

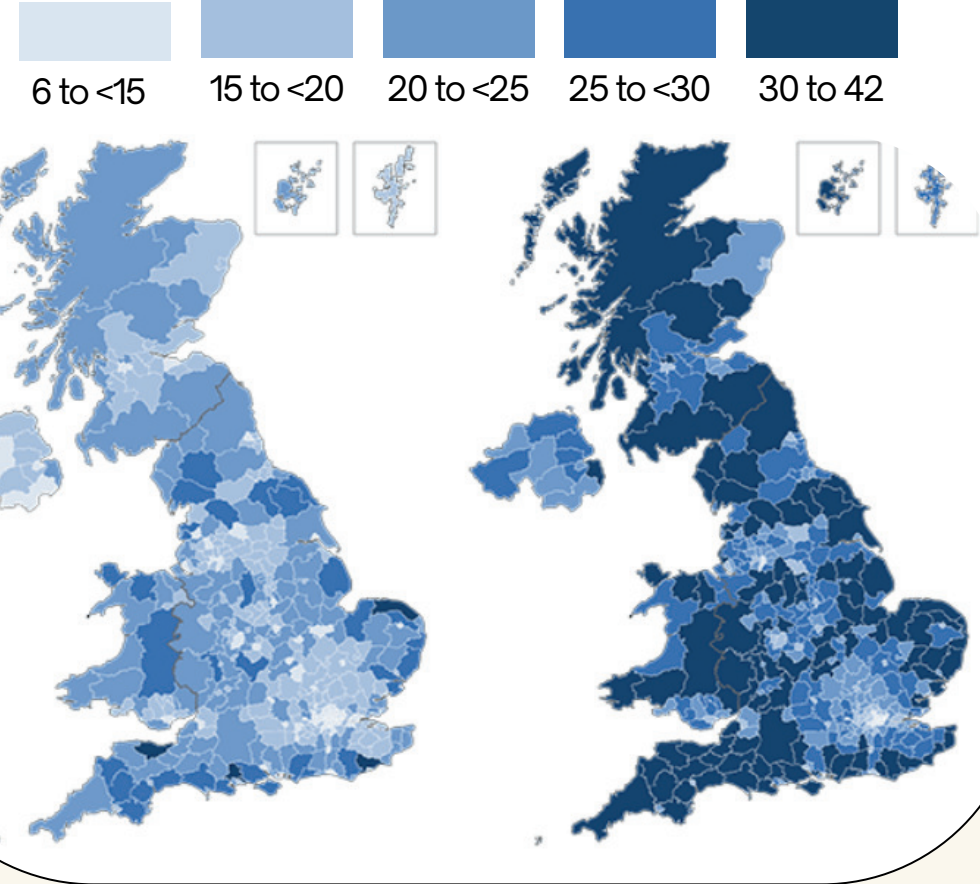
Digital Twins of the Retina: Augmenting healthcare data with maths and physics to improve outcomes

