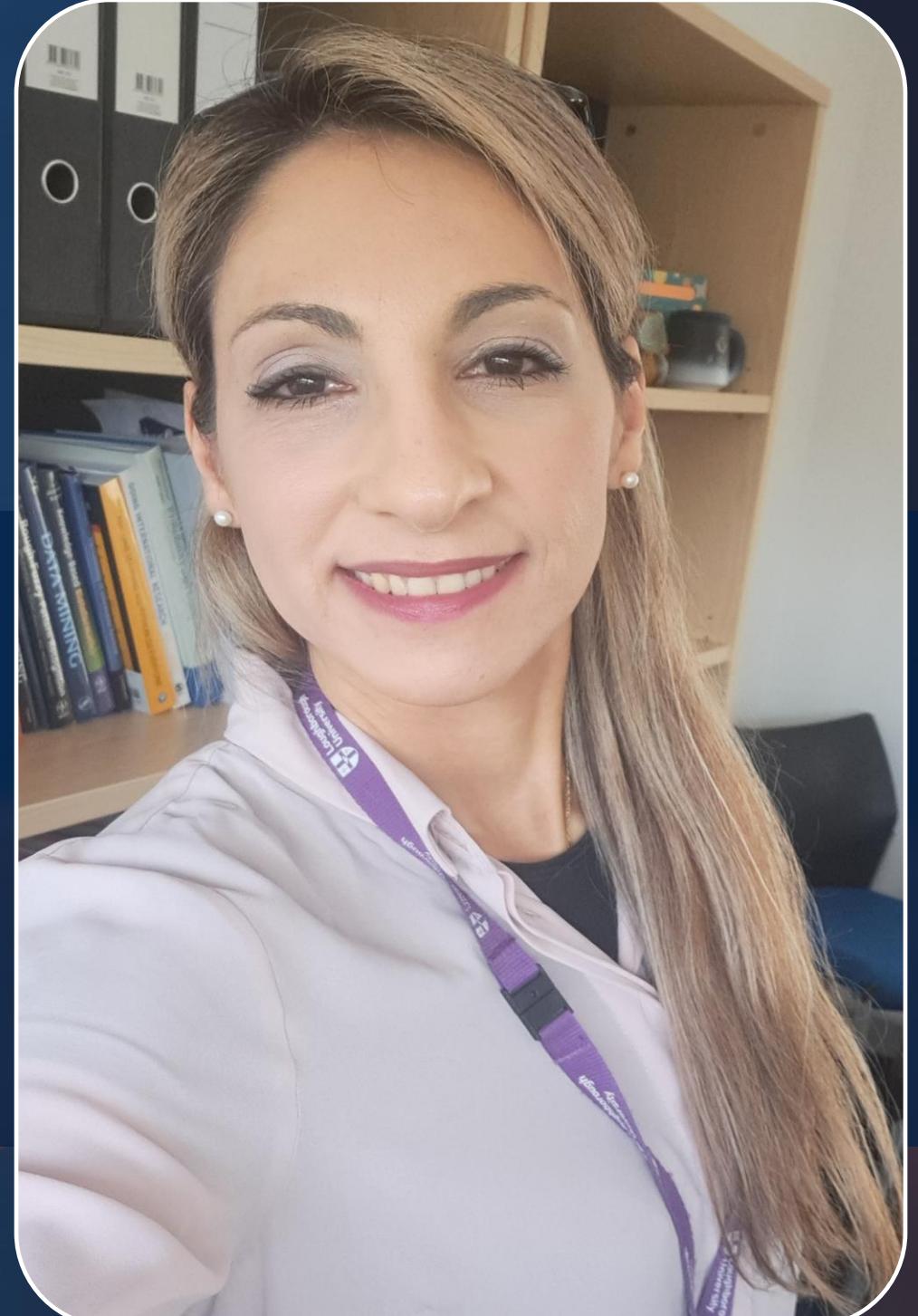


# AI in Healthcare

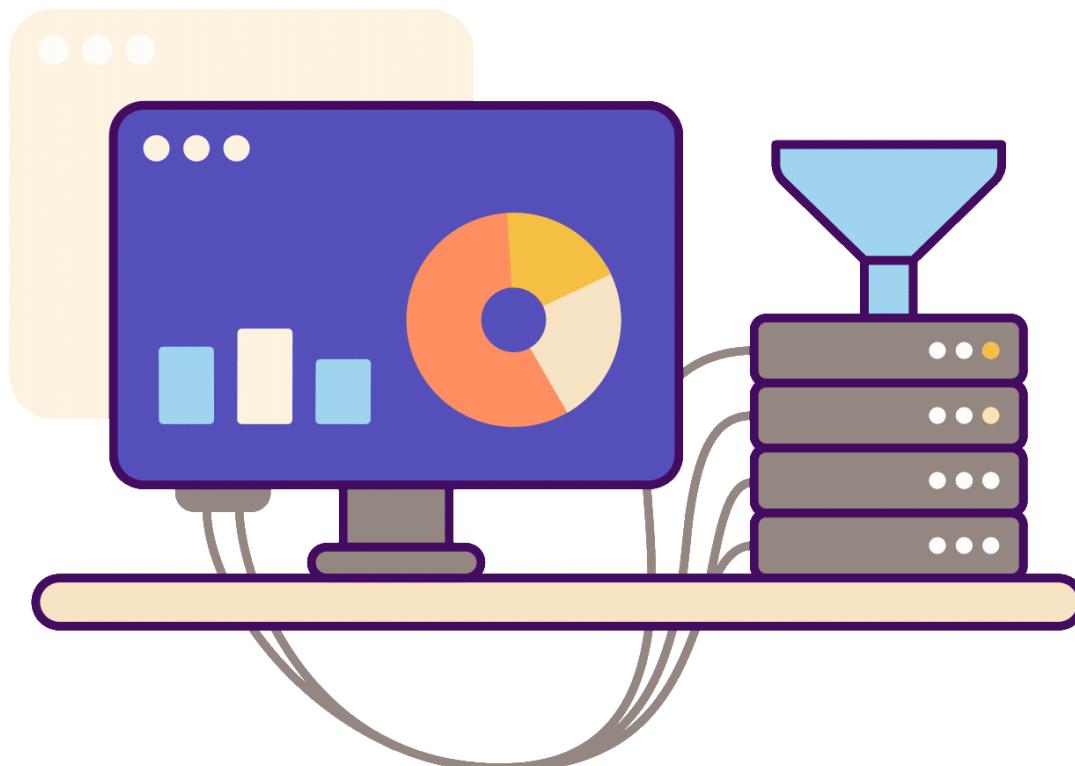
**Georgina Cosma**

Professor of AI & Data Science, Loughborough University



# Artificial Intelligence

in Healthcare



**Georgina Cosma**  
**Professor of AI and Data Science**

# Research expertise:

- Natural Language Processing
- Machine learning methods
- Artificial Intelligence

## Challenges:

- Information retrieval
- Machine learning and unlearning
- Health- and Social- care projects

Email: g.cosma@lboro.ac.uk

X: @gcosma1

Website: <https://datascienceplus.blog/>

Univ.: <https://www.lboro.ac.uk/departments/compsci/staff/georgina-cosma/>

## A.I AND DATA SCIENCE+

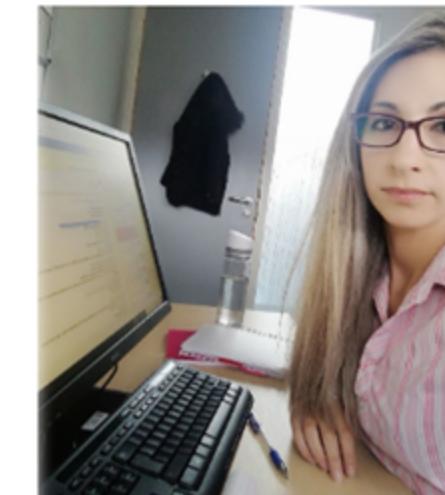
INTERESTED IN THE DEVELOPMENT OF ETHICAL AI FOR REAL-WORLD APPLICATIONS

### Professor Georgina Cosma

[GitHub](#) | [LinkedIn](#) | [Google Scholar](#) | [Twitter](#)

Professor of AI & Data Science at the Department of Computer Science, Loughborough University, UK

**Areas of research:** Intelligent & Neural Information Retrieval, Computational Intelligence & Machine Learning, Continual Lifelong Learning, Temporal Information Modelling, Bias Management & Mitigation, and AI Reasoning.



Intelligence.

**Qualifications:** Graduated from the University of Warwick with a PhD degree in Computer Science in 2008. My thesis was on Intelligent Information Retrieval. BSc Hons (First Class) & PhD Computer Science, PGCHE (Distinction), HEA Fellow. More information can be found [here](#).

**Current role:** I am Professor of AI & Data Science at the Department of Computer Science, Loughborough University, UK. I teach the Natural Language Processing (NLP) module that is a compulsory module of MSc in Artificial

**Research group:** I am leading the "Neural Information Processing, Retrieval & Modelling" research group and supervising a team of talented PhD students and Research Fellows working on neural information retrieval and other AI projects. If you are interested in joining the group as a self-funded (or sponsored) student, please see the [Neural Information Retrieval](#) page for sample projects and ideas.

### MENU

- Professor Georgina Cosma
  - Academic Appointments, Leadership, Teaching and Admin Roles
  - Outreach & Course Delivery
  - Research Collaboration & Consultancy
  - Natural Language Processing Module
    - Natural Language Processing Module
    - Public NLP Datasets
    - Book Reviews
      - Book Review: Exploring GPT-3
      - Book Reviews on Data Mining and Analytics
  - Neural Information Processing, Retrieval & Modelling Group
    - \*\*PhD Project Topics 2023-2024\*\*
    - Postgraduate Supervisions
    - Announcements & Updates!
  - Funded Projects
    - Funded Projects
    - DECODE: Data-driven machine learning aided stratification & management of multiple long-term conditions in adults with intellectual disabilities



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# What is Artificial Intelligence?

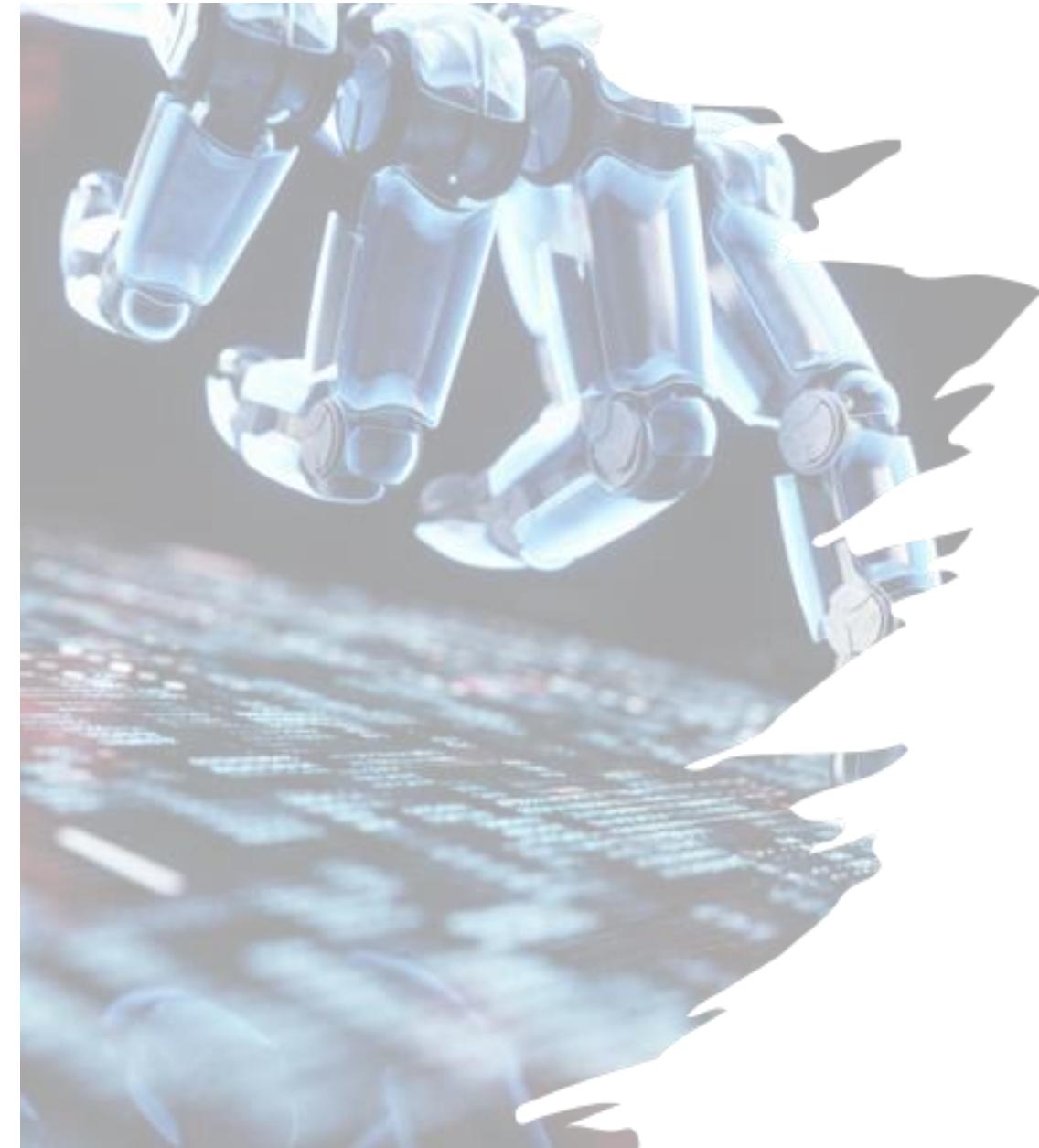
Artificial Intelligence means technology enabling the programming or training of a device or software to -

1. **perceive** environments through the use of data
2. **interpret** data using automated processing designed to approximate cognitive abilities
3. make **recommendations, predictions or decisions** with a view to achieving a specific objective



The UK government's legal definition of AI in  
the **National Security and Investment Act, 2021**

# What is Artificial Intelligence?

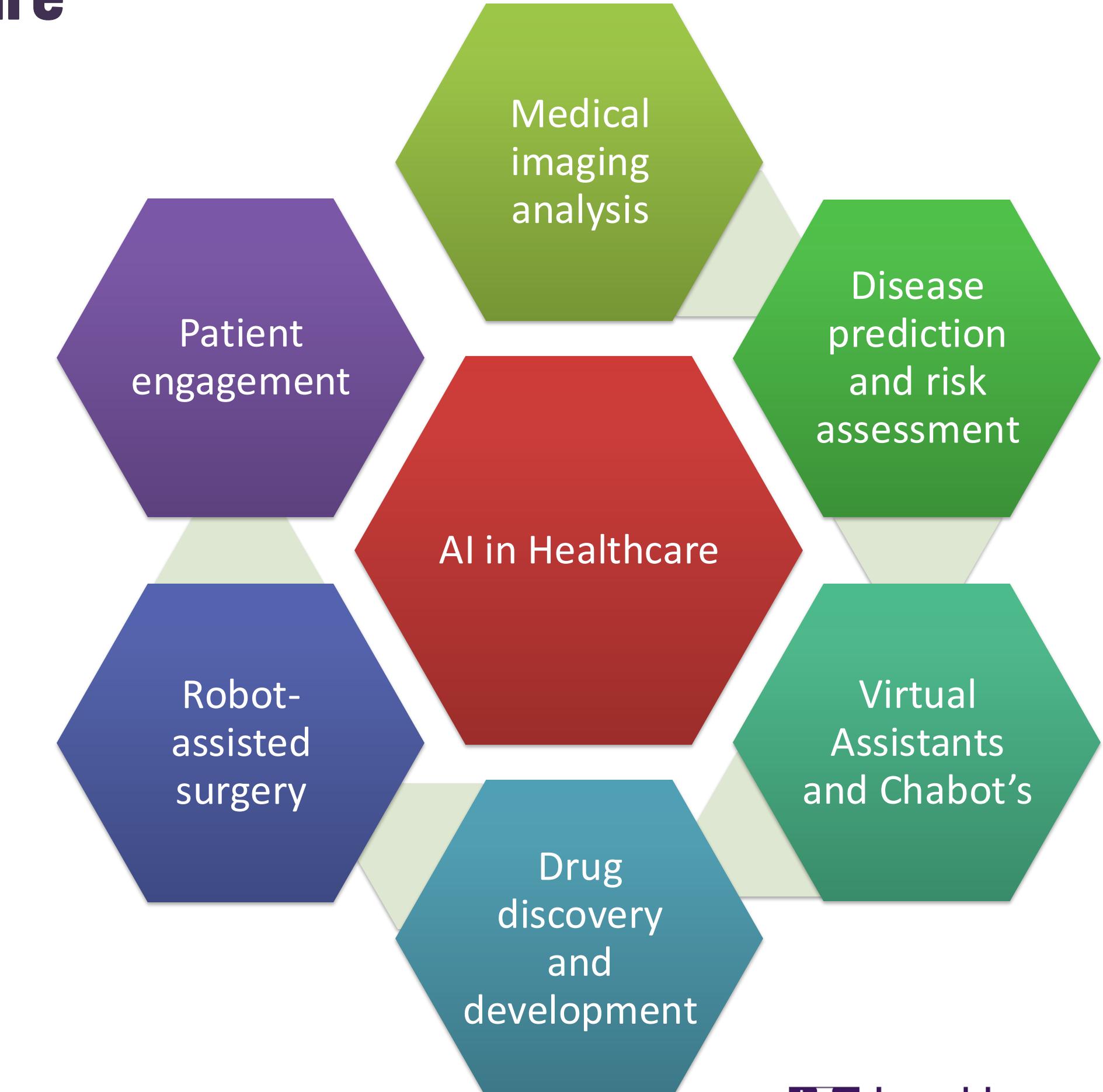


Artificial Intelligence refers to:

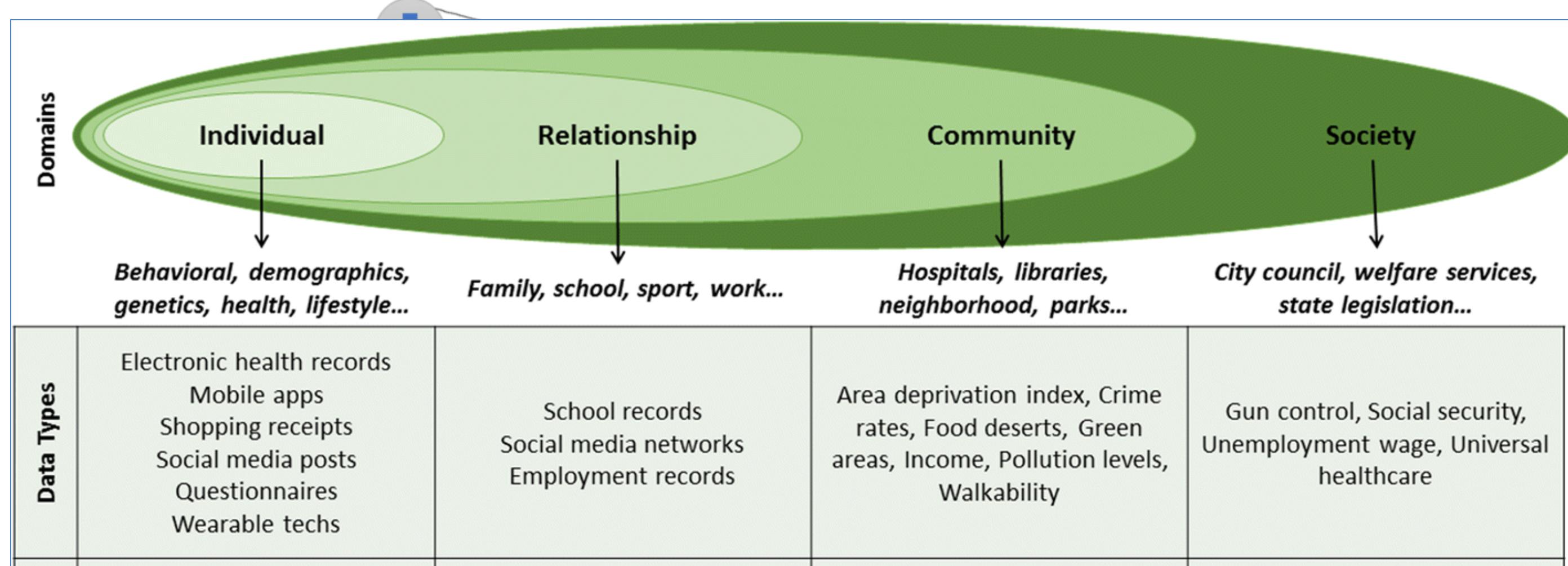
systems or machines that **mimic human intelligence** to perform tasks and can **iteratively** improve themselves based on the information **they are provided with or collect.**

# Artificial Intelligence in Healthcare

**AI in Healthcare** refers to advanced computing systems that process and learn from healthcare data to enhance clinical decision-making

