

# LOCATION INTELLIGENCE

How location is improving  
healthcare services



## INTRODUCTION

# Why location data

### The case for location data

Understanding patterns and trends is easier when placed in a geographic context. Vast amounts of information can be distilled when viewed on a map.

But a map is just the start of what can be done with location data, and many organisations and start-ups are realising that fusing location into their data systems has numerous benefits.

### Benefits

- Location data is authoritative, which means it can be trusted as being correct, accurate, and reliable.
- Location data can be used to bring multiple sources of information together. It is the chain that links together datasets.
- Location data is high quality data, captured and processed using common data principles and standards.

### What is authoritative data?

‘Authoritative’ means something you can trust and respect as true and correct; synonymous with accurate, reliable, and trustworthy. Authority needs to have a trustworthy source. Where does the data come from? Who owns, collects, and

manages that data, and how do they manage quality? Will it be reliable, i.e. still the same in five years’ time?

As the National Mapping Service, Ordnance Survey creates, maintains, and disseminates consistent, definitive, and authoritative geospatial and cartographic data of Great Britain. The capabilities we deliver support the public and private sectors and the delivery of the UK Geospatial Strategy.

OS benefits from being trusted by those who use our data, and we ensure we apply the highest standards to our data and products. In fact, we do more than follow global data standards; we lead in their development, maintaining high quality data which is ‘authoritative.’





## INTRODUCTION

# In a healthcare context

One of the principles of effective geographic data management is to make the link to geography at source and at the most granular level. That means verifying addresses, and capturing UPRNs through patient and service registration process. This approach will ensure quality address information is captured and the link between UPRNs and records can be maintained in key databases, in turn making it possible to unite and collate datasets previously separate.

Cross-collaboration helps gather even more insight, achieve greater understanding, and work towards a single version of the truth for the location of patients and services. One version of the truth that will reduce the duplication of effort to match addresses, further enhanced by daily address update capability and richer address attribution, which Ordnance Survey can provide.

And through merging datasets, it becomes possible to link people to places, and vice versa. Therein lies the possibility of understanding how places affect people's health, what services need to be prioritised and then, wherever possible, deciding how specific situations can be improved. It need not be a blanket policy approach; using location data can help better healthcare and services, at a more individual level.

