European Child & Adolescent Psychiatry (2019) 28:595–599
https://doi.org/10.1007/s00787-018-1194-0

BRIEF REPORT

Depressive symptoms at 13 years as predictors of depression in older adolescents: a prospective 4-year follow-up study in a nonclinical population

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Received: 11 February 2018 / Accepted: 2 July 2018 / Published online: 5 July 2018

Abstract

Depression is the most important source of disability in adolescents, partially due to its recurrence. There is a lack of studies on population-based samples investigating the continuity of depressive symptoms during adolescence. This study evaluates depressive symptoms at early adolescence as predictors of depressive symptoms later in adolescence. Urban adolescents born in 1990 and enrolled in schools of Porto, Portugal, in 2003–2004 (EPITeen study) were evaluated at 13 and 17 years ($n = 1106$, 55.9% females), and completed a questionnaire comprising health behaviors and Beck Depression Inventory II (BDI-II) to assess depressive symptoms. A questionnaire on socio-demographic and clinical characteristics was self-reported. Regression coefficients (β) and 95% confidence intervals (CI) were estimated using simple linear regression. The prevalence of adolescents with depressive symptoms above the cut-off (BDI-II > 13) was 11.9% at 13 years (girls: 17.1%; boys: 5.3%) and 10.8% at 17 years (girls: 14.7%; boys: 5.7%). Almost 6% of girls and 2% of boys had BDI-II > 13 at both assessments, and 35% of girls and boys with BDI-II > 13 at baseline also had BDI-II > 13 at follow-up. For both genders, depressive symptoms at age 13 were independently associated with depressive symptoms at age 17 (girls: $\beta = 0.35$, 95% CI 0.28–0.42; boys: $\beta = 0.37$, 95% CI 0.30–0.44). Depressive symptoms at age 13 were an independent predictive factor for adolescents' depressive symptoms at age 17. The prevalence of adolescents with BDI-II > 13 was higher in females, but the strength of this association was similar in both genders, highlighting the heavy burden of depressive symptoms already at an early age, among girls and boys.

Introduction

Depression is the most important source of disability within individuals with 10–24 years, corresponding to 8% of their incident disability-adjusted life-years, partially due to its high levels of recurrence [1].

There has been considerable interest in the dimensional approach of depression, considering it along a continuum of increasing severity [2, 3]. However, there is a lack of longitudinal studies on population-based samples investigating depressive symptoms from early to late adolescence, and the relevance of these symptoms at early ages needs further investigation. The present study evaluates depressive symptoms at early adolescence as predictors of depressive symptoms later in adolescence, using a prospective 4-year follow-up analysis within a population-based cohort.

Methods

Data were collected under the EPITeen study—Epidemiological Health Investigation of Teenagers in Porto, a population-based cohort that recruited adolescents born in 1990, at public and private schools of Porto, Portugal, during 2003–2004 [4]. A second evaluation took place when participants were on average 17 years. Written informed consent was obtained from adolescents and their parents/legal guardians. The study was approved by the Ethics Committee of Hospital S. João.

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At the recruitment, 2786 eligible participants were identified and 2159 (77.5%) agreed to participate. 4 years later, 1716 (79.4%) participants were re-evaluated. We excluded 334 due to missing information on depressive symptoms at baseline or follow-up and 276 with missing data on the other variables considered in this study. The final analysis was based on 1106 students.

Depressive symptoms

Beck Depression Inventory—second edition (BDI-II) was used to assess depressive symptoms. BDI-II was previously validated in Portuguese adolescents, and > 13 was the cut-off to define adolescents presenting significant depressive symptoms [5].

Other co-variables

Body image was evaluated using the Stunkard figures [6]. Body dissatisfaction was defined by the discrepancy between the perceived and the ideal figures and its association with depressive symptoms was previously described in our sample [7]. Adolescents were classified as smokers/drinkers if they had experimented or smoke/drink regardless of the frequency and amount. Parents' education was used as a proxy for socioeconomic status, considering the parent with a higher level of education. To evaluate parents' depression, each parent was asked for a previous diagnosis of depression. Body mass index (BMI) was classified according to the BMI percentiles, elaborated by the United States Centers for Disease Control and Prevention, as overweight/obesity if BMI > 85th percentile.