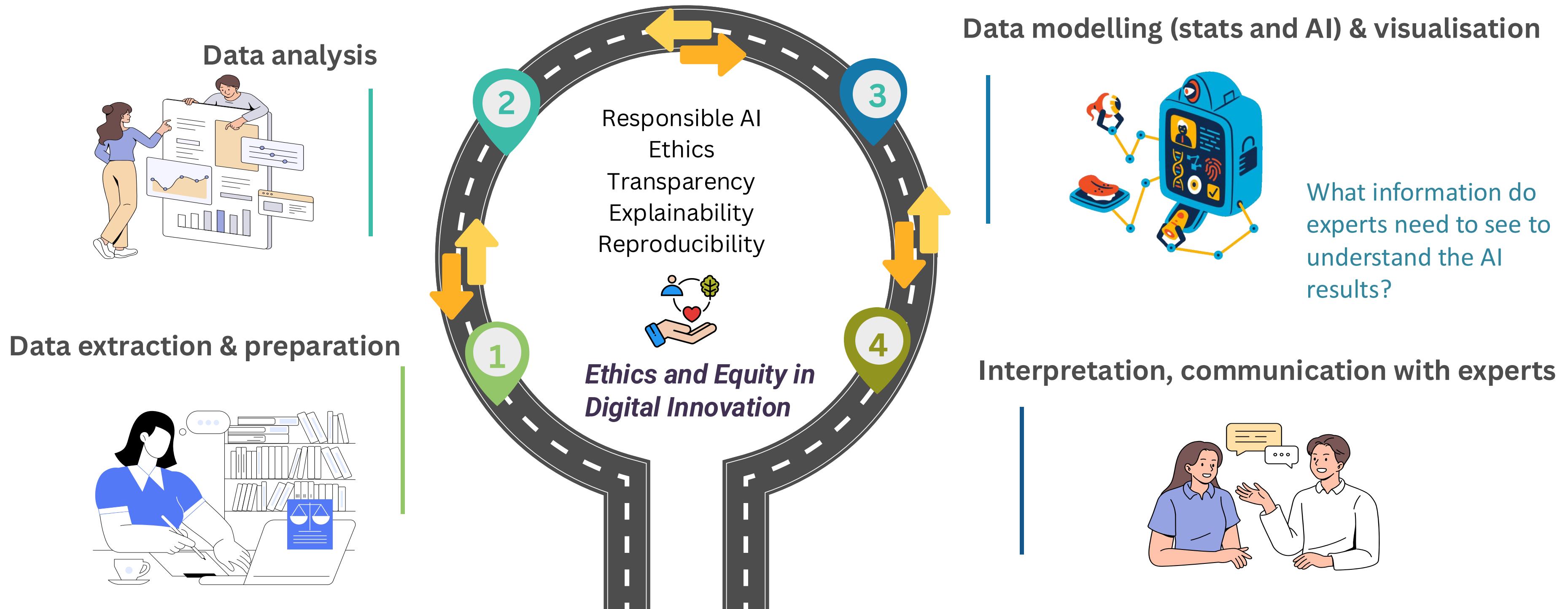


# Benefits of AI

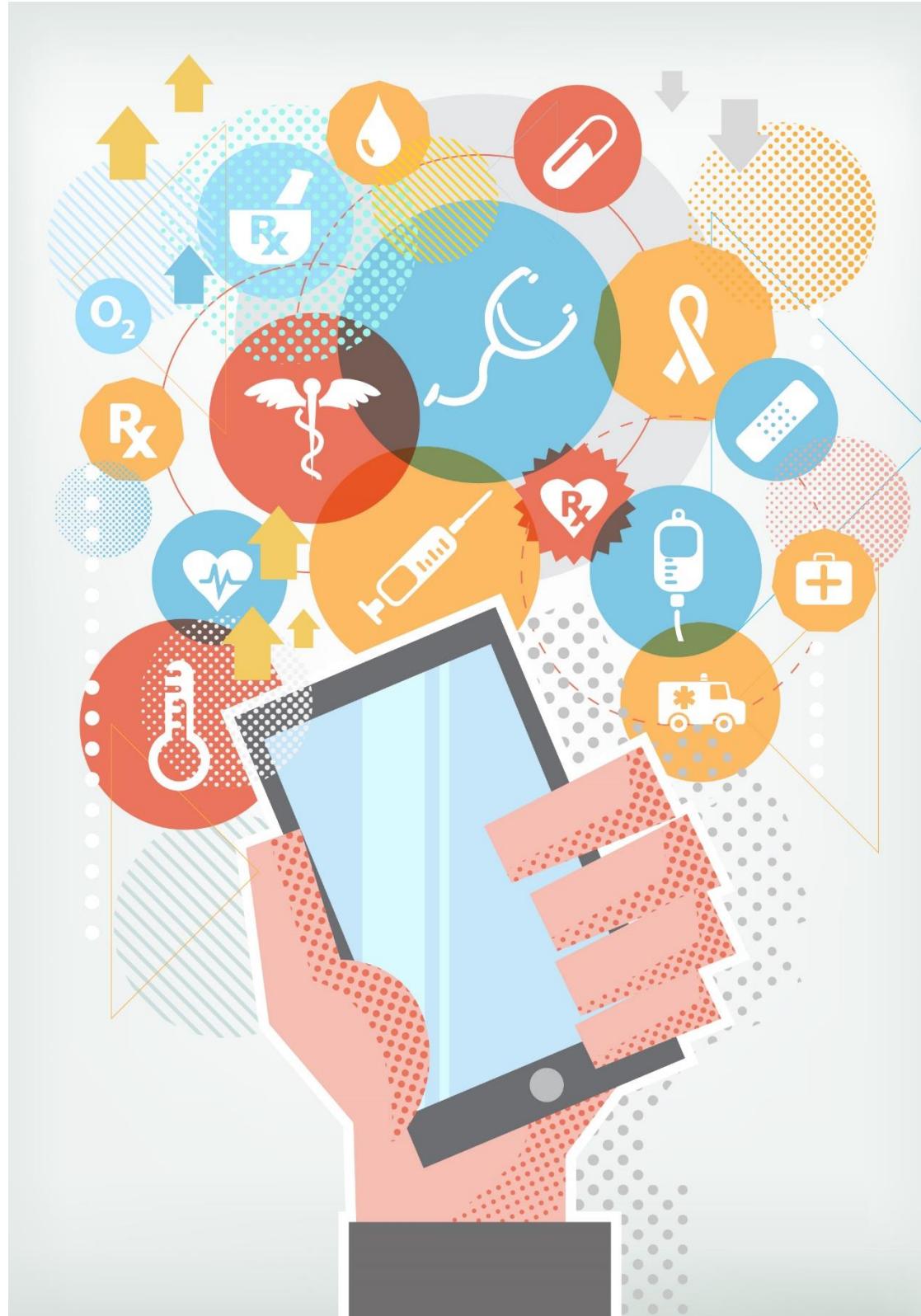


Precision public health. Community, societal and ecological factors.

# Responsible AI in Healthcare



# Artificial Intelligence in Healthcare



Extracting intelligence from maternity incident investigation reports using AI

Temporal modelling of multiple long-term conditions in patients with learning disabilities using AI



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# Artificial Intelligence in Healthcare

## Extracting intelligence from maternity incident investigation reports using machine learning

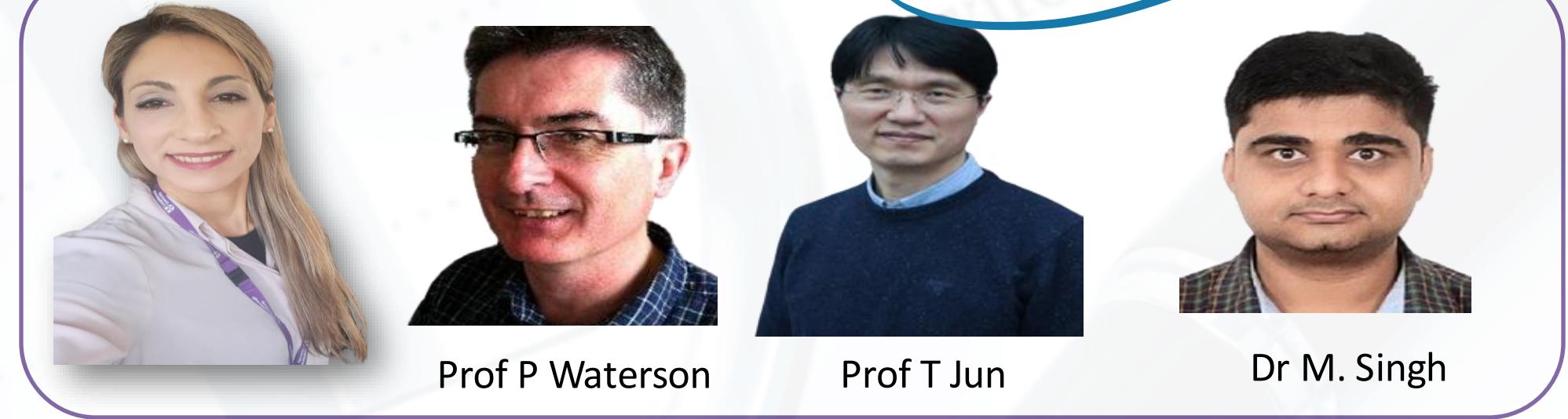


Dr J Back



Health Services Safety  
Investigations Body

HSSIB Team of  
experts and nurses



Prof P Waterson

Prof T Jun

Dr M. Singh



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University

**Funder:** This 2-year project is independent research funded by NHSX and The Health Foundation and it is managed by the National Institute for Health Research (AI\_HI200006).

## Review of maternal deaths at 'inadequate' unit

A trust has launched an external review into deaths at its "inadequate" maternity unit

after Nottingham: Maternity deaths families meet to discuss action

4 Ju

© 19 February



... BBC

### Whistleblowers accuse NHS trust of avoidable ba

Serious concerns about maternity services at an NHS trust have been raised by whistleblowers in a BBC Panorama. Midwives say a poor culture and staff...

29 Jan 2024

## 600 baby deaths to be reviewed in Nottingham hospitals maternity inquiry

CENTRAL | OCKENDEN REPORT | MATERNITY | NOTTINGHAM | © Tuesday 31 October 2023 at 6:41pm



A maternity review into Nottingham hospitals will include over 600 baby deaths, as per a freedom of information request.

This will account for 228 neonatal deaths and 409 stillbirths identified at Queen's Medical Centre and City Hospital in the past decade.

Senior midwife Donna Ockenden, who examined cases involving 1,486 families affected by a maternity scandal at the Shrewsbury and Telford NHS Trust, will chair the investigation.

The study is also expected to cover 20 maternal deaths and numerous instances of severe maternal harm and baby brain injuries.

Nottingham University Hospitals disclosed details about letters sent to 1,378 women, inviting them to participate in the late 2022 review.

This does not include several others who reached out to the review independently, with the total cases expected to surpass 1,800.

Of the 1,378 women, there were 1,541 'adverse events' recorded since 2012.

These events include stillbirth, neonatal death, brain damage, severe maternal harm, and maternal death.

 The House of Commons Library

## Quality and safety of maternity care (England)

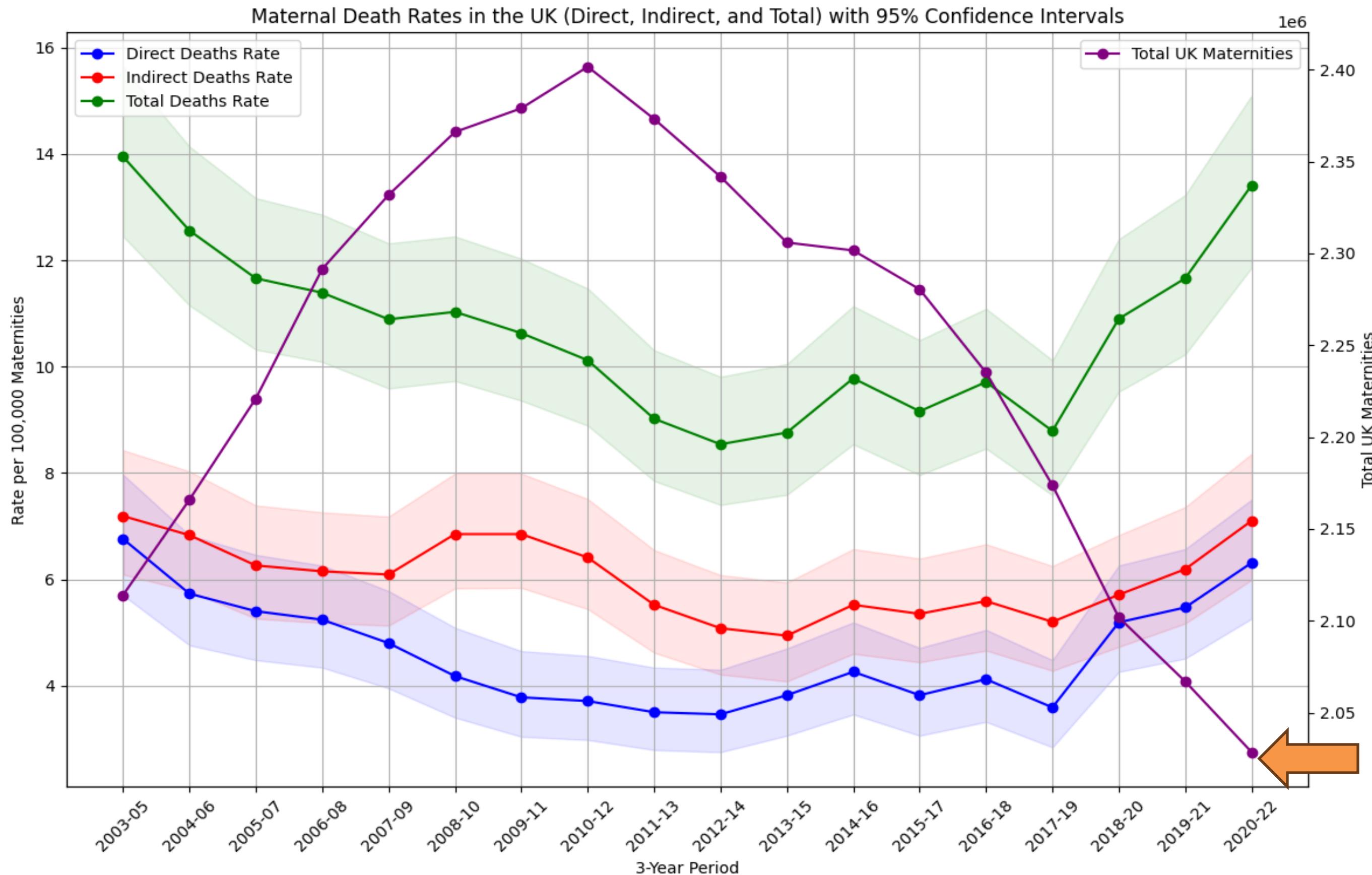
This briefing details Government and NHS policies on the quality and safety of maternity care in England.

14 May 2024



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# Maternal Mortality



Number of UK  
maternities is  
decreasing, but death  
rates are increasing.



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# Maternal Mortality



Maternal death rate in 2020-22 was 13.41 deaths per 100,000 maternities. This is significantly higher than maternal death rates reported in previous years.

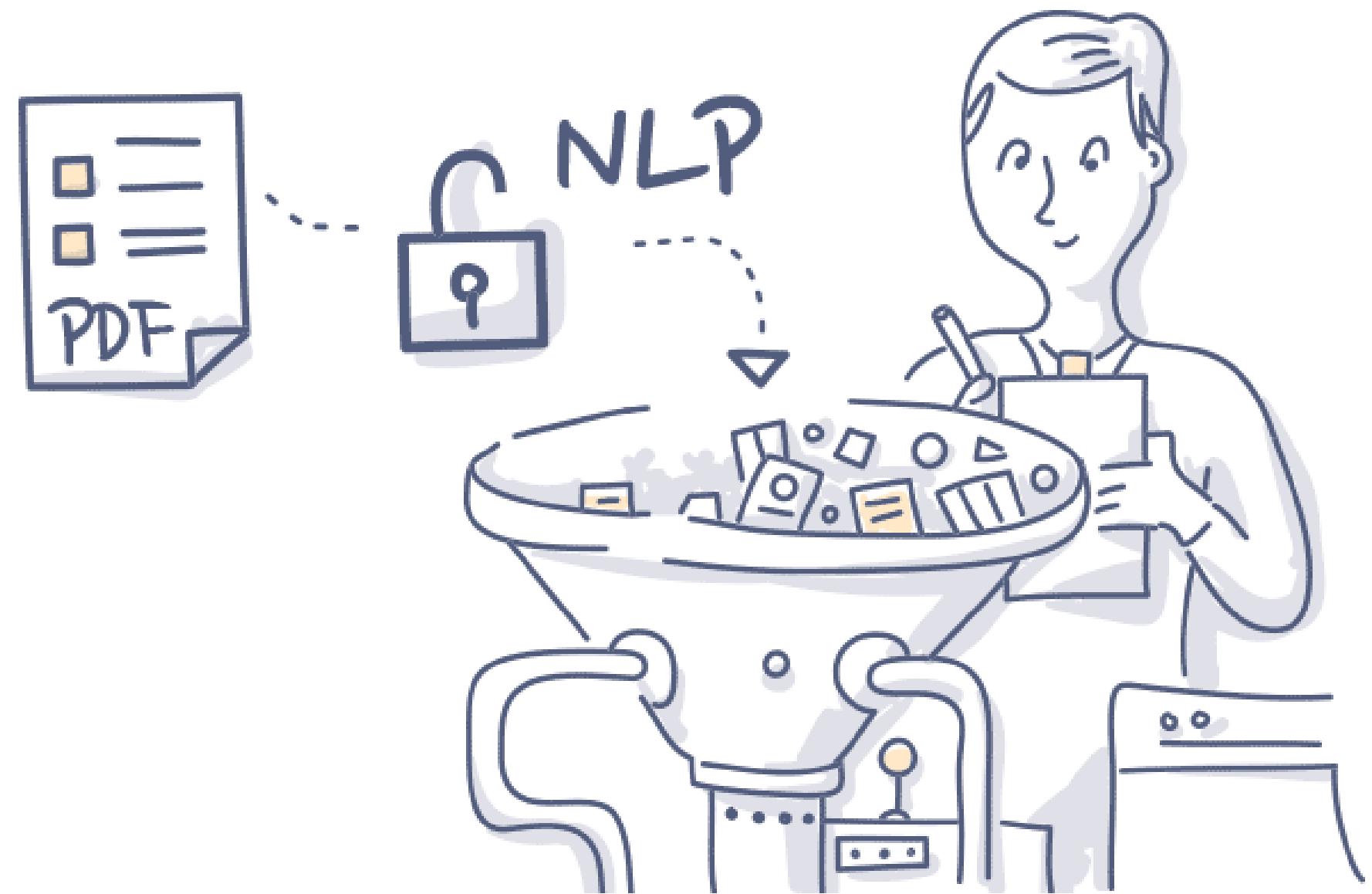
Maternal death rate for women from **Black ethnic** backgrounds has decreased slightly from the rate in 2019-21 but Black women remain four times more likely to die compared to White women.

The maternal death rate for women from **Asian ethnic** backgrounds remains two times higher than that of White women.

Women living in the 20% most deprived areas continue to have the highest maternal mortality rates.

