The impact of the COVID-19 school closure on adolescents' use of mental healthcare services in Sweden*

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Abstract

School closures used to contain the COVID-19 pandemic may have negative impact on students' mental health but credible evidence is scare. Sweden moved upper-secondary students to remote teaching but, as the only country in the OECD, kept schools at lower levels open throughout the pandemic. Using population wide register data, we employ a difference-in-difference strategy to study the change in the use of mental healthcare services among upper- and lower-secondary students. Relative to expected rates, mental healthcare use among upper-secondary students fell by 4.36% during the initial phase of school closure, largely due to a reduction in depression and anxiety-related diagnoses and prescriptions of antidepressants. We find no indication of a rebound in mental healthcare use during the fall of 2020 when upper-secondary schools were largely open, and the decrease persists through March 2021. There is no indication of a reduction in general healthcare use specific to upper-secondary students or of a substitution towards unplanned and emergency care visits, as would be expected if normal channels of care contacts were disrupted. There is thus no indication that moving to remote teaching for a relatively limited period, in a setting with no strict lockdown, led to deteriorated mental health among upper-secondary students.

JEL codes: I10; I18; I28

Keywords: COVID-19, mental healthcare, school closure, differences-in-differences

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Introduction

School closures have been one of the most widely used containment measures during the COVID-19 pandemic. These closures disrupted the education for billions of students, raising concerns regarding the consequences for learning and the mental health of children and adolescents (UNESCO, 2021). While the impact of school closures on virus transmission and student learning is relatively well studied,[4] less progress has been made regarding mental health. The main reason for research to be lacking in this regard is that isolating the impact of school closures on mental health is challenging. A number of non-pharmaceutical interventions (NPIs) were introduced concurrent with the closing of the schools. Together with the pandemic itself, these NPIs are likely to have affected student wellbeing and the access to healthcare, making simple comparisons before and during the pandemic inadequate to identify the effects of school closures. As most countries closed all schools simultaneously, there is no credible control group available, resulting in an important gap concerning the understanding of the consequences of a key NPI. This paper aims at filling this gap by studying the use of mental healthcare services among Swedish adolescents.

In contrast to all other OECD countries, Sweden only moved upper-secondary students to remote instruction at the start of the pandemic, while schools for younger students remained open (OECD 2021a). This partial school closure allows for a comparison of adolescents differently exposed to school closures but otherwise facing similar conditions. Using population wide register data, we employ a difference-in-difference strategy to study the change in the use of mental healthcare services among upper-secondary (age 17-19) relative to lower-secondary (age 14-16) students. We define mental healthcare use as either receiving a psychiatric diagnosis from a healthcare contact at hospitals or doctor at specialist psychiatric care facilities, or being prescribed a psychiatric drug. Relative to lower-secondary students, we find that the use of mental healthcare among upper-secondary students fell by 3.71 cases per 1000 during the initial phase of the pandemic, largely due to a reduction in depression and anxiety-related diagnoses and the prescription of antidepressants. This corresponds to a 4.36% decrease compared to the level prior to the pandemic. The decrease persists through July 2020-March 2021, and is concentrated to students who had not received a diagnosis or a prescription drug earlier in the academic year. The reduction is somewhat larger among males than females, among students with higher expected achievement, and among students with parents whose occupations allowed better opportunities to work from home.

According to a recent systematic review (Viner et al. 2022), no previous study has been able to separate the impact of school closures on mental health or mental healthcare use from broader lockdown measures. There are, however, several studies on how mental health and the use of mental healthcare services evolved during the pandemic. The one study of adolescents' mental health in Sweden during the pandemic using survey data, finds no change in mental health among 16-year-olds (Chen et al., 2021). This is in line with our finding of no change in mental health among lower-secondary students (age 14-16). Survey evidence of adolescents' emotional and behavioral problems from other countries during the pandemic, that attempts to adjust for selection as well as time and age trends, find both deteriorating (Thorisdottier et al., 2021; Luijten et al., 2021; Rogers et al., 2021 and unaffected mental health (Munasinghe et al., 2020; Hafstad et al., 2021). Regarding the use of mental healthcare, studies show large decreases in

[4] The literature on the impact of school closures on virus transmission and student learning is growing rapidly. See Svaleryd and Vlachos (2022) for a relatively up-to-date survey.

the use of healthcare for self-harm, anxiety, depression, and for prescriptions of psychiatric drugs among adolescents during the initial phase of the pandemic (Jollant et al., 2021; Carr et al., 2021; Evensen et al., 2021; Ougrin, 2020). After the initial phase, healthcare use seems to have reverted back to earlier levels in England (Carr et al., 2021) or possibly even higher levels in Norway (Evensen et al., 2021). A similar pattern is found for suicide in Japan (Tanaka and Okamoto, 2021). The initial reduction in mental healthcare use is plausibly explained by limited access, as the healthcare sector was urged to reduce face-to-face patient contacts and patients were hesitant to seek care. By comparing students in upper- and lower-secondary schools during the same time-periods, we effectively hold constant factors such as access to and the capacity of the healthcare system, the consequences of other NPIs, as well as other direct and indirect effects of the pandemic.

While the research design hold constant a host of factors, it is possible that closing the schools led in an asymmetric reduction in the access to healthcare or willingness to seek care among upper-secondary students. If so, the reduction in mental healthcare use might not reflect a reduction in the need of such care. Three results speaks against this. First, we find no corresponding decrease in the use of healthcare for symptoms unrelated to mental health and COVID-19. Thus, there is no indication of a reduction in general healthcare use specific to upper-secondary students. Second, if the channels that normally bring upper-secondary students in contact with mental healthcare are disrupted, we would expect a substitution towards unplanned and emergency care visits. To the contrary, we find an even larger decrease among these types of care contacts. Third, we find no indication of a rebound in mental healthcare use during the fall of 2020 when upper-secondary schools were largely open. There is thus no indication that moving to remote teaching for a relatively limited period, in a setting with no strict lockdown, led to deteriorated mental health among upper-secondary students.

1. School closures and other containment measures

In Sweden, the academic year runs from mid-August to mid-June. As a response to the rapid increase in COVID-19 infections, upper-secondary schools moved to remote instruction on March 18, 2020, until the summer break. Schools for younger students remained open and the preventive measures undertaken in these schools were mild in an international comparison (Guthrie, 2020). In particular, there were no recommendations or encouragement of the use of facemasks, no reduction in class size, no targeted testing or quarantining of students. Most school-related activities thus operated basically as usual, but the national tests during the spring were cancelled at both the lower- and upper-secondary level.

After the summer break, upper-secondary schools re-opened for in-person instruction but the possibility of reverting to remote instruction remained. Schools largely relied on in-person teaching but some upper-secondary schools had students alternate between remote and in-person classes in order to reduce congestion. The use of remote instruction increased in late October 2020 when infection rates rose rapidly and on December 7, all upper-secondary schools closed. From January 24, 2021, upper-secondary schools were required to give each student at least 20% of their classes in-person at the school premises but student presence in schools was restricted until April 2021 (PHA, 2021). Lower-secondary schools remained open throughout the spring and fall of 2020, although some spontaneous closures occurred locally. From January 24, 2021, lower-secondary schools were allowed to use remote instruction if local conditions so required. A survey of all schools conducted by Statistic Sweden (2022) shows that students at the upper-secondary level on average had 12 weeks of remote teaching during the spring of

2020, 3 weeks during the fall of 2020, and 7 weeks during the spring of 2021. For lower-secondary students, the corresponding numbers were 3 weeks during the spring of 2020, 1 week during the fall of 2020, and 5 weeks during the spring of 2021. The same survey indicates that upper-secondary students with special needs generally had more access to in-person schooling.

Around the same date as upper-secondary schools moved online, the Public Health Authorities introduced several other containment measures that were nation-wide and affected everyone. These measures included a ban against public gatherings above 50 persons; instructions to restaurants and bars to increase distance between guests, and to only allow small parties of guests; recommendations to stay at home if sick; work from home if possible; to only socialize in small groups, and to avoid unnecessary travels. A feature of the Swedish strategy was the use of recommendations rather than legally binding restrictions. Individual discretion was thus accepted, meaning for example that it was possible to socialize with friends even during the peak of the pandemic. Despite the strong reliance on voluntary action, mobile phone data reveals that mobility declined substantially during the initial phase of the pandemic and that the decrease was of similar magnitude in areas with different socioeconomic and demographic characteristics (Dahlberg et al., 2020).

