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Review Article

E-cigarettes: promise or threat?

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ABSTRACT

Use of the electronic cigarette or electronic nicotine delivery system (ENDS) is increasing globally. Its vapour delivers nicotine without the 6000 odd chemicals released during cigarette smoking and the associated harm. Experts are divided on whether ENDS promise reduction in tobacco use or threaten tobacco control. This review presents up-to-date evidence. Two trials showed an increase in cessation, but not a reduction in cigarette use. Eight cohort studies showed no increase in cessation, and two cohort studies and a recent trial showed an increased reduction in cigarette use. A US population study showed association between ENDS use and smoking cessation. Nicotine addiction and potential harm to non-smokers who use ENDS are key concerns. Nicotine affects lung and brain development. An increase in accidental poisoning, though mild, is reported in children. No significant short term health effects are reported. When heated, ENDS may emit potential toxic and carcinogenic substances such as aldehydes, acrolein, flavouring agents etc. at very low levels - but their long term impact is not known. ENDS bring potential benefits to smokers, but there are concerns about their potential for nicotine addiction, gateway effect and renormalisation of smoking. However, in the UK and the US, a rise in ENDS use is associated with a fall in the prevalence of smoking. Countries differ in their approach to ENDS. India seems to be edging towards a total ban. India should collect local data and conduct research to monitor the impact and make informed, evidence based decisions, where needed.

Keywords: Electronic cigarette, ENDS, Tobacco, Cigarette smoking, Smoking cessation

INTRODUCTION

The biggest public health threat the world has ever faced is the tobacco epidemic. It kills more than 7 million people a year, of which approximately 1 million deaths occur in India.[1]

The last decade has seen the focus of the tobacco industry shifting from the Western world to developing countries such as India. India, with a population of more than a billion and growing affordability, is an attractive market. India passed the 'Cigarettes and Other Tobacco Products Act' (COTPA) in 2003 (which came into effect in May 2004) in order to control tobacco use. The Act prohibits smoking in public places, advertisement of cigarettes and other tobacco products, and sale to minors. In 2004, India also ratified the WHO Framework Convention on Tobacco Control (FCTC), which is the first ever international health treaty of any kind.[1]

India has been successful in bringing down the use of tobacco among adults from 34.6% (14% smokers) in 2009-10 to 28.6% (11% smokers) in 2016-17, despite

difficulties in enforcement of regulations and limited success in smoking cessation.[2,3]

An overview of the 'e-cigarette'

The electronic cigarette (e-cigarette) or Electronic Nicotine Delivery System (ENDS) is a handheld device that contains a pre-filled cartridge or a tank that is refillable with e-liquid or e-juice, a nicotine-containing solution. The solution is vaporised through a heating element or an atomiser supported by a battery on demand. The nicotine-containing vapour is then inhaled by the user in a manner that closely resembles the act of smoking a cigarette ("vaping"). As there is no burning of tobacco involved as with conventional cigarettes, smoke containing tar and over six thousand chemicals associated with cancer and other smoking-related illnesses is not produced. ENDS products are not a well-defined entity, but a collection of devices that undergo constant evolution. Newer generations with improved nicotine delivery and battery power are becoming available.

ENDS products, which first gained worldwide prominence around 2010, have seen significant growth globally. According to an estimate, there were 466 brands in 2014, and the value of global sales was US$ 3 billion. A growth in sales margins to $10 billion by 2017 and seventeen-fold growth by 2030 have been predicted. Recently, major tobacco companies have entered the ENDS market. Their aggressive purchase of independent e-cigarette companies has led to the prediction that they will share 75% of the profit pool in 10 years.[4]

The potential impact of ENDS on public health has become the subject of a dispute among global advocates of tobacco control. Whilst some welcome it as another tool to facilitate reduction of tobacco use, others are worried about its potential to undo the work done hitherto to de-normalise tobacco use, and the potential adverse impact it may have on tobacco control.

