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Stress and coping strategies among youth during the COVID-19 pandemic: a population-based cohort study

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ABSTRACT

The COVID-19 pandemic caused a worldwide health- and societal crisis. Youth were exposed to enduring stressors. We examined types and load of stressors faced by youth, and their use of coping strategies. A population-based sample within Bergen municipality, Norway ($N = 1031$, 11–19 years) completed the Response to Stress Questionnaire 9 months into the pandemic. Social stressors were most frequent, with secondary control engagement being the most used coping strategy. Stress and coping strategies differed depending on sex, age, and socioeconomic status. Heightened stress were associated with primary and secondary control engagement, and disengagement. Thus, youth employed a range of coping strategies to an increasing degree with heightened levels of COVID-19 stress. The frequency of secondary control engagement aligns with the enduring uncontrollable nature of the outbreak. For future health crises, authorities should focus on social stressors experienced by youth, especially among girls, older youth, and youth with low socioeconomic status.

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“COVID-19”; stress; coping strategies; socioeconomic status; Response to stress questionnaire

Introduction

The COVID-19 pandemic caused a worldwide health- and societal crisis (World Health Organization, 2020). The societal disruptions following highly restricting suppressive measures had a cascading effect on youth. For young people, closed schools and leisure activities, restrictions regarding house visits, and other social gatherings led to social isolation and more time confined to their household with parents and siblings (Lehmann et al., 2021). Many young people were exposed to a wide range of enduring stressors like general life disruptions, interpersonal stressors, financial difficulties and health-related problems in their families (Watson et al., 2023). Studies have demonstrated increased youth mental health problems and a decline in youth quality of life during the pandemic (Lehmann et al., 2022, 2022a; Racine et al., 2021).

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Among youth, there was variability in the impact of and response to the pandemic and infection control measures implemented. During the first wave of lockdowns, decreased stress among some teenagers was reported (Bourduge et al., 2022). Several socio-demographic and contextual factors contributed to explain the variability of the impact of the pandemic. Among others, female sex, older age, lower socioeconomic status and migrant status are risk factors for mental health problems and lower quality of life among youth during the pandemic (Lehmann et al., 2022, 2022b; McElroy et al., 2020). Investigating differences among youth in coping strategies when faced with sudden and enduring adversities, may be an approach to further understand these differences.

Young people face adversities to varying degrees throughout their development. The nature of these adversities may vary from proximal environmental factors such as family conflict, neglect, parental mental health problems, and bullying to more distal environmental factors such as economic recession, or parent unemployment. Adversities seem to have a cumulative effect on mental health problems (Schilling et al., 2008). The ability to cope with stress, whether it is acute or enduring, may be crucial for resilient functioning (Compas et al., 2017). According to the transactional theory of stress and coping by Lazarus and Folkman (1987), people are constantly appraising stimuli within their environment. This process generates emotions, and when stimuli are appraised as threatening, challenging, or harmful, the resulting distress initiates coping strategies either by removing the stressor or regulating the associated emotions. In his early work, Folkman (1984) defined coping as: *'Constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person'* (p. 141). Contemporary interpretations of coping align with Folkman's definition, emphasizing the conscious awareness of the possibilities to control the situation, and the involvement of regulatory processes (Compas et al., 2001, 2014). The degree to which coping strategies are effective in terms of emotional and behavioural adjustment depends in part on the fit between the demands of the stressor and the chosen coping response (Compas et al., 2012).

Despite this dynamic nature of coping, it is agreed that there are individual differences in habitual use of coping strategies. Primary control coping strategies aim at changing the stressor or the event (i.e. problem solving), whereas secondary control coping strategies aim to regulate one's responses, adjusting to the stressor or condition (i.e. acceptance) (Connor-Smith et al., 2000). According to the multidimensional model of control and coping by Rudolph et al. (1995), the degree of controllability of a given stressor determines which coping strategy is most adaptive. Enduring societal stressors, such as those faced by many youths during the pandemic, might have limited the usefulness of certain coping strategies and amplified the importance of others, such as secondary control coping strategies. However, empirical findings from the COVID-19 pandemic nuance these assumptions. Whereas both avoidant coping, such as resignation, and approach coping such as cognitive restructuring, was used interchangeably during the six first months of the pandemic, increased use of avoidant coping after six months was associated with increased anxiety (Myruski et al., 2024). In line with this, for youth exposed to high COVID – 19 related stress, problem -focused coping (a primary control coping strategy) proved to act as a protective factor for youth mental health during the pandemic (Stein et al., 2024). Among Swiss youth, in the summer of 2020, both approach coping and avoidant coping were the most common strategies (Foster et al., 2023).

