



Research paper

Universal depressive symptom screening in middle schools in Istanbul: An epidemiologic study

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ABSTRACT

Introduction: Depression is a significant public health concern, with severe adolescent morbidity and mortality. Promoting adolescents' mental health is increasingly recognized, and schools are proposed as screening and preventive intervention sites. This cross-sectional study aimed to screen self-reported elevated depressive symptom prevalence among secondary school students in Istanbul, Turkey. The secondary objectives were determining behavioral problems, resilience, positive attitudes, and risk factors associated with depressive symptoms.

Methods: Data collection was conducted between April–June 2022. Six thousand one hundred ten students from nine randomly selected schools from different city districts were approached. Depression was screened by the Centre for Epidemiological Studies Depression Scale for Children (CES-DC). The Strengths and Difficulties Questionnaire (SDQ) was used for screening behavioral problems and positive attitudes. Resilience was evaluated by the Child and Youth Resilience Measure (CYRM).

Results: The final study sample comprised 2780 participants (response rate 47.7 %) with a mean age of 12.4 ± 1.1 years (females:52.7 %). Elevated depressive symptoms were detected in 31.2 % of the students. Female students exhibited higher scores in CES-DC and total difficulties but lower resilience scores in CYRM than male students. In a multiple regression analysis, female gender, higher total difficulties score, lower resilience score, and lower perceived academic performance significantly predicted CES-DC [$F(6,2279) = 421, p < 0.01$].

Discussion: Our findings showed high rates of elevated self-reported depressive symptoms in a city sample among Turkish adolescents at middle schools, in addition to coexisting behavioral difficulties and decreased resilience indicating poor psychosocial functioning. Given the prevalent depressive symptoms, screening and intervention programs involving resilience promotion may involve school systems to prevent adolescent depression.

1. Introduction

Depression is of great public health concern, with severe morbidity and mortality among adolescents (World Health Organization: WHO, 2021a, b). Adolescence is a period with ongoing physiological changes creating vulnerability to mental health disorders accounting for 13 % of the global burden of disease in adolescence. It is estimated that

approximately one in five adolescents experience major depression disorder before reaching adulthood (Mendelson and Tandon, 2016; Shorey et al., 2022; Deng et al., 2023; Xu et al., 2020). The global point prevalence rate of elevated self-reported depressive symptoms is much higher, with a rate of 34 % between 2001 and 2020 (Shorey et al., 2022). Consistent with global rates, the prevalence of depressive symptoms among Turkish adolescents ranged between 10 and 20 % (Toros et al.,

Abbreviations: AUC, Area under curve; CES-DC, Centre for Epidemiological Studies Depression Scale for Children CES-DC; CYRM, Child and Youth Resilience Measure; PAP, Perceived Academic Performance; RS, Resilience score; SDQ, Strengths and Difficulties Questionnaire; TDS, Total difficulties score; WHO, World Health Organization.

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2004; Demir et al., 2011; Alpaslan et al., 2016).

Depression among adolescents negatively affects social functioning, family relationships, and academic performance (Ran et al., 2020). The impairments can continue into adulthood. Subclinical depressive symptoms are also associated with impaired daily functioning (Mendelson and Tandon, 2016). Despite the high prevalence, depression is often underdiagnosed and untreated among adolescents. To improve adolescent well-being, it is critical to identify adolescents at high risk for depression. Risk factors for depression among adolescents are socio-demographic factors such as parents' occupational status, female gender, lower education levels of parents, family instability, low socioeconomic status, and undesirable academic performance (Thapar et al., 2012; Tang et al., 2020). For instance, in a longitudinal study, girls have been identified at more risk for internalizing symptoms during puberty (Wu and Lee, 2020). In addition, family structure, parenting culture, personality traits, psychological attributes, and resilience influence mental health status (Chang et al., 2019). Defining predisposing and protective factors provides targets for preventive interventions. For instance, growing evidence shows resilience protects adolescents' mental health (Gong et al., 2020). Resilience is positively associated with better interpersonal relationships, and both, in turn, mitigate depression among adolescents (Lee et al., 2021). Likewise, a better parent-child relationship can be protective against developing internalizing symptoms during puberty (Wu and Lee, 2020).

