

Open Analytics Resources for Health and Care



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This document is a resource for analysts and data scientists working in the health and care sectors. Many amazing tools and resources exist. Let's share knowledge to improve analytics.

Please feel free to add comments. We would value your amendments and additions.

Community moderation of the document is supported by the [Association of professional Healthcare Analysts \(ApHA\)](#), [This Equals](#) and [Keyah Consulting](#), in collaboration with the [Health Foundation](#).

The document was Initially developed by This Equals and Keyah Consulting for the Advancing Analytics and AI workshop (2019) hosted by [Bristol Health Partners](#) and [BNSSG Healthier Together Partnership](#).



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Introduction

This document is a resource for analysts and data scientists working in the health and care sectors. While there is a clear focus on South West England, it also includes national and international resources and references.

This document has been updated to include relevant resources in relation to Covid-19.

This is by no means an exhaustive document. We would value your amendments, comments, and additions.

Note: Please feel free to add comments. Comments will be reviewed / included periodically

Context

How do we use technology for public good? What are the opportunities and challenges? These questions have come under the spotlight with developments in artificial intelligence and machine learning and the ability to interrogate and analyse large volumes of data in a way that has never before been possible. And critical to taking up these opportunities is the building and development of the data analytics workforce.

This was made clear during the Bristol Health Partners event, [AI in health and care: how do we get it right?](#) (2018). Coming out of this was an immediate action for Bristol Health Partners to consider how to move forward with a clear focus on building and developing and data analytics workforce.

And this focus on the data analytics workforce has also been picked up at the national level with reports from [The Health Foundation](#) and the [Royal Society](#).

This work is critical to take full advantage of what data, and big data, has to offer. And this is very much at the forefront of NHS thinking with Simon Stevens calling for the [NHS to be a world leader in artificial intelligence and machine learning within the next 5 years](#).

More recently, COVID-19 has very much put the spotlight on the vital role of the data and data analytics in informing decision-making at the local and national levels.

Covid-19 specific resources

The Corona Tech Handbook provides a good overview of information about Corona related technology. See the coronavirustechhandbook.com, or for more specific research tools:

- [Coronavirus Tech Handbook Technical Tools & Resources](#) page for more information

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Software (/algorithms) - Github

- [BNSSG Analytics - Required Beds Projection](#)
- [Covid-19 SAS](#)
- [EMB Data Lab](#)
- [Health Foundation Analytics Lab](#)
- [HF Analytics Lab - COVID-19 resources - Analytics Communities and Events](#)
- [Folding at home](#)
- [NHS-R Community - Covid-19](#)
- [NHSX Chest Imaging Database](#)
- [ODI Leeds](#)
- [OpenSAFELY](#)
- [SD epidemiology models:](#)
<https://sheetless.io/@kimwarren/the-covid-19-infection-system/app>
<http://vensim.com/coronavirus/>

- [Simul8 ICU planner](#)

Data

- Emergency Care Data Set - [ECDS latest update](#)
- Gov.UK - [Coronavirus \(COVID-19\) in the UK](#)
- NPC - [Interactive COVID-19 Data for Charities and Funders](#)
- PHE - [Wider Impacts of COVID-19 on Health \(WICH\) monitoring tool](#)
- [Potential Coronavirus \(COVID-19\) symptoms reported through NHS Pathways and 111 online](#)
- [Shielded patients methodology:](#)
<https://digital.nhs.uk/coronavirus/shielded-patient-list/methodology/annexes> (England)
<https://nwis.nhs.wales/news/latest-news/identifying-vulnerable-patient-lists/> (Wales)

Other

- Government Data Science - [Slack Channel Sign-ups](#)
- Health Foundation - [Covid-19 Policy Tracker: A timeline of national policy and health system responses to COVID-19 in England](#)
- [HDRUK Covid-19](#)
 - [Slack Channel Sign ups](#)
- [HEE Knowledge for Healthcare](#)
- National Institutes for Health (US) - [Open-Access Data and Computational Resources to Address COVID-19](#)
- NHS-R Community - [Covid-19 Modelling Webinar](#)

- [OpenSAFELY](#) - Secure analytics platform for electronic health records in the NHS, created to deliver urgent results during the global COVID-19 emergency. Analyses across more than 24 million patients' full pseudonymised primary care NHS records, with more to follow.

