

SERVICE DESCRIPTION

NQM Care Analytics

Using data to manage and predict social care pressures



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Table of Contents

	1
1. Overview	3
1.1. Features	3
1.2. Benefits	3
2. Modules	4
2.1. Data import	4
2.2. Data Integrity	5
2.3. Status View	6
2.4. Service User View	7
2.5. Wellbeing Metrics	7
2.6. Scenario Planner	8
2.7. Location Analysis	9
2.8. Service Predictions	9
2.9. Cohort Builder and Bookmark	10
3. Methodology	11
3.1. Matching	11
3.2. Synthetic data	11

3.3.	Integrity and completeness	11
3.4.	Metadata mapping	11
3.5.	Time variant field	11
3.6.	Static cohort definition	11
3.7.	AI and machine learning	12
3.8.	Dynamic cohort definition	12
3.9.	Validation	12
3.10.	Fine-grained population models	13
3.11.	Population gearing – Demand model	13
3.12.	Cohort evaluations	13
3.13.	Wellbeing modelling	13
3.14.	Cohort stratified prediction models	13
4.	Background	14
5.	Further Details	14

Nquiringminds™ Care Analytics

1. Overview

The NQM Care Analytics application assists in the strategic management and planning of social care provision and ensures that it is optimised for service users within the constraints of local authority capacity. It provides robust and easy-to-use tools to import, clean and merge data from a variety of sources and uses Artificial Intelligence (AI) to provide strategic and operational insights, to perform impact analysis and to make recommendations in relation to service provision.

1.1. Features

- Data merge and clean: combine data from multiple sources with easy-to-use interoperable APIs and schemas.
- Data integrity: perform real-time checks on data coverage and quality.
- GIS/charting overview: interact with maps and charts showing the distribution and characteristics of current and previous service users.
- Cohort builder: define groups of service users with similar characteristics either manually or using advanced analytical and clustering techniques and save them for future reference.
- Bookmarking: securely share data views and insights with colleagues.
- Service user analysis: use a variety of measures to assess, compare and prioritise service users.
- Integrated service user view: combine multiple data sources for a consolidated view of each individual service user and access the following analytics:
 - Risk indications for hospitalisation or movement to residential care;
 - Care package recommendations;
 - Forecasts for future service use; and
 - Likely future costs.
- Scenario planning: investigate the consequences of critical incidents such as services being decommissioned, service providers failing, pandemics or floods. Identify which service areas and service users would be affected and see recommendations for how to respond to locational stresses.
- Service prediction: predict the future growth in demand for any group of service users under different scenarios.
- Location optimisation: optimise the catchment areas and route planning of care providers and patch teams to reduce travel time and cost and improve operational efficiency.
- Wellbeing outcomes analysis: visualise and analyse wellbeing measures across care packages.

1.2. Benefits

- Smarter planning: tools to help plan capital and service investments reduce the costs and risks that are associated with both the over- and under-provisioning of services.

- Resilience: impact analysis can be used to improve resilience and perform contingency planning, reducing the effects of emergency measures on cost and quality.
- Service optimisation: optimising the configuration of care services and travel routes reduces the cost of care provision, improves efficiency and reduces CO₂ emissions.
- Better health outcomes: by optimising care package recommendations based on empirical outcome data, it is possible to improve the outcomes for service users and reduce the long-term cost of service provision.
- Increased carer pool: by recommending 'walkable' routes, the pool of carers can be expanded to include non-drivers. This also reduces the CO₂ footprint of care services and improves community cohesion.
- Intervention impact analysis: by understanding the impact of interventions over time, more effective care packages can be developed, leading to better outcomes and lower costs.

