



## Research paper

# Gender inequalities in the prevalence of low mood and related factors in schooled adolescents during the 2019–2020 school year: DESKcohort project

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## ABSTRACT

**Background:** Mood disorders are the second most prevalent mental disorders in childhood and adolescence. Many undiagnosed people manifest subthreshold symptoms, like low mood, and present worse prognoses than asymptomatic healthy subjects. The aim of this study was to estimate the prevalence of low mood, gender inequalities, and associated factors, in 12- to 18-year-old adolescents in the rural and medium-sized urban areas of Central Catalonia during the 2019–2020 academic year.

**Methods:** Cross-sectional study with data from a cohort of high-schooled students (2019–2020), with a convenience sample of 6428 adolescents from the Central region of Catalonia (48.3 % boys and 51.7 % girls). Prevalence of low mood was estimated by gender and exposure variables, and ratios were obtained using Poisson regression models, adjusting for several exposure variables one by one, and for all of them jointly.

**Results:** The prevalence of low mood was 18.6 %, with statistically significant differences between genders (11.6 %, 95 % CI: 10.5–12.8 in boys and 25.1 %, 95 % CI: 23.7–26.6 in girls). Being an immigrant, dieting, and daily tobacco smoking were only associated with low mood in girls, whereas risky alcohol consumption was only associated in boys. Sexual violence was found to account for 36.2 % of low mood problems in girls.

**Limitations:** The main limitation of the study is its cross-sectional design, which means that no casual relationships can be extracted of this study.

**Conclusions:** The prevalence of low mood varies between the sexes, highlighting the importance of developing gender-specific interventions to reduce its incidence in young people, considering the factors associated with this condition.

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## 1. Introduction

Most mental health problems in adulthood have their origin earlier in life (Herzog and Schmahl, 2018; McKay et al., 2021), and 20 % of children and adolescents worldwide experience them (World Health Organization, 2001). At this age, the most common ones are learning disorders (5–15 %), and affective or mood disorders (5–10 %) (American Psychiatric Association, 2013). As for the latter, subjects with sub-threshold symptoms are considered healthy; therefore, they do not receive the necessary social, preventive, or medical attention, and thus their symptomatology can worsen and become chronic (Carrellas et al., 2017). This can ultimately lead to the medicalization of non-pathological moods and behaviours and worsen mental health prognosis (Carrellas et al., 2017; Fergusson et al., 2005; Wesselhoeft et al., 2013), especially in people belonging to a low social class (Muntaner et al., 1998). Finally, undiagnosed people with subthreshold symptoms have a worse prognosis than asymptomatic healthy people (Arslan et al., 2021): they are respectively four times and twice more likely to present a major depressive condition and a mood disorder in adulthood; they are more at risk of suicide; and might present impairments in academic, relational, and personal areas (Carrellas et al., 2017; Fergusson et al., 2005; Johnson et al., 2009; Masten et al., 2005; Wesselhoeft et al., 2013).

In Europe, the prevalence of subthreshold depression in 14- to 16-year-old adolescents is around 29 %, and higher among girls (Balázs et al., 2013). Low mood is one of the subthreshold symptoms of mood disorders (i.e., major depression) and a common condition during adolescence. In Spain, the prevalence of low mood stands at 15 %, with statistically significant differences between genders (13 % in boys and 17 % in girls); moreover, it increases with age (from 12.8 % in the 2nd course of compulsory secondary education to 20.7 % in the 2nd course of post-compulsory secondary education) (Vázquez Fernández et al., 2013). In Catalonia, the values are similar (13 %–19 % in boys and 21 %–24 % in girls) (Ahonen et al., 2007; Monteagudo et al., 2013).

Gender inequalities exist in physical and mental health, mainly in mood disorders (Van Voorhees et al., 2008). In particular, women are more at risk of developing depressive and anxiety disorders, and in Spain, they consume antidepressant and anxiolytic drugs three times more than men (Subdirección General de Información Sanitaria, 2021). Such gender inequalities are observed from adolescence (Faravelli et al., 2013), coinciding with a stage of change and search for identity. Some authors attribute them to the hormonal changes typical of adolescence, whereas more contextual and sociological theories mainly attribute them to the process of socialization (how adolescents establish relationships with others) and the structure of today's patriarchal society (Eagly and Wood, 1999). To study gender inequalities in low mood among adolescents, we must also consider factors related to their social context and lifestyle (Ahonen et al., 2007). The main social factors associated with low mood are the following: socioeconomic position (SEP), belonging to an ethnic minority, parental experiences of racism, parental education level, academic performance, and bullying (either as a victim or perpetrator) (Ahonen et al., 2007; Allen et al., 2014; Bahk et al., 2017; Caughy et al., 2004; Garcia Contiente et al., 2010; Livingston et al., 2018; McMahon et al., 2012; Muntaner et al., 1998; Reiss, 2013; Saluja et al., 2004; Van Voorhees et al., 2008; Vukojević et al., 2017; Weinberg et al., 2019). Moreover, in neighbourhoods with lower SEP, community relationships are negatively associated with mental health problems (Caughy et al., 2003). Finally, experiencing bullying or sexual violence has a particularly severe impact on the mental health of adolescents, being a risk factor for suicidal ideation, anxiety and depression, low self-esteem, sleep disturbances, and overweight (Garcia Contiente et al., 2010; McMahon et al., 2012). The main lifestyle factors associated with low mood consist in insufficient physical activity, dieting, out-of-normal BMI, risky alcohol consumption, abuse of other addictive substances (Gaete et al., 2017; Gutierrez and Sher, 2015; Hall and Degenhardt, 2014; Hanna et al., 2017; Johannessen et al., 2017;

Moreno-Mansilla et al., 2021; Peltzer and Pengpid, 2021; Zander Neves et al., 2018), and problematic use of mobile phone (Ahonen et al., 2007; Cao et al., 2011; Herman et al., 2015; Hoare et al., 2016; Koch et al., 2020; Monteagudo et al., 2013; O'Neil et al., 2014; O'Reilly et al., 2018; Thelwell et al., 2007; Van Voorhees et al., 2008).

Finally, it is necessary to detect mood disorders in pre-diagnostic stages and their related factors in adolescents to facilitate specific interventions to avoid the development of future worse disorders and limitations in daily life (Ahonen et al., 2007; Fergusson et al., 2005; Williams et al., 2017). To date, most studies on low mood in adolescents were performed in large cities, and few in rural or medium-sized urban areas (Dursun et al., 2020). In this context, the aim of our study was to estimate the prevalence of low mood, gender inequalities, and associated factors, in 12- to 18-year-old adolescents in the rural and medium-sized urban areas of Central Catalonia during the 2019–2020 academic year.

