

November 14, 2024

Flor Amaya, Director of Public Health
Chelsea Board of Health
Chelsea City Hall
500 Broadway, Chelsea, MA 02150

Dear Ms. Amaya and Chelsea Board of Health Members,

I am a Mass General pediatrician and mother of 3 adolescent/young adult children. I am also your neighbor, a more than 20-year resident of Melrose, MA. I am writing in support of the Nicotine-Free Generation policy.

Last summer, while driving my 15 year-old daughter and her friend, I asked, "Why do kids vape?" Their response, "*Peer pressure.*" "Why else?" I wonder. "*They help with stress...and they supposedly give you a buzz.*" "Then what happens?" I inquire. "*You can't stop. You get addicted so fast.*" "Are they bad in other ways?" "*Ya. They ruin your lungs.*"

My daughter's ninth-grade gym teacher gets an A+. He taught them well. Nicotine is in fact a highly addictive stimulant drug that is harmful, especially to young people. Nicotine binds to receptors in the brain and in multiple organs throughout the body. It is most known for its role in addiction through the rapid release of neurotransmitters that induce feelings of pleasure and stimulation. The decline of these neurotransmitters, when the brain is no longer seeing the effects of nicotine, brings feelings of intense cravings.

How nicotine affects other tissues and organs in the body is less clear. Research is underway. So far, we know that exposure to e-cigarettes ("vapes") produces inflammatory reactions across multiple organ systems. In the lungs we see such adverse effects as bronchial and pulmonary irritation, as well as impaired lung function. Vaporized nicotine can induce tachycardia, vomiting, diarrhea, headache and irritability. There have even been reports of acute renal injury from nicotine toxicity.

The data on harm caused by combustible cigarettes is vast. Nearly half a million people die in the US each year because of smoking combustible cigarettes. Though adolescents often try e-cigarettes first, one third of them ultimately start smoking combustible cigarettes, thus putting them at immense lifetime risk of all the known diseases caused by smoking. Cigarettes kill *half* the people who use them long term.

While we do not have the decades of data that we have on combustible cigarettes directly linking smoking to cancer and other diseases, we do know that nicotine plays a role in cell division and proliferation, both key components of carcinogenesis. Additionally, the aerosolized chemical solvents used in e-cigarettes have been shown to contain formaldehyde, acrolein, nickel and cadmium, all known

carcinogens. When inhaled, the aerosolized solvent particles from the vaporized nicotine solutions are immediately absorbed in the lungs and travel rapidly to the brain and other organs.

We know that smoking is bad for the brain function. Long term smokers experience cognitive decline thought to be related to narrowing of blood vessels and delivery of less oxygen. The brains of long-term smokers actually shrink. We now have emerging data that vaping also affects cognitive function. A recent study of college students showed that those who vaped had lower cognitive scores than those who didn't. And the more they vaped, the bigger the difference.

Many young people unfortunately view e-cigarettes as harmless, and sadly, because of the way their brains are wired, adolescents and young adults are more likely to develop nicotine addiction following minimal exposure. The reward centers of the adolescent and young adult brain are more active than in the mature adult brain. On top of that, the adolescent brain is primed for taking risks.

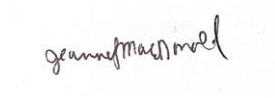
What is worse is that adolescent exposure to nicotine can lead to subsequent abuse of other substances including alcohol, marijuana, cocaine and opioids. Most concerning to me is the relationship between nicotine use and the opioid reward system in the brain. Nicotine use and opioid misuse occur together at a strikingly high rate. People with opioid use disorder are more likely to use nicotine and people who use nicotine are more likely to misuse opioids. This is thought to be because nicotine exposure alters the expression of opioid receptors in the brain and increases the reward effects of opioids. Nicotine exposure in a young person's brain has lasting effects on addiction vulnerability for years to come. Nicotine essentially primes the brain for addiction beyond nicotine. Given the current state of the opioid epidemic, this relationship has downright frightening implications.

