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Sex differences in the association between parental monitoring and substance use initiation among adolescents

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Abstract

Introduction: Parental involvement and supervision (i.e., “parental monitoring;” PM) is generally inversely associated with substance use among youth; yet, specific features of this association remain unclear. This study examined PM as a prospective predictor of substance use initiation across adolescence and whether associations generalize across a range of substances and by sex.

Methods: Participants were enrolled in a longitudinal cohort study of high school students from Southern California. We assessed, among never-users at baseline (2014; participants were in 10th grade), the role of PM in 8 substance use initiation outcomes (initiation of 7 individual substances or categories of substances: alcohol, cigarettes, electronic (e-) cigarettes, cigars, marijuana, stimulants, or opioids, as well as the total number of substances initiated) at follow-up (2017; 12th grade), controlling for sociodemographic characteristics. Multiplicative interactions assessed differences by sex.

Results: In adjusted main effects models, PM was associated with lower odds of initiation of all substances (OR range: 0.60 for cigarettes to 0.82 for alcohol) and male sex was associated with increased odds of initiating use of cigarettes (OR=1.33, 95% CI= 1.02, 1.73) and cigars (OR=1.82, 95% CI=1.32, 2.52) over follow-up. There were also significant PM × sex interactions for cigarettes (p=0.038), e-cigarettes (p=0.042), and marijuana (p=0.044), whereby lower PM was associated with greater odds of initiation among females, compared to males.

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Contributors

Keogh-Clark designed the study, conducted literature searches, and wrote the first draft of the manuscript. Whaley conducted literature searches and contributed to and approved the final manuscript. Leventhal designed the study and contributed to and approved the final manuscript. Krueger designed the study, conducted the statistical analyses, and wrote the first draft of the manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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Conclusions: PM is associated with reduced odds of initiating use of multiple substances among adolescents, particularly for females. Future research of the mechanisms underlying these associations can point towards intervention targets to prevent or delay substance use initiation among youth with low PM.

Keywords

Parental monitoring; substance use; adolescents; sex differences

INTRODUCTION

Adolescent-onset substance use confers risk for developing substance use disorder in adulthood (Chen, Storr, & Anthony, 2009; Grant & Dawson, 1998; Strong, Juon, & Ensminger, 2016; Williams, Battista, & Leatherdale, 2020). For example, adolescents who experiment with alcohol and tobacco are at increased risk for continued use and dependence on these substances, respectively, in adulthood (DeWit, Adlaf, Offord, & Ogborne, 2000; Grant & Dawson, 1998; Sharapova et al., 2020). Further, use of one substance in adolescence may be associated with increased risk for use of other substances in adulthood; longitudinal studies have shown that youth who use e-cigarettes are more likely to use alcohol and cigarettes later in life (Park et al., 2020). To prevent disordered substance use and dependence during adulthood, it is important to identify modifiable factors that increase or reduce risk for youth substance use initiation (Van Ryzin, Fosco, & Dishion, 2012), as such factors may be viable targets for intervention.

Parental monitoring (PM) is defined as parental efforts to direct, guide, or modify children's behaviors (Bahr, Maughan, Marcos, & Li, 1998; Rollins & Thomas, 1979). While PM has been measured in a number of ways (e.g., parental restrictions or control, knowledge about children's whereabouts), it has generally been shown to protect against adolescent substance use (Barnes & Farrell, 1992; Mounts, 2002). For example, in a multi-year cross-sectional sample of Swedish youth, increased PM (assessed as parental knowledge of adolescents' whereabouts and with whom they associated with) was associated with decreased adolescent drinking behavior (Larm, Livingston, Svensson, Leifman, & Raninen, 2018). However, several aspects of this association remain unclear. First, few studies have assessed whether PM prospectively reduces risk of substance use *initiation*, which requires longitudinal data (Chilcoat & Anthony, 1996; Dorius, Bahr, Hoffmann, & Harmon, 2004). Second, a majority of the existing PM and substance use work has focused on use of cigarettes, alcohol, and cannabis (Beck, Boyle, & Boekeloo, 2003; Chuang, Ennett, Bauman, & Foshee, 2005; Huansuriya, Siegel, & Crano, 2014; Lac & Crano, 2009; Lamb & Crano, 2014). However, the landscape of adolescent drug use has changed in recent years, with for instance, increased availability and use of electronic (e-) cigarettes (Foxon & Selya, 2020; Mark Anderson, Hansen, & Rees, 2015; Owotomo & Maslowsky, 2017; ProCon.org, 2021), as well as the growing opioid use epidemic among youth (Hadland et al., 2017; Carmona, Maxwell, Park, & Wu, 2020). Thus, there is a need to assess whether PM is associated with initiation of a wider range of substances among adolescents (e.g., e-cigarettes, opioids) in the current milieu.

