Subjective knowledge of Brazilian adolescent students about the health effects of smoking: association with smoking status

Conhecimento subjetivo dos estudantes adolescentes brasileiros sobre os efeitos do fumo na saúde: associação com o status de fumante

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ABSTRACT
This study aimed to assess the subjective knowledge (SK) of Brazilian adolescent students about the health effects of smoking, and the association between the smoking status and their SK. A cross-sectional school-based survey was carried out. Participants were 3034 high-school students aged 13 to 19 from 13 municipalities in Midwestern Brazil. SK was assessed regarding three questions about the (1) general health effects of smoking, (2) oral health effects of smoking, and (3) health effects of secondhand smoking. For each question, SK was rated as low or high. Smoking status categories were (1) never smokers, (2) former smokers, and (3) current smokers. Poisson regression was used in the statistical analysis. Prevalence ratios (PR) and 95% confidence intervals (CI) were reported. About half of the participants had low SK about the general health effects of smoking, and most had low SK about oral health (62.9%) and second-hand effects (61.5%). Compared with smokers and former smokers, never smokers were more likely to have low SK about general (PR=1.52; 95%CI=1.25-1.85), oral (PR=1.17; 95%CI=1.03-1.32) and second-hand effects (PR=1.21; 95%CI=1.16-1.38) of smoking. In summary, adolescents tended to perceive that they had low knowledge about the effects of smoking and second-hand smoking on general and oral health. Low SK was associated with smoking status, meaning that, compared to smokers and former smokers, never smokers had the lower SK about the health effects of smoking.

Keywords: Adolescent, Knowledge, Smoking.
RESUMO
Este estudo teve como objetivo avaliar o conhecimento subjetivo (SK) dos estudantes adolescentes brasileiros sobre os efeitos do fumo na saúde, e a associação entre o status de fumante e sua SK. Foi realizada uma pesquisa transversal com base na escola. Os participantes eram 3034 alunos de 13 a 19 anos do ensino médio de 13 municípios do Centro-Oeste do Brasil. A SK foi avaliada com relação a três perguntas sobre os (1) efeitos gerais do fumo à saúde, (2) efeitos do fumo à saúde oral, e (3) efeitos do fumo passivo à saúde. Para cada pergunta, a SK foi classificada como baixa ou alta. As categorias de status de fumantes foram (1) nunca fumantes, (2) ex-fumantes, e (3) fumantes atuais. A regressão de Poisson foi usada na análise estatística. Foram relatadas taxas de prevalência (PR) e intervalos de confiança (CI) de 95%. Cerca da metade dos participantes tinha baixa SK sobre os efeitos gerais do fumo à saúde, e a maioria tinha baixa SK sobre a saúde oral (62,9%) e efeitos de segunda mão (61,5%). Em comparação com os fumantes e ex-fumantes, nunca os fumantes tinham uma SK baixa sobre os efeitos gerais (PR=1,52; 95%CI=1,25-1,85), orais (PR=1,17; 95%CI=1,03-1,32) e de segunda mão (PR=1,21; 95%CI=1,16-1,38) do fumo. Em resumo, os adolescentes tenderam a perceber que tinham pouco conhecimento sobre os efeitos do fumo e do fumo passivo sobre a saúde geral e oral. O baixo SK estava associado ao status de fumante, o que significa que, comparado aos fumantes e ex-fumantes, nunca os fumantes tinham o SK mais baixo sobre os efeitos do fumo à saúde.

Palavras-chave: Adolescente, Conhecimento, Fumar.

1 INTRODUCTION
Smoking and exposure to tobacco smoke negatively impact health with the development of several chronic non-communicable diseases, diseases of the respiratory system and contagious diseases1. In the oral cavity, smoking also causes a devastating effect, causing neoplasms and contributing to the etiology of periodontal diseases2.

Among the various forms of presentation of tobacco products, smoked combustible cigarettes remain the most used worldwide3. Given that most adult smokers started smoking during adolescence4, the adolescent population is one of the most important target groups for preventing smoking initiation1,3. Among the adolescent smokers, it is essential to promote smoking cessation interventions1.