This review presents up-to-date evidence on whether ENDS is an effective tool to stop or reduce tobacco smoking, or can be a less harmful alternative.

DISCUSSION

Is ENDS an effective tool for smoking cessation or reduction?

ENDS, similar to nicotine replacement therapy (NRT), provide nicotine to overcome cravings and obtain relief from withdrawal symptoms. ENDS also deals with behavioural and sensory aspects of cigarette use, i.e. physical actions involved in smoking and the associated positive emotions, and is more popular.

Many surveys of ENDS users in different populations in the Western world report that most smokers use ENDS out of the desire to quit and reduce harm from smoking. Smokers and non-smokers also try ENDS out of curiosity. However, most trials of ENDS do not lead to regular use. It appears that trial for reasons such as stopping smoking or reducing harm is more likely to lead to regular use than trial out of curiosity. Stopping the use of ENDS appears to be due to dissatisfaction with products and/or safety concerns.[5,6] It is important to note that findings of this survey may not be reflective of opinions of ENDS users in India.

The most recent systematic review and meta-analysis conducted by El Dib et al looked at three RCTs involving 1,007 participants in New Zealand, Italy and Belgium, and nine cohort studies with a total of 13,115 participants from the US and Europe.[7] The summary of findings is as follows:

1. Smoking cessation

Compiled data from two RCTs (2013) comparing ENDS with Electronic Non Nicotine Delivery Systems (ENNDS) in 481 participants showed improved smoking cessation with ENDS (RR 2.03, 95% CI 0.94 to 4.38; p=0.07; I^2=0%, risk difference [RD]=64/1000 over 6 to 12 months) (low certainty of evidence).[7]

Compiled data from eight cohort studies (2013 to 2015) comparing ENDS with no ENDS, without adjunctive interventions, did not show improved smoking cessation with ENDS (adjusted OR 0.74, 95% CI 0.55 to 1.00; p=0.051; I2=56%) (very low certainty of evidence).

One of the RCTs, Bullen et al (2013) compared ENDS with NRT in 657 participants in New Zealand, and followed them up for a period of 6 months. The study did not show a difference in smoking cessation with a very wide CI, suggesting that both ENDS and NRT have a low but similar efficacy (RR=1.10, 95% CI=0.60 to 2.03, p=0.76).

El Dib et al reported that the available evidence is of low or very low certainty, and decided that they could not apply it to reach conclusions. Well designed, larger trials using newer models of ENDS and measuring biochemically validated outcomes are advised.

It is claimed that the controlled environment of RCTs may not be the ideal method to assess the effectiveness of ENDS in the real world, where use is more subject to forces such as price, availability, social norms governing its use, freedom of choice and personal preference etc. Observational studies and natural history studies are considered more useful.[8]

In 2014, a cross sectional study was conducted in England following 5,863 smokers who attempted to quit in the last 12 months without professional support.[9] The authors reported that those who used ENDS fared better compared to those who used over the counter NRT (adjusted OR=1.63, 95% CI=1.17-2.27) or no cessation

aid (adjusted OR=1.61, 95% CI=1.19-2.18), controlling for factors related to quitting. Whilst a number of population studies have also found that ENDS users quit at higher rates, few others have found the opposite.[6,10]

A population study in the US recently examined whether a rise in ENDS use between 2010 and 2014 was associated with a rise in overall smoking cessation.[11] Of 161,054 respondents to the 2014-15 survey on tobacco use, 22,548 were current smokers and 2,136 recent quitters. Among them, 38.2% of current smokers and 49.3% of recent quitters had tried ENDS.

The study reported that ENDS users, compared to non-users, were more likely to attempt smoking cessation, 65.1% v 40.1% (d=25.1%, 95% CI: 23.2% to 26.9%), and were more likely to succeed with such attempts, 8.2% v 4.8% (d=3.4, 95% CI: 2.5% to 4.5%). The overall population cessation rate for 2014-15 was significantly higher than that for 2010-11, 5.6% v 4.5% (d=1.1%, CI: 0.6% to 1.5%), as well as those of the other survey years.