Substance use in adolescent girls is of increasing public health concern, whose rates of alcohol and tobacco use, nationally, have begun to approach that of boys (Johnston et al., 2020; McHugh, Votaw, Sugarman, & Greenfield, 2018; NIDA, 2021). Further, girls are generally subjected to greater PM than are boys (Svensson, 2003; Worthen, 2011), yet few studies have assessed sex differences in the effect of PM on adolescent substance use (Svensson, 2003). The current longitudinal study tested prospective associations of PM and sex with 8 substance use initiation outcomes (initiation of 7 individual substances or categories of substances: alcohol, cigarettes, electronic (e-) cigarettes, cigars, marijuana, stimulants, or opioids, as well as the total number of substances initiated), using two waves of recently collected longitudinal data from a cohort of youth from Southern California. We also examined whether the association between PM and each outcome differed by sex.

METHODS

Study Design

Data were from a prospective cohort study of substance use among high school students in Southern California. The cohort was recruited from ten high schools in Los Angeles County in 2013, when students were in 9th grade (mean age: 14.1; N=3,396). Surveys were completed in class via paper and pencil each semester until completion of high school in 2017 (92.8% retention through the end of high school). Active written or verbal consent was required for participation in the study by both students and parents. The present analyses used surveys conducted in Fall 2014 (“baseline,” beginning of 10th grade, mean age: 15.5) and Spring 2017 (“follow-up,” end of 12th grade, mean age: 17.9). Respondents completing surveys at both waves (N=3,082) were eligible for inclusion in this study, though the study sample varied across different outcomes (see “data analysis”). This study was approved by the University of Southern California Institutional Review Board.

Study variables

Lifetime substance use was assessed at both baseline and follow-up. Respondents indicated whether they had ever used any of the following: alcohol (e.g., beer, wine, wine cooler, or shot of liquor), cigarettes (e.g., Marlboro, Camel, Newport, etc.), e-cigarettes (e.g., e-cigs, personal vaporizer, e-pen), cigars (e.g., stogies, Cubans, Swisher Sweets), marijuana (e.g., pot, weed, edibles, weed pen), stimulants (e.g., inhalants, cocaine, methamphetamine, prescription stimulants), or opioids (prescription painkillers, heroin). All responses were coded dichotomously (yes/no). In addition, a composite variable of the total number of substances used (range = 0–27) at follow-up was also included.

Parental monitoring was assessed at baseline with four items that evaluated respondents’ perceptions about parental knowledge of whereabouts, activities and friendships (Audrain-McGovern, Rodriguez, & Leventhal, 2015) (Cronbach’s $\alpha = 0.82$). Respondents indicated how strongly they agreed with the each statement: “I have a parent who... finds out if I misbehave, checks up to see whether I have done what they told me to do, believes in having rules and sticking to them, makes sure I do my schoolwork.” For all items, response options ranged from “strongly disagree” (1) to “strongly agree” (4). A scale score was created as the mean of all available items.

Several sociodemographic characteristics were assessed at baseline: Sex (female, male), race/ethnicity (Hispanic, Asian, White, Black, Other, Multiracial), age (continuous in years), and highest parental education (less than high school, high school, college, advanced degree).

