The Strategy Unit.

Advancing analytics in the NHS

Defining strategic analytics and career pathways for healthcare analysts

NHS
Midlands and Lancashire
Commissioning Support Unit

Document purpose

This document is the result of work carried out by the Strategy Unit in 2021 on behalf of NHSE/I.

Our report addressed the vital question of how analytical capability (and capacity) can be advanced across the NHS in order to support the best possible decisions to be made. To do this we described what analysis is for; what a high functioning analytical team looks like and the kind of questions they should be addressing; we unpack the skills needed to do that and what that means for analysts in developing their careers.

The results of this work are contained here in the form of:

- A description of the characteristics of a high functioning analytical team
- A typology of analytical projects
- Career pathways for healthcare analysts operating within a high-functioning team
- Existing training that healthcare analysts can access.

These products have been tested with stakeholders from across the healthcare analyst community.

The full report, including recommendations for advancing analytical capability for national bodies, regional analytical networks, and analysts and their teams, is available **here**.

Using this document

This document is designed to be 'live' and does not represent a 'final' view of strategic analytics in high functioning teams.

It is expected that it will be updated as it is engaged with by healthcare analysts and further iterations will result.

To comment or feedback on the document please contact the Strategy Unit:

strategy.unit@nhs.net

What is a high functioning analytical team?

What are the characteristics of a high functioning analytical team?

Following engagement with analytical leaders across the NHS, the following description of a high functioning analytical team has been agreed:

A high-functioning analytical team...

- Is clear that their key role is to **enhance the quality** of the decision-making process
- Has critical problem formulation skills – to help them engage with decision makers to ensure the **right questions are being addressed**
- Is **technically proficient across the range of analytical project 'types'** and able to apply these to the questions at hand
- Is aware of its own limitations and establishes **collaborative partnerships** to supplement this
- Is able to **influence the decision-making processes** by providing reliable, relevant, well communicated analyses to decision makers to ensure decision quality
- Is **dedicated to research and sharing knowledge;** producing replicable work and evidencing new ways of working
- Is **well-versed in the healthcare context** in which it operates.

Typology for analytical projects

Typology for analytical projects

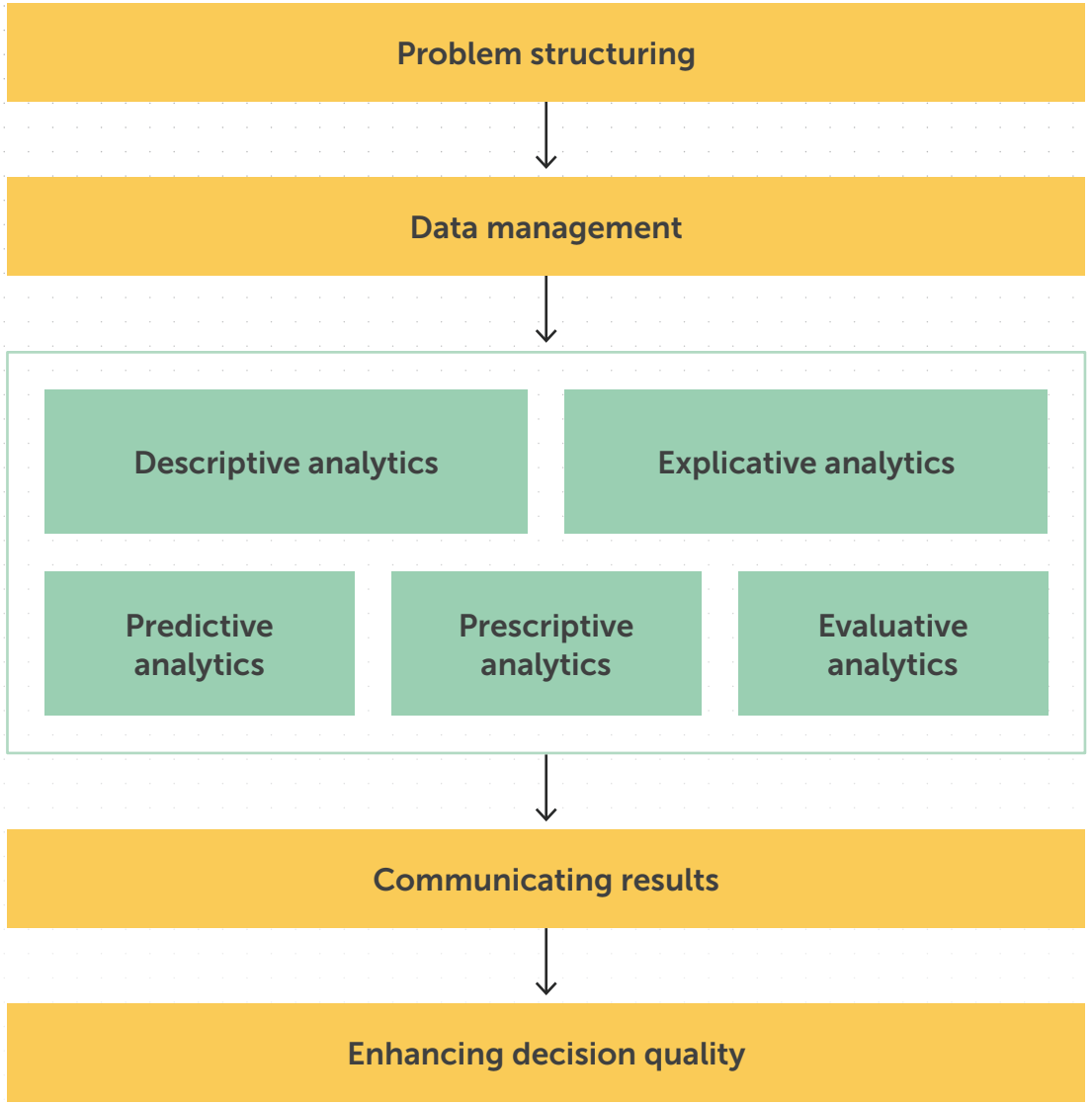
In support of the analytical career paths outlined on the following pages, a typology of analytical question types has been developed and tested with analysts.

