A longitudinal study of mental health in adolescents before and during the COVID-19 pandemic

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ABSTRACT

Objective Although cross-sectional studies have shown that the COVID-19 pandemic has negatively affected the mental health of adolescents, the effect of the pandemic on adolescents with pre-pandemic symptoms is unclear. We therefore tested the hypothesis that adolescents had increased emotional and behavioral problems during the lockdowns imposed during the pandemic.

Method This study included three measurements in a prospective cohort of 1022 adolescents who were oversampled based on their high risk of developing psychopathology. Before the pandemic, we assessed depressive, anxiety, stress, oppositional defiant problems, psychotic experiences and suicidality, using the Youth Self-Report; 445 and 333 of these 1022 adolescents subsequently completed the online questionnaire in the first lockdown (in April 2020) and in the second lockdown (in January 2021), respectively. Multilevel random intercept regression models were used to determine the change in psychiatric symptoms, including an interaction term to assess whether these changes differed based on the severity of symptoms prior to the pandemic.

Results Throughout the pandemic, the majority of adolescents reported having emotional and behavioral symptoms that were within the normal range. Moreover, the mean symptom scores for all six outcomes decreased significantly among adolescents with high clinical severity prior to the pandemic.

Conclusion In contrast to our original hypothesis, the effects of the COVID-19 pandemic may not necessarily be detrimental, at least among a specific subgroup of adolescents with preexisting mental health problems. Moreover, our finding that most adolescents did not report experiencing clinically relevant symptoms during the pandemic reflects their resilience during the pandemic.

INTRODUCTION

The COVID-19 pandemic has had a major impact on public health, the healthcare system, and our daily lives. To avoid rapid spread of the virus, most countries imposed numerous nationwide measures, including social distancing requirements, closing of schools, and severe restrictions regarding socializing, exercise, and leaving the home. Although adolescents are generally not at risk of developing severe COVID-19^{1,2}, the effects of a lockdown may still severely affect adolescents due to the changes imposed on their normal daily routine³⁻⁵. These detrimental effects could even be amplified in adolescents who are at risk of developing psychopathology⁵⁻⁸.

Cross-sectional studies conducted at the start of the pandemic showed that adolescents reported experiencing anxiety, depression, and distress⁹⁻¹¹. These symptoms were reported by parents as well, who also noted behavioral problems in their children and adolescents¹². However, these studies either assessed the adolescents' symptoms using unvalidated questionnaires or did not take into account the adolescents' pre-pandemic levels of emotional and behavioral problems.

Studies that used mental health data collected before the onset of the pandemic have yielded conflicting results. For example, studies that combined data from adult cohorts showed that the presence of preexisting mental symptoms was associated with an increase in both anxiety and depression during the pandemic¹³. In contrast, other cohort studies found that the increase in psychiatric symptoms was limited to adults without pre-pandemic symptoms, while adults with preexisting symptoms did not report an increase in their symptoms during the pandemic¹⁴. In addition, among children and adolescents a psychiatric diagnosis prior to the pandemic was predictive of both improvement and a reduction in depressive, anxiety, and irritability symptoms experienced during the pandemic¹⁵.

Determining the lasting effects of the pandemic, particularly among adolescents, requires a longitudinal approach. However, the longitudinal studies reported to date primarily examined the effects of the first few months of the pandemic. For example, a comparison of two cross-sectional studies in China showed an increase in depression and anxiety from February 2020 to April 2020¹⁶. In adults, a decrease in depression and anxiety was evident in the first few weeks of lockdown¹⁷; in children and adolescents, an immediate decrease in anxiety and depression was reported after the lockdown, although overall symptom levels remained high¹⁸. Finally, other studies found an overall decrease in psychiatric symptoms among children and adolescents^{19,20}.

Importantly, the potential effects of the pandemic on severe psychiatric symptoms such as psychotic experiences and suicidality remain unclear. Although epidemics do not necessarily affect adolescent suicidality⁸, admissions data from hospitals in the United States, Europe, and the Middle East show an increase in self-harm, suicidal ideation, and suicide attempts during the COVID-19 pandemic^{21,22}. In addition, an online survey conducted during the pandemic revealed that 37% of adolescents reported having suicidal ideation²³.