Many adolescents may not be aware that smoking is harmful for their health4-9, especially regarding second-hand smoking10-13 and oral health effects14. A lack of knowledge about the hazards of smoking has been described as a predictor of smoking status13,15-18 and susceptibility to smoking19-21 in this population group. Adolescents from Aboriginal and Black groups may be less likely than White adolescents to link smoking to health effects22. Also, male students have been found to have less knowledge of the health hazards of smoking than their female counterparts23.
Previous studies on adolescents' knowledge about smoking effects on health have focused on their objective knowledge measured by an objective test, instead of their subjective knowledge (SK). SK refers to the knowledge that individuals perceive to have. The measurement of SK about a product among its users or potential users is important because it can indicate not only their knowledge levels, but also their level of self-confidence about what they know.

Furthermore, the extant literature typically analyzed knowledge about smoking effects on health as a predictor of adolescent smoking. As the main global strategy to warn people about the harmful effects of cigarettes has been to warn smokers through the packaging of tobacco products, it can be suggested that smoking status has assumed the role of predictor of this knowledge among adolescents.

As consumers or potential consumers of both tobacco products and antitobacco messages, how do the adolescents evaluate their level of knowledge about the health effects of smoking? In this study, the aim was to assess the SK of adolescents about the health effects of smoking, and to estimate the association between the smoking status and their SK.

2 METHODS

We carried out a cross-sectional school survey. Participants were adolescent students from the Federal Institute of Education Science and Technology of Goiâs (IFG). This is a public educational institution that has high schools in 13 municipalities of Goiâs, in the Midwest region of Brazil, including one of the Brazilian capital cities. All the IFG schools (n=14) took part in the survey.

The sample size was calculated using the online OpenEpi tool and the following parameters for calculating proportions: (1) estimated population of IFG high school students in 2018, aged up to 19 years old (n=3694); (2) 5.9% expected frequency of current cigarette use (in the last 30 days) and 19.4% of cigarette experimentation, based on prevalence among Brazilian public school students aged 16 to 17 found by the National School Student Health Survey in 2015; (3) 2% sample error; and (4) 95% confidence interval. The minimum number estimated for the sample was 467 students for the ‘current smoker’ outcome and 1068 for the ‘tobacco use experimentation’ outcome. To ensure the sample size, all the IFG high-school students aged between 13 and 19 years old who were attending classes when the data were collected were invited to participate in the survey (n=3043).
The survey protocol was approved by the Research Ethics Committee (REC) of the sponsor institution, the Federal University of Goiás, Brazil (Approval #2142027). The REC exempted the survey from obtaining formal permissions from parents or guardians of underage adolescents (Approval #2431088). Subsequently, the protocol was approved by the REC of the institution where data were collected (Approval #2556510). Formal authorizations were given by school administrators, and all the participants signed informed consent forms.

Data were collected in a self-administered printed questionnaire, including validated scales and a set of questions specifically designed for this survey. The new questions were based on a literature review and later assessed by a group of six PhD researchers with experience in studies based on health questionnaires. The instrument was also pre-tested in a sample of 14 adolescents who were not part of the study’s target population. The flowchart with the procedures for systematizing the survey questionnaire is shown in Figure 1.

The outcome variables were low SK in relation to general and oral health, and second-hand effects of smoking. The choice for these three variables was based on the health content in cigarette pack warnings in Brazil. Questions were: How do you evaluate your knowledge about (1) Effects of smoking on the general health of people who smoke; (2) Effects of smoking on the oral health of people who smoke; (3) Effects of other people smoking on the health of people who do not smoke (passive smokers).

The answer categories for each question were: ‘no knowledge’, ‘little knowledge’, ‘average knowledge’, ‘good knowledge’, or ‘excellent knowledge’. Based on the responses, the sample was divided into low SK (no + little + average knowledge) and high SK (good + excellent).
The main independent variable was the adolescents’ smoking status, which was obtained in two yes/no questions: (1) ‘Have you ever tried smoking cigarettes, even one or two puffs?’, (2) ‘Currently, do you smoke cigarettes? (Select yes if you smoked at least one cigarette in the past 30 days)’. Those who answered ‘no’ to both questions were classified as never-smokers; those who answered ‘yes’ to the first and ‘no’ to the second question were former smokers; and those with two positive answers were smokers.