This describes the types of analytical work that may take place within a high functioning team and the types of analytical methods that are required to address them. The purpose of this typology is to support meaningful conversations between analysts and their leaders about the types of analytical projects they deliver; the skills and skills development trajectory needed to be able to accommodate the whole spectrum; and the art of the possible.

We have recommended the adoption of this typology nationally.

- Foundational analytical tasks
- Analytical project types

Analytical projects typology



Typology for analytical projects (cont.)

Five 'types' of analytics have been defined according to the nature and context of the problem to be addressed. We acknowledge that some projects include multiple phases, and that different phases require different 'types' of analysis.

Some commonly used methods are listed for each 'type', but these are neither exclusive nor exhaustive. In addition, four foundational analytical tasks are identified which will feature in most analyses, irrespective of 'type'.

Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	Communicating results	Enhancing decision quality

Problem Structuring

Deriving a problem definition and analytical plan from a presenting management, clinical or operational context.

Typology for analytical projects (cont.)

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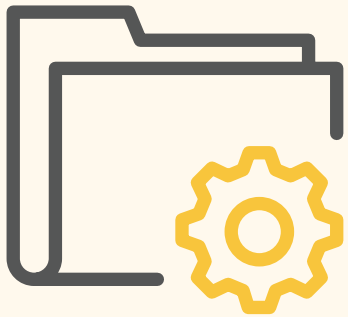
Problem Structuring	**Data Management**	Descriptive Analytics	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	Communicating results	Enhancing decision quality

Data Management

Information governance, data ethics, data processing, wrangling, and linkage.



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Problem Structuring	Data Management	**Descriptive Analytics**	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	Communicating results	Enhancing decision quality

Descriptive Analytics

What is the world like now and in the past?
Using multiple data sources to provide a coherent overview of activity, resource use, performance, quality, efficiency, experience and outcomes.

Commonly used methods:

Summary statistics, data visualisation, geospatial mapping, metric development and derivation, prevalence studies, experience surveys.

Typology for analytical projects (cont.)

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Problem Structuring	Data Management	Descriptive Analytics	**Explicative Analytics**	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	Communicating results	Enhancing decision quality

Explicative Analytics

Why is the world the way it is?
Exploring and explaining observed patterns of activity, performance and outcomes and the variation in these between groups and over time.

Commonly used methods:

Explanatory regression modelling, inferential statistics and hypothesis testing, data-mining, observational (risk) studies, choice experiments.

Typology for analytical projects (cont.)

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Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	**Predictive Analytics**	Prescriptive Analytics	Evaluative Analytics	Communicating results	Enhancing decision quality

Predictive Analytics

What might the future hold for patients, services and populations?
Estimating how activity levels, performance and outcomes change in the future under different assumptions and scenarios.

Commonly used methods:

Time series forecasting, risk prediction, machine learning, scenario planning, simulation, ex-ante modelling, epidemiological and demand modelling.

Typology for analytical projects (cont.)

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Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	Predictive Analytics	**Prescriptive Analytics**	Evaluative Analytics	Communicating results	Enhancing decision quality

Prescriptive Analytics

What should we do?
Providing specific advice for decision makers in order to make best use of available resources to maximise health outcomes.

Commonly used methods:

Opportunity assessments, options appraisals, resource allocation, resource planning, scheduling, optimisation, statistical process control, decision aids and decision analysis.

Typology for analytical projects (cont.)

Five 'types' of analytics have been defined according to the nature and context of the problem to be addressed. We acknowledge that some projects include multiple phases, and that different phases require different 'types' of analysis.

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Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	**Evaluative Analytics**	Communicating results	Enhancing decision quality

Evaluative Analytics

Did it make a difference and was it worth it?
Estimating the impact and costs of changes that are or have been made to the health system to inform decisions about implementation and whether to continue/roll-out.

Commonly used methods:

Causal inference, logic modelling, experimental and quasi-experimental studies, directed acyclic graphs, contribution, mediation and moderation analysis, cost effectiveness, cost benefit and return on investment analysis.

