CLINICAL RECORD INTERACTIVE SEARCH

NHS National Institute for Health Research

The CogStack platform: clinical applications and next steps

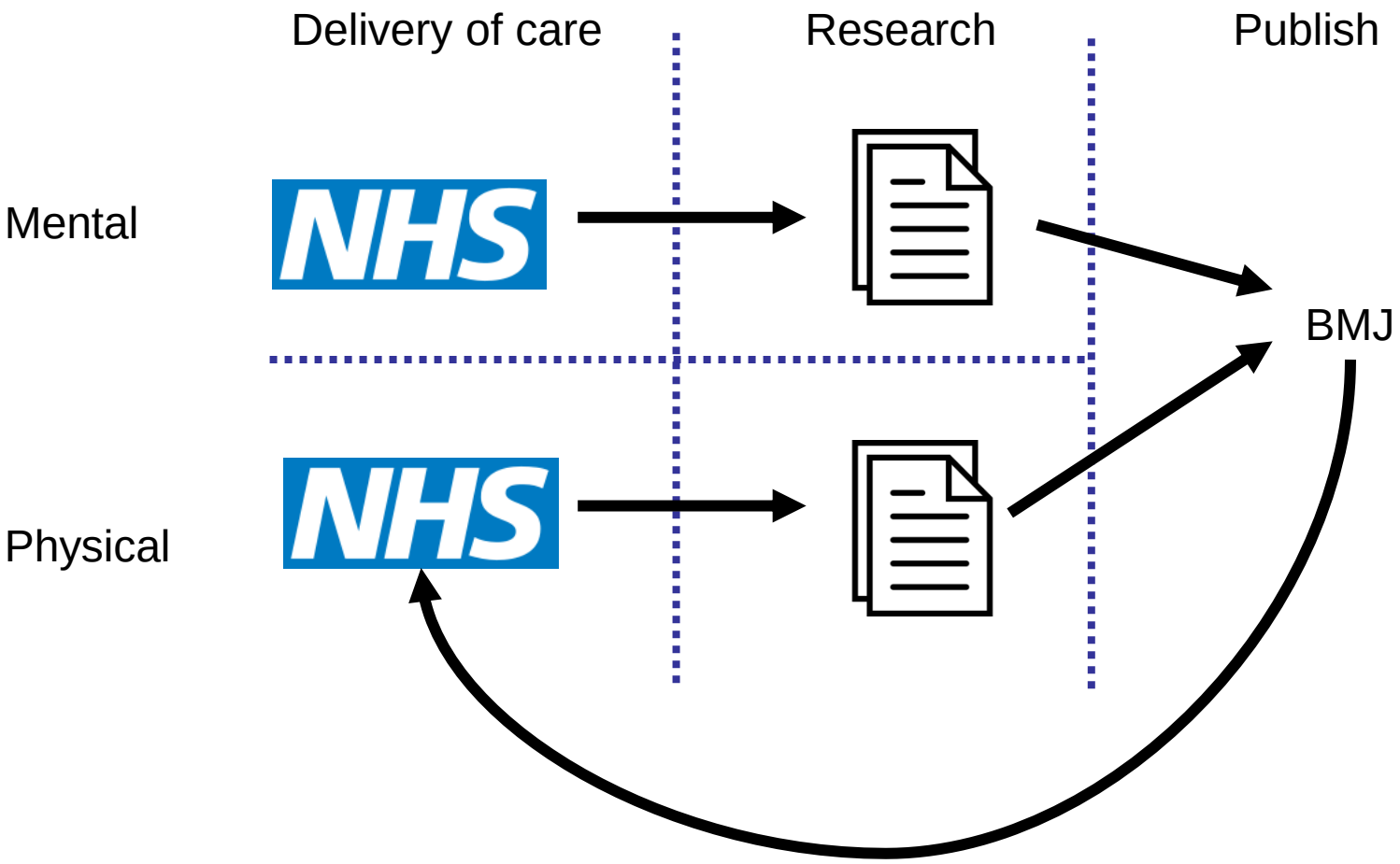
Dan Bean

UKRI Innovation Fellow (KCL/HDR-UK)

