REVIEW

Secular trends in mental health problems among young people in Norway: a review and meta-analysis

Thomas Potrebny[1] · **Sondre Aasen Nilsen**[2] · **Anders Bakken**[3] · **Tilmann von Soest**[3,4] · **Kirsti Kvaløy**[5,6,7] · **Oddrun Samdal**[8] · **Børge Sivertsen**[9,10] · **Heidi Aase**[11] · **Lasse Bang**[11]

Abstract

There is a growing concern that the mental health of recent generations of youth is deteriorating, yet the etiology of these secular changes is not fully understood. We aimed to review the evidence on trends in mental health problems among young people in Norway. Seven large-scale repeated cross-sectional studies were included in this study, comprising 35 cross-sectional data collections between 1992 and 2019, with a total sample of 776,606 young people. Our study found a clear increase in mental health problems among young females in Norway over the past few decades, while the trends were less marked for males. The proportion of individuals scoring above the problematic symptom score threshold increased on average by 11.2% (range 2.2% to 21.9%) for females and 5.2% (range −0.9% to 11.1%) for males, based on data from the individual studies. The results from a meta-regression analysis showed that across all surveys, mean symptom scores increased by 17% (95% CI 12 to 21%) among females and 5% (95% CI 1 to 9%) among males from 1992 to 2019. Overall, mental health problems have increased continually since the early 1990s among young people, especially among young females. The cause of these secular changes remains unknown but likely reflect the interplay of several factors at the individual and societal level. Protocol registration: Open science framework, November 8, 2021 (https://osf.io/g7w3v).

Introduction

Studies have shown an increase in self-reported mental health problems among young people (13–24 years of age) in high-income countries over the past few decades, particularly among females [1–4]. The increase in mental health problems among the youth also coincides with other indirect indicators of mental health problems, such as increasing rates of mental healthcare utilization and treatment [2, 5]. Clinicians, researchers, and policymakers have

✉ Thomas Potrebny
  tpo@hvl.no

1 Department of Health and Functioning, Western Norway University of Applied Sciences, Bergen, Norway

2 Regional Centre for Child and Youth Mental Health and Child Welfare, NORCE Norwegian Research Centre, Bergen, Norway

3 Norwegian Social Research (NOVA), Oslo Metropolitan University, Oslo, Norway

4 Department of Psychology, PROMENTA Research Center, University of Oslo, Oslo, Norway

5 Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, HUNT Research Centre, Norwegian University of Science and Technology NTNU, Trondheim, Norway

6 Department of Community Medicine, Faculty of Health Sciences, Centre for Sami Health Research, UiT The Arctic University of Norway, Tromsø, Norway

7 Levanger Hospital, Nord-Trøndelag Hospital Trust, Levanger, Norway

8 Department of Health Promotion and Development, University of Bergen, Bergen, Norway

9 Department of Health Promotion, Norwegian Institute of Public Health, Bergen, Norway

10 Department of Research and Innovation, Helse-Fonna HF, Haugesund, Norway

11 Department of Child Health and Development, Norwegian Institute of Public Health, Oslo, Norway

raised concerns about whether today's youth may be more prone to mental health problems than previous generations on a global scale.

A comparative systematic review and a large comparative study, comparing 36 countries across various geographical regions, highlight a noticeable increase in mental health problems among young people from 1980 to 2018. This increase appears more pronounced in countries located within Northern Europe [3, 6] and possibly Western Europe [6] compared to other regions. The authors suggest that conducting country-specific analysis of trends in mental health problems is needed to further understand the nature and underlying causes of these secular trends [3, 6].

Within Northern Europe, Norway is highlighted as one of the countries with the largest increase in mental health problems among young people over time [7]. In Norway, numerous studies have tracked self-reported mental health problems among Norwegian youth over several decades, using a repeated cross-sectional design, which is ideal when studying societal and population-level changes over time [8]. These studies are generally population-based, have well-defined sampling frames and cover the period from 1992 to the present. They all use a self-report symptom checklist to assess mental health problems, primarily focusing on internalizing problems, such as symptoms of anxiety and depression. Individually, these repeated cross-sectional surveys all indicate that self-reported, mental health problems among young Norwegians have increased at various time periods during the past 40 years [9–14]. This is particularly concerning when considering trends in light of medical and other population data that show a parallel increase in both the use of healthcare services, the diagnosis of mental disorders, the use of antidepressants, and surging self-harm rates among Norwegian youth [15–17]. Many individual surveys also indicate that these trends are more pronounced among young females, while findings for young males are more ambiguous [9–14]. There is, however, substantial variation between individual surveys concerning estimates of point prevalence, symptom score variations, and the magnitude and steepness of the increase over time [3]. This variation makes it difficult to draw strong inferences about how much young people's mental health has actually changed in Norway and the potential policy implications that this may have.

One way forward, to obtain a clearer understanding of the secular trends in mental health problems among young people in Norway, is to synthesize the findings across all repeated cross-sectional surveys. Since secular changes in mental health problems have considerable implications for public health, education, healthcare services, treatment, and policymaking, it is imperative that these secular changes are better documented and understood. The COVID-19 pandemic has certainly underscored the importance of understanding the general trends in mental health problems prior to the pandemic, to differentiate these from changes relating to the pandemic itself [18, 19]. Summarizing the numerous high-quality surveys that have been repeated over 3 decades in Norway will provide a unique opportunity for better documentation and will help understand the secular trends prior to the COVID-19 pandemic.

