Journal of Adolescence 91 (2021) 25–34

Contents lists available at ScienceDirect

Journal of Adolescence

journal homepage: www.elsevier.com/locate/adolescence

Focus on methodology

Psychotropic medication use and academic performance in adolescence: A cross-lagged path analysis

Cristian Bortes [a,*], Evelina Landstedt [b], Mattias Strandh [a,c]

[a] Department of Social Work, Umeå University, SE-901 87, Umeå, Sweden
[b] Department of Social and Psychological Studies, Karlstad University, SE-651 88, Karlstad, Sweden
[c] Centre for Research on Child and Adolescent Mental Health, Karlstad University, SE-651 88, Karlstad, Sweden

ARTICLE INFO

Keywords:
Mental health
Academic performance
Cross-lagged panel analysis
Bidirectional associations
Gender differences
Socioeconomic background

ABSTRACT

Introduction: The study investigated the directionality of associations between mental health problems and school grades across two timepoints (T1 and T2) during mid to late adolescence; in school year 9 (ages 15–16) and school year 12 (ages 17–18). The study also investigated variation in the associations as a function of gender and across socioeconomic groups.
Methods: Longitudinal data from several Swedish administrative registers were utilised. Information on prescribed psychotropic drugs was used as a proxy for mental health problems, and teacher-assigned school grades were used to measure academic performance. The study sample comprised 85 186 individuals (50.7% girls) born in 1991 who were alive and resident in Sweden in 2010. Directions of associations were analysed by estimating a series of cross-lagged path models.
Results: The model with the best fit to data showed that higher school grades at T1 were associated with relatively lower rates of mental health problems by T2, for both boys and girls, mainly in socioeconomic groups with the highest educated parents. This association was equal in size across all of the socioeconomic groups that were explored.
Conclusions: Performing well in school is equally important for boys' and girls' subsequent mental health, but only among adolescents in socioeconomic groups with the highest educated parents. The results underscore the importance of promoting opportunities for youth to do as well as they can in school.

1. Introduction

Mental health problems in adolescence may cause difficulties with functioning in various domains of life, not the least in school. Mental health problems is a broad concept covering both less serious mental strain and more severe symptoms that meet criteria for a diagnosable mental illness (Granlund et al., 2021). Based on the symptoms that characterise them, mental health problems are commonly categorised as internalised and externalised (Forns et al., 2011). Previous studies show that internalising symptoms such as depression or anxiety have a negative impact on educational attainment (McLeod & Fettes, 2007; Okano et al., 2019; Riglin et al., 2014; Suldo et al., 2011). The presence of externalising symptoms, such as attention deficit hyperactivity disorder, has also been shown to predict reduced school results (Defoe et al., 2013; McLeod et al., 2012). Most previous studies have focused on how mental health

* Corresponding author.
E-mail address: cristian.bortes@umu.se (C. Bortes).

https://doi.org/10.1016/j.adolescence.2021.07.003
Received 15 March 2021; Received in revised form 12 July 2021; Accepted 14 July 2021

influences school outcomes; thus the relationship has been widely regarded as unidirectional. However, the educational outcomes that adolescents succeed or fail to achieve are also likely to have implications for their mental health (Huebner et al., 2014). This bidirectionality is key to understanding the differential effects of mental health and education on adolescents' development, and yet research on how adolescents' educational achievements affect their mental health is limited. To address this research gap, the current study explored the directionality of associations between mental health problems and academic performance among Swedish adolescents.

1.1. The adjustment-erosion hypothesis and the academic-incompetence model

Two models from contemporary developmental theory explain how academic performance and mental health problems may be interrelated across time. Both are based on the notion of developmental cascades (Masten & Cicchetti, 2010), which holds that functioning in one domain (e.g. socioemotional functioning) spills over to influence functioning in other domains (e.g. in school). The first hypothesis – the adjustment-erosion hypothesis – posits that externalising and/or internalising difficulties can lead to academic problems (see e.g. Deighton et al., 2018; Moilanen et al., 2010). For example, disruptive and aggressive behaviours may hinder learning by affecting relationships with teachers and peers. Similarly, emotional distress can impede academic progress by impairing cognitive functions related to learning. From this perspective, the health difficulties that a child or adolescent has might 'erode' adaptive functioning in other domains. The second hypothesis – the academic-incompetence model – posits that problems related to academic competence induce the development of difficulties, or worsen those that already exist (Deighton et al., 2018; Moilanen et al., 2010). For example, low academic competence can provoke frustration and dissatisfaction, which could increase externalising behaviours, or lead to low self-esteem or other internalising symptoms. In short, mental health can affect school work which, in turn, also may affect mental health: the relationship can thus be bidirectional.

1.2. Previous research on the bidirectional association between academic performance and mental health

Empirical studies aiming to disentangle the direction of associations in models that enable us to examine bidirectionality have presented inconsistent findings. Depressive symptoms have been shown to negatively affect subsequent academic achievement but not the other way around (Hishinuma, 2012; McArdle et al., 2014). Other studies found that academic performance negatively predicts depression and anxiety and that the relationship was reciprocal (Obradovic et al., 2010; Weidman, 2015). Reciprocal effects involving externalising problems (such as conduct disorders and attention deficit hyperactivity symptoms) and school achievement have also been reported (Okano et al., 2020; Palmu et al., 2018). Overall, while bidirectional associations are gaining increased support (e.g. Esch et al., 2014; Okano et al., 2019; Zhang et al., 2019) they are still relatively understudied.

These inconsistent findings are most likely due to differences in how mental health and academic performance are measured, the different age periods in which the relationship is examined, and also differences in context concerning school and health systems. The majority of published research on the topic has been conducted in the United States and the United Kingdom. The transferability of findings from one cultural setting to another is problematic as institutional characteristics vary significantly across countries. Typical class size and the average number of educational transitions are far from uniform. To our knowledge, no previous study has investigated the directionality between academic performance and poor mental health among Swedish adolescents. The interrelationship between mental health and academic performance is thereby particularly interesting to study within the Swedish context.

