Chapter 5

Tobacco and Nicotine Use

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5.1. Literature Review

Smoking and tobacco product use continue to be among the most critical public health challenges on a global scale. Data from the World Health Organization indicate that tobacco use trends in low and middle income countries show an alarming increase compared to high income countries (Ng et al., 2014). Epidemiological studies reveal that the initial contact with tobacco products and the onset of use occur overwhelmingly during adolescence, under the age of eighteen (Jamal et al., 2017; Mackay & Eriksen, 2002). Adolescence is a critical developmental stage characterized by a heightened propensity for risk-taking behaviors and maximum vulnerability to the neurotoxic effects of addictive substances. Exposure to tobacco products during this period is not only the strongest predictor of chronic addiction development in adulthood, but it also establishes a foundation for adolescents to drift into other maladaptive and risky social contexts (Van Ryzin & Dishion, 2014). In recent years, adolescent tobacco use transitioned beyond traditional cigarettes and came under the profound influence of next generation nicotine products such as electronic cigarettes. Adolescent e-cigarette use demonstrated a dramatic surge over the past decade (Miech et al., 2019). Indeed these products, whose prevalence was near zero in 2011 (Centers for

Disease Control and Prevention, 2013), today became the most frequently consumed tobacco substitutes in the adolescent population. This rapid epidemiological transformation necessitates a comprehensive analysis of the factors driving tobacco and e-cigarette use, including parental monitoring, peer norms, and product availability.

Parental monitoring is recognized as a central dynamic in supporting overall well being, preserving health status, and preventing risky behaviors during adolescence. Historically defined within a narrow criminological focus on direct physical supervision or delegating care to another adult (Glueck & Glueck, 1950), this concept evolved to encompass structured parental awareness of the adolescent's whereabouts and activities, as well as domestic rules and expectations (Dishion & McMahon, 1998; Patterson & Stouthamer-Loeber, 1984; Stattin & Kerr, 2000). In this regard, contemporary conceptualizations treat parental monitoring not merely as a mechanism of control, but as a manifestation of holistic parenting behaviors that include non-judgemental regular information sharing within the family, open communication, and an active awareness of the adolescent's social relationships and activities (Pelham et al., 2024).

Parental knowledge and rule setting processes function as a primary protective barrier that limits adolescent orientation toward risky environments and substance use. Consequently, low parental monitoring not only increases adolescent delinquency but also reduces the adolescent's tendency to disclose information to parents, erodes parent-child closeness, and directly triggers substance use risks (Hoeve et al., 2009). Meta analytic findings in the literature confirm that parental monitoring is the most robust protective factor across a wide spectrum of risks, including adolescent alcohol abuse, smoking, cannabis use, and polydrug addiction. Systematic reviews specifically demonstrated that high levels of parental monitoring serve as a critical barrier in preventing adolescents from being introduced to tobacco products and initiating smoking (Wellman et al., 2016). Conversely, low monitoring practices, such as deficient parental attitudes toward understanding adolescent problems and a lack of supervision over leisure activities, directly

escalate the frequency of tobacco and other addictive substance use (Clark et al., 2012; Shaikh et al., 2020). Parallel to conventional tobacco products, parental monitoring maintains a vital protective role in curbing the rapidly expanding influence of e-cigarettes among youth. High levels of parental monitoring display a negative correlation with both current and lifetime e-cigarette use tendencies among adolescents (Mantey et al., 2022; Szoko et al., 2021). The mutual trust established between parent and child, open communication channels, and the existence of clear boundaries appropriate to the adolescent's developmental stage stand out as the fundamental protective mechanisms shielding youth from the adverse health outcomes of e-cigarette consumption.

Adolescence is a critical phase in socioemotional development where peer relationships elevate to a central position, while parental influence relatively recedes and peer orientation becomes dominant (Laursen, 2018; Sumter et al., 2009). Peer influence during this period is an active process resulting in the internalization of cognitive and behavioral patterns that an individual would not normally exhibit under ordinary circumstances, driven by interactions within their immediate social circle (Laursen, 2018). Peer groups do not exhibit a homogeneous structure; rather group dynamics and compliance with normative behaviors vary significantly according to the adolescent's level of popularity (Laursen & Veenstra, 2021; Sentse et al., 2014) or likeability within the group (Lansford et al., 2007; Nieuwenhuis & Veennema, 2025). Although strong peer bonds play a key role in healthy social integration (Allen & Loeb, 2015), the convergence of peer influence with the developmental vulnerability of adolescence dramatically increases the inclination toward risky behaviors such as tobacco and substance use (Steinberg, 2008).

The mechanism of peer influence on adolescent tobacco and e-cigarette use is explained through two primary processes in the literature: selection and socialization. Epidemiological data show that adolescents consider similarities in attitudes and behaviors regarding tobacco use when selecting peers, a process known as selection, and these similarities are mutually reinforced once

a friendship bond is established, which is termed socialization (Eiser et al., 1991; Urberg et al., 1991). Accordingly if an initially non-using adolescent becomes integrated into tobacco-using peer groups, their probability of initiating products like-cigarettes and e-cigarettes rises significantly compared to those with nonsmoking peers (O'Loughlin et al., 1998; Urberg et al., 1997). Although methodological limitations persist regarding the direction of peer interactions, their effects on relationship formation or termination, and their causal links with peer exclusion (Kobus, 2003), peer substance use remains the most proximal and hazardous predictor of adolescent introduction to addictive substances (Branstetter et al., 2011; Fallu et al., 2010; Hawkins et al., 1992).

Meta analytic findings confirm that peer norms exert a powerful positive effect on adolescent substance use, illustrating that adolescent consumption patterns are shaped concurrently with the behavioral orientations of their peers (Watts et al., 2024). While exhibiting nonnormative behaviors within a peer group is directly linked to future tobacco and substance use risks (Price et al., 2019), social environments dominated by negative norms toward tobacco use cause adolescents to avoid these products out of fear of peer judgement and social exclusion (Littlecott et al., 2023). Similarly, the normalization of smoking in peer environments transforms this behavior into a tool for social status (Littlecott et al., 2023), whereas peer networks that disapprove of substance use emerge as the most effective protective barrier for adolescents to terminate their current use practices and quit smoking (Marziali et al., 2022). Academic and social transition periods, such as the progression from middle school to high school, constitute the most precarious developmental windows for exposure to and internalization of peer substance use norms (Van Ryzin et al., 2012).

Characterized by the pursuit of autonomy and independence from parents, adolescence is a dynamic developmental stage accompanied by profound socioaffective and cognitive transformations (Duell et al., 2018; Willoughby et al., 2021). Risk-taking behaviors during this period follow a nonlinear age trajectory that remains low in childhood, gains momentum at

the onset of adolescence, reaches its peak in late adolescence, and shifts into a downward trend during adulthood (Romer et al., 2017). Conceptually, risk-taking is defined as a set of actions involving uncertainty, variability of outcomes, and a dual potential for both reward and harm (Mohr et al., 2010; Van Duijvenvoorde & Crone, 2013; Willoughby et al., 2013). Within the developmental spectrum, these actions are categorized into healthy or positive risk-taking and unhealthy or negative risk-taking (Duell & Steinberg, 2019). Socially-acceptable activities that provide decision-making practice and entail minor potential harms, such as participation in team sports or identity construction, fall under healthy risk-taking (Duell & Steinberg, 2019). Conversely, behaviors like smoking, e-cigarette use, and other substance use that inflict permanent damage on the individual's developmental integrity represent primary examples of unhealthy risk-taking (Duell & Steinberg, 2019).