In the Netherlands, the emerging pandemic led the Dutch government to implement far-reaching regulations, including the closing of schools, restaurants, and sports facilities, as well as a strict ban on public

gatherings. To understand the extent to which the COVID-19 pandemic and the related societal changes affected the well-being of adolescents, their mental health status before the start of the pandemic must be taken into consideration. We therefore studied the prevalence of mental health problems in an at-risk cohort before the pandemic and during two nationwide lockdowns in the Netherlands. Specifically, we tested the hypothesis that during the lockdowns imposed during the COVID-19 pandemic, adolescents had higher scores related to anxiety, depression, stress, and oppositional defiance, particularly among adolescents who experienced emotional and behavioral symptoms prior to the pandemic. Furthermore, we hypothesized that suicidality and psychotic experiences increased during the lockdown.

METHODS

This study included two additional online questionnaires (C1 and C2, administered during the first and second nationwide lockdowns in April 2020 and January 2021, respectively) conducted within the iBerry (Investigating Behavioral and Emotional Risk in Rotterdam Youth) Study; the iBerry Study cohort has been described in detail previously²⁴. In short, the iBerry Study is a population-based cohort study of adolescents designed to investigate the transition from subclinical symptoms to a psychiatric disorder. A cohort of high-risk adolescents was selected based on their self-reported emotional and behavioral symptoms experienced in the first year of high school (at 13 years of age). Each adolescent filled out the youth version of the Strengths and Difficulties Questionnaire (SDQ-Y), and adolescents with the highest 15% of scores and a random sample from the lowest 85% of scores were selected^{24,25}. The total cohort consists of 1022 adolescents, oversampled on their emotional and behavioral problems (2.5:1 ratio), showing apparent emotional and behavioral symptoms at 15 years of age²⁴.

A total of 36 adolescents (3.5%) were not invited to complete the initial online measurements because they objected to being approached for follow-up measurements, and an additional 54 adolescents (5.3%) could not be reached in order to obtain an email address and were therefore not included. The first questionnaire (C1) was sent on April 24, 2020, to the participating 932 adolescents during the first lockdown in the Netherlands, after Dutch high schools had been closed to in-class lessons (i.e., all students attended online classes only) for six weeks. The participants were able to complete the questionnaire during the six-week period until several restrictions were lifted and high schools re-opened; 445 adolescents (48%) returned this questionnaire. The second questionnaire (C2) was sent to all adolescents who completed the first questionnaire; this second questionnaire was sent on January 8, 2021, during the second full lockdown in the Netherlands, after schools had been closed to in-class lessons for three weeks, and 333 adolescents (75%) completed the second questionnaire.

Measurements

Demographics

Several sociodemographic characteristics were obtained from the participating adolescents at baseline (i.e., prior to the pandemic), including age, gender, and educational level. One of each adolescent's parents provided data regarding ethnic background, household income, and urbanicity (based on the number of

addresses per km² surrounding their home address ²⁴, with rural, suburban, and urban neighborhoods defined as <1000, 1000–1500, and >1500 addresses/km², respectively).

Emotional and behavioral problems

To measure emotional and behavioral problems in the participating adolescents, we used several subscales of the Youth Self-Report (YSR) from the Achenbach System of Empirically Based Assessment (ASEBA) ²⁶. Specifically, the adolescents completed the following subscales: Depressive problems (12 items), Anxiety problems (9 items), Oppositional defiant problems (5 items), and Stress problems (14 items). We also used the YSR subscales Externalizing problems (32 items) and Internalizing problems (31 items) for supplementary analyses. At baseline participants were instructed to indicate whether each item was “Not true”, “Somewhat or sometimes true”, or “Very true or often true” when referring to problems experienced in the previous six months; for the C1 and C2 measurements, participants were instructed to respond based on problems experienced in the previous week. The YSR has good psychometric properties, including both reliability and validity ²⁷. All scales have norm scores, which were used to determine a borderline cut-off score (>93rd percentile) and a clinical cut-off score (>98th percentile) value based on a Dutch norm group ²⁷; scores above these cut-off values reflect symptoms that are considered to be of concern, indicating clinical relevance. The YSR total problem score at baseline was used to determine problem severity.

Psychotic experiences and suicidality

The sum score of two items (visual hallucinations and auditory hallucinations) in the YSR was used to measure whether the adolescent experienced psychotic symptoms. Similarly, the sum score of three items (self-harm, suicidal ideation, and suicide attempts) in the YSR was used to measure self-reported suicidality.

