An Industry perspective on Big Data

From Genomics to Big Data to Real World Data

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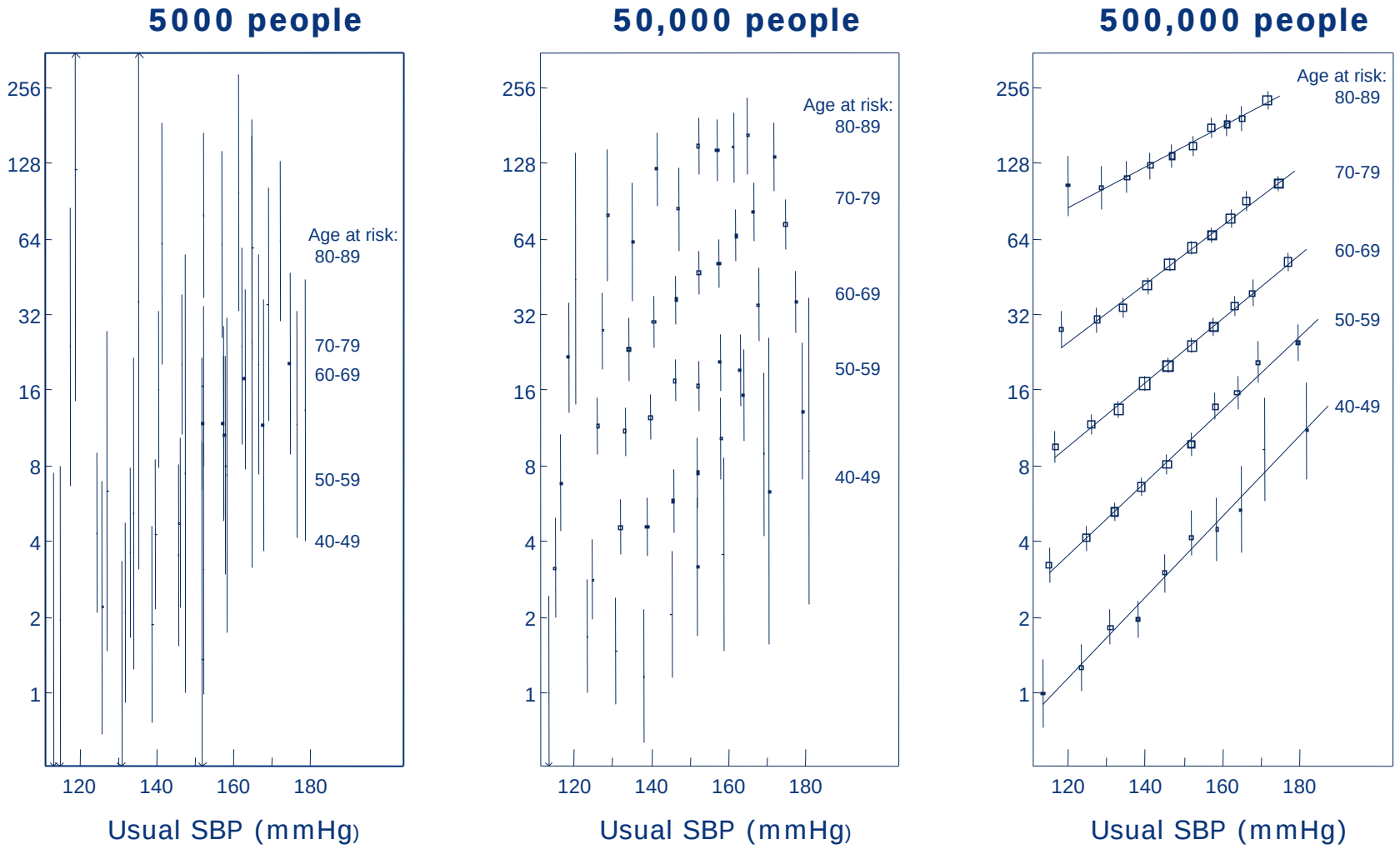
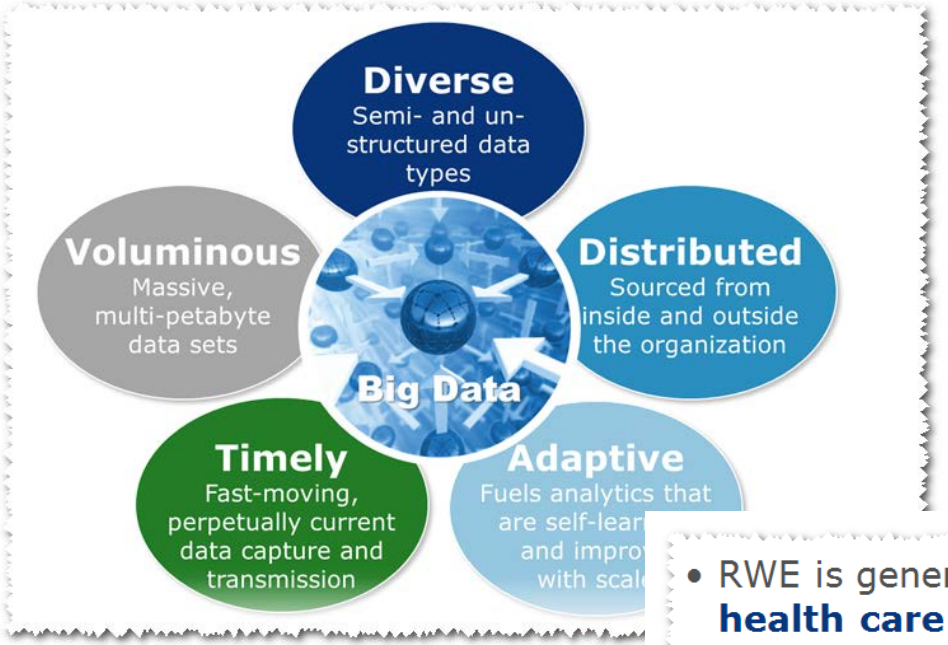
Power in numbers …



