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Adolescent Tobacco and Alcohol Use in China: A Socio-Ecological Analysis and Education-Centred Interventions

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Abstract. Adolescent tobacco and alcohol use in China cannot be explained solely as a matter of personal choice. It is shaped by interacting socio-ecological influences, including adolescents' developmental sensitivity to reward and peer approval, family and peer modelling, school environments, cultural normalization, media portrayals, and imperfect enforcement of age-based retail restrictions. Using the socio-ecological model, this paper synthesizes surveillance data and peer-reviewed evidence to examine determinants at individual, interpersonal, community/organizational, and structural levels. The analysis highlights particularly high tobacco risk among vocational school students, continued exposure to second-hand smoke, easy access to cigarettes near schools, and alcohol use that often occurs in family gatherings and private-home contexts. Based on these findings, the paper argues that slogan-based, punitive, or purely information-based prevention is insufficient. Instead, it proposes education-centred interventions that teach mechanism-based addiction literacy, strengthen refusal skills, reshape peer norms, engage parents, improve school-community cooperation, support retail compliance, and develop media literacy. A coordinated, multi-level approach is therefore needed to reduce adolescent substance use effectively.

Keywords: Socio-ecological model, adolescent health, tobacco and alcohol use, China, education-centred prevention

1. Introduction

Tobacco and alcohol use during adolescence is a major public health concern because early initiation increases the risk of long-term dependence and later disease burdens [1]. In China, adolescent substance use should not be understood only as an individual behavioural problem. It is also shaped by social relationships, school environments, family practices, and broader cultural norms. Therefore, a socio-ecological perspective is useful for explaining how different levels of influence interact [2]. Existing evidence shows that tobacco use among Chinese adolescents has clear group and environmental differences. China CDC reporting based on the 2019 China Youth Tobacco Survey indicates that smoking is not evenly distributed across students, with substantially higher prevalence among vocational senior high school students than among junior high school students [3]. Repeated cross-sectional evidence further shows that cigarette use varies across time and location, suggesting that the places where adolescents smoke are part of the risk environment [4].

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Updated national reporting also indicates continued cigarette use and second-hand smoke exposure among secondary school students in China, showing that tobacco-related risk is not limited to adolescents' own smoking behaviour [5].

Alcohol use among Chinese adolescents also has strong family and social-contextual features. National survey evidence suggests that adolescent drinking is prevalent and often occurs in socially embedded settings, including family gatherings and private homes [6]. In these contexts, alcohol may be treated as part of hospitality, celebration, or relationship maintenance, which can reduce perceived risk and make prevention more difficult.

Based on this evidence, this paper applies the socio-ecological model to examine adolescent tobacco and alcohol use in China and proposes education-centred interventions supported by appropriate environmental constraints.

2. Literature review

2.1. Socio-ecological model (SEM) and health behaviour

The socio-ecological model argues that health behaviours are shaped by interacting layers of influence and that effective health promotion targets both individuals and the social environments that structure opportunity and meaning. In this view, adolescent tobacco and alcohol use cannot be reduced to personal willpower or information deficits, it is also conditioned by peer norms, family rituals, organisational responses in schools, and the availability and marketing of products in neighbourhood spaces [2].

SEM is not merely descriptive, it implies a design principle for intervention. If multiple levels contribute to risk, then single-level programmes (e.g., classroom lectures alone) will be diluted by contradictory cues in other levels (e.g., family acceptance, easy retail access) [2].Conversely, multi-level alignment can create reinforcing protection: accurate risk beliefs at the individual level are supported by peer norms, school policies, and visible enforcement [2]. This is especially relevant for China, where smoking and drinking may be socially interpreted as "normal adult behaviours", meaning that even well-designed classroom messages can be undermined by strong informal norms in homes, shops, and media [6, 7].

2.2. Adolescent developmental vulnerability and risk taking

Adolescence is characterised by heightened sensitivity to reward and social evaluation, while cognitive control systems continue to mature. Steinberg's synthesis emphasises that this developmental configuration can increase vulnerability to risk-taking, especially under conditions of peer presence and immediate reward. This matters for tobacco and alcohol because both offer rapid psychoactive feedback, and their use may also provide perceived immediate social benefits, such as belonging, status, or stress relief, that outweigh distant health costs in adolescents' decision calculus [8].

From a prevention standpoint, developmental science suggests that information about long-term harms alone is rarely sufficient [8]. Adolescents may understand that smoking is harmful yet still experiment because the perceived probability of immediate negative outcomes is low, while the perceived benefits of experimentation may be more immediate [8]. Therefore, interventions that rely only on moralising slogans or fear appeals risk being dismissed as irrelevant or exaggerated. A stronger approach combines (a) developmentally appropriate explanations of why impulses feel

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stronger in adolescence, (b) practical self-regulation and refusal skills, and (c) environmental "friction" that makes impulsive access more difficult [8-10].

