



Association of Depressive Symptoms in Late Adolescence and School Dropout

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Abstract

The present study investigated the association between symptoms of depression in late adolescence and completion of upper secondary school, taking symptoms of ADHD and conduct disorder, and parental education into account. The study is based on the youth@hordaland-survey, conducted in Western Norway in 2012. A total of 9157 adolescents (aged 16–19 years, 53% girls) consented to participation and registry linkage and comprised the sample of the present study. Symptoms of depression, ADHD, and conduct disorder were based on adolescent self-report. Information on parental education, grade point average (GPA), and upper secondary school completion was retrieved from the National Education Database. In the sample, 14.8% had not completed upper secondary education within 5 years. Symptoms of depression were associated with higher odds of failure to graduate within 5 years (adjusted odds ratio (AOR) = 1.50). The association was attenuated but remained significant when adjusting for symptoms of ADHD, conduct disorder, and parental education. Adolescents reporting high levels of both depression and conduct disorder had the highest odds of dropout (AOR = 4.15). GPA partially mediated the association between symptoms of depression and dropout. The results show a consistent, but small association between symptoms of depression in late adolescence and failure to complete upper secondary education within five years. Given the high rate of depressive symptoms in the adolescent population, it is important to identify protective factors that promote school functioning and graduation for adolescents experiencing such symptoms.

Keywords School dropout · Depression · Adolescence · Upper secondary school · School grades

Introduction

School dropout is increasingly recognized as a societal concern, with negative consequences for the individual affected and the broader society in terms of poorer health and unemployment (Castellví et al., 2020; Freudenberg & Ruglis, 2007; Ramsdal et al., 2018). In Norway, failure to complete upper secondary education has been linked to increased risk of long-term sickness absence (De Ridder et al., 2013), both medical and non-medical social insurance benefits (De Ridder et al., 2012), and receiving disability pension (Bruusgaard et al., 2010). Therefore, it is of great importance to identify predictors of school dropout that can be targeted to promote completion of upper secondary school.

Estimates suggest that between 10 and 40% of high school dropouts are attributable to mental disorders (Breslau et al., 2008; Mikkonen et al., 2020; Stoep, Weiss, Kuo, Cheney, & Cohen, 2003), with the most recent estimate from Finland suggesting 19.1% (Mikkonen et al., 2020). When

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investigating the impact of different mental health problems, the evidence is stronger for externalizing problems such as ADHD and conduct problems than for internalizing problems such as depression and anxiety (Esch et al., 2014; Kessler et al., 1995; Lee et al., 2009). Still, depression has been described as one of the main public health challenges in adolescence (Green et al., 2005; Hyde et al., 2008; Salk et al., 2016), and there are indications that the prevalence of depression and depressive symptoms have increased in the adolescent population (Collishaw et al., 2010; Tick et al., 2007; von Soest & Wichstrom, 2014). Attempts to summarize the literature in systematic reviews (Esch et al., 2014; Melkevik et al., 2016) and meta-analyses (Riglin et al., 2014; Wickersham et al., 2021) have all identified a relationship between symptoms of depression and dropout, but the effect size is small. Still, the literature remains conflicting. While a significant association with dropout has been detected for both diagnosed depression and internalizing problems (Breslau et al., 2008; Hetlevik et al., 2018; Kessler et al., 1995; Lee et al., 2009; Mikkonen et al., 2020) and subclinical symptoms (Butterworth & Leach, 2017; Fletcher, 2010; McLeod & Fettes, 2007), others studies have either failed to find this association (Leach & Butterworth, 2012; Miech et al., 1999) or found that it could be explained by other factors (Breslau et al., 2011; Evensen et al., 2016; McLeod et al., 2012).

One reason for the discrepancies could be the timing of the assessment of depressive symptoms relative to school dropout. In a recent meta-analysis, the association between symptoms of depression and school dropout was stronger for shorter follow-up (Riglin et al., 2014), and several studies suggest that more recent depressive symptoms show a stronger association to school dropout compared to symptoms or disorders earlier in life (Dupéré et al., 2018; McLeod & Fettes, 2007; Mojtabai et al., 2015). Further, more consistent and larger effects of depression on academic achievement were identified in the high school years than in junior high school (Riglin et al., 2014; Weidman et al., 2015). Cohort effects could also be present. Kessler and colleagues (Kessler et al., 1995) found that the proportion dropping out due to mental disorders was substantially larger in the more recent cohorts. Still, participants in the most recent cohort were born between 1966 and 1975, and many studies similarly rely on data collected retrospectively from adult participants who were adolescents several decades ago (Breslau et al., 2008, 2011; Leach & Butterworth, 2012; Lee et al., 2009).

The association between depression and school completion could also be affected by how depression is measured. Composite measures of internalizing problems that include both depression and anxiety symptoms are often used (Evensen et al., 2016; Sagatun et al., 2014; Veldman et al., 2014) and could mask more specific associations with school

functioning (Riglin et al., 2014). It is plausible that anxiety and depression could be related to school functioning in different ways, and there are indications that depression is more consistently associated with poor academic attainment compared to anxiety (Riglin et al., 2014). There is even evidence that anxiety, in some cases, could work in the opposite direction and have a positive impact on school functioning, with one study reporting lower odds of school dropout for adolescents with anxiety (Borges et al., 2011).

