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DOES THE FAMILY STRUCTURE AFFECT THE HEALTH RISK BEHAVIOR OF BRAZILIAN ADOLESCENTS?

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The purpose of this study was to estimate the varied effects of family structure on the health risk behavior of Brazilian adolescents and to analyze this effect according to the levels of education (elementary school and high school). The analysis used data from the National Student Health Survey (PeNSE) for 2015, which provides information about health behavior among 13- to 17-year-old Brazilian students. The sample was subdivided into Elementary School (through 9th grade) and High School (through 12th grade). Estimations were made using the propensity score matching (PSM) method and the risky behaviors considered for the estimation were consumption of alcohol, cigarettes and illicit drugs. The results suggested that being raised in a single-parent household negatively affects the health risk behavior of adolescents when analyzed according to substance abuse, mainly regarding consumption of alcohol and cigarettes.

KEYWORDS: Family structure, Adolescents, Risky behavior, Consumption of alcohol and cigarettes, Propensity score matching.

1. INTRODUCTION

Adolescence, here broadly defined as being between 10 and 19 years old, is characterized by a series of physical, psychological, hormonal and behavioral changes associated with the process of maturing (Inchley, 2016). Factors such as the need for social affirmation, influence of peers, greater independence from the family, associated with failure to perceive long-term risks properly, make adolescence a phase with many new challenges (Patton et al., 2016).

During this phase, the family assumes a more important role as the main source of individuals' socialization, and parental figures, be they parents or guardians, have a strong influence on the well-being of adolescents in the short, medium and long terms, by building the base for their development in the transition from childhood to adulthood (Loke and Mak, 2013).

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Specifically, the family structure, regarding the conjugal status of the parents, is indicated as a factor with impact on individual formation. Youths who have experienced the divorce of their parents or the absence of a parental figure generally suffer strong emotional stress, with potential to develop behavioral disturbances, triggering future physical and mental health problems (Butters, 2002; Loke and Mak, 2013; Schenker and de Souza Minayo, 2003).

This emotional baggage together with the typically rebellious behavior that is characteristic of the phase not only can influence the early consumption of psychoactive substances, but also increase the risk of abusive use of these substances throughout adult life. Substances such as alcohol, tobacco and illicit drugs can have serious negative impacts on those who consume them, so the earlier people start using them, the greater will be their negative effects on future health, development and welfare (Aarons et al., 1999; Gruber, 2009). These substances can also detract from academic performance, in turn affecting the professional life, placement in the job market, earnings and quality of life over the long run (Inchley, 2016; Lima and Santos, 2016; Malta et al., 2010).

The literature on the effect divorce on the behavior of children and adolescents has noted the difficulty of isolating the causal effects of the huge number of factors that can lead to behavioral disturbances, such as family structure, the causes of the divorce, time gap since the divorce, socioeconomic level after the divorce, how the divorce occurred (peaceful or traumatic for the child, including degree of judicial intervention) and relationship of the parents with the child after the divorce. The interplay of these and other factors is very hard to unravel, and can result in biases in estimating the effects (Amato and Keith, 1991; Amato and Anthony, 2014).

Besides unobservable characteristics that can affect adolescents related to the rupture of the family structure, other past factors can affect changes in behavior, such as some type of abuse or an adverse situation suffered during early childhood. As astutely observed by Felitti et al. (1998), children who experience adverse situations in infancy, such as domestic violence (against the child and/or the mother), or family dysfunctions (judicial or criminal problems of the parents), tend to be more likely to engage in behavior risky to health in adolescence.

With regard to evidence about health risk behavior, the statistics produced by the Brazilian Institute of Geography and Statistics (IBGE) stand out, obtained from the National Student Health Survey (PeNSE). According to information gleaned by the survey, in 2015, 22.9% of Brazilian students between the ages of 13 and 17 years had smoked a cigarette on at least one occasion. Of them, 12.4% had first experimented with smoking tobacco with age of 13 years or under. With regard to consumption of illicit drugs, the statistic was 12%, with 4.2% having done so when they were 13 years old or younger. The prevalence of alcohol consumption among Brazilian adolescents is even more worrying, given that 61.4% of the survey's respondents reported having experimented with drinking, with 30.6% having done so for the first time in early adolescence.

In light of this scenario and recognition of the importance of the family structure on the behavior of adolescents, we designed this study to evaluate the effects of family structure on the health risk behavior of adolescents aged from 13 to 17 years as reflected in the PeNSE for 2015. Our working hypothesis was that being raised in a single-parent household rather than one with two parents can contribute to negative behaviors of adolescents, increasing their exposure to health risks due to a greater likelihood of consuming tobacco, alcohol and illicit drugs.

For this purpose, we used propensity score matching (PSM) to mitigate biases and make inferences about the effects of family structure on the risk behavior of Brazilian adolescents based on data from the PeNSE. The choice of this method was mainly due to the availability and format of the PeNSE database, as well as the mentioned ability to mitigate biases brought by observable characteristics and the absence of common support. To complement the study,

we also evaluated the existence of heterogeneous effects between students in elementary school (through 9th grade) and high school (through 12th grade), given the ample evidence that the propensity for risky behavior tends to increase with age among youths. We believe the evidence presented here contributes to the literature on the influence of family structure on the risky behavior of adolescents, and can support proposals of policies focused on reducing such behavior.

Besides this introduction, the article has five more sections. In the second, we present a review of the literature on the interplay of family background, the health risk behavior of adolescents and unobservable variables that should be considered in measuring the causal effect under analysis. In the third section, we describe the data collection and the empirical strategy to estimate the influence of family arrangements on the health risk behavior of Brazilian youths. The analysis and discussion of the results are presented in the fourth section, followed by brief considerations on public policies formulated to address the problem. Our final considerations are in the sixth section.

2. LITERATURE REVIEW

2.1. *Family background*

The nuclear family is defined as a private institution that, irrespective of its composition, has the main function of primary socialization of children, besides the choice of friends so as to build healthy ties among the members, in particular to instill standards in offspring considered socially adequate (Schenker and de Souza Minayo, 2003).

Within the nuclear family, the parental figure or figures assume the principal role of setting examples for habits and behavioral patterns. The parents (or other caregivers) thus serve as role models for the offspring, as well as taking measures to protect them from behavioral disturbances that can in some way affect their welfare in the short, medium and/or long term, and provide the foundation for the transition to adult life (Loke and Mak, 2013).

Specifically regarding behavioral disturbances, such as consumption of psychoactive substances during adolescence, some family characteristics can positively or negatively influence this consumption. The use of these substances by one or both parents or older siblings is the most direct route of negative influence. In turn, the conjugal situation of the parents and their relations with the children exert strong influences on the feelings of adolescents and hence on their behavioral problems (Schenker and de Souza Minayo, 2003; Loke and Mak, 2013; Butters, 2002).

Furthermore, a problematic family structure, gauged by the conjugal situation of the parents, can be considered a stress factor. Amato and Keith (1991) performed a meta-analysis of the effects of a family rupture on children and youths. They observed a lower level of well-being among youths who had experienced separation/divorce of their parents in comparison with peers who had not experienced such family turmoil. They also found that the reduction of well-being was more intense when experienced in the early phases of development. The reflections can be ascertained in various ways, such as lower academic performance, behavioral disturbances, psychological disturbances, altered self-perception, and changes in relations with friends and parents.

Further according to Amato and Keith (1991), the exit of a parental figure from the home can cause a reduction of aggregate household income, with a negative effect on the standard of living of adolescents. In extreme cases, this can prompt youths to drop out of school so as to help financially support the family.

Besides this, the fact of living in a single-parent household after a divorce usually means a reduction of routine contact with both parents, which can trigger a series of complications

for youths' development and mental health, among other factors. Lima and Santos (2016) observed, based on panel data on Brazilian students, a negative effect of single-parent households on school performance, providing evidence that the stress provoked by a change in the family structure really affects school results.

Various other secondary factors can cause stress, leading to lower well-being of youths whose parents are divorced or who never counted on the presence of both parents. The move to a new home, the efforts to adapt to a new school and new social context, ongoing conflicts between parents, and remarriage of one or both parents can all serve as triggers to start consuming psychoactive substances.

According to Butters (2002), in a study among young students in Ontario, Canada, the feeling of family disruption when a parent leaves the dwelling can result in a negative feeling in adolescents, making them more likely to consume marijuana and also to use it more intensely. According to the author, the feeling of reduced stress caused by this psychoactive substance leads adolescents to use it as a way to cure, so to speak, the negative feelings and stress caused by parents' divorce.

Although the isolated effect of the family structure was considered low, the author also alerted that when observing this together with the effect in school, the overall effect can be considered strong. In other words, youths with disruptive family structures tend to have more problematic school performance, with greater isolation from classmates, among other problems at school, leading to increased consumption of cannabis, generating a vicious circle.

Another perspective was presented by Loke and Mak (2013) in a study among adolescent students in a district of Hong Kong considered to be economically vulnerable and with high prevalence of youths with health risk behavior. They found that besides the behavioral and affective characteristics of the family, such as an authoritative parenting style with little emotional support, the students in the survey from single-parent households had a higher probability of developing the habits of smoking cigarettes and drinking alcohol. Among the conclusions, the authors indicated that this pattern can be due to reduced parental contact, such as the absence of a father, as well as the smaller family income earned by a single parent.