Learning the Lessons

- House of Commons: [Eighth Report - Government transparency and accountability during Covid 19: The data underpinning decisions](#)
- [RSS - Statistics, Data and Covid](#) - "Ten statistical lessons the government can learn from the past year"
- Key policy documents

Codes of Practice, regulation, and guidance

[BETA - NHS digital, data and technology standards framework](#) (2018) - This framework outlines the key standards for clinical safety, the use of data, interoperability and design interactions.

[Code of conduct for data-driven health and care technology](#) (2018) - The code of conduct contains a set of principles that set out what we expect from suppliers and users of data-driven technologies.

[Code of Practice on Confidential Information](#) (2014) - Good practice guidance for organisations collecting, analysing, publishing or otherwise disseminating confidential information concerning, or connected with, the provision of health services or adult social care in England.

[Confidentiality: NHS Code of Practice](#) (2003) - Sets out standards required for NHS organisations concerning patient confidentiality.

[Data Protection Act \(2018\)](#) - The Act makes provision about the processing of personal data

[Data Sharing Code of Practice](#) - Note, this is in the process of being updated in light of the Data Protection Act (2018). This code explains how the Data Protection Act 1998 (DPA) applies to the sharing of personal data. It also provides good practice advice that will be relevant to all organisations that share personal data.

[EU General Data Protection Regulation \(GDPR\)](#) (2016) - GDPR regulates the processing by an individual, a company or an organisation of personal data relating to individuals in the EU.

[General Practice Extraction Service \(GPES\) Data for pandemic planning and research: a guide for analysts and users of the data](#) - This guidance provides an overview of the dataset for analysts and other users of the General Practice Extraction Service (GPES) Data for Pandemic Planning and Research (GDPPR) that will provide information for coronavirus (COVID-19) planning and research.

[Government Analysis Functional Standard](#) - “The purpose of the Government Analysis Functional Standard is to set expectations for the planning and undertaking of analysis across government

[Government Digital Service - Data Ethics Framework](#) - “The Data Ethics Framework guides appropriate and responsible data use in government and the wider public sector. It helps public servants understand ethical considerations, address these within their projects, and encourages responsible innovation.”

[Guidance - PHE Data and Analysis Tools A-Z](#) - Data and analysis tools from across Public Health England (previously known as the 'Data and knowledge gateway').

[HSCIC Guide to Confidentiality \(2013\)](#) - Shows how health and care workers what they should do and why, to share information safely while following rules on confidentiality.

[Information Security Management: NHS Code of Practice \(2007\)](#) - Sets out standards for the management of information in NHS organisations.

[NICE Evidence Standards Framework for Digital Health Technologies \(2019\)](#) - The framework describes standards for the evidence that should be available, or developed, for DHTs to demonstrate their value in the UK health and care system. Intended for use by technology developers to inform their evidence development plans, and by decision makers who are considering whether to commission a DHT.

[NHS information governance: legal and professional obligations \(2007\)](#) - Sets out legal responsibilities for the management of information in NHS organisations.

Office for Statistics Regulation: [Code of Practice for Statistics](#)

[The Health Service \(Control of Patient Information\) Regulations 2002](#) - These Regulations make provision for the processing of patient information, including confidential patient information.

[Records Management Code of Practice for Health and Social Care 2016](#) - Sets out what people working with or in NHS organisations in England need to do to manage records correctly. It's based on current legal requirements and professional best practice and was published on 20 July 2016 by the Information Governance Alliance (IGA).

