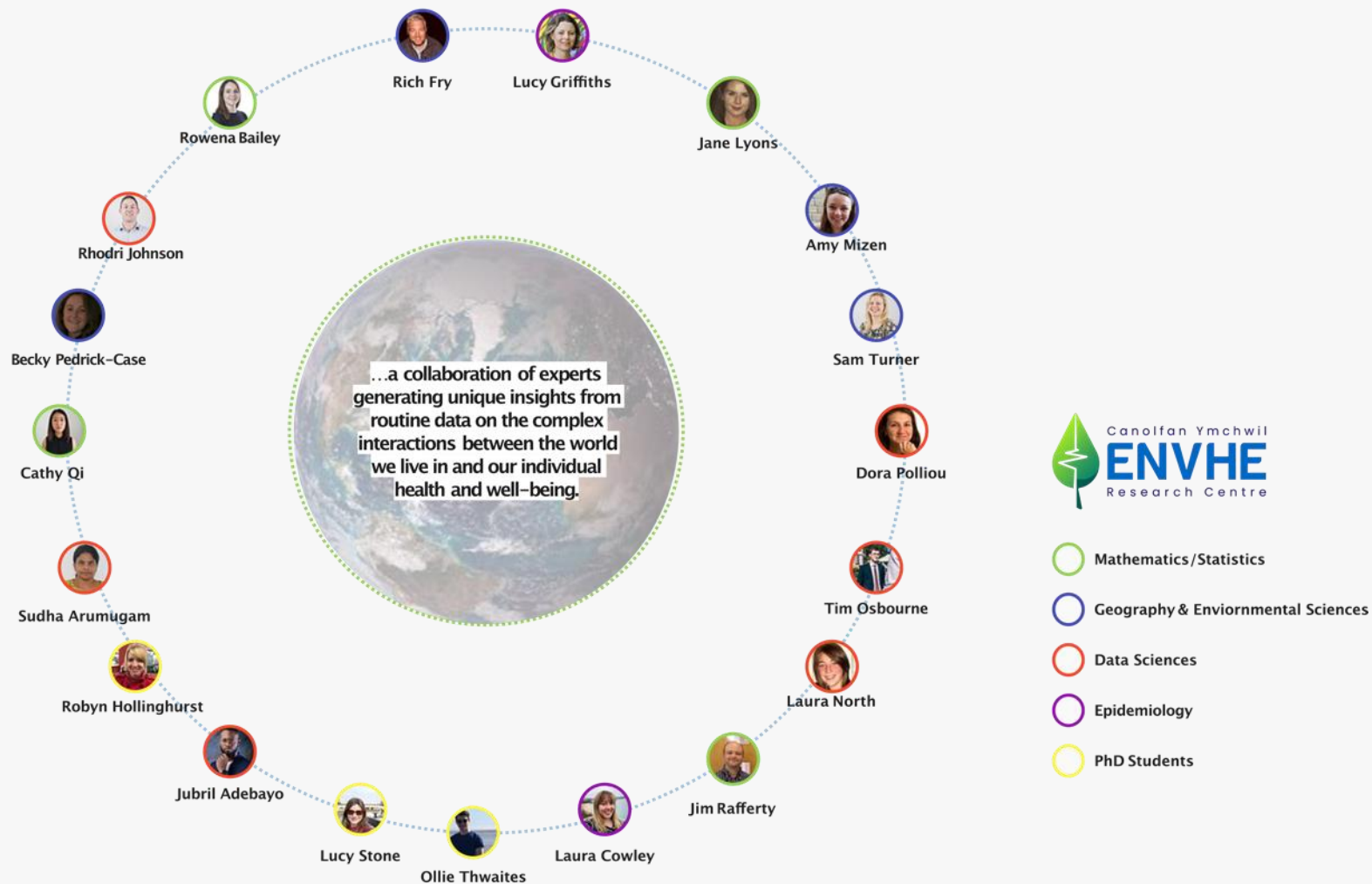


Social and Environmental Determinants of Health



The use of Unique Property Reference Numbers to understand the wider determinants of health