To say that a young adult can make an "adult decision" and just say "no" to nicotine is unfair. No one chooses addiction. We all know someone or have a loved-one who is addicted to a chemical substance, whether it's nicotine or alcohol or opioids. These folks are not making an informed decision to use or not to use. They know the substance is harming them. They want to quit. They just can't stop. That's addiction—the physiologic or psychologic need to use a substance that causes harm, despite knowing it causes harm. Helping young people avoid the perils of addiction is everyone's responsibility. Getting them hooked on nicotine at a stage in life when their brain is particularly susceptible to lasting effects of nicotine exposure, namely addiction, is the goal of Big Tobacco. It should not be the goal of our community.

In sum, e-cigarette use is not safe. Though the extent of the dangers of e-cigarette use are not fully understood, the data we have thus far is deeply worrisome. Young people are particularly susceptible to becoming dependent on nicotine very quickly, and this can have grave and lasting consequences. In just 7 years, from 2011 to 2018, we saw a nearly 20-fold increase in e-cigarette use by US teens, with over 1.5 million youth exposed and 2018. This number is only increasing.

While we cannot change the way adolescent and young adult brains are wired, we can limit their exposure to harmful substances like nicotine. We can educate, as my daughter's gym teacher has done so beautifully, and we can legislate. Passing the Nicotine-Free Generation regulation will save lives. It will save lives in Chelsea and in surrounding communities as other towns and cities adopt this regulation. I implore you to act on behalf of our young people, on behalf of our future.

Respectfully,



Jeanne MacDonald, MD

Sources

Sansone L, Milani F, Fabrizi R, Belli M, Cristina M, Zagà V, de Iure A, Cicconi L, Bonassi S, Russo P. Nicotine: From Discovery to Biological Effects. *Int J Mol Sci*. 2023 Sep 26;24(19):14570. doi: 10.3390/ijms241914570. PMID: 37834017; PMCID: PMC10572882.

Seiler-Ramadas R, Sandner I, Haider S, Grabovac I, Dorner TE. Health effects of electronic cigarette (e-cigarette) use on organ systems and its implications for public health. *Wien Klin Wochenschr*. 2021 Oct;133(19-20):1020-1027. doi: 10.1007/s00508-020-01711-z. Epub 2020 Jul 20. PMID: 32691214; PMCID: PMC8500897.

Ren M, Lotfipour S. Nicotine Gateway Effects on Adolescent Substance Use. *West J Emerg Med*. 2019 Aug 20;20(5):696-709. doi: 10.5811/westjem.2019.7.41661. PMID: 31539325; PMCID: PMC6754186.

Lichenstein SD, Zakiniaez Y, Yip SW, Garrison KA. Mechanisms and Clinical Features of Co-occurring Opioid and Nicotine Use. *Curr Addict Rep*. 2019;6(2):114-125. doi: 10.1007/s40429-019-00245-3. Epub 2019 Apr 27. PMID: 32864292; PMCID: PMC7451029.

Groff D, Freedman Z, Gilles A, Bone C, Johnson TS. Development of Opioid Use Disorder After Breast Reconstruction: Effects of Nicotine Exposure. *Ann Plast Surg*. 2024 Apr 1;92(4S Suppl 2):S241-S244. doi: 10.1097/SAP.0000000000003793. PMID: 38556681.

Custodio L, Malone S, Bardo MT, Turner JR. Nicotine and opioid co-dependence: Findings from bench research to clinical trials. *Neurosci Biobehav Rev*. 2022 Mar;134:104507. doi: 10.1016/j.neubiorev.2021.12.030. Epub 2021 Dec 27. PMID: 34968525; PMCID: PMC10986295.

Silbaugh K, Del Valle L, Robertson C. Toward a Tobacco-free Generation - A Birth Date-Based Phaseout Approach. *N Engl J Med*. 2024 May 30;390(20):1837-1839. doi: 10.1056/NEJMp2403297. Epub 2024 May 25. PMID: 38804507.

Becker TD, Arnold MK, Ro V, Martin L, Rice TR. Systematic Review of Electronic Cigarette Use (Vaping) and Mental Health Comorbidity Among Adolescents and Young Adults. *Nicotine Tob Res*. 2021 Feb 16;23(3):415-425. doi: 10.1093/ntr/ntaa171. PMID: 32905589.

Vaping is bad for Brain Health, First-of-its Kind Study Shows, American Neurological Association 2024, Sept 15 <https://www.newswise.com/articles/vaping-bad-for-brain-health-first-of-its-kind-study-shows>