An ENDS product is yet to be approved as a medicinal product for smoking cessation by any governmental agency, although the UK's Medicines and Healthcare Products Regulatory Agency is in the process of reviewing some of these products.[4]

ENDS combined with behavioural support may be useful for smokers who have tried other methods of quitting without success.[4]

2. Smoking reduction (of 50% or greater)

Compiled data from two RCTs (2013) comparing ENDS with ENNDS in 481 participants showed no difference in reduction in cigarette use but with a very wide CI (RR 0.97, 95% CI 0.57 to 1.66; p=0.92; I2=61%).[7]

However, two cohort studies suggested a positive correlation between smoking reduction and increasing ENDS use.

Brose (2015) followed 3,891 participants in the UK for a period of 12 months, and noted a higher probability of significant reduction (but not cessation) in those with daily use of ENDS (OR=2.49, 95% CI=1.14 to 5.45) but not those with intermittent use (OR=0.85 0.43 to 1.71).

Biener (2015) followed up 1,374 participants in the US for a period of 36 months, and noted an adjusted OR for cessation of 6.07 (95% CI=1.11 to 33.2) in those with intensive use versus an OR of 0.31 (0.04, 2.80) in those with intermittent use.

A recent RCT (2016) conducted in the US among 99 regular smokers reported a significant reduction in smoking cigarettes in the intervention group that received 3 weeks of 4.5% nicotine ENDS against placebo ENDS.[12]

Those who do not quit following ENDS use may subsequently use both ENDS and cigarettes, though the latter is more likely to be in reduced numbers. Such dual use may reduce intensity of smoking and exposure to harm. However, one school of thought suggests that if dual use persists for an extended period, this may not improve survival on the basis that duration rather than intensity plays a greater role in influencing long term health outcomes.[4] Longitudinal studies are required to understand the proportion of ENDS users who quit, reduce or enter dual use.

Is ENDS a less harmful alternative to cigarettes?

Since ENDS does not involve burning of tobacco, it is clearly devoid of consequent toxic and carcinogenic chemicals, including tar and carbon monoxide, and the associated harm.

E-liquids contain nicotine, propylene glycol (solvent), glycerol (to retain moisture) and flavouring agents. Different e-liquids are available on the market with varying compositions – nicotine content, flavouring agents, other additives etc., and this complicates the assessment of their health impact.

Nicotine content in the emission or inhaled vapour depends on nicotine content of the e-liquid, characteristics of ENDS product (battery output, type of wicks, ventilation holes etc.), presence of propylene glycol in the e-liquid, duration and frequency of puff etc.

Whilst cigarette smoking delivers nicotine speedily via the lungs, ENDS deliver nicotine through the buccal mucosa and upper airways, similar to NRT and hence, is slower. Newer generation ENDS may provide a degree of lung absorption. This may enhance user satisfaction and facilitate switching from cigarette smoking to ENDS vaping.

Nicotine is not a carcinogenic agent, but it is a powerfully addictive substance.

It is found to exert adverse effects on lung and brain development. Its action on the developing brain can lead to increased risk of future substance abuse. It clearly carries health risks during childhood, adolescence and pregnancy, which is supported by evidence.[13] Nicotine can have some haemodynamic effects.[14]

Few studies on prolonged use of nicotine for several years have not shown any adverse effects.[15] Patients with a history of cardiovascular co-morbidities have been shown to tolerate nicotine well for a duration of up to 3 months.[16]

Propylene glycol has a minimal adverse effect profile, and is licensed by the US Food & Drug Administration (FDA) for use as a direct food additive to ice creams etc.