## 2. Methods

We performed a cross-sectional study using data from the first wave of the DESKcohort project ([www.deskcohort.cat](http://www.deskcohort.cat)), a cohort study consisting in a biannual panel survey administered to 12- to 18-year-old adolescents schooled in Central Catalonia on health, health behaviours, and associated determinants.

### 2.1. Sampling method

The study consisted of a convenience sample of 12- to 18-year-old students attending the following courses during the academic year 2019–2020 in Central Catalonia: 2nd and 4th of compulsory secondary education (CSE); 2nd of post-compulsory secondary education (PCSE); and 2nd of Intermediate Level Training Cycles (ILTC). A letter was sent to all secondary schools of the region ( $n = 91$ ) inviting them to participate in the project, and a total of 65 (71.4 % of the total) accepted. Of these 65 secondary schools 31.0 % were private and 69.0 % were public. The Central Catalonia is a region made up of 6 counties which had the following participation of educational centres: Anoia (55.0 %), Bages (76.7 %), Berguedà (85.7 %), Moianès (50.0 %), Osona (75.9 %) and Solsonès (66.7 %). A total of 7319 students participated in the study (61.3 %), from the total population of 2nd and 4th courses of CSE, 2nd of PCSE and 2nd of ILTC ( $n = 11,943$ ). We excluded the subjects who did not answer questions with <10 % of missing values (which was a total of 891 subjects, or 12.2 % of the total sample). Those subjects who did not answer to questions with >10 % of missing values were included in the analysis as non-respondents. After missing depuration, the final sample consisted in 6428 adolescents (87.8 % of the total in the project), of whom 3105 (48.3 %) were boys and 3323 (51.7 %) were girls.

### 2.2. Survey interview and questionnaire

We designed a questionnaire based on others in the same field (available on the project website). It was confidential and self-administered in classrooms using touch-screen tablets with internet connection. Parents and adolescents signed an informed consent form. The project was approved by the Research Ethics Committee of the Universitat de Vic-Universitat Central de Catalunya (96/2919). Data were collected using the REDCap software (Harris et al., 2019).

### 2.3. Variables

The outcome variable was mood and was generated from responses to the questions “How often have you felt: 1) too tired to do things; 2) having trouble sleeping; 3) displaced, sad, or depressed; 4) hopeless about the future; 5) nervous or tense; 6) bored with things?”. For each item, there were five possible responses: from 1 (Never) to 5 (Always). Then, the results were grouped in two categories: “Never”, “Almost

never”, and “Sometimes” (value 0); and “Often” and “Always” (value 1). Finally, the scores of each item were summed up: a final score of 3 or higher was identified as low mood, as in other studies (Ahonen et al., 2007; Monteagudo et al., 2013; Nebot et al., 2010; Vázquez Fernández et al., 2013).

The main exposure variable was gender. Exposure social variables were the following: subjective SEP (Adler et al., 2000); being part of an ethnic minority (1st or 2nd generation immigrants); course; self-reported academic performance (good, average, or poor grades); and having experienced bullying (yes/no) or sexual violence (yes/no/no answer). We considered that the person had experienced sexual violence if he/she reported any of the following situations: uncomfortable sexual remarks, insistence upon refusal, forced sexual intercourse between several people, non-consensual touching, continuous non-consensual touching and forcing, and non-consensual penetrative sexual acts (rape) with and/or without physical force (Burgos et al., 2018). Other exposure variables were referred to lifestyle: physical activity (it should consist at least in 1 h a day of vigorous or moderate exercise, in compliance with the WHO recommendations); dieting (yes, no); daily tobacco smoking; risky alcohol consumption (scores above 3 on the AUDIT-C test) (Liskola et al., 2018) and cannabis (scores above 7 on the CAST test) (Cuenca-Royo et al., 2012); and problematic use of mobile phone (scores above 15 on the CERM test) (Carbonell et al., 2018).

### 2.4. Data analysis

We calculated the prevalence of low mood and its 95 % confidence intervals (CI) by gender and each exposure variable. Then, to determine which exposure variables were associated with low mood according to gender, we estimated Poisson regression (PR) models with robust variance. Specifically, we first estimated the crude models, then adjusted them for the exposure variables that showed significance and obtained adjusted PR (aPR) with 95 % CI. Finally, we modulated the aPR for each of the exposure variables separately and jointly adding the percentage change in the magnitude of association. Analyses were performed using STATA17 software.

### 3. Results

Table 1 shows the characteristics of the sample according to gender. Low mood was reported by 18.6 % (95 % CI 17.7–19.6) of the adolescents; in particular, by 11.6 % (95 % CI 10.5–12.8) of the boys and 25.1 % (95 % CI 23.7–26.6) of the girls ( $p < 0.001$ ). Girls reported a lower percentage of poor academic performance than boys (8.4 % and 12.4 %, respectively,  $p < 0.05$ ). As for the exposure social variables, a higher percentage of boys reported episodes of bullying in comparison to girls (8.4 % and 7.0 %, respectively,  $p < 0.05$ ), whereas more girls than boys experienced sexual violence (41.3 % and 13.6 %, respectively,  $p < 0.001$ ). As for exposure lifestyle variables, 47.4 % did not meet WHO criteria for physical activity (37.0 % of boys and 57.1 % of girls,  $p < 0.001$ ); 12.6 % of girls reported to diet compared to 10.9 % of the boys ( $p < 0.05$ ); 25.0 % reported a risky alcohol consumption; and 24.2 % had problems with occasional and frequent use of mobile phones.

Tables 2 and 3 show the prevalence of low mood for each exposure variable, respectively for boys and girls. As for the exposure social variables, higher prevalence of low mood was observed in both boys and girls with a disadvantaged SEP (15.2 %, 95 % CI 13.2–17.5 and 32.8 %, 95 % CI 30.1–35.6, respectively), in comparison to the rest (11.0 %, 95 % CI 9.2–13.0 and 22.5 %, 95 % CI 20.2–25.1 for medium SEP and 8.6 %, 95 % CI 7.0–10.5 and 19.6 %, 95 % CI 17.4–22.1 for advantaged SEP). Also, boys in the 2nd course of PCSE and ILTC showed a significantly higher prevalence of low mood (16.9 %, 95 % CI 14.1–20.1 and 17.6 %, 95 % CI 13.1–23.1) than those in the 2nd and 4th course of CSE (8.2 %, 95 % CI 6.7–10.0 and 11.1 %, 95 % CI 9.4–13.0, respectively). Similar statistically significant differences were observed between girls in 2nd course of PCSE and ILTC (38.3 %, 95 % CI 35.0–41.8 and 30.3 %,

**Table 1**

Distribution of participants according to gender. First wave of the DESKcohort project, 2019–2020.

