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Research paper

# Subthreshold depression in adolescence: Gender differences in prevalence, clinical features, and associated factors



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# ABSTRACT

*Background:* Subthreshold depression (SD) is an important mental health problem in adolescence given its high prevalence, comorbidity, and functional impairment. However, currently little is known about gender differences of SD in adolescence. The aim of this study was to examine gender differences in prevalence, clinical features, and associated factors in adolescents with subthreshold depressive episode (SDE).

*Methods*: The participants were 2,022 adolescents between 9<sup>th</sup> and 11<sup>th</sup> grades (49.5% girls, 15.2 years average age) recruited from eight state-subsidized schools located in the northern part of Santiago, Chile. The Patient Health Questionnaire-9 (PHQ-9) was used to assess depressive symptoms. Descriptive statistics, bivariate and multinomial logistic regression analyses were used.

*Results*: The prevalence of SDE and major depressive episode were 16.5% (95% CI: 14.9-18.2) and 17.7% (95% CI: 16.1-19.4), respectively. Both mental health problems were more prevalent in females (p < 0.001). With regard to SDE, girls displayed a higher rate of depressive mood and sleep problems, while boys had greater anhedonia, problems related with concentration, and psychomotor retardation/agitation. High levels of dysfunctional thoughts and perceived social support were associated with SDE in females and males. Social problem solving and emotion regulation had a differentiated impact on SDE depending on gender.

*Conclusion:* Depressive symptoms and SDE were found to be common health problems among adolescents in Chile. SDE had major gender differences in terms of prevalence, clinical features, and associated factors. These differences should be considered in the development of preventive and early interventions.

## 1. Introduction

In recent decades, there has been considerable interest in subthreshold forms of psychopathology, especially subthreshold depression (SD) (Cuijpers and Smith, 2004). Different terms have been used to designate this condition (e.g. subsyndromal, subclinical, or minor depression) (Rodríguez et al., 2012). However, SD has been generally used to describe clinically relevant depressive symptoms not meeting diagnostic criteria for major depressive disorder (MDD) or dysthymic disorder (Cuijpers and Smith, 2004).

There has been little consensus in the literature regarding the definition of SD in terms of the number, quality, and duration of symptoms (Bertha and Balázs, 2013; Carrellas et al., 2017; Rodríguez et al., 2012). The heterogeneity in the definition and operationalization of SD has resulted in significant variations in prevalence estimates and has resulted in low comparability between studies (Rodríguez et al., 2012). For example, using community samples of adolescents, point prevalence has been estimated at 2.2% in the Netherlands (Cuijpers et al., 2008), 14.3% in the United States (Ybarra et al., 2005), and 29.2% in eleven European countries (Balázs et al., 2013). Some studies have shown that the prevalence rate of SD increases substantially after age 12 and reaches a higher prevalence in adolescence between the ages of 14 and 16 (Cuijpers et al., 2008; Rohde et al., 2009; Sihvola et al., 2007).

Despite being a less severe condition than MDD (Wesselhoeft et al., 2013), SD in adolescence has been characterized by high levels of comorbidity (Balázs et al, 2013; González-Tejeras et al., 2005; Sihvola et al., 2007), functional impairment (Balázs et al., 2013; González-Tejera et al., 2005), recurrence of symptoms (Sihvola et al., 2007), increased use of mental health services (González-Tejera et al, 2005), and suicidal thoughts and behaviors (Balázs et al., 2013; Sihvola et al., 2007). Likewise, several studies have shown that adolescents with SD are at elevated risk for developing MDD and progressing into a persistent depressive condition (Georgiades et al., 2006; Jonsson et al., 2011; Klein et al., 2009; Rohde et al., 2009; Shankman et al., 2009); in addition, they are more likely to develop

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other psychiatric disorders, such as disruptive, anxiety, and eating disorders (Johnson et al., 2009).

Some studies have shown that SD has risk factors similar to those of MDD in terms of the negative impact of victimization, parental psychopathology, negative parental practices, and attachment difficulties (González-Tejeras et al., 2005). Other studies have shown that belonging to an ethnic minority is a risk factor for SD, while less parental education has been associated with earlier onset of SD (Rohde et al., 2009). Likewise, SD in adolescence has been associated with socioemotional dysfunction and greater interpersonal stress compared with adolescents without depressive symptoms (Balázs et al., 2013; Krackow and Rudolph, 2008).