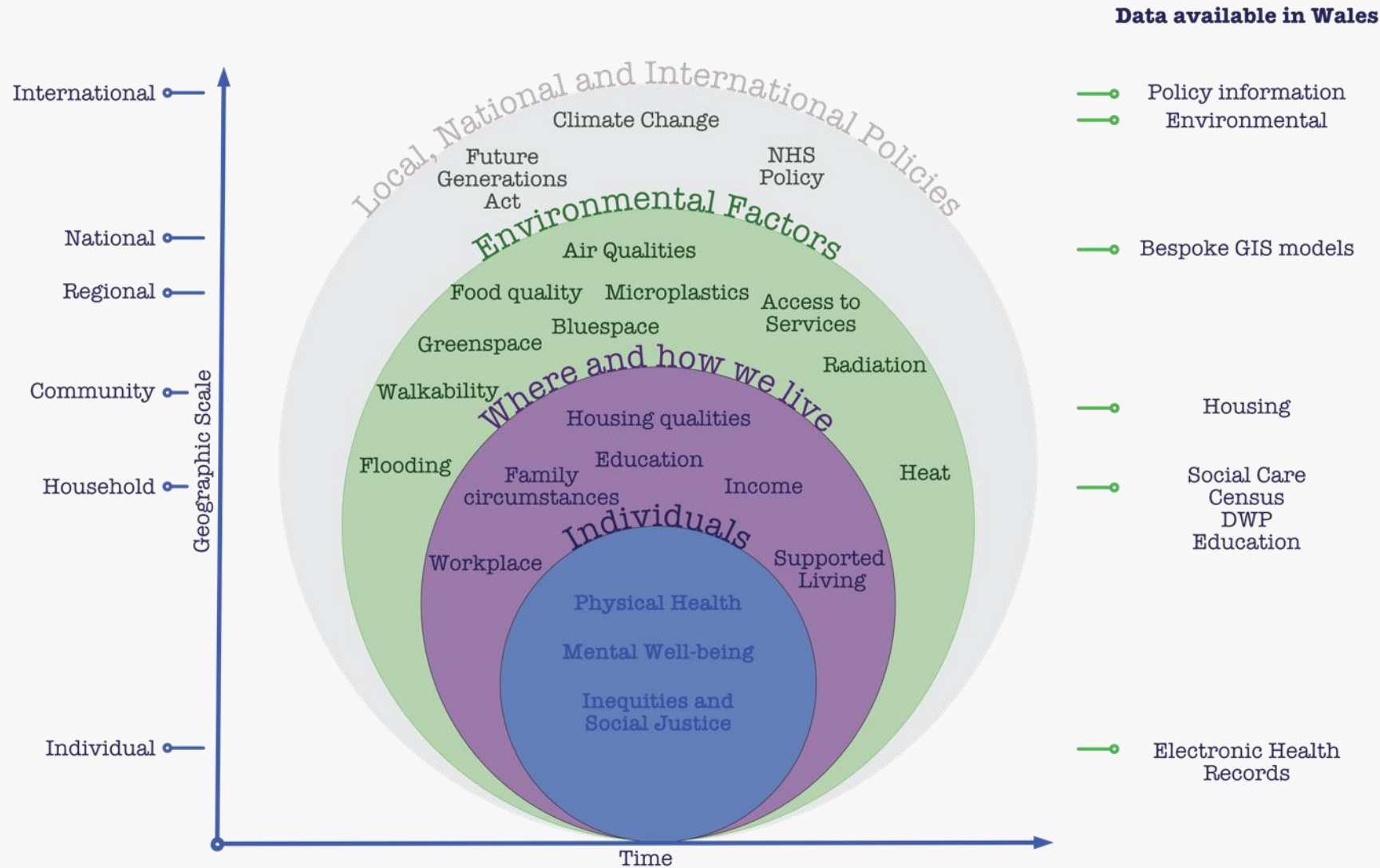
Environment and Health Research Centre at Population Data Science, Swansea University