	Gender				p value
	Boys		Girls		
	N	%	N	%	
Mood state					
High mood	2744	88.4	2488	74.9	<b><math>p &lt; 0.001</math></b>
Low mood	361	11.6	835	25.1	
Course					
2nd course of CSE <sup>a</sup>	1122	36.1	1171	35.2	<b><math>p &lt; 0.001</math></b>
4th course of CSE <sup>a</sup>	1162	37.4	1189	35.8	
2nd course of PCSE <sup>b</sup>	599	19.3	788	23.7	
ILTC <sup>c</sup>	222	7.2	175	5.3	
Socioeconomic position					
Advantaged	994	32.0	1075	32.4	$p > 0.05$
Medium	1067	34.4	1101	33.1	
Disadvantaged	1044	33.6	1147	34.5	
Immigration status					
Native	2518	81.1	2634	79.3	$p > 0.05$
Immigrant	587	18.9	689	20.7	
Academic performance					
Good	841	27.1	1056	31.8	<b><math>p &lt; 0.001</math></b>
Average	1882	60.6	1995	60.0	
Poor	382	12.3	272	8.2	
Bullying					
No	2844	91.6	3090	93.0	<b><math>p &lt; 0.05</math></b>
Yes	261	8.4	233	7.0	
Sexual violence					
No	2468	79.5	1741	52.4	<b><math>p &lt; 0.001</math></b>
Yes	421	13.6	1371	41.3	
Non-respondents	216	6.9	211	6.3	
Physical activity					
Meets criteria	1773	57.1	1172	35.3	<b><math>p &lt; 0.001</math></b>
Does not meet criteria	1149	37.0	1897	57.1	
Non-respondents	183	5.9	254	7.6	
Dieting					
No	2766	89.1	2905	87.4	<b><math>p &lt; 0.05</math></b>
Yes	339	10.9	418	12.6	
Daily tobacco smoking					
No	2898	93.3	3050	91.8	<b><math>p &lt; 0.05</math></b>
Yes	207	6.7	273	8.2	
Risky alcohol consumption					
No	2356	75.9	2468	74.3	$p > 0.05$
Yes	749	24.1	855	25.7	
Risky cannabis use					
No	2978	95.9	3206	96.5	$p > 0.05$
Yes	127	4.1	117	3.5	
Problematic use of mobile phone					
Non-problematic use	647	20.8	585	17.6	<b><math>p &lt; 0.001</math></b>
Problematic use	666	21.5	891	26.8	
Non-respondents	1792	57.7	1847	55.6	

Bold values show the statistical significant differences in the sample characteristics between men and women.

<sup>a</sup> CSE = compulsory secondary education.

<sup>b</sup> PCSE = post-compulsory secondary education.

<sup>c</sup> ILTC = Intermediate Level Training Cycles.

95 % CI 23.9–37.5), and girls in the 2nd and 4th course of CSE (15.6 %, 95 % CI 13.7–17.8 and 25.0 %, 95 % CI 22.6–27.5). Finally, both boys and girls that had lower grades (20.7 %, 95 % CI 16.9–25.0 and 46.0 %, 95 % CI 40.1–51.9), or experienced bullying (27.2 %, 95 % CI 22.2–32.9 and 41.2 %, 95 % CI 35.1–47.6) or sexual violence (22.8 %, 95 % CI 19.0–27.1 and 35.4 %, 95 % CI 32.9–38.0), showed a significantly higher prevalence of low mood in comparison to their counterparts. We also observed gender inequalities, with a higher prevalence of low mood specifically in immigrant girls, in comparison to natives (29.6, 95 % CI 26.3–33.1 and 24.0, 95 % CI 22.4–25.6).

Tables 2 and 3 also show exposure lifestyle variables, with higher prevalence of low mood in both boys and girls that did not comply with WHO recommendations for physical activity (15.1 %, 95 % CI 13.2–17.3 and 28.2 %, 95 % CI 26.2–30.2), in comparison to the ones who comply (9.0 %, 95 % CI 7.8–10.9 and 19.5 %, 95 % CI 17.4–21.9). Moreover,

**Table 2**

Prevalence of low mood in boys and crude and adjusted Prevalence Ratios (PR and aPR) according to factors associated with low mood.

	N	%	95 % CI	PR	95 % CI	aPR	95 % CI
Course							
2nd course of CSE <sup>a</sup>	1122	8.2	[6.7–10.0]	1		1	
4th course of CSE <sup>a</sup>	1162	11.1	[9.4–13.0]	<b>1.35</b>	<b>[1.05–1.75]</b>	1.16	[0.90–1.50]
2nd course of PCSE <sup>b</sup>	599	16.9	[14.1–20.1]	<b>2.06</b>	<b>[1.58–2.68]</b>	<b>1.65</b>	<b>[1.24–2.19]</b>
ILTC <sup>c</sup>	222	17.6	[13.1–23.1]	<b>2.14</b>	<b>[1.52–3.03]</b>	<b>1.61</b>	<b>[1.11–2.35]</b>
Socioeconomic position							
Advantaged	994	8.6	[7.0–10.5]	1		1	
Medium	1067	11.0	[9.2–13.0]	1.26	[0.99–1.61]	1.21	[0.94–1.57]
Disadvantaged	1044	15.2	[13.2–17.5]	<b>1.76</b>	<b>[1.41–2.21]</b>	<b>1.44</b>	<b>[1.13–1.85]</b>
Immigration status							
Native	2518	11.3	[10.1–12.6]	1		1	
Immigrant	587	13.0	[10.5–15.9]	1.14	[0.90–1.45]		
Academic performance							
High	841	9.9	[8.0–12.1]	1		1	
Medium	1882	10.6	[9.3–12.0]	1.07	[0.84–1.37]	0.97	[0.77–1.23]
Low	382	20.7	[16.9–25.0]	<b>2.10</b>	<b>[1.58–2.78]</b>	<b>1.53</b>	<b>[1.14–2.05]</b>
Bullying							
No	2844	10.2	[9.1–11.4]	1		1	
Yes	261	27.2	[22.1–32.9]	<b>2.67</b>	<b>[2.13–3.35]</b>	<b>2.39</b>	<b>[1.87–3.06]</b>
Sexual violence							
No	2468	9.8	[8.6–11.0]	1		1	
Yes	421	22.8	[19.0–27.1]	<b>2.34</b>	<b>[1.89–2.89]</b>	<b>1.76</b>	<b>[1.41–2.20]</b>
Non-respondents	216	11.1	[7.6–16.0]	1.14	[0.77–1.69]	1.00	[0.67–1.50]
Physical activity							
Meets criteria	1773	9.0	[7.8–10.4]	1		1	
Does not meet criteria	1149	15.1	[13.2–17.3]	<b>1.68</b>	<b>[1.37–2.05]</b>	<b>1.47</b>	<b>[1.20–1.79]</b>
Non-respondents	183	14.8	[10.3–20.7]	<b>1.63</b>	<b>[1.12–2.39]</b>	<b>1.49</b>	<b>[1.03–2.14]</b>
Dieting							
No	2766	11.2	[10.1–12.4]	1		1	
Yes	339	15.1	[11.6–19.3]	<b>1.31</b>	<b>[1.01–1.69]</b>		
Daily tobacco smoking							
No	2898	10.9	[9.8–12.1]	1		1	
Yes	207	21.3	[16.2–27.4]	<b>1.94</b>	<b>[1.47–2.58]</b>		
Risky alcohol consumption							
No	2356	9.6	[8.5–10.8]	1		1	
Yes	749	18.0	[15.4–20.9]	<b>1.88</b>	<b>[1.54–2.29]</b>	<b>1.37</b>	<b>[1.09–1.73]</b>
Risky cannabis use							
No	2978	10.9	[9.8–12.0]	1		1	
Yes	127	29.1	[21.9–37.6]	<b>2.68</b>	<b>[2.00–3.58]</b>	<b>1.64</b>	<b>[1.16–2.33]</b>
Problematic use of mobile phone							
No-problem use	647	8.5	[6.6–10.9]	1		1	
Problematic use	666	16.7	[14.0–19.7]	<b>1.96</b>	<b>[1.45–2.66]</b>	<b>1.53</b>	<b>[1.14–2.06]</b>
Non-respondents	1792	10.9	[9.5–12.4]	1.28	[0.96–1.70]	1.19	[0.90–1.57]