Promoting the mental health of adolescents is increasingly recognized to achieve sustainable developmental goals (Guidelines Review Committee, 2020). Mental illnesses are among the preventable causes of premature death, and suicide is one of the three leading causes of death among adolescents. The global strategy for women's, children's, and adolescents' health 2016–2030 involves promoting mental health and well-being to reduce premature mortality by one-third (Every Woman Every Child, 2021). To achieve this goal, it is advised to provide supportive services for adolescent mental health and well-being. These include universally delivered psychosocial interventions for all adolescents and indicated interventions for adolescents with emotional symptoms (Guidelines Review Committee, 2020). Schools are one of the common settings where interventions can be delivered (World Health Organization: WHO, 2021a, b). Mental health-promoting schools are suggested to support the social and emotional well-being of children as a preventive strategy. The applicability of these recommendations may differ according to culture and country. Therefore, it is imperative to address the epidemiological pattern of adolescent depression at schools and associated risk factors along with protective factors. The objectives of our study were: (1) to determine the prevalence of elevated self-reported depressive symptoms as defined by the Centre for Epidemiological Studies Depression Scale for Children (CES-DC) in a population of secondary school students from the city of Istanbul, Turkey; (2) to screen the behavioral problems, positive attitudes, and resilience among adolescents; and (3) to evaluate the risk factors related to depressive symptoms.

2. Material and methods

2.1. Sampling and selection of subjects

This study was conducted in Istanbul, Turkey's largest and most populated city. A school-based cross-sectional study including a selected group of students (from the 6th to the 8th grade only) was designed. Secondary school students in Istanbul were defined as the population sample. There are around 900 thousand students attending secondary school in Istanbul (Ministry Of National Education Strategy Development Presidency, n.d.). To ensure sample representativeness, we designed an area-stratified random sampling procedure involving three stages: (1) division of strata according to city districts from both the European ($n = 25$, 946 schools) and Asian ($n = 14$, 593 schools) sides of the city; (2) random selection of one secondary school from each district;

(3) distribution of questionnaires to all students from grades 6 to 8. Almost a 1.5:1 to 2:1 ratio was observed in the number of schools on the European: Asian sides of Istanbul, reflecting the disparity in the number of schools across these regions. The average number of students per teacher in Istanbul was determined to be 20, which served as a criterion for stratifying the city's districts: < 20 students per teacher ($n = 21$ districts, 11 on the Asian side and 10 on the European side) and > 20 students per teacher ($n = 18$ districts, 3 on the Asian side and 15 on the European side). In total, 15 schools from 15 city districts were determined to be randomly selected from each stratified group using simple random sampling. Specifically, from the Asian side, two districts from the group with < 20 students per teacher were selected randomly. All three districts from the group with more > 20 students per teacher were included due to their limited number. For the European side, approximately one-third to one-fourth of the districts were selected from each stratified group, resulting in four districts with < 20 students per teacher and six districts with > 20 , making up a total of 15 districts sampled. Six of the selected 15 schools declined to participate, with the final 6 schools from districts with > 20 students per teacher and 3 schools from districts with < 20 students per teacher. Questionnaires were distributed to all students in each school due to ethical considerations. Teachers were informed about the purpose and procedure of the study by the primary investigator (NYS). This meeting also involved an informative section about the importance of recognizing adolescent depression. Children were informed about the study by the teachers. Informed consent was delivered to families, and after obtaining parental informed consent, the questionnaires were distributed to 6110 students in April–June 2022 by teachers during one ordinary lesson. All Turkish-speaking children at the school whose parents gave consent for the study were included. A total of 2919 questionnaires filled by the students were collected back. Following the quality control of data, data on 2780 children were analyzed (Fig. 1). Permission for the study was obtained from the research committee of the Ministry of National Education on 14.10.2021 with registration number E-59090411-44-34,712,301. The Marmara University Ethics Committee approved the study (05.04.2019/09.2019.428).

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2.2. Measures

2.2.1. Sociodemographic variables

Sociodemographic variables such as age, gender, parent education, and family size and structure, were reported. Students were also asked to rate their academic performance at school on a 5-point scale (1: lowest, 5: highest academic performance) to measure perceived academic performance (PAP).