Among French adolescents, acceptance was the most frequently used coping strategy and a source of decreased stress during the COVID-19 lockdown (Bourduge et al., 2022). The same study showed that active coping, which is comparable to primary coping, was used less.

Thus, the type of stressors youth experienced during COVID-19 and what strategies they applied to cope with stress is probably closely connected. While existing literature on young people's coping during the COVID-19 pandemic contributes to an understanding of typical strategies of coping in this context, few studies shed light on how stressor characteristics may be linked to the type of coping strategy, and how both stressors and coping strategies may vary dependent on sociodemographic factors. The stressors related to COVID-19 are assumed to have had differing levels of

controllability. Following the multidimensional model of Rudolph et al, examining the possible interdependence between stressor type and use of coping strategies may contribute to a greater understanding of young peoples' strengths and vulnerabilities in face of enduring societal health crises such as the COVID-19 pandemic.

In this study, we examine the types and load of stressors faced by youth, nine months into the COVID-19 pandemic, and youths' self-reported use of coping strategies. More specifically, we examine: i) types and numbers of COVID-19-related stressors as reported by youth; ii) strategies used to cope with COVID-19 related stressors; iii) whether type and number of stressors and type of coping strategies varied with sociodemographic characteristics; and iiiii) whether type and number of stressors were associated with coping strategies, after adjusting for sex, country of birth, and socioeconomic status.

Methods

Procedure and participants

The current study is part of the COVID-19 Young, a longitudinal study of young people aged 11–19 attending lower secondary and upper secondary schools within the municipality of Bergen, Norway (Lehmann et al., 2021). Data from the first time point were collected between April 27th and May 11, 2020. This was seven weeks into the national lockdown in Norway. Data from the second time-point were collected between December 16, 2020 and January 10, 2021. During this period local restrictions implied partly closed schools, and sports- and leisure activities were put on hold.

Two age-cohorts were invited to participate in each data-collection wave. Cohort 1 were young people aged 11–15 years, whose parents participated in the Bergen in Change study (Mæland et al., 2021). Parents gave written informed consent to their child(ren) participating in the COVID-19 Young study and provided contact information for the youth. The consenting parents were more often females, older, had higher educational attainment and household income, and had less often shared residence for the child when compared to non-consenting parents (Lehmann et al., 2021). Cohort 2 were young people aged 16–19 years, attending upper secondary school. For cohort 2, the county council of Vestland provided phone numbers from the school contact registers, containing contact information for all attending students. We invited all young people in the register to participate.

The invitation procedures were the same for both cohorts in and across the two timepoints of data collection. We recruited youth via SMS with a link to a secure online platform containing an information letter and a 15–30-min survey. Two SMS reminders were sent. We included all participants in a lottery for a cellphone.

At the first time point of data the collection, we invited a total of 7512 youths to participate. Of these, 843 out of 1565 (54%) in cohort 1 and 2154 out of 5947 (36%) in cohort 2 responded, yielding a total of 2997 (40%) youth completing the survey. We invited all participants from time point one to participate in the second data collection. Of the participants from the first time point, 1598 (53.3%) youth responded in the second time point. Of these, 1031 young people completed the Response to Stress Questionnaire and had valid responses on demographic information and hence constitute our analytical sample. Hence, for this current study, data from the second timepoint were used. See Flowchart, [Figure 1](#) for details. Compared to those only participating at baseline, those participating on both timepoints, were younger (mean 16.9 (SD1.7) vs 17.1 (SD1.6); $p < 0.001$), and a larger percentage were female (54.4% vs 60.4%, $p = 0.001$). No difference was found for country of origin ($p = \text{====}$).

