World Health Organization

TECHNICAL NOTE ON

Call to action on electronic cigarettes

Why is there a need for a call to action?

WHO works with numerous independent experts, and is continuously reviewing the latest empirical scientific evidence, on electronic cigarettes through its technical advisory groups on product regulation. As part of this, the WHO Study Group on Tobacco Regulation (TobReg) has published a number of reports which contain evidence-based recommendations on electronic nicotine delivery systems and electronic non-nicotine delivery systems (ENDS and ENNDS), colloquially referred to as e-cigarettes. Policy options guided by evidence have also been articulated in the reports and decisions of the Conference of the Parties to the WHO Framework Convention on Tobacco Control (WHO FCTC). Although there are still several unknowns, including the precise quantification of risk of these products, the uptake of these products by children and adolescents, and other non-smokers has increased rapidly in many countries. Some of this uptake is potentially occurring as an attempt to stop smoking, but the evidence does not support the conclusion that e-cigarettes as actually used as consumer (non-therapeutic) products under real world conditions, are effective for cessation at the population level. Urgent and strong action is thus necessary to reduce the risk of uptake, and the following factors underpin the call to action.

The global market for electronic cigarettes is growing rapidly. Since 2018, there has been a large increase in the global e-cigarette market size, from 7,806 million USD in 2015 to 22,349 million USD in 2022 *(1)*. In the last five years, between 2018 and 2022, there has been a market increase of 116% for disposable e-cigarettes *(2)*, with over 550,000 different products,[1] and accounting for 22% of the total global e-cigarette market *(2)*.

Electronic cigarettes come in thousands of flavours, which are particularly attractive to children and young people. E-cigarettes offer, by far, the largest number of flavours of all nicotine and tobacco products *(3)*. There were approximately 16,000 unique flavours identified for e-cigarettes in 2017, more than double those in 2014 *(4)*. Many of the flavours appeal to young people and some mask the harshness of nicotine *(5)*. E-cigarette flavours are classified in various categories, including tobacco, menthol, fruit, dessert, alcohol, nut, spices, confectionery, coffee/tea, beverages and sweet-like flavours *(5)*. Flavours play a key role in product use initiation, as they are often cited as the one of the reasons for youth trying e-cigarettes (as with other nicotine and tobacco products), serving as a path from experimentation to regular use, and perpetuating the global tobacco epidemic *(6–10)*.

Children and young people are aggressively targeted in marketing of electronic cigarettes. Marketing of e-cigarettes usually relies heavily on social media and influencers, rapidly expanding their reach *(3,11)*. Studies illustrate the impact on adolescents; one study showed that daily use of one social media platform among middle school students was associated with a 3.8% increase in risk of current e-cigarette usage and an associated 6.1% increase among high school students *(12)*. Another found that each additional hour per day spent on the platform among first-year university students was associated with a 4.6% increase in the probability of lifetime e-cigarette use *(13)*. Even brief exposure to e-cigarette content on social media was associated with greater intention to use these products, as well as more positive attitudes toward e-cigarettes *(14)*. These products are portrayed as cool, with attractive colours and appealing names. For example, one major brand advertises "big vapour clouds" and contains a patent that provides for connectivity to a smartphone that would allow the user to control the size of the cloud *(15)*. Once the information is on a smartphone, it could become accessible and potentially be transmitted to the producer for marketing purposes. Many e-cigarettes are also designed to allow discreet use, marketed as such, and some can be integrated into hoodies, or resemble lipsticks and watches, so they can be hidden, especially from teachers and parents *(16)*. E-cigarettes are particularly marketed in ways that are inconsistent with public health goals, leading to marked increases in their use among adolescents in many countries that often exceed adult use *(5,17)*.

