

Non-smokers exposed to three times above safe levels of particles when living with smokers

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Credit: Vera Kratochvil/public domain

Non-smokers who live in a house with smokers are exposed to three times the officially recommend safe levels of damaging air particles, according to a study published online in the journal *Tobacco Control*.

Living with smokers is the same as living in smoke-free homes in

heavily polluted cities such as Beijing or London, found researchers who have said moving to a smoke-free home could have major health benefits for non-smokers.

There is already strong evidence to suggest that exposure to second hand smoke is linked to a wide range of adverse health events such as respiratory and heart illness.

Accordingly, many governments have introduced measures to restrict their population's exposure to second hand smoke within workplace and leisure settings.

Fine particulate matter (PM_{2.5}) such as fine dust or soot suspended in the air, has been widely used as a marker for second hand smoke exposure with data from bars and restaurants showing concentrations of second hand smoke-derived PM_{2.5} that frequently exceed the US Environmental Protection Agency levels described as "unhealthy for sensitive groups" 24 hour limit or the World Health Organization's (WHO) guidance limits.

Main outdoor sources of particulate matter include exhaust fumes from motor vehicles and industrial emissions and more is known about what impact this has on health than the impact within indoor environments.

Therefore, Scottish researchers set out to explore fine particulate matter less than 2.5 µm (PM_{2.5}) concentrations in smoking and non-smoking homes in Scotland to estimate the amount of PM_{2.5} inhaled by different age groups.

The researchers studied data from four linked studies carried out in Scotland between 2009 and 2013 that had real time measurements of PM_{2.5} in homes, and combined them with data on typical breathing rates and time-activity patterns.

In all four studies, homes that were likely to have a significant additional source of PM_{2.5} (such as coal or solid fuel fires) were excluded.

Three of the studies used the same method to assess and measure PM_{2.5} concentrations – a personal aerosol monitor that was placed in the main living area of participants' homes for a period of 24 hours – while the other study used a new, low-cost, particle-counting device.

Collectively, the four linked studies produced air quality data from 93 smoking homes with a further 17 non-smoking households. Most sampling was for a 24-hour period with the exception of one study data, which was generally carried out over a period of 6–7 days.

The results showed that the average PM_{2.5} concentrations from the 93 smoking homes were about 10 times those found in the 17 non-smoking homes.

Non-smokers living with smokers typically had average PM_{2.5} exposure levels more than three times higher than the WHO guidance for annual exposure to PM_{2.5} (10 µg/m³).

Many non-smokers living in smoking homes inhaled similar quantities of PM_{2.5} to non-smokers who lived and worked in smoke-free environments in cities such as Beijing or London with high levels of air pollution.

The researchers also calculated that overall, homes where unrestricted, heavy-smoking activity took place produced second hand smoke concentrations that were, on average, about 10 times higher than homes where efforts to reduce or restrict second hand smoke exposure were more common.

Some homes studied had particularly high rates of smoking. Around a

quarter of homes had 24 hour average concentrations in excess of 111 $\mu\text{g}/\text{m}^3$, more than 11 times that recommended as an annual average concentration by WHO.

The researchers also estimated that the overall mass of PM_{2.5} inhaled over an 80-year period for a person living in a typical smoke free home was about 0.76g compared with a similar person living in a smoking home, who would inhale about 5.82g.

Non-smokers living in smoking households would experience reductions of over 70% in their daily inhaled PM_{2.5} intake if their home became smoke-free, the researchers calculated, and the reduction was likely to be greatest for the very young and for older members of the population.

They concluded: "These findings ultimately support the need for efforts to reduce SHS [second hand smoke] exposure in the home, most notably through the implementation of smoke free home rules and smoke free multi-unit housing policies."

Dr Sean Semple of University of Aberdeen and lead author, said: "Smokers often express the view that outdoor air pollution is just as much a concern as the [second-hand smoke](#) in their home.

"These measurements show that second-hand tobacco smoke can produce very high levels of toxic particles in your home: much higher than anything experienced outside in most towns and cities in the UK. Making your home smoke-free is the most effective way of dramatically reducing the amount of damaging fine particles you inhale."

More information: *Tobacco Control*, tobaccocontrol.bmj.com/lookup/...ocontrol-2013-051635

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