Received: 27 January 2022 | Revised: 28 April 2022 | Accepted: 6 June 2022

DOI: 10.1002/smi.3179

RESEARCH ARTICLE

WILEY

Examining socioeconomic disparities in changes in adolescent mental health before and during different phases of the coronavirus disease 2019 pandemic

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Funding information
Dynamics of Youth, Utrecht University and Faculty of Social and Behavioural Sciences, Utrecht University

Abstract

This study examined socioeconomic disparities in changes in adolescent mental health between fall 2019 (pre-COVID-19), spring 2020 (initial coronavirus disease 2019 (COVID-19) phase), and fall 2020 (prevailing COVID-19 phase). Using data from 1429 adolescents (M_{age} = 17.9) from tertiary vocational schools in the Netherlands with n = 386 participating in all three waves, linear and latent basis growth curve models were assessed and multigroup analyses conducted. Results showed a small but significant decrease in life satisfaction and small but significant increases in emotional problems, peer relationship problems, conduct problems, and hyperactivity-inattention problems. For emotional problems and peer relationship problems, increases between pre-COVID-19 and the initial COVID-19 phase were more pronounced than increases between the initial and prevailing COVID-19 phase. In contrast, linear decreases were found for life satisfaction and linear increases for conduct problems and hyperactivity-inattention problems over the course of the study. Mental health patterns were largely comparable for adolescents from families with varying socioeconomic status.

KEYWORDS
adolescence, COVID-19, mental health, SES

1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) has drastically altered public life around the world. To manage COVID-19, governments have repeatedly imposed nationwide lockdowns and implemented social and physical distancing policies of varying extremity. Despite the temporary effectiveness of distancing measures in reducing transmission rates (Koo et al., 2020; Matrajt & Leung, 2020), researchers have raised concerns regarding their social and psychological effects, particularly on mental health (Holmes et al., 2020; Torales et al., 2020), and among adolescents from low socioeconomic backgrounds (Brooks et al., 2020). In light of these concerns, the COVID-19 pandemic may widen socioeconomic disparities in mental health for instance due to relatively greater increases in financial

stress and less optimal living conditions among adolescents from low socioeconomic backgrounds, in a phase of life that is particularly important for navigating the successful transition to adult roles. Notwithstanding the growing body of evidence, there is still a need of longitudinal research investigating whether and to what extent changes in mental health vary according to the socioeconomic background of adolescents. To explore these changes, such research warrants not only assessments at different phases of the pandemic but, crucially, a pre-COVID-19 assessment. Therefore, this prospective, longitudinal study examined socioeconomic disparities in changes in different indicators of adolescent mental health in the Netherlands, particularly life satisfaction, emotional problems, peer relationship problems, conduct problems, and hyperactivity-inattention problems. Assessments took place in fall 2019 (pre-COVID-19), spring 2020 (initial COVID-19 phase, with a first lockdown), and fall 2020 (prevailing COVID-19 phase, with a second lockdown).

According to the Self-Determination Theory, satisfying innate psychological needs for competence, autonomy, and relatedness are crucial in maintaining mental health (Ryan & Deci, 2000). By reducing opportunities to meet and interact with others, the measures taken to manage the COVID-19 pandemic may hamper adolescent mental health. To illustrate, school closures, closing of sports facilities, and the advice to stay at home may be negatively related to feelings of autonomy and competence, because these measures limit young people's possibilities to make their own choices and to learn new things academically, creatively, or socially, thereby reducing young people's mental health (Reed-Fitzke & Lucier-Greer, 2021). Moreover, social distancing measures may thwart the need for relatedness because these measures reduce the opportunities for social connections, resulting in feelings of loneliness and accompanying emotional problems (Bucher et al., 2019). Especially in adolescence, the pandemic may interrupt the accomplishment of pivotal developmental tasks related to the successful transition into adult roles. This developmental period is crucial for social and identity development and characterized by a high need for social connection and support (Smetana et al., 2006). It is a period when young people think about their future and goals in education, vocation, and family (Seginer, 2008), and in which the experience of autonomy and competence uniquely contribute to wellbeing (Chen et al., 2015). The COVID-19 pandemic may thereby have adverse consequences for many ingredients vital to mental health in adolescents.

1.1 | Research on the association between covid-19 and adolescent mental health

Although many previous studies addressed the potential linkage between the COVID-19 pandemic and the mental health of adolescents, there still is a scarcity of prospective, longitudinal studies that include a pre-COVID-19 assessment and different assessments during the COVID-19 pandemic within a socioeconomically diverse sample of adolescents. Such studies are important, as these gain insight into mental health changes within a same adolescent population before and during different phases of the COVID-19 pandemic and are able to test whether such changes vary across socioeconomic groups. The available longitudinal studies on this topic mostly compared mental health assessments before and during the initial COVID-19 phase. Six US studies, one Australian, one Icelandic, and one Swedish study revealed increases in different indicators of adolescent mental health problems when comparing a pre-COVID-19 assessment with an assessment during the COVID-19 pandemic (Breaux et al., 2021; Chen et al., 2021; De France et al., 2021; Gadassi Polack et al., 2021; Lee et al., 2020; Magson et al., 2021; Munasinghe et al., 2020; Rogers et al., 2021; Thorisdottir et al., 2021). In contrast, a Dutch and a Norwegian study revealed fairly stable levels of mental health problems when comparing a pre-COVID-19 assessment with an assessment during the COVID-19 pandemic (Achterberg et al., 2021; Burdzovic Andreas & Brunborg, 2021). Additionally, two US studies showed a decrease in internalizing problems in this same period of time, both in a sample of US first-year undergraduates (Copeland et al., 2021) and in a multi-ethnic sample of early adolescents (Penner et al., 2021). Thus, although the majority of the available empirical research suggests that the COVID-19 pandemic may be negatively associated with mental health in adolescence, research findings across studies and countries are inconsistent. Also, there is a scarcity of longitudinal studies that include a pre-COVID-19 assessment and several assessments during the COVID-19 pandemic as well as different aspects of mental health.