In this context, it is particularly important to take coexisting problems into account. In many studies, the association between symptoms of depression and dropout was explained by externalizing problems (Breslau et al., 2011; Evensen et al., 2016; McLeod et al., 2012; Mojtabai et al., 2015; Veldman et al., 2014). Still, many of these studies rely on composite measures of internalizing problems (Evensen et al., 2016; Mojtabai et al., 2015; Veldman et al., 2014), and it is not certain whether the same applies for depressive symptoms independently. The importance of coexisting externalizing problems could also be related to the temporal aspect of measurement. For instance, while the association between internalizing problems in childhood and school dropout was explained by externalizing problems, internalizing problems in adolescence were significantly associated with dropout after adjustment (McLeod & Fettes, 2007). It is further important to consider parental education, which is related to both educational attainment (Dubow et al., 2009) and depression (Bøe et al., 2019) in adolescence. Thus, a possible association between symptoms of depression and dropout could be due to the influence of parental education on both variables.

The impact of coexisting mental health problems also warrants further attention (Wickersham et al., 2021). Several studies show that adolescents with more than one mental disorder are at greater risk of dropout (Breslau et al., 2008; Lee et al., 2009), which has also been found for comorbid externalizing and internalizing problems (Hetlevik et al., 2018). Further, a dose–response relationship has been suggested between the number of prior disorders and dropout (Kessler et al., 1995). It would be of great interest to investigate whether such effects are also present for subclinical symptoms of mental health problems, which are experienced by a larger number of adolescents than diagnosable disorders.

A possible mechanism through which symptoms of depression could impact school dropout is academic performance. Academic performance is an important predictor of later school dropout, and as depressive symptoms are linked to poor school grades (Hishinuma et al., 2012; Weidman et al., 2015), it has been suggested that academic performance might act as a mediator between depression and later school dropout (Mikkonen et al., 2020; Sagatun et al., 2014). Different interventions could be called for depending on whether symptoms of depression have a more

direct effect on dropout or impact dropout through academic performance.

Aims

The present study aimed to investigate the association between depressive symptoms in adolescence and failure to complete upper secondary education within five years. We further aimed to examine whether the association differed by age or gender, and to control for parental education and symptoms of ADHD and conduct disorder. Further, grade point average (GPA) was examined as a mediator on the association between depressive symptoms and dropout.

Methods

Procedure

Data stem from the youth@hordaland-survey conducted during spring 2012 in Hordaland County, Western Norway, linked to information from the Norwegian Educational Database (NUDB). All adolescents born from 1993 to 1995 were invited to participate in the survey. Adolescents attending school were invited via their school e-mail address, those not at school were invited by postal mail. The main aim of the survey was to gather information on mental health and health service use among adolescents.

The schools allocated one school hour to complete the questionnaire. School personnel were present during the data collection to ensure confidentiality, and survey members were available on telephone. The adolescents could also complete the questionnaire at their convenience during the data collection period.

Sample

Of the 19,430 adolescents invited to participate, 10,257 agreed and filled out the questionnaire, yielding a participation rate of 53%. Of these, 9,166 consented to registry linkage, and 9,157 participants with valid information on the educational variables were included in the present study. The subsample consenting to registry linkage was similar to the total sample on gender and age distribution and self-reported sociodemographics (Nilsen et al., 2020).

Compliance with Ethical Standards

The study and the linkage to the NUDB were approved by the Regional Committee for Medical and Health Research Ethics (REC) in Western Norway. In addition, a Data Protection Impact Assessment was conducted for the linkage. By Norwegian rules and regulations, adolescents 16 years

of age and older can make decisions regarding their health, including participation in health studies. Thus, the adolescents gave consent themselves to participate, while parents/guardians received written information about the study in advance.

Instruments

Demographic Information

Information about gender and date of birth was provided by the personal identity number in the Norwegian National Population Register. Age was estimated by calculating the time interval between the date of birth and date of participation. Socioeconomic status was indicated by parental educational status, retrieved from the NUDB. Mothers' and fathers' highest education when the participants were 16 years old were reported separately and categorized into: 'lower,' 'upper secondary,' and 'higher.'

Information on School Functioning from the NUDB

Completion of upper secondary education. Completion of upper secondary school was defined according to the national definition used by Statistics Norway (Statistics Norway, 2020) as graduation within five years of beginning upper secondary school for students enrolled in general tracks and within six years for students enrolled in vocational tracks. Participants who had not completed upper secondary school within five/six years were defined as non-completers. Students normally finish the general tracks in three years and the vocational tracks in three or four years, depending on the program they follow.

GPA. The participants' GPA for each school year in upper secondary education was retrieved from the NUDB. The grades range from 1 (failure) to 6 (excellent). The GPA is the mean of all the grades a person received in one school year. In the present study, grades from the school year 2012–2013, the year after the study was conducted, were included. As many students had already graduated in 2012–2013, the sample size for the mediation analysis including GPA was restricted to those still at school and receiving grades the year following the survey, resulting in a sample size of 6883 students.