Healthcare services in Sweden were disrupted both by the large number of COVID-19 cases and by recommendations to limit non-essential healthcare visits.[5] Mental healthcare was, however, relatively unaffected. In the Stockholm Region – that houses 25% of the Swedish population – the number of persons receiving mental healthcare increased somewhat during March-September 2020 compared to the same period in 2019 (CEM, 2021). This was achieved by a transition to remote consultations that appears to have worked well, except for the elderly (70+) among whom visits declined somewhat. On national level there were somewhat fewer new consultations at the Child and Adolescents Psychiatric Specialist care in the spring of 2020 compared to 2019. The reason seems to be that patients cancelled or rescheduled appointments because of symptoms or fear of COVID-19. However, the number of in-depth investigations increased during the period March to December 2020 compared to previous year (NBHW, 2021).

2. Data and study population

The study population consists of all Swedish upper- and lower-secondary students in the academic years 2015/16 to 2019/20. Personal identifiers allow for linkages between registries and families. Information on school grade, sex, age, and parental characteristics are from registers held by Statistics Sweden. Information on healthcare use are from registers held by National Board of Health and Welfare (NBHW). We identify all healthcare contacts at hospitals or specialist psychiatric care facilities with diagnoses within chapter F in the ICD10 classification system - Mental, behavioral and neurodevelopmental disorder - and prescriptions of drugs for insomnia (ATC-code N05), attention deficit hyperactivity disorder (ADHD) (ATC-code N06B and C02AC02), and antidepressants (ATC-Code N06A).

The main outcome variable is an indicator taking the value one if the student had either a chapter F diagnosis or was prescribed a psychiatric drug as per above during each respective period of analysis. The data does not include information on contacts with primary healthcare. However, the prescription data include information on all drugs prescribed in Sweden, including primary

[5] By July 2020, Sweden was among the most affected countries with 54 COVID-19 deaths per 100 000 inhabitants (REF XXXX). In the Stockholm Region, this number was 98.

care. We also study different diagnoses separately, if the contacts in specialist care were planned or not, and if diagnoses were from emergency units. As a test of whether general access to healthcare decreased, we study contacts with healthcare deemed unrelated to mental health and COVID-19. This measure includes all contacts with healthcare due to neoplasm (ICD10 C, D0-D4), diseases of skin and subcutaneous tissue (ICD10 L), endocrine, nutritional and metabolic diseases (ICD10 E) and diseases of the circulatory system (ICD10 I). See the online appendix for data sources, detailed descriptions of variables and summary statistics (Table A1).

3. Empirical strategy

In order to study the impact of school closures on mental healthcare use, we primarily focus on outcomes in April-June 2020. In this period, upper-secondary schools were fully closed while lower-secondary schools remained open. Since lower-secondary students attended school essentially as normal but otherwise faced similar conditions as upper-secondary students, their use of mental healthcare services provides a counterfactual. As there are level differences in the use of healthcare services between upper- and lower-secondary students, estimate the impact of the school closure using a difference-in-difference model. In the main analysis, we analyze the change in contact with mental health care services April-June 2020 compared to the same period in 2019. We also estimate the corresponding change compared to each year 2016-2018. Thus, we estimate the difference-in-difference model (1) using linear regression:

$$(1) \qquad y_{ist} = \gamma_s + \delta_t + \sum_{\tau=2016,\tau\neq2019}^{2020} \beta_\tau D_{s\tau} + \boldsymbol{X}_{ist} + \varepsilon_{it}$$

The main outcome y_{ist} is an indicator variable taking the value one if individual *i* was in contact with mental healthcare services or picked up a prescription drug for the causes described in the data section above. γ_s is an indicator for whether the student attended upper-secondary school and *t* refers to the academic year. The estimates of β_τ are the differences between upper- and lower-secondary students for each academic year, compared to the reference year (2019) prior to the pandemic. In order to adjust for potential compositional changes in the student population a vector **X** of detailed individual- and parental characteristics is included (see the online appendix for details). To track longer-term outcomes, we follow the students exposed to the initial period of school closures until March 2021. Mental health in this later period could be affected both by lagging consequences of the initial school closure and by the partial closure during the academic year 2020/21. Moreover, during the later period, final year upper-secondary students left school while final year lower-secondary students moved to upper-secondary school. Final year students at both levels thus received a mixed exposure during the follow-up period.

For the main outcome, we provide a sub-group analysis by splitting the sample by student sex and an index of expected student achievement. The latter is a composite measure of student preconditions, derived using the prediction from a regression of the grade point average (GPA) from 9th grade on a set of socioeconomic and demographic characteristics (see appendix). Based on this prediction, students are grouped into three equally sized groups. We further provide separate analyses for students who were/were not in contact with mental healthcare services earlier in the academic year. Since easy access to parents may affect students' wellbeing when schools are closed, we also split the sample according to an indicator of parents' opportunities to work from home. Following Dingel et al. (2020) and Hensvik et al. (2020), this indicator is based on occupational characteristics and details are provided in the appendix.

A central concern is that school closures may have reduced access to healthcare asymmetrically for upper-secondary students. To assess if access to healthcare matters, we provide separate analyses for diagnoses from healthcare visits and drug prescriptions, planned or unplanned care visits, diagnoses from emergency units, and diagnoses unrelated to mental health or COVID-19. To account for the longer-term impact of the initial school closures, model (1) is estimated when the outcome is measured in the period July 2020-March 2021. To further analyze the dynamics of mental healthcare use, we estimate model (2) where we compare the outcome for students in each school grade (grade 8 being the reference group) before and after schools closed:

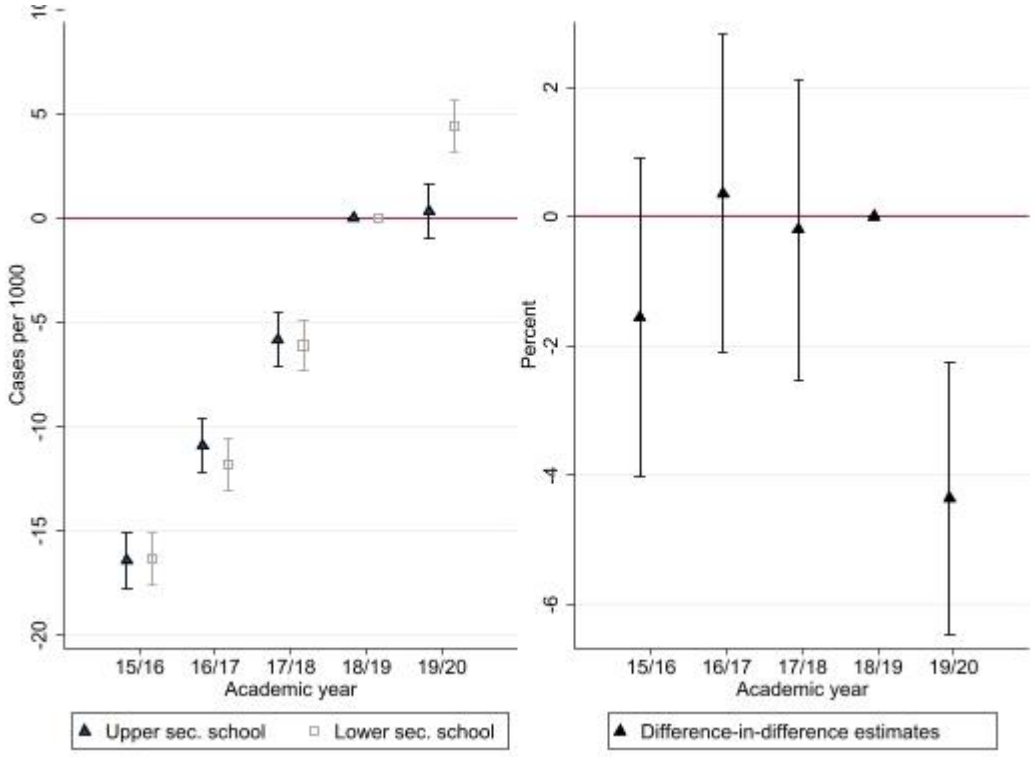
$$y_{ist} = \gamma_s + \delta_t + \sum_{\tau=7,\tau\neq 9}^{12} \beta_\tau D_{s\tau} + \boldsymbol{X}_{ist} + \varepsilon_{it} \quad (2)$$

Here, y_{ist} is the main outcome variable, *t* indicates before or after schools closed and *s* is the student school grade. The estimate β_τ shows the difference in the outcome variable between school grades *s*=7 and 9-12, compared to the reference school grade 8, April-June 2020, compared to the average for the same time-period 2016-2019. To study the development in July 2020 to March 2021, we also estimate model (2) for the periods July-October, November-December 2020, and January-March 2021. Tables corresponding to the figures presented are available in the appendix along with auxiliary results.