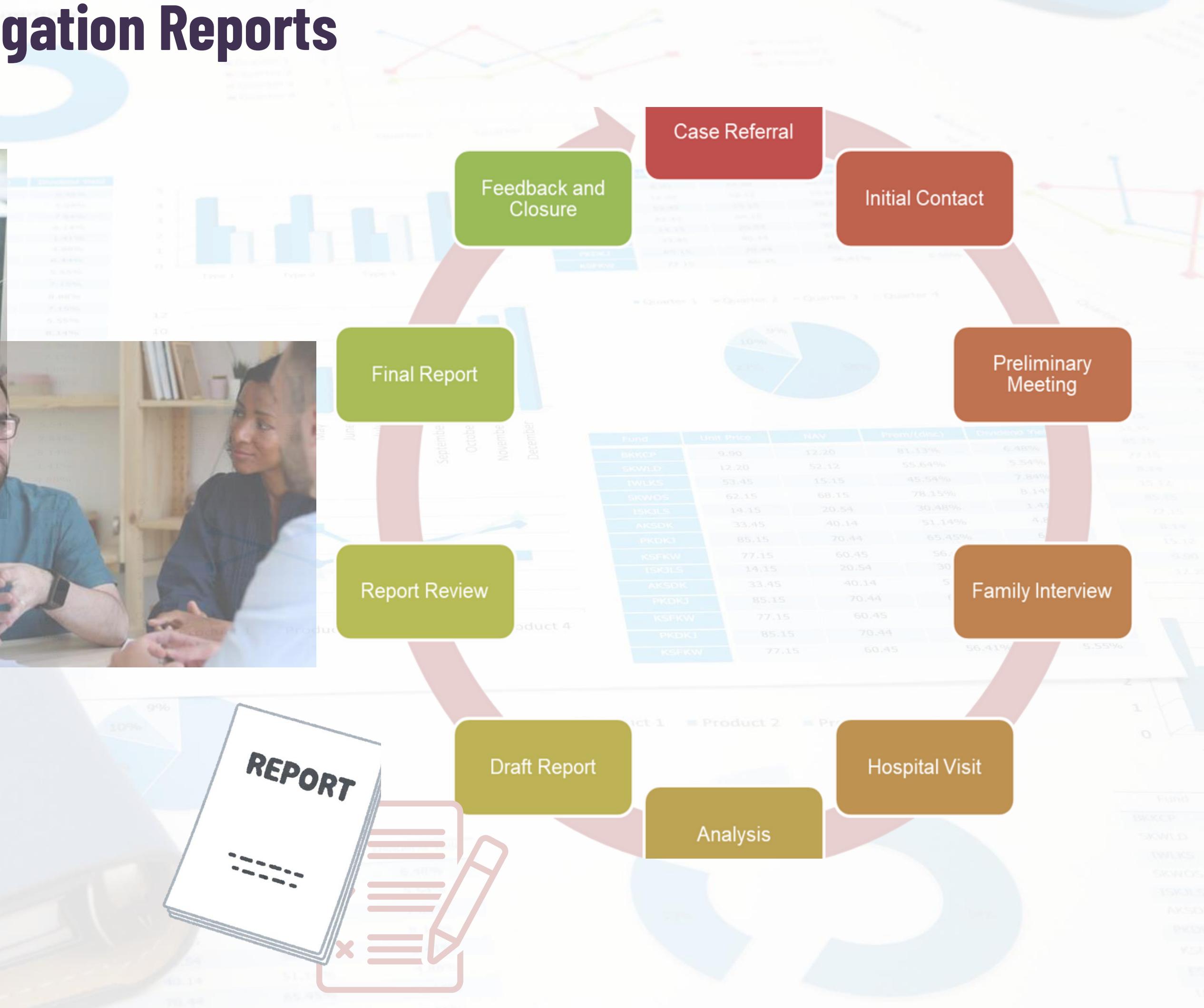
# About the Project

- HSIB was established in 2017 to improve patient safety through independent investigations
- Transformed in 2023 into MNSI (Maternity and Newborn Safety Investigations) and HSSIB (Health Services Safety Investigations Body)
- Produced reports with investigation findings and recommendations



Health Services Safety  
Investigations Body

# Maternity Incident Investigation Reports



# Maternity safety investigations



About us For families For NHS For other professionals Publications Contact us

Home > Publications

## Publications

Filter By: HSIB legacy publication National learning report Annual review Safety improvement example

Sort by: Most recently published

search Search

<b>Factors affecting the delivery of safe care in midwifery units</b> 8 May 2024 National learning report  National learning report. Read Publication →	<b>Learning from maternal death investigations during the first wave of the COVID-19 pandemic</b> 25 February 2021 National learning report HSIB legacy publication  National learning report. Read Publication →
<b>East Kent Hospitals University NHS Foundation Trust: HSIB summary report</b> 6 April 2020 HSIB legacy publication  A summary of the investigations undertaken with East Kent Hospitals University NHS Foundation Trust. Read Publication →	<b>Assessment of risk during the maternity pathway</b> 2 March 2023 National learning report HSIB legacy publication  National learning report. Read Publication →

## National learning report

This report is intended for healthcare organisations, policymakers and the public. It is based on a thematic analysis (a process that looks for common themes) of 92 maternity investigation reports, where the safety incident under investigation included care provided in a midwifery unit.

Midwifery units are staffed by midwives and support staff. Typically, pregnant women who choose to give birth in a midwifery unit have been assessed as having a low chance of complications during labour and birth. Sometimes a pregnant woman or baby may need to be transferred from a midwifery unit to an obstetric unit (a hospital unit where specialist doctors are primarily responsible for their care) to receive additional care and treatment.

The thematic analysis identified 4 main themes and findings, which include issues relating to:

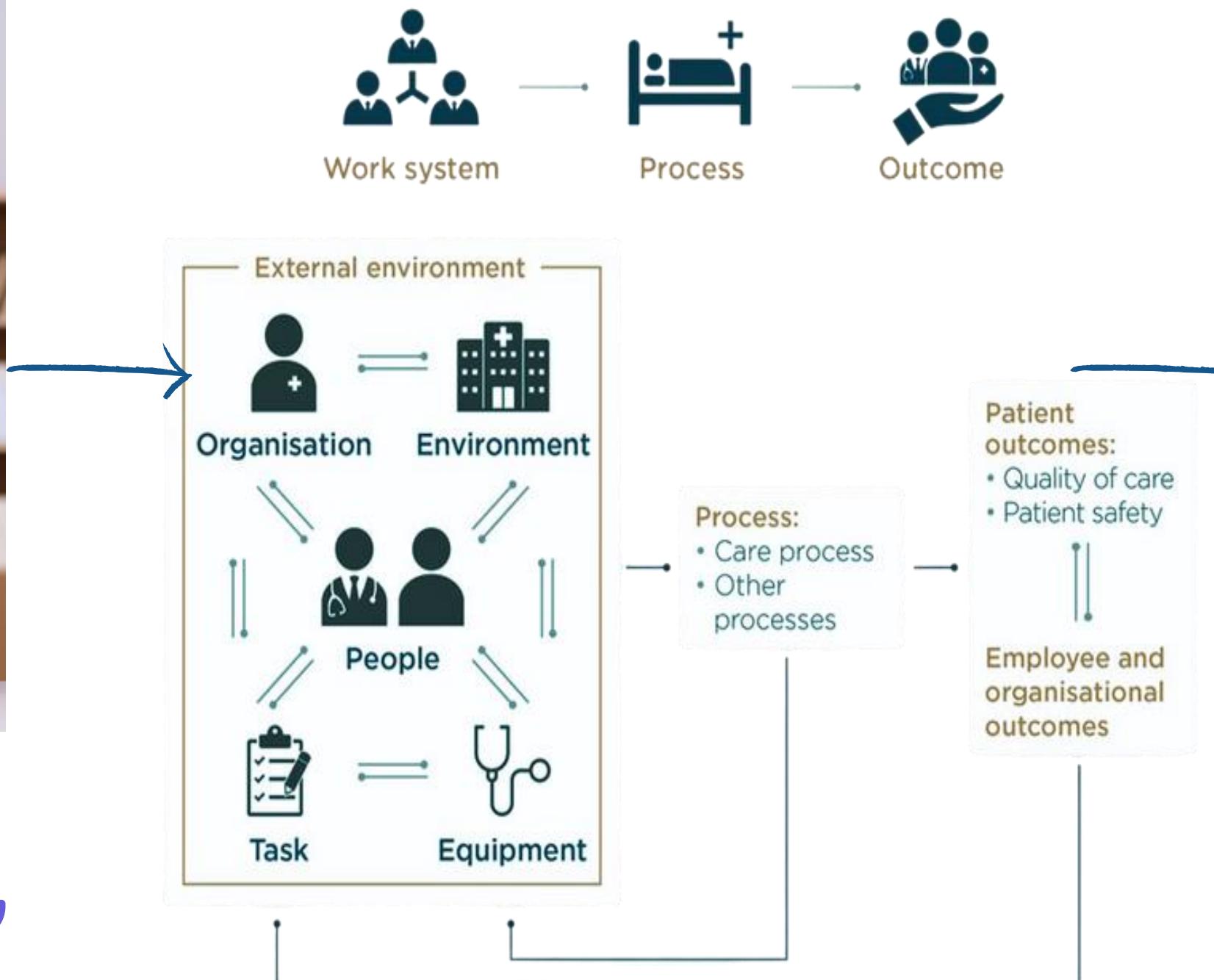
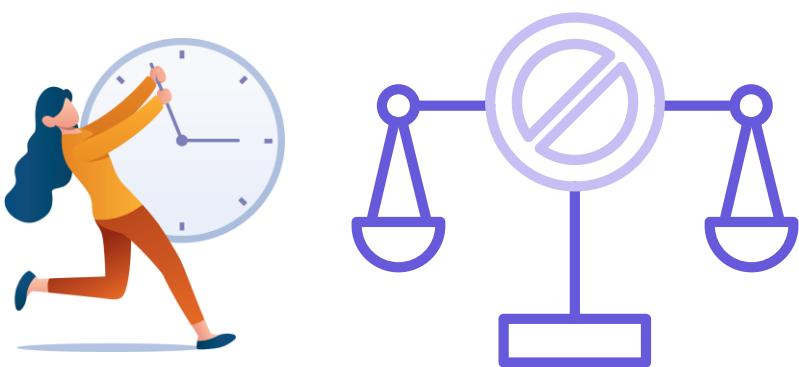
- Work demands and capacity to respond** – the number of tasks needed to be done and whether there are enough (and suitable) staff, and appropriate physical space, to do them.
- Intermittent auscultation** – a method used to assess a baby's heart rate as an indicator of their wellbeing.
- How prepared an organisation is for predictable safety-critical scenarios**, and the role played by in situ simulation (a training method that involves staff rehearsing scenarios in the workplace).
- Telephone triage** – the assessment a midwife carries out when a pregnant woman telephones because they have gone into labour or have a concern about their pregnancy.



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# *Extracting Insights from Maternity Incident Investigation Reports*

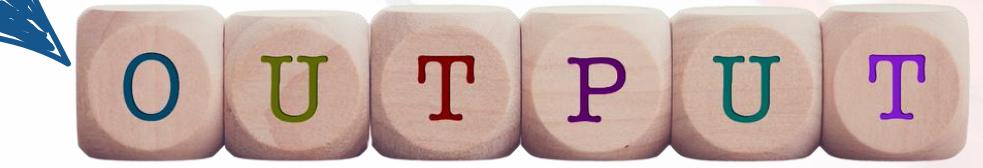
*A faster and more efficient way is needed for extracting insights from maternity incident investigation reports.*



## **Supplementary File SF1. SIRch taxonomy of human factors for maternity investigations**

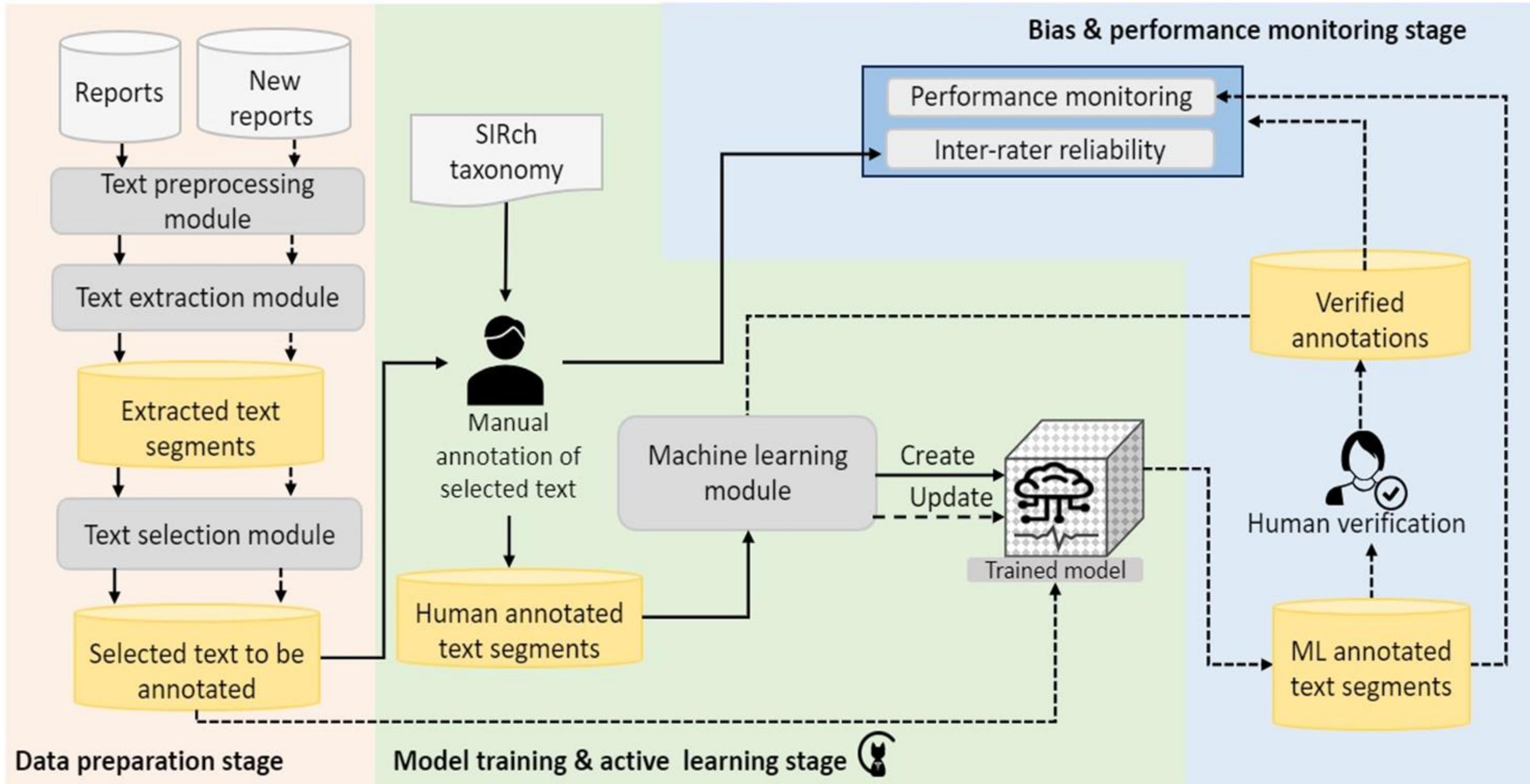
1. External Environment
    - (a) Policy factor
    - (b) Societal factor
    - (c) Economic factor
    - (d) COVID ✓
    - (e) Geographical factor (e.g. Location of patient)
  2. Internal Environment
    - (a) Physical layout and Environment
    - (b) Acuity (e.g., capacity of the maternity unit as a whole)
    - (c) Availability (e.g., operating theatres)
    - (d) Time of day (e.g., night working or day of the week)
  3. Organisation
    - (a) Team culture factor (e.g., patient safety culture)
    - (b) Incentive factor (e.g., performance evaluation)
    - (c) Teamworking
    - (d) Communication factor
      - i. Between staff
      - ii. Between staff and patient (verbal)
    - (e) Documentation
    - (f) Escalation/referral factor (including fresh eyes reviews)
    - (g) National and/or local guidance
    - (h) Language barrier
  4. Jobs/Task
    - (a) Assessment, investigation, testing, screening (e.g., holistic review)
    - (b) Care planning
    - (c) Dispensing, administering
    - (d) Monitoring
    - (e) Risk assessment
    - (f) Situation awareness (e.g., loss of helicopter view)
    - (g) Obstetric review
  5. Technologies and Tools
    - (a) Issues
    - (b) Interpretation (e.g., CTG)
  6. Person
    - (a) Patient (characteristics and performance)
      - i. Characteristics
        - A. Physical characteristics
        - B. Psychological characteristics (e.g., stress, mental health)
        - C. Language competence (English)
        - D. Disability (e.g., hearing problems)
        - E. Training and education (e.g., attendance at ante-natal classes)
        - F. Record of attendance (e.g., failure to attend antenatal classes)
      - ii. Performance
        - A. Slip or lapse (errors that tend to happen in routine tasks that people are doing without much conscious thought)
        - B. Decision error (errors in conscious judgements, decisions due to lack of knowledge and from misunderstanding of a situation)
        - C. Intentional rule breaking (deliberately do something different from rules)
    - (b) Staff (characteristics and performance)
      - i. Characteristics
        - A. Physical characteristics
        - B. Psychological characteristics (e.g., stress, mental health)
        - C. Language competence (English)
        - D. Disability (e.g., hearing problems)
        - E. Training and education (e.g., attendance at ante-natal classes)
        - F. Record of attendance (e.g., failure to attend antenatal classes)
      - ii. Performance
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        - C. Intentional rule breaking (deliberately do something different from rules)

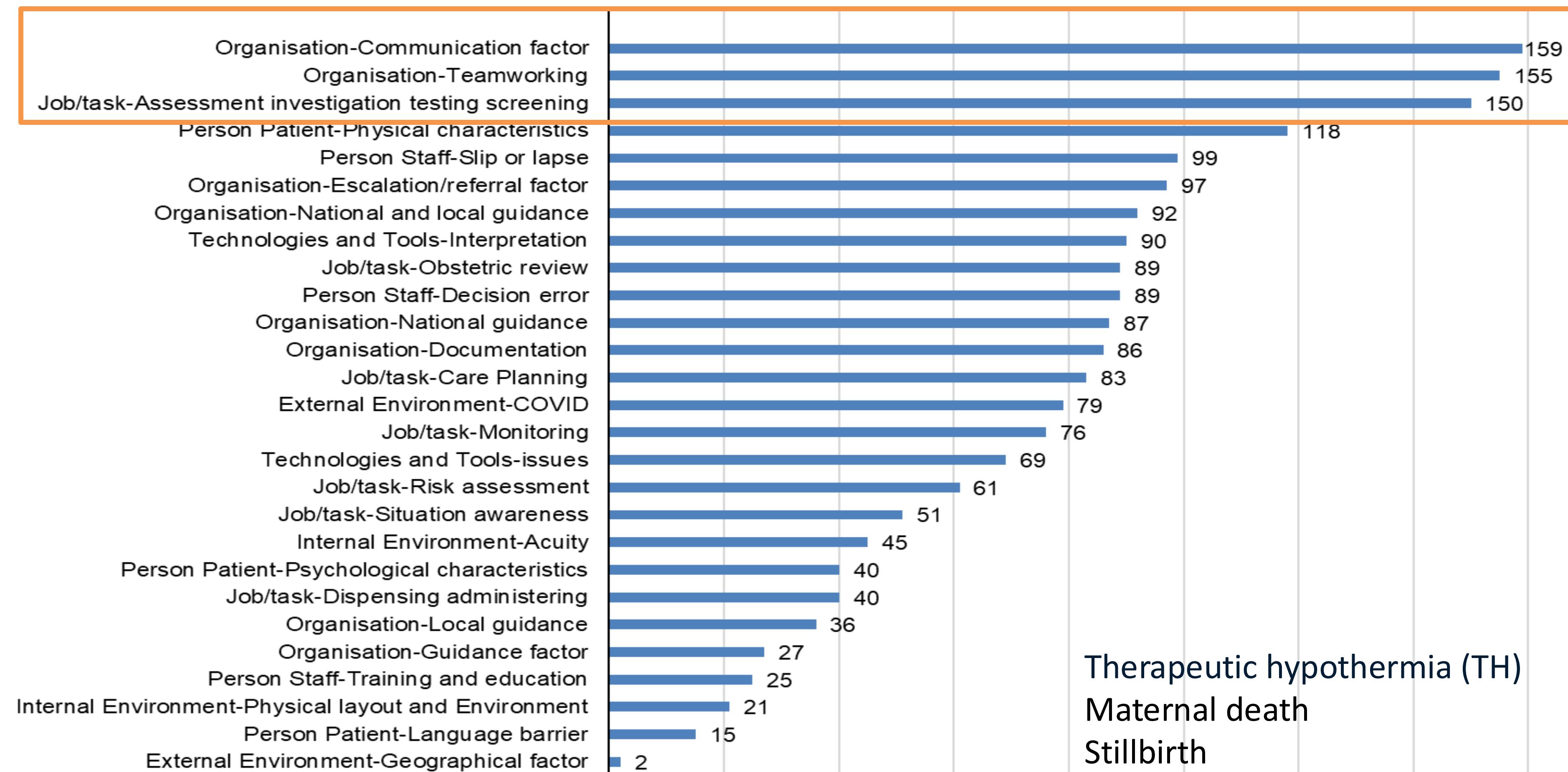
To develop a reliable and unbiased machine learning based tool to extract and analyse intelligence from maternity investigation reports using human factor concepts specifically designed for maternity investigations.



