MENTAL HEALTH STATUS OF BRAZILIAN ADOLESCENTS: ASSOCIATED FACTORS AND THE IMPACT OF THE HEALTH AT SCHOOL PROGRAM

Barbara Sant'ana Kuenka[1]
Cássia Kely Favoretto Costa[2]

ABSTRACT

This paper investigates the components associated with the mental health status perception of Brazilian adolescents and the impact of the Health at School Program (PSE) on such status. Using Brazilian schoolchildren microdata and Grossman's health production function theoretical framework, we estimated a probit and a Propensity Score Matching model for each respective analysis. Our findings show that (female) sex, risky behavior and exposure to bullying contribute negatively to adolescent mental well-being, while healthy eating and positive self-assessments of health and body imagery act as psycho-emotional protecting factors. Results also identified the PSE's beneficial impact on school mental health: even if it showed little influence on young women's psychosocial health, the program had a significant protective role against boys' levels of loneliness. We highlight the potential imperative role of the PSE in protecting the psychosocial status of Brazilian teenage schoolchildren, especially against socioeconomic, demographic and behavioral disadvantages.

Keywords: Mental health; Scholars; Quantitative methods; Propensity Score Matching; Health Economics.

RESUMO

Este estudo analisou os fatores associados à percepção do estado de saúde mental dos adolescentes brasileiros e o impacto do Programa Saúde na Escola (PSE) sobre esse estado. A partir dos microdados de escolares e sob o prisma teórico de uma função de produção em saúde proposta por Grossamn, foram estimados os modelos *probit* e *Propensity Score Matching* para as respectivas análises. Os resultados mostram que sexo (feminino), comportamento de risco e exposição ao *bullying* contribuem para a piora do *status* mental, enquanto alimentação saudável e autoavaliações positivas da saúde e do corpo são fatores de proteção psicoemocional. A avaliação do PSE sugere o impacto benéfico do programa sobre a saúde mental escolar. Mesmo exercendo pouca influência sobre as meninas, o programa teve significativo papel protetor contra os níveis de solidão dos meninos. Destaca-se a potencial função imperativa do PSE na proteção do estado psicossocial dos escolares brasileiros, sobretudo contra desvantagens socioeconômicas, demográficas e comportamentais.

Palavras-chave: Saúde mental. Escolares; Métodos quantitativos; *Propensity Score Matching*; Economia da Saúde.

JEL CODE: I1; I12; I18.

Área 2 – Desenvolvimento Econômico

---

[1] Mestre em Teoria Econômica pelo PCE/UEM. E-mail: barbarakuenka@gmail.com.
[2] Doutora em Economia Aplicada pelo PPGE/UFRGS e Docente Permanente do PCE/UEM. E-mail: ckfavoretto@uem.br.

1. INTRODUCTION

According to the World Health Organization (2017), around 4.4% and 3.6% of the world population suffer from clinical depression and anxiety disorders, respectively. Over the years, the worldwide prevalence of anxiety disorders has varied between 15% to 20% amongst children and adolescents only, while clinical depression remains one of teenage's leading diseases and suicide is the third leading cause of death amid 15 to 19 year olds (WORLD HEALTH ORGANIZATION, 2018; EUN, 2019; ZHOU, 2019). In Brazil, school adolescents have shown significant symptoms of psychological suffering: 44% of public school teenagers claimed to feel lonely and 36% reported suffering from insomnia (BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS, 2016).

Once the adolescent population represents a collective stock of human capital in formation, it is assumed that the potential debilitating nature of mental illnesses may result in the loss of present and future productivity for these individuals. Pathologies such as anxiety and depression are estimated to cost more than a trillion dollars a year in lost productivity; generating direct and indirect costs for patients, their families and healthcare systems (RAZZOUK, 2016; RAZZOUK, 2017; WORLD HEALTH ORGANIZATION, 2018).

Concerning the public policies designed for adolescent mental health in Brazil, the Health at School Program (PSE) stands out as an intersectoral policy for the integration of education and public health. Created in 2007, the PSE aims to promote prevention and healthcare actions in public schools, taking into account social and individual vulnerabilities that pose as obstacles to the development of children and adolescents (BRASIL, 2007). By providing a range of services going from dental treatments to antidrug and antibullying campaigns, the program targets to affect the behavior and to improve the physical and mental health of its beneficiary students (BRASIL, 2018).

In this study, we aim to analyze the components associated with the mental health perception status of Brazilian adolescents, as well as the impact of the Health at School Program (PSE) on the students' psychological well-being. First, we use the theoretical approach of Grossman's health production function (1972a; 1972b; 2000) and a probit model to identify the factors associated with our observations' mental health status. Then a Propensity Score Matching model is estimated in order to verify the effect of the PSE on such status. We use microdata from the 2015 National School Health Survey (NSHS) for both analyses.

Held in three editions (2009, 2012, 2015), the NSHS is a population survey created to monitor the situation of risk factors for the health of students and to detect priority areas for public policies. The questionnaire addresses the socioeconomic, domestic and behavioral conditions the individuals interviewed live under, such as family system characteristics, drug use and violence exposure (BRASIL, 2017). Based on the methodology of similar international questionnaires – the Self-Reporting Questionnaire (SRQ-20), the Global School-Based Health Survey (GSHS) and the Reynolds Adolescent Depression Scale 2nd Edition (RADS-2) – the NSHS incorporates elements like loneliness and insomnia as indicators for a deteriorating mental health status (FRICK; BARRY; KAMPHAUS, 2010; MCKINNON et al., 2016; SHARMA et al., 2017).

The pattern of direct relationship between loneliness and/or insomnia and psychological deterioration is repeatedly identified within the literature and confirms the criteria for questionnaires that investigate the psychological and somatic profile of adolescents in a given population (ZAWADZKI et al., 2013; BEUTEL et al., 2017). Loneliness and sleep disorders during adolescence negatively impact behavioral and psychological functioning, resulting in cognitive failures, relationship difficulties, generalized anxiety and clinical depression (SHARMA et al., 2017; JENKINS et al., 2019).

Based on Grossman's health production function model (1972a), we use the adolescents' mental health perception status as dependant variable in both econometric models estimated. Moreover, the variables were built from the linear sum of Brazilian adolescents' self-reports responses to loneliness and insomnia levels. Due to the heterogeneous and multidimensional nature of symptoms manifested in mental disorders, the NSHS – along with the international surveys mentioned above – offers the screening of psycho-emotional pathologies in detriment to the medical diagnosis itself (PAIXÃO et al., 2018). Therefore, we recognize the limitation in quantifying the prevalence or severity of mental disorders in the

groups interviewed, as well as the relative frailty of indicators constructed in this study (SANTOS et al., 2009). Also, such method of measuring dependent variables was adopted given the unavailability or absence of specific secondary data on mental disorders for adolescents in Brazil.

Several goal-related studies have used self-reported variables (insomnia, loneliness, body satisfaction, etc.) to analyze adolescent mental health conditions, in addition to confirming that socioeconomic and domestic circumstances have significant influence on teenage mental health and correlated risk factors (AVANCI et al., 2007; BENJET et al., 2009; KIM; HAGQUIST, 2018; HUANG et al.; 2019). As for the evaluation of public policies on the health status of adolescents, the literature presents a consistent pattern of socioeconomic (purchasing power, race, family relationships) and behavioral (drug use, alcohol consumption, sexual relations) factors associated with psycho-emotional disorders of young people in the global and Brazilian context (ANDRADE et al., 2012; ELSTAD; PEDERSEN, 2012; MALTA et al., 2014; ALAIE et al., 2018; LEMES et al., 2018; ANTUNES et al., 2018; JAEN-VARAS et al., 2019). As for the PSE in Brazil, very few studies have addressed its effects on the mental health of adolescents (FONTES et al., 2017; GIACOMOZZI et al., 2012; ATALIBA; MOURÃO, 2018).

Considering the high prevalence rates of anxiety and clinical depression in Brazil, the greater vulnerability of adolescents to the initial manifestation of the symptoms of psycho-emotional disorders and the personal, financial and epidemiological burden caused by them, we highlight the importance of the study of mental health in Economics. We consider that the contribution of this study occurs under three main approaches: (i) theoretically, by adapting Grossman's (1972a; 1972b; 2000) seminal model to the context of adolescent mental health and using a specific mental health production function for Brazilian adolescents – in which the "final product" corresponded to the perception of "not good" mental health and the "inputs" addressed consisted of the socioeconomic, demographic and behavioral factors reported by students; (ii) empirically, by partially filling the gap in the national literature regarding studies that evaluated the performance of the PSE in the field of school mental health; and finally (iii) offering evidence-based results that can be used to better understand and formulate public policies aimed at promoting adolescent mental health and the safety of society`s human capital.

This study is divided into three more sections. Section 2 describes the theoretical framework explores. Section three presents the data source, descriptive information on the variables and the empirical strategies. Section 4 addresses the results, discussion and some final considerations about the research.

2. ADOLESCENT MENTAL HEALTH PRODUCTION FUNCTION

Adolescence represents a period of biological changes and emotional adaptations –presenting itself as a crucial stage in one's psycho-emotional development (WORLD HEALTH ORGANIZATION, 2018). In this scenario, many conditions might influence a teenager's perception of mental health: the more exposed to risk factors (unstable family structure, abusive relationships, physical and sexual violence, socioeconomic deprivation, among others), the greater the negative psuchological impact (COLEY et al., 2018).

