

Health Risks of E-Cigarettes

Background

E-cigarettes come in many different fruit and sweet flavours, and they have a modern design. This makes e-cigarettes not only attractive to smokers, but also to non-smoking adults and to young people. However, by no means e-cigarettes are harmless lifestyle products, but they pose risks to health.

What are e-cigarettes?

E-cigarettes consist of an energy source, a vaporizer, a liquid tank, and a mouthpiece. In e-cigarettes, a liquid, typically containing propylene glycol, glycerine, flavouring agents, and nicotine, is heated and aerolized. The resulting aerosol is inhaled into the lungs.

E-cigarettes fall into broad categories: Open systems (featuring refillable tanks and customization options), closed systems (using pre-filled capsules/pods that are replaced), and disposable e-cigarettes. The latest generation of disposable e-cigarettes

Key points in brief

- **The problem:** E-cigarettes are marketed as harmless lifestyle products, despite posing health risks.
- **The facts:** The aerosol from e-cigarettes contains substances that are harmful to health and carcinogenic. Their use can lead to addiction.
- **The solution:** Due to the health risks and the potential for addiction, non-smokers and especially young people should not use e-cigarettes and non-consumers should not be involuntarily exposed to the harmful substances in e-cigarette aerosol. The long-term goal of smokers who use e-cigarettes to quit smoking should be to stop using any harmful and addictive products.

is predominantly used by young individuals, and their market share is rapidly increasing.^{13,19}

What are the health risks of using e-cigarettes?

There is a wide variety of e-cigarettes available, which are different in terms of their filling volume, device performance and the composition of the liquids and thus in the amount of aerosol produced, nicotine released and harmful substances. These facts complicate the assessment of health risks.^{4,12,18}



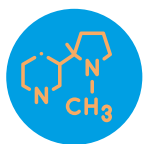
By heating the liquid, new substances may be produced that are harmful to health when inhaled. For example, carcinogenic substances such as formaldehyde, acetaldehyde and acrolein have been detected in the aerosol, as well as reactive oxygen compounds and metals, including nickel, chromium and lead.^{3,14}

Although the aerosol from e-cigarettes contains a lower amount of harmful substances than tobacco smoke, e-cigarettes pose risks to health and may cause addiction. Some ingredients in the aerosol are harmful to the respiratory tract.^{15,21} In addition, e-cigarette use can impair the function of blood vessels, promote oxidative stress and increase heart rate and blood

pressure.^{3,7,8,17} Due to the carcinogenic substances contained in the aerosol, there is concern that long-term e-cigarette use may be associated with an increased risk of cancer; however, to date there is no reliable evidence of a link between e-cigarette use and cancer.³ The nicotine in e-cigarettes, especially when released quickly and in large quantities, is addictive and may be harmful to health.^{5,6} In adolescents, nicotine use impairs brain development.^{2,9,23} When used during pregnancy, nicotine can harm the unborn child.²⁵ (Figure)

Current evidence does not allow reliable conclusions to be drawn regarding the possible long-term health effects of e-cigarette use.³

Figure
Health risks associated with e-cigarette use^{11,25}



Nicotine

- is addictive
- impairs brain development in adolescents
- use during pregnancy: impairs lung and brain development of the unborn child; preterm delivery, stillbirth



Other damage

- oxidative stress
- harmful to the genetic material
- harmful to cells
- impairment of the immune system
- impairment of wound healing



Lungs

- particles are deposited in the lungs
- various forms of pneumonia
- severe lung disease (EVALI*)



Use during pregnancy

- impairs lung development
- reduces birth weight and length growth



Cardiovascular system

- short-term increase in heart rate
- short-term increase in blood pressure
- damage to the inner wall of blood vessels (endothelial dysfunction)

*EVALI = e-cigarette or vaping product use associated lung injury

The concurrent use of e-cigarettes and conventional cigarettes (dual use), which is common, seems to be at least as harmful as smoking cigarettes or using e-cigarettes alone.²²

Exposure to second-hand aerosol from e-cigarettes

The use of e-cigarettes in smoke-free indoor environments exposes non-using bystanders to harmful emissions.^{10,24} Although the exposure is lower than from tobacco smoking, health risks cannot be ruled out, especially for sensitive persons such as children, pregnant women and chronically ill people.¹

Smoking cessation

Unlike nicotine replacement therapy, e-cigarettes are no medical devices for smoking cessation that have been tested for efficacy and safety. Nevertheless, some smokers use them with the aim to quit smoking. After

quitting smoking, however, many continue to use e-cigarettes in the long term;¹⁶ hence addiction and health risks are being upheld.

For smokers who are unable to quit with the help of evidence-based interventions, switching completely to e-cigarettes potentially may play a role in supporting cessation under controlled medical conditions. However, the most effective protection of health is to stop smoking as well as the use of all tobacco and nicotine products.

Conclusion

The aerosol from e-cigarettes contains substances that are harmful to health and nicotine containing e-cigarettes bear a high risk for addiction. Animal and cell studies as well as short-term clinical studies indicate that e-cigarette use causes various changes in the body that are likely to be harmful to health on long term, particularly to the cardiovascular system and the respiratory tract.

Given the extreme harms of smoking, for some smokers who are unable to quit with the help of evidence-based interventions, e-cigarettes may be beneficial if used to quit smoking completely, bearing in mind uncertainties about their long-term effects.^{3,20}

For non-smokers, especially non-smoking adolescents, they represent an avoidable health risk. Due to the unknown long-term health effects, non-smokers should completely abstain from e-cigarettes. To protect non-smokers, e-cigarettes should never be used indoors or in the presence of non-smokers.

Contact

Dr. Katrin Schaller
Phone: +49 6221 42 30 07
E-mail: who-cc@dkfz.de

German Cancer Research Center (DKFZ),
Cancer Prevention Unit and WHO
Collaborating Centre for Tobacco Control

More information

Further English publications are available at:
<https://www.dkfz.de/en/krebspraevention/Downloads/Downloads.html>.

Support increases the likelihood of successfully quitting smoking

The World Health Organization (WHO) *Quitting Toolkit* provides resources to help quit smoking, including toll-free quitlines worldwide, text message support, and mobile applications.



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Authors: Dr. Irina Treede, Dipl.-Biol. Sarah Kahnert, Dr. Katrin Schaller

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