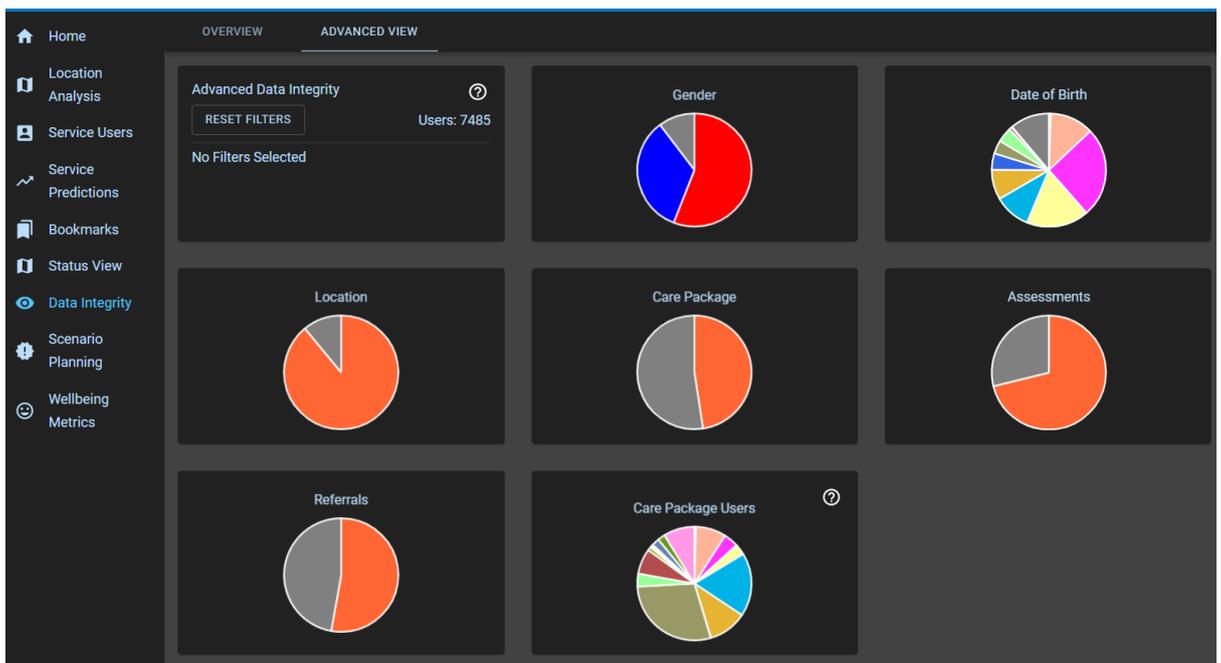
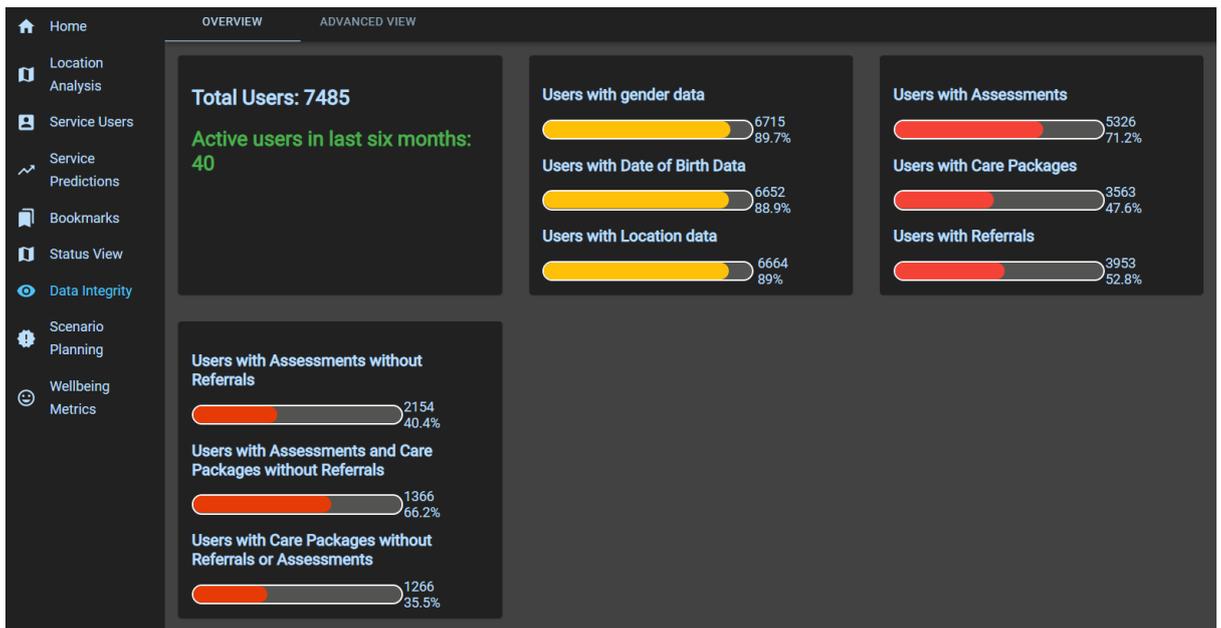
2. Modules

This section provides a list of the primary modules in NQM Care Analytics.