Exposure to propylene glycol mist may cause irritation of the eyes, as well as the upper respiratory tract.[17]

Clinically, ENDS have a more favourable short-term adverse effect profile than conventional cigarettes, with no serious adverse effects reported.[18] A systematic review of case reports documents a range of systemic, mechanical and nicotine-related adverse effects, though most are minor.[19] However, longer term adverse effects are currently unknown.

Poisoning and fire

If used as intended, ENDS products do not put vapers at risk of nicotine poisoning.

Despite widespread availability of nicotine in the form of tobacco, NRT and ENDS, fatalities are rare.[8] E-liquids contain nicotine up to a maximum of 36mg/ml in a 10ml bottle. Accidental ingestion of e-liquids, mostly by children under the age of 5, may result in acute nicotine poisoning. With the increase in the use of ENDS, there has been an increase in the frequency of calls to poison centres following accidental ingestion of e-liquids. In 2013-14, the National Poisons Information Service in the UK received 204 enquiries, of which those classed as of moderate and severe toxicity were 2 and 1 respectively, and the remainder were for symptoms such as nausea and vomiting, and irritation of the eye, mouth and throat.[20] The fatal dose is often claimed to be an ingestion of 30-60mg of nicotine, however this is strongly refuted by experts.[8]

Nicotine poisoning may follow exposure to the skin or eyes, and intentional poisoning has also been recorded.[20]

ENDS-related fires due to faulty batteries have recorded an increase in the literature.[21]

Aldehydes

Cigarette smoke contains toxic aldehydes such as acetaldehyde, formaldehyde and acrolein which contribute to the risk of cardiovascular disease and non-malignant pulmonary disease. It is reported that e-liquids, when heated, may give rise to different aldehydes - propylene glycol forms acetaldehyde and formaldehyde, whereas glycerin makes acrolein– in a quantity that is less than one fiftieth of that found in conventional cigarettes.[22]

Recently, a report claimed that ENDS released 10 times more formaldehyde than cigarettes, when the e-liquid was puffed using a machine and over-heated. Further studies confirmed that there was little to no formaldehyde production at normal settings, and formaldehyde was produced at reported higher levels only at the "dry puff" setting.[23] In practice, the aerosol produced at the "dry puff" setting is quickly identified owing to its unpleasantly bitter taste. The aversive nature of dry puffs prompts the user to avoid, and not inhale. Studies have also shown that acrolein levels in ENDS users, smokers who converted to ENDS use and smokers who entered dual use were much lower than in cigarette users.[24,25]

Toxins and carcinogens

Analysis of vapour and urine from ENDS user shows lower concentrations of hazardous toxins and carcinogens compared to cigarette users.[24,26]

Comparing the presence and level of known harmful substances in ENDS and cigarettes, it has been estimated that ENDS are 95% less harmful.[27] However, it has been shown that toxin levels vary widely between different ENDS products.

Low levels of potentially hazardous metals (i.e. chromium, lead or nickel), possibly arising from heating elements have been noted in a proportion of ENDS products.[28]

The flavouring of e-liquids with tobacco, derived from tobacco may contain other tobacco contaminants.[29] One product was found to have a low level of diethylene glycol, a potential by-product of non-pharmaceutical grade propylene glycol.[30] Regulation is needed to eliminate contaminants from ENDS products.

Although nicotine itself is not a carcinogen, it may function as a "tumour promoter".[31] Propylene glycol when heated may produce propylene oxide, a class 2B carcinogen.[32] Tobacco-specific nitrosamines are highly carcinogenic, but the low levels found in most ENDS products are unlikely to pose a substantial risk.[33]

Certain ENDS emissions can impact the viability of established cultured cell lines, however, to a lesser degree than cigarette smoke.[34,35] The emission usually contains some carcinogens and other toxins found in tobacco smoke at average levels of 1–2 times lower than in tobacco smoke, but higher than in a nicotine inhaler.[36] Flavourings are more likely than nicotine to cause cytotoxicity.[37] Any proof of carcinogenicity, if present, will be only available after years or even decades due to a long time lag in the pathogenesis of cancer.

