The Aftermath Of CoViD-19 On The Mental Health Of The Elderly

Student name: Tobias Ruysendaal

Student ID number: 571964

1 Abstract

This study explores the impact of the CoViD-19 pandemic on the elderly, establishing changes of mental health before the pandemic to its aftermath. In this study, the data used is from the LISS panel (Longitudinal Internet studies for the Social Sciences) managed by the non-profit research institute Centerdata (Tilburg University, the Netherlands). This study utilizes a Difference in Difference regression to establish any causal interference in the in- or decrease of the mental health between those who had CoViD-19 and those who did not. There was no causal interference found in this study. There are other factors such as gender, having a partner or work that influence the feeling of depression according to this study.

2 Introduction

In 2019 the world was first introduced to CoViD-19 as it appeared in Wuhan. A few months later the virus spread all over the globe and the World Health Organisation (WHO) declared a pandemic. The ministries of health of all countries worldwide had to implement guidelines and restriction as deemed necessary for each of their respective country. Social distancing and lockdowns were introduced but these measures jeopardised mental health (Kumar and Nayar, 2021; Rubin and Wessely, 2020). The WHO speculated that these changes could increase loneliness, anxiety, depression, and other mental health problems. Beside these (potential) negative consequences of a lockdown Taylor (2019) also wrote several other factors that influence mental health whilst looking back at past pandemics and added the fear of death or infection and the grief of losing a loved one. Because of the decline in mental health the author does question the effectiveness or non-effectiveness of lockdowns. However, choosing between further spread but mitigating the feeling of isolation or doing it the other way around are challenging decisions for policy makers. Talevi et al. (2020) broaden the implications of the restrictive measures because of CoViD-19 on mental health in Asia. This study was done during the pandemic thus it showed new insights on the potential new challenges in comparison to earlier mentioned studies. Besides the previously mentioned symptoms by Taylor (2019) they introduced a new syndrome called "headline stress disorder" i.e., angst and stress caused by the endless stream of news reports that may cause insomnia and palpitations. The study was done on three populations being the general population, health care workers, and the clinical population. For the sake of this study the focus is on the general population and clinical population since the older population is more vulnerable and therefore are also more likely to be part of the clinical population. In the general population the female gender and the younger generation experienced the lockdowns the most negative. The clinical population experienced post-traumatic stress symptoms. The elderly (above 60 years) had more severe cases of depression and reported a lower quality of life. There are shortcomings in the study by Talevi et al. (2020) as the participants self-report. The data collected is from several other studies so there are heterogeneity and methodological shortcomings.

Hwang et al. (2020) focus on the elderly population. The elderly are more vulnerable to isolation since they are more dependent on family members and community services for transportation, groceries, company etc. Loneliness can increase blood pressure and the risk of heart

disease.

At the other end of the age spectrum there are the students. Wang et al. (2020) conducted a survey among students in Texas that are used frequently to diagnose depression and anxiety. Just a little over 80 percent of students in this study experienced some level of depression, ranging from mild (32.45 percent) to severe (7.42 percent). 18 percent of students had suicidal or self-harming thoughts. The increase from previous research showing that 3 to 7 percent of students had suicidal thoughts outside of a pandemic, should not be taken lightly. The majority of students admitted that stress and angst increased because of the pandemic. The changes in sleeping and eating schedules are correlated with depression.

In a recent study by Nuijen et al. (2023) the authors shows that students are still struggling after the pandemic. However, less students feel isolated and fatigued and experience less pressure to perform on an academic level as compared to the same study done in 2021. In another study done by de Hollander et al. (2023) the entire population is being compared. People felt more depressed, anxious, and lonely. The first two were more present with people who had CoViD-19 in the beginning of the pandemic.

Living with a person with depression can lead to negative effects for the entire family. It leads to increased irritations, lack of interest in social life, constant worrying, hopelessness, and fatigue (Coyne et al., 1987). They found that 40 percent of family members living with a depressed family member were to such an extent distressed by that member that they needed therapeutic help themselves. Some of the previously mentioned symptoms for family members are in line with the mental problems that occur during a pandemic earlier mentioned by Taylor (2019) Depression can have a negative spillover effect on family, so it is important to be addressed in a rightful manner.