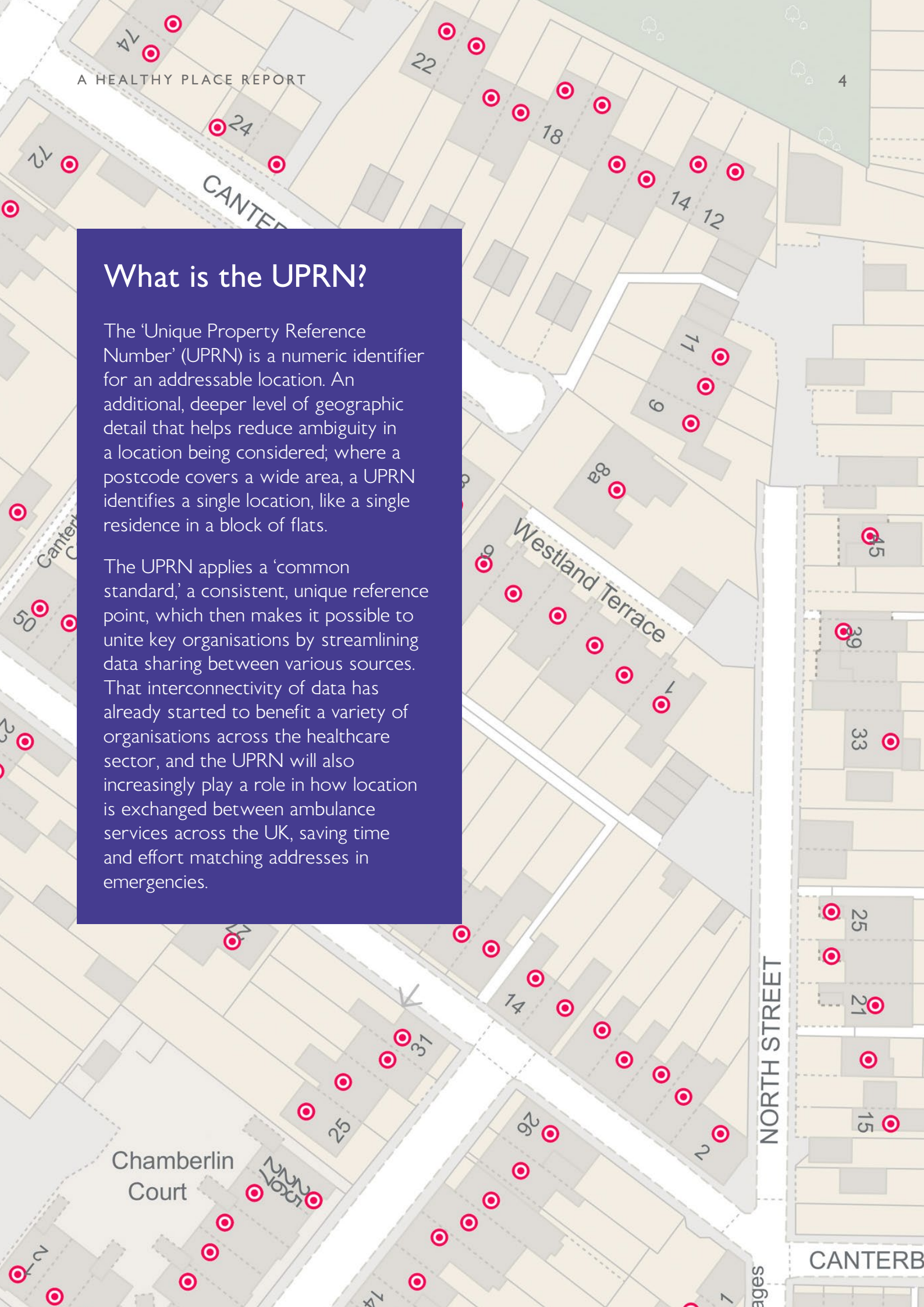
This report will explore examples, genuine use cases, of that concept: combining health and location data, across a range of organisations, to develop new projects and solutions to the improvement of people's health and quality of life.



## What is the UPRN?

The 'Unique Property Reference Number' (UPRN) is a numeric identifier for an addressable location. An additional, deeper level of geographic detail that helps reduce ambiguity in a location being considered; where a postcode covers a wide area, a UPRN identifies a single location, like a single residence in a block of flats.

The UPRN applies a 'common standard,' a consistent, unique reference point, which then makes it possible to unite key organisations by streamlining data sharing between various sources. That interconnectivity of data has already started to benefit a variety of organisations across the healthcare sector, and the UPRN will also increasingly play a role in how location is exchanged between ambulance services across the UK, saving time and effort matching addresses in emergencies.







## CUSTOMER EXAMPLE

### Protecting the nation's health

The UK Health Security Agency (UKHSA) is dedicated to protecting the nation from health threats as well as responding to and mitigating the effects of infectious diseases.

A significant element in fighting Covid-19 involved tracking patient cases, and accurately locating them to better assess how the virus was spreading. James Lewis, head of the UKHSA's Geographic Information Systems (GIS), Data Analytics & Surveillance team, said: "OS data was critical for us to do our job. Without using OS AddressBase, we couldn't have responded in the way that we did. No other dataset could

allow us to easily see each property classification for each Covid case."

Through the Public Sector Geospatial Agreement (PSGA) the UKHSA accessed a range of OS products and services, including AddressBase and the Unique Property Reference Number (UPRN), to support their response plans.

Precise locations, made possible by OS AddressBase and the UPRN, helped the UKHSA determine where to deliver Covid-19 test kits. The UKHSA also used the OS Highways dataset to understand and plot locations for potential test sites; then, assess patient accessibility to their nearest site.