4. Results

The use of mental healthcare services among adolescents has increased for several years in Sweden (NBHW, 2019). These trends are illustrated in the left-hand panel of Figure 1 for the April-June-period among upper- and lower-secondary students. The panel displays the estimates from a linear regression of contacts with mental healthcare services on year fixed effects for upper- respectively lower-secondary students. Before the pandemic, use of mental healthcare services increased in tandem for lower- and upper-secondary students with about 5 cases per 1000 each year. In 2020, when upper-secondary schools were closed, contacts with mental healthcare services among lower-secondary students increased at the same rate as earlier years, whereas contacts among upper-secondary students remained at the 2019 level. As lower-secondary students continued to follow their pre-pandemic trend, these results suggest there was no general drop in contacts with mental healthcare services.

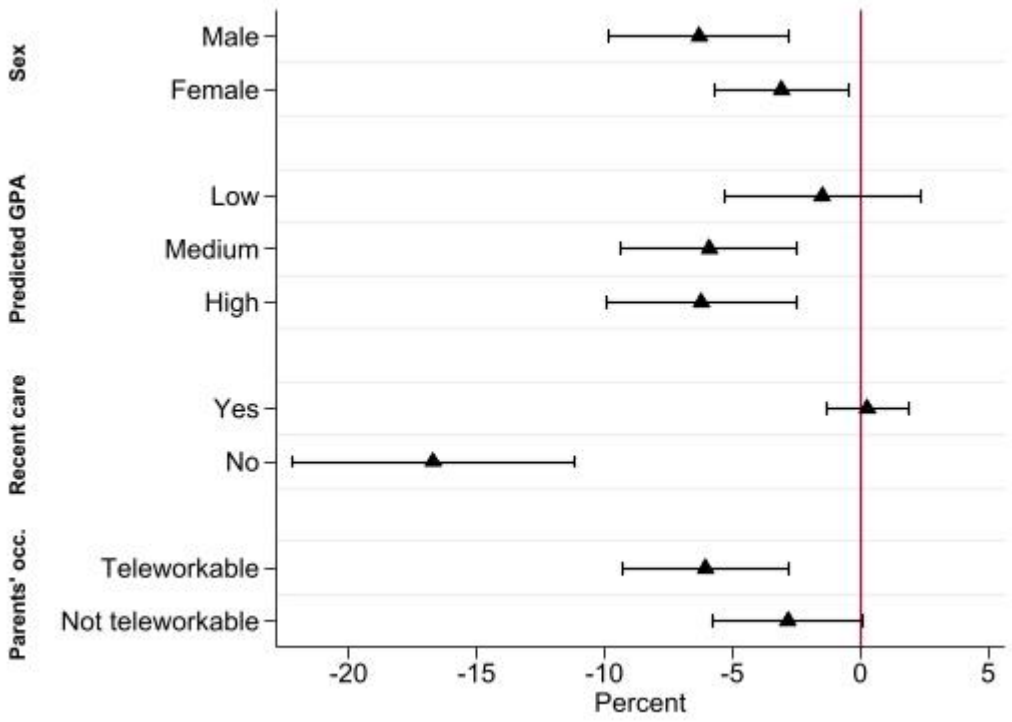
Figure 1. The use of mental healthcare services, April-June



Note: Use of mental healthcare services during April-June each respective academic year and 2018/19 is used as the reference year. The left-hand panel shows estimates from separate linear regressions for upper-secondary respectively lower-secondary students on year fixed effects. The right-hand panel shows difference-in-difference estimates from model (1) rescaled to percent. Lower-secondary students act as the control group for upper-secondary students. Standard errors cluster at school level. 95% CI indicated.

To formally test whether upper-secondary students reduced their use of mental health care services, we estimate the difference-in-difference model (1). Estimates, rescaled to differences in percent, are shown in the right-hand panel of Figure 1 and the corresponding, unscaled, estimates are shown in appendix Table A2. In the period April-June 2020, upper-secondary students reduced their healthcare contacts with 3.71 cases per 1000 relative to the expected rate. This corresponds to a 4.36% decrease relative to the mean for upper-secondary students in 2019. As can be seen in the figure, contacts with mental healthcare services followed a similar trend for the two groups in the years preceding the pandemic. Diverging long-term trends can therefore not account for the difference between upper- and lower-secondary students estimated for 2020. Furthermore, the estimates are not affected by adjusting for background characteristics, suggesting the change in 2020 is not due to compositional changes in the student population (Table A2, column 1). Appendix Table A3 shows difference-in-difference estimates for sub-diagnoses and psychiatric drugs. The results indicate reductions mainly for depression and anxiety. Healthcare contacts with diagnoses for depression and anxiety are reduced by - 7.37% and prescriptions of antidepressants by -4.70%.

Figure 2. Heterogeneity by student groups

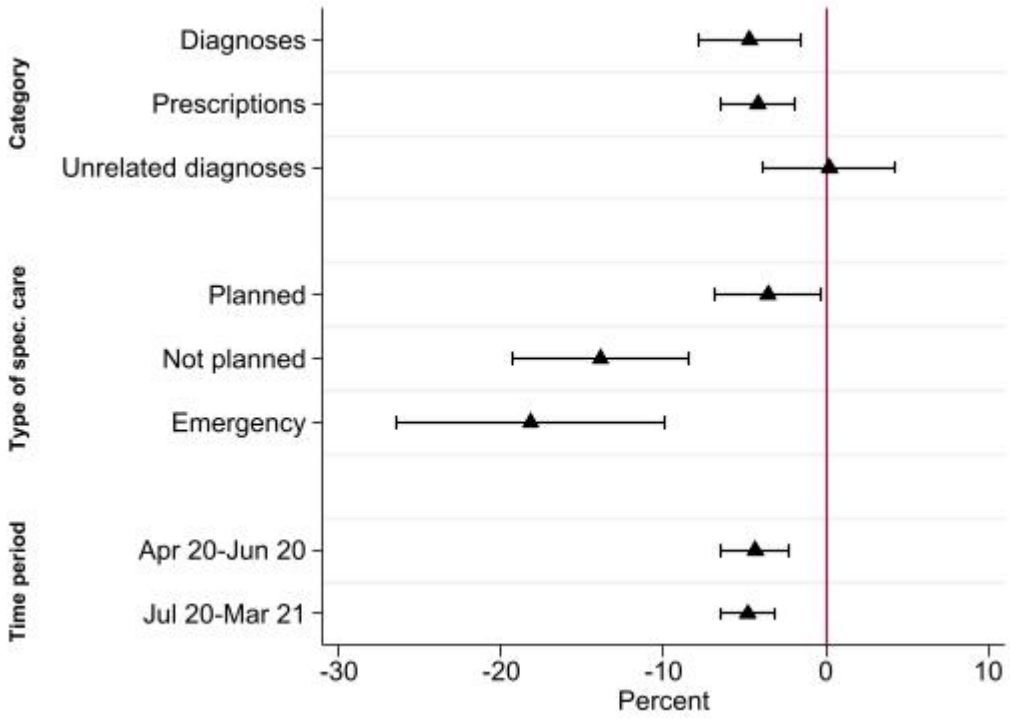


Note: Difference-in-difference estimates by sex, predicted student achievement (GPA), if the student had a mental healthcare contact earlier during the academic year, and if parents' occupations allow them to easily work from home. Outcomes are measured April-June. Estimates from separate linear regressions are rescaled to percent. Standard errors cluster at school level. 95% CI indicated.