In the study by Kleine-Budde et al. (2013) the authors conducted a cost analysis on the German population based on the information given by health insurance companies. They divided the costs in direct and indirect costs, meaning costs associated with treating the depression (e.g., antidepressants, patient care) and side-effects (e.g., production loss) due to being depressed. The annual average costs were € 458.90 per person for the general population.

As seen by the previously mentioned studies, depression can cause problems for those around a depressed person (Coyne et al., 1987), anxiety and physical problems like heart diseases for the person who suffers from depression (Taylor, 2019; Hwang et al., 2020), and it has monetary disadvantages as stated by Kleine-Budde et al. (2013). Depression is therefor a societal problem and should be diagnosed and treated right.

For this study the mental health of the elderly is observed after CoViD-19. Beside the previously mentioned negative side effects of depression the lockdown had it own effects on mental health (Kumar and Nayar, 2021; Rubin and Wessely, 2020; Talevi et al., 2020; Taylor, 2019). This study highlights the possible increase in depression after the pandemic of the elderly and students. The population of the Netherlands is aging with roughly 1 in 5 of the inhabitants being 65 years old or older in 2024 (CBS, 2024). Since the elderly are a big part of our society it is important for ethical and monetary reasons to help them. Depressed people influence other people around them and cost money to treat. The main purpose of this study is to ascertain if the aftermath of the pandemic still causes the elderly to feel depressed if they did not feel like

this before the pandemic. The 'treatment' in this study is CoViD-19 however, since it happened to everyone two groups are compared. In this study there is a comparison between people who had CoViD-19 during the pandemic and people who did not. There are, besides those who got infected with CoViD-19 and those who did not, two groups compared are students and the elderly. The elderly and students were, according to the Centraal Bureau voor Statistiek (CBS) and Rijksinstituut voor Volksgezondheid en Milieu (RIVM) two of the most vulnerable or most affected groups by the pandemic. There is a follow-up study done on the students but there are little to no studies regarding the elderly.

3 Data

The data collected for this study comes from the Longitudinal Internet studies for Social Sciences (LISS). LISS collects data from 5,000 households all over the Netherlands resulting in approximately 7,500 individuals from the age of 16. The sample was randomly drawn from the CBS. The people were invited through various ways to participate. Since the original sample there are households added to keep the number of households near 5,000 due to attrition which is 12 and 10 percent for respondents and households respectively. Every month the members complete a questionnaire which takes 60 minutes on average to complete, and the members get a monetary incentive to complete. The data has been collected since 2007. The data ranges from health to socio-economic matters. For this study the data from the health questionnaire and personality questionnaire are used. The variables used form the health questionnaire are related to mental health e.g., how depressed an individual feels or if he or she is seeing a psychiatrist. In the personality survey the respondents dive more into how they feel about themselves and how they think others see them. This data is collected at the end of each year.

For this study the data between 2017 and 2023 is used. The data of 2019 and 2023 are used as main comparison, the data between 2020 and 2022 is used for the control and dummy variables, and the data of 2017 and 2018 is used to see if a parallel trend assumption holds. The sample consists of 1,489 elderly and 193 students.

The data for this study comes from a variety of surveys. The main survey is the health survey which contains the dependent variable for this study which says if a person felt depressed or gloomy in the past month on a scale from 1 to 6 in which 1 means never and 6 is continuously. The data such as age (measured in years) and sex (1 for male, 2 for female, and 3 for other) are also contracted from this dataset. There is more household data collected like being single (0 for no, 1 for yes) and if you live together with a partner (0 for no, 1 for yes). For the CoViD-19 variable other surveys are addressed. This is because the original CoViD-19 variable in the main dataset ask if CoViD-19 was diagnosed by a physician. The reason why this may obstruct this study is explained later, but there are besides the questionnaires created by LISS other questionnaires which are for short term studies which are submitted by third parties. Some of these studies have a variable which ask if a person has had CoViD-19. The questions and answers regarding CoViD-19 vary within these 'external' datasets but for the sake of this study a simple variable is created which has a value of 1 if a person has had CoViD-19 (diagnosed by a physician, by a worker of the RIVM, or by themselves) and 0 if a person did not have CoViD-19 by the end of 2021.

