others?", was assessed on a 3-point scale according to the frequency that the participant experienced that emotion (1 = hardly ever; 2 = some of the time; 3 = often) (Appendix A, questions 32 and 33). The Likert scale approach allowed participants to record their emotions more accurately in degrees, while providing us with data that could be used to compare sub-groups in a more granular way. We compared the means between two given sub-groups (either across age groups or male/female sexes) and verified their significance with a two-sample t-test using Microsoft Excel. Significance for all statistical tests was determined using a p value of 0.001. Pearson correlation coefficients were determined using Excel.

REFERENCES

1. Francescani, Chris. "Timeline: The First 100 Days of New York Gov. Andrew Cuomo's COVID-19 Response." ABC News, ABC News Network, 17 June 2020, www.abcnews.go.com/US/News/timeline-100-days-york-gov-andrew-cuomos-covid/story?id=71292880. Accessed 16 Jun. 2022.

2. Ge, Lixia, *et al.* "Social isolation, loneliness and their relationships with depressive symptoms: A population-based study." *PloS ONE*, vol. 12, no. 8, 2017, e0182145, doi: 10.1371/journal.pone.0182145

3. Ghosh, Ritwik, *et al.* "Impact of COVID-19 on children: Special focus on the psychosocial aspect." *Minerva Pediatrics*, vol. 27, no. 3, 2020, doi:10.23736/s0026-4946.20.05887-9

4. Taylor, Harry Owen *et al.* "Social Isolation, Depression, and Psychological Distress Among Older Adults." *Journal of Aging and Health* vol. 30,2 (2018): 229-246. doi:10.1177/0898264316673511

5. Wong, Samuel Yeung Shan, *et al.* "Impact of COVID-19 on loneliness, mental health, and health service utilization: a prospective cohort study of older adults with multimorbidity in primary care." The British Journal of General Practice the Journal of the Royal College of General Practitioners vol. 70,700 e817-e824. 29 Oct. 2020, doi:10.3399/bjgp20X713021

6. "CDC Museum Covid-19 Timeline." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 5 Jan. 2022, www.cdc.gov/museum/timeline/covid19.html. Accessed 16 Jun. 2022.

7. Gao, Junling, *et al.* "Mental health problems and social media exposure during COVID-19 outbreak." *PloS ONE* vol. 15,4 e0231924. 16 Apr. 2020, doi:10.1371/journal.pone.0231924

8. Zhaoyang, Ruixue, *et al.* "Age differences in adults' daily social interactions: An ecological momentary assessment study." *Psychology and Aging* vol. 33,4 (2018): 607-618. doi:10.1037/pag0000242

9. "Nursing homes." Assets.aarp.org, AARP Public Policy Institute, Oct. 2007, www.assets.aarp.org/rgcenter/il/fs10r_homes.pdf. Accessed 25 Nov. 2021.

10. Schrempft, Stephanie, *et al.* "Associations between social isolation, loneliness, and objective physical activity in older men and women." *BMC Public Health* vol. 19,1 74. 16 Jan. 2019, doi:10.1186/s12889-019-6424-y

11. Nolen-Hoeksema, Susan, and Cheryl Ahrens. "Age differences and similarities in the correlates of depressive symptoms." *Psychology and Aging* vol. 17,1 (2002): 116-24. doi:10.1037//0882-7974.17.1.116

12. Victor, Christina R, and Keming Yang. "The prevalence of loneliness among adults: a case study of the United

Kingdom." *The Journal of Psychology* vol. 146,1-2 (2012): 85-104. doi:10.1080/00223980.2011.613875

13. Steptoe, Andrew, *et al*. "Social isolation, loneliness, and all-cause mortality in older men and women." *Proceedings of the National Academy of Sciences* 110.15 (2013): 5797-5801. doi: 10.1073/pnas.1219686110

14. Lee, Christine M, *et al.* "Increases in loneliness among young adults during the COVID-19 pandemic and association with increases in mental health problems." *The Journal of Adolescent Health*: official publication of the Society for Adolescent Medicine vol. 67,5 (2020): 714-717. doi:10.1016/j.jadohealth.2020.08.009

15. Tahmasin, Masoud, *et al.* "The interrelation of sleep and mental and physical health is anchored in grey-matter neuroanatomy and under genetic control." *Communications Biology* 3.1 (2020): 1-13. doi:10.1038/s42003-020-0892-6