Learn to map each sentence to a human factors concept from the taxonomy

Automatically annotate reports and present and analysis of the concepts





188 reports, 3122 sentences

Number of reports per concept

Therapeutic hypothermia (TH)  
Maternal death  
Stillbirth



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# Communication

Not listening to, dismissing or ignoring women's concerns, preferences and requests

Not providing sufficient information for informed decisions

Conflicting recollections of discussions

Problematic staff interactions with women and their families



# Communication

Lack of translation services, leading to concerns not being understood and lack of discussions around options, risks and care

Information provided, and confirmations around health history, risks in pregnancy, signs of infection, and post-discharge monitoring needed



# Communication

Calls not being answered, lack of communication around urgency pre-hospital and in hospital

Delays informing family leading to less time with baby before death

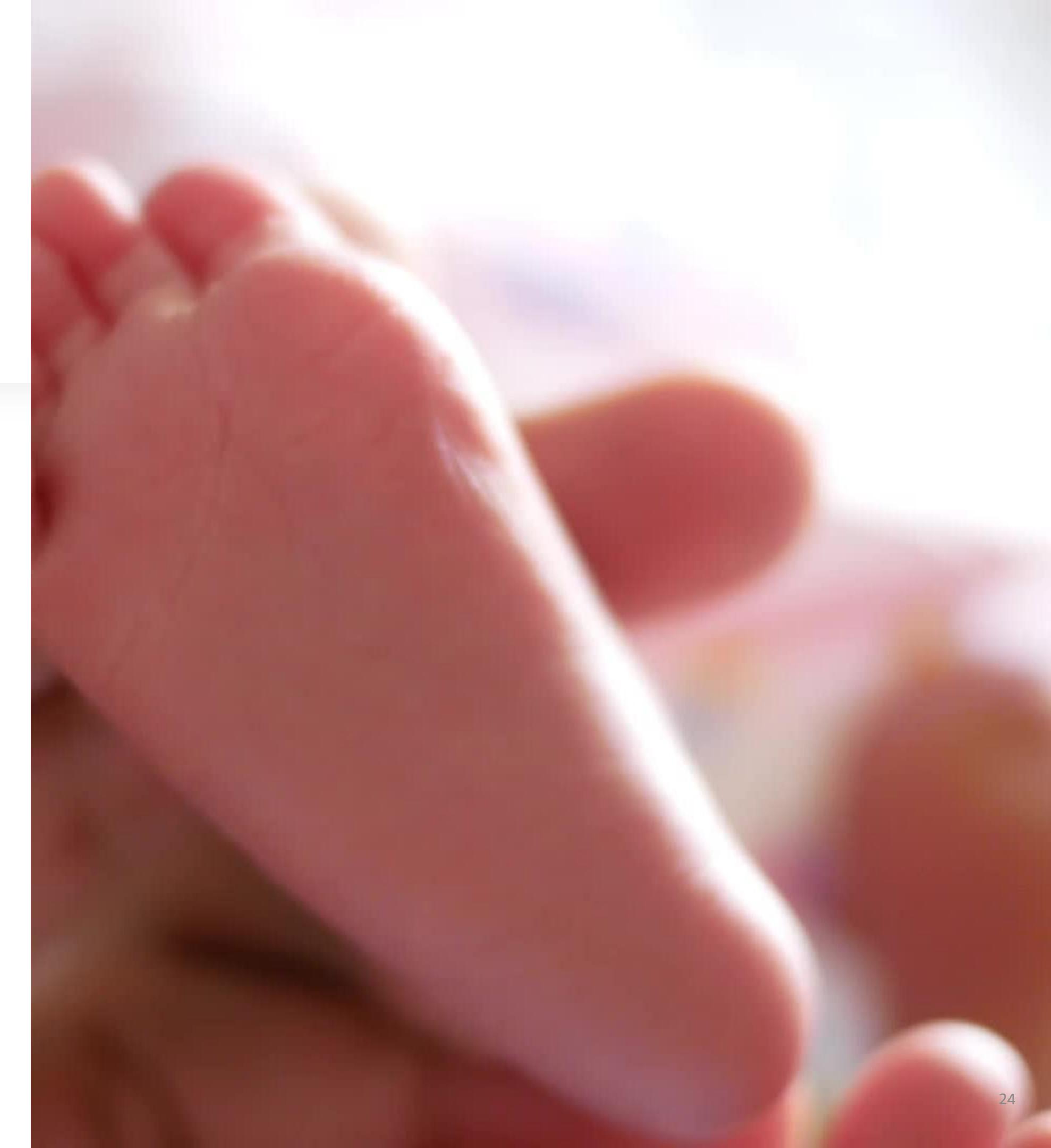


# Communication

Disputes around language used regarding baby's condition

Lack of debrief including all staff involved

Missed opportunities to communicate around risks and abnormal results that would have informed decision-making and care pathway changes





## Teamworking

Fragmented triage care with many staff and inconsistent handovers

Communication and handover issues between teams

Recurring handover issues, not sharing key details like risk factors and urgent decisions



## Teamworking

Confusing guidance leading to role uncertainties, delays expediting care

Hierarchy perceptions and communication gaps on needed interventions

Ambulance delays. Excess workloads without adequate cover



## **Assessment, investigation, testing, screening (e.g., holistic review)**

Gaps in assessments and documentation and lack of key lab tests represented

Failure to recognise start of second stage of labour

Failures to appreciate full clinical pictures, perform key examinations, and meet standards



## **Assessment, investigation, testing, screening (e.g., holistic review)**

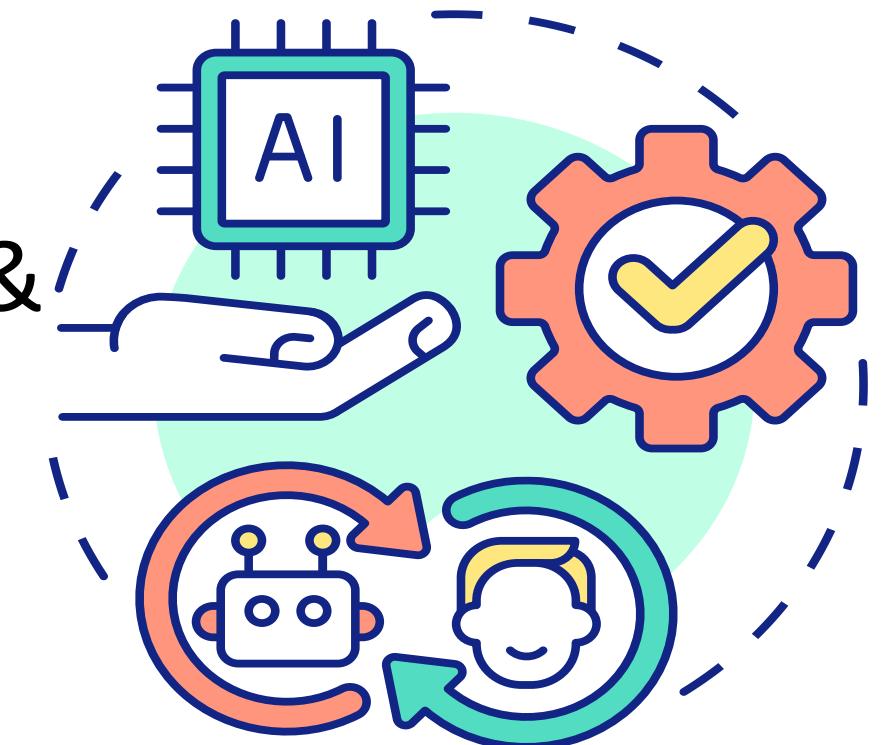
Inadequate clinical assessments and lack of holistic reviews during mothers' care

Missed assessments, examinations, and reviews

Busy units prevented appreciating mothers' concerns and performing needed assessments

# Artificial Intelligence in Healthcare

- **Concept annotation tool:** Natural Language Processing (NLP) & Machine learning to extract intelligence from reports (with human in the loop).
- Offline generative text **summarisation** tool (ethnicity & incident)
- **Topic modelling** to identify themes in the text (ethnicity & incident)
- **Robust evaluations** during development to ensure performance is fair and not biased towards certain groups.



## Publications:

- Singh, MK, Cosma, G, Waterson, P, Back, J, Jun, GT (2024) I-SIRch: AI-Powered Concept Annotation Tool For Equitable Extraction And Analysis Of Safety Insights From Maternity Investigations, Accepted. *To Appear in International Journal of Population Data Science*.
- Cosma, G, Singh, MK, Waterson, P, Jun, GT, Back, J (2024) *Unveiling disparities in maternity care: a topic modelling approach to analysing maternity incident investigation reports*. Lecture Notes in Computer Science, vol 14975. Springer, Cham. [https://doi.org/10.1007/978-3-031-67278-1\\_23](https://doi.org/10.1007/978-3-031-67278-1_23)
- Cosma, G., Singh, M.K., Waterson, P., Jun, G.T., Back, J. (2024). Intelligent Multi-document Summarisation for Extracting Insights on Racial Inequalities from Maternity Incident Investigation Reports. Lecture Notes in Computer Science, vol 14976. Springer, Cham. [https://doi.org/10.1007/978-3-031-67285-9\\_23](https://doi.org/10.1007/978-3-031-67285-9_23)

# DECODE: Data-driven machinE-learning aided stratification and management of multiple long-term COnditions in adults with intellectual disabilitiEs (DECODE)



Funding: DECODE(NIHR203981) is funded by the NIHR AI for Multiple Long-term Conditions (AIM) Programme.

FUNDED BY  
**NIHR** | National Institute for Health and Care Research

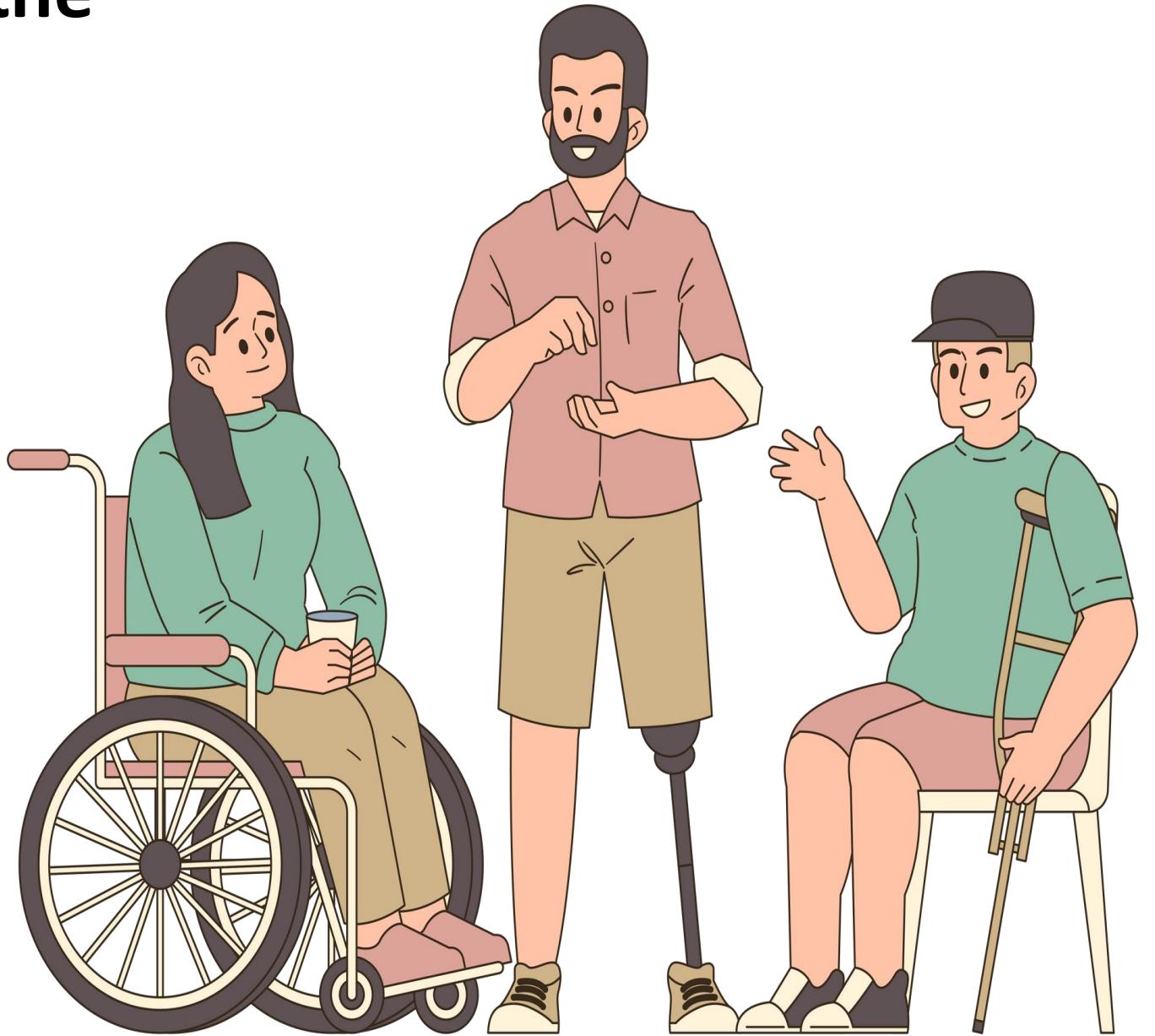


AI for Multiple Long-term Conditions  
Research Support Facility

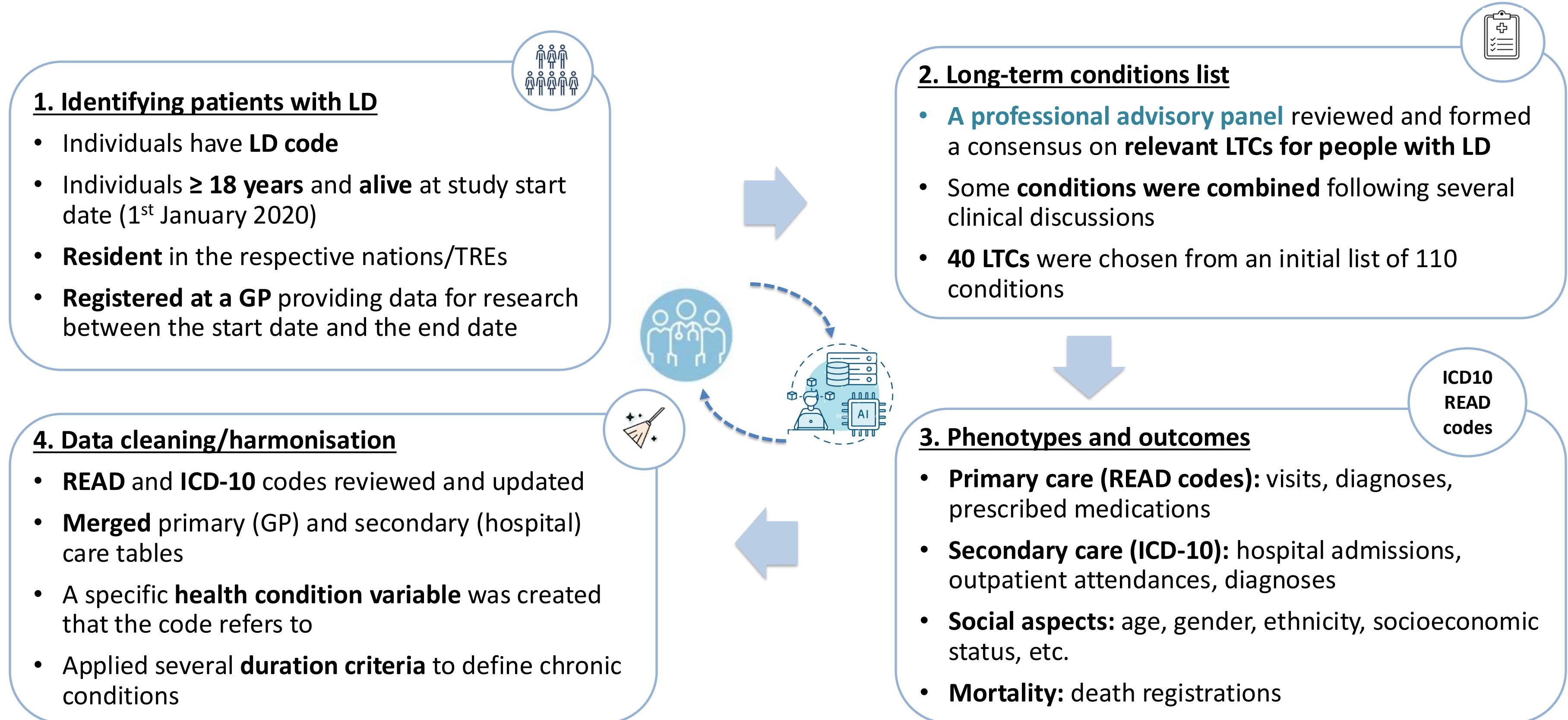
 Loughborough  
University

# Learning Disability in the UK

- **1.1 million (2.16%) adults with a learning disability in the UK**
- **956,000 adults with a learning disability in England**
- **54,000 adults with a learning disability in Wales**
- **31,000 adults with a learning disability in Northern Ireland**
- **Median age of death is 63 years old**
- Susceptible to developing multiple long term health conditions (MLTC)
- Common associated health conditions include mental health problems, epilepsy, and being underweight or overweight (MENCAP)



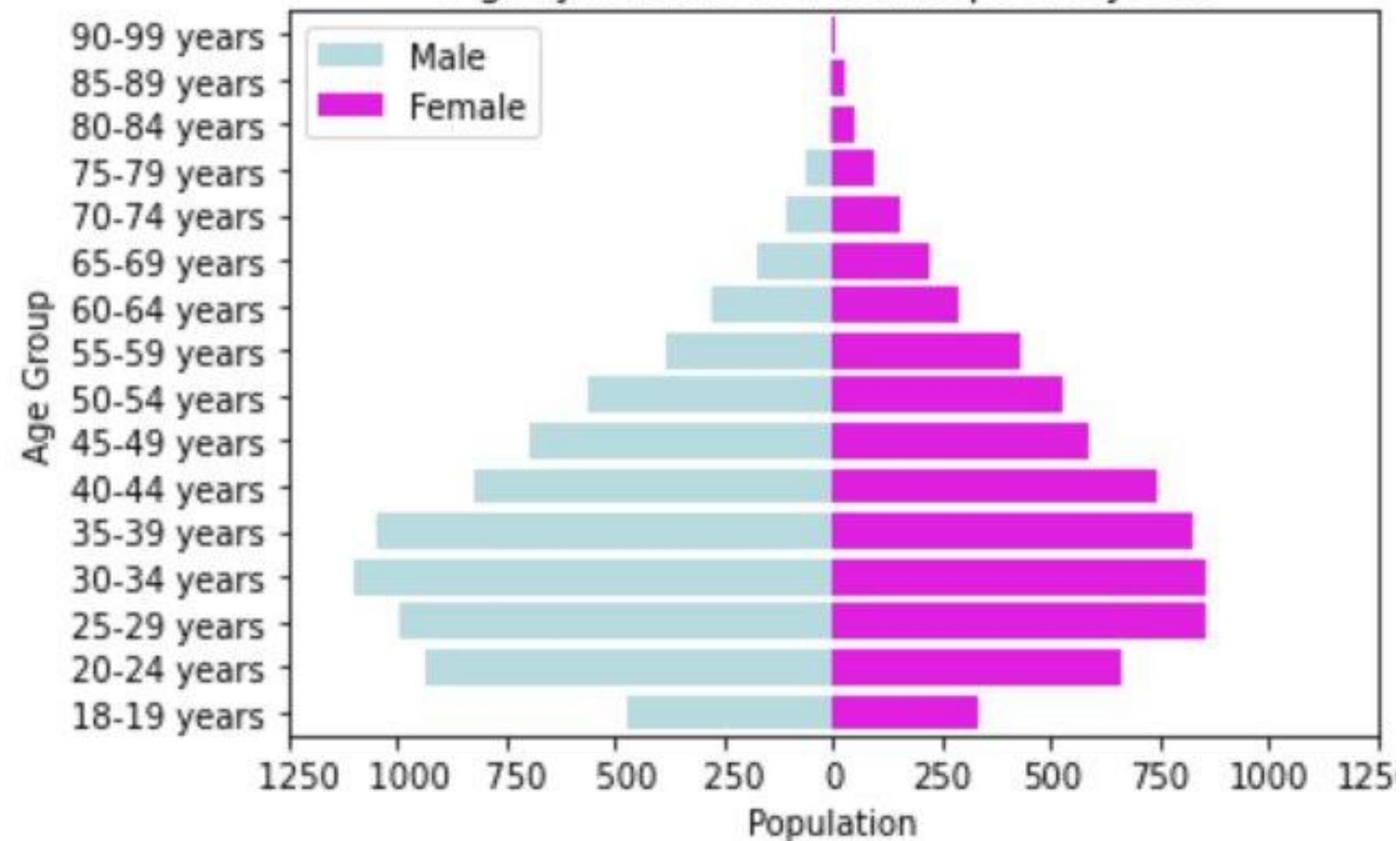
# EHR dataset preparation – SAIL and CPRD datasets



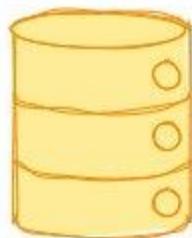
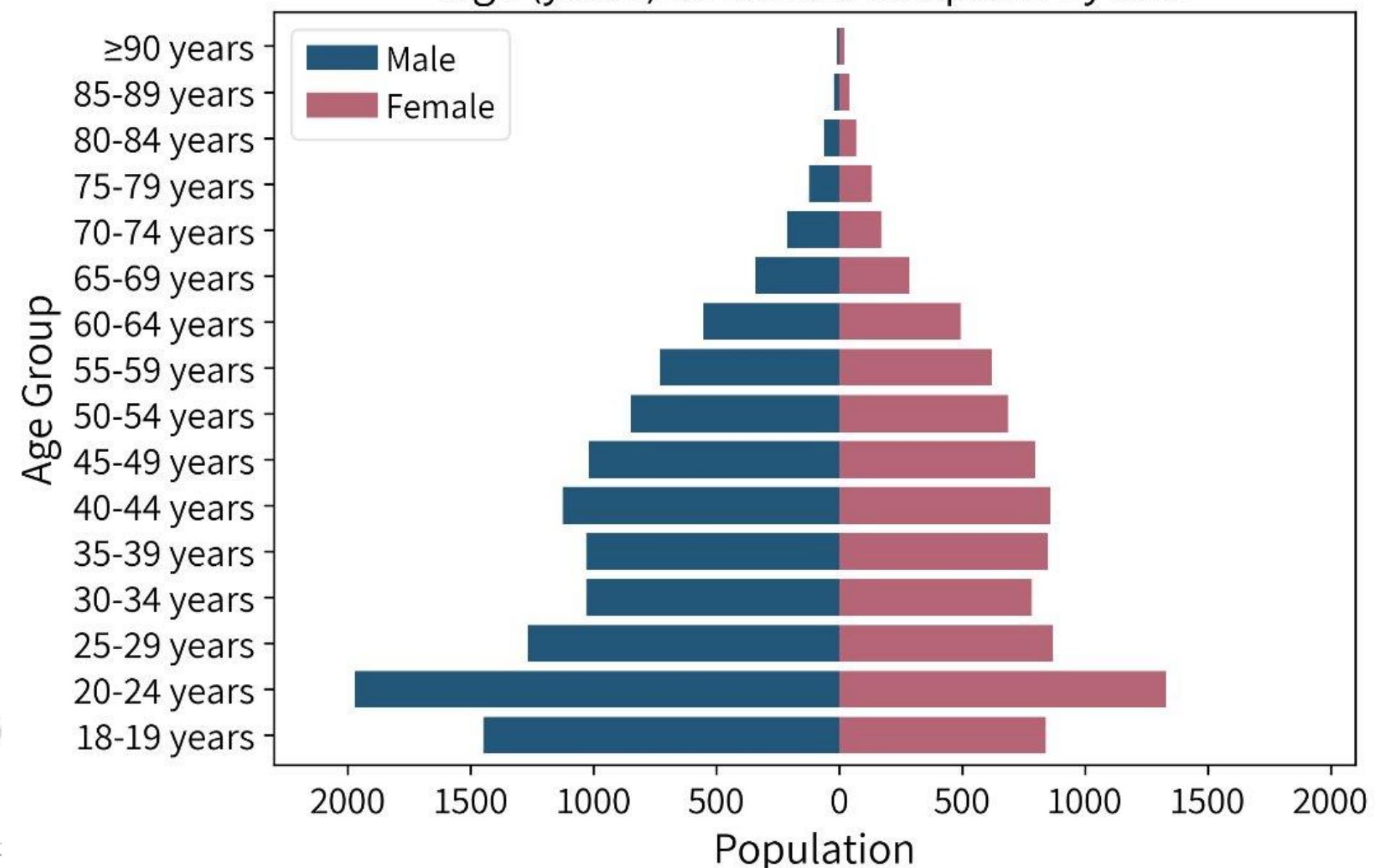
# Datasets

