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The Regulatory Challenge of Electronic Cigarettes

Electronic cigarettes (e-cigarettes or electronic nicotine delivery systems) heat a nicotine solution to generate vapor that is inhaled, without the combustion of tobacco and its toxic constituents. Use of e-cigarettes is increasing in the United States and around the world. Current smokers in the United States report an 11.4% prevalence of ever use of e-cigarettes and 4.1% use in past 30 days. They likely pose less direct hazard to the individual smoker than tobacco cigarettes and might help smokers quit smoking or reduce harm by smoking fewer tobacco cigarettes. On the other hand, there are potential harms, including promoting continued smoking of cigarettes and renormalizing cigarette smoking behaviors. The Food and Drug Administration (FDA) is authorized to regulate tobacco products, and in 2011 the agency announced plans to regulate e-cigarettes as tobacco products. The FDA will need to make a number of regulatory decisions about product safety that could have major effects on public health and will face many challenges.

The e-Cigarette as a Nicotine Delivery System
The delivery of nicotine to the lungs via inhalation, with rapid absorption into the circulation, is critical to the addictiveness of cigarette smoking. The adverse health consequences of cigarette smoking are caused primarily by inhalation of toxic tobacco constituents and organic combustion products. Nicotine per se contributes to some smoking-related diseases, but its contribution is considered to be much smaller than that of combustion products. The provision of clean nicotine (without combustion products or other tobacco plant toxins) in the form of nicotine replacement therapies (NRTs) has been in use for nearly 30 years and has proven to be a safe way to facilitate smoking cessation. Currently available NRT products are not as satisfying and are less acceptable to smokers compared with inhaling and absorbing nicotine from cigarette smoke. The possibility of an inhaled clean nicotine device has been discussed by health researchers for many years as a potentially more effective way to promote smoking cessation. Although not yet proven safe or effective for smoking cessation, the e-cigarette has been positioned as such an inhaled nicotine delivery device and has gained popularity through this perception.

Product Evolution
More than 250 e-cigarette brands are on the market currently, and products have evolved rapidly in recent years. Different e-cigarette brands are engineered differently, affecting the character and potential toxicity of the vapor. Thus, it is difficult to generalize about e-cigarettes as a single device. The FDA will need to consider the engineering of e-cigarettes with respect to different types of nicotine solutions, the capacity of the cartridges containing the solution, the nature of the heating element and battery, the types of additives and flavorings, and the potential toxicants released in the vapor.

Assessing Potential Toxicity and Health Effects
Liquids used in e-cigarettes vary with respect to concentrations of toxicants, and the quality control in e-cigarette manufacturing is questionable. Although a number of toxicants have been identified in e-cigarette vapors, the levels of these toxicants are orders of magnitude lower than those found in cigarette smoke, although higher than those found in NRT. Although it cannot be said that currently marketed e-cigarettes are safe, e-cigarette vapor is likely to be much less toxic than cigarette smoke. Among the questions that should be considered by the FDA are (1) Do low levels of contaminants in e-cigarette vapor pose a health risk? (2) What are the thresholds for toxicity of contaminants in vapor? (3) What should be the basis for product standards for e-cigarettes? (4) Could the risks be ameliorated by changes in engineering?

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Potential Health Benefits for Individual Smokers
Testimonials, surveys, and one uncontrolled clinical trial report that e-cigarettes facilitate the quitting of cigarette smoking and allow smokers to smoke fewer cigarettes per day if they continue to smoke. However, longitudinal analysis using population-level data found no difference in quit rates between e-cigarette users and nonusers. Controlled clinical trials and population-level observational cohort studies are needed to establish the utility of these cigarettes to facilitate smoking cessation. Research is also needed regarding the role of e-cigarettes in harm reduction, including reduced cigarette smoking and associated reduction of tobacco toxicant exposure. The FDA will need to determine the magnitude of potential health benefits from e-cigarettes for individual smokers.

Potential Population Harm
Several potential sources of population harm require research and subsequent weighing of individual benefit vs population risk. These include uptake of e-cigarette use...
by nonsmokers, who may later become cigarette smokers or long-
term nicotine addicts; promotion of dual use of e-cigarettes and regu-
lar cigarettes, such that use of e-cigarettes undermines quitting ciga-
rette smoking; undermining the denormalization of cigarette smoking, because e-cigarettes look like regular cigarettes and their use in public would give the appearance that cigarette smoking behavior is more acceptable; and exposure to a new source of air pol-
lation in places covered by smoke-free policies.

Advertising and Marketing
Advertising and marketing can be considered in the context of both
manufacturer and consumer. Industry has been aggressively market-
ing e-cigarettes with claims of health benefit compared with smok-
ing tobacco cigarettes, for reducing and quitting smoking, for smok-
ing without generating irritating and harmful secondhand smoke, and
for using when a person cannot smoke cigarettes.10 Marketing also
uses young models and celebrities to convey images of the product
as glamorous and modern. The net result of industry marketing and
consumer advocacy has been a substantial increase in the use of the
product. Effective promotion of e-cigarettes could be advantageous
if it was determined there was individual health benefit and a low level
of total population harm—for example, if e-cigarette use was found to
facilitate smoking cessation and not encourage dual use or appeal
to youth as a novel nicotine product.

The FDA needs to decide how marketing should be regulated in the
context of potential benefits and population risks. This in-
cludes deciding the legal age at which minors can purchase the prod-
ucts and other possible access restrictions, as well as evaluating the
appeal of the marketing to youth. Determining the effect of e-
cigarettes on the entire population will be challenging.

Broader Regulatory Issues
Assuming that e-cigarettes of high quality could be safe and could
offer net public health benefit (including high consumer acceptabil-
ity, more effective nicotine delivery, low levels of contaminants, not
undermining existing tobacco control efforts), and that product im-
provement is occurring in an environment of marketplace competi-
tion, a critical question is when the FDA should begin to require
product licensing. A disadvantage of requiring licensing is that regu-
latory requirements are likely to slow product innovation. The ad-
vantage of licensing would be to ensure the quality and consist-
tency of products.

Medications to promote smoking cessation are regulated by the
FDA Center for Drug Evaluation and Research (CDER). Tobacco prod-
ucts are regulated by the FDA Center for Tobacco Products (CTP).
According to current FDA regulations, in the event that e-
cigarettes are found to be helpful in facilitating smoking cessation,
the same product could be regulated simultaneously, both by CDER
as a medication and by CTP as a tobacco product. This makes little
practical sense. A comprehensive regulatory approach to nicotine-
containing products is needed. Regulation needs to include the full
spectrum of products, from the most hazardous to the least haz-
ardous, with consideration of the potential of less harmful prod-
ucts to reduce exposure to the most harmful combustion products
from smoked tobacco, while simultaneously evaluating the total pub-
ic health effects of the policies.

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