Use of Electronic Nicotine Delivery Systems Among Adolescents: Status of the Evidence and Public Health Recommendations

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ABSTRACT

Although the prevalence of tobacco smoking has been declining in recent years, the use of electronic nicotine delivery systems (ENDS) such as of electronic cigarettes, vaporizers, and hookahs has been steadily rising, especially among adolescents. ENDS are not only advertised to children, but their sale via the Internet has made them easily accessible to youth. In general, children perceive ENDS as safe, or at least safer than smoking traditional combustible tobacco products; however, exposure to nicotine may have deleterious effects on the developing brain. Concern also persists that ENDS may be a "starter" drug that may lead to further tobacco, drug, and/or alcohol use. In contrast to this precautionary stance that is associated with calls for legislative oversight of ENDS marketing and sales, harm reductionists claim that the risks posed by ENDS are minor in comparison with those of combustible tobacco products and that ENDS may be used as a means of nicotine replacement for smoking cessation, despite no concrete evidence to support this assertion. Many medical and health-related organizations have produced position statements concerning ENDS use, including among adolescents. This article summarizes the advantages and disadvantages of using ENDS espoused in these position statements, especially as they relate to use among adolescents. [Pediatr Ann. 2017;46(2):e69-e77.]

In the United States, there are an estimated 40 million people (approximately 17% of the population) who smoke traditional cigarettes. Tobacco use is the leading preventable cause of mortality in developed countries, causing 1 in 5 deaths per year in the US. Health care costs associated with cancer, cardiovascular disease, and lung disease attributable to tobacco use totaled an estimated $170 billion per year in 2010. In recent years, the global incidence of cigarette smoking has been slowly but steadily declining, including among adolescents; however, use varies widely by country according to variability in tobacco regulation. This decline in tobacco use may be the result of aggressive public health campaigns to “de-glamorize” and “de-normalize” cigarette smoking through public education, legislation prohibiting tobacco product sales to minors, and restrictions on advertisements and use of tobacco products in public spaces.

USE OF ELECTRONIC NICOTINE DELIVERY SYSTEMS AMONG CHILDREN AND ADOLESCENTS

In contrast to this change in the pattern of combustible tobacco use among youth, the use of electronic nicotine delivery systems (ENDS) has been steadily rising, especially among adolescents in middle school and high school. The National Youth Tobacco Survey from 2011 to 2013 of students in grades 6 through 12 in the US found that more than 250,000 tobacco smoking-naïve students had used electronic cigarettes (e-cigarettes) in 2013, which is a 3-fold increase from students surveyed in 2011. This figure of “ever use” of e-cigarettes translates into approximately one-quarter of all middle and high
Adolescents who use ENDS in the US tend to be older, white, male, of lower socioeconomic status, and concurrent tobacco users. Additionally, people who identify as lesbian, gay, bisexual, and transgender report higher rates of ENDS use.

Consisting of e-cigarettes, hookahs, and vaporizers, the broad category of ENDS refers to battery-operated devices with heating elements that aerosolize nicotine-containing solutions that include solvents (glycerol, propylene glycol) and flavorings. These aerosolized solutions are then inhaled by the user. Since the invention of e-cigarettes by a Chinese pharmacist in 2003 and their introduction into the US market in 2007, ENDS use has become a multibillion dollar global industry. Currently available in more than 460 brands, ENDS are marketed via advertisements in television, movies, stores, and over the Internet, and they are sold over the Internet, in tobacco or vaporizer retailers, pharmacies, and grocery and convenience stores. Unlike combustible tobacco products, no regulatory oversight prohibiting such advertisements initially existed in the US. This scenario created a public health dilemma, particularly as it relates to use among adolescents and young adults.

