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Prevalence of depressive symptoms in university students from Germany, Denmark, Poland and Bulgaria

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■ **Abstract** *Background* Previous research indicated a higher prevalence of depressive symptoms among students from Eastern European countries than students from Western European countries. This difference was thought to be linked to political and economic instabilities resulting from political changes in the early 1990s. We investigated whether these differences persist 15 years later. *Methods* Using data from a general

health survey among first year students ($N = 2,651$) from two Western (Germany and Denmark) and two Eastern European countries (Poland and Bulgaria), our analysis was restricted to 2,146 students below 23 years of age. Depressive symptoms were measured using the Modified Beck Depression Inventory (M-BDI). The recommended cut-off point of the M-BDI for depression screening in the general population is a score of ≥ 35 . Perceived income sufficiency was measured on a four-point scale from “totally sufficient” to “not sufficient at all”. Analysis of variance and logistic regression were performed to assess the differences in depressive symptoms between countries adjusting for income sufficiency. *Results* Depressive symptoms were more prevalent in Eastern European than Western European countries (M-BDI scores of ≥ 35 in Germany 26.7%/22.8%, in Denmark 24.9%/12.1%, in Poland 45.5%/27.3%, in Bulgaria 42.9%/33.8% for female and male students, respectively). There was an association between income perceived as insufficient and higher levels of depressive symptoms, but it did not differ across the countries. Adjusting for perceived income sufficiency had little effect on differences in the prevalence of depressive symptoms across countries. *Conclusions* The difference in prevalence of depressive symptoms in university students from Eastern and Western European countries persists 15 years after political changes have taken place and cannot be explained by differences in perceived sufficiency of income.

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Introduction

The prevalence of depressive symptoms varies across different populations. Depressive symptoms are

shown to increase from childhood to young adulthood [2]. Differences in prevalence have been found across ethnic groups [38] and across countries both in Europe [3] and worldwide [11]. Specifically, depressive symptoms are frequent among university students around the world [1, 8, 15, 29] and their prevalence appears to be increasing [19].

Two rounds of the International Health and Behaviour Survey [37, 42] have reported cross-national differences in the prevalence of moderate depressive symptoms among Eastern and Western European University students. The first round was undertaken during the rapid social and political changes taking place in 1989/1990 in Eastern European countries. The second round was implemented between 1999 and 2001. Both rounds of surveys showed a higher prevalence of depressive symptoms in Eastern European countries. The authors concluded that the increased prevalence of depressive symptoms persisted due to the continuing instability in these countries. Seeing that European unification is ongoing and more time has elapsed following the political and social changes of Eastern Europe, differences in the prevalence of depression between European countries should be diminishing.

In 2005, we conducted a survey of first year students in four European countries, Germany and Denmark in Western Europe, Poland and Bulgaria in Eastern Europe, assessing a range of health issues, including depressive symptoms. The aim of this paper is to compare the prevalence of depressive symptoms in students in these four countries. In addition to political changes, both the economic situation and overall living conditions are changing in Eastern Europe. Since the economic situation has been associated with depressive symptoms in previous studies [7, 27], we assess whether differences in perceived income sufficiency account for the difference between countries.

Methods

■ Sample and questionnaire

The analysis described in this paper is based on data collected in 2005 at four Universities in Western and Eastern Europe: the University of Bielefeld in Bielefeld, Germany; the University of Southern Denmark, Denmark; the University of Sofia, Sofia, Bulgaria; and the Catholic University of Lublin, Lublin, Poland as part of the Cross-National Student Health Survey (CNSHS) [14].

A self-administered questionnaire was distributed to all participants during regular classes of randomly selected courses for first semester students. Participation was voluntary and anonymous. Students were informed that by completing the questionnaire they were providing their informed consent to participate. The response rate was around 90% in Bulgaria and Poland, 85% in Germany and 92% in Denmark, resulting in 2,651 respondents overall. Due to different educational systems in the four countries, the distribution of age fell into non-overlapping age categories. Given the age dependence of depressive symptoms, we limited our analysis to students below 23 years of age to make samples more

comparable. The final sample included over 95% of the Polish and Bulgarian respondents, 70% of the German and 60% of the Danish respondents: overall 2,146 students.