1 WHO-commissioned paper on disposable electronic cigarettes

There is an increased uptake of electronic cigarettes among young people. Young people in many countries are increasingly taking up the use of e-cigarettes and this trend has been reported to be of great public health concern by several countries *(9,10,18–20)*. The number of 16–19-year-olds who currently use e-cigarettes in Canada has doubled from 2017 to 2022 *(20)*, and in England (United Kingdom), the number has tripled in the past three years *(21)*. Across Canada, England (United Kingdom) and the United States, between 40% and 50% of those that use e-cigarettes reported use within 30 minutes of waking *(20)*. Further, 56- 64% of the 16-19-year-olds that reported using e-cigarettes across the three countries considered themselves to be addicted (either 'a little' or 'very') to e-cigarettes *(20)*. Evaluation of available information from the Global Tobacco Surveillance System reveals that current use of e-cigarettes by school-aged children 13–15-year-olds often exceeds those of the older age groups (≥ 15 years) *(22)*. For example, in the Philippines, Romania, Ukraine and Uruguay, comparisons within a similar time period shows a range of 0.2-3.4% of adults currently using e-cigarettes, in comparison to 8.2-18.4% in the young *(22)*. Additionally, in many countries and areas, such as Albania, Belarus, the Dominican Republic, Guam, Morocco, Niue, Oman, the Russian Federation and Ukraine, the current use of e-cigarettes among 13–15-year-olds is 2–3 times more prevalent than those currently smoking conventional cigarettes, and in Paraguay, it is four-fold *(22)*. Similarly, in England (United Kingdom), more children now "vape" than smoke *(23)*. In an additional cross-country analysis among 13–15-year-olds, which examined data from 75 countries globally, prevalence of current dual use (simultaneous use of e-cigarettes and conventional cigarettes) ranged from 0.1% in Cambodia to 10.0% in Italy and 13.6% in Poland *(24)*. Current dual use was fivefold higher among boys compared to girls *(24)*. Further, a study among 15–16-year-olds across 32 countries in Europe shows 6.4% overall current dual use *(25)*. Within a smaller subset, of six Nordic countries and jurisdictions, prevalence of current dual use ranged from 23% to 31% *(26)*. The co-use of cigarettes and e-cigarettes is the most common pattern of current dual use in the majority of these countries *(26)*. In all six countries studied, triple use (e-cigarettes plus conventional cigarettes plus snus) varies between 3% to 13% among current e-cigarette users *(26)*. Additionally, high quality epidemiology studies consistently demonstrate that e-cigarettes use increases conventional cigarette uptake, particularly among non-smoking youth, by nearly three times *(27)*.

Disposable electronic cigarettes, particularly popular among youth, have increased in size, contain much more nicotine than before and are increasingly cheaper and accessible. 'Disposable' (non-rechargeable and non-refillable) e-cigarettes sold in the USA have nearly tripled in nicotine strength (dubbed as the "nicotine strength arms race"), quintupled in e-liquid capacity, and dropped in price by nearly 70% between 2017 and 2022 *(28)*. The current generation of disposable e-cigarettes in the USA contain nicotine levels comparable to several cartons of cigarettes *(28,29)*. In contrast to 2017, in which nearly no disposable e-cigarettes contained among the highest levels of nicotine (at least 5% nicotine strength), by 2022, more than 95% of disposable e-cigarettes sold in the USA did *(28)*. Additionally, with the plummeting of prices the purchasing power for price sensitive youth has nearly tripled in the USA *(28)*. A review of global sales data between 2019 and 2022 in the major markets similarly show increases in tank capacity, particularly within non-EU markets, as well as price decreases, by 30–50% *(2)*.

Electronic cigarettes are harmful. E-cigarettes heat a liquid to create aerosols that are inhaled by the user *(30)*. E-liquids may or may not contain nicotine and other additives, flavours and chemicals – many of which are toxic to people's health *(30)*. E-cigarettes generate substances some of which are known to cause cancer and, on their own, they are associated with increased risk of lung disorders, poisoning, injuries and burns and immediate nicotine toxicity through inhalation *(5,27)*. E-cigarettes can have negative effects on cardiovascular health, including increased heart rate and blood pressure. Exposure to emissions from e-cigarettes also poses risks to bystanders *(5)*. All e-cigarettes emit toxic chemicals, often including nicotine, the highly addictive substance in tobacco that can adversely affect the development of the fetus in a pregnant woman and can affect the development of children's and adolescents' brain *(5,27)*. These age groups are highly susceptible to nicotine addiction *(31)*. Additional concerns arise regarding customizable electronic cigarettes that allow the user to increase nicotine uptake, as well as newer disposable and pod systems that have higher nicotine delivery *(27)*.

