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Exposure to Tobacco in Video Games and Smoking among Gamers in Argentina

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Abstract

Background: Our objective was to assess whether exposure to tobacco in video games is associated with smoking among adolescent gamers from Argentina.

Methods: Cross-sectional data were analyzed from students in public and private middle schools in Argentina. Tobacco content in video games was estimated using previously validated methods and adolescents' tobacco exposure was assessed by multiplying tobacco content in the top three video games they play by the hours played per day. The primary outcome was current smoking. Multi-level logistic regression models adjusted for clustering within schools, regressing current smoking on tobacco exposure in video games (i.e., none, low, high) after controlling for age, sex, parental education, parenting style, parental rules about the use of video games, rebelliousness, sensation seeking, and "technophilia".

Results: Of the 3114 students who participated, 92% of boys (1685/1802) and 56% of girls (737/1312) played video games and were included in the analytic sample. The prevalence of smoking was 13.8% among boys and 22.0% among girls; 74.5% of boys played video games more than 1 hour per day compared with 47.7% of girls. High exposure to tobacco content in video games as compared to no exposure was independently associated with current smoking among girls (OR = 1.78; 95%CI = 1.02– 3.09) but not among boys (OR = 0.98; 95%CI = 0.64– 1.51).

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Competing Interests Statement: there are no competing interests provided for any authors.

Conclusions: Greater exposure to tobacco content in video games was associated with higher likelihood of smoking among Argentine girls who play video games, suggesting the need for policies that limit these exposures.

Keywords

Low/Middle income country; Media; Advertising and Promotion

INTRODUCTION

Adolescent smoking is a significant public health problem in the Latin American region. In 2012, 21.5% of Argentinean girls and 17.4% of boys (13–15 years old) were smokers.[1] There is consistent evidence that exposure to tobacco content in movies promotes youth smoking,[2–12] including evidence from Latin America.[13, 14] Another possible entertainment media vehicle for youth exposure to tobacco content is through video games, which are widely played by adolescents.[15] Many popular games include tobacco content. [16, 17]

Video games permeate modern entertainment culture. In the US, 65% of households have at least one member who plays at least three hours of video games a week.(http://www.theesa.com/wp-content/themes/esa/assets/EF2017_Design_FinalDigital.pdf).[18, 19]. In Argentina, 73% of adolescents play video games.[20, 21] Video games provide immersive, emotionally engaging experiences with high quality graphics and interactive storylines.[22] The agentic and risk-glorifying nature of many popular games has been associated with increased risk-taking inclinations as compared to more passive media consumption, such as television or film.[23]

There is some controversy over the effects of playing video games.[24–26] Still, a number of studies have shown that playing may influence a range of real-life behaviors,[27] including aggression,[28] risk-taking,[29, 30] drinking and marijuana use,[31, 32] poor school performance,[33] and prosocial behaviors.[34, 35] While tobacco content has been documented in video games,[36] including in games rated for youth,[16] to our knowledge, only one study has examined the association between tobacco exposure in video games and smoking.[37] After adjusting for sex and age, researchers found that British adolescents aged 11–17 exposed to tobacco content in video games were more likely to have used tobacco.

In order to reduce youth exposure to tobacco content in video games, the World Health Organization's Framework Convention on Tobacco Control (WHO-FCTC) recommends giving an adult rating to video games with tobacco content.[38] Nevertheless, the presence of tobacco in video games rated as appropriate for young adolescents has increased steadily. [16] Moreover, although the Entertainment Software Ratings Board (ESRB) includes tobacco in its rating considerations, these ratings are often inaccurate,[17] which makes it difficult for parents to control games for tobacco content.

This study aimed to assess the potential effects of exposure to tobacco content through video games on smoking among early adolescent gamers in Argentina using a novel methodology

to assess tobacco exposure. Our measurement combines both a more detailed quantification of tobacco content in video games, as well as the time spent playing. We hypothesized that exposure to more tobacco content in video games would be independently associated with greater likelihood of being a cigarette smoker after controlling for a range of factors that could confound the association between entertainment media exposures to risk behaviors and adolescent smoking.[2, 39, 40]

METHODS

Study Sample and Procedure

The data come from a larger study of Latin American adolescents, which aims to assess associations between tobacco use behaviors and exposure to tobacco marketing and tobacco content in entertainment media. The current study uses data from an October 2015, school-based, cross-sectional survey of students in 33 schools from 3 large cities in Argentina (Buenos Aires, Córdoba, and Tucumán), with public schools identified by the Ministry of Education (n = 18) and private schools identified through personal contacts (n = 15; 26% of Argentinean students attend private schools). A detailed description of school selection has been published elsewhere.[39] Passive consent was requested from parents or caretakers, and students signed an active consent form. Study protocols were approved by CEMIC (Centro de Educación Médica e Investigaciones Clínicas), an NIH-certified human subjects research board in Argentina.

Development of Questionnaire Measures

The anonymous, self-administered questionnaire included a range of items on media use, tobacco marketing exposures, social influences, and perceptions and use of tobacco, most of which had been used in surveys for adolescents previously implemented in Argentina, Mexico, and in the US.[41–44]

Assessment of tobacco consumption (Dependent variable)

A student was considered a “never smoker” if he or she reported never smoking cigarettes (not even a puff), “experimenter” if they reported having ever smoked but not in the past 30 days and, “current smoker” if he or she reported smoking any cigarettes during the previous 30 days.