Funding collaborations:

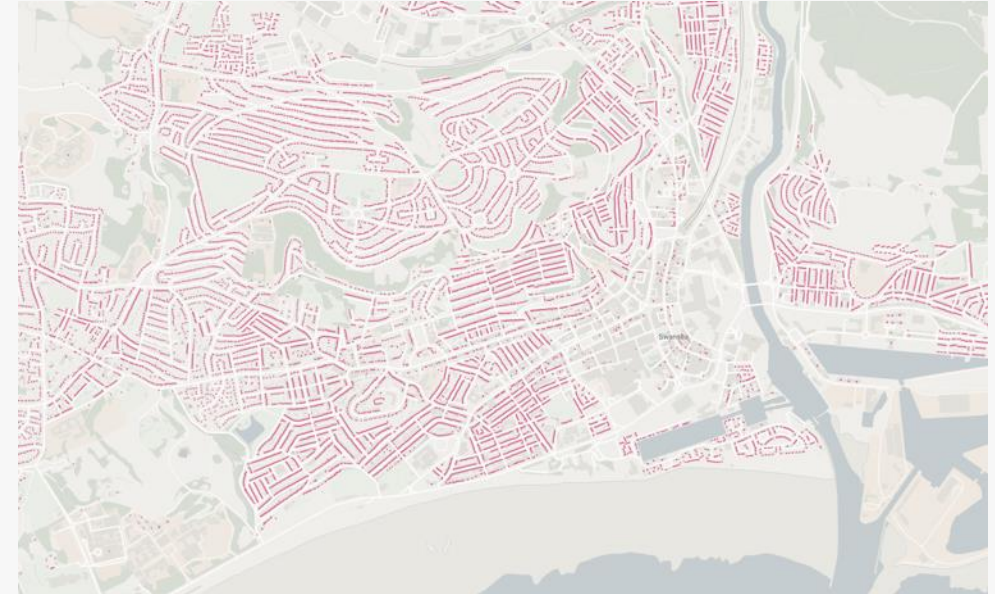


Understanding the world we live in, using linked data



Unique Property Reference Numbers for Health Data Linkages

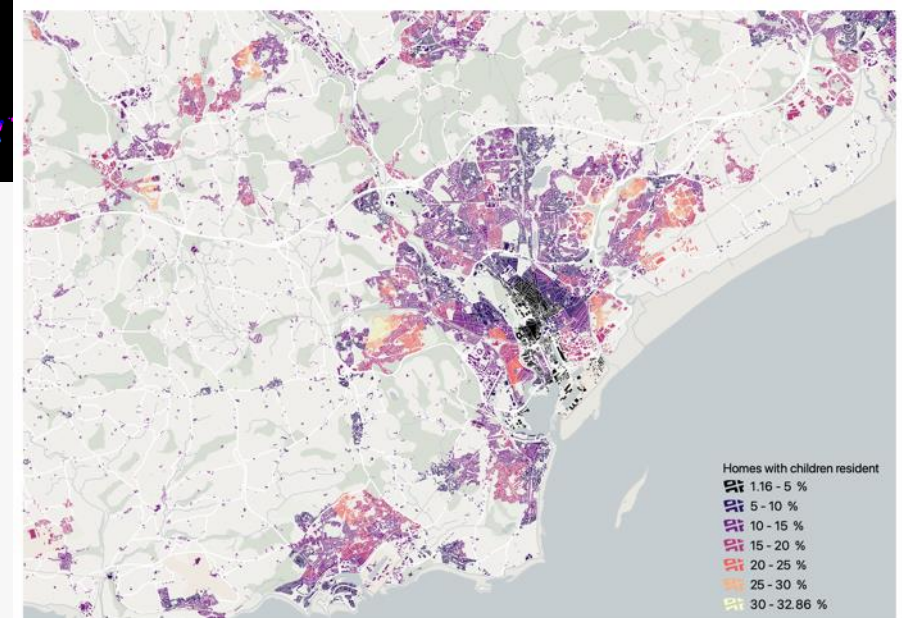
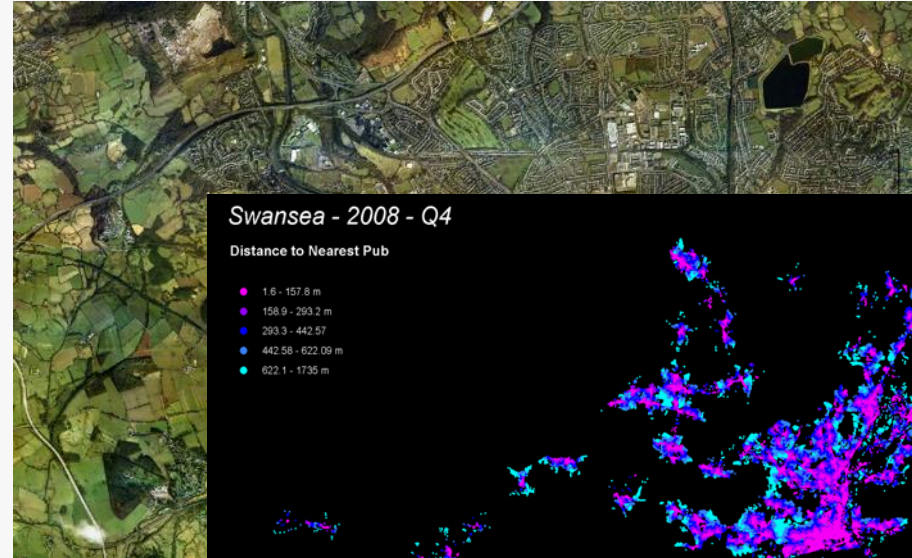
- **Unique Property Reference Number:** persistently unique identifier
- Assigned by local authorities and maintained by GeoPlace
- Made available as a Geospatial product by Ordnance Survey known as AddressBase
