

Boys who smoke in their early teens found to risk passing on harmful epigenetic traits to future children

August 30 2023



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A new study suggests boys who smoke in their early teens risk damaging the genes of their future children, increasing their chances of developing

asthma, obesity and low lung function.

Research published in *Clinical Epigenetics* is the first human study to reveal the biological mechanism behind the impact of fathers' early teenage [smoking](#) on their [children](#).

Researchers from the University of Southampton and the University of Bergen in Norway investigated the epigenetic profiles of 875 people, aged 7 to 50, and the smoking behaviors of their fathers.

They found [epigenetic changes](#) at 19 sites mapped to 14 genes in the children of fathers who smoked before the age of 15. These changes in the way DNA is packaged in cells (methylation) regulate gene expression (switching them on and off) and are associated with asthma, obesity and wheezing.

"Our studies in the large international [RHINESSA](#), RHINE and [ECRHS](#) studies have shown that the health of future generations depends on the actions and decisions made by young people today—long before they are parents—in particular for boys in early puberty and mothers/grandmothers both pre-pregnancy and during pregnancy," says Professor Cecilie Svanes from the University of Bergen and Research Director of the RHINESSA study.

"It is really exciting that we have now been able to identify a mechanism that explains our observations in the cohorts."

"Changes in epigenetic markers were much more pronounced in children whose fathers started smoking during puberty than those whose fathers had started smoking at any time before conception," says co-lead author of the paper Dr. Negusse Kitaba, Research Fellow at the University of Southampton. "Early puberty may represent a critical window of physiological changes in boys. This is when the [stem cells](#) are being

established which will make sperm for the rest of their lives."

The team also compared the paternal preconception smoking profiles with people who smoked themselves and those whose mothers smoked before conception.

"Interestingly, we found that 16 of the 19 markers associated with fathers' teenage smoking had not previously been linked to maternal or personal smoking," says Dr. Gerd Toril Mørkve Knudsen from the University of Bergen and co-lead author of the study. "This suggests these new methylation biomarkers may be unique to children whose fathers have been exposed to smoking in [early puberty](#)."

The number of young people smoking has fallen in the UK in recent years. But co-author Professor John Holloway, from the University of Southampton and the NIHR Southampton Biomedical Research Centre, is concerned about children taking up vaping.

"Some animal studies suggest that nicotine may be the substance in [cigarette smoke](#) that is driving epigenetic changes in offspring," says Professor Holloway. "So it's deeply worrying that teenagers today, especially teenage boys, are now being exposed to very high levels of nicotine through vaping."

"The evidence from this study comes from people whose fathers smoked as teenagers in the 60s and 70s, when smoking tobacco was much more common. We can't definitely be sure vaping will have similar effects across generations, but we shouldn't wait a couple of generations to prove what impact teenage vaping might have. We need to act now."

The new findings have significant implications for public health. They suggest a failure to address harmful exposures in young teenagers today could damage the respiratory health of future generations, further

entrenching health inequalities for decades to come.

The University of Southampton's LifeLab program engages with young people to show how lifestyle choices can impact their health and the health of any children they may have in the future. Dr. Kath Woods-Townsend, LifeLab Program manager says, "Parents, teachers and young people themselves are concerned about the impact of vaping. We're working with our Youth Panel to understand the role vaping plays in their lives and to cocreate resources that will help inform young people about the risks."

More information: Negusse Kitaba et al, Fathers' preconception smoking and offspring DNA methylation., *Clinical Epigenetics* (2023). DOI: [10.1186/s13148-023-01540-7](https://doi.org/10.1186/s13148-023-01540-7)

Provided by University of Southampton

Citation: Boys who smoke in their early teens found to risk passing on harmful epigenetic traits to future children (2023, August 30) retrieved 9 May 2024 from <https://medicalxpress.com/news/2023-08-boys-early-teens-epigenetic-traits.html>

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