

# Access to Healthy Assets and Hazards (AHAH)

## Short Technical Report

Updated Version (2017)



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# ACCESS TO HEALTHY ASSETS AND HAZARDS (AHAH)

UPDATED VERSION (2017)

The Index of ‘Access to Healthy Assets and Hazards’ (AHAH) is a relative measure of accessibility to health promoting aspects of small areas (Lower-layer Super Output Areas (LSOAs) for England and Wales, and Data Zones for Scotland – hereby referred collectively as LSOAs) across Great Britain. The updated version of Access to Healthy Assets and Hazards index combines together indicators under four different domains of accessibility, detailed in the following four sections:

- Retail environment
- Health services
- Physical environment
- Air quality

## RETAIL ENVIRONMENT DOMAIN

The domain focused on measuring the accessibility to retail services where individuals could purchase healthy or unhealthy foods and drink (and gambling which is indirectly related to health outcomes). We calculated the following measures of accessibility (the mean distance (km) by car travel route of postcodes within a LSOA to nearest outlet): access to gambling outlets, fast food outlets, pubs/bars/nightclubs, off licenses and tobacconists.

Field name	Units	Description	Source
<b>gamb_dist</b>	Mean (km)	Gambling outlets	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )
<b>ffood_dist</b>	Mean (km)	Fast food outlets	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )
<b>pubs_dist</b>	Mean (km)	Pubs/bars/nightclubs	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )
<b>off_dist</b>	Mean (km)	Off licenses	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )
<b>tobac_dist</b>	Mean (km)	Tobacconists	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )

Data on all retail businesses throughout Great Britain were provided by the Local Data Company (LDC). The data includes records for every operating retail business including a classification of retail type (e.g. fast food outlets, pubs, bars and nightclubs, bookmakers, casino clubs, off license, tobacconist) and the postcode of the store.

## HEALTH SERVICES DOMAIN

Geographic accessibility to health services has been demonstrated to be associated with utilization of services. We calculated accessibility (the mean distance (km) by car travel route of postcodes within a LSOA to nearest service) to different health-related services including access to GP surgeries, A&E Hospitals, Dentists, Pharmacies and Leisure Centers.

Field name	Units	Description	Source
<b>gpp_dist</b>	Mean (km)	GP surgeries	NHS Digital (May 2017), NHS Wales (May 2017) & ISD Scotland (Scottish GP practice details as at 1 <sup>st</sup> Jan 2018)
<b>ed_dist</b>	Mean (km)	A&E Hospitals	NHS digital (Care Quality Commission API), NHS Wales (via web, Feb 2017) & ISD Scotland (via web, Feb 2017)
<b>dent_dist</b>	Mean (km)	Dentists	NHS Digital and NHS Wales (Data.gov.uk, May 2017), ISD Scotland (MIDAS as at end of 2017)
<b>pharm_dist</b>	Mean (km)	Pharmacies	NHS Digital (May 2017), NHS Wales (May 2017) & ISD Scotland (as at 15 June 2016)
<b>leis_dist</b>	Mean (km)	Leisure Centers	LDC 2017 (via CDRC services, <a href="https://data.cdrc.ac.uk/product/local-data-company-retail-data">https://data.cdrc.ac.uk/product/local-data-company-retail-data</a> )

Openly available data from NHS Digital and Information Services Division (ISD) in NHS Scotland were used for GP surgeries, A&E hospitals, pharmacies and dentists. Leisure centers were acquired from the LDC data.

## PHYSICAL ENVIRONMENT DOMAIN

We measure aspects of the physical environment such as access to green and blue spaces which have demonstrated consistent associations to health and health-related behaviours. Open data from OS on Green spaces was used for preparing two variables related to the distance from the nearest green space (active) and the total green space areas available to each postcode in a range of a 900-meter buffer (passive) before creating LSOA level averages. Blue space indicator is based on the distance people have to travel to their nearest water body such as a beach, a lake and a river. Blue space locations such as beaches were acquired from OpenStreetMap and the mainland water bodies (lakes, rivers) were retrieved from the European Settlement Map (ESM 2012) raster dataset at a 5 meters resolution.

Field name	Units	Description	Source
<b>blue_dist</b>	Mean (km)	Blue Space	OpenStreetMap & European Settlement Map (ESM 2012)
<b>green_act</b>	Mean (km)	Green Space - Active	OS Open Greenspace
<b>green_pas</b>	Mean (km <sup>2</sup> )	Green Space - Passive	OS Open Greenspace

## AIR QUALITY DOMAIN

Features related to the air quality of environment have also been shown to influence health. Pollution is a major cause of ill health and is estimated to be responsible for about 8 million deaths every year globally according to the latest WHO reports (<https://www.who.int/airpollution/en/>). We measure aspects of the air quality which have demonstrated consistent associations to health and health-related behaviours: level of Nitrogen Dioxide, level of Particulate Matter 10 and level of Sulphur Dioxide.

