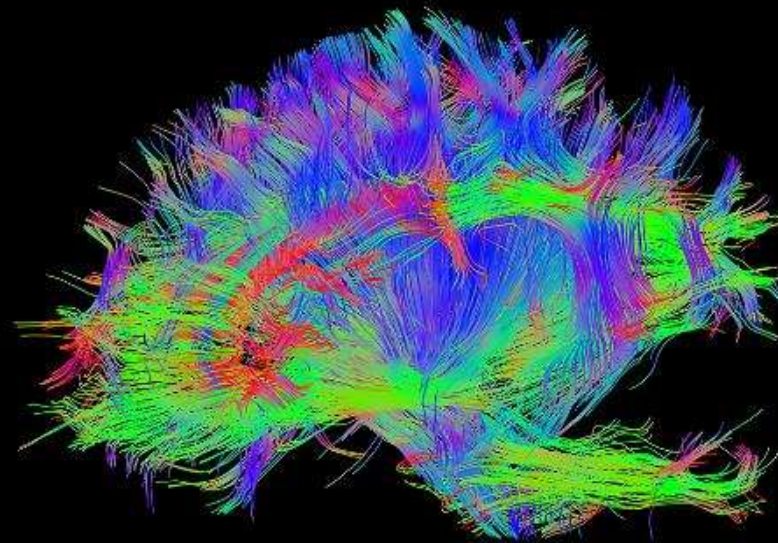


Artificial intelligence (AI) for precision psychiatry

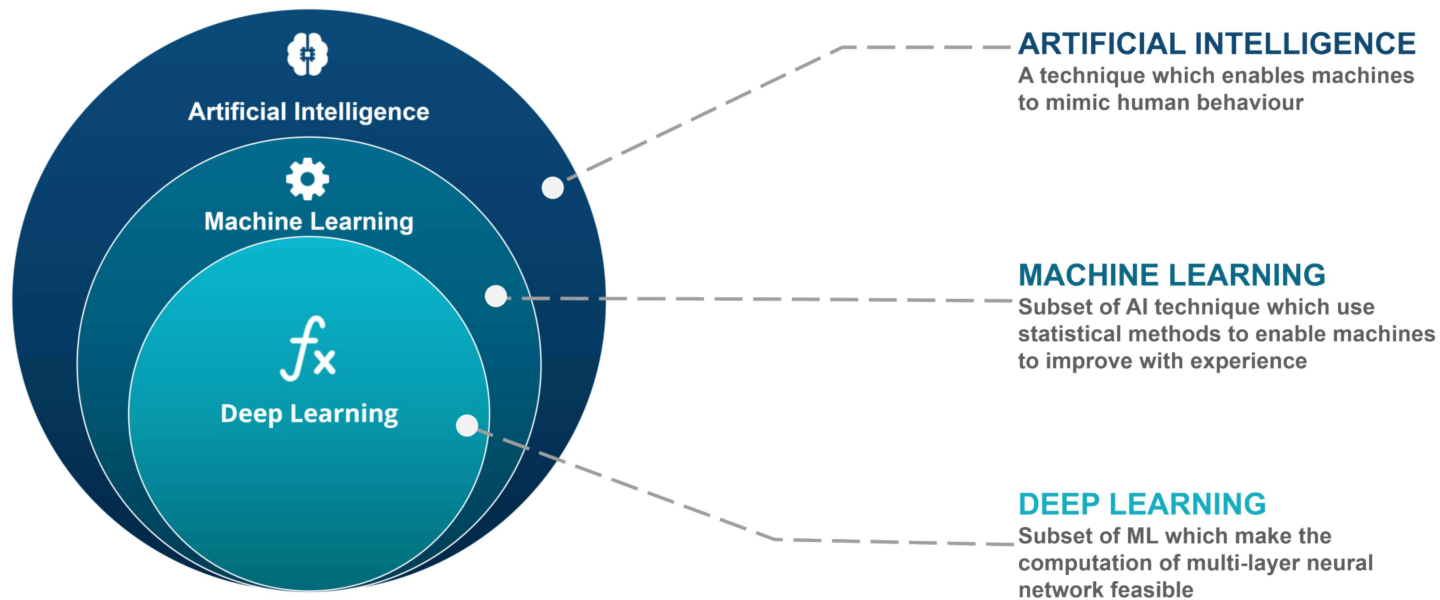
Guido van Wingen



SPINOZA

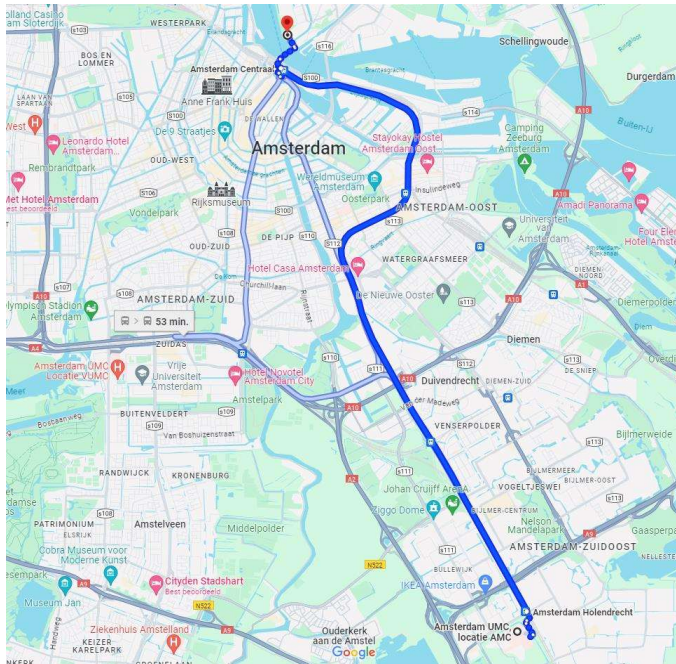


What is artificial intelligence (AI)?





AI in daily life



You

Can you create a powerpoint presentation about AI for psychiatry?

ChatGPT

I can certainly help you outline a PowerPoint presentation on AI for psychiatry. Below is a suggested structure for your presentation. Feel free to customize it according to your preferences and the specific information you want to include. Each slide title is followed by a brief description of the content you might include.

Slide 1: Title Slide

- Title: "AI in Psychiatry: Transforming Mental Healthcare"
- Subtitle: [Your Name/Organization]
- Date

Slide 2: Introduction

- Brief overview of the current state of mental health globally
- Introduction to the role of AI in addressing mental health challenges

Slide 3: Why AI in Psychiatry?

- Discuss the limitations of traditional approaches to mental health treatment
- Highlight the potential benefits of integrating AI in psychiatry



AI for psychiatry

Input

Features:

Age
Sex
Anxiety
Depression
Personality

Function

$$y = \frac{e^{(b_0 + b_1 X)}}{1 + e^{(b_0 + b_1 X)}}$$

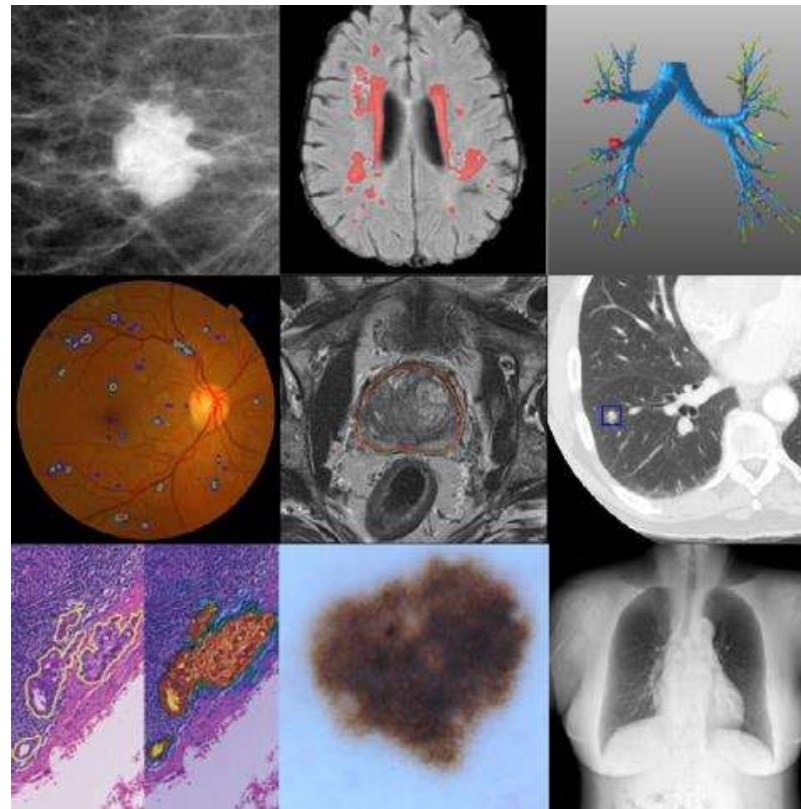
Output

Label:

Diagnosis
Prognosis



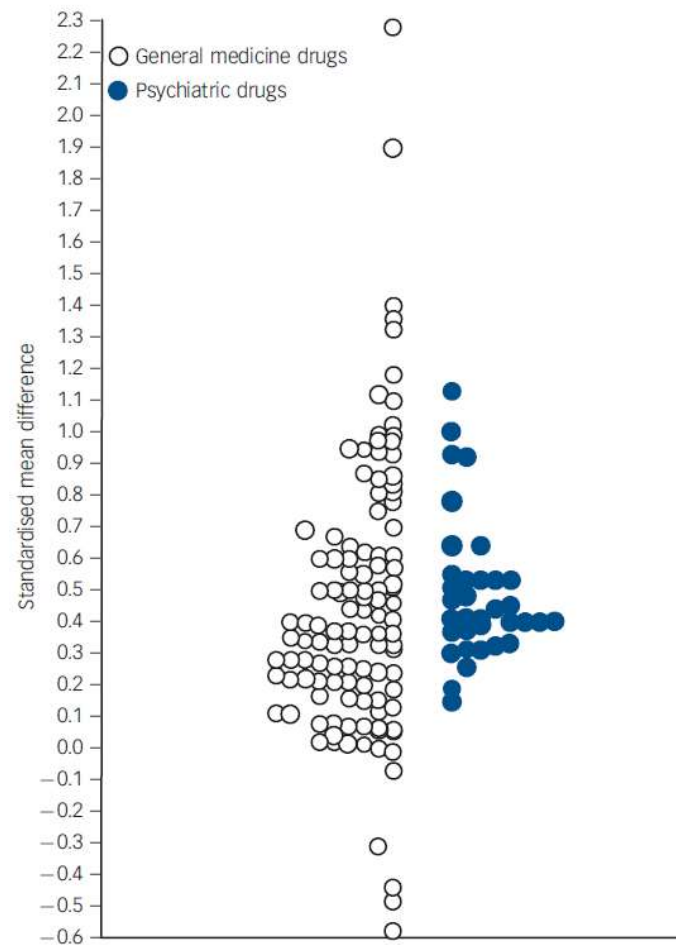
Medical AI



Litjens et al. 2017, MIA



Psychiatry vs general medicine



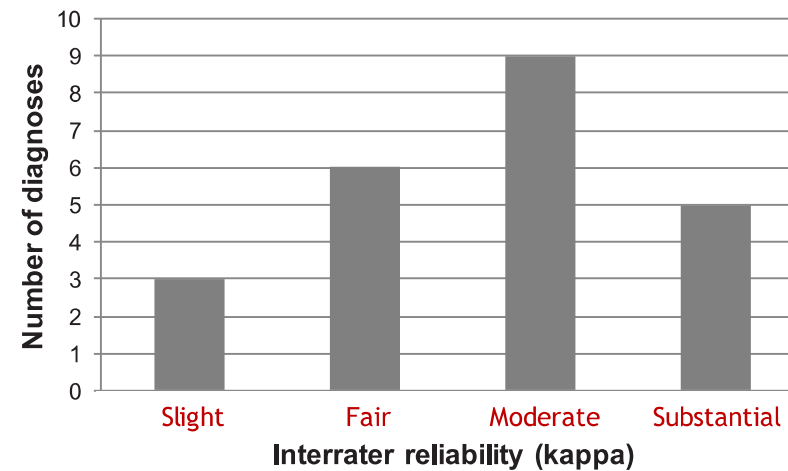
Leucht et al. 2012, BJP