Data analysis

Sample characteristics were first calculated among the full sample. Then, main effects regression models (adjusted for race/ethnicity, age, parental education) tested the associations between PM and sex at baseline and each of the substance use outcomes at follow-up. Logistic regressions were used for the individual substance use outcomes (i.e., alcohol, cigarettes, e-cigarettes, cigars, marijuana, stimulants, opioids), while negative binomial models were used for the total number of substances used models. Each model was restricted to never-users of the substance at baseline (e.g., the cigarette use initiation model was assessed among never-users of cigarettes at baseline); the total number of substances used models were restricted to never users of any substance at baseline. Thus, the analytic sample differed for each of the models: alcohol (n=1,701; 55.2% of sample); cigarettes (n=2,521, 81.8%); e-cigarettes (n=2,059, 66.8%); cigars (n=2,683, 87.1%); marijuana (n=2,263, 73.4%); stimulants (n=2,727, 88.5%); opioids (n=2,683, 87.1%); total number of substances (n=1,322, 42.9%). Finally, to assess whether these associations varied by sex, each adjusted model was repeated and included a multiplicative interaction term (PM × sex). All analyses were conducted using Stata SE version 15.

RESULTS

Sample characteristics

At follow-up, lifetime substance use ranged from 16.8% (cigars) to 64.8% (alcohol). The mean total number of substances used at follow-up was 5.4 (SE: 0.1; range: 1–27). Overall, participants reported relatively high levels of parental monitoring (mean: 3.1, SE: 0.01, range: 1–4). The sample was 54.7% female. Additionally, the majority ethnicity was Latinx/Hispanic (45.7%), followed by Asian (16.7%), and White (15.1%). At baseline, the mean age was 15.5 (SE=0.01), and at follow-up, the mean age was 17.9 (SE=0.01). Less than half the sample reporting having at least one parent who completed more than high school (44.8%).

Associations of parental monitoring, sex, and their interaction with subsequent substance use initiation

Shown in Table 1, among never users at baseline, increased PM was associated with lower odds of each substance use initiation outcome at follow-up (e.g., for alcohol: aOR= 0.82 [0.69, 0.96], p=0.017; for opioids: aOR= 0.75 [0.60, 0.93], p=0.008). Further, males were more likely than females to initiate use of cigarettes (aOR= 1.33 [1.02, 1.73], p=0.034) and cigars (aOR= 1.82 [1.32, 2.52], p<0.001) over the course of follow-up. Finally, there were significant positive interactions between PM and sex on initiation of cigarettes (p=0.038), e-cigarettes (p=0.042), and marijuana (p=0.044) at follow-up.

Figure 1 visually depicts the significant PM \times sex interactions reported above (i.e., for cigarettes, e-cigarettes, and marijuana). At lower levels of baseline PM, females had higher probabilities of using cigarettes, e-cigarettes, and marijuana at follow-up. However, these associations dissipated at higher levels of PM.

Supplemental analyses assessed, among baseline users, associations between baseline PM and frequency of use of each individual substance at follow-up, controlling for covariates (results not shown). Baseline PM was not associated with frequency of substance use at follow-up for any of the outcomes (all $p>0.05$). There were also no significant PM \times sex interactions for any of the outcomes (all $p>0.05$).

DISCUSSION

In this study, increased parental monitoring was associated with lower odds of initiation of a wide array of substances. This study extends the literature on PM and adolescent substance use that has previously focused largely on alcohol, cigarettes, and cannabis (Beck et al., 2003; Chuang et al., 2005; Huansuriya, Siegel, & Crano, 2014; Lac & Crano, 2009; Lamb & Crano, 2014) to include illicit substances, as well as non-cigarette tobacco products, including e-cigarettes and cigars. Interventions that increase parental knowledge and comfort with discussing a wide range substances (Fay et al., 2020; Luk et al., 2010) — including concealable and socially desirable products, such as e-cigarettes (Kong et al., 2019; Park, Kwon, Gaughan, Livingston, & Chang, 2019) — with youth may help to mitigate adolescent initiation of a wide variety of substances.

Additionally, interaction models showed differential effects of sex on the association between baseline PM and initiation of key substances. Specifically, at low levels of PM, females had a higher probability than males of initiating cigarette, e-cigarette, and marijuana use at follow-up. This distinction dissipated at higher levels of PM. This finding suggests that while higher PM is associated with reduced risk for substance use initiation among both youth males and females (Svensson, 2003), PM may be especially preventive for girls.

