What the research says...

CAsToR Briefing

June 2026

The Center for the Assessment of Tobacco Regulations (CAsToR) aims to provide evidence-based and expert-informed modeling of the behavioral and public health impacts of FDA tobacco rules or other regulatory actions, focusing on Impact Analysis, Behavior and Health Effects as Scientific Domains.

Health impacts of e-cigarettes and nicotine vapes (ENDS): current research and best practices

This brief summarizes research on the health effects of e-cigarettes and nicotine vapes (referred here as electronic nicotine delivery systems i.e., "ENDS") drawing from recent papers by CAsToR investigators. These studies include recommendations for research best practices on the health effects of ENDS use.

Key takeaways.

- There is a lack of standardization and methodological rigor in studies of the health effects of using e-cigarette and nicotine vapes (ENDS).
- Observational and non-randomized studies of ENDS health effects should be carefully evaluated for bias.
- Researchers should be careful to account for confounding effects of former cigarette use in studies of ENDS health effects.

What is the current state of research on the health effects of ENDS?

As the global market for ENDS has expanded, there is a need to understand the health effects of these products.

This brief draws on **seven** recent publications and **a pre-print** from CAsToR researchers on the health effects of ENDS, including studies on methodology and best practices for evaluating and improving study accuracy. The full list of papers can be found at the end of this brief.

Two umbrella reviews (reviews that summarize existing systematic reviews) found that methodological issues make it challenging to summarize evidence from existing reviews: one umbrella review of ENDS research on chemical profiles and toxicity found wide variation in the chemical profiles of products, due to a lack of standardized protocols and differences in products tested [1].

The other umbrella review found that systematic reviews need to better adhere to established reporting guidelines. There are also inconsistent definitions for the timeframe of reported health otucomes, ranging from minutes to hours for acute effects and several days to years for chronic effects, as well as a failure to account for impacts of former/current cigarette smoking [2].

Several studies by CAsToR researchers have examined the health effects of ENDS:

On cardiovascular health effects

A study examined the risk of self-reported incident diagnosed myocardial infarction and stroke associated with ENDS and/or cigarette use. The study used waves 1–5 of PATH (2013–2019) of adults aged 40+ and a prospective design, adjusting for current and former smoking status and cigarette pack-years. The study did not find a statistically significant increase in myocardial infarction or stroke over a 5-year period with ENDS use [3].

On hypertension

A longitudinal cohort study on self-reported incident hypertension diagnosis used a measure of lagged time-varying tobacco exposure and controlled for demographics, clinical risk factors, and smoking history. The study found that

CAsToR is funded by the National Cancer Institute of the National Institutes of Health (NIH) and FDA Center for Tobacco Products (CTP) under Award Number 5U54CA229974. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.

smoking increased the risk of self-reported hypertension, but ENDS use did not [4].

On chronic obstructive pulmonary disease (COPD)

Studies using PATH data from waves 1-5 (2013-2019) and waves 4-7 (2017-2022) examined whether ENDS use is associated with COPD, taking into account cigarette smoking history.

The researchers find that ENDS use did not significantly increase the risk of self-reported incident COPD over a 5-year period, controlling for smoking history [5, 6]. Meanwhile, a more recent study suggests that prolonged use of e-cigarettes may increase COPD risk for those with pre-existing respiratory risk factors [7].

How can we improve research on the health effects of ENDS?

The risk to health typically depends on the frequency and duration of use of tobacco products. Taking into account the frequency and duration of ENDS use improves measures of the relationship between dose and response [4].

Prospective, longitudinal studies of ENDS health effects should be strongly preferred over cross-sectional studies. Regardless of study design, analysts should be careful to properly account for cigarette smoking history as a confounder, especially in older adults [2, 8]. Moreover, careful assessment of the timing between exposure and outcome is critical to ensure that use of ENDS predates the disease outcome.

In work currently under review, CAsToR researchers find that ENDS use duration is moderated by baseline respiratory symptoms, or in other words, the time spent using ENDS depends in part on whether they already have respiratory symptoms at the start [7]. Health effects studies should then ideally also investigate whether symptoms preceded the use of ENDS.

Citations

1 Travis, Nargiz, Marie Knoll, Steven Cook, et al. 2023. "Chemical Profiles and Toxicity of Electronic Cigarettes: An Umbrella Review and Methodological Considerations." International Journal of Environmental Research and Public Health 20 (3): 1908. https://doi.org/10.3390/ijerph20031908.

2 Travis, Nargiz, Marie Knoll, Christopher J. Cadham, et al. 2022. "Health Effects of Electronic Cigarettes: An Umbrella Review and Methodological Considerations." International Journal of Environmental Research and Public Health 19 (15): 9054. https://doi.org/10.3390/ijerph19159054.

3 Hirschtick, Jana L., Steven Cook, Akash Patel, et al. 2023. "Longitudinal Associations Between Exclusive and Dual Use of Electronic Nicotine Delivery Systems and Cigarettes and Self-Reported Incident Diagnosed Cardiovascular Disease Among Adults." Nicotine & Tobacco Research 25 (3): 386–94. https://doi.org/10.1093/ntr/ntac182.

4 Cook, Steven, Jana L. Hirschtick, Geoffrey Barnes, et al. 2023. Time-Varying Association between Cigarette and ENDS Use on Incident Hypertension among US Adults: A Prospective Longitudinal Study. Smoking and Tobacco. April 1. https://doi.org/10.1136/bmjopen-2022-062297.

5 Cook, Steven F., Jana L. Hirschtick, Nancy L. Fleischer, et al. 2022. "Electronic Nicotine Delivery Systems (ENDS) Use during a Five-Year Period Is Not Associated with Self-Reported Chronic Obstructive Pulmonary Disease (COPD) after Adjustment of Cigarette Smoking History: A Longitudinal Analysis of PATH Data." Preprint, medRxiv, March 3. https://doi.org/10.1101/2022.02.20.22271250.

6 Cook, Steven F., Jana L. Hirschtick, Nancy L. Fleischer, et al. 2023. "Cigarettes, ENDS Use, and Chronic Obstructive Pulmonary Disease Incidence: A Prospective Longitudinal Study." American Journal of Preventive Medicine 65 (2): 173–81. https://doi.org/10.1016/j.amepre.2023.01.038.

7 Cook, S., A. F. Brouwer, J. M. G. Taylor, et al. 2026. "E-Cigarette Duration and Incident COPD Among Adults Aged 40 Years and Older with a Smoking History." Preprint, medRxiv, February 5. https://doi.org/10.64898/2026.02.04.26345592.

8 Cook, Steven F., Nancy L. Fleischer, Douglas A. Arenberg, and Rafael Meza. 2023. "Author Response to Issues for Studies on E-Cigarettes and Chronic Obstructive Pulmonary Disorder." American Journal of Preventive Medicine 65 (6): 1198–99. https://doi.org/10.1016/j.amepre.2023.09.011.

Conflicts of interest: None. None of the authors accept funds from the tobacco or vaping industries. **Funding**: This research is funded by NIH award number U54CA229974 from NCI and FDA. Content is solely the responsibility of the authors and does not necessarily represent official views of the funders.