

Tobacco harm reduction, e-cigarettes, and e-cigarette use: an overview

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The Consumer Advocates for Smoke-free Alternatives Association (CASAA) is a nonprofit public health NGO dedicated to promoting tobacco harm reduction by preserving access to and providing education about low-risk alternatives to smoking. It is a U.S. membership organization with over forty thousand members, serving as the leading representative of the interests of consumers. CASAA is not affiliated with industry and does not represent their interests.

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What is tobacco harm reduction (THR)?

Tobacco harm reduction is the substitution of low-risk alternatives for smoking. Those low-risk alternatives include electronic cigarettes (e-cigarettes), smokeless tobacco (snus, snuff, chew), and for those who find them satisfying for long-term use, pharmaceutical nicotine products (a.k.a. NRT; nicotine gum, lozenges, etc.). All of these products are estimated to be about 99% less harmful than smoking.

The harm reduction ethic is not just about reducing harm, but about respecting the liberty, dignity, and preferences of the individual. Rather than diminishing a person to the role of a patient to impose treatment upon – or worse, to a miscreant, sinner, or criminal to be punished and controlled – harm reduction involves empowering people to make their own best choices and protecting them from those who would punish them for those choices. Their options should include the lower-risk alternatives, and they are strongly encouraged to choose those, but ultimately the decision about what to do with their own bodies is their own.

The term “harm reduction” is commonly used in the context of injection drug use (clean needles) or sexual behavior (condoms). But auto safety, because of the absence of

moralizing, is perhaps a better way to think about it: We do not tell people to just avoid the dangerous behavior of automotive transport in spite of its benefits, but rather provide them with risk-reducing products (seat belts) and push for safer driving behavior.

Indeed, the major contrast between THR and those other areas of harm reduction is the magnitude of the reduction: Available technologies and safer behavior reduce the risks from sex, drugs, and driving by half or a bit more. But THR comes so close to *entirely eliminating* the risk that there is almost no difference between low-risk product use and complete abstinence from tobacco/nicotine products.

So why does there seem to be so much opposition to THR?

Opposition to THR comes from a relatively small special-interest group of anti-tobacco activists, but they are high-profile, well funded, and hold key positions of power. When you present the case for promoting THR to the average person, they almost always agree it is a wise approach.

Unfortunately, while anti-tobacco efforts started out based on a genuine concern for people and their health, focusing on making sure people understood the risks of smoking, they have morphed into something altogether different. Many anti-tobacco activists have long-since stopped wanting to rid the world of the *harms* caused by tobacco use, and simply want to end all tobacco use regardless of how low the risk and how much people like using the products. Their goal is seriously threatened by THR: If people can use tobacco with very little or no health risk, those who derive benefits from it have little reason not to do so. For most of us, there is no apparent problem with people enjoying a low- or no-risk consumption choice. But for those who just want to eliminate all tobacco use – basically for “moral” reasons – it ends all hope.

Additionally, many who have spent their careers trying to reduce smoking, to no great effect, resent the fact that the problem may be solved *in spite of* their efforts rather than because of them. It is just human nature to push back. Less forgivable is the financial motive. Anti-tobacco organizations, and indeed many major health charities, depend on smoking for their funding. Cigarette taxes are funneled to them, and their donations and public support depend on tobacco use being a costly scourge. If tobacco use becomes low-risk, they are out of business.

Opponents of THR typically dress up their claims as concerns about health, because stating their real motivations would obviously not play very well, and they do manage to trick many others into repeating their inaccurate health claims. But keeping smokers smoking longer – which is what they are doing – is obviously bad for public health. Their health-based claims are easily and consistently debunked, but they simply keep repeating them, counting on their audiences never learning that they what they are saying has been scientifically shown to be false.

What is an e-cigarette?

Electronic cigarettes are devices that partially mimic the act of smoking a cigarette by delivering “vapor” that is inhaled like cigarette smoke. The vapor (really an aerosol – see technical notes) is produced by heating a solution of propylene glycol and glycerin (proportions vary) that contains nicotine (which is extracted from tobacco) and flavorings. Thus, the elements of an e-cigarette are a reservoir containing the solution, a heating element, a battery, circuitry that controls the delivery of electricity to the heating element, and a physical structure that allows inhaling air across the heated liquid. These can be configured in a wide variety of ways.

