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RESEARCH ARTICLE

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Symptoms of depression and internalizing problems in early adulthood – associated factors from birth to adolescence

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ABSTRACT

Purpose: Even though the mechanisms behind the development of depression and internalizing problems remains unknown, many different factors have been shown to increase the risk. Longitudinal studies enable the investigation of exposure during different developmental periods during childhood. This study aims to examine factors associated with depressive and internalizing problems at age 20 in terms of sociodemographic factors, previous mental health problems and stressful life events during childhood, adolescence, and early adulthood.

Methods: A birth cohort of 1723 children were followed to age 20. At the 20-year follow-up, $n = 731$ (44%) participated. Standardized instruments were filled out at baseline and the 3-,12- and 20-year follow-ups.

Results: Depressive problems at age 20 were associated with female gender, experience of interpersonal life events reported at age 20, bullying victimization and reports on paternal mental health problems. Participants with depressive problems were also less likely to have experienced adolescence as happy and to report that their father had been a good father. Internalizing problems at age 20 were, in addition, associated with internalizing problems at age 12 and reports on maternal mental health problems. Internalizing problems were associated with a lower likelihood of experiencing adolescence as happy in the final model.

Conclusion: Recent events (i.e. interpersonal life events and bullying) seemed to be the most influential factors on the development of internalizing and depressive problems. Internalizing problems during childhood increased the risk for internalizing problems in early adulthood, emphasizing the importance of early intervention. Fewer factors were found to increase the risk for depressive problems compared to internalizing problems.

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Depression; internalizing; childhood; longitudinal; SESBiC-study

Introduction

According to the World Health Organization (WHO), depression is the world leading cause of disability in terms of Disability Adjusted Life Years (DALY) for women aged 15–44 years [1]. More recent studies list depression among the top three causes of Years Lived with Disability (YLD) among both men and women [2]. Moreover, depression is one of the most important risk factors for suicidal behavior [3]. Previous studies have reported significantly higher depression prevalence rates in women than in men with a ratio of about 2:1 [4]. Additionally, prevalence rates of depression have been shown to increase over the last decade, especially among youth [5,6]. Depression has previously shown a discontinuous homotypic pattern, with childhood depression predicting adolescent depression albeit prevalence rates temporarily decreasing during the preadolescence years [7]. Persistent trajectories of depression from preadolescence to early adulthood has been found to be associated with both genetic and environmental risk factors, indicating a complex etiology and possibly time-specific risk patterns [8].

There is a substantial comorbidity between depression and anxiety, and previous studies have shown that approximately 45% of individuals with depression had a history of anxiety disorder [9]. Together these conditions constitute internalizing disorders. Even though the mechanisms behind the development of depression and anxiety remains unknown, many factors of different nature have been shown to increase the risk of depression [10] and internalizing problems [11]. Research on the impact of constitutional factors have indicated a heritability of approximately 40% for major depression [12] and recent research support a polygenic susceptibility of the disorder [13]. Anxiety disorders have an estimated heritability of 30–70% [14]. Interestingly, twin studies indicate that only about 50% of the genetic liability for depression is shared between men and women, and that genetic factors are more influential in the development of depression in

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women than in men [15]. Moreover, there is substantial genetic predisposition overlap between anxiety and depression conditions [16]. Possibly representing both heritability and environmental risk, maternal depression has repeatedly been shown to increase the risk for mental health problems, internalizing symptoms and depression in offspring [17]. The importance of timing of maternal depression has been discussed, indicating greater child vulnerability during the postnatal period and early childhood [17,18]. In a population-based study of three generations of women, a marked increased risk for Major Depression Disorder (MDD) was noted, especially for women whose mother and grandmother were diagnosed with depression [19]. Thus, the intergenerational transmission is substantial, reflecting both constitutional and environmental factors.

Furthermore, low socioeconomic status has been shown to be associated with depression in adults [20] and with mental health problems in children and adolescents [21]. Likewise, adverse life events and trauma during childhood are known to increase the risk for the development of depression [22] and anxiety [14]. Bullying during adolescence is another important factor associated with increased risk for internalizing problems [11] and depression in early adulthood [23,24].

Some environmental factors have shown to have immediate effects on the risk of developing depression (e.g. bullying) [8], while other factors might impose individuals for more persistent vulnerability. Certain factors such as female gender, low socioeconomic status, higher stress reactivity, conduct issues, substance misuse, and problems in peer and parental relationships have been shown to be associated with high or increasing depression trajectories during childhood and adolescence [25].

Previous research has indicated that a large proportion of the genetic risk factors for life-time Major Depression is not shared by symptoms of depression as measured by self-reports [26]. A broader definition, or symptom-based self-reports, might capture certain personality traits or dysthymia as compared to diagnose register data or clinical interviews. Likewise, broadening the assessment to include internalizing symptoms could possibly differentiate between general risk factors and those specific for depressive symptomatology. Internalizing problems also include unspecific somatic symptoms such as headache, stomachache, dizziness, and nausea, and it is thus possible that current environmental stressors are of greater importance for internalizing problems compared to depressive symptoms. Moreover, depression is a phenotypically heterogenous condition with a high degree of psychiatric comorbidity, further challenging the assessment of specific risk factors.

Aim

The aim of the present study was to examine factors associated with depressive symptoms at age 20 in terms of sociodemographic factors, previous mental health problems and experience of stressful life events during childhood, adolescence, and early adulthood. Moreover, we aimed to investigate whether there were differences between risk factors for depressive symptoms measured by a DSM-oriented scale and the broadband scale of internalizing problems. We hypothesized that maternal depressive symptoms might increase the risk for child depressive symptoms to a greater extent than it would impact child internalizing symptoms, but also that the risk factors would overlap. The SESBiC study provides the opportunity to examine the association between childhood risk factors and depressive symptoms in early adulthood in a prospective longitudinal cohort study.