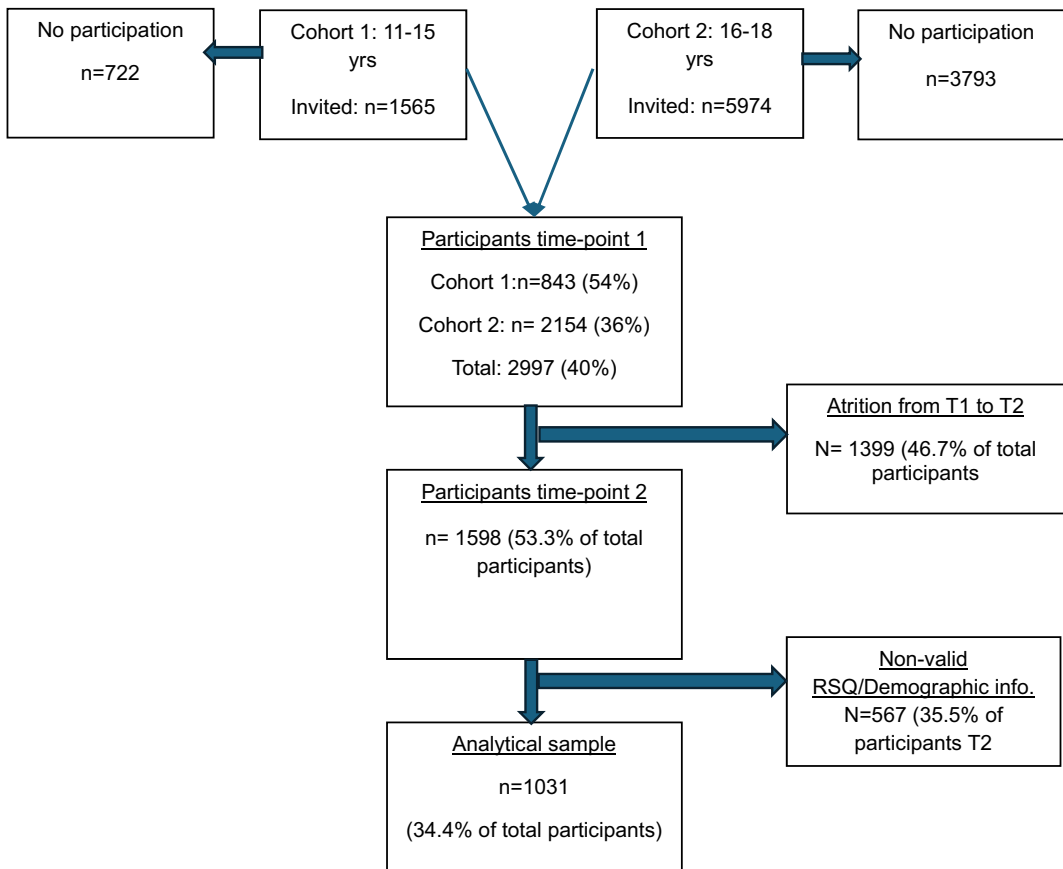


Figure 1. Flow chart.

Measures

Type and number of COVID-19 Stress and related coping strategies were assessed by the Response to Stress Questionnaire (RSQ) (Connor-Smith et al., 2000). The first part of the RSQ assesses a variety of stressors in several domains of young people's everyday life, through 14 items. The content of the items is consistent across different versions of the measure. Still, items are re-worded to refer to the targeted stressor or domain of stress relevant to the COVID-19 pandemic. (e.g. 'Could not spend time with friends due to COVID-19'; 'Worry that someone close to me will get infected'). The degree of stressfulness is measured with a score of 1 (*not at all*), 2 (*a little*), 3 (*some*), or 4 (*a lot*). For the present study, we grouped the stressors into five categories: social stressors, family-relational stressors, schoolwork-related stressors, worry-related stressors, infection-related stressors, family economy stressors and health-care related stressors. Table 1 shows the single stressors belonging to each category.

Part two of the RSQ is a multidimensional measure of voluntary coping efforts to regulate either the source of, or reactions to stress as well as involuntary stress responses. RSQ comprises a total of 57 items, yielding 21 categories ordered in five factors. Three factors assess the voluntary responses to stress: 1) *primary control* (engagement coping, problem solving, emotional regulation, emotional expression); 2) *secondary control* (engagement coping, acceptance, distraction, cognitive restructuring, positive thinking); 3) *disengagement coping* (avoidance, denial, wishful thinking). The last two of the five factors assess involuntary responses to stress.

The coping efforts and responses are further distinguished along the dimension of engagement/disengagement (i.e. whether the responses are directed towards (approach) or away from (avoidance) a stressor (Connor-Smith et al., 2000).; Primary versus secondary control strategies is categorized as engagement strategies. RSQ can be completed by either parents or adolescents as self-report. Each item is rated from 1 (*not at all*) to 4 (*a lot*) indicating the frequency of enactment by the respondent. For this study, we included the three factors of coping identified in RSQ. The psychometric properties of RSQ have been tested in a variety of youth samples, and the three-factor model of coping has overall been supported (Benson et al., 2011; Compas et al., 2006; Connor-Smith et al., 2000; Wadsworth et al., 2004). We did not include the two factors comprising involuntary stress responses in the present analyses.