There was attrition every year. Of the initial 5,954 household members only 5,145 (86.4 percent) completely filled out the questionnaire. Then, every year other household members would not fill out the questionnaire. The total number of household members in 2023 was 2,969 (57.7 percent of 5,145). Because of the data needed from the years 2020 and 2021, the continuity of the data caused a lot of attrition. Among the 2,969 participants, 1,447 (48.7 percent) were above the age of 60 in 2019 and 156 (0.1 percent) was between the age of 17 and 25 in 2019. In Figure A.1 the distribution of the ages is shown. The ages in the data are left-skewed. This could be because of the earlier mentioned problem of the population aging. But a more sensible solution is the fact that this questionnaire started in 2007 and since LISS only includes people older than 16. With the adding of new participants, which happens randomly, there is no preference for picking students.

4 Descriptive statistics

Table 4.1 depicts the baseline characteristics of the elderly. The characteristics of the control and treatments groups are noted and the combined means through a t test. The treatment group is significantly older than the control group. As seen in the table there are less women in the control and treatment group. The treatment group seems to be initially more depressed than the control group however, because of the t-test it is shown that the difference is not significant. The difference in employment between the control and treatment group is significant. Overall, there are more people working in the treatment group. There are no significant differences in being single between the control and treatment group.

Table 4.1: Baseline characteristics of the elderly.

	Control group	Treatment group	Combined
Age (in years)	69.310	67.570	69.207**
Female	0.496	0.442	0.493
Feeling of depression	1.812	1.930	1.819
Employed	0.194	0.291	0.200**
Single	0.242	0.221	0.241
Living with partner[1]	0.934	0.940	0.934
N	1,361	86	1,447

[1] *Since this question only applies to people who answered no to the question of being single the population is 1,031, 67, and 1,098 for the control group, treatment group, and combined respectively.* ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

In Table 4.2 the baseline characteristics of the students are depicted. There is no significant difference between the means of the groups. The treatment group seems to be older on average and contains more females. The control group seems to be more depressed in 2019 than the treatment group on average. The treatment group has a higher portion of employed than the control group. There are more singles in the control group than the treatment group but fewer live together with their spouse.

Table 4.2: Baseline characteristics of the students

	Control group	Treatment group	Combined
Age (in years)	20.775	21.000	20.795
Female	0.507	0.714	0.526
Feeling of depression	2.373	2.214	2.359
Employed	0.261	0.357	0.269
Single	0.669	0.643	0.667
Living with partner[1]	0.319	0.400	0.327
N	142	14	156

[1] *Since this question only applies to people who answered no to the question of being single the population is 47, 5, and 52 for the control group, treatment group, and combined respectively.* ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

5 Methodolgy

To measure the difference between groups a Difference in Difference analysis (DiD) is used. Since there is proper randomization in the sample there, the parallel assumption should hold, there is no selection bias present, and the baseline characteristics between the groups should not differ. The treatment, CoViD-19, is not assigned by any means so it should be random. Getting infected is determined by factors which this study cannot control for. The parallel assumption means that the trend of both groups is the same in absence of the treatment and had the same trend before the treatment. The trends are depicted in Figure 5.1 and Figure 5.2 for the elderly and students respectively. The trends are not parallel before the intervention. The absolute decrease or increase in would be the same for both the treatment and control group if all the assumptions held, i.e. the difference would remain constant between the groups. Selection bias means that there is no correlation within the data itself or that there is a trend in the way that it was collected. For example, if someone stands near the Erasmus university and asks people what their highest form of education is to measure education in Rotterdam, there is a significant chance that the interviewer most likely talks more to students and the results should therefore be skewed. The baseline characteristics were previously discussed. Equation (1) shows the basic DiD analysis. Y is the outcome variable of interest and indicates the feeling of depression The variables *Covid* and *Time* can have a value of 0 or 1, showing if a person had CoViD-19 and to indicate whether it is 2019 or 2023 respectively. The β shows the difference in feeling of depression between those who had CoViD-19 and those who did not. γ is the difference in feeling of depression between 2019 and 2023. The interaction term δ shows the average treatment effect of getting CoViD-19. As mentioned before, the trends are parallel meaning both groups should follow the same trajectory if there is no treatment. Due to the presence of a treatment the trajectory of the treatment group may differ in a (significant) way. The difference in the outcome of where the treatment group would initially end up in absence of the treatment and where the treatment group ended up because of being exposed to the treatment is the average treatment effect. There are control variables added in Equation (2). η shows the difference between being a man or woman, κ employed and unemployed, and ρ having a relationship or