Exposure to tobacco in video games (Independent Variable)

Students were asked “How often do you play with video games?” (0=don’t play video games; 1=1 hour a day, 2=2 hours a day, 3=3 hours a day, 4=4 hours a day respectively, 5=5 or more hours a day). Students then listed the three video games they played most frequently in the prior six months. Students who responded that they “don’t play video games” but named at least one video game in the second question (24% of the sample) were considered “casual gamers” and assigned a value of 0.25 hours of video game playing per day. Students who indicated they did not play video games and did not list any video games were not considered “gamers” and were excluded from the analysis. Our preliminary analyses (not shown) suggest that non-gamers represent a lower socioeconomic status (SES) population for which our explanatory variables (besides SES) do not do a good job of explaining

smoking. Therefore, we limit our analytic sample to those who play video games and highlight that our conclusions are restricted to that group. Furthermore, we conducted sensitivity analyses that included non-gamers (see below).

Exposure to tobacco via video games was assessed in three stages. First, we assessed tobacco content in video games that were most popular amongst students. Of 659 video games mentioned by students, we selected 105 that accounted for 85% of all games on student lists. Previous research found that the information about tobacco content provided by industry (i.e., ESRB, or Pan European Game Information, PEGI) is not reliable, especially for games with “Mature” ratings. Hence, we used a list of video games coded for tobacco content with a validated coding system.[17, 45] Fifty-nine of the 105 games were previously coded by one author (SF), and we coded the remaining 46 using the same methodology as those on the coded list of games: 1. we searched the ESRB database (<https://www.esrb.org/>) and recorded whether the game was coded as containing any tobacco content; 2. if ESRB referenced tobacco content, we entered the individual title of the game into the video game sharing website for *YouTube* (i.e.: <https://www.youtube.com/user/Willyrex>). Since many games can be played in multiple ways and may take 20 or more hours or more to complete, we selected videos that included both the arc of game play and the short cinematics (cut scenes) that tie game play sequences together and move the plot line. For each game, we watched a minimum of 90 minutes of game play, recording all tobacco content and its purpose in the game; 3. If ESRB did not reference tobacco content, we checked the information in the Common Sense Media data base (<https://www.common sense media.org>) and reviewed the video game a minimum of 90 minutes to confirm the information.

Following prior content analysis of tobacco in video games,[45] we coded videogames for six broad types of tobacco content no tobacco content found; visible tobacco paraphernalia (e.g., cigarettes, cigars, pipes, cigarette packs) present; tobacco products used to further game play; non-playable background characters using tobacco products; non-playable main characters using tobacco products; and playable characters using tobacco products. For each game, the number of these tobacco types found was summed to create a tobacco typology score (TTS) ranging from 0–5, with zero indicating no tobacco content and five indicating that all five types of tobacco typologies were found. To determine inter-rater reliability, a sample of video games coded in the US (8/59; 14%) were also coded by those coding the additional 46 games, with results indicating good reliability ($\kappa = 0.68$).

Students’ use of video games with tobacco content was assessed by averaging the TTS for the video games they reported playing most frequently. This average was then re-scaled, so that the lowest value was 0 for students who only played video games without tobacco content and the highest value was 1 for the students who played video games with all five types of tobacco typologies present in all the games they put on their list. Overall exposure was derived by multiplying this average TTS by the hours per day played (range 0.25 to 5) yielding a TTS exposure that ranged from 0 to 5. Since the TTS exposure distribution was positively skewed for both boys and girls (Figure 1), TTS was categorized into three levels: no exposure (TTS = 0), low exposure (TTS: >0 to 0.5), and high exposure (>0.5). The cutoff point between low and high exposure (0.5) allowed for approximately 1/4 of the sample of girls to be in the high-exposure group, which gave adequate sample size for model fitting.

The high exposure group included approximately 1/2 of the sample of boys, which allowed for comparison with girls.

For sensitivity analyses, tobacco exposure was calculated using two additional ways of coding video games. The Tobacco Index calculated the proportion of video games on their list with any tobacco content. The Mature Index calculated the proportion of Mature-Rated video games on their list, because tobacco content in these games is high[36] and may have been missed by our coding approach. For each of these indexes, we multiplied the proportions by game playing frequency (range 0–5), as we did for TTS.

Covariates—The sociodemographic variables included were age, sex, and educational attainment of parents (>12 years of formal education/< 12 years). Personal variables included the 4-item sensation-seeking scale (“I like to do scary things”, “I like to explore strange places”, “I like new and exciting experiences, even if I have to break the rules”, “Sometimes I do ‘crazy’ just for fun”, $\alpha=0.79$), with items averaged so that higher scores indicated higher sensation seeking tendencies (range 1–5)[46]. Rebelliousness was assessed with a 3-item scale (“I get in a lot of fights with other kids”, “I argue with my teachers”, “I like to break the rules”, $\alpha = 0.84$), where a higher score indicated more rebelliousness (range 1–5).[47] Parenting style was assessed with questions on authoritative parenting, using three items to describe responsiveness ($\alpha = 0.82$) and another 3 items for demandingness ($\alpha = 0.70$), measured separately for moms and dads, where higher scores indicated more beneficial parenting styles.[40, 48] Family structure was evaluated as living in a nuclear family (yes/no). Media-related variables included a technophilia index previously used in Mexico (i.e., summing use of smartphone, tablet, and computer; range 0–3)[49], and rules about video games use (“Do your parents have rules about what video games you can play?”, yes/no)[39, 50]. Tobacco-related variables included smoking among close social network members (i.e., any of five closest friends, any household member). Positive expectancies for tobacco was assessed with five items (“Smoking helps me have a good time”, “Smoking makes me feel older”, “Smoking is cool”, “Smoking gets rid of nervousness”, “Smoking gives me something to do when I am bored”, $\alpha = 0.79$), with responses averaged so that higher scores indicated more positive expectancies (range 1–5).

