

PWYLLGOR ADNODDAU CYNALIADWY SUSTAINABLE RESOURCES COMMITTEE

DYDDIAD Y CYFARFOD: DATE OF MEETING:	20 December 2022
TEITL YR ADRODDIAD: TITLE OF REPORT:	Planning Objective 3E – Advanced Analytics
CYFARWYDDWR ARWEINIOL: LEAD DIRECTOR:	Huw Thomas, Director of Finance
SWYDDOG ADRODD: REPORTING OFFICER:	Anthony Tracey, Digital Director

Pwrpas yr Adroddiad (dewiswch fel yn addas)

Purpose of the Report (select as appropriate)

Er Sicrwydd/For Assurance

ADRODDIAD SCAA SBAR REPORT

Sefyllfa / Situation

This report provides the Sustainable Resources Committee with a deep dive into the Planning Objective 3E, as set out below:

By March 2023 develop an advanced analytical platform that is highly accessible to operational and corporate teams that will, provide real-time, integrated data to support our clinicians and managers providing the insight, foresight, and oversight to assist with day-to-day operational delivery as well as organisation wide strategic planning. In parallel, establish mechanisms to ensure continuous innovation of our approach by utilising current technologies, best practices and direction from latest research and publications (such as machine learning, artificial intelligence, time series analysis and cluster analysis).

As an initial step, develop and implement a risk stratification model using predictive / cluster analytics to provide evidence for new approaches to the management of chronic conditions to shift the balance of care from the acute sector to primary care and community settings. This should be in place by September 2022 with full inclusion of all health and social care data (as a minimum) by March 2025

The Committee is requested to receive assurance regarding delivery of Planning Objective 3E.

Cefndir / Background

A key challenge for modern day healthcare is to meet increasing patient demand and expectation. This poses many challenges to service management, as this backdrop is often accompanied with fewer resources, putting additional pressures on decision making. Another key challenge (as observed during the COVID-19 pandemic) is providing an effective response to uncertain situations when there is limited information available.

One way to approach these challenges is to learn to understand the behaviours and trends of the services. Data science uses proven techniques to examine data with the aim of unlocking insight. This insight can then enable fact-based decision making from existing data and other new data sources.

Asesiad / Assessment

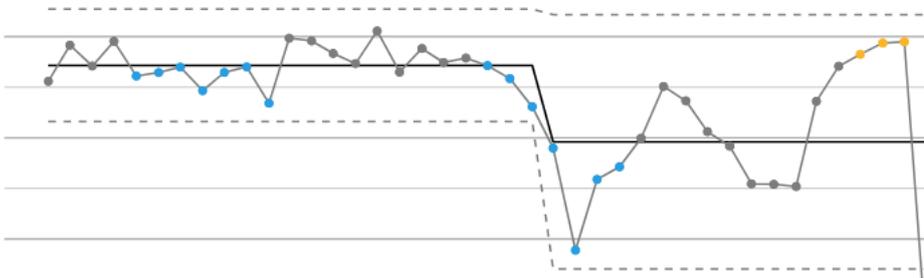
Before examining the initial concept of the Data Science Platform, it is important to understand the various advanced analytic techniques that were being investigated.

- Statistical Process Control (SPC)
- Time Series Analysis (TSA)
- Discrete Event Simulation (DES)
- Geographic Information System (GIS)

Each of these areas aims to tackle a particular type of problem.

Statistical Process Control

Statistical Process Control (SPC) is an analytical technique that plots data over time. It helps to understand variation and in so doing guides the user to take the most appropriate action.



SPC is a good technique to use when implementing change as it enables the user to understand whether changes made result in improvement;

this is a key component of the Model for Improvement widely used within the NHS.

SPC is commonly used in the NHS to understand whether change results in improvement and provides an easy way for people to track the impact of improvement projects.¹

Time Series Analysis

Time Series Analysis (TSA) uses historical data in order to identify any statistics or patterns that could be used to predict future values. Once analysis has been undertaken on a dataset, different forecasting model methodologies can be assessed using a sample of historical data against known actual values in order to determine the optimum model to use for the forecasting of that dataset.



The Data Scientist Team is currently developing TSA and forecasting. After data is loaded, statistics and guidance is provided and will aid decision making regarding which forecast method would produce the most accurate estimated projections. Forecasts can then be generated with the chosen model for any time period required.

It is envisioned that this tool could be used by the Health Board in a variety of ways to provide patient activity estimates/projections which could aid in planning care and services. Examples include clinics, specialties or departments.

