

# Open fireplaces could decrease life expectancy by up to 1.6 years, suggests modeling study

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A [recent study](#) published in the *Journal of Building Engineering* shows that using open fireplaces for housewarming can decrease your life

expectancy for up to 1.6 years, due to the fine particles that are emitted in the firewood combustion. These are the results of an experimental and computational modeling study led by the Faculty of Sciences of the University of Lisbon.

If you are reading us from a quite cold climate, chances are that you might resort to firewood to warm your home. It is one of the cheapest fuels in several countries, which contributes to wood-burning being one of the main sources of indoor fine particles—particles with a diameter inferior to 2.5 micrometers (for comparison, the smallest the human eye can see is 100 micrometers).

These fine particles have been identified as the cause of multiple respiratory and cardiovascular illnesses, as well as other [health issues](#). While there are detailed guidelines for the maximum levels of these and other particles outdoors, defined by the World Health Organization and, in several cases also by national jurisdictions, indoor levels are not regulated.

The researchers evaluated how much particle pollution was released by open fireplaces and woodstoves into homes and estimated the decrease in [life expectancy](#) that results from this increased exposure to fine particles. They considered that families would use the wood-burning equipment for four hours during evenings throughout the warming season.

"We realized that there were a few knowledge gaps about the emission of fine particles by fireplaces. One of them was the emission factor—that is, how much fine particles are emitted per kilogram of firewood. Unsurprisingly, open fireplaces emit the most—almost 60mg per kilogram of firewood, which, in the scenarios we considered, corresponds to a decrease in life expectancy by 1 to 1.6 years," says Nuno Martins, first author, researcher at Instituto Dom Luiz, at Ciências

ULisboa.

As a comparison, the results show that the emission of fine particles by standard closed woodstoves is about one-third of the emission of open fireplaces, while the resulting decrease in life expectancy is less than half of a year. The experiments also included a closed woodstove with outdoor air admission, which drastically restricted the emission of fine particles into the occupied space, resulting in negligible impacts on the life expectancy of the occupants.

The study was organized in three phases. First, the authors measured experimentally the emission of fine particles by woodstoves and fireplaces.

Then, this data was used in computer simulations of residential houses in three different cities—Birmingham (UK), Groningen (Netherlands), and Copenhagen (Denmark)—considering aspects such as thermal characteristics, the infiltration of outdoor air, and the heating needs of the building typology, among others. Lastly, these simulations were combined with data from the health effects of outdoor air pollution.

"Overall, open fireplaces should be avoided due to the negative health effects. An improvement would be to replace them with closed woodstoves or, ideally, replace wood-burning equipment completely," says Guilherme Carrilho da Graça, coordinator of the study and researcher at Instituto Dom Luiz, at Ciências ULisboa.

For the future, the researchers stress that even for closed woodstoves—the equipment with lower fine particle emissions in this study—strategies can be studied to minimize opening the glass door. Also, they warn that more research is needed concerning mechanical ventilation systems that can reduce the level of exposure to [fine particles](#).

**More information:** Nuno R. Martins et al, Health effects of PM2.5 emissions from woodstoves and fireplaces in living spaces, *Journal of Building Engineering* (2023). [DOI: 10.1016/j.jobbe.2023.107848](https://doi.org/10.1016/j.jobbe.2023.107848)

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