That PM-by-sex interactions were found for cigarettes, e-cigarettes, and marijuana, but not for cigars, alcohol, stimulants, or opioids warrants further investigation. Cigarettes, e-cigarettes, and marijuana are some of the most commonly used substances by youth today, each with relative ease of access (CDC, 2020). Evolving gender norms and expectations with respect to use of these substances may help to explain the observed interactions. Generally, young men have greater access to, and permissibility to use substances than do young women (Hemsing & Greaves, 2020), and in some cases, young men may be encouraged by family members — explicitly or implicitly — to engage in substance use, whereas young women are discouraged from the practice. Since young women are generally monitored more heavily by parents and family members (Svensson, 2003), it is possible that PM is more strongly associated with abstinence from popular and readily available substances. However, these explanations do not explain the lack of an interaction for alcohol, which is the most commonly used substance among youth. Additional research is thus needed to understand interactions between PM, sex, and initiation of certain (but not all) substances. Regardless, these findings raise concerns for public health professionals. Use of

tobacco and cannabis products, particularly via electronic vaping devices, are on the rise among youth overall (Gentzke et al., 2019; Miech et al., 2020). Lower PM may be one mechanism driving disparities in use between young males and females.

Limitations and Future Directions

While this study identified PM as a key buffer against substance initiation among adolescents, PM is not comprehensive of all aspects of parent-child relationships that may be important in shaping adolescent substance use (e.g., relationship warmth, communication style) (Mak & Iacovou, 2019; Shin, 2020). Further research is needed to more comprehensively understand how parent-child relationships may be related to substance use initiation among youth — and potentially differently for young males and females. Another limitation is that PM was reported by respondents themselves, which may not reflect parents' own perceptions of their style and degree of monitoring, though prior work has shown that adolescents' reports of PM and parental knowledge were more closely related to adolescent drinking behavior than were parents' reports (Abar, Jackson, Colby, & Barnett, 2015). Other potentially meaningful covariates were also not measured (e.g., association with a deviant peer group, involvement in extra-curricular activities, parental social support (Micalizzi, Sokolovsky, Janssen, & Jackson, 2019)). Finally, PM was assessed only at baseline, and not at follow-up. Additional research is needed to examine whether/how PM changes across adolescence, and whether changes in PM are potentially associated with changes in adolescent substance use over time (e.g., increased use, decreased use).

These analyses were conducted using responses from a large, diverse cohort of students from Los Angeles, CA. While the diversity of the sample is a considerable strength, our findings related to PM and substance use may not be representative of young people across the United States. Nearly half of respondents were of Latinx/Hispanic ethnicity, and a sizeable minority of respondents were Asian (16.7%). It is likely that cultural factors, not measured here (e.g., familism, collectivism vs. individualism), contribute to both PM and youth substance use (Unger, Ritt-Olson, Teran, et al., 2002; Johnson, 2007). In addition, small sample sizes may have limited our ability to identify differential effects of sex on the associations between PM and illicit drugs, which fewer students endorsed using, compared to cigarettes, e-cigarettes, and marijuana. Analyses were also limited to never-users of each substance at baseline, excluding respondents with very early onset (prior to 10th grade) of substance use (Dishion, Nelson, & Kavanagh, 2003). Lastly, given our study had two time points – one early in high school, and one at the end of high school, we do not know at what point in high school substance use initiation occurred.

Conclusions

Parental monitoring is associated with lower odds of substance use initiation among adolescents, across a wide range of both legal (e.g., cigarettes) and illicit (e.g., opioids) substances. Further, there was a significant interaction between PM and sex on initiation of several substances commercially available to adults in California (cigarettes, e-cigarettes, marijuana). At lower levels of baseline PM, young girls had higher odds than boys of initiating use of these substances at follow-up. Higher levels of baseline PM reduced