Data analyses

A post hoc analyses using Dunnett's *C* test were made to compare BDI-II scores according to the four groups of depressive symptoms established (BDI ≤ 13 at 13 and 17 years, BDI > 13 only at 13 years, BDI > 13 only at 17 years and BDI > 13 at 13 and 17 years). To evaluate the association between the adolescents' characteristics at baseline and depressive symptoms 4 years later, adjusting for potential confounders, regression coefficients (β) and 95% confidence intervals (95% CI) were estimated, using simple linear regression. The final model included the variables parents' education, parents' depression, BMI and tobacco smoke among girls and parents' education and parents' depression among boys.

Results

The prevalence of adolescents with BDI-II > 13 was similar in both assessments and higher among girls: 11.9% at 13 years (girls: 17.1%; boys: 5.3%) and 10.8% at 17 years (girls: 14.7%; boys: 5.7%). About 75% of girls and 90% of boys had BDI-II ≤ 13 at both evaluations, and 6% of girls and 2% of boys presented BDI-II > 13 both at 13 and 17 years. Almost 35% of girls and boys with BDI-II > 13 at baseline also had BDI-II > 13 4 years later. Adolescents with significant depressive symptoms at both evaluations presented the highest median BDI-II scores at 13 and 17 years, similar to those presented by the adolescents with significant depressive symptoms only at one specific moment (Fig. 1).

After adjustment, having depressive symptoms and a thin-ideal figure at age 13 were associated with higher scores of depressive symptoms at 17 years for both genders (Table 1). Among girls, being overweight/obese, reporting tobacco smoke and having family history of depression at 13 years were also associated with higher values on BDI-II at 17 years.

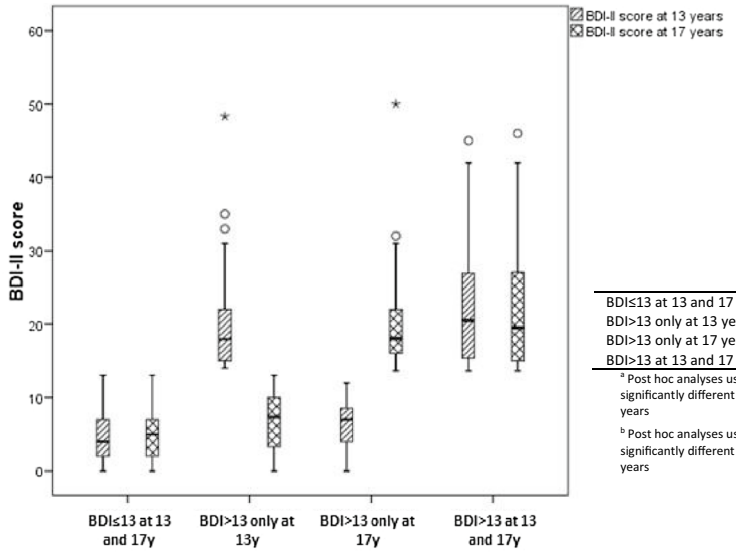
Discussion

Depressive symptoms at age 13 were an independent predictive factor for adolescents' depressive symptoms at age 17, reinforcing former research in which adolescent depression, and even subthreshold depression, has been one of the most significant predictors for later depression [3, 8, 9]. Although the prevalence of adolescents with BDI-II > 13 was higher among girls, the strength of this association was similar in both genders, highlighting the heavy burden of depressive symptoms already at an early age also among boys.

As previously described, almost 35% of adolescents with BDI-II > 13 early in adolescence also presented BDI-II > 13 4 years apart [10]. This result could parallel a recurrence rate, similar in both sexes, since the length of time between the two assessments was long enough to minimize the possibility of being measuring the same episode of depressive symptoms.