Figure 2 shows difference-in-difference estimates for sub-populations, scaled to changes in percent relative to 2019 (see also appendix Table A2). The negative estimate is larger for males, -6.30%, than for females, -3.07%. When splitting the sample by the index based on predicted student achievement (GPA), we find the decrease to be smaller and not statistically significant among relatively disadvantaged students (-1.48%). Among students with medium and high predicted achievement, the decrease is around 6%. Splitting the population by use of mental healthcare earlier in the academic year shows that students who had not received such care account for the entire reduction, -16.70%. Among student with prior contacts, there is no change. Finally, we find the decrease to be larger among students with parents whose occupations allow them to more easily work from home (-6.04% vs -2.87%). The interpretation of this result is not clear because as students with parents who can work from home have higher predicted GPA (appendix Table A7).

One concern regarding the results presented is that we lack data on primary care visits. However, data on prescribed psychiatric drugs cover all providers, including primary care. Appendix Figures A2 and A3 show that the deviation from the pre-pandemic trend between upper- and lower-secondary students is of similar magnitude for diagnoses from healthcare visits and prescription drugs. The corresponding difference-in-difference estimates shown in Figure 3 are -4.70% for diagnoses and -4.18% for prescription drugs (appendix Table A4). There is thus no indication that the lack of primary care data affect the results.

Figure 3. Different types of care and time-periods



Note: Difference-in-difference estimates by type of diagnoses, type of care visit, and time-period. Outcomes are measured during April-June, except when indicated to refer to the July-March period. Estimates are rescaled to percent. Standard errors cluster at school level. 95% CI indicated.

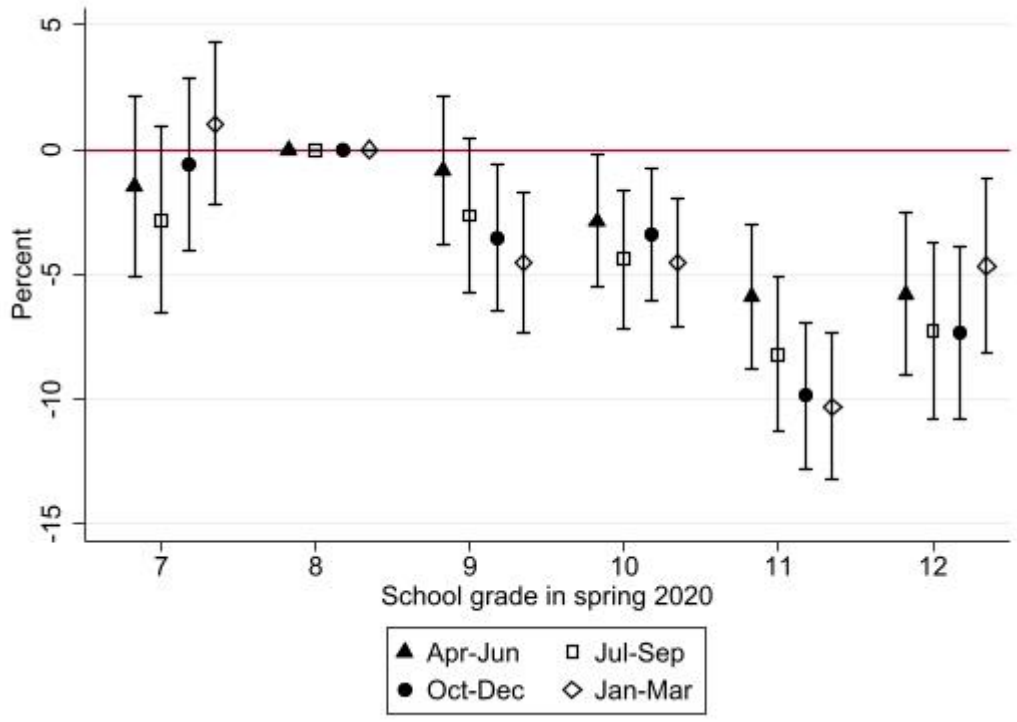
Another concern is that the results reflect an asymmetric reduction of the access to healthcare among upper-secondary students, perhaps due to reduced access through schools' healthcare facilities. As a first test of this, we estimate the difference-in-difference model for diagnoses unlikely to be related to mental health and COVID-19. As shown in Figure 3, we find a small and statistically insignificant estimate, 0.22%, for this outcome. This indicates that there is no reduction in the general access to healthcare, specific to upper-secondary students. As a second test of this concern, we consider different types of care. If access through normal channels is reduced, this would plausibly shift upper-secondary students (relative to lower-secondary students) towards unplanned care and emergency care facilities. However, difference-in-difference estimates in Figure 3 show that the relative decrease among upper-secondary students is substantially larger for unplanned, - 13.88%, than for planned care, - 3.56%, during the period when upper-secondary schools were fully closed. In particular, there is a large relative decrease in psychiatric diagnoses from contacts with emergency care units, - 18.19%. These results are inconsistent with the patterns of substitution between providers that we would expect if reduced access through normal facilities lies behind the main results. Finally, if reduced access through school facilities is a concern, we would expect a rebound during the summer and fall of 2020 when conditions for lower- and upper-secondary student were more similar. However, the reduction in the use of mental healthcare among students exposed to the initial school closure is of similar magnitude during April-June 2020, -4.36%, and July 2020-March 2021, -4.82%.[6] There is thus no indication of a built-up demand due to unmet needs.

[6] Appendix Figure A1 shows that healthcare use among lower-secondary students follows the trend for both the April-June and July-March periods, while use among upper-secondary is below trend for both time-periods.

A further concern is that the results to some extent reflect that other restrictions and access to healthcare differ between students who are above and below legal age (18 in Sweden). Most students turn 18 during their second year in upper-secondary school, meaning that they can consume alcohol in bars and clubs. It also means that students no longer have legal guardians which may have implications for their access to healthcare. For these reasons, we repeat the main analyses and the ones presented in Figure 3 including only students who were below age 18 in March. As can be seen in Appendix Table A6, the results are quite similar for this restricted sample. For our main outcome the estimated decrease is 3.17%.

Next, we analyze if mental healthcare use changed differently depending on the students' school grade in the spring of 2020. The triangles in Figure 4 show difference-in-difference estimates from model (2), rescaled to percent, of the main outcome during April-June 2020, for each school grade relative to grade 8 (see appendix Table A5). For grades 7 and 9, the estimates are small and statistically insignificant, which is expected since lower-secondary schools mainly continued operations as normal. For grade 10, the first year of upper-secondary school, there is a reduction in healthcare contacts by -2.88% but the effect is not statistically signficant. The negative impact is larger for grades 11, - 5.89%, and 12, -5.80%. Figure 4 also displays estimates for the periods July-September 2020, October-December 2020, and January-March 2021. Most grade 9-students transited to upper-secondary school in August 2020, whereas most grade 12-students graduated and left school. Relative to expected rates, healthcare contacts among grade 9-students decreased upon entering upper-secondary school in the fall of 2021. Rates among grade 12 students remained lower than expected throughout the fall and spring after graduation. Among students in grade 10, the rate of healthcare contacts remains lower than expected throughout the period of investigation. For students in grade 11, there is an initial drop and then a continued decrease until March 2021. There is thus no indication of a rebound in mental healthcare use for any group during the first year of the pandemic.

Figure 4. Mental healthcare use during the pandemic among students in school grades 7-12



Note: Difference-in-difference estimates from linear regression of model (2), rescaled to percent. Academic years 2019/20 (April-June and July-September) and 2020/21 (October-December and January-March) relative to mean prior to the pandemic. School grade 8 is the reference category. Standard errors cluster at school level. 95% CI indicated.

5. Discussion

On March 18, 2020, Sweden closed upper-secondary schools until the summer break in mid-June, while schools at lower levels remained open. We exploit this partial school closure to identify the impact of school closures on the use of mental healthcare by comparing upper- (grades 10-12) and lower- (grades 7-9) secondary students, before, during, and after the school closure. Difference-in-difference estimates show that upper-secondary students reduced their use of mental healthcare services by 4.36% relative to lower-secondary students during the initial phase of the pandemic. This lower utilization persists at least up until the end of the study period in March 2021. The largest reductions are found for diagnoses and prescriptions related to depression and anxiety, and are concentrated among students with no previous contact with healthcare for mental health issues earlier in the academic year. The results suggest that this was not due to reduced access to healthcare which is consistent with specialized psychiatric care in Sweden having managed well during the pandemic by moving consultations online (NBHW, 2021 and CEM, 2021). This is in contrast to the disruptions in mental health services reported from several other countries (WHO, 2021).