In part, the rise in ENDS use by adolescents is associated with ease of obtaining ENDS and the perception that ENDS is healthier than traditional cigarette smoking. Regulators are growing increasingly concerned that ENDS advertisements glamorize the use of e-cigarettes and will lead to the renormalization of smoking after years of progress in antismoking public health campaigns. Particularly alarming is the targeting of advertisements to children and the child-friendly ENDS flavorings such as fruit, bubble gum, cinnamon, and piña colada. Such predatory advertising practices have been banned for traditional cigarettes since the Public Health Cigarette Smoking act was signed into law in 1970; however, no such federal legislation has been enacted to protect adolescents from ENDS advertising.

ENDS AWARENESS AND REGULATION OF ENDS USE

Studies estimate that approximately three-quarters of middle school and high school students in the US are aware of ENDS. According to the 2014 National Youth Tobacco Survey of middle school and high school students in the US, approximately 70% have been exposed to ENDS advertising including via stores, the Internet, television, movies, and newspapers and magazines. Advertisements for traditional tobacco products are a risk factor for youth to begin smoking, as shown in the Global Youth Tobacco Survey, a measure for monitoring international tobacco use control efforts. Moreover, ENDS advertising spending in the US rose from $6.4 million in 2011 to $115 million in 2014. At present, no ban on ENDS advertisements exists in the US, and at least eight states have no legislation limiting the sale of ENDS only to adults older than age 18 years.

As a result of a 2010 court ruling, federal oversight of ENDS is included under the auspices of the Family Smoking Prevention and Tobacco Control Act, which gives the US Food and Drug Administration (FDA) the power to regulate products that contain nicotine.

Recently, the FDA announced that it will exert regulatory control of ENDS as part of the Federal Food, Drug, and Cosmetic Act. Provisions of this rule include requiring ENDS products to be registered with the FDA and to undergo a premarket review and authorization of new products. Ingredients and health warnings will now be required to be placed on ENDS packaging and placed in advertisements. Additionally, sales will be restricted to people age 18 years and older with verification of age by photo identification. Distribution of free samples and the sale of ENDS products via vending machines in locations accessible to people under age 18 years will be prohibited.

EASE OF ENDS ACCESS AMONG YOUTH

Underscoring the need for this regulatory oversight, one study examining the ease of access to purchasing ENDS by youth in the US found approximately 77% of adolescent participants were able to obtain ENDS on the Internet. Particularly incriminating is that fewer than 7% of Internet ENDS vendors in the study attempted to confirm the age of the purchaser at either point of sale or on delivery. Supporting this trend, sales of ENDS in US retail chains increased from $237.6 million in 2012 to $636.2 million in 2013, representing a 320% increase in sales of disposable e-cigarettes. These findings underscore the awareness of, ease of access to, and growing use of ENDS among youth.

PERCEPTION OF ENDS SAFETY

Even more alarming are the perceptions by youth that e-cigarettes are safe or pose minimal health hazards. One longitudinal study found a 2-fold increased risk of having used ENDS on follow-up among participants who believed e-cigarettes to be less harmful than traditional combustible cigarettes. Another study of e-cigarette beliefs among high school students in North Carolina reported that 60% of participants surveyed reported that e-cigarettes were safe or have minimal health risks. Approximately 50% of adolescents surveyed in the Southern California Children’s Health Study in 2014 believed that e-cigarette use was not associated...
with health risks. These perceptions of the relative lack of hazards of ENDS use are inversely proportional to societal trends in use over time, such that higher rates of use of ENDS and marijuana among youth have been linked to the general perception that these products are natural, harmless, or even beneficial. The converse, that nonsmoking adolescents with negative perceptions of smoking were less willing to use ENDS, has also been reported.

