

# Thirdhand smoke and indoor smoking bans

## Who is this fact sheet for?

This fact sheet discusses how to protect children and non-smokers from all sources of tobacco smoke pollution.

Sources of tobacco smoke pollution include:

- thirdhand smoke from indoor smoking
- smoky breath
- thirdhand smoke on the clothing, skin and hair of people who smoke.

This information may be useful for:

- people who look after children such as parents, grandparents, and carers in childcare centres or family day care
- health professionals working in nursing, midwifery and neonatal intensive care units
- workers in aged care facilities and disability or mental health services.



## What is thirdhand smoke (THS)?

**Secondhand smoke (SHS)** refers to the smoke in the air during or soon after someone has smoked a cigarette.<sup>1</sup> When a cigarette is smoked indoors, secondhand smoke rapidly spreads and particles of smoke can stay airborne for several hours.<sup>2,3</sup> The smoke undergoes further chemical reactions, and evidence shows that it becomes more toxic as it ages.<sup>4</sup>

**Thirdhand smoke (THS)** refers to the chemicals and particles from SHS that settle onto and coat walls, furniture, carpet, clothes, toys, dust and other objects. There, they can

react with other chemicals to form new ones, and they can be released back into the air hours or months after they were first deposited.<sup>2,3,5</sup> Thirdhand smoke builds up over time in the homes and cars of people who smoke, and can persist for months to years even if tobacco is no longer smoked.<sup>2,5-10</sup>

Many studies measure nicotine in order to estimate how much thirdhand smoke is present in household dust and on indoor surfaces.<sup>7</sup> Nicotine in dust has been found in the homes of people who smoke at levels 12 to 21 times those in non-smokers' homes.<sup>11</sup> Dust can easily become airborne and be breathed in. Nicotine can also react with gases normally present in homes to form cancer-causing chemicals.<sup>10</sup>

Cleaning may reduce but not entirely remove nicotine and other thirdhand smoke pollutants.<sup>2,4,11-13</sup> Nicotine levels largely decrease after people who smoke vacate their house and it's cleaned and/or renovated, but they are still higher than in homes of non-smokers.<sup>11</sup>



## Health effects of thirdhand smoke

Human tissue studies and animal experiments show that thirdhand smoke can have a range of health effects.

These include reduced birthweight, slower wound healing, hyperactivity and damage to DNA that could lead to cancer. Tests also show increased fat levels in the liver, unhealthy changes to cholesterol, higher blood sugar levels, problems with insulin, and lung problems including increased inflammation and damaged air sacs. Long term these effects may contribute to an increased risk for cirrhosis and cancer of the liver, lung diseases such as chronic obstructive pulmonary disease (COPD) and asthma, and metabolic syndrome (which predisposes people to stroke, heart disease, and type 2 diabetes).<sup>2,6,7,14</sup>

### Who is most at risk?

Infants and very young children are more likely to be exposed to thirdhand smoke than older children and adults and to be at risk from its potential health effects. Very young children are more exposed to thirdhand smoke in house dust, on surfaces and when it's re-emitted into the air. They spend more time indoors and in contact with contaminated objects such as floors, carpets and blankets, and close to any caregivers who may smoke. They have thinner skin which may make it easier to absorb more thirdhand smoke. They place their hands and contaminated objects in their mouths and breathe in more dust as they are closer to the floor. Also, their smaller size and faster breathing rate means that relative to their weight, they breathe in more air than adults do.<sup>2,3,5</sup>

## **Recommendation**

To reduce thirdhand smoke, keep all indoor spaces totally smokefree. The best way someone who smokes can protect others is by always smoking outdoors after closing doors and windows, and to smoke away from others, especially children, when outdoors.



## **Smoky breath**

A minor source of secondhand smoke is smoky breath, that is, the tobacco smoke coming from the lungs of a person after they finish a cigarette.<sup>15</sup> Studies show that the levels of fine particles of smoke and volatile organic compounds (VOCs) in breathe drop quickly within the first two to three minutes after the person finishes a cigarette.<sup>15-17</sup>

By itself, the levels of chemicals from tobacco smoke from smokers' breath after a finishing a cigarette are very low and may not affect people's health. However, it may be a concern for some particularly sensitive persons if they are in immediate contact with a person soon after they have a cigarette. Also, smoky breath can contribute to indoor pollution where many people who smoke come indoors soon after smoking.<sup>15,16,18</sup>