1.2 | The importance of comparing different phases of covid-19

The fact that few studies assessed adolescent mental health before the COVID-19 pandemic and compared this to different phases of the COVID-19 pandemic may be an important omission of the literature, because it is unlikely that the impact of the COVID-19 pandemic is similar across different phases of the pandemic. On the one hand, it is possible that the longer the COVID-19 measures last, the more impact these have on adolescent mental health. Particularly, in the initial phase of COVID-19, the novelty of the measures may have protected adolescents from its negative consequences. To illustrate, Sibley et al. (2020) found that adults reported less fatigue during the first weeks of the lockdown, potentially as a consequence of reduced commuting and out-of-home commitments resulting in increased sleep. Similarly, Tang et al. (2021) asked primary and secondary school children to evaluate their home quarantine in March 2020. Children reported more benefits (e.g., not having to go to school, increased time spent on personal stuff) than drawbacks of this situation (e.g., not being able to hang out or meet friends). Although in the initial phase, benefits might have outweighed the drawbacks, these benefits seem unlikely to have extended into the prevailing phase of COVID-19. In this perspective, decreases in adolescent mental health in the initial phase of COVID-19 may have been modest, but as COVID-19

measures continued over time, adolescent mental health may have deteriorated (the *curtailment* hypothesis).

On the other hand, it is possible that the measures in the initial phase of COVID-19 were particularly threatening for adolescents, eliciting negative emotions such as anxiety, fear, and stress (Marroquín et al., 2020; Racine et al., 2020). In response to this threat, adolescents may have mobilized social, cognitive, and emotional resources, which may have helped them to minimise the impact of the measures in the longer term (e.g., Taylor, 1991). In this perspective, in the initial phase of COVID-19, mental health may have decreased but then increased in subsequent months as adolescents adjusted to the COVID-19 pandemic and the measures it required (the *mobilization* hypothesis). As far as we know, only one study compared adolescent mental health pre-COVID-19 with various COVID-19 phases. This prospective study was conducted among adolescents with a high risk of developing psychopathology in the Netherlands (Bouter et al., 2021). Results revealed increases in depressive symptoms when comparing scores before COVID-19 with scores during the initial COVID-19 phase (April 2020), but also when comparing the initial COVID-19 phase with the prevailing COVID-19 phase (January 2021). However, for anxiety, increases were only found when comparing scores pre-COVID-19 with scores in the initial COVID-19 phase.

Taken together, although empirical evidence is largely lacking, two contrasting hypotheses regarding changes in mental health over the course of the COVID-19 pandemic can be formulated. The *curtailment hypothesis* suggests that compared to pre-COVID-19, adolescent mental health worsens as COVID-19 measures last longer. The *mobilization hypothesis*, on the contrary, suggests that compared to pre-COVID-19, adolescent mental health worsens only in the initial phase of the COVID-19 pandemic, but recovers or stabilises as measures last.

1.3 | Socioeconomic disparities in the impact of covid-19 on adolescent mental health

It has been suggested that the COVID-19 pandemic increases socioeconomic disparities in mental health, especially in adolescence (Brooks et al., 2020). However, only few studies investigated this assumption. There are several reasons why the impact of the COVID-19 pandemic may be stronger for adolescents from lower than higher socioeconomic status (SES) families. First, adolescents from lower SES families may be affected indirectly, via the economic and financial stress of their parents (Conger et al., 2010). In these families, parents are more likely to hold temporary, low-wage jobs (Frasquilho et al., 2016). In addition, these parents have a higher likelihood of being employed in sectors that are more strongly hit by the measures and lockdowns (e.g., the hospitality industry) with fewer opportunities to continue working from home (Blundell et al., 2020). Second, adolescents may experience COVID-19-related economic stress themselves. Overall, young people are disproportionally at risk of losing their jobs during the pandemic, because they often hold jobs that are likely to be temporary or in sectors affected by the lockdown (Ganson et al., 2021). Although this may apply to all young people, those from lower SES families may need their own salary more urgently, because their parents may not be able to financially support them. Thus, the economic uncertainty due to the COVID-19 pandemic may be more pronounced for adolescents from lower SES families than for their counterparts from higher SES families, which may adversely affect their mental health (Godinic et al., 2020).

Beyond economic difficulties that may be exacerbated by the pandemic, living conditions of adolescents from families with lower SES may be less well suited for coping with COVID-19 measures than those of adolescents from families with higher SES. For example, adolescents with lower SES family backgrounds are less likely to have their own bedroom, a garden to spend time in, and their Internet connection and availability of electronic devices may be more limited. The foregoing is particularly troublesome considering the robust body of evidence showing that adolescents from lower SES families–regardless of COVID-19–face more financial stress and family conflicts (e.g., Conger et al., 2010). They also have fewer personal and social resources (e.g., self-esteem, social support; Heberle & Carter, 2015) than adolescents from higher SES families to cope with the challenges associated with COVID-19 measures. Thus, COVID-19 measures may most strongly affect the mental health of adolescents from lower SES backgrounds.

This hypothesis is corroborated by some empirical research, although this research did not include several phases of COVID-19 and compared this to a pre-COVID-19 assessment. Ravens-Sieberer and colleagues (2021) showed that especially for German adolescents from low SES families, scores on diverse mental health problems were higher during the initial COVID-19 phase than in a different but comparable pre-COVID-19 cohort (Ravens-Sieberer, Kaman, Erhart, Devine, et al., 2021). Also, increases in mental health problems between the initial and prevailing COVID-19 phase were stronger for German adolescents from low than high SES families (Ravens-Sieberer, Kaman, Erhart, Otto, et al., 2021). In the UK, one study found that increases in mental health problems between pre-COVID and the initial COVID-19 phase were relatively strong among adolescents from families with lower SES (Hu & Qian, 2021). Finally, in the US, Breaux et al. (2021) found that increases in inattention problems from pre-COVID-19 to the initial COVID-19 phase were especially pronounced for adolescents from families with lower income. However, oppositional/defiant symptoms increased for adolescents from higher income families.

1.4 | This study

This prospective, longitudinal study sought to investigate changes in adolescent mental health between fall 2019 (pre-COVID-19), spring 2020 (initial COVID-19-phase), and fall 2020 (prevailing COVID-19-phase) in the Netherlands. It used different indicators of mental health, including life satisfaction, emotional problems, peer relationship problems, conduct problems, and hyperactivity-inattention

problems. Crucially, it examined whether family SES exacerbated changes in adolescent mental health over time. In the Netherlands, a first lockdown was imposed between March and June 2020, with a closure of schools, cafés, restaurants, sport, and cultural facilities (while shops remained open), a restriction of social contacts, and a strong recommendation to work from home if possible. After June 2020, measures were relaxed gradually until October 2020, when the country went into a second lockdown. At this stage, first, cafés and restaurants were closed followed by a stricter lockdown at the beginning of December 2020 when the measures as in spring 2020 were implemented and, in addition, all non-essential shops were closed. In line with theoretical notions and (part of the) empirical evidence, we expected lower adolescent mental health during COVID-19 than pre-COVID-19. Also, we expected that the level of adolescent mental health would be different in the initial than in the prevailing COVID-19-phase, although we did not hypothesize a direction. Finally, we expected the impact of COVID-19 on adolescent mental health to be more pronounced in adolescents from lower compared to higher SES families.