Typology for analytical projects (cont.)

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Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	**Communicating results**	Enhancing decision quality

Communicating results

Constructing narratives, report writing, data visualisation, verbal presentation, conveying risk and uncertainty, describing concepts and methods to non-technical audiences.

Typology for analytical projects (cont.)

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Problem Structuring	Data Management	Descriptive Analytics	Explicative Analytics	Predictive Analytics	Prescriptive Analytics	Evaluative Analytics	Communicating results	**Enhancing decision quality**

Enhancing decision quality

Supporting decision makers and the decision-making process with problem formulation, relevant and reliable data, evidence and analyses to evaluate alternatives, sound and insightful reasoning and effective communication.

Example projects by 'type'

To support understanding of these project types, some examples of each that have been conducted by the Strategy Unit and BNSSG CCG are included below.

These are for information and we are not suggesting that such work is unique to these organisations or that our examples are necessarily exemplary. The list is iterative and further contributions from other teams are invited.

Descriptive

- Exploring mental health inpatient capacity
- Health service use in the last two years of life
- Population Health Management to identify and characterise ongoing health need for high-risk individuals shielded from COVID-19: a cross-sectional cohort study

Explicative

- Waiting times and attendance durations at English A&E Departments

Predictive

- Modelling the impact of COVID on waiting lists for planned care
- Nowcasting for improved management of COVID-19 acute bed capacity

Prescriptive

- Opensource model for planning vaccine centre capacity
- Improving COVID-19 vaccination centre operation through computer modelling and simulation

Evaluative

- Evaluation of an Integrated Mental Health Liaison Service (Rapid Assessment Interface and Discharge Service) in Northern Ireland
- The Value of Triage during Periods of Intense COVID-19 Demand: Simulation Modelling Study

Career pathways for healthcare analysts operating within a high functioning team

Healthcare analyst career 'place-mats'

We have developed 'place-mats' to describe the career pathways of Data Analysts and Data Scientists in the health and care sector. We have focused on these two roles as the vast majority of healthcare analysts identify within these two groups.*

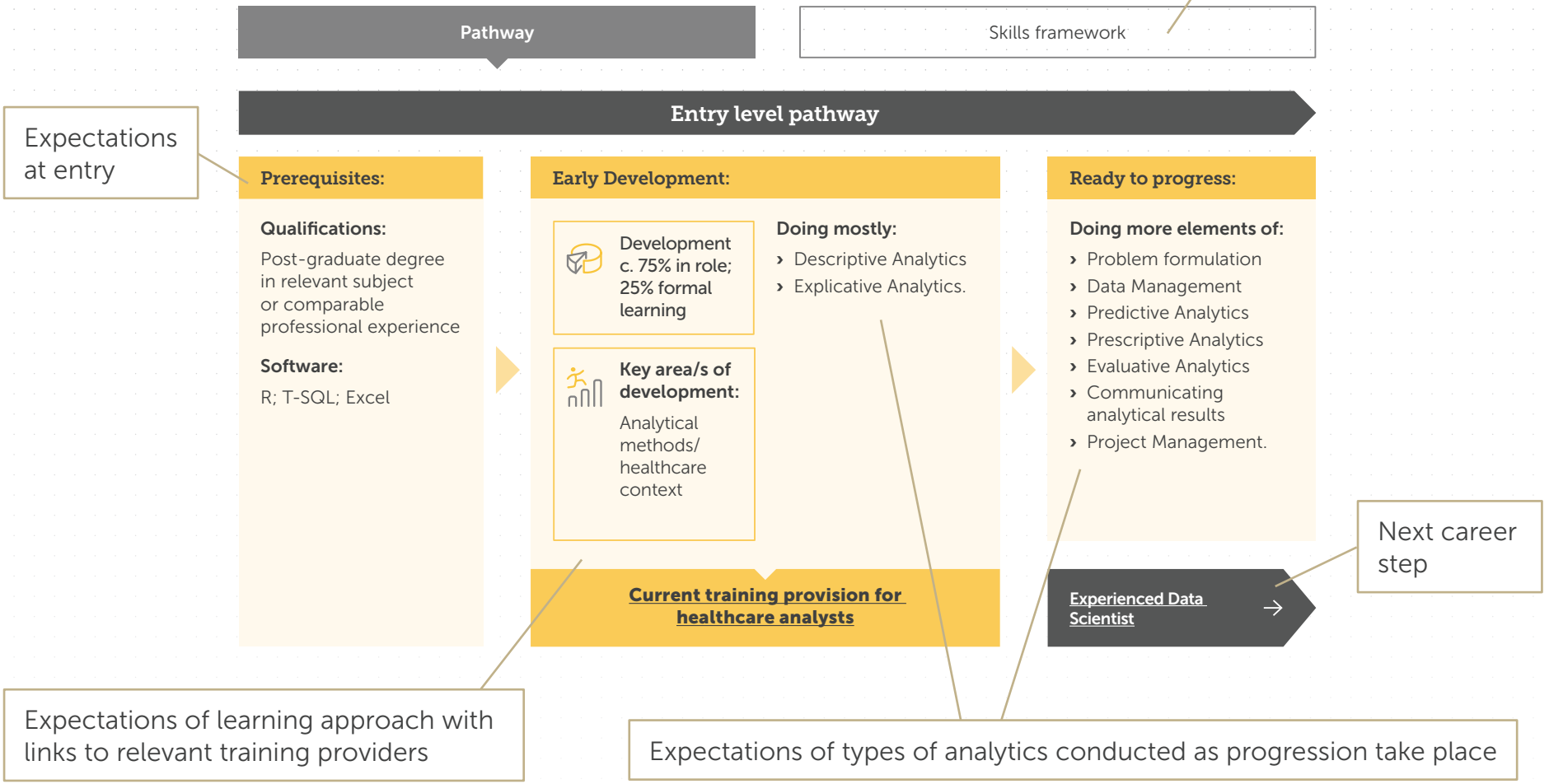
The 'place-mats' chart the pathway from career entry to Analytical Leader/Advanced Data Science Specialist, describing the prerequisites to progression in terms of qualifications, familiarity with coding/software, skills/methods employed in the role, and areas of development to focus on as they gain experience.