SAFETY OF ENDS USE

The growing use of ENDS among adolescents and young adults raises questions regarding the safety of ENDS solutions, the impact of nicotine on the developing brain, and whether ENDS use serves as a gateway to further tobacco, drug, or alcohol use. Of particular concern is that the ENDS solvent, propylene glycol, breaks down into the carcinogens formaldehyde and acetone. At least one e-cigarette brand has been shown to release metallic particles, such as silicates, that have the potential of causing respiratory disease. Moreover, the cinnamon ENDS flavorings, cinnamaldehyde and 2-methoxycinnamaldehyde, and other flavorings have been found to be cytotoxic in in vitro assays. Animal models also suggest that ENDS vapor exposure stimulates oxidative stress and weakens pulmonary immune defenses against viral and bacterial infections. However, animal model and in vitro assays do indicate that the toxicity associated with ENDS aerosol exposure is far less than that associated with combustible tobacco cigarettes.

NICOTINE IN ENDS: ADDICTION RISK AND IMPACT ON THE DEVELOPING BRAIN

In addition to concerns regarding solvents and flavorings in ENDS, leaders in public health and public policy have become increasingly worried about the impact of nicotine exposure from ENDS use in youth, especially the development of nicotine addiction and other behavior changes. Behaviorally, adolescence and early adulthood are characterized by risk-taking and novelty-seeking behaviors, as well as strong emotions. These cognitive and behavioral aspects of youth are reflected in the neuroanatomical development of the emotion centers and reward mechanisms early in childhood, followed by continued development of the prefrontal cortex and brain white matter tracts throughout adolescence. The prefrontal cortex plays a key role in executive function, impulse control, decision-making, and attention. The combination of strong emotional and reward mechanisms with immaturity of inhibitory and decision-making pathways results in a potentially increased susceptibility of adolescents to developing addictions.

Adolescents who smoke are at a higher risk of developing addictions than people who did not smoke during adolescence. Furthermore, adolescents demonstrate increased sensitivity to nicotine, developing symptoms of dependence at lower levels of nicotine exposure than adults. In addition to nicotine addiction, exposure to nicotine during these formative years may lead to problems with attention and memory and with hyperactivity. A longitudinal twin-pair study found that smoking during adolescence was associated with a statistically significant increase in attention deficits in comparison with non-smoking twins, and these deficits persisted into adulthood. Rodent models also have demonstrated that nicotine exposure during adolescence showed long-term sensitization to the rewarding effects of nicotine and potentiated novelty-seeking and anxiety-like behaviors.

These behavioral changes are also reflected in the functional impact of nicotine on the developing brain. Nicotine primarily binds to nicotinic acetylcholinergic receptors, which play a critical role in attention, sensory processing, learning and working memory, and decision-making. Other neurochemical receptors activated by nicotine are important for reward, arousal, learning and memory, and mood with corresponding activation of dopaminergic, norepinephrine, glutamatergic, and serotonergic receptors, respectively. Additionally, nicotine activates gamma-aminobutyric acid receptors involved in inhibitory signaling; however, these pathways are incompletely developed in the adolescent brain.

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Neuroanatomical correlates of the behavioral changes that occur with cigarette smoking have been reported on anatomic and neurochemical levels. Cigarette smoking is associated with a smaller brain volume with ventricular and sulcal enlargement on brain magnetic resonance imaging studies, suggesting that there is neuronal loss with chronic smoking. White matter changes have also been reported in the corpus callosum, which is involved in communication between the left and right hemispheres of the brain. On a neurochemical level, nicotine acutely activates the nicotinic acetylcholinergic receptor; however, desensitization occurs with long-term nicotine exposure with corresponding modulation of nicotinic acetylcholinergic receptors in the midbrain, cerebral cortex, and hippocampus. Persistent changes in serotonergic signaling have also been reported with chronic nicotine exposure during adolescence, with corresponding depression-like states in rat models.

These functional neuroanatomical changes among adolescents who smoke are more likely to be secondary to nico-
tinic acetylcholinergic receptor stimulation as opposed to cerebrovascular disease secondary to smoking among adults. As most of this research has centered on combustible cigarette smoking, the long-term health consequences of ENDS use on adolescents as they age will not be known for some time.