Maudsley BRC

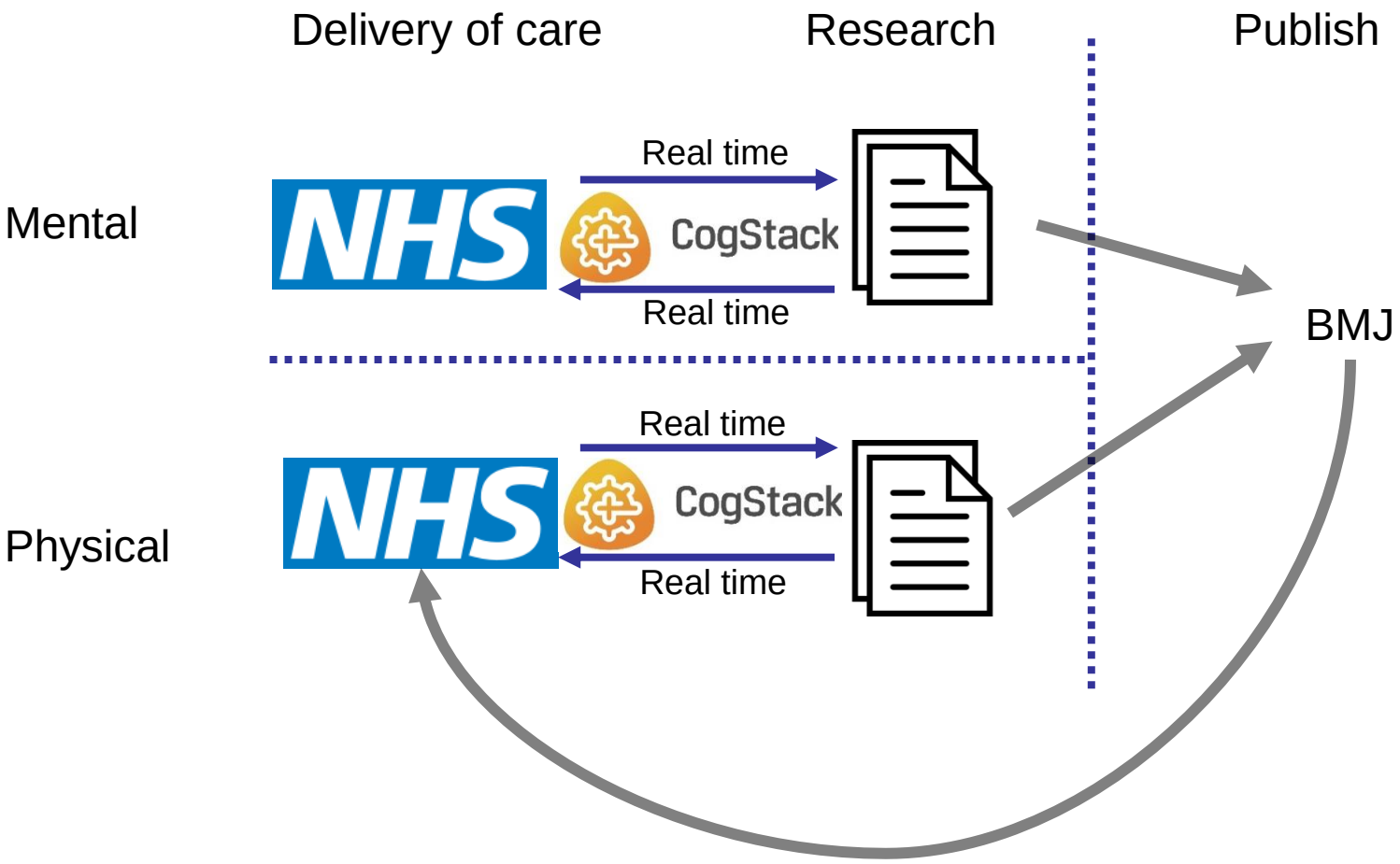
HDRUK

Data flow today



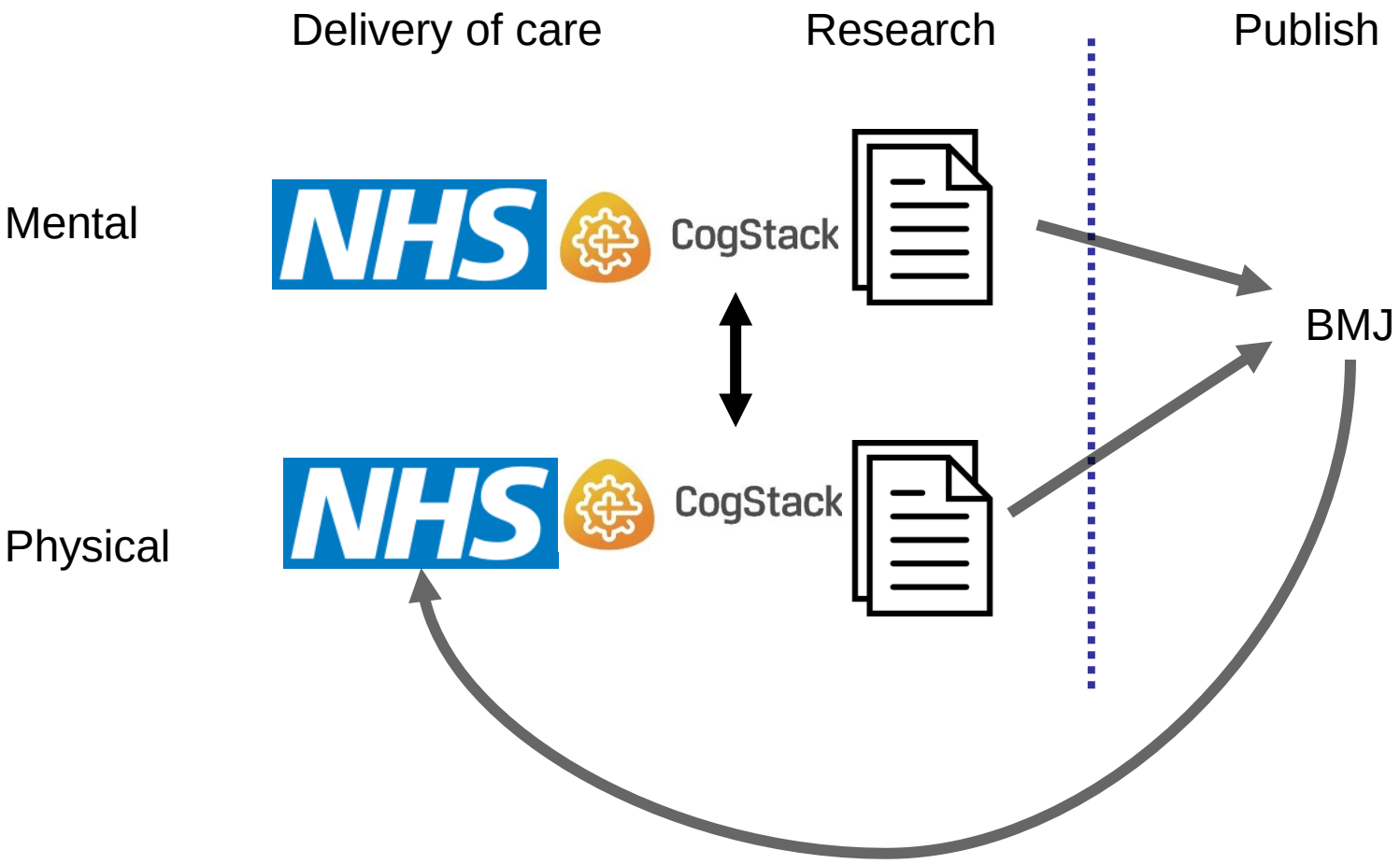
National Institute for Health Research

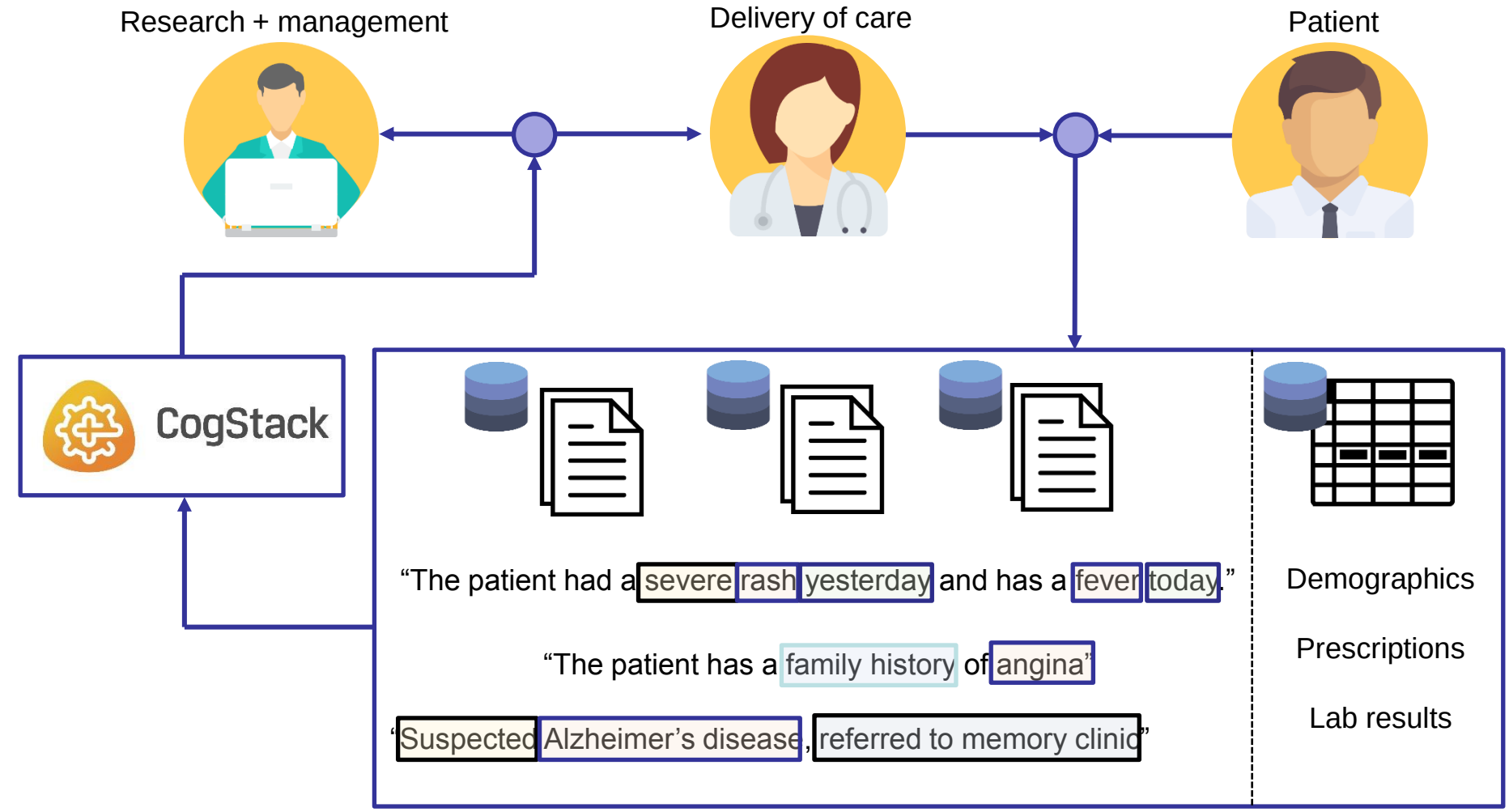
CogStack and HDR-UK



National Institute for Health Research

CogStack and HDR-UK



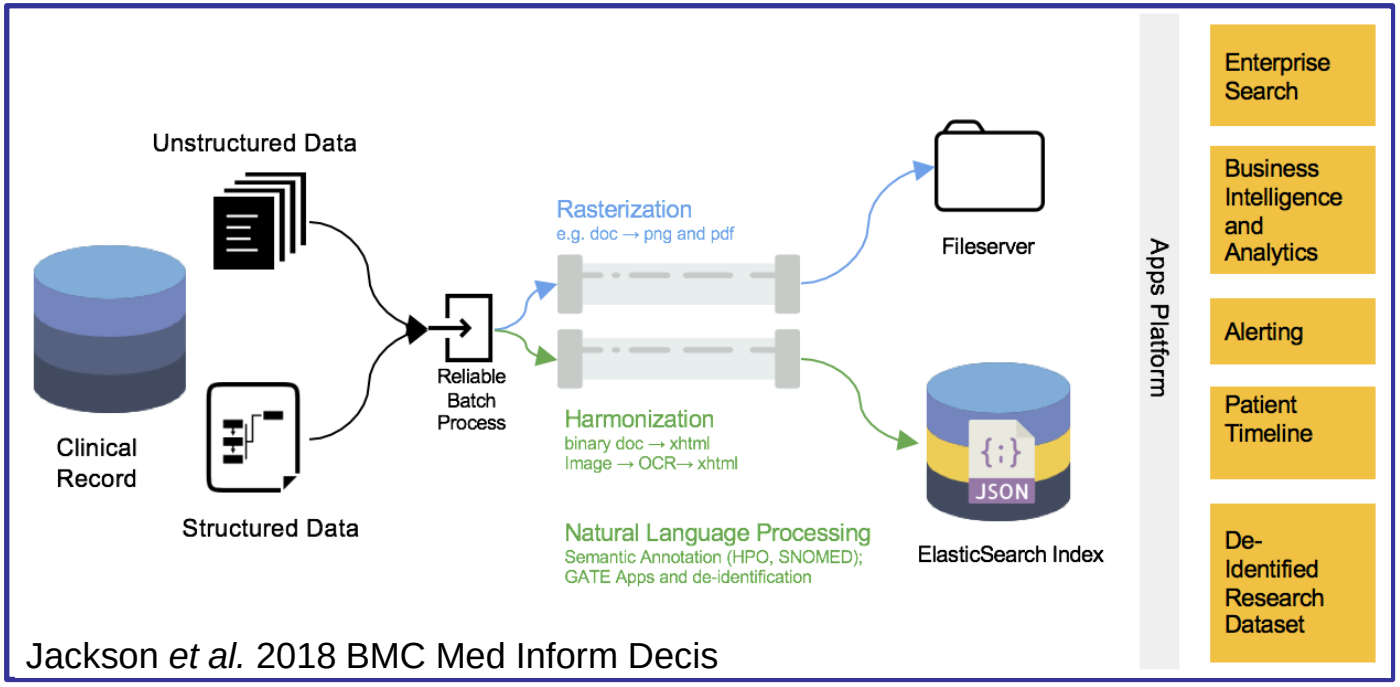

Research + management
Delivery of care