## **Recommendation**

In cases where people want to reduce exposure to secondhand smoke as much as possible, we recommend that someone who smokes wait at least two minutes before coming indoors to clear the smoke from their breath.<sup>15</sup>



## **Thirdhand smoke on persons who smoke**

Thirdhand smoke is found on the clothing, skin and hair of people who smoke.<sup>2,8,12,16,19</sup>

### **Clothing**

A variety of clothing fabrics including wool, linen, cotton, rayon and acetate tend to absorb cigarette smoke. One study showed that washing cotton fabric reduces the amount of thirdhand smoke on it.<sup>8</sup> Polyester fabrics have been found to take up and release significantly less thirdhand smoke than other tested cloths.<sup>8,16,19</sup>

## **Recommendation**

In cases where people want to reduce exposure to thirdhand smoke as much as possible, we suggest that when having a cigarette, people wear a jacket or other covering to protect their clothes from smoke and remove it and store it outside before going indoors.

## **Thirdhand smoke on the hands of people who smoke**

When people smoke, nicotine and tar coat their fingers that hold the cigarette.<sup>3,20</sup> These substances may then rub off onto surfaces they touch or handle, and this would include other people. However, there is a lack of research on whether thirdhand smoke exposure through hand contact has any health effects.<sup>20-22</sup> Hand washing helps reduce nicotine, but it is unclear how effective it is for reducing tar.<sup>8,23</sup>

Also, people who smoke are more likely to be carriers of meningococcal disease and smoking is also a risk factor for pneumonia and developing viral-related symptoms (the common cold and influenza).<sup>24-26</sup> Therefore hand washing may benefit people who smoke, their workmates and persons in their care by reducing the risk of cross infection.

## **Recommendation**

State guidelines for control of infectious diseases may require that health workers must wash their hands before attending to the people in their care.<sup>27,28</sup> This would include after having a cigarette break. Managers could check if this is a requirement of their workplace. Otherwise, health or care workers who smoke could be encouraged to wash their hands by their managers as a best practice.

## **Bedsharing with babies**

Babies who sleep with a parent who smokes have a much higher risk of sudden unexpected death in infancy (SUDI or cot death), even when their parents don't smoke near them.<sup>29-31</sup> Research shows that infants who bed share with parents who smoke have higher levels of exposure to tobacco smoke pollutants. This may be because they have close contact with parents' smoke-contaminated clothing, hair and skin over many hours each night.<sup>32</sup>

## **Recommendation**

To reduce the risk of SUDI, recommendations include that babies sleep separately in a cot in their parents' room.<sup>33</sup> More recommendations to keep babies safe in a smokefree environment are at the end of this fact sheet.

## How effective are total indoor smoking bans?

Whether people smoke and where they smoke makes a difference to other people's tobacco smoke exposure and health risk.

**HIGH.** In homes and buildings where smoking is allowed inside, non-smokers' exposure to tobacco smoke is high, which can cause serious illness in both children and adults. In some cases, this leads to death.

**LOW.** The lowest exposure to tobacco smoke pollutants is in homes or buildings where all persons are non-smokers.

**IN-BETWEEN.** In a building with a total indoor smoking ban where non-smokers and people who smoke live or work together, non-smokers' exposure to pollutants from tobacco smoke is low, but still higher than places where all persons are non-smokers.<sup>3,34-36</sup> Levels of chemicals from tobacco smoke in the air tend to be low, but levels of thirdhand smoke deposited on surfaces or dust are often higher – sometimes as high as that in homes which have no smoking restrictions.<sup>3,22,36-38</sup>

This is likely to be due to a few reasons:

- Smoke pollutants can come into a building in the air or dust, or on smokers' breath, skin, hair and clothes.<sup>3,18,21,38</sup> Smoke drift into indoor areas from outdoor smoking areas that are near open doors and windows is a common problem, which may be reduced by closing them.<sup>34,39,40</sup>
- Thirdhand smoke can persist for a long time once it's in an environment. Past indoor smoking, time passed since becoming a smokefree space, and cleaning or renovating may affect the level of thirdhand smoke.<sup>3,9-11,21,37,41</sup>

It is unknown what the health risks are from the low level of exposure to tobacco smoke pollutants where an indoor smoking ban is place.<sup>2,21</sup> However, any potential health effects are probably most likely to be more significant among groups of sensitive people. These include babies as they have underdeveloped lungs and immune defences, and people with health conditions such as asthma, cystic fibrosis or cardiovascular disease.<sup>1,2,42</sup> Of most concern are the potential effects on premature, low birthweight babies because they already have high rates of illness and death.<sup>21,22</sup>

## Summary of recommendations

The best way to protect children and non-smokers from tobacco smoke is for parents, family members or workers to stop smoking completely.