Demographic information was assessed through youth self-report on the variables age, sex country of birth and socioeconomic status (SES) relative to others. Age was reported in whole years, and sex differentiated between 'male' and 'female', based on the question '*Are you a boy or a girl?*' With the alternatives '*Boy*' or '*Girl*'. Country of birth were measured with the question '*Where are you born?*' with the following answer alternatives: '*Norway*', '*Other European country*', '*Northern America and Australia*', '*Africa, Asia, South-and MidAmerica, Oceania*'. For this study, we only differentiated between being born in Norway and being born in another country. Due to low numbers among those not born in Norway, we did not include specific country or region of birth in our analyses. SES was assessed by self-rated family affluence with the following question: '*How well off do you think your family is compared to others*'. With the following response alternatives: '*Less than others*', '*About the same*'; '*More than others*'.

Ethics

The Regional Committee for Medical and Health Research Ethics, Western Norway approved the study (project number 131,560). Written informed consent to participate in the study was provided by the participants' legal guardian for participants aged 12–15 years. Following Norwegian legislation, youth aged 16 years and older provided written informed consent on their own behalf.

Analyses

First, we describe the characteristics of the sample in-text using mean and standard deviation (SD) for age, and proportions for categorical variables. Next, we computed the proportions (with 95% confidence intervals (CI)) of the different COVID-19 related stressors while differentiating between those reporting 'not all' and 'a little' (a little or less) and 'some' and 'a lot' (some or more) in [Table 1](#). The score on each higher-level coping factor (primary control, secondary control, and disengagement), as well as specific coping strategies were presented using mean, standard deviation and 95% CIs in [Table 2](#). The results from a series of univariate regressions using grouped stressors as dependent variables, and sex, age, country of birth and socioeconomic as independent variables are presented in [Table 3](#). The associations between the same independent variables and higher-level coping factors as dependent variables were estimated and presented in [Table 4](#). For both sets of univariate regressions, the coefficients with 95% CIs and p-values were provided. To estimate the association between a) sex, b) age, c) country of birth and d) socioeconomic status and number of endorsed stressors (some or more), separate negative binomial regressions were computed. The results are presented in-text as incidence rate ratios with corresponding 95% CI. In [Table 5](#), the associations between the grouped stressors (as independent variable), and a) main coping strategies and b) average number of endorsed stressors (some or more) entered as main dependent variable while adjusting for age, gender, country of birth and socioeconomic status are presented. Separate multiple linear regressions were computed for each independent-dependent variable combination, and the coefficients with 95% CIs and p-values are provided. R version 4.2.2 (R Core Team, 2022), R Studio (Posit team, 2023), were used for all analyses, and the package `gtsummary` version 1.7.0

(Daniel et al., 2021). were used to generate the original tables. Having completed the Response to Stress Questionnaire was a prerequisite for being included in the analytical sample. Out of 1047 participants who completed RSQ, 16 (1.5%) had not provided demographic information and was omitted from the analytical sample.

Results

Characteristics of participants

The mean age was 16.8 years (SD 1.7), 63% were female, and most participants reported being born in Norway (94.0%). On the question of how the young persons perceived their family-affluence compared to peers, 84 (8%) reported being less well-off than others, 718 (70%) reported being about the same as others, while 229 (22%) perceived their family as being more well off than others.

COVID-19-related stressors

The participants reported a median number of 4 stressors each (interquartile range 2–6). Table 1 shows the proportion of the different COVID-19 related stressors as reported by the youth. Social stressors were by far the most frequently reported, with 79% of the youth experiencing one or more of these (e.g. being unable to participate in social activities and normal routines because of COVID-19). Among the youth, 54% reported worry-related stressors (e.g. not being sure about when COVID-19 will end or what will happen in the future). Nearly half (47%) of the participants experienced school-work related stress (e.g. difficulty completing online schoolwork). On the lower end, notably, few reported financial stressors, with 5.8% having family-financial trouble, and only 1.6% reporting procurement challenges.

Table 1. Frequency of COVID-19- related stressors.

Characteristics of the stressor ¹	N = 1,031	95% CI ²
Social stressors	79%	76%, 81%
No time with friends or family	54%	51%, 57%
No social activity	56%	53%, 59%
Change of plans	61%	58%, 64%
Family-relational stressors	23%	20%, 26%
Challenges at home or elsewhere	15%	13%, 18%
Greater responsibility	14%	12%, 16%
Schoolwork-related stressors	47%	44%, 50%
School work online	43%	40%, 46%
Trouble doing schoolwork	32%	29%, 35%
Worry-related stressors	54%	51%, 57%
Frightening news	20%	17%, 22%
Worry about the future	51%	47%, 54%
Infection-related stressors	44%	41%, 47%
Worry about symptoms	27%	24%, 30%
Worry about infection	37%	34%, 40%
Family economy stressors	6.2%	4.8%, 7.9%
Procurement challenges	1.6%	0.92%, 2.6%
Family financial trouble	5.8%	4.5%, 7.5%
Health-care related stressors	9.9%	8.2%, 12%
Health care	9.9%	8.2%, 12%

¹ respondent answering some or more. ² CI = Confidence Interval. Broader categories of stressors are in boldface, with single stressors belonging to the category listed below.