2 | METHOD

2.1 | Participants and procedure

We used data from the Youth Got Talent project, an ongoing longitudinal study on adolescent wellbeing. Adolescents in this study (aged 16+) attended classes (k = 72) in three vocational schools in Utrecht and participated in training in fields such as creative, technical, and health education. Utrecht is one of the largest cities in the Netherlands. In total, 1429 adolescents filled out a questionnaire at least once out of three occasions: the first measurement took place pre-COVID-19 in October 2019–January 2020 (T1, n = 1231); the second measurement took place during the first lockdown in the Netherlands, roughly 6 months later in May-June 2020 (T2, n = 830); and the third measurement took place during a second lockdown, roughly 1 year later in November 2020–January 2021 (T3, n = 576). At T1, 1519 students could have been included in the study, while 81% of them participated (n = 1231). Most of this non-participation was related to sickness/classroom absence (15%), and only 4% of the non-participation was due to refusal or invalid responses.

About a quarter of the adolescents (n = 386) participated at all three time-points. Attrition was partly due to entire classes dropping out: Roughly a quarter of the classes that participated at T1 did not participate at T2. Nearly half of the classes that participated at T1 did not participate at T3. On the class level, dropping out was mainly due to teachers either not responding to our repeated emails or refusing their students' research participation during their lessons for instance because they felt that managing the curriculum in times of COVID-19 did not allow for spending time on other activities. Within classes that did participate, adolescent response rate was adequate: Over 65% of the adolescents participated at T2 and 60% at T3. About 15% of the non-responding adolescents dropped out of school before T2 and 20% dropped out before T3.

Researchers administrated self-report questionnaires in the classroom (T1) or during online lessons (T2 and T3) and these took about 20–30 min to complete. Adolescents gave active consent and were informed that data would be anonymised. Ethical approval was gained from the Ethics Assessment Committee of the of the Faculty of Social Sciences at Utrecht University (FETC18-070) in 2018 and updated in 2020. The mean age of all participants was 17.9 years at T1 (SD = 1.95), with 57% female. At T1, 25% of the participants came from low, 44% from medium, and 31% from high SES families. Almost a quarter of the participants had an immigration background (24%). Students at vocational schools in the Netherlands are divided into four tracks based on the extent of theoretical compared to practical instruction (with level 4 as the highest educational level). In this study, 26% of the students were in level 2 or 3, and 74% in level 4.

Demographic characteristics of adolescents who participated at all three time-points (n = 386) were compared to those of adolescents who did not participate in all waves (n = 1043). Adolescents who participated in all waves were younger (Mage = 17.4 vs. Mage = 18.0), less often had an immigration background (16% vs. 29%), were more likely to be in the high family SES group (38% vs. 28%), and less likely to be in the low family SES group (18% vs. 28%) than those who did not participate in all waves. Also, 91% of the adolescents who participated in all time-points were enroled in level 4 education, this was true for 67% of those who did not participate in all waves. Adolescents who participated in all waves reported fewer conduct problems at T1 (M = 0.81 vs. 1.00), but there were no differences between those who did not participate in all waves and those who did for T1 life satisfaction, emotional problems, hyperactivity-inattention problems, or peer relationship problems. When comparing adolescents who participated at all three waves (n = 386) with adolescents who only participated at T1 (n = 461) and adolescents who participated at T1 and T2 (n = 311), highly similar differences in demographic characteristics were found. Except for conduct problems, no differences in the mental health indicators were revealed across the groups.

2.2 | Measures

Mental health. Adolescents filled in the Dutch translation of the problem scales of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), consisting of four subscales measuring mental health problems (emotional symptoms, peer relationship problems, conduct problems, and hyperactivity-inattention problems). Sample items from these respective scales are: 'I worry a lot', 'other young people pick on me or bully me', 'I get very angry and often lose my temper' and 'I am easily distracted, I find it difficult to concentrate'. Each subscale includes five ordinal items with answer categories: 'Not true' = 0, 'Somewhat true' = 1; 'Certainly true' = 2. The present study used a revised version of the SDQ (i.e., the SDQ-R, consisting of 15 items), in which the five reverse worded items of

the problem scales of the original self-report SDQ were excluded. The decision to use the SDQ-R was based on previous studies among Dutch adolescents in which confirmatory factor analyses showed that the SDQ-R showed a better fit to the data than the original SDQ (Duinhof et al., 2019, 2020). In the SDQ-R subscale hyperactivity-inattention problems, one item tapped into the inattention problems and two into hyperactivity problems. In this study, two subscales, emotional symptoms (T1: ordinal α = 0.82, T2: ordinal α = 0.82, T3: ordinal α = 0.84) and hyperactivity–inattention problems (T1: ordinal α = 0.79, T2: ordinal α = 0.80, T3: ordinal α = 0.81) had good internal consistency (Gadermann et al., 2012). Internal consistency levels for the conduct problems (T1: ordinal α = 0.58, T2: ordinal α = 0.71, T3: ordinal α = 0.67) and peer problems (T1: ordinal α = 0.53, T2: ordinal α = 0.51, T3: ordinal α = 0.59) subscales were less adequate, in line with former research (Duinhof et al., 2019).'

Life satisfaction was measured using the Cantril Ladder, an 11-point ladder with steps for reporting how participants feel about their life (0 = worst possible life to 10 = best possible life). The Cantril Ladder is easily understood and has shown high reliability among adolescents (Levin & Currie, 2014).

Family SES. Because 94% of the participants enroled in this study were still living with (one of) their parents, the 6-item *Family Affluence Scale* (FAS-III) was used to assess family material SES. This instrument, which was assessed at T1 consists of six items about family material assets: number of car(s)/van(s), own bedroom, number of holiday(s) abroad, number of computer(s), dishwasher, and bathroom(s) (Torsheim et al., 2016). The FAS is a reliable and valid instrument and shows consistent relations with other SES indicators, such as self-reported parental occupation (Torsheim et al., 2016). We computed a total FAS score by summing up the individual items for each participant and divided all participants into three groups, low (FAS $\leq$7), medium (7 < FAS $\leq$9), or high (FAS >9; see Duinhof et al., 2020).