UK Health  
Security  
Agency

## CUSTOMER EXAMPLE

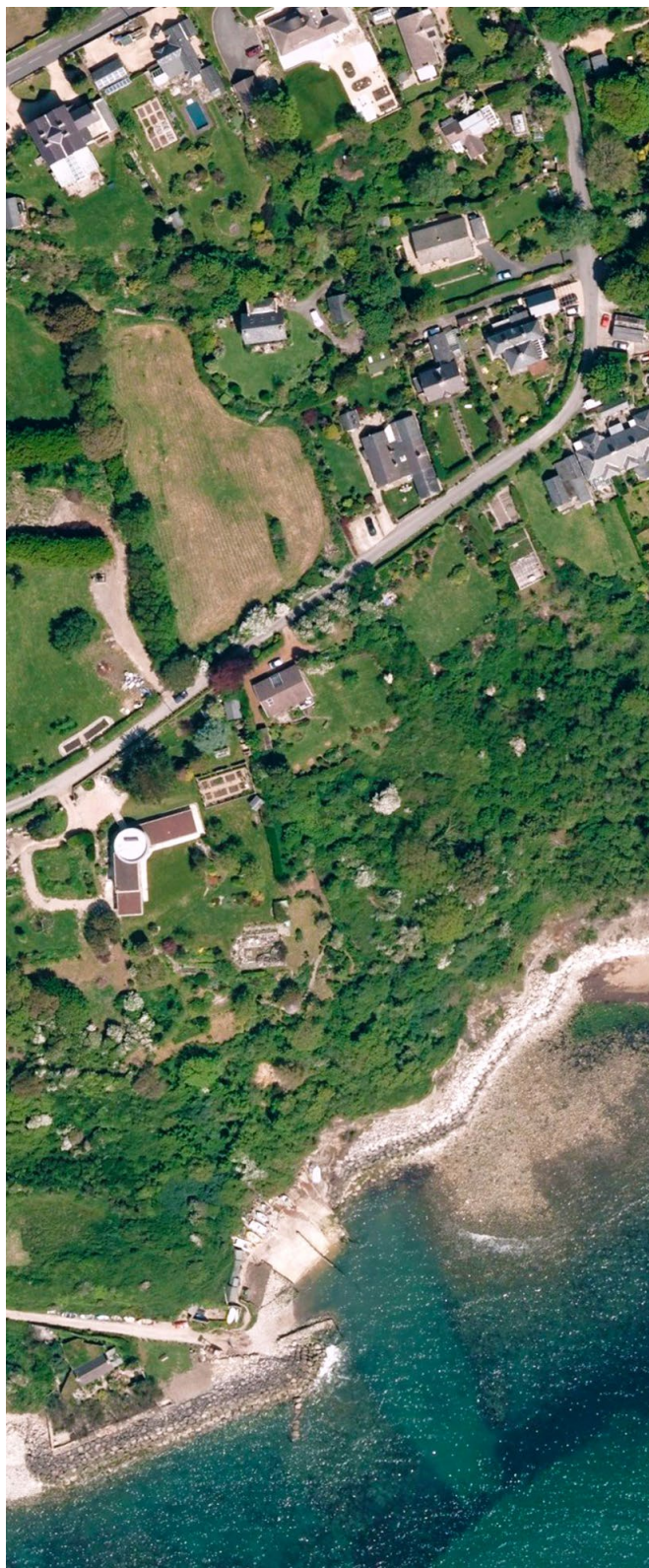


## Learning from the pandemic

Access to quality location data to link people to places was key to NHS's response to Covid-19. When the pandemic first struck, NHS England (NHSE) needed to understand specific individual needs and situations, on a household level.

NHSE used an existing dataset: the Master Patient Index (MPI), which contains pseudonymised information such as which GP someone is registered with and the area where they live. The data is securely processed by using address data from OS AddressBase Premium to then link it to the relevant Unique Property Reference Number (UPRN).