2.1. Data import

The Data Import module enables the import of data from diverse sources into the standardised format that powers NQM Care Analytics. It is designed to work with new datasets with minimal configuration and the end schemas are published as open source to prevent vendor lock-in and to encourage the adoption of open standards within social care.

2.2. Data Integrity



The Data Integrity module provides fine-grained analytics on the completeness and quality of the data that was imported. It includes advanced filtering options that allow administrators to analyse the quality of their data and to identify areas where quality improvements would be beneficial.

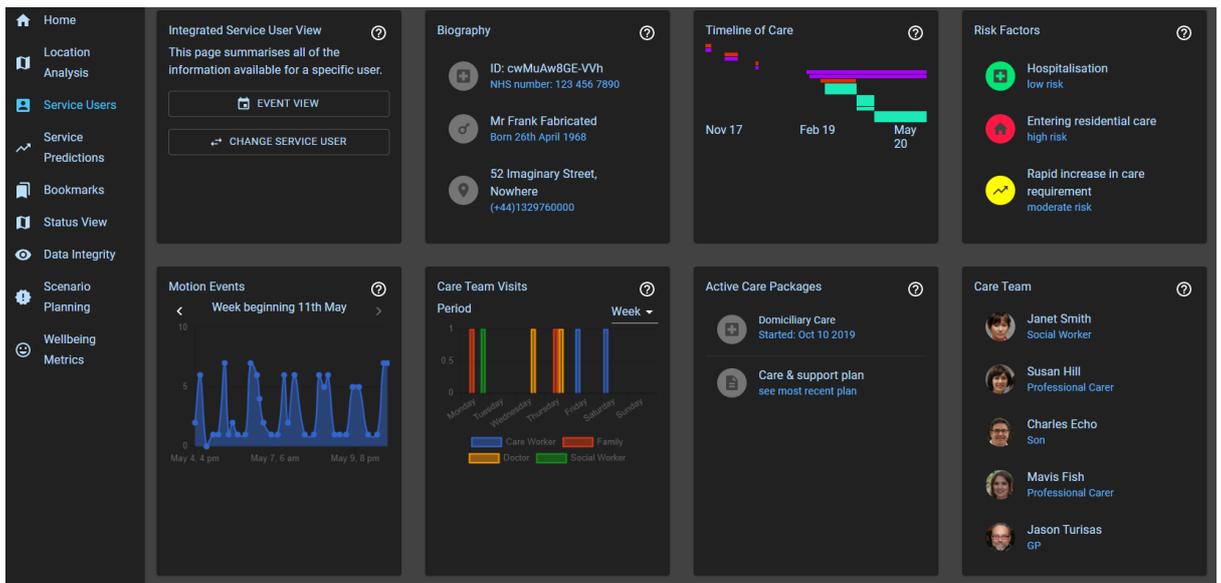
2.3. Status View



The Status View is similar to the typical GIS view that many adult health and social care workers are familiar with and it provides high-level analytics based on health and social care data. However, the NQM Care Analytics Status View is particularly powerful for the following reasons:

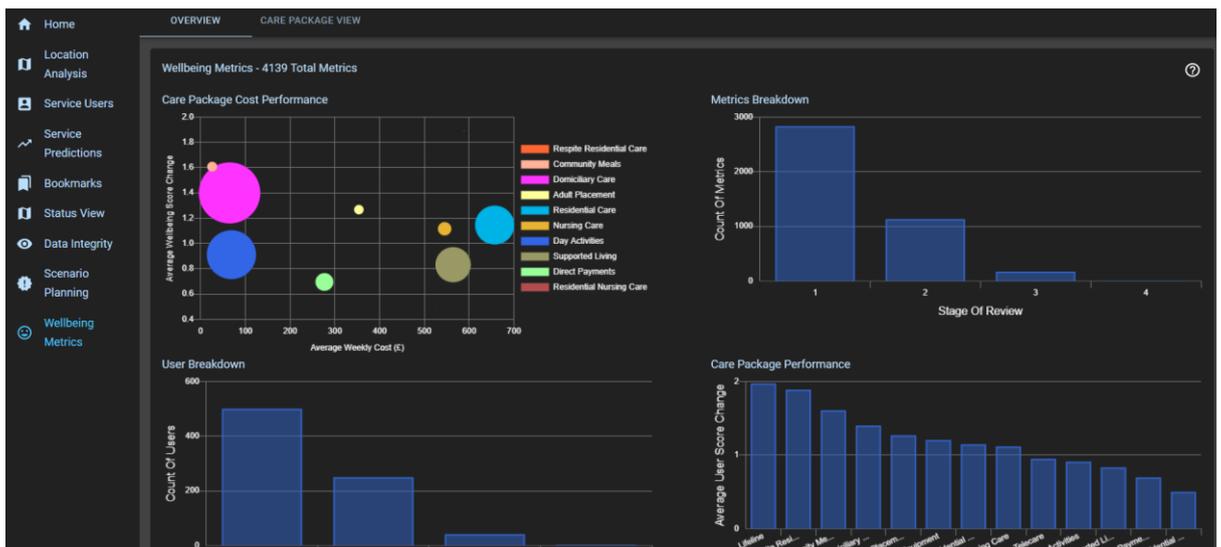
- Granularity: its views are not simply average values but are based on how individual case histories of service users change over time.
- Real-time: it can be connected to live data sources to give a precise live view of the current situation or updated less often if preferred.
- Dynamic cohorts: sub-cohorts can easily be created in any view, making it easy to drill down and perform detailed context-specific analysis.
- Advanced cohort definitions: cohorts can be based on arbitrary combinations of the attributes of individuals as well as functions of them. This allows for the creation of complex cohorts, such as a cohort of 'service users with diabetes and more than five years of service provision.'
- Integrated data: it can provide information from multiple data sources to provide detailed information on health care or outcomes.
- Flow analysis: it can model flows through the social care system (e.g. contact, referral, assessment, and commissioning).

2.4. Service User View



The Service User view facilitates detailed analysis of an individual service user's care needs and provides a number of decision support tools. A complete list of service users can be refined to show only those that meet specific criteria. Selecting an individual service user provides a rich set of visualisations that combine information from multiple sources. The visualisations include information about the history and current status of the service user, as well as recommendations for changes to their care plan, predictions relating to future care needs and the likelihood of them requiring hospitalisation or movement to residential care.