Materials and methods

The South East Sweden birth cohort (SESBiC) study

Initiated in 1995, the purpose of the SESBiC study was the early identification of psychosocially burdened children at risk for dysfunctional development. The SESBiC study is a longitudinal study of 1723 children and their mothers followed from birth to age 20 [27].

Subjects

With the start on May 1st, 1995, all mothers of children reported from the delivery wards to the Child Welfare Clinics (CWC) until December 31st, 1996 in five municipalities in southern Sweden were invited to take part. In Sweden, all children are offered health controls at CWCs, with the purpose of assessing development and health. The vast majority (97%) of parents visit the CWC for these routine examinations [28]. The baseline study was carried out at the child's three months of age, where mothers' of 1723 children (88%) took part. Out of these children, 52.8% were boys, and there were 27 twin pairs.

The first follow-up was conducted at the child's age 3. One child was deceased, and mothers' of 1452 children (84% of the children in the baseline study) accepted to participate. The second follow-up was carried out at the child's age 12. At that time, two children were deceased, ten had moved out of the country and 24 were learning disabled. The third follow-up took place when the children had reached 20 years of age. When this follow-up took place, 25 were learning disabled, 10 had moved abroad, 25 could not be located (either recent move, moved abroad, or they were deceased) and 2 were deceased. After the exclusion of these 62 individuals, a total of 731 (44%) accepted participants. There was a difference between participants and non-participants at the 20-year follow-up with respect to maternal symptoms of postpartum depression, where 10.2% of those taking part had mothers who scored above cut-off at baseline compared to 13.4% among mothers of those not taking part ($p = .049$). Moreover, 54.3% of the girls took part in the 20-year follow-up compared to 31.9% of the boys ($p < .001$). Likewise, fewer children of mothers with a high life stress score at baseline took part at the 20-year follow-up (6.7% vs. 9.7%, $p = .028$), and 9.1% of participants at the 20-year follow-up had a mother who was born outside of Sweden compared to 12.6% among non-participants ($p = .023$). For an overview of the study population, see Figure 1.

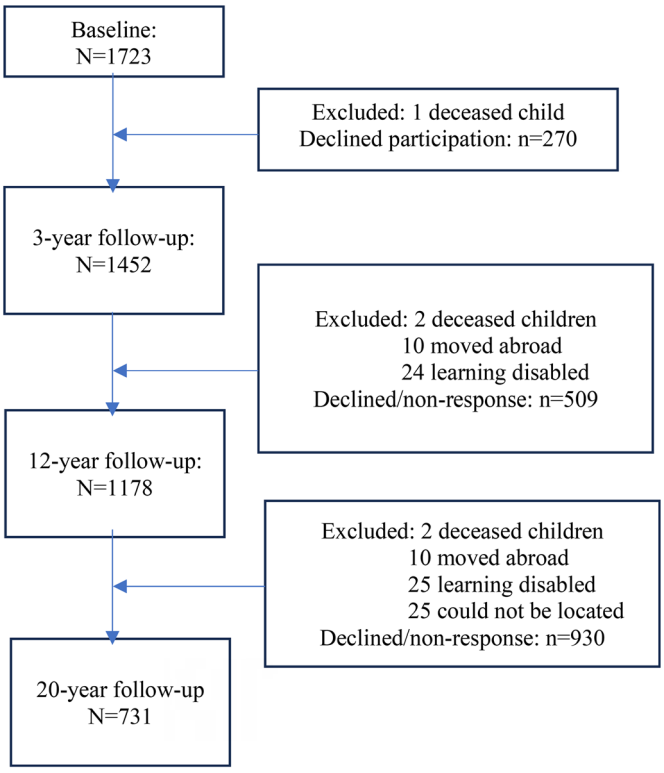

Figure 1. Flowchart of study participation at each follow-up.

Procedure

Baseline

The baseline study was carried out at the CWCs in connection with the routine three-month check-up. An attending study psychologist provided information about participation and interviewed the mother.

Three-year follow-up

The three-year follow-up was conducted in connection with the routine three-year examination at the CWCs. The CWC nurse gave information about the study and participation, and the mothers were asked to complete a series of questionnaires.

12-year follow-up

The 12-year follow-up was conducted at school. Information letters and a consent form were sent to parents (i.e. legal guardians) of each child in advance. The children were informed about the study, and questionnaires were distributed to each child to complete separately. Questionnaires about child well-being and behavior were also sent to each parent to fill out and return to the research team.

20-year follow-up

The individuals in the cohort were sent an information letter and a consent form along with a questionnaire. The individuals were asked to return the consent form, and if they agreed to participate to also include the filled-out questionnaire. In case of non-response, up to a total of three reminders were sent.

Instruments

Baseline mother assessment

The Life Stress Score (LSS) is a semi-structured interview instrument comprising three main domains; social situation, medical information, and psychological information, based on a total of 50 items [29]. All mothers were interviewed by a psychologist at baseline and after completion of the interview, the psychologist calculated the LSS scores. The cut-off was set to the 90th percentile using the total scale.

The Edinburgh Postnatal Depression Scale (EPDS) is a self-reporting screening tool comprising 10 questions on how the mother has been feeling the week preceding completion of the questionnaire [30]. The total score is 30, and any score above 10 is an indication that the woman may suffer from postnatal depression [31].

Three-year follow-up child assessment

The Coddington Life Event Scale (CLES) was used to screen for exposure to different life events at the three-year follow-up [32]. For the purpose of this study, a modified version of the questionnaire, excluding the time aspect, was used [33]. The questionnaire consists of a total of 33 questions whereof one is an open question for the purpose to capture events not identified in the event-specific questions. The cut-off was set to ≥8 events which corresponds to the 90th percentile.