[The Health Service \(Control of Patient Information\) Regulations 2002](#) - To note that The Secretary of State for Health and Social Care has issued a Notice under Regulation 3(4) of the National Health Service (Control of Patient Information Regulations) 2002 (COPI) to require relevant organisations to share confidential patient information with organisations entitled to process this under COPI for COVID-19 purposes.

[The UK Government's National Data Strategy](#) National [Data Strategy](#) - "This document is a framework for the action this government will take on data. It is not the final answer, but part of a conversation about the way that we support the use of data in the UK. We lay out the opportunities that we want to realise, the pillars that we have identified as core to unlocking the power of data for the UK, and the missions that we must prioritise now."

[The future of healthcare: our vision for digital, data and technology in health and care \(2018\)](#) - This document sets out the government's vision for the use of technology, digital and data within health and care, to meet the needs of all our users.

[The Topol Review: An independent report on behalf of the Secretary of State for Health and Social Care \(2019\)](#) - The Review makes recommendations that will enable NHS staff to make the most of innovative technologies such as genomics, digital medicine, artificial intelligence and robotics. Clear argument made that there is a need to develop a continuous pipeline of robotics engineers, data scientists and other technical specialists, who can then be attracted into the NHS to create the new technological solutions that will improve care and productivity.

Health foundations blog on open analytics

<https://towardsdatascience.com/towards-open-health-analytics-our-guide-to-sharing-code-safely-on-github-5d1e018897cb>

Relevant projects and organisations

UK

- [Government Analysis Function](#) - “The Government Analysis Function is a cross-government network of around 17,000 people involved in the generation and dissemination of analysis.”
- [Health Data Research UK](#) - The vision is that every health and care interaction and research endeavour will be enhanced by access to large scale data and advanced analytics.
- [Health Foundation \(Improvement Analytics Unit\)](#) - An innovative partnership between NHS England and NHS Improvement and the Health Foundation providing robust evaluation of complex changes in the NHS.
- [Improvement Analytics Unit Statistical Analysis Protocols](#) - A statistical analysis protocol (SAP) is a document intended to guide analytical processes. It includes the proposed evaluation design, statistical methods, and the limitations of the analysis, including how these should be considered when interpreting the results.
- [My NHS \(Open Data Beta\)](#) - Created to help developers, commissioners and the public get data in formats that are free and easy to re-use for their projects and products.
- [NHS Digital](#) - NHS Digital has responsibility for standardising, collecting and publishing data and information from across the health and social care system in England. Has over 1,000 datasets.
- [NHSX](#) - NHSX brings teams from the Department of Health and Social Care, NHS England and NHS Improvement together into one unit to drive digital transformation and lead policy, implementation and change in England.
- [Open Prescribing](#) - OpenPrescribing is one of a range of projects built by the EBM DataLab at the University of Oxford, to help make complex medical and scientific data more accessible and more impactful in the real world. It provides a search interface onto the raw prescribing data files published by NHS BSA.

- [Technology Reference Data Update Distribution \(TRUD\)](#) - A website hosted by NHS Digital. It provides a mechanism for NHS Digital to license and distribute reference data to interested parties. This is the preferred terminology distribution method of NHS Digital.
- [UK Data Service \(Health and Health Behaviour\)](#) - Funded by the Economic and Social Research Council (ESRC) to meet the data needs of researchers, students and teachers from all sectors, including academia, central and local government, charities and foundations, independent research centres, think tanks, and business consultants and the commercial sector.
- [Office for Statistics Regulation](#) -The Office for Statistics Regulation vision is simple: Statistics should serve the public good. “As regulators, it is our role to support confidence in statistics by addressing harms and making sure that statistics serve the public good.”

