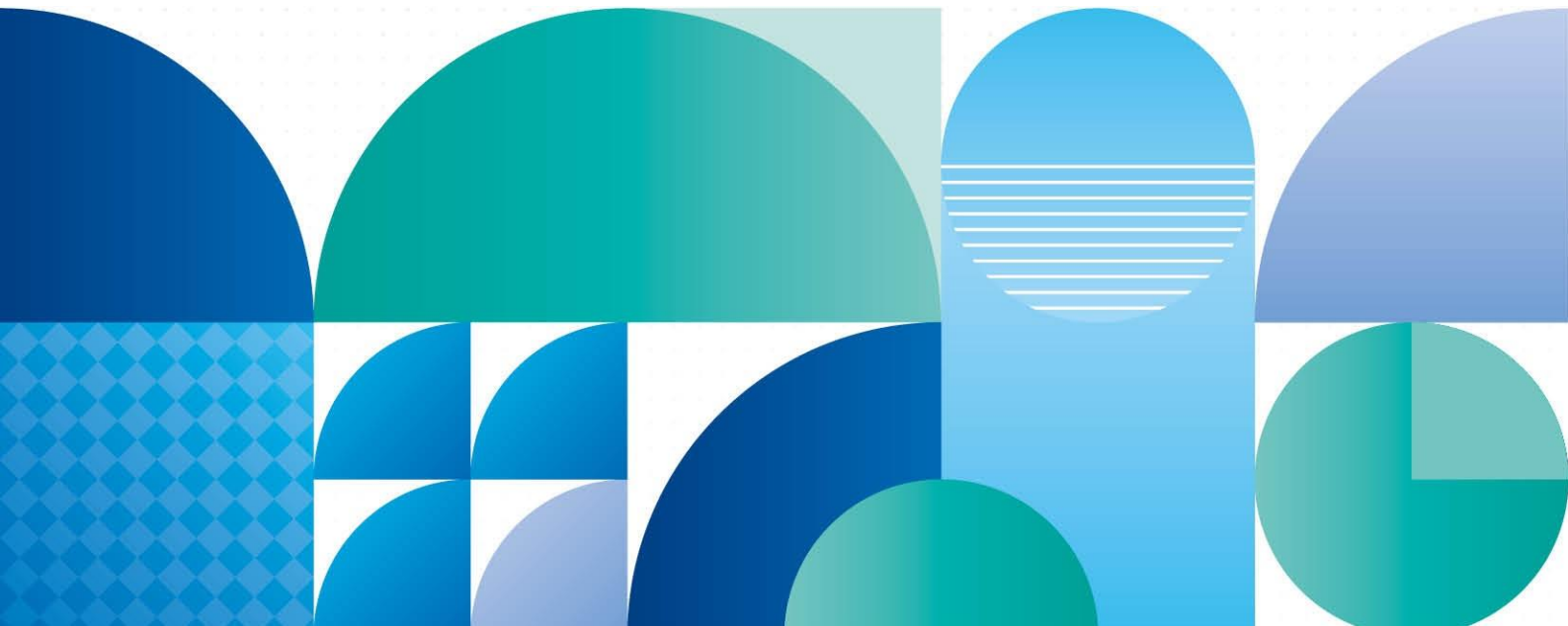


# Theographs

A 'how to' guide



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# 1 Background

Patient experience has become a frontrunning concept, along with patient safety and clinical effectiveness, in the NHS's definition of quality care. However, with the short time available to spend with individual patients, keeping track of gaps in their care can be difficult. Yet, it is essential to maximising benefits and outcomes.

The automatically-created Summary Care Records in NHS GP surgeries highlight important information such as an individual's long-term conditions, allergies and current medication, and may be accessed by emergency and acute care staff if a person has been flagged by their GP. However, what these records do not show is the patient's entire clinical pathway and, therefore, any gaps in care.

In its recent White Paper, the Department of Health and Social Care set out its plans for health and social care integration in 2023.<sup>1</sup> This includes improvements in data linkage for wider ranges of health and social care services in order to deliver coordinated care that will help people to live healthier and more independent lives. Around 10 years ago, The Nuffield Trust began thinking of innovative ways to use linked real-world patient data and found a way to display patients' actual clinical pathways.