In other words, SD has been associated with a considerable impact on the quality of life of adolescents (Balázs et al., 2013; Stewart et al., 2002), and it should be considered a major health problem during this age period (Bertha and Balázs, 2013; Wesselhoeft et al., 2013). However, currently, little is known about gender differences associated with SD in adolescents.

Previous studies have found a higher prevalence of SD in females than in males (Balázs et al., 2013; Sihvola et al., 2007), but a similar prevalence has been observed in other research (González-Tejeras et al., 2005). Likewise, Bennett et al. (2005) found gender differences in the types of symptoms of adolescents with SD, with females being more likely to feel fatigued, guilty, and ugly than males. Despite these studies, we need to attain a broader understanding of gender differences in SD during adolescence.

In this context, the aim of this study was to examine gender differences in the prevalence, clinical features, and factors associated with subthreshold depressive episode (SDE) in a sample of adolescents in Chile.

Achieving a better understanding of SDE in adolescents is relevant for several reasons. First, it is an important indicator of the clinical relevance of SDE, which is often overlooked and undertreated despite their high prevalence and impact. Second, it is important for understanding the role of clinical features and associated factors in the differences between SDE and major depressive episode (MDE). Third, the identification of adolescents with SDE may provide a rationale for the development of preventive and early interventions that could substantially decrease the morbidity associated with SDE and prevent the progression to MDD.

## 2. Method

## 2.1. Participants

The sample consisted of 2,022 adolescents between 9th and 11th grade recruited from eight state-subsidized schools located in the northern part of Santiago, Chile. The sample belongs to the "Cuida tu Ánimo" program [in English, "Take Care of Your Mood"], a stepped-care Internet-based program for the prevention and early intervention of adolescent depression in high school students (Parada et al., 2019). The sample consisted of 1,002 females (49.5%) and 1,020 males (50.5%) between 13 and 19 years old (15.2 years average age).

## 2.1. Measures

## 2.1.1. Depressive symptoms

Depressive symptoms were assessed through the Patient Health Questionnaire-9 (PHQ-9; Johnson et al., 2002). The PHQ-9 is a 9-item self-report questionnaire used for the evaluation of depressive symptoms in adolescents according to criteria set out in the Diagnostic and Statistical Manual of Mental Disorders (DSM). This questionnaire is composed of a 4-point ordinal response scale (from 0 = not at all to 3 = nearly every day). The PHQ-9 has demonstrated good diagnostic accuracy when compared to diagnoses made through semi-structured diagnostic interviews, although the optimal cut-off point is higher

among adolescents than for adult populations (Borghero et al., 2018; Levis et al., 2019). In this sample, the PHQ-9 had an internal consistency of .87.

Our theoretical definition of SDE includes two criteria: (a) one of the symptoms should be a core symptom of depression, either depressed mood or loss of interest or pleasure; (b) fewer symptoms are required than for MDE, but the duration of symptoms is the same. We use the term *episode* to operationalize that an adolescent meets the criteria for severity in terms of duration and number of symptoms at the time of assessment (Frank et al., 1991).

Since there is still no consensus on the definition of SD (Bertha and Balázs, 2013; Carrellas et al., 2017), we decided to use the diagnostic algorithm approach for the analysis of PHQ-9 scores instead of the dimensional approach (Kroenke et al., 2001). Although the PHQ-9 is not a diagnostic instrument, its items make it possible to distinguish respondents with SDE and MDE following an algorithm that resembles the major depression diagnostic criteria of the DSM-5 (American Psychiatric Association, 2013). Operationally, the MDE group was composed of adolescents who, considering the last two weeks, answered at least *"more than half the days"* on 5 or more items of the PHQ-9 and who displayed one of the two core symptoms of depression (depressive mood or anhedonia). Following Khaled (2019), the criterion for determining SDE was to answer, considering the last two weeks, at least *"more than half the days"* for 2 to 4 symptoms, one of them being depressive mood or anhedonia.

#### 2.1.2. Anxiety symptoms

Anxiety symptoms were assessed through the Generalized Anxiety Disorder-7 questionnaire (GAD-7; Spitzer et al., 2006). This is a 7-item self-report questionnaire to assess the presence and magnitude of generalized anxiety symptoms according to DSM criteria. It is composed of a 4-point response scale ranging from 0 (*not at all*) to 3 (*nearly every day*). In this sample, the GAD-7 had an internal consistency of .86.

As with the analysis of PHQ-9 scores, we believe that the diagnostic algorithm-based approach is a more rigorous criterion for assessing generalized anxiety symptoms than other methods of classification through self-report instruments.