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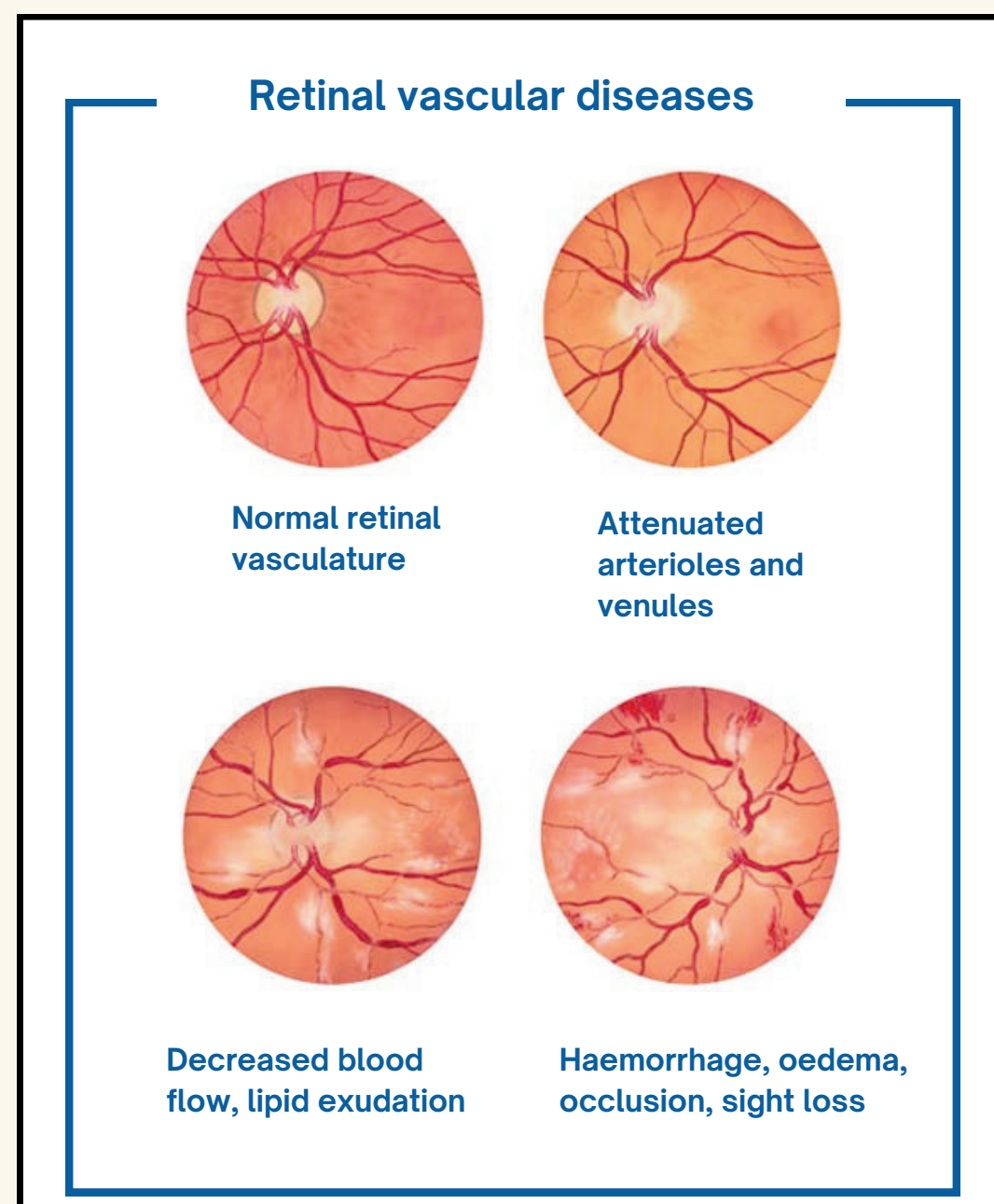
The Threat | A rapidly ageing population