The Child Behavior Check List/2–3 (CBCL) [34] is a form assessing child behavior during the past two months. In addition to the two main domains of the form, internalizing and externalizing problems, there are six specific sub-scales (destructive behavior, sleep problems, somatic complaints, withdrawn, anxious/depressed, and aggressive behavior) as well as a total scale. Cut-off was set to the 90th percentile.

12-year follow-up child assessment

The Swedish version of the Lifetime Incidence of Traumatic Experience (LITE) was used to investigate traumatic life events that the child had experienced [35,36]. The assessment was made by the mothers who filled out the 16-item (15 item specific and one open question) parent version of the form (LITE-P). In this study, only information on the occurrence of traumatic events was used.

The Child Behavior Check List/4-18 (CBCL) is a form assessing child behavior, comprising 113 questions/statements [37]. These questions are summarized into two main domains, externalizing and internalizing problems, as well as eight sub-scales (anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, aggressive behavior) and a total score. CBCL is a widely used form and has shown good precision when screening for psychiatric disorders in children [38]. The CBCL was filled out by the mother (or in some cases by the father) at the 12-year follow-up. The Cut-off was set to the 90th percentile.

The Strengths and Difficulties Questionnaire (SDQ) is a behavioral screening instrument directed to children 3–16 years old and consists of 25 items divided between four problem subscales; emotional, conduct, hyperactivity, and peer

problems, and one strengths subscale; prosocial behavior [39]. The total difficulty score is the sum of the four problem sub-scales. The SDQ is widely used in child mental health research [40], and has shown satisfactory validity and reliability [41]. The SDQ was filled out by the children themselves at the 12-year follow-up and the 90th percentile was used as cut-off.

The Rosenberg Self-Esteem Scale (RSES) is a 10-item questionnaire used to assess self-esteem [42]. Each item is answered on a four-point likert scale ranging between 0 and 3. A higher score indicates a higher self-esteem. The RSES was filled out by the children at the 12-year follow-up, and the cut-off was set to the 90th percentile.

The Hopkins Symptom Checklist (HSCL-25) [43] is designed to measure anxiety and depression during the 14 days preceding the completion of the form. The form consists of 25 items (10 regarding anxiety, 13 regarding depression and 2 regarding somatic symptoms) scoring 1–4 from 'not at all' to 'extremely'. The mean value of the respondent's score calculated with a cut off at 1.75 was used and has been used previously [44]. The HSCL-25 was filled out by the mothers at the 12-year follow-up.

At the 12-year follow-up, children, teachers, and parents reported on bullying victimization. Questions about the experience of getting teased and/or bullied were selected from the CBCL and SDQ. The answers were categorized *not true/somewhat true/very true*. Moreover, the children answered the question: 'If you think about last week, were you teased and/or bullied by other students?' The answers were categorized *never/seldom/sometimes/often/always*. Additionally, in the overarching SESBiC study, the teachers reported on child behavior problems in the school setting. The teachers were asked to assess the statement 'The child gets teased a lot' with the answer options of *not true/somewhat true/very true*. Bullying victimization was categorized as yes if the child at 12 years of age had reported experience of being teased or bullied in any of the questions above (answered somewhat true or very true and/or sometimes, often or always respectively) or if parent and/or teacher had answered somewhat true or always true on the corresponding questions.

20-year follow-up assessment

The Adult self-report (ASR) questionnaire for ages 18–59 is part of the Achenbach System of Empirically Based Assessment (ASEBA) construct and consists of 126 items that are self-rated on a scale where 0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true [45]. The ASR provides scores into two sub scales measuring internalizing and externalizing problems as well as a total problem score. The internalizing scale was used, and the cut-off set to the 90th percentile. The ASR also provides the option of calculating DSM-oriented (Diagnostic and Statistical Manual of Mental Disorders) scales on depressive, anxiety, somatic, avoidant personality, attention deficit/hyperactivity and antisocial personality problems. The DSM-oriented scale for depressive symptoms was used, and cut-off was set to T-score >65 (borderline clinical cut-off). The ASR have shown good psychometric properties [46] and generalizability between societies [47].

The Linköping Youth Life Experience scale (LYLES) is a form assessing exposure of potentially traumatic events [48]. LYLES is designed to assess the experience of interpersonal events, non-interpersonal events, and life situations in individuals 13 years and older. It holds 23 items, with 1–4 supplementary questions. The questions are answered yes or no, with specifications on how many times or for how long an event has occurred. As part of the LYLES, the study participants were asked if they had been victims of bullying. This question was analyzed both as part of the LYLES and as a separate risk factor.

At the 20-year follow-up, study participants were presented with statements about their adolescence years (age 13–19). The statements included in this study (all related to this specific time period) were: *my mother had mental health problems, my father had mental health problems, my adolescence time period was happy over all, relationships with peers were good, my mother was a good parent, my father was a good parent,* and *schooling worked fine*. The answer options ranged from totally agree to totally disagree and could also be answered neither or undecided. The answers *totally disagree* and *disagree to a great extent* were grouped together as well as *neither/undecided* and compared to *totally agree* and *agree to a great extent*.

Sociodemographic factors

Parental immigration status was obtained at baseline. Participants with one or both parents born abroad were compared to participants with parents born in Sweden. Information on maternal unemployment was obtained at the three-year follow-up and categorized into yes/no. At the 12-year follow-up, both parents reported on unemployment (during the preceding six months). If at least one of the parents reported unemployment, the variable was categorized as yes. Parental education level at age 12 was divided into compulsory/upper secondary school (≤12 years of schooling) and post-secondary education (>12 years of schooling), based on the parent with the highest level of education. Information on whether the child lived with both parents was obtained at the 12-year follow-up and used as a proxy-variable for parental divorce. Education level (compulsory school/high school/college or university) and employment status were reported by study participants at the 20-year follow-up.