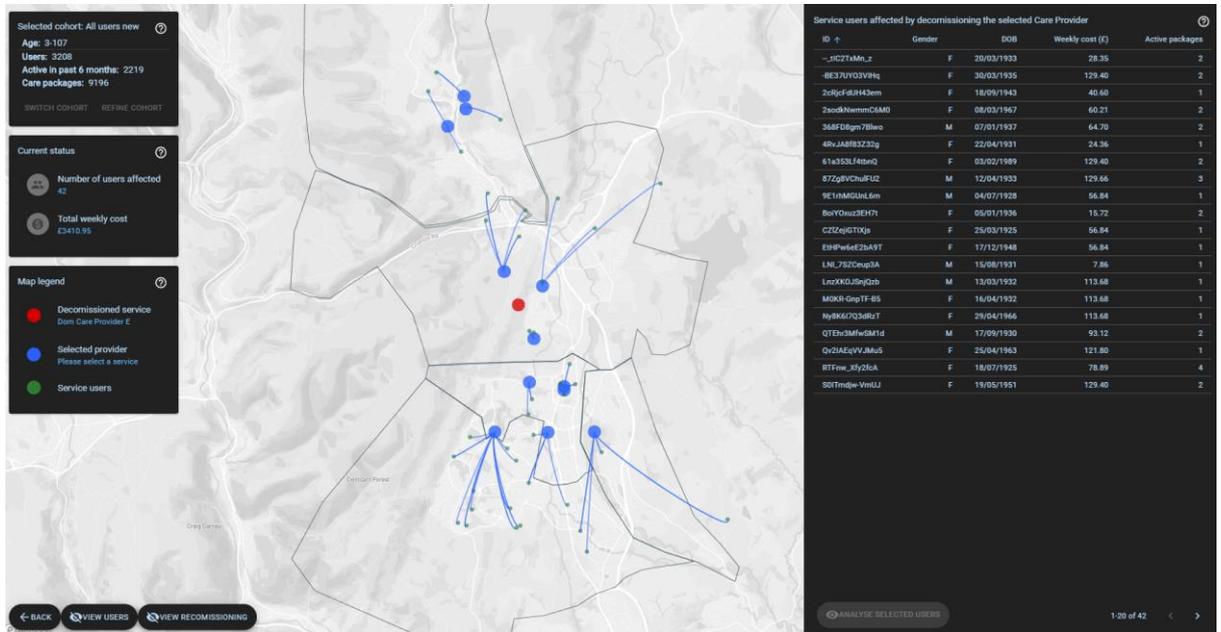
2.5. Wellbeing Metrics



Many local authorities collect information on the wellbeing outcomes of their service users; however, the information is rarely analysed at scale and across multiple users. By performing long term analysis across a cohort of users, it is possible to infer the effectiveness of a care service, not just in terms of financial cost, but also in terms of the impact on the wellbeing

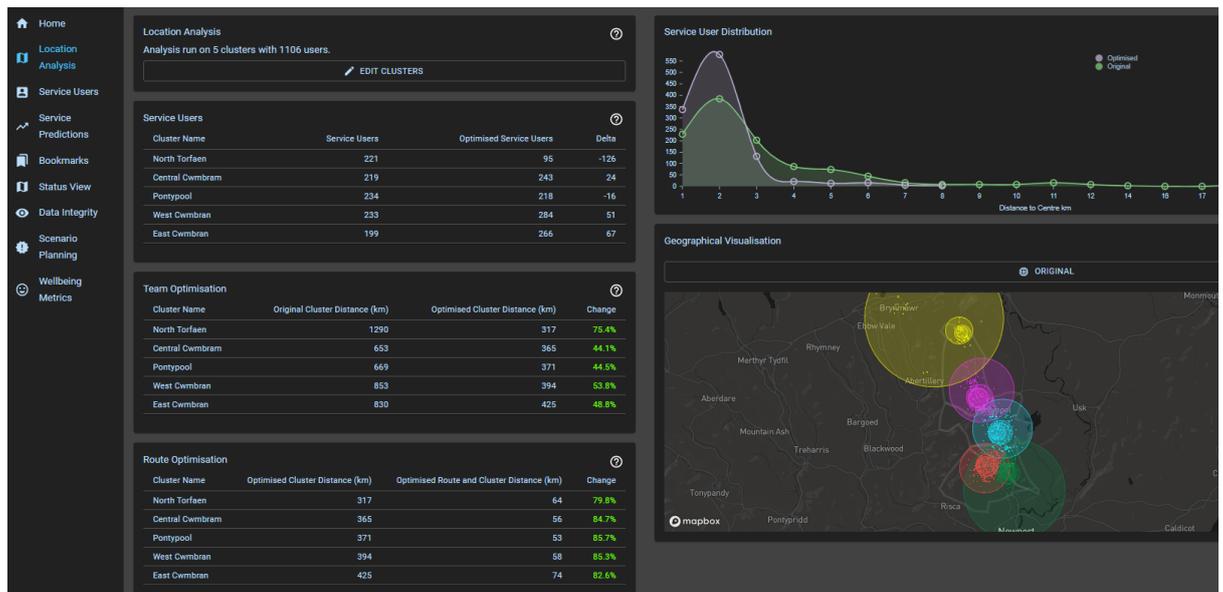
of a service user. This enables a much more nuanced understanding of the quality of care being delivered.