Although the pathways should not be considered an all-encompassing competency framework for Data Analysts and Scientists, we believe they can be used to frame the recommendation from AphA's recent report that a standardised framework for healthcare analysts should be established and adopted across the health and care system. We strongly recommend maintaining this high level view as the first line of sight for healthcare analysts and those that employ them and manage them with any further detail, as necessary, appended.

*A survey of 171 healthcare analysts conducted in April 2021 found that 85 per cent self-identify as Data Analysts or Data Scientists

How to use the 'place-mats'

The following describes the skills required on entry to each level of the career pathways, as well as the expectation of what skills will be developed as a healthcare analyst moves through that pathway.

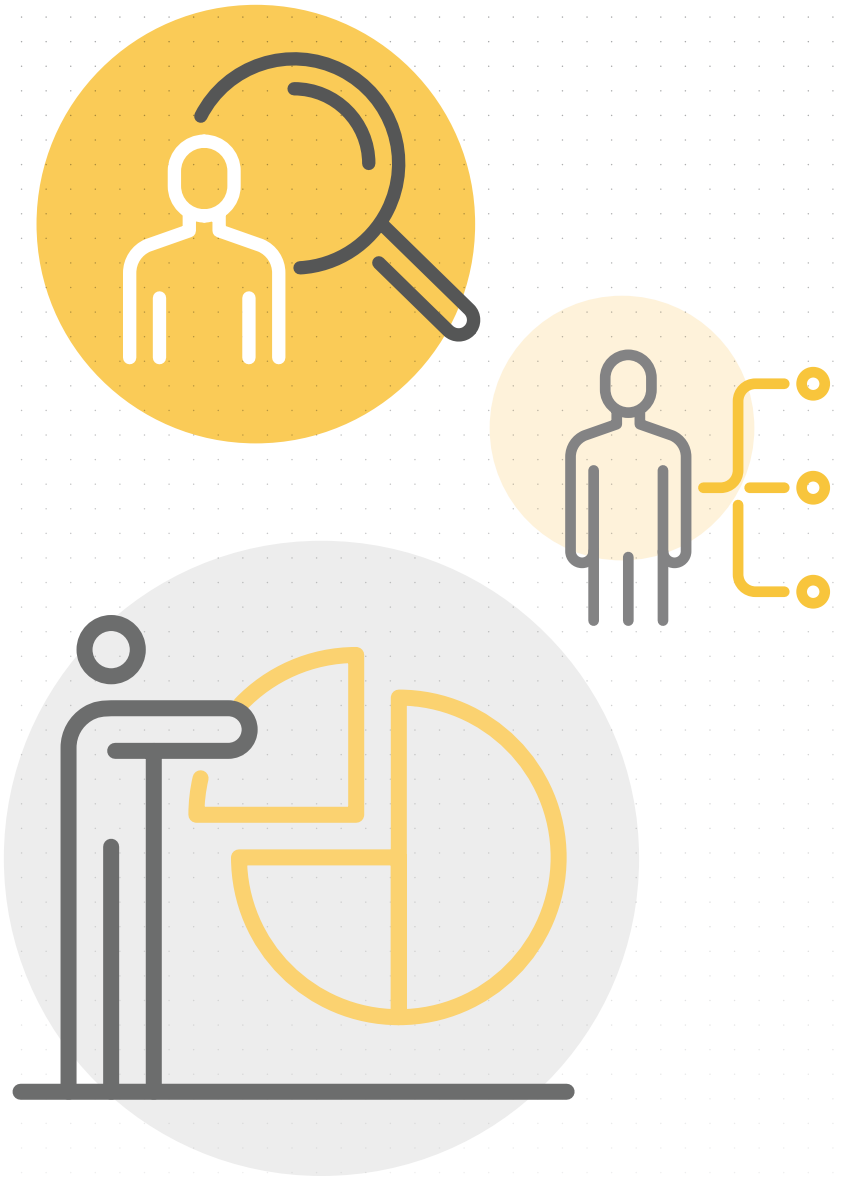


Note - what's the difference between a Data Scientist and a Data Analyst?

