

Mental and physical well-being of German high school students in the transition to post-secondary education during the COVID-19 pandemic

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Shocks to students' mental and physical well-being due to the COVID-19 pandemic may affect their transition from high school to post-secondary education. This study examines the immediate and intermediate effects of the COVID-19 pandemic - in particular school closures - on the well-being of high school students in the graduation cohorts 2020 and 2021. We also investigate how changes in well-being affected the transition plans of high school students and the transition outcomes of graduates. Our unique panel data contains survey information of the same students (N=3,697) before (fall 2019), soon after (spring 2020), and several months after (fall/winter 2020/21) the outbreak of the COVID-19 pandemic. We employ three indicators to measure students' well-being: self-rated mental health, physical health, and life-satisfaction. To investigate the short-term effects of school closures, we apply a difference-in-differences design, exploiting the fact that some students within the second survey wave at the beginning of the first lockdown responded just before and other students shortly after the school closures. To elaborate on the longer run effects of school closures and the COVID-19 pandemic in general on the three outcomes, we apply random effect growth curve models. Our results suggest that school closures had a positive immediate effect on students' well-being. Over the course of the pandemic, however, well-being strongly declined, mainly concentrated among the 2021 graduation cohort. Greater worries about one's occupational future and a higher perceived burden of distancing policies explain the stronger decrease for students in the 2021 graduation cohort. Finally, we show that a strong decline in mental health is associated with changes in career plans. Our results imply that the pandemic and related distancing policies reduce final year students' well-being in the longer run, particularly for students still in high school. The resulting effect on their career plans may have long lasting consequences.

Keywords: COVID-19; High school graduates; Mental and physical well-being; School-to-work transition

JEL-Codes: I21; I18; J24

1 Motivation

The COVID-19 pandemic and the related policies to stop the spread of the coronavirus, and in particular school closures, present a severe shock to mental and physical well-being for millions of young individuals worldwide. The according distancing measures may affect mental and physical health, and life satisfaction of young individuals, as these measures massively change schooling and leisure activities of students, such as physical activity, social contacts, substance use, and sleep time (Hisler and Twenge 2021; Emery et al. 2021; Liu et al., 2020; Shanahan et al., 2020). The pandemic policies may especially impact the well-being of young individuals who are in their final school years because the measures not only affected schooling and leisure but they have also strongly reduced student's perceived career security, job and educational opportunities. As student's well-being presents a crucial resource in the process of educational decision-making and socioeconomic attainment (Haas 2006), shocks to well-being may disrupt the transition from school to post-secondary education. Such transition disruptions at this stage may have negative consequences on future educational and labor market success, and lifetime earnings (e.g., Bönke et al. 2015; Oreopoulos 2007).

However, thus far, no empirical evidence exists on how school closures and the COVID-19 pandemic affect the well-being of students in their final high school years and how effects on their mental and physical conditions relate to their educational plans and actual transitions to post-secondary education. We fill this research gap by using large-scale panel data on well-being, career plans and educational decisions of 3,697 German high school students from the graduation cohorts 2020 and 2021. These data have two key features. First, they entail three detailed indicators of mental and physical well-being, i.e., mental health (Hopkins Symptom Checklist; Derogatis et al. 1974), self-rated physical health (5-point scale; e.g., Mossey and Shapiro, 1982), and life satisfaction (11-point scale; e.g. Lucas 2007). Second, these data are collected both pre- and during the pandemic, as they stem from three survey waves in fall 2019, spring 2020, and fall/winter 2020/21.

Drawing on these data enables us to investigate (i) the immediate effects of nationwide school closures on students' well-being in spring 2020; (ii) the intermediate effects of the COVID-19 pandemic in general on students' well-being in fall/winter 2020; (iii) the heterogeneous effects of the COVID-19 pandemic on high school graduates who transit to post-secondary education and students still enrolled in high school; and (iv) the impact of decline in mental health on career plans of high school students and the satisfaction with career decisions of graduates.

In the first step of our analysis, we separately investigate immediate and intermediate effects on well-being. This separation is important particularly with respect to school policies, since students may perceive school closures as holidays or health protecting in the short run (Helliwell and Wang 2014), while in the long run stressors due to adverse health, learning achievement, distancing measures or uncertainty about the future may prevail. The data allow the application of a difference-and-differences design to evaluate the immediate effects of nationwide school closures. To elaborate on intermediate effects of the pandemic (i.e., the developments prior and during the crisis), we employ linear growth curve modelling.

In a second step, we investigate whether the COVID-19 pandemic has different effects on students who spend almost their full last two high school years in times of the pandemic (2021 graduation cohort) and students who graduated from high school shortly after the outbreak of the pandemic (2020 graduation cohort). This separation by cohort appears important, as it may reveal specific support needs for graduates and those who are close to graduation. Differences in well-being between graduation cohorts might occur because students still enrolled in high school may face greater uncertainty about future decisions than graduates who already planned their transition to post-secondary education. However, school graduates face a completely unknown situation at their new educational institutions, since universities and vocational schools have similarly introduced distance learning (Source), which hardly enabled any interactions with new fellow students and apprentices. Additionally, the pandemic has reduced the available vocational training positions as alternative career paths after high school as well as the number of student jobs, which may affect the financial situations of university students (Source Yükselen, Sandner et al.). Thus, it remains an open question whether the pandemic and related distancing measures affect students still at school or school graduates differently.

In a final analysis step, this study investigates to what extent strong decreases in one of our well-being measures, mental health, namely, relate to changes in career plans and educational transition outcomes. Decreases in mental health are likely to influence educational plans and actual transitions because depressive symptoms in adolescences alter perceptions of the future (e.g. Levkin et al. 2011; Roepke and Seligman 2016). Thus, students with decreasing mental health may lose confidence in their future educational plans or make choices that they would not have made with a better mental health status. Additionally, decreasing perceived security may lead to less risky career investments after school which in turn may be related to lower choice satisfaction.

In analysing the immediate and intermediate effects of the COVID-19 pandemic on students' well-being in two graduation cohorts, and how changes in well-being relate to career plans and transition outcomes, we extend the existing and rapidly emerging research on the effects of the COVID-19 pandemic on the well-being and mental health of young adults and teenagers (e.g., Elmer et al. 2020; Emery et al. 2021; Giuntella et al. 2020; Shanahan et al. 2020). Furthermore, we contribute to the literature on how lockdowns affect career expectations, which until now has concentrated on university students or employed individuals (Aucejo et al. 2020; Fiaschi and Tealdi 2021). We combine these strands of literature and demonstrate that students who are close to the transition to post-secondary education are most vulnerable to shocks to their well-being due to the COVID-19 pandemic and that such shocks are related to career expectations and decisions.

2. Methods

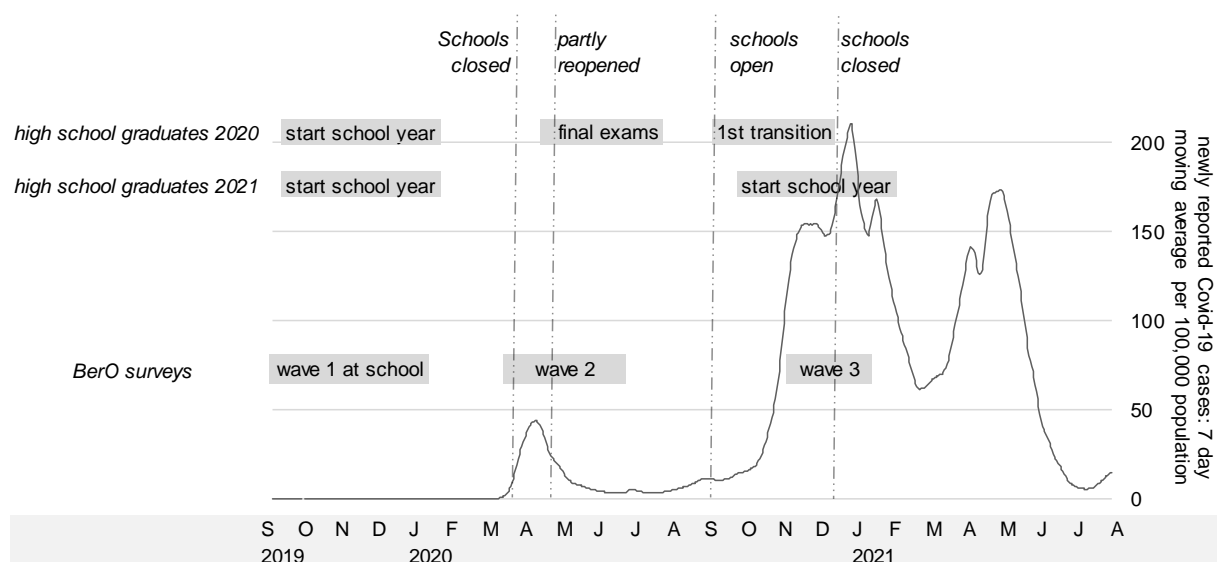
2.1. Participants and Data collection

The participants of this study attended the highest track of secondary school in Germany, “*Gymnasium*”, in the final two years. The educational system comprises three tracks of secondary school: the lower and the intermediate track prepare students for vocational training, whereas the highest track results after successful completion in the high school diploma “*Abitur*”, which qualifies students to enter university. This academic track usually ends with final examinations at grade 12. These exams largely take place in March, and students receive their graduation diploma in the summer before they enrol at university or start a vocational training in the fall.

After the outbreak of the COVID-19 pandemic at the beginning of 2020, and as one of the first nationwide pandemic prevention measures, all schools were closed after March 13th, 2020 in Germany. On April 23rd 2020, the German federal states partly started reopening schools, albeit with very large regional and institutional variations: Since educational policy is the responsibility of the 16 federal states, there was no uniform school opening policy in Germany. Furthermore, local developments of the pandemic affected the closing of whole schools, class levels, or single classes. After the summer break schools started on a regular basis, and then went gradually back to limited schooling in November and December 2020, first by allowing only alternating groups of students from each classroom and then from January 2021 switching back to completely distance schooling.

The data used in this study were collected for the BerO study, which evaluates the effectiveness of intensive job counselling for students in the highest secondary school track. The baseline survey (wave 1) was conducted as a paper-and-pencil interview (PAPI) in 214 schools in 8 of 16 German federal states. Students completed the questionnaire in school between September and November 2019, instructed by a professional data collection team. In addition to these data, our analyses draw on data from two follow-ups, which took place outside the school context as a computer-assisted web or telephone interview (CAWI/CATI). Students were interviewed from February to March 2020 (wave 2) during the first wave of infection and from October to December 2020 (wave 3) at the beginning of the second wave of infection. Figure 1 gives an overview of the timeline of the data collection.

Figure 1: Timeline of data collection and COVID-19 infections in Germany



2.2.Measures

This study investigates changes over time in three outcomes that approximate the mental and physical well-being of young individuals before and during the COVID-19 pandemic: (i) mental health problems (ii) life satisfaction, and (iii) self-rated health. The first three rows of Table 1 give an overview of the descriptive statistics of these outcome variables.

First, as a widespread measure for mental health, in waves 2 and 3 this study employs data from a subscale (SCL-10) of the well-established Hopkins Symptom Checklist (HSCL-58; Derogatis et al. 1974) to approximate individuals' risk for anxiety disorders and depression. The employed 10-item version of the HSCL-58 constitutes an epidemiological screening tool,

which in clinical validation studies has proven to indicate increased risks for anxiety and depression (Haavet et al 2011). Furthermore, epidemiological research has shown that the SCL-10 short form constitutes a very good proxy for the longer SCL-25. To indicate increased risks of anxiety and depression, the study employs a binary measure, which indicates a 1 if individuals exceed a cut-off point of 1.85 (i.e., if individuals cumulate certain risks on the 10-item scale). Research on the validity of cut-off points indicates that the 1.85 threshold constitutes the best binary predictor for increased symptoms of anxiety and depression (Strand et al. 2003).

Second, life satisfaction refers to “the degree to which an individual judges the overall quality of his/her own life as-a-whole favourably.” (Veenhoven, 2012: 67). For waves 1, 2 and 3, we employ the established 11-point scale (e.g. Lucas 2007) and rely on answers to the following question: “How satisfied are you currently with your life in general?” Respondents could answer on a scale ranging from 0 (“totally dissatisfied”) to 10 (“totally satisfied”). Prior research on life satisfaction and mortality (e.g., Diener and Chan, 2011) indicates that such cognitive evaluations of individuals’ lives predict mortality. Thus, overall life satisfaction constitutes an important well-being outcome.

Third, for waves 1, 2 and 3 this study examines self-rated health to analyse “the subjective experience of acute and chronic, fatal and nonfatal diseases, and general feelings of well-being, such as feeling run down and tired or having backaches and headaches” (Mirowsky and Ross, 2008: 104). Empirically, we rely on the question “How would you describe your current state of health?” Respondents could answer on a scale ranging from 1 (“poor”) to 5 (“very well”). This question is a widely used item in many health studies in the social sciences and has been shown to be a strong predictor of mortality because it proxies general physical well-being (e.g., Mossey and Shapiro, 1982). Thus, although this measure also incorporates mental health to some extent, it rather approximates the physical health domain.