Measures of Mental Health Problems

Symptoms of depression. Symptoms of depression were assessed using the Short Moods and Feelings Questionnaire (SMFQ) (Angold et al., 1995), consisting of 13 items assessing emotional and cognitive symptoms associated with depression. Each symptom was rated on a 3-point Likert

scale, with the response alternatives ‘not true,’ ‘sometimes true,’ and ‘true.’ The psychometric properties and unidimensionality of the measure have been supported in population-based studies (Messer et al., 1995; Turner et al., 2014) and in the sample from youth@hordaland (Lundervold et al., 2013). The Cronbach’s alpha of the SMFQ in the current study was 0.91.

Symptoms of ADHD. Symptoms of inattention and hyperactivity were assessed using the Adult ADHD Self-Report Scale (ASRS) (Kessler et al., 2005). Though originally developed for use in adults, the scale has been validated for use among adolescents (Adler et al., 2012). The ASRS consists of 18 items, 9 items assessing inattention and 9 items assessing hyperactivity, rated on a 5-point Likert scale ranging from ‘never’ to ‘very often,’ corresponding to how often the symptoms are experienced. The Cronbach’s alpha of the ASRS in the present study was 0.89.

Symptoms of conduct disorder. Symptoms of conduct disorder were assessed using the Youth Conduct Disorder (YCD) scale (Lucas et al., 2001). The scale consists of 8 items with the response options ‘yes’ and ‘no.’ The total number of positive responses was used to indicate severity of conduct problems. The Cronbach’s alpha of the YCD in the current study was 0.74.

Statistical Analyses

Differences between adolescents defined as dropouts and completers regarding gender and parental education were investigated using Chi-square tests, with Cramer’s V as a measure of effect size. Cramer’s V varies from 0 (no association) to 1 (perfect association), where values between 0.07 and 0.21 indicate small effects, values from 0.21 to 0.35 medium effects, and values larger than 0.35 large effects (Cohen, 1988). Independent-samples t-test was used to investigate differences in age and symptoms of depression. The effect size was indicated by Cohen’s d, where values below 0.20 are interpreted as small, values of about 0.50 as medium, and values above 0.80 as large effect sizes (Cohen, 1988).

Some participants had missing data on the mental health measures (4.3% on the SMFQ, 4.4% on the ASRS, and 8.1% on the YCD) and on the demographic measures (paternal education 3.1%, maternal education 1.5%, and age 0.3%). The missing values were assumed missing at random, and 10 missing imputed datasets were created using Stata. Variables entered the imputation model were gender, age, maternal education, paternal education, SMFQ-score, ASRS-score, YCD-score, and the variable indicating dropout. Ordered factor variables were imputed using logistic regression (maternal education and paternal education), the continuous variable age using linear regression, and the sum scores

of the mental health measures that should be restricted to the observed range using predictive mean matching (SMFQ-score, ASRS-score, and YCD-score). Subsequent data manipulations and analyses were conducted on all datasets, and estimates were pooled using the estimation approach inherent in Stata, except for the predictive margins plot, as predictive margins cannot be well estimated on imputed data. Thus, the predictive margins plot was based on list-wise deleted data.

To ease comparison between measures, the sum scores of the SMFQ, the ASRS, and the YCD were standardized in the imputed datasets (using z-transformation) giving each measure a mean of 0 and a standard deviation (SD) of 1. New categorical variables were created dichotomizing the sum scores at the 90th percentile. These variables are not based on a clinical cutoff identifying adolescents who fulfill diagnostic criteria for a disorder but indicate the adolescents with the 10% highest scores on each measure. The 90th percentile was chosen as it is well established as a cutoff separating children and adolescents with and without risk of mental health problems (Goodman, 2001). Further, there are no official cutoff scores available for the measures used in the present study that have been validated for use in this age group. Regarding the SMFQ, a cutoff at 12 has been suggested in a study of help-seeking adolescents aged 12–19 (Thabrew et al., 2018), and a study of Norwegian adolescents aged 10–19 used a cutoff at 11, which corresponded roughly to the 90th percentile (Larsson et al., 2016). The 90th percentile in the present study corresponds to a cutoff at 14, which is higher than in the previous studies. This could be related to the age range in the studies, where the present study is limited to late adolescence where higher scores are to be expected (Larsson et al., 2016). The mean scores of the SMFQ in the present study are similar to another study of late adolescents in Norway (Kjeldsen et al., 2016).

The dichotomous variables were created across the imputed datasets, and estimated proportions showed that 11.2% scored above the cutoff of the SMFQ (≥ 14), 10.4% scored above the cutoff on the ASRS (≥ 40), and 8.8% scored above the cutoff of the YCD (≥ 2). Further, new variables were created identifying the adolescents with high scores (above the 90th percentile on the SMFQ, the ASRS, and the YCD) on 1) the SMFQ only, 2) the SMFQ and the ASRS, and 3) the SMFQ and the YCD. Estimating the proportions of each group across the imputed datasets showed that 6.5% of the participants scored above the 90th percentile on the SMFQ only, 6.5% on the ASRS only, 5.4% on the YCD only, while 2.9 scored above the 90th percentile on both the SMFQ and the ASRS and 1% scored above the 90th percentile on both the SMFQ and the YCD.