2.2.2. Assessment of depressive symptoms

Depressive symptoms were measured by the Centre for Epidemiological Studies Depression Scale for Children (CES-DC), a 20-item self-report depression inventory with possible scores ranging from 0 to 60 (Radloff, 1977; Weissman et al., 1980). It is accepted as a general measure of the current childhood psychopathology (Fendrich et al., 1990). The scale is widely used as a screening tool in epidemiologic studies and found to be highly reliable across different cultures (Olson and von Knorring, 1997; Barkmann et al., 2008; Tsocheva et al., 2018; Essau et al., 2013; Li et al., 2010; Betancourt et al., 2012). The items were rated by a 4-point Likert scale from 0 to 3. Higher CES-DC scores indicate a greater level of depressive symptoms. A cut-off score of 15 defined in adults has also been identified as the cut-off score for high depressive symptoms in adolescents (Radloff, 1977). However, since adolescents tend to have a higher total score compared to adults, studies in the adolescent population suggested higher cut-off scores (Olson and von Knorring, 1997; Wells et al., 1987). Psychometric properties of the Turkish version of the CES-DC provided evidence for the use of screening

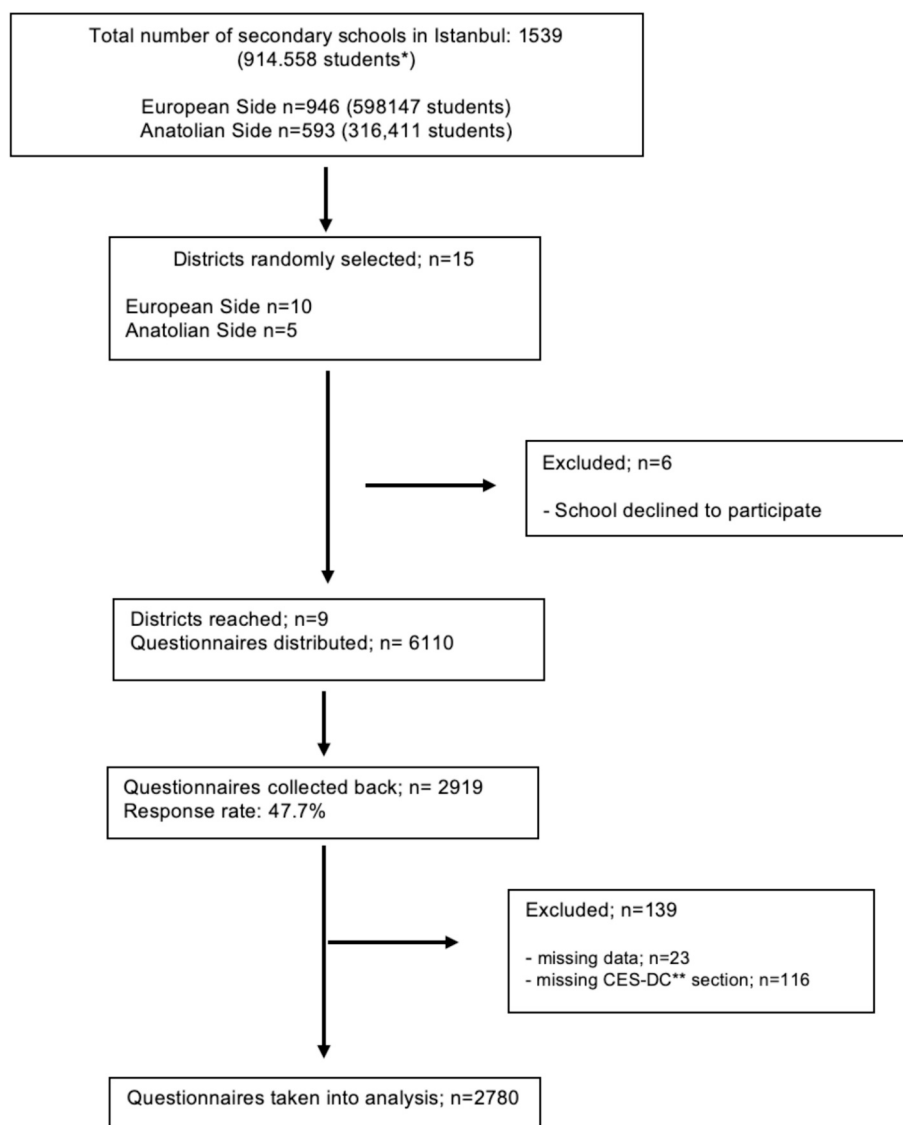


Fig. 1. Flowchart presenting recruitment of study sample.

*Grade 6th–8th students.