odds of substance use initiation for both boys and girls. Future research should more comprehensively assess family dynamics (e.g., relationship quality, social support), as they relate to substance use initiation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Abar CC, Jackson KM, Colby SM, & Barnett NP (2015). Parent—child discrepancies in reports of parental monitoring and their relationship to adolescent alcohol-related behaviors. *Journal of youth and adolescence*, 44(9), 1688–1701. [PubMed: 24964878]
- Audrain-McGovern J, Rodriguez D, & Leventhal AM (2015). Gender differences in the relationship between affect and adolescent smoking uptake. *Addiction*, 110(3), 519–529. [PubMed: 25393395]
- Bahr SJ, Maughan SL, Marcos AC, & Li B (1998). Family, religiosity, and the risk of adolescent drug use. *Journal of Marriage and the Family*, 979–992.
- Barnes GM, & Farrell MP (1992). Parental support and control as predictors of adolescent drinking, delinquency, and related problem behaviors. *Journal of Marriage and the Family*, 763–776.
- Beck KH, Boyle JR, & Boekeloo BO (2003). Parental monitoring and adolescent alcohol risk in a clinic population. *American journal of health behavior*, 27(2), 108–115. [PubMed: 12639068]
- Carmona J, Maxwell JC, Park J-Y, & Wu L-T (2020). Prevalence and health characteristics of prescription opioid use, misuse, and use disorders among US adolescents. *Journal of Adolescent Health*, 66(5), 536–544.
- CDC (2020). Teen Substance Use & Risks Retrieved from <https://www.cdc.gov/ncbddd/fasd/features/teen-substance-use.html>
- Chen C-Y, Storr CL, & Anthony JC (2009). Early-onset drug use and risk for drug dependence problems. *Addictive behaviors*, 34(3), 319–322. [PubMed: 19022584]
- Chilcoat HD, & Anthony JC (1996). Impact of parent monitoring on initiation of drug use through late childhood. *Journal of the American Academy of Child & Adolescent Psychiatry*, 35(1), 91–100. [PubMed: 8567618]
- Chuang Y-C, Ennett ST, Bauman KE, & Foshee VA (2005). Neighborhood influences on adolescent cigarette and alcohol use: Mediating effects through parent and peer behaviors. *Journal of health and social behavior*, 46(2), 187–204. [PubMed: 16028457]
- DeWit DJ, Adlaf EM, Offord DR, & Ogborne AC (2000). Age at first alcohol use: a risk factor for the development of alcohol disorders. *American Journal of Psychiatry*, 157(5), 745–750.
- Dishion TJ, Nelson SE, & Kavanagh K (2003). The family check-up with high-risk young adolescents: Preventing early-onset substance use by parent monitoring. *Behavior Therapy*, 34(4), 553–571.
- Dorius CJ, Bahr SJ, Hoffmann JP, & Harmon EL (2004). Parenting practices as moderators of the relationship between peers and adolescent marijuana use. *Journal of Marriage and Family*, 66(1), 163–178.
- Fay H, LoParo D, Shentu Y, Vasquez D, & Welsh JW (2020). Perceived parental knowledge and adolescent substance use outcomes. *Journal of School Health*, 90(9), 711–717.
- Foxon F, & Selya AS (2020). Electronic cigarettes, nicotine use trends and use initiation ages among US adolescents from 1999 to 2018. *Addiction*, 115(12), 2369–2378. [PubMed: 32335976]