Logistic regression analyses were conducted to investigate the association between symptoms of depression (dimensionally and dichotomously) and dropout. Three

models were specified. Model 1 included symptoms of depression, age, and gender. Parental education was added in model 2, and symptoms of ADHD and conduct disorder in model 3. A logistic regression analysis was conducted to investigate the association between being high scorers on only the SMFQ, only the ASRS, only the YCD, the SMFQ and the ASRS, and the SMFQ and the YCD and dropout. Age, gender, and parental education were included as adjustment variables.

The association between symptoms of depression and school dropout was further examined by estimating a structural equation model allowing for mediation by GPA. Only adolescents with GPA from the school year following the year of the survey were included to adhere to the temporal aspects of mediation analysis ($n = 6883$). The analysis was controlled for age and gender. The robust maximum likelihood estimator was used, and indirect effects were investigated using the built-in function IND in Mplus. A significant mediation effect was determined using 95% bias-corrected bootstrap confidence intervals. Standardized effect sizes are reported.

Mediation analyses were conducted using Mplus, version 8 (Muthén & Muthén, 1998–2017). The remaining analyses were conducted using Stata, version 17 (StataCorp, 2019).

The forest plots were generated using the Stata module “IPDMETAN” (Fisher, 2014).

Results

Characteristics of the Sample

The total sample consisted of 52.9% girls, and the mean age of the participants was 16.9 years (SD 0.8). Regarding parental education level, 34% of fathers and 41% of mothers had completed higher education, while 50% of the fathers and 42% of the mothers had completed upper secondary school. Of the 9,157 adolescents with valid information on the school completion variable, 1,359 (14.8%) had not completed upper secondary education within 5 years (see Table 1). Fewer boys, compared to girls, had graduated. Parental education was significantly related to graduation, with small effect sizes for both maternal and paternal education (Cramer’s $V = -0.18$ for maternal and -0.17 for paternal education, both p ’s < 0.001). A greater proportion of adolescents with lower parental education had not completed within 5 years compared to higher parental education (27.0% compared to 8.7%, respectively, for maternal education). Both for boys and girls, adolescents who graduated

Table 1 Demographic characteristics of the sample and graduation from upper secondary school

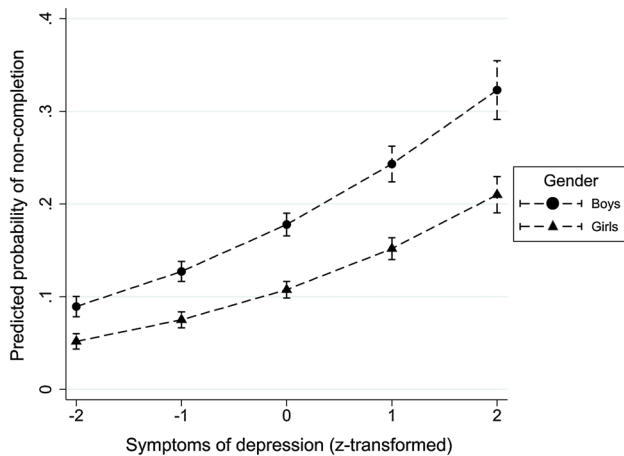
	Graduated 7798 n (%)	Not graduated 1359 n (%)	Effect size	P-value
<i>Gender</i>				
Boys	3571 (45.8)	742 (54.6)		
Girls	4227 (54.2)	617 (45.4)		
Age (m[SD])	17.0 (0.85)	16.9 (0.83)	-0.08 ^d	.010
<i>Maternal education</i>			-0.18 ^v	< .001
Lower	1111 (14.2)	410 (30.2)		
Upper secondary	3206 (41.1)	579 (42.6)		
Higher	3390 (43.5)	321 (23.6)		
<i>Paternal education</i>			-0.17 ^v	< .001
Lower	1058 (13.6)	359 (26.4)		
Upper secondary	3770 (48.3)	666 (49.0)		
Higher	2793 (35.8)	229 (16.9)		
<i>Symptoms of depression (m[SD])</i>				
Girls	7.05 (5.8)	9.6 (7.0)	0.43 ^d	< .001
Boys	3.78 (4.5)	5.99 (6.2)	0.46 ^d	< .001
<i>Symptoms of ADHD (m[SD])</i>				
Girls	27.9 (9.8)	32.0 (11.4)	0.41	< .001
Boys	24.6 (10.3)	27.6 (12.4)	0.28	< .001
<i>Symptoms of conduct disorder (m[SD])</i>				
Girls	0.27 (0.77)	0.59 (1.13)	0.38	< .001
Boys	0.44 (1.07)	0.81 (1.55)	0.32	< .001

m: mean, SD: standard deviation, ^v Effect size Cramer’s V, ^d Effect size Cohen’s d