Demographic information. Several variables (as assessed at T1, or T2/T3 if the student did not participate at T1) were added to the analyses to account for demographic differences within the sample. Participants reported their gender (0 = female, 1 = male) and age. In addition, we included immigration background in our analyses. Immigration background was based on the birth countries of participants' parents. We distinguished between adolescents with two native Dutch parents (0) and adolescents with at least one non-native parent (1).

2.3 | Analytic strategy

Using a latent growth curve model for all indicators of adolescent mental health separately (i.e., life satisfaction, emotional problems, peer relationship problems, conduct problems, and hyperactivity-inattention problems), we estimated the average score of the mental health indicator at T1 (i.e., intercept) as well as their average trajectory over time (i.e., slope; Curran et al., 2014). We tested both linear and nonlinear trajectories. For the latter, we assessed latent basis models given that examination of a quadratic change was not possible using three study waves (see Li et al., 2020 for a similar example). That is, we coded the factor loadings of T1 and T2 as 0 and 1, respectively, while freely estimating the loading of T3 (Burant, 2016; Grimm et al., 2011). Because of this free estimation, our latent basis growth curve model could reveal the shape of the change of the observed data. We compared the fit statistics of the linear and latent basis models to select the best model. Next, we investigated the associations between intercepts and slopes to test whether the level at the first study wave is a predictor of change over time. Effects of the control variables (age, gender, and immigration background) on both intercepts and slopes were included in all models. Age was centred on its mean. Gender and immigration background were half effect coded (female = −0.5 and male = 0.5; non-immigrant = −0.5 and immigrant = 0.5).

Next, using the best model selected in the previous step, multigroup analyses were conducted to investigate whether the intercept and the slope varied across adolescents from families with low, medium, and high SES. We compared the model fit of a model in which the intercepts and slopes were set equal across SES groups (i.e., the constrained multigroup model) with the model fit of a model in which the intercepts and slopes were allowed to vary across SES groups (i.e., the unconstrained multigroup model) to select the best fitting model. If we selected the unconstrained model, varying intercepts and slopes for each SES group were reported and Wald tests were conducted to compare them.

We evaluated the chi-square difference test in our comparisons, and selected the more parsimonious model in case of equalities between models. We also checked the Comparative Fit Index (CFI >0.95) and Root Mean Square Error of Approximation (RMSEA <0.05) levels in the examination of model fit. We used full information maximum likelihood estimation with robust standard errors in Mplus Version 8 (Muthén & Muthén, 1998), which deals with missing data even in studies, like ours, with large proportions of missing data (Johnson & Young, 2011).

3 | RESULTS

3.1 | Descriptive statistics

Correlations and descriptive statistics at T1, T2, and T3 for all study variables (except family SES) are displayed in Table 1. Overall, older adolescents reported lower life satisfaction and more peer problems, boys reported higher life satisfaction, fewer emotional problems, and more conduct problems than girls, and adolescents with an immigration background reported lower levels of emotional problems and fewer hyperactivity-inattention problems than adolescents without (at T1 only). Higher life satisfaction was associated with lower levels of all other indicators of mental health problems, which were all positively associated with each other.

TABLE 1 Descriptive Statistics (Means, Standard Deviations, Ranges, ns and Correlations) for Study Variables

		1	2	3	4	5	6	7	8	Mean	*SD*	Range	*n*
	1. Age									17.85	1.95	15–30	1423
	2. Gender[a]	0.04										0–1	1427
	3. Migration background[b]	0.16 **	−0.03									0–1	1377
	4. Education level[c]	−0.20 **	0.04	−0.18 **								0–1	1428
						T1							
T1	5. Life satisfaction	−0.08 **	0.09 **	0.03	−0.07 *					7.08	1.58	0–10	1195
	6. Emotional symptoms	0.04	−0.29 **	−0.11 **	0.11 **	−0.51 **				3.08	2.53	0–10	1192
	7. Peer relationships problems	0.14 **	−0.03	0.00	−0.01	−0.29 **	0.36 **			2.61	1.94	0–10	1192
	8. Conduct problems	0.04	0.09 **	−0.01	−0.02	−0.18 **	0.25 **	0.21 **		0.94	1.35	0–10	1191
	9. Hyperactivity-inattention problems	−0.06 *	−0.02	−0.13 **	0.13 **	−0.23 **	0.32 **	0.11 **	0.28 **	4.46	3.02	0–10	1193
						T2							
T2	5. Life satisfaction	−0.05	0.10 **	−0.09 *	0.00					6.94	1.43	0–10	806
	6. Emotional symptoms	0.01	−0.32 **	−0.02	0.06	−0.50 **				3.54	2.55	0–10	805
	7. Peer relationships problems	0.10 **	−0.05	0.01	−0.02	−0.24 **	0.31 **			2.84	1.96	0–10	806
	8. Conduct problems	0.05	0.03	0.10 **	0.00	−0.24 **	0.27 **	0.24 **		1.03	1.49	0–10	806
	9. Hyperactivity-inattention problems	−0.07	−0.03	−0.07	0.01	−0.20 **	0.33 **	0.07 *	0.29 **	5.07	3.04	0–10	806
						T3							
T3	5. Life satisfaction	−0.09 *	0.15 **	−0.07	0.01					6.70	1.51	1–10	559
	6. Emotional symptoms	0.02	−0.36 **	0.00	0.01	−0.50 **				3.67	2.66	0–10	558
	7. Peer relationships problems	0.13 **	−0.04	0.07	−0.15 **	−0.21 **	0.33 **			2.72	1.93	0–10	558
	8. Conduct problems	0.06	0.09 *	0.10 *	−0.01	−0.14 **	0.25 **	0.24 **		1.06	1.43	0–7.5	558
	9. Hyperactivity-inattention problems	−0.07	−0.06	−0.02	0.06	−0.21 **	0.35 **	0.05	0.22 **	5.41	3.01	0–10	559

Note: Correlations between main study variables are shown per time-point.

[a]Reference category: girl.

[b]Reference category: Dutch.

[c]Reference category: level 2 or level 3.

*$p < 0.05$. **$p < 0.01$.

3.2 | Changes in life satisfaction

We conducted both linear and latent basis growth curve models, including the control variables (age, gender, and immigration background), and examined their fit statistics (see Table 2). The chi-square difference test was non-significant, and therefore the model with more degrees of freedom (that is the linear growth curve model), was selected as the best fitting model. The linear growth curve model's fit indices were excellent. The slope of this model indicated a significant decrease in life satisfaction across the three study waves ($b = -0.17$, $SE\ b = 0.04$, $p < 0.001$; T1: $M = 7.06$; T2: $M = 6.90$; T3: $M = 6.74$). The intercept was not related to the slope ($b = -0.08$, $SE\ b = 0.12$, $p = 0.469$), indicating that the average trajectory in life satisfaction did not depend on the level of life satisfaction at T1. Age, gender, and immigration background did not significantly affect the slope (age: $b = 0.03$, $SE\ b = 0.02$, $p = 0.227$; gender: $b = -0.01$, $SE\ b = 0.06$, $p = 0.891$; immigration background: $b = 0.03$, $SE\ b = 0.08$, $p = 0.707$).