- Used in SAIL since 2012 as an evolution from the Postcode Address File
- Allows linking of discrete geospatial and address based data to health data using anonymisation processes
- Facilitates grouping of people into discrete locations e.g., households, care homes



UPRN	StartDate	EndDate	Type
100100359166	12-03-2006	-	Terrace

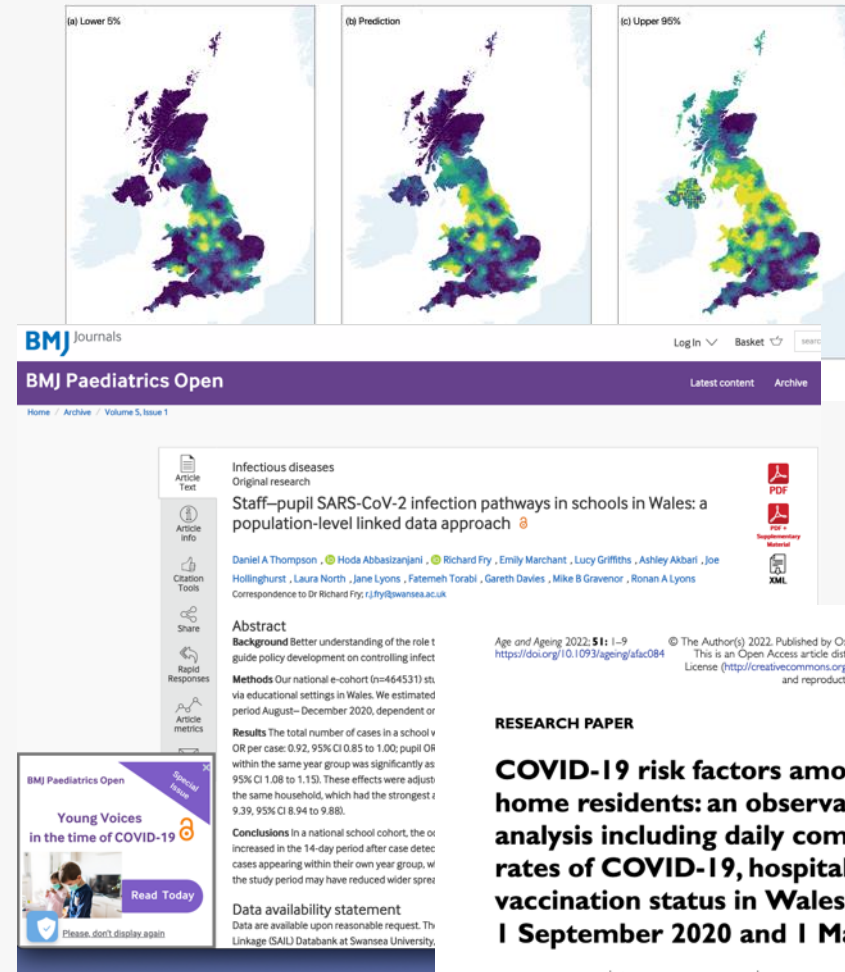
Modelling household characteristics at a total population scale