Note: The percentages presented in this table refer to people inside the categories with low mood.

Bold values show the Prevalence Ratio that are statistically significant in the crude or in the adjusted regression models.

<sup>a</sup> CSE = compulsory secondary education.<sup>b</sup> PCSE = post-compulsory secondary education.<sup>c</sup> ILTC = Intermediate Level Training Cycles.

both boys and girls that smoked tobacco daily, made risky alcohol and cannabis consumption, and reported problematic use of mobile phones, showed a significantly higher prevalence of low mood in comparison to their counterparts. Finally, there was a higher prevalence of low mood specifically in girls dieting, in comparison to the rest (31.3, 95 % CI 27.1–35.9 and 24.2, 95 % CI 22.7–25.8, respectively).

Tables 2 and 3 also show the results of the crude and adjusted regression models for the association of the exposure variables with low mood. Different social and lifestyle exposure variables were positively associated with low mood for both genders: SEP, school grade, academic performance, bullying, sexual violence, not meeting WHO physical activity recommendations, risky cannabis use, and problematic use of mobile phone. We also observed gender inequalities. In the adjusted models, low mood was also associated with being an immigrant (aPR = 1.2, 95 % CI 1.0–1.3), dieting (aPR = 1.3, 95 % CI 1.1–1.5), and daily tobacco smoking (aPR = 1.2, 95 % CI 1.0–1.4), exclusively for girls. In contrast, we found an association of low mood with risky alcohol consumption (aPR = 1.4, 95 % CI 1.1–1.7) only for boys.

Finally, Table 4 shows the results of the regression models indicating the association between gender and low mood controlled for each exposure variable, and for all except daily tobacco smoking, which did

not show significance. When incorporating sexual violence as a mediator, the difference in the prevalence of low mood between boys and girls is reduced by 37.9 %. Similarly, we observed a reduction in the association between gender and risk of low mood of 15.5 % when using as mediator not complying with physical activity recommendations. Finally, by considering all the exposure variables, we observe a reduction of 36.2 %.

#### 4. Discussion

The main finding of the study is the existence of gender inequalities in mental health among adolescents aged 12- to 18 years, with low mood being 2.2 times more prevalent in girls than in boys. Thirty six percent of this difference is explained by social determinants of health and health behaviours.

A prevalence similar to ours (18.6 %) was also found in other studies in the Catalan adolescent population (17.4 %) (Ahonen et al., 2007; Montegudo et al., 2013), and ours is slightly higher than in the Spanish population (15.0 %) (Vázquez Fernández et al., 2013). In addition to our study, many others showed that girls have a higher prevalence of low mood than boys (Ahonen et al., 2007; Balázs et al., 2013; Montegudo



**Table 3**

Prevalence of low mood in girls and crude and adjusted Prevalence Ratios (PR and aPR) according to factors associated with low mood.

