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What are the adverse health effects of exposure to dust on the London Underground?

Submission date
04/11/2021

Recruitment status
No longer recruiting

Registration date
08/11/2021

Overall study status
Completed

Last Edited
04/07/2024

Condition category
Respiratory

[_] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
The London Underground (LU) is the world's oldest subterranean transport system. It normally provides 2.8 million journeys daily and employs around 20,000 staff. Those who travel and work on the LU are exposed to varying amounts of air pollution in the form of tunnel dust, also known as particulate matter (PM).

When PM is inhaled, it can cause health risks. While the health risks of PM in outdoor air have been studied extensively, the environment inside the LU is very different. Concentrations of PM in the LU are about 15 times higher than what can usually be found outdoors in London, and there are many metallic components, such as iron, due to friction between the wheels of the train and the rails, which are not normally seen with outdoor pollution. The potential health risks associated with tunnel dust in the LU have not been studied and are poorly understood.

The aim of our study is to develop a better understanding of the (short-term) health effects of exposure to LU tunnel dust. Here we propose a secondary data analysis of routinely collected sickness absence records for LU staff. Examining an occupational group such as this is a common – and potentially efficient - way of examining an issue with potentially wider public health impact. Workers tend to have higher exposures than the general public, making signals of concern more readily detected; conversely, an absence of harm in this group can be reassuring.

Who can participate?
Employees of the LU employed between 01/01/2014 and 31/12/2019, including those who have joined or left between this period.

What does this study involve?
Data collected from the LU Human Resources department will be used to analyse the frequency of sickness absence due to lung and heart illnesses. Selected participants may also be invited to wear a lightweight personal dust monitor to measure their exposure to PM throughout the working day.

What are the possible benefits and risks of participating?
The results of this study will allow us to better understand any potential occupational hazards

employees may see during their work. It may lead to safer and cleaner working environments within the LU.

Where is the study run from?
Imperial College London (UK)

When is the study starting and how long is it expected to run for?
November 2021 to December 2023

Who is funding the study?
Transport for London (UK)

Who is the main contact?
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Contact information

Type(s)
Scientific

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Additional identifiers

Protocol serial number

P92035

Study information

Scientific Title
The adverse health effects of exposure to dust on the London Underground

Study objectives
Variations in the rates of sickness absence from cardiorespiratory disease between groups of employees on the LU will reflect their relative exposures to underground particulate matter.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 12/10/2021, Imperial College Research Ethics Committee (RGIT Office, Room 221, Medical School Building, St Mary's Campus, Imperial College London, London, W2 1NY, UK; +44 (0)20 7594 9484; rgitcoordinator@imperial.ac.uk), ref: 21IC7231

Primary study design
Observational

Study design
Dynamic retrospective cohort study

Study type(s)
Other

Health condition(s) or problem(s) studied
Cardiorespiratory sickness absence

Interventions
This retrospective cohort study will use London Underground (LU)'s Human Resources (HR) electronic records, stored on the SAP (System Analysis and Software Development) database.

Sickness absence records for all LU staff employed at any time between 01/01/2014 and 31/12/2019 inclusive will be assembled and given a unique project identification number. The HR records include position title which dictate the likely level of tunnel dust exposure for each employee and includes changes in job allowing for variations in exposure. Based on each employee's position title, job description, and location of work, employees who are judged to have similar exposure levels to particulate matter (PM) will be grouped into distinct exposure categories. Based on the exposure categories, a 'job exposure matrix' or JEM will be developed, based on each member of staff's exposure to dust.

Alongside this process, a measurement campaign will be undertaken throughout the LU network to apply quantitative estimates of PM exposure to each exposure category. A series of stationary measurements will be undertaken on representative station platforms, gates, offices, and in drivers' cabins. Selected employees will be invited to wear a lightweight personal dust monitor throughout their working shift.

The HR records include dates of each period of sickness absence and a code to denote the cause of the absence. The list of codes will be filtered appropriately to include cardiorespiratory illnesses. The total number of (uncoded) sickness absences for each employee will be used as an indicator of sickness absence behaviour. These data will be linked to HR records of employees' genders, age ranges, date of employment, and position titles.

After the JEM has been constructed, and while the direct measurements are being made and modelled, statistical analyses of HR data will be undertaken. Cause-specific incidence rates for different cardiorespiratory illnesses will be used to make comparisons across different exposure categories, after making adjustments for age, sex, sickness absence behaviour, and year/season to establish whether there is an independent relationship between estimated exposure to tunnel dust and the risk of illness from respiratory or cardiac causes.

Intervention Type
Other

Primary outcome(s)
Cause-specific incidence rates for different cardiorespiratory illnesses in LU employees with exposures to different concentrations of PM are measured using sickness absence data from the LU HR database

Key secondary outcome(s)
1. PM concentrations at different microenvironments throughout the LU network measured through the use of stationary and personal measurements over an employee's 8-hour shift
2. All-cause sickness absence incidence rates for LU employees in different exposure categories from 2014 to 2019 inclusive measured using sickness absence data from the LU HR database

Completion date
31/12/2023

Eligibility

Key inclusion criteria
LU staff employed between 01/01/2014 to 31/12/2019, including those who joined or left in this period.

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
All

Sex
All

Total final enrolment
29744

Key exclusion criteria
Non-TfL employees whose sickness absence data are not recorded in the LU employment database.

Date of first enrolment
01/01/2014

Date of final enrolment
31/12/2019

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Transport for London, Occupational Health Department
200 Buckingham Palace Road
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United Kingdom
SW1W 9TJ

Sponsor information

Organisation
Imperial College London

ROR
https://ror.org/041kmwe10

Funder(s)

Funder type
Government

Funder Name
Transport for London

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study are not expected to be made available due to the use of sensitive personal data from Transport for London.

IPD sharing plan summary

Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		01/03/2024	04/07/2024	Yes	No
Protocol file	version 2.0	11/10/2021	05/11/2021	No	No