Table 2 The association between symptoms of depression and dropout from upper secondary school

	Model 1		Model 2		Model 3	
	AOR (95% CI)	<i>p</i> value	AOR (95% CI)	<i>p</i> value	AOR (95% CI)	<i>p</i> value
Symptoms of depression	1.50 (1.42–1.58)	<.001	1.45 (1.37–1.54)	<.001	1.32 (1.23–1.40)	<.001
Symptoms of ADHD					1.16 (1.09–1.24)	<.001
Symptoms of conduct disorder					1.20 (1.13–1.26)	<.001

AOR = adjusted odds ratio, CI = confidence interval. Model 1 adjusted for age and gender, Model 2 adjusted for age, gender, paternal education, and maternal education, Model 3 adjusted for age, gender, paternal education, maternal education, symptoms of ADHD, and symptoms of conduct disorder

**Fig. 1** Predicted probability of dropout at different symptom levels of depression

within 5 years reported fewer symptoms of depression compared to those who did not, with medium effect sizes (Cohen's $d = 0.46$ for boys and 0.43 for girls, respectively).

Symptoms of Depression and Completion of Upper Secondary School

A higher symptom score of depression was associated with higher odds of dropout (AOR = 1.50, 95% CI 1.42–1.58, see Table 2). The predicted margins for dropout at different levels of depressive symptoms are shown in Fig. 1. For

girls, a depression score at the mean is associated with a predicted probability of dropout at 10.8%, a score 2 SDs below the mean with a predicted probability of 5.2%, and a score 2 SDs above the mean with a predicted probability of 21.0%. Thus, a higher score of depressive symptoms is related to a higher predicted probability of dropout. The corresponding predicted margins for boys are 17.8 for a depression score at the mean, 8.9 for a score 2 SDs below the mean, and 32.3 for a score 2 SDs above the mean.

The association between symptoms of depression and dropout was slightly attenuated but remained significant when adjusting for parental education (AOR = 1.45, 95% CI 1.37–1.54) and symptoms of ADHD and conduct disorder (AOR = 1.32, 95% CI 1.23–1.40). There were significant associations between ADHD symptoms and dropout (AOR = 1.16, 95% CI 1.09–1.24) and conduct problems and dropout (AOR = 1.20, 95% CI 1.13–1.26) when adjusting for symptoms of depression and demographics (see Table 2). Similar results were found for adolescents scoring above the 90th percentile on depressive symptoms and dropout, with larger estimates (AOR = 1.79 for depressive symptoms, AOR = 1.80 for ADHD symptoms and AOR = 1.73 for symptoms of conduct disorder in the fully adjusted analysis, see Table 3).

Gender was significantly associated with school dropout where boys had a higher odds ratio of dropout. There was no significant interaction effect between gender and symptoms of depression ($p = 0.144$, interaction based on

Table 3 The association between high symptom scores of depression and dropout from upper secondary school

	Model 1		Model 2		Model 3	
	AOR (95% CI)	<i>p</i> -value	AOR (95% CI)	<i>p</i> -value	AOR (95% CI)	<i>p</i> -value
High scores of depression	2.47 (2.10–2.91)	<.001	2.31 (1.96–2.73)	<.001	1.79 (1.50–2.14)	<.001
High scores of ADHD					1.80 (1.51–2.14)	<.001
High scores of conduct disorder					1.73 (1.49–2.01)	<.001

AOR = adjusted odds ratio, CI = confidence interval. Model 1 adjusted for age and gender, Model 2 adjusted for age, gender, paternal education, and maternal education, Model 3 adjusted for age, gender, paternal education, maternal education, high symptom scores of ADHD and conduct disorder

the original dataset). Age was not significantly associated with dropout in any of the analyses (results not shown).

High Scores on Symptoms of Depression Only, Symptoms of Depression and ADHD, or Symptoms of Depression and Conduct Disorder and School Dropout

Having scores above the 90th percentile on either depressive symptom, symptoms of ADHD, or conduct disorder was associated with increased odds of dropout (AOR = 1.99 for depressive symptoms, AOR = 2.26 for symptoms of ADHD, and AOR = 1.82 for symptoms of conduct disorder, see Fig. 2). Having high scores on both symptoms of depression and ADHD was associated with an OR of 2.70 (95% CI 2.01–3.64), while high scores on both symptoms of depression and conduct disorder was associated with the highest odds ratio of dropout of 4.15 (95% CI 2.56–6.72). Boys had higher odds of dropout than girls, but there was no significant interaction effect ($p = 0.508$, interaction analysis based on the original dataset).

The Mediating Role of GPA

A mediation model was specified where depressive symptoms were included as a predictor of school dropout, allowing for mediation by GPA. There was a significant indirect effect through GPA, while a direct effect from symptoms of depression to dropout remained, suggesting partial mediation (see Fig. 3). The total effect from symptoms of depression to dropout was $b = 0.207$. Of this total effect, $b = 0.095$ (45.9%) was mediated through GPA, where symptoms of depression predicted a decrease in GPA, and a lower GPA is related to a predicted increase in dropout. The direct effect from GPA to dropout was $b = -0.570$.