Subjective risk perception regarding the nature and consequences of a risky behavior functions as a proximal cognitive determinant in the adolescent orientation toward unhealthy risk-taking (American Psychological Association, 2018). In general, individuals tend to minimize the likelihood of encountering negative outcomes in their own lives (Ridolfi & Crowther, 2013). This bias is substantially more radical within the adolescent population. Consequently, adolescents perceptions of harm toward health threatening activities are significantly lower compared to adults (Cohn et al., 1995; Defoe et al., 2015). Empirical evidence confirms that an adolescent's perception of harm regarding tobacco and nicotine products serves as a primary predictor of use initiation and maintenance, with use rates systematically declining as harm perception increases (Lipari, 2013).

However, adolescent perceptions of new generation tobacco products remain highly susceptible to manipulation by developmental factors and industrial strategies (Lipari et al., 2016). Beliefs that e-cigarettes do not pose a major risk compared to conventional tobacco products are currently widespread among high school students (Johnston et al., 2022). Adolescents rationalize the aerosol inhaled from e-cigarette devices as harmless water

vapor, fail to classify the product as a chemical tobacco derivative, and find e-cigarettes socially more acceptable due to this cognitive distortion. This schema of low risk and high social acceptance is further reinforced by the presence of role models who use-cigarettes or e-cigarettes within the family and immediate home environment, constituting the most critical cognitive vulnerability that traps adolescents in the cycle of nicotine addiction (Amrock et al., 2016).

In addition to cognitive mechanisms, perceived accessibility plays a decisive role in the initiation, chronic entrenchment, and eventual progression of adolescent tobacco and e-cigarette use into a clinical addiction problem. Perceived accessibility represents the belief system an individual develops regarding how easily, quickly, and unobstructed they can obtain a desired substance or reach the sources retailing it. Public health literature reveals that an increase in the perceived availability of tobacco and other addictive products displays a direct parallel correlation with consumption frequency and intensity (Allen et al., 2017; Jones-Webb et al., 1997; Kuntsche et al., 2008).

The mechanism of accessibility acts as a two stage lever across the adolescent's macro and micro systems within a bioecological framework. In the first stage adolescents typically encounter tobacco and e-cigarette products in external social environments, such as school perimeters, peer groups, or retail and digital sales channels with deficient legal enforcement, where they undergo their initial experimental use phases (Bouchard et al., 2018). However, the transition from experimentation to regular use and the consolidation of addiction are driven by home-based microsystemic accessibility (Bouchard et al., 2018). The presence of tobacco products within the home environment, lax storage practices by family members, or direct and indirect exposure to the product inside the household reduce the transactional cost of obtaining the substance to zero (Broman, 2016). High domestic accessibility not only sets a stage for adolescents to encounter tobacco products at earlier ages but also structurally feeds a chronic addiction pattern that persists into adulthood (Broman, 2016).

The dynamics of risk perception and perceived accessibility regarding tobacco and next generation tobacco products do not merely direct individuals toward single product consumption; they also trigger critical transition mechanisms operating across different nicotine variants. One of the most dominant debates in contemporary public health literature centers on whether electronic cigarette use functions as a causal and independent risk factor for transitioning to conventional combustible tobacco products. Comprehensive systematic reviews synthesizing longitudinal epidemiological data confirm that being introduced to e-cigarettes during adolescence and young adulthood radically increases the risk of subsequent conventional cigarette initiation and deepens current smoking patterns (Soneji et al., 2017). Indeed robust meta analytic evidence examining this phenomenon on a global level reveals that individuals who initiate e-cigarette use during adolescence are 2.93 times more likely to transition to conventional cigarettes in subsequent years, empirically demonstrating a linear trajectory in tobacco transition processes (Chan et al., 2021; Lee et al., 2018; O'Brien et al., 2021).

The psychosocial and pharmacological processes underlying this transition mechanism are conceptualized within the framework of the Gateway Hypothesis, which posits that the e-cigarette serves as an opening move in the adolescent lifespan. According to addiction etiology, even if many adolescents and young adults who initiate nicotine use via e-cigarettes have no prior intention or motivation to smoke conventional cigarettes, they are subsequently drawn into a significantly higher pool of developmental vulnerability (Primack et al., 2015; Wills et al., 2017). The regular delivery of nicotine to the adolescent brain through these devices sensitizes neurological reward mechanisms, thereby fostering a biological liability to tobacco derivatives. Concurrently, behavioral patterns such as the aerosol inhalation ritual and the hand to mouth habit become the most proximal predictors that rationalize the intention and act of initiating smoking (Miech et al., 2017; Spindle et al., 2017).

On the other hand, quantitative findings also point toward the Common Liability Model, which addresses a shared risk pool rather than a

unidirectional causal relationship in nicotine transitions. Empirical studies reveal that adolescents who smoked a conventional cigarette at least once in their lifetime exhibit a significantly higher probability of initiating e-cigarette use compared to peers who never had contact with tobacco (Leventhal et al., 2015). This bidirectional interaction reinforces the argument that common risk factors originating from an individual's genetic, sociodemographic, and personality characteristics may underlie both e-cigarette and combustible tobacco use (Leventhal et al., 2015). In other words the factor driving the adolescent toward both products simultaneously is not merely one product opening a door to another, but rather maladaptive variables within the adolescent's developmental ecology that render the individual concurrently vulnerable to all available nicotine variants (Leventhal et al., 2015). This complex architecture rationalizing nicotine transitions and concurrent use is further aggravated by macro environmental factors that manipulate adolescent cognitive schemas. Misguided beliefs developed by youth regarding the nonharmful or nonaddictive nature of e-cigarettes, aggressive marketing strategies directly targeting the young population, and the commercial introduction of products with appealing flavors structurally sustain these transition processes (Leventhal et al., 2015).

5.2. Methodology

5.2.1. Overview and protocol deviations

Of the six pre-specified tobacco outcomes, only 30-day e-cigarette use (Y_VAPE30) was estimable from the available data. Item C07 (30-day cigarette use) was not included in the survey instrument, precluding estimation of *Y_TOB30*, *Y_DUAL30*, *Y_DAILY*, and *Y_TOBDAYS*. Age of initiation (Y_INIT) was reported descriptively in Chapter 4. All Chapter 5 analyses therefore focus exclusively on *Y_VAPE30* (vape_30d_bin; n = 91 cases, 8.7% prevalence).

As individual school identifiers were unavailable, the pre-specified multilevel random-intercept structure (1|school) could not be implemented.

All models were estimated as fixed-effects logistic regression. School type (state vs. private) was included as a covariate in Block A. In addition to the pre-specified frequentist models, Bayesian logistic regression was implemented using the brms package as a sensitivity analysis, with weakly informative priors. Model fit was assessed using AIC/BIC (frequentist) and LOO-IC (Bayesian).

Multiple testing correction (BH-FDR) was not applied in this chapter, as a single pre-specified outcome family is modelled with one primary confirmatory model. BH-FDR is applied in Chapters 8 and 9, where multiple independent outcome families are tested simultaneously.

5.2.2. Hierarchical block structure

Five hierarchical models were estimated for *Y_VAPE30*, each adding one predictor block:

- Model 5.1 (Block A): gender, school type, region, family wealth
- Model 5.2 (Block A+B): + family support, parental rule-setting, parental knowledge
- Model 5.3 (Block A+B+C): + truancy (skipping), absence (other)
- Model 5.4 (Block A+B+C+D): + peer tobacco use
- Model 5.5 (Block A+B+C+D+E): + perceived risk of tobacco use, perceived availability of cigarettes

Two pre-specified interaction terms were added to the full model: - gender × parental knowledge - gender × peer tobacco use.

5.3. Results

5.3.1. Hierarchical model comparison

A series of hierarchical logistic regression models was estimated to examine predictors of 30-day e-cigarette use (vape_30d_bin). Model fit was evaluated using AIC, BIC, and area under the receiver operating characteristic curve (AUC). The analytic sample comprised n = 589 observations following

listwise deletion of cases with missing values on perceived risk items, reflecting the correction of "Don't know" responses to missing (NA) in accordance with the ESPAD 2019 Master Questionnaire codebook specification.