In the current study, we investigated the secular trends in mental health problems among young people in Norway by aggregating and synthesizing data from all repeated cross-sectional surveys. We present the findings from each individual survey, as well as a meta-analysis to provide pooled estimates of the secular changes of mental health problems.

Methods

Search strategy and inclusion criteria

This review was structured in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [20]. A study protocol was published in the Open Science Framework (OSF) in advance of the study (https://osf.io/g7w3v).

All Norwegian repeated cross-sectional surveys were eligible for inclusion, provided that they assessed general mental health problems (i.e., symptoms of anxiety and depression) among 13–24 years old and made attempts to attain a representative sample of the general youth population. Each survey had to include data collected on at least two occasions using similar recruitment and outcome measures. Since this is a study relating to mental health problems among the youth population, in general, surveys from clinical- or at-risk samples were not included.

Data collection process

The studies eligible for inclusion in this review were known in advance by Norwegian youth health researchers and experts. The principal investigators from all Norwegian youth surveys were invited to collaborate in advance on this study. The study data were drawn from open repositories or via direct contact with the principal investigators of each youth survey in 2022.

A major advantage of this approach was that it allowed us to request information regarding relevant outcomes or indicators directly from the individual youth survey administrators, information which is not widely available or reported on previously.

Data extraction and verification was done by three authors (TP, SAN, and LB).

Operationalization of mental health problems in the included studies

After identifying studies based on our a priori inclusion criteria, there were two different operationalizations of mental health problems in the studies, both of which were self-report symptom checklists: The Hopkins Symptom Checklist (HSCL) and the Health Behaviour in School-aged Children Symptom Checklist (HBSC-SCL). Here, we will briefly present these instruments.

The Hopkins Symptom Checklist (HSCL)

The HSCL was developed as a broad measure of mental health problems, defined by the frequency of symptoms of mental health problems in clinical and non-clinical samples. The instrument originally consisted of 90 items [21]. However, shorter formats (5–25 items) have since been developed, focusing mainly on symptoms of anxiety and depression. These short versions have been comparable with the longer versions and perform well (the correlation between the different versions of the HSCL ranges from 0.91 to 0.97) [22]. The respondents were asked to what extent the symptoms have bothered them over the past 7 or 14 days. The sample items were "feeling hopeless about the future", "feeling everything is an effort", "suddenly scared for no reason", and "feeling tense or keyed up". The responses were recorded on a 1–4 scale, ranging from "not at all" to "a little" to "quite a lot" to "extremely", with higher scores signifying more severe mental health problems. The responses are typically either averaged to produce a total HSCL score or dichotomized based on recommended cut-off threshold (for the shorter formats) of either 2.0 [22] or 3.0 [23, 24]. Previous studies have shown that young people scoring above this threshold were within the range of depressive disorder [22–24].

Health Behaviour in School-aged Children Symptom Checklist (HBSC-SCL)

The HBSC-SCL was designed to assess mental health problems according to the frequency of symptoms in non-clinical youth samples. The HBSC-SCL measures eight symptoms: headache, abdominal pain, backache, feeling low, irritability or a bad mood, feeling nervous, experiencing sleeping difficulties, and dizziness. Young people were asked how often they had experienced these symptoms over the past 6 months. The responses were recorded on a 1–5 scale, namely, "about every day", "more than once a week", "about every week", "about every month", and "rarely or never". Greater symptom frequency indicated more significant mental health problems [25]. The responses are recommended to be averaged to a total HBSC-SCL score and there is no clear agreement on a cut-off threshold [25]. Previous research supports the validity and reliability of the instrument [19, 20, 26, 27].

Data analysis

Individual survey analyses

We extracted key variables from each survey in a harmonized manner. This included the mean symptom scores for each individual participant and their standard deviations, stratified by survey year, sex, and age.

To examine the secular changes of mental health problems within each survey, we fitted a series of linear and logistic regression models. First, we performed linear regression analyses to investigate the secular change in the mean symptom scores for each survey separately. To provide a standardized measure of effect size, we z-transformed (set the grand mean equal to zero and a standard deviation equal to one) the symptom scores within each survey separately for males and females. In these models, the mean symptom scores (dependent variable) were regressed on survey year and age (independent variables). The survey year was dummy coded using a backward difference contrast coding scheme, whereby each survey year was compared to the prior level (i.e., 2002 vs. 1998; 2005 vs. 2002). This generated $n-1$ contrasts, where n is the total number of survey years. All models were fitted separately for males and females.

Second, we performed binary logistic regression analysis to investigate the secular change in proportions of individuals scoring above a problematic symptom score threshold. We defined the problematic symptom score by employing a cut-off of a mean score ≥ 2. This is a threshold commonly used in many Norwegian youth surveys to indicate high symptom load and is the suggested threshold for identifying a mental disorder in the shortest versions of the Hopkins Symptom Checklist-5 (HSCL-5) [22]. The dependent variable in these models was a binary variable, denoting whether an individual scored above or below the cut-off. The independent variables were survey year and age, and the models were run separately for males and females.

For each survey, we plotted the mean symptom scores and proportions of individuals scoring above the cut-off threshold of ≥ 2 across time. As a cut-off threshold of ≥ 3 is also commonly used when reporting findings in some of the included surveys, we plotted the proportions of individuals scoring ≥ 3 across time for descriptive purposes. For each model, we reported the associations between the dependent variable, and survey year and age. The SPSS software [28] was used for these analyses and alpha was set to 0.05 for all analyses.