The questionnaire was a general health survey with a particular focus on mental health. It was initially composed in German and then translated into Polish, Bulgarian and Danish using two independent translations for each language. Cases of disagreement were reviewed by the research team and decisions were made by the authors familiar with the respective languages (usually native speakers).

Depressive symptoms were measured using a modification of the Beck Depression Inventory (M-BDI), which was originally developed in German, the primary language of this study [35, 36]. The modification of the original BDI included two approaches: (a) the four items per symptom which assessed the specific symptom's intensity in the original BDI, were replaced by a single statement per symptom with a six point Likert scale measuring its frequency in the last 4 weeks (with the two extreme categories labelled as 0 = 'Never', 5 = 'Almost Always'), (b) One symptom, which had low specificity (loss of weight) was excluded. The reduction in the number of items per symptom is consistent with another recent modification of BDI (BDI-II, [5]). The German language M-BDI, along with other versions of the BDI, computes a single score for individual respondents by summing their responses for all items of the scale. Through a German sample reflecting the general population and in selected subsamples [35, 36], the authors of the M-BDI have demonstrated its construct validity and measurement equivalence as compared to the original BDI. The authors have also provided a cut-off score for screening for clinically relevant depressive symptoms at ≥ 35 , corresponding to the 85th percentile of the representative sample of the German population [34].

Economic situation was assessed in two ways: First, students were asked about the amount of money remaining on a monthly basis after paying rent. Second, we asked students how sufficient they considered that amount of money to be on a four-point scale: totally sufficient, sufficient, rather not sufficient, not sufficient at all. Realizing that a comparison of the absolute amount of money might not be meaningful for students with different living arrangements (e.g., living at home with some meals and services provided free of cost versus living away from home), we decided to focus on the perceived income sufficiency. All students in Denmark receive the same amount of money from the government, regardless of what they receive from their parents or earn. Despite this fact, there were differences in the perceived sufficiency (Fig. 1). In all other sites there was a correlation between the amount of money available and perceived sufficiency.

■ Statistical Analysis

First, the configural measurement invariance for the translations of M-BDI was investigated by means of Confirmatory Factor Analysis (CFA) using Principal Axis Factoring (PAF) with direct oblique (Oblimin) rotation and covariance matrix as input. This specification is recommended for investigation of factor structure across different samples and takes into account potential correlation between factors. Prior to factor analysis, Kaiser–Meyer–Olkin (KMO) statistic was analysed for all individual items in each separate sample. Values of the KMO statistic > 0.60 are generally recommended to proceed with factor analysis. To ensure the metric measurement invariance, differential item functioning (DIF) across the countries was assessed by comparing three general linear models with each of the items as outcome variable and one, two or three independent variables: (a) M-BDI score, (b) M-BDI score and categorical variable coding country, and (c) M-BDI score, country and interaction between M-BDI score and country. Differences in R^2 between Step 2 and Step 1 (and no difference between Step 3 and Step 2) indicate a uniform DIF, whereas the differences between Step 3 and Step 2 indicate a non-uniform DIF. Based on recommendations given in the literature, DIF is confirmed when the improvement in adjusted R^2 between step 3 and 1 is > 0.12 [40, 43]. The internal reliability of M-BDI was investigated by means of