In longitudinal studies with more than 600 Scottish students between 13 and 18 years old (divided into subsamples with ages of 13-14, 15-16 and 17-18 years), Shucksmith et al. (1997) and Glendinning et al. (1997) observed similar results regarding the analysis of family and socioeconomic factors and their relationship with the regular consumption of cigarettes and alcoholic beverages. The results of both studies indicated that the socioeconomic status of the parents had little or no effect on the regular consumption of the two psychoactive substances in question. On the other hand, the family structure, parenting style and students' relationship with their parents had strong influences on the evolution of these habits, making consumption of the substances considered regular à *posteriori* by the students.

With respect to family structure, the authors analyzed students from single-parent, two-parent and reconstituted families (with the presence of a step-parent). Students from two-parent households tended to smoke less than those from single-parent households or those with reconstituted families. They also observed a lesser prevalence of regular consumption of alcohol among students living with both parents. More specifically, among students reporting consumption of alcohol more than once a week, the prevalences were 9%, 10% and 18% for two-parent, reconstituted and single-parent families, respectively. Nevertheless, in both studies, the authors stressed the importance of the link created between parents and offspring according to the parenting style as one of the characteristics with the strongest impacts on the healthy development of adolescents.

Shucksmith et al. (1997) divided the family parenting styles into authoritarian (little emotional support from parents associated with strong control levels), permissive (strong emotional

support and little control), and neglectful (weak control and low emotional support).[1] Based on these styles, the authors stressed that the levels of dialog with parents (support) and their control have a greater effect on consumption of alcohol in proportion to older age ranges of the sample, mainly when this consumption becomes more frequent[2].

In general, adolescents of older age ranges had a greater consumption pattern from families where the parents were authoritarian (i.e., with little dialog and strong control). On the other hand, albeit with lesser effects, in younger adolescents the authors observed greater consumption when the parents were considered neglectful (little dialog and little control). This means to say that extreme parenting styles perceived by the adolescents, both authoritarian and neglectful, had a direct effect of increasing the consumption of alcoholic beverages (Shucksmith et al., 1997).

Glendinning et al. (1997) also observed similar results regarding smoking and different parenting styles. They analyzed the same family characteristics and parenting styles as in the study by Shucksmith et al. (1997), finding a greater influence of the relationship with parents of older adolescents regarding the frequency of smoking cigarettes. Additionally, the consumption of cigarettes was higher in students who defined their parents as being authoritarian (low dialog and high control), as well as neglectful (little dialog and low control).

2.2. *Family structure and causal effect in the literature*

Important problems have been raised by many researchers who have investigated the family structure and the effects caused by family disruption on children and adolescents, namely the impossibility of conducting randomized experiments and the difficulty of preventing numerous unobservable characteristics involved in the development of children from generating endogeneity, and thus interfering in the conclusions obtained regarding the expected causal effects (Amato, 2010; Amato and Anthony, 2014).

Amato and Anthony (2014) stressed that among the difficulties of isolating effects are questions that are almost always impossible to observe. For example, many of the factors that prompt parents to separate also directly or indirectly affect the child, resulting in a spurious relationship between the results of divorce and the effects observed on the child.

When the object of study is adolescents, this difficulty can be even greater, since adolescents already carry baggage from their childhood, which also can undesirably interfere in the results, and thus hamper obtaining solid results. For example, we can mention the study by Felitti et al. (1998), based on the medical assessment of adults with a comorbidity. They found that adverse situations experienced during childhood (such as various types of abuse, often occurring concomitantly) significantly increased the chances of exposure to risky behaviors and factors such as consumption of psychoactive substances, obesity and suicidal tendencies, among others. In other words, when studying the effect of family disruption on adolescents and the relationship with health risk behaviors, a possibility exists of an alternative hypothesis according to which part of this effect is due to some form of abuse suffered during childhood.

Another finding reported in the literature is the fact that many of the effects of divorce observed on children and adolescents also can likely be blamed on problematic relations within the family. Among these are the presence of many conflicts between the parental figures and their difficulties in establishing healthy relationships with offspring (Amato, 2010; McLanahan et al., 2013).

[1] We also used the parenting style characteristics as covariates (as detailed in Table I of the variables).

[2] When questioned about the frequency of consuming alcohol, the students chose from among the following responses: “I never drink alcohol”; “I don’t drink very often”; “I drink about once a month”; “I drink about once a week”; or “I drink two or three times a week, or almost every day”.

The questions leading to divorce can also play a role in the matter of endogeneity and hamper isolating the results of the effect itself. An economic crisis can lead to unemployment, in turn reducing the quality of life of all family members, hence increasing the likelihood of divorce and directly impacting the child. Furthermore, marriage between adolescents can increase the probability of later conflicts between parents and of divorce or separation, with strong negative effects on offspring. Besides these factors, infidelity, domestic violence and high levels of dissatisfaction in the marriage are other hard-to-observe variables that can lead to divorce. with a strong impact on the offspring (Amato, 2010).

Because of these potential methodological drawbacks in this area, researchers have been seeking methods to overcome them and hence eliminate the bias caused by unobservable variables. Among these are growth curve models, individual or sibling fixed effect models and the propensity score matching (PSM) method.

When longitudinal data are available, one of the ways to mitigate this undesired effect is to apply fixed-effect models, with the aim of eliminating all time-invariant differences among the individuals analyzed. Amato and Anthony (2014) applied this method in two databases (elementary school children and high school adolescents) considering periods before and after divorce. This enabled them to capture the negative effects on the students from broken families, such as lower reading and math scores, and difficulty of self-control and externalizing problems.

Nevertheless, when the database does not permit controlling for/observing specific characteristics (of the family, the individuals' past experiences or the process of divorce of parents) that can influence the results, PSM has been employed in the literature as one of the most effective ways to circumvent this question.

Frisco et al. (2007) analyzed the possible impact of marriage dissolution on adolescents' academic performance. They compared the application of two methods, PSM and traditional ordinary least squares regression analysis, to investigate the influence of endogeneity and selection bias on the results. With both methods, the authors found lower performance of students, mainly in math scores, in the short run, but the results estimated via PSM were more robust based on the common database used.

Likewise, Hussey et al. (2016) also used PSM to control for the effect of unobservable characteristics in a longitudinal study to assess the impact of divorce on a broad range of outcomes, such as academic performance, unemployment, risk behavior during adolescence and mental health issues, in a period of 1 to 14 years after the event. Among the conclusions, they observed that students submitted to family separation had lower academic performance in all intervals studied, more precarious mental health in the short and medium run, and were more likely to develop health risk behaviors.

2.3. *Health risk behaviors during adolescence*

There are various theories about the factors that can lead adolescents to start consuming psychoactive substances and thus pose risks to their physical and mental health. Among these are the influence of peers, the various physical and psychological changes due to puberty, and stress caused by psychological traumas, among others (Gruber, 2009; Almeida and Araújo Júnior, 2016; Inchley, 2016; Malta et al., 2010).

According to data from the World Health Organization in a survey investigating the health risk and protection factors of European youths (Health Behaviour in School-Aged Children – HBSC), from 2013-2014, over 14.6 million youths stated they had consumed cannabis at least once in their lives.

Besides this, the data indicated that smoking cigarettes began on average at the age of 13 years or younger, with no differences between girls and boys. With respect to alcohol consumption, the survey for those years pointed to a worrying increase in the proportion youths aged between 13 and 15 years throughout Europe who had been drunk at least one time in their lives (Inchley, 2016).

Of equal concern, in the United States one-third of the students interviewed in the Youth Risk Behavior Survey (YRBS) stated they had smoked cigarettes in the 30 days before being questioned. Furthermore, among elementary school students (up to sixth grade), 75% stated they had tried an alcoholic beverage at least once, and over 60% of high school students stated they had been inebriated at least once (Gruber, 2009).

Among students who were already regular smokers in the USA, Gruber (2009) also found that they underestimated the probability of being addicted as adults: 56% stated they would not continue smoking for more than five years.

In turn, Harrison et al. (2019) studied "first-time offending court-involved, non-incarcerated" (FTO-CINI) youths and found evidence that recent smoking was higher among these youths than the average of their peers in the general population, and they had a high probability of developing behavioral disturbances such as delinquency, especially problems associated with anxiety.

In Brazil, based on analysis of the first version of the PeNSE (2009), Malta et al. (2010) observed that the prevalence of smoking among ninth-graders (24.2%) was relatively low compared with the data from studies at the global level. With regard to drinking, the rates were high and differed between the sexes (67.6% for boys and 71.9% for girls). These high rates were explained by the continuing social acceptance of teenage drinking and the heavy advertising of alcoholic beverages in the media. The authors urged policymakers to take measures to reduce these levels so as to preserve the future health of today's youths.

Malta *et al*. (2014a) compared the prevalences of the main health risk behaviors and measures to protect against non-communicable chronic diseases among students in Brazilian capital cities based on the 2009 and 2012 versions of the PeNSE. They reported a reduction in the percentage of adolescents who had tried cigarettes, from 24.2% to 22.3%, but no change in the percentage of regular smokers (6.0%). With regard to illicit drugs, they observed an increase from 8.7% 2009 to 9.6% in 2012, while regarding alcohol, the experimentation rate remained the same at around 70%. Finally, they found that 27% of the respondents reported having consumed alcohol in the previous 30 days, in both versions of the survey. Therefore, the authors concluded there had been only slight changes in the patterns of health risk behavior as reflected in the two versions of the PeNSE.