The sequential addition of predictor blocks produced consistent improvements in model fit across all steps. The demographic block alone (Model 5.1) yielded poor discriminative ability (AUC = 0.594), confirming that sociodemographic characteristics alone are insufficient to explain e-cigarette use. The addition of family-level variables (Block B; Model 5.2) produced a modest improvement (ΔAIC = −14.36; AUC = 0.621). School-related variables (Block C; Model 5.3) contributed further improvement (ΔAIC = −30.60; AUC = 0.754). The largest single improvement was observed upon the addition of peer tobacco use (Block D; Model 5.4; ΔAIC = −80.91; AUC = 0.839), indicating that peer influence is the dominant predictor domain. The final full model (Model 5.5), incorporating perceived risk and tobacco accessibility (Block E), achieved the best overall fit (AIC = 302.45; AUC = 0.868; ΔAIC = −199.20 from M5.4).

Table 5.1. Hierarchical logistic regression model comparison for 30-day e-cigarette use (N = 589)

Model	Block added	AIC	BIC	ΔAIC	AUC
M5.1	A: Demographic	501.65	526.27	—	0.594
M5.2	B: Family	487.29	520.17	−14.36	0.621
M5.3	C: School engagement	456.69	493.48	−30.60	0.754
M5.4	D: Peer tobacco use	375.78	416.49	−80.91	0.839
M5.5	E: Risk perception & accessibility	302.45	351.42	−73.33	0.868

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; ΔAIC = change in AIC relative to the preceding model; AUC = area under the receiver operating characteristic curve. Block A includes gender, school type, region, and family wealth. Block B adds family support, parental rule-setting, and parental knowledge. Block C adds truancy and other-reason absence. Block D adds peer tobacco use. Block E adds perceived risk of tobacco use and perceived accessibility of cigarettes.

5.3.2. Full model results (M5.5)

The full frequentist model was estimated on n = 589 observations. Two predictors demonstrated statistically significant independent associations with 30-day e-cigarette use.

Peer tobacco use was the strongest predictor (β = 0.873, SE = 0.149, p < .001), indicating that students with higher proportions of tobacco-using peers were substantially more likely to report recent e-cigarette use. Truancy (deliberate school skipping) was positively associated with vaping (β = 0.424, SE = 0.122, p < .001), suggesting that school disengagement is an independent risk factor above and beyond peer and family influences. Tobacco accessibility was positively associated with vaping (β = 0.304, SE = 0.132, p = .022), indicating that perceived ease of obtaining tobacco products independently predicts use. Perceived risk of occasional tobacco use showed a marginal negative association (β = −0.445, SE = 0.233, p = .056) that did not reach conventional significance.

Gender, school type, region, family wealth, family support, parental monitoring, knowledge score, other-reason absence, and daily tobacco risk perception did not reach statistical significance in the full model (all p > .05).

Table 5.2. Full model frequentist logistic regression coefficients for 30-day e-cigarette use (M5.5; N = 589)

Predictor	β	SE	z	p	OR	95% CI
Block A: Demographic						
Gender (female)	−0.153	0.281	−0.54	.587	0.86	[0.50, 1.49]
School type (private)	0.189	0.304	0.62	.535	1.21	[0.67, 2.19]
Region	0.041	0.182	0.22	.824	1.04	[0.73, 1.49]
Family wealth	−0.072	0.138	−0.52	.602	0.93	[0.71, 1.22]

Predictor	β	SE	z	p	OR	95% CI
Block B: Family						
Family support	−0.051	0.118	−0.43	.665	0.95	[0.75, 1.20]
Parental rule-setting	0.007	0.113	0.06	.951	1.01	[0.81, 1.26]
Parental knowledge	−0.124	0.139	−0.89	.374	0.88	[0.67, 1.16]
Block C: School engagement						
Truancy (deliberate skipping)	**0.424**	**0.122**	**3.48**	**<.001**	**1.53**	**[1.21, 1.94]**
Absence (other reasons)	0.092	0.116	0.79	.428	1.10	[0.87, 1.38]
Block D: Peer influence						
Peer tobacco use	**0.873**	**0.149**	**5.86**	**<.001**	**2.39**	**[1.79, 3.21]**
Block E: Perception & accessibility						
Perceived risk (occasional use)	−0.445	0.233	−1.91	.056	0.64	[0.41, 1.02]
Perceived risk (daily use)	−0.183	0.217	−0.84	.399	0.83	[0.55, 1.27]
Perceived accessibility	**0.304**	**0.132**	**2.30**	**.022**	**1.36**	**[1.05, 1.76]**

Note. β = unstandardized logistic regression coefficient; SE = standard error; OR = odds ratio; CI = confidence interval for OR. Statistically significant predictors ($p < .05$) are shown in bold. Reference category for gender is male. AUC = 0.868, 95% CI [0.818, 0.919]; Brier score = 0.064; AIC = 302.45; BIC = 351.42

5.3.3. Model diagnostics

The full model demonstrated strong discriminative performance (AUC = 0.868, 95% CI [0.818, 0.919]) and a Brier score of 0.064, well below the no-skill threshold of 0.25, indicating good calibration. Variance inflation

factors for all predictors were below 2.0 (maximum GVIF ^ (1/2Df) = 1.39 for perceived risk items), confirming the absence of problematic multicollinearity.

Calibration of the full model was excellent. The logistic calibration curve closely followed the ideal diagonal (Slope = 1.00, Intercept ≈ 0.00), with a maximum calibration error of Emax = 0.079 and a mean calibration error of Eavg = 0.012. The Spiegelhalter calibration test was non-significant (S:z = −0.270, p = .788), confirming that the model is well-calibrated across the full range of predicted probabilities.

Influence diagnostics were assessed using Cook's distance. While 53 observations exceeded the conventional 4/n threshold (0.007), maximum Cook's distance was 0.106, well below the substantive concern threshold of 0.5. No observations were considered unduly influential.

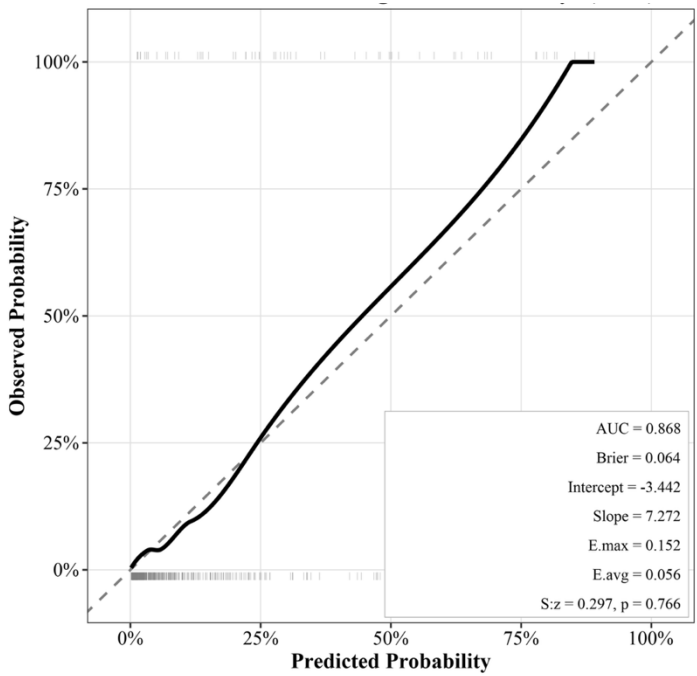

Figure 5.1. Calibration plot – e-cigarette use 30 days (M5.5)

5.3.4. Interaction models

Two pre-specified interaction terms were tested: gender × knowledge score and gender × peer tobacco use. Neither interaction reached statistical significance (gender × knowledge: $\beta = -0.408$, $p = .239$; gender × peer: $\beta = 0.189$, $p = .513$). Both interaction models produced higher AIC and BIC values relative to the main-effects-only full model (M5.6 AIC = 303.07; M5.7 AIC = 304.02; M5.8 AIC = 304.85), providing no support for gender moderation of either pathway. Interaction terms were therefore excluded from the final model.