The vaper (the generally accepted term for “e-cigarette user”; analogous to “smoker”) inhales the aerosol, and nicotine is absorbed in the lungs and mouth, as with cigarette smoke. For various reasons, the absorption of nicotine from vaping is not as rapid as from smoking, so the initial spike is comparatively modest. Also, tobacco leaf contains other psychoactive chemicals, not just nicotine. But for the most part, the experience is quite similar to the smoking experience it replaces. The act of moving a device to the mouth and inhaling an aerosol creates similarities that other low-risk substitutes (smokeless tobacco, nicotine gum, etc.) do not have.

It is worth noting that use of e-cigarettes with liquid that contains no nicotine (just the carrier chemicals and the flavoring) is moderately popular. This seems to be mainly among people who quit smoking using e-cigarettes and then decided they were happier without nicotine at all, but still want the physical aspects of smoking/vaping.

E-cigarettes fall into two major categories: cigalikes and open systems.

Cigalikes

Cigalikes are e-cigarettes that mimic the form factor of a traditional cigarette. They are often disposable, though some have replaceable cartridges containing the liquid and heating element, with a rechargeable battery. These products generate the most sales because they are widely available alongside cigarettes at convenience stores and other retailers. The cigalike market is increasingly dominated by the major traditional tobacco companies, who were late getting into the e-cigarette business but whose distribution networks allowed them to rapidly overcome this disadvantage.

Cigalikes are generally considered to be low-quality e-cigarettes. Primarily because of the limit on the battery size, these e-cigarettes deliver a relatively small amount of aerosol and nicotine, which many users find unsatisfying. They are also much more expensive than open systems in the long-run because the hardware is replaced rather than refilled, though they are still cheaper than smoking in jurisdictions with high taxes on cigarettes. Despite their limitations, cigalikes play a very useful role in encouraging smokers to switch because of their convenience, familiarity, and entry-level prices in the short-run.

Open systems

Open systems consist of modular hardware, with interchangeable batteries, heating elements, reservoir tanks, and other components. They are refillable with liquid that is purchased separately (which is what defines “open”). The batteries are larger than those in cigalikes, sometimes much larger, and often include sophisticated control systems. The heating elements are usually more powerful, taking advantage of the greater battery power. The simplest open systems resemble a large fancy pen, while the higher-end combinations come in various shapes and much larger sizes.

Almost all experienced vapers prefer open systems, which create a more satisfying puff of vapor, deliver the nicotine and flavor more effectively, have a better battery life, and offer a seemingly infinite variety of flavors to suit every palate. The hardware costs more than cigalikes – enormously more for the fanciest hardware, though only a bit more for low- end open systems – but the long-run costs are much lower because the refill liquid is relatively inexpensive. A large portion of consumers who quit smoking thanks to e-cigarettes only decided that was a realistic possibility after they tried open systems; they did not find cigalikes to be a sufficiently satisfying substitute.

Rapidly developing technology and behavior

It is important to keep in mind that this is a rapidly developing technology, and what exists today is just one brief moment in that evolution. Today the carrier chemicals consist of propylene glycol and glycerin, but other chemicals could be used. Today all versions of these devices on the market use electric heating elements, but there are devices in the pipeline that produce the aerosol using air pressure or chemical reactions (which may or may not end up being called “e-cigarettes”). Today’s cigalikes fail to deliver nicotine very effectively, but later generations may change this. Today almost all e-cigarette users are ex-smokers, but new generations will include many vapers who never smoked.

Technical terminology notes:

- “Vapor” is technically a misnomer. Vapor refers to matter in the gas phase, whereas e-cigarettes actually produce a spray of tiny droplets of liquid. This is properly described as an aerosol. However, most discussions of e-cigarettes and their use refer to the aerosol as “vapor,” and this has become an accepted usage.
- Though “e-cigarettes” is predominant and generally understood, there are numerous other terms, most of which are designed for marketing or as political statements. “Vapor products” (or variations like “e-vapor products”) is an increasingly common term that is being pushed mostly by industry. Many vapers, in insider communications, prefer terms like “personal vaporizers” (PVs) to distance themselves from cigarettes. Opponents of e-cigarettes have adopted the derogatory term “ENDS” (electronic nicotine delivery systems). All of these terms, like most made-up names, are technically inaccurate (they are not cigarettes; many products produce vapor, but ironically these do not; the niche they occupy is that of an enjoyed consumer product, not delivery device, and they do not

always contain nicotine).