Furthermore, our study investigates the extent to which decreases in these outcomes are related to the career plans and choice satisfaction of young individuals in the transition from high school to post-secondary education, which we measure in fall/winter 2020. We use established survey questions that measure the perceived success probability of completing (potential) university education; certainty about the educational pathway, expected final grade point average, probability of studying a science, technology, engineering and mathematics (STEM) subject; and – for high school graduates – three measures about satisfaction with their chosen post-secondary educational decision (i.e., satisfaction with organization, location and the decision itself). Additionally, to analyse whether students from the two cohorts perceive the COVID-19

situation differently, we use questions asking about students' worries about the future because of COVID-19, their enjoyment with learning and the extent to which they are burdened by distancing measures. The descriptive statistics of these outcomes are shown in table A1.

2.3. Analytical Strategy

Estimating the immediate effects of the first school closures

When investigating the effects of school closures, a pure outcome comparison between the students who answered before and after the school closures in March 2020 may be biased because the two groups of students may have different characteristics that could be related to our well-being outcomes under study. To solve this problem, we use the panel dimension of our data and apply a difference-in-differences estimation using data from waves 1 and 2 shown in equation 1:

$$Y_{i,t} = \beta_1 SC_i + \beta_2 W_{i,t} + \beta_3 (SC_i W_{i,t}) + \varepsilon_{i,t} \quad (\text{Equation 1})$$

where $Y_{i,t}$ is the outcome of interest of individual i at wave t (Life satisfaction and self-rated health, which are both available for waves 1 and 2). SC_i (**S**chool **C**losure) is a binary variable that takes a value of 1 for students who answered t1 in March 2020 after the school closure and 0 for students who answered t1 in March 2020 before the school closure, and β_1 captures the difference between those individuals. $W_{i,t}$ (**W**ave) contains a wave dummy for t1 interviews, where β_2 captures the corresponding coefficient. $\varepsilon_{i,t}$ is a standard error term. Finally, $SC_i W_{i,t}$ is the interaction term of SC_i and $W_{i,t}$ that takes a value of 1 for students in wave t1 who answered the questionnaire after the school closure. The coefficient β_3 then measures the divergence in the outcome between those who answered after the school closure, i.e. the treatment group, and those who answered pre-event/policy, i.e., the control group, which indicates the average treatment effect of the treated (ATT). This is the effect of interest of the school closures.

Only for the Hopkins scale we do not have information at wave 1. Therefore, for this outcome, we compare students who answered before and after the school closures including a rich set of individual characteristics as controls (shown in Table 1). For the analysis of all three outcomes, we restrict the time window to three weeks after the closures to exclude students who participate in the interviews after school reopening. Before the closures all students answered within a time window of two weeks. Therefore, we argue that it is rather unlikely that

pandemic factors, such as the infection rate explain differences in well-being before and after school closures.

Estimating the development of well-being during the COVID-19 pandemic

To investigate the development of the examined well-being outcomes during the COVID-19 pandemic we use the following specifications of linear random effects growth curve models:

$$Y_{i,t} = \alpha + \beta_n \sum_{n=2}^3 W_{n,it} + \lambda' X_i + \mu' X_{it} + \theta_i + \varepsilon_{i,t} \quad (\text{Equation 2})$$

$$Y_{i,t} = \alpha + \beta_n \sum_{n=2}^3 W_{n,it} + \gamma C_i + \delta_n \left(C_i \times \sum_{n=2}^3 W_{n,it} \right) + \lambda' X_i + \mu' X_{it} + \theta_i + \varepsilon_{i,t} \quad (\text{Equation 3})$$

In both equations, $Y_{i,t}$ represents either life satisfaction (0 to 10), self-rated health (1 to 5) or the risk for anxiety or depression (0 vs. 1). θ_i represents a person-specific error term, which is modelled as a random variable. $\varepsilon_{i,t}$ constitutes an idiosyncratic error term. $W_{n,it}$ indicates dummy variables for each survey wave. X_{it} indicates a vector with time-invariant confounding variables, whereas X_t captures time-constant confounders. In equation 3, we introduce C_i indicating whether a respondent stems from the 2021 or 2020 graduation cohort. To allow for variation across graduation cohorts, we interact C_i with each wave dummy. While the multiplicative effect of γ captures heterogeneity between cohorts at wave 1, δ_n captures heterogeneity in health between cohorts over the course of the COVID-19 pandemic.

Finally, we apply two sets of ordinary least square regressions. In the first set, we specify a model to elaborate on differences between graduation cohort 2020 and 2021 at wave 3 (fall/winter 2020). In the second set, we identify individuals with strong decreases in mental health (SCL-10) between survey waves 2 and 3 to generate a binary variable (reference group: slight or no decrease in mental health), and regress career plans at wave 3 on this binary indicator. In correlating these measures, we elaborate on the potential long-term impact of the COVID-19 pandemic. Although this procedure constitutes a descriptive (i.e., correlative) workaround due to potential reversed causality, we can rule out large parts of endogenous selection bias by using our rich data. To this end, our model specifications condition on a vast set of individual characteristics as control variables, described in section 2.4 and they also include the baseline level of each dependent variable and the baseline level of mental health (measured at wave 2).

2.4. Sample Characteristics and Control variables

From the BerO baseline sample (N=8054), we restrict our analysis sample to students who participated in all three waves, in fall 2019, spring 2020 and fall/winter 2020 with non-missing information on our outcomes and on the control variables used in this study. Furthermore, to observe the transition to post-secondary training of students from the graduation cohort 2020, we restrict the respective analyses to high school graduates 2020 who transited directly to post-secondary education, i.e. did not spend a so-called “gap year” to bridge the time between high school graduation and enrolling at university or starting vocational training. Overall, our sample consists of 3,697 students who participated in the baseline survey and in both subsequent surveys with valid information, with 2,451 students from grade 11 (graduation cohort 2021) and 1,246 students from grade 12 (graduation cohort 2020).

The set of individual characteristics that we use as controls include socio-demographics, i.e. age (graduation cohort 2021 dummy) gender (male dummy), migration background (1st/2nd generation migrant), parental education (at least one parent with university education), as well as educational achievement (GPA better than 2.5 on average on a scale from 1 – best grade to 6 – failed) and – for the graduation cohort 2020 – the post-secondary educational choice (attending university or vocational training). Moreover, we use a rich set of preferences, i.e. risk aversion and myopic behavior, and personality traits, for which we use constructs based on multiple items to measure self-efficacy, grit, and the Big Five personality dimensions openness, conscientiousness, extraversion, agreeableness, and neuroticism.

Table 1 presents the sample characteristics in the three waves, with the spring 2020 wave split into individuals who answered before and after the school closures. The first rows show the means of our overall well-being measures. They show strong variation among the waves and before and after the school closures. We will investigate these changes in detail in the next sections. The next rows depict the sociodemographic characteristics, educational achievement and educational choice, as well as preferences and personality traits of the sample. As we use a balanced sample, there are no differences in the characteristics between wave 1 (fall 2019) and wave 3 (fall/winter 2020). However, the figures reveal that the characteristics between those students who answered before and after the school closures differ; for example, more males and slightly worse performing students answered the questionnaire after the school closures compared to students who participated in the survey before the school closures. This finding supports our strategy to apply a difference-in-differences approach to rule out biases by this selection.

Overall, Table 1 reveals that more females than males participate in the survey, which corresponds to the fact that more females attend the academic high school track in Germany. Furthermore, the sociodemographic characteristics reveal that the sample includes fewer students with migration backgrounds and more students with highly educated parents (i.e., individuals with parents who attained university degrees) than the general student samples (Autorengruppe Bildungsberichterstattung 2020). Finally, students from the 2021 graduation cohort are slightly overrepresented in comparison to the 2020 graduation cohort in the sample. This slight unbalance occurs due to our restriction of the graduation cohort 2020 to students who started university or vocational training at wave 3 (fall/winter 2020). The last rows demonstrate that very few interviews were CATIs while many were CAWIs.

Appendix Table A1 shows the descriptives of the measures, which are only available for wave 3 (fall/winter 2020) and which we use for the further analyses to investigate transition outcomes and the mechanisms in our analysis of heterogeneous effects. The variables contain information on attitudes and worries, i.e. how students deal with the COVID-19 pandemic and the distancing measures, as well as on educational plans. Appendix Table A2 shows the aggregated values over the three waves for the variables shown in Table 1.

Table 1: Sample characteristics by wave

	Fall 2019	Spring 2020		Fall/ Winter 2020/21
	Oct. to Nov.	Pre- SC	Post- SC	Nov. to Jan.
Outcomes				
Life satisfaction (0-10)	7.435	7.080	7.170	6.671
Self-rated health (1-5)	3.872	3.634	3.891	3.684
Mental health problems (SCL-10, 0-1)	-	0.425	0.334	0.485
Socio-demographics				
Graduation cohort 2021 (0 vs. 1)	0.663	0.653	0.678	0.663
Male (0 vs. 1)	0.355	0.330	0.395	0.355
1st/2nd generation migrants (0 vs. 1)	0.209	0.206	0.214	0.209
Missing information on migration status (0 vs. 1)	0.055	0.058	0.050	0.055
At least one parent with univ. education (0 vs. 1)	0.540	0.526	0.562	0.540
Missing information on parental education	0.105	0.105	0.105	0.105
GPA better than 2.5 (0 vs. 1)	0.484	0.495	0.465	0.484
Missing information on GPA (0 vs. 1)	0.010	0.008	0.013	0.010
Attending university (0 vs. 1)	-	-	-	0.284
Vocational training (0 vs. 1)	-	-	-	0.054
Preferences and Personality				
Risk aversion (0-10)	5.629	5.567	5.730	5.629
Dummy for being myopic (0 vs. 1)	0.115	0.114	0.117	0.115
Self-efficacy (1-4)	2.924	2.920	2.931	2.924
Grit (1-5)	3.472	3.488	3.446	3.472
Big Five				
Openness (1-7)	4.778	4.764	4.802	4.778
Conscientiousness (1-7)	5.222	5.258	5.165	5.222
Extraversion (1-7)	4.764	4.707	4.857	4.764
Agreeableness (1-7)	5.434	5.421	5.454	5.434
Neuroticism (1-7)	4.245	4.259	4.221	4.245
Method				
CATI interview (0 vs. 1)	-	-	0.053	0.052
PAPI/CAWI interview (0 vs. 1)	1.000	1.000	0.947	0.948
<hr/>				
N Persons	3,697	2,292	1,405	3,697

Note: GPA = Grade point average, a lower GPA indicates better performance; CATI = Computer-assisted telephone interview; PAPI = Paper-and-pencil interview; CAWI = Computer-assisted web interview.

Data: BerO study wave 1, 2 and 3.

2.5. Potential effect heterogeneity

To further elaborate on heterogeneity in the potential long-term costs of school closures and the pandemic itself, we explore the effect heterogeneity of three different groups of individuals who may strongly differ in their trajectories of well-being during the pandemic.

First, middle range life course theories from gerontology and sociology (e.g., Dannefer 2003; Ferraro et al 2009; O’Rand 1996) suggest strong path dependencies between current levels of health for the future development of health. Thus, the pre-pandemic starting levels of mental and physical health should matter for the development of these outcomes, and we investigate heterogeneous effects by initial level of well-being.

Second, low achieving youth already have low well-being within schools (Literaturverweis) and usually face multiple problems in the transition to post-secondary education (Literaturverweis?). Thus, we investigate differences in our outcomes conditioned on pre-pandemic school performance measured at survey wave 1.

Third, social capital might induce effect heterogeneity. In particular, individuals with rich social contacts (i.e., both extensive and intensive social capital) might suffer from school closures and social distancing measures because these policies are explicitly designed to reduce in-person contacts. However, higher endowments with social capital could also buffer against adverse effects of the pandemic. Compared to individuals with weak peer networks, those with richer peer networks should, *ceteris paribus*, have more opportunities to communicate digitally about negative pandemic experiences, which could help, for instance, overcome difficult situations at home.

3. Results

3.1. Immediate effects of first school closures on mental and physical well-being

Table 2 presents the immediate effects of school closures on the three well-being outcomes. Using the difference-in-differences approach explained in equation 1 demonstrates that while school closures did not affect life satisfaction, self-rated health significantly increased after school closures by 0.21 standard deviations (see online Appendix F1 for a graphical illustration of the effects). Investigating the immediate effect of school closure on mental health based on OLS regressions reveals that the incidence of low mental health – while controlling for the

variables explained in section 2.4 – is 5 percentage points lower for the students who participated in the survey after the closures. Overall, these results indicate that school closures had a positive effect on overall health in the first weeks after their implementation, as indicated by improvements in two of the three measures.