- Gentzke AS, Creamer M, Cullen KA, Ambrose BK, Willis G, Jamal A, & King BA (2019). Vital signs: tobacco product use among middle and high school students—United States, 2011–2018. *Morbidity and Mortality Weekly Report*, 68(6), 157. [PubMed: 30763302]
- Grant BF, & Dawson DA (1998). Age of onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. *Journal of substance abuse*, 10(2), 163–173. [PubMed: 9854701]
- Hadland SE, Wharam JF, Schuster MA, Zhang F, Samet JH, & Laroche MR (2017). Trends in receipt of buprenorphine and naltrexone for opioid use disorder among adolescents and young adults, 2001–2014. *JAMA pediatrics*, 171(8), 747–755. [PubMed: 28628701]
- Hemings N, & Greaves L (2020). Gender norms, roles and relations and cannabis-use patterns: a scoping review. *International journal of environmental research and public health*, 17(3), 947.
- Huansuriya T, Siegel JT, & Crano WD (2014). Parent—child drug communication: Pathway from parents' ad exposure to youth's marijuana use intention. *Journal of Health Communication*, 19, 244–259. [PubMed: 24308793]
- Johnson TP (2007). Cultural-level influences on substance use & misuse. *Substance use & misuse*, 42(2–3), 305–316. [PubMed: 17558932]
- Johnston L, Miech R, O'Malley P, Bachman J, Schulenberg J, & Patrick M (2020). Monitoring the Future national survey results on drug use, 1975–2019: Overview, key findings on adolescent drug use.
- Jones TM, Eisenberg N, Kosterman R, Lee JO, Bailey JA, & Haggerty KP (2020). Parents' Perceptions of Adolescent Exposure to Marijuana Following Legalization in Washington State. *Journal of the Society for Social Work and Research*, 11(1), 21–38. [PubMed: 33841719]
- Kong G, Bold KW, Morean ME, Bhatti H, Camenga DR, Jackson A, & Krishnan-Sarin S (2019). Appeal of JUUL among adolescents. *Drug and Alcohol Dependence*, 205, 107691. [PubMed: 31706249]
- Lac A, & Crano WD (2009). Monitoring matters: Meta-analytic review reveals the reliable linkage of parental monitoring with adolescent marijuana use. *Perspectives on Psychological Science*, 4, 578–586. [PubMed: 26082797]
- Lamb CS, & Crano WD (2014). Parents' beliefs and children's marijuana use: Evidence for a self-fulfilling prophecy effect. *Addictive Behaviors*, 39, 127–132. [PubMed: 24144589]
- Larm P, Livingston M, Svensson J, Leifman H, & Raninen J (2018). The increased trend of non-drinking in adolescence: the role of parental monitoring and attitudes toward offspring drinking. *Drug and alcohol review*, 37, S34–S41. [PubMed: 29473244]
- Luk JW, Farhat T, Iannotti RJ, & Simons-Morton BG (2010). Parent—child communication and substance use among adolescents: Do father and mother communication play a different role for sons and daughters? *Addictive behaviors*, 35(5), 426–431. [PubMed: 20060651]
- Mak HW, & Iacovou M (2019). Dimensions of the parent—child relationship: Effects on substance use in adolescence and adulthood. *Substance use & misuse*, 54(5), 724–736. [PubMed: 30457893]
- Mark Anderson D, Hansen B, & Rees DI (2015). Medical marijuana laws and teen marijuana use. *American Law and Economics Review*, 17(2), 495–528.
- McHugh RK, Votaw VR, Sugarman DE, & Greenfield SF (2018). Sex and gender differences in substance use disorders. *Clinical psychology review*, 66, 12–23. [PubMed: 29174306]
- Micalizzi L, Sokolovsky AW, Janssen T, & Jackson KM (2019). Parental social support and sources of knowledge interact to predict children's externalizing behavior over time. *Journal of youth and adolescence*, 48(3), 484–494. [PubMed: 30560511]
- Miech R, Johnston L, O'Malley P, Bachman J, Schulenberg J, & Patrick M (2020). Monitoring the Future national survey results on drug use, 1975–2019: Volume I, secondary school students. In.
- Mounts NS (2002). Parental management of adolescent peer relationships in context: The role of parenting style. *Journal of family psychology*, 16(1), 58. [PubMed: 11915411]
- NIDA. (2021). Sex and Gender Differences in Substance Use. Retrieved from <https://www.drugabuse.gov/publications/research-reports/substance-use-in-women/sex-gender-differences-in-substance-use>