Ethical considerations

This study was performed in line with the principles of the Declaration of Helsinki. Ethical approval was granted by the regional ethics board at the University of Lund in 1994 (LU439-93) and by the Ethics committee at Linköping University in 2007 (M51-07) and 2015 (M131-31). Informed consent was obtained from participating mothers and children.

Statistics

Data are presented as number of individuals (*n*) and the corresponding proportion (%). Statistical significance for differences between the groups (below/above cut-off) was evaluated using Pearson's Chi-square statistics, or, when cell

counts were below five, Fisher's Exact test. Due to the rather small study population, continuous data were evaluated using Kruskal–Wallis test. Multivariable analyses were limited to forward stepwise logistic regression models due to the large number of variables and the rather small study population. Each table and outcome were modelled separately, including all variables presented in the specific table. Variables that remained statistically significant in these five models were then used in the final two stepwise regression models (one model for each outcome). Statistical significance was set to $p < .05$ (two sided), and SPSS version 24 (IBM Inc., Armonk, NY, USA) was used for all statistical analyses.

Results

Sociodemographic factors

Out of the 707 participants, $n = 51$ reported depressive problems on ASR (Table 1). Fever men ($n = 9$) than women ($n = 42$) were found in this group ($p < .001$). Corresponding numbers for internalizing problems were $n = 52$ above cut-off, whereof 45 women and 7 men. Individuals reporting depressive problems had a lower education level at age 20 compared to those without depressive problems ($p = .017$) and were also unemployed to a greater extent ($p = .033$). Participants reporting internalizing problems likewise had a lower education level ($p = .031$) but were not unemployed to a greater extent.

In the multivariable models, females were found to be at greater risk for both internalizing and depressive problems compared to men (data not shown). No other factors remained significant.

Previous mental health problems

Individuals with depressive problems at age 20 did not to a greater extent, at three or 12 years of age, score higher on the CBCL broadband scales internalizing (including subscales anxious/depressed or withdrawn depressed) or externalizing compared to individuals without depressive problems, however a tendency towards higher scores on withdrawn/depressive problems reported by parents at age 12 were noted (15.6% vs 7.3%, $p = .086$) (Table 2). Individuals with internalizing problems at age 20 had shown withdrawn/depressed problems at age three ($p = .034$), and internalizing problems at age 12 ($p = .007$) to a greater extent. Moreover, there was a tendency toward a difference for self-reports of emotional problems at age 12 (SDQ emotion), with 16.7% of individuals scoring above cut-off on ASR internalizing at age 20 compared to 8.1% of those with symptoms under cut-off ($p = .062$).

Multivariable analysis showed that internalizing problems at age 12 predicted internalizing problems at age 20 (data not shown), however, withdrawn/depressed problems at age three did not remain significant.

Early life stress, life events and bullying

There was a difference with respect to maternal experience of life stress at baseline (LSS) between individuals with and without internalizing problems at age 20 ($p = .007$), Table 3. Experience of life events (LITE) up to age 12 did not differ between those with depressive or internalizing problems at age 20 and among those without, whereas experience of interpersonal life events (LYLES) by age 20 was more common

Table 1. Sociodemographic background data on study participants in relation to depressive and internalizing problems.

	DSM-5 Depressive problems[a]			Internalizing problems > 90th percentile		
	No	Yes		No	Yes	
	($n = 656$)	($n = 51$)		($n = 495$)	($n = 52$)	
	n (%)	*n* (%)	*p*-value	*n* (%)	*n* (%)	*p*-value
Sex			<.001			<.001
Boy	275 (41.9)	9 (17.6)		212 (42.8)	7 (13.5)	
Girl	381 (58.1)	42 (82.4)		283 (57.2)	45 (86.5)	
Parental education at 12 years			.915			.058
≤12 years	222 (49.4)	16 (48.5)		161 (47.6)	22 (64.7)	
>12 years	227 (50.6)	17 (51.5)		177 (52.4)	12 (35.3)	
Maternal unemployment at 3 years			.733			.579
No	519 (91.1)	43 (89.6)		401 (91.6)	41 (89.1)	
Yes	51 (8.9)	5 (10.4)		37 (8.4)	5 (10.9)	
Parental employment at 12 years			.698			.297
Yes	579 (88.4)	46 (90.2)		377 (89.5)	38 (84.4)	
No	76 (11.6)	5 (9.8)		44 (10.5)	7 (15.6)	
Parental divorce at,12 years			.905			.731
No	456 (86.0)	35 (85.4)		337 (85.3)	35 (83.3)	
Yes	74 (14.0)	6 (14.6)		58 (14.7)	7 (16.7)	
Immigrant background parent			.186[b]			.806[b]
No	570 (87.4)	48 (94.1)		443 (90.0)	48 (92.3)	
Yes	82 (12.6)	3 (5.9)		49 (10.0)	4 (7.7)	
Education level at 20 years			.017			.031
Compulsory school	29 (4.5)	7 (13.7)		23 (4.7)	7 (13.5)	
High school	514 (79.9)	37 (72.5)		392 (80.5)	39 (75.0)	
College/university	100 (15.6)	7 (13.7)		72 (14.8)	6 (11.5)	
Employed at 20 years			.033			.557
Yes	561 (85.6)	38 (74.5)		80 (16.2)	10 (19.2)	
No	94 (14.4)	13 (25.5)		415 (83.8)	42 (80.8)	

DSM: Diagnostic and Statistic Manual.
[a]T scores above 65 used as cut-off (includes both borderline and clinical).
[b]Fisher's exact test.