Table 2: Immediate effects of school closures on mental and physical health: Results from difference-in-differences and OLS regressions

<i>Panel A</i>	Mean wave 1	Mean wave 2 before school closures	Mean wave 2 after school closures	DID in % of SE	p-value DID
<i>Life satisfaction (0-10)</i>	7.432	7.080	7.187	-0.005	0.872
<i>Self-rated health (1-5)</i>	3.875	3.634	3.882	0.213	0.000
<i>Panel B</i>				Mean Diff. pre and post school closures	p-value
<i>Mental Health Problems (SCL-10, 0-1)</i>		0.435	0.355	-0.053	0.000
<i>N Persons</i>	3503	2292	1211		

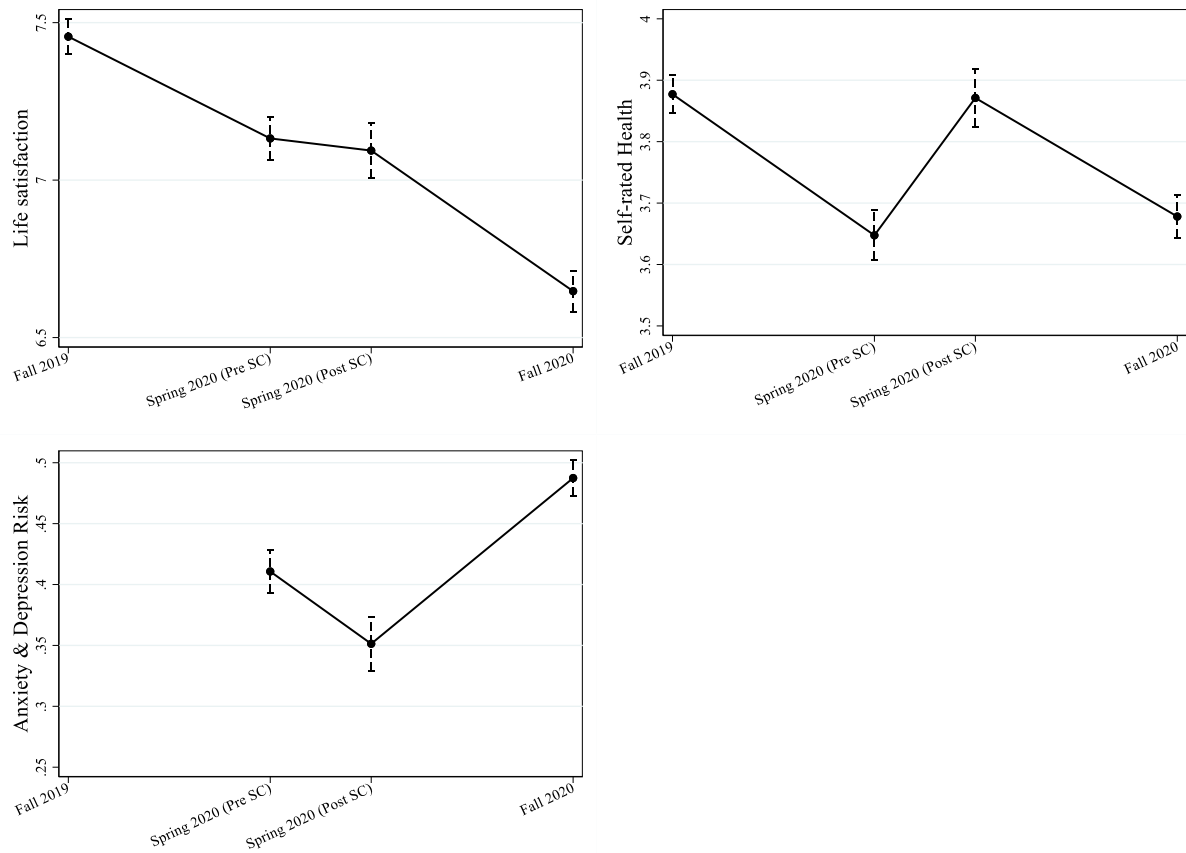
Note: Panel A presents estimates in percent of standard deviation based on difference-in-difference regressions adjusted for federal states. Panel B presents mean differences based on an OLS regression adjusted for gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode. We excluded 194 students from the analysis sample who answered more than three weeks post school closure.

Data: BerO study wave 1 and 2.

3.2. Development of mental and physical well-being before and during the first and second waves of the COVID-19 pandemic

In this section, we investigate the effects of school closures and distancing regulations 8 months after the pandemic started. Figure 2 shows the development of the three outcomes at wave 1, at wave 2 before and after the school closures and at wave 3 calculated by applying equation 2. In line with the previous section, we see an increase in self-rated health and mental health in wave 2 after the school closures. However, from spring to autumn, we observe a strong decrease in life-satisfaction and self-rated health and a particularly strong increase in mental health problems. Overall, the data suggest that after students' overall health improved in the short-term, it strongly declines in the longer term. See Appendix Table A3 for point estimates and significance levels.

Figure 2: Development of mental and physical well-being since fall 2019. Results from random effect growth curve models.

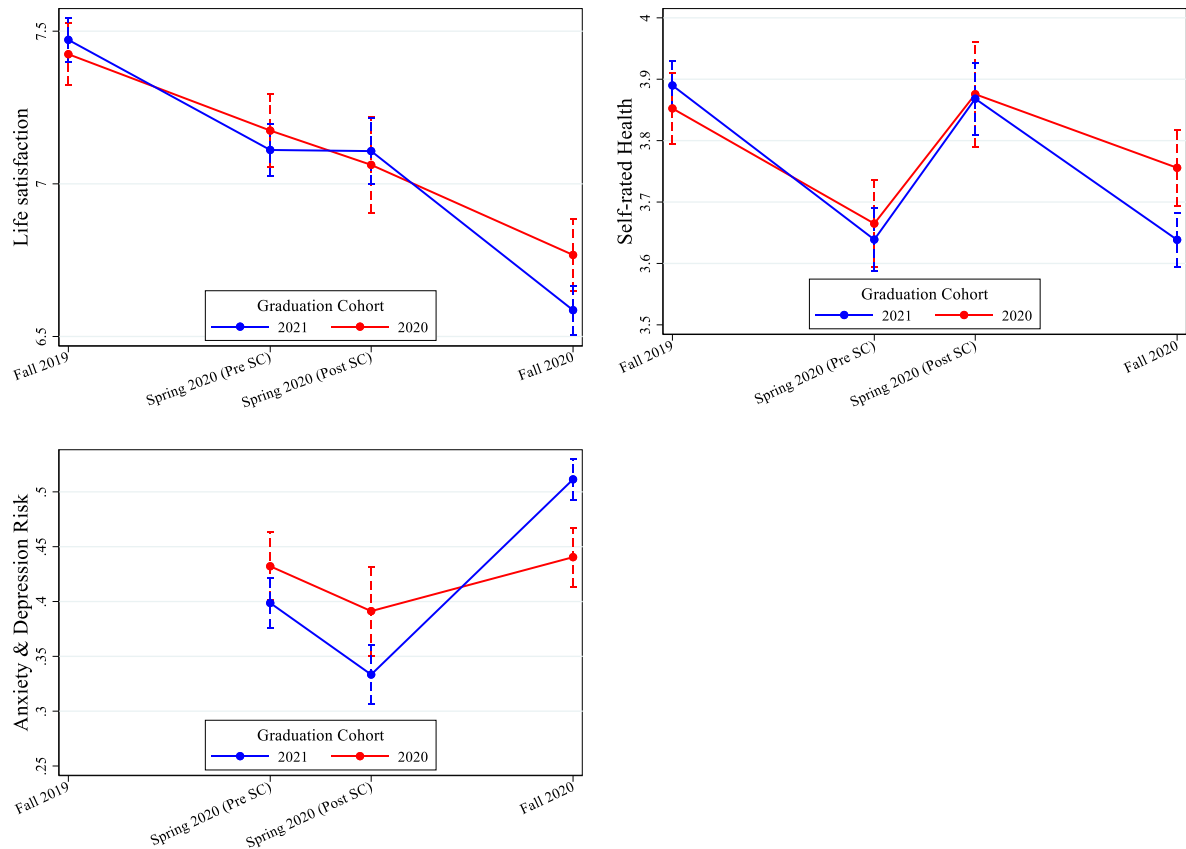


Note: *Outcomes:* Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (dummy for being below the clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: see note for Table 2.
Data: BerO study wave 1 to 3.

3.3. COVID-19 effects on physical and mental well-being by graduation cohort 2020 and 2021

We now investigate how the effects on the three well-being measures differ over time between the graduation cohort 2020 and 2021. Using equation 3, Figure 3 shows that none of the three measures differed significantly at wave 1 or 2 (before and after the school closures) between the two cohorts. However, at wave 3, in autumn 2020, the graduation cohort 2021 showed significantly worse outcomes for all three well-being measures. The difference was most pronounced for mental health problems, for which the increase for graduation cohort 2021 from wave 2 to wave 3 amounts to almost 20 pp, while the increase was 5 pp for the 2020 graduation cohort. See Appendix Table A4 for the point estimates and significance levels.

Figure 3: Development of mental and physical well-being by graduation cohort. Results from random effect growth curve models.



Note: Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); HSCL (dummy for being below the clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N HSCL = 7,394. Controls: see note for Table 2 excluding graduation cohort

Data: BerO study waves 1 to 3.

After showing that the examined outcomes developed differently for the two very similar groups of students, who only varied in that one group had already transitioned to post-secondary (2020 graduation cohort) while the other had not (2021 graduation cohort) at the time of the wave 3 interview, we now investigate two potential mechanisms for this different development: First, we test whether the students in the two cohorts dealt differently with the distancing measures. Second, we test whether future worries of the current high school students differed from the cohort of high school graduates in which the largest share (84%) studies at a university at wave 3. We assume these two mechanisms are the most important, as they present two aspects in which these young individuals, who are very similar in other aspects, may differ the most.

For this purpose, Columns 1 and 2 of Table 3 present the results of two sets of questions that the students in both cohorts answered at wave 3 and Column 3 shows the differences between the two graduation cohorts. Students who had just started their final school year (graduation cohort 2021) in fall 2020 stated that they were more burdened by distancing measures and that they had much less enjoyment of learning than those who already had left school and attend a university (84%) or started a vocational training (16%) (graduation cohort 2020). Analysing future worries reveals that students in graduation cohort 2021 were more worried than those in the graduation cohort 2020 about their occupational futures, about a negative effect of distancing policies on their future career, and about having received too little career information. Next, we investigate to what extent these higher concerns of the graduation cohort 2021, who is still in school at the time of the survey, can explain the differences in well-being between the two cohorts.

Table 3: Attitudes of the graduation cohorts 2020 and 2021 regarding distancing measures and worries (Fall 2020)

	(1) Mean graduation cohort 2021	(2) Mean graduation cohort 2020	(3) Diff. btw. Cohorts 2021-2020
<i>Dealing with the current situation</i>			
Enjoyment of learning (1-5)	3.052 (1.052)	3.715 (0.958)	-0.662***
Burden of distancing measures (1-5)	3.036 (1.304)	2.624 (1.228)	0.412***
<i>Future worries</i>			
Impact of distancing policies on future career (0 vs.1)	0.622 (0.484)	0.447 (0.497)	0.175***
Worries about occupational future (1-5)	2.322 (1.191)	1.959 (1.150)	0.363***
Worries about too little career information (1-5)	3.058 (1.337)	2.500 (1.359)	0.558***
<i>N Persons</i>	2450	1247	

Note: Standard deviations italicized in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ indicating statistical differences (based on t-tests).

Data: BerO study wave 3.

Table 4 shows the results of the estimations in which we regress the three well-being measures on the control variables (column 1) and on the two sets of questions that may explain the difference between the cohorts in well-being (Columns 2 and 3). In line with the results in Figure 3, Column 1 demonstrates that graduation cohort 2021 reported significantly worse outcomes in the health measures after we control for personality and other characteristics than the graduation cohort 2020. However, the results in column 2 show that including the present attitudes completely absorbs the difference between the cohorts for all outcomes and explains the largest share of the difference in life satisfaction, self-rated health, and mental health between the cohorts. The present attitudes explain even more of the gap than future worries, which also reduce the effect of the graduation cohort but do not fully absorb it (column 3).

Table 4: Mechanisms explaining differences in mental and physical well-being and life satisfaction between graduation cohorts 2020 and 2021.