Particles

Most particulate matter in ENDS, though at lower levels, is in the fine and ultrafine range. The nanoparticles in aerosols may contain traces of tin, nickel and chromium. The particles can penetrate deeply into the lungs and potentially enter the blood circulation. Whether the type of particles produced by ENDS will have the same toxicity as particles produced by cigarette smoking is currently unknown, but is important to ascertain.[38]

Passive smoking

Studies have found that the level of nicotine exhaled from ENDS is eight times less than than that from cigarette smoking. Side-stream smoke– smoke from the lighted end of the cigarette– accounts for around 85% of passive smoking, and there is no such smoke from ENDS.[39]

Also, studies have found that nicotine in the air, and on the surface inside vapers' homes is 6 times and 169 times less, respectively, than smokers' homes.[40,41] Mean cotinine (product of nicotine) levels in saliva and urine of partners of vapers were found to be 1,000 times less compared to partners of smokers.[40]

The ambient level of nicotine and fine particulate matter ('PM 2.5') following ENDS use was around 10% and 18% of that seen following cigarettes, respectively.[42] Schripp et al showed that formaldehyde, acrolein etc. emitted in the air following ENDS use is 5 to 40 times lower than that emitted following cigarette use.[43]

However, one study reported a similar serum cotinine following second hand exposure to ENDS use and cigarette use (2.6 versus 2.4 ng/ml).[44]

Cannabis use

It appears that the emergence of ENDS has given cannabis smokers a new method of inhaling deodorised cannabinoids whilst avoiding detection. It is concerning that ENDS could provide an alternative gateway to cannabis use for young people. Regulation to prevent product alteration is needed.[45]

Not merely a 'water vapour'

Some of the shortcomings of ENDS can be overcome, if design and manufacturing, testing and labelling of ENDS, is regulated:

- Improve design and quality of components (heating mechanism, battery etc.)
  - To make the product child safe.
  - To hinder product modification to use other drugs.
  - To mitigate production of toxic vapours.
  - To avoid fire.
- Regularly monitor levels of nicotine and other toxins in vapours.
- List all ingredients in the solution.
- Clear, consistent standards to ensure nicotine delivery is within normal limits.
- Improve accuracy of labelling of nicotine content.
- Add health warning.
- Ensure that governmental validation is a prerequisite to engaging in manufacturing and trade.

Risk to human health is dependent on two factors - presence of a hazard such as toxic or carcinogenic material, and the exposure in terms of intensity and duration. Presence of toxic and carcinogenic materials in very low quantities in ENDS vapour is expected to pose a risk that is much lower than that associated with cigarette smoke.

For smokers, ENDS use is less harmful in the short term. Long-term health effects of ENDS use are unknown, but it is likely to be less harmful compared with cigarette smoking.

For non-smokers, ENDS use is not risk free and poses a threat to foetuses and adolescents. The short-term adverse effects do not seem to be significant, even with prolonged use. The long-term health effects of prolonged nicotine use, and exposure to potential chemical emission – though in very low quantities – is not known.

Recent scares in the media erroneously associating ENDS with cancer have affected the public perception of ENDS. In the US, the proportion of people who believe that ENDS is safer than cigarette smoking has fallen from 82% in 2010 to 51% in 2014. Such misperceptions may reduce the number of smokers who switch to ENDS with a view to quit. It may also prevent health professionals from providing unbiased, scientific advice to smokers who would like to quit or reduce but do not like NRT.[46]

Do ENDS aid or affect tobacco control?