According to Grossman (1972a), individuals are health producers. Therefore, the search for "inputs" for such production elevates the demand for medical services. In order to elaborate a demand model for "good health", the author approaches our "health stock" as a durable capital stock capable of generating a healthy amount of time. Each individual inherits an initial stock of health that – despite being subject to increasing depreciation rates over time – can be increased via investment (PHELPS, 2016).

Health capital corresponds to a production process composed of the consumption of goods and services necessary for the care of one's own health, added to the time that the individual dedicates to being healthy (GROSSMAN, 1972a, 1972b; NIXON; ULMANN, 2006; OLUWATOYIN, 2015). The demand for health capital originates from individual behavior, as in the way individuals combine the resources available to them when they seek to expand their health stock. Through this process, the gross investment in the health capital of agents is determined by individual production functions, whose inputs

consist of a series of elements: medical care, educational level, disposable income, age, lifestyle, genetics and environmental aspects (FOLLAND; GOODMAN; STANO, 2013; PHELPS, 2016).

Given the purpose of this study, we adapt Grossman's idea (1972a; 1972b; 2000) – which refers to health in general – exclusively to a mental health production function for Brazilian adolescents. As identified in Health Economics literature, such kind of adaptation is commonly made to estimate mental health production functions for groups without age distinction (KNESPER et al., 1987; ALEGRÍA et al., 2003; RAMOS, 2009; OHRNBERGER et al., 2017); however, little is found when the focus is on this specific audience.

Thus, the mental health production function for Brazilian adolescents can be generically expressed by:

$$MHS = F \text{ (genetics, lifestyle, socioeconomics, demographics, environment, etc.) (1)}$$

in which MHS refers to the mental health status of adolescents and the terms in parentheses correspond to the inputs necessary to generate such status – quantitative or qualitative improvements in these factors produce more "mentally healthy" days. Consequently, the marginal product of each input consists of an increase in the quality of mental health caused by an additional unit of that input, *ceteris paribus* – the higher the consumption of a production factor, the smaller the increments added to the final product (FOLLAND; GOODMAN; STANO, 2013; JAEN-VARAS et al., 2019).

Fig. 1 shows the graphic form of a mentally healthy days production function: the relationship between the adolescent's mental health stock (M_i) and the number of healthy days produced from a psychological point of view (m_i) – whose maximum duration is 365 days. As adolescents "invest" in their mental health capital – whether through healthy eating, physical activity or a good relationship with their families – their number of mentally healthy days increases (GROSSMAN, 1972a; 2000). On the other hand, when the mental health stock is minimal (M_{min}), the number of mentally healthy days equals zero. M_{min} is the graphical representation of null mental health and, therefore, death (situation of suicide, for instance). Since marginal productivity of inputs is decreasing, the mentally healthy time increases at a gradually lower rate from the M_{min}, eventually approaching the asymptotic curve of 365 days (ZWEIFEL; BREYER; KIFMANN, 2009; BHATTACHARYA; HYDE; TU, 2014).
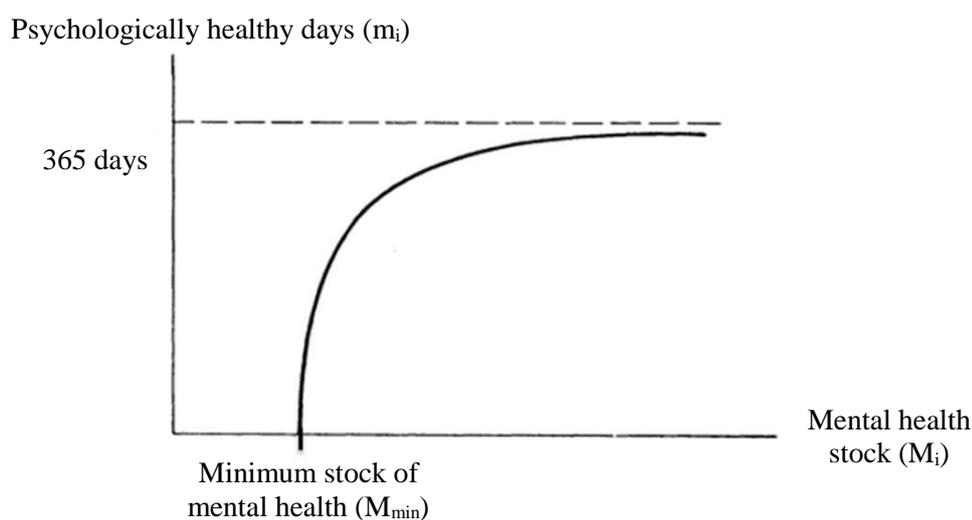

Fig. 1. Relationship between adolescent mental health stock and number of mentally healthy days
Source: Adapted from Grossman (1972a).

3. DATA

We use information from the 2015 National School Health Survey (NSHS), a population survey that includes students from public and private schools residing in the urban and rural areas of the 26

Brazilian capitals, major regions municipalities and the Federal District. The 2015 edition includes a sample of students in the 9th grade of elementary school (Sample 1) and another smaller sample of students (Sample 2) from the 6th grade of elementary school to the 3rd year of high school (3rd year of high school corresponds to the final school year in Brazil). We chose to use Sample 1 in its original form and another sample made from the sum of samples 1 and 2.

Table 1 – Description of dependent and explanatory variables

Variable	Definition	Description
Dependent: Mental health		
Loneliness	In the past 12 months, how often have you felt alone?	0 for Never and Rarely; 1 for Sometimes, Most of the Time and Always
Insomnia	In the past 12 months, how often have you been unable to sleep at night because something worried you a lot?	0 for Never and Rarely; 1 for Sometimes, Most of the Time and Always
Socioeconomic and demographic		
Gender	What is your gender?	0 for Male; 1 for Female
Race	What is your color or race?	0 for Black, Mixed Race, Yellow and Indigenous; 1 for White
Paid work	Do you receive money for this job or business? (Continuing from the question "Do you currently have a job or business?")	0 for No; 1 for Yes
Live with mother and/or father	Do you live with you mother? / Do you live with your father?	0 for No; 1 for Yes
Hunger	In the past 30 days, how often have you been hungry because you didn't have enough food in your home?	0 for Never and Rarely; 1 Always, Most of the Time and Sometimes
Macroregion	Regions of Brazil	Binary variable for each region of the country (North, Northeast, South, Southeast and Midwest)
Behavioral		
School lag	What year were you born?/ What grade are you in?	0 for No School Lag; 1 for School Lag
Food consumption	In the past 7 days, on how many days did you eat at least one type of vegetable? / In the past 7 days, how many days did you eat fresh fruit or fruit salad?	0 for None; 1 for three or more days
Physical activity	In the past 7 days, on how many days have you been doing physical activity for at least 60 minutes (1 hour) per day? (Add all the time you spent on any type of physical activity each day)	0 for None; 1 for three or more days
Risk behavior	In the past 30 days, how many days have you had at least a glass or a dose of alcohol? / In the past 30 days, how many days have you smoked cigarettes? / In the past 30 days, how many days have you used drugs such as weed, cocaine, crack, cola, loló, "lança-perfume", ecstasy, oxy, etc?	0 for None; 1 for one or more days
Sexual intercourse	Have you ever had sex?	0 for No; 1 for Yes
Bullying	In the past 30 days, how often have any of your schoolmates made fun of you, teased you, intimidated you or made fun of you so much that you were hurt, annoyed, upset, offended, or humiliated?	0 for None; 1 to Rarely, Sometimes, Most of the Time and Always
Sexual abuse	Have you ever been forced to have sex in your life?	0 for No; 1 for Yes
Health self-assessment	How would you rate your health status?	0 for Bad and Very Bad; 1 for Very Good, Good and Regular
Body self-assessment	How do you feel about your body?	for Dissatisfied and Very Dissatisfied; 1 for Very Satisfied, Satisfied and Indifferent
Management		
School type	Administrative dependency of the school	0 for Public; 1 for Private

Source: Results of the research.

Table 1 shows the description of the variables selected. Variables of interest consisted of loneliness, insomnia and the self-perception of mental health status – the latter constructed from the linear sum of responses referring to loneliness and insomnia. In the form of binary variable, an observation assumes the value of "1" if answered "Yes" to both feeling lonely and having frequent insomnia. For this category, the perception of mental health status is classified as "not good". Observations that answered with "No" to at least one of these two questions assume value "0" and are considered to have "good" mental health.

Regarding the inputs (explanatory variables) used in the students' mental health production function, socioeconomic, demographic and behavioral factors stand out, which were chosen based on theoretical and empirical review. For the purpose of compatibility with the empirical literature, we also constructed variables by combining two or more questions from the NSHS.

Family structure is encaptured by whether the student lives with their father and/or mother – assuming unit value if claimed to live with at least one of the parents. We measured school lag based on the age-grade distortion concept that sets the student a limit of two years to be enrolled in their recommended grade (INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA, 2018). The measure of eating habits combined answers to questions about vegetable and fruit consumption – adolescents who consumed fruits and vegetables at least three times a week were considered to have healthy eating habits (LEVY et al., 2010; BARUFALDI et al., 2015; BENTO et al., 2015).

Physical activity was constructed by addressing the criterion recommended by the Brazilian Society of Pediatrics (2017), which is for teenagers to exercise at least three days (or one hour a day) during the week. Lastly, students who consumed alcoholic beverages, nicotine cigarettes or psychoactive drugs at least once during the 30 days prior to the application of the questionnaire were considered to practice risk behavior (OLIVEIRA et al., 2019).