	N	%	95 % CI	PR	95 % CI	aPR	95 % CI
<b>Course</b>							
2nd course of CSE <sup>a</sup>	1171	15.6	[13.7–17.8]	1		1	
4th course of CSE <sup>a</sup>	1189	25.0	[22.6–27.5]	<b>1.60</b>	<b>[1.35–1.89]</b>	<b>1.38</b>	<b>[1.17–1.62]</b>
2nd course of PCSE <sup>b</sup>	788	38.3	[35.0–41.8]	<b>2.45</b>	<b>[2.09–2.88]</b>	<b>2.06</b>	<b>[1.75–2.43]</b>
ILTC <sup>c</sup>	175	30.3	[23.9–37.5]	<b>1.94</b>	<b>[1.49–2.52]</b>	<b>1.32</b>	<b>[1.01–1.72]</b>
<b>Socioeconomic position</b>							
Advantaged	1075	19.6	[17.4–22.1]	1		1	
Medium	1101	22.5	[20.1–25.1]	<b>1.16</b>	<b>[1.00–1.35]</b>	1.07	[0.92–1.26]
Disadvantaged	1147	32.8	[30.1–35.5]	<b>1.58</b>	<b>[1.38–1.80]</b>	<b>1.44</b>	<b>[1.24–1.66]</b>
<b>Immigration status</b>							
Native	2634	24.0	[22.4–25.6]	1		1	
Immigrant	689	29.6	[26.3–33.1]	<b>1.24</b>	<b>[1.08–1.41]</b>	<b>1.17</b>	<b>[1.02–1.33]</b>
<b>Academic performance</b>							
High	1056	21.0	[18.7–23.6]	1		1	
Medium	1995	24.5	[22.6–26.4]	<b>1.16</b>	<b>[1.01–1.34]</b>	1.09	[0.96–1.25]
Low	272	46.0	[40.1–51.9]	<b>2.19</b>	<b>[1.84–2.60]</b>	<b>1.60</b>	<b>[1.34–1.91]</b>
<b>Bullying</b>							
No	3090	23.9	[22.4–25.4]	1		1	
Yes	233	41.2	[35.1–47.6]	<b>1.72</b>	<b>[1.46–2.03]</b>	<b>1.70</b>	<b>[1.45–2.00]</b>
<b>Sexual violence</b>							
No	1741	17.6	[15.9–19.5]	1		1	
Yes	1371	35.4	[32.9–37.9]	<b>2.01</b>	<b>[1.77–2.27]</b>	<b>1.54</b>	<b>[1.35–1.75]</b>
Non-respondents	211	20.4	[15.5–26.3]	1.16	[0.87–1.54]	1.10	[0.83–1.45]
<b>Physical activity</b>							
Meets criteria	1172	19.5	[17.4–21.9]	1		1	
Does not meet criteria	1897	28.2	[26.2–30.2]	<b>1.44</b>	<b>[1.26–1.65]</b>	<b>1.21</b>	<b>[1.06–1.38]</b>
Non-respondents	254	28.4	[23.1–34.2]	<b>1.45</b>	<b>[1.16–1.82]</b>	<b>1.26</b>	<b>[1.02–1.57]</b>
<b>Dieting</b>							
No	2905	24.2	[22.7–25.8]	1		1	
Yes	418	31.3	[27.1–35.9]	<b>1.28</b>	<b>[1.11–1.47]</b>	<b>1.29</b>	<b>[1.10–1.50]</b>
<b>Daily tobacco smoking</b>							
No	3050	23.5	[22.0–25.0]	1		1	
Yes	273	43.6	[37.8–49.5]	<b>1.86</b>	<b>[1.60–2.16]</b>	<b>1.21</b>	<b>[1.02–1.43]</b>
<b>Risky alcohol consumption</b>							
No	2468	21.6	[20.0–23.2]	1		1	
Yes	855	35.4	[32.3–38.7]	<b>1.64</b>	<b>[1.46–1.85]</b>		
<b>Risky cannabis use</b>							
No	3206	24.1	[22.6–25.6]	1		1	
Yes	117	54.7	[45.6–63.5]	<b>2.27</b>	<b>[1.91–2.71]</b>	<b>1.45</b>	<b>[1.18–1.79]</b>
<b>Problematic use of mobile phone</b>							
No-problem use	585	16.6	[13.8–19.8]	1		1	
Problematic use	891	32.2	[29.2–35.3]	<b>1.94</b>	<b>[1.58–2.39]</b>	<b>1.65</b>	<b>[1.35–2.01]</b>
Non-respondents	1847	24.4	[22.5–26.4]	<b>1.47</b>	<b>[1.21–1.80]</b>	<b>1.34</b>	<b>[1.11–1.62]</b>

Note: The percentages presented in this table refer to people inside the categories with low mood.

Bold values show the Prevalence Ratio that are statistically significant in the crude or in the adjusted regression models.

<sup>a</sup> CSE = compulsory secondary education.

<sup>b</sup> PCSE = post-compulsory secondary education.

<sup>c</sup> ILTC = Intermediate Level Training Cycles.

et al., 2013; Vázquez Fernández et al., 2013). As a possible explanation, this difference could be due to the structure of our patriarchal society and political economy, with women being at a disadvantage in multiple areas (e.g., work-related, domestic, and social) in comparison to men (Eagly and Wood, 1999). Finally, we also observed that gender inequalities increase with age, as shown also in another study (Oldehinkel et al., 1999). However, different researchers reported no statistically significant differences in the prevalence of subthreshold depression between sexes (Gonzalez-Tejera et al., 2005; Kessler and Walters, 1998, p.).

In agreement with previous research, we identified different social risk factors associated with low mood in both genders, among which: disadvantaged SEP (Adler et al., 2000; McLaughlin et al., 2012), high educational course (Ahonen et al., 2007; Vázquez Fernández et al., 2013), and poor academic performance (Van Voorhees et al., 2008; Weinberg et al., 2019). As for the differences in socioeconomic position, we must consider that Spain is one of the European countries with the highest inequality in income (International Child Development Centre, 2016). We also identified different health behaviours associated with low mood in both genders, such as: less than 1 h of moderate or intense physical activity per day, risky cannabis use, and problematic use of

mobile phone (Cao et al., 2011; Gobbi et al., 2019; Herman et al., 2015; Hoare et al., 2016).

Three risk factors were uniquely associated with low mood in girls: being an immigrant, dieting, and daily tobacco smoking. A higher prevalence of mood disorders in immigrant girls in comparison to immigrant and non-immigrant boys and girls was also observed in other studies (Hilario et al., 2014; Turjeman et al., 2008). Indeed, having multiple social disadvantages (e.g., being female, being an immigrant, and having a disadvantaged SEP) may increase the likelihood of experiencing oppressions. In turn, this may increase risky behaviours and associated health problems, such as low mood (Fagrell Trygg et al., 2021). Other authors specifically attribute these gender inequalities to different coping mechanisms: on the one hand, boys have a more active socialization, developing instrumental characteristics; on the other hand, girls have a more emotionally-expressive socialization, placing more importance on relationships and the social sphere (Turjeman et al., 2008). In this context, immigrant girls in a process of acculturation may encounter difficulties in establishing relationships and in the social sphere (cultural and language changes), with a greater impact on their mental health than on boys' (Turjeman et al., 2008).

Finally, as previously shown, we found associations of low mood

**Table 4**

Adjusted Prevalence Ratios (aPR) of low mood with gender as the main exposure variable, adjusting for each exposure variable, and finally for all of them.

	PR	95 % CI	
Gender			
Boys	1		
Girls	2.16	[1.93–2.42]	
<hr/>			
	aPR	95 % CI	Change in association
Gender adjusted for course			
Boys	1		
Girls	2.12	[1.89–2.37]	3.4 %
Socioeconomic position			
Boys	1		
Girls	2.15	[1.92–2.41]	0.9 %
Immigration status			
Boys	1		
Girls	2.15	[1.92–2.41]	0.9 %
Academic performance			
Boys	1		
Girls	2.25	[2.01–2.52]	7.8 %
Bullying			
Boys	1		
Girls	2.19	[1.96–2.45]	2.6 %
Sexual violence			
Boys	1		
Girls	1.72	[1.52–1.94]	37.9 %
Physical activity			
Boys	1		
Girls	1.98	[1.76–2.22]	15.5 %
Dieting			
Boys	1		
Girls	2.15	[1.92–2.41]	0.9 %
Daily tobacco smoking			
Boys	1		
Girls	2.13	[1.91–2.39]	2.6 %
Risky alcohol consumption			
Boys	1		
Girls	2.14	[1.91–2.40]	1.7 %
Risky cannabis use			
Boys	1		
Girls	2.18	[1.95–2.44]	1.7 %
Problematic use of mobile phone			
Boys	1		
Girls	2.10	[1.88–2.35]	5.2 %
All variables <sup>a</sup>			
Boys	1		
Girls	1.74	[1.54–1.96]	36.2 %