- Extracted a residential spine for Wales (1.5 M households)
- Using sophisticated geospatial computer modelling and HPC infrastructure (UKSeRP) have a model of:
 - Ambient green, noise and air quality exposures
 - Access to services
 - Walkability
 - Access to greenspace
 - Access to unhealthy food environments
 - Access to vaccinations (378 M combinations)
- Household quality indicators – type, EPC, garden size
- Linked into SAIL via UPRN
 - Add household composition measures
 - Administrative and survey data on tenancy/home improvements
 - Allows linking of actual destination (e.g. GP) not just nearest where data available
- Dynamic GIS models – based on population characteristics to drive population relevant policy
- Capture change over time



Linked UPRN data : COVID

- 3 major pieces of insight developed using UPRN linkages
 - Impact of COVID on care homes – CARE home index
 - Disease transmission between homes and schools
 - Mapping the spread of COVID – ZOE data and PCR test data
- Allowed characterisations of care homes, grouping of people into homes and schools, and modelling spread of disease in Wales
- Major policy impacts at Welsh Gov (TAC), Scottish Gov and UK level (SAGE SCWG)
- Provided actionable evidence to policy makers at different stages through first 2 years of pandemic
- Mapped data visualisation shows power of incorporating place in science communication



Age and Ageing 2022; 51: 1–9
<https://doi.org/10.1093/ageing/afac084> © The Author(s) 2022. Published by Oxford University Press on behalf of the British Geriatrics Society. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

RESEARCH PAPER

COVID-19 risk factors amongst 14,786 care home residents: an observational longitudinal analysis including daily community positive test rates of COVID-19, hospital stays and vaccination status in Wales (UK) between 1 September 2020 and 1 May 2021

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Abstract

Background: COVID-19 vaccinations have been prioritised for high risk individuals.

Aim: Determine individual-level risk factors for care home residents testing positive for SARS-CoV-2.

Study design: Longitudinal observational cohort study using individual-level linked data from the Secure Anonymised Information Linkage (SAIL) databank.

Setting: Fourteen thousand seven hundred and eighty-six older care home residents (aged 65+) living in Wales between 1 September 2020 and 1 May 2021. Our dataset consisted of 2,613,341 individual-level daily observations within 697 care homes.

Methods: We estimated odds ratios (ORs [95% confidence interval]) using multilevel logistic regression models. Our outcome of interest was a positive SARS-CoV-2 PCR test. We included time-dependent covariates for the estimated community positive test rate of COVID-19, hospital inpatient status, vaccination status and frailty. Additional covariates were included for age, sex and specialist care home services.