Theographs, as explained by Theo Georghiou,<sup>2</sup> take linked data on the different types of health, care and social services activities for an individual patient and present the information in a format that needs no data analytical expertise to interpret at a glance. The graphs show temporal relationships between events along with the numbers, types, and durations of different events (e.g., GP visits, extended social care service provided, A&E visits and/or hospital stays). Data linked by identifiers enable objective recall of events from electronic records, removing the bias inherent in people's recollections of the order and/or timings of contacts. This guide provides a brief overview of what Theographs are, how they could be used and how to produce them, and lists some helpful resources and case studies.

## 2 What are Theographs?

**Theographs are graphical representations of an individual's contacts with different services over time.**

Theographs – also called longitudinal histories or health and care event timelines – are graphical representations of an individual's contacts with different services over time ([Figure 1](#)). They allow a visualisation of the temporal relationships within and between contacts, along with the numbers and types of potentially related contacts (e.g., GP visits to referrals, or non-elective hospital admissions to extended social care).

Within a graph, each service (e.g., primary care, hospital care, and social care) has its own row and symbol. The x-axis represents a timeline, and the y-axis includes the different contact type categories. Each contact can be represented simply by its symbol, either just at

<sup>1</sup> Department of Health and Social Care (Feb 9 2022) 'Joining up care for people, places and populations' [[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1055688/joining-up-care-for-people-places-and-populations-print-version.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1055688/joining-up-care-for-people-places-and-populations-print-version.pdf)]

<sup>2</sup> Georghiou T (2019) 'A 10-year story: visualising patient journeys' [<https://www.nuffieldtrust.org.uk/resource/a-10-year-story-visualising-patient-journeys>]

the start time (Figure 1A) or elongated to indicate duration of single events (e.g., several days in hospital) or several similar contacts in quick succession (e.g., multiple visits over several days; Figure 1B). The y-axis has no inherent scale, but it can be useful to alter the spacing between rows to group similar services together, as shown.

In Figure 1, there are several places where multiple outpatient visits seem to occur close together. If patients have several comorbidities, as in this is example of an elderly patient, it is feasible that they might have to visit different hospital departments within a short space of time for regular follow-up visits. Changes to timetabling of visits or organisation of clinics could be ways to reduce the number of visits. Similarly, a temporal relationship can be seen between several A&E visits and non-elective hospital admissions, which could be an important target for treatment review.

The timeline on a patient's Theograph is sensitive. If the dates on the timeline axis are too specific, the accuracy might risk revealing the patient's identity. Ensuring that relationships and patterns can be seen over long periods is sufficient and accuracy need not be high. However, use of minute-by-minute or hour-by-hour timelines might be more useful when reviewing emergency or surgical care, for example. In these cases, measures must be taken to anonymise data as far as possible.

Figure 1: Example of an elderly patient's contacts with secondary care to aid assessment by primary care staff



(A) Events may be marked as individual timepoints. (B) Shapes that indicate the duration of contact may also be used.

**For Theographs to be truly useful in a person's care, enough data sources (channels) are needed to make the whole patient journey visible. Thanks to the rise of population health management in integrated care systems and the creation of central data banks, the likelihood is that CCGs will already have relevant datasets for their patients across hospitals, GPs, community services, mental health, social care etc.**

# 3 Use of Theographs

## 3.1 Frontline workers

**Use of Theographs by frontline workers could help to establish not only quickly and easily the care a patient has received, but also whether it has been effective.**

Gaps in care might be identifiable if numbers of certain types of activities have not risen or fallen as expected, and whether they have led to non-elective acute care. Layers of information may also be presented with and/or be made available to access from the Theograph (see [Section 6](#)).

Theographs could also be advantageous for health and social care workers meeting patients for the first time. They remove the need for patients to have to repeat their history and lessen the risk of inaccuracy through recall bias.