Clinical Practice Research Datalink (CPRD)

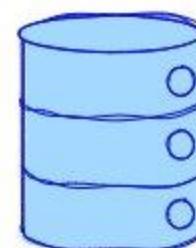
Age (years) at Cohort Inception by Sex



Age (years) at Cohort Inception by Sex



Characteristics	N (%)
Patients	13,069
Female	6,239 (47.7)
Male	6,830 (52.2)
Mean Age	30-34 years



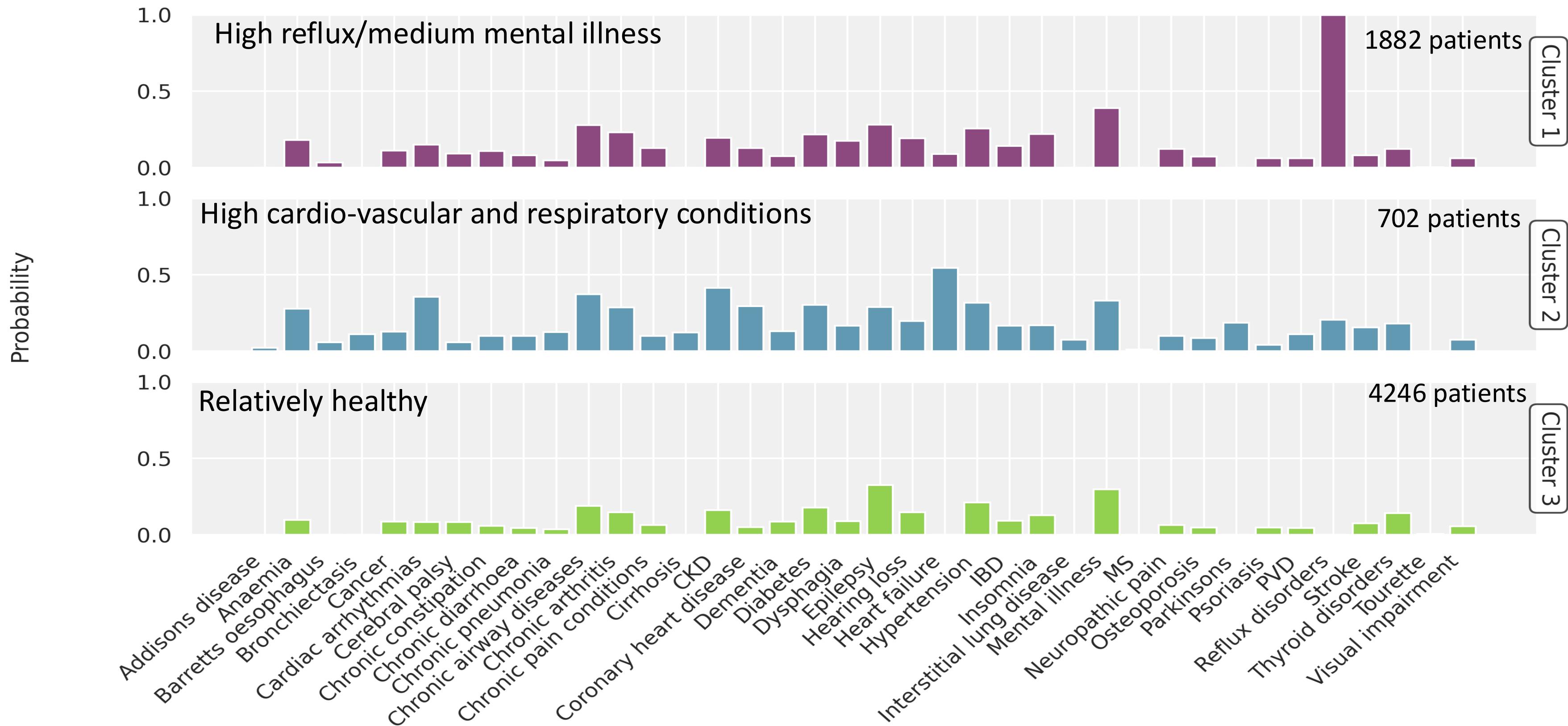
Characteristics	N (%)
Patients	20,646
Female	8,867 (43.0)
Male	11,779 (57.0)
Mean age	35-39 years



# SAIL - Clusters of LTCs

How conditions cluster together?

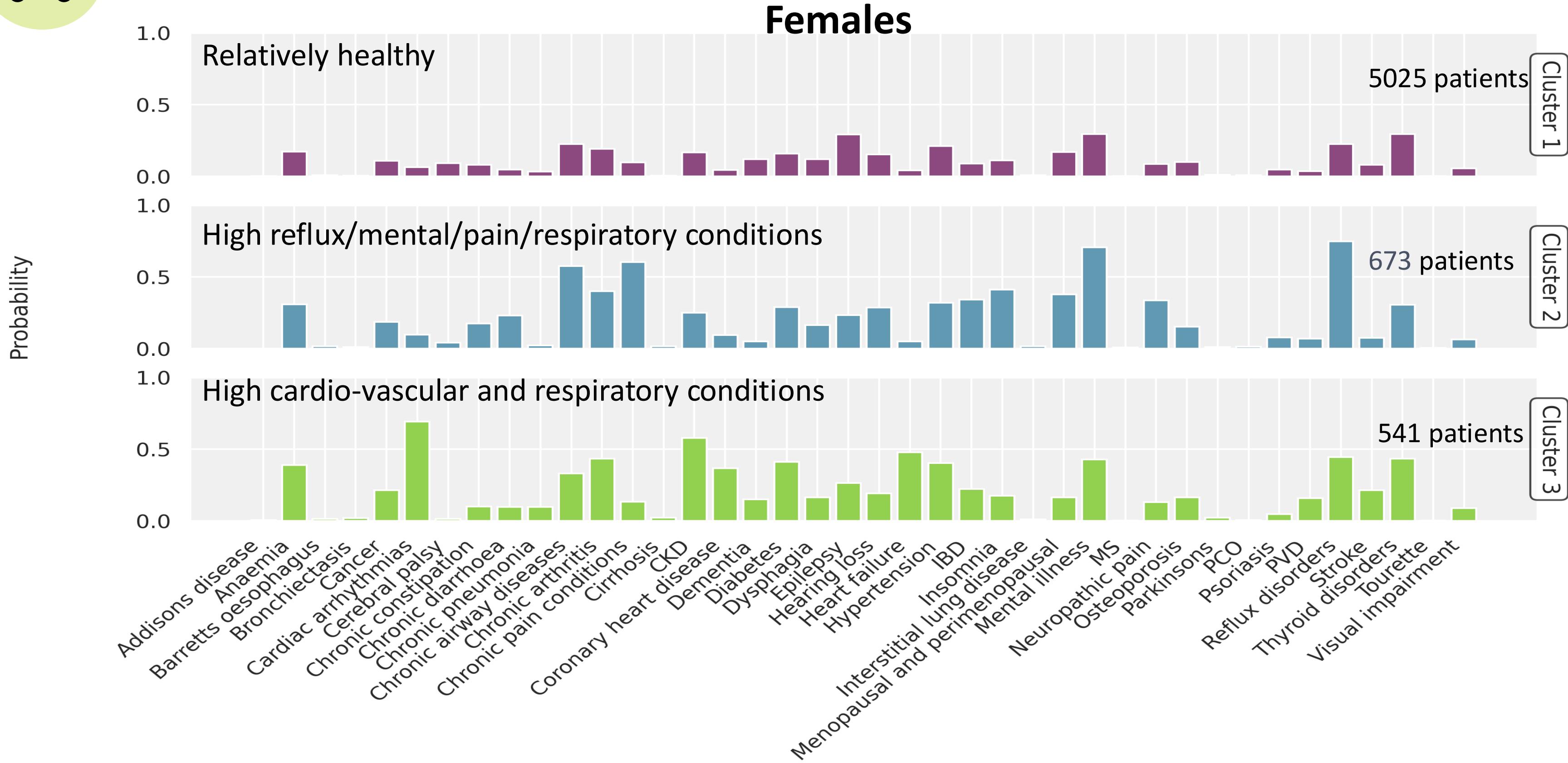
Males





# SAIL - Clusters of LTCs

How conditions cluster together?



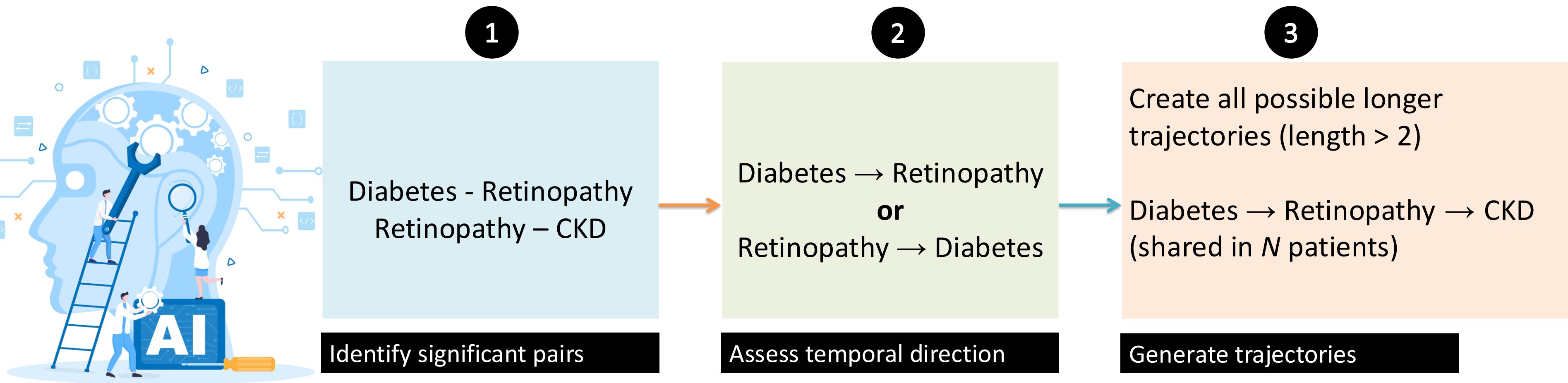
- Abakasanga E, Kousovista R, Cosma G, Jun GT, Kiani R, Gangadharan S. Identifying clusters on multiple long-term conditions for adults with learning disabilities. In: International Conference on AI in Healthcare. 2024. p. 45–58.
- Abakasanga E, Kousovista R, Cosma G, Jun GT, Kiani R, Gangadharan S. Cluster and trajectory analysis of multiple long-term conditions in adults with learning disabilities. In: International Conference on AI in Healthcare. 2024. p. 3–16.



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# Identifying Common Long-Term Condition Trajectories - SAIL

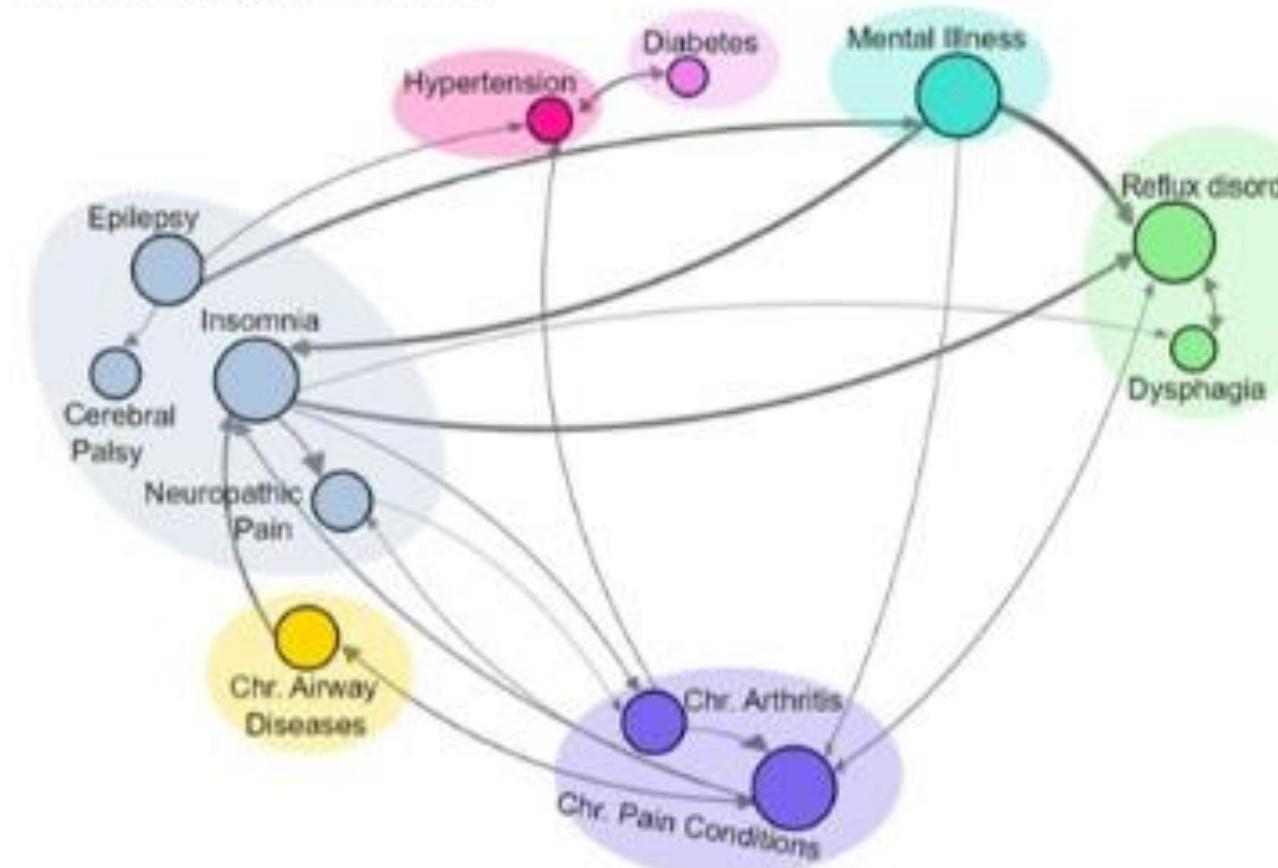
Identify which conditions are likely to co-occur and their temporal direction.



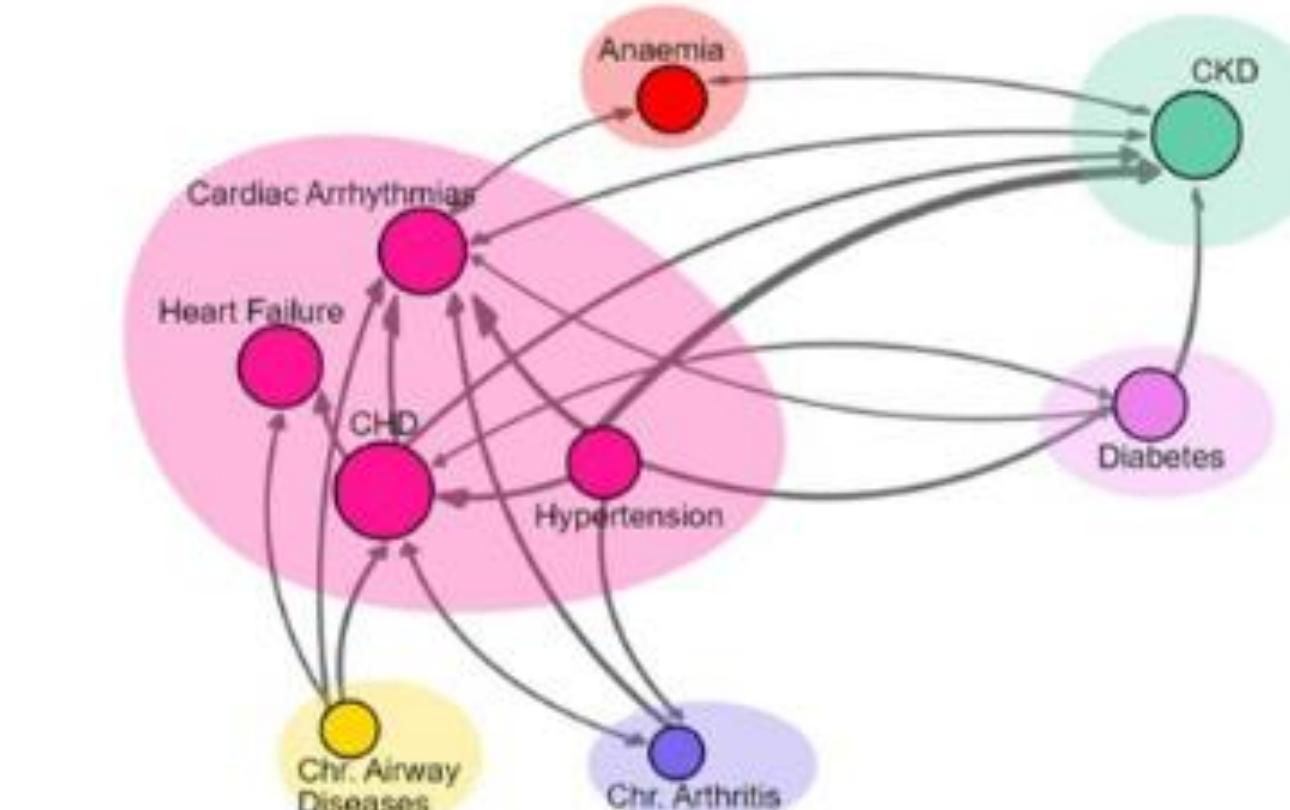
- We get different **trajectories of different lengths**, which we need to cluster based on the similar patterns they share.
- Pairs and their temporal direction helps us to understand the **progression of LTCs**.

