Systematic Review and Meta-Analysis on the Impact of Polycyclic Aromatic Hydrocarbons Exposure in Cognitive Function and Neurodegeneration in Humans

README FILE

Primary author: **Miss. Jessica Humphreys (JH)**

College of Medicine and Veterinary Medicine, University of Edinburgh, Edinburgh, UK.

Supervisor: **Dr. Maria del C. Valdés Hernández (MVH)**

Centre for Clinical Brain Sciences, Row Fogo Centre for Research into Ageing and The Brain, and Dementia Research Institute, University of Edinburgh, Edinburgh, UK.

Preparation of this dataset: **Dr. Maria del C. Valdés Hernández**

Abbreviations used (below and in the rest of the files of this dataset):

OR – Odds Ratio

IQR – Interquartile Range

CI – Confidence Interval

SD – Standard Deviation

PAH - Polycyclic Aromatic Hydrocarbons

PM 2.5 – Particulate Matter of size (diameter) equal or less than 2.5 micrometres (µm)

Summary:

Exposure to air pollution is now recognized globally by governments, leading research scientists, and civil society as one of the greatest public health hazards of the 21st century. Polycyclic aromatic hydrocarbons (PAH) are a group of air pollutants discharged mainly from incomplete combustion and pyrolysis of hydrocarbons, predominantly found in: coal, oil, wood and petrol. PAH exist in the atmosphere in a gaseous state or adsorbed to particulate matter, mainly of 2.5mm diameter or less (PM2.5). Given the anthropogenic nature of PAH sources and their small size, they are difficult to regulate and account for, but their exposure has been associated with worsening asthma, coronary heart disease, various types of cancers, decreased immune function and organ damage. However, their implications on cognitive functions and neuronal health in humans has not been systematically recorded/analysed up to date as only sporadic studies have been conducted in few countries. This submission contains the results of the systematic search, data extraction and meta-analyses from systematically reviewing the existent literature on the impact of PAH exposure in cognitive function and neurodegeneration in humans. The data is contained in two excel spreadsheets. One spreadsheet contains details of the search (i.e., search strategy, keywords, databases, search results,

included references, excluded references with reasons for exclusion, and duplicates). The other spreadsheet contains the data extracted from analysing the papers reviewed (i.e., included), and the meta-analyses (multi-variable graphs and forest plots with their sources). Worksheets not containing meta-analyses are also provided in csv (comma delimited) format.

SYSTEMATIC SEARCH

Aims: 1) to provide evidence on the potentially adverse neurological impact of all PAH 2) to create awareness surrounding the difference between metropolitan populations' cognitive function and neurodegeneration levels compared to rural populations, through the confounding effects of PAH exposure on studies addressing these outcomes.

Period searched: until February 2021

Basic Search Terms: ("polycyclic aromatic hydrocarbons") AND ("brain" OR "neurological" OR "cognitive" OR "cognition" OR "neurodegenerative" OR "neurodegeneration" OR "neurodevelopment" OR "neurodevelopmental")

Databases: Web of Science©, PubMed©

Inclusion criteria: Observational cohort studies of both male and female humans, which measured the level of exposure to ambient PAH and particulate matter 2.5 (PM2.5) through environmental air sampling or spatiotemporal modelling techniques constructed from environmental air sampling databases. Acceptable measures of exposure also included concentration of PAH metabolites in urine and dosimetry of PAH-DNA adducts in DNA extracted from white blood cells. Time of exposure included the gestational period and stretched throughout life until death. Acceptable outcomes involved a formal assessment of cognitive function, neurobehavioral symptoms of impaired cognition, and pathologies associated with neurodegeneration. Published scientific articles written in the English language.

Exclusion criteria: 1) not fulfilling the inclusion criteria; 2) Studies where PAH exposure was measured as a component of Diet, Environmental Tobacco Smoke (ETS) or Traffic Related Air Pollution (TRAP); 3) not human studies