Discussion

In a sample of older adolescents in Norway, symptoms of depression were related to higher odds of not completing upper secondary education within five years, with small effect sizes. The associations slightly attenuated but remain significant when taking parental education and symptoms of ADHD and conduct disorder into account. Adolescents

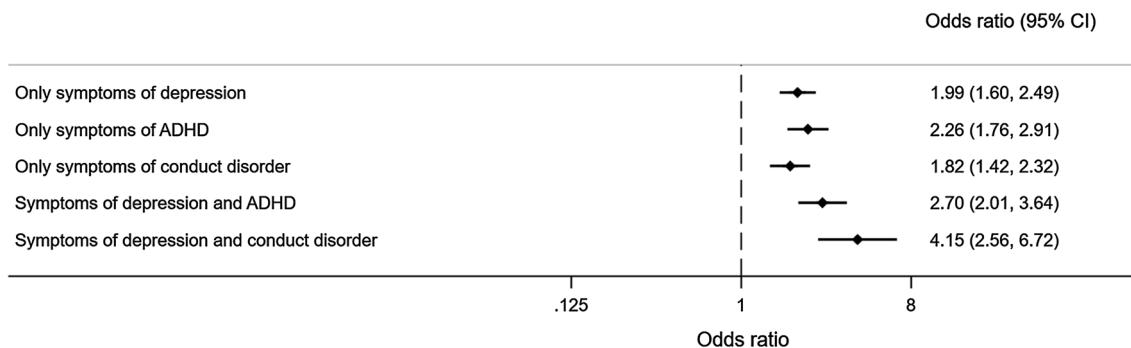


Fig. 2 The association between high scores on symptoms of depression only, ADHD only, conduct disorder only, high scores on both symptoms of depression and ADHD, or depression and conduct disorder and school dropout

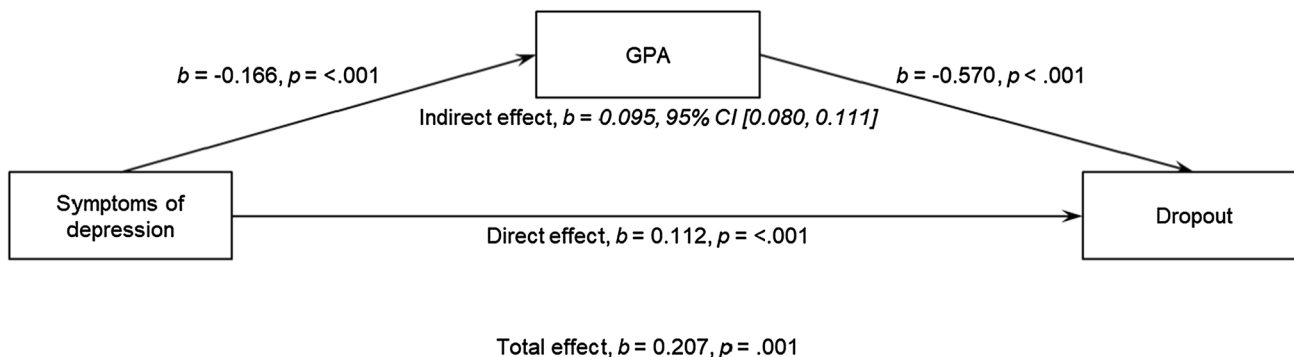


Fig. 3 Model of symptoms of depression as a predictor of school dropout, mediated by GPA. Note. GPA = grade point average. Age and gender are included as covariates in the model

with high scores above the 90th percentile on both depressive symptoms and symptoms of ADHD or conduct disorder had higher odds of not completing secondary school, compared to having high scores on either of these domains, especially for the combination depression and conduct problems. Although boys had higher odds of dropout, there was no evidence of gender differences in the association between depressive symptoms and school dropout. School grades partly mediated the association between symptoms of depression and completion of upper secondary education.

Depressive symptoms were related to dropout from upper secondary education, in line with previous studies (Breslau et al., 2008; Butterworth & Leach, 2017; Fletcher, 2010; Hetlevik et al., 2018; Kessler et al., 1995; Lee et al., 2009; McLeod & Fettes, 2007; Mikkonen et al., 2020) and a meta-analysis (Riglin et al., 2014). The association was still significant after adjusting for symptoms of ADHD and conduct disorder, which is contrary to some previous studies where the presence of coexisting externalizing problems explained the association (Evensen et al., 2016; Mojtabai et al., 2015; Veldman et al., 2014). Still, the majority of these used composite measures of internalizing problems, which could partly explain the differences in results, as anxiety is not as clearly linked to school functioning as depression (Riglin et al., 2014).