Using AddressBase Premium to verify the quality of location data across Test and Trace meant building-level data was available to support contact tracing, testing, and vaccination roll out; while the UPRN builds a bridge back to raw data, making it possible for NHSE to understand household types and variations, and how that can have implications on health and wellbeing.





## CUSTOMER EXAMPLE



### Accurate addressing can optimise capability

NHS Digital has also implemented the OS Places API for validating address data. The OS Places API can connect to detailed and authoritative address data (including the UPRN), and was used by NHS Digital to capture addresses of people requesting Covid-19 home testing kits.

The OS Places API was quickly integrated with NHS Digital's online ordering systems. The 'Capture and Verification' feature made it simple

as entering a postcode, and selecting the address from a drop-down list, removing the need to enter manually.

During the pandemic, in a period of unprecedented demand, the OS Places API optimised online user journeys by removing the need for manual address entries – speeding up the process – and by reducing the chance of less successful deliveries. NHS Digital achieved capability to send hundreds and thousands of tests at once, via the bulk ordering too.





## CUSTOMER EXAMPLE

### Improving access to services



The quality of healthcare and adult social care in the UK is monitored and regulated by the independent Care Quality Commission (CQC). They monitor and visit services, then publish their findings to help users find relevant, high-quality care; and where CQC identify lower quality, they have authority to take action.

CQC adopted the UPRN to integrate their data with NHS Digital and social care data, carry out deep analysis, and achieve a single version of the truth. CQC can provide their services reassured in the knowledge that they are better aligned with other organisations, and referring to the correct location. Sharing and aligning data sharing used to take CQC six to eight months – assigning the UPRN has reduced that time and effort.

And once these key organisations – healthcare providers, practices, pharmacists and so on – are united, into a single version of the truth, CQC and NHS Digital can use the UPRN to identify these organisations relevant to the healthcare sector and share valuable information with the general public. The CQC's decision to integrate the UPRN has optimised the means of locating and inspecting healthcare services; in turn building trust, confidence and granularity into their data, so that people can access and receive the best care and support available.



## CUSTOMER EXAMPLE

### Ensuring access to critical equipment

Knowing a defibrillator's location can be the difference between life and death, yet traditional addressing methods have been insufficient for finding them in emergency situations. One defibrillator may be held in a block of flats, for example, or on the outside of a large building. Some defibrillators aren't used at all, due to emergency services not knowing where they are, or how to access them.

The British Heart Foundation (BHF) used the UPRN in developing a new national defibrillator database. Known as 'The Circuit,' the intelligent database connects defibrillator locations directly and automatically to each ambulance service, and allows the ambulance service to identify tens of thousands of defibrillators instantly.



# Joining up information for better analytics

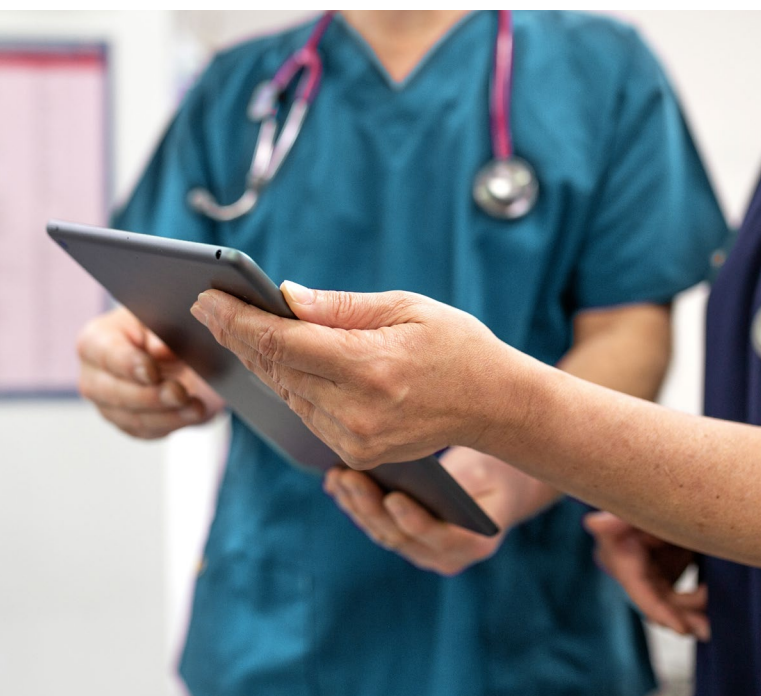
More research tells better stories.