Problem 1: diagnosis

Article

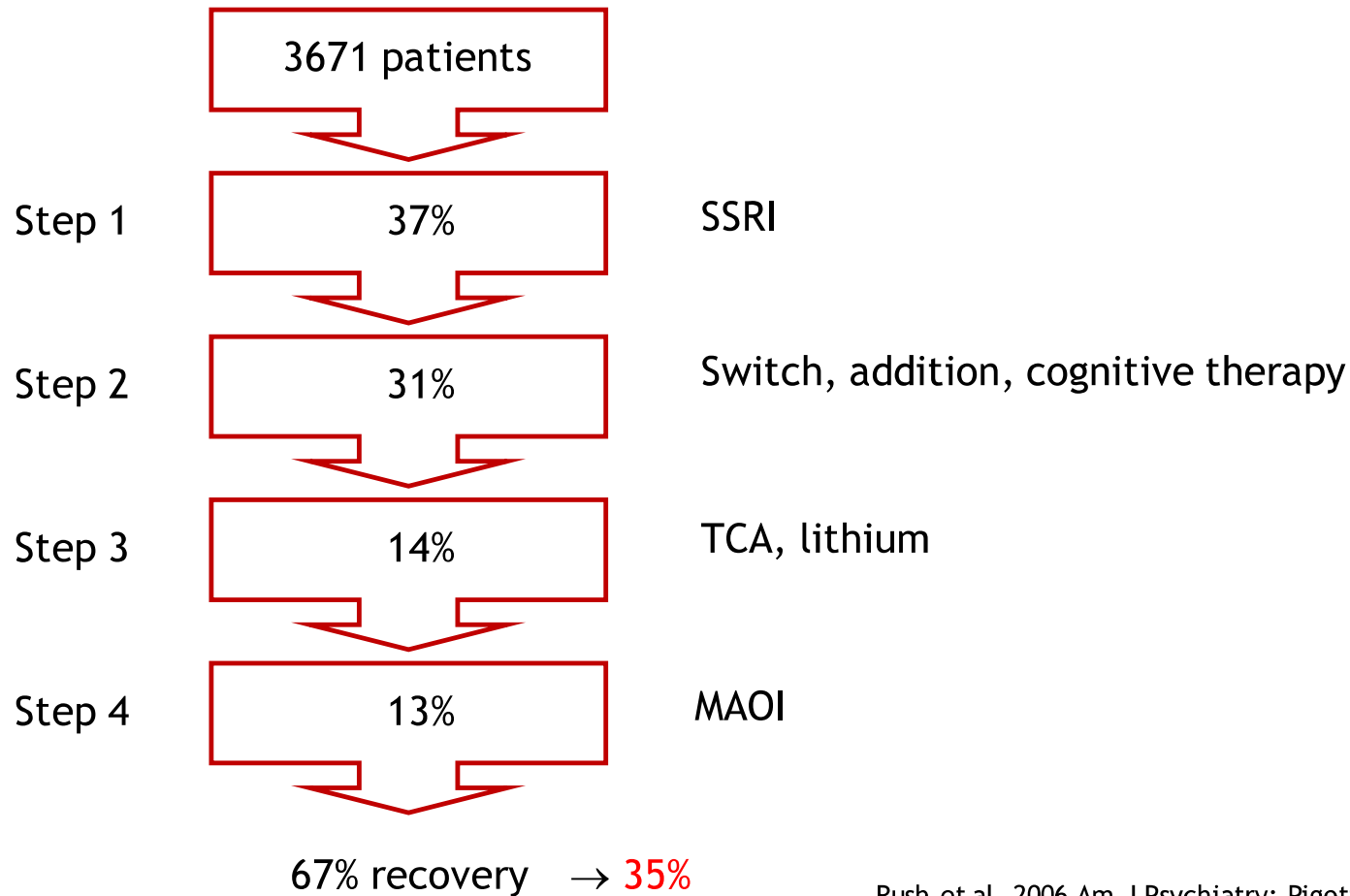
DSM-5 Field Trials in the United States and Canada, Part II:
Test-Retest Reliability of Selected Categorical Diagnoses