Next, multigroup analyses were conducted to investigate whether the intercept and slope varied across family SES. Comparing a constrained model (i.e., a model in which intercepts and slopes were set equal across groups) and an unconstrained model (i.e., a model where the intercepts and slopes were allowed to vary across SES groups), results showed a significant chi-square difference test and therefore a better fit for the unconstrained model (see Table 2). In

TABLE 2 Fit indices for the linear and latent basis growth models, and the constrained and unconstrained multigroup models

	Linear growth model			Latent basis growth model				
Variable	**BIC**	**CFI**	**RMSEA**	**BIC**	**CFI**	**RMSEA**	**$\Delta\chi^2$ (df)**	***p***
Life satisfaction	8725.718	0.995	0.021	8731.864	0.994	0.026	1.217 (1)	0.350
Emotional problems	10,890.875	0.996	0.027	10,892.816	1.000	0.000	0.894 (1)	0.015
Peer relationships problems	10,101.272	0.994	0.022	10,103.176	1.000	0.000	1.040 (1)	0.024
Conduct problems	8426.715	0.991	0.017	8432.837	1.000	0.000	1.886 (2)	0.111
Hyperactivity-inattention problems	11,907.598	0.999	0.011	11,912.160	1.000	0.000	1.047 (1)	0.112
	Constrained multigroup model			**Unconstrained multigroup model**				
	BIC	**CFI**	**RMSEA**	**BIC**	**CFI**	**RMSEA**	**$\Delta\chi^2$ (df)**	***p***
Life satisfaction	8363.465	0.985	0.031	8379.468	1.000	0.000	1.136 (4)	0.029
Emotional problems	10,443.307	0.996	0.025	10,467.239	0.996	0.027	0.995 (4)	0.327
Peer relationships problems	9676.683	0.999	0.007	9702.686	0.992	0.023	1.319 (4)	0.749
Conduct problems	7993.242	0.982	0.024	8016.908	0.984	0.026	1.111 (4)	0.356
Hyperactivity-inattention problems	11,401.502	0.974	0.053	11,412.700	0.989	0.038	1.088 (4)	0.003

Note: In the constrained multigroup models, intercepts and slopes were set equal across SES groups. Effects of the control variables age, gender, and migration background, on the intercepts and slopes were included in all models. Variances of some slopes were set to zero: for life satisfaction in the low SES group, for conduct problems in the linear model for the whole sample, for hyperactivity-inattention problems in the low SES group, and for peer problems in the low and medium SES group. Chi-square difference tests ($\Delta\chi^2$) are conducted using the scaling correction factors for maximum likelihood estimation models with robust standard errors (MLR; Muthén & Muthén, 1998).

Abbreviations: $\Delta\chi^2$, Chi-square difference test; BIC, Bayesian Information Criterion; CFI, Comparative Fit Index; df, degrees of freedom; RMSEA, Root Mean Square Error of Approximation.

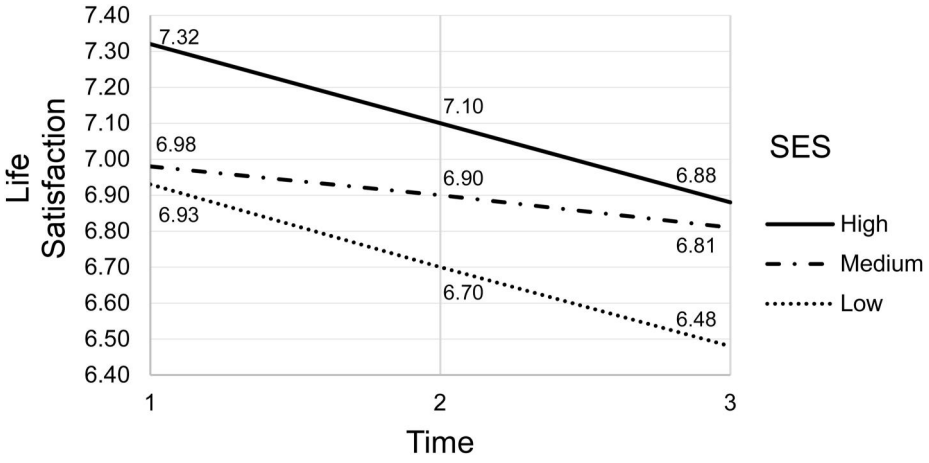

FIGURE 1 Trajectories of Life satisfaction across socioeconomic status (SES) Groups. Estimated means for the latent variables in each SES group are derived from the models with control variables

Figure 1, the estimated means in the three waves for the three SES groups are reported. Intercepts and slopes across the three SES groups were compared using Wald tests. Results revealed that the intercept of life satisfaction was significantly higher in the high SES group ($M = 7.35$) than in the other two groups ($M = 6.97$ for low SES; $M = 7.03$ for medium SES; Wald for low vs. high SES = 5.57, $df = 1$, $p = 0.018$; Wald for medium vs. high SES = 4.25, $df = 1$, $p = 0.039$). There was no difference between low and medium SES groups regarding life satisfaction at T1 (Wald = 0.24, $df = 1$, $p = 0.627$).

Regarding the average trajectories over time, slopes were significant and negative for the low and the high SES groups (Low SES: $b = -0.23$, $SE\ b = 0.06$, $p < 0.001$; High SES: $b = -0.28$, $SE\ b = 0.09$, $p = 0.002$), but non-significant for the medium SES group ($b = -0.08$, $SE\ b = 0.06$, $p = 0.220$). These findings suggest that there was a linear decrease in life satisfaction for the low and high SES groups, but that life satisfaction was stable for the medium SES group. Results of the Wald tests, however, revealed that the slopes in the three groups were not significantly different (low vs. high SES: Wald = 0.20, $df = 1$,

$p = 0.657$; medium vs. low SES: Wald = 3.26, $df = 1$, $p = 0.071$, medium vs. high SES, Wald = 3.34, $df = 1$, $p = 0.067$).