Considering that in the production function the variables loneliness, insomnia and perception of "not good" mental health status are final products that express negative perceptions of students, it is admitted that inputs that positively affect the final product are acting as elements that deteriorate the state of mental health of the analyzed observations. Those with negative effects are responsible for improving or at least protecting the psycho-emotional status of adolescents.

In the second stage of the study, we estimate PSE's impact on the mental health status of Brazilian students attending the public schools that joined the program. We estimate the effect for Sample 1 separately and then for the group corresponding to the sum of samples 1 and 2, given the relatively small size of the second sample. Since the PSE is aimed at public schools only, all private schools were excluded from the econometric estimates. We then compared public schools participating in the PSE to public schools that did not participate (but were eligible to do so).

Under the methodology of the Propensity Score Matching, the information in the mental health block alternated as a variable of interest (outcome), while some of the variables previously used as "inputs" (race, regions of Brazil, bullying, physical activity and risk behavior) assumed the role of control variables to estimate the impact of the PSE on the participating students. The selection criterion for the choice of controls is justified by the need to balance the model before pairing. We followed the recommendation to select only variables that may simultaneously influence both participations in the program and generated outcomes (CUONG, 2012).

Considering it is a program aiming the improvement of aspects that might affect – directly and indirectly – the psychological plenitude of students, we assumed that PSE's effect is significant and beneficial (negative sign) to the indicators of loneliness, insomnia and "not good" mental health for both sexes, (BRASIL, 2011).

On the subject of sampling stratification, all observations that were either missing or did not fit the criteria for constructing the variables were excluded. For the probit estimations, the total sample of students attending 9th grade was 12,390 and the total of students attending from 6th grade to 3rd year of high school (HS) was 14,777. For the Health at School Program (PSE) evaluation, the total number of observations attending 9th grade was 42,290 participants (treated) for 5,405 non-participants (untreated). The total number of observations attending from 6th grade to 3rd year/HS was 47,758 treated for 6,125

untreated. It was possible to deal with relatively large samples, reducing the possibility of bias in the estimates. All estimates were made using the STATA software version 13.

3.1 DESCRIPTIVE STATISTICS

Table 2 shows the description of the interviewees' samples from the 2015 NSHS. Among 9th grade students, 44.73% claimed they felt alone, 36.21% reported experiencing frequent insomnia and 24.42% had perceived mental health status classified as "not good". Within the sample of students attending from 6th grade to 3rd year/HS, 44.5% reported feelings of loneliness, 36.28% declared frequent insomnia and 24.4% showed indications of "not good" mental health.

Table 2 - Descriptive profile of the dependent variables loneliness, insomnia and perception of mental health status related to schoolchildren

Variables	Attending 9th grade 2015 (n=101,527)			Attending 6th grade to the 3rd year/HS 2015 (n=117,992)		
	General %	Boys %	Girls %	General %	Boys %	Girls %
Loneliness						
No	55.27	32.41	22.86	55.5	32.52	22.99
Yes	44.73	15.76	28.96	44.5	15.91	28.59
Insônia						
No	63.79	35.32	28.46	63.72	35.29	28.43
Yes	36.21	12.85	23.36	36.28	13.13	23.14
Perception of mental health status						
Good mental health	75.58	40.84	34.75	75.6	40.91	34.68
"Not good" mental health	24.42	7.34	17.08	24.4	7.50	16.88

Note: The percentage for each sex in each sample is calculated based on the total number of observations (n) in their respective "general" group.
Source: Results of the research.

Girls showed the highest percentages of loneliness and insomnia in all observed samples (28.96% and 28.59% for loneliness and 23.36% and 23.14% for insomnia, respectively) when compared to boys (15.76% and 15.91% for loneliness and 12.85% and 13.13% for insomnia). Due to the predominance of the female audience in the percentage of loneliness and insomnia, girls were the majority among the observations that revealed a perception of "not good" mental health in the two sample blocks. The participation of boys with "not good" mental health was 7.34% among 9th grade students and 7.5% among boys from 6th grade to 3rd year/HS. Considering only the female group, 17.08% of 9th graders and 16.88% attending from 6th grade to 3rd year/HS reported "not good" mental health.

Table 3 shows the descriptive socioeconomic, demographic and behavioral profiles of students interviewed by the NSHS. In both samples, the majority of interviewees were female and non-white students from public schools. The Northeast region had the largest share of representatives in both samples, followed by the North region.

Analyzing 9th grade interviewees, 7.39% of boys and 4.03% of girls received financial compensation for some type of work in 2015. About 5% of male and 6% of female schoolchildren claimed to have suffered from hunger for not having any food at home (famine). Healthy food consumption was around 19% for boys and girls in both samples, while 7% of boys and 5% of girls reported age-grade distortion (school lag).

The behavioral factors (Table 3) that might draw the most attention are the ones expressing large discrepancies between the sexes – the difference between boys and girls who practice physical activity regularly was approximately 10 percentage points in favor of the male group in both samples analyzed. In addition, 17% of boys and 10% of girls have had sexual intercourse before.

On the other hand, there was a larger female participation in alcohol and other drugs consumption. From the subjective point of view, it is noted that most students of both sexes had a good perception of their own health and body. 5.66% of boys attending 9th grade and 5.76% of boys attending from 6th grade

to the 3rd year/HS had a negative body perception, while 12.17% of girls reported being dissatisfied with their own bodies in both samples.

Furthermore, the percentage of young people exposed to bullying was approximately 44%. As for sexual violence, 4.03% of students from 9th grade and 3.96% of students from 6th grade to 3rd grade/HS reported that they had already suffered sexual abuse – the highest percentage of victims being in the female group.

Table 3 – Descriptive socioeconomic and behavioral profile of students

Variable	Attending 9th grade 2015 (n = 99,285)			Attending 6th grade to the 3rd year/HS 2015 (n = 115,224)		
	General (%)	Boys (%)	Girls (%)	General (%)	Boys (%)	Girls (%)
Socioeconomic and demographic						
Sex		47.91	52.09		48.17	51.83
(White) Race	33.21	16.62	16.59	34.13	17.17	16.97
Paid work	11.42	7.39	4.03	11.73	7.54	4.19
Live with mother and / or father	93.53	45.16	48.37	93.52	45.39	48.13
Famine	11.43	5.03	6.4	11.44	5.1	6.34
North Region	23.44	11.38	12.06	22.89	11.14	11.75
Northeast Region	35.61	16.5	19.11	33.56	15.61	17.95
Southeast Region	17.49	8.53	8.95	17.83	8.73	9.1
South Region	9.59	4.71	4.88	10.93	5.46	5.47
Midwest Region	13.87	6.78	7.08	14.8	7.24	7.56
Behavioral						
School Lag	12.14	7.01	5.14	12.13	7.04	5.09
(Healthy) Food consumption	38.09	19.06	19.03	38.45	19.3	19.15
Practices physical activity regularly	37.18	23.53	13.64	37.13	23.47	13.66
Risk behavior	23.14	10.77	12.37	23	10.83	12.17
(Have had) Sexual intercourse	27.88	17.66	10.21	27.75	17.4	10.35
Bullying	44.22	21.58	22.64	44.25	21.74	22.51
Sexual abuse	4.03	1.67	2.36	3.95	1.65	2.3
(Good) Health self-assessment	92.25	44.49	47.76	92.4	44.8	47.6
(Good) Body self-assessment	82.17	42.25	39.92	82.06	42.41	39.65
Management						
Public school	79.2	37.83	41.37	78.53	37.75	40.78
Private school	20.8	10.08	10.72	21.47	10.43	11.04

Source: Results of the research.

4. EMPIRICAL APPROACH

The use of probit as a binary response model originates from the search to avoid the main limitations of linear probability models – which correspond to their adjusted values being less than zero or greater than one and the partial effect of any independent variable is constant (WOOLDRIDGE, 2013). Whereas the information collected as variables of interest consists of discrete values, the dependent variable y "perception of the student's mental health status" assumes only zero or one value in the process of estimating the mental health production function for Brazilian adolescents. Thus, the model takes the following form:

$$P\left(MHS = 1|x\right) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k = G(\beta_0 + x\beta) \qquad (2)$$

Where $x\beta = \beta_1 x_1 + \cdots + \beta_k x_k$. In equation (2), MHS corresponds to the mental health status perception (*mental health status*) of Brazilian adolescents and *x* is the vector of socioeconomic, demographic, and behavioral variables that may represent statistically significant associated factors for the construction of this psycho-emotional status (GREENE, 2014).

Due to the impossibility of intervening directly in the environment and observed sample characteristics, non-experimental studies end up disregarding the randomization of their observation units – becoming more susceptible to the presence of selection bias (SOUZA, 2010). Covariates can have

different probability distributions, which means groups are not fully comparable and the effect estimates of a given treatment or policy becomes biased.

In this context, we opted for the propensity score matching (PSM) model. When estimating the impacts of treatment, propensity scores represent an efficient alternative to eliminate any potential bias (ROSENBAUM; RUBIN, 1983). In general terms, the PSM builds a statistical comparison group by modeling the likelihood that a group will participate in a given intervention based on observable characteristics not affected by the intervention itself (KHANDER; KOOLWAL; SAMAD, 2010). Thus, it is necessary to create a control group that is as similar as possible in observable characteristics to the treatment group (KHANDER; KOOLWAL; SAMAD, 2010). Thereafter, each treated observation is paired with an observationally similar counterfactual as they now share identical probability distributions and propensity scores. The difference between the average results in the treated and control groups is the unbiased estimate of the average treatment effect (SOUZA, 2010).