Leading the concern fueling efforts to ban ENDS marketing and sales is the notion that use of ENDS among youth may serve as a “gateway” leading to use of combustible tobacco, alcohol, or illegal drugs. Support for this assertion comes from state-sponsored, national, and international studies reporting associations between ENDS use and consumption of traditional combustible cigarettes. Cross-sectional studies of middle and high school students in the US show that e-cigarette users report concurrent use of traditional combustible tobacco. Furthermore, up to 55% of adolescent e-cigarette users consume multiple tobacco products. A longitudinal study of non-tobacco smoking high school students in California comparing adolescents who use e-cigarettes to those who do not found a 4-fold increased likelihood of experimenting with traditional combustible tobacco cigarettes among e-cigarette smokers. Even more striking is an over 8-fold increased risk of progression to combustible cigarettes among adolescents who smoke e-cigarettes at baseline in the US. These results provide support for the assertion that ENDS use may lead to the initiation of other tobacco product use.

**POSITION STATEMENTS OF HEALTH AGENCIES REGARDING THE USE OF ELECTRONIC NICOTINE DELIVERY SYSTEMS**

With the growing popularity of ENDS, several prominent health agencies have released position statements with recommendations regarding the use of ENDS on both an individual level and a public health level (Table 1). Most of these agencies focus on potential for smoking cessations, safety, and regulation.

**Royal College of Physicians**

In April 2016, the Royal College of Physicians (RCP) published recommendations regarding the use of e-cigarettes. In contrast to most other recommendations to date, the RCP has positioned itself in support of e-cigarettes, but only as a therapy for those attempting to quit smoking. They state that e-cigarettes appear to be an effective tool for smoking cessation, and one that is more popular than existing methods such as nicotine replacement therapy.

According to the RCP, those who smoke are addicted to the nicotine contained in cigarettes, but the harmful effects of smoking are actually from the other ingredients in tobacco and not nicotine itself. For this reason, nicotine products are a safe method for smoking cessation because they do not contain the harmful constituents of cigarette smoke. They state that although nicotine replacement therapy along with physician support is the current gold standard for smoking cessation, nicotine replacement therapy is much less effective for those trying to quit without support. According to the RCP, e-cigarettes can act as nicotine replacement without the harmful tobacco smoke and with less need for support.

Furthermore, the RCP disagrees with the argument that use of e-cigarettes will only popularize smoking by acting as a gateway and giving the appearance that smoking is once again a societal “norm.” They state that there is no current evidence to support this concern and that the majority of those who currently use e-cigarettes are indeed trying to quit smoking. They do concede that the current production of e-cigarettes is not regulated or subject to any sort of standards, so e-cigarettes may be more hazardous than nicotine replacement therapy. Even so, they contend that the long-term harm potentially caused by use of e-cigarettes is likely to be far less than the harm from the continued use of tobacco. They pose that with further regulation and advancement in technology, e-cigarettes promise to be safe and effective tools for smoking cessation that should be promoted in the interest of public health.

**Centers for Disease Control and Prevention**

In 2015, the Centers for Disease Control and Prevention (CDC) released its own recommendations on e-cigarettes. In contrast to the RCP, the CDC has advised against the use of e-cigarettes, citing dangers to both the individual and public health. The CDC categorized the harms and benefits of e-cigarettes based on various populations—youth, non-pregnant smokers, pregnant adult smokers, and non-tobacco users.

The CDC advises against the use of any form of tobacco by children, including e-cigarettes, stating that tobacco in any form has known harms for youth, including affecting the development of the adolescent brain. Furthermore, in disagreement with the RCP, the CDC poses that e-cigarette use in young people can act as a gateway to other forms of tobacco use. For these reasons, the CDC has deemed e-cigarettes unsafe for young people.