Table 2. Previous emotional and behavioral problems by depressive and internalizing problems.

	DSM-5 Depressive problems			Internalizing problems >90th percentile		
	No	Yes		No	Yes	
	n (%)	*n* (%)	*p* value	*n* (%)	*n* (%)	*p* value
3 year follow-up						
CBCL Externalizing, >90th percentile			.788[a]			1.000[a]
No	528 (91.5)	44 (93.6)		405 (91.2)	42 (91.3)	
Yes	49 (8.5)	3 (6.4)		39 (8.8)	4 (8.7)	
CBCL Internalizing, >90th percentile			.742			.173
No	524 (90.8)	42 (89.4)		404 (91.0)	39 (84.8)	
Yes	53 (9.2)	5 (10.6)		40 (9.0)	7 (15.2)	
CBCL Anxious/depressed, >90th percentile			.491[a]			.282[a]
No	544 (95.3)	44 (93.6)		418 (95.2)	42 (91.3)	
Yes	27 (4.7)	3 (6.4)		21 (4.8)	4 (8.7)	
CBCL Withdrawn/depressed, >90th percentile			.521			.034
No	537 (94.0)	43 (91.5)		416 (94.8)	40 (87.0)	
Yes	34 (6.0)	4 (8.5)		23 (5.2)	6 (13.0)	
12 year follow-up						
SDQ conduct, >90th percentile			.256			.669
No	483 (90.8)	35 (85.4)		358 (90.2)	37 (88.1)	
Yes	49 (9.2)	6 (14.6)		39 (9.8)	5 (11.9)	
SDQ emotion, >90th percentile			.194			.062
No	496 (93.2)	36 (87.8)		365 (91.9)	35 (83.3)	
Yes	36 (6.8)	5 (12.2)		32 (8.1)	7 (16.7)	
CBCL Anxious depressed, >90th percentile			.470[a]			.267[a]
No	424 (93.6)	30 (90.9)		318 (93.8)	30 (88.2)	
Yes	29 (6.4)	3 (9.1)		21 (6.2)	4 (11.8)	
CBCL Withdrawn depressed, >90th percentile			.086			.085
No	412 (92.8)	27 (84.4)		311 (93.4)	29 (85.3)	
Yes	32 (7.2)	5 (15.6)		22 (6.6)	5 (14.7)	
CBCL Internalizing, >90th percentile			.150[a]			.007
No	426 (94.0)	29 (87.9)		320 (94.4)	28 (82.4)	
Yes	27 (6.0)	4 (12.1)		19 (5.6)	6 (17.6)	
CBCL Externalizing, >90th percentile			.726[a]			1.000[a]
No	420 (92.7)	30 (90.9)		311 (91.7)	32 (94.1)	
Yes	33 (7.3)	3 (9.1)		28 (8.3)	2 (5.9)	
Selfesteem, >90th percentile			.712[a]			.384[a]
No	502 (94.9)	40 (97.6)		379 (95.9)	42 (100.0)	
Yes	27 (5.1)	1 (2.4)		16 (4.1)	0 (0.0)	

DSM: Diagnostic and Statistic Manual; CBCL: Child Behaviour Checklist; SDQ: Strengths and Difficulties Questionnaire.
[a]Fisher's exact test.

in individuals with depressive problems and internalizing problems compared to individuals with low scores ($p = .008$ and $p < .001$ respectively). A high number of total life events was also more common in individuals with internalizing problems at age 20 ($p = .025$). Groups were, however, small. Reports from age 20 of ever being bullied indicated higher prevalence in individuals with depressive and internalizing problems (51.0% vs 27.1%, $p < .001$ and 51.9% vs 27.5%, $p < .001$ respectively).

In the multivariable models, reports on interpersonal life events at age 20 and bullying victimization at age 20 were associated with both internalizing and depressive problems (data not shown). Life stress or bullying victimization earlier in life did not stay significant in the multivariable models.

Parental mental health problems

Maternal symptoms of postpartum depression were associated with internalizing problems at age 20 ($p = .034$) (Table 4). Participants with depressive and internalizing problems reported that during their adolescent years, their mother had mental health problems to a greater extent than those with low scores (11.8% vs 4.4%, $p = .022$ and 11.5% vs 4.3%, $p = .002$ respectively). Similarly, 15.7% of individuals with depressive problems at age 20 reported that their father had mental health problems during their adolescent years compared to 4.4% among those without ($p = .002$). The same applied to individuals with internalizing problems at age 20, out of whom 17.3% reported that their father had had mental health problems, compared to 4.7% of those scoring low on internalizing problems ($p < .001$).

In the multivariable models, internalizing problems were associated with reports on mothers and fathers having mental health problems (as reported by study participants at the 20-year follow-up), while depressive problems were associated with reports on fathers having mental health problems (data not shown). No associations were found for maternal mental health at baseline or the 12-year follow-up.

Questions about wellbeing, relationships, and schooling during adolescence

When asked about their adolescence period, only 17.6% with depressive problems at age 20 reported that their adolescence period was happy, compared to 77.2% of those without ($p < .001$) (Table 5). The corresponding numbers for internalizing problems were 21.2% vs 77.1% ($p < .001$). Likewise, both depressive and internalizing problems at age 20 were associated with reporting good relationships with peers to a lesser extent ($p < .001$; $p < .001$). Similarly, a

Table 3. Life stress, life events and bullying by depressive and internalizing problems.