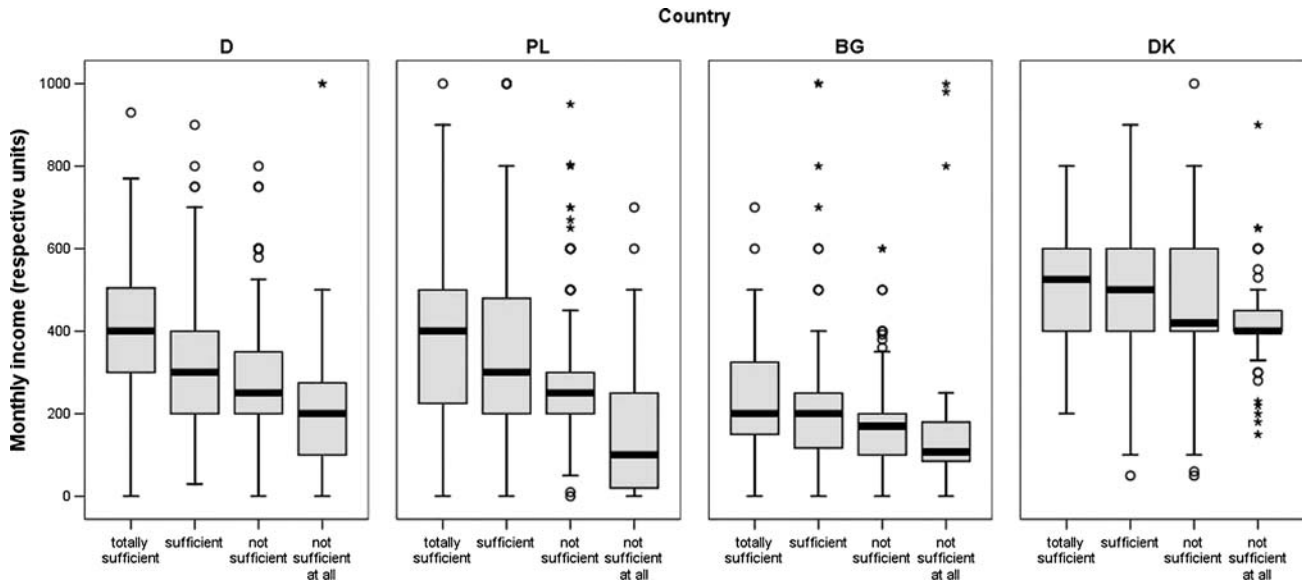


Fig. 1 Monthly income and perceived income sufficiency among students in four countries (on the y-axis income in Euro in Germany, in Zloty in Poland (1 Zloty = 0.26 Euro), in Lev in Bulgaria (1 Lev = 0.51 Euro), and in Danish Krone (divided by 10) in Denmark (1 Krone = 0.13 Euro), on the x-axis perceived income sufficiency in each country from left: totally sufficient, sufficient, rather not sufficient, not sufficient at all)

Cronbach's alpha for each language separately. The distribution of M-DBI scores was compared for different countries using selected percentiles and mean values and visualised by cumulative distribution plot. Analysis of variance was employed to investigate the effects of country, gender, and perceived sufficiency of income on M-BDI score. Additionally, logistic regression was performed to compare persons with a score ≥ 35 and below with respect to the above variables. Significance level was set at $p < 0.05$. In both models (analysis of variance and logistic regression) differential effects across categories were investigated by means of two-way interactions. Hierarchical structure of the data was accounted for as random effects in PROC MIXED for analysis of variance and macro %glimmix for logistic regression in SAS 9.1 [24].

Results

■ Socio-demographic description of the sample

There were statistically significant differences with respect to gender and migration background across the four countries. Samples from the two Western European countries were more similar to one another and the Eastern European samples likewise, exhibited the similarities between the two countries (Table 1). The ratio of females to males was considerably higher in Eastern European countries, whereas the proportion of students born abroad was higher in Western European countries. The subjective perception of having totally sufficient or sufficient income was highest in Germany (62%) and Poland (52%) and lowest in Denmark (40%) and Bulgaria (45%). Students' living arrangements differed as well: In Germany and Bulgaria, most students were living with their parents or shared a flat, while most of the Danish students were living alone or with their partner. In

Poland around 31% had other living arrangements: Most of the students in this category lived in a rented room in the flat of their landlord.

■ Measurement invariance of M-BDI

Kaiser–Meyer–Olkin (KMO) statistic for each of the items and among the countries displayed high (>0.90) values (data not shown) in most cases. The single exception was the item 14: “I am worried about my appearance” in Bulgaria, with KMO of 0.57. Confirmatory factor analysis resulted in only one factor in each of the countries studied. Again, with the single exception of the item 14, there was no indication of differential item functioning (Table 2). Mean value of item 14 in Bulgaria was 3.6, whereas in the remaining countries it was around 2.2 (on a 0–5 scale). We re-examined the translation but could not find an explanation for this phenomenon. Given this difference, we repeated the analysis of mean M-BDI score including only the remaining 19 items. The internal consistency for the 20 items M-BDI was high for all four countries, with Cronbach's alpha ranging from 0.87 to 0.92. In general, the translations M-BDI showed good configural and metric measurement invariance for the investigated samples justifying cross-national comparisons.

