Association between depression and educational outcomes among young adults

Julia Dementeva¹ and Ivan Smirnov¹

Abstract

Background

Higher academic performance is known to be negatively associated with the odds and severity of depressive symptoms. These results, however, were mostly obtained by using data on students from one educational organization or by relying on relative measures of academic performance such as grade point average. As a result, the relationship between academic performance measured by standardized tests and depressive symptoms at the population level is less known.

Methods

We use the data from the Russian study 'Trajectories in Education and Careers' (N = 4,400). This panel is nationally representative for one age cohorts and includes information on educational outcomes measured by an internationally recognized standardized test (PISA) at the age of 15 along with self-reported depression symptoms 6 years later (PHQ-9).

Results

The prevalence of depression was 20% among women and 12% among men. We find no association between PHQ-9 scores for women and their PISA scores, however we find positive linear association for men ($r = 0.15$; $CI_{95\%} = [0.10, 0.20]$). This results in an increase of risk of being depressed from 4% for low-performing men to 17% for high-performing men. This result holds after controlling for the socioeconomic status of participants, the fact of studying at university, and the selectivity of their university.

Conclusions

It is generally believed that higher academic performance is negatively associated with depression. Our results indicate that the association might be more complex than has been previously thought and that high academic performance might be a risk factor for depression.

Keywords

depressive disorders, mental health, patient health questionnaire, graduate students, education, academic performance

¹Institute of Education, HSE University, Moscow, Russia

Corresponding Author:

Ivan Smirnov, Institute of Education, HSE University, Russia, 101000, Potapovskiy Pereulok. 16/10, Building 10.
Email: ibsmirnov@hse.ru

Introduction

Depression is recognized as one of the major public health problems that affects hundreds of millions of people worldwide [1]. One particularly vulnerable group is young adults. Among all age groups, the prevalence of depression is the highest for 18–29 years old [2], and for people younger than 24 years old, mental disorders are the most important cause of disability corresponding to 45% of the YLDs [3].

During the critical period when young people study at universities or start their careers, the onset of depression might have a profound long-lasting effect on their future trajectories. That is why it is particularly important to understand factors associated with depression at this age. One of such factors is academic achievements which in its turn is closely related to many important life outcomes [4,5]. Overall health and education are considered to be the most important dimensions contributing to social inequality [6].

It has been previously observed that academic performance is negatively associated with the odds and severity of depressive symptoms [7–10]. The observed negative association might be explained by the negative effect of depression on cognitive functioning [11–13]. Alternatively, low academic achievements might result in high levels of stress leading to depression [7,14]. Most probably, both of the mechanisms are at play and the relationship between depression and lower academic performance is bidirectional [7].

These results, however, often rely on data from one educational organization, i.e. a school or a university. When data is collected on a larger scale [15,16], the relative measures of academic performance such as grade point average are typically used. These measures do not allow direct comparisons between students from different educational organizations and as a result, the relationship between academic performance and depression on a population level is not well understood.

The aim of the present study is to address this issue by exploring the relationship between depression and academic performance measured by a standardized test in a nationally representative sample.

Methods

We used data from the Russian Longitudinal Panel Study of Educational and Occupational Trajectories (TrEC) [17]. The study tracks 4,400 students from 42 Russian regions who took the PISA test in 2012 [18]. We used PISA reading scores as a measure of students' academic performance. PISA defines reading literacy as “understanding, using, reflecting on and engaging with written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society” and considers it a foundation for achievement in other subject areas within the educational system and also a prerequisite for successful participation in most areas of adult life

[19]. PISA scores are scaled so that the OECD average is 500 and the standard deviation is 100, while every 40 score points roughly correspond to the equivalent of one year of formal schooling [18].

To help interpret what student scores mean in substantive terms, the PISA scale is divided into six proficiency levels [18]. According to the OECD, Level 2 is a baseline proficiency that is required to participate fully in modern society. Students who do not meet this baseline are considered low-performing. High-performing students are those who achieve proficiency Level 5 or higher.