Interestingly, though small, the association between symptoms of depression and dropout was similar in size to the associations with symptoms of ADHD and conduct disorder across all analyses, which is in contrast to previous studies reporting more consistent and stronger effects of externalizing problems (Esch et al., 2014; Kessler et al., 1995; Lee et al., 2009). Thus, the present study clearly emphasizes the importance of depressive symptoms for school completion. This could be related to timing of the measurement in late adolescence when the adolescents were attending upper secondary education. Previous studies have found stronger associations with recent depressive symptoms (Dupéré et al., 2018; McLeod & Fettes, 2007), and a meta-analysis of depression and school grades found effect sizes almost three times larger when symptoms were assessed in late rather than early adolescence (Riglin et al., 2014). Further, several of the previous studies relied on adult participants' retrospective reports regarding their mental health (Kessler et al., 1995; Lee et al., 2009).

The link between symptoms of depression and dropout was partly mediated by GPA, which is consistent with previous studies of internalizing problems (Mikkonen et al., 2020; Sagatun et al., 2014). Still, a larger proportion of the total effect was mediated by grades, which could be related to investigating depressive symptoms alone, versus using a composite measure. Possible mechanisms underlying the association include negative thinking and procrastination, difficulties in completing assignments and concentrating

in class (Humensky et al., 2010). One study found that the association between depression and GPA could be explained by difficulties concentrating, difficulties with social relationships and self-reliant school performance, and perceiving schoolwork as highly loading (Fröjd et al., 2008). Such school-related difficulties could lead to low grades, which could increase a feeling of hopelessness, leading to less effort, and ultimately failure to receive passing grades and early school leaving.

The associations between symptoms of depression and dropout were clear and consistent in the present study but yielded rather small effect sizes. The largest effects were found for concurrent high scores on symptoms of depression and conduct disorder. This increased risk related to co-occurring problems aligns with a previous study investigating the impact of concurrent diagnosed internalizing and externalizing problems (Hetlevik et al., 2018) and a study on grades which found stronger associations with GPA for comorbid depression and conduct problems compared to either alone (Rockhill et al., 2009). Several studies have indicated that the effect of comorbid depression and conduct disorder is more than additive (Ezpeleta et al., 2006; Marmorstein & Iacono, 2003), and academic functioning is one of the areas with the largest impairment (Lewinsohn, Rohde, & Seeley, 1995).

It has been suggested that comorbidity with conduct problems should be considered an effect modifier, increasing the impact of symptoms of depression on dropout (Rockhill et al., 2009). Further, a dual failure pathway has been suggested to explain these associations, where disruptive behaviors related to conduct disorder leads to conflicts with parents, peers, and teachers which has a negative impact on academic functioning, which in turn leads to depressed mood (Capaldi, 1991). The co-occurrence of symptoms of depression and conduct disorder can probably be explained by a mix of common and unique risk factors (Wolff & Ollendick, 2006). Social functioning has been suggested as a central common risk factor as lower social competence and lower social support has been related to the functional impairment of concurrent symptoms (Rockhill et al., 2009). Difficulties with social functioning could be important for school functioning as the school is a social setting as well as an academic setting. It is further possible that exclusionary practices for students with disruptive behaviors could contribute to disengagement from school and subsequently to dropout.

Although girls report more symptoms of depression and boys have a higher rate of dropout in the present study, the association between these was similar for both genders, in line with previous studies (Butterworth & Leach, 2017) and a meta-analysis (Riglin et al., 2014). It therefore appears that depressive symptoms have a similar effect on academic functioning for boys and girls. This is important to note, as

poor school functioning in boys is often related to externalizing problems and acting out, while less attention is paid to boys who are withdrawn and silent in the classroom. The present study suggests that symptoms of depression have a similar negative effect on school completion as externalizing problems, also for boys.

The age of the adolescents was not related to dropout in the present study, and there was no interaction between age and symptoms of depression in predicting dropout. This could be due to the restricted age range in the study, in comparison with previous studies spanning both early and late adolescence. Although parental education was significantly associated with dropout, adjusting for parental education had a very small effect on the association between symptoms of depression and dropout. This is consistent with a study investigating prescription of psycholeptic and psychoanaleptic drugs and dropout (Brännlund et al., 2017), and a recent study from Sweden where a substantial part of income-related inequality in failure to complete upper secondary school was explained by the mental health of the adolescent (Vaezghasemi et al., 2020). It has been suggested that this is evidence of social selection, where adolescents with mental health problems are less likely to complete upper secondary education regardless of their socioeconomic background (Evensen et al., 2016).

Implications

Although the associations between symptoms of depression and dropout were consistent in the present study, the effect sizes were small. Thus, many adolescents will experience elevated levels of depressive symptoms and still manage to complete their education. Weaker associations are to be expected when investigating symptom scores in the general population rather than diagnosable disorders; however, as subclinical symptom levels are experienced by a larger number of adolescents than diagnosable disorders, it is possible that interventions aimed at reducing depressive symptoms in the general adolescent population during late adolescence could promote school functioning and graduation. Indeed, adolescents who had recovered from previous depressive symptoms were at no greater risk of dropout than adolescents who had never experienced symptoms (Dupéré et al., 2018). We found stronger effects in late adolescence than have previously been established in early adolescence, suggesting that interventions could be especially beneficial in late adolescence, when the adolescents are attending upper secondary school. Although we have not found any studies investigating the effect of depression prevention programs on school completion, a meta-analysis of such programs found that they were more effective when delivered in late adolescence (Stice et al., 2009). Even though preventive interventions often yield small effect sizes, even small reductions in

symptom levels overall could positively impact the graduation rates. Future research on interventions aimed to reduce depressive symptoms in adolescence could benefit from measuring the effect also on school functioning and school completion rates.

