Providing information on wood heating to decrease indoor air pollution in France

Researchers:

Coralie Chevallier

Elise Huillery

Mathieu Perona

Rita Abdel Sater

Sector(s): Environment & Energy, Health

Location: Paris area, France

Sample: 281 households

Target group: Families and households

Outcome of interest: Pollution Attitudes and norms Health outcomes

Intervention type: Information Nudges and reminders

AEA RCT registration number: AEARCTR-0007980

Partner organization(s): Direction Interministérielle à la Transformation Publique, Direction régionale et interdépartementale à l'environnement et l'énergie Île-de-France, Direction Générale de la Santé, Agence Régionale de la Santé, Fonds Air Bois de l'Essonne

Wood heating is a key source of indoor and outdoor pollution, posing harm to individuals' health and the environment. Yet, wood-burning is a common household practice, even when it is not used as a primary source of heating. Researchers evaluated the impact of a program in France that monitored indoor pollution and informed households of the negative effects of wood heating. Overall, the program led to a reduction in the usage of wood heating but only for households who received personalized feedback on their pollution levels.

□□□□□□□ □□□□□□□

Outdoor and indoor air pollution are both significant causes of mortality worldwide.[1], Indoor air pollution in particular is a serious issue in many higher-income countries, where residents spend more than 80 percent of their time in closed environments on average.[2]

Household behavior can significantly impact the quality of indoor air, with cooking, tobacco, and wood burning being some of the primary sources of indoor pollution. Across economics, the literature is mixed on the effectiveness of information provision in changing behaviors, with effects differing by the content and format of information delivered. In recent years, several studies have found that personalized information on household energy usage through smart meters can alter households' consumption habits, while others have found more generic information on best practices to also be effective at reducing pollution. However, few interventions have compared the effects of generic and personalized information. Can information on the risks related to indoor combustion activities improve households' air quality, and can personalized information on current pollution levels

enhance this effect?

التقييم سياق

In France, the Indoor Air Quality Observatory estimates that 34 percent of dwellings are rendered unsafe by high concentrations of PM2.5 (fine particulate matter that poses health risks at high levels),[3], but households tend to overestimate indoor air quality.[4] , Wood burning is an especially large contributor to pollution as measured though PM2.5. While wood burning is only responsible for 3 percent of Europe’s household energy production, residential wood burning constitutes 45 percent of all PM2.5 contamination in Europe.[5]

Despite this, the general public is largely unaware of the negative impacts of wood burning. Furthermore, most households in France have not invested in high-quality wood burning equipment and are unaware of best practices regarding wood burning. In France, only 21 percent of occasional wood burners believe that wood burning impacts indoor pollution, and 48 percent say they would not abide by a wood burning ban if one were implemented.

Photo: Shutterstock.com

التدخل عن تفصيلية معلومات

Researchers conducted a randomized evaluation to test the impact of general and personalized information regarding the relationship between wood burning and indoor pollution on households’ knowledge, polluting activities, and air quality. This intervention was developed in collaboration with the Interministerial Directorate for Public Transformation (DITP) and the Île-de-France Regional and Intergovernmental Department of Environment and Energy (DRIEE). Researchers randomly assigned 281

households that participated in the study into one of three groups:

1. **Generic information group (93 households):** Households in this group were provided a series of eight informational leaflets. These leaflets varied by week, but generally contained information about the types of activities that produce PM2.5 emissions and associated health risks, as well as potential mitigation techniques, with a specific focus on wood burning.
2. **Generic + personalized information group (94 households):** In addition to the generic informational leaflets, households in this group also received personalized information on their own PM2.5 emissions over the prior week. This information was collected from air quality monitors, which were installed in all households (including those that did not receive personalized information). Households selected for personalized information received a figure of their own air quality over time, with times and dates of heightened pollution levels highlighted. Furthermore, these households received information on their own air quality relative to households in the comparison group.
3. **Comparison group (94 households):** Households in this group did not receive access to any information.

The core generic informational intervention took place between January and March 2020. All households also completed two online surveys: one prior to the start of the intervention (between August and December 2019), and one after the intervention was completed (at the end of March 2020). These surveys measured individuals' knowledge about air pollution, knowledge about wood burning, and their own self-reported pollution practices, including wood burning. For all households, air quality monitors collected information on PM2.5 concentration every five minutes throughout the intervention.

Participants were recruited into the evaluation through a website, which offered to install an air quality monitor in homes. Of the 4200 people who volunteered from the website, 370 reported wood burning on occasion (the population of interest for this study), and 281 of these households were ultimately eligible for the study. The sample population for this study, which was based in Ile-De-France, France, was relatively highly educated (with 46 percent of respondents having a Masters' degree or above) and had high mean incomes. Within this sample, half of participants engaged in wood burning more than once a week at baseline.