The more data and information you can gather, the more informed and stronger your analytics shall be. The Public Sector Geospatial Agreement (PSGA) licence enables data sharing between health and social care bodies, making new, beneficial solutions possible. Rich and valuable data, stored across numerous, separate organisations, even other agencies such as the DWP or HMRC, can be combined to enhance data flows, enable joined-up working between organisations, and help to develop new datasets and models.

For example, by combining GP, hospital, pharmacy, and social care datasets, it could be possible to map out the entire journey an individual takes, between the health system and other healthcare organisations. This model could then be used to highlight areas of strain, or delay to the patient, and create new focus for improvement. It could also be used to check for individual vulnerability – once the data's merged, it's more a matter of imagination. There is significant benefit to data interoperability.

However, merging datasets is subject to compliance, data protection, data sharing standards, and basic competitiveness between organisations.

Location data can be the uniting link between other organisations, and their data, acting as a trusted, and neutral enabler of information. Consider the UPRN; a digitised and machine-readable identifier for a given location. The data attached to it can be pseudonymised, and filtered to ensure users access just the data they need. Data can be shared; the insight still achievable, while the integrity of the data remains intact.





## CUSTOMER EXAMPLE

### Intelligent Vehicle Monitoring



To improve their data analysis, and make more authoritative decisions, South Central Ambulance Service (SCAS) used geospatial (location-based) data in their investigative projects. Their idea was to monitor and manage vehicle telemetry in their fleet of ambulances, considering the vehicles themselves and how the environment affected their performance. Performance data could predict when vehicles needing to be taken off road for repairs, and geospatial data could then identify certain locations and criteria to better understand how the characteristics of a journey could assist with prediction.

The SCAS ambulance fleet is almost 100% deployed, leaving very little resilience in the system which is then made worse when ambulances have to be taken off road for unforeseen maintenance. SCAS approached Ordnance Survey and asked that we map data for 300 vehicles, to better understand how geospatial data – road types, distance from road, urban/non-urban area, postcode areas – could benefit their analyses.

SCAS wanted to build a predictive data model to achieve new insight, both analytical – what do the vehicles look like when they get back after a shift? – and predictive – what is the numeric probability of an ambulance going wrong, for example. Predicting when an ambulance engine will need servicing is one crucial data point, and to unlock that, SCAS can link their data to road networks and interpret how locations are affecting engine telemetry.

The fleet of 300 ambulances contain two trackers per vehicles. The engine tracker,

monitoring the internals such as engine and electronics; and the cab tracker, monitoring inside the driver's cab. These trackers can then gather all sorts of vehicle telemetry data, which can be combined with OS geospatial data.

OS then consider the journeys and the conditions of the locations against SCAS' data of vehicle stress. Where was the vehicle at the time? Was the ambulance somewhere urban or rural, going uphill or downhill, and so on. Driving uphill causes overheat, so what strain does that cause to the engine? What effects can harsh braking and harsh acceleration have?

All of that can be combined with maintenance data to produce the predictive and analytical data model.

SCAS only have access to a limited number of ambulances, and without the option of acquiring more, the priority is improving the efficiency of what they already have. This new data model can help them achieve that goal, by using it to predict potential off-road time, to get better use out of their fleet, and wherever possible, help to improve the welfare of the drivers and crew.