2.6. Scenario Planner



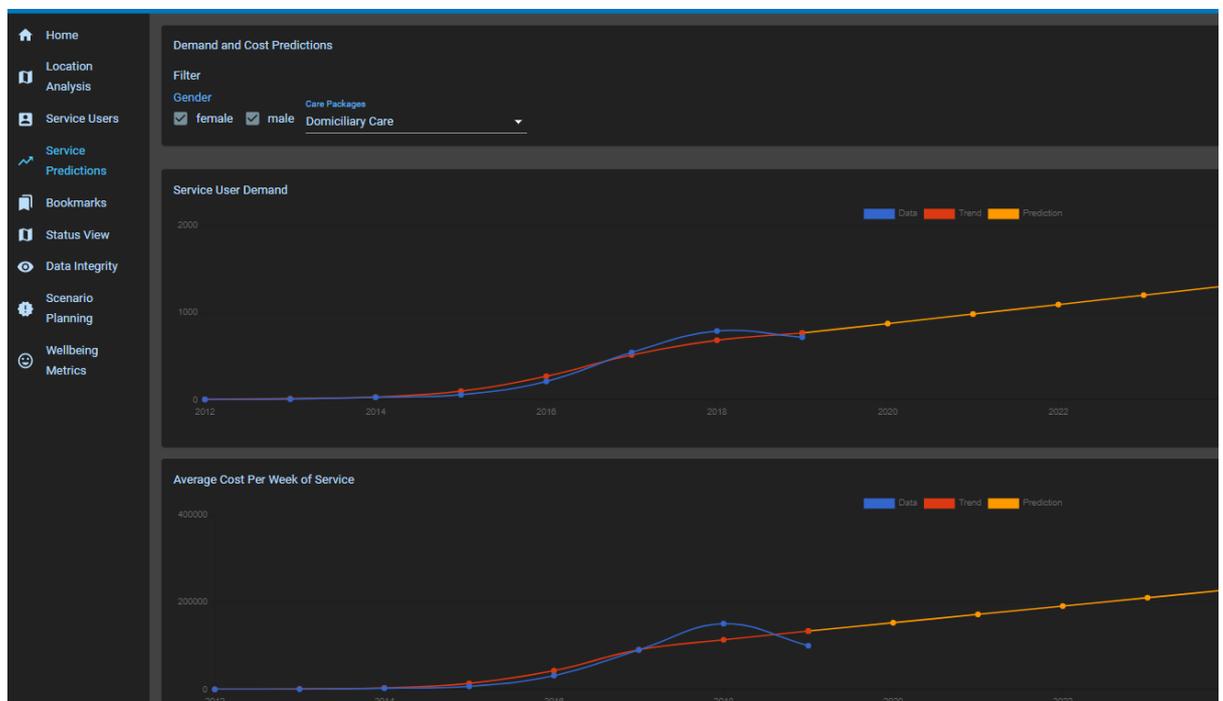
The Scenario Planner makes it possible to investigate the impact of adverse events, such as extreme weather or a service provider exiting the market or discontinuing a specific service. Scenario Planner assesses the financial implications of an event, identifies the affected service users and suggests alternative providers or patch teams.

2.7. Location Analysis



In the Location Analysis view, it is possible to see the geographical efficiency with which services are supplied to users in terms of travel time, travel cost and distance, and to use AI to optimally allocate service users to service providers and patch teams.

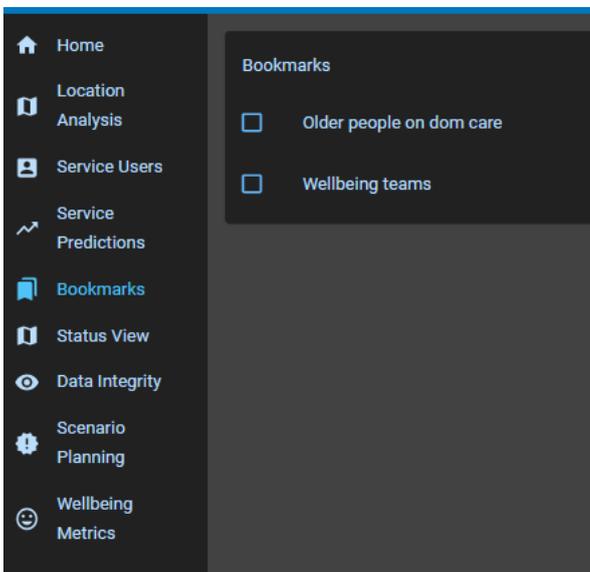
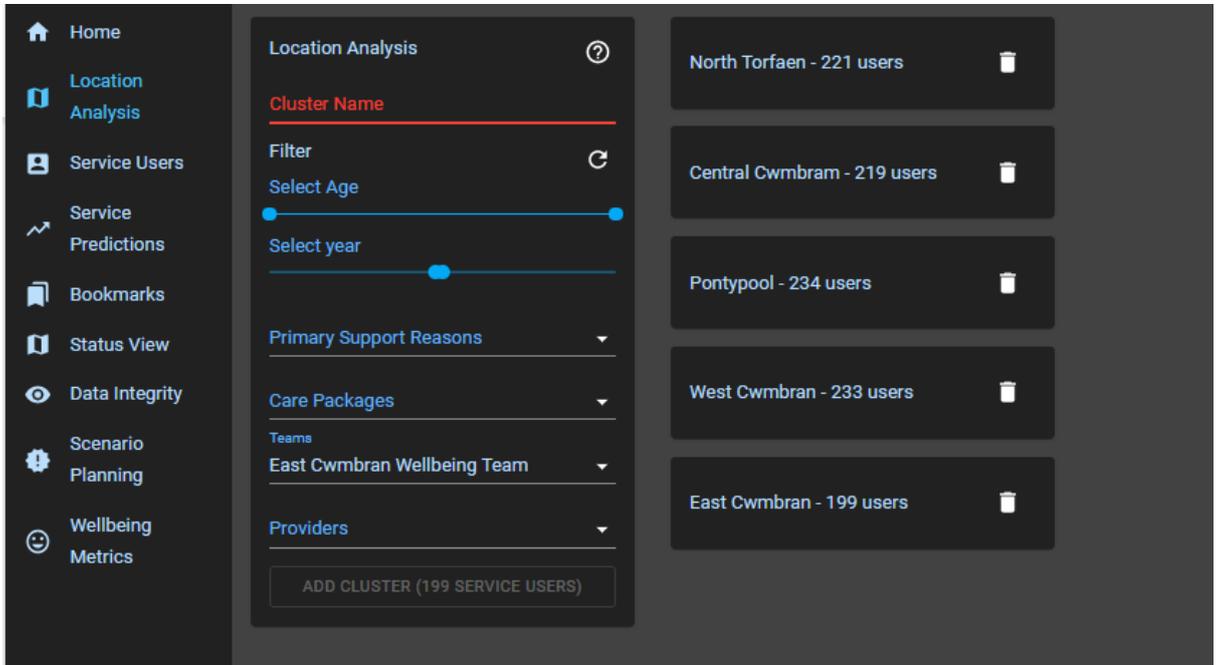
2.8. Service Predictions