being single. The control variables are added to control for certain variables which may correlate with the outcome and improve the accuracy of the *Covid* and *Time* variable. Lastly there is normal regression which shows the plain differences of the variables between 2019 and 2023. The interaction term is left out to see there is a change without a treatment of some kind. The regression used is seen in Equation (3).
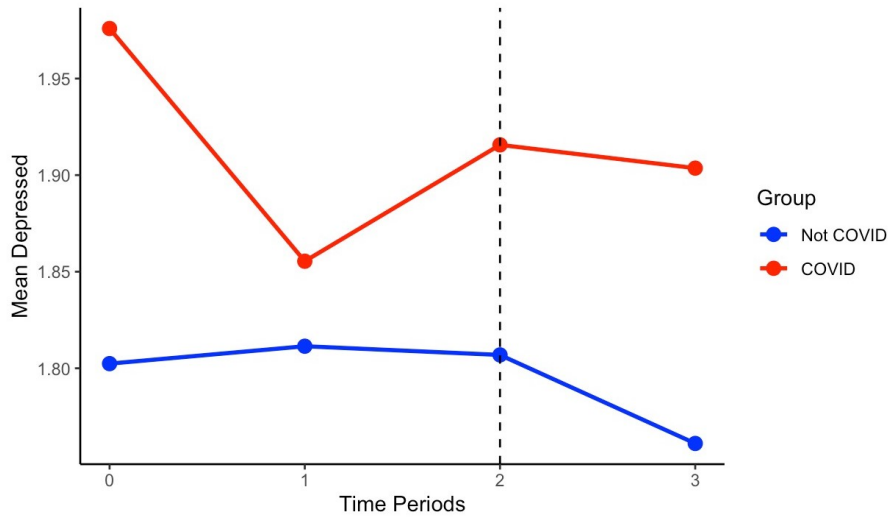

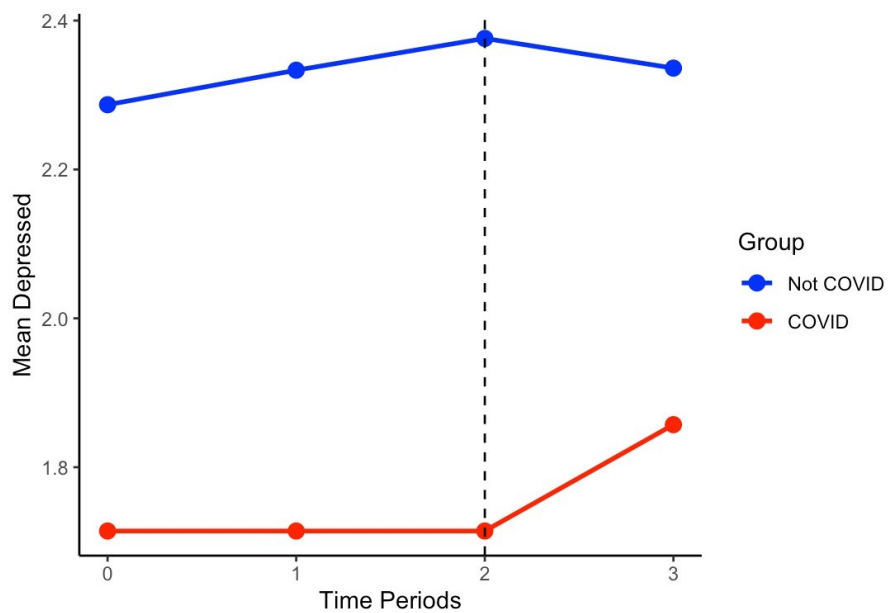Figure 5.1: Difference in Difference analysis for the elderly

