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ORIGINAL ARTICLE

Depression, generalized anxiety and risk of problematic substance use in high school students

Depresión, ansiedad generalizada y riesgo de consumo problemático de sustancias en estudiantes secundarios

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What do we know about the subject matter of this study?

During adolescence, mental disorders have a high prevalence, burden of disease, and comorbidity, and generally begin at this stage and often persist into adulthood. Knowing their prevalence and comorbidity in our context can contribute to the planning of services and the development of preventive interventions.

What does this study contribute to what is already known?

We estimated the prevalence, comorbidity, and relationship with sociodemographic variables of depression, generalized anxiety, and risk of problematic substance use in adolescents in the northern area of Santiago. There was a high prevalence and comorbidity and the sociodemographic variables examined showed different relationships with the mental health problems studied.

Abstract

Objective: To estimate the prevalence and comorbidity of depression, generalized anxiety, and risk of problematic substance use in adolescents, and to examine the sociodemographic variables associated with these mental health problems. **Subjects and Method**: 2,022 students from first to third year of high school (9th to 11th grade) from 8 educational establishments in the northern area of Santiago, Chile, participated in the study. The mean age was 15.2 years and 49.5% of the sample was female. Sociodemographic, measures of depression (Patient Health Questionnaire-9 [PHQ-9]), generalized anxiety (Generalized Anxiety Disorder 7-item [GAD-7]), and risk of problematic substance use (Car, Relax, Alone, Forget, Family/Friends, Trouble [CRAFFT]) data were collected. Data were analyzed using bivariate hypothesis testing and logistic and Poisson regression models. **Results**: 52.9% met the criteria for one or more mental health problems. A total of 35.2% scored positive for depression, 25.9% for generalized anxiety, and 28.2% for risk of problematic substance use, with differences by

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gender in the first two and differences by gender and age in the third. A total of 26.5% scored positive for two or more mental health problems. Regression models showed differences in the associations between gender, age, and not living with both parents with the mental health problems studied. **Conclusions**: There is a high prevalence and comorbidity in the three mental health problems studied. The results show the importance of assessing comorbidity in clinical work with adolescents and the development of transdiagnostic preventive interventions for this population.

Introduction

Mental disorders during adolescence and youth are a worldwide public health concern due to their high burden of disease[1,2]. During this stage, mental health disorders are highly prevalent. A decade ago, epidemiological studies in the United States reported that 40.3% of adolescents met the criteria for a mental disorder during the last 12 months[3] and 49.5% met the criteria for a mental disorder during their lifetime[4]. In Chile, Vicente et al.[5] found that 16.5% of adolescents met the criteria for a mental disorder with some level of impairment. Among these, 7.4% met the criteria for an anxiety disorder, 7.0% for depressive disorders, and 3.3% for substance abuse.

Most mental disorders have the onset in adolescence[6,7], show a high persistence into adulthood[6,8], and high comorbidity[3-5,9].

Knowing the prevalence of the most common mental health problems during adolescence in our country can be useful for planning services, policies, and interventions aimed at prevention and early intervention. The objective of this study is to estimate the prevalence and comorbidity of mental health problems (depression, generalized anxiety, and risk of problematic substance use) in adolescents and to examine the sociodemographic variables associated with these mental health problems.

Subjects and Method

Participants

2,022 students from first to third year of high school (9th to 11th grade), from eight subsidized private schools, were recruited by convenience sampling. The schools belonged to four municipalities in the northern area of Santiago, Chile (Recoleta, Independencia, Conchalí, and Huechuraba). According to the last census[10], 43,381 young people between 13 and 19 years of age live in these four municipalities, with a sex distribution of 51.1% males and 48.9% females, and 11.1% of the total corresponds to immigrant youth. The sample is part of the baseline evaluation of the stepped-care Internet-based program for the prevention and early intervention of depression in adolescents "*Cuida tu Ánimo*"[11] (Take Care of Your Mood, in Spanish).

Measures

Depressive symptoms. The version adapted to the Chilean adolescent population[12] of the Patient Health Questionnaire-9 (PHQ-9)[13] was used, which assesses the presence and severity of depressive symptoms based on the DSM-IV criteria[14]. It is a 9-item self-administered instrument with a 4-point ordinal response scale, ranging from 0 = *not at all* to 3 = *nearly every day*, where higher scores indicate greater severity of symptoms. In this study, each student's total score was transformed into a dichotomous variable using the 11-point cut-off point proposed by the authors of the Chilean adaptation of the instrument[12], where 0 = *no depression* and 1 = *depression*. Participants' scores were also categorized according to the level of severity of depressive symptoms according to the cut-off points proposed by the original authors of the questionnaire[13], where 1 = *none or minimal* (0 - 4 points), 2 = *mild* (5 - 9), 3 = *moderate* (10 - 14), 4 = *moderately severe* (15 - 19), and 5 = *severe* (20 - 27).

