C2-Ai
PATIENT RISK-STRATIFICATION TOOL

Case study | April 2023

Summary

The NHS has a blueprint to tackle backlogs that have developed during the pandemic. The plan includes supporting innovative solutions that can help trusts meet the elective recovery priority. The Innovation Agency has for several years supported Cambridge company **C2-Ai**, which specialises in deploying artificial intelligence systems to help healthcare professionals avoid harm to patients and mortality while reducing costs. C2-Ai's systems accurately judge the risk faced by each patient and help hospitals identify up to 90 per cent more harm than their current systems. Its technology helps identify which hospitals are doing well, where they have problems with mortality and complications, and how to resolve those problems and avoid future harm.

The challenge

The pandemic widely disrupted the delivery of healthcare services, including elective surgery, and the number of patients awaiting surgery has risen sharply. Current methods of prioritising patients do not identify individuals who deteriorate more quickly because of their pattern of morbidities, so a more accurate system for assessing such patients is a priority.

While there is no shortage of data available to clinical teams to help them prioritise patient care, and so reduce waiting lists, it is often difficult to use this information to optimum effect.

Actions

The Innovation Agency supported the 12-month trial of a C2-Ai risk-stratification system at three trusts in Cheshire and Merseyside: Liverpool University Hospitals NHS Foundation Trust, St Helens and Knowsley Teaching Hospitals NHS Trust and Warrington and Halton Teaching Hospitals NHS Foundation Trust. The aim was to reduce the elective backlog.

Clinical teams applied the C2-Ai Patient Tracking List (PTL) triage system to the well-established POSSUM (physiological and operative severity score for the enumeration of mortality and morbidity) system to generate a risk-stratified value for each patient on an elective surgical waiting list. The PTL system takes account of a great many factors, including social determinants of health. C2-Ai has developed an algorithm that uses data from more than 200 million records from 46 countries from the last 30 years to review individual patient health profiles, as well as the type of surgery they face, to estimate the risk of complications during or after surgery.

The system identifies the most likely complication that a patient may have after surgery. This enables the surgical team to take steps to reduce the risk of that happening or prepare expert treatment if it does.

Role of the Innovation Agency

The Innovation Agency has supported the rollout of the C2-Ai technology in the three North West Coast trusts. The company's background is in clinical audit and, when it became clear that its resources and expertise made it particularly well suited to reprioritising waiting lists, the Innovation Agency used its connections in the health and care system to identify suitable sites for a trial.

The Innovation Agency also arranged for **Surgery Hero** to work alongside C2-Ai in preparing patients for surgery. Surgery Hero is the 'world's first digital clinic for surgery', combining technology and health coaching to help patients prepare for and recover from surgery. Surgery Hero were brought in to support patients who had been waiting the longest, and the project focused on patients facing a high risk of chest infections who tend to suffer worse morbidity and mortality after operations. The Innovation Agency is carrying out a real-world evaluation of the system.

Results

A report has been prepared into the impact of the project: *A tool to prioritise patients waiting for elective surgery: an implementation report,* corresponding author Mr Videha Sharma of the Department of Renal and Pancreatic Transplantation at Manchester University NHS Foundation Trust. It studied the impact of the PTL on 11,837 patients.

The study found the tool accurately predicted the risk of mortality and complications for patients listed for elective surgery. Qualitative feedback showed that users valued the tool's accuracy and the time saved by replacing an onerous manual process.

Waiting list managers said 98 per cent of surgeons agreed with the prioritisation metrics.

There was anecdotal evidence of a 15-minute saving of surgeon time per patient whenever the waiting list was re-prioritised.

Elsewhere, the system has been successfully deployed in many NHS trusts. It requires no IT integration and has been adopted in several regional data hubs.

PTL has been independently validated by the Getting it Right First Time programme and by the Royal College of Surgeons.

NHS England evaluation shows:

- **125 bed-days freed up per 1,000 patients on PTL**

- **an eight per cent reduction in emergency admissions**

- **a 100 per cent reduction in the avoidable cancellation rate**

- **a 27 per cent reduction in long-waiters**

Provisional findings from other sources show a three-day reduction in the average length of stay, post-operative avoidable harm events/ICU admissions minimised, and the conversion of many inpatient stays to day cases.

Testimonials

> "I, like every surgeon, get a report every month detailing the complications we had and what we would have expected, based on the patient's background. I saw waiting lists balloon through the pandemic, so went back to colleagues at C2-Ai, the technology firm we have worked with for many years now, and asked if we could get a forward-looking report predicting patient need, rather than looking at retrospective outcomes. And they could."
>
> **Professor Rowan Pritchard-Jones**
> Executive Medical Director at Cheshire and Merseyside Integrated Care Board

> "We wouldn't be where we are today without the help of the Innovation Agency and the support of the ASHN Network."
>
> **Dr Mark Ratnarajah**
> Managing Director of C2-Ai

Next steps

The Innovation Agency aims to help C2-Ai position itself as a company that can scale up to meet national health and care priorities. The company is extending its work into Manchester, Yorkshire, the Midlands and London.

See this short **film** in which Dr Mark Ratnarajah from C2-Ai describes how his innovation journey started in the North West.

Contact

Mike Kenny, Acting Co-Director of Enterprise and Growth at the Innovation Agency:
mike.kenny@innovationagencynwc.nhs.uk

INNOVATION AGENCY
Academic Health Science Network
for the North West Coast

NHS