Surprisingly absent from the existing literature are also analyses of how patterns might vary according to gender and socioeconomic background. Determinants of mental health include not only individual attributes but also social factors, meaning that certain individuals and groups in society are more vulnerable in terms of being at higher risk of experiencing mental health problems (WHO, 2013). In the research on developmental cascades, variables such as socioeconomic background and parental characteristics are typically used as covariates to assess the influence of shared risks (Deighton et al., 2018; Okano et al., 2019). According to the shared-risk hypothesis, the effects of both the adjustment-erosion and the academic-incompetence model are explained by 'third variables' (Moilanen et al., 2010). For example, socioeconomic disadvantage is negatively associated with both socioemotional functioning and academic achievement (Sirin 2005; WHO, 2013). Likewise, children of parents with a history of mental illness (a parental characteristic) have an elevated risk of developing mental illness themselves (Dean et al., 2010). This is partly due to genetic factors but also because the increased risk of dysfunctional family functioning associated with parental mental illness (Kamis, 2021; Küng et al., 2019; Sweeney & MacBeth, 2016). Earlier studies indicate, however, that the influence of shared risks on the established links between mental health difficulties and academic performance is generally weak (Masten et al., 2005; Moilanen et al., 2010; Panayiotou & Humphrey, 2017). Regarding gender, studies indicate that the long-term effects of internalising problems on educational outcomes are stronger in girls than boys (Esch et al., 2014; Okano et al., 2019; Riglin et al., 2014). Other work has identified that boys experience a more negative academic effect of externalising problems than girls do (Panayiotou & Humphrey, 2017). To date, however, no studies have assessed whether these associations are equally strong across different socioeconomic groups and if gender patterns can be identified within those associations.

2. The current study

The current study aimed to examine the longitudinal relationship between mental health problems and academic performance among Swedish adolescents. The main objective was to explore the directionality of associations by estimating a series of cross-lagged path models. Five research questions guided the study: (1) Is poor academic performance predicting subsequent increases in mental

health problems? (2) Is elevated mental health problems predicting subsequent declines in academic performance? (3) Is academic performance and mental health problems simultaneously predicting each other? (4) What influence do socioeconomic background and parental psychiatric morbidity (shared risk variables) have on these associations? (5) How do the associations vary by gender and across different socioeconomic groups?

These questions were addressed by analysing longitudinal register data, held by the Umeå SIMSAM Lab (Lindgren et al., 2016), that cover the entire Swedish population. By using total population registers this study responds to calls that have been made for research on the topic which utilises a larger and diverse sample (Weidman et al., 2015). This approach also enabled us to move beyond self-reporting survey methods, and we employed a measure of mental health problems based on prescriptions of psychotropic drugs (see below for details). One advantage of using psychotropic drug purchases as a proxy of poor mental health is that it implies that a physician has clinically assessed the symptoms as psychiatric.

3. Methods

3.1. Study population

The population comprised all individuals born in 1991 who were alive and resident in Sweden in 2010 ($N = 133\,640$). Since the aim was to study academic performance, we excluded adolescents without data on school grades (the data were missing mainly because of lack of completion or emigration). In the end, the effective sample in our analyses consisted of 85 186 individuals (50.7% girls) who received a complete diploma with grades *both* when graduating compulsory school, when they were 15–16-years-old (in year 2007 = T1), and three years later, when graduating upper secondary school, when they were 17–18-years-old (in year 2010 = T2). These individuals are referred to here as 'index persons'. Each individual is assigned a unique and fully anonymised personal identification number that links them to family members across registers.

In Sweden, children start compulsory school the year they turn six (pre-school class) and finish after ten at the age of 15–16 (school year 9). The transition from compulsory education to a vocationally or academically oriented programme in upper secondary school is a major educational change during adolescence. This transition entails increased academic pressure and responsibility, as well as social changes related to having to manage new peer groups (SKL, 2013). Nearly 99% of all 16-year-olds in Sweden transition directly to an upper secondary education (Statistics Sweden, 2020a, 2020b). Around 75% of these complete their upper secondary education within three years (SKL, 2013). In addition to the Total Population Register, the study also used information from other registers as described below. The Regional Ethical Vetting Board in Umeå approved all research based on data from the Umeå SIMSAM Lab, including the present study (Dnr.2010-157-31).

3.2. Measures

3.2.1. Academic performance

School grades assigned to students by teachers in accordance with the Swedish grading system at T1 and T2 were used to measure academic performance. Academic performance at T1 comprises *the sum* of the 16 highest subject grades obtained by the student in her/his final year of compulsory schooling (9th grade). For each subject, a student could obtain a grade ranging from 0 (indicating that the minimal knowledge requirements for that subject were not achieved) to 20, so the possible sum ranged from 0 to 320 and indicated the general academic achievement at that timepoint. Academic performance at T2 comprises grade point *averages* obtained in the final year of upper secondary schooling (12th grade). In upper secondary school, students take different courses with varying credits. For each course, a student could obtain a grade ranging from 0 to 20, as in the compulsory school system, but in the upper secondary school grading system, this grade is multiplied by the credits for that particular course. The final grade obtained when graduating is the sum of each grade divided by the total educational credits (at least 2500 credits), thus yielding a grade point average. To enable comparison between the two timepoints, the two measures of academic achievement were standardised into *z*-scores (mean = 0, standard deviation = 1). In compulsory school, all students follow the same curriculum. With the transition to upper secondary school, students choose different programmes that have different orientations and curricula (roughly divided into vocational and academic), meaning that school grades at T2 are not fully comparable across upper secondary school programmes. This concern was addressed by means of sensitivity analyses, presented below. Data were drawn from the Swedish National Agency for Education's Pupil Register.