	(1) Baseline model	(2) + current situation	(3) + future worries
<i>Panel A: Mental Health Problems^b</i>			
Graduation cohort 2021 dummy	0.095***	0.025	0.059**
Enjoyment of current education		-0.090***	
Burden of distancing measures		0.023***	
Impact of distancing policies on future career			0.044**
Worries about occupational future			0.040***
Worries about too little career information			0.019**
R ²	0.233	0.267	0.251
<i>Panel B: Self-rated Health^a</i>			
Graduation cohort 2021 dummy	-0.058**	0.005	-0.028
Enjoyment of current education		0.187***	
Burden of distancing measures		-0.051**	
Impact of distancing policies on future career			-0.056**
Worries about occupational future			-0.065***
Worries about too little career information			-0.046*
R ²	0.147	0.178	0.160
<i>Panel C: Life Satisfaction^a</i>			
Graduation cohort 2021 dummy	-0.067***	0.016	-0.038+
Enjoyment of current education		0.273***	
Burden of distancing measures		-0.018	
Impact of distancing policies on future career			-0.045**
Worries about occupational future			-0.090***
Worries about too little career information			-0.030+
R ²	0.183	0.242	0.197
N Persons	3697	3697	3697

Note. ^a Standardized beta coefficients from OLS regressions. ^b Predicted probabilities from OLS regressions. Dependent variables: Life satisfaction (0–10), self-rated health (1–5), and HSCL (dummy for being below clinical threshold). Statistical significance at: * p < 0.10, ** p < 0.05, *** p < 0.01. Control variables: see note for Table 2. Data: BerO study wave 3.

3.4. Heterogeneous Effects

In this section, we analyse whether the effects differ by student characteristics, as explained in section 2.5. Looking at the immediate effects reveals no differences by student characteristics (see online Appendix Table A5). However, investigating heterogeneity in the intermediate effects reveals that those students who reported high happiness in fall 2019, before the COVID-19 pandemic, showed a stronger decline in life satisfaction than those with low life satisfaction. In line with these results, students with good health also showed a stronger decrease in health than students with low health (see online Appendix Figures A2 to A7). The analyses for the other student characteristics do not show any further heterogeneities (see online Appendix Figures A8 to A13).

3.5. Effects on career plans

In this section, we analyse whether and to what extent the decrease in well-being that we observe from spring 2020 to autumn 2020 is related to students' transition outcomes, i.e., success probability, expected GPA and satisfaction with the chosen degree in the two cohorts. In the analysis, we focus on mental health, for which we find the strongest decrease between spring 2020 and autumn 2020. As described in section 2.3, we regress our transition outcomes, measured in autumn 2020, on a dummy that takes a value 1 if a student showed a strong decline in mental health (i.e., an increase on the HSCL-10 scale above a value of 0.4, which represents the upper quartile) from spring to autumn. In the first model, we control for several student characteristics explained in section 2.4. The second model additionally uses the panel dimension of our data and includes mental health at wave 2 and the dependent variable of the model, i.e., the transition outcome, at wave 2 as control variables. These two additional controls exclude the possibility that our estimates merely capture the effect of a student's generally low mental health and that those students with a decrease in mental health would have already stated low transition outcomes before the decrease.

Table 5: Associations between strong decreases in mental health and transition outcomes in fall 2020

	Cohort 2020		Cohort 2021	
	(1) Base model	(2) + Base-line value of DV & SCL-10	(3) Base model	(4) + Baseline value of DV & SCL-10
<i>Success probability¹</i>				
Strong SCL-10 increase	-0.093**	-0.118***	-0.064**	-0.067***
R ²	0.269	0.308	0.172	0.271
N persons	1244	1244	2447	2447
<i>Security of educational path</i>				
Strong SCL-10 increase	-	-	-0.038*	-0.043**
R ²	-	-	0.155	0.254
N persons	-	-	2449	2449
<i>Expected GPA</i>				
Strong SCL-10 increase	-	-	0.050**	0.044**
R ²	-	-	0.523	0.674
N persons	-	-	2372	2372
<i>Probability of STEM Studies</i>				
Strong SCL-10 increase	-	-	-0.035*	-0.020
R ²	-	-	0.286	0.684
N persons	-	-	2414	2414
<i>Satisfaction with decision²</i>				
Strong SCL-10 increase	-0.133***	-0.158***	-	-
R ²	0.275	0.305	-	-
N persons	1242	1242	-	-
<i>Satisfaction with location²</i>				
Strong SCL-10 increase	-0.081**	-0.089**	-	-
R ²	0.258	0.268	-	-
N persons	1177	1177	-	-
<i>Satisfaction with institution²</i>				
Strong SCL-10 increase	-0.124***	-0.141***	-	-
R ²	0.256	0.282	-	-
N persons	1181	1181	-	-

Note. Standardized beta coefficients. Statistical significance at * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Dependent variables: Success probability (11-point Likert scale), security of educational path (5-point Likert scale), satisfaction with decision (11-point Likert scale).

Overall, 26.81% of the sample experienced a strong decrease in mental health (i.e., an increase on the HSCL-10 scale of more than 0.4 points). The share of strong decreases was stronger among the 2021 graduation cohort, in which 29.92% of respondents exhibited a strong decline in mental health, while the corresponding share from the 2020 graduation cohort was only 20.69%.

¹ Success probability for the 2020 cohort refers to the likelihood of finishing the current post-high school education. For the 2021 cohort, success probability refers to the likelihood of successfully finishing a potential future academic study.

² The baseline value here constitutes overall happiness at survey wave 1.

Control Variables: graduation cohort (Panel A), gender, migration status, school performance, school fixed effects, parental education, subjective household income, parental unemployment in last 6 months, onsite education, self-efficacy, grit, time preference, risk aversion, Big Five personality traits, and interview mode.

Data: BerO study wave 3.

Table 5 shows the results of the estimations. While columns 1 and 2 present the results for the 2020 graduation cohort, Columns 3 and 4 present the results for the 2021 graduation cohort. Both cohorts were asked for their success probability, and in both cohorts, a strong decline in mental health was related to a lower success probability of the current or future career path. The next rows present the results for transition outcomes, which were measured in only one of the two cohorts. For the 2020 graduation cohort, the results reveal that students with a strong decline in mental health were less satisfied with their current career decision, location, and institution than students with a lower or no decline. In line with these results, students with a strong decline in mental health in the 2021 graduation cohort stated that they felt less secure about their future career paths, they expected a worse GPA, and they had a lower probability of wanting to study STEM subjects. Columns 2 and 4 demonstrate that in addition to the last result, all these results hold in the very tight specification, which includes lagged mental health and the lagged dependent variable, the transition outcome, of the model. The sizes of the effects (between 10 and 15% of a standard deviation) are higher for the 2020 graduation cohort than for the 2021 cohort. However, for the 2021 cohort, the effects were in a relevant range, with approximately five percent of a standard deviation.

4. Discussion

We start the discussion of the results with the question of why school closures create positive effects on well-being in the short run. Our first explanation for the positive short-run effects refers to the idea that students perceived school closures as a relief, hence resembling additional holidays. This explanation is based on the finding that individuals are happier on weekends and during holidays (e.g., Ryan et al. 2010), which in the case of students may be caused by the fact that studying provides less life satisfaction and well-being than other leisure activities (Helliwell and Wang 2014). Additional studies have shown that high school students feel less stressed if they are not at school because of reduced pressure and bullying, which in extreme cases even leads to less suicide during the holiday months (Hansen and Lang 2011, Kim and Leventhal 2008). The finding that students spend much fewer hours studying during school closures than in normal times supports the holiday explanation (Anger et al. 2020 for the present sample; Grewenig et al. 2020, Grätz and Lipps, 2021) Furthermore, we find that overall health increases more for students with few friends. These students may be more isolated and miss social contact less, potentially also because they may be more often victims of bullying.

An alternative explanation for the increase in well-being might be the students' perception that the school closures presented a measure to protect their health and relieved their fear of

becoming infected with COVID-19. The finding that self-rated health and life satisfaction declined from wave 1 to wave 2 for the students who answered the questionnaire before the school closures supports this explanation, as the decline may have resulted from COVID-19 fear. In addition, we observe that life satisfaction and self-rated health for students who answered the questionnaire after the school closures remained at the same level as in wave 1 and did not increase. In the case of a holiday effect, we may have expected an increase in these outcomes. However, interview mode or honesty-in-reporting effects may also explain the decline in life satisfaction and self-rated health from wave 1 to wave 2, which supports the holiday explanation (Chadi 2013; Warren and Halpern-Manners 2012). Irrespective of the final explanation for the increase in well-being shortly after school closures, the findings are highly relevant, as they demonstrate that short-term school closures are not harmful to students' well-being.

Next, we discuss why well-being declines in the long run and why this decline is stronger for students who are still in high school. We think that in the longer run, the burdens of school closures and other distancing measures accumulate because students suffer more from social distancing and home schooling and may be afraid about a loss of human capital. Additionally, the burden may accumulate because students increasingly perceive the pandemic not only as a short-term event but also as a long-term condition. This is an important finding, as little research exists on how mental and physical well-being develops over the course of a pandemic. For example, Sachser et al. (2021) also found positive immediate effects of lockdown measures on mental health in a representative sample of the German population without assessing longer-term outcomes. Therefore, our results indicate that physical and mental well-being developed very dynamically during the pandemic and that measuring health at one point in time during the crisis may be misleading.

Analysing the longer-run differences between graduation cohorts in decline in well-being revealed that those students who were still in school were more affected than the students who graduated in 2020. As an explanation for the stronger effects on the students in the 2021 graduation cohort, we find that students who were still in school were more worried about their future careers and were more burdened by the current COVID measures, in particular school closures, and the overall situation. These differences in perceptions explain the difference in decline in overall well-being almost completely.

The existence and the explanation of the difference between the cohorts are surprising, as the students from the graduation cohort 2020, of whom 84% study at a university in fall 2020, were also strongly affected by distancing measures, such as having online lectures or prohibitions of

freshman events, and for them, the future was not secure. However, in the first year, students appeared to cope better with the situation. One explanation for the finding may be that the new students were not familiar with university without distancing measures and that therefore they did not miss anything, for example, on-site lectures. Additionally, after having made a successful transition, worries about the future may have decreased. Overall, the results indicate that students who were locked down while still in school are most vulnerable to an overall health decline, which should be considered in prevention or support services.

Finally, it is important that the decline in well-being is related to career decisions and satisfaction with the chosen path. As students from the 2020 graduation cohort with a decline in mental health reported less satisfaction with their choices, they may drop out, causing high costs for the individual and society. The same is true for the 2021 graduation cohort: our results, i.e., that these students felt less secure about the future, suggest that they will make decisions which they would have not made without the pandemic, which also may lead to high individual and society costs.

Although our study has many strengths, it also shows limitations. First, we cannot state whether the COVID-19 distancing measures causally generated the decline in physical and mental well-being, as we do not have a control group who was not affected by the measures. However, it is very unlikely that only time, seasonal effects or any other event caused the reduction, as the decline was too strong for these explanations. Similar declines only occur in regions where a war started or in individuals who have experienced a stroke of fate, such as becoming widowed or disabled (Coupe and Obrizan; Infurna et al. 2017; Oswald and Powdthavee 2008). Furthermore, other studies showed that well-being was stable for cohorts who graduated before the pandemic (Herke et al. 2019). Second, the size of the relation between the decline in mental health and the transition outcomes was not very large. However, we believe that they are meaningful, supported by findings from the literature that even smaller changes in this critical stage of the career can have life-long effects (Citation).

5. Conclusion

This paper analysed how the COVID-19 pandemic and the related measures to reduce the spread of the COVID-19 virus have affected the well-being and career plans of students from the high school graduation cohorts 2020 and 2021. The results show that after an immediate increase in the examined well-being measures around the time of the first school closures, well-

being strongly declined in the longer run, particularly for students in the 2021 graduation cohort, who were still in school at the time of the survey. Additionally, our results demonstrate that this decline in well-being was related to several school to post-secondary education transition outcomes. The results clearly indicate that the COVID-19 pandemic, including school closures and distancing measures, has had negative effects on current graduation cohorts, which may cause life-long harm. These findings are important, in particular as the effectiveness of school closures, a main policy to prevent COVID-19 infections, is disputed (Courtemanche et al. 2021; Isphording et al. 2021; van Bismarck-Osten et al. 2021). Finally, our results also point to the question of intergenerational justice, as our study demonstrates that members of the young generation are likely to bear the long-term costs of distancing measures, while the benefits of distancing measures in terms of lower infections may be higher for older individuals.