# Common Long-Term Condition Trajectories

A Males < 45 years – Cluster 1



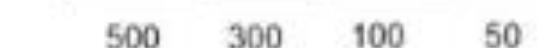
B Males  $\geq 45$  years – Cluster 1



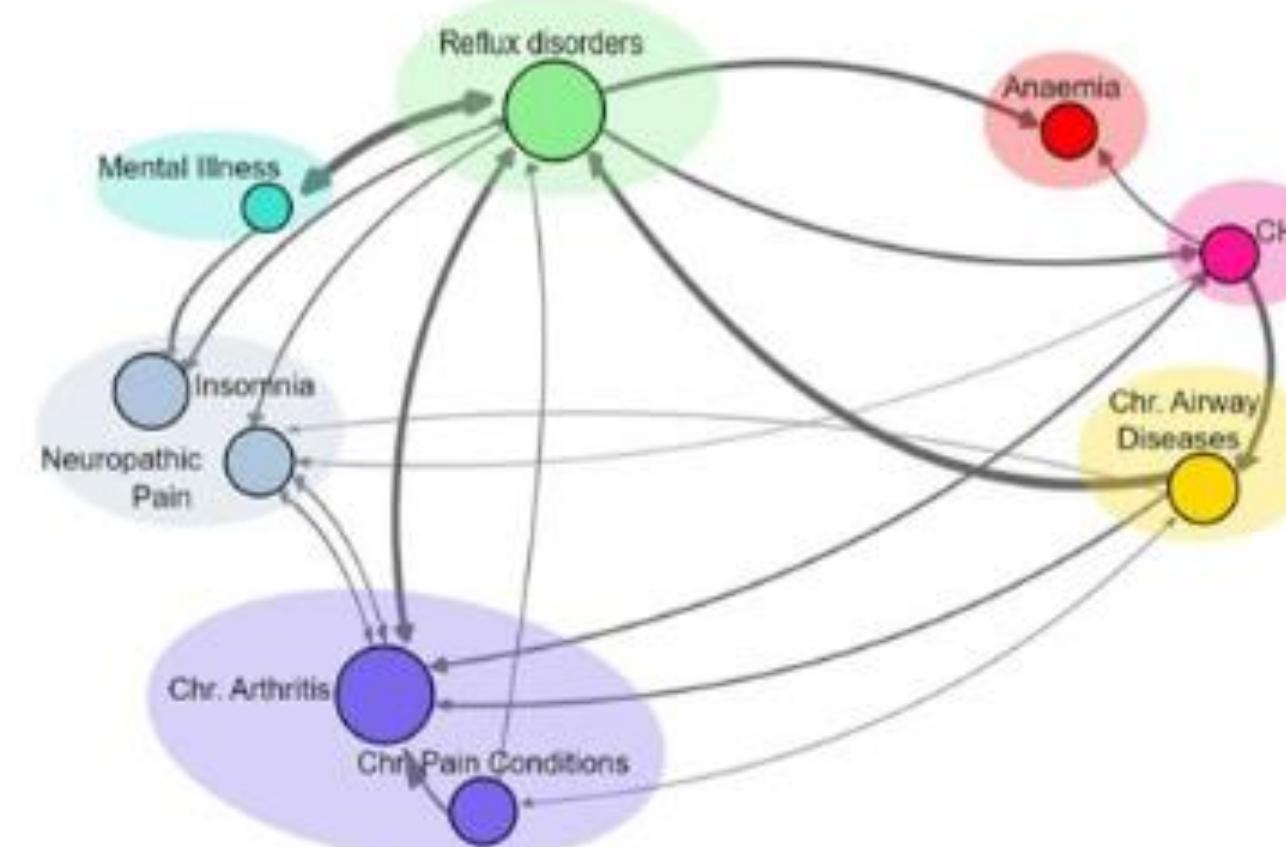
Condition category

- Neoplasms
- Blood
- Endocrine
- Mental
- Nervous
- Ear
- Eye
- Circulatory
- Respiratory
- Digestive
- Musculoskeletal
- Genitourinary

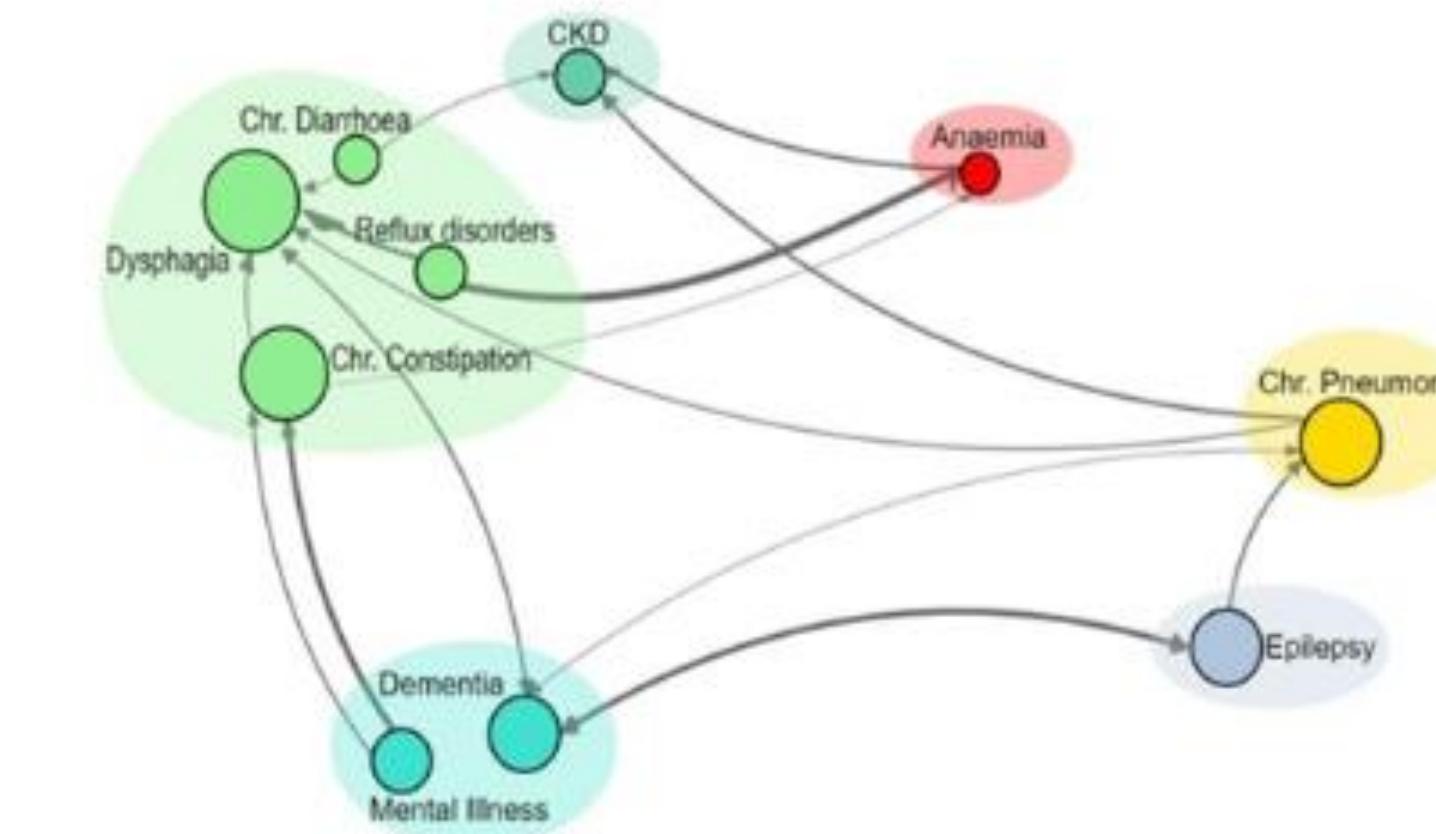
Number of patients



C Males  $\geq 45$  years – Cluster 2

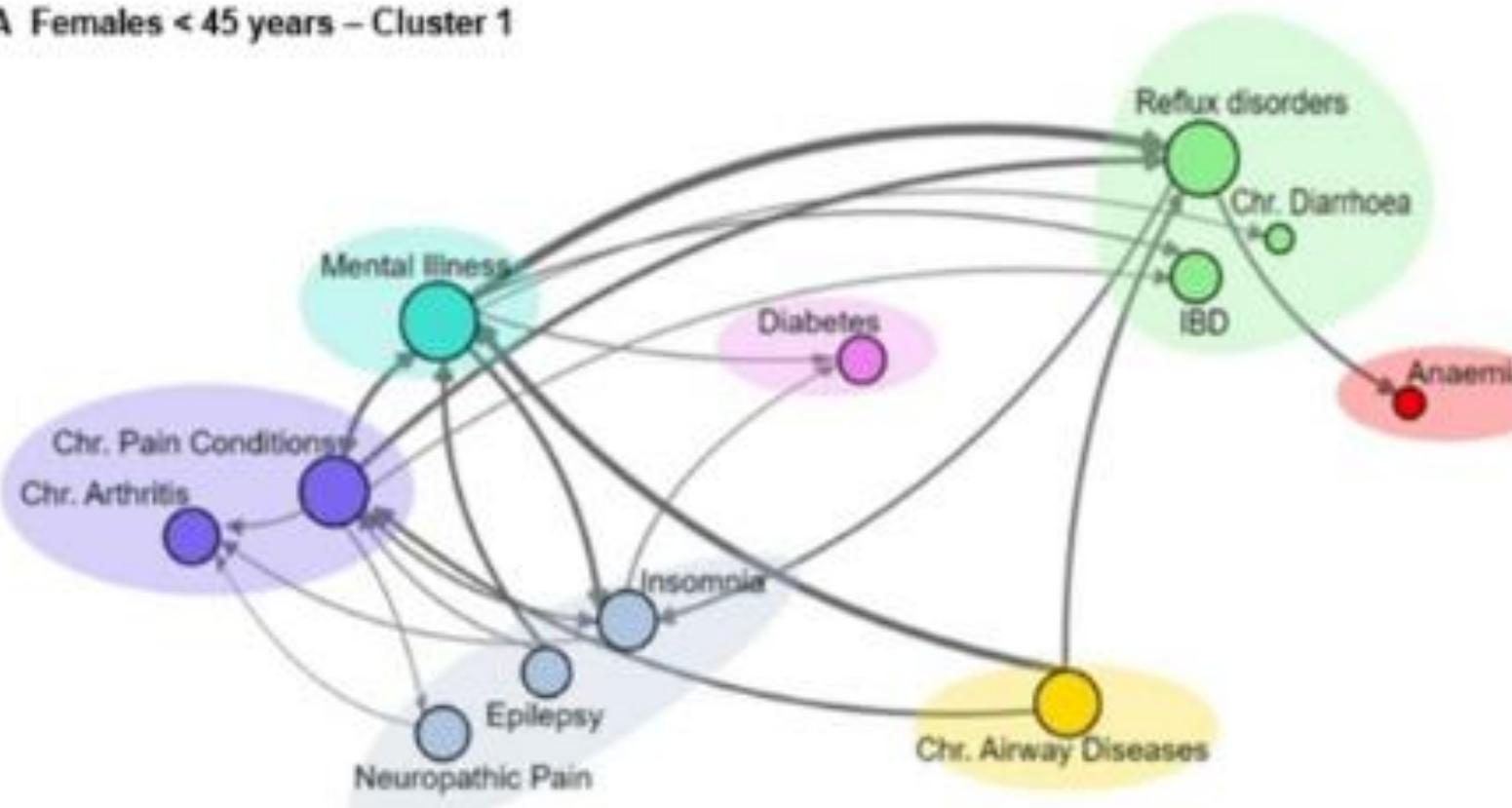


D Males  $\geq 45$  years – Cluster 3

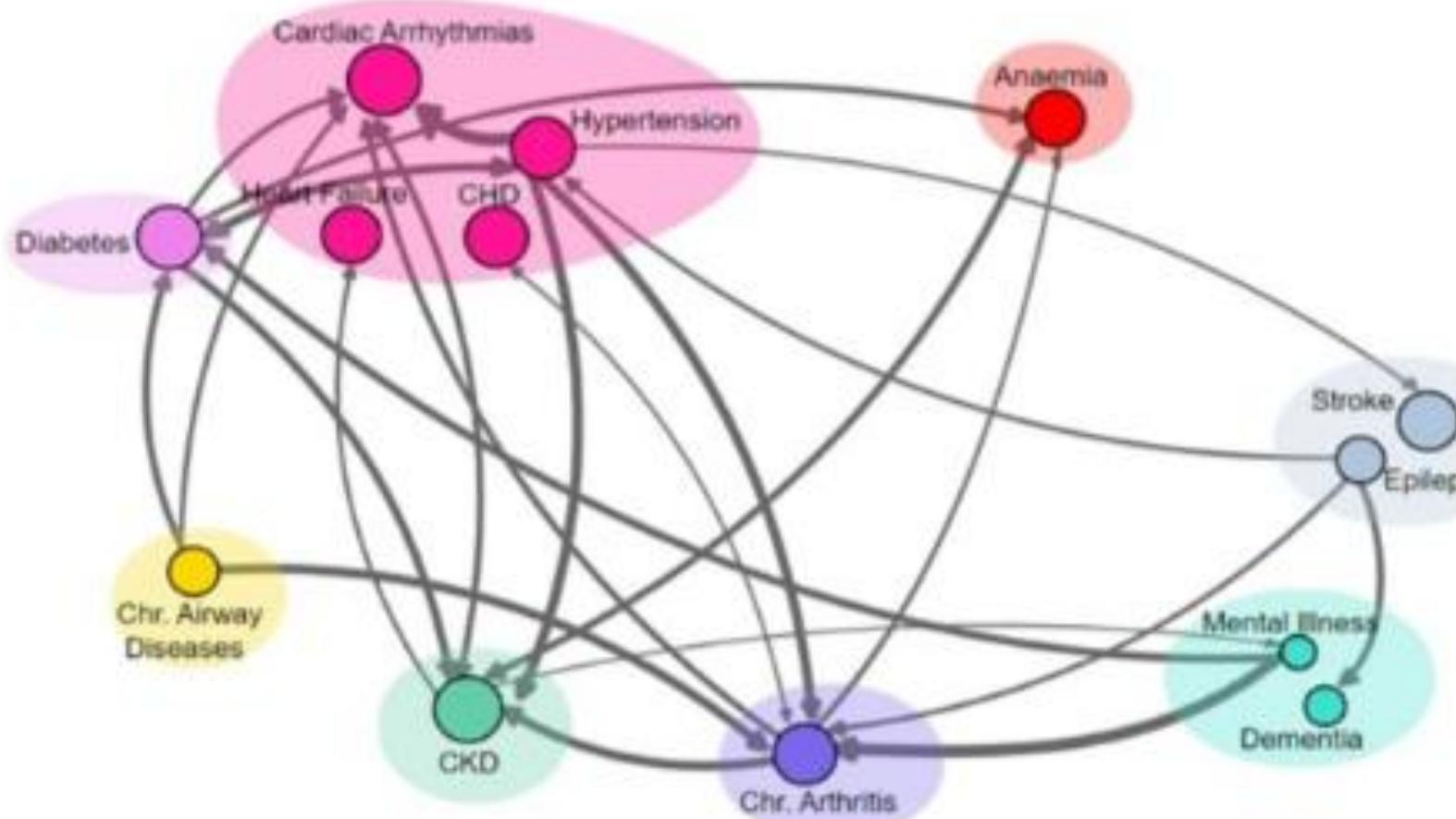


# Common Long-Term Condition Trajectories

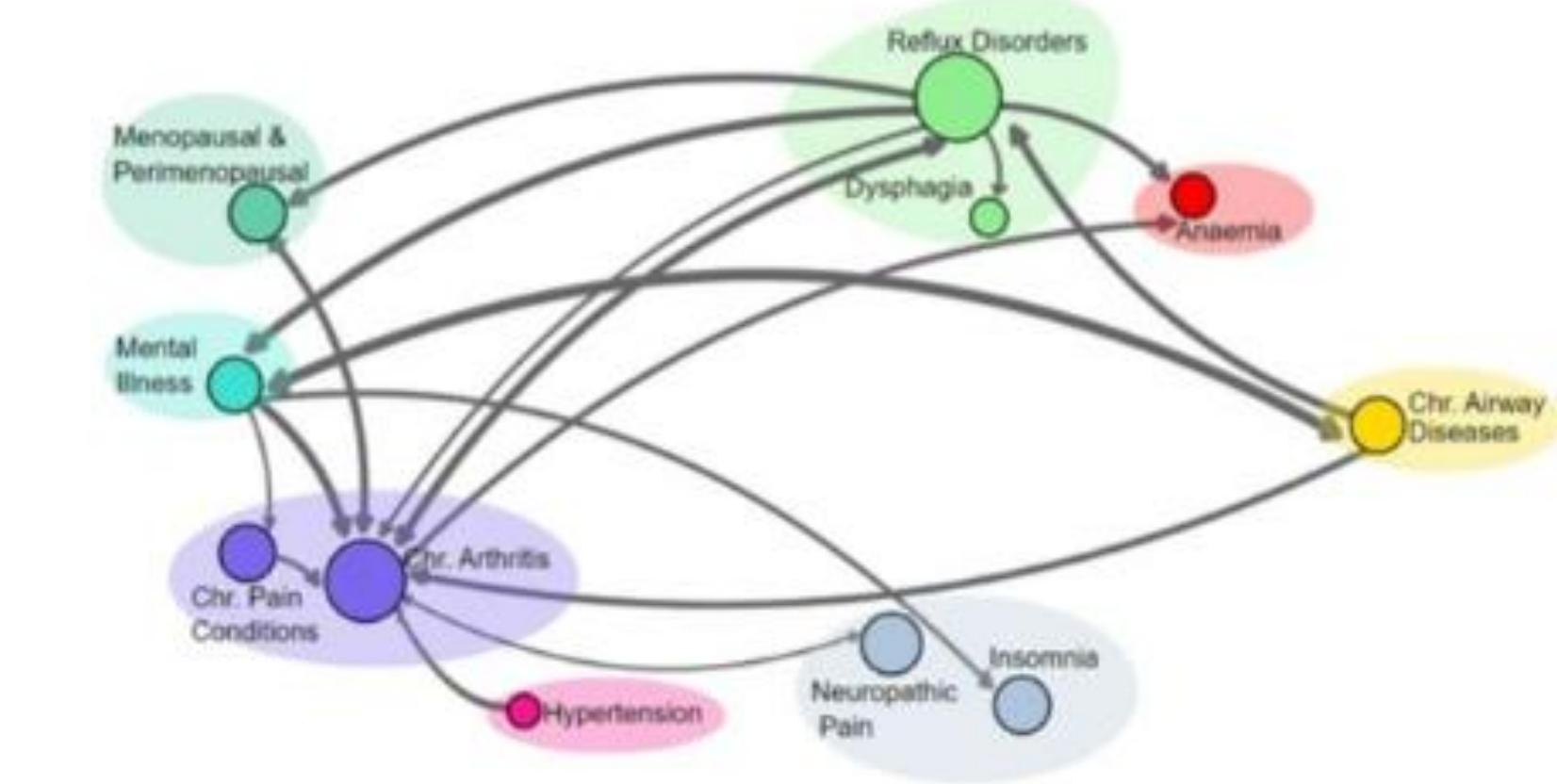
A Females < 45 years – Cluster 1



B Females ≥ 45 years – Cluster 1

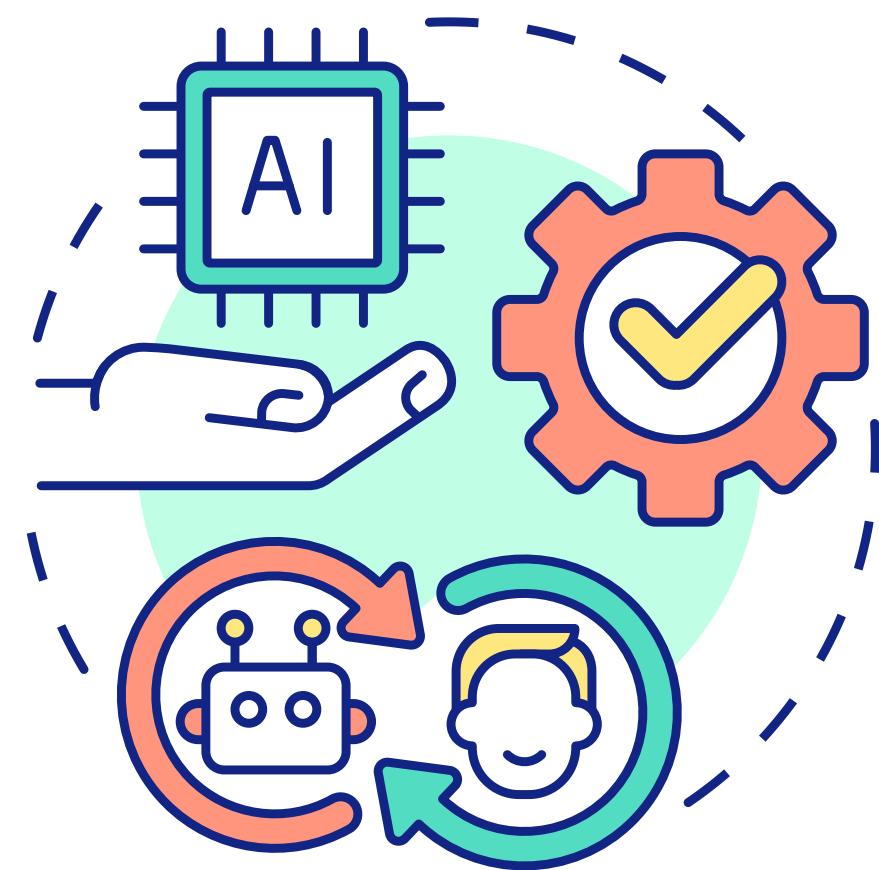


C Females ≥ 45 years – Cluster 2



# Comorbidity Patterns and Temporal Associations of Multiple Long-Term Conditions in Adults with Intellectual Disabilities: an observational study in England - CPRD

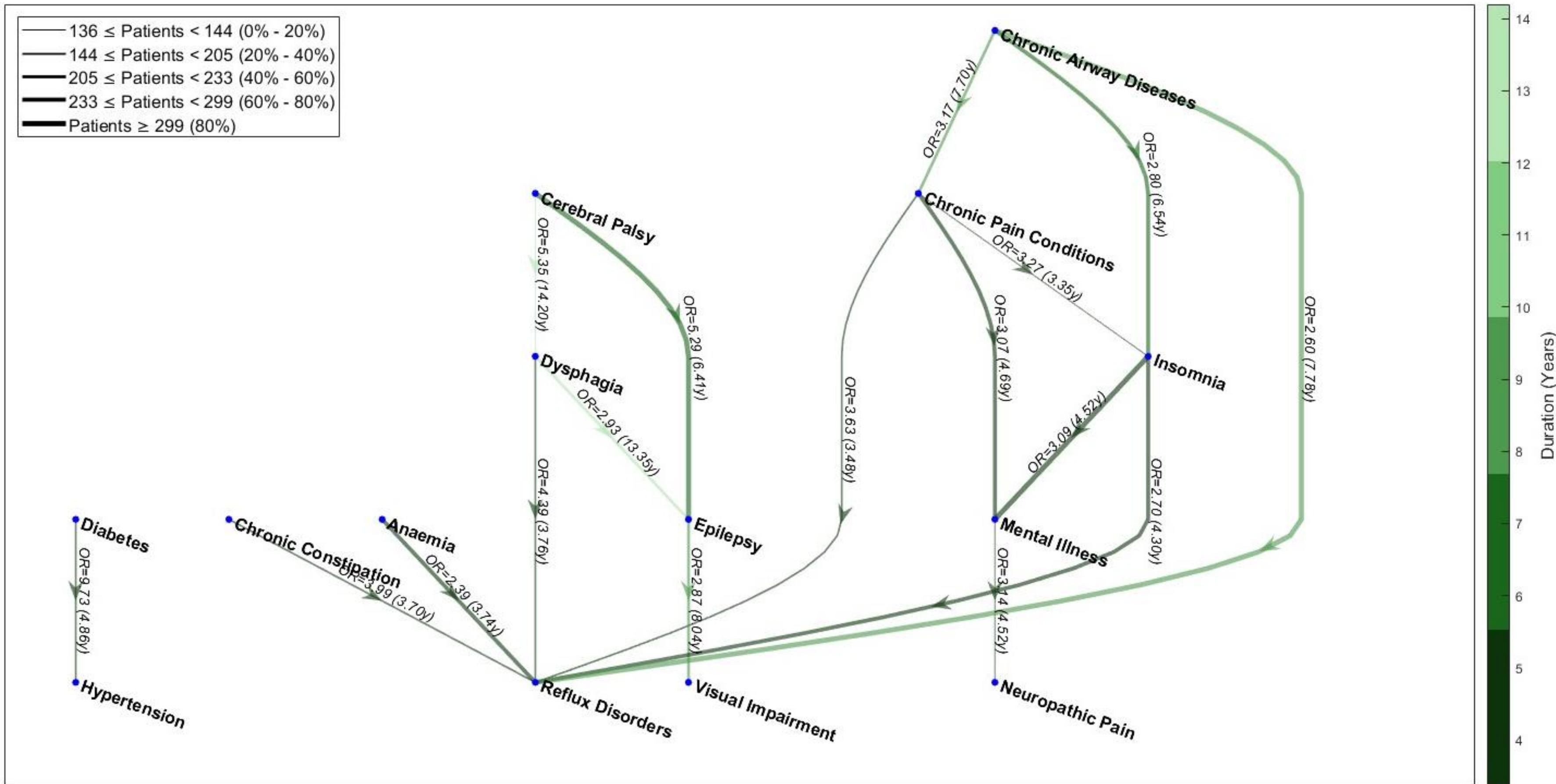
- 18 144 adults with an ID and MLTCs identified in the UK CPRD between 1st January 2000 and 31st December 2021
- Temporal analysis to establish trajectories among 40 long term conditions
- Stratification (1) gender; (2) Three age groups: <45, 45-64, and 65+



Cosma G, Abakasanga E, Kousovista R, Shabnam S, Akbari A, Kiani R, Jun T, Zaccardi F, Gangadharan S, Comorbidity Patterns and Temporal Associations of Multiple Long-Term Conditions in Adults with Intellectual Disabilities: An Observational Study in England. Under Review at Lancet Public Health. Available at: SSRN: <https://ssrn.com/abstract=4989209> or <http://dx.doi.org/10.2139/ssrn.4989209>

# Statistical modelling – Females Under 45

CPRD Data



(a) Gender: Females. Age group: <45. Total patients with diagnoses in this group: 6397. Odds ratio range: [2.39 - 9.73]. Observed pair minimum prevalence: 2.13% (136 patients). Number of condition pairs shown: 17. Total sum of odds ratios: 64.41.