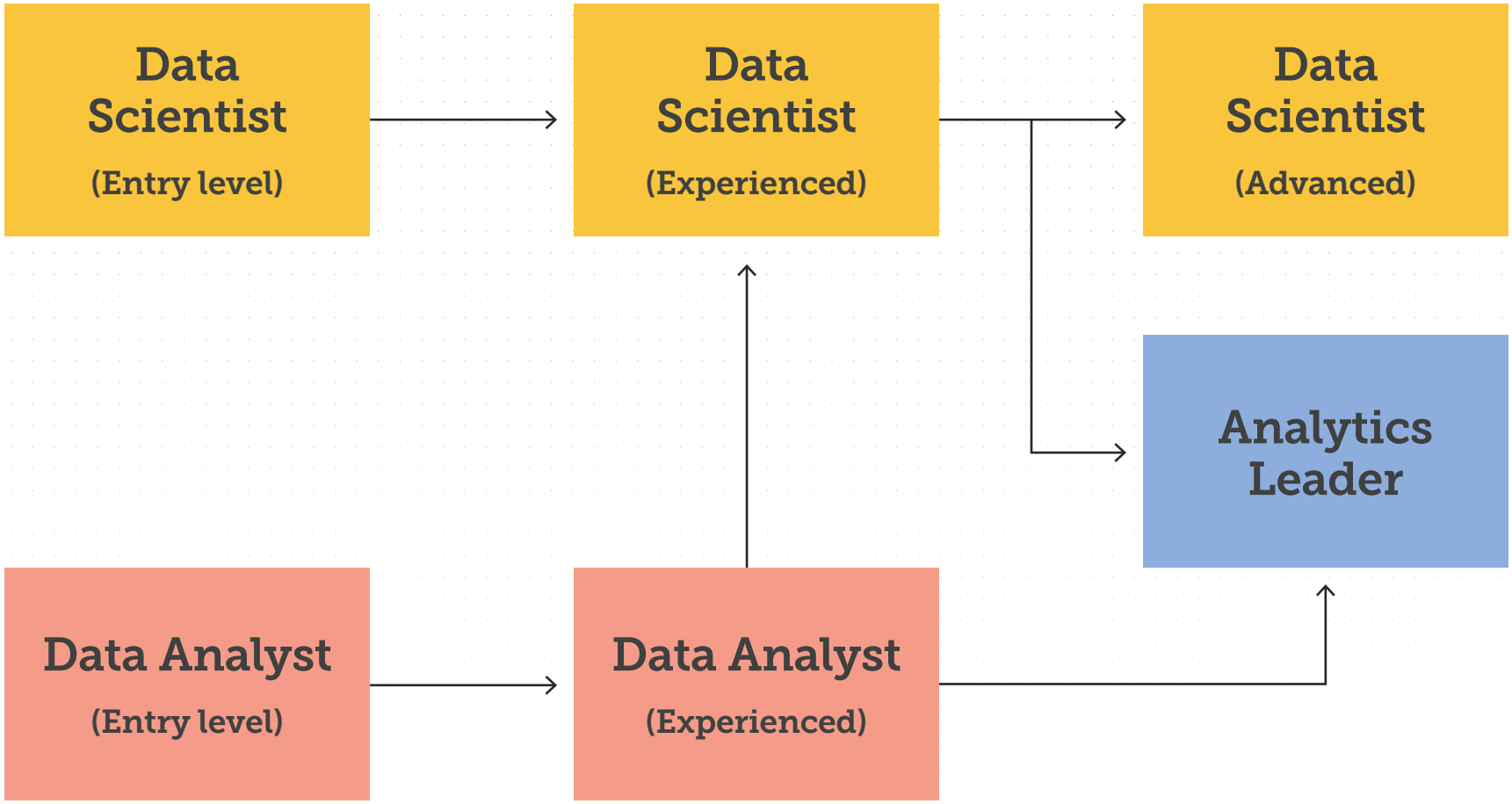
The differences between these two roles in what we have set out have been informed by existing professional frameworks including the Digital, Data and Technology Profession Capability Framework (DDaT) and Government Analysis Career Framework, as well as by a survey of healthcare analysts.

The significant divergences are that:

- Data Scientists have a higher suggested entry bar in terms of academic qualifications and knowledge of relevant software/coding
- Data Scientists have an option under current NHS job structures to pursue an 'Advanced Data Science Specialist' pathway. For an Analyst to pursue this option, it is suggested that they transfer to the Scientist pathway.



Career pathways at a glance



Entry Data Scientist

Pathway | Skills framework

Entry level pathway

Prerequisites:

Qualifications:

Post-graduate degree in relevant subject or comparable professional experience

Software:

R; T-SQL; Excel

Early Development:

Development c. 75% in role; 25% formal learning

Key area/s of development:

Analytical methods/ healthcare context

Doing mostly:

- Descriptive Analytics
- Explicative Analytics.