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Online Appendix

Table A1: Variables only included in fall/winter 2020/21

	Mean	Std. Dev.	Min	Max
Dealing with the current situation				
Fun with current education	3.276	1.068	1	5
Burden distancing measures	2.897	1.294	1	5
Worries about occupational future	2.200	1.190	1	5
Worries about too less career information	2.870	1.370	1	5
Distancing policies have impact on future career	0.563		0	1
Educational plans				
Security educational path	3.666	1.134	1	5
Success probability of finishing pot. study	8.258	1.803	0	10
Success probability of finishing current post-sec. edu.	7.742	2.272	0	10
Satisfaction with decision	7.407	2.055	0	10
Satisfaction with location	7.381	2.234	0	10
Satisfaction with institution	7.500	1.915	0	10
Strong increase in anxiety & depression risk	0.268		0	1
Control variables for wave 3-specific analyses				
Dummy for a unemployed relative	0.257		0	1
Subjective household income				
<i>1 much less than one needs for a decent life</i>	0.012			
2	0.062			
3	0.229			
4	0.549			
<i>5 much more than one needs for a decent life</i>	0.140			
Missing information on subj. HH income	0.009			
Onsite education at time of interview	0.641			
Baseline fun with education	3.300	0.890	1	5
Baseline security with educational path	3.545	1.135	1	5
Baseline success probability of finishing pot. study	8.517	1.573	0	10
Baseline happiness	7.435	1.940	0	10
N Persons	3,697			

Table A2: Overall Sample characteristics

	Mean	Std. Dev.	Min	Max
Outcomes				
<i>Life satisfaction</i>	7.074	2.040	0	10
<i>Self-rated health</i>	3.763	1.065	1	5
<i>Anxiety & depression risk</i>	0.438	0.496	0	1
Socio-demographics				
Graduation cohort 2021	0.663		0	1
Male	0.355		0	1
1st/2nd generation migrants	0.209		0	1
Missing information on migration status	0.055			
At least one parent with university education	0.540		0	1
Missing information on parental education	0.105			
GPA better than 2.5	0.484		0	1
Missing information on GPA	0.010			
Personality and Preferences				
Self-efficacy	2.924	0.407	1	4
Grit	3.472	0.615	1	5
Dummy for being myopic	0.115		0	1
Openness	4.778	1.220	1	7
Conscientiousness	5.222	1.023	1.333	7
Extraversion	4.764	1.381	1	7
Agreeableness	5.434	0.947	1	7
Neuroticism	4.245	1.234	1	7
Risk aversion	5.629	2.183	0	10
Method				
CATI interview	0.024		0	1
Observations	11,091			
N Persons	3,697			

Table A3 Development of mental and physical health since fall 2019. Results from random effect growth curve models

	Life-satisfaction	Self-rated Health	Anxiety & Depression risk
Spring 2020 (Pre SC)	-0.323*** (0.036)	-0.230*** (0.022)	
Spring 2020 (Post SC)	-0.362*** (0.045)	-0.006 (0.026)	-0.059*** (0.014)
Fall 2020	-0.808*** (0.037)	-0.199*** (0.021)	0.077*** (0.010)
Graduation cohort 2021	-0.053 (0.056)	-0.033 (0.029)	0.014 (0.014)
At least one parent with university education	0.147*** (0.056)	-0.015 (0.029)	-0.000 (0.014)
Missing information on parental education	0.109 (0.099)	-0.039 (0.049)	-0.018 (0.024)
CATI interview	0.861*** (0.099)	0.224*** (0.061)	-0.137*** (0.027)
Male	0.163*** (0.056)	0.214*** (0.028)	-0.185*** (0.015)
GPA better than 2.5	0.197*** (0.052)	0.040 (0.027)	-0.010 (0.014)
Missing information on GPA	-0.127 (0.272)	-0.092 (0.116)	-0.101* (0.060)
1st/2nd generation migrants	-0.222*** (0.069)	0.017 (0.034)	0.072*** (0.017)
Missing information on migration status	-0.361*** (0.124)	-0.016 (0.061)	0.087*** (0.030)
Dummy for being myopic	0.035 (0.081)	-0.027 (0.039)	0.006 (0.020)
Risk aversion	-0.042*** (0.014)	-0.022*** (0.007)	0.014*** (0.003)
Openness	-0.018 (0.022)	-0.049*** (0.011)	0.038*** (0.005)
Conscientiousness	0.002 (0.035)	0.041** (0.017)	0.005 (0.009)
Extraversion	0.121*** (0.021)	-0.004 (0.011)	0.000 (0.005)
Agreeableness	0.269*** (0.030)	0.079*** (0.014)	-0.032*** (0.007)
Neuroticism	-0.190*** (0.024)	-0.120*** (0.012)	0.083*** (0.006)
N observations	11091	11091	7394

Note: Robust standard errors in parentheses; Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. School fixed effects are included. Für life-satisfaction und self-rated health ist die referenz für die wave dummies „Fall 2019“. Für anxiety depression und risk ist die referenz spring 2020 (pre sc), deswegen ist die zelle auch frei.

Data Source: Bero-Study wave 1 to 3

Table A4 Development of mental and physical health by graduation. Results from random effect growth curve models

	Life-satisfaction	Self-rated Health	Anxiety & depression risk
Spring 2020 (Pre SC)	-0.250*** (0.061)	-0.188*** (0.038)	
Spring 2020 (Post SC)	-0.363*** (0.080)	0.023 (0.047)	-0.041* (0.025)
Fall 2020	-0.657*** (0.066)	-0.097*** (0.036)	0.008 (0.017)
Graduation cohort 2021	0.047 (0.066)	0.037 (0.037)	-0.033* (0.020)
Spring 2020 (Pre SC) x Graduation cohort 2021	-0.111 (0.076)	-0.063 (0.047)	
Spring 2020 (Post SC) x Graduation cohort 2021	-0.002 (0.096)	-0.045 (0.056)	-0.024 (0.030)
Fall 2020 x Graduation cohort 2021	-0.228*** (0.079)	-0.155*** (0.044)	0.104*** (0.021)
At least one parent with university education	0.146*** (0.056)	-0.015 (0.029)	-0.000 (0.014)
Missing information on parental education	0.110 (0.099)	-0.039 (0.049)	-0.018 (0.024)
CATI interview	0.865*** (0.099)	0.226*** (0.061)	-0.139*** (0.027)
Male	0.163*** (0.056)	0.214*** (0.028)	-0.185*** (0.015)
GPA better than 2.5	0.198*** (0.052)	0.040 (0.027)	-0.010 (0.014)
Missing information on GPA	-0.129 (0.272)	-0.092 (0.116)	-0.100* (0.060)
1st/2nd generation migrants	-0.221*** (0.069)	0.017 (0.034)	0.072*** (0.017)
Missing information on migration status	-0.362*** (0.124)	-0.016 (0.061)	0.087*** (0.030)
Self-efficacy	0.930*** (0.080)	0.305*** (0.039)	-0.200*** (0.019)
Grit	0.301*** (0.060)	-0.004 (0.029)	-0.027* (0.015)
Dummy for being myopic	0.035 (0.081)	-0.027 (0.039)	0.006 (0.020)
Risk aversion	-0.042*** (0.014)	-0.022*** (0.007)	0.014*** (0.003)
Openness	-0.017 (0.022)	-0.049*** (0.011)	0.038*** (0.005)
Conscientiousness	0.002 (0.035)	0.041** (0.017)	0.005 (0.009)
Extraversion	0.121*** (0.021)	-0.004 (0.011)	0.000 (0.005)
Agreeableness	0.269*** (0.030)	0.079*** (0.014)	-0.032*** (0.007)
Neuroticism	-0.190*** (0.024)	-0.120*** (0.012)	0.083*** (0.006)
Constant	2.630*** (0.408)	3.265*** (0.210)	0.700*** (0.105)
N observations	11091	11091	7394

Note: Robust standard errors in parentheses; Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. School fixed effects are included. Für life-satisfaction und self-rated health ist die referenz für die wave dummies „Fall 2019“. Für anxiety depression und risk ist die referenz spring 2020 (pre sc), deswegen sind in den zellen für den einze- und interaktionseffekt keine Angaben enthalten.

Data Source: Bero-Study wave 1 to 3

Table A5: Heterogeneity in immediate effects of school closures on mental and physical health: Results from difference-in-differences and ordinary least square regressions

	Life Satisfaction		Physical Wellbeing		Mental Wellbeing	
	DID in % of SE	p-value DID	DID in % of SE	p-value DID	Mean Diff. pre and post school closures	p-value
<i>Low Social Support</i>						
No	-0.012	0.716	0.226	0.000	0.056	0.000
Yes	0.297	0.414	-0.510	0.093	0.060	0.714
<i>Good Performing Student</i>						
No	0.020	0.684	0.208	0.000	0.062	0.002
Yes	-0.020	0.639	0.208	0.000	0.040	0.062
<i>Low Health at Wave 1</i>						
No	-0.011	0.741	0.209	0.000	0.055	0.000
Yes	0.045	0.659	0.276	0.010	0.067	0.121
<i>Low Happiness at Wave 1</i>						
No	0.002	0.961	0.226	0.000	0.056	0.001
Yes	0.041	0.583	0.186	0.042	0.054	0.085

Note: Upper part of table A3 presents estimates in percent of standard deviation based on difference-in-difference regressions adjusted for federal states. Lower part of table X presents mean differences based on an ordinary least squares regression adjusted for graduation cohort, sex, migration status, school performance, federal state fixed effects, parental education, self-efficacy, Grit, big five personality traits, time preferences, risk aversion, household size, happiness, self-rated health, and interview mode.

Data: BerO study wave1 and 2.

Figure A1. Immediate effects of school closures on mental and physical health: Results from difference-in-difference regressions

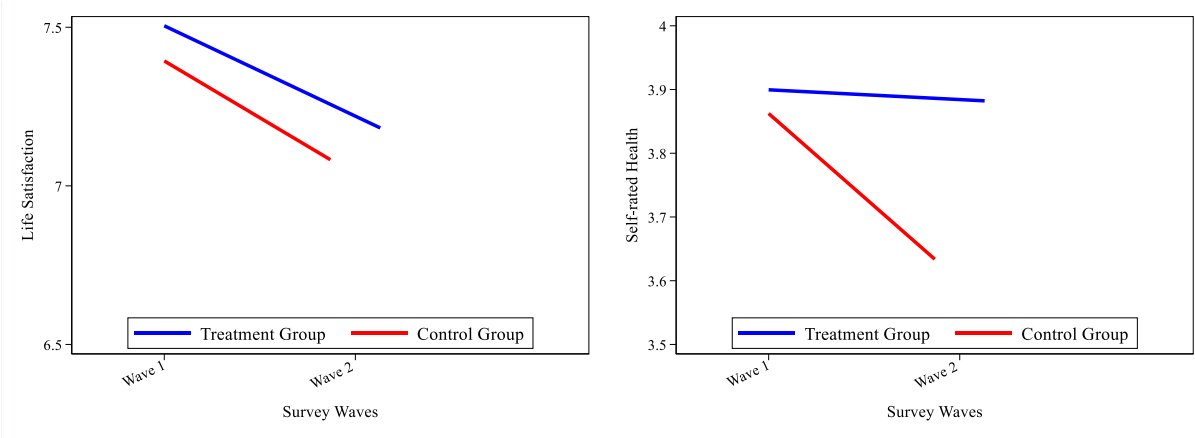
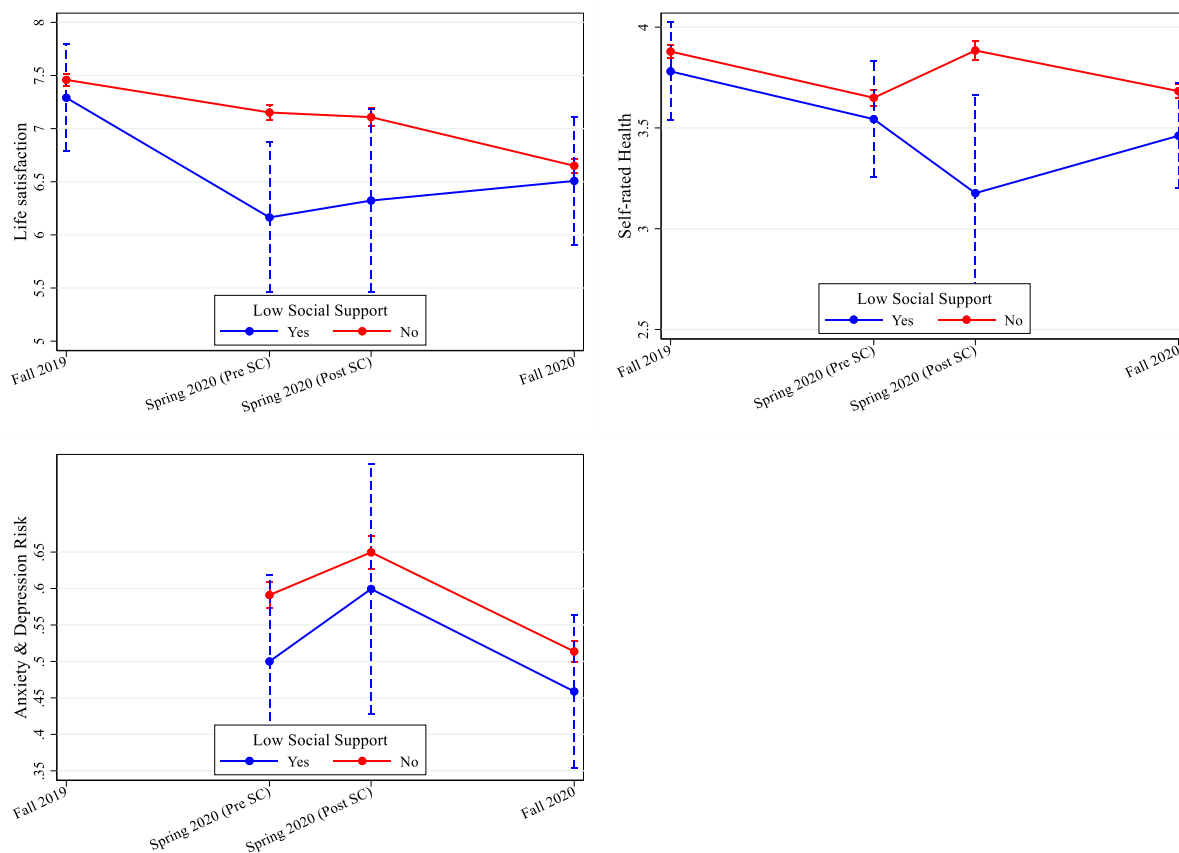