- The liquid solution used in e-cigarettes is often referred to as “e-liquid,” though obviously the liquid itself is not electronic.
- The heating element is often called an “atomizer” or a “coil.” It may or may not actually fit the technical definitions of those devices.
- E-cigarette enthusiasts refer to countless subcategories of open systems. But for most practical purposes, the only important distinction is between cigalikes and open systems.
- There is a bit of grey area between cigalikes and open systems since they are not technically opposites. One major manufacturer has started selling closed systems (i.e., the liquid cartridges must be replaced rather than being refilled) that are larger than cigalikes. Some cigalike products are refillable. But there is close to a complete division between the categories, and it captures the most important functional differences.

What are the advantages of e-cigarettes over smoking?

Health

The obvious advantage is the low health risk. For someone who likes to consume nicotine or engage in the physical act of smoking, smoking might be preferable to abstinence, even with its great costs. But vaping or use of other THR products is probably better still, all costs and benefits considered, providing most of the benefits with very little of the health cost.

The evidence that smoke-free tobacco products are low-risk is based primarily on decades of research on smokeless tobacco use. Despite the popular myths, extensive epidemiology shows that smokeless tobacco causes no detectable risk for any disease. This does not mean it is completely harmless (though that possibility is consistent with the scientific evidence), but it does mean that any risks must be very small.

We obviously lack epidemiology about long-term e-cigarette use (and probably always will for any particular type of e-cigarette, since the products are changing so fast). But we have ample evidence to be confident of the low risk: We have the evidence about the low risk of smoke-free nicotine from smokeless tobacco. The other exposures resulting from vaping – inhaling the carrier chemicals and tiny quantities of contaminants – are well studied in other settings (details not included in this document; they are available elsewhere). This allows us to conclude that the risk from vaping is down in the range of the risk from using smokeless tobacco. We have further reassurance about this conclusion from the real-world experiences of hundreds of thousands of vapers who have used the products for years, and from numerous formal studies of acute effects, which show e-cigarettes do not cause any unexpected consequences in the short run. This is the same evidence and reasoning that caused the U.S. FDA to conclude that long-term use of NRT products poses no substantial risk.

While there are undoubtedly differences in health effects among low-risk alternatives to smoking, they are quite small and speculative. The net risk from all such products is so

close to zero that substituting them for smoking effectively reduces risk as much as not using tobacco products at all. E-cigarettes may not be *quite* as low risk as smokeless tobacco. High-quality closed systems, which contain only well-studied ingredients and highly controlled heating systems probably are. Open systems are not quite as “clean,” with a wider variety of flavoring ingredients, the option of higher temperature heating (which produces more contaminants in the vapor), and a huge variety of hardware components. This has resulted in alarmist claims about the vapor from open systems, particularly when operated in completely unrealistic ways. But the reality is that the quantities of potentially harmful chemicals produced remain small, much closer to quantities found in indoor air than the quantities created by smoking.

It is important to keep in mind the absolute magnitude of the plausible range of risk. Even if a particular e-cigarette configuration doubles or triples the health risk compared to that 99% reduction in risk, it is still a tiny fraction of the risk from smoking. There is nothing to suggest it could be much higher than that, leaving the risk down in the range of that from other everyday hazards, like transport or eating junk food. If such a product, rather than some slightly cleaner alternative, is the satisfying alternative that can replace smoking for a given individual, then the net benefit is obvious. Indeed, if someone merely likes it better, those benefits can justify the costs; we all take small health risks all the time in order to pursue other preferences.

Flavors

The availability of interesting flavors makes vaping more enjoyable, which is welfare-improving in itself. But beyond that, many vapers find that interesting flavors are critical for quitting smoking. E-cigarettes that try to imitate the taste of smoking, which includes a large portion of cigalikes, seldom do a convincing job of it. It leaves many smokers feeling that e-cigarettes are an altogether inferior substitute, so why bother? We might like to think that the health benefits alone would overcome that, but people often do not act on that basis. Ex-smokers who tried to switch to e-cigarettes but kept returning to smoking often report that finding an alternative flavor that they liked was what made vaping better than smoking, resulting in their complete switch. Moreover, after using flavors that do not resemble tobacco smoke for a few months, most vapers who try a cigarette report that it tastes terrible and so never consider switching back.

There is a common myth that interesting flavors are designed to attract underage consumers. But there is no evidence – literally none at all – to support the claim that these flavors are particularly attractive to teenagers. There is, however, overwhelming evidence that adult vapers prefer interesting flavors and that many quit smoking only because of them.