Dual use, which is common, is at least as dangerous and likely more dangerous than smoking conventional cigarettes or using e-cigarettes alone *(32)*.

Electronic cigarettes as actually used in the population as consumer products have not been proven to be effective for cessation at the population level and may lead to ongoing nicotine dependence. One of the reasons given for use of e-cigarettes is to quit smoking *(33,34)*. Despite being promoted for this purpose, e-cigarettes as used in the real-world, have not been proven to be effective for smoking cessation at the population level *(35,36)*. While there is some evidence from randomized controlled trials that nicotine containing e-cigarettes, as medical interventions in clinical settings and when used daily, can assist in stopping smoking cigarettes *(37)*, a meta-analysis examining nicotine abstinence found that randomization to e-cigarettes was associated with significantly lower odds of being nicotine free than nicotine replacement therapy *(38)* and others reported high continuing use of e-cigarettes among people who had stopped cigarettes *(39,40)*, suggesting that e-cigarettes may lead to ongoing dependence on nicotine. The lack of evidence on the safety of e-cigarettes for major health outcomes combined with the risk of ongoing dependence limits any conclusions regarding the overall balance of benefits and harms of using e-cigarettes to quit smoking, as compared with other approaches. For a product to be appropriate for cessation, it must demonstrate both efficacy and safety.

Currently, the evidence does not support a generalizable conclusion that commercialization of e-cigarettes as consumer products will improve population health by supporting tobacco use cessation. Use of e-cigarettes as consumer products has not proven effective for cessation at the population level, as actually used in the real world (*5,27,41,42*). Given the risk of uptake, it is not recommended that governments permit sale of e-cigarettes as consumer products in pursuit of a cessation objective. Recognizing that there is emerging evidence of some e-cigarettes potentially playing a role in supporting cessation under controlled medical conditions, it is recommended that any cessation objective governments may have utilizing e-cigarettes, be pursued by regulating e-cigarettes as medicines - with a comprehensive tobacco control strategy. This means subjecting specific products to marketing authorization procedures for medicines under national law requiring evidence of their efficacy and safety, with authorities attaching any necessary conditions to authorization, taking account of the risk of uptake, and whether products should be available on a prescription-only or over the counter basis.

There is a wide diversity of electronic cigarettes, many of which allow the user to customise the products, including increasing nicotine uptake, and/or the level of toxicants. E-cigarettes vary greatly and are evolving rapidly, even within the broad categories of open systems (refillable tanks and customizable), and closed systems (pre-filled cartridges or pods and disposables that are not meant to be modified) *(5)*. The extent of the delivery of nicotine depends both on the concentration of nicotine in the e-liquid itself and a variety of factors of which the user of an open-system system or manufacturer of a closed system could manipulate *(5)*. Devices can be manipulated to produce a satisfactory experience in terms of the speedy delivery of sufficient nicotine to mimic the sensory feel of smoking *(43)*. By controlling the desired delivery of nicotine, the user of an open system can also often unknowingly negatively influence the extent to which e-cigarettes emit non-nicotine toxicants *(3)*, as well as emissions to which bystanders are exposed *(5)*. The levels of toxicants can vary enormously across and within brands and sometimes reach higher levels than in tobacco smoke *(44,45)*.

- **Device characteristics – battery power and customizable wattage.** The voltage of the battery and default power settings differ widely among models, and more advanced devices often allow the user to adjust the power settings *(5)*. The electrical power generated in the device can determine the amount of nicotine and toxicants to which the user is exposed. Increasing the device power increases nicotine yields, with one study finding that increasing the power output from 3 to 7.5 W increased the nicotine yield by four or five times *(3)*. However, increasing the power from 4.1 to 8.8 W approximately tripled volatile aldehyde emissions; increasing the power from 6 to 13 W increased emissions of the carcinogen benzene 100 times *(44)*. While earlier models were powered at about 10 W, some models have increased to more than 250 W, thereby increasing the risk of users' exposure to harmful and potentially harmful constituents *(5,44)*.