3.3 | Changes in emotional problems

We selected the latent basis model as the best model (see Table 2). This model with a significant slope ($b = 0.42$, $SE\ b = 0.08$, $p < 0.001$) and an estimated factor loading of 1.22 for T3, indicated a nonlinear change in emotional problems across study waves. A stronger increase was found between T1 and T2 than between T2 and T3 (means were 3.12 at T1, 3.48 at T2, and 3.56 at T3). The intercept was not significantly associated with the slope ($b = -0.81$, $SE\ b = 1.45$, $p = 0.576$). The slope of emotional problems was not significantly affected by age, gender, or immigration background (age: $b = -0.04$, $SE\ b = 0.03$, $p = 0.196$; gender: $b = -0.16$, $SE\ b = 0.12$, $p = 0.180$; immigration background: $b = 0.30$, $SE\ b = 0.16$, $p = 0.061$). Comparing models that either constrained or did not constrain the intercept and slopes across family SES showed that the constrained model fits the data better (Table 2). Thus, results indicated that the intercept and slope for emotional problems did not vary across SES groups.

3.4 | Changes in peer relationship problems

Similar to emotional problems, the latent basis growth curve model showed a better fit to the data than the linear growth curve model (Table 2). This nonlinear model had a significant slope ($b = 0.24$, $SE\ b = 0.08$, $p = 0.001$), and an estimated factor loading of T3 of 0.83. Estimated means suggested a slight increase between T1 and T2, and stability between T2 and T3 (T1: $M = 2.60$; T2: $M = 2.84$; T3: $M = 2.80$). Intercept and slope were not significantly associated ($b = -0.18$, $SE\ b = 1.06$, $p = 0.868$), and neither were the slope and age ($b = -0.06$, $SE\ b = 0.04$, $p = 0.189$), gender ($b = 0.03$, $SE\ b = 0.13$, $p = 0.851$), or immigration background ($b = 0.04$, $SE\ b = 0.16$, $p = 0.820$). As compared to the unconstrained multigroup model, the constrained multigroup model showed a better fit to the data (Table 2). Results thus indicated that intercepts and slopes were similar across SES groups.

3.5 | Changes in conduct problems

For conduct problems, a better fit to the data was found for the linear than for the latent basis growth curve model (Table 2). Results indicated a linear increase in conduct problems across three study waves ($b = 0.12$, $SE\ b = 0.04$, $p = 0.001$; T1: $M = 0.96$; T2: $M = 1.05$; T3: $M = 1.13$). The association between slope and intercept could not be tested because the variance of the slope was set to zero. Slopes were not significantly affected by age or gender (age: $b = 0.01$, $SE\ b = 0.02$, $p = 0.477$; gender: $b = -0.03$, $SE\ b = 0.05$, $p = 0.578$), but the slope was associated with immigration background ($b = 0.16$, $SE\ b = 0.08$, $p = 0.035$). In the multigroup analyses, the constrained model showed a better fit to the data than the unconstrained model (Table 2). This result suggests that the intercept and slope for conduct problems did not vary across SES groups.

3.6 | Changes in hyperactivity-inattention problems

Finally, for hyperactivity-inattention problems, comparison of models showed a better fit to the data for the linear model (Table 2). A significant linear increase in hyperactivity-inattention problems was found across study waves ($b = 0.40$, $SE\ b = 0.07$, $p < 0.001$; T1: $M = 4.52$; T2: $M = 4.92$; T3: $M = 5.31$), and the average slope did not vary with the level of hyperactivity-inattention problems at T1 ($b = -0.12$, $SE\ b = 0.30$, $p = 0.685$). Also, the slopes were not affected by age, gender, or immigration background (age: $b = 0.01$, $SE\ b = 0.03$, $p = 0.746$; gender: $b = 0.05$, $SE\ b = 0.10$, $p = 0.657$; immigration background: $b = 0.01$, $SE\ b = 0.15$, $p = 0.957$).

The comparison of the unconstrained and constrained multigroup models revealed a better fit to the data for the unconstrained model (Table 2). The estimated means in the three waves for the three SES groups are displayed in Figure 2. Wald tests indicated significantly lower mean levels of hyperactivity-inattention problems at T1 for the low SES group ($M = 3.81$) as compared to the medium SES group ($M = 4.39$; Wald = 6.35, df = 1, $p = 0.011$) and as compared to the high SES group ($M = 4.72$; Wald = 11.13, df = 1, $p < 0.001$), while no differences were found between the medium and high SES groups (Wald = 1.60, df = 1, $p = 0.205$). Slopes were significant for the low SES group ($b = 0.63$, $SE\ b = 0.13$, $p < 0.001$) and the high SES group ($b = 0.29$, $SE\ b = 0.14$, $p = 0.035$), but not for the medium SES group ($b = 0.18$, $SE\ b = 0.12$, $p = 0.126$). Slopes were significantly different for the low versus medium SES group (Wald = 6.43, $df = 1$, $p = 0.011$), and nonsignificant for the low versus high SES group (Wald = 3.38, $df = 1$, $p = 0.066$) and the medium versus high SES group (Wald = 0.32, $df = 1$, $p = 0.572$). Given the similar hyperactivity-inattention problems across the three SES groups at T3 (see Figure 2), we re-ran our multigroup analysis by coding time as −2, −1, and 0. That is, we defined T3 as the intercept and assessed the differences between each SES group's intercepts using Wald tests. Results revealed that average hyperactivity-inattention levels at T3 were not significantly different from each other across SES groups (Walds = 0.31–1.92, df = 1, $ps = 0.166$ –0.576).

4 | DISCUSSION

To our knowledge, this prospective, longitudinal study was one of the first to investigate socioeconomic disparities in changes in adolescent mental health between fall 2019 (pre-COVID-19), spring 2020 (initial COVID-19 phase), and fall 2020 (prevailing COVID-19 phase). Our results showed a small but significant increase in emotional problems, peer relationship problems, conduct problems, and