Statistical analysis

We examined the mean change in depressive problems, anxiety problems, stress problems, oppositional defiant problems, psychotic symptoms, and suicidality measured before the COVID-19 pandemic (baseline) and at C1 and C2. Multilevel random intercept regression models were estimated using a Restricted Maximum Likelihood estimator as implemented in the “lme4” package in R (v. 1.1.23) ²⁸.

A set of three models with increasing complexity was fit to each outcome. The first model included only a random intercept to account for within-individual correlations and a time variable for changes between measurements. The second model included a random intercept in the mixed models in order to compare the changes in outcome scores from baseline to during the COVID-19 pandemic among various symptom severity groups. The interaction term between “time” and “group” indicated whether changes in symptoms differed between severity groups. We also obtained estimated marginal means in order to quantify changes in symptoms by severity group at baseline. Based on these estimated mean changes, we then calculated Cohen’s *d* effect sizes. Significance for these mean changes were determined using post-hoc univariate linear regressions. In the third model, the following four demographic characteristics were added as covariates: age, gender, ethnic background (Dutch or non-Dutch), and urbanicity (rural, suburban, or urban). For each model, variance explained by both the fixed and random effects was obtained using the conditional R² metric ²⁹.

Several supplementary analyses were also performed. We compared complete and incomplete case analyses and changed how baseline problem severity was operationalized in order to test the robustness of the interaction findings. We also used the baseline internalizing problems score for the anxiety, depressive, stress, suicidality, and psychosis outcomes. For oppositional defiant problems, we used the baseline externalizing problems score.

To determine whether missing data were missing at random, we used a univariate analysis to compare the participants who completed the C1 questionnaire with the participants who only completed the baseline questionnaire. For missing covariate data, we performed multiple imputation using the “mice” package in R (v. 3.11.0) ³⁰.

RESULTS

The C1 questionnaire was completed by 445 adolescents, 266 of whom (60%) were female. The majority (85%) of the participants had a Dutch ethnic background, and the mean age at C1 was 17.7 years (SD: 0.67 years) (Table 1). At C1, 31 of the 445 participants (7%) were positive for SARS-CoV-2 (the virus that causes COVID-19), and 138 participants (31%) reported having a relative and/or friend who was positive for SARS-CoV-2.

Between baseline and C1, we observed an increase in depressive problems ($B: 0.93$, 95% CI: [0.43, 1.42]). In contrast, anxiety problems ($B: -0.58$, 95% CI: [-0.94, -0.21]) and psychotic experiences ($B: -0.147$, 95% CI: [-0.23, -0.07]) decreased, whereas stress problems ($B: 0.05$, 95% CI: [-0.48, 0.59]), oppositional defiant problems ($B: 0.30$, 95% CI: [-0.18, 0.24]), and suicidality ($B: -0.05$, 95% CI: [-0.13, 0.03]) were unchanged. Between C1 and C2, depressive problems ($B: 2.20$, 95% CI: [1.71, 2.70]) and stress problems ($B: 0.96$, 95% CI: [0.43, 1.50]) increased, psychotic experiences ($B: -0.13$, 95% CI: [-0.21, -0.05]) decreased, and anxiety problems ($B: -0.03$, 95% CI: [-0.40, 0.34]), oppositional defiant problems ($B: -0.13$, 95% CI: [-0.34, 0.08]), and suicidality ($B: 0.03$, 95% CI: [-0.04, 0.11]) did not change.

Figure 1 visually illustrates the percentage of participants at baseline whose symptoms for anxiety, depressive, oppositional defiant, and stress problems either changed (increased or decreased) or were unchanged from normal, borderline, or clinical at C1, as well as the percentage of participants at C1 whose symptoms either changed or were unchanged at C2. Between baseline and C1, 8.5%, 19.3%, 5.6%, and 11.4% of adolescents had an increase in anxiety, depressive, oppositional defiant, and stress problems, respectively, while 8.5%, 9.9%, 3.8%, and 7.8% of adolescents had a decrease in these subscales, respectively. Between C1 and C2, 10.0%, 20.5%, 2.6%, and 14.7% of adolescents had an increase in anxiety, depressive, oppositional defiant, and stress problems, respectively, while 4.4%, 7.3%, 4.7%, and 5.6% of adolescents had a decrease in these subscales, respectively. All other adolescents were unchanged (i.e., neither increased nor decreased) between baseline and C1 and/or between C1 and C2.

