



Keep e-cigarette vaping away from juveniles: immediate interventions

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Immediate interventions are required to deal with the constantly mounting prevalence of e-cigarette use in teenagers, especially the influence of toy-shaped e-cigarettes <https://bit.ly/3IkMA0C>

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Tobacco use has been falling for decades in developed countries, yet smoking remains one of the leading causes of preventable death globally [1]. Importantly, electronic nicotine delivery systems (ENDS; also known as e-cigarettes) are gaining in prevalence (4.5% increase between 2018 and 2022 in the USA) [2], with contributions from vaping gadgets appealing to teenagers [3]. This is a massive problem at the global scale, and is echoed by similar trends revealed in Europe [4] and Asia [5].

Use of tobacco products by teenagers, including e-cigarettes, bears a lifelong impact. According to the US Centers for Disease Control and Prevention (CDC), over 16 million people in the USA suffer from debilitating illnesses caused by smoking. Tobacco consumption and e-cigarette use can lead to significantly increased risks for a diverse range of human diseases, such as cardiovascular, cerebrovascular, respiratory, metabolic and reproductive abnormalities. Moreover, for teenagers, exposure to nicotine products (combustible or non-combustible) correlates with a heavier tendency for acquired mental health complications (*e.g.* depression, anxiety) [6]. In fact, non-combustible varieties (*e.g.* e-cigarettes) exhibit a stronger correlation [6]. Thus, it is especially concerning that the e-cigarette is now the most prevalent form of initiation of tobacco consumption in teenagers [7]. According to the National Youth Tobacco Surveys (NYTS) conducted by CDC, 11.3% (2021), 14.1% (2022), 10.0% (2023) and 7.8% (2024) of high school students responded as active vapers [7]. A multinational sociology study showed that vaping is regarded as more socially acceptable than smoking among teenagers [8]. Moreover, with the Fagerström test for nicotine dependence (FTND) (the gold standard for dependence assessment), JANKOWSKI *et al.* [9] concluded that vaping is more addictive than smoking.

Changes in consumer perceptions of tobacco products can lead to drastic changes in usage pattern. As a case in point on the tobacco industry's nimbleness towards market dynamics, toy-shaped e-cigarettes quickly gained momentum among teenagers in 2022 [3, 10], a likely contributor to the surge in e-cigarette use in this group that was also boosted by social media campaigns (figure 1). Quickly recognising the harm of such youth-appealing gadget-shaped e-cigarettes, during 2023 and 2024, the US Food and Drug Administration informed schools of this new trend, issued warning letters to thousands of entities involved in the manufacture, distribution and retail of such products, and pursued civil money penalty complaints against some of those entities. Going one step further, the agency published a list of all authorised e-cigarette products, making it abundantly clear for the supply chain what is not permissible. The outcome is reflected in significantly less presence of youth-appealing products on the market, underscored by decreases in usage prevalence among high school students in 2023 and 2024 as shown by NYTS studies (*i.e.* from a peak of 14.1% in 2022 to 7.8% in 2024). Still, 7.8% of high school students in the 2024 NYTS would project as over 1 million e-cigarette users among teenagers in the USA.



