



# HEATED TOBACCO: A RESEARCH REVIEW

The premise of heated tobacco (HT) is simple: it is heated, never burnt, so avoiding many of the harmful byproducts of combustion. But what do we know about the physiological and health effects of heated tobacco? Find out more in this research review infographic.

## CELLS, TOXICANTS AND TOXICITY



### → HOW DOES HEATED TOBACCO AEROSOL COMPARE TO CIGARETTE SMOKE?

Harmful and Potentially Harmful Constituent (HPHCs) can cause, or may cause, smoking-related disease. A broad body of scientific research demonstrates **96%**<sup>[1]</sup> reductions in harmful constituents levels in heated tobacco aerosol compared to cigarette smoke.

### → HOW DO REDUCED HPHCs AFFECT *IN-VITRO* TOXICITY?

**40 studies**<sup>[2]</sup> show reductions in harmful chemical levels in HT aerosols translate into significant reductions *in-vitro* toxicity (mutagenicity, genotoxicity, cytotoxicity) compared to cigarette smoke.



Across **14 studies** using the Bacterial Mutagenicity assay (Ames test), researchers demonstrated either an absence, or a significant reduction in mutagenicity, compared to cigarettes.



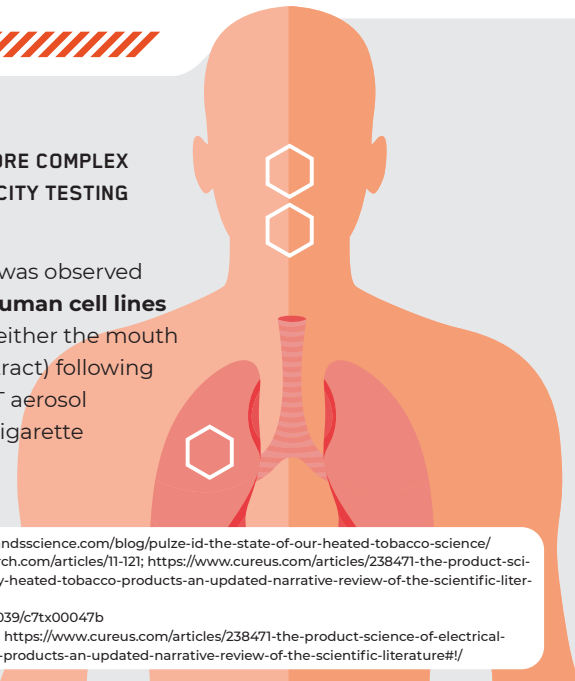
In **12 studies** using the Micronucleus assay found either no evidence of genotoxicity, or a significant reduction compared to cigarettes.



**14 studies** using the Neutral Red Uptake assay for cytotoxicity indicate HT products typically demonstrate significant reductions compared to cigarettes.

### → WHAT CAN MORE COMPLEX CELLULAR TOXICITY TESTING TELL US?

Lower toxicity was observed across **three human cell lines** (all present in either the mouth or respiratory tract) following exposure to HT aerosol compared to cigarette smoke<sup>[3]</sup>.



### → 24 BIOMARKERS OF EXPOSURE FROM 32 STUDIES

24 biomarkers<sup>[4]</sup> of exposure – which indicate the presence of HPHCs or their metabolites in the body – showed significant reductions compared to cigarettes across a range of studies.



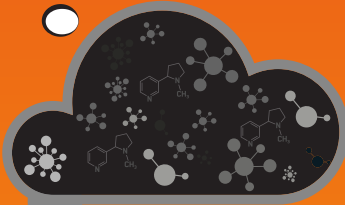
1. <https://imperialbrandscience.com/blog/pulze-id-the-state-of-our-heated-tobacco-science/>  
2. <https://f1000research.com/articles/11-121>; <https://www.cureus.com/articles/238471-the-product-science-of-electrically-heated-tobacco-products-an-updated-narrative-review-of-the-scientific-literature>  
3. <https://doi.org/10.1039/c7tx00047b>  
4. Cordery et al 2024. <https://www.cureus.com/articles/238471-the-product-science-of-electrically-heated-tobacco-products-an-updated-narrative-review-of-the-scientific-literature#!>



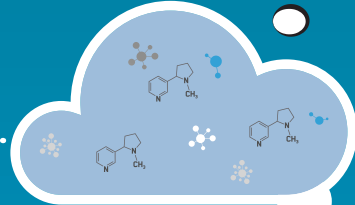
➔  
**NICOTINE DELIVERY  
FROM HEATED TOBACCO**



**Adult smoker satisfaction** and urge-to-smoke scores are broadly comparable between HT and cigarettes<sup>[1]</sup>.



**HT systems deliver nicotine efficiently to the blood**, while importantly not exceeding that of cigarettes<sup>[2, 3, 4]</sup>.



**Peak nicotine levels** and overall nicotine exposures are lower – potentially indicating HT has a lower abuse liability compared to cigarettes<sup>[5]</sup>.

