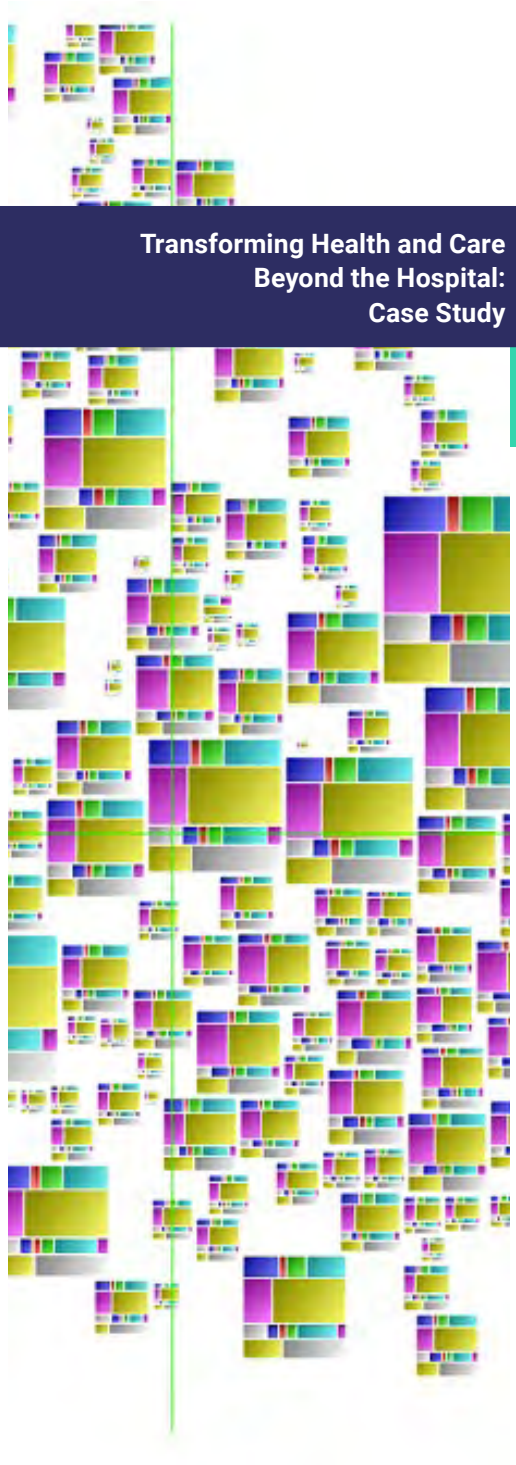

Engineering and Physical Sciences Research Council

Transforming Health and Care Beyond the Hospital: Case Study

Visualising a big advance in harnessing healthcare data

Versatile, engaging, easy to use, instantly informative: a new breed of interactive graphics that succinctly summarise rising raw-data mountains will help optimise the use of NHS resources.

Meeting the Grand Challenge:

Led by the University of Nottingham, the 'Bringing Healthcare Data to Life' project is developing novel data-visualisation tools that will enable users to pinpoint patterns, hotspots, trends and anomalies for all kinds of diseases and disorders. One key benefit will be the extra dimension these tools deliver in terms of informing measures aimed at preventing illnesses and aiding their management at home – options crucial to easing pressure on hospitals and meeting the needs of the UK's ageing population.

Vision and Value:

From Electronic Health Records to information held by healthcare providers and public health agencies across the country, the UK's reservoir of medical data is vast and fast-growing. The challenge is to turn this huge resource into valuable insights that help combat conditions such as cancer, coronary heart disease, depression, hypertension, stroke and asthma. Not only are the datasets extremely diverse, complex and variable in quality; their sheer size is also an issue when trying to develop sound platforms to support decisions that can make a material difference to disease prediction, prevention, diagnosis and treatment.

The Nottingham team's solution is rooted in a proven fact: visual images can offer the best way of ensuring the brain accesses information quickly and indelibly. But traditional line, bar and pie charts have their limitations. The team's vision, then, is to develop new data-visualisation software tools that, for any UK-based collection of raw public healthcare data, enable users not just to gain rapid, accurate overviews but also to drill down easily into the detail. Combining sophistication with ready comprehensibility, these tools will offer a number of innovations, including novel filtering and selection techniques and the ability to facilitate new types of data overview never previously possible.

Key Components:

Supported by £358,000 of EPSRC Standard Research grant funding[1] and running until 2023, the four-year project is dovetailing computer science with data analytics to tackle this classic 'big data' challenge. Input from partners in the digital health sector will ensure outputs achieve the primary aim of meeting the real-world requirements of data analysts in the healthcare space.

The goal is to build data-mining software that generates easy-to-understand graphics showing the prevalence and geographical spread of individual medical conditions, and uses state-of-the-art visualisation techniques to reveal how the prevalence and spread of these conditions has changed over the course of time. Filtering and selection options will allow users to focus on subsets of particular interest, such as disease incidence among specific age groups. All healthcare data is being carefully anonymised and aggregated for privacy protection.