Regier et al. 2013 Am J Psychiatry; Landis & Koch 1977



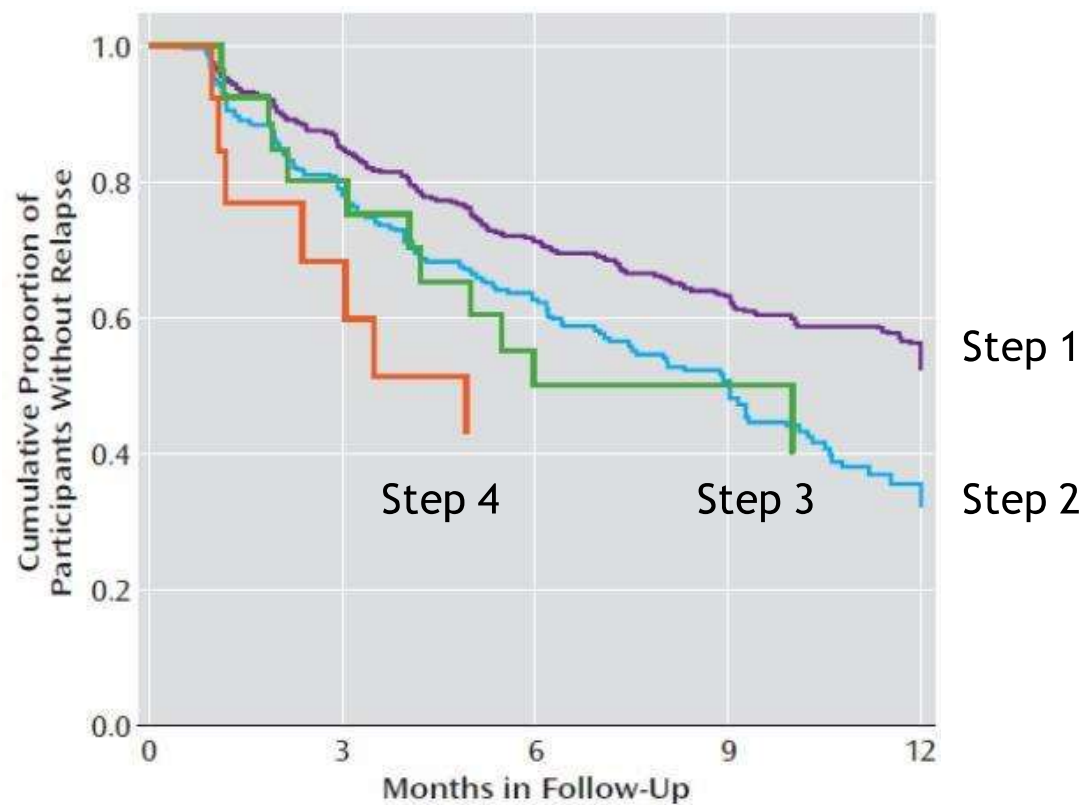
Problem 2: effectiveness



Rush et al. 2006 Am J Psychiatry; Pigott et al. 2023



Problem 3: relapse





Personalized prediction





Can clinicians predict outcome?