Current training provision for healthcare analysts

Ready to progress:

Doing more elements of:

- Problem formulation
- Data Management
- Predictive Analytics
- Prescriptive Analytics
- Evaluative Analytics
- Communicating analytical results
- Project Management.

Experienced Data Scientist

Entry Data Scientist

Pathway | **Skills framework**

	Career Stage	
	On entry	**To develop before progressing**
Descriptive Analytics	Summary statistics; data visualisation	Geospatial mapping; metric development
Explicative Analytics	Inferential statistics and hypothesis testing	Explanatory regression modelling; data mining
Predictive Analytics		Time series forecasting; machine learning; simulation; epidemiological modelling; demand modelling
Prescriptive Analytics		Optimisation; statistical process control
Evaluative Analytics		Experimental and quasi-experimental studies; cost effectiveness
Project Design, Management and Dissemination		Problem formulation; data management; communicating analytical results; project management
Coding/software	R; T-SQL; Excel	
Academic or equivalent	Post-graduate degree in relevant subject or comparable professional experience	

Experienced Data Scientist

Pathway | Skills framework

Experienced level pathway

Prerequisites:

Qualifications:

Post-graduate degree in relevant subject or comparable professional experience

Software:

R; T-SQL; Excel

Mid-career Development

Development c. 90% in role; 10% formal learning

Key area/s of development:

Leadership development/ advanced analytical methods

Doing mostly:

- Problem formulation
- Data Management
- Predictive Analytics
- Prescriptive Analytics
- Evaluative Analytics
- Communicating analytical results
- Project Management.

Current training provision for healthcare analysts

Ready to progress:

Doing more elements of:

- Leading Teams
- Coaching
- Decision Quality
- Advanced analytics.

Analytics Leader; Advanced Data Science Specialist

Experienced Data Scientist

Pathway | **Skills framework**

	Career Stage		
	On entry	**To develop before progressing**	**Possible specialisms**
Descriptive Analytics	Summary Statistics; data visualisation; geospatial mapping; metric development	Experience surveys	Prevalence studies
Explicative Analytics	Inferential statistics and hypothesis testing; explanatory regression modelling; data mining		Observational (risk) studies; experience surveys; choice experiments
Predictive Analytics	Time series forecasting; machine learning; simulation; epidemiological modelling; demand modelling	Risk prediction	Scenario planning
Prescriptive Analytics	Statistical process control; optimisation	Resource allocation; resource planning; scheduling; risk prediction	Opportunity assessments; options appraisals; decision aids
Evaluative Analytics	Experimental and quasi-experimental studies; cost effectiveness	Causal inference; qualitative methods	Directed and acyclic graphs; contribution and mediation analysis
Project Design, Management and Dissemination	Problem formulation; data management; communicating analytical results; project management	Leadership development; coaching; decision quality	
Coding/software	R; T-SQL; Excel		
Academic or equivalent	Post-graduate degree in relevant subject or comparable professional experience		

Entry Data Analyst

Pathway | Skills framework

Entry level pathway

Prerequisites:

Qualifications:

Degree in relevant subject or comparable professional experience; apprenticeship

Software:

Excel

Early Development

Development c. 75% in role; 25% formal learning

Key area/s of development:

Software/coding; analytical methods/ healthcare context

Doing mostly:

- Descriptive Analytics.

Current training provision for healthcare analysts

Ready to progress:

Doing more elements of:

- Problem formulation
- Data Management
- Explicative Analytics
- Predictive Analytics
- Prescriptive Analytics
- Evaluative Analytics
- Communicating analytical results
- Project Management.

Experienced Data Analyst

Entry Data Analyst

Pathway | **Skills framework**

	Career Stage	
	On entry	**To develop before progressing**
Descriptive Analytics	Summary Statistics; data visualisation	Metric development
Explicative Analytics		Inferential statistics and hypothesis testing; explanatory regression modelling
Predictive Analytics		Time series forecasting
Prescriptive Analytics		Statistical process control
Evaluative Analytics		Cost effectiveness; qualitative methods
Project Design, Management and Dissemination		Problem formulation; data management; communicating analytical results; project management
Coding/software	Excel	T-SQL; R
Academic or equivalent	Degree in relevant subject or comparable professional experience; apprenticeship	

Experienced Data Analyst

Pathway | Skills framework

Experienced level pathway

Prerequisites:

Qualifications:

Degree in relevant subject or comparable professional experience

Software:

Excel, T-SQL, R

Mid-career Development

Development c. 90% in role; 10% formal learning

Key area/s of development:

Academic training; leadership development

Doing mostly:

- Problem formulation
- Data Management
- Explicative Analytics
- Predictive Analytics
- Prescriptive Analytics
- Evaluative Analytics
- Communicating analytical results
- Project Management.

Current training provision for healthcare analysts

Ready to progress:

Doing more elements of:

- Leading Teams
- Coaching
- Decision Quality.