The Service Predictions module combines Office for National Statistics (ONS) population projections with local care usage data to forecast the future population in care and the cost of provisioning their care. Forecasts can be made for the entire cohort in care, or for specific

subgroups that can be defined by gender, age, type of care and community to gain deeper insights.

2.9. Cohort Builder and Bookmark



The Cohort Builder makes it possible to create multiple subsets of service users that can quickly be selected for comparison and analysis throughout the application. By allowing cohorts to be defined against arbitrary values within the source data, the Cohort Builder allows for extremely flexible and fine-grained analysis.

NQM Care Analytics provides a bookmarking system that enables users to easily save and share their insights, providing deep link bookmarks that restore the application to the exact state that it was in when each bookmark was created.

3. Methodology

The NQM Care Analytics application imports data from many different sources and applies a variety of sophisticated analytical techniques. Below is a high-level overview of the key techniques that it uses; more detailed information can be provided upon request.

3.1. Matching

Not all data sources identify service users in the same way. Fuzzy matching is therefore used when consistent service user identifiers are not available, making it possible to automatically, robustly and intelligently merge data from a wide range of disparate sources.

3.2. Synthetic data

NQM Care Analytics can automatically anonymise service user data to generate non-personally identifiable synthetic data that preserves the most important trends and patterns. This can be useful when demonstrating key findings to third parties that might not be allowed to see personally identifiable data due to data protection controls.

3.3. Integrity and completeness

Data sets often contain missing values. The data integrity and completeness viewer makes it easy to see how complete data are, which fields are worst affected by missing values and to see their effects on the integrity and quality of data relating to specific cohorts.

3.4. Metadata mapping

Different local authorities often have different ways of categorising processes and events and those categorisations sometimes change over time. NQM Care Analytics has an explicit metadata model that makes it easy to model category differences, facilitating like-for-like comparisons between authorities and within the same authority over time.

3.5. Time variant field

Many input data sets are poorly normalised and certain attributes that change over time are not well preserved. For example, a classic problem occurs when a service user changes address. Unless such a change is well modelled, key data relating to the user's history, such as their previous address, can be lost. NQM Care Analytics automatically identifies and corrects common problems relating to data normalisation on import.