- Brief IPT or CBT (+SSRI) for depression
- Response rate 62% (≥ 5 points improvement PHQ)
- N = 159
- 129 patients will improve (81% response) 80 correct
- 30 patients will not improve 12 correct

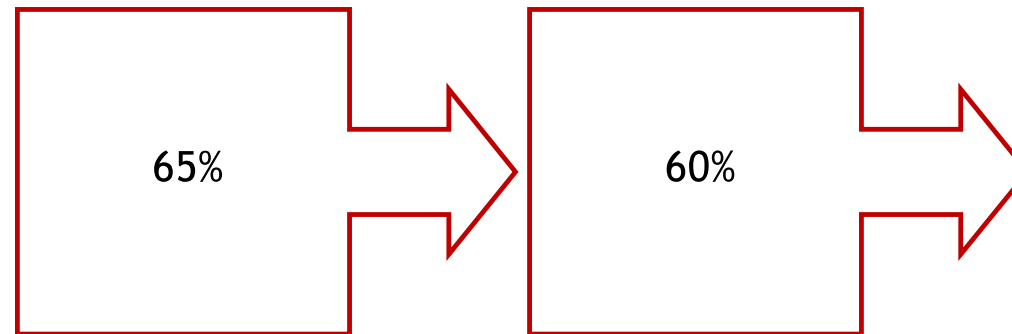
	Predicted		
		Yes	No
Observed	Yes	80	18
	No	49	12



Machine learning with clinical data

Citalopram (N=1949)

Escitalopram (N=151)



Spring Health 



Medical Device Regulation





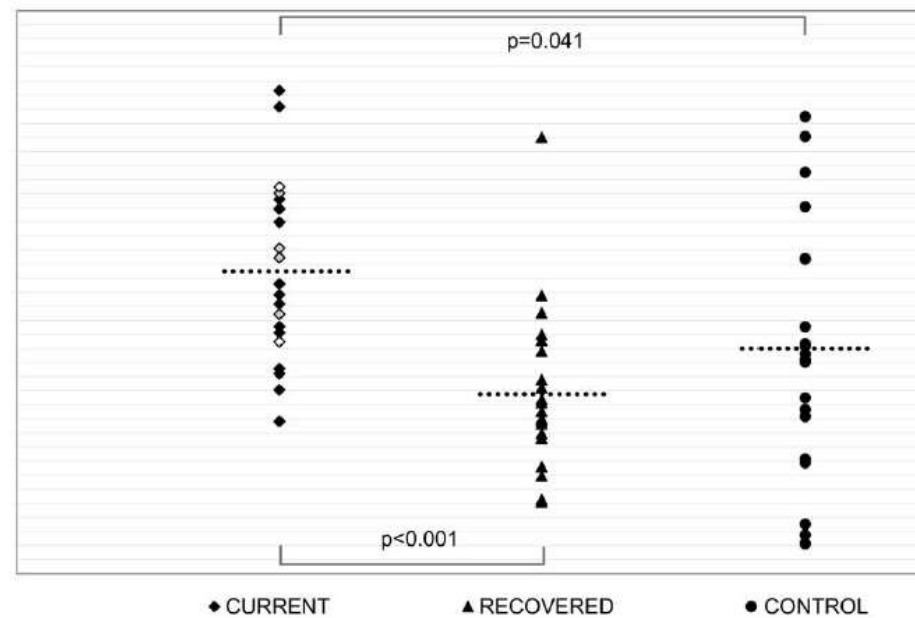
Which scan is from a depressed patient?