The Prospective Studies Collaboration: Lewington et al. 2002

Big data vs Real World Data



- RWE is generated using data typically collected in **usual health care settings**. RWE is most commonly **generated using a range of non-interventional (observational) studies**, including:
  - **Primary data** collections such as **registries** collecting prospective and/or retrospective data, or **surveys** collecting cross-sectional or retrospective information.
  - Analyses of **secondary data that includes (electronic) medical records, insurance claims data, and government databases** which provide data typically used for retrospective analyses.

Big Data offers value to the pharma industry

Research	▪ In silico target screening ▪ Genomic diagnostics ▪ Toxicity prediction
Development	▪ Trial simulation ▪ Patient recruitment ▪ Trial design ▪ Asset prioritization ▪ Competitive insights ▪ Unmet need ▪ Reimbursable dossier development
Market Access	▪ Formulary/ protocol negotiation ▪ Value-based pricing ▪ Payor collaboration (e.g., patient selection, adherence)
Medical	▪ Safety monitoring ▪ Targeted physician/ patient education
Operations	▪ Quality analytics ▪ End-to-end supply chain forecasting/ planning ▪ Externalization ▪ Distribution channel strategy

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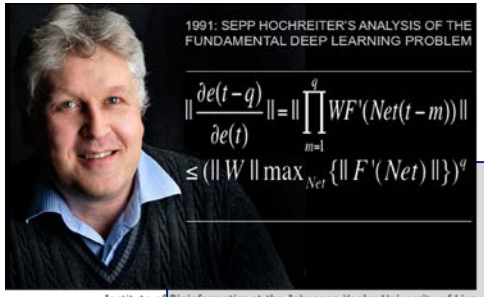
Discovery → Development → Launch / Post-launch

Machine Learning Chemogenomics: leveraging approaches from other industries



Internet re-salers

Product descriptors

Known affinity for products

Machine learning

Predicted affinity to customers

Suggest to customer

Chemo-genomics

Compound descriptors

Known affinity for targets

Machine learning

Predicted affinity for targets

Suggest for screening

THE NETFLIX-IZATION OF DRUG DISCOVERY

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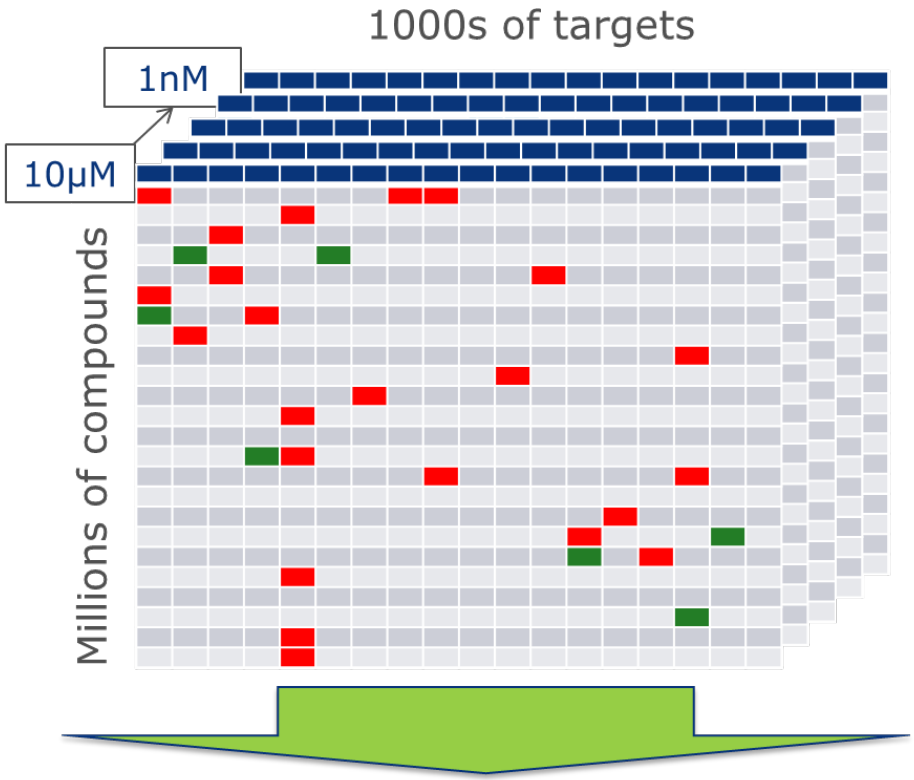
>100M data points with biochemical activities of tested compounds available for training

ABCD
GOSTAR
GVK BIO Online Structure Activity Relationship Database
THOMSON REUTERS
ChEMBL
OpenTox