¹ <https://www.england.nhs.uk/statistical-process-control-tool/>

Discrete Event Simulation

Discrete Event Simulation (DES) is a method of simulating the behaviour and performance of a real-life process, facility or system. In essence it attempts to model a system whose state can only change at discrete points in time. Therefore, it is useful for examining existing and/or hypothetical models to gain insight.

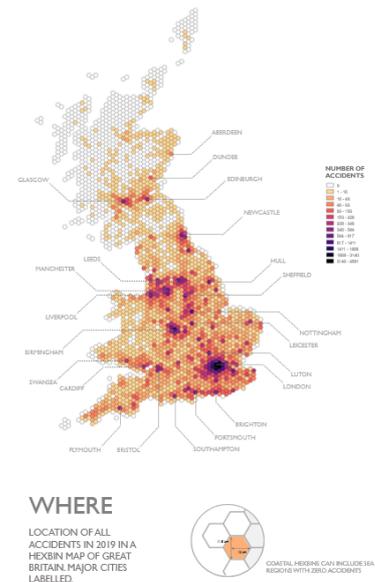
Stakeholders want to understand what will happen to an existing service if anything is to change within the current system. To achieve this there are hypothetical questions that need to be answered. 'What if' scenario analysis is a necessity for general management, but also transformation and service redesign. People conduct this type of analysis regularly without DES, however, a functional DES model could enable visualisation, quantification and provide an evidence base for any decision making.

By comparing a baseline scenario to an alternate scenario, the effects can be assessed. This allows the effect and the magnitude of possible service changes to be determined. DES fundamentally supports and advocates evidence-based decision making and planning by enabling:

- Visualisation of patient flow
- Bottleneck identification
- Generate insight into systems
- Test hypothesised changes without consequence
- Stress test existing systems using projected demand
- Helping to answer hypothetical questions about change

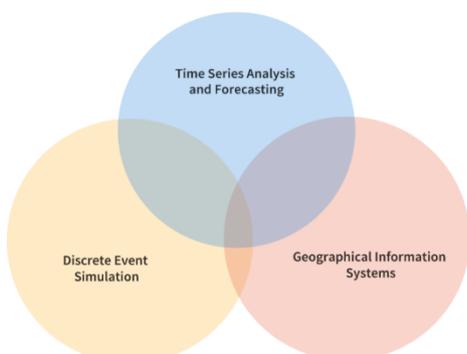
Geographical Information System

Geographical Information Systems (GIS) are computer-based tools used to store, visualise, analyse, and interpret geographic data. Geographic data (also called spatial, or geospatial data) identifies the geographic location of features. This data includes anything that can be associated with a location on the globe, or more simply anything that can be mapped. For example, roads, country boundaries, and address are all types of spatial data. The use of GIS can help answer questions about how location impacts disease and disability. If this is coupled with Drive Time Analysis (DTA) questions regarding how a diverse geographic area impact service redesign can start to be understood.



Initial Concept

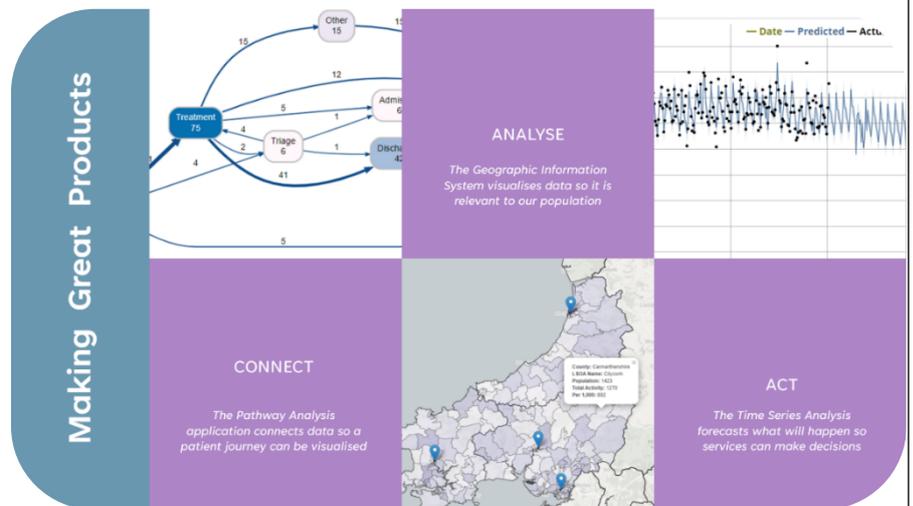
The initial concept of a Data Science Platform arose from the idea of connecting the various advanced analytic techniques



The realisation was that these techniques overlapped and combined could potentially provide further insight. For example, TSA could provide forecasts into Emergency Department (ED) attendances. This forecast data could then be used as input into the DES, to simulate what might happen in the future. This could then potentially be visualised and better understood with a GIS application. The concept is to connect analytics techniques, analyse the combined result in order to produce actionable results.

