UK Biobank – Environmental Exposures – Metadata

The exposure data provided are the result of several years' work from various research teams. Before using any of the exposure estimates in any study we strongly advise that the planned analyses are discussed with the relevant contacts (contact details are provided in the metadata).

Depending on the focus of the research and level of involvement, the authors of the exposure work should be acknowledged in any publication or included as co-authors.

1. Data

File: *UK_Biobank_AP_Noise.csv* (Number of records: 502,499)

This file contains air pollution and noise estimates for UK Biobank participants modelled at their residential address. Individual fields and models used to derive the environmental exposure are described in detail below. Please note that 7,221 addresses could not be geo-coded and consequently have not been assigned an environmental exposure and have missing data (-999) instead.

2. Air pollution estimates

2.1. Annual average air pollution concentrations, 2010

Air pollution estimates for the year 2010 were modelled for each address using a Land Use Regression (LUR) model developed as part of the European Study of Cohorts for Air Pollution Effects (ESCAPE) (http://www.escapeproject.eu/), funded under the EU 7th Framework Programme (for references see below). The LUR model is based on ESCAPE monitoring done between 26 Jan 2010 - 18 January 2011, and air pollution estimates are representative for the year 2010. Traffic variables were calculated within a geographic information system (GIS) during the course of LUR.

Please note that the ESCAPE estimates for particulates are valid up to 400km from the monitoring area, which was in Greater London, but it is unclear how good the estimates are outside this area. All addresses which are more than 400km away from Greater London are not assigned PM_{10}, $PM_{2.5}$, $PM_{2.5}$ absorbance and PM coarse concentrations and have missing data (-999) instead (number of records: 33,935).

For more information on the individual models please see the referenced papers below and the ESCAPE project website.

Table 1. Field description for ESCAPE air pollution variables in category 114 – Residential air pollution

Field ID	Description
24014	Close to major road
24012	Inverse distance to the nearest major road
24010	Inverse distance to the nearest road
24003	Nitrogen dioxide air pollution; 2010
24004	Nitrogen oxides air pollution; 2010
24005	Particulate matter air pollution (pm10); 2010
24007	Particulate matter air pollution (pm2.5) absorbance; 2010
24006	Particulate matter air pollution (pm2.5); 2010
24008	Particulate matter air pollution 2.5-10um; 2010
24015	Sum of road length of major roads within 100m
24013	Total traffic load on major roads
24011	Traffic intensity on the nearest major road
24009	Traffic intensity on the nearest road

Contact:

Prof Bert Brunekreef, Utrecht University, NL (PI of the ESCAPE study); email: b.brunekreef@uu.nl

Dr Kees de Hoogh, Swiss Tropical and Public Health Institute, CH (leader of the ESCAPE exposure assessment for the UK); email: c.dehoogh@unibas.ch

References:

Beelen R, Hoek G, Vienneau D, Eeftens M, Dimakopoulou K, Pedeli X, Tsai M-Y, Künzli N, Schikowski T, Marcon A, Eriksen KT, Raaschou-Nielsen O, Stephanou E, Patelarou E, Lanki T, Yli-Tuomi T, Declercq C, Falq G, Stempfelet M, Birk M, Cyrys J, von Klot S, Nádor S, Varró MJ, Dėdelė A, Gražulevičienė R, Mölter A, Lindley S, Madsen C, Cesaroni G, Ranzi A, Badaloni C, Hoffmann B, Nonnemacher M, Krämer U, Kuhlbusch T, Cirach M, de Nazelle A, Nieuwenhuijsen M, Bellander T, Korek M, Olsson D, Strömgren M, Dons E, Jerrett M, Fischer P, Wang M, Brunekreef B, de Hoogh K. 2013. Development of NO_2 and NO_X land use regression models for estimating air pollution exposure in 36 study areas in Europe – The ESCAPE project. Atmospheric Environment 72: 10-23.