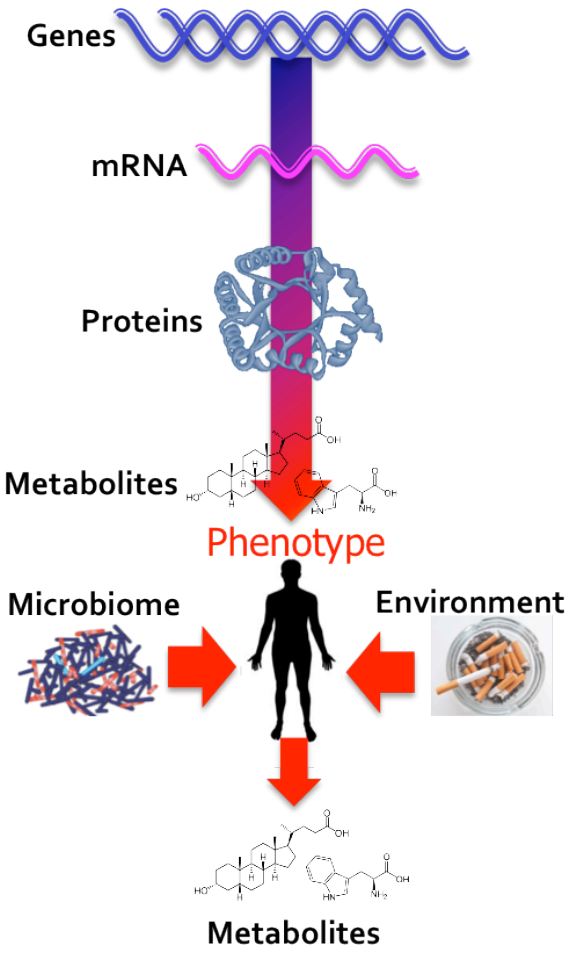
>100M training points



Identify and select compounds with good biochemical activity for target(s) of interest.

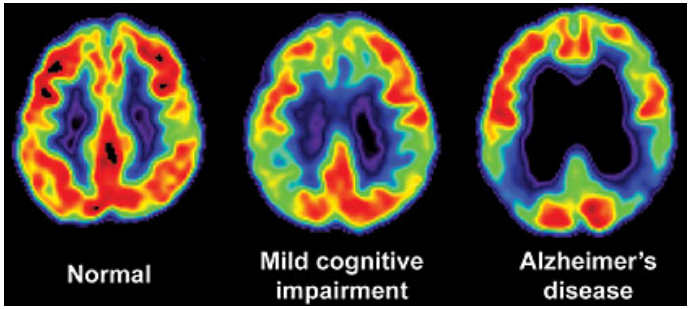
THE NETFLIX-IZATION OF DRUG DISCOVERY

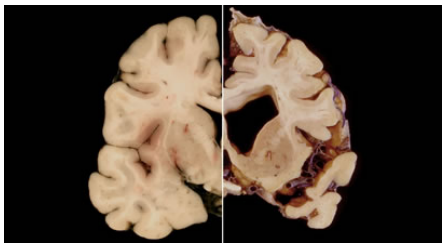
Multi-omics – search for the needle



Public-private collaborations, e.g.

- EMIF-AD
- DP-UK
- UK BioBank
- Multiple cohorts





EMIF project overview

ACADEMIC PARTNERS

SME PARTNERS

EFPIA PARTNERS

PATIENT ORGANISATION

- 57 partners from 14 European countries
- €56 million worth of resources
- Three projects in one

EMIF-Metabolic

Identify predictors of metabolic complications in obesity

EMIF-AD

Identify predictors of Alzheimer's Disease (AD) in the pre-clinical and prodromal phase

EMIF-Platform

Develop a framework for evaluating, enhancing and providing access to human health data across Europe, support EMIF-Metabolic and EMIF-AD (the specific topics below) as well as support research using human health data in general

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Data available through consortium

Primary care data sets | Hospital data | Administrative data | Regional record-linkage systems | Registries and cohorts (broad and disease specific) | Biobanks

Data is available from more than
40 million subjects from seven EU countries

EMIF creates a network that supports a flow from:

Data Discovery
→ Data Assessment
→ Data Reuse

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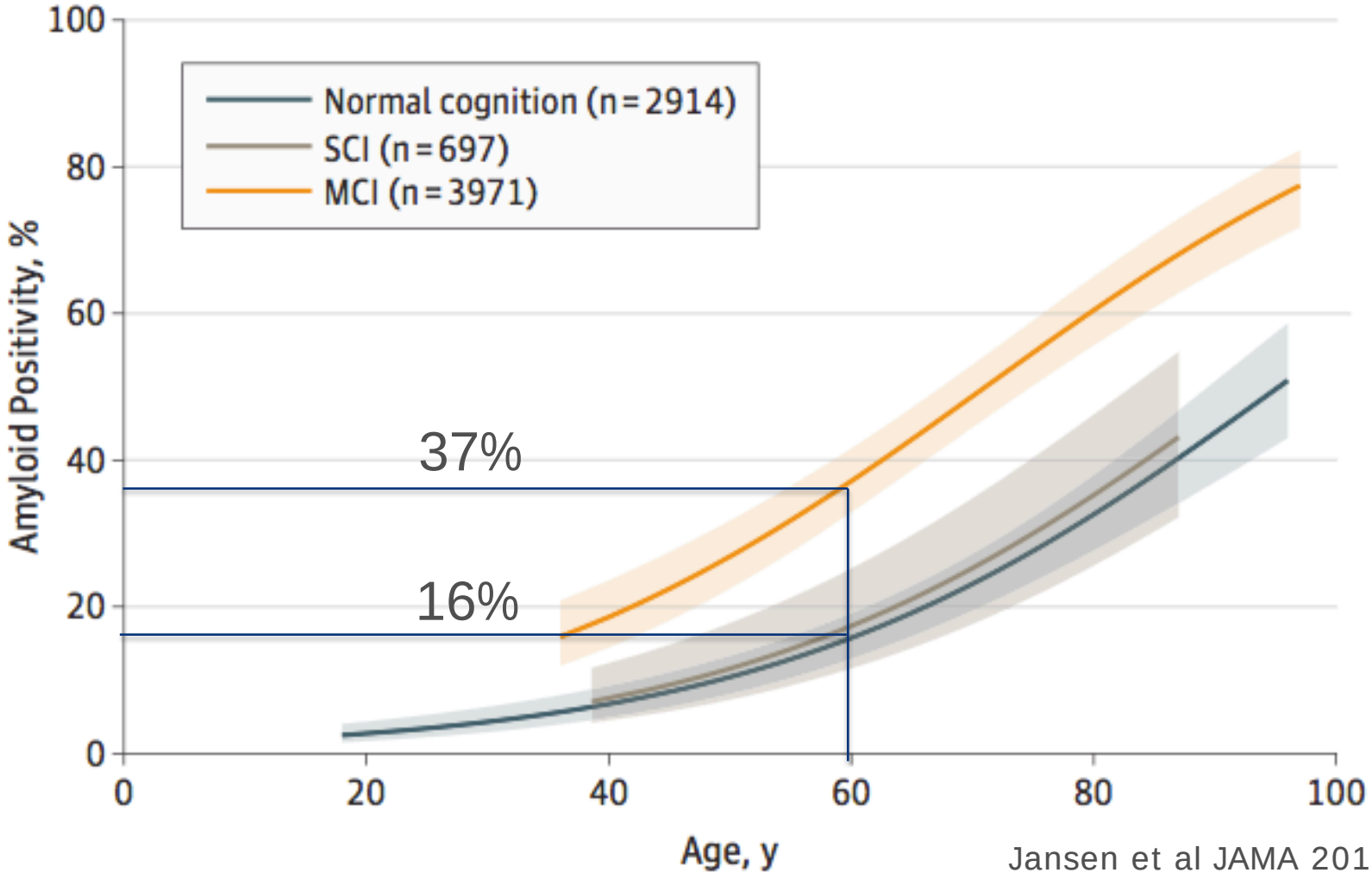
Prevalence amyloid positivity



Jansen et al JAMA 2015

Big challenges in clinical development

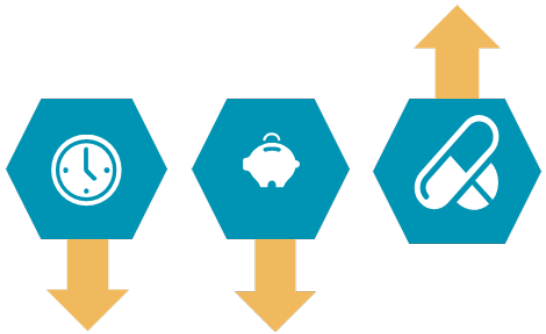
Only 18% in Europe, and 7% in the US complete their enrolment on time.

Almost 50% of all trial delays caused by patient recruitment problems

50% of today's clinical trials fail to achieve the target recruitment

1/3 of protocol amendments are avoidable, at a cost of $0.5m

Potential for the use of
Real World Data



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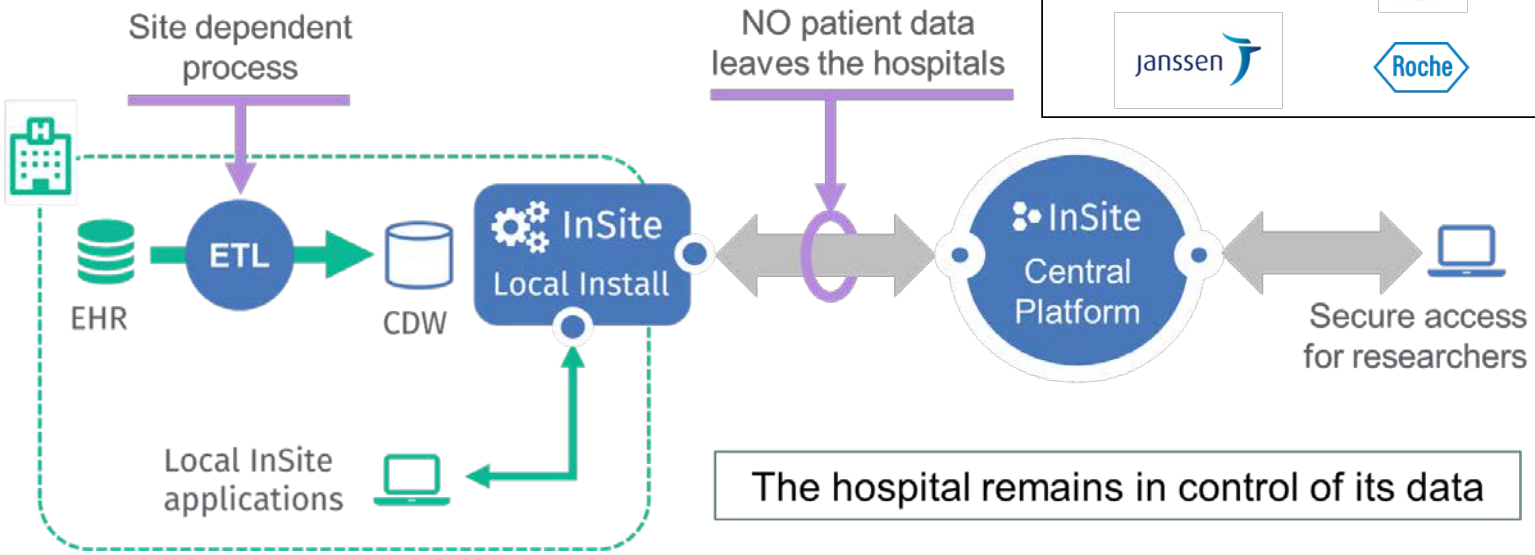
Creating a network of hospitals