Malta *et al.* (2014b) studied the consumption of alcohol and other drugs using the database of the PeNSE for 2012 and reported evidence of an equally worrying scenario. In particular, they found very young ages for first consumption of alcohol (12- 13 years old), possibly explained by the facility in Brazil of buying alcoholic beverages at bars, restaurants and supermarkets, among other establishments.

With regard to smoking, when analyzing 9th-grade students using data from the PeNSE for 2012, Barreto et al. (2014) observed that one in five students interviewed had tried smoking. Among these, one-fourth were defined as regular smokers. Besides this, they found that students with the highest risk, mainly regular smokers, more often were gainfully employed or came from single-parent households.

Finally, Horta et al. (2014) investigated the prevalence of the use of illicit drugs using the same database. Besides identifying a positive relationship between the frequency of consumption and the age of the respondents, they observed earlier start of consumption. Furthermore, they also found no significant differences between the sexes, indicating the possible occurrence of homogenized consumption among boys and girls.

3. METHODOLOGY

3.1. *Description of the database*

This study is based on data from the PeNSE carried out by the IBGE together with the Ministry of Health (MS). The specific objective is to monitor and evaluate the health risk and protection behaviors of adolescent Brazilian students. Among the risk factors are matters such as sexual and reproductive behavior, smoking, consumption of alcohol and illicit drugs, diet, sedentary lifestyle, mental stress and some types of violence.

The survey covers elementary and high school students in Brazilian private and public schools, which are selected from the list schools registered with the Anísio Teixeira National Institute of Educational Research and Studies (Inep). Our focus is on 9th-grade students between the ages of 13 and 15 years. We chose this age range in accordance with the recommendations of the World Health Organization (WTO), whereby students older than 13 years have the necessary skills to fill out a self-applied questionnaire, and mainly for being the age range when adolescents are considered susceptible to exposure to various risk factors.

The PeNSE used in this study is that applied in 2015, when the IBGE decided to add a second sample to enable comparison at the international level. In this respect, , the age range was expanded to between 13 and 17 years old (roughly corresponding to 6th to 12th grades, depending on how old they were when entering 1st grade and possible grade repetition). This second sample was obtained by interviewing 16,608 students from 371 Brazilian schools from all five of the country's geographic regions (North, Northeast, Midwest, Southeast and South). The sample is relatively balanced as to gender, with 49.95% girls (8,269 students) and 50.05% boys (8,287 students). Furthermore, 60.37% were in elementary school and 39.63% were in high school at the time of the survey.

The PeNSE database comes from a transversal sample, so it has some limitations, mainly regarding observation of characteristics and occurrences in the respondents' lives before the application of the questionnaire. Another drawback is that it is a recent survey[3] in comparison with other similar surveys used as models for its creation. Among these are the Youth Risk Behavior Surveillance System (YRBSS), which involves multiple surveys applied since 1991 among adolescents in all American states, and the Health Behaviour in School-aged Children (HBSC) survey, which began in 1983 in 5 European countries and in its latest version (2017-18) encompasses 45 countries from Europe and North America. [I consulted the website and discovered these numbers.] Table I below identifies the variables used in the estimations. The result variables pertain to the three risk factors: consumption of alcoholic beverages, consumption of cigarettes and consumption of illicit drugs. The treatment variables designate the control and treatment groups, along with the covariates.

3.2. *Propensity score matching*

It is not possible to conduct a randomized study to investigate the impacts of a family structure on the descendants. Indeed, it would be a violation of ethical questions to randomly designate which adolescent would undergo certain experiences (Amato, 2010; McLanahan et al., 2013). This leads to the inability to isolate the causal effects of the event from other unobservable variables that can influence the results obtained, causing selection biases and endogeneity (Caliendo and Kopeinig, 2008; Caliendo et al., 2017; Ichino et al., 2008).

Therefore, since our database came from a transversal survey with determined observable characteristics of Brazilian students, we applied the PSM of (Rubin, 1974) and Rosenbaum

[3]The PeNSE was conducted in three years (2009, 2012 and 2015). We used the most recent survey.

TABLE I

DESCRIPTION OF THE VARIABLES OF THE RESULT (RISK FACTORS), IDENTIFICATION (FAMILY STRUCTURE) AND STUDENTS' CHARACTERISTICS (COVARIATES)

Variables	Description of the Variables
	Health Risk Behaviors
Cigarette Smoking	= 1, if the student has smoked a cigarette once in his/her life; = 0, otherwise.
Frequency of Cigarette Smoking	= 1, if the student has used a tobacco product in the 30 days before the survey; = 0, otherwise.
Drinking	= 1, if the student has consumed an alcoholic beverage; = 0, otherwise.
Frequency of Drinking	= 1, if the student has consumed an alcoholic beverage in the 30 days before the survey; = 0, otherwise.
Illicit Drugs	= 1, if the student has experimented with a type of illicit drug[a]; = 0, otherwise.
Frequency of Using Illicit Drugs	= 1, if the student has experimented with a type of illicit drug in the 30 days before the survey; = 0, otherwise.
	Family Structure
Single-parent Household	= 1, if the student lives with only one parent; = 0, if the student lives with both parents.
	Covariables
Gender	= 1, for female, = 0, for male.
Age	Age of the student, where 11 represents the group with age of 11 years or younger and 19 denotes those aged 19 years or older.
Race	= 1, for students who classify themselves as non-white, = 0, for students who classify themselves as White
National Regions	= 1, North; = 2, Northeast; = 3, Southeast; = 4, South; = 5, Midwest.
Grade Level	= 1, if the student is in 6th grade; = 2, if the student is in 7th grade; = 3, if the student is in 8th grade; = 4, if the student is in 9th grade; = 5, if the student is in 10th grade; = 6, if the student is in 11th grade; and = 7, if the student is in 12th grade.
School Level	= 1, if the student is in elementary school; = 0, if the student is in high school.
Public/Private School	= 1, if the student attends a public school; = 0, if the student attends a private school.
Location	= 1, if the school is located in an urban region; = 0, if the school is located in a rural region.
Study Regime	= 1, if the student studies in the full-day regime; = 0, otherwise.
Mother's Schooling Level	= 1, if the mother never attended school; = 2, if the mother had incomplete elementary school; = 3, if the mother had complete elementary school; = 4, if the mother had incomplete high school; = 5, if the mother had complete high school; = 6, if the mother had incomplete college; = 7, if the mother has a college degree; and = 8, *missing*
Gainful Employment	= 1, if the student has gainful employment; = 0, otherwise.
Friends Who Consume Alcoholic Beverages	= 0, if none of them consume alcoholic beverages of any type; = 1, if a few consume some type of alcoholic beverage; = 2, if a some of them consume alcoholic beverages; = 3, if the great majority consume alcoholic beverages; and = 4, if all of them consume alcoholic beverage.
Lives with Mother	= 1, if the student lives with his/her mother; = 0, otherwise.
Authoritarian Parents	= 1, if the parents or guardians most of the time know what the student does during his/her leisure time, verify performance of chores and homework and do not understand the student's problems and worries; = 0, otherwise.
Strict Parents	= 1, if the parents or guardians most of the time know what the student does during his/her leisure time, verify performance of chores and homework and understand the student's problems and worries; = 0, otherwise.
Permissive Parents	= 1, if the parents or guardians never or almost never know what the student does during his/her leisure time, verify performance of chores and homework and understand the student's problems and worries; = 0, otherwise.
Parents Smoke	= 1, if at least one of the parents smoke; = 0, otherwise.

Note: Prepared by the authors based on PeNSE survey. [a]According to the glossary of the PeNSE (2015), in this item students were questioned about whether they had used an illicit substance at least once in their lives, such as marijuana, cocaine, crack, organic solvents, ecstasy, oxy, etc.

and Rubin (1983a;b).[4] We believe this is the best strategy to circumvent these problems, and thus to minimize the biases caused by unobservable characteristics, seeking to obtain more robust results (Caliendo and Kopeinig, 2008; Li, 2012). Thus, we applied the PSM method to estimate the effect of a single-parent family structure on the health risk behavior of adolescents related to consumption of alcohol, tobacco and illicit drugs.

The PSM method basically involves evaluating the differences between individuals receiving a certain treatment from those not receiving it. In this case, the treatment is coming from a single-parent household. Nevertheless, it is not possible simply to observe this difference based on an individual in two different scenarios, nor is this possible by means of the average result of individuals from two-parent households. Hence, the problem arises of selection bias, where individuals that participate and do not participate in the treatment can differ. This difference precludes the desired comparison (ROSENBAUM; RUBIN, 1983a).

The PSM technique aims to overcome that problem by the process of matching. This involves the identification of two subsamples, here according to the students' family structure. According to the terminology of Heckman et al. (1997), the first group, called the treated group, is composed of students living in single-parent households, while the second group, called the control group, is composed of students from two-parent families. Considering the two subsamples, the idea is to identify individuals from the two groups that are as similar as possible based on determined characteristics X (vector of covariates), thus enabling a counterfactual exercise (Caliendo and Kopeinig, 2008).