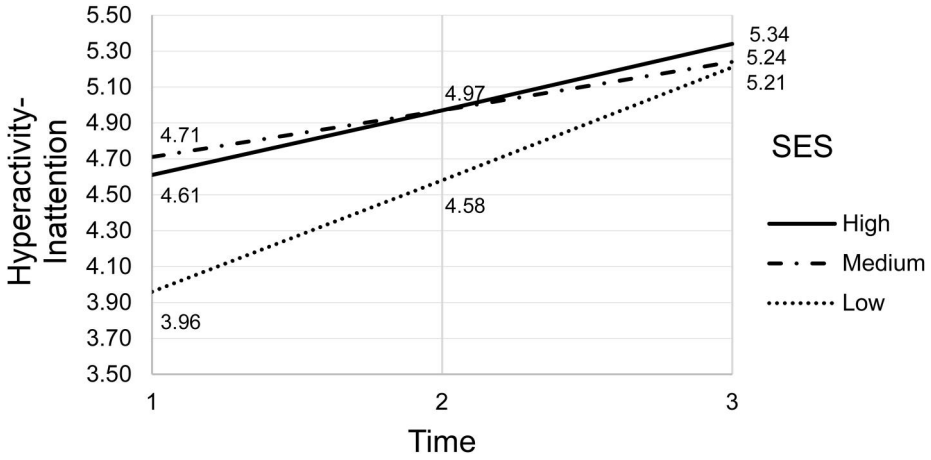

FIGURE 2 Trajectories of Hyperactivity-inattention problems across socioeconomic status (SES) groups. Estimated means for the latent variables in each SES group are derived from the models with control variables

hyperactivity-inattention problems over the course of the study. Also, a decrease in adolescent life satisfaction was found. Providing some support for the mobilization hypothesis, increases in emotional problems and peer relationship problems between pre-COVID-19 and the initial COVID-19 phase were more pronounced than increases between the initial and prevailing COVID-19 phase. We even found stable levels of peer relationship problems between the initial and prevailing COVID-19 phase. In contrast, linear decreases in life satisfaction and linear increases in conduct problems and hyperactivity-inattention problems were found over the course of the study, which supports the curtailment hypothesis. Mental health patterns were hardly associated with the SES of the family and the pre-COVID-19 level of mental health, neither did they vary as a function of age, gender, or immigration background.

Notwithstanding the fact that changes in mental health overall were small, they are important. Our study covered a broad range of mental health indicators and decreases were found for all five of them (that is decreases in life satisfaction and increases in mental health problems were found). Additionally, the observed changes in mental health were neither qualified by the level of mental health pre-COVID-19, nor age, gender, or immigration background, further supporting their robustness. As such, these results provide some support for the notion that COVID-19 hampers adolescent mental health in general. COVID-19 measures reduced social interactions for adolescents, obliged them to study from home for considerable periods of time, and more generally limited possibilities to go out and have fun. Therefore, these measures may have impacted young people's ability to fulfil their needs for competence, autonomy, and relatedness (Ryan & Deci, 2000) and, in turn, their mental health. Our findings are in line with the majority of previous studies that revealed a decline in adolescent mental health when comparing a pre-COVID-19 assessment with one assessment during the COVID-19 pandemic (Breaux et al., 2021; Chen et al., 2021; De France et al., 2021; Gadassi Polack et al., 2021; Lee et al., 2020; Magson et al., 2021; Munasinghe et al., 2020; Rogers et al., 2021; Thorisdottir et al., 2021).

Throughout the course of the study, linear decreases were found for life satisfaction and linear increases for conduct problems and hyperactivity-inattention problems. These findings suggest that the longer COVID-19 measures last, the more the mental health of adolescents may suffer. For emotional problems and peer relationship problems, increases between pre-COVID-19 and the initial COVID-19 phase were more pronounced than increases between the initial and prevailing COVID-19 phase. All results are inconsistent with the hypothesis that the novelty of the lockdown protected adolescents from its negative consequences during the initial COVID-19-phase. Possibly, the novelty disappeared within (a couple of) week(s). It is also possible that the benefits of the COVID-19 measures, such as not having to go to school or spending extra time with the family (Tang et al., 2021), did not outweigh their costs, such as not being able to meet friends, going to school, visiting clubs and festivals, or engaging in team sports, especially as COVID-19 measures continued to be implemented. The patterns of emotional problems and peer relationship problems seem compatible with the suggestion that adolescents mobilized at least some social, cognitive, and emotional resources during the initial COVID-19-phase (e.g., Taylor, 1991). This mobilization of resources may have enabled them to slow down the mental health deterioration during the prevailing COVID-19-phase. An alternative explanation might be that the COVID-19 measures were slightly less invasive in the prevailing COVID-19-phase, than in the initial COVID-19-phase.

We can only speculate about why we found less pronounced increases in mental health problems between the initial and prevailing COVID-19-phase than between the pre-COVID-19 and the initial COVID-19-phase for emotional problems and peer relationship problems, while we found linear increases in conduct problems and hyperactivity-inattention problems and linear decreases in life satisfaction across the same period. Following the line of reasoning from the previous paragraph, adolescents might particularly have mobilized resources that prevented further increases in peer relationship problems and emotional problems. For instance, after dealing with the COVID-19 pandemic for more than half a year,

cognitive resources might have prevented adolescents from (stronger) increases in anxiety and sadness, and as such in emotional problems. In contrast, COVID-19 measures such as the closure of cafés, restaurants, sports and cultural facilities during many months in 2020, might have continuously affected how satisfied adolescents were with their lives. Future studies should test the robustness of our findings across different indicators of mental health and ideally even extend them to post-COVID-19 phases.

Contrary to our expectations, we hardly found evidence for the notion that the impact of COVID-19 measures on adolescent mental health is most pronounced for adolescents from lower SES families. Instead, the results indicate that the impact of COVID-19 on adolescent mental health is comparable across SES groups. It is possible that our findings are particular to the Dutch context, and as such contrast studies conducted in the UK and in Germany (Hu & Qian, 2021; Ravens-Sieberer, Kaman, Erhart, Devine, et al., 2021; Ravens-Sieberer, Kaman, Erhart, Otto, et al., 2021). The decision of the Dutch government to financially support employers, for example, may have contributed to the remarkably low number of unemployed in fall 2020 (4%; Statistics Netherlands, CBS, 2020). Considering the overrepresentation of people from lower SES groups in temporary, low wage jobs (Frasquilho et al., 2016), and in sectors most strongly hit by the lockdowns (Blundell et al., 2020), this economic intervention may have reduced stress particularly in families with lower SES. Additionally, in general socioeconomic disparities in adolescent mental health are rather modest in the Netherlands when compared to other European countries (Inchley et al., 2020). This might imply that the risks for mental health associated with families' SES (Conger et al., 2010) among adolescents in the Netherlands is relatively mild. Alternatively, it has been suggested that some exposure to adversity often associated with low SES backgrounds (e.g., disadvantaged housing, parental divorce) may foster subsequent resilience (Seery et al., 2010). For example, stressful events, such as school lockdowns, may offer some adolescents the opportunity for growth by mobilising coping resources that they did not know they had, thereby increasing their confidence that they can surmount stress and master stressful situations (Updegraff & Taylor, 2000).