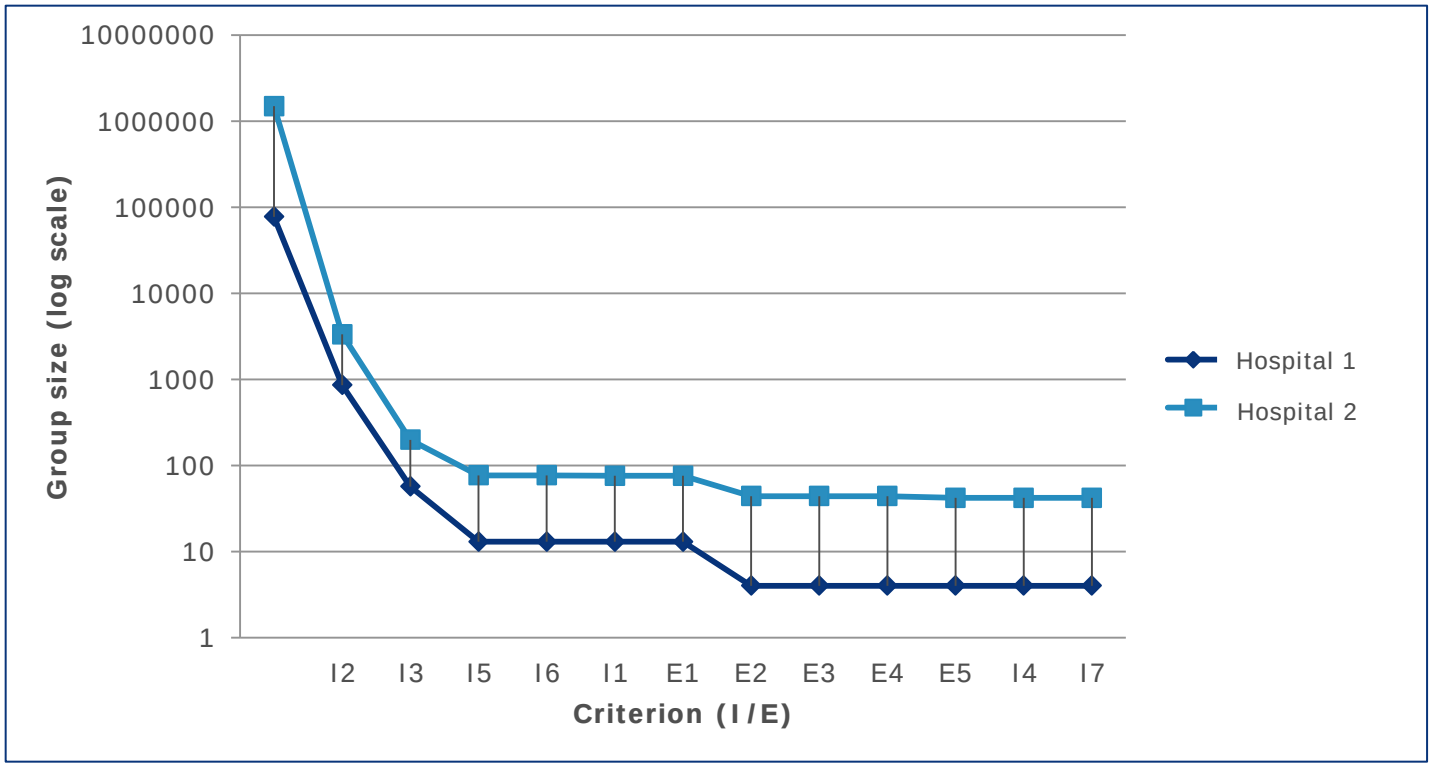
- The Electronic Health Record For Clinical Trials project - **EHR4CR –** was accomplished within IMI and aims at improved access to hospital clinical information for optimizing clinical trials