## 2.1.3. Perceived social support

Perceived social support was assessed through four questions adapted from the Social Support Questionnaire-Short Form (SSQ6; Sarason et al., 1987). These questions assessed respondents' degree of satisfaction with the support received from family, friends, school staff, and other community members. The questionnaire is composed of a 6-point response scale (from 1 = very dissatisfied to 6 = very satisfied). In this sample, the internal consistency of this instrument was .71.

## 2.1.4. Social problem solving

This dimension was evaluated through the Social Problem-Solving Inventory-Revised: Short (SPSI-R:S; D'Zurilla et al., 1998), which is a 25-item questionnaire that evaluates three dysfunctional (Negative Problem Orientation, Impulsivity/Carelessness Style, and Avoidance Style) and two adaptive (Positive Problem Orientation [PPO] and Rational Problem Solving [RPS]) forms of problem solving. The latter two dimensions were used in this study. PPO evaluates people's beliefs that problems can be solved and the self-efficacy to solve them, while RPS evaluates the application of rational techniques in a systematic manner to solve problems. Each dimension is composed of five items, with a 5point response scale (from 0 = not at all true of me to 4 = extremely true of me). For the analysis, we combined both scales into one indicator of social problem solving, which had an internal consistency of .90.

## 2.1.5. Dysfunctional thoughts

To assess this dimension, the Personal Failure subscale of the Children's Automatic Thoughts Scale was used (CATS; Schniering and Rapee, 2002). The CATS is a self-report measure designed to assess a

#### Table 1

Sociodemographic characteristics of the sample by diagnosis criteria and gender

	Total Females n (%)	Males n (%)	NoDE Females n (%)	Males n (%)	SDE Females n (%)	Males n (%)	MDE Females n (%)	Males n (%)
n	1002 (49.5)	1020 (50.5)	555 (41.7)	776 (58.3)	198 (59.5)	135 (40.5)	249 (69.5)	109 (30.5)
Age*	$15.2 \pm 1.0$	$15.3 \pm 1.0$	$15.2 \pm 1.0$	$15.2 \pm 1.0$	$15.2 \pm 1.0$	$15.4 \pm 1.0$	$15.2 \pm 1.0$	$15.4 \pm 1.0$
Migrant status of the adolescent	78 (7.8)	56 (5.5)	44 (7.9)	47 (6.1)	15 (7.6)	7 (5.2)	19 (7.6)	2 (1.8)
Migrant status of any parent	106 (10.6)	91 (8.9)	64 (11.5)	70 (9.0)	19 (9.6)	13 (9.6)	23 (9.2)	8 (7.3)
Lives with parents								
Both parents	547 (54.6)	582 (57.1)	334 (60.2)	449 (57.9)	100 (50.5)	78 (57.8)	113 (45.4)	55 (50.4)
One parent	413 (41.2)	395 (38.7)	206 (37.1)	299 (38.5)	90 (45.5)	47 (34.8)	117 (47.0)	49 (45.0)
Other	42 (4.2)	43 (4.2)	15 (2.7)	28 (3.6)	8 (4.0)	10 (7.4)	19 (7.6)	5 (4.6)
Parents' years of education**								
8 or less	64 (7.1)	52 (5.7)	38 (7.6)	40 (5.8)	11 (6.2)	6 (5.1)	15 (6.7)	6 (6.2)
9-12	458 (50.8)	475 (52.4)	256 (51.2)	372 (53.6)	88 (49.4)	56 (47.9)	114 (50.9)	47 (49.0)
13 or more	380 (42.1)	380 (41.9)	206 (41.2)	282 (40.6)	79 (44.4)	55 (47.0)	95 (42.4)	43 (44.8)

\* Mean and standard deviation.

\*\* n = 1809 without missing values in this variable. In bold, statistically significant differences between females and males ( $\chi^2$  test and t-test).

wide range of negative self-statements in children and adolescents. The questionnaire asks for negative thoughts during the last week using a 5-point response scale (from 0 = not at all to 4 = all the time). The Personal Failure subscale consists of 10 items and accounts for adolescent self-statements of failure. In this sample, the subscale had an internal consistency of .95.