- Owotomo O, & Maslowsky J (2017). Marijuana and e-cigarette use in a US national sample of 8th and 10th grade never-smokers of conventional cigarettes. *Journal of Applied Research on Children: Informing Policy for Children at Risk*, 8(2), 5.
- Park E, Kwon M, Gaughan MR, Livingston JA, & Chang Y-P (2019). Listening to adolescents: Their perceptions and information sources about e-cigarettes. *Journal of pediatric nursing*, 48, 82–91. [PubMed: 31362205]
- Park E, Livingston JA, Wang W, Kwon M, Eiden RD, & Chang Y-P (2020). Adolescent E-cigarette use trajectories and subsequent alcohol and marijuana use. *Addictive behaviors*, 103, 106213. [PubMed: 31862618]
- Pierce GR, Sarason BR, & Sarason IG (1996). *Handbook of social support and the family*: Springer Science & Business Media.
- ProCon.org. (2021). Legal Medical Marijuana States and DC. Retrieved from <https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/>
- Rodríguez-Meirinhos A, Vansteenkiste M, Soenens B, Oliva A, Brenning K, & Antolín-Suárez L (2020). When is parental monitoring effective? A person-centered analysis of the role of autonomy-supportive and psychologically controlling parenting in referred and non-referred adolescents. *Journal of youth and adolescence*, 49(1), 352–368. [PubMed: 31664598]
- Rollins BC, & Thomas DL (1979). Parental support, power, and control techniques in the socialization of children. *Contemporary theories about the family: research-based theories/edited by Wesley R Burr...[et al.]*.
- Rusby JC, Light JM, Crowley R, & Westling E (2018). Influence of parent—youth relationship, parental monitoring, and parent substance use on adolescent substance use onset. *Journal of family psychology*, 32(3), 310. [PubMed: 29300096]
- Sharapova S, Reyes-Guzman C, Singh T, Phillips E, Marynak KL, & Agaku I (2020). Age of tobacco use initiation and association with current use and nicotine dependence among US middle and high school students, 2014–2016. *Tobacco control*, 29(1), 49–54. [PubMed: 30498008]
- Shin Y (2020). Narrative engagement and interpersonal communication about substance use on adolescent substance use behaviors: a case study of keepin’it REAL. *Western Journal of Communication*, 1–24.
- Steinberg L, Fletcher A, & Darling N (1994). Parental monitoring and peer influences on adolescent substance use. *Pediatrics*, 93(6), 1060–1064. [PubMed: 8197008]
- Strong C, Juon H-S, & Ensminger ME (2016). Effect of adolescent cigarette smoking on adulthood substance use and abuse: the mediating role of educational attainment. *Substance use & misuse*, 51(2), 141–154. [PubMed: 26787191]
- Svensson R (2003). Gender differences in adolescent drug use: The impact of parental monitoring and peer deviance. *Youth & Society*, 34(3), 300–329.
- Unger JB, Ritt-Olson A, Teran L, Huang T, Hoffman BR, & Palmer P (2002). Cultural values and substance use in a multiethnic sample of California adolescents. *Addiction Research & Theory*, 10(3), 257–279.
- Van Ryzin MJ, Fosco GM, & Dishion TJ (2012). Family and peer predictors of substance use from early adolescence to early adulthood: An 11-year prospective analysis. *Addictive behaviors*, 37(12), 1314–1324. [PubMed: 22958864]
- Williams GC, Battista K, & Leatherdale ST (2020). An examination of how age of onset for alcohol, cannabis, and tobacco are associated with school outcomes in grade 12. *Addictive behaviors*, 102, 106215. [PubMed: 31785476]
- Worthen MG (2011). Gender differences in parent—child bonding: implications for understanding the gender gap in delinquency. *Journal of Crime and Justice*, 34(1), 3–23.

HIGHLIGHTS

- Parental monitoring (PM) was associated with lower odds of substance use initiation
- Males (vs. females) had higher odds of cigarette and cigar use initiation
- At lower PM, females (vs. males) had greater odds of cigarette initiation
- At lower PM, females (vs. males) had greater odds of e-cigarette initiation
- At lower PM, females (vs. males) had greater odds of marijuana initiation