3.6. Static cohort definition

NQM Care Analytics lets the user create arbitrary cohorts of service users based on the values of attributes in the imported data, which are referred to as basic attributes, and additional attributes that are automatically generated from them. The following are typical examples of basic and generated attributes:

Example basic attributes

- Age
- Sex
- Care package x N
- Care package history x N

- Wellbeing team
- Primary Support Reason
- Address
- Assessments x N
- Contacts x N
- Referrals x N
- Outcomes x N

Example generated attributes

- Number of assessments
- Number of failed assessments
- Index of deprivation (induced from location)
- Time since first referral
- Time on any care item
- Time on specific care item
- Keyword search on package

Cohorts can be defined using arbitrary combinations of basic and generated attributes. The following are examples of cohort definitions:

- Male service users over 60 with diabetes on assessment or referral
- Service users under 30 with multiple addresses in time frame

3.7. AI and machine learning

NQM Care Analytics uses sophisticated AI and machine learning technologies for a variety of purposes, ranging from automatically identifying clusters of similar service users to determining risk factors and making personalised care recommendations. These technologies excel at identifying patterns in data and using them to make predictions, whilst also being robust to uncertainty and errors in the data.

As well as state-of-the-art AI and machine learning technologies, NQM Care Analytics also employs formal statistical methods where appropriate. Such methods are typically easier to analyse and can often be shown to provide optimum solutions in specific situations.

3.8. Dynamic cohort definition

In addition to the static cohorts that can be defined and quickly accessed throughout the application, dynamic sub-cohorts can be defined in any view based on the attributes of service users or arbitrary functions of those attributes. This makes it possible to define complex sub-cohorts, such as 'service users belonging to cluster A and with at least three failed assessments.'

3.9. Validation

In order to ensure the accuracy and robustness of the AI models that are used in NQM Care Analytics, they are validated against partitions of the historical service user data and, where appropriate, against service user data from other local authorities. Operational performance statistics are also collected to ensure the models' continuing validity over time.

3.10. Fine-grained population models

The service predictions module combines ONS population projections for local authorities with local care usage data to forecast the population in care and the cost of provisioning their care. These forecasts are at the level of ONS Lower Layer Super Output Areas (LSAOs), which are specifically designed for reporting small area statistics, and therefore offer much more detail than is usually available. Forecasts can be made for the whole cohort in care, or to arbitrary subgroups to gain deeper insights into the future of care provision.

3.11. Population gearing – Demand model

Using fine-grained population models, NQM Care Analytics creates demand models that are highly localised by region, age, ethnicity, and gender. An experienced social worker will know that the demand for services is much higher in some areas than in others due to causes such as local deprivation. NQM Care Analytics demand models infer differences in local demand empirically from historical data, making it possible to produce much more sophisticated demand models.

3.12. Cohort evaluations

One important reason for using NQM Care Analytics is to optimise resource allocation. By analysing provisioning at both a cohort and an individual level, NQM Care Analytics is able to make reliable and statistically well-founded actionable decisions relating to the care of individual service users.

3.13. Wellbeing modelling

Understanding what a good wellbeing outcome looks like for an individual service user is complex because what counts as 'good' is very context specific. For example, a 30-year-old with learning difficulties may expect to see a long-term improvement in wellbeing if an appropriate package is identified; but an 87-year-old with dementia and diabetes is unlikely to see long-term improvements under any circumstances.

NQM Care Analytics solves this problem by assessing wellbeing outcomes relative to those of other service users in similar and automatically identified cohorts. This provides contextualised wellbeing measures that are conceptually similar to the value-added measures that are used in education and ensures that wellbeing scores are not consistently poor for service users for which no practical improvement can actually be made.

3.14. Cohort stratified prediction models

In order to make accurate predictions of future service use, NQM Care Analytics identifies cohorts that are likely to have distinct trajectories and creates separate models for each, taking account of not just demographics, but also factors such as known medical conditions and care packages. This approach allows for much more accurate predictions than traditional methods, which typically extrapolate a single measure, such as the current rate of change of service use across all cohorts.

4. Background

NQM Care Analytics has been created in partnership with UK local authorities with funding from Innovate UK. Its features are designed to meet the requirements of adult social care staff and to solve problems faced by both senior management and staff on the ground.

Nquiringminds™ is a British company specialising in Smart Cities, Secure IoT, and AI Analytics. Established in 2010, our solutions focus on digital transformation, using our expertise in IoT and data analytics to unlock efficiency and cost savings. We have won multiple awards for our work.

5. Further Details

If you are interested to learn more about NQM Care Analytics, please do get in touch. We will be happy to discuss your requirements in detail and to provide a demonstration account so that you can try NQM Care Analytics for yourself.

Email - info@nqminds.com

Website - <https://nquiringminds.com>