Statistical analysis—All data analyses were conducted with Stata version v13 (StataCorp, College Station, TX). The analytic sample included only gamers. First, we examined the distribution of study variables among girls and boys. To assess significant differences in these characteristics by sex, continuous and categorical variables were compared using multi-level linear or logistic regression respectively, with random intercepts for school, which adjusted for correlation among observations within schools. Multilevel ordered logistic regression models (with random intercepts for school) were used to regress TTS exposure (none, low, high) on sociodemographic, personal, and media-related covariates. Finally, multilevel logistic regression models with random intercepts for school were used to regress current smoking on TTS exposure and covariates. As the interaction between sex and exposure was significant ($p<0.05$), all analyses were stratified by sex.

Missing data affected primarily the list of video games most often played; of 2422 gamers, 278 (11.5%) did not mention any video game. To minimize bias we used multiple

imputation by chained equations to impute missing data on tobacco content in video games played by each respondent (TTS index, Tobacco Index, and Mature Index). Separate imputation models for boys and girls with 50 different data sets in each case were created. Then we calculated tobacco exposure for each respondent as described above (see Exposure to tobacco in video games, Measurement). We compared analyses from multiple imputation and complete case models, and results were consistent in terms of magnitude of effect and valence, although statistical significance changed for some covariates. Use of either approach would not influence our interpretation of the primary study results. Hence, results from regression models based on imputation are presented.

Sensitivity analyses were conducted by testing whether results were consistent for alternative measures of tobacco exposure, namely using the Tobacco Index and the Mature Index for assessing exposure. Results were consistent across measures; therefore, our results focus primarily on results from models with the most detailed exposure measure (TTS). In other sensitivity analyses, we fitted models including non-gamers (Supplementary Tables I and II). As the results did not change regarding the associations with higher vs lower exposure to tobacco content in games, we prefer to keep our primary analytic sample focused on those who play video games.

RESULTS

Of all students eligible to participate ($n = 3,646$), 3,114 students responded to the survey (response rate 85.4%), 1,802 boys and 1,312 girls; 1,685 (93.5%) boys and 737 (56.2%) girls were gamers and were included in the analytic sample ($n = 2,422$). Their characteristics are described in Table 1.

Boys played video games more frequently than girls: 74.5% of boys played more than 1 hour per day compared with 47.7% of girls, and 6.1% of boys compared with 15.5% of girls were casual gamers (students who responded that they “don’t play video games” but named at least one video game they played most frequently). In our sample, the video games most often played by boys were *Grand Theft Auto* (13.1%), *FIFA Soccer* (12.0%) and *Pro Evolution Soccer –PES* (10.6%). The most popular video games among girls were: *Grand Theft Auto* (11.7%); *Super Mario Bros* (4.1%), and *Candy Crush Saga* (4.1%). The video games that boys played were more likely to contain tobacco than those played by girls, as indicated by their scores on the TTS, Tobacco Index, and Mature Index ($p < 0.001$ for all three). Total video game tobacco exposure that accounted for time spent playing followed this same pattern (e.g., 54% of girls vs 23.9% of boys were not exposed; $p < 0.001$, see Figure 1).

Table 2 shows the variables associated with video game TTS exposure. After adjusting for other covariates, technophilia was the only variable associated with TTS exposure among boys (OR = 1.18, 95% CI = 1.04 – 1.33). Among girls no variables were independently associated with TTS exposure.

Table 3 shows that high exposure to tobacco as compared to no exposure to tobacco in video games was independently associated with current smoking among girls (OR = 1.78; 95% CI

= 1.02 – 3.09) but not among boys (OR = 0.98; 95% CI = 0.64 – 1.51). Similarly, Figure 2 shows the predicted probabilities of current smoking from these models for no, low, and high exposure to tobacco in video games among boys and girls, with a dose-dependent association among girls but no association among boys.

The three alternative measures of tobacco content in video games were strongly correlated (Spearman $r > .78$, $p < 0.001$). We conducted sensitivity analysis for adjusted models predicting current tobacco use by substituting the Tobacco Index exposure and the Mature Index exposure variables for the TTS exposure variable. Model results followed a similar pattern for both boys (i.e., OR_{Tobacco Index high vs none} = 0.88 95% CI = 0.55 – 1.39; OR_{Mature Rated Exposure high vs none} = 0.77, 95% CI = 0.50 – 1.21) and girls (i.e., OR_{Tobacco Index high vs none} = 1.91 95% CI = 1.02 – 3.58; OR_{Mature Rated Exposure high vs none} = 2.01, 95% CI = 1.07 – 3.81).