Number of studies included: 37

Number of participants from the studies included: data not exact due to partially overlapping samples from various studies unknown.
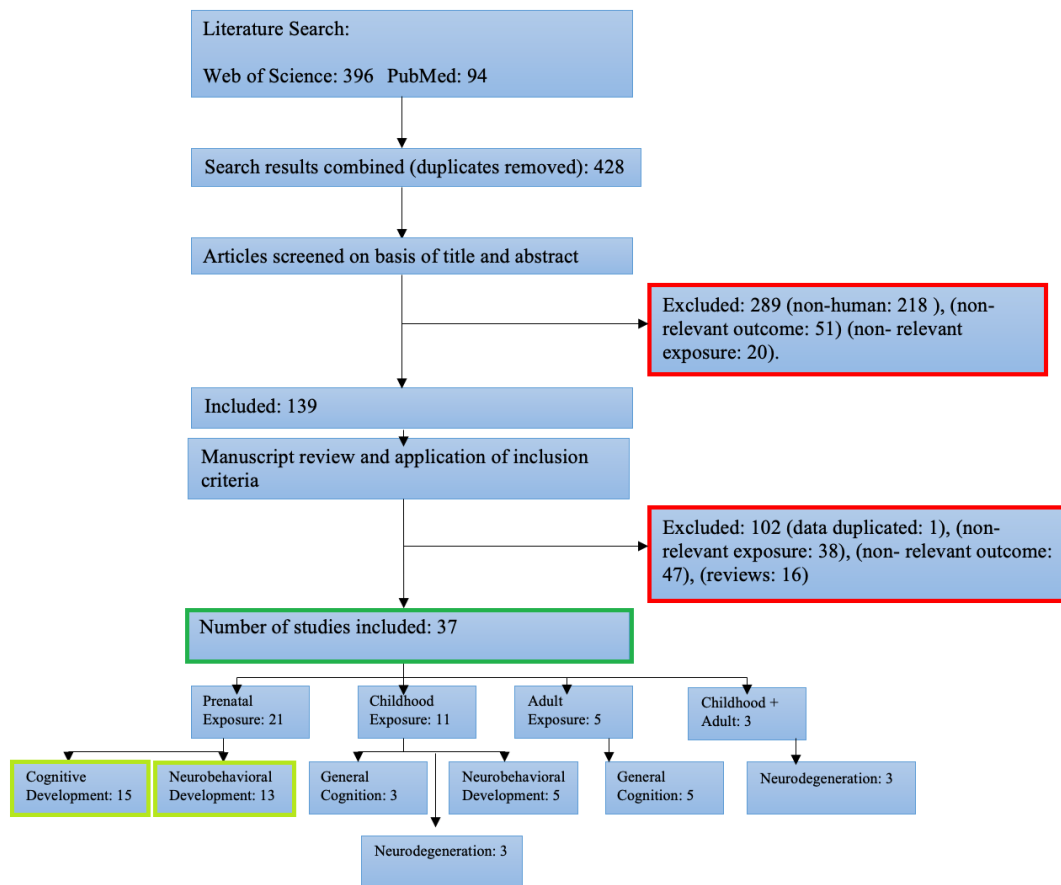
Figure 1. Flow chart of the systematic search highlighting the exclusions, inclusions and the two outcome domains that are meta-analysed in forest plots (see file PAH_PM2_Exposure_DataExtraction_and_metaanalyses.xlsx)

Figure 2. Map highlighting the countries from which this review analyses data, colour-coded according to the number of studies included.

DATA

Submission files:

1.- PAH_PM2_Exposure_Readme_file (this file, PDF format)

2.- PAH_PM2_Inclusion_Exclusion_Studies.xlsx (excel workbook)

3.- PAH_PM2_Studies_duplicated.csv (CSV, comma delimited)

4.- PAH_PM2_Studies_excluded.csv (CSV, comma delimited)

5.- PAH_PM2_Studies_included.csv (CSV, comma delimited)

6.- PAH_PM2_Exposure_DataExtraction_and_metaanalyses.xlsx (excel workbook)

7.- PAH_PM2_Analysis_of_bias.csv (CSV, comma delimited)

8.- PAH_PM2_Data_extracted.csv (CSV, comma delimited)

Excel Workbooks files contents:

PAH_PM2_Inclusion_Exclusion_Studies.xlsx

Contains 4 workbooks, all which are separately provided as csv (comma separated) files:

Workbook "Search Terms" contains the exact terms entered in each database for conducting the search.

Workbook "Inclusion" contains the title of the references included in the review, year of publication, name of the source (i.e., journal/book), URL accessed to retrieve/download the publication, and reason for inclusion/relevant finding, for each included publication.

Workbook "Exclusion" contains the title of the references excluded, year of publication, name of the source (i.e., journal/book), URL accessed to retrieve and examine the publication, and reason for exclusion, for each excluded publication.

Workbook "Duplicates" contains the title of the references duplicated, whether they (i.e. one of the duplicates) were included or not, year of publication, name of the source (i.e., journal/book), URL accessed to retrieve and examine the publication, and relevant notes (e.g., main outcome, reason for exclusion, etc.), for each publication that was found more than once while conducting the search.

PAH_PM2_Exposure_DataExtraction_and_metaanalyses.xlsx

Contains 10 workbooks, two of which are separately provided as csv (comma separated) files and 8 which contain the meta-analyses of the data extracted.

Workbook "DATAEXTRACTION" contains the data extracted from each reviewed publication: First author's name and year of publication, title, outcome domain, sample size, sample characteristics including male/female split, age mean, range and SD, and comorbidities, air pollution component, exposure time, method for quantifying/estimating the air pollutant(s), outcome measure(s) of each study, numeric results, and information about whether brain imaging data was present/analysed or not.

Workbook "Papers Validity" contains the results from screening each paper according to the QUADAS instrument.

Workbook "PRENATAL" contains a 2-by-3 table grouping the references that analysed the impact of prenatal exposure of PAH and PM2.5 in either cognitive and/or neurobehavioural development.

Workbook "Prenatal_PAH_behav" contains the meta-analysis (including forest plot) of the references that analysed the impact of prenatal exposure of PAH in neurobehavioural development.

Workbook "Prenatal_PAH_cog" contains the meta-analysis (including forest plot) of the references that analysed the impact of prenatal exposure of PAH in cognitive and motor development.

Workbook "CHILDHOOD" contains a 2-by-4 table grouping the references that analysed the impact of childhood exposure of PAH and PM2.5 in either cognitive and/or neurobehavioural development and/or markers of possible long-term neurodegenerative effect.

Workbook "ADULT" contains a 1-by-3 table grouping the references that analysed the impact of exposure of PAH during adulthood in either cognitive functions and/or in the development/progression of neurodegenerative diseases like Parkinson's and AD.

Workbook "Childhood + Adult" contains a 1-by-2 table grouping the references that analysed the impact of PAH during both childhood and adulthood, in neurodegeneration.

Workbook "Sample_Characteristics" contains the meta-analysis of the whole sample's size and age data ordered by the life stage of the exposure analysed by each study, in a bubble graph.

Workbook "Exposure Outcome" contains the meta-analysis of the measures of exposure to the air pollutant(s), in a pie chart.