Patient
CogStack
"The patient had a severe rash yesterday and has a fever today."
"The patient has a family history of angina"
"Suspected Alzheimer's disease, referred to memory clinic"
Demographics
Prescriptions
Lab results

CogStack

NHS National Institute for Health Research

Abnormal pathology results for rheumatology patients on Methotrexate
High-CCA antibodies suggesting pre-clinical Rheumatoid Arthritis
Patients being discharged on anticoagulants but not referred to Anticoagulation Clinic

Alerting via Watcher



Jackson *et al.* 2018 BMC Med Inform Decis

Cohorts

Patient flow

Adverse events

Care delivery

Research

Genomics england

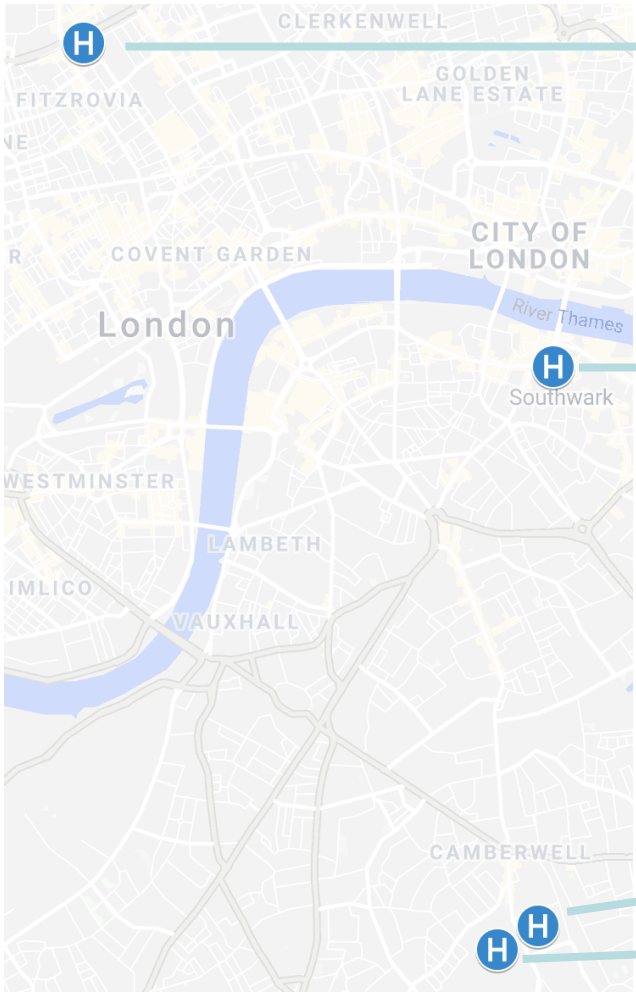
King's College Hospital NHS Foundation Trust