The CDC has based its recommendations regarding e-cigarettes for non-pregnant adult smokers on their use as a tool for smoking cessation. The CDC states that e-cigarettes are only useful and safe if the person has completely stopped all cigarette and other forms of combustible tobacco use. They emphasize that e-cigarettes are not an FDA-approved method of smoking cessation,
and that there is little evidence regarding their efficacy.\textsuperscript{52}

The CDC recommends against any tobacco use, including e-cigarettes, in pregnant women, stating that nicotine exposure is dangerous to fetal development, especially the brain and lungs. For pregnant women who need help quitting, the CDC recommends discussing the risks and benefits of nicotine replacement with a physician.\textsuperscript{52}

The CDC has identified several second-hand dangers of e-cigarettes on nonsmokers. They emphasize that e-cigarettes contain more than just water vapor that can be inhaled, including heavy metals and cancer-causing agents like acrolein. They also contain propylene glycol, which although it has been deemed by the FDA as safe to ingest, its safety when inhaled has never been studied. For these reasons, the CDC recommends that nonsmokers should avoid second-hand inhalation from e-cigarettes, and should avoid using e-cigarettes themselves.\textsuperscript{52}

**American Academy of Pediatrics**

The American Academy of Pediatrics (AAP) has released a policy statement on all tobacco and nicotine products, and they take a strong stand against ENDS.\textsuperscript{53,54} The AAP states that

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**TABLE 1.**

<table>
<thead>
<tr>
<th>Health Agency</th>
<th>Perceived Advantage</th>
<th>Perceived Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal College of Physicians\textsuperscript{51}</td>
<td>Aid in smoking cessation, especially for those quitting without support Less harmful than combustible cigarettes</td>
<td>No quality control Could be more dangerous than nicotine replacement</td>
</tr>
<tr>
<td>Centers for Disease Control and Prevention\textsuperscript{52}</td>
<td>Could lead to a society with no combustible tobacco products Could lead to smoking cessation if switched to ENDS completely</td>
<td>Initiate nicotine addiction Gateway to other tobacco products for youth Contain potentially harmful ingredients Delay smoking cessation in current smokers Second-hand exposure</td>
</tr>
<tr>
<td>American Academy of Pediatrics\textsuperscript{53,54}</td>
<td>None</td>
<td>Progression to combustible cigarettes Decreased rates of smoking cessation in youth Toxic and carcinogenic substances in second-hand smoke</td>
</tr>
<tr>
<td>American Heart Association\textsuperscript{55}</td>
<td>Reduction in the use of combustible tobacco Reduction in second-hand smoke exposure</td>
<td>Not more effective for smoking cessation than NRT Appealing to youth Contain metals and chemicals with unknown safety</td>
</tr>
<tr>
<td>American Association for Cancer Research and American Society of Clinical Oncology\textsuperscript{56}</td>
<td>Lower levels of harmful tobacco constituents, less toxic than combustible cigarettes Smoking cessation tool Withdrawal relief after smoking cessation</td>
<td>Renormalize smoking behavior Initiate/maintain nicotine addiction Gateway for youth Not regulated by the FDA</td>
</tr>
<tr>
<td>International Respiratory Societies\textsuperscript{57}</td>
<td>Less tar and carcinogens than combustible cigarettes Reduced overall health risk compared to combustible cigarettes Reduction in the number of combustible cigarettes in smokers using both</td>
<td>Increased risk for nonsmokers to develop nicotine addiction Increased smoking initiation and reduced smoking cessation No regulation</td>
</tr>
<tr>
<td>American College of Physicians\textsuperscript{58}</td>
<td>Aid in smoking cessation</td>
<td>No quality control Nicotine addiction Gateway to other tobacco products for youth Contain particles harmful to the lungs Second-hand exposure</td>
</tr>
</tbody>
</table>

Abbreviations: ENDS, electronic nicotine delivery systems; FDA, US Food and Drug Administration; NRT, nicotine replacement therapy.