The main contribution of this study is to compare outcomes of students facing in-person and remote schooling during the same time-periods, thereby adjusting for factors that affect both groups similarly. Thus, we do not estimate the total effect of the pandemic but isolate the impact of moving to remote instruction. Should the results then be interpreted as if remote learning actually improves mental health? It is important to take the Swedish context into account when interpreting the results. As discussed, psychiatric care has been accessible during the pandemic and there are no indications of unmet needs among upper-secondary students. In an international comparison, the restrictions in the Swedish society have been mild. Although there were recommendations against travelling, meeting with elderly, and socializing in larger groups, there were no stay-at-home orders and restaurants, cafés, and gyms largely remained open. Thus, it was possible for upper-secondary students to socialize outside of school. In addition, the full school closure lasted less than 3 months. The potential negative consequences of remote learning may be larger when students are isolated for longer periods.

Another feature of the Swedish setting is that internet penetration is high and the conditions for remote learning are among the best in the world (OECD, 2021b). Reports also suggest that the move to remote teaching worked relatively well (Swedish National Agency for Education, 2020). As in many countries, standardized tests were largely cancelled which may have reduced stress and anxiety but as tests in lower-secondary school were also cancelled, this alone cannot account for the differences between lower- and upper-secondary students. Among US high school students, there is evidence that the disruption of in-person schooling led to a substantial reduction of bullying, including cyberbullying (Bacher-Hicks et al, 2022). We are not aware of similar evidence from Sweden but this is another potential channel through which remote learning may have a positive impact on student wellbeing.

This study has some limitations. Ideally, it would include self-reported surveys of mental health to validate if the results should be interpreted as improvements in mental health. No such information is available, however. Further, the outcome measure includes contacts with hospitals and specialized psychiatric care, and all prescriptions of drugs in Sweden, but it does not include information on contacts with primary care or personnel working with healthcare in schools. School closures may have reduced access to school nurses and counselors who may refer students to specialized mental healthcare services. Thus, although the evidence presented suggests otherwise, we cannot entirely rule out this explanation. Another limitation is that other disease containment measures, such as restrictions on nightlife, may have differently affected on upper- and lower-secondary students. As the age of majority is 18 in Sweden, we address this concern by showing that the main results are similar when performing a separate analysis for those under 18. A final limitation is the focus on immediate and medium-term effects. School closures may have reduced learning and opportunities for social interactions that can have detrimental long-term implications. With these caveats in mind, we can at least conclude that there we find no indications of worsened mental health by the closure of Swedish upper-secondary schools during the pandemic.

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Appendix

Data

The database used is part of the research program "Covid-19 in Sweden: Infection tracing, control and effects on individuals and society" at Stockholm University. Ethical approval for the study was obtained from the Swedish Ethical Review Authority application 2020-06492. The estimation sample is constructed using the Student Register held by Statistics Sweden consists of all students in upper- and lower secondary school the academic years 2015/16-2020/21. Each student has a personal identifier and is connected to their biological or adoptive parents using the Multi-Generational register. Information on demographic and socio-economic variables of the parents are taken from the Longitudinal integrated database for health insurance and labor market studies (LISA) maintained by Statistics Sweden. Data on contacts with doctors in specialized psychiatric care and hospital visits is available in the Patient registers, and drug prescriptions in the Drug register. Both these registers are held by the National Board of Health and Welfare.

Definitions of outcome variables are described in the main text. Most control variables are self-explanatory but the income measure renders a description. The measure of parental income is based on individual disposable income and constructed as follows: We use the average income for the years 2015-2019 and percentile rank each individual by birth cohort and sex. Note that the rank measure is constructed using all individuals in Sweden. For newly immigrated individuals we only use the income after immigration. When dividing the sample by income, a student is coded as "high income" if any of the parents has an income rank in the fourth quartile.

As a composite measure of student background characteristic envisaging school performance, we create an index by predicting grade point average (GPA) in grade 9 from an OLS regression for the period 2015-19. The explanatory variables used to predict GPA are student indicators for: birth month; if the student arrived in Sweden less than 4 and 4-8 years ago; if the student is born in a foreign country; if both and if one of the parents are born in a foreign country; if the parents live together and number of children in the family. For respective parent we include: 98 indicators of educational level-by-field, income percentile (linear), indicators of receiving social assistance, unemployment benefit, sickness pay (spells exceeding 2 weeks) or old age pension, and indicators of parent civil status (unmarried, married, divorced, widowed or other). The indicator for receiving unemployment insurance and the indicator for social assistance are interacted with an indicator of being foreign born. We also include indicators of not being in the register, which means the parent does not live in Sweden or is deceased. The model explains 0.3 of the variance in GPA. The predicted values are used to percentile rank students by year and school grade. Based on the ranking we divide the students into three equally sized groups.

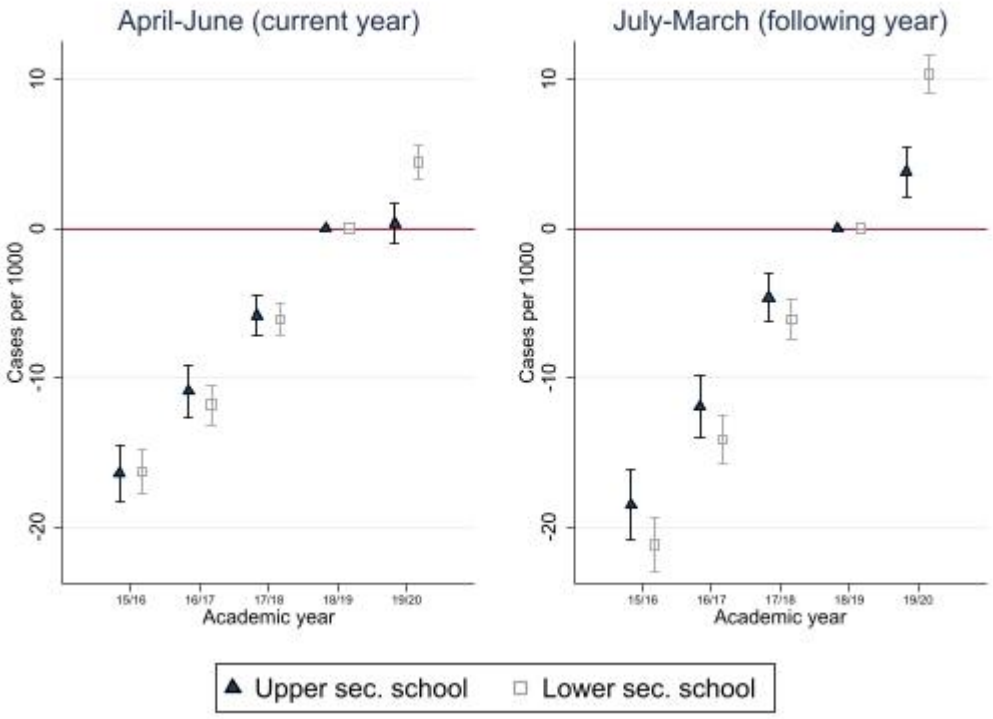
To determine which occupational groups are more likely to work from home, we use the classification of the feasibility of working remotely developed by Dingel and Neiman (2020). The original classification at Standard Occupational Classification (SOC) 12-level is aggregated to SOC10. SOC10 is then translated to the Swedish classification system SSYK2012 via the International Standard Classification of Occupations 8-digit level using the cross-table in Hensvik et al (2020). At each step we use the average value of teleworkable. From Hensvik et al (2020) we also collect the variable "share of work conducted at home" defined according to the American Time Use Survey (ATUS) at 4-digit SSYK2012 level. Using these classifications we create the variable Teleworkable occupation. A parent is categorized as having a teleworkable occupation if the Dingle and Neiwork classification "teleworkable" take a value in the range 0.5-1 and non-teleworkable if it takes a lower value. We adjust categories

by coding the occupation as teleworkable if more than 35 percent of the work could be conducted from home according to Hensvik et al (2020). The occupation is coded as non-teleworkable if less than 10 percent of the work could be conducted at home. Finally, we do some manual changes: school and pre-school personnel below upper-secondary school (SSYK2012 1411-1492, 2341-2359, 4116, 5311-5312), military personnel (110-310) some healthcare occupations (1511-1532), and traffic instructors (3441) are categorized as not being teleworkable occupations. Due to the restrictions on public gatherings, artists (2651-2655, 3433-3439) and politicians (1111) are classified as teleworkable, as are priests (3412), a missing occupational category in the original data.