3.2.2. Mental health problems

Information about *psychotropic drug prescriptions*, with details of the patient and the active substance prescribed, was used as a proxy for mental health problems. These data were obtained from the Swedish Prescribed Drug Register (PDR), which holds information on all drug prescriptions dispensed from Swedish pharmacies, excluding medical drugs consumed in inpatient hospital care. Due to a large degree of skewness, this variable was coded into a binary variable. The measure at T1 indicates whether the index person ever retrieved at least one dispensed psycholeptic (for treatment of psychological disorders, bipolar disorder, anxiety, and insomnia) or psychoanaleptic (for treatment of depression and attention deficit hyperactivity disorder) drug during any of their three last years (2005–2007) of compulsory school (no/yes). The measure at T2 indicates (no/yes) whether the index person ever retrieved at least one dispensed psycholeptic or psychoanaleptic drug during any of their three and total years of upper secondary school (2008–2010). These indicators reflect medical drug treatment for, and consequently the presence of, a wide array of clinically diagnosed mental health problems. Prescribed drugs in Sweden are covered by the country's universal health insurance system, meaning that costs are capped at a low maximum. Patients paid on average about 22% of the actual cost of the prescribed drugs (MSA, 2011). The costs should

thus not be an obstacle to the purchase of prescribed drugs, even for low-income families. Information from the PDR was only available to us for the years 2005–2010. Drug prescription has, it should be noted, been used as an indicator of poor mental health in similar studies (see e.g. Hollander, 2013).

3.2.3. Shared risk variables

Information on socioeconomic background and parental psychiatric morbidity was used to examine the role of potential 'shared risk' factors that could influence both mental health problems and academic performance. *Socioeconomic background* was measured by the parents' level of education. To be in line with the literature on developmental cascades (Masten & Cicchetti, 2010; Moilanen et al., 2010) we refer to this measure as socioeconomic background. Parental level of education is a well-established and widely used indicator of children's socioeconomic background (Barone, 2006; Sirin, 2005). In this study, parental level of education was operationalised as the highest level of education attained by either parent (mother or father) when the child was seven (the age at which most Swedish children have spent one year in compulsory school). Three categories were defined: compulsory education, two to three years of upper secondary education, and post-secondary education. Index persons with missing information on this variable comprise a fourth group; these individuals were predominantly foreign-born. For brevity, these categories will be referred to as socioeconomic groups 1, 2, 3, and 4. Data were obtained from the Longitudinal Integration Database for Health and Labour Market Studies (LISA) (Statistics Sweden, 2020a, 2020b). *Maternal* and *paternal psychiatric morbidity* indicates (no/yes) whether the parent had been hospitalised with a main diagnosis of psychiatric disorder (ICD-9: 290–319, ICD-10: F00–F99) since the birth of the index person, and together reflect parental history of mental illness. Relevant data were retrieved from the National Patient Register.

3.3. Data analyses

Independent sample *t*-tests and chi-square tests were used to examine differences in the study variables between boys and girls and across socioeconomic groups. The direction of associations between mental health problems and academic performance over time was examined by comparing alternative cross-lagged path models in four steps (Kline, 2016). First, in the baseline model (A), we specified the autoregressive paths, which describe the stability of individual differences in the measured construct from one timepoint to the next. A small (closer to zero) autoregressive coefficient indicates less stability in the construct from the previous timepoint, while a larger (closer to 1) autoregressive coefficient indicates more stability from the previous timepoint (Selig & Little, 2012, pp. 265–278). In the baseline model, we also specified the cross-sectional correlations between the constructs at each timepoint. Then, in the first alternative model (B), a directional path from mental health problems to academic performance was added. In the second alternative model (C), a directional path from academic performance to mental health problems was added. Finally, in the fourth model, the bidirectional model (D), paths from both mental health problems and performance were included simultaneously.

The models were assessed by combined use of several model fit statistics and information criteria: the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), which should both be close to or exceed 0.95, and the Root Mean Square Error of Approximation (RMSEA), which should be close to or below 0.06. The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were also used to evaluate the relative goodness of fit. For each criterion, the model with the lowest value relative to the other models should be favoured (Kuha, 2004).

After selecting the best fitting model, in order to estimate the influence of shared common risk factors on the pathways between mental health and academic performance (the shared-risk hypothesis), the shared risk variables (socioeconomic background and parental psychiatric morbidity) were included as covariates in the model. The analytical idea is that if the inclusion of shared risk variables renders a significant improvement in overall model fit or non-significant pathways, the shared-risk hypothesis is supported. Differences in fit between nested models and between 'basic' and 'shared-risk' models were tested using chi-square difference tests. In addition, multiple group analyses were performed, with gender and socioeconomic background as grouping variables, comparing results for boys and girls across different socioeconomic groups. Parameters in all models were estimated using the Full Information Maximum Likelihood (FIML) method. All estimates presented are standardised. The significance level was set at 95%.

Table 1
Descriptive statistics for the main study variables by gender.

	Boys (n = 41 968)				Girls (n = 43 218)				Boys–Girls		
	Min	Max	Mean	SD	Min	Max	Mean	SD	Mean diff.		Cohen's *d*
Academic performance									*t*-test	*t*	
T1	−4.69	1.93	−0.20	0.95	−4.69	1.93	0.19	1.00	−0.40***	−59.18	0.41
T2	−4.64	2.42	−0.23	0.99	−4.67	3.02	0.22	0.95	−0.46***	−68.50	0.47
Mental health problems									chi^2 (df)	*p*	
T1	0.00	1.00	0.01	0.11	0.00	1.00	0.02	0.14	72.76 (1)	***	0.06
T2	0.00	1.00	0.03	0.17	0.00	1.00	0.06	0.24	436.75 (1)	***	0.14