■ Prevalence of depressive symptoms

Due to incomplete response on the 20 items of the M-BDI, 14% of scores based on all items were missing in Germany and 23% in Poland; in Bulgaria and Den-

Table 1 Description of the sample (restricted to students below age of 23 years) by country (%)

| Variables | Germany N = 565 | Denmark N = 334 | Poland N = 562 | Bulgaria N = 685 | p-Value* |
|------------------------------|--------------------|--------------------|-------------------|---------------------|----------|
| Gender | | | | | |
| Female | 58.3 | 55.4 | 70.7 | 68.3 | <0.001 |
| Male | 41.7 | 44.6 | 29.3 | 31.7 | |
| Migration background | | | | | |
| Yes | 9.7 | 8.6 | 0.9 | 4.2 | <0.001 |
| No | 90.3 | 91.4 | 99.1 | 95.8 | |
| Perceived income sufficiency | | | | | |
| Totally sufficient | 17.6 | 8.3 | 13.5 | 7.9 | <0.001 |
| Sufficient | 43.9 | 31.2 | 38.6 | 37.0 | |
| Rather not sufficient | 31.2 | 43.4 | 36.6 | 43.0 | |
| Not sufficient at all | 7.3 | 17.1 | 11.3 | 12.1 | |
| Living place during term | | | | | |
| Alone | 21.2 | 39.0 | 17.5 | 3.7 | <0.001 |
| With partner | 9.6 | 28.1 | 2.2 | 3.4 | |
| At parents' home | 41.1 | 13.3 | 30.1 | 41.9 | |
| Shared flat | 27.4 | 8.2 | 19.5 | 47.5 | |
| Other | 0.7 | 11.5 | 30.8 | 3.4 | |

* Chi-square test for comparison between countries

mark around 5% of responses were missing. The mean values of M-BDI were higher among students from Poland and Bulgaria than those from Germany and Denmark (Table 3). There was also a gender difference with higher scores among female students as compared to their male peers in all of the countries. The fraction with scores ≥ 35 was above 40% among female students in Poland and Bulgaria as compared to around 25% among female students from Denmark and Germany. For male students the fractions were substantially lower. Cumulative distribution of M-BDI scores is shown in Fig. 2.

■ Gender, perceived income sufficiency and differences between countries in regard to depressive symptoms

No interactions between the three above variables investigated in respect to M-BDI score were found, thus homogenous effects for gender and economic situation can be assumed. The depression scores were on average more than eight points higher in Poland and Bulgaria than in Denmark (Table 4, first column). The results were nearly the same when the analysis was repeated with the score based on 19 items only.

Table 2 Test for Differential Item Functioning (DIF) for Modified Beck Depression Index (M-BDI) across the countries (adjusted R^2 values)

| Item | Model 1 | Model 2 | Model 3 | Model 3-1 |
|--|---------|---------|---------|-----------|
| 1. I feel sad | 0.47 | 0.47 | 0.48 | 0.01 |
| 2. I feel discouraged about the future | 0.45 | 0.45 | 0.45 | 0.01 |
| 3. I feel I have failed | 0.53 | 0.54 | 0.54 | 0.01 |
| 4. It is hard for me to enjoy things | 0.44 | 0.45 | 0.45 | 0.01 |
| 5. I feel guilty | 0.42 | 0.43 | 0.43 | 0.01 |
| 6. I feel I am being punished | 0.39 | 0.39 | 0.40 | 0.01 |
| 7. I am disappointed in myself | 0.54 | 0.55 | 0.55 | 0.01 |
| 8. I am critical of myself for my weaknesses or mistakes | 0.53 | 0.53 | 0.53 | 0.00 |
| 9. I have thoughts of killing myself | 0.24 | 0.26 | 0.27 | 0.03 |
| 10. I cry | 0.29 | 0.30 | 0.31 | 0.01 |
| 11. I feel annoyed and irritated | 0.45 | 0.45 | 0.45 | 0.00 |
| 12. I have lost interest in other people | 0.31 | 0.32 | 0.33 | 0.02 |
| 13. I put off making decisions | 0.29 | 0.34 | 0.34 | 0.05 |
| 14. I am worried about my appearance | 0.19 | 0.32 | 0.35 | 0.16 |
| 15. I have to force myself to do anything | 0.29 | 0.34 | 0.35 | 0.06 |
| 16. I don't sleep well | 0.24 | 0.25 | 0.26 | 0.01 |
| 17. I am tired and listless | 0.50 | 0.52 | 0.52 | 0.02 |
| 18. I have no appetite | 0.23 | 0.23 | 0.23 | 0.00 |
| 19. I am worried about my health | 0.21 | 0.21 | 0.21 | 0.01 |
| 20. I lost interest in sex | 0.15 | 0.19 | 0.19 | 0.04 |