Proportion of the population aged 65 years and over



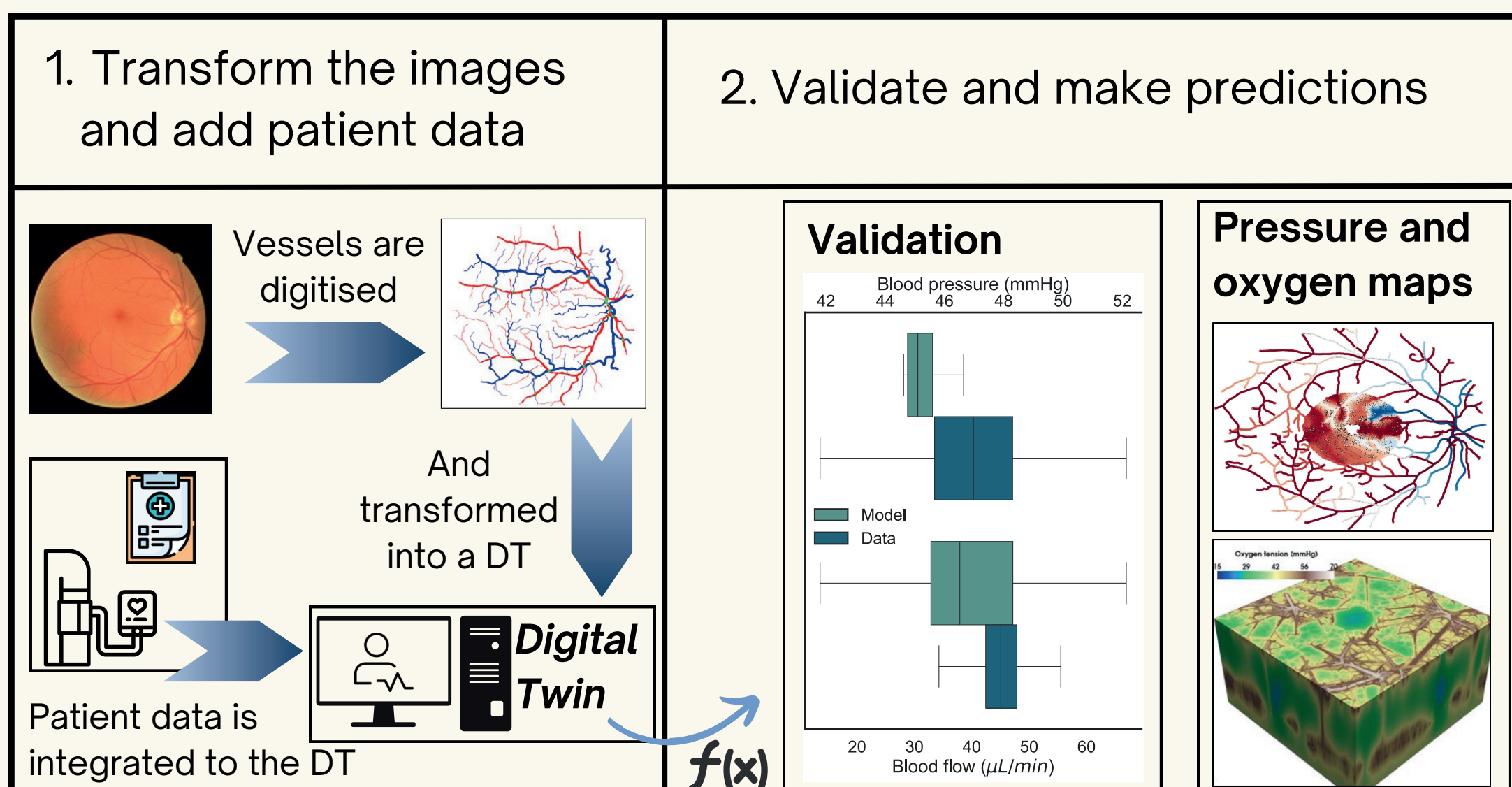
- Over **2 million** people in the UK have **visual impairment**, 80% are over 65.
- By 2040, nearly 30% of the UK population will be 65 or older
- Vision loss costs an estimated £25 billion per year

- Treating age-related macular degeneration costs **£0.5B per year** in hospital prescriptions
- Many causes and symptoms stem from the **retinal microcirculation**
- Early detection is essential for preserving vision