The data insight from IVM has the potential to implement strategies which can reduce vehicle off-road time and downtime, thereby improving the efficiency of the overall fleet. The IVM helps SCAS understand the condition of their fleet, plan and react accordingly, and having as many ambulances available as possible means a greater percentage of helping those in need.

## CUSTOMER EXAMPLE

### Prioritising vulnerability



Responding to emergency situations and providing necessary support is not a one-size-fits-all procedure. Persons deemed 'more vulnerable' in a community have their own needs and requirements in terms of healthcare, and therefore need to be prioritised during a major incident or emergency.

The Welsh Government therefore combined its own data with Dwr Cymru (Welsh Water) Priority Services Register (PSR): a recognised, regularly maintained list of registered households which have defined themselves as vulnerable. It uses data captured from households, consisting of multiple vulnerabilities, and has Unique Property Reference Numbers (UPRNs) integrated into it.

Welsh Gov can harness the UPRN to gather vital information and record vulnerability on an address-by-address basis, to better understand the requirements of their communities, and prioritise emergency services accordingly so citizens can receive the help and support that they need.

As an example, during storm Eunice (February 2022) it was possible to gather a list of at-risk properties within three minutes. Previous incidents had required five to eight hours, to achieve the same outcome. An incredible reduction in time and effort, which wouldn't have been possible without UPRN.

The Resilience Community have informed Welsh Gov that by using this method, by prioritising the evacuation or additional support to the most vulnerable in our communities during a major incident or emergency, then lives can be saved.





## CUSTOMER EXAMPLE

### Proactive before reactive



The Welsh Government, and Welsh emergency services both have a longstanding relationship and appreciation for the UPRN; they have been using it for over ten years.

Much like the DataMap Wales work, a project has been developed where the UPRN links data between social services' departments, and emergency services teams to help the Fire and Rescue Service carry out routine Home Safety Visits.

The use of vulnerability data can be used during normal operational activities, such as the home checks, creating new possibilities for proactive services and potentially avoiding greater risks in future.





## CUSTOMER EXAMPLE

### Correct addressing lessens delays



London Ambulance Service  
NHS  
NHS Trust

During the Covid-19 pandemic, ambulance service call handlers received unprecedented and sustained volumes of 999 calls, leading to services across the country supporting one another by answering overflow emergency calls. London Ambulance had been using AddressBase Premium data to locate addresses, which though effective, only has location data for the London area. If answering an overflow call from elsewhere, not being able to check the address could lead to serious delays.

London Ambulance Service therefore implemented OS Places API into their system for out-of-area address queries. This API provides the most up-to-date and correct address, grid reference, and UPRN – enabling additional data links, if required – and significantly reducing crucial time when trying to locate the patient.

“The benefits of using the OS Places API is significant for avoiding unnecessary delays in mobilising the resources to the incident location.” John Downard, Head of IM&T Applications



# How location data can improve health outcomes

There are many environmental factors that can affect our behaviours and health outcomes (known as the wider determinants of health) including the built and natural environment, such as how an individual location might impact health outcomes, through unequal access to key services, and amenities.

Using location data to model accessibility is key to understanding the relationship between the demand for and supply of services.

Ordnance Survey want to go beyond mapping access to health services, and consider a wider set of geographic characteristics. For example, we are working with NHS England to develop a gridded data approach to analysing walkability, and potential health benefits, at the neighbourhood level.



## CUSTOMER EXAMPLE

### Steps in the right direction

The 20-minute neighbourhood is a relatively new concept being considered worldwide: ensuring people can reach their essential needs within a 20-minute walk (within approx. 800m) of their home.

Implementing 20-minute neighbourhoods can help:

- enable people live better, healthier lives
- provide an alternative to driving
- make it more accessible to those who are unable to drive or can't afford to
- reduce air and noise pollution
- ease congestion

OS has started to develop the idea of neighbourhood walkability, using a gridded approach to understand: where residents are, and what services are available to

them. Our teams generated a grid of 50m squares for the full land extents of England, to calculate walk time to relevant services; healthcare (GP, pharmacies), retail, public transport, and so on.