South West UK

- [One Care](#) is a GP-led organisation that represents and supports practices in Bristol, North Somerset and South Gloucestershire (BNSSG). It is a Community Interest Company that provides accurate data and business intelligence to support population health management, patient risk management, and continuity of care.
- The Clinical Commissioning Group and wider Sustainability and Transformation Partnership (STP) is undertaking work on how advanced analytics and AI can support the local health service; and is developing local population health analytics function with development of a BNSSG population dataset.
- Patient and public 'digital critical friends'. These are members of the public who have participated in training developed by People in Health West of England (PHWE) and Bristol Health Partners, on digital health and the uses of data. The aim of this work is to create a group of public contributors who can meaningfully contribute to discussions about digital health and data use.
- An emerging local 'Citizen Panel', [Healthier Together STP](#), is engaging 1,000 people from across Bristol, North Somerset and South Gloucestershire to participate in patient and public involvement for commissioning decisions. Bristol Health Partners are working with People in

Health West of England to pilot Digital Health training for Patient and Public representatives to gain insight into technology, data and specifically AI in health and care.

- As part of the 'Using Data Better' strategic programme, the Bristol Health Partners have developed the [Local Digital Health Research and Development Group](#) (since 2016). Work includes the development of an [inventory of health-related data sources](#) in the region - supported by the [Elizabeth Blackwell Institute](#) at the University of Bristol
- Staff from the local Clinical Commissioning Group and Sustainability and Transformation Partnership Business intelligence services are developing an intelligence network;
- The local Clinical Commissioning Group has created one of the only CCG data modelling teams in the country;
- The [West of England Local Enterprise Partnership](#) (LEP) are reviewing the local digital health industry landscape and the [West of England Academic Health Science Network](#) provide advice and support on how to best evaluate digital healthcare innovations and how to bring them into practice;
- Bristol, North Somerset and South Gloucestershire benefits from the pioneering [Connecting Care Programme](#) - sharing local health records;
- The University of Bristol is home to the data focused [Jean Golding Institute](#), and the [Intelligent Systems Lab](#). Bristol University has partnered with the Alan Turing Institute. The University of West of England hosts the [Artificial Intelligence Group](#) with high profile national and international projects; and,
- A range of other research activities are being conducted under the auspices of [National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care West \(NIHR CLAHRC West\)](#). For example, their study on the [impact of digital tools in primary care](#).
- [The West of England Academic Health Science Network](#) are joining up the health services across the West of England through the [Connecting Data for Patient Benefit](#) programme. This is helping to make sure that health and community care professionals are fully informed, productivity and efficiency is maximised, patients' safety is optimised and the best possible care is provided to our service users.

Midlands

- [The Strategy Unit](#) The Strategy Unit is a specialist NHS team, based in Midlands and Lancashire Commissioning Support Unit. We focus on the application of high-quality, multi-disciplinary analytical work.

International

- [IEEE](#) - The world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. Also a standard setting body in areas like mobile health technologies.
- [Global Health Data Exchange](#) - A catalog of global health and demographic data. The goal to help people locate data by cataloging information about data including the topics covered, by providing links to data providers or explaining how to acquire the data, and in cases where we have permission, providing the data directly for download.

Featured projects

- [Open Safely](#) - a new secure analytics platform for electronic health records in the NHS, created to deliver urgent results during the global COVID-19 emergency. It is now successfully delivering analyses across more than 24 million patients' full pseudonymised primary care NHS records, with more to follow shortly. All our analytic software is open for security review, scientific review, and re-use.
- [Care and Health Information Exchange](#) - The Care and Health Information Exchange (CHIE) is a secure system which shares health and social care information from GP surgeries, hospitals, community and mental health, social services and others. CHIE helps professionals across Hampshire, the Isle of Wight and surrounding areas provide safer and faster treatment.
- [Kent Integrated Dataset](#) - The Kent Integrated Dataset (KID) is a relatively mature exemplar of a population-level linked dataset. It comprises of routine administrative datasets from

more than 200 local health and care organisations. The KID includes data from April 2014 and is updated on a monthly basis.