According to Rosenbaum and Rubin (1983a), PSM is based on the key assumption of strongly ignorable treatment assignment, meaning that the distribution of the covariates between the two groups is the same due to the propensity score matching carried out. That score is estimated as a function of the observable characteristics and indicates the probability of an adolescent's belonging to a single-parent family, given the observed characteristics, denoted by the vector X, satisfying the following proposition:

$$X \perp D \mid b(X), \tag{1}$$

were the treatment status of the individual is represented by the dummy variable D, which assumes value of 1 for students from single-parent families and $D_i = 0$ for those from two-parent families; and $b(X)$ represents the propensity score.

Besides the hypothesis of ignorability, the data for PSM also must satisfy the condition of unconfoundedness, basically stating that since the covariates are the same between individuals belonging to the control and treated groups, this implies that systematic differences observed between the two groups can be attributed to the treatment (Caliendo and Kopeinig, 2008):

$$Y_1, Y_0 \perp D \mid X \tag{2}$$

These potential results were observed in relation to the three types of health risk behavior of adolescents: consumption of cigarettes, alcohol and illicit drugs. The effects of the family structure were estimated for each of the risk behaviors. Thus, in this setup, Y_{1i} represents the risk behavior of individual i ($i = 1, \ldots, N$) if $D_i = 1$ and Y_{0i} if $D_i = 0$.

A second key condition for PSM is overlap, which indicates the characteristics that are common between the two groups (same value of X), and the consequent probability of being caused by the same treatment:

$$0 < \Pr(D = 1 \mid X) < 1 \tag{3}$$

[4]For more details about the PSM method, see Rosenbaum and Rubin (1983a).

After realization of the propensity score matching, the average effect of the treatment on the treated (ATT) can be defined as the difference between the average effect observed in the treated groups (students from single-parent families) and the average effect observed in the control group (students from two-parent families) (Li, 2012; Imbens and Wooldridge, 2009):

$$ATT = E\{Y \mid D = 1, b(X)\} - E\{Y \mid T = 0, b(X)\} \tag{4}$$

We also separately estimated models with subsamples composed of elementary and high school students, and students living in rural versus urban zones.

The last step of PSM is to certify that the hypothesis of ignorability has not been violated. In our study, this meant verifying that the unobservable variables did not cause biased results. In other words, through sensitivity analysis, we detected the robustness of the results by considering, for example, variables such as the causes of a family rupture in which the relationships forged between parents and offspring suffered, or of belonging to a family with only one parent from the outset, had the least possible influence on individuals' assignment to the treatment group (in this case the type of family structure), and thus did not influence the health risk behaviors (Becker and Caliendo, 2007).

This step was carried out by considering the Rosenbaum limits and the Mantel and Haenszel (1959) test.[5] Hence, we considered the upper limits (Q+mh), which indicate overestimation of the effect, and the lower limits (Q-mh), which indicate underestimation of the effect, along with the gamma factor (Γ).[6]

4. ANALYSIS AND DISCUSSION OF RESULTS

4.1. *Descriptive analysis*

As can be seen from the descriptive statistics in Table II, the national disaggregation of the PeNSE sample was 5,752 students from single-parent families (37.25%) and 9,689 from two-parent families (62.75%). The differences were small regarding the family types from the five macro-regions, with the leaders being 21.24% single-parent families in the Midwest region and 20.56% in the Northeast. Besides this, in the national sample, 51% were girls and 49% boys, and the average age of all students was 14.16 years. Additionally, 86.63% of the students from single-parent families said they lived with their mother.

With regard to mother's education, there were no significant differences, with the overall average being complete elementary school (through ninth grade). However, with respect to the schooling level of mothers of single-parent families, slightly over 84% had high school diplomas (with or without complete college) and only 15% had college degrees. That breakdown was slightly different for mothers of two-parent families, with corresponding percentages of 80% and 20%.

Nearly 84% of the students from single-parent families attended public schools. The most common parenting style among students from single-parent families was permissive (5%), while for those from two-parent families, equal portions came from families with strict parents and from those with permissive parents (4.8%). A minority of these students stated their parents were authoritarian (0.6% of students from single-parent families versus 0.4% of students from two-parent families).

[5]For more details about the use of Mantel-Haenszel methods for detection of the differential functioning of questionnaire items, see Fidalgo and Scalon (2012).

[6]The Q^{+}_{mh} statistic adjusts the mh statistic downward for positive (unobserved) selection. On the other hand, Q^{-}_{mh} adjusts the mh statistic downward for negative (unobserved) selection.

With regard to health risk behaviors, students from single-parent families were more likely to consume psychoactive substances. This pattern was the same both for initiation (try for the first time) and repeated consumption (measured by frequency). The majority of students from single-parent households stated they had tried alcoholic beverages (64.05%), 8.18 percentage points higher than students from two-parent families (55.87%). Besides this, 23.7% of the students from single-parent families admitted having consumed a psychoactive substance on more than one occasion in the 30 days before the survey. That percentage was lower among students from two-parent families (19.06%).

Although low, the proportions of students who reported smoking and consumption of illicit drugs were worrying in terms of public health. All told, 28% of the students from single-parent families had tried smoking at least once in their lives, in contrast to 19.5% of students from two-parent families. Furthermore, the proportion of students from single-parent families who admitted having experimented with an illegal substance at least once in life was 14.74%, versus 9.86% of students from two-parent households. Nearly half of these students who had experimented with psychoactive substances came from single-parent families (44.39%) while 45.16% of students from two-parent families stated they had consumed such substances at least once in the previous 30 days.

Further according to Table II, 30% of the youths from single-parent families stated that the household head (parent or guardian) smoked, about 10% [percentage points?] greater than those from two-parent families. Therefore, we sought not only to control for the risk behavior of tobacco use, but also for the risk behaviors associated with alcohol and illicit drugs. According to Gilman et al. (2009), smoking by one or both parents is significantly associated with the risk smoking by adolescent offspring.

Finally, Malta *et al.* (2014), working with data from previous versions of the PeNSE, found similar statistics as ours. With respect to the risk factors analyzed here, they found for 2012 that the most common behavior was consumption of alcohol. The percentage was even greater then we observed: 70.5% of the students in 2012 stated they had consumed alcoholic beverages. Besides this, that year more than 22% of the students stated they had tried smoking cigarettes, while 9.6% stated they had experimented with illicit drugs. The levels were higher among public school students, but there were no significant differences between the genders.

4.2. *Results of the estimations*

We estimated the propensity score for the complete sample (elementary and high school) for each health risk behavior through a logit model. The intervals established for the common support of the scores between the treated and control groups were, respectively, for the complete sample [0.14570534, 0.54987186]; elementary school [0.11929106, 0.70930107] and high school [0.1409808, 0.56212328]. Furthermore, the propensity score balance before matching was satisfactory for all the teaching levels.

After defining the propensity score and delineating the sample (based on the common support), we performed the matching through three methods: nearest neighbor, kernel and radius.[7] However, it was important to verify the balance of the distribution of the covariates, of both the control and treatment groups, since we utilized the propensity score to carry out the matching. That required some tests. Thus, we applied the t-test and verified the pseudo-R2, Rubin's B and Rubin's R statistics[8] to test the balance. Moreover, for each risk behavior of the adolescents,

[7]The Appendix D presents the graphs of the propensity scores between the treated and control groups before and after the balancing of the estimates performed (Figures D.1, D.2 and D.3).

[8]Rubin's B denotes the absolute standardized difference of the means of the linear index of the propensity scores between the treated and untreated groups, while Rubin's R represents the ratio between the propensity score variances

TABLE II

DESCRIPTIVE STATISTICS ACCORDING TO FAMILY STRUCTURE OF BRAZILIAN STUDENTS

Variable	Single-Parent		Two-Parent	
	Mean	St. Dev.	Mean	St. Dev.
Cigarette Smoking	0.280	0.449	0.195	0.396
Frequency of Tobacco Use	0.100	0.300	0.064	0.245
Drinking	0.641	0.480	0.559	0.497
Frequency of Alcohol Consumption	0.237	0.426	0.191	0.393
Illicit Drugs	0.147	0.355	0.099	0.298
Frequency of Consuming Illicit Drugs	0.444	0.497	0.452	0.498
North	0.196	0.397	0.182	0.385
Northeast	0.206	0.404	0.208	0.406
Southeast	0.201	0.401	0.202	0.402
South	0.185	0.388	0.204	0.403
Midwest	0.212	0.409	0.204	0.403
Age	14.16	2.080	13.93	2.080
Gender	0.518	0.500	0.483	0.500
Race	0.633	0.482	0.576	0.494
Lives with Mother	0.866	0.340	1.000	0.000
Mother's Schooling Level	2.500	1.120	2.570	1.150
Public/Private School	0.792	0.406	0.708	0.455
All-Day School	0.251	0.434	0.254	0.435
Grade Level	3.730	1.930	3.700	1.990
Gainful Employment	0.138	0.345	0.125	0.331
Authoritarian Parents	0.006	0.079	0.004	0.064
Strict Parents	0.037	0.189	0.048	0.214
Permissive Parents	0.055	0.228	0.048	0.214
Parents Smoke	0.303	0.459	0.200	0.400
Friends Consume Alcohol	1.700	1.140	1.630	1.150

Note: Prepared by the authors based on the PeNSE survey.

the ATT chosen was that with the best balance of the covariates, based on the Pseudo-R2 value, which indicates how well the regressors explain the likelihood of participation in the treatment group. Thus, after the matching, there should be no systematic differences in the distribution of the covariates between the two groups, so the Pseudo-R2 should be very low (Caliendo and Kopeinig, 2008). Tables B.I–B.VIII in the Appendix B present these statistics, and confirm that our estimations were balanced.