ENDS bring potential benefits to smokers, but there is a general concern about their use and acceptance due to potential for:

- Initiation of nicotine use among non-smokers, particularly youth
- Addiction to nicotine, and conversion to cigarette smoking (gateway effect)
- Renormalisation of smoking behaviour
- Re-initiation of smoking among ex-smokers
- Sustenance of dual use among smokers
- Erosion of gains made in tobacco control

However, data from the UK and the US is encouraging.[47,48] In England, ENDS use has risen from 0.5% in 2011 to 5.5% in 2015.[49] Whilst ENDS use amongst adult smokers and young smokers (11 to 18 years old) are 17.6% and 19.1%, respectively, ENDS use amongst adult non-smokers and young non-smokers are only less than 0.2% and 0.3%, respectively. Amongst ENDS users, 60% are smokers and 40% are ex-smokers, whilst the proportion of non-smokers is negligible.[48]

In 2015, the proportion of youth who had ever tried ENDS was 12.7%, compared to 21% who had ever tried cigarettes. Similarly, the proportion of youth who used ENDS regularly was 0.5%, compared to 4% who smoked cigarettes regularly.[50]

The prevalence of smoking in England has declined from 19.6% in 2010 to 15.5% in 2016.[51]

Up to now, in the UK, it is estimated that 800,000 smokers have switched to vaping and another 650,000 smokers who vaped have stopped both.[52]

The significant point is that whilst awareness, experimentation and use of ENDS has risen; prevalence of smoking, cigarette consumption, as well as overall nicotine use have continued to decrease.[48,51]

A similar trend- rise in use of ENDS, and fall in cigarette smoking– has also been reported in the US and France.[47,53] In the US, from 2013 to 2014 ENDS use increased from 4.5% to 13.4% and from 1.1% to 3.9% among High School and Middle School students, respectively. During the same period, cigarette smoking declined from 15.8% to 9.2% and 4.7% to 2.5% among High School and Middle School students, respectively.[47]

The rise in ENDS use, and fall in cigarette smoking may be causally related, but this is difficult to prove. Currently, significant initiation of nicotine use among non-smokers, particularly youth, has not happened.

According to the WHO, the likelihood and significance of gateway and renormalization effects happening in a country is a result of complex interplay of individual, market and regulatory factors. (4) It is difficult to comment on the effect ENDS use has had on India. India should start collecting empirical data regarding ENDS use, and plan a strategy based on evidence.

Regulation of ENDS

Globally, countries vary in their approach to dealing with the rising trend in ENDS use – which ranges from a complete ban on the sale of any ENDS to applying existing laws (tobacco, medicine/nicotine, poison) to ENDS to allowing ENDS to be sold under general consumer product regulations.[4]

We will discuss the first two options, since the last option is unacceptable on the basis that ENDS is not risk free.

1. Complete ban

The countries which are risk averse take a precautionary approach to e-cigarette regulation. A complete ban is implemented as a means to protect the public from exposure to harm, when scientific investigation has found a plausible risk. The primary objective is to protect non-smokers from taking up ENDS and suffer the potential risk. The unintended consequence is the denial of a relatively safer option to smokers. Unfortunately, evidence on long term adverse effect of ENDS or the lack of it will take years to emerge.

Globally, 13 countries including Australia and Canada have banned the sale of ENDS. In India, states such as Punjab, Maharashtra, Karnataka and Kerala have chosen to ban the production, sale and advertisement of ENDS, and it appears that the central government is also edging towards a ban. Anecdotally, experts in India believe that communicating risk to the populace is difficult, and that the local tobacco industry is aggressive in marketing their products, particularly targeting youth and women. In India, denial of a potentially beneficial alternative to smokers, who number more than 100 million and are at risk of serious tobacco related illness and death is the key disadvantage.[4]

According to the WHO, most of the other 13 countries that have instituted a ban have reported that ENDS products are still widely available, probably through illicit trade and cross-border Internet sales.[4] ENDS products are banned in Malaysia and that is where the highest use of ENDS in the world has been reported.[54] Canada has already stated that their ban on ENDS has not been successful in preventing its use, and is reviewing its strategy.[55] The profile of ENDS users includes current smokers, young adults, those with a higher education and/or high income etc.[8] It is difficult to make a ban work against a product popular in such a group.