## 3.2 Wider applications

**Anonymised Theographs are being used in strategic planning for populations.**

Knowledge of within-patient patterns of care activities for a large cohort can support the design or redesign of strategies to improve personalised care and help transitions between primary, secondary, tertiary, and social services – an important aspect for the planning and commissioning of services. Although data linkage is improving, services are not always aware of what other care or provision a patient has received, which increases the risks of under-treatment, over-treatment, unnecessary testing and/or interventions, and duplication of efforts.

At a case-management level, certain behaviours might be useful indicators for changes in treatment approach. For example, if a patient has a few GP visits but is frequently calling 111 or attending A&E, there is the potential to reduce risk and costs by increasing monitoring in primary care.

If patients are found in the past to have required emergency social care, it might be possible to plan ways to ease that burden by identifying and discussing needs earlier as part of primary care.

Additionally, this method is useful for understanding changes in care needs after a new treatment model has been introduced. Creation of a new graph based only on the data after service changeover allows comparison of contacts.

# 4 Preparation of Theographs

## 4.1 Data

Theographs require linked data to generate graphs across services. NHS England has provided guidelines on how data may be linked and used.<sup>3</sup> Various methods are used to link data, such as patient indexes and events.<sup>4</sup> The Master Patient Service will enable secure linkage of datasets across care settings for which person-level data are held, removing the dependency on patient activity datasets such as the Hospital Episode Statistics database.

## 4.2 Software

Most analytics software should be able to create timeline graphs. Some examples are Tableau, Power BI, QlikView, R, and Excel. Some packages, like Excel or R might require add-ons/templates, but these are readily available online. Consider options for interactive graphs that allow the data to be viewed in greater or less detail.

## 4.3 Graph creation

All the linked data will need to be cleaned and separated in 'channels' for the different types of service/healthcare activity to be represented on the y-axis. This can be achieved by tabulation in Excel. Data can include setting (e.g., primary care, A&E, social services), event (e.g., GP visit, emergency care, home carer visits), the start date of the event and the duration.

# 5 Resources

NHS Commissioning Support Units can provide business intelligence support.

The [Association of Professional Healthcare Analysts](#) has numerous experts who can help with preparation, analysis, and visualisation of data.

A [step-by-step guide](#) to creating Theographs in Tableau is available online from Imperial College Health Partners.

<sup>3</sup> NHS Digital (2022) 'Data Access Request Service (DARS)' [<https://digital.nhs.uk/services/data-access-request-service-dars>]

<sup>4</sup> NHS Digital (April 2018) 'Delivering linked datasets to support health and care delivery and research' [<https://digital.nhs.uk/binaries/content/assets/website-assets/services/dars/linked-datasets-in-nhs-digital-final.pdf>]

# 6 Case studies

## 6.1 NHS Midlands and Lancashire Commissioning Support Unit Aristotle portal

The Aristotle business intelligence portal of the NHS Midlands and Lancashire Commissioning Support Unit (MLCSU) has been developed to help healthcare leaders and staff to access information and transform data into actionable insights. As well as being used to generate user reports in the portal, the data (e.g., from MLCSU, CCGs, GPs, councils, public health organisations, community providers, and secondary care) can be accessed for further interrogation and analysis. Along with members of the health and social care networks, colleagues in broader organisations, such as the police or those in the voluntary, community, and faith sectors can request access to information. Contracts are designed to control access rights.

The system was recently tailored to support population health management (PHM) at a local level, as more primary care workers have shown interest in the platform. A primary care reporting suite is offered, providing tools for GP practices to aid with risk stratification and patient profiling, including presentation of data in Theographs. Outputs can be identifiable for patient-level assessment or pseudonymised for practice-level analyses.

One example is the Chorley Central PHM Project that aimed to improve population health management via sharing of data across stakeholders. Health, social, and other areas of data were used to assess patients' health in the context of social and community help available. Theographs were created per patient to track activity in primary and secondary care as well as use of the 111 and 999 acute care services, to provide insights into use of accident and emergency and outpatient care. This project led to a preventive social prescribing model in which patients' needs were established from Theographs and face-to-face interviews, and care plans were personalised. After implementation, outcomes improved and spending was reduced.