In 2018, participants of the TrEC reported depressive symptoms using the PHQ-9 scale. At that point, they were 20–21 years old. We study the association between PISA scores and severity of depressive symptoms and also compare the risk of depression for high- and low-performing students as defined by PISA.

We then use OLS regression to control for the socioeconomic status of participants and their current occupation. Socioeconomic status was measured by the PISA index of economic, social and cultural status (ESCS) [18].

For those participants who study at university, we additionally control for the selectivity of their university. This was measured by the average academic performance of university enrollees. This information is publicly available for all Russian universities [20].

Results

The depression questionnaire was filled by 3,793 participants (52% women). The prevalence of depression ($\text{PHQ} \geq 10$) in this sample is 20% among women and 12% among men. The PISA reading scores were available for 3,498 participants. We find no association between the PISA scores and depression symptoms (PHQ-9 scores) for women: Pearson's $r = 0.02$; $\text{CI}_{95\%} = [-0.02; 0.07]$. However, we find a positive association for men: $r = 0.15$; $\text{CI}_{95\%} = [0.10; 0.20]$ (see Figure 1). This results in an increase in risk of being depressed from 4% for low performing men to 17% for high performing men.

The socio-economic status was not associated with depression for women ($r = 0.01$; $\text{CI}_{95\%} = [-0.03; 0.06]$) but was positively associated for men ($r = 0.08$; $\text{CI}_{95\%} = [0.03; 0.13]$). This however cannot explain the relationship between depression and academic performance (see Table 1).

Figure 1. The association between educational outcomes and depression. The average severity of depression symptoms is similar for women regardless of their performance levels. However, there is a positive association between depressive symptoms and educational outcomes for men. Vertical bars are standard errors.

One potential explanation of the positive relationship between depression and educational outcomes might be the fact of studying at university. It has been previously found that rates of elevated psychological distress and prevalence of depression are particularly high for university students in many countries [21–24]. At the same time, the fact of studying at university is obviously related to educational outcomes. In our sample, the men who study at university have scored on average 61 points higher than those who do not study ($P < 10^{-26}$), the difference is 62 points for women ($P < 10^{-26}$). However, the difference in PHQ-9 scores between those groups is relatively small: 4.94 vs 4.02 for men ($P = 0.01$). We demonstrate that this is substantially lower than might be expected from PISA scores. For that purpose, we build a simple logistic regression model to predict if a student studies at university based solely on their PISA scores. We then compare PHQ-9 scores for those students who are predicted to study at a university and those who are not, and found a substantially higher difference than for the actual university status: 5.44 vs 3.56 ($P < 10^{-6}$). This indicates that the observed relationship cannot be explained by the fact of studying in university, this is additionally demonstrated by Model 2 (Table 1). The fact of studying in university might be, however, a weak predictor because universities substantially vary in their selectivity. It could be that the prevalence of depression is elevated only in highly selective universities. That is why we additionally control for the selectivity by adding the average academic performance of university enrollees in the Model 3 (Table 1).

Table 1. The relationship between PHQ-9 scores and independent variables for men. PISA scores and SES are normalized to have a mean of zero and a standard deviation of one. Coefficients from linear regression models are presented along with the corresponding 95% confidence intervals.

	Model 1	Model 2	Model 3
Intercept	4.519*** [4.289; 4.749]	4.508*** [4.171; 4.844]	4.976*** [4.556; 5.395]
PISA scores	0.652*** [0.412; 0.891]	0.680*** [0.428; 0.932]	0.526** [0.081; 0.971]
SES	0.207* [−0.033; 0.447]	0.230* [−0.015; 0.476]	0.069 [−0.358; 0.497]
Studying in university		−0.077 [−0.582; 0.428]	−0.027 [−0.476; 0.422]
University USE			
N	1643	1579	535

* — $P < 0.1$; ** — $P < 0.05$; *** — $P < 10^{-3}$

Discussion

Our results might seem to contradict previous studies that have found a negative link between depression and educational outcomes. However, it is not necessarily the case because most of these studies were conducted not on a population level or used relative measures of academic performance.