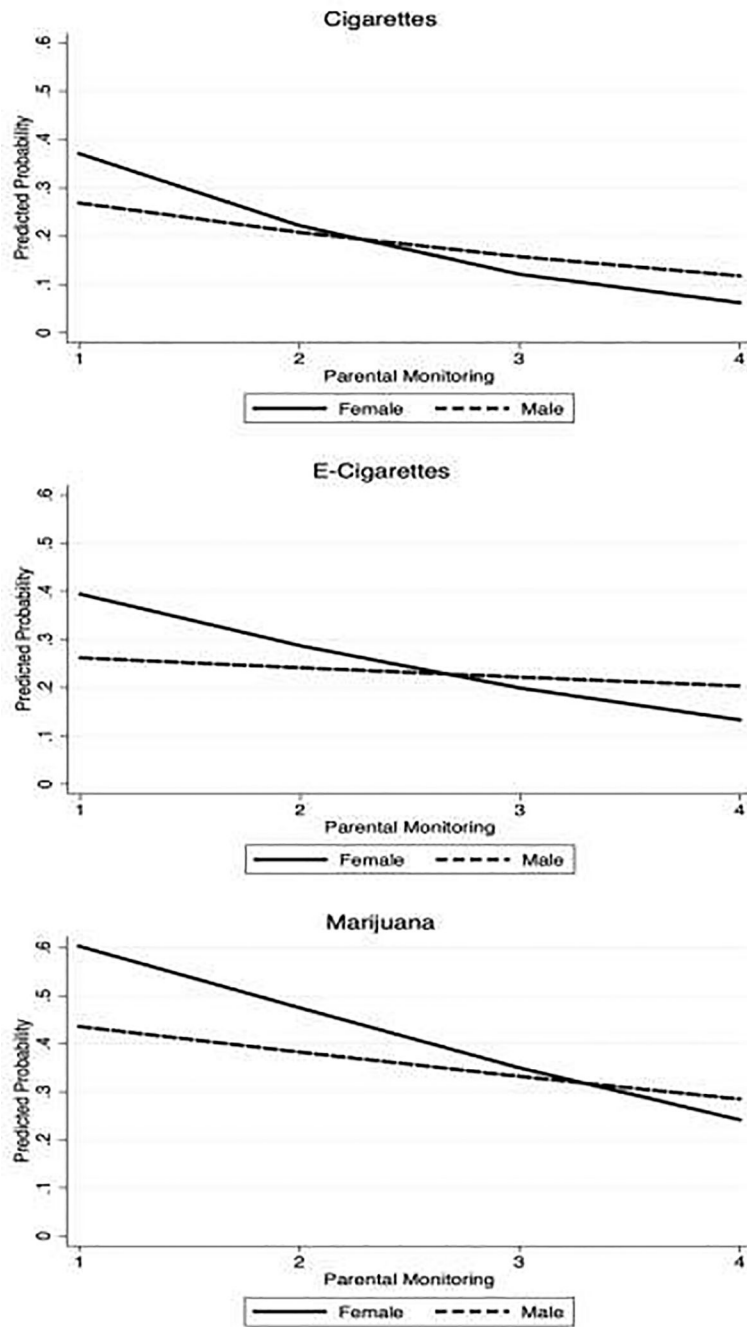


Figure 1. Interaction effect between parental monitoring and sex on substance use outcomes

Table 1.

Associations between parental monitoring, sex, and substance use initiation at follow-up, among never users at baseline

	Main Effects				Interaction Effects	
	Parental Monitoring		Sex (Male v. Female)		P-Value	
	Statistic	P-Value	Statistic	P-Value		
Substance Initiated						
Alcohol, aOR (95% CI)	0.82 (0.69, 0.96)	0.017	0.80 (0.64, 1.01)	0.056		0.541
Cigarettes, aOR (95% CI)	0.60 (0.50, 0.72)	<0.001	1.33 (1.02, 1.73)	0.034		0.038
E-Cigarettes, aOR (95% CI)	0.74 (0.62, 0.89)	0.001	1.18 (0.92, 1.50)	0.196		0.042
Cigars, aOR (95% CI)	0.71 (0.57, 0.89)	0.003	1.82 (1.32, 2.52)	<0.001		0.602
Marijuana, aOR (95% CI)	0.68 (0.59, 0.80)	<0.001	0.94 (0.77, 1.15)	0.558		0.044
Stimulants, aOR (95% CI)	0.75 (0.61, 0.93)	0.010	0.82 (0.60, 1.11)	0.193		0.143
Opioids, aOR (95% CI)	0.75 (0.60, 0.93)	0.008	1.01 (0.74, 1.38)	0.928		0.928
Number of substances, B (SE)	-0.34 (0.09)	<0.001	0.18 (0.12)	0.149		0.917

Notes. Logistic regressions were used for all substance-specific models (i.e., alcohol, cigarettes, e-cigarettes, cigars, marijuana, stimulants, opioids), and were limited to never users of that substance at baseline. Negative binomial regressions were used for the total number of substances models, and were limited to never users of any substance at baseline. All models were adjusted for race/ethnicity, age, and parental education.