Data sources for these services include AddressBase, Sites Layer, Retail Geographies, and directories of the Care Quality Commission (CQC), and Organisation Data Service (ODS).

Using the OS MasterMap Highways Network – Paths meant OS could create routes between residential areas and relevant services, and then provide a walkability score. Locations with lower scores can then be prioritised by government and local authorities, to start helping people reach the care and support they need.





## CUSTOMER EXAMPLE

### Identifying gaps in care provision



Department  
of Health &  
Social Care

In a similar vein to walkable neighbourhoods, we also wanted to model distances and identify areas of England considered to be lacking in their access to care homes. The Department of Health and Social Care (DHSC) wanted to make sure people can easily access a care home when they need one, without having to move far away from family and friends.

Data scientists from OS and DHSC worked together to develop a tool to calculate the distance from care homes to population centres, using open-source coding tools. The flexible tool uses OS AddressBase Plus and OS Open Roads geospatial data to create routes and produce driving distances, alongside ONS data on the over 65 population of each area, and Care Quality Commission data on the number of beds within each care home.

DHSC now have detailed data showing the driving distance from care homes to communities, giving them a much greater understanding of gaps in care home provision across different local authorities, and how far people need to travel from family and friends. To help tackle these gaps, DHSC are developing a dashboard with a map window to visualise the data for stakeholders, and plan to develop the tool with PSGA data.





## CUSTOMER EXAMPLE

### New solutions for new insights



Business Services Authority

The NHS Business Services Authority (NHSBSA) is dedicated to better health, and becoming the delivery partner of choice for the NHS. NHSBSA manages over £ 35 billion of NHS spend annually, delivering a range of national services to NHS organisations, NHS contractors, patients, and the public.

Their teams wanted to address a key gap in their knowledge base: to identify care home prescriptions, within their wider prescription data, to then share their new insight with other NHS organisations – with the potential to optimise medicine management, improve the quality of care and patient safety, and reduce cost and waste.

With OS data and expertise, primary care prescription address data was linked to care home addresses in AddressBase Plus and Care Quality Commission (CQC) data. The findings confirmed that care home patients tend to receive more prescribing compared to other NHS patients, including for a wider range of medicines and pain relief.

The NHSBSA has created the first ever prescription form-level analysis of care home prescribing, highlighting trends underpinned by figures. It is now able to share valuable insights across the NHS to inform the use and management of medicines in care homes, helping to improve health outcomes, the quality of care, and ensure the best value.



# What is the future for geospatial in health?

This report has primarily focused on the organisation-to-user perspective; how agencies in the healthcare sector are bettering themselves, to the benefit of their people. By visualising data for management information, organisations are able to use geography to understand trends and patterns over time, and through this process, understand how geography can inform new and redesigned services.

And as technologies evolve, and as methods of geospatial data capture unlock even more detail and insight, we can continue that journey of optimisation.



But while mapping can help numerous organisations understand health on an individual basis; so can mapping assist the individual themselves. Mapping can play a role in improving our fitness and wellbeing, by supporting outdoor exercise. In August 2022, the UK government announced a new policy of GPs offering ‘social prescriptions’ – walking, wheeling, cycling – to encourage people to get active, as part of a trial to improve mental and physical health. Dr Amir Khan, an OS Ambassador, regularly prescribes time outdoors with nature for his patients.

At OS we talk about making the outdoors enjoyable, accessible, and safe and the new trials really support these messages. During the Covid-19 lockdowns walking and cycling became a key part of people’s daily routines supporting both their physical and mental health. Our free mapping app, OS Maps, saw an 80% increase in downloads and huge activity across our urban maps including green spaces and cycle networks.

Getting outside more often can lead positive change in individual health and wellbeing; and access to accurate location data can help facilitate that effort.