Adolescents with significant depressive symptoms at 13 and 17 years had the highest median BDI-II scores at both assessments. However, their scores were similar to those presented by the adolescents with significant depressive symptoms only at that specific moment (13 or 17 years), being likely that the severity of depression is not the major determinant of depressive symptoms later. Adolescents with BDI-II > 13 only at 13 or 17 years had

Girls

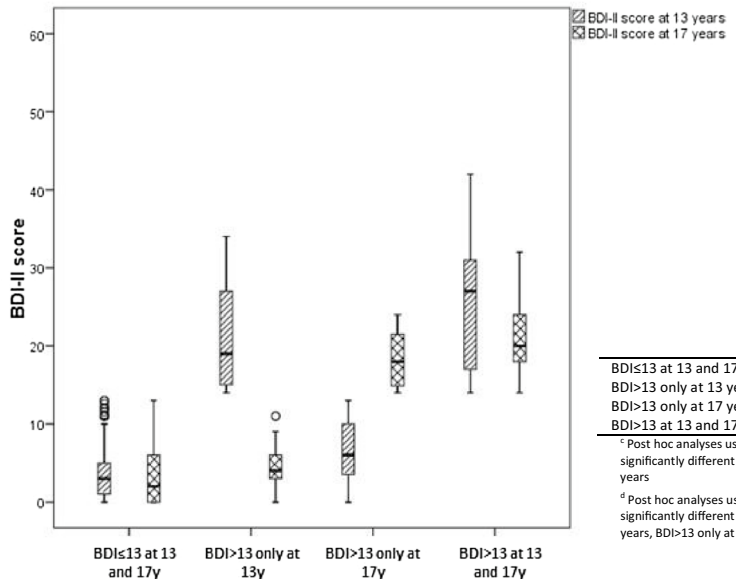


	BDI-II Median (P25-P75)	
	13 years[a]	17 years[b]
BDI≤13 at 13 and 17 years	3.99 (2.00-6.99)	5.00 (2.00-6.99)
BDI>13 only at 13 years	17.92 (14.99-22.01)	7.35 (3.32-10.00)
BDI>13 only at 17 years	6.99 (3.99-9.01)	18.00 (16.00-22.01)
BDI>13 at 13 and 17 years	20.50 (15.37-27.00)	19.50 (14.99-27.12)

[a] Post hoc analyses using Dunnett's C test indicated that each of the 4 groups was significantly different at p≤0.05, except for BDI>13 only at 13 years and BDI>13 at 13 and 17 years

[b] Post hoc analyses using Dunnett's C test indicated that each of the 4 groups was significantly different at p≤0.05, except for BDI>13 only at 17 years and BDI>13 at 13 and 17 years

Boys



	BDI-II Median (P25-P75)	
	13 years[c]	17 years[d]
BDI≤13 at 13 and 17 years	3.00 (1.01-5.00)	2.00 (0.00-6.01)
BDI>13 only at 13 years	19.01 (14.99-27.01)	3.99 (3.00-6.01)
BDI>13 only at 17 years	6.01 (3.00-10.00)	18.00 (14.70-22.01)
BDI>13 at 13 and 17 years	27.01 (17.01-31.00)	19.99 (18.00-24.00)

[c] Post hoc analyses using Dunnett's C test indicated that each of the 4 groups was significantly different at p≤0.05, except for BDI>13 only at 13 years and BDI>13 at 13 and 17 years

[d] Post hoc analyses using Dunnett's C test indicated that each of the 4 groups was significantly different at p≤0.05, except for BDI≤13 at 13 and 17 years and BDI>13 only at 13 years, BDI>13 only at 17 years and BDI>13 at 13 and 17 years

Fig. 1 BDI-II scores at 13 and 17 years (*y*) according to the longitudinal approach of depressive symptoms, by sex

higher scores of depression at the other moment of evaluation than adolescents presenting always BDI ≤ 13, reinforcing the perspective that depressive symptoms do not merely indicate benign adolescence, with high levels of emotional intensity.

The strength of this prospective study relies on the large representative single-age cohort comprising pupils from all social classes from a major city. The attrition at follow-up was satisfactorily low, but may have caused a slight bias as non-participants had a higher prevalence of significant depressive symptoms at baseline. We have two assessment points 4 years apart, but no information between them. Individuals classified as not having significant depressive symptoms later in adolescence may have presented it during this time.

The findings of our study support being aware to depressive symptoms already at an early phase of adolescence, considering target interventions for them.