Image credit: University of Nottingham

[1] Bringing Healthcare Data to Life. Grant number: EP/S010238/2

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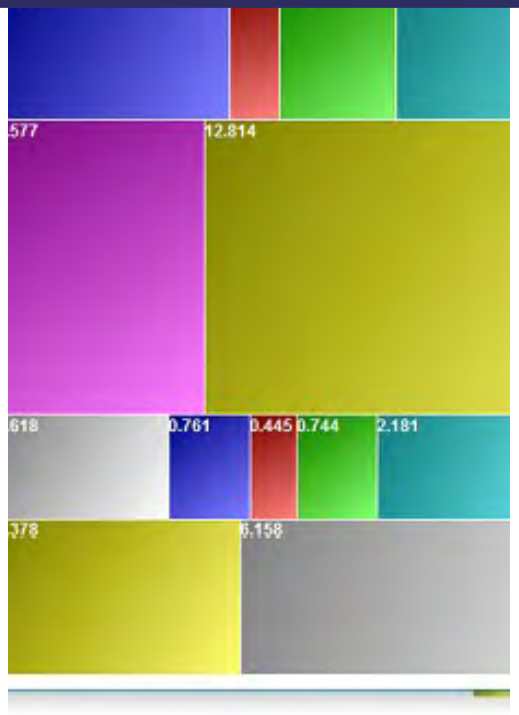

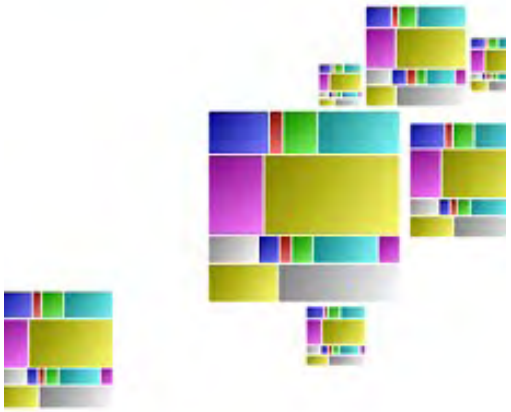

Image credit: University of Nottingham

Outputs and Outcomes:

- The team has already succeeded in building an intuitive, user-friendly data-visualisation software platform that can be applied to all UK-based collections of public health data.
- This freely available, open-source software is downloadable at http://github.com/thevisgroup/
- Already incorporating a range of interactive visual interfaces and map-based features for presenting data, the software will now be strengthened by adding 'story-telling' capabilities that depict disease incidence, spread and contraction over time.
- To encourage widespread uptake and use, the team is proactively promoting the software not only through regular academic channels but also via popular web platforms such as YouTube and social media/networking services such as Facebook and LinkedIn.

Impacts and Benefits:

- **A healthier nation.** Ready access to an unprecedentedly practical set of visualisation tools will help data analysts in the public, private and academic sectors gain and maintain a clearer understanding of the UK's collective health, as well as of specific drivers behind increasing cancer rates, for instance. This understanding will inform, influence, reinforce and accelerate healthcare-related decision-making and increase confidence among decision-makers regarding the effectiveness of the measures they introduce. The tools will be ideal suited, for example, to enabling rapid analysis of the trajectory of COVID-19 infections over time and across the country.
- **Better care beyond hospitals.** Preventing, treating and managing a growing range of medical conditions in people's own homes is critical to ensuring the cost-effectiveness of healthcare provision throughout the UK. Smarter, more agile healthcare-related decision-making facilitated by advanced data-visualisation tools could make a substantial contribution to extending the scope of community-based healthcare, reducing the need for in-patient and out-patient treatment at hospitals and unlocking more of the potential dividends of a digitally enabled healthcare sector.
- **Opportunities for economic growth.** UK companies in the digital healthcare sector can use the software as the basis for new data-analysis products designed to serve a growing global market in the years ahead. Historically, the UK has been outpaced by Europe and North America in the field of data visualisation. The EPSRC-funded project at the University of Nottingham is helping to redress the balance.

Next Steps:

The team will further refine the software and issue downloadable updates once or twice a year. They will also develop additional features such as visual interfaces for information held in the millions of doctors' letters written every year. Initiatives to encourage software uptake will continue and will work to address any residual reticence within the healthcare sector about harnessing the extraordinary potential of novel data-visualisation tools.

Behind the Project:

Professor Bob Laramee is the project's Principal Investigator. A computer scientist with experience in academia and industry, he is currently Associate Professor of Data Visualisation at the University of Nottingham. Working with Bob, Research Assistant Qiru Wang has made an important contribution to the project. Bob also leads 'RAMP VIS', a new EPSRC-funded project aiming to make visualisation-based data analytics an integral part of the battle against COVID-19. "Data that's inaccessible or invisible is basically worthless," he says. "It only has value when you can see it and readily comprehend the messages concealed there. By turning data mountains into pictures, visualisation technologies can help deliver a step change in tackling any aspect of healthcare where data is collected."

8 billion+:

the ever-growing number of Electronic Health Records currently stored in England alone

Relevant EPSRC Research Areas:

- Mathematical Biology
- Statistics and Applied Probability
- Graphics and Visualisation
- Human-Computer Interaction