Note. Independent variables included in the models: Model 1—only M-BDI score; Model 2—M-BDI score and country; Model 3—M-BDI score, site and their interaction

Table 3 Modified Beck Depression Index (M-BDI) by gender and site

| | Female | | | | Male | | | |
|------------------------|--------------------|--------------------|-------------------|---------------------|--------------------|--------------------|-------------------|---------------------|
| | Germany N = 285 | Denmark N = 177 | Poland N = 301 | Bulgaria N = 441 | Germany N = 202 | Denmark N = 140 | Poland N = 128 | Bulgaria N = 204 |
| Mean | 27.9 | 25.8 | 33.6 | 33.5 | 24.8 | 19.0 | 27.6 | 29.9 |
| Median | 25 | 23 | 32 | 32 | 22 | 19 | 24 | 27 |
| 80th percentile | 40 | 39.4 | 48 | 48 | 36 | 29.6 | 41.2 | 42 |
| 90th percentile | 51 | 50.2 | 58 | 55.8 | 46.1 | 35 | 49 | 49.5 |
| % With score ≥ 35 | 26.7 | 24.9 | 45.5 | 42.9 | 22.8 | 12.1 | 27.3 | 33.8 |

Similarly, odds of M-BDI score ≥ 35 in Poland and Bulgaria were three times higher than in Denmark (Table 4, second column). The differences between countries were almost unaffected, when perceived income was removed from the model (data not shown). Females had on average a higher depression M-BDI score of 4.16 points. Likewise, females odds of having M-BDI ≥ 35 were 1.62 that of males. A consistent gradient existed over the categories of perceived sufficiency of income, which resulted in higher depression scores for respondents with less sufficient income. When the income that was rated as “totally sufficient” was considered as reference group, students with “sufficient” income had slightly increased odds of having a depressive symptom score ≥ 35 . However, there was a substantial increase for the remaining categories: the odds ratio for the last category (“not sufficient at all”) was as high as 2.5 compared to “totally sufficient” income.

Discussion

We used data from a cross-national student health survey to obtain and compare estimates of the prevalence of depressive symptoms in student populations from two Eastern and two Western European countries. A large proportion of students had M-BDI

scores ≥ 35 , the cut-off point for screening for clinically relevant depression in general population samples, as recommended by authors of the M-BDI [34]. We also found considerable differences in mean depression scores across the countries, with higher scores in both Eastern European countries. Females reported on average higher depression scores. Depression score increased with decreasing perceived sufficiency of income, with the largest increase between the “insufficient” and “insufficient at all” categories.

The M-BDI scores in our sample were considerably higher than those reported in a previous study of a representative sample of the German population [34]. In this study the mean score for age group 21–30 was slightly below 20. However, similar to our findings, other studies among students, which used the original BDI also found a high prevalence of depressive symptoms [42]. Clearly, the self-reported depressive symptoms measured by BDI are different from a clinical diagnosis of depression and previous research has indicated a low specificity of the BDI in the general population [32]. Some of the major somatic symptoms of depression (sleep disorder or eating disorder) may not always indicate depressive symptoms in student samples seeing as though they can be caused by external factors related to studying (e.g., changes in sleep pattern before exams due to studying

Fig. 2 Cumulative distribution of the Modified Beck Depression Index in university students from four countries (dotted line indicates M-BDI score of 35)