Figure 5.2: Difference in Difference analysis for the students

$$Y = \alpha + \beta * Covid + \gamma * Time + \delta * (Covid * Time) \tag{1}$$

$$Y = \alpha + \beta * Covid + \gamma * Time + \delta * (Covid * Time) + \eta * Female + \kappa * Job + \rho * Single \tag{2}$$

$$Y = \alpha + \beta * Covid + \gamma * Time + \eta * Female + \kappa * Job + \rho * Single \qquad (3)$$

Besides the Difference in Difference test a t test is also done to see how in general the mental health of the entire groups developed over time during the pandemic. The t test will not include the treatment, it just a simple before and after with no treatment to see if the mental health in the sample used for this study worsened over time. Since the data used in this study is randomised, more on that later, there should be no selection bias. This means that there is no correlation within the data itself or that there is a trend in the way that it was collected. For example, if someone stands near the Erasmus university and asks people what their highest form of education is to measure education in Rotterdam, there is a significant chance that the interviewer most likely talks more to students and the results should therefore be skewed.

6   Results

The results of the difference in difference test for the elderly are shown in Table 6.1. In the second column, the results of the standard Difference in Difference regression, there is no significant effect of the interaction term on the feeling of depression or gloominess. The interaction term is not significant, meaning that there is no significant deviation of having CoViD-19 on the feeling of depression. In Regression 2 the variable time is significant, but the interaction term is again insignificant but positive. The feeling of depression increases if a person had CoViD-19 in the beginning of the pandemic, but it is not significant. There are also variables added to Regression 2 such as gender, having a job, and having a partner. Being a female tends to worsen the average feeling of depression by 0.150. Working lightens the feeling of depression by –0.118 and being single increases the depression by 0.095 on average. The average treatment effect of the Regression 1 is –0.030, meaning that your feeling of depression decreases if you had CoViD-19 in the early stages of the pandemic.

Table 6.1: Difference in Difference en regression results of the elderly.

	Regression 1	Regression 2	Regression 3
Covid	0.118	0.140	0.154**
	(0.108)	(0.108)	(0.072)
Time	-0.054	-0.061*	-0.060**
	(0.034)	(0.034)	(0.033)
Interaction	-0.030	0.029	
	(0.144)	(0.144)	
Female		0.150***	0.150***
		(0.034)	(0.034)
Job		-0.118***	-0.118***
		(0.040)	(0.040)
Single		0.095**	0.095**
		(0.041)	(0.041)
Constant	1.812***	1.492***	1.491***
	(0.025)	(0.029)	(0.069)
Observations	1,447	1,447	1,447
R^2	0.002	0.015	0.015

$^{***}p < 0.01,\ ^{**}p < 0.05,\ ^{*}p < 0.1$

When looking at the students in Table 6.2 similarities are observed in Regression 1'. There is again no significant effect on having CoViD-19 in the early stages of the pandemic. Furthermore, there are no significant effects this time in Regression 2' when there are variables added. For the students there seems to be no variables that are controlled for to have an effect on the feeling of depression or gloominess. In this study, there are no variables that affect the feeling of depression for the younger generation.

Table 6.2: Difference in Difference en regression results of the students.