Covariates were: (1) Social exposure to smoking and (2) sociodemographic characteristics of the adolescents. Social exposure to smoking (No / Yes) was based on the information provided by the adolescents on the smoking status of their parents, friends, and romantic partners. If any of those were smokers, adolescents were classified as being socially exposed to smoking. The sociodemographic variables were: (1) Age: 13 – 19 years; (2) Sex: Male / Female; (3) Race/skin color according to official categories in
Brazil: White / Black / Brown / Yellow / Indigenous; (4) Educational level of the adolescents’ mothers, with seven categories ranging from no education to higher education.

In the statistical analysis, the IBM SPSS Statistics Software (v24) was used. We describe our data using counts (n) and proportions (%). Poisson regression with robust variance was used to estimate the raw and adjusted associations between the smoking status and SK. Prevalence ratios (PR) and 95% confidence intervals (CI) are reported.

The inclusion of covariates in the multivariable models was not based on statistical significance, but on the extant knowledge about the determinants of smoking among adolescents. Therefore, all the study covariates were included. To avoid reporting fallacious findings, estimates for associations between SK and the covariates were not reported.

3 RESULTS

A total of 3034 adolescents participated in the study (response rate = 99.7%). They were mostly female (53.6%), Brown (50.9%), and their mean age was 16 years (SD=1.1). The educational level of their mothers was mainly high school (32.4%) or higher education (29.4%). The majority had never experimented cigarettes (72.7%) and were socially exposed to smoking (65.6%) (Table 1).

The prevalence of low SK was 47.8% regarding effects of smoking on general health, and above 60% regarding both oral and second-hand effects (Table 1). The higher prevalence of low SK about each of these three effects occurred among never smokers (Figure 2).

Table 1. Participants’ sociodemographic and smoking-related characteristics (n=3034).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race/skin color</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>397</td>
<td>13.1</td>
</tr>
<tr>
<td>Brown</td>
<td>1543</td>
<td>50.9</td>
</tr>
<tr>
<td>White</td>
<td>952</td>
<td>31.4</td>
</tr>
<tr>
<td>Yellow</td>
<td>116</td>
<td>3.8</td>
</tr>
<tr>
<td>Indigenous</td>
<td>14</td>
<td>0.5</td>
</tr>
<tr>
<td>Not reported</td>
<td>12</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1404</td>
<td>46.3</td>
</tr>
<tr>
<td>Female</td>
<td>1625</td>
<td>53.6</td>
</tr>
<tr>
<td>Not reported</td>
<td>5</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Mothers’ level of education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>23</td>
<td>0.8</td>
</tr>
<tr>
<td>Incomplete elementary school</td>
<td>376</td>
<td>12.4</td>
</tr>
<tr>
<td>Elementary school</td>
<td>163</td>
<td>5.4</td>
</tr>
<tr>
<td>Incomplete High-school</td>
<td>258</td>
<td>8.5</td>
</tr>
<tr>
<td>High school</td>
<td>982</td>
<td>32.4</td>
</tr>
</tbody>
</table>
In both the unadjusted and adjusted Poisson regression analyses, low SK was statistically associated with the adolescents’ smoking status (Table 2). In comparison with smokers, never-smokers were 52% more likely to have low SK about smoking effects on general health, 17% more likely to have low SK about oral effects, and 21% more likely to have low SK about second-hand effects. Furthermore, former smokers were 41% more likely to have low SK about general health effects, and 16% more likely to have low SK on the second-hand effects of smoking, compared to smokers.

Figure 2. Percentages of low subjective knowledge about the health effects of smoking among adolescents, according to their smoking status. Source: Authors.
Table 2. Poisson regression between smoking status and low subjective knowledge about the health effects of smoking among adolescent students in Goiás, Midwestern Brazil.