Meta-analysis

For each individual survey, we collected means and standard deviations of the outcome measures. These estimates were then pooled and synthesized using a multilevel meta-regression analysis as the primary meta-analytic technique, by utilizing the package, "Metafor", in the R statistical environment [29, 30]. As the mean symptom scores from different surveys varied on a relative scale, the mean symptom scores were log-transformed to express the outcome score on a comparable metric, indicating relative change on the log scale. This procedure "normalizes" the relative differences between the surveys, thereby rendering the differences between the surveys interpretable and ensuring the validity of inference [31].

The data had a natural multilevel structure with three levels; outcomes from individual participants from the primary surveys (level 1), outcomes summarized from individual surveys at each data collection (level 2), and outcomes clustered within each survey (level 3). We expected that the outcome within the surveys would be fairly homogeneous, but with substantial variance between surveys, due to the differences in the instruments used, the sampling procedure, and the time period of the data collection. To model and correct for this complex three-level structure, we modeled a three-level meta-regression, examining within-cluster heterogeneity at level 2 (the variation of the true effect size within studies) and between-cluster heterogeneity at level 3 (variation between surveys) using restricted maximum-likelihood estimation. The I^2 statistic was computed as an indicator of heterogeneity in percentages, with values 0–50% indicating no heterogeneity, 50–75% indicating moderate heterogeneity, and 75–100% indicating substantial heterogeneity [32].

The amount of (residual) heterogeneity accounted for in the full three-level model can be regarded as a (pseudo) R^2 value (corresponding to the interpretation of a traditional adjusted R^2 value) and is the percentage of the variance explained [33]. The full model (three levels) was compared to a reduced model (two levels) to assess model fit using the likelihood ratio test.

To inform our modeling strategy, we conducted preliminary analyses comparing the fit of a linear and non-linear functions (quadric and cubic functions) of the time trend. Both on the total sample and gender stratified samples, a linear function of the time trend had best fit to data and was therefore chosen in our substantive analyses (see Supplementary Table S3 and Supplementary Figure S1).

The final three-level meta-regression results are presented as the relative change in the (log-) mean symptom scores (95% CI) per year, including differences by sex, and the interaction effect between sex and year. In addition, regression estimates are adjusted for age and centered at the mean age across the samples (age 17). Alpha was set to 0.05 for all analyses.

Results

Characteristics of included studies

Our review included seven repeated cross-sectional surveys, investigating mental health problems among young Norwegian people:

1. Young in Norway (YiN).
2. Young in Oslo (YiO).
3. The Trøndelag Health Study (Young-HUNT).
4. Students' Health and Wellbeing Study (SHoT).
5. Living Conditions Survey (SILC).
6. Health Behaviour in School-aged Children (HBSC).
7. The Ungdata Survey.

These seven surveys comprise 35 separate cross-sectional data collections carried out between 1992 and 2019 and contain data on self-reported mental health problems among $n = 776.606$ young people between the ages of 13 and 24. Sex was generally evenly distributed across the surveys, with females comprising 47.4% to 69.2% of the survey samples. See Table 1 for the key characteristics of each survey dataset, as included in the current study.

Analysis of individual youth surveys

Most of the surveys are nationally representative, except for the SHoT which represents the overall student population. Subsequently, the sex distribution in the SHoT samples can be slightly skewed, due to the fact that females outnumber males in the university setting. Furthermore, most surveys use a cluster-randomized sampling procedure, based on lists of schools or school classes; a notable exception is Ungdata, which is a census used for municipal health impact assessments and planning. All but one survey used a variation of the HSCL to assess mental health problems [21]. One repeated cross-sectional survey used the HBSC-SCL [25]. All but one survey used the same symptom measure across time. The exception was the SILC survey, which used the HSCL 25-item version for the first five collections (1998 to 2012), then changed to a 13-item version for the sixth collection (in 2015), and finally changed to a six-item version for the seventh collection (in 2019) (Table 1). An additional note is that the specific items included in the various HSCL versions across studies were not necessarily the same.

We identified two additional surveys that were eligible for inclusion in our study (the Hedmark Youth Survey and the Østfold Youth Survey). These surveys are older,