16. Twenge, Jean M., *et al.* "Age, period, and cohort trends in mood disorder indicators and suicide-related outcomes in a nationally representative dataset, 2005–2017." *Journal of Abnormal Psychology* 128.3 (2019): 185. doi:10.1037/abn0000410

17. Loades, Maria Elizabeth, *et al.* "Rapid systematic review: the impact of social isolation and loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19." *Journal of the American Academy of Child and Adolescent Psychiatry* vol. 59,11 (2020): 1218-1239. e3. doi:10.1016/j.jaac.2020.05.009

18. Borland, Johnathan M., *et al.* "Sex-dependent regulation of social reward by oxytocin receptors in the ventral tegmental area." *Neuropsychopharmacology* 44.4 (2019): 785-792 doi: 10.1038/s41386-018-0262-y

19. Bureau USC. 2017 American community survey single-year estimates [Internet]. Census.gov. US Census Bureau; 2021. Available from: www.census.gov/newsroom/press-kits/2018/acs-1year.html. Accessed 26 Nov. 2021.

20. "NY Project Hope: Coping with Covid-19." NY Project Hope - NYC Health, NYC Health, www1.nyc.gov/site/doh/health/health-topics/crisis-emergency-services-project-hope.page. Accessed 16 Jun. 2022.

21. Rusch, Tessa, *et al.* "Covid-dynamic: A large-scale multifaceted longitudinal study of socioemotional and behavioral change across the pandemic." *PsyArXiv,* 7 Mar. 2021. Web.

22. Henderson, M., Fitzsimons, E., Ploubidis, G., Richards, M., and Patalay, P. (2020) Mental health during lockdown: evidence from four generations - Initial findings from the COVID-19 Survey in Five National Longitudinal Studies. London: UCL Centre for Longitudinal Studies.

23. Nemoto, Tomoko, and David Beglar. "Likert-scale questionnaires." *JALT 2013 conference proceedings*. Tokyo: Jalt, 2014.

Appendix A. COVID-19 Social Isolation Survey (Questions and Answer Choices)

Consent:

1.   I understand that participation in this survey is completely voluntary. (Yes, No)

2.   I understand that at any point in this survey I may stop answering questions. (Yes, No)

3.   I understand that this survey is completely anonymous. (Yes, No)

General Information:

4.   What is your gender? (Male, Female, prefer not to say)

5.   Which age group do you fall under? (Under 18, 18-25, 26-40, 41-55, 56-70, 71+)

6.   How would you describe the area you live in? (Urban, Suburban, Rural)

7.   Employment status prior to the "stay-at-home" order? (Full-time student, Part-time work, Full-time work, Unemployed/seeking employment, Unemployed/not seeking employment, stay at home caretaker (unpaid), Retired)

8.   What is your current living situation? (I live with my immediate family, I live alone, I live with a significant other, I live in a retirement home, I live with one or multiple roommates)

9.   In general, how do you feel that your lifestyle has been affected by the pandemic? Select a number 1-10 (1 = little to no change, 10 = radical change)

10. In general, how do you feel that your quality of life been affected by the pandemic? Select a number 1-10 (1 = little to no change, 10 = radical decline in the quality of life)

11. Who do you know that is currently or has been infected with COVID-19? (Select all that apply – Myself, an individual or multiple people within my close (immediate family, Acquaintance(s) or work colleague(s), Distant relative(s) or friend(s), I do not know anyone who has had or been infected with COVID-19)

12. How has your employment status changed following the "stay-at-home" order? (Essential worker, working from home/distance learning (student), Working from home with reduced hours/salary, Essential worker with reduced hours/salary, laid off/furloughed/no income, No change (retired/caretaker)

13. Has your consumption of the news increased since the pandemic? (Yes, No)

14. Describe where you are getting your news? (Newspapers, TV news, Websites)

15. How frequently did you usually watch/read the news prior to the pandemic? (Almost constantly, Every few hours, Twice per day, Once per day, Once every few days, Once per week, Less than once per week, Never)

16. How frequently do you usually watch/read the news now? (Almost constantly, Every few hours, Twice per day, Once per day, Once every few days, Once per week, Less than once per week, Never)

17. Are you generally someone who enjoys being at home or being out of the house? (Home, Out of the house, Mixture of both)

Physical Health:

18. How would you generally describe the amount of sleep you get now, compared to the pre-pandemic time? (Sleeping more than before, sleeping less than before, Sleeping about the same amount)

19. Has your bedtime shifted at all in general? Select all that apply (Go to bed later, go to bed earlier, Go to bed at the same time)