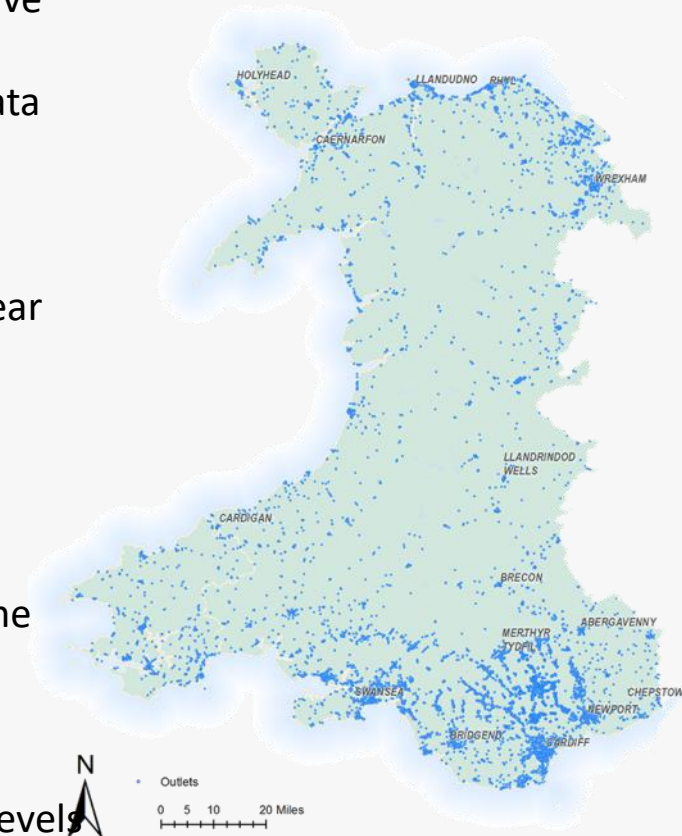
Results: The multivariable regression model indicated an increase in age (OR 1.01 [1.00, 1.01] per year), community positive test rate (OR 1.13 [1.12, 1.13] per percent increase), hospital inpatient status (OR 7.40 [6.54, 8.36]), and residents in care homes

Changes in Alcohol Availability

- Two themes
 - Alcohol related health conditions/incidents
 - Alcohol related crime incidents
- 22 LAs in Wales approached to gather licence data (administrative data – ADRC-W)
 - Licence data geocoded to create GIS database of outlet data
 - Four density calculations – 2 GIS network based:
- Median distance to an outlet within in 10 mins walk/drive
 - Temporal Spatial Interaction Gravity Model to produce an outlet density score at household level quarterly over 7 year period (~2.5 billion calculations)
 - Modelled for type of outlet (e.g. pub, supermarket etc.)
- GWR analysis to explore the relationships between density and crime and density and health outcomes

Results

- We found that higher availability of alcohol and change over time were related to an increase in alcohol-related harm
- We found that the patterns of harm were not the same across Wales.
- We found that more deprived local authority areas had higher levels of poorer health caused by alcohol and more violent crime.
- High baseline alcohol availability was significantly associated with a **20–25% increased risk of an emergency admission to hospital**



Blue and Green Spaces: NIHR PHR - 16/07/07

Can Spending Time in Parks, Woodlands and Beaches Improve Our Mental Health and Wellbeing?

- Used linked environmental, health and survey data to explore associations with CMDs
- Modelled multiple exposures including ambient greenness and access to green and blue space linked via UPRN
- Created an e-cohort of linked environmental and mental health data with 24.9 million-person-years of follow-up
- Novel environmental exploration of environment and mental health data
- Report published 2023:

<https://fundingawards.nihr.ac.uk/award/16/07/07>

The screenshot shows the article page for a protocol published in the *International Journal of Epidemiology*. The article title is "Longitudinal access and exposure to green-blue spaces and individual-level mental health and well-being: protocol for a longitudinal, population-wide record-linked natural experiment". The authors listed are Amy Mizen, Jiao Song, Richard Fry, Ashley Akbari, Damon Berridge, Sarah C Parker, Rhodri Johnson, Rebecca Lovell, Ronan A Lyons, Mark Nieuwenhuijsen, Gareth Stratton, Benedict W Wheeler, James White, Mathew White, and Sarah E Rodgers. The article is part of Volume 51, Issue 5, published in October 2022. The page includes a sidebar with navigation options like Article Text, Article Info, Citation Tools, Share, Rapid Responses, Article metrics, and Alerts. The main content area features the journal title, a navigation bar with links for Issues, More Content, Submit, Purchase, Alerts, and About, and a section for the article's title and authors. Below this, there is a section for "Article Contents" with a list of topics such as "Why was the cohort set up?", "Who is in the cohort?", "How often have they been followed up?", "What has been measured?", "What has it found?", "What are the main strengths and weaknesses?", "Can I get hold of the data? Where can I find out more?", "Ethics approval", "Data availability", "Supplementary data", and "Author contributions". On the right side, there is a "JOURNAL ARTICLE" section with the title "Cohort Profile: The Green and Blue Spaces (GBS) and mental health in Wales e-cohort" and a list of authors. Below this, there is a "Key features" section with two bullet points: "The Green Blue Spaces (GBS) e-cohort includes 2.8 million UK adults (2008-19) and was established to quantify the impact of natural environments on mental health and wellbeing in Wales, UK." and "This is the first e-cohort with national household-level longitudinal environment metrics (annual) for 1.4 million residences linked to longitudinal electronic health records (updated quarterly), with a subgroup".

Housing Studies

Carmarthenshire Housing Project



- Secure Anonymised Information Linkage (SAIL) databank
- Carmarthenshire County Council
- Used encrypted UPRN
- Allows us to link **new regeneration data** but residence location remains unknown to researchers
- Anonymised links from houses to people and their health conditions
- Found that home improvements led to a reduction in hospital admissions

<https://fundingawards.nihr.ac.uk/award/09/3006/02>

Care and Repair: Evaluation of home modifications




























- Evaluate fall prevention home modifications on fall-related hospital admissions i.e. which is “best”
- Which home modifications slow or prevent moves from private residences to care homes.
- Intervention data from 2009-2017 contribute to a longitudinal study distinguishing between pre and post intervention at an individual level, including a similarly frail national comparator group.
- Study showed that interventions reduced care home admissions for moderately and severely frail people

Built Environments and Child Health in Wales and Australia: BEACHES

- MRC funded international study comparing built environments and child health in Wales and Australia
- Using linked EHR and cohort data
- Harmonised geospatial models – different geographies shared models
- Linked Health data
 - In Wales child weight only routinely measured at 5 years old as part of the National Child Measurement Programme (CMP)
 - Can we use routinely collected health data to create follow up measures from WECC (n=~1.3m)
 - Study period 2012 – 2019 to temporally align with CMP data
 - 246,817 have one BMI measure
 - 222,772 had CMP measurement and were in WDS
 - 31,521 (14.2%) children with a CMP measurement have a follow up in primary care
- Implications
 - Assuming the CMP is representative of the population, the primary care measurements are not representative of the population (too many measurements of high BMI z-score and low BMI z-score) – confirms selection bias in other studies
 - Children from less deprived areas, that were underweight, overweight or obese at baseline CMP measurement were male and more likely to have a follow up measurement in primary care.

Open access Protocol

BMJ Open Built Environments And Child Health in WalEs and AuStralia (BEACHES): a study protocol


Rebecca Pedrick-Case ¹, Rowena Bailey,¹ Ben Beck ², Bridget Beesley ³, Bryan Boruff ⁴, Sinead Brophy ¹, Donna Cross ^{3,5}, Gursimran Dhamrait ^{5,6}, John Duncan ⁴, Peter Gething ^{5,7}, Rhodri D Johnson ¹, Ronan A Lyons ¹, Amy Mizen ¹, Kevin Murray ³, Theodora Poulou ¹, James Rafferty ¹, Trina Robinson ⁵, Michael Rosenberg ⁸, Jasper Schipperijn ⁹, Daniel A Thompson ¹, Stewart G Trost ¹⁰, Alan Watkins ¹, Gareth Stratton ¹¹, Richard Fry ¹, Hayley Christian ^{3,5}, Lucy J Griffiths ¹

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► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-061978>).