<sup>a</sup> Except for tobacco smoking, which did not have an association.

with bullying and sexual violence (Garcia-Continente et al., 2013; Vázquez Fernández et al., 2013). In other studies, such associations were only observed for girls (Monteagudo et al., 2013) or for boys (Ahonen et al., 2007). In general, girls report sexual violence more frequently than boys, and boys report bullying more frequently than girls (Smith et al., 2019; Walker et al., 2004). In our study, we found that most of the difference between genders in the prevalence of low mood is due to sexual violence. Similarly, another study found a prevalence of mood disorders (depressive episodes, depression, suicide attempts, etc.) of 20 %–40 % among victims of sexual violence, with a higher prevalence among women (Campos-Mondin et al., 2016). In another research, not only the authors reported a higher prevalence of sexual violence in women, but also a more severe impact on their mental health than in men's (Meade et al., 2009). Apart from being a woman, other social vulnerability-related factors have been identified for sexual violence: being young, belonging to a non-Caucasian race, having a history of victimization in childhood, and presenting risk behaviours like substance use and abuse (Basile and Smith, 2011). The second factor could further explain the association we found between low mood and being an immigrant specifically in girls. Finally, the relationship between sexual violence and low mood must be studied more in depth and with

longitudinal methodologies to discern causes and effects and design interventions considering key concomitant elements.

## 5. Limitations

The present study has several limitations. First, its design is cross-sectional, so no causal relationship can be established with the dependent variable, and we can simply establish associations between exposure variables and low mood. However, at the level of public health, our estimation of the prevalence of low mood in adolescents is relevant to plan proper interventions. Another limitation consists in the fact that we only used one source of data and assessed the outcome variable with a non-validated scale. However, there have been many studies published with Catalan and Spanish adolescents using the same variable, so our results are comparable. Finally, the questionnaire was self-reported, and some items refer to past behaviour, implying possible recall and social desirability biases. However, the latter can be minimized thanks to the confidentiality of the questionnaire and the data grouping (Teixidó-Compañó et al., 2019). The main strength of the study consists in the large population and territorial variability of central Catalonia, with rural and urban settings, and the high percentage of participation of the educational centres of the different counties of the region. This allows extrapolating the results of this study to the rest of the Catalan adolescent population.

## 6. Conclusions

In the future, it is important to perform longitudinal studies, establish causal relationships, and better identify predictors of low mood in adolescence. In conclusion, we must consider these predictors to develop specific and effective interventions, with a gender and inter-sectional perspective.

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## Conflict of interest

The authors declare that they have no conflict of interest.