Generalized anxiety symptoms. The version adapted to the Chilean population[15] of the Generalized Anxiety Disorder 7-item (GAD-7)[16] was used, which evaluates the presence and severity of symptoms of generalized anxiety disorder (GAD) according to DSM-IV criteria[14]. The GAD-7 is a 7-item self-administered instrument with a four-point ordinal response scale, ranging from 0 = *not at all* to 3 = *nearly every day*. Higher scores indicate greater severity of GAD symptoms. In this study, the sum of the scores of each participant was transformed into a dichotomous variable from the cut-off of 10 points, where 0 = *no generalized anxiety* and 1 = *generalized anxiety*, which has been used in other studies to indicate the presence of moderate to severe symptoms of generalized anxiety[16]. The level of severity of generalized anxiety symptoms proposed by the authors[16] was also used, for which a polytomous variable of four categories was created, where 1 = *minimum* (0 - 4 points), 2 = *mild* (5 - 9), 3 = *moderate* (10 - 14), and 4 = *severe* (15 - 21).

Risk of problematic substance use. The Car, Relax, Alone, Forget, Family/Friends, Trouble (CRAFFT)[17] questionnaire was used to detect a risk of problematic alcohol and/or drug use in adolescents. It has six questions with two possible response forms, 0 = *no* and 1 = *yes*. Scores greater than or equal to 2 indicate the presence of risk of problematic substance use.

Number of mental health problems. From the dichotomous variables of depression, generalized anxiety, and risk of problematic substance use, an ordinal variable was created to indicate the number of mental health problems present in each participant, ranging from 0 to 3.

Sociodemographic characteristics. A questionnaire was used to collect information on participants' age (in years), sex (0 = *male* and 1 = *female*), living with parents (1 = *both parents*, 2 = *mother or father*, and 3 = *other*), immigrant status of the adolescent (0 = *non-immigrant* and 1 = *immigrant*), and years of parental education (1 = *8 years or less*, 2 = *9 - 12 years*, and 3 = *13 years or more*), considering the parent or caregiver with the most years of education.

Procedure

The project was first approved by the Human Research Ethics Committee of the Faculty of Medicine of the University of Chile. Then, principals of the schools were invited to participate in the study and the participating adolescents and their parents or caregivers signed an informed consent form. The students answered the instruments on school computers, supervised by the research team.

Analysis

First, the characteristics of the sample were described using absolute and relative frequencies for the categorical variables and the mean and standard deviation for the age variable. The prevalence of depression, generalized anxiety, and risk of problematic substance use was estimated as well as the percentages for the severity levels of symptoms of depression and generalized anxiety, and the number of mental health disorders according to sex and age. Differences by sex and age were examined using the χ^2 test. The percentages of comorbidity between depression, generalized anxiety, and risk of problematic substance use were also examined using contingency tables.

To examine the relationship between sociodemographic variables and mental health disorders, logistic regression models were performed using the dichotomous variables of depression, generalized anxiety, and risk of problematic substance use as dependent variables and the sociodemographic variables as independent ones. A Poisson regression model was used to examine the relationship between the sociodemographic variables and the number of mental health problems since the dependent variable is ordinal. In all regression models, the sociodemographic variables were entered simultaneously, excluding the variable years of parental education as it has 10.5% of missing values. The analyses were performed in the Stata 17 software.

Results

Table 1 shows the sociodemographic characteristics of the sample. Almost half of the participants were female, with an average age of 15.2 years (±1.0) and ranging between 13 and 19 years. About 7% corresponded to immigrant students, most lived with one or both parents and to a lesser extent came from families with parents with 8 or less years of education, corresponding to complete and incomplete elementary education.

Table 2 shows the prevalence of the mental health problems examined. More than a third of the students scored positive for depression and more than a quarter for generalized anxiety and for risk of problematic substance use. Females show twice as high prevalence as males for depression (Prevalence Ratio [PR] = 2.02) and generalized anxiety (PR = 2.11), observing no differences by age. Regarding the risk for problematic substance use, an increase in prevalence was observed according to age, where the prevalence in the 17-19

Table 1. Sociodemographic characteristics of the sample

	n (%)
Gender	
Male	1020 (50.5)
Female	1002 (49.5)
Age[1]	15.2 ± 1.0
Immigrant status of the adolescent	134 (6.6)
Living with parents	
Both parents	1129 (55.8)
Mother or father	808 (40.0)
Other	85 (4.2)
Years of parental education[2]	
8 or less	116 (6.4)
9 – 12	933 (51.6)
13 or more	760 (42.0)

[1]mean and standard deviation. [2]n = 1809 without missing values.