	Regression 1'	Regression 2'	Regression 3'
Covid	-0.159	-0.012	-0.188
	(0.248)	(0.252)	(0.161)
time	-0.014	-0.012	0.012
	(0.127)	(0.144)	(0.134)
Interaction	0.014	-0.004	
	(0.320)	(0.325)	
Female		0.161	0.161
		(0.125)	(0.124)
Job		-0.079	-0.079
		(0.125)	(0.139)
Single		-0.068	-0.068
		(0.133)	(0.132)
Constant	2.373***	2.265***	2.265***
	(0.025)	(0.347)	(0.346)
Observations	156	156	156
R^2	0.002	0.010	0.010

$^{***}p < 0.01,\ ^{**}p < 0.05,\ ^{*}p < 0.1$

In Table 6.3 the t test for the elderly and the students is shown. There are no significant differences between the control and treatment group for the elderly and the students at both time periods. There are also no significant differences for each group at both time periods. The persons who did not catch CoViD-19 have a decrease in feeling of depression between 2019 and 2023 and the persons who did catch CoViD-19 vice versa, but both differences are not significant. Overall, the feeling of depression for both groups did decrease but not a significant amount.

Table 6.3: T test to compare means.

	Elderly			Students		
	Covid	Non-Covid	Total	Covid	Non-Covid	Total
Time						
t = 0	1.930	1.812	1.819	2.214	2.373	2.356
t = 1	1.907	1.758	1.767	2.214	2.359	2.346
N	86	1,361	1,447	14	142	156

$^{***}p < 0.01,\ ^{**}p < 0.05,\ ^{*}p < 0.1$

7 Shortcomings

This study can be improved in a variety of ways. First of all, the dependent variable is one dimensional. It is a self-reported number based on a single question. There are online indexes for mental health which should be utilised to create a better and more accurate measurement

of mental health. A good example for this index is the Patient Healt Questionnaire 9 (PHQ-9) which is a questionnaire which measures depression (Kroenke et al., 2001). The current questionnaire asks the same questions, but the format is different (the questions in the PHQ-9 are ranked 0 to 3), and some questions are missing about losing appetite for example. There is a questionnaire for personalities, the Big 5 personality traits to be precise. Lamers et al. (2012) also use the LISS dataset and make a valid point regarding mental health; the authors say that mental health is not solely determined by the absence of psychopathological symptoms but can also be determined by a feeling of well-being. There is no causality between mental health and personality traits but there is correlation between certain traits and well-being, being either psychological or emotional. Staying on the same subject of measuring mental health on the positive side, there also is a short study in the LISS dataset which uses the Mental Health Continuum-Short Form (MHC-SF). Because of the broadness of the mental health spectrum, ideally the MHC-SF or PHQ-9 should be used to measure well-being or depression respectively. However, since the data is from the past a questionnaire, it is impossible to alter or add these questionnaires to already existing data.

The severity of CoViD-19 is not present in the data. Long COVID is a more severe form of CoViD-19 where symptoms may persist for several weeks or months (Raveendran et al., 2021). When having long COVID people can still have symptoms after several weeks or even months. These symptoms range from, continuously or sporadic, having flue like symptoms to fatigue and loss of smell or taste. The authors claim long COVID is more present at older generation making it a valuable insight for this study and should be used in future research.

The variable regarding CoViD-19 is a bit complicated. During the pandemic people were often tested by employees of the RIVM who were not physicians per se. The question in the main questionnaire used asked if CoViD-19 was diagnosed by a physician. During the pandemic phycisians did not test all of their patients if they had symptoms because of the aforementioned reason of RIVM employees. To make up for the low number of CoViD-19 patients, different questionnaires had to be used to see if a person has had CoViD-19. But even with the extra questionnaires the percentage of reported CoViD-19 cases in this study, 6.3 percent, is not in line with the percentage of CoViD-19 cases in 2021 which was nearly 25 percent (CBS, 2023). This can form a skewed view of the results of this study simply because of the lack of persons who had CoViD-19. There are extra questionnaires used in this study to see if a person had CoViD-19. But these questionnaires had far less respondents than the usual questionnaire and there also was overlap between these questionnaires of people who filled out both questionnaires.