At C1, 88.5%, 74.6%, 93.7%, 85.1% of the adolescents scored in the normal range for anxiety, depressive, oppositional defiant and stress problems, respectively. Similarly, 83.9%, 64.5%, 95.6%, and 76.0% of the adolescents at C2 scored in the normal range for anxiety, depressive, oppositional defiant and stress problems, respectively.

Figure 2 summarizes the estimated mean subscale scores for all outcomes at baseline, C1, and C2, stratified by symptom severity at baseline. Based on the significant interaction of time and group, the change in the outcome scales between baseline and during the COVID-19 pandemic (with the exception of suicidality) differed among the various symptom severity groups at baseline. Supplementary Table S1 summarizes the coefficient estimates for all variables and outcomes. Our analysis showed that adolescents who scored in the clinical range at baseline had the largest decrease in problem scores between baseline and C1 for anxiety problems (Cohen's $d = 0.22$), depressive problems ($d = 0.11$), oppositional defiant problems ($d = 0.12$), stress problems ($d = 0.18$), psychotic symptoms ($d = 0.17$), and suicidality ($d = 0.11$). The scores for these adolescents increased slightly between C1 and C2, albeit with small effect sizes, with Cohen's d values ranging from 0.00 to 0.09. Adolescents who scored in the borderline range at baseline had a similar pattern as those who scored in the clinical range at baseline, although all effect sizes were small, with Cohen's d values ranging from 0.00 to 0.07. Finally, adolescents who scored in the normal range at baseline had an increase in scores between baseline and C1 and again between C1 and C2, but all effect sizes were negligible, with Cohen's d values ranging from 0.00 to 0.04 for all outcomes. The absolute estimated scores and Cohen's d effect sizes for each group and outcome are summarized in Supplementary Table S2. The variance accounted for by the models ranged from 38% for suicidality and psychotic experiences to 60% for stress problems (see Supplementary Table S1).

In supplementary analyses, we observed only minimal changes in our estimates when we discarded incomplete cases rather than imputing the missing data, and when using internalizing problems rather than using total problems. Using externalizing problems rather than total problems for the outcome regarding oppositional defiant problems, however, increased the interaction effects with time. At baseline, the individuals in the clinical severity group for externalizing problems scored higher compared to the individuals in the clinical severity group for total problems (6.16 versus 4.66, respectively); this translated to a larger relative decrease and thus a larger standardized effect (Cohen's $d = 0.51$), explaining the higher estimates of the interaction coefficient. Finally, a comparison between responders and non-responders with respect to the missing data analysis revealed a difference in demographic characteristics, but no difference in symptom severity at baseline (Supplementary Table S3).

DISCUSSION

In this longitudinal study of adolescents, we found a modest overall increase in depressive problems and stress problems during the COVID-19 pandemic. In contrast, we found that anxiety problems, oppositional defiant problems, psychotic experiences, and suicidality were either unchanged or decreased during the pandemic relative to pre-pandemic levels. Most notably, when we took the participants' pre-pandemic mental health into account, we found a decrease in psychiatric symptoms among the adolescents who had more severe emotional and behavioral problems prior to the pandemic.

These findings support different conclusions than most previous studies regarding the effects of the COVID-19 pandemic on mental health, which described an increase in mental health problems among adolescents⁹⁻¹². Importantly, the majority of participating adolescents in our study reported symptoms in the normal range at both time points during the pandemic. Moreover, the cross-sectional studies that reported

negative effects of the pandemic may have been affected by self-selection bias, i.e. an increased selection of participants who were more willing to share their negative experiences during the pandemic.

Due to our observation that symptoms decreased among adolescents with the most severe pre-pandemic symptoms, we can reject our hypothesis that these adolescents were more vulnerable to the COVID-19 pandemic. One possibility to explain this finding is that the restrictive measures may have led to adjustments that improved these adolescents' symptoms, for instance fewer social obligations or smaller differences in experiences compared to less-vulnerable adolescents. Similar results were reported in psychiatric case-control cohort studies involving adults and elderly with depression and anxiety, in which individuals with the highest mental health burden tended to have a slight decrease in symptoms during the pandemic ¹⁴. Similarly, young adolescents with high pre-pandemic symptoms reported a decrease in both internalizing problems and externalizing problems during the pandemic ³¹.