2.3. Addiction as a health condition and implications for education

Modern addiction science conceptualises substance use disorder as involving neurobiological adaptations affecting reward, learning, stress responses, and executive control. Volkow, Koob, and McLellan review advances supporting the brain disease model of addiction and show why "just stop" messaging may be insufficient for individuals experiencing dependence, particularly when environmental cues and stressors remain present. For adolescent prevention, this does not mean treating all experimentation as disease, rather, it supports mechanism-based education that explains how dependence develops, why early initiation increases risk, and why relapse vulnerability can persist even after abstinence [1].

This scientific framing has two important educational implications. First, it directly challenges the "illusion of control" common in early experimentation ("I can quit any time") by explaining how repeated exposure can shift behaviour from initially voluntary use toward more cue-driven patterns. Second, it supports stigma reduction. If addiction is treated purely as moral weakness, adolescents may hide use, parents may respond with shame or punishment, and schools may prioritise discipline over early support. A health-oriented framework can preserve responsibility while making help-seeking psychologically safer, which is vital because early intervention is more feasible than late-stage treatment [1].

2.4. Empirical evidence on adolescent tobacco and alcohol in China

National youth tobacco surveillance indicates that experimental and current cigarette smoking exist at meaningful levels among secondary school students, with marked differences by school type, vocational schools show particularly high prevalence [3]. Updated China CDC reporting continues to document cigarette use and secondhand smoke exposure in secondary school populations, reinforcing that exposure remains an ongoing public health issue rather than a solved problem [5]. At a more local level, a school-based cross-sectional study in Zhejiang Province found that adolescent smoking was associated with personal characteristics and family and school factors, supporting the SEM claim that behaviours are socially patterned [1].

Beyond prevalence, environmental studies highlight that tobacco is often "present" in adolescents' daily geographies. Research in 10 cities found tobacco retailers around schools, implying repeated exposure to cues and increased opportunities for purchase [9]. Complementary evidence from the 2019 China Youth Tobacco Survey indicates that cigarette availability and affordability are high among youth smokers, with many underage smokers reporting recent purchases, suggesting that age-based restrictions are not fully effective in real-world retail practice [1]. Together, these studies motivate a key SEM insight: education is likely to be undermined when the surrounding environment continuously supplies cues, access, and social reinforcement [2, 9, 11].

For alcohol, a national survey reports that a large proportion of adolescents have consumed alcohol, with past-year and past-month use also present, importantly, drinking often occurs during family gatherings and within private homes [6]. Another study examining drinking patterns among adolescents in Chinese metropolitan contexts provides detail on how use varies with socio-demographic factors and drinking situations [12]. Evidence using instrumental-variable methods further suggests that peer drinking can causally influence adolescent drinking behaviour, underlining that alcohol use is partly a network phenomenon rather than purely an individual

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attribute [13]. School environment factors also show associations with adolescent drinking behaviour in multi-city research, further supporting the need for school-based interventions that are connected to wider family and community environments [14].

3. Theoretical framework: applying SEM to adolescent tobacco and alcohol use in China

This section clarifies how the SEM will be used: each level is analysed in terms of (a) the main mechanisms that may increase risk, (b) the best available evidence supporting those mechanisms, and (c) intervention levers that can realistically be implemented in China's school and community systems.

3.1. Individual level

At the individual level, SEM includes neurodevelopment, cognition, health literacy, emotional regulation, and coping strategies [2]. Developmental vulnerability suggests that adolescents may underestimate cumulative risk and overvalue immediate social rewards [8]. In addition, limited "addiction literacy" (understanding of dependence mechanisms) can sustain the illusion of control ("I can quit any time"), which is inconsistent with addiction neuroscience [1]. Individual-level prevention therefore must do more than provide warnings, it should teach how dependence develops, how to manage stress and cues, and when to seek help [1, 8].

In China, a further individual-level factor is the possibility that students experience strong academic stress and role expectations, when cigarettes and alcohol are framed as socially legitimate adult tools, adolescents may view experimentation as a means of coping, social participation, or demonstrating maturity [6]. The goal of education is therefore not simply to say "don't do it," but to provide a coherent explanation of why reward sensitivity and social influences can increase vulnerability during adolescence and how to navigate it without losing face or social belonging [1, 8].

3.2. Interpersonal level

Interpersonal influences include parental modelling, sibling behaviour, peer norms, and social networks [3]. In the Chinese context, alcohol use being common in family gatherings implies that parental behaviour can inadvertently legitimise early drinking [6]. Even when parents believe small exposure is harmless, repeated exposure can normalise the idea that alcohol is a routine part of celebration and bonding [6]. Parenting practices also matter because they shape monitoring, communication, and behavioural boundaries, evidence from China suggests that parenting can buffer risk and influence patterns of early alcohol experimentation [11].