** The Center for Epidemiological Studies Depression Scale for Children.

purposes in adolescents with an acceptable Cronbach’s alpha of 0.74; however, a specific cut-off was not defined (Tatar and Saltukoglu, 2010; Tatar et al., 2013). The comparative analyses were performed in this study with cut-off scores of >15 and > 30 based on the previous literature (Radloff, 1977; Olson and von Knorring, 1997). The calculated Cronbach’s alpha for the CES-DC in this study is 0.89.

2.2.3. Assessment of behavioral problems and resilience

The Strengths and Difficulties Questionnaire (SDQ) is a brief behavioral screening tool with 25 items which are divided into five subscales, each composed of 5 items scored between 0 (not true) to 2 (certainly true): 1) emotional symptoms, 2) conduct problems, 3) hyperactivity/inattention, 4) peer relationship problems and 5) prosocial behavior (Goodman et al., 1998). It is a generally well-correlated measure of adolescent psychopathology. A total difficulties score (TDS) ranging between 0 and 40 is generated by adding the first four subscales. Higher scores on the total difficulties subscale indicate more behavioral problems, whereas higher scores on the prosocial subscale indicate more positive attributes. Total difficulties scores and emotional symptom subscale scores was dichotomized according to the suggested cut-off points as normal and borderline/abnormal to test the sensitivity of

CES-DC (Goodman et al., 1998). The validated Turkish version of the self-rated SDQ for 11–17-year-olds was used (Güvenir et al., 2008), which was shown to have acceptable internal consistency for both parent and adolescent forms.

Resilience was evaluated by the Turkish version of the 12-item Child and Youth Resilience Measure (CYRM). The Turkish scale has high internal consistency with a Cronbach’s alpha of 0.91. Each item is scored between 1 and 5, and higher resilience scores (RS) indicate better resilience (Liebenberg et al., 2013; Arslan, 2015).

2.3. Statistical analysis

Statistical analyses were performed using SPSS Version 28.0 (IBM Inc., United States). Descriptive data were presented as mean ± SD or n (%) with significance at the $p < 0.05$ level.

Continuous variables were compared by independent samples *t*-test and categorical variables were compared by Chi-Square test. The item nonresponse rate was between 1.0 and 2.8 %. To reduce nonresponse bias, missing data (item nonresponse) of CES-DC and CYRM were imputed by linear interpolation (Brick and Kalton, 1996). For the missing data of SDQ, scores were scaled up pro-rata if at least three items

were completed as suggested. Pearson correlation analysis was conducted to determine the relationship between CES-DC with SDQ and CYRM scores. A multiple regression was run to explain CES-DC score from gender, mother/father educational years, TDS, resilience score, and PAP in the school. Elevated depressive symptom rates were defined in both cutoff values of CES-DC (>15 and > 30) due to the uncertainties in the current literature for adolescents. ROC analysis showed that at a cut-off level > 15, the sensitivity of CES-DC to discriminate increased total difficulties was 0.94, the specificity 0.54 [AUC: 0.83 (%95 CI 0.82–0.85)], and to discriminate increased emotional symptoms sensitivity was 0.96, specificity 0.63 [AUC is 0.82 (%95 CI 0.81–0.84)].

3. Results

3.1. Demographic characteristics

The final study sample was composed of 2780 participants included in the analyses. The mean age was 12.4 ± 1.1 years (Table 1). There was low maternal employment (26.2 %). There was a weak positive correlation between CES-DC scores with the number of siblings (r:0.10, p < 0.001) and number of people living at home (r:0.04, p:0.01). Both maternal (r:-0.06, p:0.001) and paternal educational years (–0.04, p:0.02) showed a negative correlation with the CES-DC scores.

3.2. Depressive symptoms, behavioral problems, and resilience

The mean score from CES-DC was 24.1 ± 12.7, the TDS from SDQ was 14.46.1, and the CYRM score was 45.4 ± 8.4 (Table 2). The rates of elevated depressive symptoms were 71.2 % and 31.2 %, according to the cut-offs of 15 and 30, respectively. Children with elevated depressive symptoms were living more frequently in separated families (Table 1). For both cut-off values, elevated depressive symptoms were significantly higher in female students compared to the male students (for >15, 75.7

Table 1
Characteristics of the study participants.