However, if a person is not ready to stop smoking, the next best option is to always smoke outdoors after closing doors and windows, and to smoke away from others, especially children, when outdoors.

To protect babies from sudden unexpected death in infancy (SUDI) it's important that they sleep separately in a cot in their parents' room.

To keep tobacco smoke pollution as low as possible, particularly if people who smoke are living or working with babies, young children or adults vulnerable to ill health, we recommend that when people smoke they:

- wait at least two minutes before coming indoors to clear the smoke from their breath.
- wear a jacket or other covering to protect their clothes from smoke and remove it and store it outside before going indoors.
- wash their hands before attending to the people in their care.

## Help to stop smoking

Workplaces can visit our website to see how they can support people who smoke when they are ready to quit: [quit.org.au/communities-and-places-resources](https://quit.org.au/communities-and-places-resources)

The best way to stop smoking is to talk with Quitline and use stop smoking medications. These include prescribed tablets or [nicotine patches, lozenges, mouth spray, inhalator or gum](#). Your doctor or pharmacist can advise you on what would suit you.

If you are taking any medicines, talk with your doctor or pharmacist as they may need to look at your medicines before you stop smoking.

## Contact Quitline

Quitline is a welcoming, free and confidential counselling service. Quitline counsellors are experts at helping you gain the skills to break free from smoking or vaping, or both. We will help you build and keep up your motivation to quit and help you create a quit plan that works for you. We listen carefully and answer your questions without judgement and can support you throughout your quit journey. Quitline counsellors can also support you if you are using vapes to stop smoking and can help you stop vaping.

## There are many ways to contact Quitline:

- **Call 13 7848** Mon – Fri 8am to 8pm
- **Text 'call back' to 0482 090 634** (VIC, SA, WA, NT only)
- **Webchat** at [quit.org.au](https://quit.org.au) (VIC, SA, WA, NT only)
- **Facebook Messenger @quitvic** or **WhatsApp 61 385 832 920** (VIC, SA, WA, NT only)
- Ask Quitline to call you back **for free** at [quit.org.au/callback](https://quit.org.au/callback)

Aboriginal and Torres Strait Islander people can call Quitline and ask to yarn with an Aboriginal and/or Torres Strait Islander Quitline Counsellor if they wish, for Culturally sensitive support, delivered by mob, for mob.

Quitline has worked with people in the LGBTIQ+ community to make Quitline a safe and inclusive space. You can speak to Quitline in a language other than English: call 13 7848 and tell us you need an interpreter and we will call you back. We also use the National Relay Service with people with a hearing or speech impairment.

## Go online: [quit.org.au](https://quit.org.au)

Create your own quit plan to stop smoking or vaping with easy-to-find information. You'll find tips, distractions, tools and stories from people who quit.

*Please note, this information is for general use only. Please consult your health professional for further advice.*