Table 1 Association between adolescents characteristics at 13 years and depressive symptoms at 17 years of age, by sex

Characteristics at 13 years	Girls ($n=618$) β (95% CI)			Boys ($n=488$) β (95% CI)	
	Model 1[b]	Model 2[b]	Model 3[b]	Model 1[b]	Model 2[b]
BDI-II score at 13y	0.35 (0.28 to 0.43)	0.35 (0.28 to 0.42)	0.34 (0.27 to 0.41)	0.37 (0.30 to 0.44)	0.37 (0.30 to 0.44)
Age at menarche, year	−0.08 (−0.52 to 0.36)	−0.73 (−0.51 to 0.36)	0.05 (−0.39 to 0.49)	–	–
BMI[a] (≥p85)	1.52 (0.22 to 2.83)	1.46 (0.16 to 2.76)	1.46 (0.17 to 2.75)	0.49 (−0.49 to 1.46)	0.47 (−0.50 to 1.45)
Body image					
Ideal figure > current figure	−1.30 (−2.76 to 0.17)	−1.17 (−2.63 to 0.29)	−0.84 (−2.34 to 0.66)	−0.20 (−1.14 to 0.74)	−0.18 (−1.12 to 0.76)
Ideal figure < current figure	2.14 (0.99 to 3.28)	2.09 (0.95 to 3.23)	1.79 (0.45 to 3.13)	1.82 (0.92 to 2.73)	1.77 (0.86 to 2.68)
Sleeping duration, h	−0.58 (−1.32 to 0.16)	−0.57 (−1.31 to 0.17)	−0.51 (−1.24 to 0.23)	−0.18 (−0.76 to 0.40)	−0.14 (−0.72 to 0.44)
Smoking (never vs ever)	2.07 (0.76 to 3.38)	1.98 (0.67 to 3.29)	1.98 (0.67 to 3.29)	0.91 (−0.22 to 2.04)	0.83 (−0.32 to 1.97)
Drinking alcohol (never vs ever)	0.49 (−0.65 to 1.63)	0.44 (−0.70 to 1.59)	0.14 (−1.02 to 1.30)	0.68 (−0.21 to 1.57)	0.63 (−0.26 to 1.52)
Physical exercise (≥2 times/week)	−0.10 (−1.38 to 1.18)	−0.29 (−1.62 to 1.03)	−0.20 (−1.51 to 1.12)	0.53 (−0.36 to 1.42)	0.39 (−0.52 to 1.30)
Parents' education, year	0.09 (−0.03 to 0.22)	0.11 (−0.02 to 0.24)	0.12 (−0.01 to 0.24)	0.05 (−0.05 to 0.15)	0.06 (−0.04 to 0.15)
Household (both parents vs mother/father/other)	0.72 (−0.66 to 2.10)	0.44 (−0.99 to 1.86)	0.19 (−1.23 to 1.61)	0.55 (−0.65 to 1.74)	0.16 (−1.13 to 1.44)
Parents' depression					
At least one	1.85 (0.59 to 3.11)	2.06 (0.66 to 3.45)	1.89 (0.50 to 3.27)	0.69 (−0.35 to 1.73)	0.99 (−0.14 to 2.13)
Do not know	1.43 (−0.81 to 3.68)	2.21 (−0.13 to 4.54)	1.83 (−0.50 to 4.16)	1.20 (−0.44 to 2.83)	1.69 (−0.25 to 3.40)
No information	−1.07 (−2.36 to 0.23)	−0.07 (−1.49 to 1.35)	−0.22 (−1.63 to 1.20)	−0.04 (−1.05 to 0.96)	0.47 (−0.63 to 1.57)

BMI body mass index (calculated as weight in kilograms divided by height in meters squared), *BDI-II* Beck Depression Inventory—second edition, *CI* confidence interval

[a]BMI was classified according to the age- and sex-specific BMI percentiles, elaborated by the United States Centers for Disease Control and Prevention

[b]Model 1: null model; Model 2: Model 1 plus adjustment for parents' education and parents' depression; Model 3: Model 2 plus adjustment for BMI and smoking

Funding This study was supported through FEDER from the Operational Programme Factors of Competitiveness—COMPETE and through national funding from the Portuguese Foundation for Science and Technology—FCT (Portuguese Ministry of Education and Science) within the project PTDC/DTP-EPI/6506/2014, and by the Epidemiology Research Unit—Institute of Public Health, University of Porto (UID/DTP/047507/2013). Individual grant attributed to CB (SFRH/SINTD/60138/2009) was supported by the Portuguese Foundation for Science and Technology—FCT.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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