## 6.2 North West London Whole Systems Integrated Care dashboards

The North West London Whole Systems Integrated Care (NWL WSIC) dashboards draw together information from eight CCGs covering around two million patients. De-identified data is gathered through an information sharing agreement. One of the tools they were used to create was the Asthma Radar.<sup>5</sup> As there are several risk factors for asthma attacks, it is difficult for clinicians to check for each one during consultations. The tool was designed to help clinicians easily identify those patients at risk and whose care needs optimising.

Patients with flagged risk factors are tabulated and can be selected individually to see various summary pages ([Figure 2](#)). This has been used by practices in NWL in multiple ways. For example, patients in the highest risk group in one GP practice were identified by selected red flags, and further exploration of factors such as adherence to treatment and

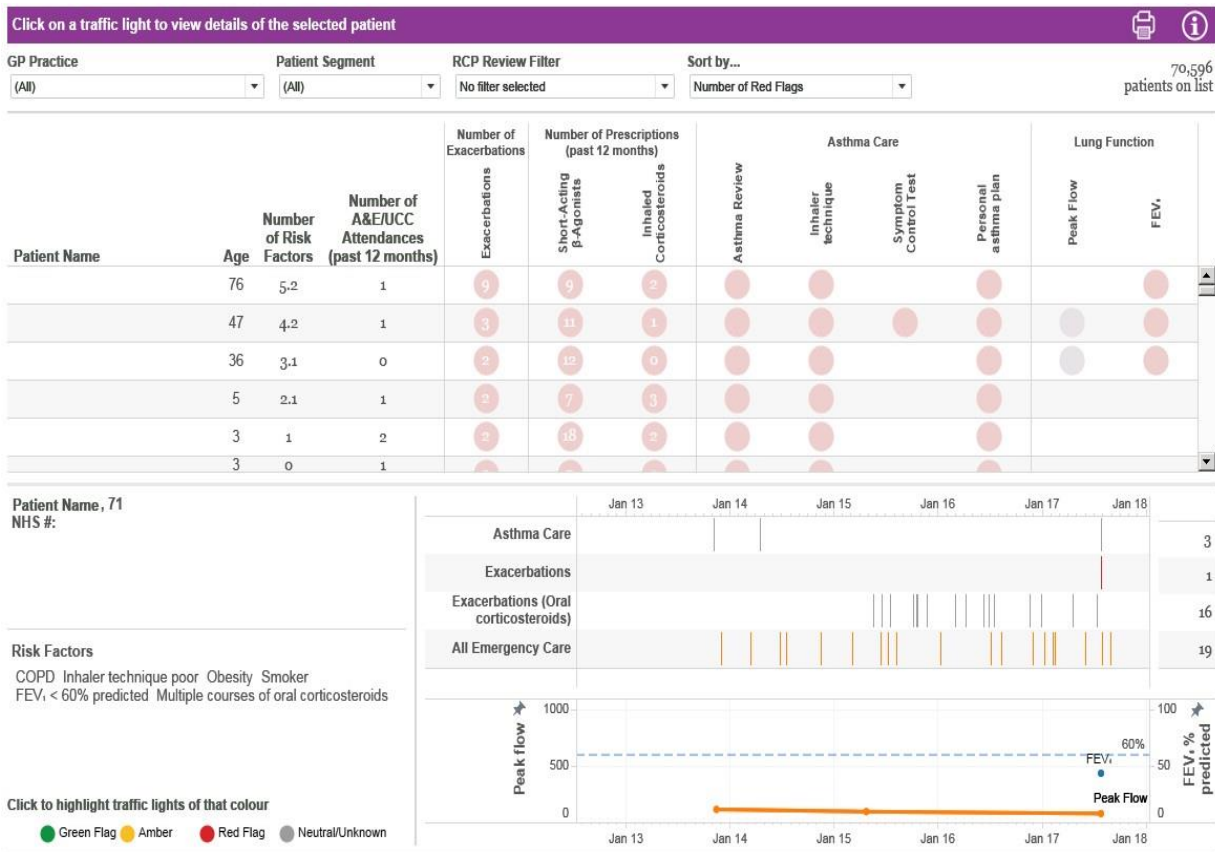
<sup>5</sup> North West London (2019) 'Whole Systems Integrated Care (WSIC) dashboards collaboration of NWL CCGs: Asthma' [<https://www.healthylondon.org/wp-content/uploads/2019/03/CYP-Asthma-NWL-event-WSIC-Dashboards-Asthma-Part-3.pdf>]

regularity of asthma reviews. It was recommended that group consultations be tried instead of the traditional asthma review so that patients and their families could meet others experiencing similar issues.