Progress

A year-ago, the Data Science Team embarked on an ambitious workplan to deliver an innovative, interactive and interoperable Data Science Platform. Using the professional offerings of RStudio the development of advanced data science applications was undertaken to consume data directly from the Digital Services data warehouse. The intention was to utilise a single truth of data, perform complex analytics, and to present these in an easy to use and understandable interface.



The Data Science Platform has been built using R and Shiny as a modular web tool. R is a free and powerful open-source scripting language, which is used for predictive analytics and data visualization. It is used extensively across the NHS to solve complex problems and as a result there is an active, thriving NHS R community. Shiny is the Graphical User Interface (GUI) for R that provides an elegant and powerful web framework for building web applications using R.

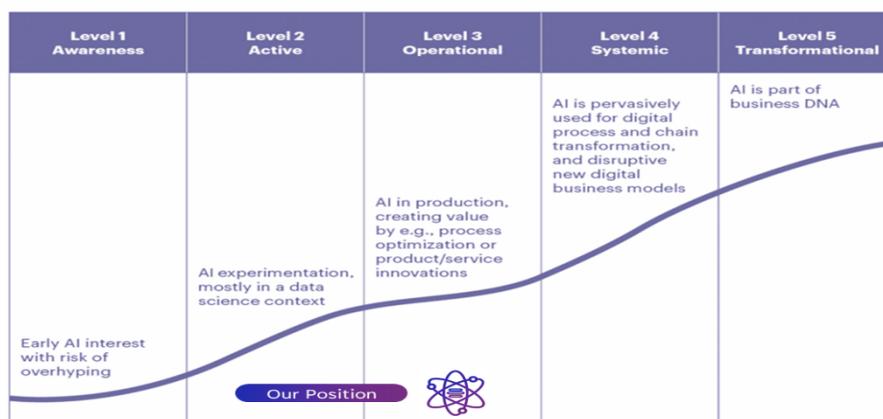
The advantages of building a Data Science Platform are that it provides the ability to dynamically alter analysis through a user interface. Different datasets can be generated, then visualised to show current and forecasted information. This level of analytics usually cannot be performed in a tool such as Power BI, as the data imported is generally static.

Applications for connecting, analysing and acting upon data were developed. This ensures complete control and flexibility without the reliance on expensive proprietary software.

The benefits to the Health Board that the Data Science Platform could promote are:

- Planning or deployment of workforce with greater accuracy and optimisation
- Financial and resource savings
- Increased chances of successful implementation of change
- Enhanced patient experience
- Better patient outcomes
- Increased clinician satisfaction/morale

AI Maturity Model



Maturity

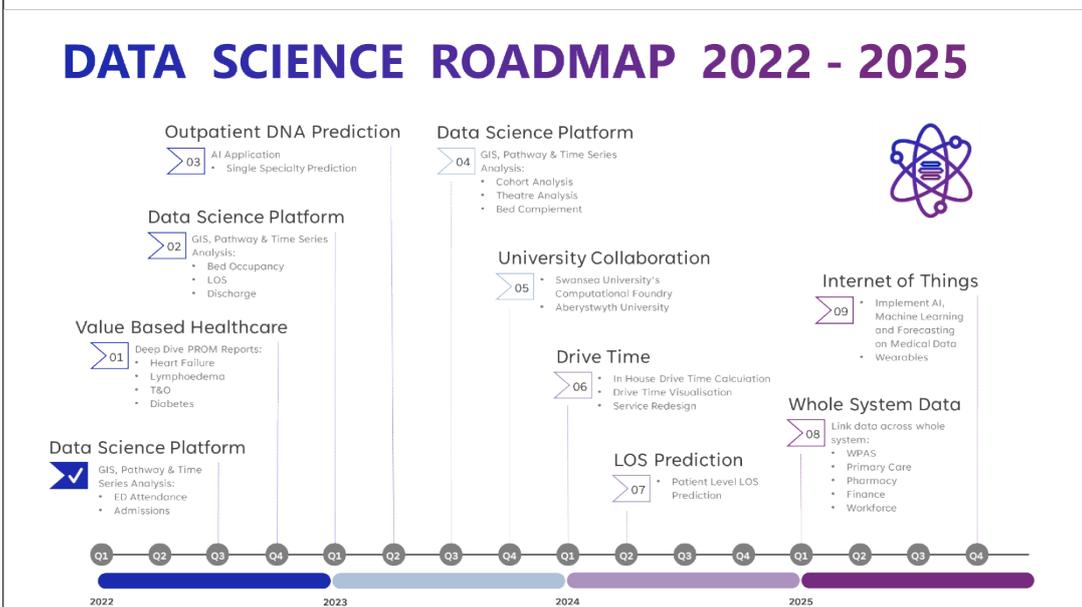
The Data Science team is actively undertaking AI research and development and have begun the journey of operationalising research. Sophisticated applications that forecast, provided geographical visuals and pathway analysis