Peer effects are significant as well. Instrumental-variable evidence from China provides evidence consistent with a causal influence of peer drinking behaviour, suggesting that changing peer norms can change behaviour rather than merely correlate with it [13]. For tobacco, family and school social environments are repeatedly implicated as correlates of youth smoking, aligning with the idea that modelling and perceived norms are central [15]. Thus, interpersonal interventions should combine parent guidance with peer-norm, communication, and refusal-skill components that are sensitive to adolescents' concerns about peer acceptance and social conformity [13, 16].

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3.3. Community/organisational level

Schools can be protective or permissive depending on climate, policy enforcement, and support capacity [14]. However, even a strong school climate is weakened when retail environments provide easy access. Evidence shows significant tobacco retailer presence around schools in multiple Chinese cities, suggesting that students may be repeatedly exposed to products and purchase opportunities during daily commuting [9]. Affordability and underage purchase patterns further support the claim that access barriers are not sufficiently high [11]. These findings imply that "availability control" should complement educational prevention, because adolescents may receive contradictory signals when society discourages youth smoking while products remain highly visible and accessible [9, 11].

E-cigarettes introduce an additional organisational challenge. A randomized clinical trial on e-cigarette sales to school-uniformed adolescents indicates high rates of successful purchase without age verification, pointing to a compliance gap that education alone cannot fix [10]. Organisational interventions should therefore combine school–community partnerships, retail compliance monitoring, and environmental controls around schools, including education about e-cigarette risks and marketing tactics [7, 9, 10].

3.4. Structural/policy/cultural-level causes

Cultural normalisation means that adolescents often encounter tobacco and alcohol as socially endorsed tools rather than dangerous drugs [6]. At the same time, addiction may be moralised, leading to stigma and concealment [1]. An addition-as-health-condition perspective can challenge purely moral interpretations of substance use, which may discourage early help-seeking and place excessive emphasis on personal failure [1]. A prevention strategy that ignores stigma risks pushing use underground, which is especially harmful for adolescents because secrecy reduces the chance of early support [1].

Media imagery can contribute to normalisation. Longitudinal evidence on movie smoking exposure supports a causal pathway from portrayals to youth behaviour change, suggesting that media content may contribute to earlier initiation and continued experimentation [7]. Structural prevention therefore includes both regulatory and cultural actions: strengthening compliance in retail systems, limiting youth exposure to promotional cues, and promoting public narratives that recognise addiction risk while supporting early help-seeking [7, 9, 10].

4. Education-centred intervention strategies

This paper treats education as the organising core because schools can reach most adolescents repeatedly and can integrate prevention into broader developmental support (mental health, life skills, peer relationships). However, consistent with SEM, the content and delivery of education must be aligned with interpersonal norms and environmental constraints, otherwise, it may become a "low-power signal" drowned out by daily cues and easy access. Education is therefore treated as a coordinating component rather than a standalone solution.

4.1. Mechanism-based "addiction literacy" curriculum

A core intervention is to redesign school health education from moral exhortation to mechanism-based instruction. Curriculum should teach (a) adolescent vulnerability to reward and peer influence,

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(b) how nicotine and alcohol can produce neuroadaptations, cravings, and impaired control, and (c) how environmental cues (peer contexts, retail exposure) can trigger use. This can correct the illusion of control and increase perceived susceptibility without relying on fear-only messaging.

To make addiction literacy usable rather than abstract, instruction should translate mechanisms into everyday decision tools. For example, students can learn to identify "high-risk situations" (after exams, celebrations, peer invitations, and boredom) and to plan coping and refusal strategies in advance [8]. They can also learn that craving is often cue-triggered and temporary, and that delaying tactics and leaving the setting can reduce a risk of acting on impulses [1]. These skills are particularly important in contexts where cigarettes and alcohol are framed as social tools, because refusal must preserve relationships and face [6, 8].

4.2. Mechanism-based "addiction literacy" curriculum

Education should explicitly separate the person from the condition, promoting help-seeking as responsible behaviour rather than moral failure [1]. A health-oriented understanding of addition can provide a basis for reducing moral judgement and encouraging engagement with counselling [1]. Schools should establish confidential counselling pathways, screening for early risk, and tiered supports (universal education, targeted group support, and individual counselling) [7]. The goal is to reduce the likelihood that experimentation develops into more habitual use while providing early support for students already at risk [1].

Because vocational senior high schools show higher tobacco burden in national data, resource allocation should be proportional to risk: more intensive screening, counselling availability, and targeted skills modules in higher-risk school types [3]. This should be done carefully to avoid labelling or stereotyping vocational students, the point is to match prevention intensity to observed environmental and social risks, consistent with an ecological approach [2, 3].