South London and Maudsley NHS Foundation Trust

UCLH NHS

Guy's and St Thomas' NHS Foundation Trust

HDRUK



King's College Hospital

- Most mature deployment
- 15 mins behind live record
- De-identification running in parallel with identifiable record
- 13M free text documents
- 300M observations
- **CRIS-style governance model under review to enable research**

SLaM

- Running now
- 30 mins behind live record
- Identifiable data only (i.e. delivery of care)

National Institute for Health Research

Clinical Applications

Objective	Areas	Data	Scale
Patient flow	Dynamic network	KCH	78,400 admissions
Automatic risk scores	CogStack, SemEHR, Knowledge Graph	KCH	10k patients 6.5 years
Prescribing patterns	CogStack	KCH	10k patients 6.5 years
Adverse drug reactions	ADEPt, Knowledge Graph	SLaM (CRIS)	260k patients
Kidney failure in ICU	SemEHR, Knowledge Graph	MIMIC-III UCLH	44k admissions
Blood cancer subtyping	NLP, Graph	KCH	100s patients

National Institute for Health Research

Audit example – Heart Failure

Extract medical history

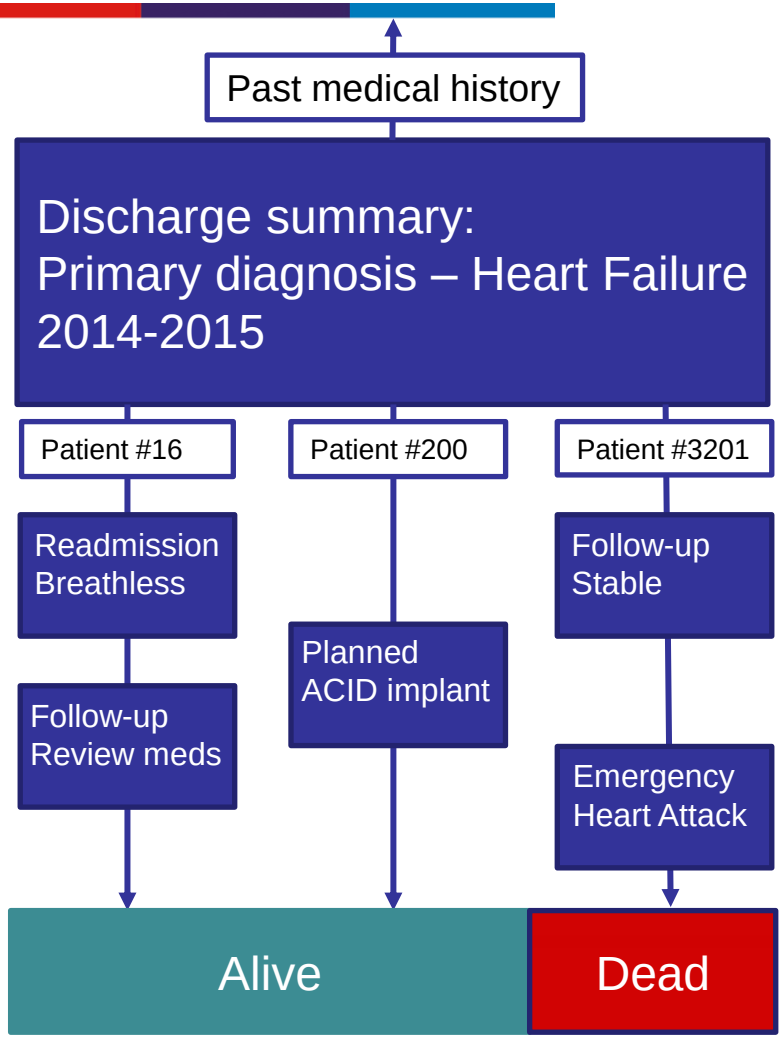
Cohort selection

Baseline data extraction
Procedures
Comorbidities
Medication

Electronic follow-up

2 years
Secondary outcomes

Primary outcome



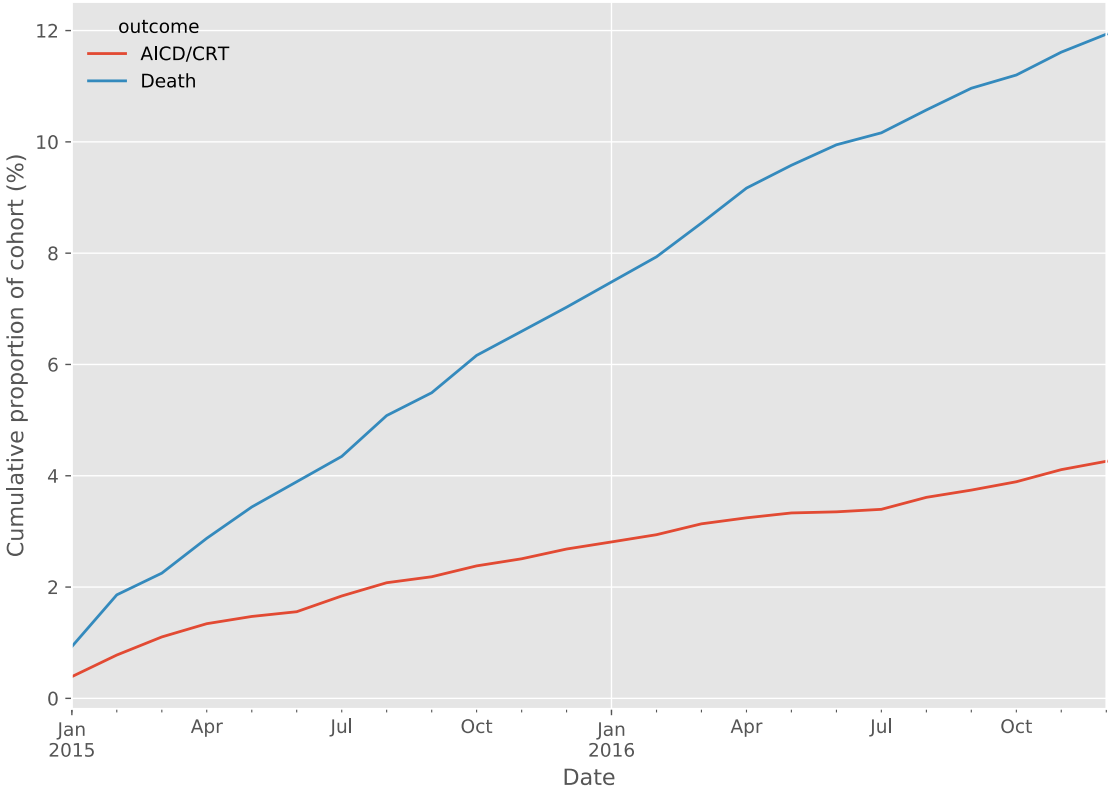
National Institute for Health Research