***$p < 0.001$.

4. Results

Descriptive statistics for the measures of mental health problems and academic performance are presented in Table 1; differences in means of both grades and psychotropic drug prescriptions between boys and girls at T1 and T2 are shown. At both timepoints, girls had higher grade points and higher levels of prescribed psychotropic drugs than boys. For these reasons, associations were modelled separately for boys and girls. Regarding differences in prescribed psychotropic drugs between socioeconomic groups, at T1 the proportion of adolescents who had been prescribed and purchased psychotropic drugs did not differ by socioeconomic background, X^2 (3, $N = 85\ 186$) = 5.8, $p = 0.12$. At T2 on the other hand, the analyses revealed a significant association between prescribed psychotropic drugs and socioeconomic background, X^2 (3, $N = 86\ 186$) = 8.6, $p = 0.03$. A two-sample test of proportion showed that the proportion which had been prescribed and purchased psychotropic drugs significantly differed between socioeconomic groups 1 and 2–3, and between groups 4 and 2–3. Adolescents in socioeconomic groups 2 and 3 were more likely to have had prescribed psychotropic drugs at T2.

Table 2 shows the goodness-of-fit statistics for the four models that were compared for boys and girls respectively. Both Model C and Model D have a perfect fit in terms of the RMSEA, CFI, and TLI. In terms of their relative fit, however, the AIC and BIC indicate that Model C provides a better fit to the data as these values are lower for this model. Results from the chi-square difference test (farthest to the right in the Table) showed that there is no statistically significant difference in fit between these two models. Also, when inspecting the path coefficients in the bidirectional model (Model D), the cross-path from mental health problems to academic performance was nonsignificant for both boys and girls (not shown). Hence, we found no support for bidirectional relations between mental health problems and academic performance across the timespan employed in this study. Model C was thus selected for the continuing analyses.

Fig. 1 and Fig. 2 display the results from Model C for boys and girls, respectively, across the four socioeconomic groups. The autoregressive path coefficients for mental health problems from T1 to T2 are small, for both boys and girls in all socioeconomic groups. This indicates that there were notable changes in adolescents' mental health problems between the two timepoints. In contrast, the autoregressive path coefficient for academic performance from T1 to T2 is closer to 1, indicating that the adolescents' standings on this measure were quite stable across the two timepoints. While the stability in performance was quite similar between boys (0.61–0.69) and girls (0.62–0.68), the autoregressive (stability) coefficients for mental health problems differed by at most 0.11 standard deviations between boys (0.36) and girls (0.25) in socioeconomic group 2.

In the next step, we included the shared risk variables socioeconomic background and parental psychiatric morbidity as covariates in the model. This weakened the model fit for both boys and girls in terms of all statistics. Chi-square difference tests revealed that the 'shared-risk model' differed from the 'basic model' (the latter had a better fit than the former), and the inclusion of the shared risk variables rendered an insubstantial change in the path coefficients (not shown). The influence of shared risks on the established pathways was thus very weak.

In the last step, we investigated the cross-lagged associations, which were estimated while controlling for the cross-sectional correlations between the constructs and their variance across time (the autoregressive associations). As can be seen in Figs. 1 and 2, the cross-paths from academic performance at T1 to mental health problems at T2 all have a negative coefficient. This indicates that higher academic performance at T1 was associated with lower rates of mental health problems at T2 (except for boys in socioeconomic group 4, for which the coefficient was nonsignificant). Tests for differences between path coefficients revealed that none of the cross-paths from academic performance at T1 to mental health problems at T2 was significantly different from one another – for neither boys nor girls – in any of the socioeconomic groups. Thus, we can assert that the 'effect' of academic performance on subsequent mental health problems was equal in size for both boys and girls across all of the socioeconomic groups that we explored.

Table 2
Goodness-of-fit statistics for the tested models.

	Goodness-of-fit statistics					χ^2 difference test	
	RMSEA	CFI	TLI	AIC	BIC	vs. Model	*p*
Boys							
Model A [a]	0.025	0.998	0.996	107772.137	107875.873	–	–
Model B [b]	0.035	0.998	0.992	107773.629	107886.009	A	0.476
Model C [c]	**0.000**	**1.000**	**1.000**	**107720.500**	**107832.880**	A	0.000
Model D [d]	0.000	1.000	1.000	107722.011	107843.036	A/B/C	0.000/0.000/0.485
Girls							
Model A [a]	0.031	0.997	0.993	162851.743	162955.831	–	–
Model B [b]	0.045	0.997	0.986	162853.555	162966.318	A	0.665
Model C [c]	**0.000**	**1.000**	**1.000**	**162766.200**	**162878.962**	A	0.000
Model D [d]	0.000	1.000	1.000	162767.996	162889.432	A/B/C	0.000/0.000/0.652

All models include cross-sectional correlated error terms between mental health problems and academic performance. Preferred model in bold.
[a] Only auto-regressive paths and cross sectional correlations.
[b] Mental health problems at T1 predict academic performance at T2.
[c] Academic performance at T1 predicts mental health problems at T2.
[d] Bidirectional associations between mental health problems and academic performance over time.

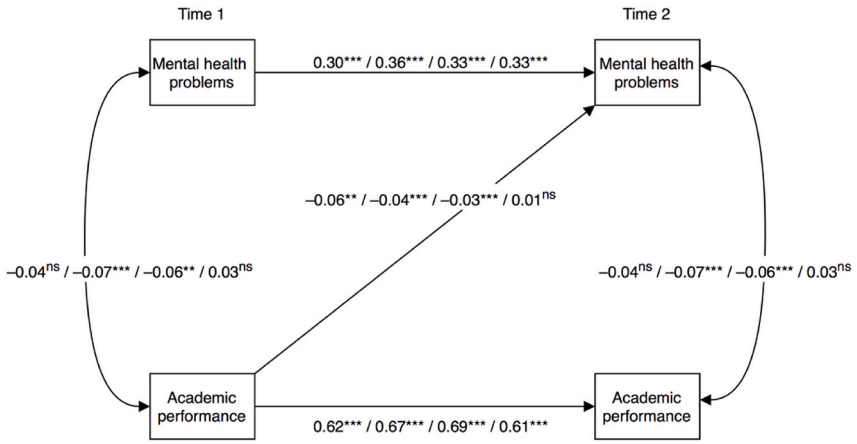

Fig. 1. Estimated cross-lagged path model relating academic performance (school grades) and mental health problems (psychotropic drug prescriptions) among *boys* across socioeconomic groups. Estimates (standardised) are displayed as 'socioeconomic group 1/2/3/4'. Error terms have been omitted from the figure. $^{**}p < 0.01$, $^{***}p < 0.001$.