5.3.5. Bayesian replication (M5.5)

The full model was replicated using Bayesian logistic regression with weakly informative priors ($\beta \sim \text{Normal}(0, 2.5)$; Intercept $\sim \text{Normal}(0, 5)$) via brms with CmdStan backend (4 chains, 2,000 iterations, 1,000 warmup). All chains converged satisfactorily (Rhat = 1.00 for all parameters; Bulk ESS > 3,797; Tail ESS > 2,544).

Bayesian estimates were consistent with frequentist results. Peer tobacco use showed the strongest positive association (posterior mean = 0.93, 95% CrI [0.62, 1.24]), followed by truancy (0.45, 95% CrI [0.21, 0.71]) and tobacco accessibility (0.33, 95% CrI [0.06, 0.60]). Perceived risk of occasional tobacco use showed a credible interval spanning zero (−0.47, 95% CrI [−0.93, 0.01]), consistent with the frequentist marginal non-significant finding. All other predictors had credible intervals spanning zero, consistent with the frequentist null findings.

Leave-one-out cross-validation (LOO-IC = 305.9) indicated good out-of-sample predictive performance. All Pareto-k estimates were good ($k < 0.7$), confirming model reliability.

5.3.6. Average marginal effects

Average marginal effects (AME) were computed to facilitate interpretation of predictor associations on the probability scale. Peer tobacco use showed the largest marginal effect (AME = 0.057, SE = 0.009, $p < .001$), indicating that a one-unit increase in peer tobacco use was associated with a 5.7 percentage point increase in the probability of 30-day vaping. Tobacco accessibility showed a positive marginal effect (AME = 0.020, SE = 0.009, $p = .022$). Truancy was also associated with a meaningful increase in vaping probability (AME = 0.028, SE = 0.008, $p < .001$). Perceived risk of occasional tobacco use showed a non-significant marginal effect (AME = -0.029, $p = .055$). All other predictors showed non-significant marginal effects

5.4. Discussion

In this study, the demographic, familial, academic, peer-relational, and perceptual dynamics predicting the past thirty-day electronic cigarette use among adolescents were comprehensively analyzed through hierarchical logistic regression and Bayesian replication models. Model diagnostic tests confirm that the final full model exhibits an exceptionally high performance in discriminating adolescent e-cigarette use and demonstrates a well calibrated curve. The emerging empirical findings strongly support some of the tested hypotheses, while indicating that others attenuate toward zero in the fully adjusted models.

The H1 hypothesis, which posits that parental monitoring and domestic rule setting processes establish an inverse protective barrier against adolescent e-cigarette and tobacco practices, was not supported in the final full model outputs of the hierarchical regression analysis. When the model steps are examined, the inclusion of familial variables initially provided a significant but modest contribution to explaining e-cigarette use; however, in subsequent stages, as peer tobacco exposure entered the equation, the independent effect of parental monitoring entirely lost its statistical significance. This phenomenon, frequently encountered in the literature, is directly related to

the structural overshadowing of the familial context by peer groups and the developmental shift of focus during adolescence. The addiction literature targeting adolescents confirms that while domestic rule setting processes initially hold a protective role in adolescent lifespan, the explanatory power of familial variables remains highly limited once peers consumption patterns are integrated into the model (Schwinn & Schinke, 2014). Indeed, when the variance over adolescents substance use intentions is decomposed within the etiology of adolescent addiction, it is reported that peer effects alone can account for an overwhelming thirty percent of this variability, whereas parental influences hold a marginal share of only three percent over the same variance (Schwinn & Schinke, 2014). Therefore, the most radical improvement in model fit observed in the current study during the transition from the familial block to the peer block, along with the attenuation of parental monitoring, is a direct statistical reflection of this massive variance dominance that the peer world holds over the adolescent population.

This powerful and proximal effect of peer tobacco exposure on e-cigarette use sits on a robust theoretical foundation within the assumptions of Social Learning Theory by Akers and Jennings (2015). According to the theory, an individual's substance use behavior during adolescence is shaped through four primary mechanisms provided by the peer group, namely differential associations, imitation or social modeling, definitions or attitudes, and differential reinforcement. The attenuation of parental monitoring upon adding peer tobacco use to the model demonstrates that the consumption of tobacco and e-cigarettes exhibited by peers within the adolescent's daily social space functions directly as objects of imitation and social modeling. Intensive differential associations established with the tobacco-using peer group can trigger the development of definitions and cognitive schemas that view e-cigarettes as harmless or acceptable, and furthermore, e-cigarette use within these friendship networks can be subjected to differential reinforcement as a symbol of prestige, autonomy, and status. These high frequency, proximal social learning and reward mechanisms occurring within the adolescent's daily social microsystem may directly undermine the strength of parental control

and distal rules set by the family. Nevertheless, the inability of parental monitoring to exhibit an independent main effect in simultaneous full models should not be interpreted as familial boundaries being entirely dysfunctional in the adolescent lifeworld. Studies conducted on adolescent substance use indicate that strict, clear, and perceived consumption boundaries set by parents can function as an indirect protective mechanism that weakens the risky links between heavy or excessive consumption behaviors of adolescents and direct offers from peers or social modeling processes in friend environments (Wood et al., 2004). However, the empirical outcomes of the current study reveal that peer tobacco use completely encompasses the adolescent microsystem as a dominant and proximal risk factor, and this dense social learning input thoroughly overshadows the directly inhibitory function of parental monitoring in full models.

The behavior of intentional and unexcused school truancy, which is one of the current outputs of this study, remains a highly significant and independent risk factor for past thirty-day e-cigarette use even after powerful proximal determinants such as peers and family are controlled. It is observed that a structural one unit increase in truancy directly raises the probability of adolescent e-cigarette consumption by 2.8 percent. This finding establishes a rational ground for divergence and discussion with certain multivariate model outputs in recent international literature. In fact, there are studies in the literature reporting that the strong correlations detected between truancy and e-cigarette use in bivariate analyses completely disappear when other psychosocial predictors enter the equation (Leung et al., 2025). The aforementioned researchers argued that the relationship between truancy and adolescent substance use is not causal, but rather that both maladaptive actions are surface level shared reflections of an underlying general risk profile (Leung et al., 2025). However, in this study, the fact that truancy remains a robust independent predictor despite controlling for a powerful source of variance such as peer tobacco exposure in the full model suggests that detachment from the school context triggers a unique risk mechanism that

directly feeds e-cigarette prevalence in the adolescent population, moving beyond a general risk propensity.

How truancy independently predicts e-cigarette use can be explained through the psychosocial and spatial dynamics of the school environment. School truancy at the behavioral level is actually one of the most proximal indicators of the weakening of psychological bonds an adolescent feels toward the educational institution and the erosion of school connectedness. The health psychology literature states that there is a strong positive correlation between low school connectedness or inadequate institutional belonging and the propensity for adolescent e-cigarette use, experimentation tendencies, and the lifetime risk of consuming nicotine products at least once (Springer et al., 2022). Similarly, it is expressed that as the level of institutional connectedness and integration toward school rises, adolescents general substance and tobacco use practices systematically decrease (Manning et al., 2024). When this theoretical framework is merged with the findings of the current research, adolescents who exhibit low school connectedness and structural truancy behavior remove themselves entirely from the institutional supervision, prosocial rules, and protective barrier spaces provided by the school environment. These unsupervised and unstructured time periods expanding outside school boundaries not only increase the frequency of physical exposure to maladaptive peer groups who use substances, but also, in alignment with the findings of this study, maximize the ease of physical access to e-cigarette devices from retailers with deficient legal enforcement or through digital spaces. Consequently, it can be argued that truancy functions as an independent developmental accelerator that deprives the adolescent of the protective institutional shield and draws them into the cycle of tobacco addiction.