In another example, after proactively identifying high-risk cases in a childcare GP hub, the Asthma Radar was used to plan care for a child who had experienced five asthma exacerbations in the previous twelve months, impairment of daily activities, and multiple courses of oral steroids that were causing weight gain. Additionally, the social situation was complex due to a diagnosis of ADHD, recent family bereavements, and the mother having depression and being a full-time carer for the child's uncle. The overview of the severe clinical status and social issues presented in a Theograph facilitated multidisciplinary team discussion, and a referral for specialist paediatric care to be held in the familiar hub clinic was arranged with GP follow-up. Understanding the full picture of this patient's situation and needs provided clarity that improved continuity of care.

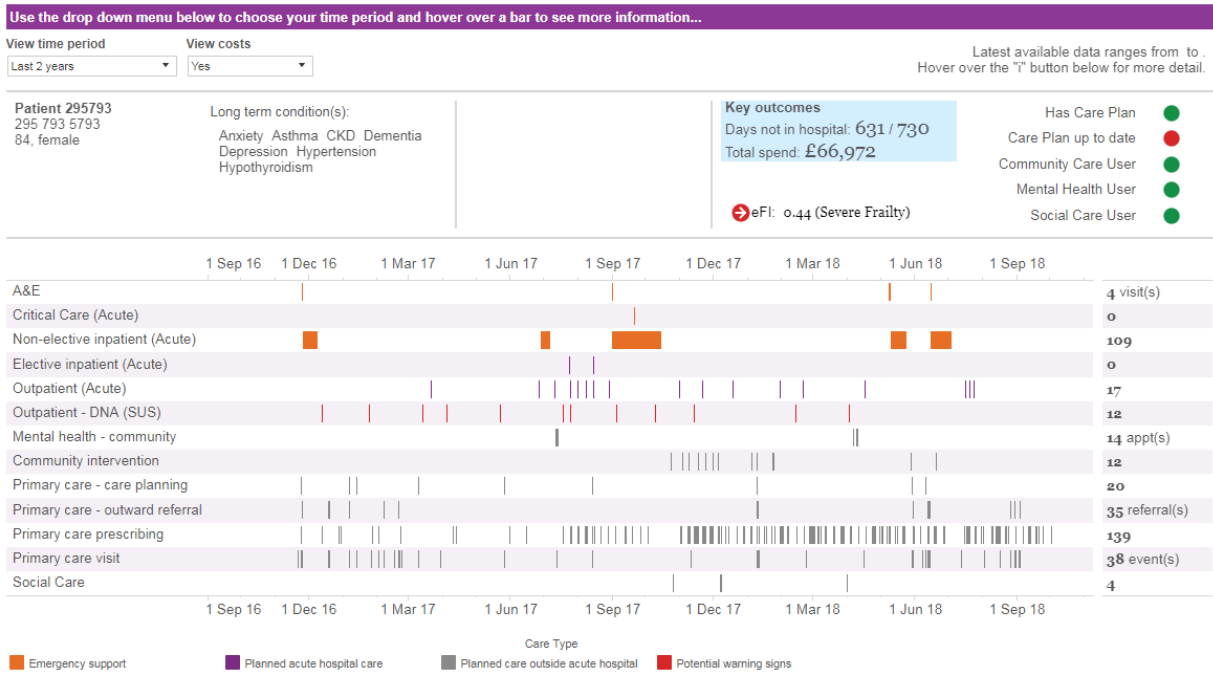
Figure 2: The NWL WSIC Asthma Radar dashboard presents different configurations and layers of linked data

2A





2B



- (A) A patient's brief overview can be brought up from a tabulated list of patients at highest risk.  
 (B) If required, more extensive data across all care settings can be viewed.