Summary statistics of the main outcome variable, sex, foreign background and parental educational attainment and income percentile are presented in Table A1. The left panel shows values for the academic years 2015/16 to 2019/20 for lower-secondary students and the right panel for upper-secondary students. As can be seen in the table, the use of mental healthcare services increases over time for both groups prior to the pandemic. When upper-secondary schools closed, mental healthcare use among upper-secondary students in April-June 2020 decreased from 85.21 per 1000 to 84.83 per 1000 whereas use among lower-secondary students increased from 75.00 to 78.45 students per 1000. Inspecting the background variables show no drastic change over time. In particular, judging by these variables there is no change in the composition of students in the academic year 2019/20 that could explain changes in use of mental health services. Students in upper-secondary school are slightly more likely to be male, have foreign background and have parents without university education and lower income. The reason is that students without complete school leaving certificate from lower-secondary school begin preparatory programs in upper-secondary school to attain the requirements in core subjects. These students then stay more than one year in grade 10.

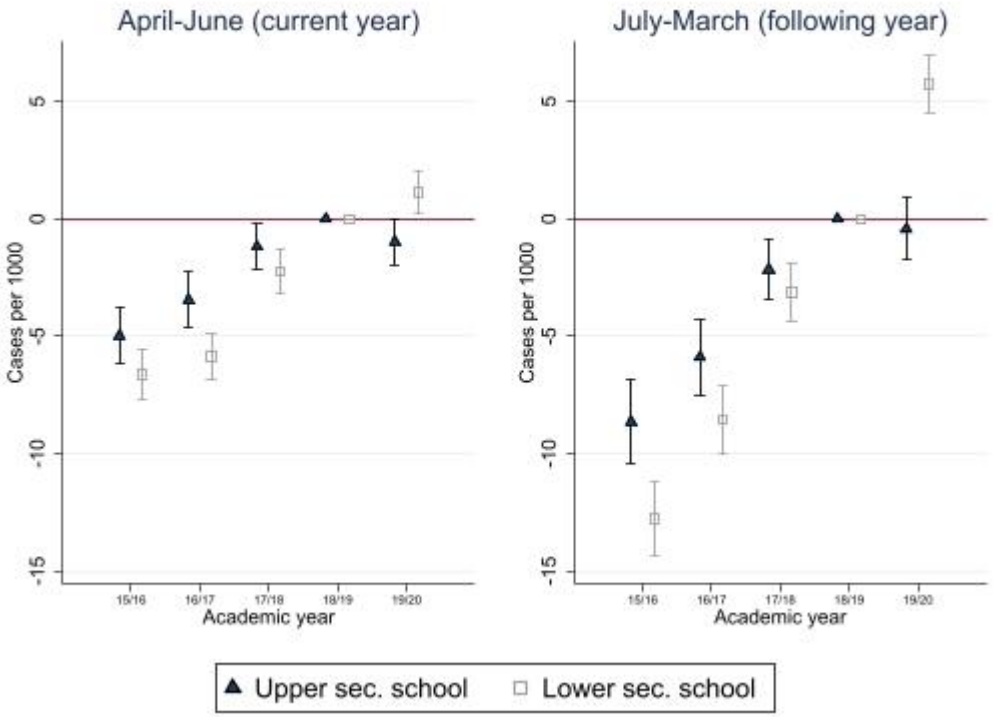
Figures

Figure A1. Trends in use of mental healthcare services



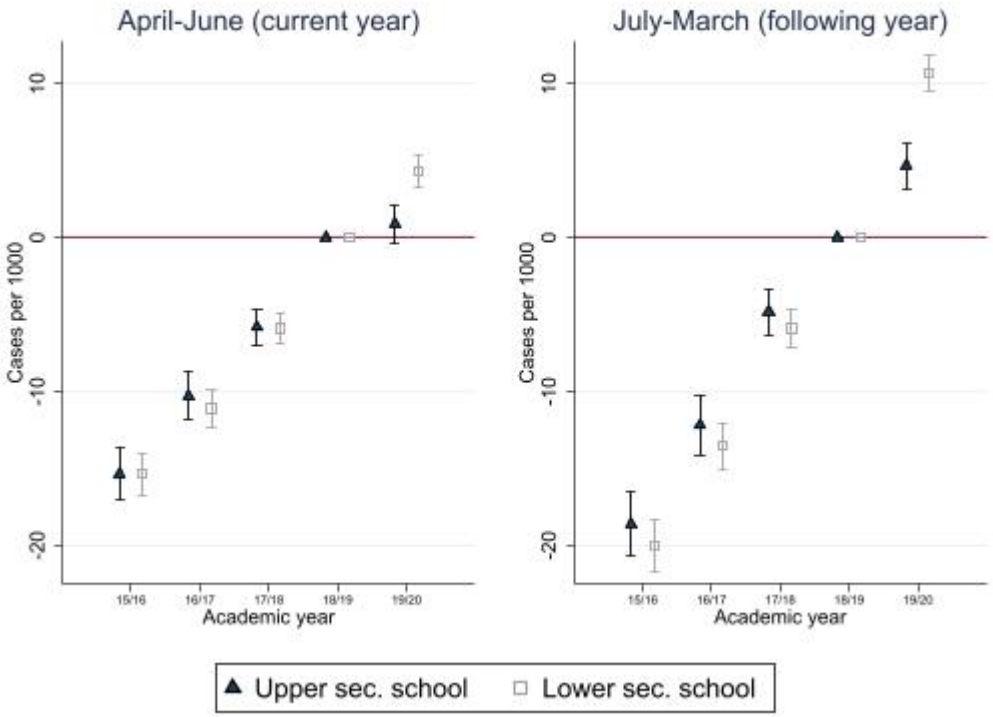
Note: Outcome: main measure of mental healthcare use (diagnoses from healthcare facilities and psychiatric prescription drugs). Estimates from separate linear regressions for upper-secondary and lower-secondary students. Outcomes in the left-hand panel are measured April-June in the current academic year and July-March the coming academic year in the right-hand panel. Standard errors clustered at school level. 95% CI indicated.

Figure A2. Diagnoses from mental healthcare contacts



Note: Outcome: diagnoses from contacts with mental healthcare facilities. Estimates from separate linear regressions for upper-secondary and lower-secondary students. Outcomes in the left-hand panel are measured April-June in the current academic year and July-March the coming academic year in the right-hand panel. Standard errors clustered at school level. 95% CI indicated.

Figure A3. Psychiatric prescription drugs



Note: Outcome: use of psychiatric prescription drugs. Estimates from separate linear regressions for upper-secondary and lower-secondary students. Outcomes in the left-hand panel are measured April-June in the current academic year and July-March the coming academic year in the right-hand panel. Standard errors clustered at school level. 95% CI indicated.

Tables

Table A1. Summary statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Lower secondary students					Upper secondary students				
Academic year	2015/16	2016/17	2017/18	2018/19	2019/20	2015/16	2016/17	2017/18	2018/19	2019/20
Care Apr-Jun in *t*	62.98	66.40	70.41	75.00	78.45	72.77	77.25	80.49	85.21	84.83
Care Jul-Mar in *t*+1	95.27	100.84	106.65	110.72	119.68	112.22	117.38	122.28	125.41	128.15
Care Jul-Mar in *t*	76.72	82.63	88.06	92.28	97.18	102.36	109.80	114.53	120.87	123.37
Male	0.51	0.51	0.51	0.51	0.51	0.52	0.53	0.53	0.53	0.53
Foreign background	0.22	0.23	0.24	0.25	0.25	0.26	0.27	0.29	0.30	0.30
University edu. mother	0.45	0.47	0.48	0.49	0.51	0.41	0.41	0.42	0.43	0.45
University edu. father	0.35	0.36	0.37	0.37	0.38	0.31	0.32	0.32	0.33	0.34
Income percentile mother	49.13	49.79	49.97	50.18	50.25	46.88	46.80	46.37	46.60	46.97
	(30.15)	(30.22)	(30.35)	(30.33)	(30.34)	(30.91)	(31.01)	(31.30)	(31.40)	(31.50)
Income percentile father	49.97	50.47	50.55	50.58	50.67	46.94	46.79	46.28	46.48	46.82
	(31.52)	(31.47)	(31.54)	(31.51)	(31.44)	(32.56)	(32.71)	(32.94)	(32.96)	(33.00)
N	302872	313961	330306	338433	346840	313339	318060	327259	337436	347897

Note: Mean values. Standard deviations in parentheses. Care in *t* refers to the academic year in the column head and *t*+1 to the following year.