## 2.1.6. Emotion regulation

This dimension was assessed using the Cognitive Reappraisal subscale of the Emotion Regulation Questionnaire (ERQ; Gross and John, 2003). This instrument evaluates emotional regulation techniques and has a 7-point response format (from  $1 = strongly \ disagree$  to  $7 = strongly \ agree$ ). The Cognitive Reappraisal subscale has 6 items and measures respondents' ability to cognitively modify the meaning of situations to regulate emotions. In this sample, the internal consistency of this questionnaire was .84.

## 2.1.7. Risk of substance abuse

This dimension was evaluated through the Car, Relax, Alone, Forget, Family/Friends, Trouble questionnaire (CRAFFT; Knight et al., 1999), which is an instrument for the detection of problematic consumption, abuse, or dependence on alcohol and/or drugs in adolescents. It is composed of six questions with two possible answers (1 = yes and 0 = no). Scores  $\geq 2$  indicate the presence of risk for drug and/or alcohol consumption.

## 2.1.8. Sociodemographic characteristics and health service utilization

These dimensions were evaluated through specific questions in the questionnaire that contained the rest of the instruments. To evaluate utilization of health services, we included questions on access to treatment for depression (*Have you ever received any type of depression treatment sometime in your life?*), pharmacotherapy (*Are you currently being treated with any antidepressant medication (e.g. fluoxetine, sertraline, escitalopram, citalopram, venlafaxine, bupropion)?*), and psychotherapy (*Are you currently in treatment with a psychologist (psychotherapy) outside of school?*).

In this study, the Spanish versions of all the above-mentioned questionnaires were used, which have previously been used in other studies with Chilean adolescents (i.e. Borghero et al., 2018; Martínez et al., 2019; Pfeiffer et al., 2012).

## 2.2. Procedure

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine of the University of Chile. Subsequently, the directors of the schools were contacted to request their participation. Adolescents and their parents or primary caregivers signed informed consents stating their willingness to participate in the study. Finally, the adolescents answered the questionnaires in digital format on school computers, supervised by the research team.

# 2.3. Analysis

Gender differences in sociodemographic characteristics, depressive symptom frequencies, health service utilization, and mean scores on possible associated factors were obtained using the  $\chi^2$  test for categorical variables and the t-test for continuous variables.

Multinomial logistic regression models were performed using depressive symptoms as a dependent variable in three categories: no depression episode (NoDE), SDE, and MDE. NoDE was the reference group in the regression models. In order to observe possible gender differences, multinomial logistic regression models were performed for each possible associated factor stratified by gender. Each model was adjusted by age, adolescent migrant status, and anxiety scores (GAD-7).

## 3. Results

## 3.1. Sociodemographic characteristics of the sample

With respect to the sociodemographic characteristics of the sample (Table 1), there were statistically significant differences in the proportions of females and males in the three groups (NoDE, SDE, and MDE). In the SDE and MDE groups, the proportion of females was much higher than males, especially in the MDE group, in which there were nearly twice as many females as males. Regarding the migration status of participants, there were more female than male migrants in the sample. In the MDE group, this difference was also statistically significant, with more female than male migrants having MDE. In the rest of the sociodemographic variables, no differences in gender distribution were observed.

# 3.2. Prevalence

Table 2 presents the prevalence of SDE and MDE in the sample. The prevalence of SDE in the total sample was 16.5%, while that of MDE was 17.7%. There was a statistically significant difference by gender (p < 0.001), with both diagnoses being more prevalent in females. 19.8% and 24.9% of the females met the criteria for SDE and MDE, respectively, whereas 13.2% and 10.7% of the males met the criteria for SDE and MDE, respectively. There were no statistically significant differences (p = 0.789) in the prevalence of SDE and MDE by age.

 Table 2

 Prevalence of SDE and MDE.

	SDE %	CI	MDE %	CI	p-value*
Total	16.5	14.9-18.2	17.7	16.1-19.4	
Gender					< 0.001
Female	19.8	17.4-22.3	24.9	22.3-27.6	
Male	13.2	11.3-15.6	10.7	8.9-12.7	
Age					0.789
14 or less	15.3	12.4-18.6	17.0	14.0-20.5	
15	15.7	13.2-18.7	18.0	15.4-21.1	
16	18.3	15.4-21.5	18.1	15.3-21.3	
17 or more	16.5	11.7-22.7	16.5	11.7-22.7	

p-values were estimated using Pearson's  $\chi^2$  test.

## 3.3. Clinical features

Table 3 shows the means and proportions of the psychological variables by diagnostic criteria and gender. Statistically significant gender differences are observed for the total sample in all variables, except for risk of alcohol and drug abuse (CRAFFT).