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## References

- Adler, N.E., Epel, E.S., Castellazzo, G., Ickovics, J.R., 2000. Relationship of subjective and objective social status with psychological and physiological functioning: preliminary data in healthy white women. *Health Psychol.* 19, 586–592.
- Ahonen, E.Q., Nebot, M., Giménez, E., 2007. Negative mood states and related factors in a sample of adolescent secondary-school students in Barcelona (Spain). *Gac. Sanit.* 21, 43–52.
- Allen, J., Balfour, R., Bell, R., Marmot, M., 2014. Social determinants of mental health. *Int. Rev. Psychiatry* 26, 392–407.
- American Psychiatric Association, 2013. *Diagnostic And Statistical Manual of Mental Disorders: DSM-5*. American Psychiatric Publishing, Washington, D.C.
- Arslan, I.B., Lucassen, N., van Lier, P.A.C., de Haan, A.D., Prinzie, P., 2021. Early childhood internalizing problems, externalizing problems and their co-occurrence and (mal)adaptive functioning in emerging adulthood: a 16-year follow-up study. *Soc. Psychiatry Psychiatr. Epidemiol.* 56, 193–206.
- Bahk, J., Kim, A.M., Khang, Y.-H., 2017. Associations of multicultural status with depressive mood and suicidality among Korean adolescents: the roles of parental country of birth and socioeconomic position. *BMC Public Health* 17, 116.
- Balázs, J., Miklósi, M., Keresztény, A., Hoven, C.W., Carli, V., Wasserman, C., Apter, A., Bobes, J., Brunner, R., Cosman, D., Cotter, P., Haring, C., Iosue, M., Kaess, M., Kahn, J.-P., Keeley, H., Marusic, D., Postuvan, V., Resch, F., Saiz, P.A., Sisask, M., Snir, A., Tubiana, A., Varnik, A., Sarchiapone, M., Wasserman, D., 2013. Adolescent subthreshold-depression and anxiety: psychopathology, functional impairment and increased suicide risk. *J. Child Psychol. Psychiatry* 54, 670–677.
- Basile, K.C., Smith, S.G., 2011. Sexual violence victimization of women: prevalence, characteristics, and the role of public health and prevention. *Am. J. Lifestyle Med.* 5, 407–417.
- Burgos, A., Foradada, M., Oriols, I., Zabala, P., 2018. 5o Informe Anual 2017–2018. Observatorio Noctamul@s, Barcelona.
- Campos-Mondin, T., de Azevedo Cardoso, T., Jansen, K., Konradt, C.E., Ferrazza Zaltron, R., de Oliveira Behenck, M., Dias de Mattos, L., Azevedo da Silva, R.A. da, 2016. Sexual violence, mood disorders and suicide risk: a population-based study. *Ciênc. saúde coletiva* 21, 853–860.
- Cao, H., Qian, Q., Weng, T., Yuan, C., Sun, Y., Wang, H., Tao, F., 2011. Screen time, physical activity and mental health among urban adolescents in China. *Prev. Med.* 53, 316–320.
- Carbonell, X., Chamorro, A., Oberst, U., Rodrigo, B., Prades, M., 2018. Problematic use of the internet and smartphones in university students: 2006–2017. *Int. J. Environ. Res. Public Health* 15, 475.
- Carrellas, N.W., Biederman, J., Uchida, M., 2017. How prevalent and morbid are subthreshold manifestations of major depression in adolescents? A literature review. *J. Affect. Disord.* 210, 166–173.
- Caughy, M.O., O'Campo, P.J., Muntaner, C., 2004. Experiences of racism among African American parents and the mental health of their preschool-aged children. *Am. J. Public Health* 94, 2118–2124.
- Caughy, M.O., O'Campo, P.J., Muntaner, C., 2003. When being alone might be better: neighborhood poverty, social capital, and child mental health. *Soc. Sci. Med.* 57, 227–237.
- Cuenca-Royo, A.M., Sánchez-Niubó, A., Forero, C.G., Torrens, M., Suelves, J.M., Domingo-Salvany, A., 2012. Psychometric properties of the CAST and SDS scales in young adult cannabis users. *Addict. Behav.* 37, 709–715.
- Dursun, O.B., Esin, I.S., Akıncı, M.A., Karayağmurlu, A., Turan, B., Özhan Aşıkhasanoğlu, E., 2020. The prevalence of childhood mental disorders in different habitations: are we underestimating their prevalence in rural areas? *Nord. J. Psychiatry* 74, 201–207.
- Eagly, A.H., Wood, W., 1999. The origins of sex differences in human behavior. Evolved dispositions versus social roles. *Am. Psychol.* 54, 408–423.
- Fagrell Trygg, N., Månsdotter, A., Gustafsson, P.E., 2021. Intersectional inequalities in mental health across multiple dimensions of inequality in the Swedish adult population. *Soc. Sci. Med.* 283, 114184.
- Faravelli, C., Alessandra Scarpato, M., Castellini, G., Lo Sauro, C., 2013. Gender differences in depression and anxiety: the role of age. *Psychiatry Res.* 210, 1301–1303.
- Fergusson, D.M., Horwood, L.J., Ridder, E.M., Beautrais, A.L., 2005. Subthreshold depression in adolescence and mental health outcomes in adulthood. *Arch. Gen. Psychiatry* 62, 66–72.
- Gaete, J., Tornero, B., Valenzuela, D., Rojas-Barahona, C.A., Salmivalli, C., Valenzuela, E., Araya, R., 2017. Substance use among adolescents involved in bullying: a cross-sectional multilevel study. *Front. Psychol.* 8.
- García Continente, X., Pérez Giménez, A., Nebot Adell, M., 2010. Factores relacionados con el acceso escolar (bullying) en los adolescentes de Barcelona. *Gac. Sanit.* 24, 103–108.
- García-Contiente, X., Pérez-Giménez, A., Espelt, A., Nebot Adell, M., 2013. Bullying among schoolchildren: differences between victims and aggressors. *Gac. Sanit.* 27, 350–354.
- Gobbi, G., Atkin, T., Zytynski, T., Wang, S., Askari, S., Boruff, J., Ware, M., Marmorstein, N., Cipriani, A., Dendukuri, N., Mayo, N., 2019. Association of Cannabis use in adolescence and risk of depression, anxiety, and suicidality in young adulthood: a systematic review and meta-analysis. *JAMA Psychiatry* 76, 426–434.
- Gonzalez-Tejera, G., Canino, G., Ramirez, R., Chavez, L., Shrout, P., Bird, H., Bravo, M., Martínez-Taboas, A., Ribera, J., Bauermeister, J., 2005. Examining minor and major depression in adolescents. *J. Child Psychol. Psychiatry* 46, 888–899.
- Gutierrez, A., Sher, L., 2015. Alcohol and drug use among adolescents: an educational overview. *Int. J. Adolesc. Med. Health* 27, 207–212.
- Hall, W., Degenhardt, L., 2014. The adverse health effects of chronic cannabis use. *Drug Test. Anal.* 6, 39–45.
- Hanna, R.C., Perez, J.M., Ghose, S., 2017. Cannabis and development of dual diagnoses: a literature review. *Am. J. Drug Alcohol Abuse* 43, 442–455.
- Harris, P.A., Taylor, R., Minor, B.L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., Duda, S.N., 2019. The REDCap consortium: building an international community of software platform partners. *J. Biomed. Inform.* 95, 103208.
- Herman, K.M., Hopman, W.M., Sabiston, C.M., 2015. Physical activity, screen time and self-rated health and mental health in Canadian adolescents. *Prev. Med.* 73, 112–116.
- Herzog, J.I., Schmah, C., 2018. Adverse childhood experiences and the consequences on neurobiological, psychosocial, and somatic conditions across the lifespan. *Front. Psychiatry* 9.
- Hilario, C.T., Vo, D.X., Johnson, J.L., Saewyc, E.M., 2014. Acculturation, gender, and mental health of Southeast Asian immigrant youth in Canada. *J. Immigrant Minority Health* 16, 1121–1129.
- Hoare, E., Milton, K., Foster, C., Allender, S., 2016. The associations between sedentary behaviour and mental health among adolescents: a systematic review. *Int. J. Behav. Nutr. Phys. Act.* 13, 108.
- Fairness for Children: A League Table of Inequality in Child Well-being in Rich Countries, Innocenti Report Card, 2016. UNICEF Office of Research - Innocenti, Florence.
- Johannessen, E.L., Andersson, H.W., Bjørngaard, J.H., Pape, K., 2017. Anxiety and depression symptoms and alcohol use among adolescents - a cross sectional study of Norwegian secondary school students. *BMC Public Health* 17, 494.
- Johnson, J.G., Cohen, P., Kasen, S., 2009. Minor depression during adolescence and mental health outcomes during adulthood. *Br. J. Psychiatry* 195, 264–265.
- Kessler, R.C., Walters, E.E., 1998. Epidemiology of DSM-III-R major depression and minor depression among adolescents and young adults in the national comorbidity survey. *Depress. Anxiety* 7, 3–14.
- Koch, E., Tost, K., Braun, U., Gan, G., Giurgiu, M., Reinhard, I., Zipf, A., Meyer-Lindenberg, A., Ebner-Priemer, U.W., Reichert, M., 2020. Relationships between incidental physical activity, exercise, and sports with subsequent mood in adolescents. *Scand. J. Med. Sci. Sports* 30, 2234–2250.
- Liskola, J., Haravuori, H., Lindberg, N., Niemelä, S., Karlsson, L., Kiviruusu, O., Marttunen, M., 2018. AUDIT and AUDIT-C as screening instruments for alcohol problem use in adolescents. *Drug Alcohol Depend.* 188, 266–273.
- Livingston, J.A., Derrick, J.L., Wang, W., Testa, M., Nickerson, A.B., Espelage, D.L., Miller, K.E., 2018. Proximal associations among bullying, mood, and substance use: a daily report study. *J. Child Fam. Stud.* 28, 2558–2571.
- Masten, A.S., Roisman, G.I., Long, J.D., Burt, K.B., Obradović, J., Riley, J.R., Boelcke-Stennes, K., Tellegen, A., 2005. Developmental cascades: linking academic achievement and externalizing and internalizing symptoms over 20 years. *Dev. Psychol.* 41, 733–746.
- McKay, M.T., Cannon, M., Chambers, D., Conroy, R.M., Coughlan, H., Dodd, P., Healy, C., O'Donnell, L., Clarke, M.C., 2021. Childhood trauma and adult mental disorder: a systematic review and meta-analysis of longitudinal cohort studies. *Acta Psychiatr. Scand.* 143, 189–205.
- McLaughlin, K.A., Costello, E.J., Leblanc, W., Sampson, N.A., Kessler, R.C., 2012. Socioeconomic status and adolescent mental disorders. *Am. J. Public Health* 102, 1742–1750.
- McMahon, E.M., Reulbach, U., Keeley, H., Perry, I.J., Arensman, E., 2012. Reprint of: bullying victimisation, self harm and associated factors in Irish adolescent boys. *Soc. Sci. Med.* 74, 490–497.
- Meade, C.S., McDonald, L.J., Graff, F.S., Fitzmaurice, G.M., Griffin, M.L., Weiss, R.D., 2009. A prospective study examining the effects of gender and sexual/physical abuse on mood outcomes in patients with co-occurring bipolar I and substance use disorders. *Bipolar Disord.* 11, 425–433.
- Monteagudo, M., Rodriguez-Blanco, T., Pueyo, M.J., Zabaleta-del-Olmo, E., Mercader, M., García, J., Pujol, E., Bolibar, B., 2013. Gender differences in negative mood states in secondary school students: health survey in Catalonia (Spain). *Gac. Sanit.* 27, 32–39.
- Moreno-Mansilla, S., Ricarte, J.J., Hallford, D.J., 2021. Cannabis use among early adolescents and transdiagnostic mental health risk factors. *Clin. Child Psychol. Psychiatry* 26, 531–543.
- Muntaner, C., Eaton, W.W., Dials, C., Kessler, R.C., Sorlie, P.D., 1998. Social class, assets, organizational control and the prevalence of common groups of psychiatric disorders. *Soc. Sci. Med.* 47, 2043–2053.
- Nebot, M., Pérez, A., García-Contiente, X., Ariza, C., Espelt, A., Pasarín, M., Brugal, T., Díez, E., Egea, L., Guitart, A., 2010. Informe FRESC 2008. Resultats Principals. Agència de Salut Pública de Barcelona, Barcelona.
- Oldehinkel, A.J., Wittchen, H.-U., Schuster, P., 1999. Prevalence, 20-month incidence and outcome of unipolar depressive disorders in a community sample of adolescents. *Psychol. Med.* 29, 655–668.