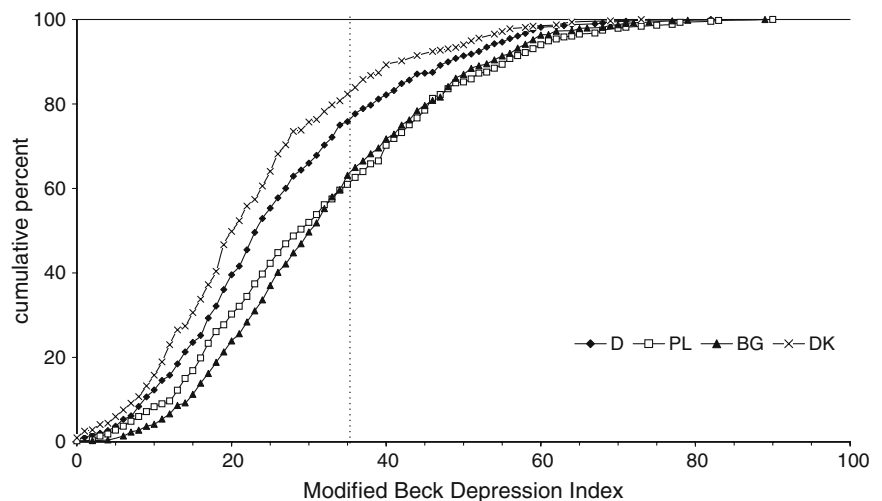


Table 4 Associations between depressive symptoms and country, gender and sufficiency of income (analysis of variance with continuous M-BDI score and logistic regression for dichotomised outcome, sites included as random effects)

| Variable | Continuous M-BDI score Linear coeff. (95% CI) ^a | p-Value Wald-test | M-BDI score ≥ 35 vs. < 35 OR (95% CI) | p-value Wald-test |
|-----------------------|---|----------------------|---|----------------------|
| Country | | <0.001 | | <0.001 |
| Denmark | -5.33 (-9.66; -1.01) | | 0.55 (0.32; 0.94) | |
| Germany | -1.18 (-5.45; 3.09) | | 0.82 (0.48; 1.39) | |
| Poland | 3.13 (-1.16; 7.42) | | 1.53 (0.90; 2.60) | |
| Bulgaria | 3.39 (-0.86; 7.63) | | 1.46 (0.87; 2.45) | |
| Gender | | <0.001 | | <0.001 |
| Male | 0 | | 1.00 | |
| Female | 4.16 (2.72; 5.59) | | 1.62 (1.30; 2.01) | |
| Income | | <0.001 | | <0.001 |
| Totally sufficient | 0 | | 1.00 | |
| Sufficient | 1.64 (-0.66; 3.95) | | 1.15 (0.80; 1.65) | |
| Rather not sufficient | 3.64 (1.33; 5.95) | | 1.46 (1.02; 2.10) | |
| Not sufficient at all | 7.60 (4.71; 10.49) | | 2.45 (1.59; 3.78) | |

^aGlobal intercept: BDI = 22.9

Note. There was no significant interaction between the independent variables in any of the models

all night) [20]. Thus, the BDI may overestimate the extent of depressive symptoms in student samples [33]. Additionally, it was shown that BDI does not differentiate well between general distress or anxiety symptoms and depressive symptoms [10, 31]. Despite these unresolved questions, comparisons within and between student samples are warranted.

Consistent with previous studies [37, 42], we found that the proportion of students with high depression scores varied considerably between Eastern and Western European countries with the highest proportions in Eastern Europe (Poland and Bulgaria). Some studies observed that changes surrounding the political and economic transition in post-communist countries in the early 1990's had detrimental effects on mental health [13], however these patterns were not homogenous across all the countries [26]. A survey of older adults in 1999/2000 in Poland, the Czech Republic and Russia found slightly elevated depressive symptoms but these elevated levels still fell within the range found in Western European countries [7]. A study conducted in Poland indicated that depressive symptoms in the general population improved between 1991 and 1997 [12]. However, it is possible that students, as young adults not yet participating in the professional life, might differ in their reactions or be affected in different ways by political/social changes than older adults; thereby limiting the potential extrapolation of findings from other age groups. Interestingly, previous studies of depressive symptoms demonstrated an increase in the proportion of students with depressive symptoms from 23.5% to 30.6% in Western but not in Eastern European countries between 1990 and 2000 [42]. Our findings suggest that in 2005, more than 15 years after a period of rapid changes in the Eastern European countries, disparities in depressive symptoms between students in Eastern and Western European countries remain substantial.