	DSM-5 Depressive problems			Internalizing problems >90th percentile		
	No	Yes		No	Yes	
	n (%)	*n* (%)	*p* value	*n* (%)	*n* (%)	*p* value
LSS total score, >90th percentile			.298			.007
No	615 (93.9)	46 (90.2)		467 (94.3)	44 (84.6)	
Yes	40 (6.1)	5 (9.8)		28 (5.7)	8 (15.4)	
Life events at 3 years			.736[a]			.445[a]
<8 events	543 (94.6)	44 (93.6)		411 (95.7)	42 (93.3)	
≥8 events	31 (5.4)	3 (6.4)		19 (4.3)	3 (6.7)	
LITE total at 12 years, median/min-max	2/0-10	2/0-7	.819[b]	2/0-10	2/0-7	.971[b]
Lite nIP at 12 years, median/min-max	2/0-6	1/0-5	.887[b]	0/0-6	1.5/0-7	.796[b]
Lite IP at 12 years, median/min-max	0/0-5	0/0-3	.244[b]	0/0-5	0/0-2	.694[b]
Lyles total at 20 years, median/min-max	6/0-23	7/1-20	.204[b]	6/0-18	8/1-20	.025[b]
Lyles nIP at 20 years, median/min-max	4/0-14	4/0-12	.897[b]	4/0-14	5/0-17	.335[b]
Lyles IP at 20 years, median/min-max	2/0-9	2/1-9	.008[b]	2/0-8	3/1-9	<.001[b]
Bullying reported at 12 years			1.000[a]			.324[a]
No	516 (97.7)	40 (97.6)		384 (97.1)	40 (95.2)	
Yes	12 (2.3)	1 (2.4)		10 (2.5)	2 (4.8)	
Bullying reported at 20 years			<.001			<.001
No	473 (72.9)	25 (49.0)		354 (72.5)	25 (48.1)	
Yes	176 (27.1)	26 (51.0)		134 (27.5)	27 (51.9)	

DSM: Diagnostic and Statistic Manual; LSS: Life Stress Score; LITE: Life Incidence of Traumatic Events; nIP: non-interpersonal; IP: interpersonal; LYLES: Linköping Youth Life Event Scale.
[a]Fisher's exact test.
[b]Kruskal–Wallis Test.

Table 4. Parental mental health problems in relation to depressive and internalizing problems.

	DSM-5 Depressive problems			Internalizing problems >90th percentile		
	No	Yes		No	Yes	
	n (%)	*n* (%)	*p* value	*n* (%)	*n* (%)	*p* value
EPDS			.136			.034
No	588 (90.7)	43 (84.3)		450 (91.6)	43 (82.7)	
Yes	60 (9.3)	8 (15.7)		41 (8.4)	9 (17.3)	
HSCL-25			.481[a]			.702
No	352 (80.7)	27 (87.1)		270 (82.1)	27 (79.4)	
Yes	84 (19.3)	4 (12.9)		59 (17.9)	7 (20.6)	
EPDS + HSCL-25			.342[a]			.976[a]
No	328 (75.6)	26 (83.9)		255 (78.0)	26 (76.5)	
Once	19 (4.4)	2 (6.5)		17 (5.2)	2 (5.9)	
Twice	87 (20.0)	3 (9.7)		55 (16.8)	6 (17.6)	
Mental health problems mother			.022			.002
Agree	29 (4.4)	6 (11.8)		21 (4.3)	6 (11.5)	
Disagree	590 (90.4)	40 (78.4)		449 (91.1)	39 (75.0)	
Neither/undecided	34 (5.2)	5 (9.8)		23 (4.7)	7 (13.5)	
Mental health problems father			.002[a]			<.001
Agree	29 (4.4)	8 (15.7)		23 (4.7)	9 (17.3)	
Disagree	573 (87.9)	39 (76.5)		436 (88.4)	36 (69.2)	
Neither/undecided	50 (7.7)	4 (7.8)		34 (6.9)	7 (13.5)	

DSM: Diagnostic and Statistic Manual; EPDS: Edinburgh Postnatal Depression Scale; HSCL-25: Hopkins Symptom Checklist 25.
[a]Fisher's exact test.

smaller proportion reported that their father was a good parent ($p < .001$; $p < .001$). No differences were noted for reports on the mother being a good parent for individuals with depressive problems at age 20, however, a difference was noted for participants reporting internalizing problems at age 20 ($p = .009$). With respect to school, fewer individuals with depressive or internalizing problems reported that their schooling from age 13 and onwards worked fine, compared to those with low symptom scores at age 20 (45.1%.vs 81.3%, $p < .001$ and 42.3% vs 81.9%, $p < .001$ respectively).

Multivariable analysis showed that participants with depressive problems were less likely to have experienced their adolescent period as happy and also less likely to report that their father had been a good father (data not shown). Study participants with internalizing problems were likewise less likely to report that their father had been a good father.

Extended analyzes with multiple regression models

Finally, multivariable models were run separately for internalizing and depressive problems including independent variables that were significantly associated with the respective outcome in the multivariable block models (Table 6). Females were found to be at increased risk for depressive problems (OR = 2.28, CI = 1.04–5.02), and individuals with depressive symptoms were less likely to report their adolescent period as happy and that their father had been a good parent (OR = 14.96, OR = 6.34–35.32; OR = 2.92, CI = 1.28–6.64). Likewise, females had an increased risk for internalizing problems (OR

Table 5. Retrospective reports on adolescence by depressive and internalizing problems.