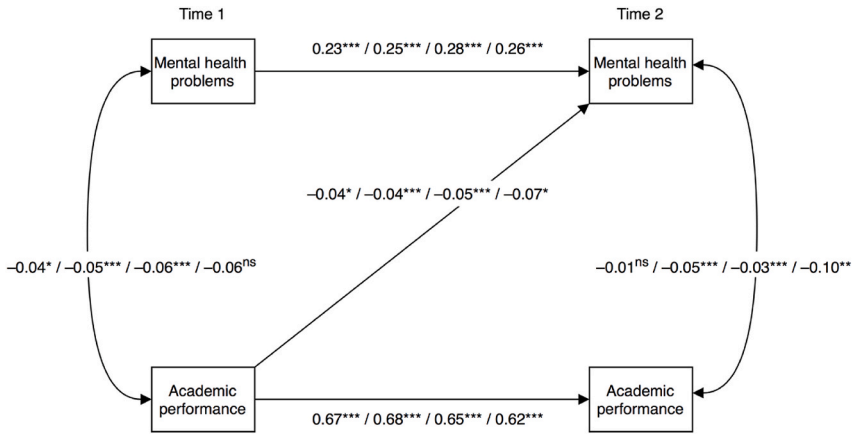

Fig. 2. Estimated cross-lagged path model (Model C) relating academic performance (school grades) and mental health problems (psychotropic drug prescriptions) among *girls* across socioeconomic groups. Estimates (standardised) are displayed as 'socioeconomic group 1/2/3/4'. Error terms have been omitted from the Figure. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, ns $= p > 0.05$.

4.1. Supplementary analyses

As previously mentioned, school grades at T2 are not entirely comparable across upper secondary school programmes, as their orientation and curricula differ. Vocational programmes prepare students for working life so that they can begin a career directly after completing their upper secondary education. Academic programmes have the main purpose of preparing students for tertiary studies at colleges and universities (although students in vocational programmes also have the right to choose such courses as are required to achieve eligibility for tertiary studies). In order to take these differences into account, two types of sensitivity tests were performed.

First, a binary variable indicating programme orientation (vocational programmes vs. academic programmes) was included as a covariate in the selected model (Model C). This did not render any change in the path coefficients. Second, the model was re-estimated, stratified by upper secondary programme orientation, and results for students on vocational vs. academic programmes were compared. The overall negative association remained, i.e. higher grades at T1 were associated with lower rates of prescribed psychotropic drugs at T2, but only significantly so for adolescents from certain socioeconomic groups. For boys who chose vocational programmes, higher grades at T1 were associated with lower rates of prescribed psychotropic drugs at T2 only for those in socioeconomic group 2. For boys who chose academic programmes the association was only significant for those in socioeconomic group 3 (see Table 3 for detailed coefficients). Recall that the socioeconomic groups were operationalised based on parental level of education. Youth in socioeconomic group 1 are those whose parents have a compulsory school education, while youth in socioeconomic groups 2 and 3 have parents with an upper secondary and university education, respectively. For girls who chose vocational programmes, higher grades at T1 were associated with lower rates of prescribed psychotropic drugs at T2 only for those in socioeconomic groups 2 and 3. For girls who chose academic programmes, the association was significant for those in all but socioeconomic group 1 (which consisted of those with

missing information on parental education, mainly foreign-born individuals).

Overall, after these sensitivity tests, the associations remained statistically significant mainly in the socioeconomic groups with the highest educated parents. Youth from these groups are often the highest-performing ones and are also probably experiencing higher expectations from their parents regarding their academic performance. Achieving high grades could therefore be of greater importance for their mental health, as these results suggest. Moreover, when considering vocational vs. academic programme orientation, one is likely to capture factors such as academic aspirations, which are in part reflected through the choice of upper secondary programme. Thus, these results also suggest that the importance of (higher) grades and doing well in school for future mental health also differs as a function of academic aspirations (which generally is stratified based on socioeconomic background).

5. Discussion

Although previous research on how young people with mental health difficulties cope with school has provided many insights, most studies have regarded the relationship between mental health and academic performance as unidirectional. As outlined in the introduction of this paper, studies on the bidirectional relationship between these two constructs are few. Consequently, there is a lack of knowledge on how educational outcomes are related to subsequent mental health. To bridge this research gap, the current study investigated how mental health problems and academic performance are interrelated across mid to late adolescence among Swedish adolescents. Informed by the literature on developmental cascades (Masten & Cicchetti, 2010; Moilanen et al., 2010), we examined whether poor academic performance would predict subsequent increases in mental health problems, whether mental health problems would predict subsequent declines in academic performance, or if the two would simultaneously predict each other over time (bidirectionality). The main objective was thus to investigate the longitudinal directionality in these associations.

The results showed no support for a bidirectional relationship across the selected time span. Mental health problems by the end of compulsory school (T1), measured by psychotropic drug prescriptions, were not associated with subsequent academic achievements by the end of upper secondary school (T2). This is in contrast to previous studies (e.g. Deighton et al., 2018; Zhang et al., 2019). One possible explanation for this result may be found in the measure of mental health problems that was used in the study. The medical drug treatment might have had the desired effect and improved functioning concerning school performance, implying that the effects of the underlying mental health difficulties and that of the drug treatment cancelled each other out.