Our study also found a gender difference where female students on average had higher depression scores than male students and were twice as likely to have M-BDI scores ≥ 35 . The gender difference with respect to depressive symptoms, increases from early adolescence, peaks in late adolescence (16–18 years) [4, 17, 18, 30, 41] and decreases towards older ages [6] (but contradictory findings in [9]). Larger gender differences were found for minor forms of depression than for major depression [28]. In a multinational study of health complaints including depressive moods among school-age children, it was proposed that gender differences are bigger in countries with more gender inequalities, with respect to job opportunities and political rights, whereby the role models for males and females are very different [40]. We did not find any interaction between country and gender with respect to depressive symptoms, meaning that the effect of gender on depressive symptoms did not differ across the four countries in our sample.

A meta-analysis found compelling evidence that, for adults and the elderly, low-income individuals had higher odds of being depressed and a dose-response relationship was observed for education and income [25]. In the Netherlands, a longitudinal study of older adults found that those with the lowest levels of education or income had a 50% higher risk of depression compared to those in groups with the highest socio-economic status [22]. In Poland, similar differences in health and quality of life were found among the elderly from various social strata [21]. In addition, adolescents from lower socio-economic status groups report lower self-perceived health and more psychosomatic complaints, including depressive moods [16, 23, 39]. Our study adds to these findings by contributing information on a particular segment in the population, young adults who are university students. While the effects of the income sufficiency were strong but did not differ across the countries, the differences in perceived income sufficiency did not

explain the differences between countries in respect to the prevalence of depressive symptoms. In all countries except Denmark, perceived income sufficiency was correlated to the available money. Despite a good overall economic situation in their country, students in Denmark reported as low perceived income sufficiency as students in Bulgaria. This might be explained by the high level of independency of Danish students from their parents, which increases costs for housing and food and decreases parental financial support, and by generally high costs of living in Denmark. But in general, perceived income sufficiency while being related to depressive symptoms, might not convey all aspects of economic situation associated with living in a given country in relation to depressive symptoms and differences between countries can also evolve from other than economic causes.

Limitations of this study include that fact that students were sampled from one university in each country. Therefore the data may not be representative of all students. Since, all respondents were first year students we cannot examine depressive symptoms by duration of study. In relation to the research tools, this inquiry measured depressive symptoms using a relatively recent modification of an established instrument [36], with validity/reliability information on the M-BDI restricted to German samples [34]. There was some indication of differential item functioning of an item related to worries about the appearance in Bulgaria, but retaining the item in the analysis did not affect the results. We used a score of ≥ 35 for the dichotomisation of the study subjects. There are no agreed upon cut-off scores for the M-BDI to indicate the presence of depressive symptoms in *student* populations yet. While the score of 35 showed optimal sensitivity and specificity (equal values of both parameters were considered optimal in their analysis) for the diagnosis of clinically relevant depression in general population [34], authors recommended clinical evaluation only after two elevated values within several days. Our study provided a single measurement for each participant and no information was available about variation within the subject. The study also measured depressive symptoms during the few days preceding the survey and no information was collected on events that could temporarily increase the stress levels of the students within or outside the university setting, which in turn could affect depressive symptoms [33]. For the assessment of economic status we used the subjective measure of income sufficiency. Due to the specific situation of students and potential differences in their living conditions, it might be difficult to measure their economic situation based on any given criterion. While we decided on the subjective measurement of perceived income sufficiency and related it to the current situation only, in this age group the future prospects or general perceived conditions in the

country might be more relevant. Our samples from Eastern Europe had a substantially higher fraction of female participants. Since the response rate was high in general, this imbalance might be due to a selection of courses with higher female participation. Also there is a stronger separation of technical and other subjects in the education system in Poland, with more males studying in technical universities.

Conclusions

Fifteen years after major political changes have taken place in Eastern Europe, differences in the prevalence of depressive symptoms between Western and Eastern European university students persist. Female gender and perceived income insufficiency were associated with higher levels of depressive symptoms. Differences in perceived income sufficiency did not explain the differences between countries.

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