	DSM-5 Depressive problems			Internalizing problems >90th percentile		
	No	Yes		No	Yes	
	n (%)	*n* (%)	*p* value	*n* (%)	*n* (%)	*p* value
20 year follow-up						
Adolescent period happy			<.001			<.001
Agree	504 (77.2)	9 (17.6)		380 (77.1)	11 (21.2)	
Disagree	66 (10.1)	25 (49.0)		46 (9.3)	25 (48.1)	
Neither/undecided	83 (12.7)	17 (33.3)		67 (13.6)	16 (30.8)	
Relationships with peers were good			<.001			<.001
Agree	554 (84.7)	29 (56.9)		422 (85.6)	27 (51.9)	
Disagree	47 (7.2)	17 (33.3)		31 /6.3)	19 (36.5)	
Neither/undecided	53 (8.1)	5 (9.8)		40 (8.1)	6 (11.5)	
Mother was a good parent			.070			.009
Agree	617 (94.3)	44 (86.3)		470 (95.3)	45 (86.5)	
Disagree	20 (3.1)	4 (7.8)		15 (3.0)	3 (5.8)	
Neither/undecided	17 (2.6)	3 (5.9)		8 (1.6)	4 (7.7)	
Father was a good parent			<.001			<.001
Agree	549 (84.3)	24 (47.1)		417 (85.1)	27 (51.9)	
Disagree	55 (8.4)	14 (27.5)		38 (7.8)	14 (26.9)	
Neither/undecided	47 (7.2)	13 (25.5)		35 (7.1)	11 (21.2)	
School worked fine			<.001			<.001
Agree	532 (81.3)	23 (45.1)		404 (81.9)	22 (42.3)	
Disagree	65 (9.9)	20 (39.2)		45 (9.1)	23 (44.2)	
Neither/undecided	57 (8.7)	8 (15.7)		44 (8.9)	7 (13.5)	

DSM: Diagnostic and Statistic Manual.

Table 6. Multiple logistic regression on depressive and internalizing problems, each outcome modelled separately, presented with odds ratios (or) and corresponding 95% confidence intervals (CI).

	DSM-5 Depressive problems	Internalizing problems
	OR (95% CI)	**OR (95% CI)**
Gender		
Boy	*Reference*	*Reference*
Girl	2.28 (1.04–5.02)	12.61 (2.78–57.24)
LYLES IP	–	1.32 (1.04–1.68)
Adolescent period happy		
Agree	*Reference*	*Reference*
Disagree	14.96 (6.34–35.32)	12.36 (4.17–36.70)
Neither/undecided	8.00 (3.32–19.33)	11.76 (4.25–32.54)
Father was a good parent		
Agree	*Reference*	–
Disagree	1.88 (0.85–4.18)	–
Neither/undecided	2.92 (1.28–6.64)	–

LYLES: The Linköping Youth Life Experience scale; IP: interpersonal.
– Variable not included in the final model.

= 12.61, CI = 2.78–57.24). Experience of interpersonal life events at age 20 was associated with internalizing problems (OR = 1.32, CI = 1.04–1.68), and individuals with internalizing problems were less likely to report their adolescent period as happy (OR = 12.36, CI = 4.17–36.70).

Discussion

The aim of the present study was to examine factors associated with depressive problems at age 20 in terms of sociodemographic factors, previous mental health problems and experience of stressful life events during childhood, adolescence, and early adulthood. The results of the study can be summarized in the following three main findings.

Firstly, as could be expected, internalizing problems during childhood (specifically withdrawn/depressed) and adolescence increased the risk for subsequent internalizing problems in the bivariate analysis. Using the narrower categorization of depressive problems according to the DSM-5 oriented scale, no association with internalizing or externalizing problems at age three was found. The broader definition of internalizing problems most likely capture a wider range of problems, which seem to be rather stable over time. Previous studies have indicated discontinuous homotypic pathways for both depression and anxiety in childhood and adolescence, but also an association between childhood anxiety and depression during adolescence [7]. It is plausible that different mechanisms are at play, and that both constitutional and environmental risk factors are shared between depression and anxiety. Interestingly, internalizing symptoms at age 12 as reported by mothers were associated with internalizing problems in early adulthood, whereas self-reports on emotional problems at age 12 were not. Adolescent onset depression has been shown to be reactive to stressful life events, hyperactivity, and aggression [49], indicating at least in part different pathways and patterns of vulnerability during different parts of childhood. Internalizing problems at age 12 predicted internalizing problems at age 20 in the multivariable block model but did not stay significant in the final model. This indicates that more recent symptoms (i.e. 12 years compared to three years) are of greater importance for current problems, but also that other factors are more influential on the presence of internalizing and depressive problems in early adulthood compared to internalizing problems during early childhood and adolescence.

Secondly, early life stress as reported by the mothers at baseline was more common in individuals with internalizing problems, but not more common in individuals with depressive problems compared to their low-scoring counterparts. Life stress was measured at the child's three months of age, yet many of these circumstances are likely to be relatively stable and impact the environment and developmental conditions onwards during early childhood. Previous research has investigated different mechanisms linking early adversity with psychopathology, including neurobiological processes

[50]. In a study on foster care versus institutional care for abandoned children in Romania, children who stayed in institutional care showed blunted hypothalamic-pituitary-adrenal (HPA) and sympathetic nervous system (SNS) response to psychosocial stress, compared to children who were placed in foster care [51]. Age at placement was significantly associated with respiratory sinus arrhytmia (RSA) activity and cortisol activity, and thus adversity during the first two years in life is suggested to be particularly detrimental for the development of stress response systems in children [51]. Such periods of increased sensitivity are due to enhanced neuroplasticity and enable crucial development. However, studies on humans distinguishing the specific time period from the length of exposure are lacking (i.e. whether the effect is due to the duration of adversity or the age/developmental stage at exposure) [50]. It is plausible that internalizing problems catches a wider range of psychosocial symptoms that might be induced by environmental stressors to a greater extent than endogenous depressive problems. Early life stress did, however, not stay significant in the multivariable models. Subsequent measurements of life stress factors would have been interesting to enable the evaluation of developmental timing versus immediate consequences.