Since the data had to be collected over several years, there is a problem with attrition. Missing or not filling in one of the several questionnaires renders a participant's data unreliable. For the elderly this is no problem because of the distribution of ages as seen in Appendix A but the younger generation does not nearly have as many respondents as the elderly making attrition a severe problem. The sample used in this study only consisted of 156 students. The small sample impairs the representativeness of the results. This may be the cause of why the parallel trend assumption does not hold as seen in Figure 5.2. However, the parallel trend assumption does aso not hold for the elderly as seen in Figure 5.1. Both of this could be because of the low percentage of CoViD-19 cases but this cannot be concluded and should be further

studied.

These shortcomings are hard to implicate in future studies because the pandemic was an event which happened in the past and it is not clear when another pandemic will happen. It is hard to add data to something that already happened and have people recall how they felt back then.

8 Discussion & Conclusion

The main question of this paper was if the elderly are still experiencing mental issues after CoViD-19. The elderly and students were compared because the latter were not as vulnerable to CoViD-19 as the elderly and therefore should be less afraid of obtaining the virus. There is no effect found on having CoViD-19 and having an increased feeling of depression for the elderly and there is no significant effect of the mere existence of CoViD-19 on the mental health. Even though pandemics should cause fear and a decline in mental health (Taylor, 2019). There are however significant effects for other variables. Being a woman means you are more prone to feel depressed. This is in line with different studies (Albert, 2015; Parker and Brotchie, 2010; Kuehner, 2017). This is largely due to hormones and different coping mechanisms according to these studies. Having a job decreases the feeling of depression. This can be caused because of several reasons. First the circadian rhythm can contribute to depression if it is disturbed (Walker et al., 2020). Altered rhythms are correlated with mental problems such as major depressive disorder and anxiety. However, there is the problem of reversed causality, e.g., does depression cause a disturbance in your circadian rhythm or does a disturbance in your circadian cause depression? Working a regular 9 to 5 job on itself causes a disturbance in the circadian rhythm (Potter et al., 2016). How is it than that depression decreases in this study? During the pandemic social interaction was reduced due to the virus. Unemployment can cause to lower life satisfaction and mental health (Pohlan, 2019). However, the author also states that having a partner decreases symptoms of depression, which also aligns with our study. Singh and Misra (2009) find that loneliness and depression are positively correlated in the study they conducted for the elderly population. The authors find that loneliness can also be present beside the fact that a person may be socially active i.e., outgoing and having friends.

The results of this study are opposite of those of other studies (Kumar and Nayar, 2021; Rubin and Wessely, 2020; Talevi et al., 2020; Taylor, 2019). Whilst the previous general consensus of these authors was that lockdowns and pandemics worsen the mental health, this is not proven in this study. There are different factors that do have a significant effect on ones mental health. For the students these factors were absent and there was also no significant effect on the mental health of the students. Nuijen et al. (2023) conducted a study in the name of the RIVM concluded that students still do struggle with the aftermath of the pandemic. For further research a second look could be taken on the long term to see if there is all any effects from the pandemic.

References

Albert, P. R. (2015). Why is depression more prevalent in women? *Journal of Psychiatry and Neuroscience*, 40(4):219–221.

CBS (2023). Pienter corona onderzoek. `https://www.rivm.nl/pienter-corona-onderzoek/resultaten`. Accessed: June 25, 2024.

CBS (2024). Elderly people. `https://www.cbs.nl/en-gb/visualisations/dashboard-population/age/elderly-people`. Accessed: June 20, 2024.

Coyne, J. C., Kessler, R. C., Tal, M., Turnbull, J., Wortman, C. B., and Greden, J. F. (1987). Living with a depressed person. *Journal of Consulting and Clinical psychology*, 55(3):347.

de Hollander, E., Plantinga-Muis, L., Boer, J., Gerkema, M., Koning, M., Schurink, T., and Loef, B. (2023). Invloed van de corona-epidemie op de gezondheid en leefstijl van nederlandse volwassenen. *RIVM rapport 2022-0182*.