Analytics leader; Experienced Data Scientist

Experienced Data Analyst

Pathway | **Skills framework**

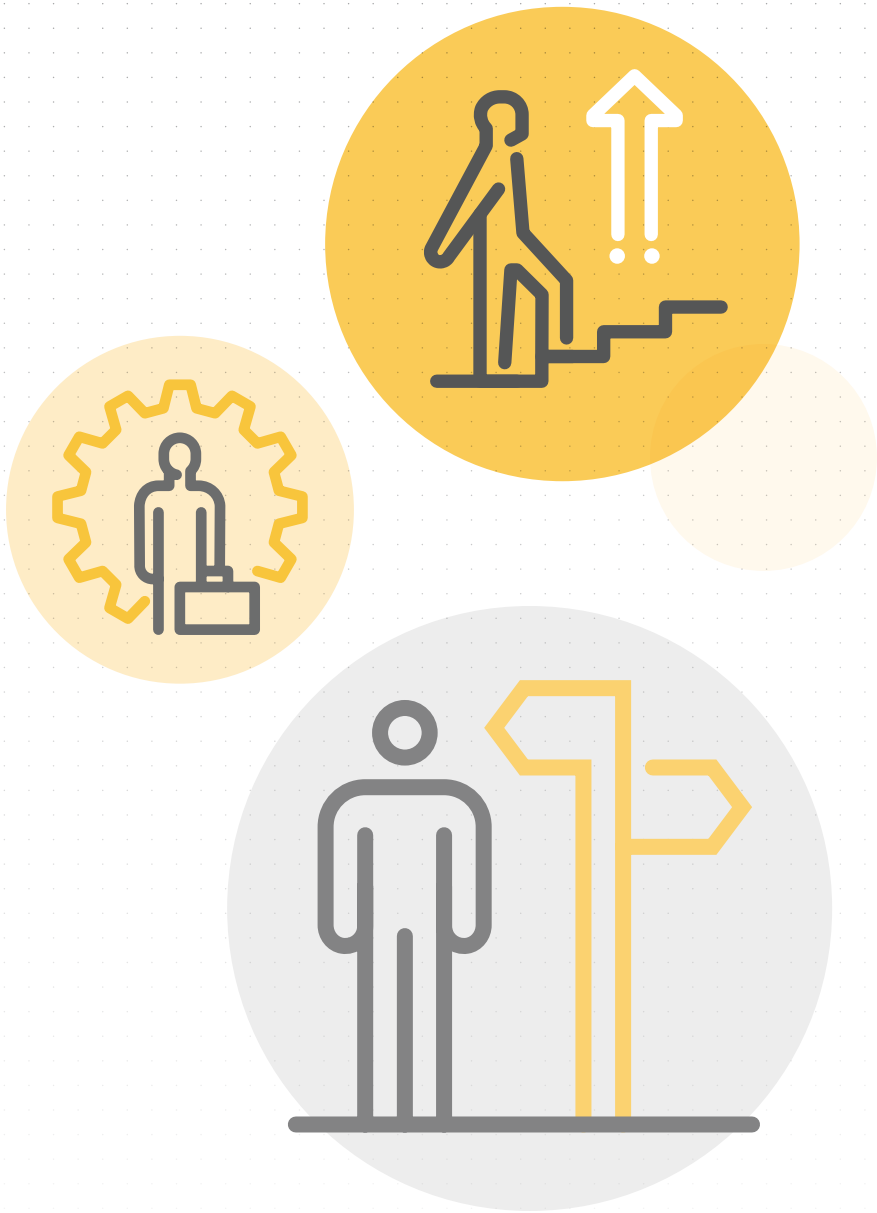
	Career Stage		
	On entry	**To develop before progressing**	**Possible specialisms**
Descriptive Analytics	Summary Statistics; data visualisation; metric development		Experience surveys; geospatial mapping; prevalence studies
Explicative Analytics	Inferential statistics and hypothesis testing; explanatory regression modelling	Data mining	Observational (risk) studies
Predictive Analytics	Time series forecasting	Demand modelling	Risk prediction; epidemiological modelling; scenario planning
Prescriptive Analytics	Statistical process control	Options appraisals; resource allocation; resource planning; opportunity assessments	Optimisation; decision aids; scheduling
Evaluative Analytics	Cost effectiveness; qualitative methods	Causal inference; experimental and quasi-experimental studies	
Project Design, Management and Dissemination	Problem formulation; data management; communicating analytical results; project management	Leadership development; coaching; decision quality	
Coding/software	T-SQL; Excel, R		
Academic or equivalent	Degree in relevant subject or comparable professional experience	Post-graduate degree in relevant subject	

Top end of pathway career options

There are two suggested options at the end of the pathways for Data Analysts and Data Scientists:

Analytical Leader

Advanced Data Science Specialist



As these two roles are not on a pathway to a further role, they do not lend themselves to this framework. As a starting point for describing these roles, an outline role specification for each has been included, click on the links above to find out more.

These should be viewed as the culmination of experience gained from completing the preceding pathways. These can be informed by any future work to establish a competency framework for healthcare analysts.