Table III below reports the effects of the risk behavior of the complete sample (elementary and high school students) in function of the family structure (one or two parents). Adolescents from single-parent families presented greater health risk behavior, thus jeopardizing their well-being (Amato and Keith, 1991; Loke and Mak, 2013; Butters, 2002). The average effects of the risk behavior of a student from a single-parent family were significant for consumption of cigarettes and alcoholic beverages.

With regard to elementary and high school students, living in a single-parent family structure was associated with a 5.85% increase in the percentage of students who had tried smoking. The respective effects for the two school levels separately were 6.16% among elementary school students and 7.01% among high school students. Thus, in our sample, as youths progressed in school, the effect of living in a single-parent family on risky behaviors increased.

of the treated and untreated groups. According to Rubin (2001), B should be lower than 25 and R should be between 0.5 and 2 for the samples to be considered sufficiently balanced. An asterisk is placed after the sample values of B and R that are outside these limits, indicating they are not sufficiently balanced.

Similar effects were found with regard to alcohol consumption. The risk behavior of students from single-parent families was approximately 6.84% higher than those from two-parent families. Analysis of the data disaggregated by grade level revealed that elementary school students (high school students) from single-parent families on average consumed 8.37% (5.26%) more alcohol than their peers from two-parent families.

The propensity to use illicit drugs also was higher among students from single-parent families, by 3.98%. Regarding the effects of the school levels, high school students had 5.3% higher propensity than their elementary school counterparts from single-parent households, for whom consumption of illicit drugs was 2.92%.

These results corroborate those described by Butters (2002) in a study of adolescents in Ontario (Canada), regarding use of cannabis. The author also emphasized negative effects of the association of this risk behavior with the stress caused on youths by family instability, mainly when leading to family breakup. She also mentioned that other factors besides family instability influence the use of cannabis over the long term.

The results for the elementary school students in our study also were not statistically significant regarding frequency of consuming tobacco and illicit drugs (this last result was not significant for any of the groups analyzed). A possible explanation is the fact that because elementary school students are younger, not only are they less likely to have experimented with psychoactive substances, but also they are less likely to honestly answer the questionnaire. In other words, younger students are more likely to give imprecise and incorrect responses. As described by Tavares et al. (2004), when responding to a self-applied questionnaire, despite the guarantee of anonymity and the classroom setting, information bias can still occur, i.e., the tendency to under-report illicit behavior.

4.3. *Sensitivity (robustness) analysis*

The estimates obtained for the risk behavior (tobacco, alcohol and illicit drug use, including frequency of consumption) by the PSM technique minimized the biases resulting from the observed characteristics of a single-parent family structure. However, there was no guarantee of the robustness of the estimates of the unobserved heterogeneity (Rosenbaum and Rubin, 1983a; 1985; Becker and Caliendo, 2007).

Table IV presents sensitivity test results of the Rosenbaum limits to verify the influence that unobservable characteristics can have on the estimated risk behavior factors of the total sample (elementary and high school).[9] For the samples estimated, the risky behaviors of the adolescents did not present bias due to unobservable characteristics for $\Gamma = 1$, while for $\Gamma = 2$, it can be inferred that no bias existed that could interfere in the chances of a student belonging to a single-parent family, according to the values of the statistics (Q^{+}_{mh}) and (Q^{-}_{mh}).

Therefore, based on this robustness test, despite the possible influence of unobserved variables on the risky behavior of students from single-parent households, the estimates found can be interpreted as reflecting the causal effect of the risky behavior of the samples used in the estimates.

5. DISCUSSION AND CONSIDERATIONS REGARDING PUBLIC POLICIES

The occurrence of divorce or being raised from the outset in a single-parent household can be a source of strong emotional stress. Hence, to soften or even prevent this impact that affects

[9]Table B.III presents the results of sensitivity testing of risky behavior of elementary and high school students. The results of the sensitivity analysis of these two subsamples are similar to the results reported in Table IV.

TABLE III

AVERAGE EFFECT OF FAMILY STRUCTURE ON THE HEALTH RISK BEHAVIOR OF BRAZILIAN ADOLESCENTS

	Treated	Control	ATT	St. Error	T-test
Cigarette Smoking					
Elementary School – Nearest neighbor	0.2867	0.2282	0.0585	0.0117	5.00
Elementary School – Kernel	0.2356	0.1741	0.0616	0.0175	3.91
High School – Nearest neighbor	0.3199	0.2498	0.0701	0.0156	4.48
Frequency of Consuming Cigarettes					
Elementary School – Nearest neighbor	0.0809	0.0634	0.0174	0.0069	2.54
Elementary School – Kernel	0.0714	0.0605	0.0108	0.0105	1.13
High School – Nearest neighbor	0.0877	0.0627	0.0249	0.0089	2.75
Drinking					
Elementary School – Nearest neighbor	0.6662	0.6078	0.0684	0.0129	4.52
Elementary School – Kernel	0.5559	0.4721	0.0837	0.0210	4.27
High School – Nearest neighbor	0.7479	0.6883	0.0526	0.0153	3.35
Frequency of Consuming Alcohol					
Elementary School – Nearest neighbor	0.3483	0.3061	0.0422	0.0126	3.35
Elementary School – Kernel	0.2779	0.2359	0.0420	0.0170	2.47
High School – Nearest neighbor	0.3954	0.3478	0.0475	0.0167	2.84
Consumption of Illicit Drugs					
Elementary School – Nearest neighbor	0.1572	0.1175	0.0398	0.0092	4.33
Elementary School – Kernel	0.1258	0.0966	0.0292	0.0122	2.39
High School – Nearest neighbor	0.1785	0.1192	0.0593	0.0122	4.84
Frequency of Consuming Illicit Drugs					
Elementary School – Nearest neighbor	0.4286	0.4399	-0.0113	0.0343	-0.33
Elementary School – Kernel	0.4611	0.5211	-0.0637	0.0699	-1.16
High School – Nearest neighbor	0.4158	0.3384	0.0317	0.0412	0.77

Note: Prepared by the authors based on the PeNSE survey.

TABLE IV

SENSITIVITY ANALYSIS OF THE FULL SAMPLE: ELEMENTARY SCHOOL

Cigarette Smoking					Frequency of Cigarette Smoking				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	5.5217	5.5217	0.0000	0.0000	1	3.3927	3.3927	0.0003	0.0003
2	1.5155	13.0622	0.0000	0.0000	2	3.2317	10.4619	0.0000	0.0000
Drinking					**Frequency of Alcohol Consumption**				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	4.9052	4.9052	0.0000	0.0000	1	4.8850	4.8850	0.0000	0.0000
2	7.7470	17.7916	0.0000	0.0000	2	7.7642	17.7677	0.0000	0.0000
Consumption of Illicit Drugs									
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-					
1	5.1735	5.1735	0.0000	0.0000					
2	3.7544	14.6050	0.0000	0.0000					

Note: In the sensitivity estimates for the health risk behavior, we did not consider the frequency of consuming illicit drugs, given that the effect of a respondent's belonging to a single-parent household did not have an effect on this risk behavior. Prepared by the authors based on the PeNSE survey.

various aspects of the development of a child/adolescent, it is important to improve the well-being not only of the youths, but of an entire generation.

In Spain, the psycho-educational program called Egokitzen accompanies couples going through divorce, focusing on minimizing conflicts between them, in turn easing the stress caused on their offspring. It plays an informative role about the divorce process for the parents, as well as paying attention to the impact this can cause on the children, seeking to protect them from stress and teach them how to deal with the conflict in a healthy manner (Martínez-Pampliega et al., 2015).

According to the authors, the Egokitzen program has helped reduce the perception of conflicts by children, also improving the relationship and communication among all the family members. It also increases the parents' awareness of the negative impacts that can be suffered by the children. The couples that participated in the treated group fought less and more effectively conveyed to the children that they were not at the center of the conflict.

In the early 1970s, in response to the growing number of single mothers who wound up depending on government assistance in the United States due to the absence of financial support, as well as the lack of emotional support to the offspring from fathers (Allen et al., 2011), several programs were created. Among them were Child First (Kramer and Washo, 1993); Children in the Middle (Arbuthnot and Gordon, 1996); New Beginnings Parenting Program (Sigal et al., 2012); and Assisting Children through Transition (Pedro-Carroll et al., 2001).

Kramer and Washo (1993), and subsequently Jewell et al. (2017), observed positive impacts of the Children First program, created in the 1980s, one of the pioneer psycho-educational programs. It was created to counsel parents and children undergoing family problems. In particular, Jewell et al. (2017) found a positive effect of the second and third versions of the Children First program, applied in some regions of Illinois, on the understanding by parents of the negative impact on their children. Among the results were better resolution of conflicts and adaptive communication between parents and children, as well as greater engagement in coparenting.

One in four families with children in Ireland has a single parent. Due to this high rate, the Plus-Parenting When Separated program was created. It has been found to be effective in counseling parents and children undergoing family disruption. In comparison with the control group, formed by parents on the program's waiting list, the treated group showed significant improvements regarding the process of dealing with conflicts, both intraparental and between parents and children. In particular, there was lower stress among children whose parents had concluded the program.