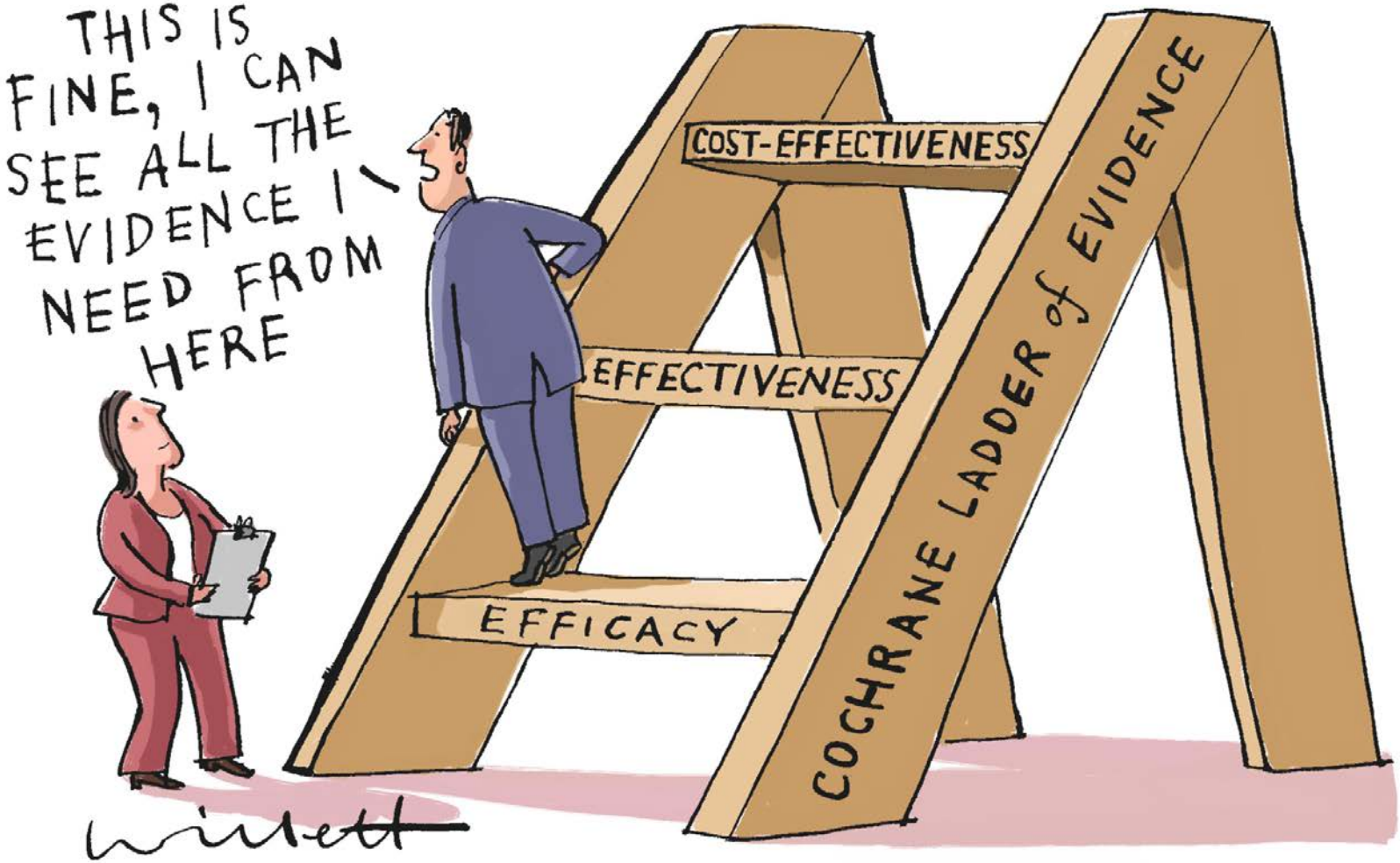
- Janssen participates in the **EHR4CR Champion Program**, with 7 other EFPIA Partners in 2016



Estimating study feasibility

Number of matches after each consecutive criterion has been applied




THIS IS FINE, I CAN SEE ALL THE EVIDENCE I NEED FROM HERE
COST-EFFECTIVENESS
EFFECTIVENESS
EFFICACY
COCHRANE LADDER of EVIDENCE
willett

RWE is incrementally gaining importance for required drug evidence package

Wave 1 : Safety and Efficacy (RCTs with placebo controls)

1938 FDA safety requirement

1948 1st RCT in UK

1962 FDA efficacy requirement

First regulated components of evidence *required to register a drug; remaining the main components of a drug evidence package but now* ***need to be complemented by additional evidence***

Wave 2 : Reimbursement (Standard of care comparison)

1988 CMS effectiveness initiative

1999 NICE

2003 US CER investment

2004 IQWIG

Pressure on health care budget and multiplication of drugs for same indications created need for extra evidence: Demonstrating the ***improvement a drug represents versus standard of care***

Wave 3 : Real World Outcomes (RWE)

1986 US outcomes research

1990 Evidence-based medicine publications

2009 Mini sentinel

2011 PCORI

2014 EMA adaptive licensing

Increased complexity requiring ***addition of evidence collected in routine practice***