Experience of traumatic life events reported by early adulthood was more common in individuals with internalizing as well as depressive problems. This finding is in line with previous studies indicating the impact of early life trauma, specifically interpersonal events such as bullying, maltreatment and parental loss on adult mental health [52]. The impact of major life events on the development of depression is well-known and has been shown in community samples [22]. However, individuals predisposed to depression expose themselves to high-risk environments to a greater extent than others, thus increasing the exposure to traumatic life events [10]. Interpersonal life events reported at age 20 was one of the few factors that stayed significant in the final multivariable model for internalizing problems, suggesting an association of importance between the experience of interpersonal events and internalizing problems in early adulthood.

Bullying victimization was reported by more than half of the individuals with internalizing and depressive problems respectively, compared to around ¼ of study participants at age 20. This finding is in line with previous prospective studies that have shown bullying victimization to be associated with depression and anxiety in early adulthood [23,24]. However, the association noted in this study is based on retrospective reports on bullying victimization, which needs to be taken into account. It is plausible that a depressive state of mind as well as recall bias could affect the accuracy of answers to this type of questions. On the contrary, reports on bullying victimization at age 12 was not associated with internalizing or depressive problems by age 20 in this study. Bullying has been argued to be one of the strongest risk factors for depression in adolescence and adulthood and have been associated with immediate effects on depression onset during childhood [8]. Multiple vulnerabilities rather than casual mechanisms have been suggested to explain the association between bullying and mental health problems [53]. Bullying victimization was associated with both internalizing and depressive problems in the multivariable block models, but did not stay significant in the final model, indicating a stronger association for other factors.

Thirdly, maternal symptoms of postpartum depression were associated with internalizing problems at age 20 in the bivariate analysis. However, maternal symptoms of depression postpartum or at age 12 did not predict internalizing or depressive problems at age 20 in the multivariable models. This finding is partly inconsistent with previous studies, where recurrent and chronic depression in mothers have been shown to impact behavior problems in preschool children [54,55], however, few studies examined the effects in older children and adolescents [56,57]. Early childhood has been pointed out as a sensitive period for development, and it is plausible that maternal depression during this phase is particularly detrimental due to increased vulnerability [17]. Thus, the health status and presence of the other parent as well as social support or support from welfare can be crucial. Moreover, studies investigating parenting styles have indicated that anxious behavior in parents increases the risk for anxiety in children [58]. This way, parental anxiety has both constitutional and environmental impact on child behavior and mental health.

In this study, 20-year-olds with internalizing and/or depressive problems reported that their mothers and fathers had had mental health problems during their upbringing to a greater extent than their counterparts with low or no symptoms, results that stayed significant also in the multivariable block analysis. The discrepancy regarding maternal mental health could be impacted by a depressive state of mind when study participants, at age 20, were reporting on parental mental health retrospectively. Another explanation could be that information on maternal mental health (i.e. depressive problems) was limited to assessments at the 3- and 12-year follow-ups. Mothers could have exhibited other types of mental health problems or depressive episodes at other occasions. Previous studies have indicated that exposure to parental mental health problems during a long period of time exerts the greatest risk for negative consequences for the offspring [54]. Parental mental health problems could also entail social end economic consequences for the family, that in turn impact the child mental health. On the other hand, socioeconomic factors might impact child- as well as parental mental health directly [20,21].

Strengths and limitations

The study is strengthened by the long follow-up time with multiple data collection points. To our knowledge, very few studies follow the mental health and development of the Millennial generation from birth into adulthood. However, the following limitations need to be considered when interpreting the results.

A considerable attrition rate was noted at age 20, with 41.7% of the baseline population taking part in the survey. The drop-out analysis on the 20-year follow-up revealed few differences between participants and non-participants, however, fewer men than women participated. Given the higher prevalence rates of depression in women compared to men, this skewness is not likely to impact the result to

a great extent. No differences between participants and non-participants were found with respect to behavioral and emotional problems at age 3 and 12. It is plausible that attrition may be more common in individuals with depressive symptoms. Moreover, retrospective reports on bullying, parental mental health, schooling, and friendship might be influenced by a depressive state of mind when filling out the questionnaire. For example, there were discrepancies in results on bullying and maternal mental health when comparing information from the 12-year follow-up with retrospective reports from the 20-year follow-up. However, these discrepancies could also be the results of events appearing later during adolescence. Moreover, information on mental health, life events and parental mental health was retrieved from several informants (self-reports as well as parental reports). This can be considered a strength of the study; however, it can also be one reason for diverging results.

Conclusion

Recent events (i.e. interpersonal life events and bullying) seemed to be the most influential factors on the development of internalizing and depressive problems among young adults, a result that highlight the importance to address these issues in clinical practice. Moreover, internalizing problems at preschool age and adolescence increased the risk for internalizing problems in early adulthood, however, other factors were of greater importance in the final model. Nevertheless, the results emphasize the importance of early intervention to prevent dysfunctional development and persistent symptoms. Future research should focus on factors associated with persistent or recurrent symptoms to identify prevention targets. Furthermore, the importance of parental mental health cannot be understated, even though the present study showed different results depending on the informant and the timeframe used. As expected, females were at a greater risk for internalizing and depressive problems than men. Fewer factors were found to increase the risk for depressive problems compared to internalizing problems, possibly explained by the fact that a broader concept such as internalizing problems is more sensitive to psychosocial and stress-related symptoms.

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Data availability statement

The datasets used are available from the corresponding author on reasonable request.

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