Coping strategies

Table 2 provides a detailed overview of the use of coping strategies. *Secondary control engagement coping* had a higher mean score among the youth than *primary control engagement coping* ($p < 0.001$), whereas *primary control engagement coping* had a higher mean score than *disengagement coping* ($p < 0.001$). *Acceptance* was the coping strategy with the highest mean score of 2.86 (SD 0.73).

Table 2. Summary statistic of coping strategies.

Factors of Coping, with subscales	$N = 1,031^1$	95% CI ²
Primary control engagement coping	2.04 (0.52)	2.01, 2.07
Problem solving	1.86 (0.59)	1.83, 1.90
Emotional regulation	1.95 (0.64)	1.91, 1.99
Emotional expression	2.31 (0.75)	2.27, 2.36
Secondary control engagement coping	2.24 (0.53)	2.21, 2.27
Cognitive restructuring	2.01 (0.66)	1.97, 2.05
Positive thinking	2.07 (0.75)	2.02, 2.11
Acceptance	2.86 (0.73)	2.82, 2.91
Distractions	1.90 (0.68)	1.86, 1.95
Disengagement coping	1.79 (0.52)	1.76, 1.83
Denial	1.49 (0.53)	1.46, 1.53
Avoidance	1.87 (0.65)	1.83, 1.91
Wishful thinking	2.01 (0.78)	1.96, 2.06

¹Mean (SD). ²CI = Confidence Interval. Scores ranging from 1 ('Not at all') to 4 ('A lot').

Sociodemographic variation of type and number of stressors and coping strategies

Table 3 shows sociodemographic variation across stressors. Compared to males, females reported a higher score on all groups of stressors, except for family-economy stressors. Higher age and lower subjective SES was associated with higher scores on all types of stressors. Youth born outside Norway reported more stress related to access to healthcare (e.g. medical care or mental health services).

Table 3. Results from univariate regressions with grouped stressors as dependent variables and gender, age, country of birth and socioeconomic status as independent variables.

Outcome	Gender ³		Age		Country of birth ⁴		Socioeconomic status ⁵	
	b^1	95% CI ²	b^1	95% CI ²	b^1	95% CI ²	b^1	95% CI ²
Social stressors	.32**	.23, .42	.06**	.03, 0.09	-.15	-.36, .05	-.09*	-.18, .00
Family-relational stressors	.14**	.06, .23	.02	.00, 0.05	.17	-.01, .35	-.17**	-.25, -.10
Schoolwork-related stressors	.32**	.20, .43	.18**	.15, 0.21	.14	-.11, .39	-.17**	-.28, -.06
Worry-related stressors	.55**	.46, .64	.05**	.02, 0.07	-.07	-.28, .13	-.10*	-.19, -.01
Infection-related stressors	.45**	.36, .55	.06**	.03, 0.09	-.05	-.26, .16	-.13**	-.22, -.03
Family economy stressors	-.01	-.07, .04	.02*	.01, 0.04	.08	-.03, .20	-.23**	-.28, -.18
Health-care related stressors	.22**	.12, .31	.05**	.03, 0.08	.24*	.04, .43	-.17**	-.25, -.08

¹ b = unstandardized coefficient. ²CI = Confidence Interval. ³Males as reference category. ⁴Born in Norway as reference category.

⁵Socioeconomic status entered as ordinal variable with 'Worse off than others' as lowest category. * $p < .05$. ** $p < 0.001$.

Regarding total number of stressors, females had an increased risk of experiencing a higher number of stressors compared to males (Incidence rate ratio (IRR) 1.53, 95% CI 1.40–1.68, $p < 0.001$). Older youth had an increased risk of experiencing a higher number of stressors (IRR 1.11, 95% CI 1.08–1.14, $p < 0.001$). Higher socioeconomic status was associated with lower number of endorsed stressors (IRR 0.84, 95% CI 0.77–0.91, $p < 0.001$). No difference was found regarding numbers of stressors and country of birth (Norwegian born vs. born outside Norway), $p = 0.600$.

Table 4 shows that overall, compared to males, females reported using more coping-strategies across all three coping factors. Older youth used more secondary control coping strategies compared to younger youth. Those with lower subjective SES used disengagement coping strategies more often than youth with average or higher subjective SES. There were no differences between youth born outside of or in Norway regarding the type of coping strategies reported.

Table 4. Results from univariate regressions with main coping strategies as dependent variables and gender, age, country of birth and socioeconomic status as independent variables.