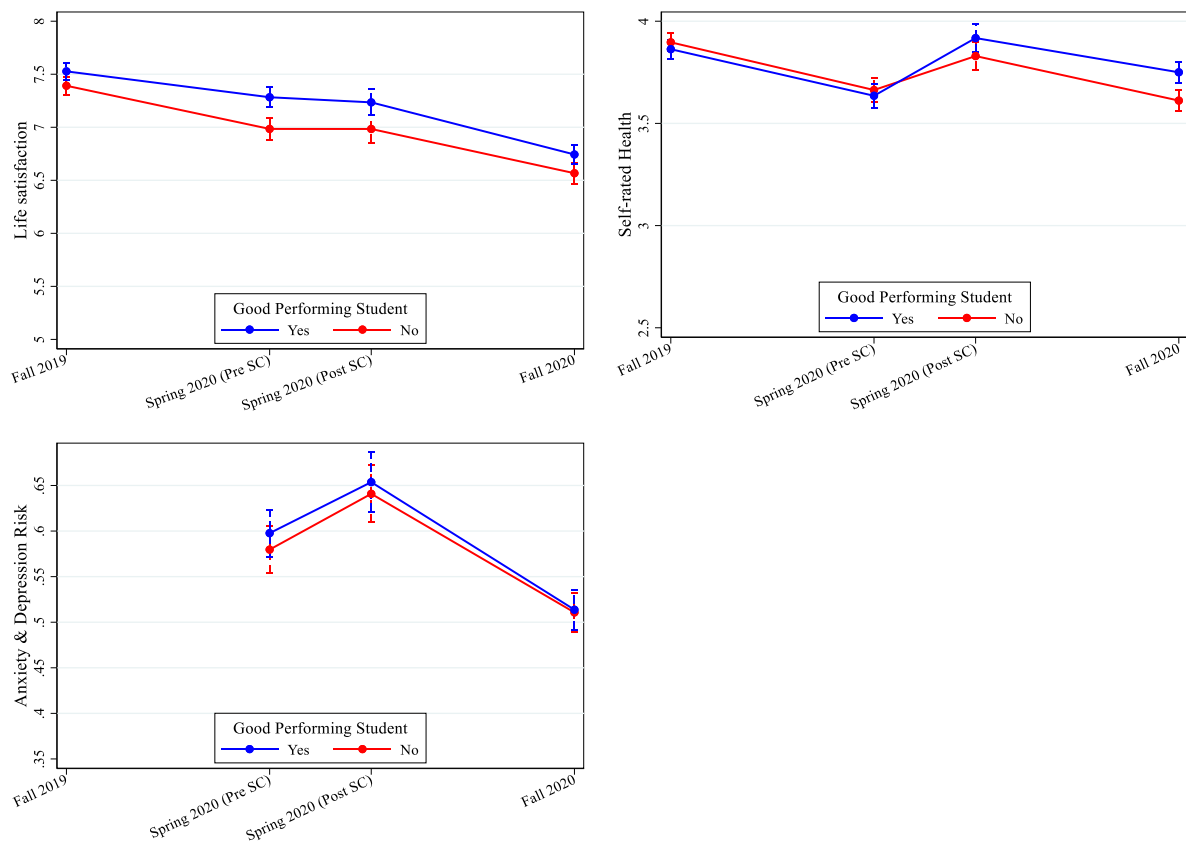
Figure A2. Development of mental and physical health by **level of social support** (i.e., number of friends within and beyond school). Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

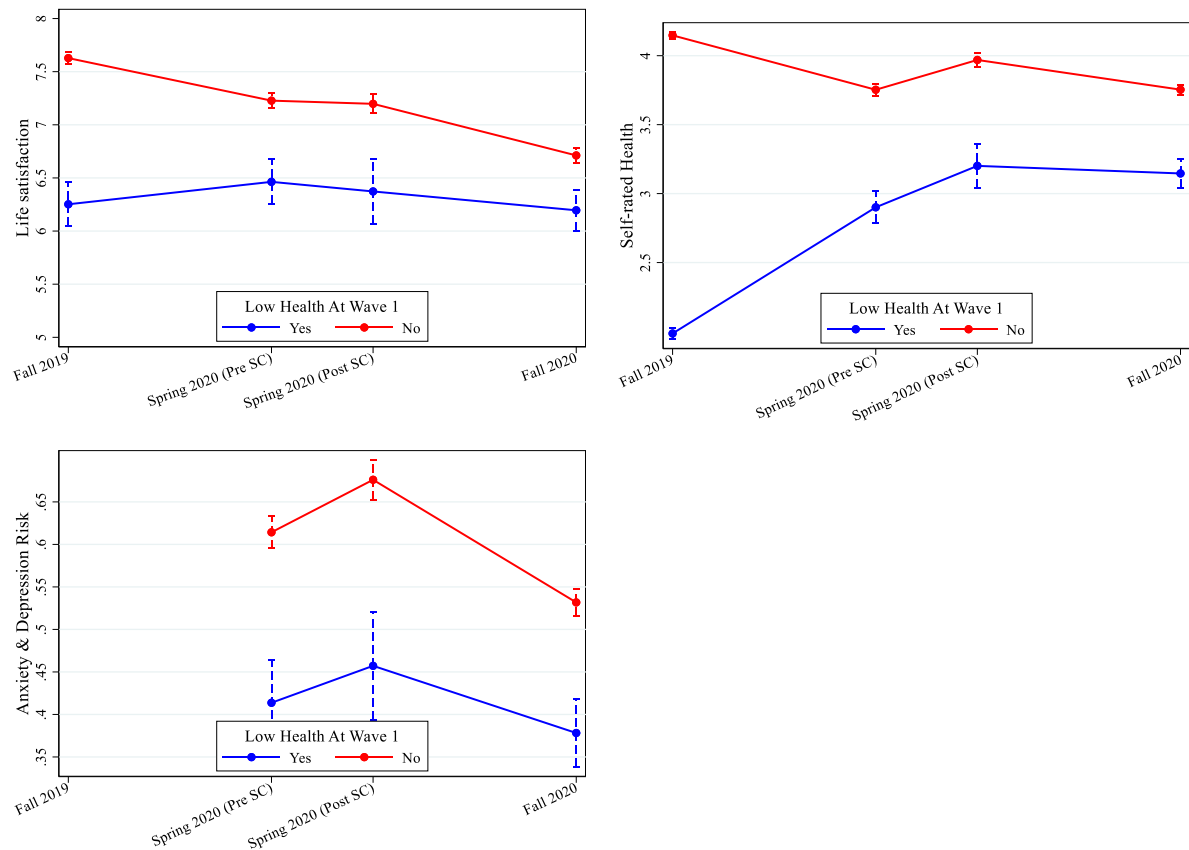
Figure A3. Development of mental and physical health by **school performance at wave 1** (i.e., grade point average in math and German is better than 2.5). Results from random effect growth curve models



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

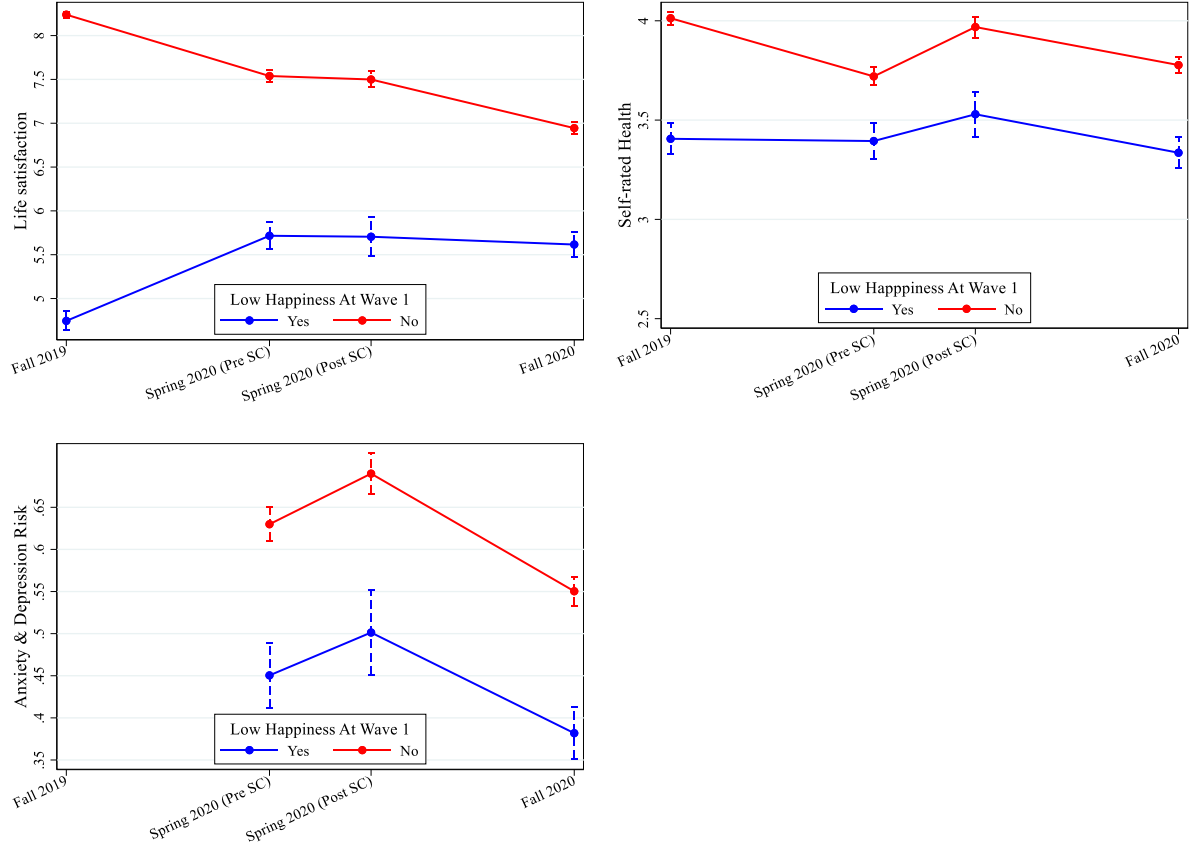
Figure A4. Development of mental and physical health by **level of health at wave 1** (i.e., self-rated health at wave 1 is smaller than 3). Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

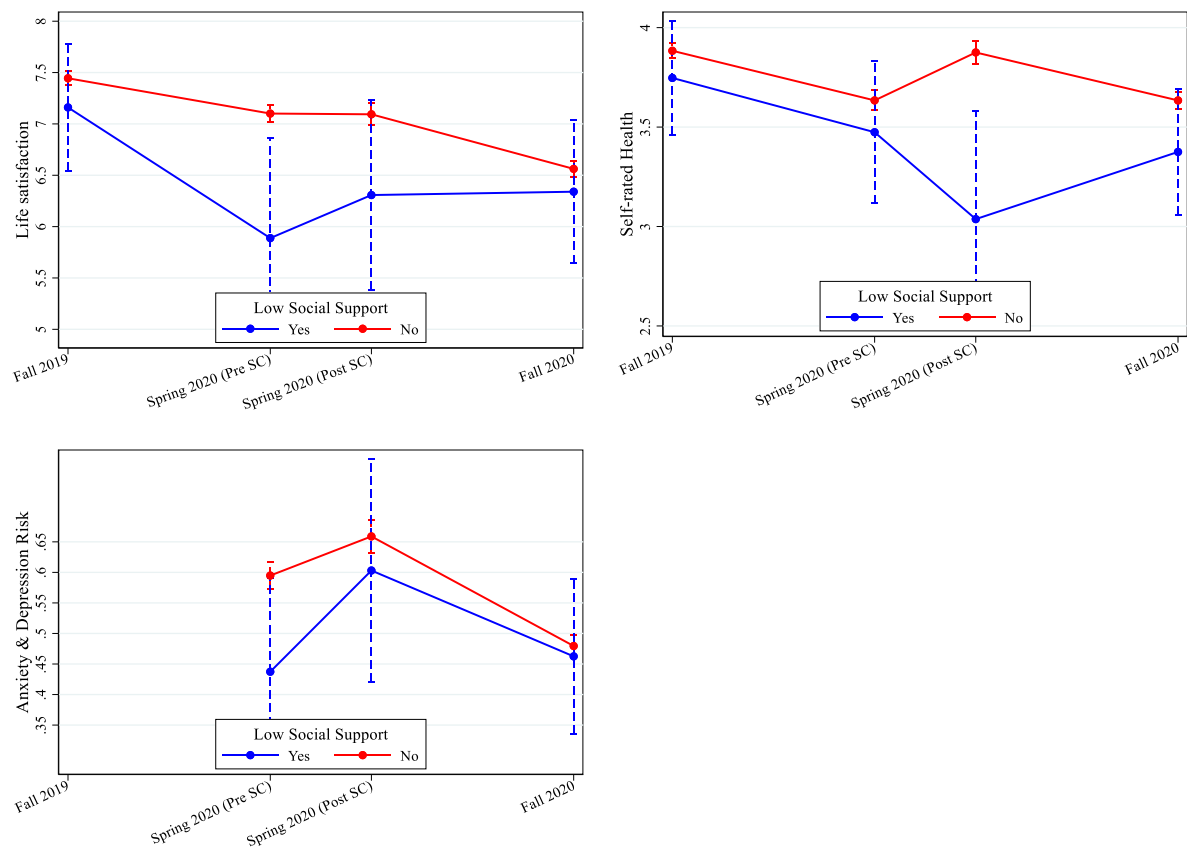
Figure A5. Development of mental and physical health by **level of life satisfaction at wave 1** (i.e., life satisfaction at wave 1 is smaller than 7). Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