GS, RF, HC and LJJ are joint senior authors.

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 Check for updates

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Correspondence to

ABSTRACT
Introduction Childhood obesity and physical inactivity are two of the most significant modifiable risk factors for the prevention of non-communicable diseases (NCDs). Yet, a third of children in Wales and Australia are overweight or obese, and only 20% of UK and Australian children are sufficiently active. The purpose of the Built Environments And Child Health in WalEs and AuStralia (BEACHES) study is to identify and understand how complex and interacting factors in the built environment influence modifiable risk factors for NCDs across childhood.
Methods and analysis This is an observational study using data from five established cohorts from Wales and Australia: (1) Wales Electronic Cohort for Children; (2) Millennium Cohort Study; (3) PLAY Spaces and Environments for Children's Physical Activity study; (4) The ORIGINS Project; and (5) Growing Up in Australia: the Longitudinal Study of Australian Children. The study will incorporate a comprehensive suite of longitudinal quantitative data (surveys, anthropometry, accelerometry, and Geographic Information Systems data) to understand how the built environment influences children's modifiable risk factors for NCDs (body mass index, physical activity, sedentary behaviour and diet).
Ethics and dissemination This study has received the following approvals: University of Western Australia Human Research Ethics Committee (2020/ET000353), Ramsay Human Research Ethics Committee (under review) and Swansea University Information Governance Review Panel (Project ID: 1001). Findings will be reported to the following: (1) funding bodies, research institutes and hospitals supporting the BEACHES project; (2) parents and children; (3) school management teams; (4) existing and new industry partner networks; (5) federal, state and local governments to inform policy; as well as (6) presented at local, national and international conferences; and (7) disseminated by peer-reviewed publications.

STRENGTHS AND LIMITATIONS OF THIS STUDY
⇒ The Built Environments And Child Health in WalEs and AuStralia (BEACHES) project uses large representative samples of children from five Wales and Australian cohort studies.
⇒ Standardised built environment measures will be applied across Wales and Australia and linked to the cohort study data at the individual level.
⇒ The contrasting time points, climates, geographies and policy approaches in Wales and Australia will provide stronger evidence of the causal pathways between the built environment and child health.
⇒ The use of existing cohort data sets can limit the use of consistent health outcomes across studies.
⇒ Analyses using routinely recorded data (Wales) may omit some unknown confounders, thereby introducing a moderate level of bias due to confounding.

risk factors for non-communicable disease (NCD) prevention in children.¹ The 2017 Commission on Ending Childhood Obesity emphasised that the prevention of modifiable risk factors for NCDs should start as early as possible.² Yet only 20% of UK and Australian children are sufficiently active, and over 60% engage in excessive sedentary time, with a third overweight or obese.^{1,3}
The built environment in which we live is integral to human health. Research has shown that residing in 'liveable' neighbourhoods characterised by good access to shops, services, quality parks, connected streets to facilitate walking, sufficient residential densities to support public transport services and local businesses, minimal crime and traffic and social connectedness oppor-

INTRODUCTION

Challenges and opportunities

- Multi-sectoral **linked data** is amazing! It helps us explore health in new ways which have previously been restricted to silos
- Wales is a unique environment with total population linkage and hard-won knowledge
- However, to generate, understand and analyse the linked data we need:
 - **HPC**
 - **New methods**
 - **A deeper understanding of geoprivacy in multiple linked datasets**
- There are multiple holders of vast geospatial environmental data – vast majority free at the point of use:
 - **Met Office**
 - **CEDA**
 - **NERC repositories**
 - **Centre for Ecology and Hydrology**
 - **European Space Agency & NASA**
- **Spatial Epidemiology with linked data provides unique opportunities**
- **Multi-site exposures e.g. schools and workplaces**
- **Currently working with lab-based colleagues on air pollution and**



https://twitter.com/Cmdr_Hadfield/status/326731436788944896?s=20&t=xt_qrbKyF9L4t1Sxcqdyw