<table>
<thead>
<tr>
<th>Smoking status</th>
<th>General health effects</th>
<th>Oral health effects</th>
<th>Second-hand effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never-smokers</td>
<td>1.62 (1.34; 1.96)</td>
<td>1.23 (1.08; 1.38)</td>
<td>1.27 (1.12; 1.44)</td>
</tr>
<tr>
<td>Former smokers</td>
<td>1.44 (1.17; 1.77)</td>
<td>1.13 (0.98; 1.29)</td>
<td>1.19 (1.04; 1.37)</td>
</tr>
<tr>
<td>Smokers</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Adjusted PR (95%CI) *

<table>
<thead>
<tr>
<th>Smoking status</th>
<th>General health effects</th>
<th>Oral health effects</th>
<th>Second-hand effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never-smokers</td>
<td>1.52 (1.25; 1.85)</td>
<td>1.17 (1.03; 1.32)</td>
<td>1.21 (1.06; 1.38)</td>
</tr>
<tr>
<td>Former smokers</td>
<td>1.41 (1.14; 1.74)</td>
<td>1.09 (0.95; 1.25)</td>
<td>1.16 (1.01; 1.34)</td>
</tr>
<tr>
<td>Smokers</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

* Adjusted for mother’s level of education, social exposure to smoking, race/skin color, age, and sex. PR: Prevalence ratio. CI: Confidence interval. Significance level: \(^1 p < 0.001; ^2 p < 0.01; ^3 p < 0.05\) (Wald test).

4 DISCUSSION

In this study, adolescent students reported their levels of SK about the effects of smoking on general and oral health, and second-hand smoking effect. High rates of low SK were observed, especially about the effects on oral health and the second-hand effects, indicating possibilities for improvements. These findings agree with several previous studies that observed low levels of knowledge on the harms of smoking among adolescents using objective measurements\(^5\)\(^\text{-}\)\(^1\)\(^4\).

When we compared the adolescents’ SK according to their smoking status, controlling for social exposure to smoking and sociodemographic characteristics, higher rates of low SK were reported by never-smokers in comparison with smokers and former smokers. This finding may be reflecting the current global situation when it comes to warning people about the dangers of smoking. While the coverage of mandatory health warnings in packs of tobacco products increased substantially worldwide during the past decade, a decrease in mass media campaigns was observed\(^1\).

Noticing health warning labels on cigarette packages has been associated with increased cognition about the harms of smoking\(^2\)\(^8\)\(^-\)\(^3\)\(^3\). Health warnings in tobacco products are one of the most powerful anti-smoking interventions of the W axis of the Monitor, Prevent, Offer, Warn, Enforce and Raise (MPOWER) initiative operated by the World
Health Organization to help countries controlling the smoking epidemics worldwide\textsuperscript{1}. However, because it mainly reaches people when they are exposed to tobacco products, it should be considered a high-risk strategy of anti-smoking education.

Anti-tobacco mass media campaigns are also effective anti-smoking interventions to reduce tobacco use\textsuperscript{1,31}, and cost-effective to fully educate large populations about the risks of tobacco use and exposure to second-hand smoke\textsuperscript{1}. Because the goal is to inform the whole population about the dangers of smoking, they should be recognized as population-based strategy of anti-smoking education.

Considering that knowledge about the health effects of smoking may reduce tobacco use\textsuperscript{34,35}, our findings suggest that the awareness of non-smokers should be specially targeted for the achievement of the fourth MPOWER global measure to promote smoking control: to warn people about the dangers of tobacco\textsuperscript{1}.

An analogy can be drawn between improving smokers’ knowledge about the harms of smoking and improving pregnant adolescents’ knowledge about the risks of becoming pregnant, which is to say that it is unacceptable to wait for adolescents to become smokers and only then provide warnings to them about the health harms of smoking. It may be too late, given that their knowledge may be overwhelmed by nicotine dependence\textsuperscript{36}.

By itself, knowledge and its rational assessment may not drive the smoking behaviour\textsuperscript{37}. Still, it is an essential domain related to the psychological capability of individuals to change their smoking behaviour, along with motivation and the opportunity to change\textsuperscript{35}.

The ‘smoking kills’ warning should be delivered properly to each adolescent, in addition to reaching those who are exposed to tobacco products. Although a high-risk education strategy to improve tobacco users’ knowledge is important, an intensification of population education strategies is now crucial to promote equity in the right to information about the dangers of tobacco use among adolescents.

The limitations of this study include its observational design which does not allow causal inference. Also, only public schools were included. An analysis among adolescents from public and private schools would have guaranteed better representativeness and, therefore, generalizability of the findings.

In summary, adolescents tended to perceive that they had low knowledge about the effects of smoking and second-hand smoking on general and oral health. Low SK was
associated with the smoking status, meaning that, compared to smokers and former smokers, never-smokers had lower SK about the health effects of smoking.
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