

## Study reveals lung changes in mice exposed to second-hand smoke in utero

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Credit: Vera Kratochvil/public domain

Mice exposed to second-hand smoke only during gestation undergo abnormal changes to lung structure and function that persist into adulthood, according to research published in the open access journal *Respiratory Research*. The study provides new insight into the role second-hand smoke exposure may play in predisposing unborn offspring to adult lung diseases.

Male and female mice exposed to second-hand smoke during gestation were found to have altered lung structure that was indicative of tissue damage. In addition, [lung function](#) tests on those offspring after they reached adulthood revealed that tidal volume (the amount of air inhaled and exhaled per breath during normal breathing) and minute volume (the volume of air inhaled or exhaled per minute during normal breathing) were significantly decreased in male mice that had been exposed to second hand smoke, but not in [female mice](#). Molecular analysis of [lung tissue](#) revealed that several genes were impacted by second hand smoke exposure, including a gene in humans, called A1AT, which is a known genetic risk factor for emphysema.

Professor Arthur Penn, senior author from Louisiana State University, said: "Our study strongly indicates that in utero second hand smoke exposure alone has significant persistent repercussions on the respiratory system, suggesting that in utero second-hand smoke exposure can predispose to adult [lung diseases](#) in mice."

Dr Alexandra Noël, lead author and Assistant Professor at Louisiana State University School of Veterinary Medicine, said: "The more pronounced lung function changes in male versus female offspring are consistent with results of other studies showing that lung development of male fetuses lags behind that of females".

In the US, over 126 million people each year, including pregnant women, are exposed to second-hand smoke. While it is known that offspring of mothers who smoked while pregnant exhibit altered lung function and increased susceptibility to respiratory diseases, not much is known about the effects of direct exposure to second-hand smoke on fetal lungs.

Pregnant mice were exposed to second-hand smoke mixed with filtered air in order to isolate the mice from any other potential airborne

exposures that could affect the developing fetus. Mice from the litters were then allowed to develop to adulthood isolated from exposures other than filtered air and separated by sex and the type of in utero exposure to create four test groups. Lung function measurements, examination of lung tissue for signs of damage, and molecular analysis of [lung](#) tissue were all performed once the mice had reached adulthood at 15 weeks of age.

This study is limited by the fact that it was carried out in [mice](#), so it is difficult to extrapolate the findings directly to humans. The results however, provide a possible explanation for the association between second-hand smoke exposure in pregnant women and elevated risk of respiratory diseases in their offspring. Another limitation is that levels of [second-hand smoke](#) exposure used in this experiment may not be directly comparable to exposure levels encountered by human fetuses.

**More information:** Alexandra Noël et al, Sex-specific lung functional changes in adult mice exposed only to second-hand smoke in utero, *Respiratory Research* (2017). [DOI: 10.1186/s12931-017-0591-0](https://doi.org/10.1186/s12931-017-0591-0)

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