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## References

1. U.S. Department of Health and Human Services. The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General. [Atlanta, Ga.]: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2006.
2. Jacob P, 3rd, Benowitz NL, Destailats H, Gundel L, Hang B, Martins-Green M, et al. Thirdhand Smoke: New Evidence, Challenges, and Future Directions. *Chemical Research in Toxicology* 2017;30(1):270-294.
3. Matt GE, Quintana PJ, Hovell MF, Bernert JT, Song S, Novianti N, et al. Households contaminated by environmental tobacco smoke: sources of infant exposures. *Tobacco Control* 2004;13(1):29-37.
4. Matt GE, Quintana PJ, Destailats H, Gundel LA, Sleiman M, Singer BC, et al. Thirdhand tobacco smoke: emerging evidence and arguments for a multidisciplinary research agenda. *Environmental Health Perspectives* 2011;119(9):1218-26.
5. Drehmer JE, Walters BH, Nabi-Burza E, Winickoff JP. Guidance for the Clinical Management of Thirdhand Smoke Exposure in the Child Health Care Setting. *Journal of Clinical Outcomes Management* 2017;24(12):551-559.
6. Martins-Green M, Adhami N, Frankos M, Valdez M, Goodwin B, Lyubovitsky J, et al. Cigarette smoke toxins deposited on surfaces: implications for human health. *PLoS One* 2014;9(1):e86391.
7. Diez-Izquierdo A, Cassanello-Penarroya P, Lidon-Moyano C, Matilla-Santander N, Balaguer A, Martinez-Sanchez JM. Update on thirdhand smoke: A comprehensive systematic review. *Environmental research* 2018;167:341-371.
8. Bahl V, Jacob P, 3rd, Havel C, Schick SF, Talbot P. Thirdhand cigarette smoke: factors affecting exposure and remediation. *PLoS One* 2014;9(10):e108258.
9. Matt GE, Quintana PJE, Zakarian JM, Hoh E, Hovell MF, Mahabee-Gittens M, et al. When smokers quit: exposure to nicotine and carcinogens persists from thirdhand smoke pollution. *Tobacco Control* 2017;26(5):548-556.
10. Schick SF. Thirdhand smoke: here to stay. *Tobacco Control* 2011;20(1):1-3.
11. Matt GE, Quintana PJ, Zakarian JM, Fortmann AL, Chatfield DA, Hoh E, et al. When smokers move out and non-smokers move in: residential thirdhand smoke pollution and exposure. *Tobacco Control* 2011;20(1):e1.
12. Northrup TF, Jacob P, 3rd, Benowitz NL, Hoh E, Quintana PJ, Hovell MF, et al. Thirdhand Smoke: State of the Science and a Call for Policy Expansion. *Public Health Reports* 2016;131(2):233-8.
13. Matt GE, Quintana PJE, Hoh E, Zakarian JM, Dodder NG, Record RA, et al. Remediating Thirdhand Smoke Pollution in Multiunit Housing: Temporary Reductions and the Challenges of Persistent Reservoirs. *Nicotine Tob Res* 2021;23(2):364-372.
14. Hang B, Wang P, Zhao Y, Chang H, Mao JH, Snijders AM. Thirdhand smoke: Genotoxicity and carcinogenic potential. *Chronic Dis Transl Med* 2020;6(1):27-34.
15. Invernizzi G, Ruprecht A, De Marco C, Paredi P, Boffi R. Residual tobacco smoke: measurement of its washout time in the lung and of its contribution to environmental tobacco smoke. *Tobacco Control* 2007;16(1):29-33.
16. Ueta I, Saito Y, Teraoka K, Miura T, Jinno K. Determination of volatile organic compounds for a systematic evaluation of third-hand smoking. *Analytical Sciences* 2010;26(5):569-74.



17. Gordon SM, Wallace LA, Brinkman MC, Callahan PJ, Kenny DV. Volatile organic compounds as breath biomarkers for active and passive smoking. *Environmental Health Perspectives* 2002;110(7):689-98.
18. Sheu R, Stonner C, Ditto JC, Klupfel T, Williams J, Gentner DR. Human transport of thirdhand tobacco smoke: A prominent source of hazardous air pollutants into indoor nonsmoking environments. *Sci Adv* 2020;6(10):eaay4109.
19. Noble RE. Environmental tobacco smoke uptake by clothing fabrics. *The Science of the total environment* 2000;262(1-2):1-3.
20. Torres S, Merino C, Paton B, Correig X, Ramirez N. Biomarkers of Exposure to Secondhand and Thirdhand Tobacco Smoke: Recent Advances and Future Perspectives. *International Journal of Environmental Research and Public Health* 2018;15(12).
21. Northrup TF, Khan AM, Jacob P, 3rd, Benowitz NL, Hoh E, Hovell MF, et al. Thirdhand smoke contamination in hospital settings: assessing exposure risk for vulnerable paediatric patients. *Tobacco Control* 2016;25(6):619-623.
22. Northrup TF, Matt GE, Hovell MF, Khan AM, Stotts AL. Thirdhand Smoke in the Homes of Medically Fragile Children: Assessing the Impact of Indoor Smoking Levels and Smoking Bans. *Nicotine & Tobacco Research* 2016;18(5):1290-8.
23. Curwin BD, Hein MJ, Sanderson WT, Nishioka MG, Buhler W. Nicotine exposure and decontamination on tobacco harvesters' hands. *The Annals of Occupational Hygiene* 2005;49(5):407-13.
24. Arcavi L, Benowitz NL. Cigarette smoking and infection. *Archives of internal medicine* 2004;164(20):2206-2216.
25. Bagaitkar J, Demuth DR, Scott DA. Tobacco use increases susceptibility to bacterial infection. *Tobacco Induced Diseases* 2008;4:12.
26. United States. Dept. of Health and Human Services. The health consequences of smoking - 50 years of progress: a report of the Surgeon General. Rockville, MD: U.S. Dept. of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014.
27. Department of Health (Victoria). Infection control - standard and transmission-based precautions. Melbourne, Vic: Victorian State Government; 2023. Available from: <https://www.health.vic.gov.au/infectious-diseases/infection-control-standard-and-transmission-based-precautions>. Accessed 20th March, 2024.
28. Queensland Health. Clinical practice guidelines procedures. Hand hygiene. Brisbane: Queensland Government; 2024. Available from: <https://www.health.qld.gov.au/clinical-practice/guidelines-procedures/diseases-infection/infection-prevention/standard-precautions/hand-hygiene>.
29. Fleming P, Pease A, Blair P. Bed-sharing and unexpected infant deaths: what is the relationship? *Paediatric Respiratory Reviews* 2015;16(1):62-7.
30. Mitchell EA, Thompson JM, Zuccollo J, MacFarlane M, Taylor B, Elder D, et al. The combination of bed sharing and maternal smoking leads to a greatly increased risk of sudden unexpected death in infancy: the New Zealand SUDI Nationwide Case Control Study. *The New Zealand Medical Journal* 2017;130(1456):52-64.
31. Moon RY. SIDS and Other Sleep-Related Infant Deaths: Evidence Base for 2016 Updated Recommendations for a Safe Infant Sleeping Environment. *Pediatrics* 2016;138(5).

