



HEATED TOBACCO: A RESEARCH REVIEW

The premise of heated tobacco 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

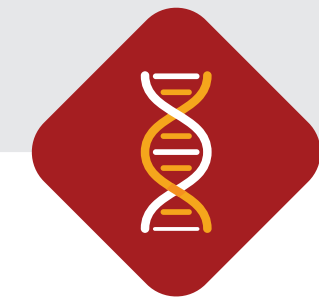


→ HOW DOES HT AEROSOL COMPARE TO CIGARETTE SMOKE?

Harmful and Potentially Harmful Constituent (HPHCs) can cause, or may cause, smoking-related disease. A broad body of scientific research demonstrates **90%**^[1] reductions in harmful constituents levels in heated tobacco (HT) aerosol compared to cigarette smoke.

→ HOW DO REDUCED HPHCS AFFECT *IN-VITRO* TOXICITY?

35 studies^[1] show reductions in harmful chemical levels in HT aerosols translate into significant reductions in *in-vitro* toxicity (mutagenicity, genotoxicity, cytotoxicity) compared to cigarette smoke.



Across **12 studies** using the bacterial mutagenicity assay (Ames test), researchers demonstrated either an absence or a significant reduction in mutagenicity, compared to combustible cigarettes.



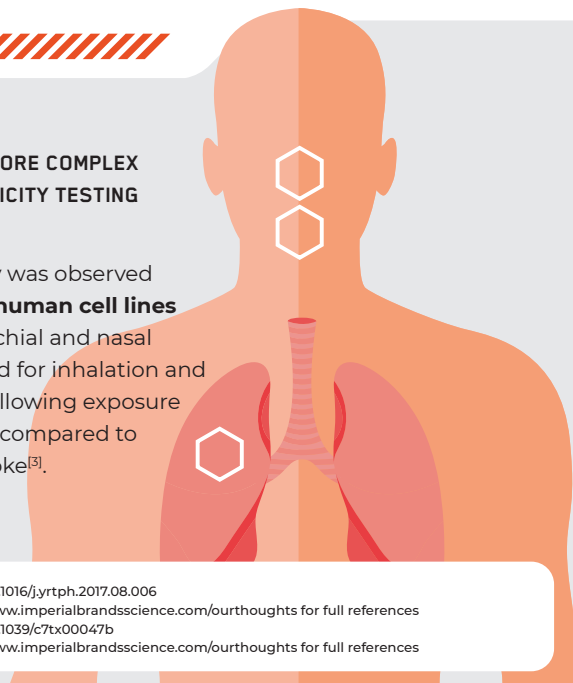
In **10 studies** using the *in-vitro* micronucleus (IVM) assay, 4 found no evidence of genotoxicity and 6 a significant reduction compared to combustible cigarettes.



13 studies using the Neutral Red Assay for cytotoxicity indicate HT products typically demonstrate significant reductions compared to combustible cigarettes.

→ WHAT CAN MORE COMPLEX CELLULAR TOXICITY TESTING TELL US?

Lower toxicity was observed across **three human cell lines** (buccal, bronchial and nasal epithelial used for inhalation and exhalation) following exposure to HT aerosol compared to cigarette smoke^[3].



→ 24 BIOMARKERS OF EXPOSURE FROM 32 STUDIES

24 biomarkers^[4] of exposure – which indicate the presence of HPHCs or their metabolites in the body – showed significant reductions compared to combustible cigarettes **across 32 studies**.

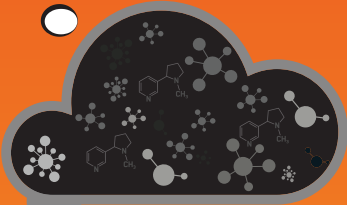


1. <https://doi.org/10.1016/j.jrtp.2017.08.006>
2. See feature at www.imperialbrandscience.com/ourthoughts for full references
3. <https://doi.org/10.1039/c7tx00047b>
4. See feature at www.imperialbrandscience.com/ourthoughts for full references

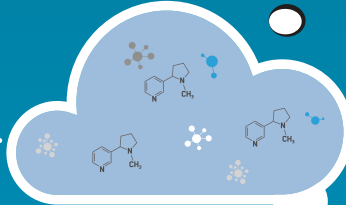
→
**NICOTINE DELIVERY
FROM HEATED TOBACCO**



Adult smoker satisfaction urge-to-smoke scores are similar between HT and cigarettes^[5].