Hence, we use the PSM methodology to: (i) estimate the probability of Brazilian adolescents to attend a public school that has performed PSE activities in the year in which the information was collected (treatment); (ii) based on this probability, find in the same sample adolescents from public schools who did not participate in the program but have similar characteristics to students who were exposed to the program and (iii) pair PSE participants and non-participants to capture the effect of the program on the observations' mental health perception status.

The effect of the PSE on the mental health perception status of students is represented by the average effect of treatment on the treated (ATT), formally expressed by:

$$ATT = E[Y_i(1) - Y_i(0)|T_i = 1] = E[Y_i(1)|T_i = 1] - E[Y_i(0)|T_i = 1] \qquad (3)$$

Once the goal is to compare outcomes for students exposed to the program (T = 1) and for those who were not (T = 0; in which T stands for Treatment), the estimation of a participation model was here performed by a probit model.

Considering equation (3), it is possible to predict the outcomes that represent the propensity scores. In this context, each participant and non-participant presents an estimated score in the form $\hat{P}(X|T = 1) = \hat{P}(X)$. Then, we define the common support region in which the distribution of treatment propensity scores and control group overlap. Finally, the pairing between treated and counterfactuals can be completed (ROSENBAUM; RUBIN, 1983).

The pairing of treated and non-treated propensity scores can be achieved through a series of different techniques (AUSTIN et al., 2018). Ultimately, they entail calculating a weight for each matched treated and untreated pair; the means different techniques will assign their particular weights to the pairs, resulting in different estimates (ZANUTTO, 2006).

Surveys commonly use the nearest neighbor matching, which consists of matching each treated unit with a non-treated unit that has the closest propensity score (CALIENDO; KOPEINIG, 2008). Meanwhile, Khander, Koolwal and Samad (2010) point out that the distance between scores of the treated unit and its non-participating neighbor may remain large even with the nearest neighbor estimation, therefore generating statistically undesirable matchings. To avoid this from happening, an interval (caliper) of maximum distance between propensity scores is established so that different treated units can be paired with the same non-treated. The risk of this technique is that a very small number of non-participants that satisfy the range constraint remain available. That makes the kernel matching an interesting alternative to add to the estimation process. This particular form of nonparametric matching is characterized by using a weighted average of all non-participants to build an equivalent counterfactual for each participant – the average treatment effect is equal to the average difference in outcomes in the common support area, weighting the units of comparison by the distribution of propensity scores (CALIENDO; KOPEINIG, 2008; KHANDER; KOOLWAL; SAMAD, 2010).

5 RESULTS

5.1 PROBIT ANALYSIS

Table 4 shows the estimated probit models results referring to the variables loneliness and insomnia for Brazilian adolescents in 2015. We observe that girls were more likely to feel lonely. The socioeconomic variables revealed that famine was directly related to feelings of loneliness and that living with at least one parent had a protective effect only for boys. Living in the Southeast region contributed to ease feelings of loneliness among young people, with the sole exception of 9th grader males.

Risky behavior was harmful for all groups, as school lag had a negative effect for the mental health of the general group and boys in 9th grade. Both violence exposure variables (bullying and sexual abuse) contributed to make adolescents of all samples feel lonelier. In contrast, the subjective variables of perception revealed that teenagers who were more satisfied with their own health and bodies felt less alone. Students who had healthy eating habits also felt less lonely and regular physical activity proved to be a protective agent against feelings of loneliness for male students. As for school management, attending public schools had a protective effect against the loneliness of 9th graders in the general and male groups.

Pertaining to insomnia, results indicate that girls had greater difficulties in having a healthy sleep (Table 4). Living with at least one parent represented a factor of improvement and/or prevention of insomnia for the general group and boys attending 9th grade, while famine had a significant aggravating role for all groups. Furthermore, schoolchildren of both sexes, living in the North and Northeast regions, were more likely to suffer from insomnia. Race and paid work did not show any significant results.

Adolescents of both sexes who had already had sexual intercourse and exhibited risky behavior were more likely to suffer from difficulties with sleeping, as well as the general and male groups of both samples who are falling behind in school. Healthy eating habits were relevant to prevent insomnia only for male 9th graders, whilst regular physical activity was harmful to female adolescents.

Moreover, bullying and exposure to sexual abuse were prominent factors for the mental deterioration of all groups and samples, demonstrating that young people exposed to such forms of violence had more difficulties to sleep. Male and female adolescents who were satisfied about their health and bodies were less likely to suffer from insomnia, as well as those who attended public schools.

Table 5 presents the results regarding the mental health perception status of Brazilian students observed. In general, we identified the same behavior previously shown by the female sex and the famine component, those that contributed negatively to the mental health of adolescents. Simultaneously, living with at least one of the parents had an overall protective effect on the boys. In demographic terms, male 9th graders residing in the North region showed greater chances of dealing with unhealthy psychological conditions, whereas females residing in the South and Southeast regions were more inclined to present a good perception of psycho-emotional health.

As for the lifestyle aspect, we note the significant degree of influence of risky behavior on the mental health of students. Positive for all groups, the variable that captures the consumption of alcohol and other drugs reflected its direct relationship with the deterioration of adolescent mental health. In addition, school lag played a significant detrimental role for boys in the 9th grade, while regular physical activity practice – in an unexpected result – proved itself harmful for girls attending from 6th grade to 3rd year/HS.

Table 4 – Marginal effects of the estimated probit models, loneliness and insomnia as dependent variables

	Loneliness						Insomnia					
	Attending 9th grade			Attending 6th grade to 3rd year/HS			Attending 9th grade			Attending 6th grade to 3rd year/HS		
Variables	General	Boys	Girls	General	Boys	Girls	General	Boys	Girls	General	Boys	Girls
	(n=12,390)	(n=7,988)	(n=4,402)	(n=14,777)	(n=9,483)	(n=5,294)	(n=12,390)	(n=7,988)	(n=4,402)	(n=14,777)	(n=9,483)	(n=5,294)
Socioeconomic and demographic												
Gender (female)	0.2303***			0.2213***			0.2132***			0.2114***		
Race	-0.0001	0.0042	-0.0099	-0.0056	-0.0002	-0.0169	-0.0082	-0.0122	0.0024	-0.0150*	-0.0185*	-0.0065
Paid work	-0.0263	-0.0186	-0.0357	-0.0186	-0.0143	-0.0229	-0.0172	-0.0264	0.0009	-0.015	-0.0292	0.0131
Live with mother/ father	-0.0284	-0.0410*	-0.0091	-0.0370**	-0.0457**	-0.0231	-0.0286*	-0.0522**	0.0141	-0.0224	-0.0463**	0.0186
Famine	0.1329***	0.1499***	0.0907***	0.1400***	0.1552***	0.1004***	0.1494***	0.1509***	0.0136***	0.1527***	0.1552***	0.1368***
North Region	0.0187	0.0202	0.0075	0.0111	0.0122	0.004	0.0361**	0.0376**	0.0285	0.0285**	0.0251*	0.0315
Northeast Region	0.011	0.0107	0.0090	0.0108	0.0109	0.0095	0.0490***	0.0461***	0.0543**	0.0415***	0.0367**	0.0505**
Southeast Region	-0.0410*	-0.0278	-0.0633**	-0.0461***	-0.0352**	-0.0621***	0.0061	0.0137	-0.0081	-0.0037	0.0052	-0.021
South Region	-0.0132	-0.0101	-0.0194	-0.0138	-0.0113	-0.0186	0.0076	0.0321	-0.0426	0.0104	0.0259	-0.0221
Midwest Region	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Behavioral												
School Lag	0.0226*	0.0351***	-0.0058	0.0159	0.0273**	-0.0092	0.0315***	0.0325**	0.0266	0.0186*	0.0201*	0.0164
Food consumption	-0.0291***	-0.0283**	-0.0280*	-0.0326***	-0.0287***	-0.0357**	-0.0126	-0.0198*	0.0026	-0.0123	-0.0152	-0.0048
Physical activity	-0.0244**	-0.0340***	-0.0022	-0.0221**	-0.0299***	-0.0031	0.01498	0.0071	0.0310*	0.0153*	0.0099	0.0264*
Risk behavior	0.0656***	0.0434***	0.0940***	0.0621***	0.0411***	0.0905***	0.0924***	0.0767***	0.1123***	0.0887***	0.0711***	0.1126***
Sexual intercourse	0.0179*	0.0211*	0.0151	0.0115	0.013	0.0122	0.0549***	0.0384***	0.0901***	0.0508***	0.0357***	0.08191***
Bullying	0.1380***	0.1308***	0.1331***	0.1468***	0.1378***	0.1458***	0.1055***	0.0944***	0.1153***	0.1092***	0.1004***	0.1150***
Sexual abuse	0.0707***	0.0372*	0.1177***	0.0784***	0.0444**	0.1234***	0.0549***	0.0488**	0.0593**	0.0612***	0.0574***	0.0615**
Health self-assessment	-0.0648***	-0.0633***	-0.0606**	-0.0649***	-0.0647***	-0.0577***	-0.0739***	-0.0802***	-0.0572**	-0.0741***	-0.0733***	-0.0694***
Body self-assessment	-0.1644***	-0.1482***	-0.1664***	-0.1601***	-0.1534***	-0.1530***	-0.0863***	-0.0750***	-0.0988***	-0.0790***	-0.0750***	-0.0833***
Management												
Public school	-0.0303**	-0.0341**	-0.0205	-0.0199	-0.0192	-0.0221	-0.0398***	-0.0289*	-0.0590**	-0.0404***	-0.0272*	-0.0657***
Private school	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Log pseudolikelihood	-7742.21	-4938.67	-2790.67	-9250.26	-5877.45	-3360.27	-7605.35	-4703.76	-2889.53	-9107.77	-5608.78	-3486.73
Wald test	1388.27***	462.26***	319.75***	1646.75***	568.57***	396.69***	1161.84***	419.17***	308.21***	1355.07***	482.93***	347.54***
Pseudo R2	0.0887	0.0466	0.0593	0.0878	0.0479	0.0601	0.0747	0.0436	0.0527	0.0727	0.0419	0.0494

Notes: *** Significant at 1%. ** Significant at 5%. * Significant at 10%.
Source: Results of the research.