- [Sail Databank](#) - Allows for the sourcing, accessing, linking and analysing health and population data all within a governed infrastructure that is safe and secure. Researchers can access a broad range of routinely collected data spanning up to 20 years from an entire population. It provides linkable, anonymised datasets ready for analysis that can be accessed remotely via the SAIL Gateway platform, complete with analysis tools.
- [Understanding patient data](#) - Understanding Patient Data supports better conversations about the uses of health information. Our aim is to explain how and why data can be used for care and research, what's allowed and what's not, and how personal information is kept safe. We work with patients, charities and healthcare professionals to champion responsible uses of data.
- [Bristol, N Somerset and S Gloucestershire CCG Analytics: PathSimR](#)
This project aimed to improve understanding of how care pathways are performing and enable 'what if' analysis to identify more effective and efficient service configurations. A versatile pathway tool was developed allows NHS analysts and managers to understand and model patient flow. PathSimR has supported many projects & business cases within the CCG & further afield. As well as improving the evidence base for decision making, the tool opened the eyes of clinicians & managers to the benefits of advanced analytics.
 - Find the tool on GitHub [here](#) and a Q&A with Dr Rich Wood about the tool [here](#). This project was funded by the Health Foundation, an independent charity, as part of its programme, Advancing Applied Analytics
- [Cardiff and Vale University Health Board: Harnessing data analytics to maximise NHS learning from patient safety incident reports](#)
This project aimed to realise the synergy between data analysts, managers and clinicians for identifying and acting on learning from patient safety data. Analytical strategies in the child health directorate were developed and tested to inform the design of quality improvement projects led by paediatric trainees. The team developed a 'how to' guide, summarising the concepts, challenges and resources required to introduce the new analytical approach – allowing other organisations to adopt the approach, if successful.
 - The following modules are available for further reading:
 - [Module 1 - Using patient safety data to inform the planning of a QI project](#)
 - [Module 2 - Incident data analysis](#)

- [Module 3 - Further analysis and other data sources](#)
- [Module 4 - Permission to improve](#)

This project was funded by the Health Foundation, an independent charity, as part of its programme, Advancing Applied Analytics

- [North East Quality Observatory Services: Can interactive data visualisation help clinicians improve patient care?](#)

This project aimed to improve the way in which interactive data visualisation is used by clinicians so that it can lead to improvements in quality of care. It is not always clear how useful data visualisation tools are to clinicians or whether they can in fact lead to actionable outcomes. This project by NEQOS explored clinician requirements for engaging with these tools and explored whether more bespoke DV or other data interfaces may be more in line with clinician requirements. A literature review was conducted and an options appraisal undertaken before producing four interactive data visualisation dashboards: hip, knee, maternity and mortality monitoring. These were produced following extensive interaction with clinicians to establish their requirements as the end users.

- NEQOS have shared all outputs and made them available [here](#) including a webinar, slideset and standard operating procedures. These design principles for data visualisation in a healthcare setting were also described in a publication [here](#).

This project was funded by the Health Foundation, an independent charity, as part of its programme, Advancing Applied Analytics

- [Health and Social Care N Ireland & Business Services Organisation: Pathways to cancer diagnosis: Monitoring variation in the patient journey across Northern Ireland](#)

This project was run by the Business Services Organisation Information Unit, with analytical support from Queen's University Belfast. It aimed to improve understanding of the variation in routes-to-diagnosis (for example screen-detected, GP referral, emergency presentation) of cancer in Northern Ireland, in order to increase earlier diagnoses and treatment effectiveness. It produced estimates for routes-to-diagnosis at different health geographies down to GP practice level, and created an online tool for health service practitioners, informing national cancer strategy.

- The report can be found [here](#) and the interactive tool can be found [here](#).