Standard univariate analysis

Amygdala volume



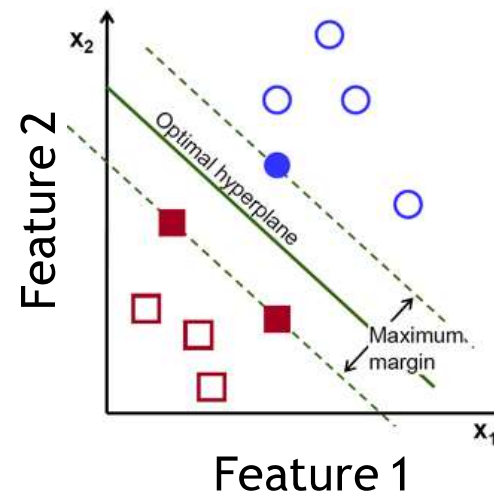


Machine learning analysis

Group 1

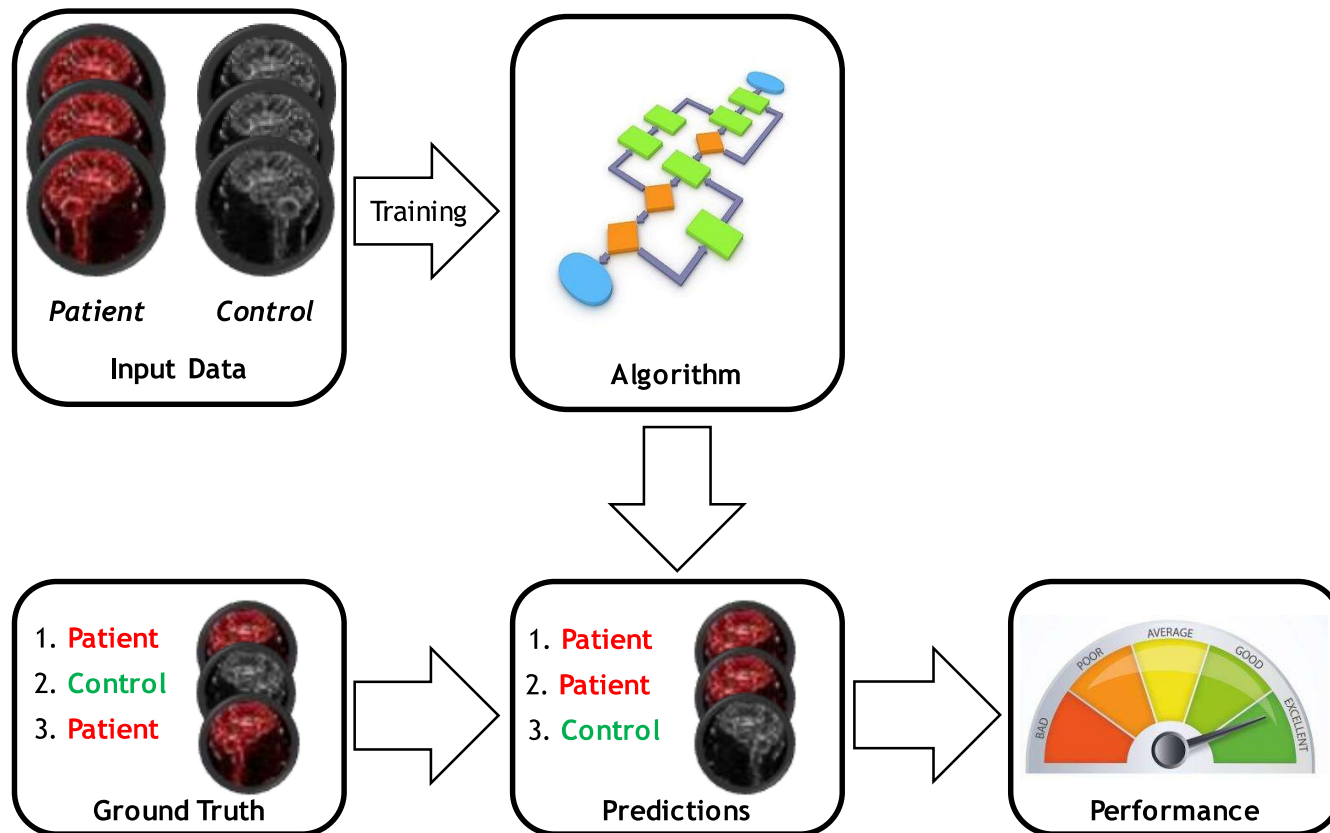


Group 2





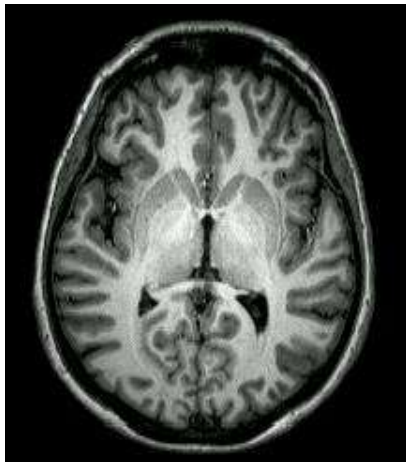