Eeftens M, Beelen R, de Hoogh K, Bellander T, Cesaroni G, Cirach M, Declercq C, Dėdelė A, Dons E, de Nazelle A, Dimakopoulou K, Eriksen K, Falq G, Fischer P, Galassi C, Gražulevičienė, Heinrich J, Hoffmann B, Jerrett M, Keidel D, Korek M, Lanki T, Lindley S, Madsen C, Mölter A, Nádor G, Nieuwenhuijsen M, Nonnemacher M, Pedeli X, Raaschou-Nielsen O, Patelarou E, Quass U, Ranzi A, Schindler C, Stempfelet M, Stephanou E, Sugiri D, Tsai M-Y, Yli-Tuomi T, Varró MJ, Vienneau D, von Klot S, Wolf K, Brunekreef B, Hoek G. 2012. Development of Land Use Regression models for $PM_{2.5}$, $PM_{2.5\ absorbance}$, PM_{10} and PM_{COARSE} in 20 European study areas; results of the ESCAPE project. Environmental Science & Technology 46(20): 11195−11205.

ESCAPE project website: http://www.escapeproject.eu.

2.2. Annual average air pollution concentrations, 2005-07

Air pollution estimates for the years 2005-2007 were derived from EU-wide air pollution maps (resolution 100m x 100m). The x,y-coordinates of UK Biobank participants were overlaid with these maps (projected to British National Grid) and the corresponding air pollution concentration of the 100m x 100m grid cell were assigned to the coordinate.

EU-wide air pollution maps were modelled based on a LUR model for Europe which also includes satellite derived air pollution estimates to improve the model performance. For details of the model and model performance see the referenced paper below.

Table 2. Field description for variables from EU air pollution maps 2005-07 in category 114 – Residential air pollution

Field ID	Description
24016	Nitrogen dioxide air pollution; 2005
24017	Nitrogen dioxide air pollution; 2006
24018	Nitrogen dioxide air pollution; 2007
24019	Particulate matter air pollution (pm10); 2007

Contact:

Dr Danielle Vienneau, Swiss Tropical and Public Health Institute, CH; email: Danielle.Vienneau@unibas.ch

Dr Kees de Hoogh, Swiss Tropical and Public Health Institute, CH; email: c.dehoogh@unibas.ch

References:

Vienneau D, de Hoogh K, Bechle MJ, Beelen R, van Donkelaar A, Martin RV, Millet DB, Hoek G, Marshall JD. 2013. Western European land use regression incorporating satellite- and ground-based measurements of NO_2 and $_{PM10.}$ Environmental Science and Technology 47(23): 13555-13564.

3. Noise estimates

3.1. Annual average noise estimates, 2009

Noise estimates for the year 2009 were modelled using a version of the CNOSSOS-EU noise model. These **C**ommon **NO**ise a**SS**essment meth**O**d**S** (CNOSSOS) are recommended by the European Noise Directive 2002/49/EC. Full details on the model can be found in the references provided below. A paper on the implementation of this model in the UK is in preparation (Morley & Gulliver et al.).

Table 3. Field descriptions for 2009 noise estimates in category 115 – Residential noise pollution

Field ID	Description
24023	Average 16-hour sound level of noise pollution
24024	Average 24-hour sound level of noise pollution
24020	Average daytime sound level of noise pollution
24021	Average evening sound level of noise pollution
24022	Average night-time sound level of noise pollution

Contact:

Dr John Gulliver, Imperial College London, UK; email: j.gulliver@imperial.ac.uk

References:

Kephalopoulos S, Paviotti M, Anfosso-Lédée F. (2012). Common Noise Assessment Methods in Europe (CNOSSOS-EU) EUR 25379 EN. Publications Office of the European Union, Luxembourg: http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/26390/1/cnossos-eu%20jrc%20reference%20reportfinalon%20line%20version10%20august%202012.pdf

Kephalopoulos S, Paviotti M, Anfosso-Lédée F, Van Maercke D, Shilton S, Jones N. 2014. Advances in the development of common noise assessment methods in Europe: The CNOSSOS-EU framework for strategic environmental noise mapping. Science of the Total Environment 482-483: 400-410.