All variables that sought to represent violence exposure and health/body self-assessment (Table 5) were statistically significant for all groups. The good perception of one's own body and health had a positive influence on the improvement of mental health status, but bullying and sexual abuse represented significantly harmful components to the psychological well-being of adolescents.

Table 5 - Marginal effects of the estimated probit models, perception of "not good" mental health status as a dependent variable

| | Perception of mental health status | | | | | |
| | Attending 9th grade | | | Attending 6th grade to 3rd year/HS | | |
Variables	General (n=12,390)	Boys (n=7,988)	Girls (n=4,402)	General (n=14,777)	Boys (n=9,483)	Girls (n=5,294)
Socioeconomic and demographic						
Gender (female)	0.1917***			0.1898***		
Race	-0.0022	-0.0053	0.0057	-0.0079	-0.0087	-0.0058
Paid work	-0.0117	-0.0155	-0.0035	-0.0112	-0.0215	0.0106
Live with mother / father	-0.023	-0.0463**	0.0117	-0.0221*	-0.0427***	0.0132
Famine	0.1285***	0.1192***	0.1351***	0.1343***	0.1251***	0.1396***
North Region	0.0210*	0.0268**	0.0041	0.0126	0.0137	0.0072
Northeast Region	0.0109	0.0139	0.0057	0.0085	0.0098	0.0077
Southeast Region	-0.0144	0.0035	-0.0500**	-0.0241**	-0.0086	-0.0535**
South Region	-0.0109	0.0114	-0.0586**	-0.0101	0.0058	-0.0443*
Midwest Region	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Behavioral						
School Lag	0.0166*	0.0185*	0.0112	0.0124	0.0150	0.0077
Food consumption	-0.0033	-0.0034	-0.0029	-0.0058	-0.0050	-0.0060
Physical activity	0.0026	-0.0062	0.2287	0.0052	-0.0034	0.0249*
Risk behavior	0.0712***	0.0502***	0.1052***	0.0651***	0.0425***	0.1028***
Sexual intercourse	0.0275**	0.0168*	0.0538***	0.0255***	0.0155*	0.0502***
Bullying	0.0967***	0.0819***	0.1158***	0.1030***	0.0880***	0.1224***
Sexual abuse	0.0683***	0.0435**	0.1071***	0.0796***	0.0529***	0.1191***
Health self-assessment	-0.0750***	-0.0729***	-0.0727***	-0.0711***	-0.0666***	-0.0733***
Body self-assessment	-0.1161***	-0.0936***	-0.1467***	-0.1084***	-0.0930***	-0.1299***
Management						
Public school	-0.0259**	-0.0189	-0.0396	-0.0216*	-0.0113	-0.0439*
Private school	(omitido)	(omitido)	(omitido)	(omitido)	(omitido)	(omitido)
Log pseudolikelihood	-6305.20	-3554.69	-2739.47	-7573.91	-4259.51	-3301.06
Wald test	1256.73***	404.28***	347.56***	1479.19***	482.36***	407.47***
Pseudo R2	0.0961	0.0549	0.0624	0.0941	0.0542	0.0610

Notes: *** Significant at 1%. ** Significant at 5%. * Significant at 10%.
Source: Results of the research.

5.2 PROPENSITY SCORE MATCHING ANALYSIS

In order to to verify the PSE's impact on the mental health perception status of students, we applied the Propensity Score Matching method to each group (general, boys and girls) in both samples analyzed (9th grade students and 6th grade students to 3rd year/HS). As a "not good" mental health perspective is adopted as reference, we emphasize that effects presented with a negative sign actually mean a beneficial impact on adolescent mental health. The estimates are presented in Table 6.

Table 6 – ATT effect of the Health at School Program (PSE) on the perception of "not good" mental health status, loneliness and insomnia

Variables of interest	Attending 9th grade			Attending 6th grade to 3rd year/HS		
	General	Boys	Girls	General	Boys	Girls
Perception of "not good" mental health status						
Nearest neighbor	-0.006	-0.004	-0.008	-0.004	-0.002	-0.005
Radius matching 0,1	-0.006	-0.005	-0.007	-0.005*	-0.004	-0.006
Radius matching 0,01	-0.005**	-0.002	-0.003	-0.004*	-0.002	-0.003
Kernel matching 0,06	-0.005**	-0.005	-0.007	-0.005	-0.004	-0.006
Loneliness						
Nearest neighbor	-0.010	-0.026**	0.005	-0.010	-0.026***	0.005
Radius matching 0,1	-0.009	-0.028***	0.006	-0.011***	-0.029***	0.005
Radius matching 0,01	-0.009**	-0.023***	0.013	-0.010	-0.024***	0.010
Kernel matching 0,06	-0.009**	-0.028***	0.007	-0.011**	-0.028***	0.005
Insomnia						
Nearest neighbor	-0.006	0.001	-0.011*	-0.002	0.002	-0.005
Radius matching 0,1	-0.007*	-0.005	-0.011	-0.005	-0.003	-0.007
Radius matching 0,01	-0.006**	-0.001	-0.005	-0.003	0.001	-0.005
Kernel matching 0,06	-0.007***	-0.004	-0.010	-0.005	-0.003	-0.006
n treated	42.290	20.097	22.193	47.758	22.832	24.926
n control	5.405	2.588	2.817	6.125	2.938	3.187
n blocks	8	10	8	8	9	8
Control variables						
Race						
Regions of Brazil						
Bullying						
Physical activity						
Risk behavior						

Notes: *** Significant at 1%. ** Significant at 5%. * Significant at 10%.
Source: Results of the research.

Focusing first on the mental health perception status as a whole, we observe that the program had a beneficial impact for the general groups of both students attending 9th grade and atudents attending from 6th grade to 3rd year/HS. Despite showing the expected signs, the specific results for boys and girls were not statistically significant.

Individually, loneliness was the variable of interest most affected by the program: we were able to identify beneficial impacts on the boys' levels of loneliness in both samples and under all matching techniques. Influenced by the favorable results within the male groups, the program was still statistically significant in improving the general group levels of loneliness in the two samples analyzed.

As for the final outcome, the PSE's impact on adolescent levels of insomnia was statistically significant for 9th graders in the general group. Finally, in the only statistically relevant result for the female group in the entire sample, we identify the program's contribution to reduce the levels of insomnia of female 9th graders.

Table 7 shows the tests that verified the level of reliability in the matching process, as well as the differences between treated and counterfactuals. We observe that bias – the difference between the groups being compared – was reduced to a minimum in all samples (general, boys and girls). Values for B (Rubin's B) – which consist of the absolute standardized difference of the means between treated and counterfactuals and which must be below 25% – were also all reduced to zero. Values for R (Rubin's R) – the ratio of treated and counterfactual variances of propensity scores – were all set within the recommended range of 0.5 and 2 (RUBIN, 2001). Null values for pseudo-R^2 and the non-significance of

the chi-square tests after pairing are also indicators that the matching process was appropriate and the results came from comparable groups (HAGEN, 2016).

Table 7 – Balancing between treated and control groups, before and after pairing

		Attending ninth-grade					Attending sixth-grade to third year/HS				
		General									
Interest variable	**Status**	**Pseudo R²**	**Chi-square**	**Mean Bias**	**B (%)**	**R**	**Pseudo R²**	**Chi-square**	**Mean Bias**	**B (%)**	**R**
Loneliness, Insomnia, Mental health	Unmatched	0.006	196.16***	5.3	20.2	0.95	0.005	172.31***	4.7	17.8	0.97
	Matched	0.000	0.00	0.0	0.0	1.00	0.000	0.00	0.0	0.0	1.00
		Boys									
		Pseudo R²	**Chi-square**	**Mean Bias**	**B (%)**	**R**	**Pseudo R²**	**Chi-square**	**Mean Bias**	**B (%)**	**R**
Loneliness, Insomnia, Mental health	Unmatched	0.007	113.12***	6.1	22.3	0.99	0.005	95.6***	5.3	19.2	0.96
	Matched	0.000	0.00	0.0	0.0	1.00	0.000	0.00	0.0	0.0	1.00
		Girls									
		Pseudo R²	**Chi-square**	**Mean Bias**	**B (%)**	**R**	**Pseudo R²**	**Chi-square**	**Mean Bias**	**B (%)**	**R**
Loneliness, Insomnia, Mental health	Unmatched	0.005	89.40***	5.0	18.8	0.92	0.004	84.43***	4.5	17.3	0.97
	Matched	0.000	0.00	0.0	0.0	1.00	0.000	0.00	0.0	0.0	1.00

Notes: *** Significant at 1%. Desirable parameters: low pseudo-R²; mean biases below 5; B below 25%; and R between 0.5 and 2 (RUBIN, 2001; HAGEN, 2016).
Source: Results of the research.