Table 2. Prevalence of mental health problems, levels of severity of symptoms, and number of mental health problems by gender and age

	Total	Females	Males	p value	13-14 years	15-16 years	17-19 years	p value
Depression								
PHQ-9 ≥ 11	35.2	47.2	23.4	< 0.001	33.8	35.7	35.2	0.731
Depression severity				< 0.001				0.481
None-minimal (0 - 4)	24.9	13.7	35.9		28.2	24.1	21.0	
Mild (5 - 9)	34.2	33.3	35.1		34.4	34.1	35.2	
Moderate (10 - 14)	22.1	26.0	18.1		19.5	22.7	25.0	
Moderately severe (15 - 19)	12.0	16.3	7.7		11.6	11.9	13.1	
Severe (20 - 27)	6.9	10.7	3.1		6.3	7.3	5.7	
Generalized anxiety								
GAD-7 ≥ 10	25.9	35.2	16.7	< 0.001	24.8	26.4	25.0	0.747
Anxiety severity				< 0.001				0.319
None-minimal (0 - 4)	37.6	27.1	47.8		41.8	36.5	33.5	
Mild (5 - 9)	36.5	37.6	35.5		33.4	37.1	41.5	
Moderate (10 - 14)	16.7	22.2	11.3		16.2	17.0	15.3	
Severe (15 - 19)	9.2	13.1	5.4		8.6	9.4	9.7	
Risk of problematic substance use								
CRAFFT ≥ 2	28.2	29.8	26.7	0.113	16.4	30.8	44.3	< 0.001
Comorbidity								
Number of problems				< 0.001				< 0.001
0	47.1	37.2	56.8		56.9	45.2	32.4	
1	26.4	27.1	25.6		18.9	27.5	39.8	
2	16.7	21.8	11.8		16.6	16.5	18.8	
3	9.8	13.9	5.9		7.6	10.8	9.1	

PHQ-9: Patient Health Questionnaire-9. GAD-7: Generalized Anxiety Disorder 7-item. CRAFFT: Car. Relax. Alone. Forget. Family/Friends. Trouble questionnaire.

years group versus the 13-14 year-old group was 2.70 times higher, and no sex differences were observed. According to the level of symptom severity (Table 2), it is observed that females present more moderate to severe symptoms than males in depression and generalized anxiety.

When examining the prevalence of risk for problematic substance use by age and sex simultaneously (Figure 1), it is observed that in the 13-14 years age group, females present more risk of problematic substance use than males; however, in the 17-19 years age group, males present more risk of problematic substance use than females.

Regarding the number of mental health problems (last rows of Table 2), it is observed that 52.9% of the students present at least one mental health problem, and 26.5% present two and three mental health problems simultaneously, with females presenting more problems than males. In contrast, when examining the number of problems by age, an increase in having one mental health problem is observed; however, the proportions for two or three simultaneous mental health problems are similar between age groups.

Table 3 shows the results on comorbidity among the three mental health problems examined for the total sample and according to sex. Among those who scored positive for depression, 61.9% also scored positive for generalized anxiety, and, among those who scored positive for generalized anxiety, 84.3% scored positive for depression. Sex differences were also observed among those who scored positive for risk of problematic substance use, with females having higher percentages of comorbidity than males (females: between 50.8% and 60.5%; males: between 23.2% and 36.0%).

When examining the relationship between sociodemographic variables and mental health problems,

