Connie the Clever Cockie presents

Tobacco Control News

Research Round Up August 2023

Passive Vaping

Most people are aware of the harms of second- and third-hand smoke (SHS and THS) from tobacco ('passive smoking'), but what do we know about passive vaping? This month I decided to see what the evidence says. In this research round up I share four recent research papers that shed light on this topic.

Recent research from Europe and the USA confirms that vaping indoors increases toxins in the air. An experimental study carried out in Greece (Tzortzi et al., 2020) found that vaping in a closed indoor area increased SHA. Other people exposed to this SHA experienced irritation of the eyes, nose, throat and chest. This irritation was temporary, but exposure was only for 30 minutes. What impact might regular or longer exposure to SHA have on someone's health?

A study from the USA (Son et al., 2020) found that vaping indoors caused THA as well as SHA. This THA included nicotine and other cancer-causing chemicals. THA was deposited on indoor surfaces and different materials including paper, baby clothing and glass. Whilst this study took place in vape shops, it's not hard to see how the findings might translate to homes where people regularly vape inside.

Vaping inside vehicles has also been shown to pollute the air (Soule et al., 2023), with disposable vapes producing the most SHA. This was an experimental study so the vaping was controlled, however once again it is not hard to see how this could apply to a family car.

Finally, I took a look at the case study of a family from Spain (Ballbè et al., 2023). Although it only describes the experiences of one family, the study does highlight the effects of regular exposure to SHA at home. The father vaped indoors regularly, which exposed the mother and three-year-old child to SHA. Urine, hair, and blood samples taken from the mother (who did not vape or smoke) contained a number of harmful substances including nicotine and heavy metals.

You can read my more in-depth reviews of these papers below.

What is second and third hand aerosol?

When someone vapes, they breathe in aerosol. This aerosol is made up of tiny particles, some of which are so small they can only be seen with a special type of microscope. Because these 'nanoparticles' are so small they can travel deep into the lungs when inhaled. They are also easily absorbed into the blood stream. Research on air pollution has shown that inhaling nanoparticles containing toxic chemicals causes lung and heart inflammation. The toxic chemicals in e-cigarette aerosol can include nicotine, propylene glycol, flavourings, and heavy metals. When the person vaping breaths out, they are exhaling these same chemicals into the environment. This is second-hand aerosol (SHA). When that aerosol is deposited on surfaces in the environment such as furniture, clothing and children's toys, it is known as third-hand aerosol (THA). Other people in the environment ('bystanders') will breathe in the SHA and the toxins it contains. If they touch surfaces which have THA on them, toxins may be absorbed through the skin.

Take Home Message for TIS

The health risks of passive vaping should not be underestimated. Homes and cars should be vape-free as well as smoke-free to protect children and adults from exposure to harmful SHA and THA.

Recent research from Europe and the USA confirms that vaping indoors increases toxins in the air.

Homes and cars should be vape-free as well as smoke-free to protect children and adults from exposure to harmful second and third-hand aerosols.

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In Depth Paper Reviews

Greek Research

Tzortzi, A., Teloniatis, S., Matiampa, G., Bakelas, G., Tzavara, C., Vyzikidou, V. K., Vardavas, C., Behrakis, P., Fernandez, E., Fernández, E., Castellano, Y., Fu, M., Amalia, B., Tigova, O., López, M. J., Continente, X., Arechavala, T., Gallus, S., Lugo, A., . . . Roca, A. (2020). Passive exposure of non-smokers to E-Cigarette aerosols: Sensory irritation, timing and association with volatile organic compounds. Environmental Research, 182, 108963. https://doi.org/https://doi.org/10.1016/j.envres.2019.108963

This experimental study investigated how quickly people reported experiencing irritation of the eyes, nose, throat and chest when exposed to SHA from electronic cigarettes. Forty healthy people aged 18 to 35 years who did not smoke, participated in three 30-minute experiments:

- Sitting in a closed room, 1.5 metres from someone using a vape set to produce high levels of aerosol.
- Sitting in a closed room, 1.5 metres from someone using a vape set to produce low levels of aerosol.
- Sitting in a closed room, with no-one vaping (control).

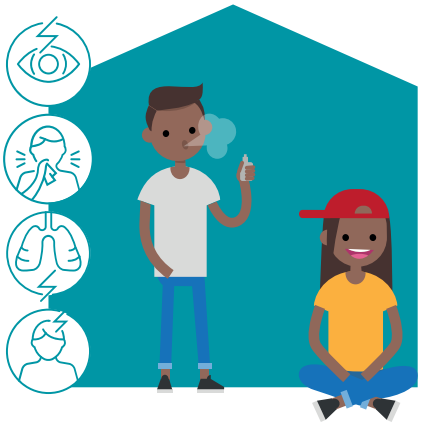
The participants completed an irritation questionnaire before, during, and after each session. The environmental pollution (SHA) was also measured continuously in each session.