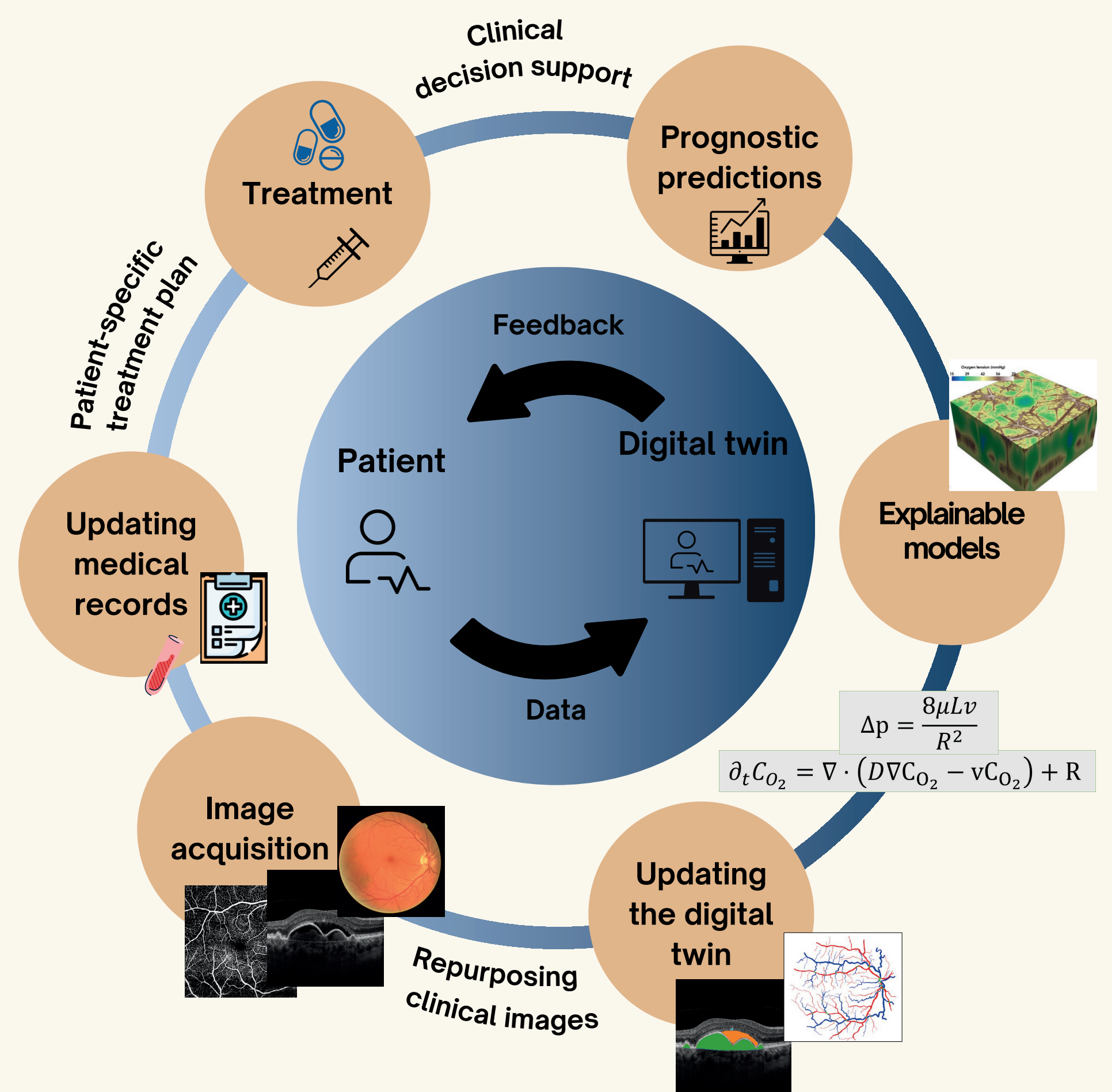
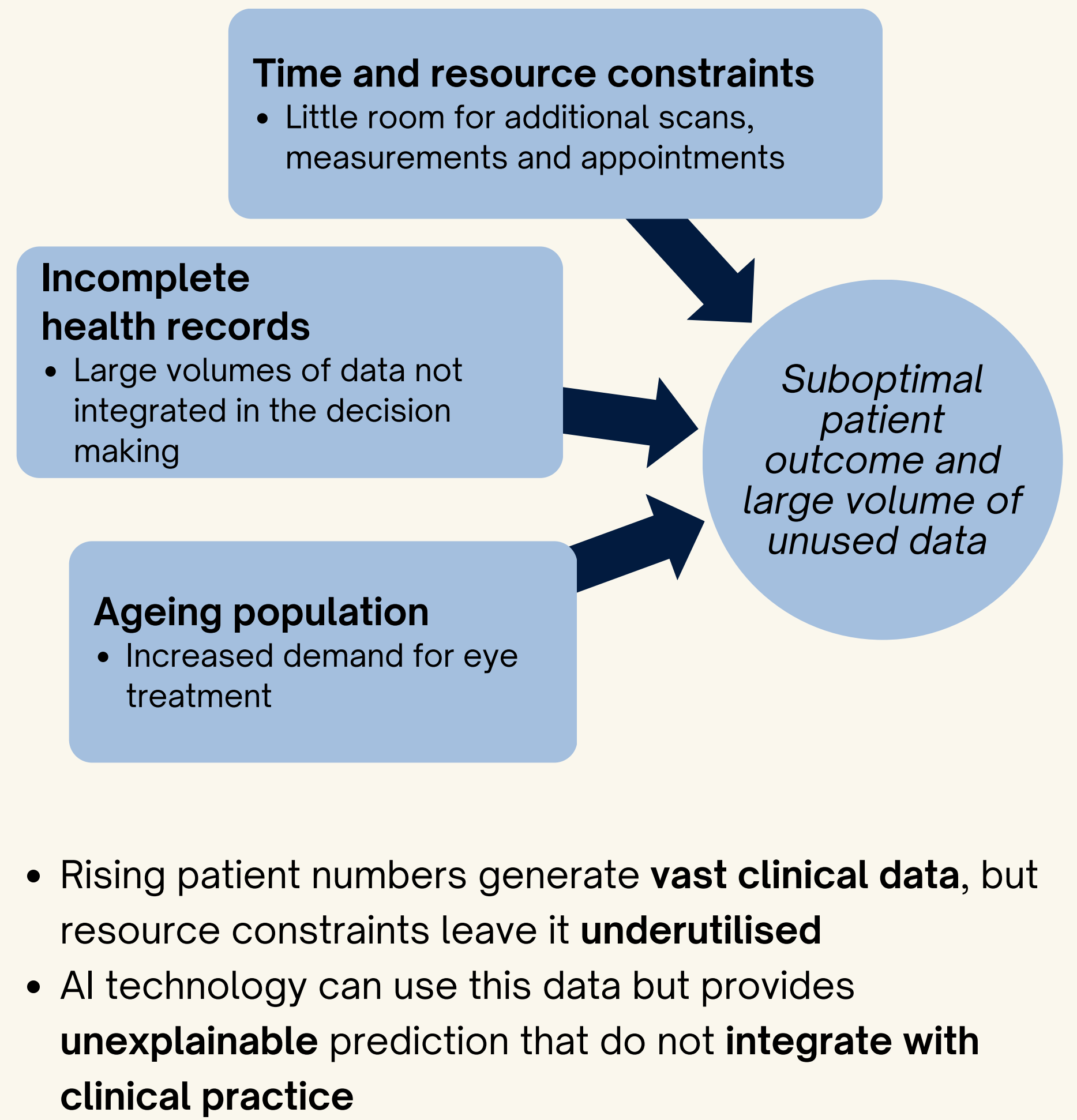
The Solution | Digital Twins

- A **Digital Twin (DT)** is a digital counterpart of a patient's retina that:
 - Is created from existing images and data **Integration** into clinical practice
 - Makes predictions grounded in physics and mathematical concepts **Explainable**
 - Provide insight at a scale too small to observe **Personalised treatment**
 - Can test 'what-if' scenarios



- **Predictions** of blood flow and pressure align well with clinical data
- Our **DTs** are made from **non-invasive** routine retinal images and simple **blood pressure** readings
- We can look into **capillary** haemodynamics, derive **vascular risk factors**, identify high-risk patients
- We will be testing our model in real-world conditions with patient from the *Royal Liverpool University Hospital*

The Challenge



Advantages of Digital Twins

- The DT stays **up-to-date** with the patient
 - It incorporates comorbidities, test results **informing** future treatment plans
- DTs can be enrolled in '**virtual clinical trials**' for quicker drug development
- With the '**eye as a window to the brain**', DTs can be adapted to other vascular systemic disorders