5.3 DISCUSSION

Several studies have shown that women present the highest prevalence rates of mental disorders worldwide, as girls live with twice the risk of developing depressive disorders (BOYD et al., 2015; SASSARINI, 2016; KUEHNEN, 2017). Other previous findings addressed how healthy family relationships and parental supervision are effective in protecting teenagers from developing common mental disorders (ANDRADE et al., 2012; ANTUNES et al., 2018).

Demographic aspects – confirmed by indicators such as per capita income or basic household conditions – highlighted the socioeconomic discrepancies inherent to the persistent inequalities between South and Southeast Brazil and the North and Northeast regions of the country (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2019). In this scenario, socioeconomic disadvantages actively interfere in the adolescent's maturing process, which can result in moderate or severe psychological complications (ELSTAD; PEDERSEN, 2012).

Academic components like school lag, school dropout or the excessive pressure for high grades had previously been linked to substance abuse and clinical depression (MICHELI; FORMIGONI, 2004; AVANCI et al., 2007; BENJET et al., 2009; ALAIE et al., 2018). In contrast, regular physical activity assumes a protective position for the male audience against feelings of loneliness, in what is inferred to be a relevant form of social interaction (NOVAIS et al., 2018). It appears that a large part of students in our three samples who regularly practiced physical activity are boys (average of 63%), which is corroborated by scientific findings that show how girls are less physically active than boys (FARIAS JÚNIOR et al., 2012; GROTH et al., 2016). For girls, physical activity had little or unfavorable effect on loneliness, insomnia and overall mental health perception. Although unexpected, these results can be explained by the greater female tendency towards a sedentary lifestyle in adolescence and the insecurity about their own appearance while performing physical exercises (BRODERSEN et al., 2007; ROBBINS et al., 2003; STANDIFORD, 2013).

As well as widely identified in the literature, we can observe in our study how young people inclined to risky behaviors or who have been sexually abused usually show greater tendencies towards loneliness, insomnia and a perception of "not good" mental health status (ANDRADE et al., 2012;

MALTA et al., 2014a; MALTA et al., 2014b; FONTES et al., 2017). It is presumed that using the school environment to discuss and educate teenagers about sexual violence and risky behaviors might promote healthier lifestyles and safe-sex awareness – thus, promoting positive social externalities in the long run.

We also highlight bullying's crucial role in school environment due to its considerable harmful effect on the psycho-emotional well-being of both sexes and in all our samples. School violence represents a psychological burden for its victims by triggering situations of social isolation, substance abuse, feelings of loneliness and insomnia (MALTA et al., 2014a; 2014b). These findings draw attention both for the psychological implications attributed to bullying and for the increasing spread of its practices inside educational institutions: according to the NSHS, the number of Brazilian 9th grade students who claimed to have been bullied has more than doubled between 2012 and 2015 (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2016). It has become imperative that, in order to fully comprehend the conditions for the mental well-being of the modern adolescent, policy makers recognize how school settings are intertwined with one's psychological status.

Our results related to "good" self-assessments of health and body also match with the evidence found in the literature. Studies claim that body dissatisfaction is often related to the deterioration of female mental health, especially in the intersectional axis of gender, race and socioeconomic conditions – emphasizing the legitimacy of the debate about health prevention and body image acceptance among teenagers (JOHNS et al., 2017; CICIURKAITE; PERRY, 2018; GUIMARÃES et al., 2020).

As the promotion of physical activity and leisure represents a priority guideline for the Health at School Program (PSE) – aiming, ultimately, to reduce obesity and related illnesses (BRASIL, 2013) – we find in the practice of team sports a possible explanation for the PSE's significant protective effect against the worsening of loneliness levels among male students. However, despite being a requirement in the program's legal framework, case studies often find beneficiary institutions failing to establish joint action groups between health and education professionals for the proper performance of physical and bodily activities. Such inadequacies are often motive for criticism towars the program's efficiency and idealized intersectoral communication (COSTA et al., 2013; SILVESTRE et al., 2016; VIANA et al., 2017). Nevertheless, even if the PSE's physical activity iniciatives might not be totally effective when we observe its results on the physical aspects of students, the program's potential to protect their mental health through the combination of body practices and social integration becomes very clear when we expand the analysis to psychosocial assessment (SILVESTRE et al., 2016).

Empirical evidence indicates that avoiding alcohol and tobacco consumption, practicing physical activity during the day and eating lightly at nighttime are preventive habits against insomnia (BAGNATO, 2017; CHEN et al, 2017). That illustrates that priority guidelines such as preventing the use of alcohol and other drugs and, again, promoting body practices and healthy eating (BRASIL, 2013) can explain the PSE's role in preventing insomnia among adolescents. Initiatives like these can also explain the program's performance as a protective factor against loneliness and a "not good" perception of mental health: obesity reduction promotes body satisfaction and improves adolescent self-esteem; thus generating better self-assessments of body and health (PAIXÃO et al., 2019; MATIAS et al., 2020).

It should be worth mentioning that impact assessments of the PSE in the specific context of student mental health as the one carried out in this research are still inecipient. Qualitative local case studies evaluating the PSE's performance in certain communities are predominant in Brazilian scientific literature and often highlight the diversity of strategies adopted in different educational institutions.

In addition to the heterogeneity inherent to the program, political and managerial difficulties are also present among the PSE's operational limitations. Despite the merit of strengthening the link between education and public health, weaknesses in the interactions between the two sectors are still found across the country – studies frequently address the substantially greater share of the health sector's participation in budgetary and operational decisions, attributing a peripheral role to education (BRASIL et al., 2017; FONTENELE et al., 2017; SOUSA et al., 2017).

However, the improvement of direct and indirect actions dedicated to school psychosocial well-being provided by the PSE's guidelines might already symbolize an important foundation for further mental health public policies in Brazil. From an economic point of view, adolescents correspond to a collective human capital stock in development: therefore, any potential risk to their physical or mental

health may result in future productivity and financial losses. One in five teenagers worldwide suffers from a mental illness that will persist into adulthood (LEE et al., 2014). Alternatively, estimates for the 2016-2030 period reveal that a US$ 147 billion investment in the effective treatment of clinical depression would generate US$ 230 billion in productivity gains – the same investment, if entirely directed towards the treatment of anxiety disorders, could generate US$ 169 billion in return (CHRISHOLM et al., 2016; RAZZOUK, 2016). As for the losses already consolitated, it has been estimated that mental illness among the economically active population in the 36 OECD countries (Organization for Economic Co-operation and Development) resulted in monetary costs of US$ 1.7 billion in 2017 – the equivalent to 3.5% of an OEDC's nation average gross domestic product (WORLD BANK, 2018). These outcomes suggest the investment in adolescent mental health in the present period is capable of expanding future productivity and human capital (ZECHMEISTER et al., 2008).

The relationship between economics and mental health instinctively raises concern about the relatively scarce psychosocial public policies made available to Brazilian adolescents (COUTO; DELGADO, 2015). Under this scenario, the circumstances assign even greater responsibility to the PSE – which, despite the challenges of intersectoriality; limited financial resources; and the socioeconomic, demographic and cultural plurality of Brazilian municipalities still engendered a beneficial impact on the mental health of its participants.

Based on the evidence found, we suggest the development of an explicit priority guideline dedicated to mental health promotion activities in Brazilian schools and to the prevention against disorders of this nature. These actions can be carried out under minimal cost demands by the mere strategic strengthening of already existing practices, such as anti-bullying policy, physical activities and anti-drug campaigns. In addition, considering the trends and prevalence rates in mental disorders among women, we also suggest a more thorough epidemiological assessment that's able to clarify which initiatives under the PSE can better benefit female adolescents.

As for research limitations, we admit to the strong subjectivity in quantifying psychological variables, especially when using young people's perception of their own mental health status. Official data restrictions for both Brazilian adolescent mental health indicators and the PSE's overall performance at national and longitudinal level were also a narrowing point.

Lastly, this study concludes that socioeconomic, behavioral and demographic factors affect the mental health status of Brazilian adolescents. As for public policy aspects, we emphasize the PSE's potential to achieve satisfactory results in the field of psychosocial health. The program, however, has not been effective in reaching the female audience when considering mental health issues separately.

In summary, our findings underline that even if not entirely directed towards adolescent mental health, the Health at School program has still been able to provide psychological aid for its participating students. We expect our findings to raise questions about the potential returns that investing in a public policy exclusively dedicated to adolescent mental health might generate on Brazil's present human capital stock and future productivity.

REFERENCES

ALAIE, I. et al. Uppsala Longitudinal Adolescent Depression Study (ULADS). **BMJ Open**, v. 9, p. 1-14, 2018.

ALEGRÍA, M. et al. The role of public policies in reducing mental health status disparities for people of color: public policies can improve the social conditions underlying the mental health disparities among minority populations. **Health Affairs**, v. 22, n. 5, p. 51-64, 2003.