The hypothesis proposing that risk perception would function as a protective inhibitor, whereas perceived accessibility would increase e-cigarette use as a structural facilitator, was partially confirmed by the findings of the study. Perceived tobacco accessibility emerged as a positive independent predictor of e-cigarette use, confirming that the subjective belief developed by

the adolescent regarding how easily they can obtain the product directly increases the probability of consumption. In contrast, the expectation that the perception of risk and harm regarding the occasional use of tobacco products would establish a protective barrier did not fully materialize.

The attenuation of adolescents risk and harm perceptions to a degree that fails to produce an inhibitory main effect in the full model may be directly related to the aggressive marketing tactics of the tobacco industry and the cycles of visual or social exposure within adolescents immediate environments. Studies in the literature state that individual exposure to e-cigarette advertisements constructs a direct structural risk for tobacco addiction and device use propensity in the adolescent population (Grilo et al., 2021). Advertisements in digital and traditional media portray e-cigarette use as an aesthetic, modern, and harmless action, and similarly, direct exposure both to these advertisements and to peer or adult role models who use e-cigarettes in the immediate social circle adversely impacts adolescents harm schemas regarding the product (Agaku et al., 2020; Yazidjoglou et al., 2024). Environmental exposure and industrial manipulation feed the cognitive distortions of adolescents who rationalize the aerosol as water vapor, thereby reducing the protective function of risk perception in the face of accessibility.

On the other hand, the fact that direct sociodemographic indicators such as family wealth emerged as statistically nonsignificant in the final full model of the study harbors a subtle nuance in light of recent evidence in the literature. Systematic reviews in the addiction literature point out that the impact of socioeconomic status on e-cigarette use may operate indirectly through the calibration of cognitive harm perceptions rather than via a direct main effect (Ahuja et al., 2024). It is reported that adolescents from low socioeconomic backgrounds tend to find e-cigarette devices and tobacco derivatives less harmful compared to their higher socioeconomic peers (Ahuja et al., 2024). This situation suggests that although family wealth did not emerge as a significant direct predictor in the full model of the current study, it may affect the risk perception levels across different socioeconomic strata of

the sample heterogeneously, and this internal variability may create a condition that left the impact of risk perception marginal in the final model.

The hypothesis of the study arguing that gender would moderate the relationships between parental monitoring or peer influence and adolescents e-cigarette use practices was not supported by the findings. The registered outputs reveal that the predictive mechanisms of peer socialization and knowledge levels on e-cigarette use do not operate asymmetrically between female and male adolescents; on the contrary, the risk pathways possess a gender invariant and universal nature. This emerging gender invariance exhibits a strong parallel with prominent studies in contemporary addiction literature. There are studies in the literature reporting that gender does not play a direct or indirect moderating role during the initiation processes of e-cigarette use behavior in adolescence (Kintz et al., 2020). Similarly, when lifetime risk status of adolescent e-cigarette use are analyzed, no significant interaction pattern could be detected between the effect sizes of psychosocial risk factors and the gender variable (Lessard et al., 2014). In contrast, certain systematic reviews in global literature argue that male adolescents have an epidemiologically much higher probability of using e-cigarettes compared to females, and that this next generation nicotine consumption should fundamentally be read as a gender specific masculine behavior pattern (Kim et al., 2022). However, the full model outputs of the current study prove that even if superficial differences in prevalence frequencies exist between the e-cigarette rates of adolescents, the underlying psychosocial mechanisms rationalizing addiction, such as peer norms and detachment from institutional bonds, operate with the same statistical weight and direction for both genders. When the structural determinants obtained in this study are addressed within the context of the criteria from the ESPAD 2024 report, which represents the most up to date regional macro database, the global validity of the current study is thoroughly certified. According to the ESPAD 2024 European data, a majority of school aged students, specifically sixty percent, believe that they could easily gain access to e-cigarette devices if they wished, without facing any structural obstacles. The report states that no statistical differences exist

between male and female adolescents regarding these high rates of perceived accessibility. Furthermore, the ESPAD 2024 report declared the presence of e-cigarette-using peers within the adolescent's developmental ecology as the most dominant and primary risk factor drawing the individual into the cycle of addiction. Therefore, the vast variance dominance exhibited by peer tobacco exposure in the hierarchical regression models of the current study can be viewed not merely as a local sample dynamic, but as a universal peer socialization process that directly drives and structures the adolescent tobacco epidemic across Europe.

5.5. Conclusion and Policy Recommendation

This study provides a rigorous, multi-methodological evaluation of the psychosocial and structural forces that drive 30-day electronic cigarette use among tenth grade adolescents. The empirical evidence generated through simultaneous frequentist logistic regression and Bayesian replication models demonstrates that adolescent vaping is primarily dictated by proximal social environments and institutional detachment rather than distal sociodemographic background characteristics. The comprehensive decomposition of model variance reveals that peer tobacco exposure operates as the absolute dominant predictor in the adolescent nicotine ecology, completely overshadowing the direct protective effects of parental monitoring and domestic rule-setting within fully adjusted models. Furthermore, intentional school truancy persists as a powerful, robust, and independent behavioral accelerator of e-cigarette consumption, validating the perspective that programmatic separation from formal academic structures triggers unique risk pathways. Finally, the structural validation of perceived accessibility as a significant facilitator, contrasted with the systemic erosion of subjective harm frameworks under macro-industrial marketing manipulation, highlights a precarious cognitive vulnerability among youth. Taken together, these findings confirm that the adolescent vaping epidemic is a highly interconnected phenomenon requiring immediate, systemic, and ecologically valid interventions.

Based on the integrated model findings and the established socioecological evidence, a series of targeted interventions are required to mitigate adolescent nicotine use in North Cyprus. Because the empirical data demonstrate that peer socialization and institutional detachment operate as the primary drivers of recent vaping, generic prevention strategies are structurally insufficient. The following multi component policy recommendations are proposed to address these proximal risk mechanisms directly:

School based positive peer influence and social norm correction: Intervention programs should mobilize popular student leaders to model pro-social, tobacco free behaviors within their school networks. Additionally, schools must deploy data driven campaigns showcasing that the vast majority of the 2010 birth cohort does not vape regularly, thereby dismantling artificial social pressure and conformity expectations.

Routine attendance monitoring and early warning behavioral observation: School administrations should utilize classroom monitoring protocols and teacher observations to identify emerging patterns of unexcused absence immediately. Detecting initial instances of school skipping through routine roll calls should automatically trigger standard guidance counseling and parental contact. Treating truancy as an observable behavioral marker of institutional disengagement allows educators to disrupt dangerous peer modeling before substance use habits become entrenched.

Supply side legal enforcement and environmental restrictions: Law enforcement and municipal bodies must intensify random age verification audits and compliance checks around commercial zones surrounding school perimeters. Severe administrative and legal sanctions should be imposed on illicit supply chains, while public health campaigns should educate parents on restricting physical access to nicotine devices within the household micro-system.

5.6. Bias and Limitations

Several limitations should be considered when interpreting the findings. First, the cross-sectional design prevents causal inference and limits the ability to establish temporal ordering between predictors and e-cigarette use. Although the modeled relationships were theoretically informed, reciprocal influences and residual confounding from unmeasured factors, such as family history of substance use or psychological comorbidities, cannot be excluded.

Second, the absence of school-level identifiers prevented the implementation of multilevel analyses. As a result, potential clustering effects within schools were not accounted for, which may have led to modest underestimation of standard errors.