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tobacco exposure is a health threat to children, and that there is no safe level of tobacco exposure, especially to the still-developing brains of children and adolescents. As such, the AAP recommends that the sale of ENDS to children should be prohibited, with the minimum age to purchase any tobacco product set to age 21 years. They further state that public smoking bans should include ENDS to prevent second-hand smoke exposure from these devices. Measures to curb the appeal of ENDS to youth include prohibiting the promotion and advertisement of the devices in any media that could be viewed by youth and by prohibiting the use of flavoring agents in the devices.

American Heart Association

Although the American Heart Association (AHA) recognizes the potential for ENDS to act as smoking cessation tools, they acknowledge the same concerns shared by other organizations that ENDS can renormalize the act of smoking and serve as a gateway for nicotine addiction. In their policy statement on ENDS, the AHA classifies e-cigarettes that contain nicotine as tobacco products that should be under the same legal regulation as other tobacco products. They state that ENDS should be added to already existing smoke-free air laws so that nonsmokers will not be exposed to the nicotine potentially emitted from ENDS. This is especially important because ENDS manufacturers advertise the devices to be used in locations where cigarettes are banned. Because this is not yet the case, the AHA states that physicians should not yet recommend ENDS as smoking cessation aids, and should include ENDS in their questioning when screening for tobacco use.

The FDA has already put forth a proposal to oversee addressing youth access, sampling, ingredient listing, manufacturing, and warning labels, but the AHA believes it should also regulate advertising and flavoring. The ultimate goal would be to produce quality-controlled devices that can safely help people quit smoking.55

The AHA recommends that state and federal laws be established that prohibit the sale of ENDS to minors.55 Their concern lies in the fact that ENDS are easily accessible and their “high-tech” nature and the availability of a variety of flavors make them more appealing to young people, which can lead to increased nicotine addiction and cigarette use among youth. The AHA also recommends that legislation should be passed restricting marketing of ENDS to youth, mirroring the legislation already in place that restricts the marketing of combustible tobacco to youth. Additionally, the AHA recommends that legislation should be passed to ensure ENDS are taxed at a high enough rate to discourage youth from purchasing them. This should be accompanied by a concurrent increase in the tax on combustible forms of tobacco so those who can no longer afford ENDS do not turn to combustible cigarettes as a cheaper alternative. They endorse that the revenue generated from these taxes should be used to support smoking cessation programs.

American Association for Cancer Research and the American Society of Clinical Oncology

The American Association for Cancer Research (AACR) and the American Society for Clinical Oncology (ASCO) recognize the same potential benefits and harms of ENDS, and their position mirrors many of those already noted.56 They are in favor of regulation of both the ENDS delivery systems and the nicotine-containing liquid by the FDA. The AACR and ASCO recommend that legislation should be passed restricting marketing of ENDS to youth, which can lead to increased nicotine addiction and cigarette use among youth. The AHA also recommends that legislation should be passed prohibiting the sale of ENDS to children. Additionally, the AHA recommends that legislation should be passed restricting the marketing of ENDS to youth, mirroring the legislation already in place that restricts the marketing of combustible tobacco to youth. Additionally, the AHA recommends that legislation should be passed requiring warning labels and nicotine warnings on ENDS packaging and advertising. Mirroring the view of the AHA, the AACR and ASCO also recommend that legislation should be passed restricting marketing of ENDS to youth.

With respect to youth, the AACR and ASCO believe in stringent regulations regarding the marketing and sale of ENDS to youth that should be regulated by the FDA. Specific stipulations that would discourage marketing to youth include prohibition of self-service displays, forbidding the use of cartoon characters or other youth-oriented methods of marketing, and prohibiting brand-name sponsorship of sports teams and musical events. They also recommend the elimination of flavored ENDS to discourage youth appeal and even state that the packaging should be child-proof. Finally, the AACR and ASCO endorse that federal regulation of ENDS should extend to Internet markets, requiring sellers to verify the age of buyers.