For the SDE and MDE groups, there were statistically significant gender differences in depressive symptoms, social problem solving, dysfunctional thoughts, and emotion regulation. In all these variables, females perform worse than males. There were no statistically significant gender differences in either group in terms of substance abuse risk and perceived social support.

In relation to comorbidity with other mental health problems, 16.8% of adolescents with SDE and 56.7% of adolescents with MDE also meet the criteria for generalized anxiety disorder (Table 3). Females in the MDE group had a higher comorbidity with generalized anxiety disorder than males.

Regarding the frequencies of depressive symptoms (Table 4), gender differences were observed in all groups. Females in the NoDE group reported significantly more depression symptoms than males in all symptoms, except for anhedonia. Females in the SDE group had more depressive mood and sleep problems, while males in the same group reported more anhedonia, concentration problems, and psychomotor retardation/agitation. In the MDE group, there was only one significant gender difference: a loss of or increased appetite, which was more frequent in females. It is important to note that around 6% of the adolescents in the NoDE and SDE groups report suicidal thoughts. In contrast, this problem increases dramatically in the MDE group, where more than 50% of adolescents report suicidal thoughts.

#### 3.4. Health service utilization

In general, health service utilization (any treatment for depression, current psychotherapy, and pharmacotherapy for depression) was low for the SDE and MDE groups (Table 5). Specifically, 18.1% of females

and 15.6% of males that met MDE criteria were on psychotherapy, while 5.2% of females and 9.2% of males were on pharmacotherapy for depression. There were statistically significant gender differences regarding any treatment for depression in the total sample, NoDE, and SDE groups, with females reporting a higher rate of current treatment for depression than males. In the total sample, there is a significant difference in access to psychotherapy between females and males; however, this difference disappears when the participants are grouped into the different diagnostic categories (NoDE, SDE, and MDE).

## 3.5. Associated factors

Table 6 shows the factors associated with SDE and MDE, after controlling for age, migrant status, and anxiety symptoms.

On the one hand, dysfunctional thoughts emerge as a factor positively associated with SDE and MDE in both genders. Results also show that substance abuse risk is positively associated with MDE in females and males. On the other hand, social problem solving and emotion regulation skills are factors negatively associated with SDE in females and with MDE in females and males. Likewise, perceived social support emerges as a factor negatively associated with SDE and MDE in both genders.

## 4. Discussion

This study contributes to the understanding of gender differences in terms of prevalence, clinical features, and factors associated with SDE in a community sample of adolescents.

Results show that there is a high point prevalence of SDE in the sample (16.5%), being more frequent in females than in males (19.8% vs. 13.2%, respectively). When comparing these results with the point prevalence obtained in other studies, our estimates are slightly higher than the 14.3% reported in the United States (Ybarra et al., 2005) and lower than the 29.2% reported in 11 European countries (Balázs et al., 2013). Likewise, the gender differences observed in terms of the point prevalence of SDE coincide with those reported in other studies (Balázs et al., 2013). These results are in line with internationally reported gender differences associated with depression symptoms and diagnosis, which generally arise early in adolescence (Salk et al., 2017). Our results may be a sign of this trend.

Gender differences are also observed in the frequency of depressive symptoms: females have more depressive mood and sleep problems, but fewer problems with concentration and psychomotor retardation/agitation than males. Results also show that, on the one hand, females and males have similar associated factors (dysfunctional thoughts and perceived social support); on the other hand, they display some differences in these factors, especially related to social problem solving and emotion regulation skills.

In relation to clinical features, this study shows that one of the main differences between SDE and MDE is associated with the high presence

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Means and proportions of psychological variables by diagnosis criteria and gender