Only for hyperactivity-inattention problems, patterns differed between adolescents from low and from medium SES families. That is, adolescents from low SES families reported lower pre-COVID-19 levels of hyperactivity-inattention problems than adolescents from medium SES families. However, for these adolescents increases in hyperactivity-inattention problems were found between pre-COVID-19 and the prevailing COVID-19-phase, while for adolescents from medium SES families no changes in hyperactivity-inattention problems were found in the same period. As a result, in the prevailing phase of the COVID-19 pandemic, no differences in hyperactivity-inattention problems between adolescents from low and from medium SES families were found. These differences in patterns of hyperactivity-inattention problems between adolescents from low and medium SES families, might have been explained by the fact that the former group of adolescents is more likely to grow up in smaller houses than the latter. A lower likelihood of having a private place at home among adolescents from low SES families may have hampered adequate participation in online education and/or an adequate execution of schoolwork when working at the educational institution was impossible. In turn, this situation may have led to experiences of loss of concentration and/or feelings of distraction among adolescents from low SES families, and may have explained the increases in hyperactivity-inattention problems among adolescents from low SES families between pre-COVID-19 and the prevailing COVID-19-phase. Alternatively, as the pre-COVID-19 level of hyperactivity-inattention problems was relatively low among adolescents from low SES families (which is in line with other Dutch studies, see Weinberg et al., 2019), an increase in these problems may also have been more likely.

This study had several strengths. Its longitudinal, prospective design included three data collections, one prior to COVID-19 and two during COVID-19 measures, including the initial and the prevailing COVID-19 phases. Additionally, we made use of a relatively diverse school-based sample and assessed several indicators of mental health. The current study also has several limitations that should be addressed in future research. First, we cannot conclude that changes in mental health reported here were only driven by the pandemic. Other time trends, such as ageing, school schedules, or seasons, may also have played a role. Particularly, between fall 2019 and fall 2020, adolescents included in our sample have not only been confronted with the pandemic, but they also became one year older (on average from 17.9 to 18.9 years). Previous research indicates that the peak in the age of onset of mental health problems is around 14.5 years and this onset decreases considerably afterwards (Solmi et al., 2021). This suggests that the differences in mental health problems across this period of time may only be partly explained by ageing effects. Even more importantly, the consistent decrease we observed for all mental health indicators and in various subgroups suggests that COVID-19, and the measures taken to address it, play an important part in these findings.

Second, although we assessed students from tertiary vocational education in the (online) classroom to include a diverse and large sample of adolescents, almost 20% percent of the students enroled in these classes at T1 did not participate. Also, attrition across timepoints was sizeable. Partly, this attrition was due to entire classes dropping out of the study because of COVID-19-related circumstances. Nevertheless, individual drop-out was considerable and selective with regard to age, education level, family SES, and immigration background. Still, adolescents who participated in all waves hardly differed in levels of mental health when compared to those who participated in one or two waves. Also, our results showed that mental health patterns did not vary as a function of pre-COVID level of mental health, which might also indicate that potential effects of attrition were limited. Third, our sample might be considered as rather specific as it included students from tertiary vocational schools in one city in the Netherlands, which may limit the generalisability of our findings to other populations. Fourth, mean levels of mental health problems in the sample were fairly low and internal

consistencies of the subscales peer problems and conduct problems were considerably lower than these for emotional problems and hyperactivity-inattention problems. Nevertheless, the SDQ showed generally adequate psychometric properties across a wide age range (Brann et al., 2018; Van Roy et al., 2008), indicating that it is appropriate to assess mental health in the present sample. Finally, although this study monitored changes in mental health over an entire year, future studies should examine the long-term effects of the pandemic. Ideally such studies also include post-pandemic measures to paint a more complete picture of the resilience and mental health of adolescents.

In conclusion, this prospective, longitudinal study among adolescent tertiary vocational students in the Netherlands examined mental health changes comparing pre-COVID-19 with the initial and prevailing COVID-19 phase. We found a decrease in life satisfaction and small but significant increases in emotional problems, peer relationship problems, conduct problems, and hyperactivity-inattention problems. The decrease in life satisfaction, and the increases in conduct problems and hyperactivity-inattention problems were linear. For emotional problems and peer relationship problems, the increase was stronger between the pre-COVID-19 and initial COVID-19-phase than between the initial and prevailing COVID-19-phase. The decrease in mental health hardly varied across family SES. Also, in our study, neither demographic variables (age, gender, and immigration background) nor pre-COVID-19 mental health affected changes in mental health.

The COVID-19 pandemic has had a profound effect on societies and citizens around the world. Lockdown restrictions affected individuals in various ways, and some may have been affected more profoundly than others. Our findings suggest small yet widespread increases in mental health problems and a small but significant decrease in life satisfaction. These findings not only draw attention to the need to monitor the longer-lasting effects of mental health problems among adolescents in schools, but also to identify subgroups of adolescents who show resilience in coping with COVID-19 and those who show increased vulnerability to the adversities associated with the pandemic.

AUTHOR CONTRIBUTIONS

Gonneke W.J.M Stevens conceived of the study and the design of the larger study, interpreted analyses and draughted the manuscript; Asuman Buyukcan-Tetik conducted the analyses and critically revised the manuscript; Marlies Maes helped interpreting statistical analyses and critically revised the manuscript; Dominic Weinberg and Sander Vermeulen performed datacollection and critically revised the manuscript; Kirsten Visser participated in the design of the study and critically revised the manuscript; and Catrin Finkenauer conceived of the study and the design of the larger study, interpreted analyses and critically revised the manuscript.

ACKNOWLEDGEMENTS

The authors thank the schools, teachers, and adolescents who participated in the YOUth Got Talent project. This work was supported by funding from Utrecht University's Dynamics of Youth strategic theme and the Faculty of Social and Behavioural Sciences, but the funder played no role in study design, analysis of data, interpretation of results, or writing of the report.

CONFLICTS OF INTEREST

The authors report no conflict of interests.

DATA AVAILABILITY STATEMENT

The datasets generated and/or analysed during the current study are not publicly available but are available from the corresponding author on reasonable request.

ETHICS STATEMENT

Ethical approval was gained from the Ethics Assessment Committee of the Faculty of Social Sciences at Utrecht University (FETC18-070).

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How to cite this article: Stevens, G. W. J. M., Buyukcan-Tetik, A., Maes, M., Weinberg, D., Vermeulen, S., Visser, K., & Finkenauer, C. (2022). Examining socioeconomic disparities in changes in adolescent mental health before and during different phases of the coronavirus disease 2019 pandemic. *Stress and Health*, 1–13. https://doi.org/10.1002/smi.3179