20. Has your wake-up time shifted at all in general? Select all that apply (Wake up later, wake up earlier, Wake up at the same time)

21. Perceived sleep quality (Better sleep, Worse sleep, About the same)

22. Are you experiencing insomnia? (Regularly, Sometimes, Never)

23. Did you experience insomnia before the pandemic? (Regularly, Sometimes, Never)

24. How would you describe the amount of physical activity you get now, compared to the pre-pandemic time? (More activity, Less activity, About the same amount)

25. Describe how much time you spent on each activity before the pandemic (Bicycle riding, walking without dog/animals, walking with dog/animals, Running, At-home workouts, Gym-workouts) [For each select: Never, Once a week, 2–3 times per week, Every other day, Every day]

26. Describe how much time you now spend on each activity (Bicycle riding, walking without dog/animals, walking with dog/animals, Running, At-home workouts, Gym-workouts) [For each select: Never, Once a week, 2-3 times per week, Every other day, Every day]

27. Describe your eating habits compared to before the pandemic. (More calories than before, Less calories than before, About the same as before, Inconsistent and varying day to day)

28. Describe the food choices you make compared to before the pandemic. (Healthier than before, Not as healthy as before, Little change, Inconsistent and varying day to day)

29. If you are over 21, have you been drinking more alcohol than you usually would before the pandemic? (Yes, I have greatly increased my consumption; Yes, I have moderately increased my consumption; Yes, I have slightly increased my consumption; No, I am continuing to drink as much I as did before; I don't drink; I'm under 21)

30. Are you attempting to keep a similar routine every day? For example: wake up, eat, work, exercise, go to bed, etc. at the same times every day (I am trying to keep the same routine every single day, I am trying to keep the same routine on all weekdays or all work/school days, I am trying to keep a routine going for at least a few days per week, I had a regular routine most days before the pandemic started but now my days have no routine, I did not really have a routine most days before the pandemic and I do not have one now)

Mental Health:

31. Overall, how would you generally describe your change in mental health since the pandemic began (It has gotten better compared to before the pandemic, it has gotten worse compared to before the pandemic, it has remained the same compared to before the pandemic)

32. Describe how often you experienced each emotion before the pandemic. (Feelings of anxiety, Feelings of sadness, Feelings of depression, Feelings of inability to "get going", Feelings of loneliness) [I don't often feel this emotion, Less than once per week, Once per week, Regularly, but not every day, Every day]

33. Describe how often you experience each emotion now. (Feelings of anxiety, Feelings of sadness, Feelings of depression, Feelings of inability to "get going", Feelings of loneliness) [I don't often feel this emotion, Less than once per week, Once per week, Regularly, but not every day, Every day]

34. How worried/anxious are you about the following things as a result of this pandemic? Rate (1) not worried to (5) very worried. (Your health, your family's health, Finances, Food shortages, Lack of social contact, Isolation in your house/neighborhood, Loss of employment, Educational interruption, Missing important life events, Economy, Politics)

35. If you answered earlier that your mental health status has changed as a result of this pandemic, rank the following in terms of how much you think each has affected your mental health in a negative way. Rank from (1) has not negatively affected my mental health at all to (5) has strongly negatively affected my mental health (Social isolation, Changes to employment/finances, Being homebound, Poor diet/lack of physical exercise/poor sleep, Economy/politics)

Social Health:

36. How often are you now in virtual contact with friends? (Multiple times per day, once per day, A few times per week, once per week, A few times per month, Less than a few times per month, I am not in contact with friends)

37. How often are you now in virtual contact with family you do not live with? (Multiple times per day, once per day, A few times per week, once per week, A few times per month, less than a few times per month, I am not in contact with family)

38. How likely are you to use the following virtual contact methods? Rank each from least used (1) to most used (5) (Email, Text message, Phone call, Virtual face-to-face meeting/Facetime/Zoom, Social Media Messaging)

39. How often during the pandemic lockdown do you find yourself arguing with those that you live with? (Multiple times per day, once per day, once every other day, Weekly, I do not live with anyone)

40. Has the arguing gotten worse in your household since before the lockdown began? (Yes, No, I do not live with anyone)

41. Would you normally describe yourself as an introvert or extrovert? (Introvert, Extrovert, Ambivert – a mixture of both)

42. How much more socially isolated do you feel from family, friends, coworkers, etc., compared to before the pandemic lockdown began? (Choose a number 1–10; 1 = Little to no change, 10 = Dramatic change)