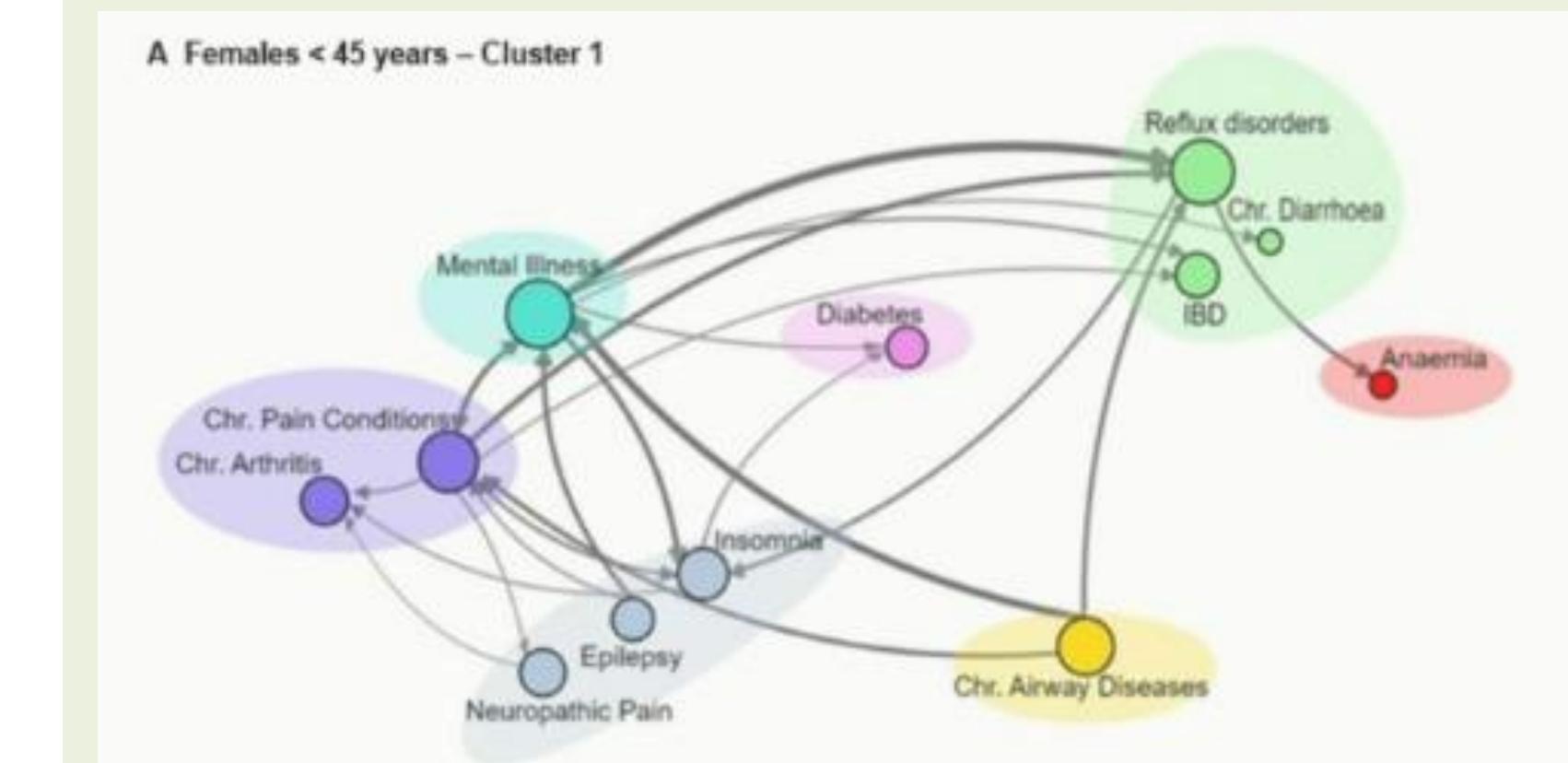
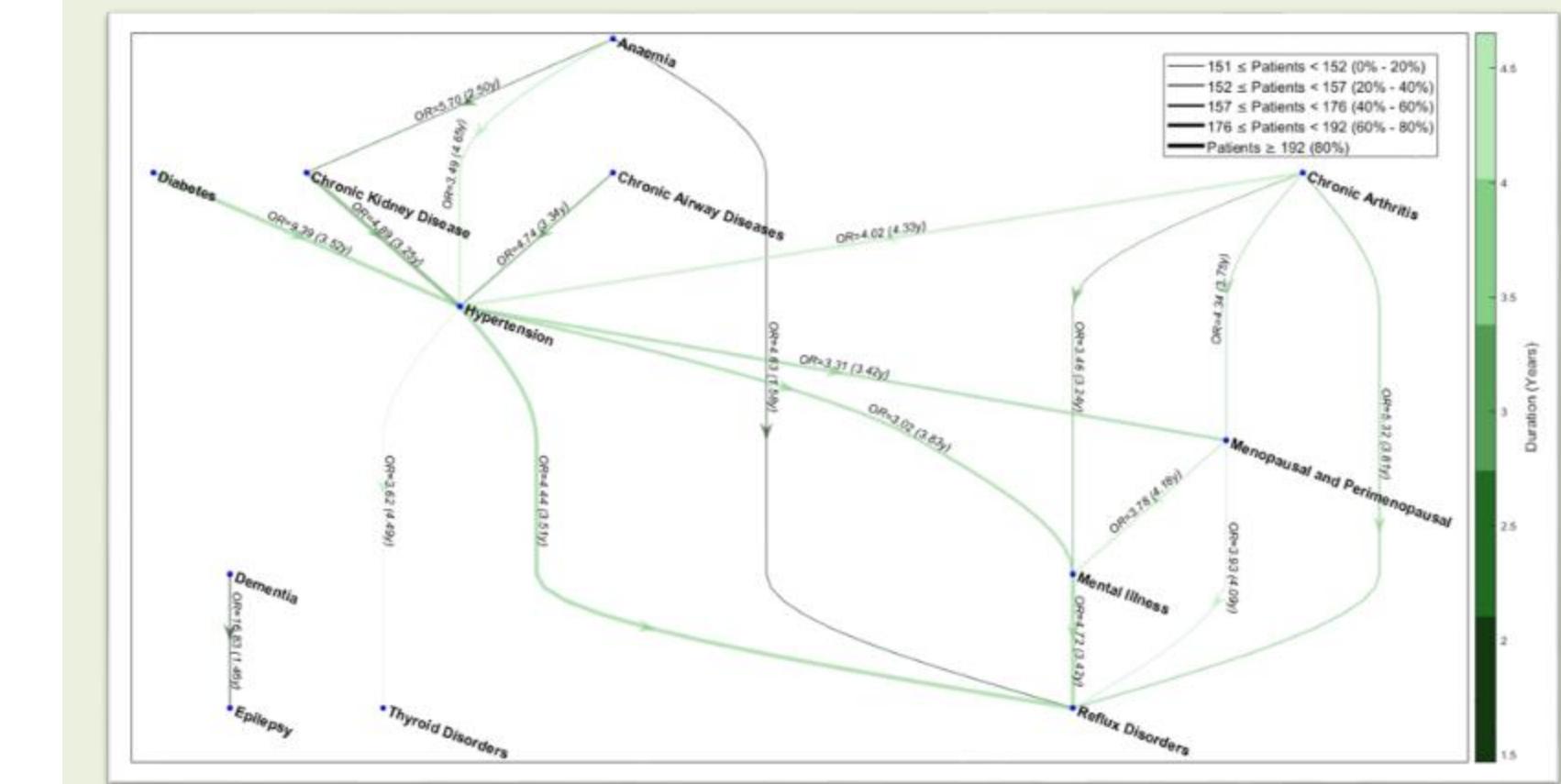
Loughborough  
University

## Females under 45 years

Combination	No. of conditions	Min. pair frequency	Prevalence of combination %
Chronic Airway Diseases + Insomnia + Reflux Disorders	3	239	3·74
Chronic Airway Diseases + Chronic Pain Conditions + Reflux Disorders	3	203	3·17
Cerebral Palsy + Dysphagia + Epilepsy	3	139	2·17
Chronic Airway Diseases + Chronic Pain Conditions + Insomnia	3	136	2·13
Chronic Pain Conditions + Insomnia + Mental Illness	3	136	2·13
Chronic Pain Conditions + Insomnia + Reflux Disorders	3	136	2·13
Chronic Airway Diseases + Chronic Pain Conditions + Insomnia + Reflux Disorders	4	136	2·13
Anaemia + Dysphagia + Reflux Disorders	3	121	1·89
Cerebral Palsy + Epilepsy + Visual Impairment	3	118	1·84
Chronic Pain Conditions + Mental Illness + Neuropathic Pain	3	100	1·56
Chronic Pain Conditions + Neuropathic Pain + Reflux Disorders	3	100	1·56

# Some of our findings

- Epilepsy and mental illness were the most prevalent conditions in both genders.
- Chronic airway diseases, reflux disorders, hypertension, and hearing loss affected both.
- Gender differences emerged in anaemia and thyroid disorders.
- Cerebral palsy in males and chronic pneumonia in females were key precursors to MLTCs in younger people (under 40), while hypertension had a similar effect in older people of both genders.



Cosma G, Abakasanga E, Kousovista R, Shabnam S, Akbari A, Kiani R, Jun T, Zaccardi F, Gangadharan S, Comorbidity Patterns and Temporal Associations of Multiple Long-Term Conditions in Adults with Intellectual Disabilities: An Observational Study in England. Under Review at Lancet Public Health. Available at:  
SSRN: <https://ssrn.com/abstract=4989209> or <http://dx.doi.org/10.2139/ssrn.4989209>

# Limitations

- The UK focus may restrict direct applicability to countries with different healthcare systems or population characteristics.
- The study population comprises individuals who have accessed healthcare services, potentially underrepresenting those facing barriers to access.
- Changes in diagnostic practices over the 22-year study period may have influenced the observed patterns.



# Conclusion

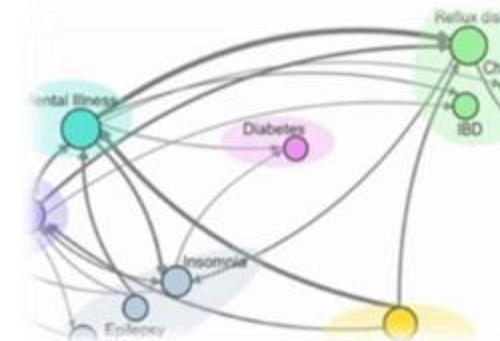
First study to reveal complex patterns of MLTCs across different age groups and genders in people with learning disabilities.



gender-specific  
associations  
across age  
groups



temporal  
associations  
of  
conditions



insights into  
disease  
progression  
patterns



inform  
targeted  
prevention  
strategies



early  
interventions to  
prevent  
premature  
mortality



# Thank you!



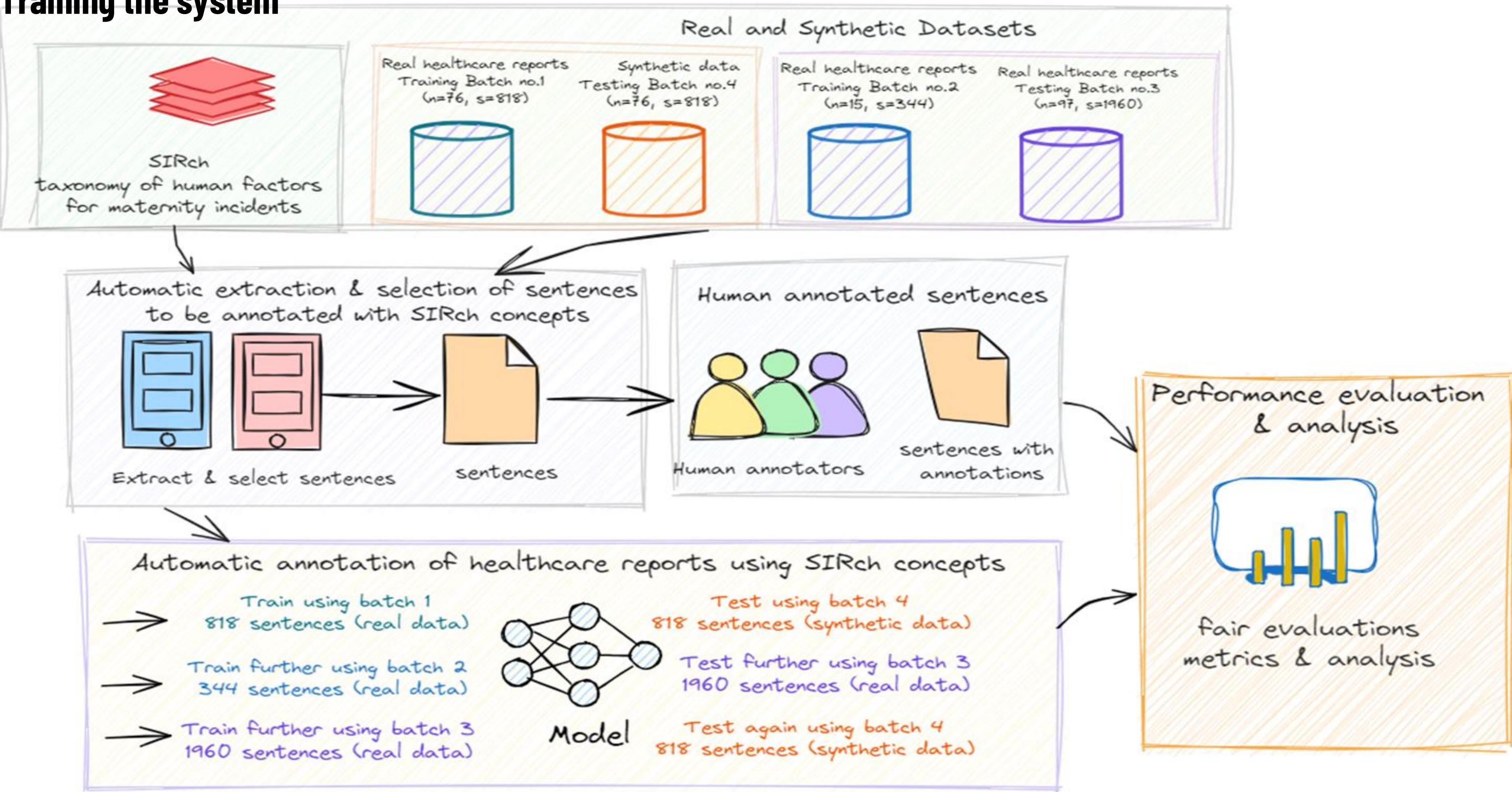
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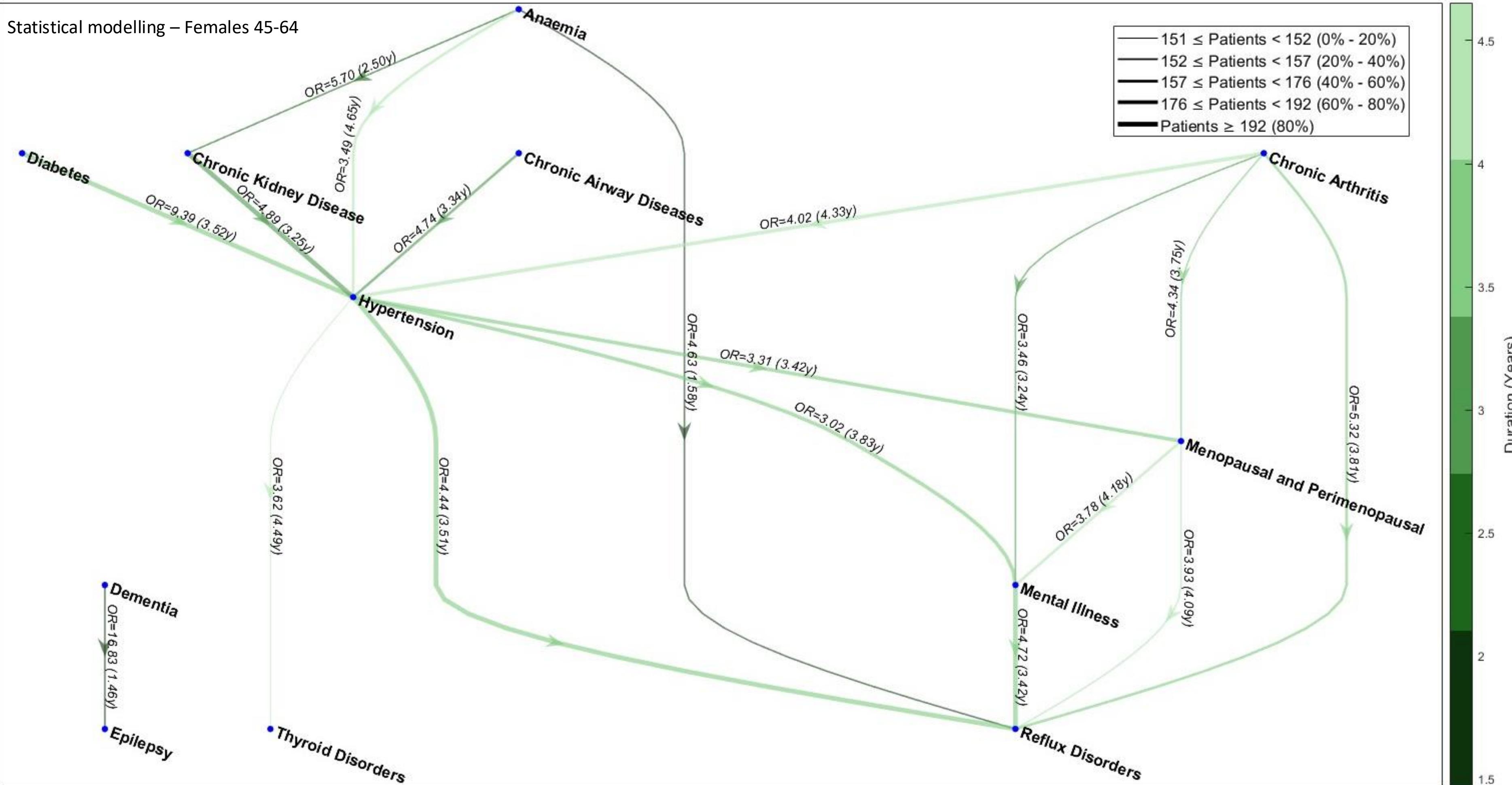
**Website:** <https://datascienceplus.blog/>