Therefore, there is strong evidence in the literature of the benefits of social assistance programs, with the most effective ones having a psycho-educational character, seeking to minimize the conflicts and possible sources of stress for the children of parents undergoing family disruption. The focus should be on making parents aware of the negative impacts on children and adolescents caused by disputatious divorce processes, mainly through triangulation where the offspring are in the center of the discussions, because they generally feel pressured to choose sides in the conflict, and thus suffer emotional stress.

6. FINAL REMARKS

This study examined, using data from Brazil's National Student Health Survey (PeNSE) for 2015, the effect of the family structure on the health risk behaviors of adolescents, more specifically in relation to the consumption of psychoactive substances (illicit drugs, alcohol and tobacco).

In methodological terms, we used the propensity score matching (PSM) technique to compare students from single-parent and two-parent households, considering three samples: i) elementary school students; ii) high school students; and iii) students of both levels together. To

investigate robustness, we applied sensitivity analyses to compute the Rosenbaum limits, to minimize the influence of unobservable characteristics.

According to the results, adolescents from single-parent families were more likely to consume all three psychoactive substances. These effects among students at both levels were 3.82% for consumption of illicit drugs and 6.22% each for tobacco and alcohol. When the sample was divided into high school and elementary school students, the results were similar. However, this rough equality could have been caused by underreporting by younger students in the survey, since many studies have shown that the initial experimentation and frequency of consuming psychoactive substances is higher among older students.

Based on these results, confirming the high prevalence of experimentation and consumption of psychoactive substances by Brazilian students, it is necessary to establish psychoeducational public policies that have broader scope than the school setting or individual level. The resulting programs need to be mulitsectorial, with the combined actions of educators, social assistants, psychologists and healthcare professionals, working with adolescents and their parents to ameliorate the negative impacts of family instability and improve the well-being of family members of the present and future generations.

APPENDIX A: DESCRIPTIVE STATISTICS ACCORDING TO SCHOOL LEVEL

TABLE A.I

DESCRIPTIVE STATISTICS FOR ELEMENTARY SCHOOL

Variable	Single-Parent		Two-Parent	
	Mean	St. Dev.	Mean	St. Dev.
Cigarette Smoking	0.233	0.423	0.145	0.352
Frequency of Tobacco Use	0.072	0.259	0.041	0.198
Drinking	0.540	0.499	0.410	0.492
Frequency of Alcohol Consumption	0.146	0.353	0.096	0.295
Illicit Drugs	0.114	0.318	0.071	0.256
Frequency of Using Illicit Drugs	0.489	0.501	0.522	0.501
North	0.209	0.407	0.194	0.395
Northeast	0.186	0.389	0.192	0.394
Southeast	0.187	0.390	0.194	0.396
South	0.183	0.387	0.197	0.397
Midwest	0.235	0.424	0.223	0.416
Age	12.890	1.400	12.640	1.370
Gender	0.518	0.500	0.477	0.500
Race	0.647	0.478	0.587	0.492
Lives with Mother	0.867	0.340	1.000	0.000
Mother's Schooling Level	2.440	1.130	2.540	1.180
Public/Private School	0.799	0.401	0.719	0.450
All-Day School	0.261	0.439	0.248	0.432
Grade Level	2.390	1.030	2.320	1.050
Gainful Employment	0.079	0.270	0.072	0.259
Authoritarian Parents	0.007	0.086	0.005	0.069
Strict Parents	0.044	0.206	0.060	0.238
Permissive Parents	0.048	0.214	0.042	0.200
Parents Smoke	0.329	0.470	0.217	0.413
Friends Consume Alcohol	1.400	1.150	1.210	1.110

Note: Prepared by the authors based on the PeNSE survey.

TABLE A.II

DESCRIPTIVE STATISTICS FOR HIGH SCHOOL

Variable	Single-Parent		Two-Parent	
	Mean	St. Dev.	Mean	St. Dev.
Cigarette Smoking	0.324	0.468	0.235	0.424
Frequency of Tobacco Use	0.144	0.352	0.102	0.303
Drinking	0.732	0.443	0.676	0.468
Frequency of Alcohol Consumption	0.382	0.486	0.342	0.474
Illicit Drugs	0.178	0.382	0.121	0.326
Frequency of Using Illicit Drugs	0.417	0.494	0.420	0.494
North	0.176	0.381	0.162	0.368
Northeast	0.236	0.425	0.234	0.423
Southeast	0.223	0.416	0.216	0.411
South	0.187	0.390	0.216	0.411
Midwest	0.178	0.382	0.173	0.379
Age	16.150	1.220	15.990	1.190
Gender	0.518	0.500	0.492	0.500
Race	0.612	0.487	0.559	0.497
Lives with Mother	0.865	0.341	1.000	0.000
Mother's Schooling Level	2.570	1.110	2.620	1.120
Public/Private School	0.781	0.414	0.691	0.462
All-Day School	0.236	0.425	0.263	0.441
Grade Level	5.850	0.790	5.910	0.780
Gainful Employment	0.231	0.422	0.209	0.407
Authoritarian Parents	0.005	0.067	0.003	0.057
Strict Parents	0.025	0.157	0.029	0.167
Permissive Parents	0.066	0.249	0.058	0.234
Parents Smoke	0.281	0.450	0.187	0.390
Friends Consume Alcohol	1.960	1.070	1.940	1.090

Note: Prepared by the authors based on the PeNSE survey.

APPENDIX B: COVARIATE BALANCING TESTS

TABLE B.I

COVARIATE BALANCING T-TEST - ELEMENTARY SCHOOL

Controls	Non-Paired (NP) Paired (P)	Mean		t-test	
				t	p >t
North	NP	0.20	0.18	2.27	0.02
	P	0.19	0.19	–0.03	0.97
Northeast	NP	0.21	0.21	–0.39	0.70
	P	0.21	0.22	–0.63	0.53
Southeast	NP	0.20	0.20	–0.23	0.82
	P	0.18	0.18	0.72	0.47
Midwest	NP	0.21	0.20	1.28	0.20
	P	0.21	0.20	0.92	0.36
Age	NP	14.16	13.94	6.53	0.00
	P	15.23	15.24	–0.17	0.86
Gender	NP	0.52	0.48	4.16	0.00
	P	0.53	0.51	1.99	0.05
Race	NP	0.63	0.58	7.03	0.00
	P	0.63	0.64	–0.91	0.36
Lives with Mother	NP	0.87	1.00	–38.67	0.00
	P	1.00	1.00	0.00	0.00
Mother's Schooling Level	NP	2.50	2.58	–3.50	0.00
	P	2.49	2.46	0.84	0.40
Public/Private School	NP	0.79	0.71	11.58	0.00
	P	0.79	0.79	–0.41	0.69
Grade Level	NP	1.46	1.43	1.58	0.12
	P	1.23	1.22	0.14	0.89
All-Day School	NP	0.25	0.25	–0.35	0.73
	P	0.23	0.25	–1.57	0.12
Gainful Employment	NP	0.14	0.13	2.34	0.02
	P	0.18	0.20	–2.08	0.04
Authoritarian Parents	NP	0.01	0.00	1.83	0.07
	P	0.00	0.00	0.94	0.35
Strict Parents	NP	0.04	0.05	–3.28	0.00
	P	0.03	0.03	–0.50	0.62
Permissive Parents	NP	0.06	0.05	1.93	0.05
	P	0.05	0.05	1.00	0.32
Parents Smoke	NP	0.30	0.20	12.18	0.00
	P	0.29	0.29	0.33	0.74
Friends Consume Alcohol	NP	1.71	1.63	3.29	0.00
	P	1.76	1.71	1.46	0.14

Note: Prepared by the authors based on the PeNSE survey.

TABLE B.II

COVARIATE BALANCING T-TEST - ELEMENTARY SCHOOL

Controls	Non-Paired (NP) Paired (P)	Mean		t-test t	p >t
North	NP	0.21	0.19	1.78	0.08
	P	0.23	0.22	0.54	0.59
Northeast	NP	0.19	0.19	–0.75	0.46
	P	0.17	0.18	–0.64	0.52
Southeast	NP	0.19	0.19	–0.86	0.39
	P	0.15	0.15	0.31	0.76
Midwest	NP	0.23	0.22	1.31	0.19
	P	0.26	0.26	0.42	0.68
Age	NP	12.90	12.65	8.53	0.00
	P	13.86	13.84	0.45	0.65
Gender	NP	0.52	0.48	3.78	0.00
	P	0.53	0.50	1.36	0.17
Race	NP	0.65	0.59	5.82	0.00
	P	0.66	0.67	–0.20	0.84
Lives with Mother	NP	0.87	1.00	–30.25	0.00
	P	1.00	1.00	0.00	0.00
Mother's Schooling Level	NP	2.45	2.55	–3.29	0.00
	P	2.37	2.37	–0.14	0.89
Public/Private School	NP	0.80	0.72	8.78	0.00
	P	0.83	0.81	0.87	0.39
All-Day School	NP	0.26	0.25	1.42	0.16
	P	0.24	0.24	0.04	0.97
Gainful Employment	NP	0.08	0.07	1.23	0.22
	P	0.11	0.12	–0.80	0.43
Authoritarian Parents	NP	0.01	0.00	1.67	0.10
	P	0.01	0.01	0.00	1.00
Strict Parents	NP	0.04	0.06	–3.33	0.00
	P	0.03	0.03	0.56	0.57
País Permissivo	NP	0.05	0.04	1.50	0.13
	P	0.05	0.05	–0.26	0.79
Parents Smoke	NP	0.33	0.22	8.66	0.00
	P	0.32	0.29	1.65	0.10
Friends Consume Alcohol	NP	1.41	1.21	5.71	0.00
	P	1.44	1.37	1.45	0.15

Note: Prepared by the authors based on the PeNSE survey.

