

## C2-Ai: Supporting Elective Restart with Patient Tracking List Validation and Prioritisation

*“Helping put the right patient, in the right environment, with the right team, at the right time”.*

*Mr Rowan Pritchard-Jones: MD St Helens and Knowsley NHS Teaching Hospitals*

C2-Ai’s PTL system, commissioned by NHS England and deployed at a number of NHS Trusts, risk stratifies the elective surgical waiting list based on clinical need, risk of deterioration and is inclusive of social determinants of health policies.

The extended waiting list for elective surgery means providers face challenges managing clinical risk. In the face of this, Trusts have been asked to undertake a manual clinical validation and prioritisation, but this is taking clinicians up to 15 minutes per patient every time the list is prioritised.

Analysis from C2-Ai’s partner trusts, various pilot trials with our system, and our broader referential dataset of 200m records across 46 countries, suggests the impact of delays will be a doubling of mortality of patients while on the waiting list with complications increasing by 40%. In addition, 6 – 8% of those on the waiting list are predicted to need an emergency admission.

### **Advanced, evidence-based assessments built on existing technology used in the NHS**

C2-AI has repurposed and automated existing systems that have been in use by the NHS and globally for 12 years, building on 30 years of research and around our referential patient dataset. C2-Ai’s Patient List Triage system supports the needs of elective restart by ensuring that patients are risk stratified on their individual clinical need. This enables clinicians to rapidly assess them against their risk of mortality and complications using proven and reliable methodologies and importantly, including calculation of the impact of deterioration caused by the patient’s time on the waiting list. This means clinicians can quickly position them more accurately onto the Patient Treatment List and removes subjectivity and variation between specialities and trusts.

The system adapts and combines C2-Ai’s COMPASS pre-operative assessment tool and CRAB (as used by the CQC and the Keogh Review), built around the most up to date version of the POSSUM methodology (known to all surgeons and recommended by the RCS), which was developed by our co-founder and has been evolved over 12 years around our 200m patient dataset.

#### **Detailed System Outputs...**

Patient identifier (hospital number)  
Patient identifier (NHS number)  
Date of birth  
Date first listed  
Current length of time on the waiting list  
Intended procedure and intended procedure code  
Surgeon supplied priority  
Procedure specific priority “P” code  
Overall risk of death  
Overall risk of complication  
List of specific complications with a risk over 2.5% highlighted  
Change in mortality risk if surgery delayed (magnitude)  
Change in overall complication risk if surgery delayed (magnitude)  
Change in complication profile if surgery delayed (magnitude)

#### **...linking to Improved Clinical Prioritisation**

The system includes a scoring matrix for a number of key measures for each patient. The system helps the Trust more accurately prioritise each patient with customised weightings across 6 factors:

- Surgeon’s priority
- Procedure priority “P” code
- The presence of a deterioration in the event of a delay
- The impact of a delay on the patient’s risk of mortality (increase in risk)
- The impact of a delay on the patient’s risk of overall complications (increase in risk)
- The length of time in weeks the patient had waited since being added to the waiting list

The **system integrates into existing pathway management tools** and can triage hundreds of thousands of patients a day, processing and reprocessing the waiting list dynamically at scale to deliver:

- Faster clearing of the backlog
- Lower patient harm and mortality (estimating a 50% reduction of the impact of delays)
- Better use of surgeon time (potentially saving 6 weeks per clinician and 100+ surgeon years per region)
- More detailed view of clinical risk for each patient
- Better capacity planning of sites and routing across trusts/regions/providers to match patient risk
- Better alignment of patient risk to sophistication of site and allocation of theatre and anaesthetic workforce

- Improve pre-habilitation supporting identifying which patients to optimise prior to their elective procedure
- Reduction in emergency admissions (our pilots with NHS trusts have shown 6-8% of patients would be at risk of an emergency admission if their surgery were delayed)
- Transparent process helping reduce chances of lawsuits, regulatory investigations etc.