Tools and Resources

Software

- [Jupyter notebooks](#): Supporting open-source software, open-standards, and services for interactive computing across dozens of programming languages. See also: [Jupyter Cheat Sheet](#)
- [Github](#) / [GitLab](#): GitHub is a development platform where you can host and review code, manage projects, and build software alongside 36 million developers. GitLab is a complete DevOps platform, delivered as a single application. From project planning and source code management to CI/CD, monitoring, and security. See also: [GIT Cheat Sheet](#)
 - [NHS Connect](#)
 - [NHSEI Analytics](#)
 - [NHS-R Community](#)
 - [NHSX](#)
 - [SHERE HyperStream](#)
 - [IBM Streams Health](#)
 - [Jupyter Server](#)
- Cloud: To use Cloud storage to share data.
- [R and Python cheat sheets](#)
- [Triangular Irregular Networks \(TIN\)](#): These digital data structures are used in a variety of applications including Geographic Information Systems.
- [QGIS](#): A Free and Open Source Geographic Information System

- [Shiny by RStudio](#): Shiny is an open source R package that provides a web framework for building web applications using R. Shiny helps you turn your analyses into interactive web applications without requiring HTML, CSS, or JavaScript knowledge.
- Visualisation type guides - [Financial times guide](#)
- Data
- [Data Access Request Service](#)
- Data in local projects. ie . ALSPAC Data Set
- Bristol Open Data Platform

Training and development opportunities

[Note: the focus of this list is training and development in the region for those courses where you are required to be present. Others are online. This is by no means a comprehensive list]

Short Courses

- Future Learn
 - [Data Science for Healthcare: Using Real World Evidence](#)
 - [Health data analytics](#)
 - [Quality Improvement in Healthcare: the Case for Change](#)
- University of Bristol
 - [Data Linkage](#)
 - [Improving your Stata: data management, publication-quality outputs, and automating tasks](#)
 - [Introduction to R](#)
 - [Introduction to Stat](#)
- University of West of England
 - [Big Data](#)
 - [Introduction to R](#)
 - [Introduction to SPSS](#)
 - [Linked, Open data](#)
 - [Machine Learning and Predictive Analytics](#)

Degrees

- University of Bath
 - [Data Science MSc](#)
- University of Bristol
 - [MSc Advanced Computing - Machine Learning, Data Mining and High-Performance Computing](#)

- PHD opportunities: <https://www.bristol.ac.uk/cdt/digital-health/>
- University of Derby
 - [MSc Big Data Analytics](#)

Learning Resources

- [UK GOV- Government Analysis Function - Learning Curriculum](#) - “Whether you’re an experienced government analyst looking to refresh or develop your skills, or brand new to your role, a member of one (or more) of the analytical professions or not, the AF Learning Curriculum has something for everyone.”

Training / Apprenticeship Schemes

- Graduate Management Training Scheme: Health Analysis
- Apprenticeships: [Level 4 Data Analyst](#)
- Apprenticeships: [Level 6 \(Integrated degree\) Data Scientist](#)

Fora and networks

South West Local

- [Bristol Data Scientists Meetup](#) - The aim of this meetup is to promote discussion, learning and interaction around Data Science in the South West. This is a group for statisticians, mathematicians, programmers, data scientists, data alchemists and anyone interested in using data for analytics. Aim to run meetings on a quarterly basis
- [Bristol Project Data Analytics Meetup](#) - Meetup to share best practise on leveraging data within a project, programme and portfolio environment. This meetup will explore some of the challenges at the intersection of data analysis and project, programme and portfolio management and discuss how practitioners are working to resolve them,

- [Elizabeth Blackwell Institute Health Data Science Research Strand](#) - A University of Bristol group of academics with an interest in making better use of routinely collected data.
- [Local Digital Health Research and Development Group](#) - Bristol Health Partners convenes a Local Digital Health Research and Development Group, bringing together academics, NHS organisations and local authorities in Bristol, North Somerset and South Gloucestershire (BNSSG).
- [Southwest Data Meetup](#) - The Bristol-based holistic data group that is all things to do with managing, handling, analysing and delivering data in the mild mild South West.
- Health Intelligence network - Staff from the local Clinical Commissioning Group and Sustainability and Transformation Partnership Business intelligence services are developing an intelligence network.