Table 1 Overview of included repeated cross-sectional surveys

| Survey	Year(s)	Sample n	Female (%)	Age $M \pm SD$	Outcome[a]	Outcome range	Population	Response rate	Response level
YiN	1992	10,612	50.8%	15.9 ± 2.09	HSCL-6	1–4	National	97.0%	Individual
	2002	11,149	51.4%	15.7 ± 1.8	HSCL-6	1–4	National	91.0%	
	2010	7343	50.6%	14.9 ± 1.8	HSCL-6	1–4	National	84.3%	
Young-HUNT	1995–1997	8653	49.8%	16.1 ± 1.8	HSCL-5	1–4	Trøndelag County	88.1%	Individual
	2006–2008	7911	50.8%	15.9 ± 1.7	HSCL-5	1–4	Trøndelag County	78.4%	
	2017–2019	7603	51.4%	16.1 ± 1.8	HSCL-10	1–4	Trøndelag County	76.0%	
YiO	1996	10,822	49.6%	15.4 ± 0.9	HSCL-6	1–4	Oslo county	94.0%	Individual
	2006	10,856	52.0%	15.3 ± 0.9	HSCL-6	1–4	Oslo county	92.7%	
HBSC	1994	3334	48.9%	14.5 ± 1.1	HBSC-SCL	1–5	National	82%	Individual
	1998	3267	49.2%	14.5 ± 1.1	HBSC-SCL	1–5	National	93%	
	2002	3343	50.3%	14.4 ± 1.0	HBSC-SCL	1–5	National	88%	
	2006	3096	47.4%	14.5 ± 1.1	HBSC-SCL	1–5	National	85%	
	2010	2646	49.3%	14.6 ± 1.0	HBSC-SCL	1–5	National	81%	
	2014	1930	52.1%	14.5 ± 1.1	HBSC-SCL	1–5	National	76%	
	2018	1456	51.1%	14.5 ± 1.1	HBSC-SCL	1–5	National	84%	
SILC	1998	877	53.6%	19.7 ± 2.7	HSCL-25	1–4	National	79.2%	Individual
	2002	611	52.5%	19.9 ± 2.7	HSCL-25	1–4	National	71.9%	
	2005	591	54.7%	19.6 ± 2.6	HSCL-25	1–4	National	73.1%	
	2008	461	56.6%	19.4 ± 2.7	HSCL-25	1–4	National	66.1%	
	2012	436	57.1%	19.8 ± 2.6	HSCL-25	1–4	National	57.4%	
	2015	1183	49.0%	19.8 ± 2.6	HSCL-6	1–4	National	61.7%	
	2019	1074	47.0%	20.1 ± 2.6	HSCL-6	1–4	National	54.8%	
SHoT	2010	5962	65.8%	23.1 ± 3.3	HSCL-25	1–4	National	23.5%	Individual
	2014	13,525	66.5%	23.8 ± 3.3	HSCL-25	1–4	National	28.5%	
	2018	49,730	69.2%	23.2 ± 3.3	HSCL-25	1–4	National	31.5%	
Ungdata	2010	17,725	49.5%	14.4 ± 1.2	HSCL-6	1–4	National	80.3%	Individual
	2011	11,971	51.0%	14.5 ± 1.2	HSCL-6	1–4	National	82.3%	
	2012	24,079	49.4%	14.7 ± 1.2	HSCL-6	1–4	National	85.2%	
	2013	81,541	49.7%	14.7 ± 1.4	HSCL-6	1–4	National	> 80%	
	2014	45,525	50.6%	14.9 ± 1.5	HSCL-6	1–4	National		
	2015	70,81	49.9%	15.1 ± 1.6	HSCL-6	1–4	National		
	2016	68,007	50.5%	14.9 ± 1.4	HSCL-6	1–4	National		
	2017	100,361	50.4%	15.1 ± 1.6	HSCL-6	1–4	National		
	2018	70,579	49.6%	15.2 ± 1.6	HSCL-6	1–4	National		
	2019	117,567	50.4%	15.3 ± 1.6	HSCL-6	1–4	National		

[a]*HSCL* Hopkins Symptom Checklist, *HBSC-SCL* Health Behaviour in School-aged Children

smaller in terms of scale, are regionally designed and are no longer in operation. Despite our efforts, we were unable to gain access to the survey data or obtain a comparable summary effect from these studies; therefore, they were not included in the current study. We note, however, that the results from these studies are in line with the findings presented later in this review, based on white paper documents [34, 35].

Trends in mental health symptoms scores among young people by study

Based on the individual survey results, all repeated cross-sectional surveys showed an increase in mean symptom scores from the first to the last survey year, particularly among females (see Fig. 1). Results from the linear regression models confirmed that all surveys pointed to significant

Fig. 1 Mean symptom scores across time, stratified by sex and survey
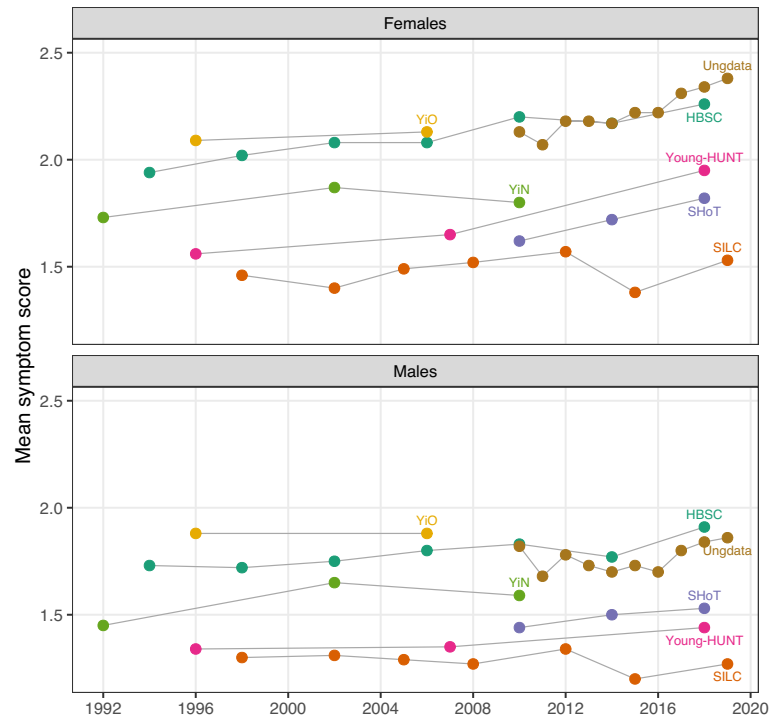
increases in mean symptom scores at some time point in time, for both males and females. In relation to females, no surveys indicated significant declines in mean symptom scores at any point, compared to the baseline. Among males, surveys show a similar increase over time overall, but results were generally more mixed (Supplementary information; Table S1).