4.3. Peer-norm and refusal-skill interventions

Because peer effects can be causal for drinking, schools should implement peer-norm correction (e.g., showing that many students do not drink/smoke) and skills training for refusal in face-threatening contexts. Student leaders and peer educators can provide alternative forms of social participation and status, reducing the perceived social rewards of substance use. In practice, peer components should be integrated into normal class and dormitory life rather than confined to one-off campaigns, because norms are sustained through repeated micro-interactions [13].

For tobacco prevention, peer work can also address "misperceived norms" (overestimating how many peers smoke) and can support smoke-free identities as compatible with maturity and autonomy [8]. When combined with adult modelling (teachers adhering to smoke-free rules) and visible school policies, peer-norm interventions can reduce the gap between what students hear and what they see [9, 15].

4.4. Family engagement: parent education for home-based normalisation

Given that adolescent drinking frequently occurs in family gatherings and private homes, parent-focused education is essential [6]. Schools can offer parent workshops and materials that address: why early supervised drinking may still increase normalisation, how to model stress coping without substances, and how to communicate clear family rules [6]. Evidence on parenting and gender disparities in early alcohol experimentation suggests parenting practices can moderate risk [16].

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Family engagement should also address practical exposure reduction. Parents who smoke can reduce adolescents' modelling exposure by not smoking at home and by communicating explicit expectations that adolescent smoking is unacceptable. Even when parents cannot quit immediately, reducing home exposure and discussing addiction mechanisms can strengthen protective messaging. Because alcohol use is often socially embedded, parents may also need practical guidance on setting clear boundaries around adolescent drinking during family and social gatherings [6].

4.5. School–community enforcement partnerships to reduce access

Education gains credibility when students see consistent enforcement. Evidence of retailer density around schools, underage purchasing and affordability, and weak e-cigarette age verification implies that schools should partner with local health and market regulators for compliance monitoring, reporting of suspected underage sales, and enforcement of existing age restrictions [9-11]. Where feasible, local policy can also focus on reducing product visibility and access around schools, aligning the environment with educational messages [9].

A practical enforcement partnership can also include regular communication channels between schools and local regulators: reporting nearby retailers who sell to students, coordinating inspection windows after school hours, and providing retailer education on legal obligations [9, 10]. Because affordability and accessibility can facilitate impulse purchasing, strict age verification and restrictions on promotional displays can complement education by increasing barriers to youth access [11].

4.6. Media literacy to counter glamorisation

Given evidence linking movie smoking exposure to youth smoking trajectories, media literacy modules should help students deconstruct portrayals, recognise symbolic "coolness" narratives, and understand commercial incentives. This approach is realistic in a digital media environment where implicit promotion may be more influential than overt advertising [7].

Media literacy can be taught as a practical protective skill rather than as a moral lecture: students identify how films use smoking to signal rebellion, competence, or intimacy, and then practise reframing these cues as constructed media representations rather than evidence of real-life benefits [7]. This reframing supports self-control by reducing the affective pull of cues and can be paired with addiction literacy so students understand why cue exposure can trigger craving even without conscious intention [1].

5. Conclusion

Using the socio-ecological model, this paper argues that adolescent tobacco and alcohol use in China should be understood as the result of multiple interacting influences rather than simply as individual misconduct. At the individual level, adolescents' developmental vulnerability, reward-seeking, stress coping needs, and limited addiction literacy may increase experimentation and reduce awareness of dependence. At the interpersonal level, family practices and peer modelling shape what young people perceive as normal, acceptable, or socially rewarding. At the community and organisational level, school environments, retail availability, weak age-verification practices, and retailers near schools can increase access. At the structural level, cultural normalisation, stigma, and media portrayals further influence attitudes toward tobacco and alcohol.

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The evidence reviewed in this paper shows that adolescent smoking and drinking remain important public health concerns in China. Tobacco use is unevenly distributed, with vocational school students facing particularly high risk. Alcohol use also has clear family and social-contextual features, as drinking often occurs in private homes and family gatherings. These patterns suggest that prevention cannot rely only on moral warnings, punishment, or general health slogans. Such approaches may raise awareness, but they do not sufficiently change the social and environmental conditions that make tobacco and alcohol use accessible or acceptable.

Therefore, the strongest prevention strategy is coordinated, multi-level, and education-centred, but not education-only. Mechanism-based addiction literacy can help adolescents understand dependence, correct misconceptions, strengthen coping and refusal skills, and reduce stigma around help-seeking. Peer- and family-based interventions are also necessary because adolescent behaviour is strongly shaped by everyday relationships. At the same time, schools and communities should strengthen retail compliance, age verification, and environmental controls around school areas. Overall, aligning knowledge, norms, relationships, and environments offers the most realistic path to reducing initiation and preventing escalation among Chinese adolescents.

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