Air pollution at home, work and school: Evidence from Ireland

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Introduction

Air pollution is an important risk factor for poor health and early death. Most research on the health effects of air pollution measures outdoor air pollution near people's homes and uses this to represent their exposure to air pollution. However, people do not spend all their time at home. Most adults spend a large portion of their day at work, while children and young people spend most of their time at school or college. Air pollution levels in these places may differ from levels where people live.

This study compares levels of outdoor air pollution at people's homes with levels at their place of work, school or college. It also examines how the difference between the two levels varies by key population characteristics including socioeconomic position, commuting patterns, etc.

Data and methods

The study links information on home and work, school or college locations (at small area level) from the 2022 Census of Population with detailed maps of annual air pollution levels from the Environmental Protection Agency (EPA). The maps cover four pollutants: fine particulate matter, coarser particulate matter, nitrogen dioxide and ozone. Fine particulate matter, which originates largely from burning solid fuel for heating, and nitrogen dioxide, derived from road transport, largely diesel engines, are the main contributors to poor air quality in Ireland. The analysis includes approximately 1.5 million workers (those working mainly from home are excluded) and 1.1 million students. For each person, air pollution levels at home and work, school or college are compared.

Results

Average air pollution levels at home and work, school or college meet current European Union limits, but they are above the stricter World Health Organization guidelines. For most pollutants, air pollution levels are higher at work, school or college than at home, with the differences most pronounced for nitrogen dioxide. On average, workers are exposed to almost 50 per cent more nitrogen dioxide at work than at home. Nitrogen dioxide shows the largest difference because it is highly localised and originates mainly from road traffic, so it builds up in the urban areas where many people work.

The size of the difference in air pollution levels between home and work, school or college varies across the population. It tends to be larger for more advantaged socioeconomic groups, such as those with higher education, homeowners and households with more cars. These groups are more likely to live in less polluted areas and to travel into more polluted areas. However, a larger difference does not mean higher overall exposure. People in less advantaged socioeconomic positions tend to live in more polluted areas. For nitrogen dioxide, renters face higher absolute levels than homeowners both at home and at work, even though the difference between the two locations is smaller for them.

Commuting patterns are strongly associated with air pollution levels and differences between home and work, school or college. People who travel from a rural home to an urban workplace experience the largest difference between

home and work levels. Among students, the difference is largest for those in third level education, as colleges and universities are concentrated in cities.Using outdoor air pollution levels at the home alone can therefore understate the pollution people are exposed to. Adjusting for the time spent at work, school or college can help correct for this. For particulate matter and ozone, the adjustment is small, but for nitrogen dioxide it increases estimated air pollution levels by around 8 per cent for workers and 4 per cent for students.

Conclusions

For pollutants that disperse evenly across an area, such as particulate matter, air pollution measured at the home is a reasonable proxy for outdoor air pollution exposure. For nitrogen dioxide, which is more localised, home-based measures can understate exposure. This is particularly true for people who commute into cities.

This finding has implications for research on the links between air pollution and health. If home-based measures understate the pollution people encounter, research linking air pollution to health may not fully capture its effects, especially for nitrogen dioxide. Future research should consider including information on the locations in which people spend their time, as well as indoor air quality in these locations.