Trends in problematic mental health symptom scores among young people by study

The proportions of individuals scoring above the problematic score threshold(s) generally increased from the first to the last survey year, similar to that of mean symptom scores. This was especially evident among females (see Fig. 2). The proportion of individuals scoring above the problematic score threshold (≥ 2) increased, on average, by 11.2% (range 2.2% to 21.9%) for females and 5.2% (-0.9% to 11.1%) for males from the first to the last survey year. The largest change was observed among young females in the Young-HUNT Study, in which the proportion scoring above the problematic score threshold (≥ 2) increased from 20.5% to 42.4% between 1995 and 2019. In all surveys, a higher proportion of females than males scored above both cut-offs across all survey years. There was, however, considerable variability between surveys (Fig. 2). The results from the binary logistic regression models suggest an increase in the proportion scoring above the problematic score threshold at certain time points for both males and females (Supplementary information; Table S2). No surveys showed significant decreases for females overall, compared to the baseline. Among males, the results were again generally more mixed.

Furthermore, results of the individual surveys suggest that there was a positive association between age and mental health problems. Older youth were more likely to have a higher mean symptom score or score above the problematic score threshold across the individual surveys. The only exception was for females in the SHoT sample where age was negatively associated with symptom scores and problematic scores. The sample was slightly older, which likely account for the conflicting results (Supplementary information; Table S1 and Table S2).

Evidence of increasing mental health problems among young people

Results from the pooled three-level meta-analytic model indicated an increase in the log-mean score of mental health problems among young people in Norway between 1992 and 2019. The interaction effect between sex and year was significant, suggesting a greater increase in symptom scores across the years for females compared to males. More specifically, as the results from Table 2 show, the mean symptom scores increased annually from the year 1992 onwards by approximately 0.2% for males and 0.6% for females. In 2019, 27 years later, the annual increase accumulated to a relative increase in mean symptom scores of 5% for males
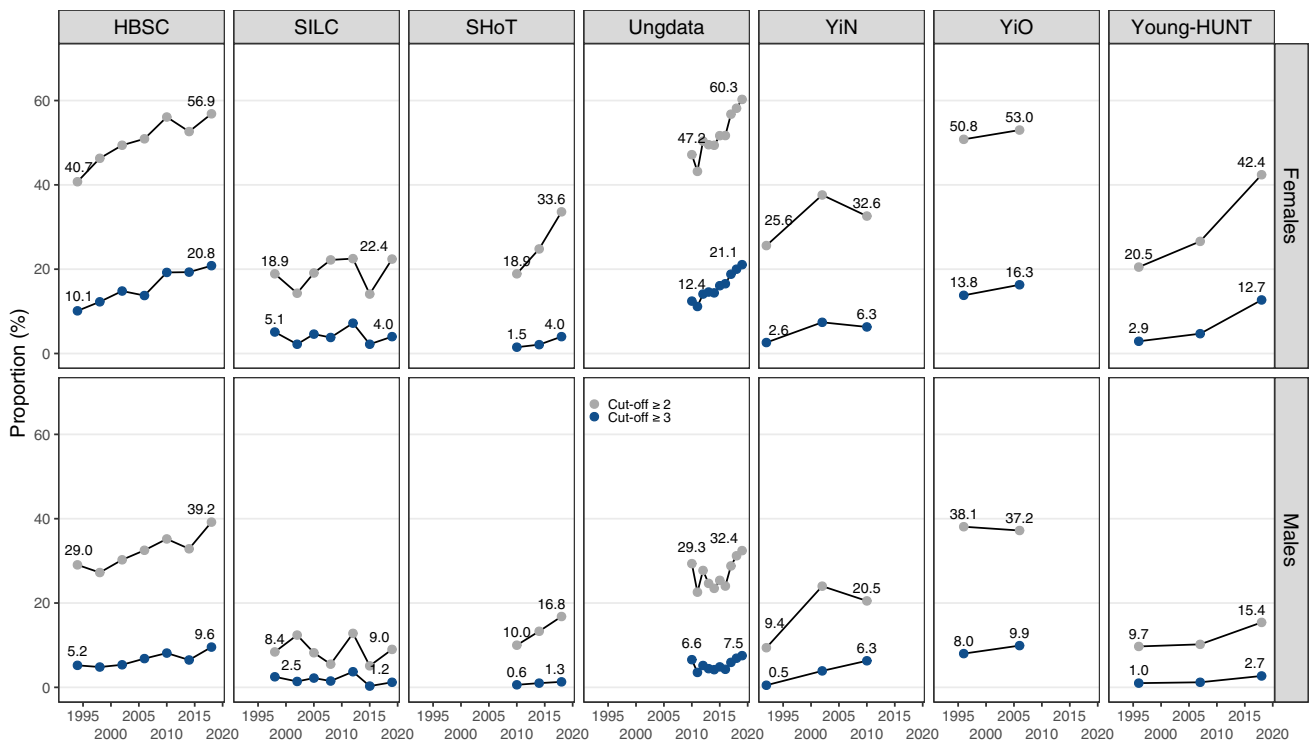
Fig. 2 Proportions scoring ≥ 2 and ≥ 3 in the symptom outcome measures by survey, survey year, and sex