**OPERATIVE SEVERITY AND PHYSIOLOGICAL VARIABLES CREATE HUGE COMPLEXITY**

MORTALITY RISK (%)

**1.6%**  
Normal Physiology

**x3**  
Abnormal BP


**x10**  
Abnormal BP and Sodium

COMPLICATION RISK (%)

**9.6%**  
Normal Physiology

**x2**  
Abnormal BP

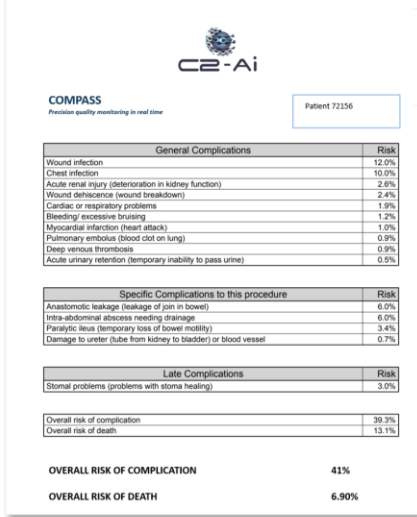
**x4**  
Abnormal BP and Sodium



**C2-Ai systems consider key physiological variables and operative risk**

Assessing risk is difficult and time-consuming

A change of 2 physiological variables increases mortality risk by **10X** and morbidity risk by **4X**



**Detailed mortality and risk information for each patient to support prioritisation and optimisation decisions**

Procedure	Weeks on Waiting List	Trust Priority Code	C2-AI Code	Mortality Risk (%)	Overall Complication Risk (%)	Dominant Complication (%)	Change to Mortality Risk If Delayed (%)	Change to Complication Risk If Delayed (%)	Ranked Priority (out of 5,627)
Laparoscopic Cholecystectomy (Patient C)	65	P4	P3/4	8.3	50.7	Chest Infection 24	+ 20.3	+ 22.9	2
Dilatation Of Urethra	51	P4	P4	0.4	6.1	Haemorrhage 2.5	+ 0.1	+ 0.9	3,104
Hysteroscopy No Curettage	25	P3	P3/4	0.4	5.8	Haemorrhage 5.3	+ 0	+ 0.8	=2,221
Laparoscopic Cholecystectomy (Patient B)	18	P3	P3/4	0.3	5.3	Chest Infection 3.3	+ 0.8	+ 7.8	=2,221
Laser Lithotripsy	22	P2	P2/3	29.5	78.2	Chest Infection 12	+ 11.5	+ 6.3	17
Umbilical Hernia Repair With Mesh	55	P3	P4	8.5	52.8	Chest Infection 11	+ 11.1	+ 13.8	=129
Laparoscopic Cholecystectomy (Patient A)	2	P2	P3/4	0.3	5.3	Chest Infection 3.3	+ 0.8	+ 7.8	3,722
Laparoscopic Nephrectomy	53	P4	P2	0.9	10.7	Chest Infection 4.1	+ 0.7	+ 4.7	=129
Mastectomy	3	P2	P2	1.1	10.4	Wound Dehiscence 2.7	+ 0	+ 0	1,529

**Evidence-based triage calculation of individualised risk of mortality and complications – built into overall scoring and prioritisation matrix**

### System and ongoing support

The system has a live, secure, remotely hosted system (by trust and centrally) for authorised staff to access and interrogate individual patient listings, including summary patient records and score sheets.

A “points matrix” builds into the live system for each Trust to apply to its finished list. This enables adjustment of prioritisation according to specific local circumstances (for example greater weight being accorded to surgeon assessment in a given specialty, and/or procedure-specific priorities). Dashboard visualisation of matrix level scoring of patients supports area-wide decision-making about the most appropriate treatment site and the planning of capacity/potential ICU requirements accordingly.

For ongoing maintenance of the PTL to ensure currency, an upload function allows trusts to submit regular data updates and automate their integration into the overall system with **refreshes on a monthly basis**, and outputs as above.

C2-Ai is a proud partner of NHS Digital with full access to national HES data built around our highest-level IG processes, MHRA and ISO approvals. Our data hosting is within the NHS N3/HSCN network.

### Awards and Recognition in the last 12 months



One of '10 Essential Digital Health ideas for a COVID-19 UK National Response'



Best Overall Innovation for Covid-19



One of Healthcare's Most Innovative Companies 2020



Medtech Company of the Year



Best Medical App 2020



'Top 100 Digital Health Company' - in the highest 'Essential' category



2021 Award for Excellence in Innovation - UK



Patient Safety Finalist



Best Health Tech Solution of the Year



AI Company of the Year - Finalist



Most Innovative Solution for Covid-19



Best Covid-19 Health Innovation



Featured on BBC



Efficiency Saving of the Year



2021 AI in Healthcare Finalist