Hwang, T.-J., Rabheru, K., Peisah, C., Reichman, W., and Ikeda, M. (2020). Loneliness and social isolation during the covid-19 pandemic. *International psychogeriatrics*, 32(10):1217–1220.

Kleine-Budde, K., Müller, R., Kawohl, W., Bramesfeld, A., Moock, J., and Rössler, W. (2013). The cost of depression–a cost analysis from a large database. *Journal of affective disorders*, 147(1-3):137–143.

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The phq-9: validity of a brief depression severity measure. *Journal of general internal medicine*, 16(9):606–613.

Kuehner, C. (2017). Why is depression more common among women than among men? *The Lancet Psychiatry*, 4(2):146–158.

Kumar, A. and Nayar, K. R. (2021). Covid 19 and its mental health consequences. *Journal of Mental Health*, 30(1):1–2.

Lamers, S. M., Westerhof, G. J., Kovács, V., and Bohlmeijer, E. T. (2012). Differential relationships in the association of the big five personality traits with positive mental health and psychopathology. *Journal of Research in Personality*, 46(5):517–524.

Nuijen, J., Verweij, A., Dopmeijer, J., Van Wamel, A., Schouten, F., Buijs, M., Van der Horst, M., and Van den Brink, C. (2023). Monitor mentale gezondheid en middelengebruik studenten hoger onderwijs 2023.

Parker, G. and Brotchie, H. (2010). Gender differences in depression. *International review of psychiatry*, 22(5):429–436.

Pohlan, L. (2019). Unemployment and social exclusion. *Journal of Economic Behavior & Organization*, 164:273–299.

Potter, G. D., Skene, D. J., Arendt, J., Cade, J. E., Grant, P. J., and Hardie, L. J. (2016). Circadian rhythm and sleep disruption: causes, metabolic consequences, and countermeasures. *Endocrine reviews*, 37(6):584–608.

Raveendran, A., Jayadevan, R., and Sashidharan, S. (2021). Long covid: an overview. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 15(3):869–875.

Rubin, G. J. and Wessely, S. (2020). The psychological effects of quarantining a city. *Bmj*, 368.

Singh, A. and Misra, N. (2009). Loneliness, depression and sociability in old age. *Industrial psychiatry journal*, 18(1):51–55.

Talevi, D., Socci, V., Carai, M., Carnaghi, G., Faleri, S., Trebbi, E., Di Bernardo, A., Capelli, F., and Pacitti, F. (2020). Mental health outcomes of the covid-19 pandemic. *Rivista di psichiatria*, 55(3):137–144.

Taylor, S. (2019). *The psychology of pandemics: preparing for the next global outbreak of infectious disease*. Taylor & Francis.

Walker, W. H., Walton, J. C., DeVries, A. C., and Nelson, R. J. (2020). Circadian rhythm disruption and mental health. *Translational psychiatry*, 10(1):1–13.

Wang, X., Hegde, S., Son, C., Keller, B., Smith, A., and Sasangohar, F. (2020). Investigating mental health of us college students during the covid-19 pandemic: Cross-sectional survey study. *Journal of medical Internet research*, 22(9):e22817.
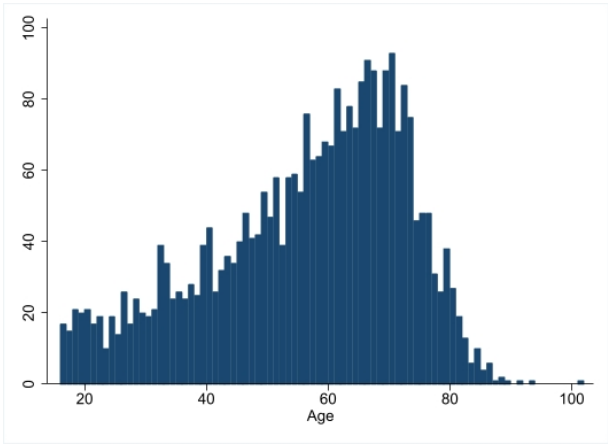
A   Appendix A: Distrubtion of ages

Figure A.1: The distribution of ages in the data.