Table 2 Adjusted multilevel meta-regression estimates of annual change in mental health problems among young people between 1992 and 2019

Predictors	Log-symptom scores	95% CI	p
Intercept	0.430	0.247–0.614	<0.0001
Year	0.002	0.001–0.003	0.048
Sex (female)	0.101	0.062–0.140	<0.0001
Year: sex (female)	0.005	0.002–0.007	<0.0001

(95% CI 1 to 9%) and 17% for females (95% CI 12 to 21%), adjusted for age- and between-survey differences. Moreover, the significant effect of sex indicated that females generally had more mental health problems at any given time point (a higher symptom score of approximately 10%). Figure 3 shows the estimated symptom score increase, accounting for within- and between-survey heterogeneity and age differences against unadjusted symptom scores, on a log scale.

In the context of trying to understand and quantify the sources of variation in youth health data, we compared different statistical models trying to account for variation both within individual surveys and differences between surveys. We found that a three-level model provided a significantly better fit compared to a two-level model, with level 3 heterogeneity constrained to zero ($\chi^2_1 = 112.47$; $p < 0.001$). In the case of the three-level model, the estimated variance

component was $\tau^2_{\text{Level 3}} = 0.06$ and $\tau^2_{\text{Level 2}} = 0.01$. This suggests that 98.13% ($I^2_{\text{Level 3}}$) of the total variation can be attributed to between-survey variation (high between-survey heterogeneity in the outcome) and 1.85% ($I^2_{\text{Level 2}}$) to within-survey heterogeneity (no substantial heterogeneity within individual surveys). The R^2 coefficient indicated that the three-level meta-regression model reduced 89.8% of the initial heterogeneity variance compared to a model not accounting for the multilevel structure of the data [36]. This suggests that considering between-survey differences is crucial for explaining and reducing variation when conducting a meta-analysis on youth health data in a country like Norway.

Discussion

Overview of main findings

This review and meta-analysis aimed to provide an overview of the secular trends in mental health problems among young people in Norway, by synthesizing data from all large-scale, repeated cross-sectional surveys. Seven surveys were included, covering 35 measurement points between 1992 and 2019, with a total sample of 776,606 young people. Our study demonstrates an increase in self-reported mental health problems among young females in Norway over the past few decades, while trends are less marked for males. In
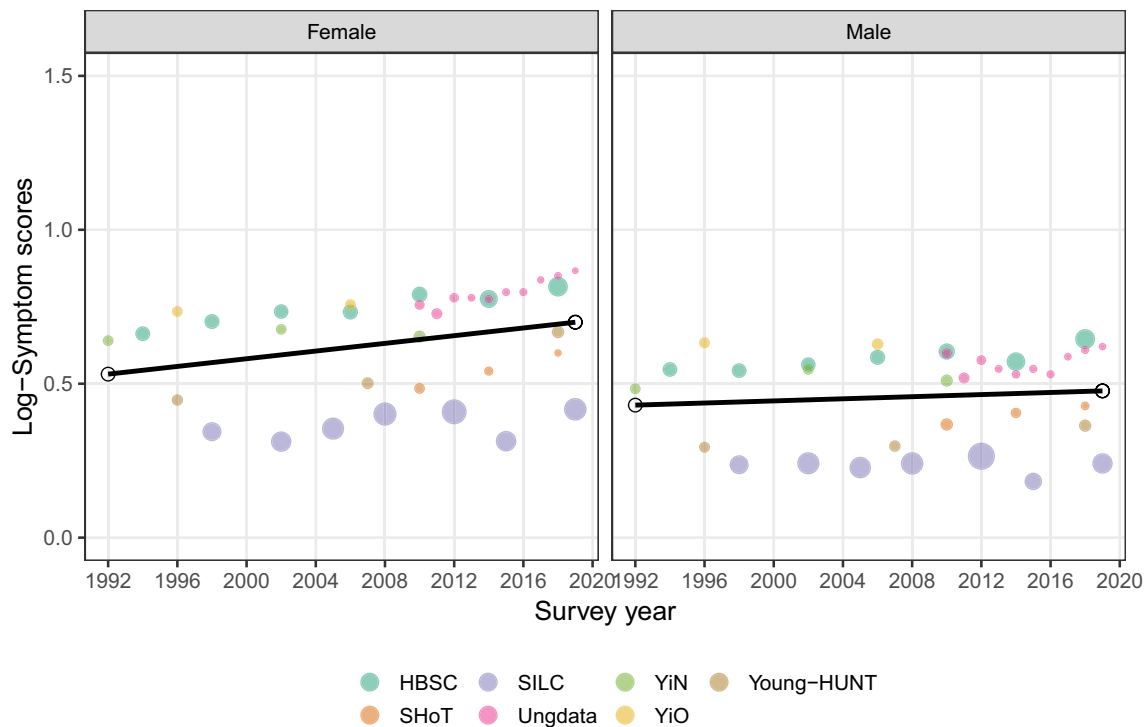
Fig. 3 Estimated trends in the scores of mental health problems among young people by sex against the unadjusted values on a log scale (larger circles indicate greater variance)

the individual surveys, the difference in the proportion of individuals scoring above the problematic score threshold from the first to the last survey year was, on average, 11.2% for females and 5.2% for males. Pooled meta-regression estimates showed that from 1992 to 2019, the mean symptom scores increased by approximately 17% for females and 5% for males.