32. Joseph DV, Jackson JA, Westaway JA, Taub NA, Petersen SA, Wailoo MP. Effect of parental smoking on cotinine levels in newborns. *Archives of disease in childhood. Fetal and neonatal edition* 2007;92(6):F484-488.
33. SIDS and Other Sleep-Related Infant Deaths: Updated 2016 Recommendations for a Safe Infant Sleeping Environment. *Pediatrics* 2016;138(5).
34. Johansson A, Hermansson G, Ludvigsson J. How should parents protect their children from environmental tobacco-smoke exposure in the home? *Pediatrics* 2004;113(4):e291-295.
35. Protano C, Andreoli R, Manini P, Vitali M. How home-smoking habits affect children: a cross-sectional study using urinary cotinine measurement in Italy. *International Journal of Public Health* 2012;57(6):885-92.
36. Rumchev K, Jamrozik K, Stick S, Spickett J. How free of tobacco smoke are 'smoke-free' homes? *Indoor Air* 2008;18(3):202-208.
37. Matt GE, Quintana PJ, Hovell MF, Chatfield D, Ma DS, Romero R, et al. Residual tobacco smoke pollution in used cars for sale: air, dust, and surfaces. *Nicotine & Tobacco Research* 2008;10(9):1467-75.
38. Matt GE, Quintana PJE, Hoh E, Zakarian JM, Chowdhury Z, Hovell MF, et al. A Casino goes smoke free: a longitudinal study of secondhand and thirdhand smoke pollution and exposure. *Tobacco Control* 2018;27(6):643-649.
39. World Health Organization; Tobacco Free Initiative. Protection from exposure to second-hand tobacco smoke: policy recommendations. Geneva, Switzerland: World Health Organization; 2007. Available from: <http://who.int/tobacco/resources/publications/wntd/2007/PR%5Fon%5FShS.pdf>.
40. Brennan E, Cameron M, Warne C, Durkin S, Borland R, Travers MJ, et al. Secondhand smoke drift: examining the influence of indoor smoking bans on indoor and outdoor air quality at pubs and bars. *Nicotine & Tobacco Research* 2010;12(3):271-7.
41. Matt GE, Quintana PJ, Fortmann AL, Zakarian JM, Galaviz VE, Chatfield DA, et al. Thirdhand smoke and exposure in California hotels: non-smoking rooms fail to protect non-smoking hotel guests from tobacco smoke exposure. *Tobacco Control* 2014;23(3):264-72.
42. California Environmental Protection Agency. Air Resources Board. Office of Environmental Health Hazard Assessment. Proposed identification of Environmental Tobacco Smoke as a toxic air contaminant: as approved by the Scientific Review Panel on June 24, 2005. Part B: Health effects. Sacramento, Calif: California EPA; 2005. Available from: <http://www.arb.ca.gov/regact/ets2006/ets2006.htm>  
<ftp://ftp.arb.ca.gov/carbis/regact/ets2006/app3part%20b.pdf>.