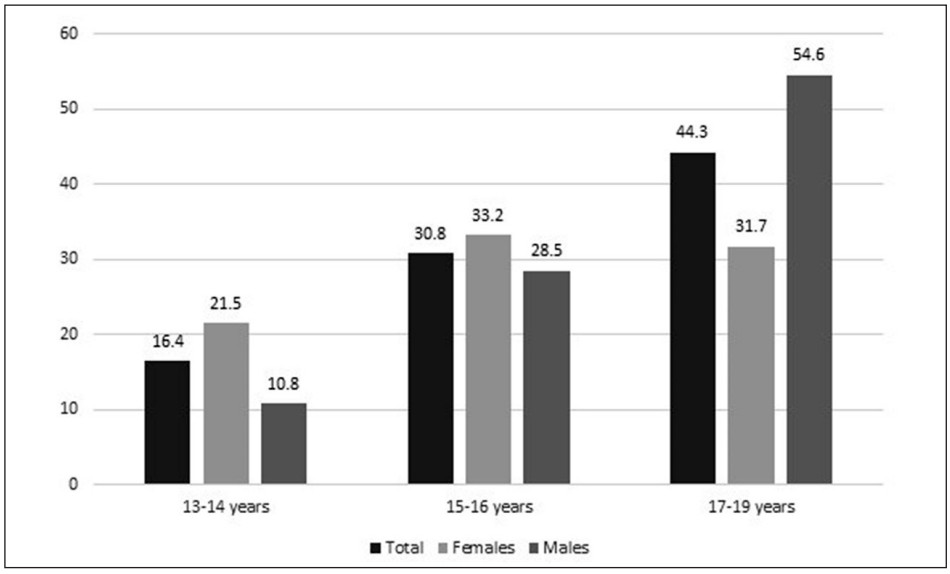

Figure 1. Risk of problematic substance use by age and gender.

Table 3. Comorbidity between depression, generalized anxiety and risk of problematic substance use by gender

	Total			Females			Males		
	1 %	2 %	3 %	1 %	2 %	3 %	1 %	2 %	3 %
1. Depression	-	61.9	39.2	-	63.9	38.3	-	58.2	41.0
2. Generalized anxiety	84.3	-	41.1	85.6	-	43.1	81.8	-	37.1
3. Risk of problematic substance use	48.9	37.7	-	60.5	50.8	-	36.0	23.2	-

Table 4. Association between sociodemographic variables and mental health problems

	Depression		Generalized anxiety		Risk of problematic substance use		Number of problems	
	OR (IC95%)		OR (IC95%)		OR (IC95%)		IRR (IC95%)	
Female	2.98***	(2.46 - 3.61)	2.74***	(2.22 - 3.38)	1.21	(0.99 - 1.47)	1.70***	(1.54 - 1.87)
Age	1.07	(0.97 - 1.18)	1.02	(0.92 - 1.13)	1.54***	(1.39 - 1.70)	1.12***	(1.07 - 1.17)
Immigrant status	0.72	(0.48 - 1.06)	0.83	(0.55 - 1.27)	1.05	(0.70 - 1.57)	0.90	(0.74 - 1.09)
Living with parents								
Both parents	1		1		1		1	
Mother or father	1.21	(1.00 - 1.48)	1.10	(0.89 - 1.36)	1.33**	(1.09 - 1.64)	1.14**	(1.03 - 1.25)
Other	2.53***	(1.60 - 4.02)	1.59	(0.98 - 2.58)	1.11	(0.68 - 1.83)	1.38**	(1.12 - 1.70)

*p < 0.050; **p < 0.010; ***p < 0.001.

it was observed that the variables female sex and not living with parents (compared with living with both parents) were positively associated with depression. For generalized anxiety, only a positive relationship was found with the female sex variable. In contrast, the variables positively associated with the risk of problematic substance use were age and living with one parent (compared with living with both parents). For the number of disorders, a positive relationship was observed with the variables female sex, age, living with one parent, or living with neither parent (compared with living with both). No statistically significant relationship was observed between the immigrant status of the adolescent and mental health problems or the number of disorders after controlling for the other sociodemographic variables.

Discussion

The objective of this study was to estimate the prevalence and comorbidity of three common mental health problems during adolescence and to examine the associated sociodemographic variables. The results showed (1) a high prevalence of depression, generalized anxiety, and risk of problematic substance use, with differences by sex in the first two problems and differences by sex and age in the third; (2) high comorbidity in the three mental health problems examined, especially in depression and generalized anxiety; and (3) differences in the associations between the variables sex, age, and not living with both parents with the mental health problems examined.

Comparing the prevalence of mental health problems across studies can be difficult because of differences in the instruments used (e.g., diagnostic interviews or screening instruments), sample characteristics (e.g., age of participants, community sample, or subgroup), or time of assessment (e.g., current, last 12 months, or lifetime). Compared with studies that have used similar screening instruments, the results of this study show a prevalence of depression similar to that observed in adolescents worldwide (34%)[18], but higher than that observed for generalized anxiety in Finnish adolescents (11.6%)[19]. For risk of problematic substance use, these results are higher than those observed in Norwegian adolescents (22%)[20] and in adolescents consulting primary care in the United States (14.8%)[21], but similar to those observed in Argentine adolescents (29%)[22].