A comparative perspective on the trends in mental health problems among young people

Our findings align with prior studies from other high-income countries in Europe [3, 37–43] and North America [44, 45]. Combined, these studies show that self-reported mental health problems among young people have increased over the past 3 decades, particularly among females. The findings for males are more mixed, however, with certain studies identifying increases over time [39, 42, 44] and others finding more stable or decreasing trends [37, 38, 41]. This was also the case in our study, as we pinpointed shorter periods indicating flat or even declining trends in some surveys (e.g., see [13]). However, over a longer time period, the studies all show a general increase over time and secular trends in self-reported mental health problems coincide with increasing rates of treatment for mental disorders among young people [5, 46–49].

Other studies from other country contexts have noted trends of mental health problems among youth may depend on survey characteristics like sex, age, study period, country, and outcome measures [1–3, 43]. For example, a review of 36 UK surveys of children and youth found large variations both within and between surveys based on survey characteristics, such as country, time, age, and outcome measure [43]. The researchers observed an increase in long-standing mental health conditions but a stable trend for measures of psychological distress and emotional well-being. In line with Pitchforth and colleagues [43], our findings also indicated substantial variation between comparable national surveys, which could significantly affect precision if not appropriately addressed. However, even after accounting for between-survey characteristics and comparing our findings with other mental health outcomes, such as reports of increase of diagnoses of mental health disorders, increased use of healthcare services, increased use of antidepressants, and increasing rates of self-harm among Norwegian youth [15–17], the evidence consistently shows deteriorating mental health among young people in Norway, particularly among young females, between the 1990s and the present.

Other extensive comparative studies have also emphasized the need for caution when comparing cross-national trends, given the substantial variation within and between nations, even when employing similar mental health outcomes [3, 6]. Country-specific societal factors, such

as policy or economy difference, have the potential to strongly influence or mediate the trajectories of mental health problems among youth populations, thus leading to genuine cross-national differences [50]. However, as our findings show, in line with Pitchforth and colleagues [43], survey characteristics substantially influence outcome variation even within nations. This underscores the need for consistent methodology, identifying the best methodological practices, and the use of a common instruments to enhance precision in country-specific estimates of mental health problems. Additionally, improving methodological consistency within countries can feasibly enhance validity when comparing mental health problems cross-nationally in the future.

Has there been a general increase in mental health problems among young people?

The secular trends identified in the previous studies and in our own are exclusively related to internalizing problems as opposed to externalizing problems. Studies that have assessed both externalizing and internalizing problems suggest that only the latter have increased over time, among young people [38, 40, 51]. Therefore, the observed increase in mental health problems appears to be specific to symptoms of anxiety and depression (e.g., see [37]). This is also mirrored in the rates of treatment for mental disorders, where the proportions treated for externalizing problems have decreased over time [17, 47]. Unfortunately, the surveys included in our review did not include standardized and comparable measures of externalizing problems. However, there are no indications otherwise that externalizing problems have increased in Norway the past decades—if anything available evidence (statistics produced publicly by Norwegian health registries) suggests that such problems have decreased in the youth population [17]. Furthermore, the increase in mental health problems is related to age and more pronounced among older youth, compared to child and adult populations [10–12, 39, 44]. Studies of children under the age of 11 generally show no increasing mental health problems over time [1, 2, 11, 52]. None of the surveys included in our review included children under the age of 13 years, so we were unable to investigate trends in this age group further. A recent Norwegian population study found that mental health problems increase over the last decades among young people, but not for adults [10]. In fact, declining rates of mental health problems were evident among those aged 60 or older. This may suggest that increasing mental health problems are specific to internalizing problems among cohorts of female youth, as opposed to constituting a broader phenomenon.

Potential causes of the trends in mental health problems

Several explanations for the increasing trends in mental health problems both in Norway and internationally have been proposed; changes in health-related behaviours, frequent social media use, increasing school-related stress, and greater willingness to report symptoms of ill-health.

To our knowledge, only two publications, which utilize the included survey data, have empirically investigated a range of potential causes for the highlighted Norwegian trends in our review. One of these [13] suggests that the increase in self-reported depressive symptoms among boys and girls from 1992 to 2002 could be partially attributed to increases in eating problems and cannabis use. Reduced satisfaction with own appearance also appeared to contribute, particularly among girls. The second study [14] found that increase of self-reported eating problems, such as bulimia nervosa symptoms and food preoccupation, over time could be partially linked to appearance satisfaction, alcohol intoxication and global self-worth. However, these studies generally found that these proposed mechanisms only account for a small part of the increasing trajectories of mental health problems between 1992 and 2010. Additionally, other mechanisms might underlie the continued increase in mental health problems after 2010.

In contemporary discussion around deteriorating mental health among young people, the "social media hypothesis" is garnering the most attention. The social media hypothesis posits that excessive social media use might be the major cause of the surge of mental health problems among youth, after around year 2007 [53]. Recent reviews do indeed suggest that there might be a weak association between social media and mental health problems [54–56]. However, there is a lack of evidence to establish whether this association is causal [57]. An important prior study leveraged a natural experimental design and reported that the introduction and expansion of social media, specifically Facebook, in American student communities in 2004–2006 had an adverse impact on their mental health [58]. However, this study used data collected during the emergence of social media and there is a lack of similar studies that capture the past decade's developments in social media platforms. Additionally, there is some evidence that the negative effects of social media use are more pronounced for females than males [59, 60]. This seemingly fits the pattern that mental health problems have increased more among females than males. Nevertheless, the effect of social media use on mental health remains a subject of the ongoing debate and there is a need for future research that can establish the degree to which social media use can account for the increasing trend of mental health problems observed in Norway and other high-income countries.