Our results should be interpreted in the context of the situation in the Netherlands ³². In particular, the closure of schools and sports facilities is considered to significantly affect adolescents. On the other hand, the direct effects of COVID-19 on our participants was likely to be limited given the relatively small number of SAR-CoV-2 infections in our study population. Nevertheless, our findings suggest that the COVID-19 pandemic did not increase the participants' symptoms above the clinically relevant threshold, an indication of adolescents' resilience to the adverse effects of the pandemic ^{33,34}.

An important limitation of our study is the possibility of selection bias, as only 36% of our cohort completed both additional measurements (C1 and C2), resulting in relatively small sample sizes in the borderline and clinical severity groups. Although our analysis suggests responding and non-responding participants did not differ with respect to problem severity at baseline, we cannot rule out the possibility that the adolescents who did not participate experienced the most problems during the COVID-19 pandemic. A strength of our study is the availability of extensive pre-pandemic data, including symptom severity, which allowed us to study changes in symptoms, interaction effects, and the sociodemographic characteristics of non-responders. Furthermore, our measurements, which were performed eight months apart during the pandemic, provide an indication of the effects of the ongoing pandemic on mental health among adolescents.

Importantly, we were able to study adolescents during a period marked by significant changes both developmentally and due to the COVID-19 pandemic. Our findings suggest that the lockdowns due to the COVID-19 pandemic did not lead to an overall increase in symptoms among adolescents. Moreover, the majority of adolescents reported symptoms that were within the normal range and therefore not above the threshold for reaching clinical relevance. As the pandemic develops, future studies should address the long-term effects of the COVID-19 pandemic on mental health among adolescents.

Declarations

All authors declare that they have no conflict of interest.

The iBerry Study was conducted in accordance with the guidelines established by the Declaration of Helsinki and was approved by the Medical Ethics Research Committee of Erasmus University Medical Center,

Rotterdam. Informed consent was provided by all adolescents and if necessary by their parent(s) or legal guardian.

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Table 1. Baseline sociodemographic characteristics of the 445 participants who subsequently completed the C1 questionnaire, stratified by the severity of baseline problems measured using the total emotional and behavioral problem score from the Youth Self-Report (YSR).

	Normal n = 321	Borderline n = 63	Clinical n = 61
Gender			
Female	188 (59%)	41 (65%)	37 (61%)
Male	133 (41%)	22 (35%)	24 (39%)
Age, years			
Baseline	14.79 (0.85)	15.02 (0.93)	15.10 (0.94)
C1	17.66 (0.65)	17.78 (0.80)	17.64 (0.73)
Ethnic background			
Dutch	260 (86%)	48 (86%)	43 (78%)
Non-Dutch	44 (14%)	8 (14%)	12 (22%)
Household monthly income			
<1599 euros	17 (6%)	3 (6%)	5 (10%)
1600–2399 euros	45 (15%)	8 (15%)	13 (25%)
2400–4399 euros	155 (54%)	34 (64%)	22 (42%)
>4400 euros	72 (25%)	8 (15%)	12 (23%)
Educational level			
Special needs secondary education	5 (2%)	1 (2%)	1 (2%)
Pre-vocational secondary education	116 (36%)	20 (32%)	34 (55%)
Higher general secondary education	73 (23%)	22 (35%)	12 (20%)
Pre-university education	88 (28%)	17 (26%)	11 (18%)
Mixed educational level	36 (11%)	3 (5%)	3 (5%)
Urbanicity			
Rural	78 (25%)	16 (25%)	6 (10%)
Suburban	65 (20%)	12 (19%)	12 (20%)
Urban	178 (55%)	35 (56%)	43 (70%)

Data are presented as n (%) or mean (SD). Data regarding ethnic background, household income and educational level were missing for 30, 513, and 3 adolescents, respectively.

Anxiety problems

Depressive problems

Oppositional defiant problems

Stress problems

Figure 1. Percentage of adolescents whose symptom severity increased, decreased, or was unchanged from normal, borderline, or clinical severity between baseline and C1 and between C1 and C2. Note that the majority of adolescents were in the normal range throughout the study; to improve readability, the percentages in the normal range were scaled down by a factor of 10.