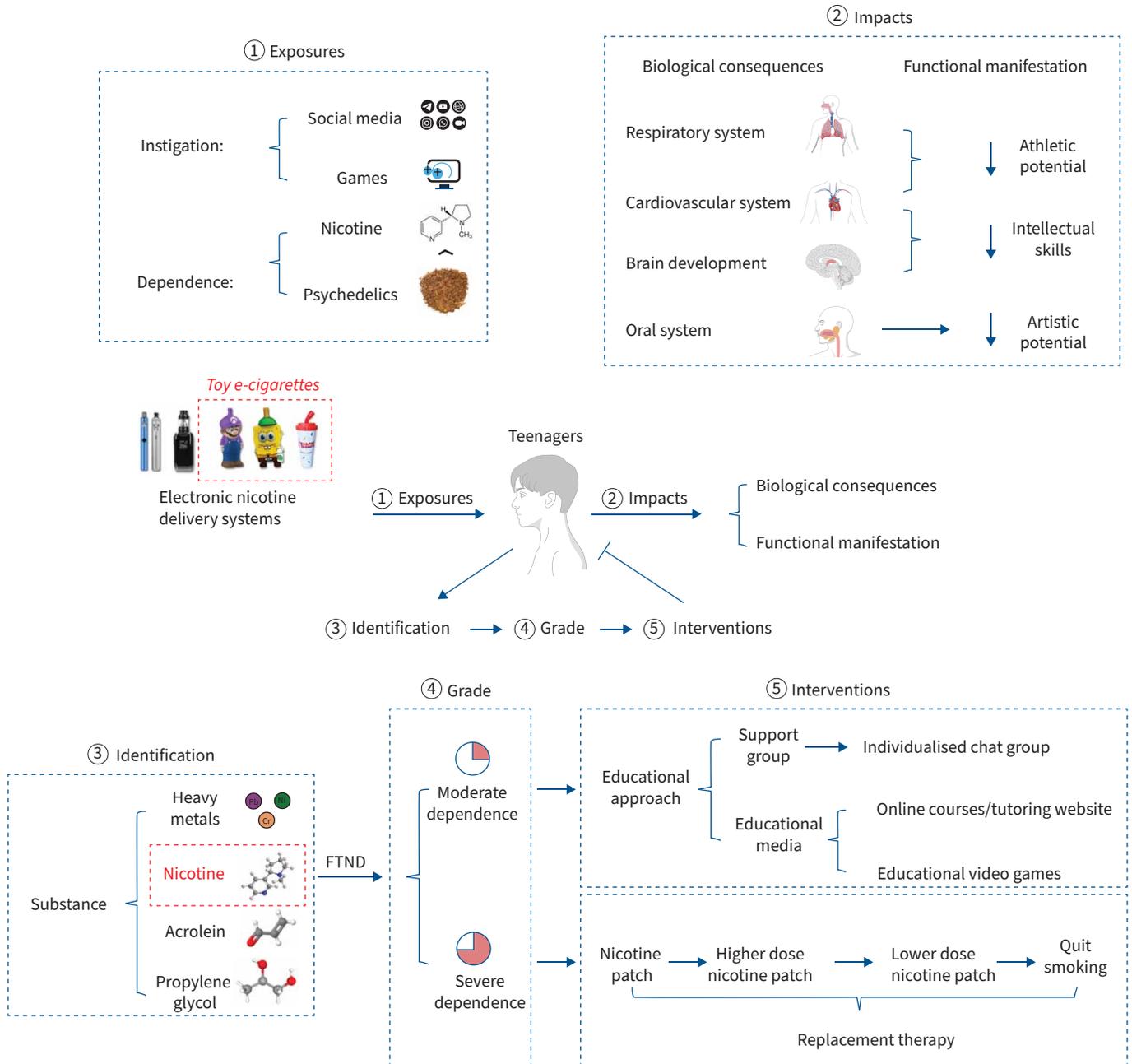


FIGURE 1 Impacts and mitigations of e-cigarette use in teenagers. The use of e-cigarettes in the teenagers has become a worsening pandemic. The prevalence has been aided by social media campaigns and other influences (e.g. video games), taking advantage of the curious yet rebellious temperament of teenagers. Chronic exposures can result in early nicotine adaptation and different levels of dependence that need strategic interventions. Consumption inflicts direct injuries on the respiratory, cardiovascular, oral and neurological systems, leading to multifaceted overt functional declines. Identification of characteristic products, and thus relevant toxic chemicals consumed, could instigate a specific plan to taper individual injuries from progressing. An effective management strategy can be developed given the specific level of dependence. The toolbox of intervention can be comprised of a panel of educational programmes and options for replacement therapies. A combinational approach can be formulated to tackle specific cases. FTND: Fagerström test for nicotine dependence.