Table A2. Difference-in-difference estimates of psychiatric care or prescriptions. Main results and results for subgroups and time-periods

	(1) No controls	(2) Controls	(3) Males	(4) Females	(5) Pred grade low	(6) Pred grade medium	(7) Pred grade high
	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)
Upper sec × 2016	-0.42 [-2.92,2.07] (0.74)	-1.13 [-3.50,1.24] (0.35)	1.83 [-0.98,4.63] (0.20)	-4.49** [-7.77,-1.21] (0.01)	3.43 [-0.37,7.24] (0.08)	-2.22 [-5.81,1.36] (0.22)	-4.14* [-7.41,-0.87] (0.01)
Upper sec × 2017	0.64 [-1.64,2.93] (0.58)	0.26 [-1.93,2.44] (0.82)	0.02 [-2.42,2.47] (0.98)	0.49 [-2.71,3.69] (0.76)	3.84* [0.41,7.28] (0.03)	-0.59 [-3.98,2.80] (0.73)	-2.01 [-5.19,1.18] (0.22)
Upper sec × 2018	-0.14 [-1.92,1.65] (0.88)	-0.15 [-1.89,1.58] (0.86)	-1.07 [-3.11,0.98] (0.31)	0.91 [-1.65,3.47] (0.49)	2.61 [-0.30,5.51] (0.08)	-0.30 [-3.19,2.58] (0.84)	-2.28 [-4.89,0.34] (0.09)
Upper sec × 2019	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Upper sec × 2020	-3.84*** [-5.69,-1.98] (0.00)	-3.71*** [-5.48,-1.95] (0.00)	-4.26*** [-6.42,-2.11] (0.00)	-3.22* [-5.76,-0.69] (0.01)	-1.27 [-4.24,1.69] (0.40)	-5.39*** [-8.39,-2.38] (0.00)	-4.85*** [-7.33,-2.37] (0.00)
Mean dep var upper sec 2019	85.21	85.21	67.69	104.90	85.93	91.45	78.05
Effect (%)	-4.50	-4.36	-6.30	-3.07	-1.48	-5.89	-6.21
CI95 (%)	[-6.68,-2.33]	[-6.43,-2.29]	[-9.48,-3.12]	[-5.49,-0.66]	[-4.93,1.97]	[-9.17,-2.60]	[-9.39,-3.03]
R2	0.001	0.025	0.025	0.028	0.049	0.015	0.010
N	3,276,398	3,276,398	1,706,036	1,570,362	1,081,228	1,113,973	1,081,197

Note: Results from linear regression model specified in main text. Reference year 2019. Specifications presented in (2)-(11) adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level.

Table A2 (continued). Difference-in-difference estimates of psychiatric care or prescriptions. Main results and results for subgroups and time-periods

	(8) Recent contact	(9) No recent contact	(10) Teleworkable	(11) Not teleworkable
	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)
Upper sec × 2016	-7.98 [-18.74,2.78] (0.15)	0.47 [-0.40,1.34] (0.29)	-2.19 [-5.64,1.26] (0.21)	0.36 [-2.80,3.52] (0.82)
Upper sec × 2017	4.66 [-5.97,15.29] (0.39)	0.12 [-0.72,0.96] (0.77)	-0.79 [-3.99,2.42] (0.63)	1.32 [-1.60,4.23] (0.38)
Upper sec × 2018	2.49 [-7.13,12.11] (0.61)	0.61 [-0.19,1.41] (0.14)	-1.51 [-4.17,1.15] (0.27)	1.36 [-1.03,3.74] (0.26)
Upper sec × 2019	ref	ref	ref	ref
Upper sec × 2020	1.63 [-7.58,10.83] (0.73)	-2.40*** [-3.22,-1.59] (0.00)	-5.39*** [-7.91,-2.87] (0.00)	-2.57* [-4.99,-0.14] (0.04)
Mean dep var upper sec 2019	600.34	14.38	89.19	89.47
Effect (%)	0.27	-16.70	-6.04	-2.87
CI95 (%)	[-1.26,1.80]	[-22.37,-11.03]	[-8.87,-3.22]	[-5.58,-0.16]
R2	0.034	0.003	0.015	0.028
N	331,388	2,945,010	1,239,372	1,624,261

Note: Results from linear regression model specified in main text. Reference year 2019. Specifications presented in (2)-(8) adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level.

Table A3. Difference-in-difference estimates for different diagnoses and perscriptions. Outcomes measured April-June

	(1) Depression and anxiety	(2) Disorder due to psychoactive substance use	(3) Self-destructive behavior	(4) Eating disorder	(5) Anti-depressants	(6) Adhd medication
	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)
Upper sec × 2016	0.34 [-0.65,1.33] (0.50)	0.17 [-0.14,0.47] (0.29)	-0.10 [-0.33,0.14] (0.41)	0.21 [-0.13,0.56] (0.23)	-2.61*** [-3.96,-1.27] (0.00)	0.61 [-0.81,2.03] (0.40)
Upper sec × 2017	0.57 [-0.42,1.57] (0.26)	0.38* [0.08,0.67] (0.01)	-0.15 [-0.38,0.07] (0.18)	0.36* [0.02,0.69] (0.04)	-1.20 [-2.51,0.11] (0.07)	0.88 [-0.40,2.16] (0.18)
Upper sec × 2018	-0.17 [-1.02,0.68] (0.69)	0.29* [0.01,0.57] (0.04)	-0.09 [-0.31,0.13] (0.44)	0.04 [-0.28,0.36] (0.81)	-0.96 [-2.03,0.12] (0.08)	0.39 [-0.63,1.42] (0.45)
Upper sec × 2019	ref	ref	ref	ref	ref	ref
Upper sec × 2020	-1.49*** [-2.35,-0.64] (0.00)	-0.10 [-0.38,0.19] (0.51)	-0.13 [-0.34,0.09] (0.24)	0.11 [-0.19,0.42] (0.46)	-1.80** [-2.91,-0.70] (0.00)	-0.85 [-1.95,0.25] (0.13)
Mean dep var upper sec 2019	20.28	2.56	1.33	2.45	38.42	27.34
Effect (%)	-7.37	-3.78	-9.72	4.69	-4.70	-3.12
CI95 (%)	[-11.58,-3.15]	[-14.97,7.41]	[-25.85,6.40]	[-7.89,17.27]	[-7.57,-1.83]	[-7.14,0.91]
R2	0.009	0.001	0.001	0.003	0.016	0.018
N	3,276,398	3,276,398	3,276,398	3,276,398	3,276,398	3,276,398

Note: Results from linear regression model specified in main text. Reference year 2019. Model adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level.

Table A4. Difference-in-difference estimates for type of care. Outcomes measured April-June

	(1) Diagnoses	(2) Psychiatric drugs	(3) Planned care	(4) Unplanned care	(5) Emergency unit	(6) Diagnoses unrelated to mental health and Covid-19	(7) July 20- March 21 (following)
	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)
Upper sec × 2016	1.18 [-0.41,2.77] (0.15)	-1.03 [-3.20,1.14] (0.35)	1.38 [-0.21,2.97] (0.09)	0.25 [-0.49,0.99] (0.51)	-0.28 [-0.71,0.15] (0.21)	0.31 [-0.90,1.51] (0.62)	1.34 [-1.51,4.19] (0.36)
Upper sec × 2017	2.08** [0.53,3.63] (0.01)	0.13 [-1.85,2.11] (0.90)	1.94* [0.41,3.46] (0.01)	0.56 [-0.16,1.28] (0.12)	0.45* [0.01,0.89] (0.04)	0.96 [-0.17,2.09] (0.09)	1.37 [-1.28,4.01] (0.31)
Upper sec × 2018	0.87 [-0.45,2.19] (0.20)	-0.31 [-1.89,1.26] (0.70)	0.69 [-0.61,2.00] (0.30)	0.99** [0.30,1.68] (0.01)	0.11 [-0.31,0.53] (0.61)	0.31 [-0.74,1.35] (0.56)	0.92 [-1.14,2.98] (0.38)
Upper sec × 2019	ref	ref	ref	ref	ref	ref	ref
Upper sec × 2020	-1.92** [-3.24,-0.60] (0.00)	-3.05*** [-4.68,-1.42] (0.00)	-1.38* [-2.70,-0.07] (0.04)	-1.65*** [-2.30,-1.01] (0.00)	-0.89*** [-1.29,-0.50] (0.00)	0.06 [-0.95,1.06] (0.91)	-6.04*** [-8.12,-3.96] (0.00)
Mean dep var upper sec 2019	40.91	72.94	38.95	11.91	4.92	25.61	125.41
Effect (%)	-4.70	-4.18	-3.56	-13.88	-18.19	0.22	-4.82
CI95 (%)	[-7.93,-1.47]	[-6.41,-1.95]	[-6.92,-0.19]	[-19.31,-8.46]	[-26.14,-10.23]	[-3.71,4.14]	[-6.47,-3.16]
R2	0.012	0.023	0.011	0.002	0.002	0.001	0.034
N	3,276,398	3,276,398	3,276,398	3,276,398	3,276,398	3,276,398	3,276,398