For example, if depression negatively affects cognitive functioning then the academic performance of a depressed student would be lower than expected. This would manifest in a negative correlation between academic performance and depression in a relatively homogenous population. This does not necessarily translate to a negative correlation on a population level, because the decrease in academic performance would not be strong enough to substantially change a ranking of a student on a global scale, e.g student from a top quartile would not end up in the bottom quartile. Thus, both locally negative correlation and globally positive correlation between academic performance and depression could occur simultaneously (cf. Simpson's paradox [25]).

Unfortunately, most of the studies that analyze the association between depression and academic performance do not rely on standardized tests, and on a university level, such tests simply do not exist. One alternative measure that could be used to compare students from different educational organizations is their performance on standardized cognitive tasks such as IQ tests. While IQ scores

are not equivalent to the academic performance they share the common component [26] and, in particular, are highly correlated with PISA scores on a national level [27]. It could therefore be relevant to note that the results from two large cohort studies have found no direct correlation between intelligence and depression [28], that depressed individuals were found to perform better than do non-depressed individuals on cognitive tasks [29], and that negative affect could also increase performance [30].

Overall, our results suggest that the relationship between depression and academic performance might be more complex than has been previously thought and that high-performing men might be a risk group for depression.

Funding

This work was supported by a grant from the Russian Science Foundation (project No.019-18-00271).

Conflicts of interest

Authors declare no conflict of interest.

Data Availability

This paper uses data from TrEC study which is available to interested researchers upon request (see <https://trec.hse.ru/en/data> for details)

References

1. James SL, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, Abbastabar H, Abd-Allah F, Abdela J, Abdelalim A, Abdollahpour I. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2018 Nov 10;392(10159):1789-858.
2. Centers for Disease Control and Prevention, U.S.: <https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm> [23.11.2020]
3. Gore FM, Bloem PJ, Patton GC, Ferguson J, Joseph V, Coffey C, Sawyer SM, Mathers CD. Global burden of disease in young people aged 10–24 years: a systematic analysis. *The Lancet*. 2011 Jun 18;377(9783):2093-102.
4. Roth PL, BeVier CA, Switzer III FS, Schippmann JS. Meta-analyzing the relationship between grades and job performance. *Journal of Applied Psychology*. 1996 Oct;81(5):548.
5. Olsson CA, McGee R, Nada-Raja S, Williams SM. A 32-year longitudinal study of child and adolescent pathways to well-being in adulthood. *Journal of Happiness Studies*. 2013 Jun 1;14(3):1069-83.
6. Binelli C, Loveless M, Whitefield S. What is social inequality and why does it matter? Evidence from Central and Eastern Europe. *World Development*. 2015 Jun 1;70:239-48.
7. Andrews B, Wilding JM. The relation of depression and anxiety to life-stress and achievement in students. *British Journal of Psychology*. 2004 Nov;95(4):509-21.
8. Grimm KJ. Multivariate longitudinal methods for studying developmental relationships between depression and academic achievement. *International Journal of Behavioral Development*. 2007 Jul;31(4):328-39.
9. Huang C. Academic achievement and subsequent depression: A meta-analysis of longitudinal studies. *Journal of Child and Family Studies*. 2015 Feb 1;24(2):434-42.
10. Shen W. A tangled web: The reciprocal relationship between depression and educational outcomes in China. *Social Science Research*. 2020 Jan 1;85:102353.
11. Kovacs M, Goldston D. Cognitive and social cognitive development of depressed children and adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*. 1991 May 1;30(3):388-92.