DISCUSSION

Our results indicate that playing video games is much more common among boys than girls and that boys spend more time playing video games than girls. Because of this, it was not surprising to find that estimated exposure to tobacco in video games was higher for boys, who were also more likely to play video games with tobacco content, including adult-rated games. Nevertheless, our results suggest that tobacco exposure in video games is associated with current smoking only among girl gamers.

Our findings are partially consistent with those of Cranwell et al.[37] Similar to them, we found that boys played more often than girls and played adult video games or games with tobacco content more often than girls. Cranwell et al also reported a positive association between tobacco exposure in video games and smoking, although differences by sex were not reported. Our study included a more accurate measure of tobacco exposure in video games and several control variables in the models.

Although our survey was not designed to specifically investigate gender differences and therefore did not include questions to explore this issue in depth, the pattern of results suggests a number of reasons for this difference. One possible explanation is the significantly higher smoking prevalence among Argentine girls than boys (22% vs. 14%, respectively), which suggests that girls may be more susceptible to pro-tobacco influences than boys. Another possibility is omitted variable bias, due to not adjusting for a characteristic of girls that is associated with both smoking and playing mature-rated games for which we were unable to control. However, our models adjusted for key potential confounders, such as rebelliousness and sensation seeking, and found that they were not independently correlated with smoking or tobacco content exposure amongst girls. While some omitted variable would better explain this phenomenon, qualitative research with females who do and do not play video games and who do and do not smoke may be necessary to further explore potential confounding factors.

This study has several limitations which should be acknowledged. First, data on exposure to tobacco in video games and current smoking were all cross-sectional; therefore, we cannot

determine the temporal sequence of events. Second, the sample may not be representative of the broader Argentinean population, as schools were not randomly selected. Selected schools, however, had a wide range of economic diversity, and the frequency of playing video games in the studied population was similar to that reported in a national survey[21] suggesting that our results are not likely to be substantially biased. Third, we restricted our analysis to gamers. Further studies will be necessary to better characterize non-gamers, especially girls, given that non-gamers also have a higher likelihood of being smokers compared to gamers who do not play video games with tobacco content. Because many students reported the name of the game but not the specific version played, we did not know whether the actual version played was the same as the one that we used to assess tobacco content. Tobacco content may vary between versions. For example, in earlier versions of *Grand Theft Auto*, players did not have the option of in-game smoking for the playable characters, but in the latest version, *Grand Theft Auto V*, one of the playable characters smoked and players could direct the character to smoke during various sequences. Our estimation of tobacco content assessed the last version of video game at the time of the survey, which may not accurately represent the game version that students used. Furthermore, the TTS does not capture the average amount of time that any player may be exposed to tobacco content, but rather the number of ways that tobacco is depicted in games. Inaccuracies regarding game version may be compounded by these measurement decisions. It is important to note that the amount of exposure to tobacco content in individual games will vary depending on how the player engages with the game. For example, in some *Call of Duty* games players may choose to play in either campaign or multiplayer mode. If players play in campaign mode, they play through the story and are exposed to multiple tobacco impressions. If players play in multiplayer mode, the story arc is muted and players see no tobacco imagery. However, we believe our approach does a reasonably good job of accounting for exposure to tobacco in video games because we based our assessment of tobacco content on a novel strategy to categorize the level of tobacco content in video games, applied this content coding scheme to the top video games that students report playing, and included time spent playing, since the amount of repeated playing of video games is one of the ways that it differs from watching movies (where exposure is much less likely to be repeated as frequently). Additionally, we conducted sensitivity analyses with alternative approaches for measuring exposure, namely using the Tobacco Index (proportion of video games with any tobacco content) and the Mature Index (proportion of Mature-Rated video games). Results were consistent across the measures, but we focused primarily on results from models with the more detailed exposure measure (TTS) that we believed to adequately consider key parameters of interest. It is possible that other aspects of video game play besides the tobacco content could play a role in prompting tobacco use. For example, Hull et al[47] found that playing violent games like *Grand Theft Auto* was associated with multiple deviant behaviors and theorized that this is because adolescents play generally deviant characters in those types of games, leading to a higher tolerance of many risky behaviors. Finally, we examined exposure to only one type of entertainment media and we are not able to estimate how much overlap there is between exposure to tobacco in video games and exposure to tobacco use in other entertainment media; additional research is needed to clarify the independent and potentially interactive contributions of these sources.

Despite the limitations of this study, the association we found between exposure to tobacco in video games and smoking during early adolescence among Argentinean girl gamers merits further inquiry. This is the second study of which we are aware that examines the correlates of playing video games with tobacco content among adolescents, and the first from any Latin American or low- or middle-income country. Our findings also are important for Argentina, suggesting that tobacco exposure should be included in the rating system of video games and parents should be encouraged to limit the use of video games with tobacco content.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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REFERENCES