Third, limitations in the survey dataset required modifications to the original analytical plan. Missing information for key tobacco-related items prevented the construction of several intended outcomes, while cannabis and polydrug use variables were excluded due to low statistical estimability and model convergence issues. Consequently, the analyses were restricted to 30-day e-cigarette use.

Finally, all measures were based on self-reported data and are therefore subject to recall and social desirability biases. In addition, external validation was not feasible, meaning that the reported performance metrics reflect internal model fit rather than confirmed generalizability to other populations.

References

Agaku, I. T., Perks, S. N., Odani, S., & Glover-Kudon, R. (2020). Associations between public e-cigarette use and tobacco-related social norms among youth. *Tobacco Control, 29*(3), 332–340. https://doi.org/10.1136/ tobacco control-2018-054728

Ahuja, N. A., Kedia, S. K., Regmi, S., & Dillon, P. J. (2024). Disparities in e-cigarette harm and addiction perceptions among adolescents in the United States: A systematic review of the literature. *Journal of Racial and Ethnic Health Disparities, 11*(2), 696–709. https://doi.org/10.1007/s40615-023-01553-1

Akers, R. L., & Jennings, W. J. (2015). Social learning theory. In Piquero AR (Ed.), The Handbook of Criminological Theory (pp. 230–240). John Wiley & Sons.

Allen, H. K., Caldeira, K. M., Bugbee, B. A., Vincent, K. B., O'Grady, K. E., & Arria, A. M. (2017). Drug involvement during and after college: Estimates of opportunity and use given opportunity. *Drug and Alcohol Dependence*, *174*, 150–157. https://doi.org/10.1016/j.drugalcdep.2017.01.025

Allen, J. P., & Loeb, E. L. (2015). The autonomy-connection challenge in adolescent peer relationships. *Child Development Perspectives*, *9*(2), 101–105. https://doi.org/10.1111/cdep.12111

American Psychological Association. (2018). Risk perception. In *APA dictionary of psychology*. Retrieved May 24, 2026, from https://dictionary.apa.org/risk-perception

Amrock, S. M., Lee, L., & Weitzman, M. (2016). Perceptions of e-cigarettes and noncigarette tobacco products among US youth. *Pediatrics*, *138*(5), e20154306. https://doi.org/10.1542/peds.2015-4306

Bouchard, M., Gallupe, O., Dawson, K., & Anamali, M. (2018). No place like home? Availability, opportunity, and substance use in adolescence. *Journal of Youth Studies*, *21*(6), 747–764. https://doi.org/10.1080/13676261.2017.1420760

Branstetter, S. A., Low, S., & Furman, W. (2011). The Influence of parents and friends on adolescent substance use: A multidimensional approach. *Journal of Substance Use*, *16*(2), 150–160. https://doi.org/10.3109/14659891.2010.519421

Broman, C. L. (2016). The availability of substances in adolescence: Influences in emerging adulthood. *Journal of Child & Adolescent Substance Abuse*, *25*(5), 487–495. https://doi.org/10.1080/1067828X.2015.1103346

Centers for Disease Control and Prevention (CDC). (2013). Notes from the field: Electronic cigarette use among middle and high school students - United States, 2011-2012. *MMWR. Morbidity and Mortality Weekly Report*, *62*(35), 729–730.

Chan, G. C. K., Stjepanović, D., Lim, C., Sun, T., Shanmuga Anandan, A., Connor, J. P., Gartner, C., Hall, W. D., & Leung, J. (2021). Gateway or common liability? A systematic review and meta-analysis of studies of adolescent e-cigarette use and future smoking initiation. *Addiction, 116*(4), 743–756. https://doi.org/10.1111/add.15246

Clark, H. K., Shamblen, S. R., Ringwalt, C. L., & Hanley, S. (2012). Predicting high risk adolescents' substance use over time: the role of parental monitoring. *The Journal of Primary Prevention*, *33*(2-3), 67–77. https://doi.org/10.1007/s10935-012-0266-z

Cohn, L. D., Macfarlane, S., Yanez, C., & Imai, W. K. (1995). Risk-perception: Differences between adolescents and adults. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *14*(3), 217–222. https://doi.org/10.1037//0278-6133.14.3.217

Defoe, I. N., Dubas, J. S., Figner, B., & van Aken, M. A. (2015). A meta-analysis on age differences in risky decision making: Adolescents versus children and adults. *Psychological Bulletin*, *141*(1), 48–84. https://doi.org/10.1037/a0038088

Dishion, T. J., & McMahon, R. J. (1998). Parental monitoring and the prevention of child and adolescent problem behavior: a conceptual and empirical formulation. *Clinical Child and Family Psychology Review*, *1*(1), 61–75. https://doi.org/10.1023/a:1021800432380

Duell, N., & Steinberg, L. (2019). Positive Risk Taking in Adolescence. *Child Development Perspectives*, *13*(1), 48–52. https://doi.org/10.1111/cdep.12310

Duell, N., Steinberg, L., Icenogle, G., Chein, J., Chaudhary, N., Di Giunta, L., Dodge, K. A., Fanti, K. A., Lansford, J. E., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Uribe Tirado, L. M., Alampay, L. P., Al-Hassan, S. M., Takash, H. M. S., Bacchini, D., & Chang, L. (2018). Age patterns in risk taking across the world. *Journal of Youth and Adolescence*, *47*(5), 1052–1072. https://doi.org/10.1007/s10964-017-0752-y

Eiser, J. R., Morgan, M., Gammage, P., Brooks, N., & Kirby, R. (1991). Adolescent health behaviour and similarity-attraction: Friends share smoking habits (really), but much else besides. *British Journal of Social Psychology, 30*(4), 339-348. https://doi.org/10.1111/j.2044-8309.1991.tb00950.x

ESPAD Group. (2025). *ESPAD report 2024: Results from the European school survey project on alcohol and other drugs*. European Union Drugs Agency.

Fallu, J. S., Janosz, M., Brière, F. N., Descheneaux, A., Vitaro, F., & Tremblay, R. E. (2010). Preventing disruptive boys from becoming heavy substance users during adolescence: A longitudinal study of familial and peer-related protective factors. *Addictive Behaviors*, *35*(12), 1074–1082. https://doi.org/10.1016/j.addbeh.2010.07.008

Glueck, S., & Glueck, E. (1950). *Unraveling juvenile delinquency*. Harvard University Press.

Grilo, G., Crespi, E., & Cohen, J. E. (2021). A scoping review on disparities in exposure to advertising for e-cigarettes and heated tobacco products and implications for advancing a health equity research agenda. *International Journal for Equity in Health, 20*(1), 238. https://doi.org/10.1186 /s12939-021-01576-2

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin*, *112*(1), 64–105. https://doi.org/10.1037/0033-2909.112.1.64

Hoeve, M., Dubas, J. S., Eichelsheim, V. I., van der Laan, P. H., Smeenk, W., & Gerris, J. R. (2009). The relationship between parenting and delinquency: A meta-analysis. *Journal of Abnormal Child Psychology*, *37*(6), 749–775. https://doi.org/10.1007/s10802-009-9310-8

Jamal, A., Gentzke, A., Hu, S. S., Cullen, K. A., Apelberg, B. J., Homa, D. M., & King, B. A. (2017). Tobacco use among middle and high school students - United States, 2011-2016. *MMWR. Morbidity and Mortality Weekly Report*, *66*(23), 597–603. https://doi.org/10.15585/mmwr.mm6623a1

Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2022). Monitoring the future national survey results on drug use, 1975-2021: Overview, key findings on adolescent drug use. *Institute for Social Research*.