An essential aspect to bear in mind in the context of bidirectionality concerns the time lag, or the time interval, between measurement occasions. Since the idea of bidirectionality assumes feedback loops between mental health and performance, the time interval between observation points in the presumed feedback loop(s) could affect whether bidirectional effects are observed or not. For example, too long an interval between observation points could increase the likelihood of not capturing some of the critical points in such feedback loops. It is possible that the long time span between observation points in the present study (three years) could be a reason why no bidirectionality was detected. Nevertheless, the non-significant association between psychotropic drug use at T1 and academic performance at T2 suggests that drug treatment for mental health problems is at least not negatively associated with subsequent schooling outcomes in adolescence.

Concerning the opposite direction of association, the results showed that academic performance was associated with subsequent mental health problems. In accordance with the academic-incompetence hypothesis – which states that problems related to academic competence might induce the development of mental health difficulties – higher school grades at T1 predicted decreases in mental health problems by T2. These results are also in line with previous studies suggesting that low academic performance predicts subsequent poor mental health (Weeks et al., 2016; Wiedman et al., 2015). In the current study, and due to the operationalisation of academic performance, this is inversely expressed, i.e. the better adolescents were performing academically at T1 the less mental health problems they had at T2. These results lend further evidence to the notion that academic competence may have beneficial effects on young people's mental health and thus underscore the importance of early interventions to promote adolescents' academic competence.

The study also investigated how these associations varied as a function of gender and across socioeconomic groups. Initial analyses revealed gender differences in both academic performance and levels of psychotropic drug prescriptions. Associations were therefore modelled separately for boys and girls. For both boys and girls, academic performance was stable across the two timepoints, whereas mental health showed low stability. The stability of performance is consistent with previous research showing that prior academic achievement is one of the strongest predictors of subsequent achievement (Khattab, 2015).

Despite the gender differences in performance and mental health, the strength and size of the association between academic performance at T1 and mental health problems at T2 was *not* significantly different between boys and girls (Fig. 1 cf. Fig. 2). This is noteworthy, as previous research demonstrate how girls to a higher degree than boys report that their future depends on doing well in school, while boys have not perceived school grades to be as decisive for their future (Östberg et al., 2015). Adolescent girls thus tend to attach other values to their performance at school than boys, and school grades in particular have been shown to have different effects on adolescent girls' and boys' subsequent subjective well-being (Bortes et al., 2021). One could therefore have expected that the association between academic performance and subsequent mental health problems would be stronger among girls. Subjective well-being, however, is a different construct than what is measured by psychotropic medications, and this is probably one reason for these discrepant results.

As for the two potential shared risk factors that were examined (socioeconomic background and parental psychiatric morbidity), they had very limited influence on the associations. This is in line with prior studies showing that the influence of shared risks on the associations between mental health difficulties and academic performance is weak (Moilanen et al., 2010; Panayiotou & Humphrey, 2017). This suggests that the effects central to the academic-incompetence model are not explained by 'third variables' that, according

to the shared-risk hypothesis, affect multiple, interrelated domains of development (Moilanen et al., 2010). Rather, the path between academic performance and mental health problems appeared to be independent of common risk factors attributed to socioeconomic background and parental history of mental illness. Our study took into account possible risk factors that could increase the vulnerability to reduced levels of academic performance and mental health (socioeconomic background and parental psychiatric morbidity). Hence, the reduction of psychotropic drug use from T1 to T2 may largely be attributable to academic performance.

In the main analyses our findings indicated that academic performance was equally important for young people's subsequent mental health, regardless of their socioeconomic background. The nonsignificant difference in the strength of associations across socioeconomic groups are particularly interesting because in general there are systematic differences in both school performance and mental health among adolescents from different socioeconomic groups. However, interestingly, when stratifying the analyses by upper secondary programme orientation, another layer of complexity emerged, suggesting that the link between performance at school and future mental health may also vary as a function of academic aspirations (and most likely it varies by other characteristics as well). Consequently, the results of our supplementary analyses suggest that the associations are not entirely straightforward. Rather, the results indicate that there are some third variables after all – such as academic aspirations – that do influence the effects of the academic-incompetence model, at least during the period of mid to late adolescence. These are important aspects to consider in future studies aiming to better understand the interrelationship between academic performance and mental health problems in adolescence.

Some limitations of the current study should be mentioned. The measure of mental health problems was a binary indicator and did not distinguish between types of difficulties or levels of morbidity. As such, our conclusions relate to mental health problems as a rather broad concept; future studies could investigate differential effects across specific symptoms. This was not possible in the current study due to data limitations. Moreover, while used as a proxy for mental health problems, prescriptions of psychotropic drugs measures *treatment* for mental health problems and do not correspond to the actual problems. In addition, there is a probable selection of individuals who seek such medical attention for their mental health problems. Thus, the measure fails to capture the effects of untreated mental health problems. A related aspect concerns the fact that the sample consisted of individuals born in 1991 who were alive and resident in Sweden in 2010. Since then, the prescription of psychotropic drugs has increased and more adolescents today than before are being prescribed psychotropic medication for mental illness (NBHW, 2019). If more recent data had been used, more adolescents would have been included in the applied measure of mental health problems.

Furthermore, it should also be clarified that while we draw upon insights from the literature on developmental cascades, we did not study cascading associations *per se*, as that requires at least three waves of data. Information on school grades was only available at the two timepoints selected, i.e. at the end of compulsory school and the end of upper secondary school. Additionally, it should also be mentioned that the excluded individuals without information on grades had a higher proportion of prescribed psychotropic drugs. While the rationale for excluding these individuals was that we were studying academic performance (without information on school grades as a measure of academic performance that would not have been feasible), this also implies that the study suffers from selection bias. Thus, the results of the study apply to youth without the most severe mental health difficulties and who managed to complete their schooling. This, in turn, implies that the association between mental health problems and academic performance is underestimated. More longitudinal research is needed to further evaluate the findings.