- [1]. Ministerio de Salud y Ambiente de la Nación. Encuesta Mundial de Tabaquismo en Jovenes, Resumen Ejecutivo. Argentina 2012 Buenos Aires, Argentina: Ministerio de Salud 2013.
- [2]. National Cancer Institute. The Role of the Media in Promoting and Reducing Tobacco Use. Tobacco Control Monograph No. 19 Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute 2008.
- [3]. US Department of Health and Human Services. Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health 2012.
- [4]. Dalton MA, Sargent JD, Beach ML, et al. Effect of viewing smoking in movies on adolescent smoking initiation: a cohort study. *Lancet* 2003;362(9380):281–285. [PubMed: 12892958]
- [5]. Morgenstern M, Poelen EaP, Scholte R, et al. Smoking in movies and adolescent smoking: cross-cultural study in six European countries. *Thorax* 2011;66:875–883. [PubMed: 21873322]
- [6]. Morgenstern M, Sargent JD, Engels RC, et al. Smoking in movies and adolescent smoking initiation: longitudinal study in six European countries. *Am J Prev Med* 2013;44(4):339–344. [PubMed: 23498098]
- [7]. Sargent JD. Smoking in film and impact on adolescent smoking: with special reference to European adolescents. *Minerva Pediatr* 2006;58(1).
- [8]. Dalton MA, Bernhardt AM, Gibson JJ, et al. Use of cigarettes and alcohol by preschoolers while role-playing as adults: “Honey, have some smokes”. *Arch Pediatr Adolesc Med* 2005;159(9): 854–859. [PubMed: 16143745]
- [9]. Tickle JJ, Sargent JD, Dalton MA, et al. Favourite movie stars, their tobacco use in contemporary movies, and its association with adolescent smoking. *Tob Control* 2001;10(1):16–22. [PubMed: 11226355]
- [10]. Sargent JD, Dalton MA, Beach ML, et al. Viewing tobacco use in movies: does it shape attitudes that mediate adolescent smoking? *Am J Prev Med* 2002;22(3):137–145. [PubMed: 11897456]
- [11]. Arora M, Mathur N, Gupta VK, et al. Tobacco use in Bollywood movies, tobacco promotional activities and their association with tobacco use among Indian adolescents. *Tob Control* 2012;21(5):482–487. [PubMed: 21730099]
- [12]. Hanewinkel R, Sargent JD, Karlsdottir S, et al. High youth access to movies that contain smoking in Europe compared with the USA. *Tob Control* 2013;22(4):241–244. [PubMed: 22184208]

- [13]. Thrasher JF, Sargent JD, Huang L, et al. Does film smoking promote youth smoking in middle-income countries?: A longitudinal study among Mexican adolescents. *Cancer epidemiology, biomarkers & prevention* 2009;18:3444–3450.
- [14]. Barrientos-Gutierrez I, Mejia R, Perez-Hernandez R, et al. Time trends for tobacco and alcohol use in youth-rated films popular in Mexico and Argentina, from 2004–2012. *Salud publica de Mexico* 2017;59(1):76–83. [PubMed: 28423113]
- [15]. Gentile D Pathological video-game use among youth ages 8 to 18: a national study. *Psychological science* 2009;20(5):594–602. [PubMed: 19476590]
- [16]. Barrientos-Gutierrez T, Barrientos-Gutierrez I, Lazcano-Ponce E, et al. Tobacco content in video games: 1994–2011. *The Lancet Oncology* 2012;13(3):237–238. [PubMed: 22489290]
- [17]. Forsyth SR, Malone RE. Tobacco imagery in video games: ratings and gamer recall. *Tob Control* 2015.
- [18]. Entertainment Software Association. *Industry Facts* 2015.
- [19]. truth initiative. *Smoking and Video Games* Washington, DC 2015.
- [20]. Gobierno de la Ciudad de Buenos Aires. Hábitos de uso del tiempo libre y prácticas culturales de la población de la Ciudad de Buenos Aires,. *Encuesta Anual de Hogares 2012*. Ciudad Autonoma de Buenos Aires http://www.estadisticaciudad.gob.ar/eyc/wp-content/uploads/2015/04/eah_2012_habitos_uso_tiempo_libre_info_2014_mayo.pdf 2012.
- [21]. Sistema de Informacion Cultural de la Argentina. *Encuesta nacional de Consumos Culturales Buenos Aires, Argentina: Ministerio de Cultura* <http://www.sinca.gob.ar/sic/publicaciones/libros/EECC.pdf> 2013.
- [22]. Barrientos-Gutierrez T, Barrientos-Gutierrez I, Thrasher J. Video games and the next tobacco frontier: smoking in the Starcraft universe. *Tob Control* 2012;21(4):443–444. [PubMed: 22550085]
- [23]. Fischer P, Greitemeyer T, Kastenmüller A, et al. The effects of risk-glorifying media exposure on risk-positive cognitions, emotions, and behaviors: a meta-analytic review. *Psychological bulletin* 2011;137:367–390. [PubMed: 21341887]
- [24]. Ferguson CJ. Pay No Attention to That Data Behind the Curtain: On Angry Birds, Happy Children, Scholarly Squabbles, Publication Bias, and Why Betas Rule Metas. *Perspectives on psychological science : a journal of the Association for Psychological Science* 2015;10(5):683–691. [PubMed: 26386008]
- [25]. Ferguson CJ. Do Angry Birds Make for Angry Children? A Meta-Analysis of Video Game Influences on Children's and Adolescents' Aggression, Mental Health, Prosocial Behavior, and Academic Performance. *Perspectives on psychological science : a journal of the Association for Psychological Science* 2015;10(5):646–666. [PubMed: 26386002]
- [26]. Ferguson CJ, Trigan B, Pilato S, et al. Violent Video Games Don't Increase Hostility in Teens, but They Do Stress Girls Out. *The Psychiatric quarterly* 2015.
- [27]. Subrahmanyam K, Greenfield P, Kraut R, et al. The impact of computer use on children's and adolescents' development. *Applied Developmental Psychology* 2001;22:7–30.
- [28]. Anderson CA, Shibuya A, Ihori N, et al. Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: a meta-analytic review. *Psychological bulletin* 2010;136(2):151–173. [PubMed: 20192553]
- [29]. Fischer P, Greitemeyer T, Morton T, et al. The racing-game-effect: Why do video racing games increase risktaking inclinations? *Personality and Social Psychology Bulletin* 2009;35:1395–1409. [PubMed: 19596767]
- [30]. Fischer P, Kubitzki J, Guter S, et al. Virtual driving and risk taking: Do racing games increase risk taking cognitions, affect, and behaviors? *Journal of Experimental Psychology: Applied* 2007;13:22–31. [PubMed: 17385999]
- [31]. Armstrong KE, Bush HM, Jones J. Television and video game viewing and its association with substance use by Kentucky elementary school students, 2006. *Public health reports* 2010;125(3):433–440. [PubMed: 20433038]
- [32]. Denniston MM, Swahn MH, Hertz MF, et al. Associations between Electronic Media Use and Involvement in Violence, Alcohol and Drug Use among United States High School Students. *The western journal of emergency medicine* 2011;12(3):310–315. [PubMed: 21731788]