Jones-Webb, R., Toomey, T. L., Short, B., Murray, D. M., Wagenaar, A., & Wolfson, M. (1997). Relationships among alcohol availability, drinking location, alcohol consumption, and drinking problems in adolescents. *Substance Use & Misuse*, *32*(10), 1261–1285. https://doi.org/10.3109/10826089709039378

Kim, J., Lee, S., & Chun, J. (2022). An international systematic review of prevalence, risk, and protective factors associated with young people's e-cigarette use. *International Journal of Environmental Research and Public Health*, *19*(18), 11570. https://doi.org/10.3390/ijerph191811570

Kintz, N., Liu, M., Chou, C. P., Urman, R., Berhane, K., Unger, J. B., Boley Cruz, T., McConnell, R., & Barrington-Trimis, J. L. (2020). Risk factors associated with subsequent initiation of cigarettes and e-cigarettes in adolescence: A structural equation modeling approach. *Drug and Alcohol Dependence*, *207*, 107676. https://doi.org/10.1016/j.drugalcdep. 2019.107676

Kobus, K. (2003). Peers and adolescent smoking. *Addiction, 98,* 37–55. https://doi.org/10.1046/j.1360-0443.98.s1.4.x

Kuntsche, E., Kuendig, H., & Gmel, G. (2008). Alcohol outlet density, perceived availability and adolescent alcohol use: A multilevel structural equation model. *Journal of Epidemiology and Community Health*, *62*(9), 811–816. https://doi.org/10.1136/jech.2007.065367

Lansford, J. E., Capanna, C., Dodge, K. A., Caprara, G. V., Bates, J. E., Pettit, G. S., & Pastorelli, C. (2007). Peer social preference and depressive symptoms of children in Italy and the United States. *International Journal of Behavioral*

Development, *31*(3), 274-283. https://doi.org/10.1177/0165025407076440

Laursen, B. (2018). Peer influence. In W. M. Bukowski, B. Laursen, & K. H. Rubin (Eds.), *Handbook of peer interactions, relationships, and groups* (Second ed., pp. 447-469). Guilford Press.

Laursen, B., & Veenstra, R. (2021). Toward understanding the functions of peer influence: A summary and synthesis of recent empirical research. *Journal of Research on Adolescence*, *31*(4), 889-907. https://doi.org/10.1111/jora.12606

Lee, P. N., Coombs, K. J., & Afolalu, E. F. (2018). Considerations related to vaping as a possible gateway into cigarette smoking: an analytical review. *F1000Research*, *7*, 1915. https://doi.org/10.12688/f1000research.16928.3

Lessard, J., Henrie, J., Livingston, J. A., Leonard, K. E., Colder, C. R., & Eiden, R. D. (2014). Correlates of ever having used electronic cigarettes among older adolescent children of alcoholic fathers. *Nicotine & Tobacco research: Official journal of the Society for Research on Nicotine and Tobacco*, *16*(12), 1656–1660. https://doi.org/10.1093/ntr/ntu148

Leung, J., Tisdale, C., Choi, J., Ellem, R., Davidson, L., Chan, G. C. K., White, M. J., Kavanagh, D. J., Quinn, C., & Hides, L. (2025). E-cigarette use among high school students—A cross-sectional study of associated risk factors for the use of flavour-only and nicotine vapes. *International Journal of Mental Health and Addiction, 23*(1), 236–250. https://doi.org/10.1007/ s11469-023-01099-7

Leventhal, A. M., Strong, D. R., Kirkpatrick, M. G., Unger, J. B., Sussman, S., Riggs, N. R., Stone, M. D., Khoddam, R., Samet, J. M., & Audrain-McGovern, J. (2015). Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA*, *314*(7), 700–707. https://doi.org/10.1001/jama.2015.8950

Lipari, R. N. (2013). Trends in Adolescent Substance Use and Perception of Risk from Substance Use. The CBHSQ Report. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2013. https://www.ncbi.nlm.nih.gov/books/NBK385059/

Lipari, R. N., Williams, M. R., Copello, E. A. P., & Pemberton, M. R. (2016). Risk and protective factors and estimates of substance use initiation: Results from the 2015 national survey on drug use and health. In *CBHSQ Data Review*. Substance Abuse and Mental Health Services Administration.

Littlecott, H. J., Moore, G. F., Evans, R. E., Melendez-Torres, G. J., McCann, M., Reed, H., Mann, M., Dobbie, F., Jennings, S., Donaldson, C., & Hawkins, J. (2023). Perceptions of friendship, peers and influence on adolescent smoking according to tobacco control context: A systematic review and meta-ethnography of qualitative research. *BMC Public Health*, *23*(1), 424. https://doi.org/10.1186/s12889-022-14727-z

Mackay, J., & Eriksen, M. P. (2002). *The tobacco atlas*. World Health Organization.

Manning, M. C., Modrowski, C. A., Aldrich, D. P., & Rizzo, C. J. (2024). School connectedness and substance use among early adolescents with diverse maltreatment histories. *Journal of Family Trauma, Child Custody & Child Development*, *21*(1), 57–75. https://doi.org/10.1080/26904586.2023.2177232

Mantey, D. S., Clendennen, S. L., Springer, A. E., & Harrell, M. B. (2022). Perceived parental knowledge reduces risk for initiation of nicotine and cannabis vaping: A longitudinal study of adolescents. *American Journal of Health Promotion: AJHP*, *36*(4), 623–632. https://doi.org/10.1177/0890117 1211061941

Marziali, M. E., Levy, N. S., & Martins, S. S. (2022). Perceptions of peer and parental attitudes toward substance use and actual adolescent substance use: The impact of adolescent-confidant relationships. *Substance Abuse*, *43*(1), 1085–1093. https://doi.org/10.1080/08897077.2022.2060439

Miech, R., Johnston, L., O'Malley, P. M., Bachman, J. G., & Patrick, M. E. (2019). Adolescent vaping and nicotine use in 2017-2018 - U.S. National Estimates. *The New England Journal of Medicine*, *380*(2), 192–193. https://doi.org/10.1056/NEJMc1814130

Miech, R., Patrick, M. E., O'Malley, P. M., & Johnston, L. D. (2017). E-cigarette use as a predictor of cigarette smoking: Results from a 1-year follow-up of a national sample of 12th grade students. *Tobacco Control*, *26*(e2), e106–e111. https://doi.org/10.1136/tobaccocontrol-2016-053291

Mohr, P. N., Biele, G., & Heekeren, H. R. (2010). Neural processing of risk. *Journal of Neuroscience, 30*(19), 6613-6619. https://doi.org/10.1523/JNEUROSCI.0003-10.2010

Ng, M., Freeman, M. K., Fleming, T. D., Robinson, M., Dwyer-Lindgren, L., Thomson, B., Wollum, A., Sanman, E., Wulf, S., Lopez, A. D., Murray, C. J., & Gakidou, E. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. *JAMA*, *311*(2), 183–192. https://doi.org/10.1001/jama.2013.284692

Nieuwenhuis, J., & Veennema, D. (2025). Adolescent health in relation to their peers: likeability as a resilience factor. *SSM - Population Health*, *31*, 101833. https://doi.org/10.1016/j.ssmph.2025.101833

O'Brien, D., Long, J., Quigley, J., Lee, C., McCarthy, A., & Kavanagh, P. (2021). Association between electronic cigarette use and tobacco cigarette smoking initiation in adolescents: A systematic review and meta-analysis. *BMC Public Health*, *21*(1), 954. https://doi.org/10.1186/s12889-021-10935-1

O'Loughlin, J., Paradis, G., Renaud, L., & Gomez, L. S. (1998). One-year predictors of smoking initiation and of continued smoking among elementary school children in multiethnic, low-income, inner-city neighbourhoods. *Tobacco Control*, 7, 268–275. https://doi.org/10.1136/tc.7.3.268

Patterson, G. R., & Stouthamer-Loeber, M. (1984). The correlation of family management practices and delinquency. *Child Development*, *55*(4), 1299–1307. https://doi.org/10.2307/1129999