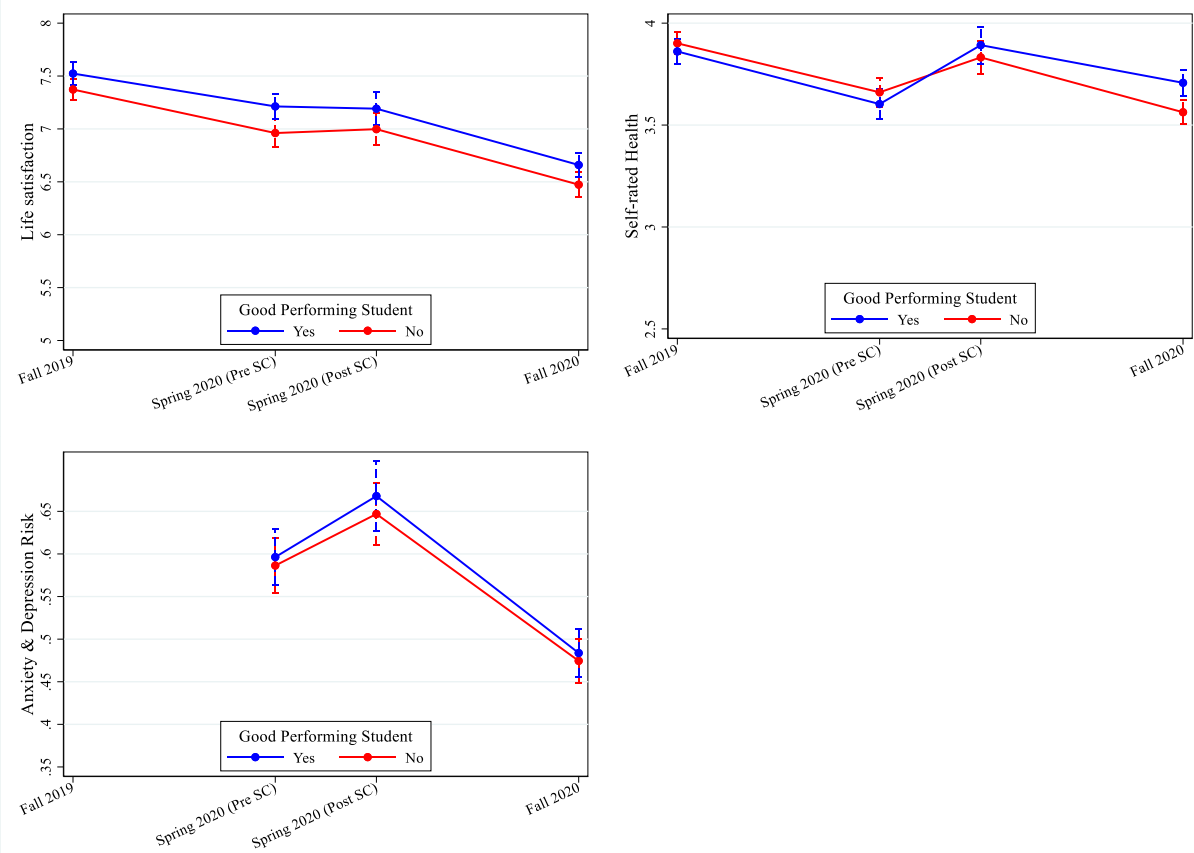
Figure A6. Development of mental and physical health by **level of social support** (i.e., number of friends within and beyond school) among cohort 2021. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

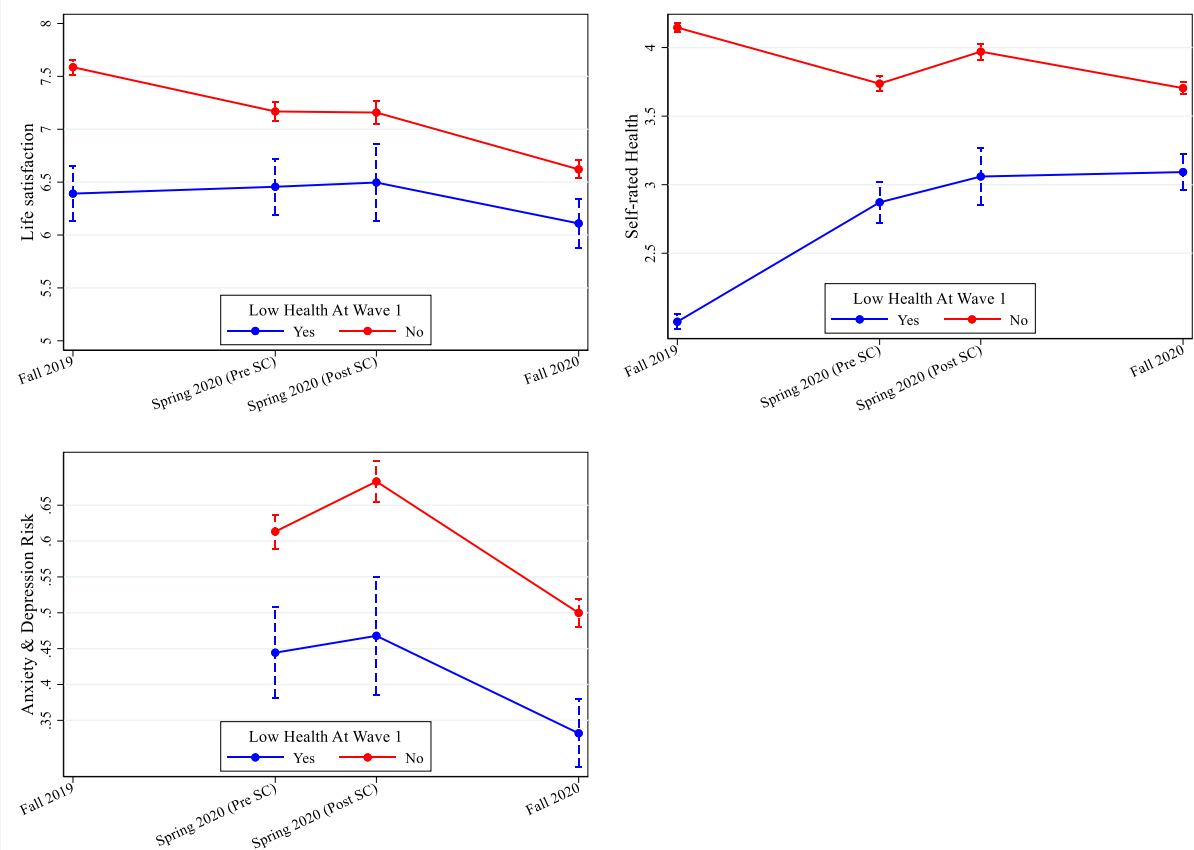
Figure A7. Development of mental and physical health by **school performance at wave 1** (i.e., grade point average in math and German is better than 2.5) among cohort 2021. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

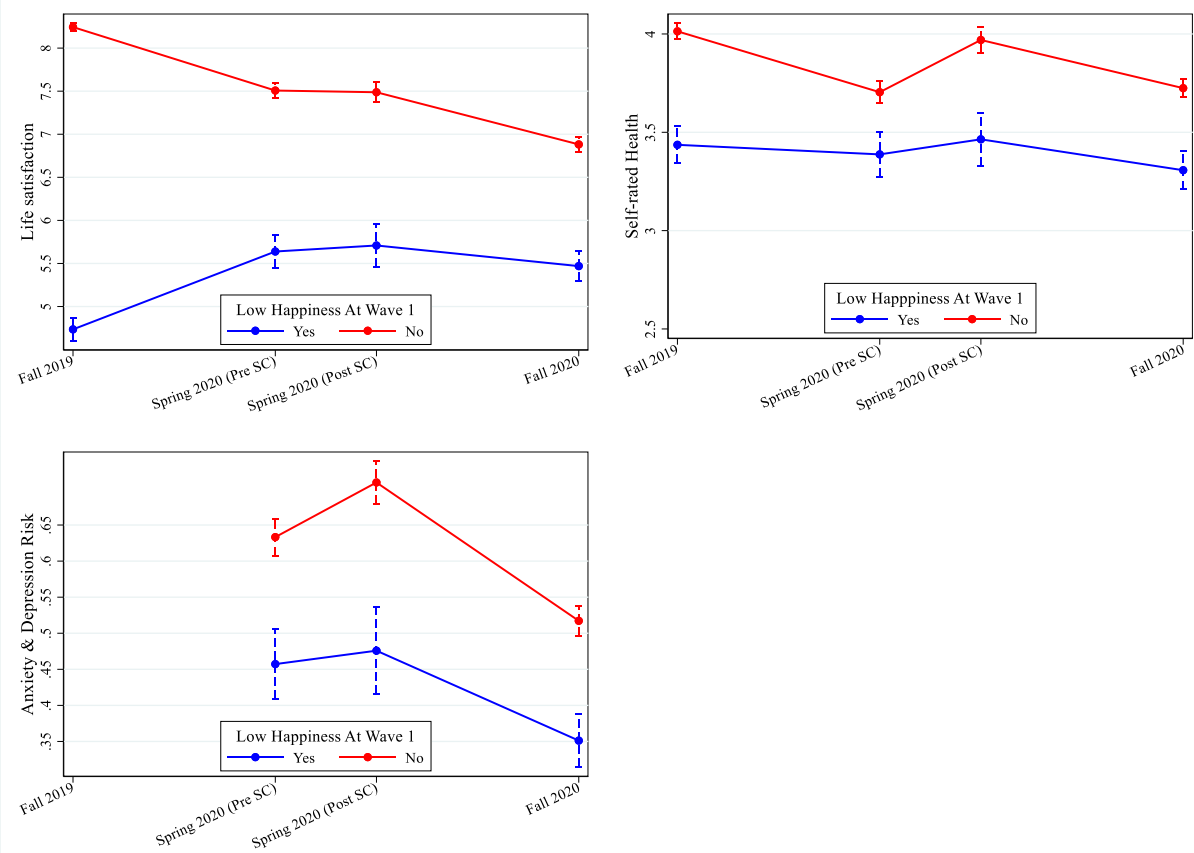
Figure A8. Development of mental and physical health by **level of health at wave 1** (i.e., self-rated health at wave 1 is smaller than 3) among cohort 2021. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