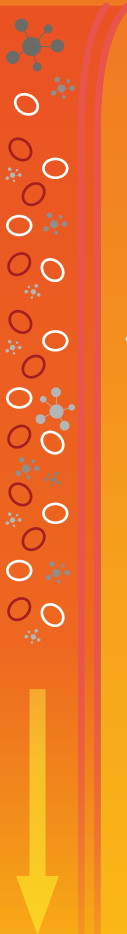
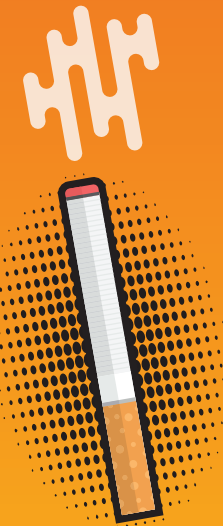


Nicotine levels in HT aerosols are comparable to those in combustible cigarette smoke^[1].

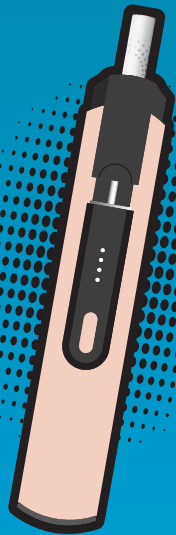


Delivery of nicotine to blood is also comparable, and importantly does not exceed that of cigarettes^[2, 3, 4].

CIGARETTES



HEATED TOBACCO



TOGETHER, THIS MEANS HT CAN PROVIDE NICOTINE COMPARABLE TO THE SMOKING EXPERIENCE.

1. <https://doi.org/10.1093/ntr/ntv220>
 2. <https://doi.org/10.1016/j.jrtp.2017.08.006>
 3. <https://doi.org/10.1093/ntr/ntv220>
 4. <https://doi.org/10.1016/j.jrtp.2017.07.032>
 5. <https://doi.org/10.1016/j.jrtp.2017.07.032>



PHYSIOLOGICAL EFFECTS OF TRANSITIONING TO HEATED TOBACCO

In one study, users of a HT product demonstrated **improved physiological performance^[a]** to the same levels as cigarette abstinence^[1].

Improved lung function^[b] was also observed in HT users compared to adult smokers of combustible cigarettes^[3].

Another study showed **improved cardiovascular markers^[c]** after using a HT system compared to continued smoking^[2].

[a] As measured by anaerobic threshold, working capacity, and peak oxygen uptake
[b] As measured by specific airway conductance and forced expiratory flow
[c] As measured by decreased resting heart rate and rate-pressure product

1. <https://doi.org/10.1111/j.1520-037x.2007.06036.x>
2. <https://doi.org/10.1177/1074248408321571>
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^[2].

Across 16 studies Indoor Air Quality (IAQ) chemical markers in HT aerosols were much lower than those found in cigarette smoke – or were present at such low levels they could not even be accurately quantified or detected!^[1]

Based on current science^[9], use of HT products indoors is unlikely to present a concern to bystanders. However, HT users should **always be courteous** to those around them.

HT SYSTEMS ARE PERCEIVED POSITIVELY BY ADULT SMOKERS
Out of 3,600 people surveyed about HT^[3]:



47.5%
saw HT products as less harmful than combustible 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. Reported HT use by never smokers **across 5 studies** was very small: just 0.02% to 0.4%^[4, 5, 6, 7, 8].

HEATED DEBATE

This infographic is based on an academic review of **over 325 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** concludes that there's "likely a reduction in risk for conventional smokers" who use HTPs instead of smoking cigarettes. **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".

Like all potentially harm-reduced Next Generation Products, we believe further research is warranted to better understand

what happens when adult smokers transition to HT to reduce and replace combustible cigarettes.

Increased scientific knowledge will help policy makers and regulators develop risk proportionate regulation that maximises THR potential for individual adult smokers and for optimal population-wide health benefits.

1. See feature at www.imperialbrandsscience.com/ourthoughts for full references
2. <https://doi.org/10.1016/j.chemosphere.2018.05.039>
3. <https://doi.org/10.3390/ijerph17072394>
4. <http://dx.doi.org/10.1136/tobaccocontrol-2018-054390>
5. <https://doi.org/10.1371/journal.pone.0191008>
6. <https://doi.org/10.1371/journal.pone.0220241>
7. <http://dx.doi.org/10.1136/tobaccocontrol-2018-054719>
8. <http://dx.doi.org/10.1136/tobaccocontrol-2019-054949>
9. <https://doi.org/10.4209/aaqr.200653>

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