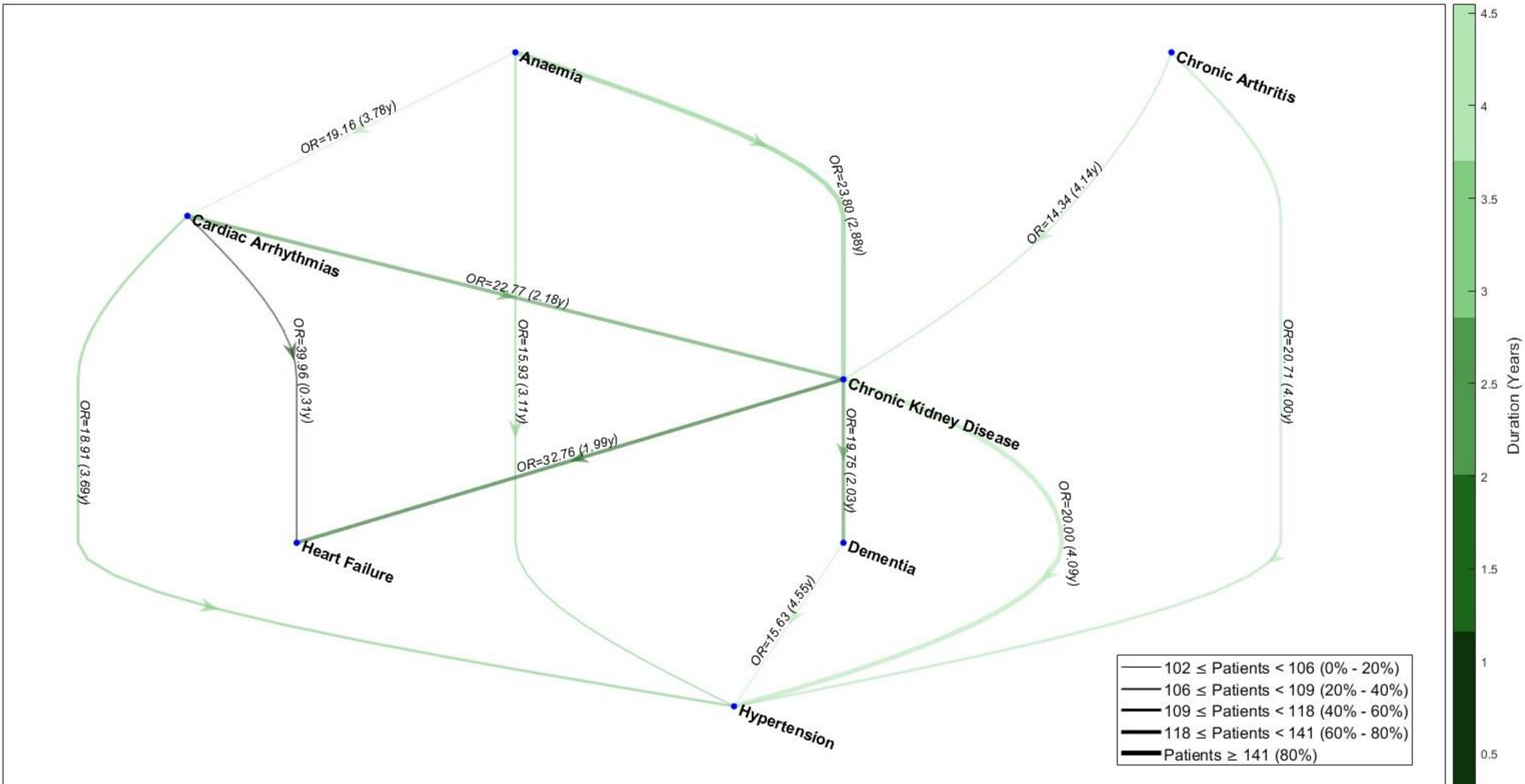
**Univ.:** <https://www.lboro.ac.uk/departments/compsci/staff/georgina-cosma/>

# Training the system

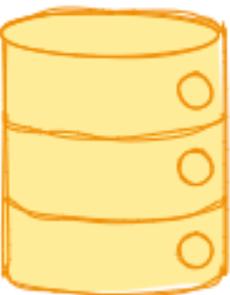


Statistical modelling – Females 45-64

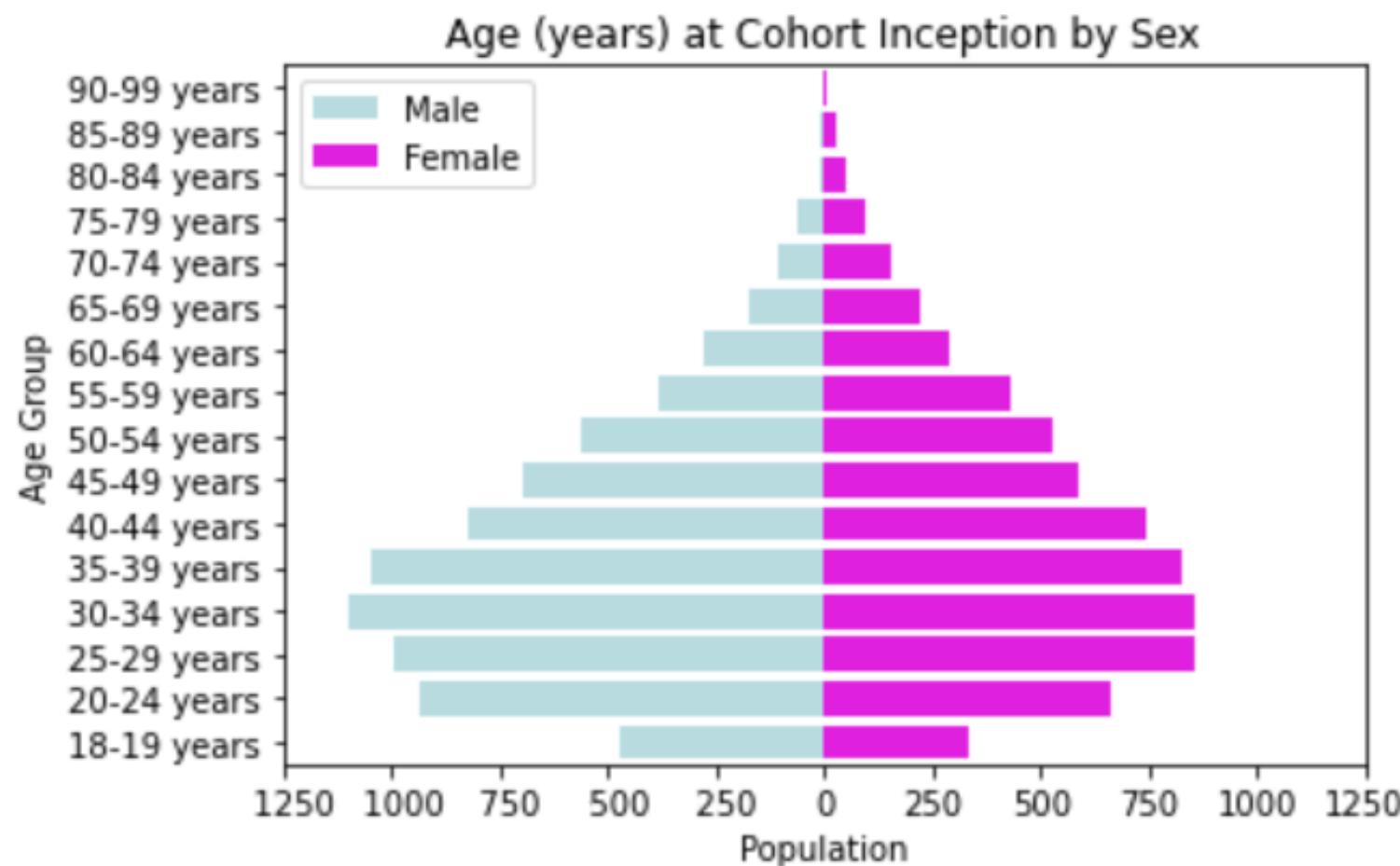




# Patient characteristics



SAIL database  
(Wales)



Characteristics	N (%)
Patients	13,069 (100)
Gender	
Female	6,239 (47.7)
Male	6,830 (52.2)
Age	
<20	684 (5.2)
20-29	2221 (16.9)
30-39	3156 (24.4)
40-49	3096 (23.6)
50-59	2157 (16.5)
60-69	1116 (8.5)
70-79	502 (3.8)
80+	137 (1.0)
Ethnicity	
White	9161 (70.0)
Asian	179 (1.3)
Black	43 (0.3)
Mixed/Other	48 (0.3)
Unknown	3638 (27.8)
Welsh Index of Multiple Deprivation	
1 (most deprived)	3195 (28.6)
2	2582 (23.1)
3	2087 (18.7)
4	1949 (17.4)
5 (least deprived)	1346 (12.0)

# Dataset Preparation

- Reduced the **list of LTCs** from 110 conditions to **40** through thorough review with clinicians.
- Reviewed, corrected, and updated **READ (GP)** and **ICD10 (hospital)** codes.
- Several **duration criteria** were applied to specific conditions to be defined as chronic.
- **Risk factors** list:

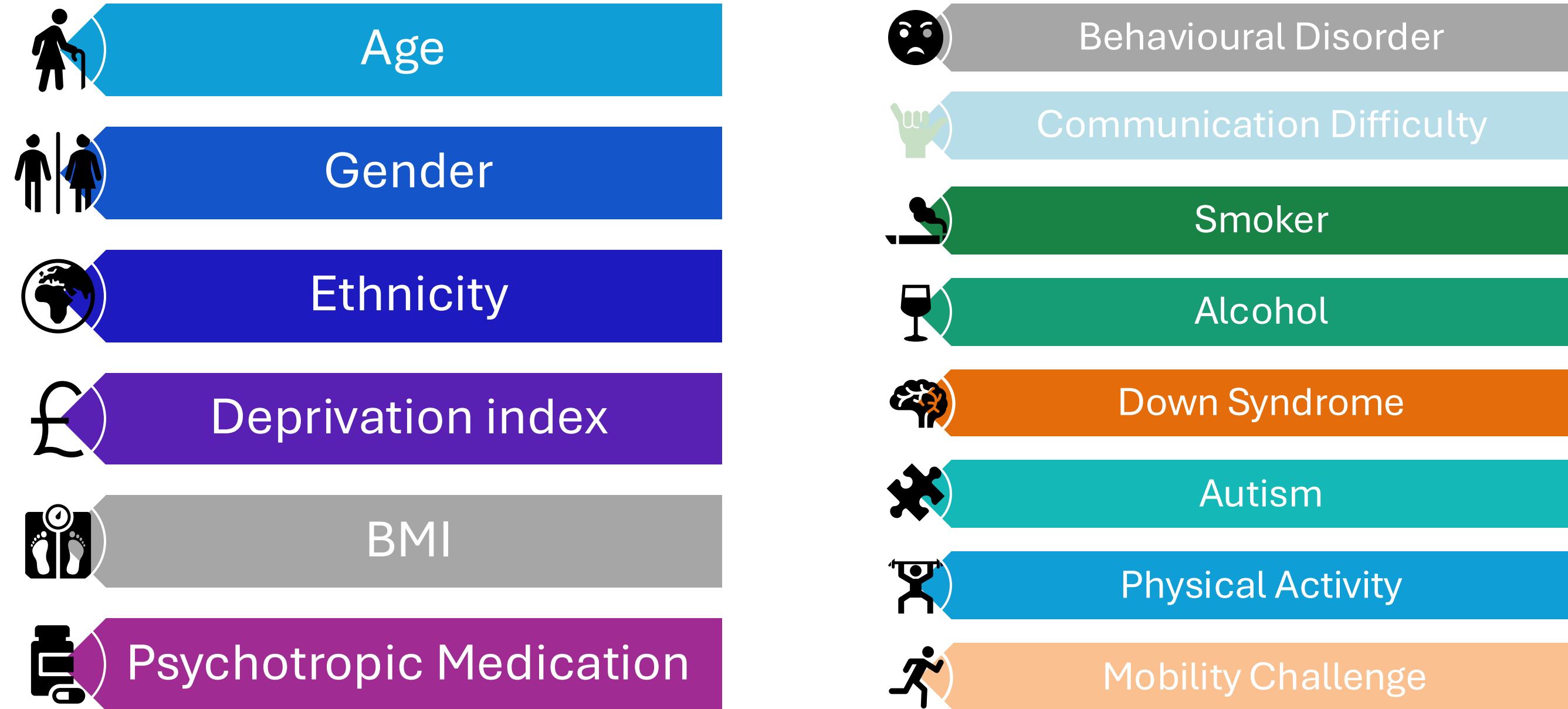
- **Age**
- **Gender**
- **Ethnicity**
- **Deprivation index**
- **Behavioural disorder:**  
Binary (present or not present) [Poorly recorded]

- **Autism:** Binary (present or not present)
- **Weight, height and BMI** [Poorly recorded]
- **Smoking:** Binary (<sup>50</sup>present (current or ex-smoker) and absent (never smoked))
- **Alcohol:** Binary (present or not present)

- **Presence or not of four psychotropic medications:** a) Binary (present or not present); b) Continuous (total number of medications)
- **Physical activity:** Binary (no or limited exercise or has exercise)

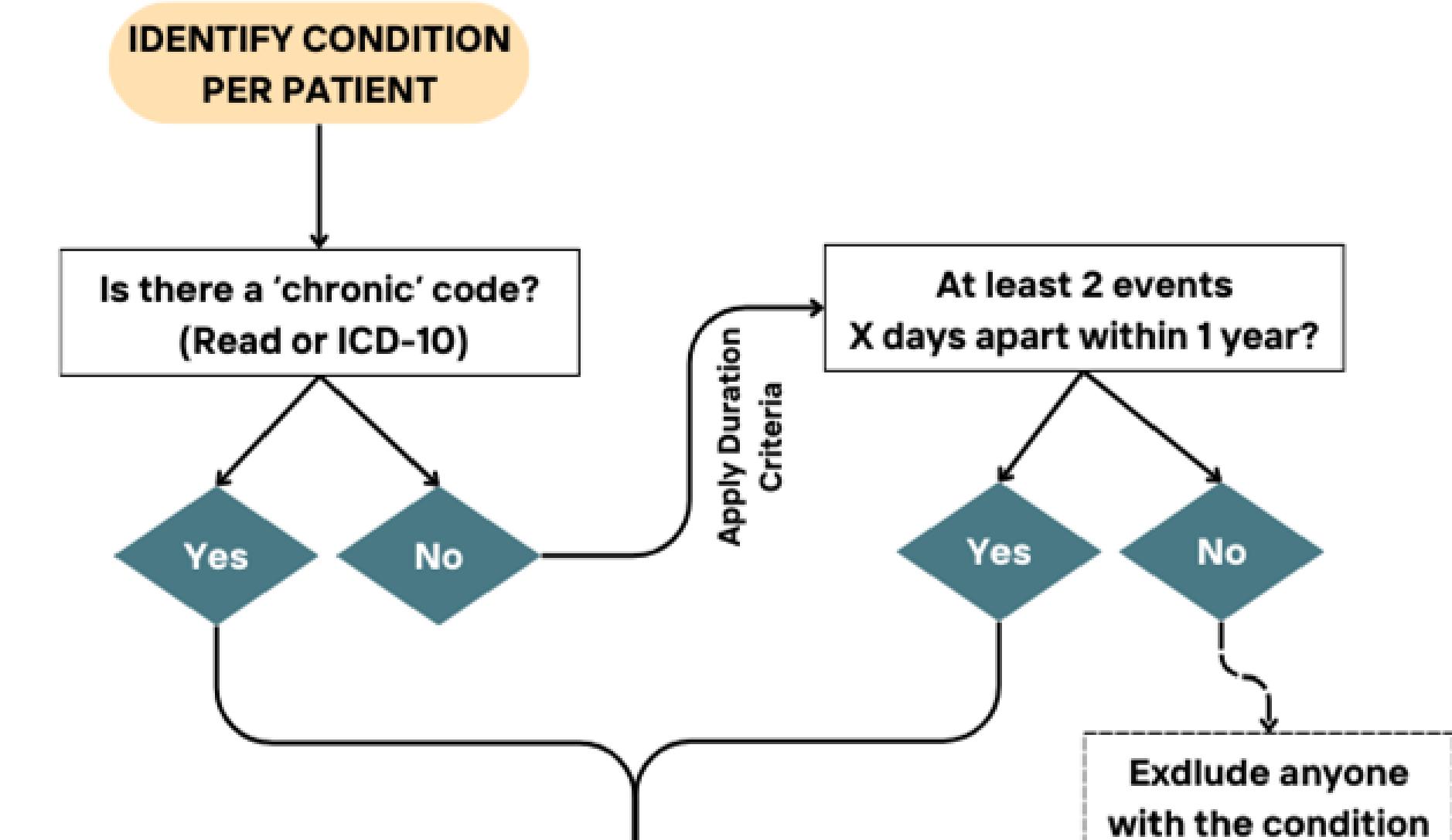


# Risk factors



# What defines a long-term condition?

- **Standard definition:** a long-term condition is a condition that cannot, at present, be cured but is controlled by medication and/or other treatment/therapies.
- **Examples of LTCs** include Diabetes, Hypertension and others.
- For conditions like **constipation, diarrhoea, back pain, and pneumonia** that do not always fall into the **chronic (or long-term)** category, we determine if a condition is considered long-term or chronic assessing its duration.

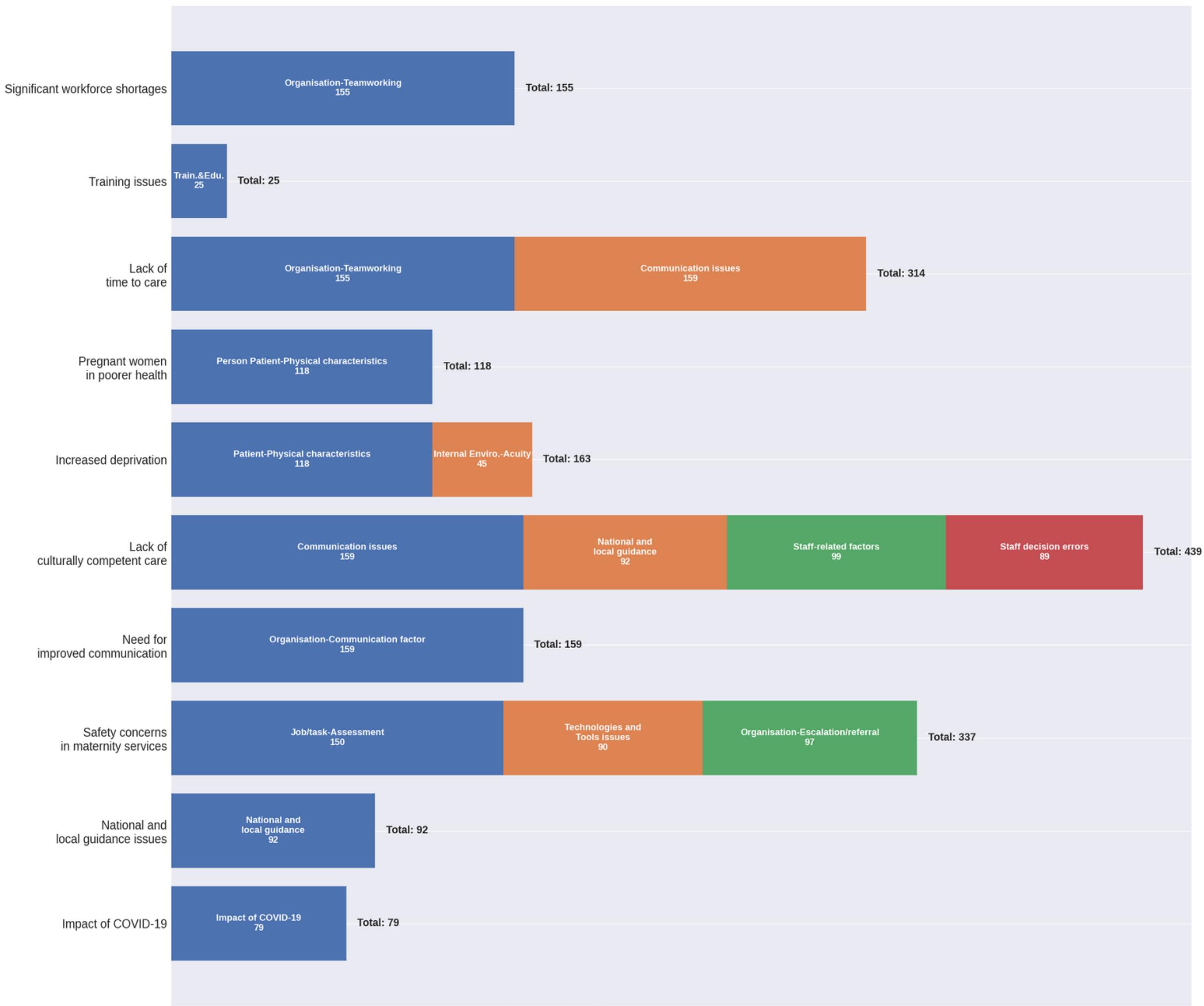


Only Patients Meeting  
Criteria Included



## Our findings mapped to Ockenden's Points

### Ockenden's findings



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