National and International

- [Association of Professional Healthcare Analysts \(AphA\)](#) - Aims to raise the profile of healthcare analysts and provide a professional support network. Membership organisation.
- [Deep Intelligence Telegram Group](#) - The main topics discussed by the group include: Business Development and Business Model in Digital Transformation Age; Data Science; Artificial Intelligence; Machine Learning; Deep Learning; Cognitive Science, and; Neuroscience
- [NHS-R Community](#) - The NHS-R community aims to support the learning, application and exploitation of R in the NHS through workshops, video tutorials and providing a platform for discussion and sharing of developing best practice solutions to NHS problems.
- [Royal Statistical Society](#) - The Data Science Section is a newly formed section of the Royal Statistical Society that was established in 2017. The Section includes representatives from

business, industry, government and academia and was formed to address emerging topics that will impact the long term success of data science as a profession.

- [UK Health Data Research Alliance](#) - The UK Health Data Research Alliance will unite expertise and act as a clearing house for best practice in the stewardship of the UK's health data – including patient and administrative data from the NHS, genomic data and other molecular data – to enable faster, more efficient access for research at scale. This will speed up progress in science, medicine and healthcare at pace.
- [Open Data Leaders Network](#) - The Open Data Institute (ODI) has developed the Open Data Leaders Network – a global peer network of public sector open data leaders at different levels (city, regional and national) – to promote peer-learning and knowledge exchange.

Professional bodies

- [Association of Professional Healthcare Analysts \(AphA\)](#) - The organisation's aim is to raise the profile of healthcare analysts and provide a professional support network.
- [BCS - The Chartered Institute of IT](#) - Champions the interests of IT professionals through sharing expertise, providing CPD and qualifications, and setting industry standards. BCS does not specialise in supporting those working in health and social care, however the range of IT professionals and service areas it supports is wide; from technical and systems development, to information sharing and data analysis.
- [Institute of Health Records and Information Management \(IHRIM\)](#) - Provides members with information on legislation, best practice and current affairs for people working in health records, clinical coding or information governance. IHRIM also offers qualifications for health records and health information professionals.
- [Royal Statistical Society](#) - The Society promotes the importance of statistics and data. A professional body for all statisticians and data analysts. Advocate on the key role of statistics

and data in society, and work to ensure that policy formulation and decision making are informed by evidence for the public good.

- [Society for IT Management \(SOCITM\)](#) - Represents leaders and managers using information and digital technology to benefit people and communities. It provides members with professional development, peer support and research to support organisational improvements. Other professional bodies can support the roles identified, but SOCITM specialises in leadership.
- [The Operational Research Society](#) - A member-led organisation supporting professional operational researchers across industries and academia. The Society promotes the understanding and use of operational research in all areas of life, including industry, business, government, health and education.

Knowledge resources

The Bristol, North Somerset and South Gloucestershire Research and Evidence Team; The Bristol, North Somerset and South Gloucestershire Knowledge and Intelligence Collaborative (KIC). (2018). Presentation - [Making sense of evidence and evaluation across Bristol, North Somerset and South Gloucestershire](#)

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<https://www.nesta.org.uk/report/missing-numbers-childrens-services/> [Accessed 20 March 2021]

Bringing NHS data analysis into the 21st century

Ben Goldacre, Martin Bardsley, Tim Benson, Kate Cheema, Roger Chinn, Ellen Coughlan, Sarah Dougan, Marc Farr, Loraine Hawkins, Adrian Jonas, Andy Kinnear, Morag McInnes, Mohammed Amin Mohammed, Caroline Morton, Rahul Pasumarthy, Neil Pettinger, Ben Rowland, Neil Sebire, Paul Stroner, Jeni Tennison, Samantha Warnakula, Oliver Watson, Emma Wright, Hamish Young, Jessica Morley  [2021] *Journal of the Royal Society of Medicine*. Available at <https://journals.sagepub.com/doi/full/10.1177/0141076820930666> [Accessed 20 March 2021]

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- See also - [Dynamics of data science skills: What data professionals say about data science – career stories](#)
- See also - [Dynamics of Data Science: Models and mechanisms](#)

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