RWE as complementary element to RCTs for required drug evidence package

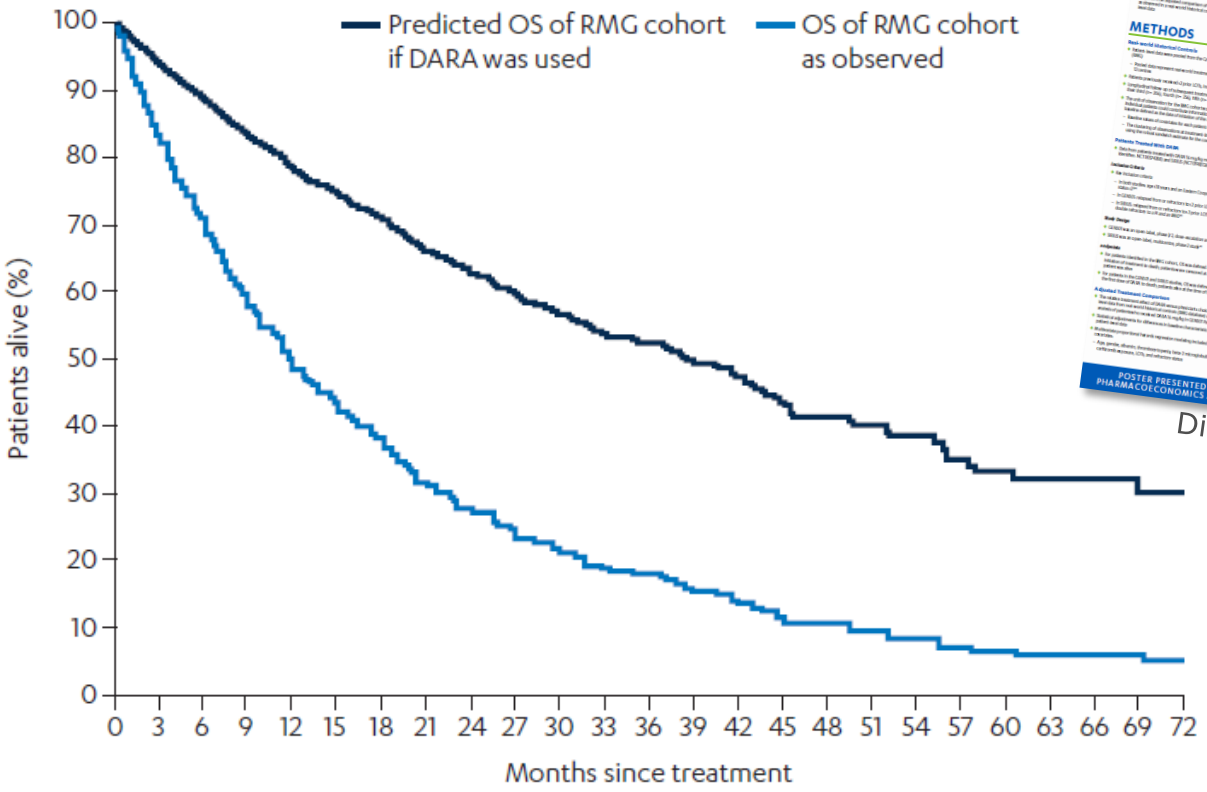
Alternative Pathways

The Challenges That Need to Be Addressed in MAPPs

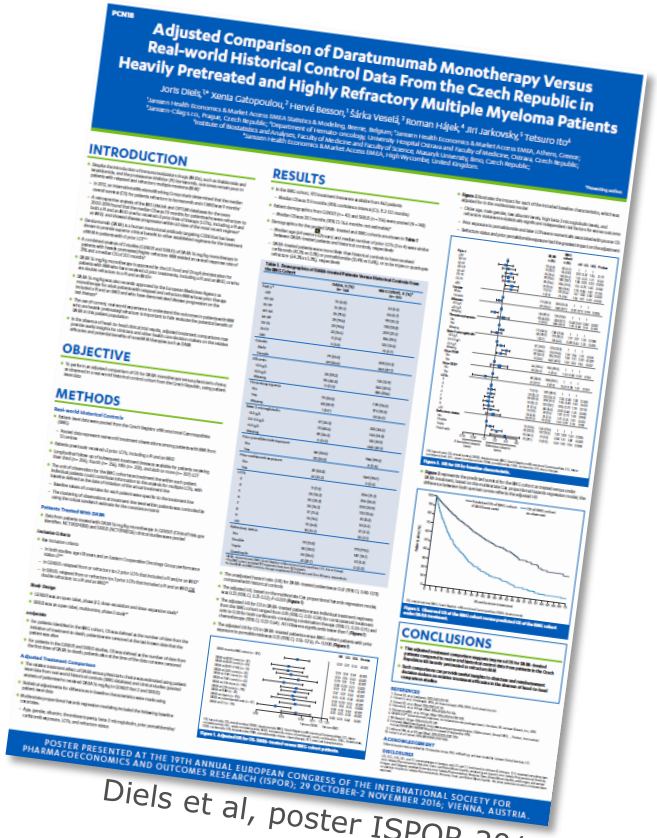
- The MAPPs concept, involving earlier access for (some) patients with more limited data will not be acceptable for some stakeholders
- Smaller patient subpopulations will make it difficult to achieve sustainability for both the research enterprise and healthcare payers
- Payer willingness to accept the MAPPs concept with early access and initially limited data is likely to be poor
- MAPPs may find uneven acceptance across EU member states (e.g. Eastern versus Western EU member states)
- It may be politically difficult to remove a drug from the market or restrict payment should the initial benefit risk balance or value proposition not be confirmed post approval
- MAPPs may present specific challenges for orphan drugs in light of the EU orphan legislation (e.g. the concept 'significant benefit' which is unique to orphan designations)
- Perception that MAPPs entails a shift from evidence generation by way of RCTs to observational studies which have lower evidence standard(s)
- MAPPs may cause extra work for regulators, HTA bodies, and payers

Daratumumab case

Using RWD to build a case for regulatory approval – predictive survival model



OS, overall survival; RMG, Czech Registry of Monoclonal Gammopathies; DARA, daratumumab.