**TOGETHER, RESEARCH SUGGESTS HT PROVIDES AN ACCEPTABLE AND SATISFYING ALTERNATIVE TO CIGARETTES**

CIGARETTES

HEATED TOBACCO

1. <https://www.nature.com/articles/s41598-023-36259-1>  
 2. <https://doi.org/10.1016/j.jrtph.2017.08.006>  
 3. <https://doi.org/10.1093/ntr/ntv220>  
 4. <https://doi.org/10.1016/j.jrtph.2017.07.032>  
 5. <https://imperialbrandsscience.com/press-office/new-clinical-research-pulzeid-demonstrate-credentials-as-a-viable-smoking-alternative/>

## → PHYSIOLOGICAL EFFECTS OF TRANSITIONING TO HEATED TOBACCO

Users of HT demonstrated **improved cardiovascular function<sup>[a]</sup>** to the same levels as cigarette abstinence<sup>[1]</sup>.

**Improved lung function<sup>[b]</sup>** was also observed in HT users compared to adult smokers of cigarettes<sup>[3]</sup>.

HT aerosols exhibit a reduction in the biological activity associated with atherosclerosis – **a potential cause of heart disease<sup>[c]</sup>** – compared to cigarettes<sup>[2]</sup>.

[a] As measured by anaerobic threshold, working capacity, and peak oxygen uptake  
[b] As measured by specific airway conductance and forced expiratory flow  
[c] In-vitro toxicological assessment via an human cardiovascular model on-a-chip

1. <https://doi.org/10.1111/j.1520-037x.2007.06036.x>  
2. <https://www.frontiersin.org/journals/toxicology/articles/10.3389/ftox.2024.1395670/full>  
3. <https://doi.org/10.1016/j.yrtph.2009.12.013>

## AIR QUALITY, AND HOW HEATED TOBACCO IS PERCEIVED

### HT SYSTEMS AND AIR QUALITY

Other authors have concluded HT product use is typically associated with IAQ marker levels **indistinguishable from background**, or comparable to other conventional indoor environmental pollutants<sup>[2]</sup>.

The available scientific evidence indicates a range of indoor air quality chemical markers are either undetectable, or present at markedly lower concentrations, compared to cigarette smoke; these are **typically comparable to background levels** and/or below regulatory standards<sup>[1]</sup>.

Based on current science<sup>[6]</sup>, use of HT products indoors is unlikely to present a concern to bystanders. However, HT users should **always be courteous** to those around them.

### PERCEPTIONS OF HT SYSTEMS

Out of 3,600 people surveyed<sup>[3]</sup>:



**47.5%**

saw HT products as less harmful than cigarettes.



**24.6%**

viewed them as equally harmful.



**1.8%**

believed they were actually more harmful.



**26.1%**

stated they did not know.



→ HT SYSTEMS AND NON-SMOKER TAKE-UP, OR 'ON-RAMPING' TO NICOTINE

HT products are far more likely to be used by adult smokers than non-smokers<sup>[4]</sup>. HT use by never smokers was very small: recently reported as just 0.1%<sup>[5]</sup>.

### HEATED DEBATE

This infographic is based on various academic reviews featuring **over 700 references**. The growing weight of evidence suggests heated tobacco products can make a meaningful contribution to tobacco harm reduction (THR) globally. The **UK Committee for Toxicity** concluded there's "likely a reduction in risk for conventional smokers" who use HT instead of cigarettes<sup>[7]</sup>.

**New Zealand's Associate Health Minister and Public Health England (PHE)** also recognise the harm reduction potential of heat-not-burn technology, with PHE arguing heated tobacco may be "considerably less harmful than smoking". The Cochrane review cited evidence that "smokers switching to HTPs have lower exposure to toxicants and carcinogens than smokers continuing to smoke."<sup>[8]</sup>

Like all potentially harm reduced next generation products, further research is warranted to better understand what happens when adult smokers transition to HT to reduce and replace cigarettes. Increased scientific knowledge will help regulators develop risk proportionate regulation that maximises THR potential for individual adult smokers and likely improves broader public health.

1. Cordery et al 2024. <https://www.cureus.com/articles/238471-the-product-science-of-electrically-heat-ed-tobacco-products-an-updated-narrative-review-of-the-scientific-literature#!/>
2. <https://doi.org/10.1016/j.chemosphere.2018.05.039>
3. <https://doi.org/10.3390/ijerph17072394>
4. Carreras G, Minardi V, Lugo A, et al.: Italians are still loyal to conventional cigarettes, despite novel tobacco products. *Ann Ist Super Sanita*. 2022, 58:264-268. 10.4415/ann\_22\_04\_06
5. Cox S, Brown J, Kock L, Shahab L: Prevalence and characteristics of ever regular use of non-combustible nicotine for 1 year or more: a population survey in England. *Harm Reduct J*. 2021, 18:114. 10.1186/s12954-021-00562-9
6. <https://doi.org/10.4209/aaqr.200653>
7. [https://cot.food.gov.uk/sites/default/files/heat\\_not\\_burn\\_tobacco\\_statement.pdf](https://cot.food.gov.uk/sites/default/files/heat_not_burn_tobacco_statement.pdf)
8. <https://www.gov.uk/government/publications/nicotine-vaping-in-england-2022-evidence-update/nicotine-vaping-in-england-2022-evidence-update-summary#chapter-14-heated-tobacco-products>

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