Figure 2. Summary of the estimated scores for anxiety problems, depressive problems, oppositional defiant (OD) problems, stress problems, psychotic experiences, and suicidality reported at baseline, C1, and C2, stratified by emotional and behavioral problem scores measured before the COVID-19 pandemic. * $p < 0.05$ and ** $p < 0.001$ versus C1 (post-hoc univariate test).

Supplementary Table S1. Summary of the coefficient estimates for the six investigated outcomes from the final models

	Anxiety problems ($R^2 = 0.60$)				Oppositional defiant problems ($R^2 = 0.47$)				Psychotic experiences ($R^2 = 0.38$)			
	<i>B</i>	95% <i>CI</i>	<i>p</i> -value		<i>B</i>	95% <i>CI</i>	<i>p</i> -value		<i>B</i>	95% <i>CI</i>	<i>p</i> -value	
Time (C1)	0.15	-0.27	0.57	.476	0.29	0.04	0.53	.023	-0.04	-0.13	0.06	.437
Time (C2)	0.51	0.09	0.93	.017	0.14	-0.11	0.38	.274	-0.04	-0.13	0.06	.436
Baseline Severity (Borderline)	2.89	1.90	3.88	<.001	1.25	0.73	1.77	<.001	0.22	0.03	0.40	.024
Baseline Severity (Clinical)	5.93	4.92	6.95	<.001	2.82	2.28	3.35	<.001	1.00	0.80	1.19	<.001
Baseline Severity (Borderline) * Time (C1)	-1.14	-2.14	-0.14	.026	-0.35	-0.93	0.24	.246	-0.20	-0.42	0.02	.079
Baseline Severity (Clinical) * Time (C1)	-3.89	-4.90	-2.87	<.001	-1.43	-2.02	-0.83	<.001	-0.55	-0.78	-0.33	<.001
Baseline Severity (Borderline) * Time (C2)	-0.98	-1.98	0.02	.054	-0.39	-0.98	0.19	.189	-0.04	-0.26	0.18	.711
Baseline Severity (Clinical) * Time (C2)	-2.72	-3.74	-1.70	<.001	-1.48	-2.07	-0.88	<.001	-0.57	-0.80	-0.35	<.001
Age	-0.01	-0.33	0.31	.947	-0.06	-0.21	0.10	.492	0.00	-0.05	0.06	.905
Ethnic background (Non-Dutch)	0.30	-0.53	1.14	.477	0.24	-0.20	0.68	.289	-0.14	-0.29	0.01	.071
Gender (Male)	-1.59	-2.18	-1.00	<.001	-0.22	-0.51	0.07	.143	0.00	-0.09	0.10	.922
Urbanicity (Suburban vs. Rural)	-0.11	-0.96	0.74	.806	0.21	-0.21	0.63	.328	0.03	-0.11	0.17	.669
Urbanicity (Urban vs. Rural)	0.28	-0.42	0.99	.429	0.11	-0.24	0.46	.530	0.00	-0.12	0.1	.936
	Depressive problems ($R^2 = 0.58$)				Stress problems ($R^2 = 0.58$)				Suicidality ($R^2 = 0.38$)			
	<i>B</i>	95% <i>CI</i>	<i>p</i> -value		<i>B</i>	95% <i>CI</i>	<i>p</i> -value		<i>B</i>	95% <i>CI</i>	<i>p</i> -value	
Time (C1)	1.84	1.27	2.42	<.001	1.17	0.56	1.78	<.001	0.06	-0.03	0.15	.182
Time (C2)	2.92	2.35	3.49	<.001	1.97	1.36	2.58	<.001	0.09	-0.00	0.18	.062
Baseline Severity (Borderline)	4.35	3.08	5.63	<.001	5.26	3.91	6.60	<.001	0.38	0.19	0.56	<.001
Baseline Severity (Clinical)	8.34	7.04	9.64	<.001	9.65	8.27	11.03	<.001	0.75	0.55	0.94	<.001
Baseline Severity (Borderline) * Time (C1)	-1.86	-3.24	-0.49	.008	-1.98	-3.43	-0.64	.005	-0.32	-0.54	-0.10	.005
Baseline Severity (Clinical) * Time (C1)	-4.43	-5.83	-3.03	<.001	-5.70	-7.17	-4.22	<.001	-0.46	-0.68	-0.23	<.001
Baseline Severity (Borderline) * Time (C2)	-1.74	-3.11	-0.36	.013	-2.10	-3.55	-0.64	.005	-0.15	-0.36	0.07	.192
Baseline Severity (Clinical) * Time (C2)	-3.17	-4.57	-1.77	<.001	-4.80	-6.28	-3.32	<.001	-0.22	-0.04	0.07	.056
Age	0.13	-0.27	0.52	.526	-0.03	-0.44	0.39	.903	0.02	-0.04	0.07	.566
Ethnic background (Non-Dutch)	0.83	-0.22	1.88	.121	0.66	-0.44	1.76	.241	-0.02	-0.17	0.13	.822
Gender (Male)	-2.28	-3.01	-1.55	<.001	-2.10	-2.87	-1.33	<.001	-0.10	-0.20	-0.00	.048
Urbanicity (Suburban vs. Rural)	-0.23	-1.28	0.81	.661	-0.16	-1.27	0.95	.772	0.05	-0.10	0.19	.537
Urbanicity (Urban vs. Rural)	-0.30	-1.17	0.57	.502	-0.12	-1.05	0.80	.792	0.04	-0.16	0.08	.544