TABLE B.III

COVARIATE BALANCING T-TEST – HIGH SCHOOL

Controls	Non-Paired (NP) Paired (P)	Mean		t-test t	p >t
North	NP	0.18	0.16	1.43	0.15
	P	0.17	0.17	–0.24	0.81
Northeast	NP	0.24	0.23	0.25	0.80
	P	0.25	0.25	0.12	0.90
Southeast	NP	0.22	0.22	0.66	0.51
	P	0.21	0.21	0.09	0.93
Midwest	NP	0.18	0.17	0.41	0.69
	P	0.18	0.18	0.09	0.93
Age	NP	16.16	16.00	5.10	0.00
	P	16.16	16.12	0.85	0.40
Gender	NP	0.52	0.49	1.92	0.06
	P	0.53	0.51	1.36	0.17
Race	NP	0.61	0.56	4.01	0.00
	P	0.60	0.60	–0.07	0.94
Mother's Schooling Level	NP	2.57	2.62	–1.49	0.14
	P	2.57	2.59	–0.47	0.64
Lives with Mother	NP	0.87	1.00	–24.07	0.00
	P	1.00	1.00	0.00	0.00
Public/Private School	NP	0.78	0.69	7.57	0.00
	P	0.76	0.76	0.04	0.97
All-Day School	NP	0.24	0.26	–2.34	0.02
	P	0.23	0.25	–1.50	0.13
Gainful Employment	NP	0.23	0.21	1.99	0.05
	P	0.23	0.24	–0.89	0.38
Authoritarian Parents	NP	0.00	0.00	0.79	0.43
	P	0.00	0.00	0.38	0.71
Strict Parents	NP	0.03	0.03	–0.79	0.43
	P	0.03	0.02	0.46	0.64
Permissive Parents	NP	0.07	0.06	1.22	0.22
	P	0.06	0.05	0.85	0.40
Parents Smoke	NP	0.28	0.19	8.38	0.00
	P	0.26	0.27	–0.28	0.78
Friends Consume Alcohol	NP	1.97	1.94	0.74	0.46
	P	1.97	1.92	1.18	0.24

Note: Prepared by the authors based on the PeNSE survey.

TABLE B.IV

CIGARETTE SMOKING: BALANCING TESTS - PSEUDO-R^2; B & R OF RUBIN

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Elementary School:								
Nearest-Neighbor Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.003	18.44	0.361	2.2	2.0	11.8	0.98	0
Kernel Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.005	33.40	0.010	2.2	1.1	15.9	1.10	0
Radius Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.007	51.08	0.000	2.6	1.3	19.7	1.18	0
Elementary School								
Nearest-Neighbor Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	14.91	0.531	3.3	2.4	16.8	1.01	33
Kernel Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.003	10.03	0.865	2.4	1.8	13.7	1.02	33
Radius Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	15.90	0.460	2.9	1.7	17.3	1.11	33
High School								
Nearest-Neighbor Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.002	9.10	0.909	1.8	1.1	10.8	1.00	0
Kernel Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.006	25.72	0.058	2.6	1.2	18.1	1.08	0
Radius Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.008	34.36	0.005	3.0	1.7	21.0	1.10	0

Note: * if B>25%, R is outside [0.5; 2]. Prepared by the authors based on the PeNSE survey.

TABLE B.V

FREQUENCY OF CIGARETTE SMOKING: BALANCING TESTS - PSEUDO-R^2; B & R OF RUBIN

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Elementary School:								
Nearest-Neighbor Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.003	18.44	0.361	2.2	2.0	11.8	0.98	0
Kernel Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.005	33.40	0.010	2.2	1.1	15.9	1.10	0
Radius Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.007	51.08	0.000	2.6	1.3	19.7	1.18	0
Elementary School								
Nearest-Neighbor Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	14.91	0.531	3.3	2.4	16.8	1.01	33
Kernel Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.003	10.03	0.865	2.4	1.8	13.7	1.02	33
Radius Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	15.90	0.460	2.9	1.7	17.3	1.11	33
High School								
Nearest-Neighbor Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.002	9.10	0.909	1.8	1.1	10.8	1.00	0
Kernel Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.006	25.72	0.058	2.6	1.2	18.1	1.08	0
Radius Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.008	34.36	0.005	3.0	1.7	21.0	1.10	0

Note: * if B>25%, R is outside [0.5; 2]. Prepared by the authors based on the PeNSE survey.

TABLE B.VI

DRINKING: BALANCING TESTS - PSEUDO-R^2; B & R OF RUBIN

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Elementary School:								
Nearest-Neighbor Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.003	18.37	0.366	2.2	2.0	11.8	0.98	0
Kernel Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.005	33.29	0.010	2.2	1.2	15.9	1.10	0
Radius Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.007	50.93	0.000	2.6	1.3	19.7	1.18	0
Elementary School								
Nearest-Neighbor Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	14.91	0.531	3.3	2.4	16.8	1.01	33
Kernel Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.003	10.03	0.865	2.4	1.8	13.7	1.02	33
Radius Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	15.90	0.460	2.9	1.7	17.3	1.11	33
High School								
Nearest-Neighbor Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.002	9.00	0.913	1.9	1.1	10.7	1.00	0
Kernel Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.006	25.59	0.060	2.6	1.2	18.1	1.08	0
Radius Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.008	34.19	0.005	3.0	1.7	21.0	1.10	0

Note: * if B>25%, R is outside [0.5; 2]. Prepared by the authors based on the PeNSE survey.

TABLE B.VII

CONSUMPTION OF ILLICIT DRUGS: BALANCING TESTS - PSEUDO-R^2; B & R OF RUBIN

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Elementary School:								
Nearest-Neighbor Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.003	18.44	0.361	2.2	2.0	11.8	0.98	0
Kernel Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.005	33.40	0.010	2.2	1.1	15.9	1.10	0
Radius Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.007	51.08	0.000	2.6	1.3	19.7	1.18	0
Elementary School								
Nearest-Neighbor Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	14.91	0.531	3.3	2.4	16.8	1.01	33
Kernel Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.003	10.03	0.865	2.4	1.8	13.7	1.02	33
Radius Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.005	15.90	0.460	2.9	1.7	17.3	1.11	33
High School								
Nearest-Neighbor Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.002	9.10	0.909	1.8	1.1	10.8	1.00	0
Kernel Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.006	25.72	0.058	2.6	1.2	18.1	1.08	0
Radius Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.008	34.36	0.005	3.0	1.7	21.0	1.10	0

Note: * if B>25%, R is outside [0.5; 2]. Prepared by the authors based on the PeNSE survey.

TABLE B.VIII

FREQUENCY OF ILLICIT DRUG CONSUMPTION: BALANCING TESTS - PSEUDO-R^2; B & R OF RUBIN

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Elementary School:								
Nearest-Neighbor Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.006	7.07	0.983	3.6	2.9	18.5	1.14	0
Kernel Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.006	6.71	0.987	3.3	2.6	18.0	1.05	0
Radius Matching								
Non-Paired	0.021	206.13	0.000	9.3	4.7	34.9*	1.00	25
Paired	0.007	8.24	0.961	3.4	2.4	20.0	1.05	0
Elementary School								
Nearest-Neighbor Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.040	14.23	0.581	10.1	7.1	47.3*	0.74	0
Kernel Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.038	13.89	0.607	9.1	7.5	46.0*	0.83	0
Radius Matching								
Non-Paired	0.028	104.81	0.000	11.4	7.2	39.9*	1.15	67
Paired	0.043	15.37	0.498	9.9	7.3	49.2*	0.78	0
High School								
Nearest-Neighbor Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.012	9.54	0.848	4.7	3.6	26.2*	1.05	0
Kernel Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.011	8.43	0.935	4.4	4.2	24.6	1.01	0
Radius Matching								
Non-Paired	0.020	121.61	0.000	9.5	4.3	34.5*	0.92	0
Paired	0.013	9.76	0.879	4.7	4.0	26.5*	0.99	0

Note: * if B>25%, R is outside [0.5; 2]. Prepared by the authors based on the PeNSE survey.

APPENDIX C: SENSITIVITY ANALYSIS OF SUBSAMPLES

TABLE C.I

SENSITIVITY ANALYSIS OF SUBSAMPLES: ELEMENTARY SCHOOL AND HIGH SCHOOL

Elementary School									
Cigarette Smoking					Drinking				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	5.5217	5.5217	0.0000	0.0000	1	6.2414	6.2414	0.0000	0.0000
2	1.5154	13.0622	0.0000	0.0000	2	2.5938	15.3861	0.0000	0.0000
Frequency of Alcohol Consumption					Consumption of Illicit Drugs				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	6.2414	6.2414	0.0000	0.0000	1	3.7350	3.7350	0.0000	0.0000
2	2.593	15.3861	0.0000	0.0000	2	1.6537	9.6005	0.0000	0.0000
High School									
Cigarette Smoking					Frequency of Smoking Cigarettes				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	4.8866	4.8866	0.0000	0.0000	1	3.3562	3.3562	0.0000	0.0000
2	4.3032	14.4049	0.0000	0.0000	2	1.8424	9.0208	0.0000	0.0000
Drinking					Frequency of Alcohol Consumption				
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-
1	3.5813	3.5813	0.0000	0.0000	1	3.8733	3.8733	0.0000	0.0000
2	6.3643	13.7746	0.0000	0.0000	2	5.3203	13.3204	0.0000	0.0000
Consumption of Illicit Drugs									
Gamma (Γ)	Q_mh+	Q_mh-	p_mh+	p_mh-					
1	5.6572	5.6572	0.0000	0.0000					
2	1.4529	13.3172	0.0000	0.0000					

Note: (1) For Elementary School students, the sensitivity estimates for health risk behavior (frequency of smoking cigarettes and frequency of consuming illicit drugs) were not considered, given the absence of effect among youths from single-parent households for these risk behaviors; (2) For Elementary School students, the sensitivity estimates for the health risk behavior (frequency of consuming illicit drugs) was not considered, due to the absence of effect among youths from single-parent households for this risk behavior. Prepared by the authors based on the PeNSE survey.