	Total Females	Males	NoDE Females	Males	SDE Females	Males	MDE Females	Males
Depressive symptoms	$11.0\pm6.0$	7.4 ± 5.2	7.1 ± 3.6	$5.3 \pm 3.2$	$11.4\pm2.3$	$10.8 \pm 2.3$	19.1 ± 3.4	$18.2\pm3.5$
Social problem solving	$19.5 \pm 8.7$	$24.1 \pm 8.0$	$\textbf{21.9} \pm \textbf{8.6}$	$25.1 \pm 7.7$	$\textbf{18.3} \pm \textbf{7.9}$	$\textbf{22.8} \pm \textbf{8.2}$	$\textbf{15.3} \pm \textbf{8.0}$	$18.5 \pm 7.7$
Dysfunctional thoughts	$\textbf{13.4} \pm \textbf{10.7}$	$\textbf{7.8} \pm \textbf{8.2}$	$\textbf{8.1} \pm \textbf{7.6}$	$5.3 \pm 5.4$	$13.7~\pm7.6$	$10.9 \pm 6.8$	$25.1 \pm 9.3$	$\textbf{22.1} \pm \textbf{10.0}$
Emotion regulation	$27.0 \pm 7.4$	$28.1 \pm 7.1$	$28.8 \pm 7.2$	$28.7 \pm 7.1$	$26.1 \pm 6.0$	$27.6 \pm 6.7$	$23.6\pm7.6$	$\textbf{24.4} \pm \textbf{7.1}$
Substance abuse risk*	299 (29.8)	272 (26.7)	125 (22.5)	178 (22.9)	60 (30.3)	45 (33.3)	114 (45.8)	49 (45.0)
Perceived social support	$14.1 \pm 3.5$	$15.2 \pm 3.3$	$15.2 \pm 3.3$	$15.7 \pm 3.1$	$13.5 \pm 3.2$	$14.2 \pm 3.4$	$12.0 \pm 3.4$	$12.6 \pm 3.3$
Generalized anxiety disorder*a	220 (22.0)	92 (9.0)	35 (6.3)	18 (2.3)	35 (17.7)	21 (15.6)	150 (60.2)	53 (48.6)

Results are presented in mean and standard deviations, except for variables with an \*, which are presented in frequencies and percentages in parenthesis. In bold, statistically significant differences between females and males ( $\chi^2$  test and t-test).

<sup>4</sup> Obtained from GAD-7 algorithm (if item 1 plus three or more of items 2-7 are more than half the days)

#### Table 4

Frequencies of depressive symptoms by diagnosis criteria and gender

1 1 51 5	0	0				
	NoDE Females n = 555	Males n = 776	SDE Females n=198	Males n=135	MDE Females n=249	Males n=109
Depressive mood	2.5	1.0	63.1	41.5	89.2	83.5
Anhedonia	3.2	3.4	51.0	72.6	73.9	80.7
Sleep problems	25.1	17.1	46.5	30.4	84.3	78.9
Fatigue	23.2	17.3	50.5	45.9	88.0	86.2
Loss or increased appetite	17.1	8.4	28.3	23.7	82.7	60.6
Feelings of guilt or worthlessness	11.7	4.9	30.8	23.0	79.5	80.7
Concentration problems	18.6	14.3	27.3	41.5	69.9	72.5
Psychomotor retardation/agitation	7.8	4.3	6.1	12.6	51.4	51.4
Suicidal ideation	5.1	1.7	6.6	5.9	52.2	51.4

In bold, statistically significant differences between females and males ( $\chi^2$  test).

of suicidal ideation in the most severe forms of depressive symptomatology. Other studies have found that adolescents who meet the criteria for SDE differed significantly from non-depressed adolescents regarding depressive mood (Georgiades et al., 2006), suicidal thoughts, anxiety, and family-related adversities (Jonsson et al., 2011). In addition to the severity of depressive symptoms and difficulties with emotion regulation, suicidal thoughts are a key symptom that predicts escalation from SDE to MDE (Bertha and Balázs, 2013; Hughes et al., 2011; Klein et al., 2009). Overall, our results and the international literature underscore the importance of exploring suicidal thoughts in the diagnosis of MDD in adolescent females and males.

In this study we also found a greater comorbidity between MDE and generalized anxiety disorder compared to the group of adolescents who met the criteria for SDE, which is consistent with previous studies on adolescent depression (Klein et al., 2009).

Regarding gender differences in the frequency of depressive symptoms, in this study it was observed that females who meet the criteria for SDE had more depressive mood and sleeping problems, while males had more concentration problems and psychomotor retardation/agitation. Other studies have found gender differences in other depressive symptoms in adolescents who meet the criteria for SD. For example, Bennett et al. (2005) found that females with SD had more fatigue and feelings of guilt than males, while Sihvola et al. (2007) found more symptoms associated with appetite, feelings of worthlessness and excessive guilt, and a stronger tendency to suicidality in females compared to males. While there are gender differences in the pattern of symptoms in each particular study, there are also differences between studies, which may be due to transcultural differences in the experience of symptoms (Choi and Park, 2006). Therefore, testing this hypothesis would require further investigation in future studies.

