

# Flows of tenants within social residential accommodation

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This project explores mathematical models to simulate tenant flows, and clustering techniques to represent the different patterns of support and care provided for segmented tenant groups. It aims to answer the question: “what can we learn about the system behaviour of residential social housing and the interactions with health and social care services?”.

## Team members

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## The need

This research would enable a better understanding of the:

- case mix of tenant groups within residential social accommodation; the characteristics and service usage patterns, which could be used to tailor services to meet individual needs
- movement of tenants within the system and the changing level of need over time, which could help predict resource requirements and enable advanced preparation for individual provision
- interactions with other public services, which could also help identify the main areas that may potentially relieve pressure by addressing blockages, sufficiently resourcing constraints, and reducing and removing delays in the system

This research has the potential to help residential social landlords improve meaningful outcomes for their tenants, such as the timely provision of care and adequate accommodation suited to individual need and place of preference. It

will provide sophisticated analytical tools to facilitate evidence-based decision-making with regards to a complex social system, which could be adopted by other third sector organisations to support operational delivery. This research will provide valuable and much-needed insights regarding the movement of tenants within social housing, which could also identify savings to other public services such as the NHS and local authority social services.

## **Impact**

This project will seek to explore the flows of tenants within social residential accommodation and residential health care provisions, using data from Housing, Care and Support Services Across South Wales (Hafod) - a social residential tenant organisation - which manages accommodation for 16,000 households across South Wales. Hafod is in a unique position as a service provider for both housing and health care provisions and would like to better understand the interactions of individuals within and between these two functions and other public services such as the NHS.

The analysis will produce quantitative descriptives of the demographics and service interaction patterns of individual tenants, create outputs relating to system behaviour such as rates of demands, churn of tenancies, processing times and delays, redundant capacity and sufficiency of resources. The project deliverable will be an analytical tool using visual graphics and user interaction features to enable what-if scenario exploration. This will also facilitate intuitive interpretation for a non-technical user and thus improve accessibility for real-world application.

## **Data science**

The primary method to be used will facilitate systems flow analysis, where customers are represented as individual entities in different states over time. Outputs from customer segmentation analysis will be used to represent pathways for specific customer groups and together with machine learning techniques will facilitate what-if scenario analysis to model future system behaviour.

## **Cluster analysis**

Use clustering techniques to segment the customer base into groups based on common demographics and service use patterns. The outputs of which will be used to represent segment customer pathways. This will generate insights into the case mix of the customer base, for example, between long-term and permanent tenants, and those accommodated on a short-term emergency basis, or the difference in residents accommodated in residential care following an unplanned

and unexpected duration in hospital compared with those who self-initiated their move into a care home.

### **Agent-based modelling**

Model entities with individual attributes to understand whole system behaviour of pathways and interactions with different services. Modelling the flows of groups of individuals with similar characteristics within the same system. Output main metrics such as the change in demand for important services, bottlenecks in flows, emergent behaviours within the system.

### **Machine learning**

Use supervised machine learning techniques to identify predictive factors and drivers for main outcomes such as changes to circumstances and level of required support and services. Apply these factors to the systems model to predict future outcomes within the model to facilitate scenario analysis. This could be used to predict the outcomes for individuals' current moving through the system based on the observed and known behaviours of customers who have previously moved through different sectors. This could also help us to answer things like, given what we know about the demand for support and services based on our current customer base, what levels of support and where will resource be required in future.

### **Data**

Hafod holds micro-level data on all their managed households at an individual tenant record level going back to 1998, collected through a CRM system and held in SQL databases. National Insurance numbers and DOB are used for unique identifiers. Information includes financial circumstances, employment status, measures of well-being, family situation, benefits data. Data generated from care home and domiciliary care services is a rich data source containing detailed records of services and support provided on a regular/routine basis, daily for certain cases and situations. The data is collected and stored in disparate systems, usually held locally within the care homes and service settings. Currently, the data is collected and aggregated for high-level analysis of service performance but not used to explore individual services or their interactions. The data includes information such as time-stamped interactions with care workers, movement between hospital, residential care and hospices. Hafod also holds an asset management database containing information on their housing stock, also held within a SQL database.

## **Collaboration**

The work will be carried out in collaboration with Hafod. The methods will rely on open source tools and the code used will be made publicly available. An accompanying report will be produced and guidance/advice for continued in-house development and implementation. Project teams will be work flexibly between co-located office and communication via regular/weekly stand ups.

## **Stakeholders**

- Hafod

## **Code and outputs (so far)**

- Caring for the future – working with Hafod (Blog post, 25 September 2018).

## **Delivery**

- [x] September 2018: project started

## **Further information**

Please contact [datasciencecampus@ons.gov.uk](mailto:datasciencecampus@ons.gov.uk) for more information.

## **Updates**

- No updates yet.