are already in production. Aligning to the Gartner AI maturity model, the Data Science team is entering and progressing at level 3.

Data Science Roadmap

The process of connecting data, analysing data and creating the opportunities to act on data will continue to form the path of the Data Science team. Existing operational applications will be expanded to include more datasets from the Digital Services data warehouse, to provide deeper insights. Machine learning techniques have already been developed to generate prediction models for outpatient attendance. The performance is better than comparable current literature findings. The next phase is to create an interactive AI application where service delivery managers can engage and use the predictions to trial interventions or undertake targeted overbooking.

These machine learning techniques have the power to then be applied to further administrative data, for example, predicting a patient's Length of Stay. Ultimately, in conjunction with clinicians, machine learning could be used on medical data to predict patient outcomes, or disease prevalence. Other initiatives planned are partnership



collaborations with universities. The vision is to constantly be aligned with the latest academic research and embed local university expertise within the Health Board. The combination of cutting-edge academic knowledge and the Data Science team's ability to productionise solutions will advance the AI maturity of the Health Board to the next level. The future availability of data will allow for a 360-degree view of a patient. This then facilitates richer data science and AI capabilities.

Argymhelliad / Recommendation

The Committee is asked to **RECEIVE ASSURANCE** regarding delivery of Planning Objective 3E and the ambition of the Health Board to create a Data Science Platform.

Amcanion: (rhaid cwblhau) Objectives: (must be completed)	
Committee ToR Reference: Cyfeirnod Cylch Gorchwyl y Pwyllgor:	2.2 To receive an assurance on delivery against all relevant Planning Objectives falling in the main under Strategic Objective 6 Sustainable Use of Resources (See Appendix 1), in accordance with the Board approved timescales, as set out in HDdUHB's Annual Plan.

Cyfeirnod Cofrestr Risg Datix a Sgôr Cyfredol: Datix Risk Register Reference and Score:	Not Applicable
Safon(au) Gofal ac Iechyd: Health and Care Standard(s):	3.4 Information Governance and Communications Technology 3.5 Record Keeping All Health & Care Standards Apply
Amcanion Strategol y BIP: UHB Strategic Objectives:	6: Sustainable Use of Resources
Amcanion Cynllunio Planning Objectives	3E Business intelligence and modelling
Amcanion Llesiant BIP: UHB Well-being Objectives: Hyperlink to HDdUHB Well-being Statement	Not Applicable

Gwybodaeth Ychwanegol: Further Information:	
Ar sail tystiolaeth: Evidence Base:	Not Applicable
Rhestr Termau: Glossary of Terms:	Contained within the main body of the report
Partïon / Pwyllgorau â ymgynhorwyd ymlaen llaw y Pwyllgor Adnoddau Cynaliadwy: Parties / Committees consulted prior to Sustainable Resources Committee:	Not Applicable

Effaith: (rhaid cwblhau) Impact: (must be completed)	
Ariannol / Gwerth am Arian: Financial / Service:	The ability to provide real time information for the Health Board that can be linked to financial data will provide a new insight into the current and future costs of providing healthcare within Hywel Dda
Ansawdd / Gofal Claf: Quality / Patient Care:	The additional insight from predictive analytics will affect the way the Health Board is able to plan services and therefore impact patient care, by improving our knowledge, also introducing foresight in the planning of services
Gweithlu: Workforce:	With the introduction of workforce information into the data science platform we will be able to triangulate workforce, finance, and activity to provide additional insights into future workforce planning.
Risg: Risk:	Not applicable

Cyfreithiol: Legal:	Not applicable
Enw Da: Reputational:	Providing a platform that can provide hindsight, insight and foresight that will increase the reputation of the Health Board as a forward-thinking organisation that is using data science as a progressive tool to aid in the planning of healthcare
Gyfrinachedd: Privacy:	Not applicable
Cydraddoldeb: Equality:	Not applicable