APPENDIX D: PROPENSITY SCORE GRAPHS BEFORE AND AFTER MATCHING

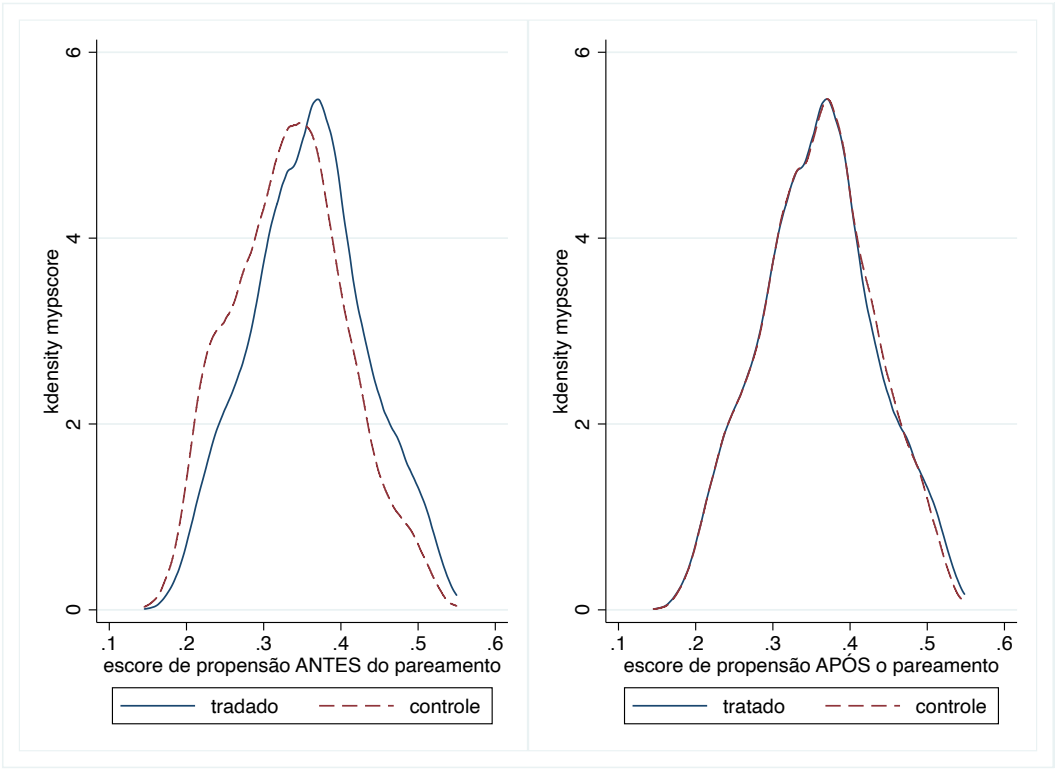

FIGURE D.1.—Complete sample (elementary school). Nearest-Neighbor matching; Prepared by the authors based on the PeNSE survey.

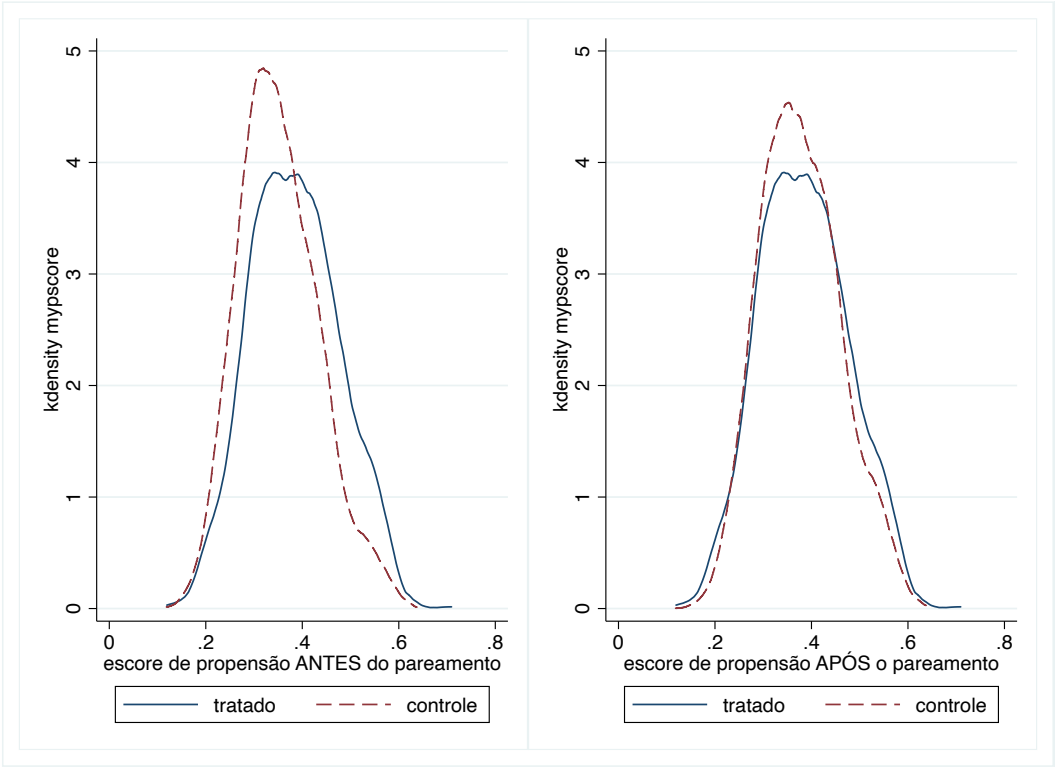

FIGURE D.2.—Elementary school. Kernel matching; Prepared by the authors based on the PeNSE survey.

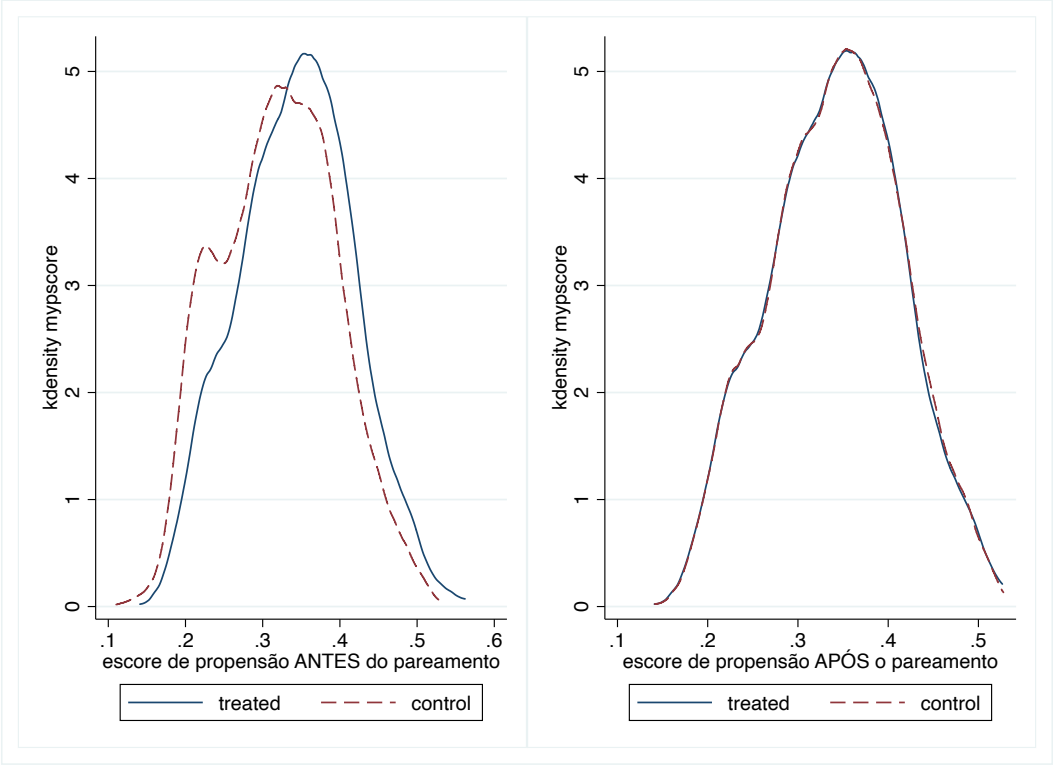

FIGURE D.3.—High school. Nearest-Neighbor matching; Prepared by the authors based on the PeNSE survey.

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