Characteristics	Total	CES-DC > 15 n: 1979	CES-DC ≤ 15 n: 801	OR (95% CI)
Age, years	12.4 ± 1.1	12.4 ± 1.1	12.3 ± 1.1	
Interquartile range	12–13	12–13	12–13	
Gender, female	52.7	56.4*	43.8*	1.6 (1.4–1.9)
Maternal age, years	38.6 ± 5.5	38.6 ± 5.4	38.8 ± 5.5	
Maternal education, years	8.4 ± 4.1	8.2 ± 4.1*	8.9 ± 3.9*	
≤8 years	64.7	66.4*	60.7*	1.2 (1.1–1.5)
>9 years	35.3	33.6	39.3	
Maternal employment	26.2	26.1	26.5	
Paternal age, years	42.8 ± 5.6	42.8 ± 5.57	42.9 ± 5.5	
Paternal education, years	9.3 ± 3.7	9.1 ± 3.7*	9.7 ± 3.6*	
≤8 years	56.1	59.1*	48.8	
>9 years	43.9	40.9	51.2	1.5 (1.3–1.8)
Paternal employment	94.9	94.7	95.5	
Number of siblings	2.2 ± 1.5	2.3 ± 1.6*	2.0 ± 1.3*	
Divorced parents	6.6	7.2**	5.1**	1.4 (1.1–2.1)
Number of people in the house	4.9 ± 1.7	1.8 ± 0.04*	1.2 ± 0.05*	

Data are represented as % or mean ± SD. Chi square test was used to compare proportions. Odds ratios were calculated using 2 × 2 contingency tables. The mean values were compared by independent samples t-test.

* p < 0.01.

** p:0.04.

Table 2
Scores in CES-DC, CYRM and SDQ.

	Total	Female	Male	p
CES-DC	24.1 ± 12.7	26.4 ± 13.4	21.6 ± 11.7	<0.001
CES-DC > 15	71.2	75.7	65.2	<0.001
CES-DC > 30	31.2	39.5	22.7	<0.001
CYRM (Child and youth resilience measure)	45.5 ± 8.5	45.1 ± 8.7	45.9 ± 8.3	0.01
SDQ (Strengths and Difficulties Questionnaire)				
Total difficulties score	14.4 ± 6.1	15.1 ± 6.3	13.6 ± 5.9	<0.001
Emotional symptoms	3.7 ± 2.5	4.2 ± 2.6	3.1 ± 2.4	<0.001
Conduct problems	3.0 ± 2.0	2.9 ± 2.0	3.0 ± 2.0	0.33
Hyperactivity (inattention)	4.3 ± 2.2	4.5 ± 2.3	4.1 ± 2.1	<0.001
Peer relationship problems	3.5 ± 1.9	3.5 ± 1.8	3.4 ± 1.9	0.32
Prosocial behavior	7.6 ± 2.1	7.8 ± 1.9	7.4 ± 2.1	<0.001
Internalizing symptoms (peer + emotional)	7.2 ± 3.7	7.6 ± 2.6	6.5 ± 3.6	<0.001
Externalizing symptoms (conduct + hyperactivity)	7.3 ± 3.5	7.4 ± 3.5	7.1 ± 3.2	0.01

Data are represented as % or mean ± SD. Chi square test was used to compare proportions. The mean values were compared by independent samples t-test.

% vs. 65.2 %; for>30, 39.5 % vs. 22.7 %, p < 0.001) (Table 2). Female students exhibited higher scores in CES-DC and total difficulties but lower scores in CYRM compared to the male students (Table 2). Prosocial behavior was increased in female students compared to male students.

Increasing CES-DC scores were associated with increasing TDSs (r:0.66, p < 0.01) and decreasing prosocial behavior (r: –0.18, p < 0.01) and RS (r: –0.53, p < 0.01) (Table 3). Regarding other subscales of SDQ, emotional symptoms, peer problems, hyperactivity, and conduct problems were increased with increasing depressive symptoms (Table 3).

Higher PAP was associated with a lower depression score (r: –0.25, p < 0.01), TDS (r: –0.25, p < 0.01), and increasing prosocial behavior (r: 0.17, p < 0.01), and resilience (r: 0.26, p < 0.01).

A multiple regression was run to assess the relationship of CES-DC scored with gender, mother/father educational years, TDS, resilience score, and PAP. Female gender, higher TDS, lower resilience score, and lower PAP were significantly related to CES-DC scores (Table 4) [F (6,2279) = 421.000, p < 0.01].

4. Discussion

The results of our study indicate a strikingly high rate of elevated depressive symptoms among middle school students in Istanbul. Elevated depressive symptoms were closely related to behavioral problems, decreased resilience, female gender, and decreased PAP. The findings of this study showed that higher depressive symptoms were positively associated with poor psychosocial functioning providing evidence for the accurate identification of high-risk adolescents.