In light of the current study, social media also cannot account for the observed increase in mental health problems that occurred before the huge expansion of social media platforms. The decades prior to 2007 were also characterized by increasing screen time in relation to e-mailing, Internet browsing, and computer gaming. Such activities have been associated with poor perceived health (mediated through negatively affecting sleeping habits) [61] and negative physical complaints [62]. It is important to account for the increases in mental health problems prior to the emergence of social media as well, as several studies including our own, indicate that the deterioration of mental health among young people was evident even before the emergence of social media (e.g., [63]).

Others have suggested that school-related stress and pressure have contributed to the mental health trajectories [64]. This has been spurred by observations that stress and pressure related to school have increased over the past decades [6, 42, 65]. Large comparative studies of 43 countries in Europe and North America demonstrated an increase in schoolwork pressure and its association with increased mental health problems over time [6, 65]. However, these associations were generally modest. Another study [66] found that the effects of school stress on psychosomatic symptoms became stronger over time in the period between 1993 and 2017, but that school stress only partly explained the increase in such symptoms. Interestingly, one study showed that the association between school stress and mental health problems was stronger for countries that were richer and more educated, suggesting that societal factors may influence trends of mental health problems [50]. The aforementioned studies focus on a relatively recent time period (i.e., from 2000 and onwards). A less recent study conducted in Scotland [67] showed that school disengagement and worries about school were among the explanatory factors most strongly associated with the increase in mental health problems in the time period from 1987 to 2006. This suggests that the association between school-related variables and mental health trajectories may have persisted over the last 3 decades. Despite the evidence that support the notion that school-related stress and pressure may have contributed to the rising trajectories of mental health problems, such contributors only account for a relatively small portion of the trends.

It has also been suggested that the increasing trend of mental health problems could be "inflated", due to reduced societal stigma and a subsequent increased willingness to report symptoms [2]. If willingness to report mental health symptoms had changed over time, one would expect to find signs of factorial invariance across time, when assessing the psychometric properties of the instruments used, which at present, does not seem to be the case [13, 68]. Moreover, a study conducted in the UK found that improvements in attitudes toward mental illness did not mirror changes in self-reported mental health problems across English regions over the past decade [69]. In addition, evidence from experimental studies suggests that training youth to recognize symptoms of mental health problems does not influence mental health problem outcomes, at least in a controlled setting [70].

While conclusive causal analyses regarding deteriorating mental health in Norway are lacking, several concurrent societal trends might have contributed to the observed increase in mental health problems. Recent national studies indicate that young people are dedicating more time to digital screens and social media, and subsequently spend less time with friends [9]. Additionally, negative attitudes toward school have increased during the past decade [9]. Moreover, there has been a notable reduction in the stigma surrounding mental health problems in recent decades, encouraging today's youth to be more open about such issues compared to older generations.

Despite increased efforts to understand the determinants of increasing mental health problems, there is still a need for future research to extensively examine the potential causes. Considerable challenges persist in establishing causality between explanatory factors and secular trends in mental health problems. Where associations do exist, they are generally small and feasibly account for only a small portion of the total increase in mental health problems over time. It seems more and more unlikely that there is a single catalyst for increasing mental health problems among young people, but rather that several determinants working together to drive the negative trend in Norway and several other high-income countries.

Limitations

A major strength of this study is that it includes a sample of over 770,000 to examine the trends in youth mental health problems in Norway, which provides a solid evidence base for public health decision-makers. However, several limitations should be noted. First, based on the protocol for this study, we planned to include socioeconomic status and minority background in our analyses. Unfortunately, we were not able to include comparable measures of socioeconomic status and minority background as explanatory variables in our data extraction and analysis, due to the data being missing or not comparable across surveys.

Another limitation is that despite the individual surveys included in this study having both comparable designs, and being drawn from the same population, there were still substantial variations between them. Other factors not directly examined in this study, that might have contributed to between-survey differences could be (a) the difference in the response rate between surveys and the change in rates over

time, (b) the sampling procedure and efforts to control for low initial response rates, (c) and the length and content of the different survey questionnaires (e.g., various versions of the main outcome measure). This does, however, emphasize the need for a common instrument and consistent methodology when operationalizing mental health problems. Further research into psychometric properties, item functioning, and other validation work on youth health measures can provide further insights into the current youth trends.

Conclusion

In conclusion, mental health problems have been increasing continually since the early 1990s among young people in Norway, especially among young females. The causes of these secular changes are not fully understood but likely reflect the interplay of several factors at the individual and societal level. The trend of increasing mental health problems, such as the one seen among young people in Norway, is a public health concern.

Author contributions LB, TP and SAN conceptualized and prepared the outline of the first draft, created the data analysis and verified the data, and analyzed the data. All authors contributed to data collection, data interpretations, writing and editing the draft of the manuscript and approved the final version of the manuscript before submission.

Availability of data and materials Data used in this study are presented in Table 1. Any additional data are available for researchers to access through the respective data owners.

Declarations

Conflict of interest The authors declare no competing interests.

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