Adjusted Comparison of Daratumumab Monotherapy Versus Real-world Historical Control Data From the Czech Republic in Heavily Pretreated and Highly Refractory Multiple Myeloma Patients

INTRODUCTION

OBJECTIVE

METHODS

RESULTS

CONCLUSIONS

POSTER PRESENTED AT THE 19TH ANNUAL EUROPEAN CONGRESS OF THE INTERNATIONAL SOCIETY FOR PHARMACOECONOMICS AND OUTCOMES RESEARCH (ISPOR); 29 OCTOBER-2 NOVEMBER 2016; VIENNA, AUSTRIA.

Diels et al, poster ISPOR 2016

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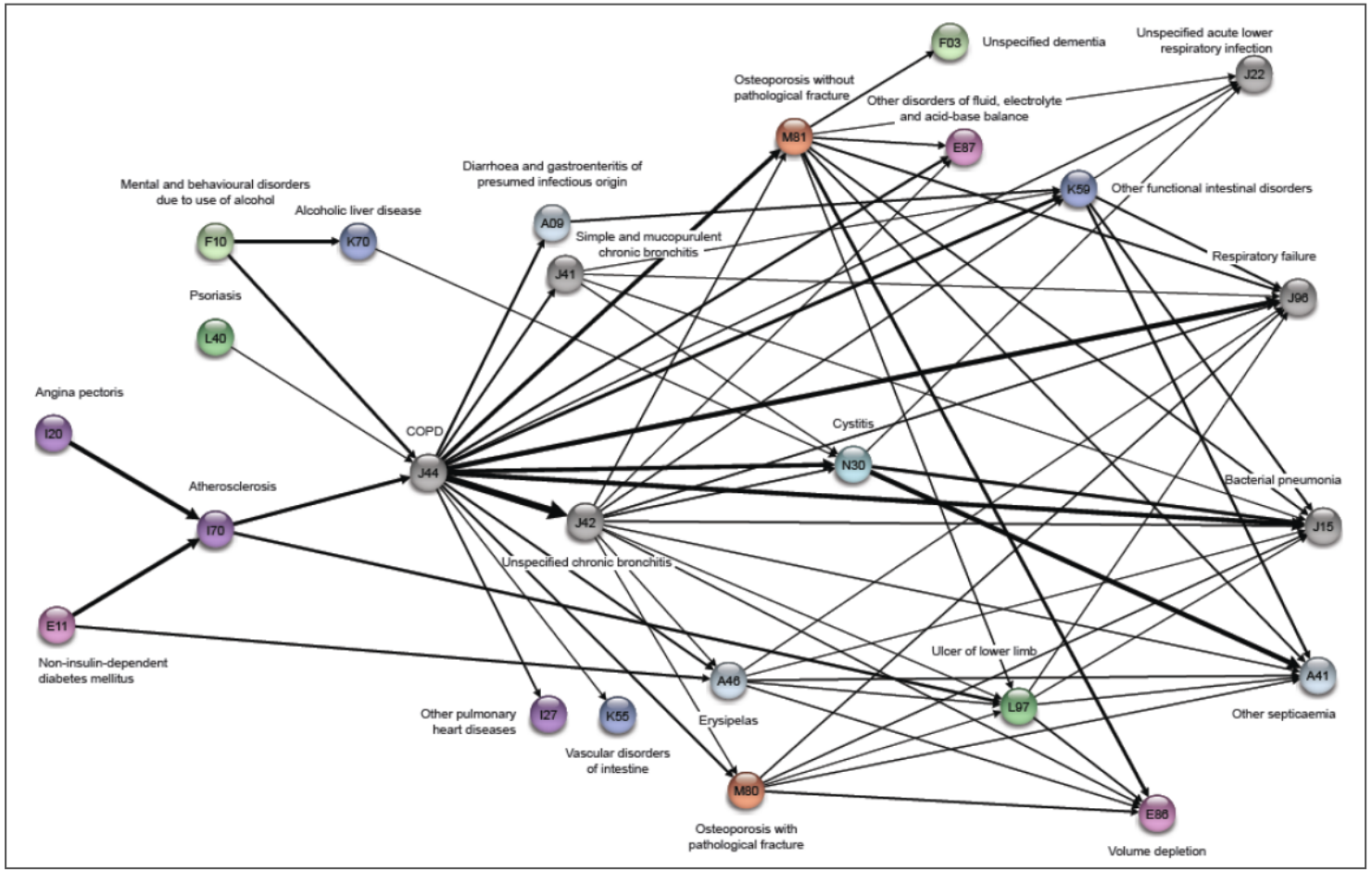
Novel analytical methods – gaining new insights



AB Jensen et al., Nature Comm., 2014

Conclusions

- Big data offers opportunities along the full product life cycle
- Specific analytical skills and methods are required
- Analysis and approaches to big data need to take patient / subject privacy challenges into account
- Federated approaches can help to mitigate privacy challenges

Questions ??

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