- O'Neil, A., Quirk, S.E., Housden, S., Brennan, S.L., Williams, L.J., Pasco, J.A., Berk, M., Jacka, F.N., 2014. Relationship between diet and mental health in children and adolescents: a systematic review. *Am. J. Public Health* 104, e31–e42.
- O'Reilly, M., Dogra, N., Whiteman, N., Hughes, J., Eruyar, S., Reilly, P., 2018. Is social media bad for mental health and wellbeing? Exploring the perspectives of adolescents. *Clin. Child Psychol. Psychiatry* 23, 601–613.
- Peltzer, K., Pengpid, S., 2021. Tobacco use and its association with mental morbidity and health compromising behaviours in adolescents in Indonesia. *Asian Pac. J. Cancer Prev.* 22, 31–35.
- Reiss, F., 2013. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Soc. Sci. Med* 90, 24–31.
- Saluja, G., Iachan, R., Scheidt, P.C., Overpeck, M.D., Sun, W., Giedd, J.N., 2004. Prevalence of and risk factors for depressive symptoms among young adolescents. *Arch. Pediatr. Adolesc. Med.* 158, 760–765.
- Smith, P.K., López-Castro, L., Robinson, S., Görzig, A., 2019. Consistency of gender differences in bullying in cross-cultural surveys. *Aggress. Violent Behav.* 45, 33–40.
- Subdirección General de Información Sanitaria, 2021. Salud mental en datos: prevalencia de los problemas de salud y consumo de psicofármacos y fármacos relacionados a partir de los registros clínicos de atención primaria.
- Teixidó-Compañó, E., Sordo, L., Bosque-Prous, M., Puigcorbó, S., Barrio, G., Brugal, M.T., Belza, M.J.J., Espelt, A., 2019. Individual and contextual factors related to binge drinking among adolescents in Spain: a multilevel approach. *Adicciones* 31, 41–51.
- Thelwell, R.C., Lane, A.M., Weston, N.J.V., 2007. Mood states, self-set goals, self-efficacy and performance in academic examinations. *Pers. Individ. Differ.* 42, 573–583.
- Turjeman, H., Mesch, G., Fishman, G., 2008. The effect of acculturation on depressive moods: immigrant boys and girls during their transition from late adolescence to early adulthood. *Int. J. Psychol.* 43, 32–44.
- Van Voorhees, B.W., Paunesku, D., Kuwabara, S.A., Basu, A., Gollan, J., Hankin, B.L., Melkonian, S., Reinecke, M., 2008. Protective and vulnerability factors predicting new-onset depressive episode in a representative of U.S. adolescents. *J. Adolesc. Health* 42, 605–616.
- Vázquez Fernández, M.E., Muñoz Moreno, M.F., Fierro Urturi, A., Alfaro González, M., Rodríguez Molinero, L., Bustamante Marcos, P., 2013. Estado de ánimo de los adolescentes y su relación con conductas de riesgo y otras variables. *Rev. Pediatr. Aten. Primaria* 15, e75–e84.
- Vukojević, M., Zovko, A., Talić, I., Tanović, M., Rešić, B., Vrdoljak, I., Splavski, B., 2017. Parental socioeconomic status as a predictor of physical and mental health outcomes in children – literature review. *Acta Clin. Croat.* 56, 742–748.
- Walker, J.L., Carey, P.D., Mohr, N., Stein, D.J., Seedat, S., 2004. Gender differences in the prevalence of childhood sexual abuse and in the development of pediatric PTSD. *Arch. Womens Ment. Health* 7, 111–121.
- Weinberg, D., Stevens, G.W.J.M., Duinhof, E.L., Finkenauer, C., 2019. Adolescent socioeconomic status and mental health inequalities in the Netherlands, 2001–2017. *IJERPH* 16, 18.
- Wesselhoeft, R., Sørensen, M.J., Heiervang, E.R., Bilenberg, N., 2013. Subthreshold depression in children and adolescents – a systematic review. *J. Affect. Disord.* 151, 7–22.
- Williams, N.J., Scott, L., Aarons, G.A., 2017. Prevalence of serious emotional disturbance among U.S. children: a meta-analysis. *Psychiatr. Serv.* 69, 32–40.
- The World Health Report: 2001: Mental Health: New Understanding, New Hope, repr. ed. The World Health Report, 2001. World Health Organization, Geneva.
- Zander Neves, C., Devicari Bueno, C., Pires Felden, G., Costa Irigaray, M., Rivadeneira, M.F., Oenning, N.S.X., Goulart, B.N.G., 2018. Tabaco en adolescentes escolares brasileiros: associação com saúde mental y contexto familiar. *Gac. Sanit.* 32, 216–222. <https://doi.org/10.1016/j.gaceta.2017.07.003>.