DIAGNOSTIC AND PREDICTIVE MODELS FOR KNEE OSTEOARTHRITIS

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1. What is Osteoarthritis?

Osteoarthritis (OA) is a **degenerative** bone disease, most commonly affecting **knee joints** and people in **old age**.

1 in 5 adults aged 45+ have knee OA

The **prevalence of OA is high** but is hard to diagnose. As of 2019, **over 8.75 million** people **aged 4+** sought help for OA

OA is **one of the leading costs** on the NHS, by 2017 the **total cost** of RA and OA to NHS **£10.2 billion**.

2. What's the Problem?

Diagnosis for OA is **partially subjective**, so clinicians can have different diagnoses for the same person.

Common sense rules means that **complex ideas** are easily integrated into **human reasoning models**.

Interpretability is critical for the successful implementation and safe crossover of **machine learning algorithms** in decision-making.

Aims

- ✓ Build a model to help diagnose knee OA at first presentation

- ✓ Build a model to identify those at risk of developing knee OA in 5 years

3. The Data

Osteoarthritis Initiative (OAI) *[n = 4796]* and the **Multicentre Osteoarthritis Study (MOST)** *[n = 3026]* were used.

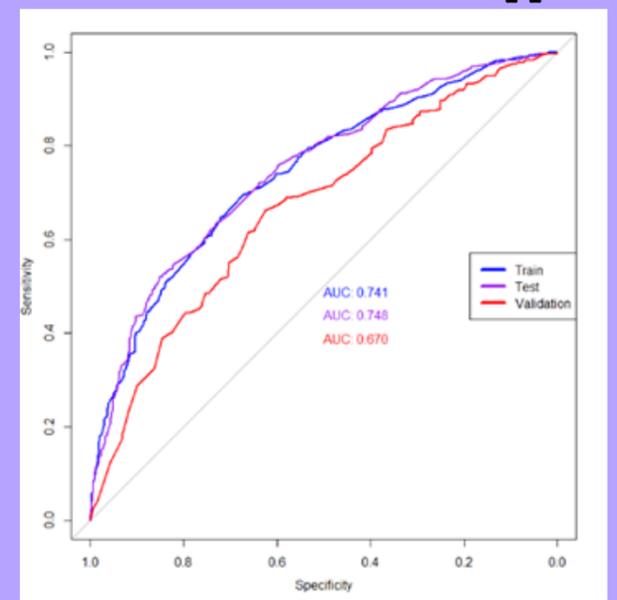**OAI** was used to **develop** the models. **MOST** was used to **externally validate**.

Follow people for up to **10 years** who either **have or are likely to develop** KOA.

OAI
n = 2707
MOST
n = 831

DIAGNOSTIC

PREDICTIVE

OAI
n = 2005
MOST
n = 1155

4. Diagnosis Model

Modelled using **Logistic Regression** which is a statistical model that is commonly used in **medical decision support**.
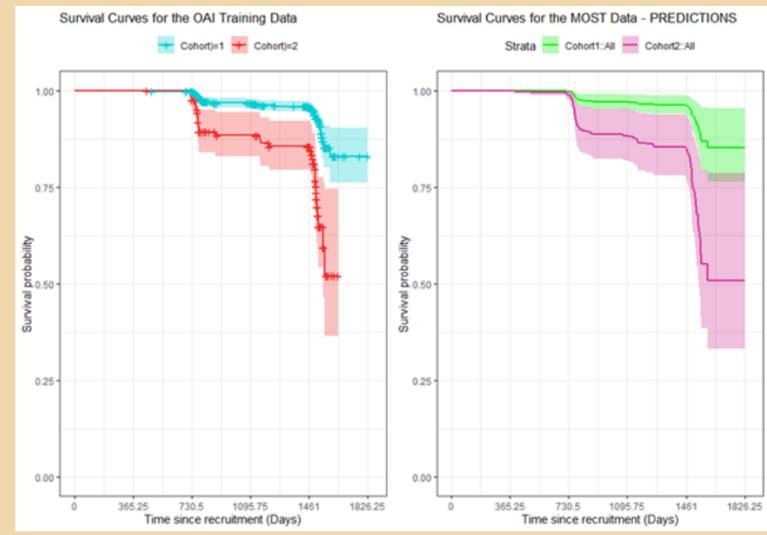

The **AUC** for the **OAI** data is **0.748** and the **MOST** data is **0.670**.

The model covers:
- Knee stiffness in the last 30 days
- Difficulty getting upstairs
- Knee pain impacting activity last 30 days
- Gender
- Presenting with symptoms
- BMI
- Age

5. Predictive Model

Modelled using **Cox Regression** which is method for investigating the effect of features upon the time a specified event takes to happen, frequently used to **analyse time to develop a disease**.

The **AUC** for the OAI test set is **0.74** and the **MOST** data is **0.72**

The model covers:
- Family history of knee surgery
- BMI
- Gender
- History of knee injury
- WOMAC score

6. What's the Impact?

Models can be made into **apps** This will **streamline diagnosis** and **enhance patient education**

→ **Improve** clinical **management** of disease from **first presentation**

→ **Better disease understanding** will help give those with KOA a **better self-percieved quality of life**