Outcome	Gender ³		Age		Country of birth ⁴		Socioeconomic status ⁵	
	<i>b</i> ¹	95% CI ²	<i>b</i> ¹	95% CI ²	<i>b</i> ¹	95% CI ²	<i>b</i> ¹	95% CI ²
Primary control engagement coping	.21**	.14, .27	.01	-.01, .03	-.01	-.15, .12	.03	-.03, .09
Secondary control engagement coping	.12**	.06, .19	.02*	.00, .04	-.05	-.19, .09	-.04	-.10, .02
Disengagement coping	.28**	.21, .34	.01	-.01, .03	.06	-.08, .19	-.07*	-.12, -.01

¹*b* = unstandardized coefficient. ²CI = Confidence Interval. ³Males as reference category. ⁴Born in Norway as reference category. ⁵Socioeconomic status entered as ordinal variable with 'Worse off than others' as lowest category. **p* < .05. ***p* < 0.001.

Associations between type and number of stressors and coping strategies, adjusted for sociodemographic characteristics

All types of stressors were associated with primary control engagement coping (Table 5). Thus, increase in any single stressor, increased the use of primary control coping strategies, *ceteris paribus*. Likewise, an increase in any stressor was associated with an increase in the use of disengagement coping. Except for Family economy- and Healthcare-related stressors, the use of secondary control coping strategies increased with increase in the remaining types of stressors.

Table 5. Results from separate multiple linear regressions with main coping strategies and average number of endorsed stressors (some or more) as dependent variables and grouped stressors as independent variables. Adjusted for age, gender, country of birth and socioeconomic status.

Characteristic	Primary control engagement coping		Secondary control engagement coping		Disengagement coping	
	<i>b</i> ¹	95% CI ²	<i>b</i> ¹	95% CI ²	<i>b</i> ¹	95% CI ²
Social stressors	.13**	.09, .17	.09**	.05, .13	.15**	.11, .19
Family-relational stressors	.09**	.04, .13	.06*	.01, .11	.32**	.28, .36
Schoolwork-related stressors	.04*	.00, .07	.05*	.01, .08	.18**	.15, .22
Worry-related stressors	.13**	.09, .17	.08**	.04, .12	.30**	.26, .34
Infection-related stressors	.14**	.10, .18	.09**	.05, .13	.24**	.20, .28
Family economy stressors	.15**	.07, .23	.03	-.05, .11	.31**	.23, .38
Health-care related stressors	.07**	.03, .11	-.02	-.06, .03	.22**	.18, .26
Number of stressors (some or more)	.04**	.03, .05	.03**	.02, .04	.09**	.08, .10

¹ *b* = unstandardized coefficient. ²CI = Confidence Interval. **p* < .05. ***p* < 0.001.

Discussion

Research on the experiences of youth during the COVID-19 pandemic is still being widely published, but few studies have investigated their stress levels and coping strategies. The current study provides insight into the pandemic-related stressors as perceived by youth, and the corresponding use of coping strategies, nine months into the pandemic.

COVID-19-related stressors, overall and sociodemographic variations

The present study indicates that social stressors were by far the most frequent type of stressor, such as having no time with friends/family and no social activity. Further, approximately half of the youth

reported worries about the future, and schoolwork-related stressors. Many reported infection-related stressors, while only a few worried about financial issues. Females, older youths, and those with lower SES reported more stressors compared to males, younger youths, and youth with average or higher subjective SES.

Our finding of sex-differences related to the load of stressors, is in line with research from Switzerland, where females reported more perceived COVID-19-related stress than males (Foster et al., 2023).

Youth born outside of Norway reported more stress related to accessing healthcare, an important finding, and may be related to previous research indicating that adult immigrants tend to experience more barriers than non-immigrant, in accessing health services (Straiton et al., 2014). Our findings are in line with findings among immigrant youth in Norway, where first generation have been found to use health services less than non-immigrants. However, these findings are somewhat nuanced by the same study, showing that youth born to immigrant parents use health services more than non-immigrants (Fadnes et al., 2016). This may be explained by the gate-keeper role of parents in accessing health care for children and youth. Moreover, immigrants and children born outside of Norway may have in common that their parents meet several barriers concerning ensuring health care for their children, i.e. language problems, and lack of information on available services.

Findings from this study, nine months into the pandemic, corroborate our earlier findings from timepoint 1 of the data collection. Here, females, 7–9 weeks into the pandemic older youth, and those reporting lower than average SES, were more worried about their future and had more sleep problems. Youth born outside Norway worried more about their future and reported more negative impact of schools closing, than youth born in Norway (Lehmann et al., 2021).