Supplementary Table S2. Summary of the estimated score and effect sizes for each group (normal, borderline, and clinical severity assessed at baseline) for the two measurement periods.

	Baseline	C1	C2	Cohen's <i>d</i> from baseline to C1	Cohen's <i>d</i> from C1 to C2
Anxiety problems					
Normal	4.04	4.19	4.55	0.00	0.01
Borderline	6.92	5.93	6.44	0.06	0.03
Clinical	9.98	6.23	7.76	0.22	0.09
Depressive problems					
Normal	4.29	6.13	7.2	0.04	0.02
Borderline	8.63	8.61	9.80	0.00	0.05
Clinical	12.64	10.0	12.3	0.11	0.10
Oppositional defiant problems					
Normal	1.84	2.12	1.97	0.01	0.01
Borderline	3.08	3.03	2.83	0.01	0.02
Clinical	4.66	3.52	3.32	0.12	0.02
Stress problems					
Normal	6.16	7.33	8.13	0.02	0.02
Borderline	11.42	10.60	11.20	0.03	0.03
Clinical	15.82	11.20	12.90	0.18	0.07
Psychotic experiences					
Normal	0.14	0.10	0.10	0.00	0.00
Borderline	0.36	0.12	0.28	0.06	0.04
Clinical	1.13	0.54	0.52	0.17	0.01
Suicidality					
Normal	0.08	0.14	0.16	0.01	0.00
Borderline	0.45	0.20	0.39	0.07	0.06
Clinical	0.82	0.43	0.69	0.11	0.07

Supplementary Table S3. Comparison of sociodemographic characteristics between the participants who dropped out before C1 and the participants who completed the C1 questionnaire.

	Dropped out after baseline N = 577	Participated after baseline N = 445	p-value^a
Gender			<0.001
Female	256 (44%)	266 (60%)	
Male	321 (56%)	179 (40%)	
Age, years	14.99 (0.95)	14.87 (0.88)	<0.001
Ethnic background			<0.001
Dutch	358 (72%)	351 (85%)	
Non-Dutch	142 (28%)	64 (15%)	
Household monthly income	<0.001		
<1599 euros	83 (17%)	25 (6.3%)	
1600–2399 euros	72 (15%)	66 (17%)	
2400–4399 euros	223 (47%)	211 (54%)	
>4400 euros	101 (21%)	92 (23%)	
Educational level			<0.001
Special needs secondary education	29 (5.6%)	7 (1.6%)	
Pre-vocational secondary education	261 (50%)	170 (38%)	
Higher general secondary education	112 (22%)	107 (24%)	
Pre-university education	70 (14%)	116 (26%)	
Mixed educational level	46 (8.9%)	42 (9.5%)	
Urbanicity			0.2
Rural	109 (19%)	100 (22%)	
Suburban	103 (18%)	89 (20%)	
Urban	365 (63%)	256 (58%)	
Total problems			0.019
Normal	415 (79%)	321 (72%)	
Borderline	47 (9.0%)	63 (14%)	
Clinical	62 (12%)	61 (14%)	

Data are presented as the mean (SD) or n (%). Data regarding educational level, ethnic background, and household income were missing for 62, 107, and 149 adolescents, respectively.

^a Mann-Whitney *U* test (age); chi-square test of independence (categorical variables).

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