Against these limitations, the current study also has a number of notable counter-balancing strengths; it adds to current research in at least three major ways. First, as most of the existing studies on the topic rely on small samples with various degrees of attrition, the current study responds to calls that have been made for research that utilises a larger and diverse sample (Weidman et al., 2015). Our sample consisted of more than 85 000 adolescents from all over Sweden with various ethnic and socioeconomic backgrounds. The large sample size enabled us to investigate heterogeneity across socioeconomic groups. Because the findings are based on data from total population registers, they have high generalisability and may apply to countries with health and education systems similar to that in Sweden. Second, we employed a measure of poor mental health based on psychotropic drug prescriptions – moving beyond the use of self- or teacher-report mental health data – thus capturing psychiatric conditions that can be verified based on clinically assessed criteria. Third, our use of teacher-assigned school grades as a measure of academic performance overcomes the shortcomings of earlier studies that used self-assessments, which are considered a less valid measure of students' school performance (Kuncel et al., 2005). Taken together, the current study is a novel contribution to the existing literature on the relations between poor mental health and academic performance in adolescence.

6. Conclusion

The current study found no support for bidirectional associations between academic performance and mental health problems. The findings suggest a unidirectional association, for both boys and girls, where higher school grades by the end of compulsory school predicted relatively lower rates of mental health problems, measured by psychotropic medication use, by the end of upper secondary school. These associations were valid mainly among adolescents with the highest educated parents. The current study confirms the importance of efforts to promote opportunities for youth to do as well as they can in school: thoroughly preparing the ground for young people to flourish in school is important for their mental health.

Acknowledgements

The Umeå SIMSAM Lab data infrastructure used in this study was developed with support from the Swedish Research Council and strategic funds from Umeå University. This study was supported through grants from the Swedish Research Council (Dnr.2014-1992) and the Markus and Marianne Wallenberg's fund (Dnr.2014.0154).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.adolescence.2021.07.003.

References

Barone, C. (2006). Cultural capital, ambition and the explanation of inequalities in learning outcomes: A comparative analysis. *Sociology, 40*(6), 1039–1058.

Bortes, C., Ragnarsson, S., Strandh, M., & Petersen, S. (2021). The bidirectional relationship between subjective well-being and academic achievement in adolescence. *Journal of Youth and Adolescence, 50*, 992–1002.

Dean, K., Stevens, H., Mortensen, P. B., Murray, R. M., Walsh, E., & Pedersen, C. B. (2010). Full spectrum of psychiatric outcomes among offspring with parental history of mental disorder. *Archives of General Psychiatry, 67*(8), 822–829.

Defoe, I. N., Farrington, D. P., & Loeber, R. (2013). Disentangling the relationship between delinquency and hyperactivity, low achievement, depression, and low socioeconomic status: Analysis of repeated longitudinal data. *Journal of Criminal Justice, 41*(2), 100–107.

Deighton, J., Humphrey, N., Belsky, J., Boehnke, J., Vostanis, P., & Patalay, P. (2018). Longitudinal pathways between mental health difficulties and academic performance during middle childhood and early adolescence. *British Journal of Developmental Psychology, 36*(1), 110–126.

Esch, P., Bocquet, V., Pull, C., Couffignal, S., Lehnert, T., Graas, M., Fond-Harmant, L., & Ansseau, M. (2014). The downward spiral of mental disorders and educational attainment: A systematic review on early school leaving. *BMC Psychiatry, 14*, 237.

Forns, M., Abad, J., & Kirchner, T. (2011). Internalizing and externalizing problems. In R. J. R. Levesque (Ed.), *Encyclopedia of adolescence*. New York, NY: Springer.

Granlund, M., Imms, C., King, G., Andersson, A. K., Augustine, L., Brooks, R., … Almqvist, L. (2021). Definitions and operationalization of mental health problems, wellbeing and participation constructs in children with NDD: Distinctions and clarifications. *International Journal of Environmental Research and Public Health, 18*, 1656.

Hishinuma, E. S., Chang, J. Y., McArdle, J. J., & Hamagami, F. (2012). Potential causal relationship between depressive symptoms and academic achievement in the Hawaiian high schools health survey using contemporary longitudinal latent variable change models. *Developmental Psychology, 48*(5), 1327–1342.

Hollander, A. C. (2013). Social inequalities in mental health and mortality among refugees and other immigrants to Sweden – epidemiological studies of register data. *Global Health Action, 6*, 1–11.

Huebner, E. S., Hills, K. J., Siddall, J., & Gilman, R. (2014). Life satisfaction and schooling. In M. J. Furlong, R. Gilman, & E. S. Huebner (Eds.), *Educational psychology handbook series. Handbook of positive psychology in schools* (pp. 192–207). Routledge/Taylor & Francis Group.

Kamis, C. (2021). The long-term impact of parental mental health on children's distress trajectories in adulthood. *Society and Mental Health, 11*(1), 54–68.

Khattab, N. (2015). Students' aspirations, expectations and school achievement: What really matters? *British Educational Research Journal, 41*(5), 731–748.

Kline, R. B. (2016). *Principles and practices of structural equation modelling* (4th). New York: Guilford Press.

Kuha, J. (2004). AIC and BIC: Comparisons of assumptions and performance. *Sociological Methods and Research, 33*(4), 188–229.

Kuncel, N. R., Crede, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*(1), 63–82.

Küng, A. L., Pham, E., Cordera, P., Hasler, R., Aubry, J. M., Dayer, A., Perroud, N., & Piguet, C. (2019). Psychiatric disorders among offspring of patients with bipolar and borderline personality disorder. *Journal of Clinical Psychology, 75*(10), 1810–1819.