- [33]. Gentile DA, Lynch PJ, Linder JR, et al. The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance. *Journal of adolescence* 2004;27(1):5–22. [PubMed: 15013257]
- [34]. Gentile DA, Anderson CA, Yukawa S, et al. The effects of prosocial video games on prosocial behaviors: international evidence from correlational, longitudinal, and experimental studies. *Personality & social psychology bulletin* 2009;35(6):752–763. [PubMed: 19321812]
- [35]. Greitemeyer T Playing violent video games increases intergroup bias. *Personality & social psychology bulletin* 2014;40(1):70–78. [PubMed: 24085715]
- [36]. Forsyth SR, Malone RE. Smoking in Video Games: A Systematic Review. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco* 2015.
- [37]. Cranwell J, Whittamore K, Britton J, et al. Alcohol and Tobacco Content in UK Video Games and Their Association with Alcohol and Tobacco Use Among Young People. *Cyberpsychology, behavior and social networking* 2016;19(7):426–434.
- [38]. WHO. Guidelines for implementation of Article 13 of the WHO Framework Convention on Tobacco Control Geneva, Switzerland: World Health Organization, Tobacco Free Initiative http://www.who.int/fctc/guidelines/article_13.pdf 2009.
- [39]. Mejia R, Perez A, Pena L, et al. Parental Restriction of Mature-rated Media and Its Association With Substance Use Among Argentinean Adolescents. *Academic pediatrics* 2015.
- [40]. Pena L, Lorenzo-Blanco EI, Perez A, et al. Parental Style and Its Association With Substance Use in Argentinean Youth. *Subst Use Misuse* 2017;52(4):518–526. [PubMed: 28010167]
- [41]. Dal Cin S, Worth KA, Dalton MA, et al. Youth exposure to alcohol use and brand appearances in popular contemporary movies. *Addiction* 2008;103(12):1925–1932. [PubMed: 18705684]
- [42]. Thrasher JF, Jackson C, Arillo-Santillan E, et al. Exposure to smoking imagery in popular films and adolescent smoking in Mexico. *Am J Prev Med* 2008;35(2):95–102. [PubMed: 18617078]
- [43]. Alderete E, Kaplan CP, Gregorich SE, et al. Smoking behavior and ethnicity in Jujuy, Argentina: evidence from a low-income youth sample. *Substance use & misuse* 2009;44(5):632–646. [PubMed: 19360537]
- [44]. Mejia R, Perez A, Abad-Vivero EN, et al. Exposure to Alcohol Use in Motion Pictures and Teen Drinking in Latin America. *Alcohol Clin Exp Res* 2016;40(3):631–637. [PubMed: 26857804]
- [45]. Forsyth SR, Malone RE. Tobacco Content in Video Games: Categorization of Tobacco Typologies and Gamer Recall. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco* 2017 Date; Volume <http://www.ncbi.nlm.nih.gov/pubmed/29149304> (accessed Nov 15).
- [46]. Sargent JD, Tanski S, Stoolmiller M, et al. Using sensation seeking to target adolescents for substance use interventions. *Addiction* 2010;105(3):506–514. [PubMed: 20402995]
- [47]. Hull JG, Draghici AM, Sargent JD. A Longitudinal Study of Risk-Glorifying Video Games and Reckless Driving. *Psychology of Popular Media Culture* 2012;1(4):244–253.
- [48]. Jackson C, Henriksen L, Foshee VA. The Authoritative Parenting Index: predicting health risk behaviors among children and adolescents. *Health education & behavior : the official publication of the Society for Public Health Education* 1998;25(3):319–337. [PubMed: 9615242]
- [49]. Thrasher JF, Abad-Vivero EN, Barrientos-Gutierrez I, et al. Prevalence and Correlates of E-Cigarette Perceptions and Trial Among Early Adolescents in Mexico. *J Adolesc Health* 2016;58(3):358–365. [PubMed: 26903433]
- [50]. Tanski SE, Cin SD, Stoolmiller M, et al. Parental R-rated movie restriction and early-onset alcohol use. *J Stud Alcohol Drugs* 2010;71(3):452–459. [PubMed: 20409440]

What this paper adds:**“What is already known on this subject”.**

Many studies have found a relationship between tobacco content in movies and youth smoking. Video games are played by most adolescents, yet only one study has assessed the association between tobacco exposure in video games and smoking.