ANDRADE, S. S. C. de A. et al. Relação entre violência física, consumo de álcool e outras drogas e *bullying* entre adolescentes escolares brasileiros. **Cad. Saúde Pública**, v. 28, n. 9, p. 1725-1736, 2012.

ANTUNES, H. A. et al. Familiar factors and illicit drug use among Brazilian adolescents: an analysis of the Brazilian National Survey of School Health (PeNSE, 2015). **Cad. Saúde Pública**, v. 34, n. 12, p. 1-11, 2018.

ATALIBA, P.; MOURÃO, L. Avaliação de impacto do Programa Saúde nas Escolas. **Psicologia Escolar e Educacional**, v. 22, n. 1, p. 27-36, 2018.

AUSTIN, P. C. et al. Propensity score matching and complex surveys**. Statistical Methods in Medical Research**, v. 27, n. 4, p. 1240-1257, 2018.

AVANCI, J. Q. et al. Fatores associados aos problemas de saúde mental em adolescentes. **Psicologia: Teoria e Pesquisa**, v. 23, n. 3, p. 287-294, 2007.

BAGNATO, M. C da. **Sírio-Libanês**. 2017. Disponível em: <https://www.hospitalsiriolibanes.org.br/sua-saude/Paginas/insonia-10-dicas-para-dormir-melhor-.aspx>. Acesso em: 12 mar. 2020.

BARUFALDI, L. A. et al. ERICA: prevalência de comportamentos alimentares saudáveis em adolescentes brasileiros. **Rev. Saúde Pública**, v. 50, n. 1, p. 1-9, 2016.

BENJET, C. et al. Youth mental health in a populous city of the developing world: results from the Mexican Adolescent Mental Health Survey. **Journal of Child Psychology and Psychiatry**, v. 50, n. 4, p. 386-395, 2009.

BENTO, I. C. et al. Alimentação saudável e dificuldades para torná-la uma realidade: percepções de pais/responsáveis por pré-escolares de uma creche em Belo Horizonte/MG, Brasil. **Ciência & Saúde Coletiva**, v. 20, n. 8, p. 2389-2400, 2015.

BEUTEL, M. E. et al. Loneliness in the general population: prevalence, determinants and relations to mental health. **BMC Psychiatry**, v. 17, n. 97, 2017.

BHATTACHARYA, J.; HYDE, T.; TU, P. **Health Economics**. 1 ed. Londres: Red Globe Press, 2013. Cap 3.

BOYD, A. et al. Gender differences in mental disorders and suicidality in Europe: results from a large cross-sectional population-based study. **Journal of Affective Disorders**, v. 173, p. 245-254, 2015.

BRASIL. Decreto nº 6.286, de 5 de dezembro de 2007. Institui o Programa Saúde na Escola - PSE, e dá outras providências. **Diário Oficial da União**, Brasília, DF, 6 de dez. 2007. Disponível em: <http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2007/Decreto/D6286.htm>. Acesso em: 17 maio. 2019.

BRASIL. **Indicadores e padrões de avaliação** – PSE Ciclo 2017/2018. Brasília: Ministério da Saúde, 2017.

BRASIL. **Orientações gerais sobre a ação de práticas corporais, atividade física e lazer no Programa Saúde na Escola**. Brasília, DF: Ministério da Saúde, 2013.

BRASIL. **Passo a passo Programa Saúde na Escola**. Brasília, DF: Ministério da Saúde, 2011.

BRASIL. **Programa Saúde nas Escolas**. Ministério da Educação, 2018. Disponível em: <http://portal.mec.gov.br/programa-saude-da-escola/194-secretarias-112877938/secad-educacao-continuada-223369541/14578-programa-saude-nas-escolas>. Acesso em: 9 maio 2019.

BRASIL, E. G. M. et al. Promoção da saúde de adolescentes e Programa Saúde na Escola: complexidade na articulação saúde e educação. **Rev. Esc. Enferm. USP**, v. 51, p. 1-9, 2017.

BRODERSEN, N. H. et al. Trends in physical activity and sedentary behaviour in adolescence: ethnic and socioeconomic differences. **British Journal of Sports Medicine**, v. 41, p. 140-144, 2007

CALIENDO, M.; KOPEINIG, S. Some practical guidance for the implementation of Propensity Score Matching. **The Institute for the Study of Labor (IZA)**, v. 1588, p. 1-32, 2005.

CHRISHOLM, D. K. et al. Scaling-up treatment of depression and anxiety: a global return on investment analysis. **Lancet Psychiatry**, v. 3, p. 415-424, 2016.

CICIURKAITE, G.; PERRY, B. L. Body weight, perceived weight stigma and mental health among women at the intersection of race/ethnicity and socioeconomic status: insights from the modified labelling approach. **Sociology of Health and Illness**, v. 40, n. 1, p. 18-37, 2018.

COLEY, R. L. et al. Locating economic risks for adolescent mental and behavioral health: poverty and affluence in families, neighborhoods, and schools. **Child Development**, v. 89, n. 2, p. 360-369, 2018.

COSTA, G. M. et al., a importância do enfermeiro junto ao PSE nas ações de educação em saúde em uma escola municipal de Gurupi – TO. **Revista Científica do ITPAC**, v. 6, n. 2, p, 1-12, 2013.

COUTO, M. C. V.; DELGADO, P. G. G. Crianças e adolescentes na agenda política da saúde mental brasileira: inclusão tardia, desafios atuais. **Psic. Clin.**, v. 27, n.1, p. 17-40, 2015.

CUONG, N. V. Selection of control variables in Propensity Score Matching: evidence from a simulation study. **Munich Personal RePEc Archive**, p. 1-15, 2012.

ELSTAD, J. I.; PEDERSEN, A. W. The Impact of Relative Poverty on Norwegian Adolescents' Subjective Health: A Causal Analysis with Propensity Score Matching. **International Journal of Environmental Research and Public Health**. v. 9, p. 4715-4731, 2012.

EUN, S. J. Contextual Association between Political Regime and Adolescent Suicide Risk in Korea: A 12-year Repeated Cross-Sectional Study from Korea. **International Journal of Environmental Research and Public Health**, v. 16, n. 874, p. 1-13, 2019.

FOLLAND, S.; GOODMAN, A. C.; STANO, M. **The Economics of Health and Health Care**. 7 ed. Pearson, 2013. 625p.

FONTENELE, R. M. et al. Construção e validação participativa do modelo lógico do Programa Saúde na Escola. **Saúde Debate**, v. 41, p. 167-179, 2017.

FONTES, L. F. C. et al. Violência sexual na adolescência, perfil da vítima e impactos sobre a saúde mental. **Ciência & Saúde Coletiva**. v. 22, n. 9, p. 2919-2928, 2017.

FRICK, P. J.; BARRY, C. T.; KAMPHAUS, R. W. **Clinical assessment of child and adolescent personality and behavior**. Nova Iorque: Springer, 2010. Cap. 18.

GIACOMOZZI, A. I. et al. Levantamento sobre uso de álcool e outras drogas e vulnerabilidades relacionadas de estudantes de escolas públicas participantes do Programa Saúde do Escolar/saúde e prevenção nas escolas no município de Florianópolis. **Saúde Soc.**, v. 21, n. 3, p. 612-622, 2012.

GREENE, W. Models for Ordered Choices. In: HESS, S.; DALY, A. **Handbook of Choice Modelling**. Cheltenham: Edward Elgar Publishing, 2014. v. 1, p. 333-362.

GROSSMAN, M. On the concept of health capital and the demand for health. **The Journal of Political Economy**, v. 80, n. 2, p. 223-255. 1972a.

GROSSMAN, M. **The Demand for Health**: a theoretical and empirical investigation. New York: Columbia University Press, 1972b.

GROSSMAN, M. The human capital model of the demand of health. In: CULYER, A. J; NEWHOUSE, P. **Handbook of Health Economics**. V 1A. Amsterdã: North Holland, 2000.

GROTH, S. W. et al. Relationships among obesity, physical activity and sedentary behavior in young adolescents with and without lifetime asthma. **Journal of Asthma**, v. 53, n. 1, 19-24, 2016.

GUIMARÃES, B. E. B de. et at. O consumo excessivo de álcool e a insatisfação com a imagem corporal por adolescentes e jovens de um município baiano, Brasil. **Cad. Saúde Pública**, v. 36, n. 1, p. 1-15, 2020.

HUANG, P. et al. Fruit and vegetable consumption and mental health across adolescence: evidence from a diverse urban British cohort study. **International Journal of Behavioral Nutrition and Physical Activity**, v. 16, n. 19, p. 1-13, 2019.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Pesquisa nacional de saúde do escolar**. Rio de Janeiro: IBGE, 2016.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Síntese de Indicadores Sociais**: uma análise das condições de vida da população brasileira. Rio de Janeiro: IBGE, 2019. Disponível em: <https://biblioteca.ibge.gov.br/visualizacao/livros/liv101678.pdf>. Acesso em: 19 mar. 2020.

INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA (INEP). **Dados do censo escolar**: rede pública tem maior número de alunos com idade acima do recomendado para a série de ensino. Disponível em: <http://portal.inep.gov.br/artigo/-/asset_publisher/B4AQV9zFY7Bv/content/dados-do-censo-escolar-rede-publica-tem-maior-numero-de-alunos-com-idade-acima-do-recomendado-para-a-serie-de-ensino/21206>. Acesso em: 1 out. 2019.