Adolescents presenting with high scores on symptoms of depression and conduct disorder were identified as a high-risk group. Little is known about this group, as studies often control for the impact of coexisting problems rather than investigate how different symptoms interact. Following a transdiagnostic perspective, symptoms of depression and conduct disorder could have the same underlying cause and common protective and maintaining factors (Dalglish et al., 2020). Further investigation of the impact of coexisting problems within this perspective could be an important avenue for future research. Often, preventive interventions target a specific mental health problem, and students with high scores on other mental health problems would neither receive the intervention nor be included in research on its effectiveness. It is possible that interventions with a transdiagnostic approach, such as Affect Regulation Training (ART) (Berking & Lukas, 2015), could be useful for these adolescents. Lack of social competence and social support has been identified as a mediator between comorbid problems and academic outcomes and could be a common focus point (Rockhill et al., 2009).

The differences identified between the impact of concurrent depression and ADHD and concurrent depression and conduct disorder on dropout further emphasize the importance of investigating different mental health problems separately rather than combining them into overarching categories such as externalizing problems.

It is important to emphasize that dropout often results from a long-term process of school disengagement where several other factors are also of importance (Alexander et al., 2001). A qualitative study of reasons for early school leaving describes a long-term process where mental health symptoms developed through the school years (Ramsdal et al., 2018). In order to reduce the negative impact of depressive symptoms, it is important to focus on mediating or moderating factors that could be altered through preventive interventions in the adolescent years (Esch et al., 2014). Factors related to the school, the family, and the individual adolescent could be the targets of preventive interventions aimed to increase school functioning and completion.

Strengths and Limitations

A central strength of the study is the use of a high-quality registry to define graduation from upper secondary school, GPA, and parental education, which was linked to a large population-based survey using well-validated mental health measures. The

prospective design of the study, where symptoms of depression were assessed while the adolescents were attending upper secondary education, is a further strength.

A limitation related to the mediation analysis concerns the temporal relationship between symptoms of depression and GPA. In the present study, we specified a mediation model where symptoms of depression predicted GPA. Although several studies have concluded that there is more evidence for symptoms of depression preceding lower GPA, especially in late adolescence (Agnafors et al., 2020; Hishinuma et al., 2012; Weidman et al., 2015), there is also evidence of a bidirectional relationship between depressive symptoms and academic achievement in adolescence (Weidman et al., 2015). Including measures of depression and GPA at several time points could therefore have given a more complete picture of these complex associations.

In the present study, the 90th percentile was used as a cutoff for identifying adolescents with high symptom scores on the SMFQ, the ASRS, and the YCD and does not indicate fulfilling the diagnostic criteria for depression, ADHD, and conduct disorder.

An important limitation concerns the generalizability of the results, where the response rate of 53% indicates that selection bias could be present. The youth@hordaland was primarily a school-based survey, and although it was possible to complete the questionnaire at any time during the data collection period, it is likely that those who did not participate in the survey were at higher risk of school dropout. Further, it is possible that some adolescents had already dropped out before the time of the survey, especially in the older age groups. In the present study, 14.8% of adolescents had not completed upper secondary education within five years. Although this is similar to previous population-based studies of Norwegian adolescents (De Ridder et al., 2012), it is lower than the 21.9% non-completion rate in the general population (Statistics Norway, 2020) and the percentage of non-completers found in studies identifying all adolescents in specified cohorts from national registries (Hetlevik et al., 2018). This indicates that the present sample differs from the total adolescent population regarding school completion, and likely also in other, relevant background characteristics related to school functioning, such as socioeconomic status. It is further possible that the adolescents with the most severe mental health problems were not present at school during the hours allocated to complete the survey or chose not to participate. Therefore, the associations between symptoms of depression and school dropout could be underestimated in the present study.

Conclusion

There was a small, but consistent association between symptoms of depression and dropout from upper secondary school in the present study, which persisted when symptoms of ADHD and conduct disorder were taken into account. While this suggests a potential for early interventions aimed at reducing depressive problems to prevent dropping out of school, future studies should also investigate potential malleable protective factors that can help students complete their education when they are experiencing symptoms of depression. Adolescents reporting high symptom scores of both depression and conduct disorder were identified as a high-risk group, with the largest odds of dropout. Of note, the association between symptoms of depression and dropout was similar for boys and girls.

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Data availability Data and analysis code for this study are not available.

Declarations

Conflicts of interest The authors have no relevant financial or non-financial interests to disclose. The study's design and the project it is a part of was preregistered at <https://osf.io/xgstb>. The analysis plan was not preregistered. We have no conflicts of interest to disclose.

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study and the linkage to the NUDB was approved by the Regional Committee for Medical and Health Research Ethics (REC) in Western Norway (014/326/REK vest).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

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