Taken together, our current and previous findings from the two time points of data collection imply that worries about the future and school-related stressors were rather stable over time during the COVID-19 pandemic. Also, this underpins that females, older youth, youth with lower SES, and immigrant background experienced the lockdown more difficult, compared to their peers. Pre-pandemic findings corroborate that worries seem to increase with age (Matos et al., 2016); and that these worries often focus on school performance (da Matos et al., 2013). Females are generally more prone to anxiety and depression (Keyes et al., 2019), and the closing of schools during the COVID-19 lockdown was expected to disproportionately impact youth from low-income families, due to inequalities in living conditions and suitability of digital learning from home (Van Lancker & Parolin, 2020). Hence, our findings in this later phase of the pandemic of differences in levels of impact and worries were in line with sociodemographic differences observed early in the COVID-19 pandemic phase (Lehmann et al., 2021), and patterns found pre-pandemic. Thus, the efforts on societal and individual levels to mitigate the negative impact of restrictions on youth well-being, seem to not have been sufficient for these subpopulations.

Coping strategies, overall and sociodemographic variation

Secondary control engagement was the most frequently reported coping factor, with acceptance being the most frequently used coping strategy. Following the multidimensional model of control and coping (Rudolph et al. (1995), the degree of controllability of a given stressor determines which coping strategy is most adaptive. Secondary control coping involves strategies that entail altering or adapting the self to a stressful situation, including cognitive reappraisal and positive thinking. Such strategies are common and assumed to be more adaptive in situations in which people experience reduced control and predictability (Zimmer-Gembeck & Skinner, 2016). Our results align with findings from Poland (Babicka-Wirkus et al., 2021) and France (Bourdugue et al., 2022), as well as findings from a clinical sample of Norwegian youth (Haugland et al., 2023) indicating that, overall, the characteristics of the pandemic seem to elicit secondary control engagement strategies over other possible coping responses. Taken together, this indicates that the sudden and enduring character of the pandemic, followed by national restrictive measures led many young people to choose coping

strategies such as acceptance to adapt to stress. Findings from the UK have shown that during the COVID-19 lockdown, higher scores on acceptance were associated with lower levels of mental health problems among youth (Dewa et al., 2021).

Older youth used more secondary control coping strategies compared to younger youth. According to Zimmer-Gembeck and Skinner (2011), the age periods from early to middle and late adolescence involve changes in cognitive and emotional development, and regulatory capacities and social context. In their review, they conclude that the deployment of specific coping strategies improves with age. This implies that older youth are more capable of selecting a coping strategy better suited to deal with a certain type of stressor. Given the enduring and uncontrollable nature of the COVID-19 pandemic, secondary-control coping may have been more frequently employed by older youth because they had the developmental capacity to select more adaptive strategies.

Our results show that, females used a broader range of coping strategies compared to males. The broader array of coping strategies may indicate increased flexibility in adapting coping responses to the demands of the situation. Primary control coping with strategies such as changing the stressful situation may also have been adaptive when coping with some types of COVID-19 stressors. These are strategies aiming to change the situation or one's emotional reactions to the stressor and are commonly associated with better mental health outcomes. Thus, more use of primary control coping during COVID-19 has been associated with fewer anxiety symptoms in a clinical sample of youth (Haugland et al., 2023). According to Bonanno and Burton (2013), the most efficacious use of self-regulatory strategies is likely to be most flexible. However, it's worth noting that despite our findings suggesting a broader coping repertoire for females, results from our baseline study showed that females also were more likely to experience sleeping problems and worries about the future (Lehmann et al., 2021).

Youth with lower subjective SES used disengagement coping strategies more often than those with average or higher subjective SES. The link between SES and coping is well documented in the more extended research literature. Disengagement or avoidant coping strategies during the pandemic are associated with poorer mental health among youth (Dewa et al., 2021; Hussong et al., 2021; Turk et al., 2021). Disengagement includes strategies of orienting away from a stressful situation, including avoidance, denial, and wishful thinking. The greater utilization of such strategies may reflect fewer resources to employ more adaptive strategies.