Lindgren, U., Nilsson, K., de Luna, X., & Ivarsson, A. (2016). Data resource profile: Swedish microdata research from childhood into lifelong health and welfare (Umea SIMSAM Lab). *International Journal of Epidemiology, 45*(4), 1075–1075.

Masten, A., & Cicchetti, D. (2010). Developmental cascades. *Development and Psychopathology, 22*(3), 491–495.

Masten, A. S., Roisman, G. I., Long, J. D., Burt, K. B., Obradovic, J., Riley, J. R., … Tellegen, A. (2005). Developmental cascades: Linking academic achievement and externalizing and internalizing symptoms over 20 years. *Developmental Psychology, 41*(5), 733–746.

McArdle, J., Hamagami, F., Chang, J. Y., & Hishinuma, E. S. (2014). Longitudinal dynamic analyses of depression and academic achievement in the Hawaiian high schools health survey using contemporary latent variable change models. *Structural Equation Modeling: A Multidisciplinary Journal, 21*(4), 608–629.

McLeod, J. D., & Fettes, D. L. (2007). Trajectories of failure: The educational careers of children with mental health problems. *American Journal of Sociology, 113*(3), 653–701.

McLeod, J. D., Uemura, R., & Rohrman, S. (2012). Adolescent mental health, behavior problems, and academic achievement. *Journal of Health and Social Behavior, 53*(4), 482–497.

Moilanen, K. L., Shaw, D. S., & Maxwell, K. L. (2010). Developmental cascades: Externalizing, internalizing, and academic competence from middle childhood to early adolescence. *Development and Psychopathology, 22*(3), 635–653.

MSA [Ministry of Social Affairs]. (2011). *Uppdaterade högkostnadsskydd – öppen hälso- och sjukvård samt läkemedel [Updated high-cost protection – open health car and medicines]*. Stockholm: Fritzes.

NBHW [National Board of Health and Welfare]. (2019). *Psykiatrisk vård och behandling till barn och unga – Öppna jämförelser 2019 [Psychiatric care and treatment for children and young people – open comparisons 2019*. Socialstyrelsen.

Obradovic, J., Burt, K. B., & Masten, A. S. (2010). Testing a dual cascade model linking competence and symptoms over 20 years from childhood to adulthood. *Journal of Clinical Child and Adolescent Psychology, 39*(1), 109–117.

Okano, L., Jeon, L., Crandall, A., Powell, T., & Riley, A. (2020). The cascading effects of externalizing behaviors and academic achievement across developmental transitions: Implications for prevention and intervention. *Prevention Science, 21*, 211–221.

Okano, L., Jeon, L., Crandall, A., & Riley, A. (2019). Differential effects of internalizing behaviors on academic functioning for girls versus boys: An analysis of developmental cascades from elementary to high school. *Development and Psychopathology, 32*(2), 1–14.

Östberg, V., Almquist, Y. B., Folkesson, L., Låftman, S. B., Modin, B., & Lindfors, P. (2015). The complexity of stress in mid-adolescent girls and boys. *Child Indicators Research, 8*, 403–423.

Palmu, I. R., Närhi, V. M., & Savolainen, H. K. (2018). Externalizing behaviour and academic performance - the cross-lagged relationship during school transition. *Emotional & Behavioural Difficulties, 23*(2), 111–126.

Panayiotou, M., & Humphrey, N. (2017). Mental health difficulties and academic attainment: Evidence for gender-specific developmental cascades in middle childhood. *Development and Psychopathology, 30*(2), 523–538.

Riglin, L., Petrides, K. V., Frederickson, N., & Rice, F. (2014). The relationship between emotional problems and subsequent school attainment: A meta-analysis. *Journal of Adolescence, 37*(4), 335–346.

Selig, J. P., & Little, B. P. (2012). Autoregressive and cross-lagged panel analysis for longitudinal data. *Handbook of Developmental Research Methods*. New York: Guilford Press.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417–453.

SKL [Swedish Association of Local Authorities and Regions]. (2013). Preventing early school leaving. The challenge of making sure that all students complete their upper secondary education. Available from URL https://webbutik.skr.se/sv/artiklar/preventing-early-school-leaving.html.

Statistics Sweden. (2020a). Analysis and statistics concerning education of the population. Available from URL https://www.scb.se/uf0549.

Statistics Sweden. (2020b). Longitudinal integrated database for health insurance and labour market studies (LISA). Available from URL www.scb.se/lisa-en.

Suldo, S., Thalji, A., & Ferron, J. (2011). Longitudinal academic outcomes predicted by early adolescents' subjective well-being, psychopathology, and mental health status yielded from a dual factor model. *The Journal of Positive Psychology, 6*(1), 17–30.

Sweeney, S., & MacBeth, A. (2016). The effects of paternal depression on child and adolescent outcomes: A systematic review. *Journal of Affective Disorders, 205*, 44–59.

Weeks, M., Ploubidis, G. B., Cairney, J., Wild, T. C., Naicker, K., & Colman, I. (2016). Developmental pathways linking childhood and adolescent internalizing, externalizing, academic competence, and adolescent depression. *Journal of Adolescence, 51*, 30–40.

Weidman, A. C., Augustine, A. A., Murayama, K., & Elliot, A. J. (2015). Internalizing symptomatology and academic achievement: Bi-directional prospective relations in adolescence. *Journal of Research in Personality, 58*, 106–114.

World Health Organization. (2013). Mental health action plan 2013-2020. Available from URL http://apps.who.int/iris/bitstream/10665/89966/1/9789241506021_eng.pdf.

Zhang, W., Zhang, L., Chen, L., Ji, L., & Deater-Deckard, K. (2019). Developmental changes in longitudinal associations between academic achievement and psychopathological symptoms from late childhood to middle adolescence. *Journal of Child Psychology and Psychiatry, 60*(2), 178–188.