12. Nolen-Hoeksema S, Girgus JS, Seligman ME. Predictors and consequences of childhood depressive symptoms: A 5-year longitudinal study. *Journal of Abnormal Psychology*. 1992 Aug;101(3):405.
13. Hartlage S, Alloy LB, Vázquez C, Dykman B. Automatic and effortful processing in depression. *Psychological Bulletin*. 1993 Mar;113(2):247.
14. Herrmann K, Déchelotte P, Ladner J, Tavoracci MP. Depression, anxiety stress and associated factors among university students in France. *European Journal of Public Health*. 2019 Nov 1;29(Supplement_4):ckz186-555.
15. Jonsson U, Goodman A, von Knorring AL, von Knorring L, Koupil I. School performance and hospital admission due to unipolar depression: a three-generational study of social causation and social selection. *Social Psychiatry and Psychiatric Epidemiology*. 2012 Oct 1;47(10):1695-706.
16. Wallin AS, Koupil I, Gustafsson JE, Zammit S, Allebeck P, Falkstedt D. Academic performance, externalizing disorders and depression: 26,000 adolescents followed into adulthood. *Social Psychiatry and Psychiatric Epidemiology*. 2019 Aug 12;54(8):977-86.
17. Malik V. The Russian panel study 'Trajectories in Education and Careers'. *Longitudinal and Life Course Studies*. 2019 Jan 25;10(1):125-44.
18. Organisation for Economic Co-operation and Development. PISA 2012 Results: What Students Know and Can Do. Student Performance in Mathematics, Reading and Science. OECD Publishing; 2014.
19. Schleicher A, Zimmer K, Evans J, Clements N. PISA 2009 Assessment Framework: Key Competencies in Reading, Mathematics and Science. OECD Publishing (NJ1). 2009.
20. Higher School of Economics: Quality of University Admission. <https://ege.hse.ru/> [23.11.2020]
21. Adlaf EM, Gliksman L, Demers A, Newton-Taylor B. The prevalence of elevated psychological distress among Canadian undergraduates: Findings from the 1998 Canadian Campus Survey. *Journal of American College Health*. 2001 Sep 1;50(2):67-72.
22. Ovuga E, Boardman J, Wasserman D. Undergraduate student mental health at Makerere University, Uganda. *World Psychiatry*. 2006 Feb;5(1):51.
23. Bayram N, Bilgel N. The prevalence and socio-demographic correlations of depression, anxiety and stress among a group of university students. *Social Psychiatry and Psychiatric Epidemiology*. 2008 Aug 1;43(8):667-72.
24. Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. *Journal of Psychiatric Research*. 2013 Mar 1;47(3):391-400.
25. Blyth CR. On Simpson's paradox and the sure-thing principle. *Journal of the American Statistical Association*. 1972 Jun 1;67(338):364-6.
26. Krapohl E, Rimfeld K, Shakeshaft NG, Trzaskowski M, McMillan A, Pingault JB, Asbury K, Harlaar N, Kovas Y, Dale PS, Plomin R. The high heritability of educational achievement reflects many genetically influenced traits, not just intelligence. *Proceedings of the National Academy of Sciences*. 2014 Oct 21;111(42):15273-8.
27. Lynn R, Mikk J. National IQs predict educational attainment in math, reading and science across 56 nations. *Intelligence*. 2009 May 1;37(3):305-10.
28. Navrady LB, Ritchie SJ, Chan SW, Kerr DM, Adams MJ, Hawkins EH, Porteous D, Deary IJ, Gale CR, Batty GD, McIntosh AM. Intelligence and neuroticism in relation to depression and psychological distress: Evidence from two large population cohorts. *European Psychiatry*. 2017 Jun;43:58-65.
29. von Helversen B, Wilke A, Johnson T, Schmid G, Klapp B. Performance benefits of depression: Sequential decision making in a healthy sample and a clinically depressed sample. *Journal of Abnormal Psychology*. 2011 Nov;120(4):962.
30. Forgas JP. Don't worry, be sad! On the cognitive, motivational, and interpersonal benefits of negative mood. *Current Directions in Psychological Science*. 2013 Jun;22(3):225-32.