Similarly, a recent meta-analysis found gender differences in symptom frequencies in depressed adults, with females having more depressed mood, appetite and sleeping problems, fatigue, anhedonia, and diurnal variation than males; however, males reported more alternative symptoms than females, such as alcohol/drug abuse and risk taking/poor impulse control, which suggests that is necessary to determine what constitutes depression in women and men (Cavanagh et al., 2017).

Our results also showed that anhedonia is highly prevalent in females and males with SDE (51.0% vs 72.6%, respectively), which was a statistically significant gender difference, and in females and males with MDE (73.9% vs 80.7%, respectively), which was not a statistically significant gender difference. These results are worrying because anhedonia has been found to be a predictor of longer time to remission and fewer depression-free days compared to other dimensions of depression among selective serotonin reuptake inhibitor treatment-resistant adolescents (McMaking et al., 2012). Also, greater anhedonia severity has been found in depressed adolescents with suicidal attempts compared to depressed adolescents with suicidal ideation (Auerbach et al., 2015). This suggests that anhedonia could be an important predictor of depression severity and poorer prognosis.

Regarding the use of health services, our study shows that there is a significant treatment gap for depressive symptoms among adolescents and that males have greater difficulty accessing treatment. As several studies have shown, limited access to mental health services and the availability of treatments for adolescents with depression in low- and middle-income countries is a major concern (Thapar et al., 2012). Likewise, in line with previous studies (González-Tejera et al., 2005; Jonsson et al., 2011; Sihvola et al., 2007), our results show greater use of health services associated with depression treatment by adolescents who met the criteria for SDE than those with NoDE (23.2% vs. 14.8% in females; 13.3% vs. 8.4% in males) and greater use of psychotherapy (13.1% vs. 8.3% in females; 11.9% vs. 5.9% in males). In addition, in the SDE group, more females had received previous treatment for depression (23.2% of females vs. 13.3% of males). On the other hand, health service utilization in the SDE group was lower than in the MDE group (23.2% vs. 32.5% in females; 13.3% vs. 38.5% in males), which is consistent with other studies (Jonsson et al., 2011; Sihvola et al., 2007). This can be explained by the fact that adolescents with more severe symptoms tend to demand more help in mental health services.

In general, our results underline the importance of some factors traditionally associated with depressive symptoms in adolescents (Thapar et al., 2012). However, at the same time, they show gender differences regarding the associated factors with SDE and MDE. In the SDE group, some factors are shared by both genders, which are also associated factors for females and males who meet the criteria for MDE (e.g. dysfunctional thoughts and perceived social support). However, there are some other factors that differ between females and males in the SDE group (e.g. social problem solving and emotion regulation) but are common to females and males who meet the criteria for MDE. These

## Table 5

Health service utilization by diagnosis criteria and gender

	Total Females	Males	NoDE Females	Males	SDE Females	Males	MDE Females	Males
Any treatment for depression	<b>209 (20.9)</b>	125 (12.2)	<b>82 (14.8)</b>	<b>65 (8.4)</b>	<b>46 (23.2)</b>	<b>18 (13.3)</b>	81 (32.5)	42 (38.5)
Current pharmacotherapy for depression	26 (2.6)	28 (2.8)	11 (2.0)	12 (1.5)	2 (1.0)	6 (4.4)	13 (5.2)	10 (9.2)
Current psychotherapy	<b>117 (11.7)</b>	79 (7.8)	46 (8.3)	46 (5.9)	26 (13.1)	16 (11.9)	45 (18.1)	17 (15.6)

In bold, statistically significant differences between females and males ( $\chi^2$  test).

#### Table 6

Associated factors with SDE and MDE stratified by gender\*

-								
	SDE Females RRR CI		Males BRB CI		MDE Females BBB CI		Males BBB CI	
						-		-
Dysfunctional thoughts	1.06	1.03, 1.08	1.07	1.04, 1.10	1.16	1.13, 1.20	1.21	1.16, 1.26
Substance abuse risk (ref = $no$ )**	1.20	0.81, 1.76	1.29	0.82, 2.02	1.61	1.05, 2.45	2.02	1.13, 3.60
Social problem solving	0.96	0.94, 0.98	0.97	0.95, 1.00	0.95	0.92, 0.97	0.91	0.88, 0.95
Emotion regulation	0.96	0.94, 0.98	0.99	0.96, 1.02	0.95	0.92, 0.97	0.94	0.90, 0.98
Perceived social support	0.88	0.84, 0.93	0.92	0.87, 0.98	0.82	0.78, 0.88	0.82	0.76, 0.89

\* NoDE = reference model. RRR = relative risk ratio.