A recent nationwide study indicated a 2.5 % of any mood disorder among Turkish children (Ercan et al., 2019). However, this study included only children in 2nd and 4th grades, which limits the comparison of our findings with the nationwide prevalence. Older studies conducted among Turkish adolescents have reported a prevalence of depressive symptoms ranging from 12 to 26 % (Toros et al., 2004; Demir et al., 2011; Alpaslan et al., 2016). For instance, Toros et al. found a 12.5 % prevalence of depressive symptoms among adolescents with a mean age of 14.5 years as measured by Child Beck Depression Inventory (Toros et al., 2004). In another study from Istanbul, 11.6 % of the students with a mean age of 12 years had scores above the cut-off on the

Table 3
Correlation matrix of the CES-DC scores with CYRM and subscales of SDQ.

	1	2	3	4	5	6	7	8	9	10
1.CES-DC	1									
2.Emotional symptoms	0.63*	1								
3. Conduct problems	0.43*	0.39*	1							
4. Hyperactivity	0.38*	0.37*	0.35*	1						
5. Peer problems	0.40*	0.36*	0.35*	0.17*	1					
6. Prosocial behavior	-0.18*	-0.08*	-0.35*	-0.22*	-0.22*	1				
7. Total difficulties	0.66*	0.78*	0.72*	0.68*	0.63*	-0.29*	1			
8. Externalizing symptoms	0.49*	0.46*	0.80*	0.83*	0.31*	-0.34*	0.85*	1		
9. Internalizing symptoms	0.64*	0.87*	0.45*	0.34*	0.76*	-0.17*	0.87*	0.48*	1	
10. CYRM	-0.53*	-0.31*	-0.39*	-0.30*	-0.32*	0.37*	-0.46*	-0.42*	-0.38*	1

CES-DC: Centre for Epidemiological Studies Depression Scale for Children, CRYM: Child and Youth Resilience Measure.

* Correlation is significant at $p < 0.001$ (2-tailed), Pearson correlation.

Table 4
Multiple regression model to predict CES-DC.

CES-DC total score	Bs	95 % CI for B		t	p	B	R ²	ΔR ²
		LL	UL					
Model							0.526*	0.524*
Female gender	2.931*	2.197	3.666	7.82	<0.001	0.114		
Mother educational years	0.028	-0.075	0.132	0.52	0.58	0.009		
Father educational years	-0.002	-0.115	0.111	-0.03	0.97	-0.001		
Total difficulties score	1.068*	1.000	1.137	30.76	<0.001	0.511		
Resilience score	-0.423*	-0.472	-0.375	-17.09	<0.001	-0.284		
Perceived academic performance	-0.678*	-1.149	-0.206	-2.82	0.005	-0.043		

Note. Model = ‘Enter’ method in SPSS Statistics; B = unstandardized regression coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; Bs = standardized coefficient; R² = coefficient of determination; Δ R² = adjusted R²; SDQ = Strengths and Difficulties Questionnaire.

* $p < 0.0001$.

Child Depression Inventory (CDI) (Demir et al., 2011). Furthermore, a cross-sectional study among high school students identified that 26.6 % of the sample had depressive symptoms according to by CDI scores (Alpaslan et al., 2016). Our results indicate a higher rate of depressive symptoms among adolescents than those reported in previous studies. This can be attributed to the timing of the study, which was after the COVID-19 pandemic. In addition, these older studies may not capture the trend from the latest decade. However, comparisons are limited by differences in study samples and the instruments used to measure depressive symptoms.

American Academy of Pediatrics and the US Preventive Services Task Force recommend universal annual depression screening in adolescents in primary care settings. Yet, depression screening in clinical care settings has unique challenges, such as time constraints, limited training, and lack of available mental health resources (Guo and Jhe, 2021). Besides, adolescents living in the most deprived conditions may be unable to be reached if they do not utilize healthcare services. A universal school-based screening program was effective in increasing the identification of depression (Sekhar et al., 2021; Xu et al., 2020). Annual visits in primary care settings for children aged 6–19 are recommended by the Turkish Ministry of Health, Public Health Department, yet universal depression screening is not integrated into routine care. Besides, the rate of adolescents accessing regular primary care health visits in Turkey is unknown. Given the prevalent presence of depressive symptoms in a school sample of students in our study, we suggest that school-based universal screening programs can identify youth at risk for depressive disorders in Turkey.