JAEN-VARAS, D. et al. The association between adolescent suicide rates and socioeconomic indicators in Brazil: a 10-year retrospective ecological study. **Brazilian Journal of Psychiatry**, v. 41, n. 5, p. 389-395, 2019.

JENKINS, J. H. et al. Loneliness, adolescence, and global mental health: Soledad and structural violence in Mexico. **Transcultural Psychiatry**, v. 0 n. 0, p. 1-15, 2019.

JOHNS, M. M. et al. Resilient minds and bodies: size discrimination, body image, and mental health among sexual minority women. **Psychology of Sexual Orientation and Gender Diversity**, v. 4, n. 1, p. 34–42, 2017.

JÚNIOR, J. C. F de. et al. Physical activity practice and associated factors in adolescents in Northeastern Brazil. **Rev Saúde Pública**, v. 46, n. 3, p. 1-10, 2012.

KHANDER, S. R.; KOOLWAL, G. B.; SAMAD, H. A. **Handbook on Impact Evaluation**. 1 ed. Washington: World Bank, 2010. Cap 4.

KIM, Y.; HAGQUIST, C. Trends in adolescent mental health during economic upturns and downturns: a multilevel analysis of Swedish data 1988-2008. **Journal of Epidemiology and Community Health**, v. 72, p. 101-108, 2018.

KNESPER, D. et al. Preliminary production functions describing change. **Medical Care**, v. 1, p. 222-237, 1987.

KUEHNEN, C. Why is depression more common among women than among men? **The Lancet Psychiatry**, v. 4, n. 2, p. 146-158, 2017.

LEE, F. S. et al. Adolescent mental health – opportunity and obligation: emerging neuroscience offers hope for treatments. **Science**, v. 346, n. 6209, p. 547-549, 2014.

LEMES, D. C. M. et al. Satisfação com a imagem corporal e bem-estar subjetivo entre adolescentes escolares do ensino fundamental da rede pública estadual de Canoas/RS, Brasil. **Ciência & Saúde Coletiva**, v. 23, n. 12, p. 4289-4298, 2018.

LEVY, R. B. et al. Consumo e comportamento alimentar entre adolescentes brasileiros: Pesquisa Nacional de Saúde do Escolar (PeNSE), 2009. **Ciência & Saúde Coletiva**, v. 15, n. 2, p. 3085-3097, 2010.

MALTA, D. C. et al. Fatores associados aos ferimentos em adolescentes, a partir da Pesquisa Nacional de Saúde dos Escolares (PeNSE 2012). **Revista Brasileira de Epidemiologia**, p. 46-61, 2014a.

MALTA, D. C. et al. Uso de substâncias psicoativas, contexto familiar e saúde mental em adolescentes brasileiros, Pesquisa Nacional de Saúde dos Escolares (PeNSE 2012). **Revista Brasileira de Epidemiologia**, p. 183-202, 2014b.

MATIAS, T, S de. et al. Attitudes towards body weight dissatisfaction associated with adolescents' perceived health and sleep (PeNSE 2015). **Ciência & Saúde Coletiva**, v. 25, n. 4, p. 1483-1490, 2020.

MCKINNON, B. et al. Adolescent suicidal behaviours in 32 low- and middle-income countries. **Bulletin of the World Health Organ**., v. 94, p. 340-350, 2016.

MICHELI, D. de; FORMIGONI, M. L. O. S. Drug use by Brazilian students: associations with family, psychosocial, health, demographic and behavioral characteristics. **Society for the Study of Addiction**, v. 99, p. 570-578, 2004.

NIXON, J,; ULMANN, P. The relationship between health care expenditures and health outcomes. **European Journal of Health Economics**, v. 7, p. 7-18, 2006.

NOVAIS, M. V. et al. Atuação do professor de Educação Física no Programa Saúde na Escola: uma análise da efetividade. In: CONGRESSO NACIONAL DE EDUCAÇÃO, 5., 2018, Olinda. **Anais V Congresso Nacional de Educação – 2018**. Olinda, PE. p. 1-12.

OHRNBERGER, J. et al. The relationship between physical and mental health: a mediation analysis. **Social Science & Medicine**, v. 195, p. 42-49, 2017.

OLIVEIRA, L. M. F. T de. et al. Influência do tabagismo parental no consumo de álcool e drogas ilícitas entre adolescentes. **Einstein**, v. 17, n. 1, p. 1-6, 2019.

OLUWATOYIN, M. A. et al. Public health expenditure and health outcomes in Nigeria. **International Journal of Financial Economics**, v. 4, n. 1, p. 45-56, 2015.

PAIXÃO, R. F. et al. Autoestima e sintomas de transtornos mentais na adolescência: variáveis associadas. **Psicologia: Teoria e Pesquisa**, v. 34, p. 1-8, 2018.

PHELPS, C. E. **Health Economics**. 5 ed. Routledge, 2016. 526p.

RAMOS, M. **Estimating mental health production functions**: what does explain the mental health status of the Portuguese population? 2009. Dissertação (Mestrado em Economia) – Universidade Técnica de Lisboa, Portugal, 2009.

RAZZOUK, D. **Mental Health Economics**: The Costs and Benefits of Psychiatric Care. São Paulo: Springer, 2017.

RAZZOUK, D. Por que o Brasil deveria priorizar o tratamento da depressão na alocação dos recursos da Saúde? **Epidemiol. Serv. Saude**, v. 25, n. 4, p. 845-848, 2016

REYNOLDS, W. M. *Reynolds Adolescent Depression Scale, 2nd edition* **(RADS-2).** Lutz, FL: Psychological Assessment Resources. 2002.

ROBBINS, L. B. et al. Barriers to physical activity perceived by adolescent girls. **Journal of Midwifery & Women's Health**, v. 48, n. 3, p. 206-2012, 2003.

ROSENBAUM, P. R.; RUBIN, D. B. the central role of the propensity score in observational studies for causal effects. **Biometrika**, v. 70, n. 1, p. 41-55, 1983.

SANTOS, K. O. B. et al. Estrutura fatorial e consistência interna do *Self-Reporting Questionnaire* (SRQ-20) em população urbana. **Cad. Saúde Pública**, v. 25, n. 1, p. 214-222, 2009.

SASSARINI, J. Depression in midlife women. **Maturitas**, v. 94, p. 149-154, 2016.

SHARMA, B. et al. Loneliness, insomnia and suicidal behavior among school-going adolescents in Western Pacific Island countries: role of violence and injury. **Int. J. Environ. Res. Public Health**, v. 14, n. 791, p. 1-11, 2017.

SILVESTRE, C. et al. Análise de promoção das práticas corporais e atividade física propostas pelo Programa Saúde na Escola nas escolas de Samambaia/Distrito Federal. **Investigação Qualitativa em Saúde**, v. 2, p. 1645-1652, 2016.

SOCIEDADE BRASILEIRA DE PEDIATRIA. **Manual de orientação**: promoção da atividade física na infância e adolescência. Rio de Janeiro, 2017.

SOUSA, M. C de. et al. A intersetorialidade no Programa Saúde na Escola: avaliação do processo político-gerencial e das práticas de trabalho. **Ciência & Saúde Coletiva**, v. 22, n. 6, p. 1781-1790, 2017.

SOUZA, M. C. S. C. de. **Escores de propensão**: aplicações à Epidemiologia. 2010. Monografia (Graduação em Estatística) – Universidade Federal do Rio Grande do Sul, Porto Alegre, 2010.

STANDIFORD, A. The secret struggle of the active girl: a qualitative synthesis of interpersonal factors that influence physical activity in adolescent girls. **Health Care for Women International**, v. 34, n. 10, p. 860-877, 2013.

VIANA, F. A. N do. et al. Programa Saúde na Escola (PSE): o olhar sobre a participação da educação física escolar. **Redfoco**, v. 4, n. 1, p. 11-23, 2017.

WOOLDRIDGE, J. M. **Introductory Econometrics**: A Modern Approach. 5 ed. Mason: South-Western Cengage Learning. 2013. Cap 17.

WORLD HEALTH ORGANIZATION. **Adolescent mental health**. Disponível em: <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health>. Acesso em: 10 mar. 2019.

WORLD HEALTH ORGANIZATION. **Global health workforce, finances remain low for mental health**. Disponível em: <https://www.who.int/mediacentre/news/notes/2015/finances-mental-health/en/>. Acesso em: 7 maio. 2019.

WORLD HEALTH ORGANIZATION. **Mental health:** a state of well-being. Disponível em: <https://www.who.int/features/factfiles/mental_health/en/>. Acesso em: 28 mar. 2019.

ZANUTTO, E. L. A comparison of Propensity Score and Linear Regression Analysis of complex survey data. **Journal of Data Science**, v. 4, p. 67-91, 2006.

ZAWADZKI, M. J. et al. Rumination and anxiety mediate the effect of loneliness on depressed mood and sleep quality in college students. **Health Psychology**, v. 32, n. 2, p. 212-222, 2013.

ZECHMEISTER, I. et al. Is it worth investing in mental health promotion and prevention of mental illness? A systematic review of the evidence from economic evaluations. **BMC Public Health**, v. 8, n. 20, p. 1-11, 2008.

ZHOU, X. et al. Different types and acceptability of psychotherapies for acute anxiety disorders in children and adolescents: a network meta-analysis. **JAMA Psychiatry**, v. 76, n. 1, p. 41-50, 2019.

ZWEIFEL, P; BREYER, F; KIFMANN, M. **Health Economics**. 2 ed. Berlim: Springer, 2009.