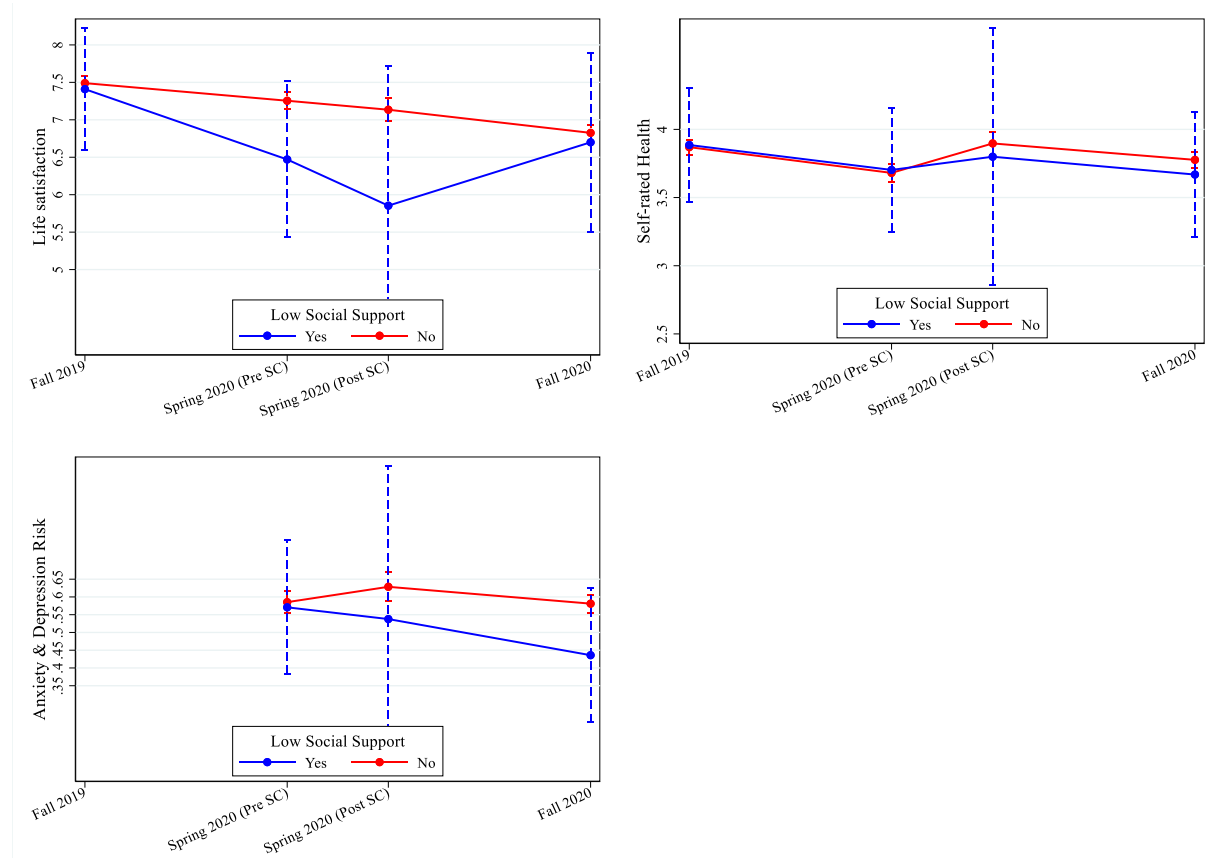
Figure A9. Development of mental and physical health by **level of life satisfaction at wave 1** (i.e., life satisfaction at wave 1 is smaller than 7) among cohort 2021. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

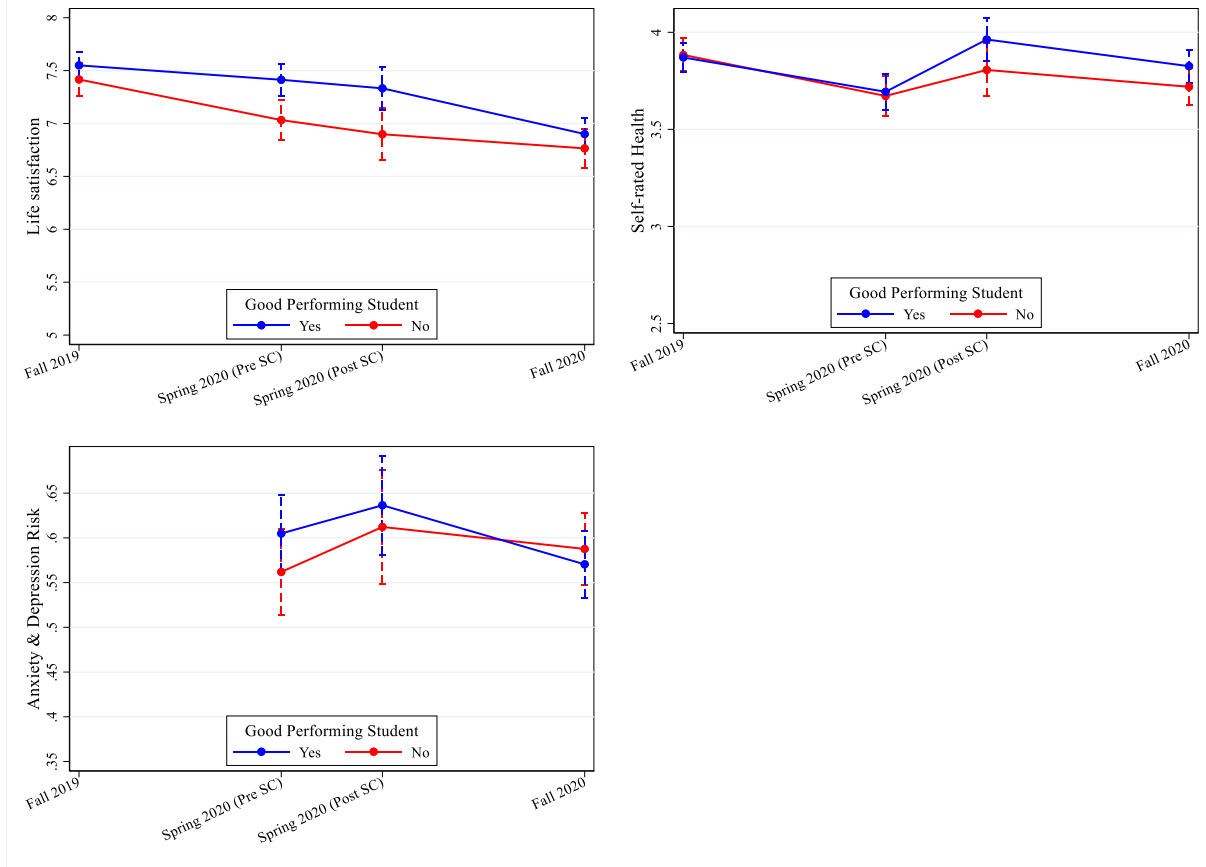
Figure A10. Development of mental and physical health by **level of social support** (i.e., number of friends within and beyond school) among cohort 2020. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

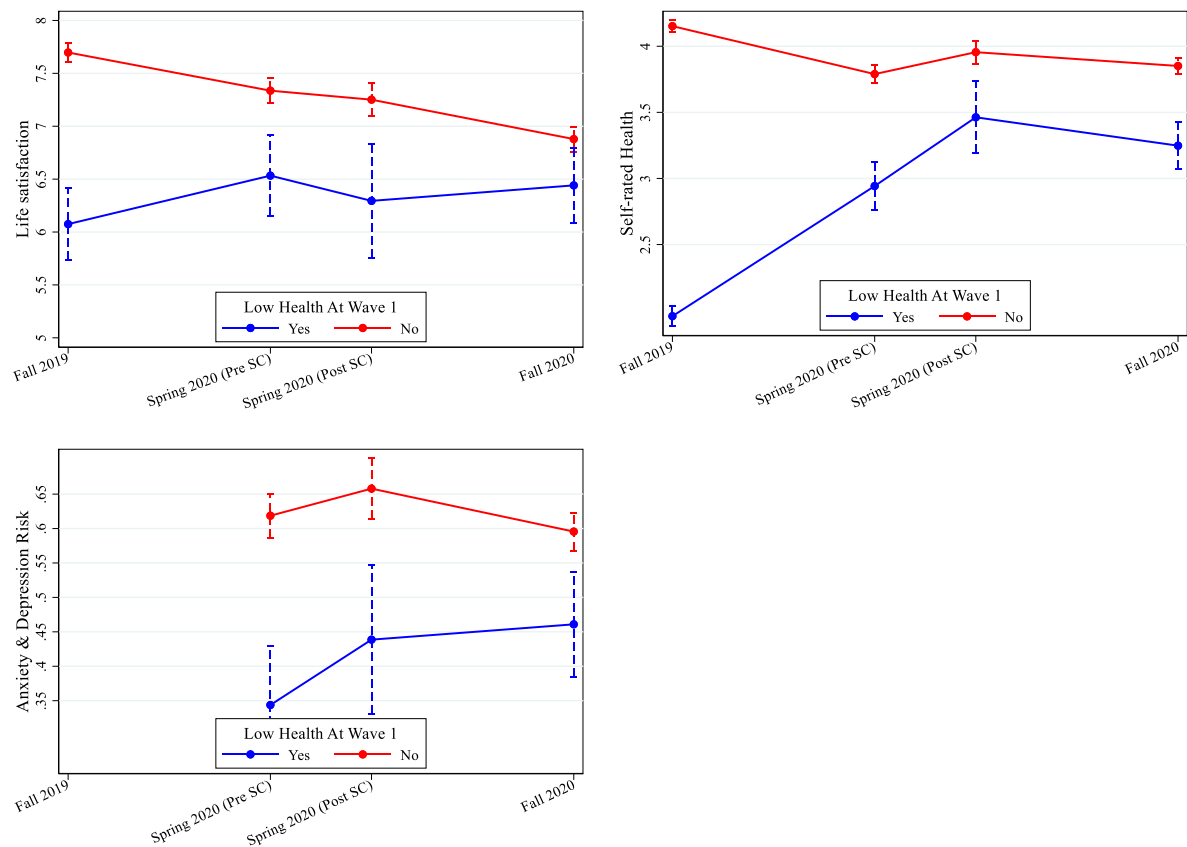
Figure A11. Development of mental and physical health by **school performance at wave 1** (i.e., grade point average in math and German is better than 2.5) among cohort 2020. Results from random effect growth curve models



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

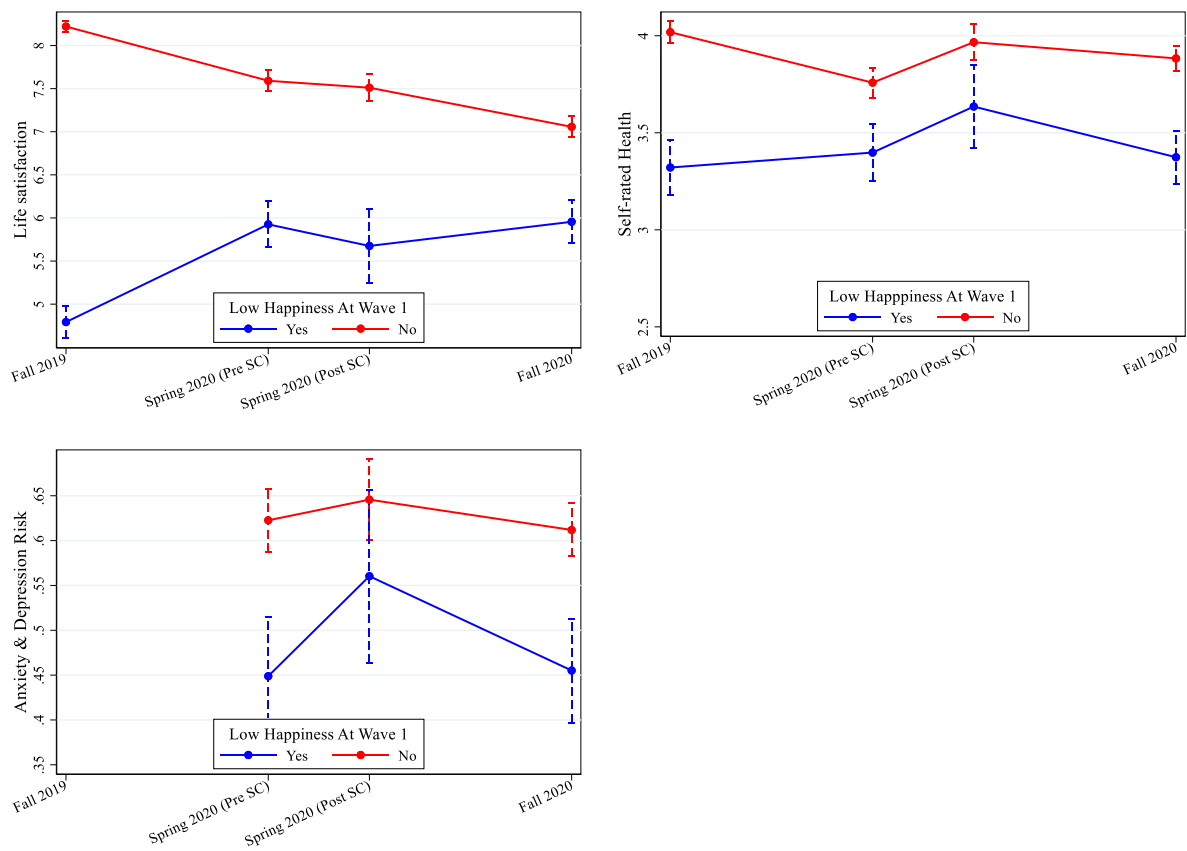
Figure A12. Development of mental and physical health by **level of health at wave 1** (i.e., self-rated health at wave 1 is smaller than 3) among cohort 2020. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.

Figure A13. Development of mental and physical health by **level of life satisfaction at wave 1** (i.e., life satisfaction at wave 1 is smaller than 7) among cohort 2020. Results from random effect growth curve models.



Data: BerO study wave 1 to 3.

Outcomes: Life satisfaction (0 to 10); self-rated health (1 to 5); SCL-10 (Dummy for being below clinical threshold). N Life Satisfaction = 11,091; N SRH = 11,091; N SCL-10 = 7,394. Controls: gender, school fixed effects, migration status, parental education, school performance, self-efficacy, Grit, big five personality traits, graduation cohort, risk aversion, time preferences and interview mode.