Audit example – Heart Failure

HF patients 2014-15
4625 patients

Follow up 2016/01– 2017/12
10,709 documents
12 with AICD implanted (0.26%)
187 with CRT implanted (4.04%)
552 died (11.27%)

Unstructured routine data to cohort
Total time: 3 hours



National Institute for Health Research

Atrial Fibrillation - Motivation

- Atrial Fibrillation (AF) is a heart condition causing an irregular heart rate
- Affects approx. 1m people in the UK
- AF patients have 5x higher stroke risk
  - AND stroke more likely to be fatal
  - 20% of strokes linked to AF
- Calculate stroke risk with CH_2DS_2-VASc score
- Stroke risk is effectively managed by oral anticoagulants (OAC)
- OAC known to be underutilized in primary care and research cohorts
  - No real idea of what's happening in secondary care

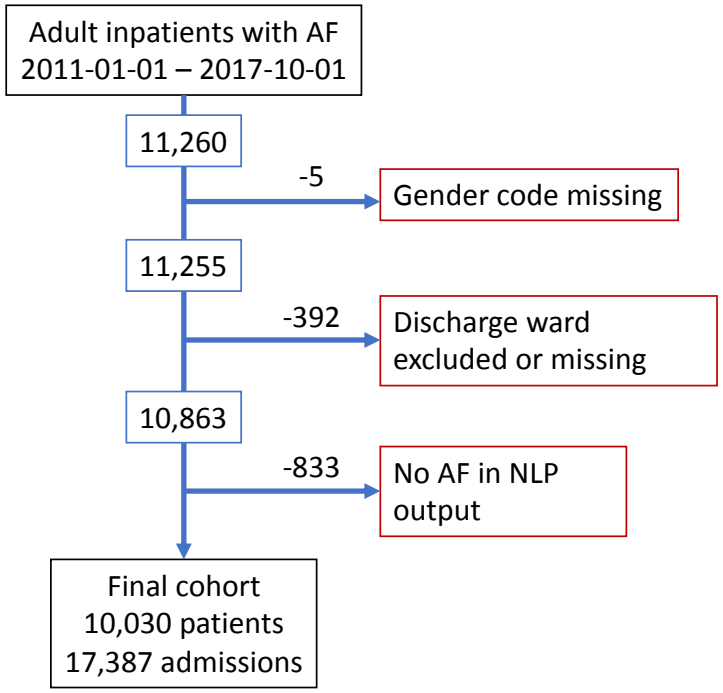
National Institute for Health Research

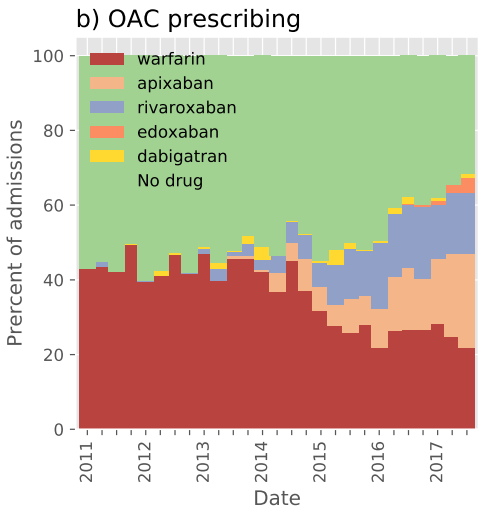
Atrial Fibrillation - Questions

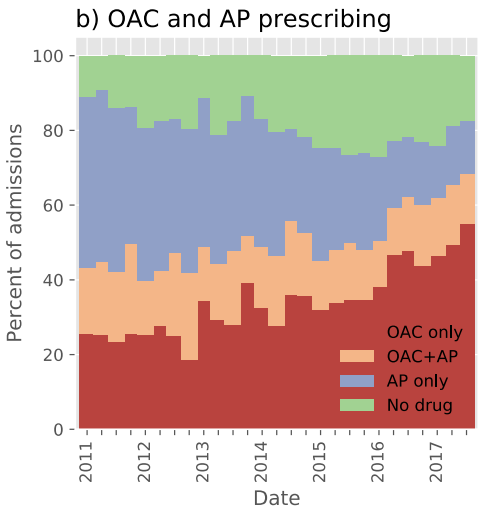
- What proportion of AF patients are being prescribed an OAC
- Has that proportion been affected by the introduction of new drugs?
- What features are associated with prescribing?
- Could the proportion be improved somehow?
  - If the ~40% of AF patients not taking OAC are all contraindicated then there's no point pushing OAC prescribing