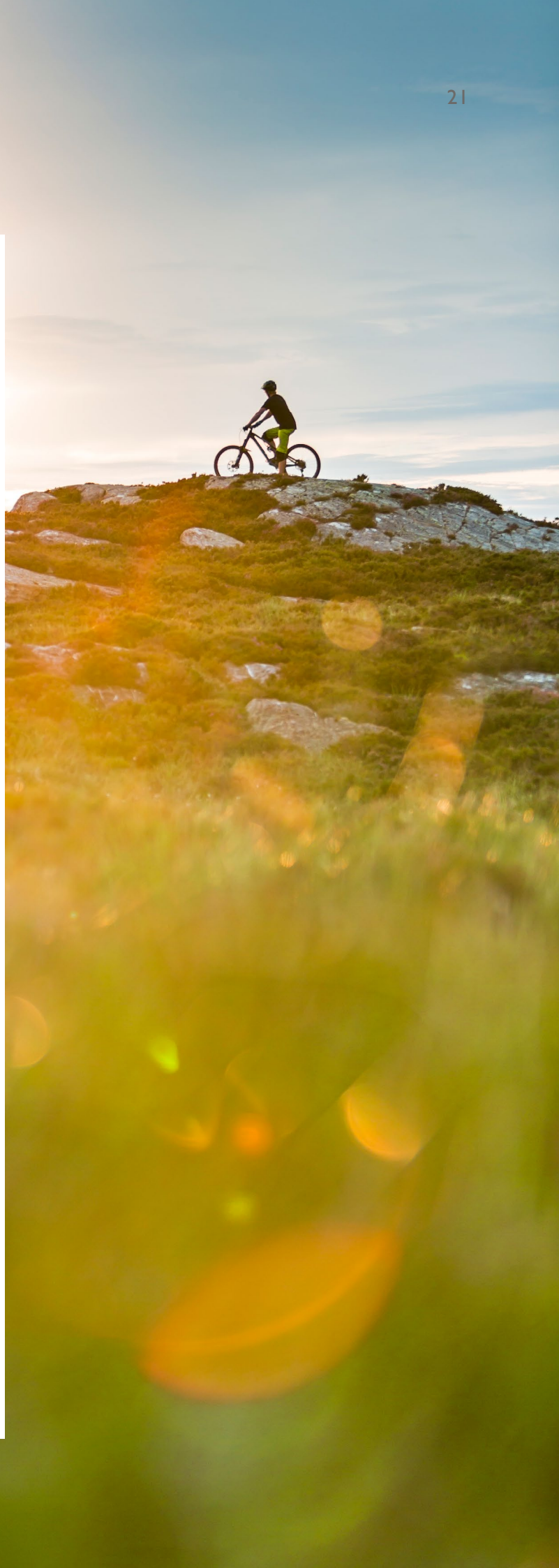
# A healthier place

Understanding both the geographic characteristics of places, and how those places then reflect in individual requirements, is a key component in tackling the wider determinants of health, and reducing health inequalities. With foundational data in place, you can share information, analyse health determinants, and predict future demand. The power of geography to link and share real world information can be unlocked through integration.

That's why the PSGA provides the NHS with a wealth of geographic information for use in the planning and delivery of services. Our location IDs have been implemented into key NHS data flows, and NHS England's data platforms can help to realise the benefits of geography across the health and care system.

If you work for the NHS and are interested in benefiting from geographic analysis, please get in touch – our expertise in managing and exploiting geographic information is freely available to NHS members of the PSGA.

Meanwhile we will continue to develop new data models, new solutions, new collaborations with other organisations; combine our knowledges and insights, and so our customers create a healthier place.



# Solutions for public sector organisations

Discover how your organisation can access world-leading location data and expertise

The Public Sector Geospatial Agreement (PSGA) supports the delivery of critical infrastructure and services, as well as working to help protect our environment.

[Learn more about the PSGA](#)

# Bring your solutions to life with OS data and APIs

Get started for free and benefit from the power of location by incorporating Great Britain's most comprehensive geographic data into your applications.

[Visit the OS Data Hub](#)