Pelham, W. E., 3rd, Racz, S. J., Davis, I. S., Aks, I. R., Patel, H., McMahon, R. J., Thornburg, M. A., Huang, Y. W., Schulze, E. M., Gonzalez, O., Tapert, S. F., & Brown, S. A. (2024). What is Parental Monitoring? *Clinical Child and Family Psychology Review*, *27*(2), 576–601. https://doi.org/10.1007/s10567-024-00490-7

Price, J., Drabick, D. A. G., & Ridenour, T. A. (2019). Association With Deviant Peers Across Adolescence: Subtypes, Developmental Patterns, and Long-Term Outcomes. *Journal of Clinical Child and Adolescent Psychology: The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *48*(2), 238–249. https://doi.org/10.1080/15374416.2017.1405351

Primack, B. A., Soneji, S., Stoolmiller, M., Fine, M. J., & Sargent, J. D. (2015). Progression to traditional cigarette smoking after electronic cigarette use among US adolescents and young adults. *JAMA Pediatrics*, *169*(11), 1018–1023. https://doi.org/10.1001/jamapediatrics.2015.1742

Ridolfi, D. R., & Crowther, J. H. (2013). The link between women's body image disturbances and body-focused cancer screening behaviors: a critical review of the literature and a new integrated model for women. *Body Image*, *10*(2), 149–162. https://doi.org/10.1016/j.bodyim.2012.11.003

Romer, D., Reyna, V. F., & Satterthwaite, T. D. (2017). Beyond stereotypes of adolescent risk taking: Placing the adolescent brain in developmental context. *Developmental Cognitive Neuroscience*, *27*, 19–34. https://doi.org/10.1016/j.dcn.2017.07.007

Schwinn, T. M., & Schinke, S. P. (2014). Alcohol Use and Related Behaviors among Late Adolescent Urban Youth: Peer and Parent Influences. *Journal of Child & Adolescent Substance Abuse*, *23*(1), 58–64. https://doi.org/10.1080/1067828x.2012.735561

Sentse, M., Kiuru, N., Veenstra, R., & Salmivalli, C. (2014). A social network approach to the interplay between adolescents' bullying and likeability over time. *Journal of Youth and Adolescence*, *43*(9), 1409-1420. https://doi.org/10.1007/s10964-014-0129-4

Shaikh, M. A., Zare, Z., Ng, K. W., Celedonia, K. L., & Lowery Wilson, M. (2020). Tobacco use and parental monitoring-observations from three diverse island nations-Cook Islands, Curaçao, and East Timor. *International Journal of Environmental Research and Public Health*, *17*(20), 7360. https://doi.org/10.3390/ijerph17207360

Soneji, S., Barrington-Trimis, J. L., Wills, T. A., Leventhal, A. M., Unger, J. B., Gibson, L. A., Yang, J., Primack, B. A., Andrews, J. A., Miech, R. A., Spindle, T. R., Dick, D. M., Eissenberg, T., Hornik, R. C., Dang, R., & Sargent, J. D. (2017). Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: A systematic review and meta-analysis. *JAMA Pediatrics*, *171*(8), 788–797. https://doi.org/10.1001/jamapediatrics.2017.1488

Spindle, T. R., Hiler, M. M., Cooke, M. E., Eissenberg, T., Kendler, K. S., & Dick, D. M. (2017). Electronic cigarette use and uptake of cigarette smoking: A longitudinal examination of U.S. college students. *Addictive Behaviors*, *67*, 66–72. https://doi.org/10.1016/j.addbeh.2016.12.009

Springer, A. E., Mantey, D. S., Omega-Njemnobi, O., Ruiz, F., Attri, S., Chen, B., Marshall, A., & Kelder, S. H. (2022). School connectedness and e-cigarette susceptibility/ever use in Texas 6th-grade students. *American Journal of Health Behavior*, *46*(6), 673–682. https://doi.org/10.5993/ AJHB.46.6.10

Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development*, *71*(4), 1072–1085. https://doi.org/10.1111/1467-8624.00210

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*(1), 78–106. https://doi.org/10.1016/j.dr.2007.08.002

Sumter, S. R., Bokhorst, C. L., Steinberg, L., & Westenberg, P. M. (2009). The developmental pattern of resistance to peer influence in adolescence: Will the teenager ever be able to resist? *Journal of Adolescence*, *32*(4), 1009-1021. https://doi.org/10.1016/j.adolescence.2008.08.010

Szoko, N., Ragavan, M. I., Khetarpal, S. K., Chu, K. H., & Culyba, A. J. (2021). Protective factors against vaping and other tobacco use. *Pediatrics*, *148*(2), e2020048066. https://doi.org/10.1542/peds.2020-048066

Urberg, K. A., Cheng, C., & Shyu, S. (1991). Grade changes in peer influence on adolescent cigarette smoking: A comparison of two measures. *Addictive Behaviors, 16*(1-2), 21–28. https://doi.org/10.1016/0306-4603(91)90036-H

Urberg, K. A., Degirmencioglu, S. M. & Pilgrim, C. (1997). Close friend and group influnce on adolescent cigarette smoking and alcohol use. *Developmental Psychology, 33,* 834–844. https://doi.org/10.1037/0012-1649.33.5.834

Van Duijvenvoorde, A. C., & Crone, E. A. (2013). The teenage brain: A neuroeconomic approach to adolescent decision making. *Current Directions in Psychological Science*, *22*(2), 108-113. https://doi.org/10.1177/0963721413475446

Van Ryzin, M. J., & Dishion, T. J. (2014). Adolescent deviant peer clustering as an amplifying mechanism underlying the progression from early substance use to late adolescent dependence. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *55*(10), 1153–1161. https://doi.org/10.1111/jcpp.12211

Van Ryzin, M. J., Fosco, G. M., & Dishion, T. J. (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. https://doi.org/10.1016/j.addbeh.2012.06.020

Watts, L. L., Hamza, E. A., Bedewy, D. A., & Moustafa, A. A. (2024). A meta-analysis study on peer influence and adolescent substance use. *Current*

Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues, 43(5), 3866–3881. https://doi.org/10.1007/s12144-023-04944-z

Wellman, R. J., Dugas, E. N., Dutczak, H., O'Loughlin, E. K., Datta, G. D., Lauzon, B., & O'Loughlin, J. (2016). Predictors of the onset of cigarette smoking: A systematic review of longitudinal population-based studies in Youth. *American Journal of Preventive Medicine*, *51*(5), 767–778. https://doi.org/10.1016/j.amepre.2016.04.003

Willoughby, T., Good, M., Adachi, P. J., Hamza, C., & Tavernier, R. (2013). Examining the link between adolescent brain development and risk taking from a social-developmental perspective. *Brain and Cognition*, *83*(3), 315–323. https://doi.org/10.1016/j.bandc.2013.09.008

Willoughby, T., Heffer, T., Good, M., & Magnacca, C. (2021). Is adolescence a time of heightened risk taking? An overview of types of risk-taking behaviors across age groups. *Developmental Review*, *61*, 100980. https://doi.org/10.1016/j.dr.2021.100980

Wills, T. A., Knight, R., Sargent, J. D., Gibbons, F. X., Pagano, I., & Williams, R. J. (2017). Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii. *Tobacco Control*, *26*(1), 34–39. https://doi.org/10.1136/tobaccocontrol-2015-052705

Wood, M. D., Read, J. P., Mitchell, R. E., & Brand, N. H. (2004). Do parents still matter? Parent and peer influences on alcohol involvement among recent high school graduates. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, *18*(1), 19–30. https://doi.org/10.1037/0893-164X.18.1.19

Yazidjoglou, A., Watts, C., Joshy, G., Banks, E., & Freeman, B. (2024). Electronic cigarette social norms among adolescents in New South Wales, Australia. *Health Promotion International, 39*(2), daae018. https://doi.org/10.1093/heapro/daae018