The sex differences in prevalence estimates coincide with those previously reported in the literature, with depression and generalized anxiety being more frequent in females than in males[4,18,23]. Regarding the risk of problematic substance use, sex differences were observed if the data are disaggregated by age, with females aged 13-14 years showing a higher risk of problematic substance use than males, versus 17-19 years where males show a higher risk than females. These sex differences were not evident when examining the data in aggregate. These results deepen and challenge what has been previously reported in the literature regarding the narrowing of the risk gap for problematic substance use by sex in adolescence[20,24] and call for consideration of age when examining sex differences in future studies.

The results of this study show high comorbidity between the mental health problems examined, especially between depression and generalized anxiety, which shows the close relationship between both disorders since adolescence[25]. A high comorbidity is also observed between the risk of problematic substance use and depression and generalized anxiety, which is consistent with what has been observed in some studies[20,26]. In the study by Cioffredi et al.[26], they observed a closer relationship between depression and risk of substance abuse than between generalized anxiety and risk of substance abuse, since generalized anxiety scores alone were not statistically significant after adjusting for depressive symptoms, which could be related to the results found, where higher percentages of comorbidity were observed between depression and risk of problematic substance use than between anxiety and risk of problematic substance use.

Besides, the results showed that the comorbidity between the risk of problematic substance use and depression and generalized anxiety was higher in females than in males, which coincides with some studies that suggest greater substance use in females with generalized anxiety[27] and depression[28], but contradicts others that have observed greater substance use in African-American male adolescents with generalized anxiety compared with females and males of other races/ethnicities[29] and others that have observed no sex differences in substance use in adolescents with symptoms of depression or anxiety[30]. These results could account for cultural and sex differences in relation to substance use, for example, to alleviate emotional symptoms[31] or in relation to the adoption of "masculine norms" and peer pressure that promote substance use[32].

Our results are in line with what has been observed in epidemiological studies on the associations between sociodemographic variables and the mental health problems examined. As reported in the literature[5,18,23], being female was associated with depression, generalized anxiety, and number of mental health problems. Also, an effect of age on the risk of problematic substance use and number of mental health problems was observed[4,26], and not living with either parent (compared with living with both parents) was associated with depression and number of problems[5] and living with either mother or father (compared with living with both parents) with risk of problematic substance use and number of mental health problems[5]. Regarding not living with parents, although there was an association with three of the four variables for mental health problems examined, the results do not allow us to determine that there is a causal effect of this variable on mental health problems. In particular, the variable lives with parents does not account for the role that the extended family or the presence of other support networks could have, among other reasons, so it is recommended that this result be interpreted with caution.

Among the limitations of this study is its cross-sectional design, which does not allow us to establish causality between the associations analyzed. In addition, the study was carried out in the northern area of Santiago, which may not be representative of all the

municipalities that make up the Metropolitan Region. Also, all the participating schools were subsidized private schools attended by students from low to medium socioeconomic levels, so they would not be representative of private schools or schools attended by students from high socioeconomic levels. Although the sample showed a similar distribution by sex and a slightly lower distribution of immigrant students compared with the population of the same area from which the participants were recruited, there may be differences between the sample and the population since convenience sampling was used, which may limit its representativeness. Finally, screening instruments were used to detect mental health problems, which does not imply a diagnosis of mental health disorder.

Despite the above, the results of this study show the prevalence of three common mental health problems in adolescence in students from subsidized private schools in the northern area of Santiago, which may be useful for the planning of local health services and communal public policies aimed at improving the mental health of the adolescent population. In addition, these results suggest that it is important to evaluate the possible comorbidity of different mental health problems in clinical settings since those who present one mental health problem are highly likely to present another. Also, given the high comorbidity, it is suggested that future studies evaluate the efficacy of transdiagnostic interventions aimed at preventing mental health problems, and it is recommended that sex differences be considered in their design and implementation.

Conclusions

Mental health problems during adolescence are highly prevalent. In this study, more than half of the adolescents were observed to meet the criteria for depression, generalized anxiety, and/or risk for problematic substance use. In addition, high comorbidity was observed, with more than a quarter of the adolescents meeting the criteria for two or more mental health problems. The sociodemographic variables examined showed different relationships with mental health problems: females showed higher levels of depression, anxiety, and number of problems; older age was associated with a higher risk of problematic substance use and number of problems; and not living with both parents was associated with depressive symptoms and risk of problematic substance use. The results account for the importance of assessing comorbidity in clinical work with adolescents and the development of transdiagnostic preventive interventions for this population.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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