Numerous studies supported using CES-DC to screen depressive symptoms in adolescents, though its use in the clinical setting is limited due to moderate specificity. (Fendrich et al., 1990). We herein report high rates of elevated self-reported depressive symptoms in two different cut-offs (71.2 % and 31.2 %) compared to the other studies using CES-DC (Olson and von Knorring, 1997). Distinct from other studies, we did not perform diagnostic clinical interviews for depressive disorders. Therefore, the screening procedure in our study identified

high-risk adolescents rather than clinically depressed ones. However, our results supported the recent findings indicating an increased trend of depressive disorders among adolescents. In a nationally representative U.S. cohort, an increase in major depressive episodes in adolescents from 8.7 % to 13.2 % was detected from 2005 to 2017 (Twenge et al., 2019). Similarly, the global point prevalence of elevated self-reported depressive symptoms from 2001 to 2020 was 34 %. Remarkably, a 14 % increase between 2001 and 2010 and 2011–2020 was noted (Shorey et al., 2022).

Studies suggesting a cut-off point suspicious for depressive disorder using CES-DC were mainly performed before 2010. Considering the increased prevalence of elevated depressive symptoms among adolescents in the last decade, studies revising the cut-off value of CES-DC may be needed. For instance, a study conducted in Rwanda showed a depression rate of 47 % among children and adolescents using a cut-off of 30 in the CES-DC (Betancourt et al., 2012). Similarly, a comparative study from Italy and Sweden reported depression rates ranging from 15.2 to 18.4 %, with a cut-off of 30 (Raffetti et al., 2022). In our study, using a cut-off of 30, we found that 39.5 % of female students and 22.7 % of male students exhibited elevated depressive symptoms. These studies commonly suggest an increase in depressive symptoms among adolescent samples compared to the past despite adjustment of cut-off values. The recent systematic review by Shorey et al. reported a pooled prevalence of 34 % for elevated depressive symptoms, similar to our results. Although direct comparisons are constrained by different cut-offs across studies, our data underline the substantial presence of depressive symptoms among Turkish adolescents, a group underrepresented in the literature.

In addition to the contemporary global trends in the increased rates of depressive disorders among adolescents, cultural factors may impact the epidemiological pattern of depressive symptoms. Adolescents in geographic regions such as the Middle East, Africa, and Asia had a higher prevalence of elevated depressive symptoms than in Europe and North America (Shorey et al., 2022; Xu et al., 2020). This has been attributed to predisposing risk factors of communal cultures, such as

cohabitation with parents, having many siblings, single-parent families, poor family function, and difficulties in peer relationships. The current study may also present similar culture-related factors since Turkey is a rather collectivistic country. Supporting these assumptions, we found higher rates of depressive symptoms in adolescents living in separated families, having more siblings or household crowd at home. Located in a similar geographic region, an Iranian study using CES-DC found 62.5 % of elevated depressive symptoms (Essau et al., 2013). Identifying cultural risk factors may be crucial in tailoring acceptable preventive interventions.

Factors related to the trend of elevated depressive symptoms in the last decade have to be elucidated. It has been suggested that cultural trends, such as electronic communication and digital media, and decreased sleep duration impact adolescent mood disorders (Twenge et al., 2019). In a recent study conducted in Turkey, problematic internet use during the pandemic has been linked to poor sleep quality (Orhon et al., 2023). In our study, COVID-19 may also have an impact, as the high prevalence of depression among children and adolescents during pandemic has been highlighted (Ma et al., 2021; Racine et al., 2021; Deng et al., 2023). This has been attributed to various factors such as social isolation, financial difficulties, loss of peer interactions, and particularly to school closures, the most common location for many adolescents to get mental health services (Masonbrink and Hurley, 2020). These findings underline the importance of school-based universal interventions for depression prevention in adolescents.

In line with previous literature, the female gender was associated with increased depressive symptoms (Salk et al., 2017; Ravens-Sieberer et al., 2021; Mridha et al., 2021; Nabunya et al., 2020; Alpaslan et al., 2016). The gender difference was constantly reported in the validity studies of CES-DC across different cultures (Essau et al., 2013; Li et al., 2019). Emerging gender differences in depressive symptoms during adolescence tend to widen with age (Salk et al., 2017). Interestingly, even more likely to have elevated depressive symptoms, female students in our study exhibited higher prosocial behavior scores, which might be a target for gender-specific interventions.