- **Liquid constituents – choice of e-liquid.** The nicotine content of e-liquids in pre-filled devices can contain very high levels of nicotine of > 60 mg/mL *(3,27)*, and "do-it-yourself" liquids can reach levels of nicotine of about 130 mg/mL *(3)*. In addition to nicotine, e-cigarette emissions contain other toxicants, which are either present in the liquid or are formed by thermal breakdown of the liquid's ingredients *(44)*. Flavours in e-cigarettes can increase the general toxicity of the aerosols *(3)*. Several flavourings have raised health concerns *(44)*. Fourth generation e-cigarettes (pods, pod mods and disposables) almost exclusively contain high concentration nicotine salt e-liquid, which makes the nicotine easier to inhale and increases delivered dosage, creating greater dependence potential than other products *(27)*. In addition, open systems allow the users to fill the tank of their device with the mixtures they want *(5)*. Users commonly mix and match flavours in refillable systems, and "do-it-yourself" is a common practice, sometimes with the addition of illicit substances *(3)*.

- **User behaviour – user's puffing style.** Increasing puffing intensity can generate more nicotine in the smoke *(7)*. By puffing more intensely, some users of e-liquids with low nicotine strength can also achieve the same amount of nicotine per puff as high nicotine liquid users *(3)*. More intensive puffing patterns can also expose users to higher amounts of toxicants, including an increase of the production of carbonyls, which have been correlated with pulmonary disease in smokers *(3)*.

Labelling is not always accurate. Much remains unknown about all the contents of the wide variance in e-liquids, as well as their emissions *(45)*. These products are not routinely tested by governments, mainly due to lack of capacity, and people are not aware of what they are ingesting *(46)*. Further, studies have found that labelling is not consistently a reliable indicator of nicotine content and mislabelling is a common issue *(47,48)*.

Commercial and other vested interests related to e-cigarettes harm public health. There is a "fundamental conflict of interest between the tobacco industry and public health" *(49)*. The tobacco industry and its front groups *(50)* have a long history of misleading the public about the risks associated with tobacco products, and now with new and emerging tobacco and nicotine products. This means that research and advocacy funded by tobacco companies and their front groups cannot be accepted at face value. The sixth session of the Conference of the Parties to the WHO Framework Convention on Tobacco Control (WHO FCTC) stressed the critical need to protect public health from the interests of "all commercial and other vested interests related to ENDS/ENNDS, including interests of the tobacco industry" *(51)*. In a review of 105 studies analysing the composition of liquids and emissions, 30% had authors that had received funding from ENDS/ENNDS interests – including the tobacco industry and related industries *(43)*.

Insufficient country level action. Very few countries have measures in place to protect children from e-cigarettes *(30)*. E-cigarettes also carry the additional risk of renormalizing smoking behaviour, particularly among younger populations. 88 countries, covering a population of 2.3 billion people, have no minimum age at which these products can be bought and 74 countries, with over 2 billion people, have no regulations in place addressing e-cigarettes *(30)*. These products are regulated in some way in 121 countries, including 34 countries that have banned their sale and 4 that ban all flavours *(30)*.

A comprehensive approach to tobacco control. Countries should implement a comprehensive approach to tobacco control, which includes raising tobacco excise taxes, bans on tobacco advertising, promotion and sponsorship, health warnings, smoke-free areas, and mass-media campaigns. This call to action is intended to prompt action in parallel with WHO FCTC implementation for Parties, which in addition to stipulating that Parties develop appropriate policies for preventing and reducing tobacco consumption, as well as exposure to tobacco smoke, requires Parties to adopt policies to prevent and reduce nicotine addiction. Therefore, the measures recommended above to strengthen action on e-cigarettes should form part of a comprehensive approach to tobacco control and should be implemented in line with national circumstances, including existing tobacco control measures. Accordingly, the approach that a government takes to regulation of e-cigarettes (such as whether to ban sale or permit commercialization as consumer products) should be considered in light of national circumstances.

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