Analytical Leader

Outline role specification

Has significant demonstrable experience in the following areas:

- Exercising autonomy within broad parameters
- Authority over all aspects of a significant area of work
- Contributes to the formulation and application of policy
- Contributes to the formulation and implementation of strategy
- Addresses complex, non-routine organisational problems
- Has a full range of strategic leadership and management skills
- Has an in-depth understanding of the industry and implications of emerging technologies on the wider business environment
- Coaching and overseeing career development of colleagues
- Advocate for the assessment of decision quality based on analytical outputs, including developing methods for doing so.

Adapted from AphA and the NWSkDF

Advanced Data Science Specialist

Outline role specification

Has significant demonstrable experience in the following areas:

- Strong programming experience using a range of coding practices to build scalable data products for a range of users within a technology context (e.g. Big data, unstructured cloud)
- Identifies efficient and effective ways to use data science to tackle business and organisational challenges, applying innovative techniques
- Applies a range of scientific methods through experimental design, exploratory data analysis and hypothesis testing to reach robust conclusions. Is confident in using analytical approaches and interpreting data
- Understands the ethical considerations of potential data science approaches, and the legislation applicable in this area, i.e. GDPR, DPA etc. Awareness of existing Government and other frameworks
- Continuously promotes professional development by expanding data science knowledge and sharing best practice across departments/industry
- Applies data science techniques to present, communicate and disseminate data science products to achieve and measure impact whilst maintaining user focus
- Use data engineering and manipulation techniques to produce/ improve data product performance by selecting the most appropriate tools and technologies
- Understands the different product delivery methods and phases to contribute to decision making with impact. Use a range of data sources, analytical tools and techniques throughout the life cycle to develop and deploy robust data science solutions into the business
- Has an in depth understanding of the industry and implications of emerging technologies on the wider business environment.

Taken from the Government Analysis Career Framework

Current training provision for healthcare analysts

Current training provision for healthcare analysts

The table on the following pages represents a mapping exercise of current training provision and providers available to healthcare analysts.

This is based on desktop research; a survey of analysts; and interviews with analyst leaders.

This table is not exhaustive and should be reviewed and added to by stakeholders.

The accompanying report to this document has recommended that healthcare analysts nationally are allocated 10 per cent of their time each week to pursue learning and development activities. Additionally, analysts should have a dedicated week for learning each year, coordinated by their regional network.

Return to:

Entry Data Scientist Pathway

Experienced Data Scientist Pathway

Entry Data Analyst Pathway

Experienced Data Analyst Pathway

Key:

DM	Data Management
DS	Descriptive
EX	Explicative
PR	Predictive
PS	Prescriptive
EV	Evaluative
C	Communicating results

	Health context					Analytical methods								
	Data Analyst/ Scientist Apprenticeships	Big Data and Data Science Explained	Health Informatics	Health Economics	Population/ Public Health	Problem Structuring	DM: Data Ethics	DM: Data Linkage	DS: Data Visualisation	DS: Geospatial Mapping	EX: Data Mining	EX. Regression Modelling	PR: Time Series Forecasting	PR: Demand Modelling
AphA							✓							
Health Education England			✓	✓	✓									
Government Statistics Service		✓					✓	✓	✓				✓	
NHS R Community									✓				✓	
Midlands Decision Support Network					✓				✓			✓	✓	
FutureNHS														
Healthcare Evaluation Data														
Kurtosis									✓					
Skills Development Network									✓					
Operational Research Society						✓			✓	✓	✓			
QA	✓	✓												
EDX		✓					✓		✓					
WiseOwl														
FutureLearn		✓			✓		✓		✓		✓			
Laria									✓					
Udemy		✓												
Jumping Rivers		✓							✓				✓	
Population Health Exchange					✓									
NIHR CLAHRC North Thames														
Faculty of Public Health					✓									
Public Health England	✓				✓				✓					
East Midlands AHSN		✓							✓					
Strategy Unit														
Software carpentry														
PenARC														
Mango		✓							✓				✓	

	Analytical methods										Coding/Software		
	PR: Simulation	PR: Machine Learning	PR: Epidemiology	PS: Intro to Prescriptive Analytics	PS: SPC	PS: Decision Analysis	EV: Evaluation	EV: Causality	C: Knowledge Mobilisation	C: Leadership Development	R	SQL	Power BI
AphA													
Health Education England													
Government Statistics Service		✓									✓	✓	
NHS R Community											✓		
Midlands Decision Support Network	✓					✓	✓	✓	✓	✓			
FutureNHS												✓	
Healthcare Evaluation Data		✓									✓		
Kurtosis					✓				✓				
Skills Development Network										✓	✓	✓	✓
Operational Research Society				✓					✓		✓		
QA		✓										✓	✓
EDX		✓									✓	✓	✓
WiseOwl												✓	✓
FutureLearn		✓									✓	✓	
Laria													
Udemy		✓									✓		✓
Jumping Rivers		✓									✓	✓	
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Public Health England			✓						✓				
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Strategy Unit	✓												
Software carpentry											✓		
PenARC													
Mango		✓									✓	✓	

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Commissioning Support Unit