Forum of International Respiratory Societies

The Forum of International Respiratory Studies (FIRS) has taken an even stronger stance on ENDS, stating that
they should be banned altogether until their safety can be adequately tested, and they have laid out contingencies if a ban does not occur. They cite the recurring issue that ENDS are not currently under any regulation and there have been inadequate studies to demonstrate their safety and efficacy in aiding with smoking cessation. They want organizations other than tobacco and e-cigarette companies to fund and conduct research about the safety and health impacts of ENDS and that the results of this research should be shared with the public.

The FIRS states that in lieu of a complete ban, ENDS should be treated like medicine and regulated as such. This would mean ENDS could not be marketed as a means for smoking cessation until thorough studies had been carried out testing their safety. FIRS recommends that at the very least, ENDS should be regulated as tobacco products and should be covered under the same legislation. This would include a ban on the following: sale to minors, displays in retail stores, flavoring and packaging that would attract young people, and their use in public places. This would also include taxation at the same rates as other tobacco products, regulation of Internet sales, and labels that include ingredients and the appropriate warnings.

American College of Physicians

The American College of Physicians (ACP) supports the regulation of ENDS by the FDA and legislation that incorporates ENDS into smoke-free air laws. They also support laws that would impose the same regulations on advertising on ENDS as currently exist for other tobacco products, including a prohibition on television advertisement. They encourage the federal government to fund research pertaining to the public and individual health impacts of ENDS and their efficacy in smoking cessation.

They recommend that a federal agency such as the Agency for Healthcare Research and Quality, National Institutes of Health, or CDC should evaluate current and future data to produce clinical guidelines for ENDS use.

The ACP’s recommendations pertaining to youth specifically include banning flavoring and imposing taxation rates on ENDS similar to cigarettes. They also recommend that antismoking education in the schools and in media should include the risks related to ENDS.

SUMMARY

Two public health perspectives, reflected in conflicting public health recommendations, drive the reaction to the rising use of ENDS: the precautionary principle and harm reductionism (Table 1).

On the precautionary principle side are agencies that have produced position statements arguing for greater regulation of ENDS marketing, sales, and production. From a precautionary stand point, ENDS could lead to nicotine addiction, expose the user to harmful metals and chemicals, and expose the public, including children, to second-hand vapor with potentially harmful ingredients. When applied specifically to youth, the precautionary principle would include that ENDS could renormalize the act of smoking and be a gateway to combustible cigarettes.

The harm reductionism view is based on the comparison of ENDS with combustible cigarettes, both on an individual and public health level. Arguments for the harm reductionism potential of ENDS include that the harm caused by using ENDS is minor in comparison with the harm associated with combustible tobacco use. Because ENDS do not contain the harmful constituents of tobacco smoke, they are thought to be safer to both the smoker and at the second-hand level. Harm reductionists further suggest that ENDS may aid current smokers in smoking cessation and may be more effective than current nicotine-replacement therapy. This would reduce the number of people who smoke and the number of people exposed to second-hand smoke, thereby reducing harm at both the individual and public health level.

There is insufficient evidence of ENDS as a smoking cessation aid; furthermore, it is too soon to assess the long-term health consequences of ENDS use. Some randomized controlled trials testing the efficacy of ENDS in smoking cessation have found a benefit of ENDS over smoking cessation aids currently approved by the FDA, but it is clear that more research regarding the safety and efficacy of ENDS is necessary before they can be used as smoking cessation tools. More importantly, although the premise of the harm reductionism argument may be valid among an adult population, it should not be applied to children’s experimentation with and use of ENDS. Children and adolescents should have no or minimal exposure to ENDS, be that in advertisements or out in public. Because the main advantage of ENDS lies in their potential as smoking cessation tools, they should not be considered safe alternatives to smoking and should not be used by youth.

REFERENCES