A key risk of a precautionary approach is that it might reduce the appeal and effectiveness of ENDS, and thereby, unwittingly, sustain, rather than reduce, smoking.

'Nicotine without smoke' – a report published by the Royal college of physicians states the following:

"A risk-averse, precautionary approach to e-cigarette regulation can be proposed as a means of minimising the risk of avoidable harm, e.g. exposure to toxins in e-cigarette vapour, renormalisation, gateway progression to smoking, or other real or potential risks. However, if this approach also makes e-cigarettes less easily accessible, less palatable or acceptable, more expensive, less consumer friendly or pharmacologically less effective, or inhibits innovation and development of new and improved products, then it causes harm by perpetuating smoking. Getting this balance right is difficult."[56]

2. Proportionate regulation under existing law

Countries such as the UK and the US have chosen to regulate proportionally, applying existing laws (tobacco) to ENDS. Availability of local data and evidence allow them to make informed, evidence based decisions and monitor the impact. Currently, ENDS is seen as a key smoking cessation/ reduction tool. The new smoking in non-smokers, which the data says is negligible, is considered to be a minor collateral damage for a greater public health benefit – improved survival and health among thousands of smokers who successfully quit. However, the strategy may be modified suitably if the

decline in tobacco smoking halts, uptake of ENDS among non-smokers increase significantly, or a serious adverse effect of ENDS comes to light.

Here, we elaborate on two key aspects of proportionate regulation:

ENDS as a tobacco product

ENDS do not contain tobacco, but they contain nicotine derived from tobacco. The Indian central government should immediately amend the definition of the term 'tobacco product' in order to include ENDS- "any product made or derived from tobacco that is intended for human consumption"– so that they may be brought under existing tobacco product legislations.[57]

This would immediately prohibit the sale and marketing of ENDS to youth, comprehensively prohibit their advertising, promotion and sponsorship, and prohibit their use in public places and indoor spaces.

Globally, over thirty countries– that are signatories to the FCTC– have implemented these measures.[4]

ENDS, though defined as tobacco products, still can and should be treated differently within tax legislation and regulation. The rate of taxation should be high enough to discourage youth use, but not so high that a barrier to switching from cigarette to ENDS use develops. Cigarettes should be subject to increased taxation to maintain the price differential in order to encourage smoking cessation and reduction. Since youth and ENDS users are more sensitive to price alterations, this would aid prevention of a potential gateway effect and re-normalisation.[58,59]

Banning access to youth

Youth consider ENDS as readily accessible, convenient to use, "high-tech" devices. Though surveys have shown that only a small proportion of young non-smokers use ENDS on a regular basis, a few recent studies have suggested an association between ENDS use and openness to cigarette smoking.[60] Though its extent and significance are not clear, the history of the tobacco industry, their current interest in ENDS and their marketing that appears to be targeted at youth causes concern.

Current ENDS promotion conveys the message to youth that ENDS are fun, desirable, a lifestyle choice, a sign of independence and even social superiority over others. The advertisements appear to glamorise smoking by aligning it with celebrities, fashion and youthful activities. ENDS products are estimated to be available in 7,764 unique flavours. In particular, fruit, candy-like and alcohol-like flavours may entice youths to experiment with ENDS. Such measures appear to be geared towards drawing young, non-smokers towards ENDS use.[4]

Exposure to ENDS, and thereby nicotine, carries health risks for adolescents and women of reproductive age.[13]

The ban on the sale and marketing of ENDS to youth is one area where all experts agree.

CONCLUSION

India, with the second highest prevalence of tobacco use worldwide, should consider the full implications of a complete ban and tread carefully. If this path is chosen, it is important that India collects empirical data and conducts research locally to monitor the impact and make informed, evidence based decisions, where needed.

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