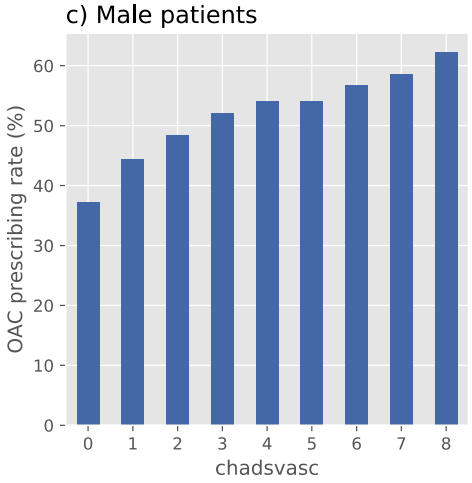
National Institute for Health Research

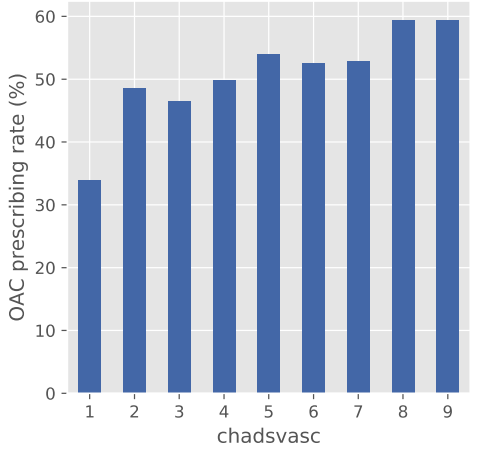
OAC Prescribing





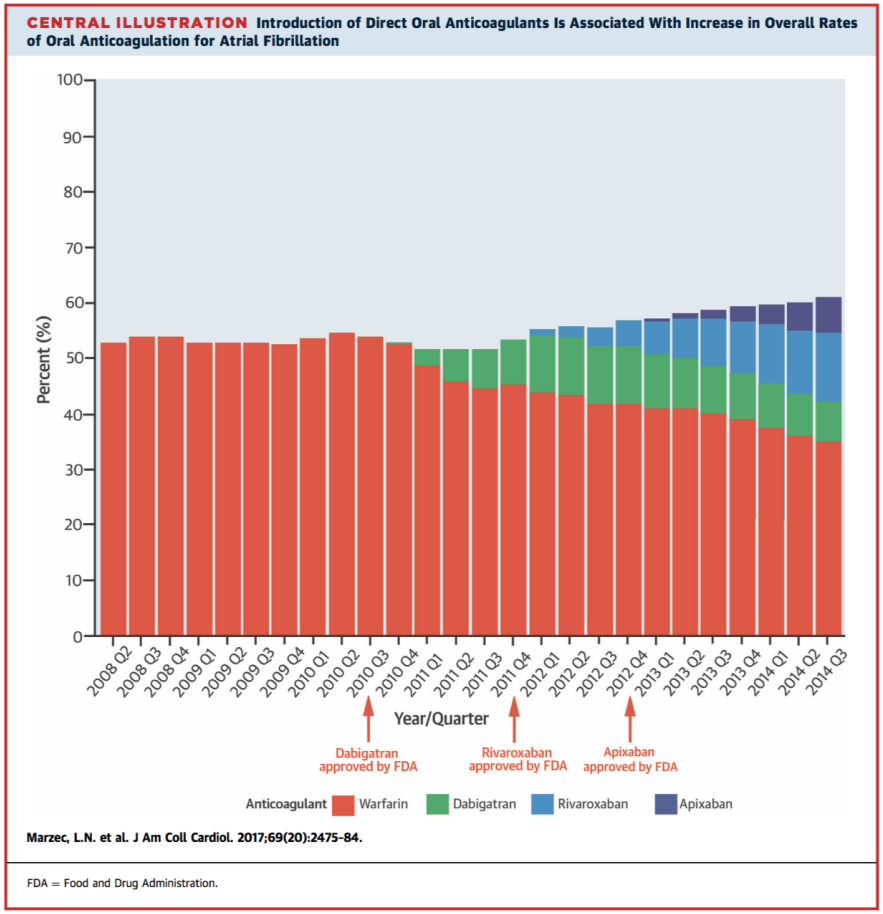


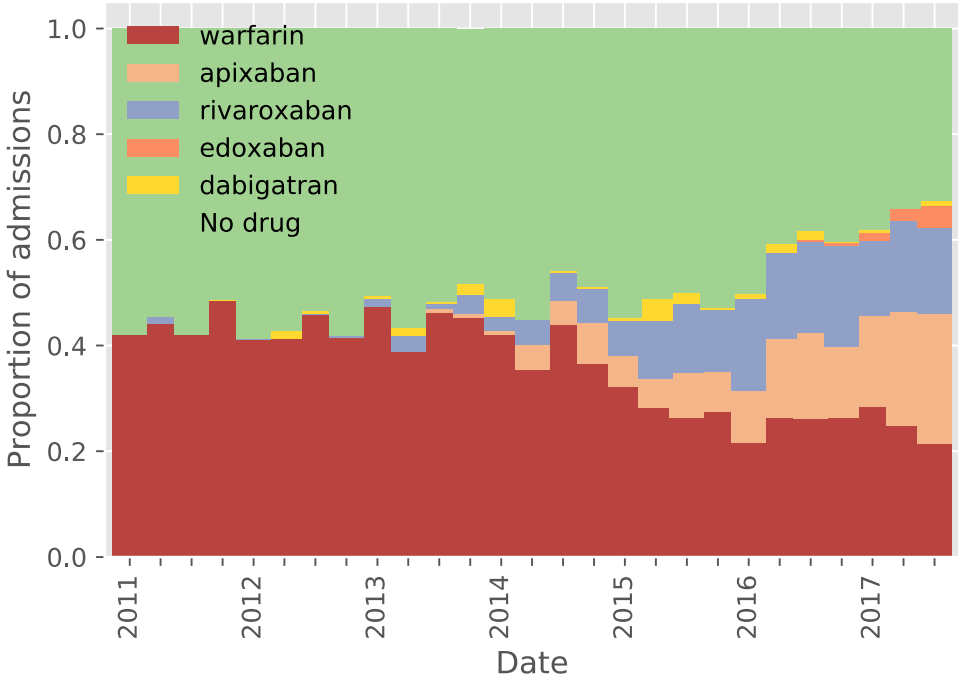




National Institute for Health Research

Routine vs. registry





KCH routine free text data
10,030 AF patients with CHA2DS2-VASc score > 1

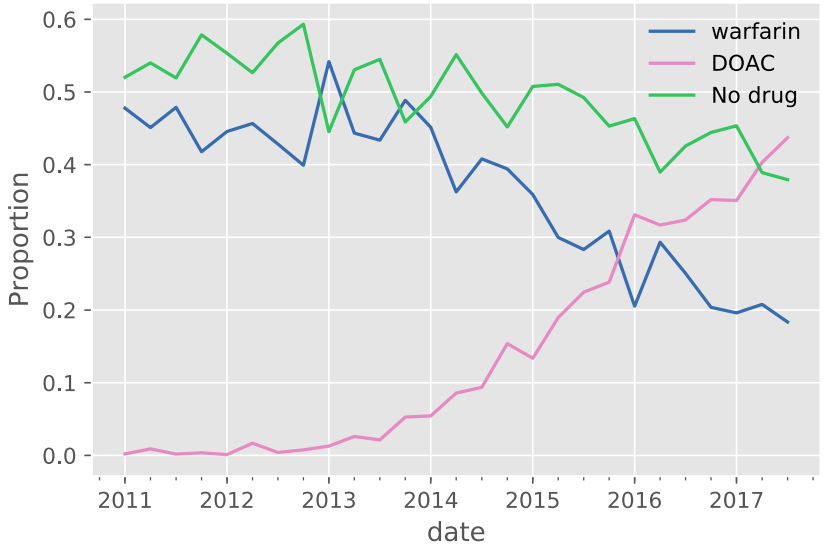
Marzec *et al.* 2017
National Cardiovascular Data Registry PINNACLE registry
655,000 patients with nonvalvular AF and a CHA2DS2-VASc score of >1

National Institute for Health Research