“What important gaps in knowledge exist on this topic”.

Only one prior study has examined the association between tobacco exposure in video games and tobacco consumption among youth. Differential effects of such exposures by sex have not been studied even though boys and girls differ in the amount and types of games that they play.

“What this study adds”.

This study used a novel approach to measure tobacco exposure in video games. Greater exposure to tobacco in video games was independently associated with higher likelihood of smoking among girls but not boys who play video games, suggesting that the effects of video games on risk behaviors may differ by sex.

Figure 1: Distribution of tobacco exposure in video games among boys (left) and girls (right). Tobacco exposure was calculated using a summative measure of five types of tobacco content in the three video games reported as most often played, multiplied by the frequency of playing video games. TTS, Tobacco Typology Score.

Figure 2:

Adjusted probability of current smoking by amount of tobacco exposure among adolescent gamers, stratified by sex. TTS exposure is the Tobacco content (assessing the 5 typologies of tobacco content) in the three video games reported by each student multiplied by the frequency of playing video games.

Table 1.

Characteristics of adolescent gamers stratified by sex (n = 2,422)

Variable	Boys N= 1,685 n (%)	Girls N= 737 n (%)	p-value
Sociodemographic and personal characteristics			
Age, years; mean (SD)	14.36 (1.1)	14.06 (1.0)	0.002
Public school	1,243 (73.8)	430 (58.3)	<0.001
Highest parent education> 12 years	644 (38.3)	292 (39.7)	0.39
Sensation seeking (range=1–5), mean (SD)	3.48 (0.9)	3.46 (1.0)	0.32
Rebelliousness (range= 1–5), mean (SD)	2.33 (1.0)	2.27 (1.00)	0.24
Parenting style (range= 1–5), mean (SD)			
<i>Mother</i>	4.03 (0.8)	3.97 (0.8)	0.048
<i>Father</i>	3.71 (1.0)	3.34 (1.1)	<0.001
Nuclear family	1,013 (60.9)	418 (57.3)	0.12
Technophilia (range= 0–3), mean (SD)	2.10 (0.8)	2.11 (0.7)	0.64
Tobacco related variables			
<i>Current smoker</i>	231 (13.8)	162 (22.0)	<0.001
<i>Experimenters</i>	303(17.9)	151 (20.5)	<0.001
<i>Never smokers</i>	1,151 (68.3)	424 (57.5)	<0.001
Someone smokes at home	917 (54.4)	444 (60.2)	0.02
At least one friend smokes	922 (55.3)	477 (64.8)	<0.001
Positive tobacco expectancies (1–5), mean (SD)	2.29 (0.9)	2.36 (0.9)	0.14
Video game variables			
Rules about video game use	210 (12.6)	89 (12.2)	0.92
Frequency of playing video games			<0.001
<i>Casual gamers</i> *	102 (6.1)	114 (15.5)	
<i>< 1 hour/day</i>	327 (19.4)	271 (36.8)	
<i>1–2 hours/day</i>	536 (31.8)	164 (22.2)	
<i>3–4 hours/day</i>	397 (23.5)	98 (13.3)	
<i>5 hours/day</i>	323 (19.2)	90 (12.2)	
Tobacco in video games played			
<i>TTS average (range=0–1)</i>	0.33 (0.3)	0.22 (0.3)	<0.001
<i>Tobacco Index (range=0–1)</i>	0.42 (0.3)	0.27 (0.3)	<0.001
<i>Mature Index (range=0–1)</i>	0.39 (0.3)	0.25 (0.3)	<0.001
Total video game tobacco exposure			
TTS exposure			<0.001
<i>none</i>	376 (23.9)	309 (54.0)	
<i>low</i>	357 (22.7)	139 (24.3)	
<i>high</i>	839 (53.4)	124 (21.7)	

Variable	Boys N= 1,685 n (%)	Girls N= 737 n (%)	p-value
Tobacco Index exposure			<0.001
<i>none</i>	376 (23.9)	309 (54.0)	
<i>low</i>	359 (22.8)	136 (23.8)	
<i>high</i>	837 (53.2)	127 (22.2)	
Mature Index exposure			<0.001
<i>none</i>	447 (28.4)	318 (55.6)	
<i>low</i>	349 (22.2)	131 (22.9)	
<i>high</i>	776 (49.4)	123 (21.5)	

TTS average: Tobacco content (assessing the 5 typologies of tobacco content) in the three video games reported by each student

Tobacco Index: Tobacco content (yes/no) in the three video games reported by each student

Mature Index: Exposure to mature rated video games in the three video games reported by each student

Tobacco exposure in video games measure combines tobacco in video games played with frequency of playing video games.