□□□□□□□ □□□□□□□ □□□□□□□□□ □□□□ □□□□□□□□

Both general and personalized information increased households' awareness of pollution, but only personalized information improved households' measured air quality.

Air quality: Using data from air quality monitors, PM2.5 decreased by 24 percent in the personalized information group relative to the comparison group, while no significant change was observed in the general information group. The personalized information group started to engage in significantly different polluting behaviors starting in the third week of the intervention, which persisted until the end of the intervention. Furthermore, WHO guidelines state that individuals should not be exposed to PM2.5 concentrations greater than 25 μg/m3 more often than three times a year. Over the four months of the intervention, households in the personalized information group were over this threshold for 1.44 days from a base of 2.91 in the comparison group (a 50 percent decrease).

Among those in the personalized information group, households in the top quartile of PM2.5 pollution at baseline accounted for the majority of the effectiveness of the intervention. These households, which were less affluent and reported more wood burning at prior to the study, reduced their indoor pollution by 36 percent relative to the comparison group. This corresponded to a drop in the number of days with PM2.5 concentrations over WHO guidelines from 12.4 days to 5.9 days, a 52 percent decrease.

Knowledge of sources of pollution: Groups receiving both general information and personalized information had higher levels of knowledge on a range of pollution-related topics. For instance, they were more likely to cite both wood burning and cigarette smoking as primary sources of indoor PM2.5 pollution. However, neither group was more likely to mention candles, incense, or

cooking as sources of pollution after the intervention. Increases in perceptions of wood-burning as a source of pollution were particularly concentrated among the highest quartile of polluted households at baseline. Though both groups gained more information on the polluting nature of wood burning generally, only the personalized information intervention led to a decrease in perceived home air quality.

Perceived risks of pollution: Though the intervention provided information regarding health and environmental risks associated with pollution (and wood burning in particular), neither the general information nor the personalized information groups altered their perceptions of pollution's health risks. Furthermore, households were no more likely to support anti-wood burning regulations, and no less likely to report enjoying lighting a fire. They also did not report any differences in their levels of wood burning during the intervention (though households receiving information were more likely to report an intention to decrease wood burning going forward). Researchers suggest that this lack of self-reported behavior change, despite observed decreases in pollution levels, may result from inaccurate self-reporting or memory issues.

Researchers' findings suggest that information can be highly effective at reducing household pollution, particularly among the most polluted households, and particularly when information is personalized to individuals' pollution habits. The pollution reduction across all individuals receiving personalized information, which averages 1.3 μg/m3, may be significant for public health. As little as a 1 μg/m3 increase in PM2.5, for instance, is associated with a 55 percent higher risk of dementia[6], and an 11 percent increase in mortality from Covid-19.[7]

---

1. Burnett, Richard, Hong Chen, Mieczysław Szyszkowicz, Neal Fann, Bryan Hubbell, C. Arden Pope III, Joshua S. Apte, J. S., Michael Brauer, Aaron Cohen, Scott Weichenthal, et al. 2018. "Global estimates of mortality associated with long-term exposure to outdoor fine particulate matter." Proceedings of the National Academy of Sciences 115(38): 9592–9597. https://doi.org/10.1073/pnas.1803222115

2. Klepeis, Neil E., William C. Nelson, Wayne R. Ott, John P. Robinson, Andy M. Tsang, Paul Switzer, Joseph V. Behar, Stephen C. Hern, and William H. Engelmann. 2001. "The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants." Journal of Exposure Science & Environmental Epidemiology 11(3): 231–252. https://doi.org/10.1038/sj.jea.7500165

3. Boulanger, Guillaume, Thomas Bayeux, Corinne Mandin, Séverine Kirchner, Benoit Vergriette, Valérie Pernelet-Joly, and Pierre Kopp. 2017. "Socio-economic costs of indoor air pollution: A tentative estimation for some pollutants of health interest in France." Environment International 104: 14–24. https://doi.org/10.1016/j.envint.2017.03.025

4. Langer, S., Ramalho, O., Le Ponner, E., Derbez, M., Kirchner, S., and Mandin, C. 2017. "Perceived indoor air quality and its relationship to air pollutants in French dwellings." Indoor Air 27(6): 1168–1176. https://doi.org/10.1111/ina.12393

5. Oudin, Anna, David Segersson, Rolf Adolfsson, and Bertil Forsberg. 2018. "Association between air pollution from residential wood burning and dementia incidence in a longitudinal study in Northern Sweden." PLoS One 13(6): e0198283. https://doi.org/10.1371/journal.pone.0198283

6. Wu, X., Nethery, R. C., Sabath, M., Braun, D., and Dominici, F. 2020. "Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis." Science Advances 6(45): eabd4049. https://doi.org/10.1126/sciadv.abd4049