Note: Results from linear regression model specified in main text. Reference year 2019. Model adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level.

Table A5. Difference-in-difference estimates by school grade. Outcomes for different time-periods

	(1) Apr-June 2020		(2) Jul-Sep 2020		(3) Oct-Dec 2020		(4) Jan-Mar 2021	
	β (p-value)	[95%CI]	β (p-value)	[95%CI]	β (p-value)	[95%CI]	β (p-value)	[95%CI]
School grade 7 × 2020	-0.95 (0.45)	[-3.40,1.50]	-1.77 (0.17)	[-4.32,0.77]	-0.44 (0.75)	[-3.10,2.23]	0.80 (0.56)	[-1.90,3.49]
School grade 8	ref	ref	ref	ref	ref	ref	ref	ref
School grade 9 × 2020	-0.71 (0.60)	[-3.37,1.95]	-2.11 (0.11)	[-4.74,0.51]	-3.16* (0.03)	[-5.94,-0.38]	-4.30** (0.00)	[-7.15,-1.45]
School grade 10 × 2020	-2.64 (0.08)	[-5.65,0.36]	-3.83* (0.01)	[-6.85,-0.82]	-3.30* (0.04)	[-6.45,-0.15]	-4.62** (0.00)	[-7.78,-1.45]
School grade 11 × 2020	-5.03*** (0.00)	[-7.89,-2.18]	-6.55*** (0.00)	[-9.39,-3.70]	-8.69*** (0.00)	[-11.70,-5.68]	-9.17*** (0.00)	[-12.17,-6.17]
School grade 12 × 2020	-4.41** (0.00)	[-7.25,-1.57]	-5.09*** (0.00)	[-7.85,-2.32]	-5.45*** (0.00)	[-8.37,-2.53]	-3.53* (0.02)	[-6.53,-0.53]
Mean dep var gr 7 2019	64.90		63.15		73.16		79.53	
Effect (%) gr 7	-1.46	[-5.24,2.32]	-2.81	[-6.84,1.21]	-0.60	[-4.24,3.04]	1.03	[-2.38,4.39]
Mean dep var gr 9 2019	84.21		79.96		89.42		94.09	
Effect (%) yr 9	-0.84	[-4.00,2.31]	-2.64	[-5.93,0.64]	-3.54	[-6.64,-0.43]	-4.55	[-7.60,-1.54]
Mean dep var gr 10 2019	91.67		87.45		97.66		102.00	
Effect (%) gr 10	-2.88	[-6.16,0.40]	-4.39	[-7.83,-0.94]	-3.39	[-6.61,-0.16]	-4.52	[-7.63,-1.42]
Mean dep var gr 11 2019	85.52		79.79		88.29		88.98	
Effect (%) gr 11	-5.89	[-9.23,-2.55]	-8.21	[-11.77,-4.64]	-9.84	[-13.26,-6.43]	-10.30	[-13.68,-6.93]
Mean dep var gr 12 2019	76.13		69.90		74.41		75.69	
Effect (%) gr 12	-5.80	[-9.52,-2.07]	-7.28	[-11.23,-3.32]	-7.33	[-11.25,-3.40]	-4.66	[-8.63,-0.70]
R2	0.024		0.025		0.027		0.028	
N	3,276,398		3,276,398		3,276,398		3,276,398	

Note: Results from linear regression model specified in supplementary materials. Reference school grade is grade 8. The model adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level..

Table A6. Difference-in-difference estimates for type of care for studentens younger than 18 years old. Outcomes measured April-June if not otherwise stated.

	(1) Diagnoses or drug	(2) Diagnoses	(3) Psychiatric drugs	(4) Planned care	(5) Unplanned care	(6) Emergency unit	(7) Diagnoses unrelated to mental health and Covid-19	(8) July 20- March 21 (following)
	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)	β [95%CI] (p-value)
Upper sec × 2016	-4.13** [-7.03,-1.23] (0.01)	-2.21* [-4.25,-0.17] (0.03)	-3.14* [-5.76,-0.52] (0.02)	-1.91 [-3.95,0.14] (0.07)	-0.21 [-1.11,0.69] (0.64)	-0.30 [-0.81,0.21] (0.25)	0.38 [-1.18,1.95] (0.63)	-1.62 [-5.08,1.84] (0.36)
Upper sec × 2017	-1.76 [-4.47,0.94] (0.20)	-0.35 [-2.30,1.59] (0.72)	-1.39 [-3.85,1.07] (0.27)	-0.53 [-2.46,1.40] (0.59)	0.31 [-0.57,1.19] (0.49)	0.37 [-0.16,0.90] (0.17)	0.91 [-0.59,2.41] (0.23)	0.12 [-3.15,3.40] (0.94)
Upper sec × 2018	-1.05 [-3.40,1.29] (0.38)	-0.06 [-1.87,1.76] (0.95)	-0.93 [-3.04,1.19] (0.39)	-0.03 [-1.82,1.75] (0.97)	0.85 [-0.03,1.73] (0.06)	0.18 [-0.34,0.70] (0.50)	0.18 [-1.26,1.63] (0.81)	0.11 [-2.60,2.81] (0.94)
Upper sec × 2019	ref	ref	ref	ref	ref	ref	ref	ref
Upper sec × 2020	-2.78* [-5.12,-0.45] (0.02)	-2.96*** [-4.72,-1.21] (0.00)	-2.02 [-4.19,0.15] (0.07)	-2.57** [-4.31,-0.83] (0.00)	-1.53*** [-2.35,-0.71] (0.00)	-0.63* [-1.13,-0.13] (0.01)	-0.03 [-1.39,1.33] (0.96)	-4.71** [-7.53,-1.90] (0.00)
Mean dep var upper sec 2019	87.79	45.80	75.60	44.86	10.64	3.93	29.81	130.32
Effect (%)	-3.17	-6.47	-2.67	-5.73	-14.38	-16.11	-0.11	-3.62
CI95 (%)	[-5.83,-0.51]	[-10.30,-2.64]	[-5.54,0.20]	[-9.60,-1.85]	[-22.10,-6.66]	[-28.80,-3.42]	[-4.67,4.45]	[-5.78,-1.46]
R2	0.026	0.012	0.024	0.011	0.001	0.001	0.001	0.035
N	2,373,227	2,373,227	2,373,227	2,373,227	2,373,227	2,373,227	2,373,227	2,373,227

Note: Results from linear regression model specified in main text. Reference year 2019. Model adjust for: sex, birth month, newly immigrated to Sweden, parental foreign background, income, education, income from social security systems, family size and if the biological parents live in the same household. Sample restricted to students younger than 18 in March the academic year. Standard errors clustered at school level. *, ** and *** indicate statistical significance at 0.1, 1 and 5% level.

Table A7: Number of students by predicted GPA and parents' occupation teleworkable in 2020

	Not telework	Telework	No information of occupation	Total
Predicted GPA <34 percentile	139 941	25 058	63 368	229 267
Predicted GPA >33 & <67 percentile	138 052	90 632	7 524	236 208
Predicted GPA > 66 percentile	65 482	161 584	2 196	229 262
Total	343 475	278 174	73 088	694 737