Field name	Units	Description	Source
<b>no2_mean</b>	Annual mean (µgm <sup>3</sup> )	Nitrogen Dioxide	DEFRA 2017 - ( <a href="https://uk-air.defra.gov.uk/data/pcm-data">https://uk-air.defra.gov.uk/data/pcm-data</a> )
<b>pm10_mean</b>	Annual mean (µgm <sup>3</sup> )	Particulate Matter	DEFRA 2017 - ( <a href="https://uk-air.defra.gov.uk/data/pcm-data">https://uk-air.defra.gov.uk/data/pcm-data</a> )
<b>so2_mean</b>	Annual mean (µgm <sup>3</sup> )	Sulphur Dioxide	DEFRA 2017 - ( <a href="https://uk-air.defra.gov.uk/data/pcm-data">https://uk-air.defra.gov.uk/data/pcm-data</a> )

Open data from DEFRA on modelled air quality estimates was used for pollution variables.

## METHODS

Accessibility measures were created using the Routino open source tool. Routino is an application for finding a route between two points using the OSM road network and takes into account restrictions on roads as well as tagged speed limits and barriers. In this study, we measured the network distance (travel time) between the centroid of each postcode in Great Britain and the coordinates of the nearest service (e.g. postcode centroid of GP practice).

Measured network distances for each indicator for postcodes were aggregated to the LSOA level providing average network distances for each indicator (as a measure of accessibility). All other indicators were also summarised for LSOAs. The indicators within each domain were standardised by ranking and transformed to the standard normal distribution. The direction of each variable was dictated by the literature (e.g.

accessibility to fast food outlets were identified as health negating, whereas accessibility to GP practices was health promoting see Table 1).

To calculate our overall index (and domain specific values), we followed the methodology of the 2015 IMD (Smith et al., 2015). For each domain, we ranked each domain  $R$  and any LSOA scaled to the range [0,1].  $R=1/N$  for the most 'health promoting' LSOA and  $R=N/N$  for the least promoting, where  $N$  is the number of LSOAs in Great Britain. Exponential transformation of the ranked domain scores was then applied to LSOA values to reduce 'cancellation effects' (Smith et al., 2015). So, for example, high levels of accessibility in one domain are not completely cancelled out by low levels of accessibility in a different domain. The exponential transformation applied also puts more emphasis on the LSOAs at the end of the health demoting side of the distribution and so facilitates identification of the neighbourhoods with the worst health promoting aspects. The exponential transformed indicator score  $X$  is given by:

$$X = -23 \ln(1 - R(1 - \exp^{-100/23}))$$

where ' $\ln$ ' denotes natural logarithm and ' $\exp$ ' the exponential transformation.

The main domains across our indicators: retail services, health services, physical environment and air quality then were combined to form an overall index of 'Access to Healthy Assets and Hazards' (AHAH).

**Table 1.** Indicator weights generated for each domain of AHAH.

Domain	Indicator	Indicator weight	Health promoting	
			Low value	High value
Retail Services	Accessibility to Fast food outlets	1/5	-	+
	Accessibility to Gambling outlets	1/5	-	+
	Accessibility to Off-licenses	1/5	-	+
	Accessibility to Tobacconists	1/5	-	+
	Accessibility to Pubs, bars and nightclubs	1/5	-	+
Health Services	Accessibility to GP practices	1/5	+	-
	Accessibility to A&E hospitals	1/5	+	-
	Accessibility to Pharmacies	1/5	+	-
	Accessibility to Dentist practices	1/5	+	-
	Accessibility to Leisure services	1/5	+	-
Physical Environment	Accessibility to Blue spaces	1/3	-	+
	Accessibility to Green spaces (Active)	1/3	-	+
	Accessibility to Green spaces (Passive)	1/3	-	+
Air Quality	Nitrogen Dioxide (NO2)	1/3	+	-
	PM10 Particles	1/3	+	-
	Sulphur Dioxide (SO2)	1/3	+	-

## REFERENCES

Smith, T., Noble, M., Noble, S., Wright, G., McLennan, D., Plunkett, E. 2015. The English Indices of Deprivation 2015, Department for Communities and Local Government. Available at: <https://www.gov.uk/government/publications/english-indices-of-deprivation-2015-technical-report> [Accessed 10 Dec 2016]

## APPENDIX I: Summary of the Statistical Methods used to create the AHAH index