* Casual gamers: Students who responded that they “don’t play video games” but named at least one video game and were assigned 0.25 hours of video game playing per day

Table 2.

Correlates of exposure to tobacco in videogames (TTS) among adolescent gamers, by sex

Variable (reference group)	Boys		Girls	
	Crude OR (95% IC)	Adj. OR (95% IC)	Crude OR (95% IC)	Adj. OR (95% IC)
Age, years	1.01 (0.92 – 1.11)	1.01 (0.92 – 1.11)	1.08 (0.91 – 1.28)	1.11 (0.93 – 1.34)
Parent education> 12 years (12 years)	1.16 (0.95 – 1.42)	1.18 (0.96 – 1.44)	1.13 (0.79 – 1.60)	1.16 (0.84 – 1.61)
Sensation seeking [range=1–5]	1.17 (1.06 – 1.30)	1.12 (0.99 – 1.26)	1.18 (1.00 – 1.40)	1.14 (0.93 – 1.39)
Rebelliousness [range=1–5]	1.11 (1.01 – 1.23)	1.05 (0.94 – 1.18)	1.14 (0.98 – 1.33)	1.05 (0.87 – 1.26)
Nuclear family (no)	0.95 (0.77 – 1.15)	0.99 (0.81 – 1.23)	1.19 (0.88 – 1.62)	1.21 (0.87 – 1.69)
Parenting style, mother [range=1–5]	1.05 (0.92 – 1.19)	1.13 (0.97 – 1.31)	0.98 (0.82 – 1.17)	0.98 (0.80 – 1.20)
Parenting style, father [range=1–5]	0.97 (0.87 – 1.07)	0.94 (0.83 – 1.06)	1.02 (0.88 – 1.19)	1.00 (0.85 – 1.18)
Technophilia (range= 0–3)	1.19 (1.06 – 1.35)	1.18 (1.04 – 1.33)	1.22 (0.98 – 1.50)	1.17 (0.94 – 1.45)
Rules about video games use (no)	1.00 (0.88 – 1.14)	1.02 (0.75 – 1.37)	0.99 (0.82 – 1.19)	0.73 (0.45 – 1.21)

* Ordinal regression models with random intercept for school for TTS exposure (categorized as none, low and high). Values in **bold** indicate $p < 0.05$

TTS exposure is the Tobacco content (assessing the 5 typologies of tobacco content) in the three video games reported by each student multiplied by the frequency of playing video games.

Table 3.

Crude and adjusted likelihood of being a current smoking among adolescent gamers

Variable (reference group)	Boys		Girls	
	Crude OR (95% IC)	Adj. OR (95% IC)	Crude OR (95% IC)	Adj. OR (95% IC)
Age, years	1.78 (1.52 – 2.08)	1.65 (1.39 – 1.97)	1.33 (1.08 – 1.63)	1.37 (1.10 – 1.70)
Parent education > 12 years (12 years)	0.83 (0.60 – 1.15)	1.11 (0.76 – 1.61)	0.80 (0.53 – 1.19)	0.98 (0.62 – 1.55)
Sensation seeking [range=1–5]	2.35 (1.95 – 2.85)	1.58 (1.25 – 2.00)	2.09 (1.67 – 2.62)	1.32 (1.01 – 1.73)
Rebelliousness [range=1–5]	2.01 (1.74 – 2.32)	1.43 (1.19 – 1.72)	2.09 (1.72 – 2.53)	1.33 (1.05 – 1.68)
Nuclear family (no)	0.49 (0.36 – 0.65)	0.66 (0.47 – 0.92)	0.73 (0.50 – 1.05)	0.77 (0.49 – 1.22)
Parenting style, mother [range=1–5]	0.75 (0.63 – 0.89)	0.88 (0.70 – 1.11)	0.75 (0.61 – 0.93)	0.88 (0.69 – 1.13)
Parenting style, father [range=1–5]	0.84 (0.73 – 0.97)	1.11 (0.92 – 1.34)	0.88 (0.75 – 1.04)	0.99 (0.8 – 1.22)
Someone smokes at home (no)	1.90 (1.39 – 2.59)	1.42 (0.99 – 2.03)	2.34 (1.55 – 3.53)	1.39 (0.86 – 2.24)
At least one close friend smokes (no)	9.45 (5.92 – 15.07)	5.16 (3.16 – 8.45)	12.14 (6.15 – 25.07)	6.68 (3.19 – 13.98)
Positive smoking expectancies [range=1–5]	2.35 (1.97 – 2.79)	1.70 (1.39 – 2.07)	2.88 (2.27 – 3.65)	2.06 (1.58 – 2.69)
TTS exposure (none)				
low	1.39 (0.91 – 2.14)	1.34 (0.81 – 2.23)	1.82 (1.08 – 3.06)	1.65 (0.91 – 2.98)
high	1.01 (0.69 – 1.48)	0.98 (0.64 – 1.51)	2.37 (1.42 – 3.95)	1.78 (1.02 – 3.09)

* Logistic regression models with random intercept for school. Values in **bold** indicate $p < 0.05$

TTS exposure is the tobacco content (assessing the 5 typologies of tobacco content) in the three video games reported by each student multiplied by the frequency of playing video games.