Take home message:

Exposure to SHA from vaping can quickly lead to irritation of the eyes, nose, throat and chest. Irritation caused by short-term exposure to SHA in this study did go away sometime after the participant had left the vaping environment. However longer or more regular exposure to SHA could be more harmful for a person's respiratory and general health. Avoiding any exposure to SHA, especially in enclosed areas, has the greatest benefit for health.

Key findings:

- The amount of environmental pollution increased significantly during sessions where a vape was being used, compared to the control session (no vaping). This tells us that SHA contains toxins that pollute the environment (it is not just harmless water vapour).
- The most common symptoms experienced by participants exposed to vaping were burning and dryness of the eyes, sore throat, cough, breathlessness, and headaches. These symptoms appeared within 15 minutes of SHA exposure and continued for some time after the exposure.
- Symptoms were also positively associated with the amount of SHA produced by the vape, meaning that the more SHA produced, the more symptoms experienced by participants.



The most common symptoms experienced by participants exposed to vaping were burning and dryness of the eyes, sore throat, cough, breathlessness, and headaches.

Study limitations:

- The room used in this study, a private office space, had its window and door closed during the experiments. This may not reflect real-life conditions. This means findings may overestimate how quickly the participants experienced these symptoms in response to the SHA exposure.
- The distance between the participants and the person using a vape was kept constant (1.5 metres). Again, this may not reflect real-life conditions.
- The study used a cross-over design, which means participant responses may have been influenced by a carry-over effect (see Box 1).
- This study did not have a 'blind' control group (participants who are unaware of which experiment session they are in) since the aerosol produced by the vapes was clearly visible to the participants. This could have influenced people's responses.

Box 1: What is the difference between control studies and cross-over design studies?

Research studies known as 'control studies' put participants into different groups for the duration of the study:

- control group – participants have no exposure to the treatment or condition being studied;
- experimental group (s) – participants are exposed to the treatment(s) or condition(s) being studied.

The effects of the exposure are then compared between the participants in these groups. So, for a study on the effects of SHA we could compare a group of people exposed to high SHA ('experimental group 1') to a group of people exposed to low SHA ('experimental group 2') and a group of people not exposed to SHA ('control group') to see if there were differences in symptoms experienced by each group.

In cross-over design studies, there is no control group. Instead, each participant acts as their own control. Each participant experiences both exposure and no exposure to the condition being studied at different times, and the effect of these different exposures is compared. This was the approach taken by Tzortzi et al (2023) study. Participants experienced high SHA, low SHA and no SHA at different times and their symptoms compared.

The advantage of control studies is that they allow us to compare different treatments or conditions at the same time. But these studies need a large number of participants, which can be both time-consuming and expensive. In cross-over studies, there are fewer participants because the same people try each treatment or condition, which saves time and money. However, one limitation of a cross-over design is the 'carry-over effect'. A carry-over effect is when a participant's experience in one experimental condition influences their response in following experimental conditions. For example, in the Tzortzi et al (2023) study if a participant experienced nose and throat irritation in the first vaping experiment, they may have expected to experience the same feelings in the second vaping experiment. This might have influenced their responses to the irritation questionnaire.

American Research

Son, Y., Giovenco, D. P., Delnevo, C., Khlystov, A., Samburova, V., & Meng, Q. (2020). Indoor Air Quality and Passive E-cigarette Aerosol Exposures in Vape-Shops. Nicotine & Tobacco Research, 22(10), 1772-1779. https://doi.org/10.1093/ntr/ntaa094

This study examined the impact of indoor e-cigarette use on SHA and THA. The study was carried out in five vape-shops in New Jersey (USA). SHA was assessed by indoor air quality measurements taken during the shops' opening and closing hours for a day. THA was measured through the levels of nicotine and other harmful chemicals on indoor surfaces and on five different materials (paper, baby clothing, glass, rubber ball and fur ball hair) placed in the vape-shops for 14 days.

Take home message:

Vaping causes SHA and THA in indoor environments. This has implications for homes and cars where vapes are used, especially for families with young children. Homes and cars should be vape-free as well as smoke-free to avoid exposure to harmful SHA and THA.

Key findings:

- Indoor air quality was influenced by factors such as the number of people and the ventilation system within the shop.
- Indoor air contaminants (harmful chemicals) were significantly higher during shop opening hours (when customers were actively vaping indoors), than during closing hours.
- The strong presence of nicotine and cancer-causing chemicals on various surfaces in the vape-shops indicated that vaping indoors causes THA.
- Notably, large amounts of nicotine were detected on the materials placed in the vape-shops, especially on the baby clothing and toys.

Study limitations:

- The sample size used in this study was small, only five vape shops in one city, so the results may not be representative of all vape shops across the USA or in other countries such as Australia.
- As the study was conducted in vape-shops, findings might not be directly applicable to SHA and THA from vaping in other indoor environments such as homes and cars. However, the study does show that nicotine from vaping is left on the type of materials and surfaces commonly seen in homes and cars.

