

# New study reveals high levels of pollution on London Underground

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Researchers from King's College London have carried out the first comprehensive study of fine particles on the London Underground to evaluate the exposure of people travelling on different parts of the

network.

In the study, published today in the journal *Environment International*, they found that concentrations of fine particles (PM2.5) which are linked to several [health problems](#), were many times greater than in other [modes of transport](#) such as cycling, driving and taking a bus and those in subway systems around the world.

Researchers monitored [pollution levels](#) by wearing special backpacks fitted with devices that measure PM2.5 levels during their different testing campaigns. These included comparing the variations in PM2.5 levels underground to those above ground in congested diesel areas (Oxford Street) or in parkland (Hyde Park), comparing across most of the underground network and analysing the physical and chemical characteristics of PM2.5 on the southbound platform at Hampstead Northern Line station.

They found that:

- PM2.5 concentrations in the Underground network were approximately 15 times greater than in the surface and roadside environments in central London.
- Concentrations varied between lines and locations, with the Victoria Line experiencing the highest levels and Docklands Light Railway and the District Line the lowest on parts of the lines.
- The median concentrations recorded on trains on the Victoria and Northern lines are greater than any of the concentrations reported from studies in Beijing, Guangzhou, Los Angeles, Mexico, New York, Seoul, Taipei, Sydney, and Barcelona.
- Considering passenger numbers and measured PM2.5 concentrations the stations with the most exposure and where interventions would be recommended are Oxford Circus,

Waterloo and London Bridge.

- At Hampstead station where exposure was measured throughout the day, minimum concentrations were observed between 3.00 and 6.00 and maximum between 9.00 and midnight.
- Those who travel on the London Underground are exposed to higher concentrations of PM2.5 than those who travelled on other modes of transport.
- A typical daily commute can make up a significant proportion of a person's daily exposure to PM2.5.

Lead author Dr. David Green, Senior Research Fellow in the School of Population Health & Environmental Sciences at King's College London said: "Our aim in this study was to make high-quality measurements of the PM2.5 that people are exposed to in the London Underground. The results show that they can be some of the highest concentrations they will encounter during their day. Currently, our understanding of the health effects of air pollution is based on measurements taken by fixed measurement stations above ground. Clearly these don't represent what people are exposed to as they travel on the underground and these new measurements will help us improve these assessments."

Inhalation of particulate pollution is known to have adverse health impacts including heart disease, stroke, lung cancer, and chronic obstructive pulmonary disease. However, the relative toxicity of PM2.5 in subway environments compared to above-ground remains poorly understood.

"There might be ways to reduce your exposure such as switching to an alternative line with lower concentrations of PM2.5 or for shorter journeys it might be possible to switch to alternative modes of transport," Dr. David Green said.

On average, the London Underground handles 2.8 million passenger

journeys each day and the average journey is 47 minutes.

The study was carried out in collaboration with Transport for London and provides information for their ongoing program of improving the air quality of the London Underground.

The team is planning to continue to work with Transport for London to fully examine the health effects, including on London Underground workers. [This interactive map](#) allows the results to be studied in more detail.

**More information:** J.D. Smith et al. PM2.5 on the London Underground, *Environment International* (2019). [DOI: 10.1016/j.envint.2019.105188](#)

Provided by King's College London

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