Mitigating and halting e-cigarette consumption by teenagers is no easy task, especially in the era of social media. This age group and young adults can be more prone to be affected by their peers and marketers. Legislative efforts and federal actions are the backbone for any progress in protecting the young, but a fraction of the intended beneficiaries may view these as restraints on their individual preferences. Adoption

of a “working with” instead of a “working on” attitude towards activities to stop e-cigarette use in teenagers is likely to be more effective (figure 1).

Teenagers can benefit from media interventions that they frequently access. Traditional anti-smoking messages through TV, radio and roadside billboards are largely tailored to adults. Warnings on increased incidences of lung cancer or other terminal illnesses are not as compelling from the perspective of teenagers. Hence, messages can be articulated in verses that they can identify with and relate to (figure 1). An example of relatable messaging could be that a habit of using tobacco products might affect their physical appeal. For example, it may instigate negative impacts on their eventual height, skin tone and/or dental health [11]; its influence on the vocal cords will tamper their potential on artistic achievements [12]; or the impacts on the lung will cast a shadow on those with athletic ambitions. In some studies, nonsmoking students statistically scored higher on cognitive tests compared to their smoking counterparts [13]. Social media and online streaming sites popular among teenagers (e.g. YouTube, Instagram) are the top choices to deliver such messages. There are also opportunities for more targeted approaches if relevant stakeholders are willing to join forces. Online classes/tutoring have turned into a part of the daily routine for students since the COVID-19 pandemic; adding a voluntary e-cigarette quitting chat group to this routine should not be difficult to implement. eSports (i.e. electronic gaming) is another highly trafficked channel and up to 42% of video games featured scenes with some characters smoking [14]. These scenes generally imply smoking is “cool” or “chic”. Thus, games developed for teenagers should have such graphics removed.

Monitoring of tobacco consumption among underage teenagers is a necessary yet sensitive issue. The assistance of parents or guardians is often needed. Vaping products on the market are quite diverse, and mislabelling of formulations does happen [15]. Testing can identify exposure to tobacco products by measuring metabolites. Cigarette-specific (e.g. 4-methylnitrosamino)-4-(3-pyridyl)-1-butanol), e-cigarette-specific (e.g. 1,2-propylene glycol), cannabis infusion (e.g. delta-9-tetrahydrocannabinol), and e-cigarette or vaping use-associated lung injury (EVALI) risk factors (e.g. vitamin E acetate) can be readily quantified by mass spectrometers operated in clinical laboratories. Meanwhile, it can also provide data on unknown exposure to other psychedelic chemicals, such as cannabis, which are often co-used with traditional cigarettes or e-cigarettes [16]. Samples can be collected at home under consent by teenagers and/or their parents. Another key factor is insurance coverage for testing/ceasing measures, which can be explored by policy makers. Less vaping will save healthcare costs for treating respiratory complications as well as other pathological consequences, especially those compounded by viral infection, cannabis infusion (risk for EVALI) and environmental factors [17]. Thus, screening-enabled early intervention is highly beneficial for the wellbeing of the teenagers, while reducing related healthcare burdens.

Compared with adults, medical interventions to stop vaping in teenagers need to be handled with finesse (figure 1). However, we are not treading in uncharted waters [18]. Existing protocols used for smoking cessation in adults can be adapted and integrated [19]. Depending on the severity of dependence, a scaled response can be formulated. FTND score provides a yardstick for this purpose [20]. With a low level of dependence, *smokeSCREEN* [21] and *This is Quitting* [22] provide individualised support in the form of an educational video game or message chat group. For advanced dependence, nicotine patches have been shown to be effective among teens [18]. The engagement of parents and schools is necessary during replacement therapy to make sure students are on track and supported, while an accurate dosage is applied.

New generations of nicotine products have established deep roots among teenagers, precluding to a major rebound of tobacco consumption and consumption of other unexpected toxic substances, if not addressed efficiently and quickly. Interventions in this age group require a multipronged strategy that is sensitive to their distinct preferences and routines, which can also be leveraged for enforced efficacies. Done properly, they can be more approachable, effective and economical to address the uprising pandemic of vaping in teenagers.

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