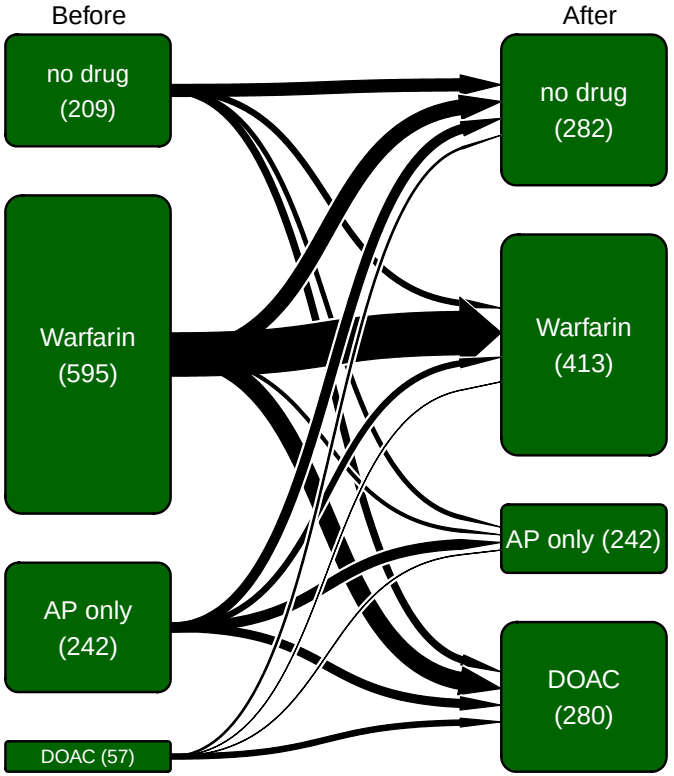
First medication

Updated 2014 NICE guidelines recommend DOAC over warfarin for stroke risk management in AF

First medication for new AF cases in KCH, 2011-2017



Medication switching for existing cases



Thanks

CogStack Team

PHIdatalab (KCL/UCL)

Richard Dobson

Amos Folarin

Angus Roberts

Lucasz Roguski

Hegler Tissot

Honghan Wu

SLaM

Robert Stewart

KCH

Clive Stringer

James Teo

Atrial Fibrillation

KCH

Paul Scott

James Teo

Ajay Shah

Ricardo Olivera

Raj Patel

KCL

Honghan Wu

Rebecca Bendayan

Richard Dobson