Soule, E. K., Sousan, S., Pender, J., Thomas, L., Gold, E., Fresquez, S., Mooring, R., Coombs, V., Gogineni, A., & Tiet, A. (2023). Second hand electronic cigarette aerosol in vehicles impacts indoor air quality. Drug and Alcohol Dependence, 250, 110889. https://doi.org/ https://doi.org/10.1016/j.drugalcdep.2023.110889

This study examined the impact of electronic cigarette use on air quality in vehicles. Sixty participants over 18 years of age, who reported vaping regularly (including inside their own vehicle) took part in a controlled experiment. Participants were told to use their vape for 5 minutes (total of 10 puffs with 30 seconds in between) followed by as many puffs as they desired for 25 minutes. During this time the air quality in the vehicle was monitored.

Take home message:

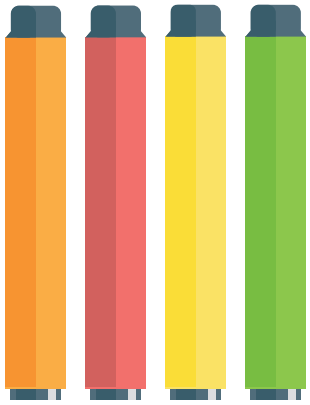
Vaping inside a vehicle can significantly increase air pollution. This suggests that people who do not vape, including children, will be exposed to SHA when they are in a vehicle with someone who is vaping. The study also found that disposable vape devices could produce larger amounts of SHA. Cars should be vape-free to protect children and adults who do not vape from SHA.

Key findings

- The level of SHA inside the vehicles was approximately 22 times higher when participants were vaping than at baseline (before participants used their vape).
- The number of puffs participants took during the experiment was directly linked to the increase in SHA. So, the greater the number of puffs, the higher the level of SHA.
- Most participants used disposable vape devices. These were found to produce significantly higher levels of SHA compared to pod mod devices.

Study limitations:

- The air quality of the vehicles was examined under quite controlled conditions, including a 10-puff directed session within a limited time and all the doors and windows of the vehicle closed. This may differ from typical vape use in vehicles. However, most study participants (two-thirds) reported vaping with the windows closed.
- Participants were allowed to adjust the climate control in their vehicles, which may have impacted (reduced) the level of SHA inside their vehicles.



Most participants used disposable vape devices. These were found to produce significantly higher levels of second hand aerosols compared to pod mod devices.

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Spanish Research

Ballbè, M., Fu, M., Masana, G., Pérez-Ortuño, R., Gual, A., Gil, F., Olmedo, P., García-Algar, Ó., Pascual, J. A., & Fernández, E. (2023). Passive exposure to electronic cigarette aerosol in pregnancy: A case study of a family. Environmental Research, 216, 114490. https://doi.org/https://doi.org/10.1016/j.envres.2022.114490

This case study describes the impact of one family's exposure to SHA from e-cigarettes. The family were a 40-year-old pregnant mother, a three-year-old child, and a 47-year-old father living in a two-bedroom apartment. The father had been vaping daily for about eight years, after quitting smoking. The mother had never smoked. The mother and child were not exposed to tobacco smoke at home, or anywhere else. They were only exposed to e-cigarette aerosol at home. The researchers collected urine, hair and saliva samples from each family member during the pregnancy and after the birth. They also collected a sample of cord blood at delivery and breast milk after delivery. They analysed the samples for nicotine, cancer causing chemicals, heavy metals and other harmful chemicals that were present in the vape refill liquid.

Take home message:

Harmful substances (particularly nicotine and heavy metals) were found in the mother and three-year-old's urine, hair and blood samples. Nicotine and heavy metals (copper and zinc) were also found in the mother's breast milk. This case study highlights the need to raise awareness about the potential health risks associated with exposure to SHA from vapes during pregnancy and early childhood. It also emphasises the benefits of having a vape-free home and car.

Key findings:

- The father had high levels of nicotine in his urine and saliva samples. Cancer-causing chemicals were also found in his samples. Heavy metals (zinc, copper, and nickel) were also present in very high levels. Levels of all toxic chemicals were higher for the father that the rest of the family.
- In the pregnant mother's samples, low levels of nicotine were detected, indicating exposure to SHA. Low levels of toxic chemicals and heavy metals, with the exception of nickel, were found in her samples. Nickel was present at higher levels than previously reported in the general population.
- No nicotine was detected in cord blood. Heavy metals (chrome, nickel, lead, and zinc) were detected.
- Nicotine was detected in the breast milk sample which indicates that the newborn was exposed to this toxic chemical.
- The three-year-old showed evidence of exposure to SHA in his urine and hair samples. Chemical levels were similar to those of his mother.

Study Limitations:

- The results from this study are from one family and might not be true for all pregnant women or young children living with someone who vapes. Findings may be different for families living in different household types (e.g., extended families). Other factors such as type and size of accommodation, the number of people who vape in a household, type of device used, and how often or where they vape may also be important.
- The researchers did not consider the diets of the family members, which could have influenced the presence of metal in blood and urine samples.