Associations between type of stressors and coping strategies

Adjusted for sex, country of birth, and socio-economic status, we discovered that there was no distinguishable correlation between the type of stressors and the type of coping strategies used. Rather, we found that higher scores on each single stressor increased the score on all types of coping strategies. Furthermore, increased numbers of reported stressors increased the use of both primary and secondary control engagement strategies as well as disengagement coping. These results indicate that multiple coping strategies were utilized simultaneously. In the current study, these findings of non-specific relations between stress and coping may be related to the features of COVID-19 as a pervasive social context yielding multiple enduring stressors. The experienced risk of contagion and death of loved ones, combined with the wide range of consequences of the restrictive measures on youth everyday life and social relations, affected inter- and intrapersonal as well as practical aspects of life. Thus, we may speculate that it was adaptive for youth to utilize multiple coping strategies to deal with the range of different and enduring stressors. The employment of a wide range of coping strategies in the face of the pandemics may facilitate resilient functioning among youth in the face of enduring stressors (Compas et al., 2017)

Strengths and limitations

This study has several strengths and limitations. The study is population-based. However, non-response and loss-to-follow-up reduce representativeness of the population, especially regarding the descriptive findings. It should be noted that the youngest cohort was contacted based on parental consent. Consenting parents had higher educational levels and household income compared to non-consenting parents, which may reduce the representativeness of the sample. Information about school (class) membership or other clustering factors were not available. Therefore, we are not able to account for potential effects of clustering in our analyses. Nevertheless, school or class was not a sampling unit, reducing the likelihood of non-independent observations typically observed with hierarchical structures. The study includes youth aged 11 to 19 years. This contributes to generalizability, but also provides some challenges fitting questionnaires to suit the large age span. Even though data was deidentified and encrypted, some participants might still have provided socially desirable responses, or been reluctant to answer honestly due to worries about confidentiality. Family affluence was assessed through self-report, due to lack of data on parents' income. Subjective assessments of SES have been deemed meaningful measures irrespective of objective family socioeconomic status (Präg, 2020). However, the potential for bias in these judgements should be acknowledged. The infection rates in Norway nine months into the pandemic were considerably lower than in other parts of the world. Also, our sample is recruited from a geographically restricted area and does not necessarily capture the situation of youth in Norway in general. The severity of government-imposed restrictions differed widely based on rates of infection. In the geographic area of our sample, most schools were closed in December 2020 during the data collection. This is representative of the situation for many youths in Europe during the pandemic. Still, in Norway, few municipalities had infection rates as high as Bergen in December 2020. Consequently, participants in this study were somewhat more affected by disease-suppressive measures than young people in general in Norway.

Implications

A repertoire of different coping strategies may be useful for youth who face stressors related to widespread health crises or pandemics. Some of the COVID-19 stressors were characterized by low control, probably making secondary control strategies most adaptive. Other stressors related to COVID-19 may have been more controllable, suggesting that primary control strategies could be malleable. Knowledge about different coping strategies when facing pandemics, and sociodemographic differences in strategies applied could guide the development of prevention and intervention programs for future widespread health crises.

Whereas stress related to pandemics is inevitable, increasing youth's flexibility in coping with different types of stressors could make them more prepared for future major societal or widespread health crises and pandemics. Knowledge about different coping strategies and how these may fit with different types of stressors, could be introduced in the school curriculum presented to all youth (i.e. universal prevention), or included in prevention programs targeting at-risk groups (i.e. selective and indicative prevention interventions). Cognitive behavioural therapy prevention programs focusing on problems solving as effective coping already exist (Eskin et al., 2008; Spence et al., 2003), and could be revised to be used during or after future health crises/pandemics.

Future studies are needed to examine the direction of associations between number, type and level of stress and coping strategies, as well as how these are related to youth mental health symptoms during and after widespread health crises. The connection between stress and coping could be bidirectional, with youth using ineffective coping strategies experiencing more COVID-19-related stress and those experiencing less stress being more able to apply adaptive coping strategies. To broaden our understanding of this connection and its progression, longitudinal studies are warranted.

Conclusion

During the COVID-19 pandemic, youth employed a wide range of coping strategies to an increasing degree with heightened exposure to stressors. Secondary control engagement coping were the strategies most frequently reported, and this seems to align with the enduring and uncontrollable nature of the COVID-19 outbreak. In future pandemic or widespread health crises, authorities should prioritize addressing social stressors that affect young people, particularly among the subgroups identified in this study (e.g. females, older adolescents and youth with lower SES). It is crucial to consider ways to minimize these stressors when implementing infection control measures.

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Authors' contributions

SL conceived of the study, participated in its design and coordination, and drafted the manuscript; JCS performed the statistical analysis and drafted the manuscript; GMS and BSMH helped interpret the data and helped to draft the manuscript; RB & EH conceived of the study, and participated in its design and coordination and helped to draft the manuscript; SM & LTF Participated in the coordination of the study and acquisition of data, and critically revised the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to the sensitive character of health data, but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All methods carried out in the study were performed in accordance with relevant guidelines and regulations. The Regional Committee for Medical and Health Research Ethics, Western Norway approved the study (project number 131560). Written informed consent to participate in the study was provided by the participants' legal guardian for participants aged 12–15 years. Following Norwegian legislation, youth aged 16 years and older provided written informed consent on their own behalf.

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