Our findings support the previous literature demonstrating the negative association between adolescent depressive symptoms and academic achievement (Monzonis-Carda et al., 2021; Bi et al., 2022; López-López et al., 2021). Early adolescence is also characterized by increased academic demand due to the transition from primary to middle school. Turkish educational system is characterized by competitive exams, which might cause distress in adolescents. Perceived failing academic performance has been identified as an indicator of suicide attempts and depressive symptoms (Richardson et al., 2005). Therefore, adolescents with lower academic achievement may need special care for mental health evaluations.

Comparing behavioral correlates of depressive symptoms, higher behavioral difficulties and lower prosocial behavior were identified, indicating poor psychosocial functioning. Behavioral problems were closely related to the development of depressive symptoms (Brière et al., 2015). Our results contribute to the previous literature showing that adolescents with depression have an increased risk of poor psychosocial functioning (Thapar et al., 2012).

Our findings highlight the importance of universal interventions targeting middle school students (Gillham et al., 2008). Preventive strategies targeting early adolescence may halt the progression of depressive symptoms through adolescence into adulthood. Identifying specific risk factors might be required in developing culturally acceptable intervention programs. One of the preventive strategies for the adolescents in this study could be resilience enhancement since decreased resilience was noted as a potentially modifiable risk factor. Many children at high risk do not develop clinical depression due to protective factors, such as emotion-regulation capacities, coping mechanisms, and strong interpersonal relationships, all target areas to support resilience (Thapar et al., 2012). Adolescence is an opportunistic period to promote resilience due to the ability to gain cognitive and

problem-solving skills (Masten and Barnes, 2018; Pinto et al., 2021). Universal resilience-promoting programs delivered by school systems in early adolescence demonstrated efficacy in preventing depressive symptoms (Brunwasser et al., 2009; Gillham et al., 2008). The feasibility of similar interventions at schools for Turkish adolescents to prevent depression has to be studied.

This study has several strengths and limitations. Our study is among the few studies investigating the rates of elevated depressive symptoms among Turkish adolescents in early adolescence. Besides, it is performed post-pandemic, providing insights about the early psychological situation, though the generalizability of our findings is limited since the study population includes only adolescents in Istanbul. In addition, we report a high prevalence of elevated depressive symptoms but do not know the exact prevalence of clinical depression, which was beyond the scope of this study. However, subclinical depressive symptoms and minor depression are still important due to significant impairment, later depressive disorder development, or suicide risk (Carrellas et al., 2017). The CES-DC lacks a cut-off specific for adolescents in the Turkish population, which might have caused the increased rates of elevated depressive symptoms (71.2 % and 31.2 %) compared to similar studies in the literature. Nevertheless, the CES-DC scores were strongly associated with behavioral problems measured by SDQ, confirming the compromised mental well-being. However, causality cannot be established due to the cross-sectional nature of the study. Finally, the response rate was 47.7 %, which might create a potential bias in the results. Notably, similar studies assessing mental health performed at schools reported an almost 30 % response rate (Galanti et al., 2016). Nonetheless, the potential for non-response bias must be carefully considered when interpreting the findings.

In conclusion, our findings indicate the substantial presence of elevated self-reported depressive symptoms in a city sample among Turkish adolescents at middle schools, in addition to coexisting behavioral difficulties and decreased resilience. Given the prevalent depressive symptoms, screening and intervention programs involving resilience promotion may involve school systems to prevent adolescent depression.

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Ethical approval

Each stage of the study was conducted with ethical principles. Before the application, approval from the ethics committee (Permission for the study was obtained from the research committee of the Ministry of National Education on 14.10.2021 with registration number E-59090411-44-34712301. The Marmara University Ethics Committee approved the study (05.04.2019/09.2019.428))

Consent to participate

The participant has consented to the submission to this journal.

Consent for publication

The participant has consented to the submission to this journal.

CRedit authorship contribution statement

Nicel Yildiz Silahli: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Hatice Ezgi Baris:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Lubna**

Qutranji: Writing – original draft, Investigation, Data curation. **Burçin Yorgancı Kale:** Data curation. **Özge Günal:** Data curation. **Burak Ütük:** Data curation. **Melda Karavuş:** Supervision, Methodology, Formal analysis, Conceptualization. **Ayşe Rodopman Arman:** Supervision. **Perran Boran:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare no competing interests.

Data availability

Raw data is available upon reasonable request (correspondence author).

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