\*\* Ref = reference category for categorical variables. Models were adjusted by age, migrant status of the adolescent, and anxiety scores (GAD-7). In bold p < 0.05.

differences between the SDE and MDE groups could be explained by the fact that, on average, females scored worse than males on all the factors assessed in this study; therefore, SDE in females tend to be more similar to MDE, sharing the same associated factors.

## 4.1. Limitations

One of the main limitations of this study is associated with its crosssectional design, which prevents us from observing the longitudinal evolution of the multiple levels of depressive symptomatology. What we call subthreshold symptomatology may consist of prodromes, residual symptoms or subclinical fluctuations in affective disorders (Cuijpers et al., 2004). Since we have no longitudinal data, it is not possible to distinguish between these different subgroups. Likewise, SDE may lead to mental health problems other than MDD, such as anxiety disorders.

In this regard, there may be differences between groups that underlie different clinical profiles. Future longitudinal studies could explore these possible differences. Another limitation is the use of selfreport questionnaires and the absence of clinical diagnostic interviews, which could have resulted in an information bias in the categorization of the SDE and MDE groups. Furthermore, the sample analyzed in this study comes from state subsidized schools in the northern part of Santiago, Chile, so it is not representative of the Chilean adolescent population. In spite of this, the schools that participated in the study are characterized by having students from middle- and low-income households.

## 4.2. Clinical implications and future research

Considering the prevalence, clinical features, and functional impairment associated with SDE, this condition should be considered an important health problem during adolescence (Bertha and Balázs, 2013). Adolescents with subthreshold symptoms represent good targets for preventive and early interventions of depression (Wesselhoeft et al., 2013). Some randomized controlled trials have examined the effect of preventive intervention programs and brief psychotherapy among adolescents with SD and have found evidence that it is possible to reduce the number of new cases of MDD (Garber et al., 2009; Stice et al., 2010). Likewise, counseling programs in schools and primary care could offer a way of initially dealing with clinically relevant subthreshold symptoms of depression, while also reducing the risk of later MDD among adolescents (Pössel et al., 2004; Thapar et al., 2012).

In a context of resource scarcity, such as low- and middle-income countries, Internet-based interventions could be less costly and more accessible approaches for adolescents, as well as a pragmatic way to reduce the treatment gap in this population (Hoek et al., 2009; Jiménez-Molina et al., 2019). At the same time, these programs would benefit from the implementation of a stepped-care model, which begins with low-intensity interventions aimed at less severe problems and progressively becomes more complex if necessary (Parada et al., 2019;

van Straten et al., 2010). In this regard, early interventions aimed at subthreshold symptoms can range from continuous monitoring through digital technology to face-to-face psychotherapy or pharmacotherapy. This model could make it possible to improve the efficiency of health services by adapting interventions to the specific needs of adolescents.

Based on the results of this study, we recommend considering a gender-informed approach to preventive and early interventions for depression, given that some clinical features and associated factors differ between females and males. Our results show that it would be possible to intervene in factors associated with SDE that are common to females and males (e.g. dysfunctional thoughts and perceived social support) and others that differ by gender; in females, for example, it would be advisable to work on the development of social problemsolving and emotional regulation skills.

Overall, few studies have explored associated factors for SDE in adolescents (e.g. González-Tejeras et al., 2005; Krackow and Rudolph, 2008; Rohde et al., 2009); even more so, none of them provides an analysis of results stratified by gender. Considering the existence of gender differences in the prevalence of SDE (Balázs et al., 2013; Sihvola et al., 2007) and the types of symptoms experienced (Bennett et al., 2005; Sihvola et at., 2007), it is extremely important to continue examining these differences through the analysis of genderdisaggregated data. We consider that it is important to study this problem from a mixed-methods perspective, since qualitative studies make it possible to delve deeper into meanings that cannot be accessed through traditional questionnaires. A detailed analysis of the gender differences expressed through the various manifestations of depressive symptoms during adolescence will allow the development of appropriate responses that could be considered by health care systems and public health policies.

## Contributors

VM was the principal investigator of the original research project ("Cuida tu ánimo"). MC conceived this study and performed the statistical analyses. All authors analyzed the results, contributed to the drafting of this paper and approved the final manuscript.

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## **Institutional Board Review**

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine of the University of Chile.

# Declaration of competing interest

none

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## Supplementary materials

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