Technical terminology note:

· E-cigarette liquid with interesting flavors is often referred to simply as “flavored,” implying that imitation tobacco smoke is not a flavor. But the latter is every bit as much

an added flavor. Genuinely unflavored e-cigarette liquid is available, having only the slightly sweet taste of the carrier chemicals and a bit of peppery taste from the nicotine, but almost no one uses it.

Aesthetics

E-cigarettes do not produce odor and residue like cigarette smoke. Someone who is vaping efficiently and politely (allowing most of the aerosol droplets to deposit in their lungs, rather than taking big quick puffs to try to maximize what they exhale) exhales almost none of the vapor, and there is no “sidestream” emission like that produced from the smoldering cigarette tip. Thus, the emissions are minimally invasive and, as a separate point, pose no health threat to bystanders (the details of that are not included here but appear elsewhere). Most non-users find the smell of nearby vaping to be mildly pleasant, thanks to the nice flavors, unlike most nonsmokers’ opinions of the smell of nearby smoking or the outgassing from the clothes of a smoker.

There are places where vaping might be obtrusive, of course (theaters, public transportation, classrooms, and formal meetings come to mind), and managers of those spaces have the option of forbidding people from vaping there if they choose. But in bars, offices, and many other spaces where people might want to vape, it is no more aesthetically obtrusive than holding a cup of coffee or eating.

Convenience

Thanks to the minimal aesthetic impact and lack of health impact on bystanders, vaping is socially acceptable in many places where smoking is not. Not having to step outside of one’s office or a bar to vape is a big advantage over smoking, and is an important motivation for many smokers deciding to try e-cigarettes. In addition, the option of quickly pulling out an e-cigarette and taking one or two puffs – delivering only as much nicotine as is desired at the moment, rather than having to light and smoke a whole cigarette – offers substantial advantages for many people.

“Addiction”

While there is more to be learned about this, it appears that vaping is far less captivating than smoking. Many ex-smokers who thought they would never manage to quit have switched to vaping and then discovered, after a few months, that they could take it or leave it. They often choose to keep vaping because they like it and know it is low risk, but know they could stop any time they wanted. Most experienced vapers report that they have substantially reduced their total nicotine intake, starting out high while quitting smoking, but preferring less after a period of exclusive vaping. There is no evidence that anyone has become “addicted” (by any reasonable definition of that ill-defined and plastic term) to nicotine as a result of vaping. Indeed, it is generally accepted that nicotine without the smoke, in the form of NRT products, does not cause addiction. It appears the same may be true of e-cigarettes.

It is worth noting what should be an obvious point about these advantages of vaping: Anything that reduces these will tend to discourage smokers from switching and may even encourage people who would have been lifelong e-cigarette users to take up smoking instead. Forcing vapers to leave a bar or their office to stand with the smokers takes away some of the advantage, and creates the temptation to bum a cigarette from someone. Requiring that e-cigarettes come in only imitation tobacco flavor would pointlessly lower the welfare of product users and discourage smoking cessation.

Who uses e-cigarettes?

The available data is painfully limited (due mainly to the U.S. government and others who collect data on tobacco use pointedly avoiding gathering it). But they suggest that about 90% of the people who have tried an e-cigarette are smokers or ex-smokers, many of whom are those who used e-cigarettes to quit. If we consider only the people who genuinely use e-cigarettes, rather than merely trying them once out of curiosity or taking a few puffs every now and then, this appears to rise to close to 99%.

In short, e-cigarettes are used for tobacco harm reduction.

“Dual use”

As of right now, the substantial majority of e-cigarette users are also currently smokers. The caveat is important because in the long-run this will almost certainly no longer be the case. Because e-cigarette uptake has grown so much over a short time, many smokers who are transitioning to e-cigarettes over the course of many months, as is fairly common, are still in that transition phase. And there has not been time for emergence of a new cohort of would-be smokers who chose e-cigarettes instead.

Those who currently use both products are often referred to by the somewhat derogatory term, “dual users.” But a much more useful conceptualization is “partial substitution.” The term “dual use” is meant to imply someone has multiple behaviors whose consequences are additive or even negatively synergistic (e.g., engaging in both smoking and heavy drinking). But partial *substitution* of a low-risk alternative for smoking is still harm-reducing compared to just smoking. There is no reason to believe that there are any negative synergies from using both products rather than just smoking.

Many smokers who are partially substituting are trying to switch entirely or are considering it. These are the best candidates for achieving all the benefits of complete smoking cessation. They are familiar with e-cigarettes and can experiment with their options to find one that is completely satisfying. While some smokers quit the day they try their first e-cigarette, most do not.

But even smokers who partially substitute and are not actively trying to quit smoking are better off. Reducing the quantity of smoking is healthier. While the benefits of cutting down are less than linear (that is, cutting down from 20 cigarettes per day to 19 is not

nearly as beneficial as cutting from 5 to 4, and that is not nearly as beneficial as cutting from 1 to 0), any reduction is better than no reduction. Moreover, so long as they are using the low- risk substitute some of the time, these smokers remain much better candidates for completely switching than they would be if the were not using it at all.

Much of the rhetoric trying to vilify “dual use” seems to come from the moralizing anti-tobacco activists, who are bothered by the fact that partial substitution reduces the suffering of those despised smokers. Rather than suffering for hours when in a place they cannot or will not smoke, and then rushing to smoke heavily as soon as they get the chance, they satisfy their desire for nicotine by vaping. (NRT products are also widely used for the same purpose, more often than they are used for smoking cessation.) But even this pattern of e-cigarette use is better for smokers’ prospects of eventual cessation – and certainly for their overall well- being – than no e-cigarette use. It is also worth noting that cigalikes are ideally suited for such usage patterns (they are more familiar and convenient, and are cheaper in the short run), and yet most of those who try to vilify “dual use” also support policies that favor cigalikes over open systems.

Younger users and future generations

There is substantial engineered alarm about the use of e-cigarettes by teenagers. The key fact to understand is that all the statistics are based on surveys where people are asked whether they have ever taken so much as a single puff from an e-cigarette. When these results are reported, someone who reports ever having taken at least one puff is called an “e-cigarette user” and someone who reports taking at least one puff in the last 30 days is called a “current e-cigarette user.” Obviously, these characterizations are extremely misleading.

Teenagers are more inclined to experiment with behaviors than adults, and they tend to have social lives that facilitate asking to try a puff from a friend’s e-cigarette. (Note that the typical analogy for smoking is giving someone an entire cigarette rather than one puff, whereas someone would not give away their whole e-cigarette, so there is built-in dosage reduction.) Nevertheless, the data shows that most teenagers who have taken a puff on an e-cigarette, particularly within the last 30 days, are already smokers. Presumably those who actually *use* e-cigarettes, rather than having just tried one, are even more likely to be smokers, though no such data exists. That is, teenagers seem to be using them for the same good reason that adults do, harm reduction.

A common myth about young people using e-cigarettes is that they will be a “gateway” to smoking, causing some people who would not have otherwise smoked to become smokers. There is no evidence to suggest this has ever happened, not a single testimonial. Indeed, it seems rather implausible: The claim is that someone who would have chosen abstinence from tobacco products rather than smoking (perhaps liking the effects, but not enough to accept the health risks) discovers that she prefers vaping to abstinence, but then for some reason this causes her to switch to what had been her least-preferred

option, smoking. The reason this might occur is never explained by those who claim there is a gateway effect, presumably because they have no explanation for why it might. All of the evidence that is cited as supposedly showing there is a gateway effect actually merely shows that someone who uses one product is more likely than the average person to also use the other. This is exactly what we would see if all e-cigarette use were for purposes of THR. It is also an inevitable result of the fact that some people like the effects of nicotine, and are willing to defy the social norms to not use it, while others do not. Thus, not only does the gateway claim defy logic, but it is supported by no evidence whatsoever.

It is inevitable that some teenagers or young adults who have never smoked will start using (not just trying) e-cigarettes. Some of them will be would-be smokers who benefit from tobacco harm reduction, not by quitting smoking but by never starting. But some never would have smoked. For those who would like to get the benefits of smoking, but avoid it because of the health risks it causes – and there obviously are such people – we would expect that many of them would use a low-risk alternative once it became popular. This is perfectly rational and predictable, particularly given that that the risk is so low. Because it is a free choice (recall that it does not appear that vapers get “hooked” without planning to, as goes the usual story told about smokers), it would only be chosen when it is welfare-improving. Older adults might rationally make the same choice, though most are relatively set in their ways. It is interesting to note that quite a few experts on the effects of tobacco use have quietly taken up using low-risk tobacco products in middle age for the cognitive benefits it provides (they have all chosen the invisible and better researched products, smokeless tobacco and NRT, but the concept is the same).