Machine learning analysis



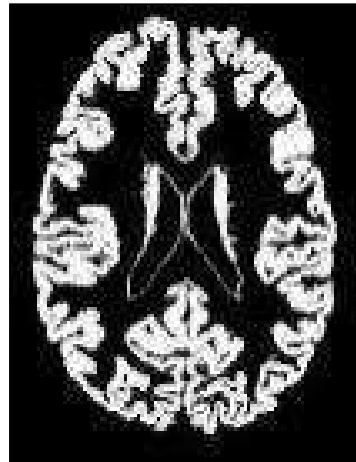


Structural neuroimaging

Original scan



Gray matter

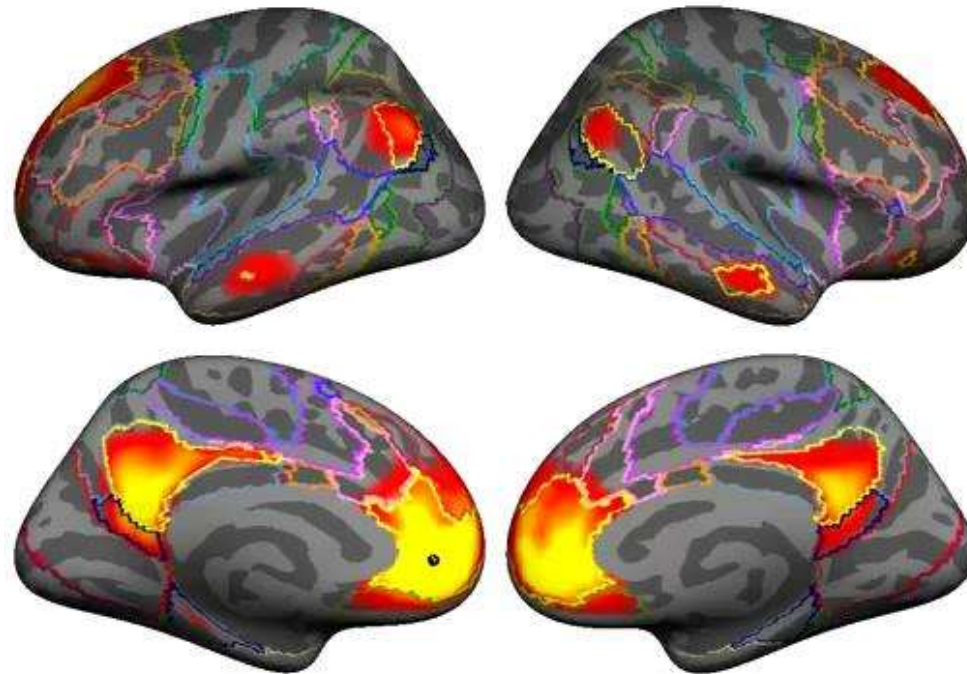


Volume





Functional neuroimaging





Problem 1: diagnostics

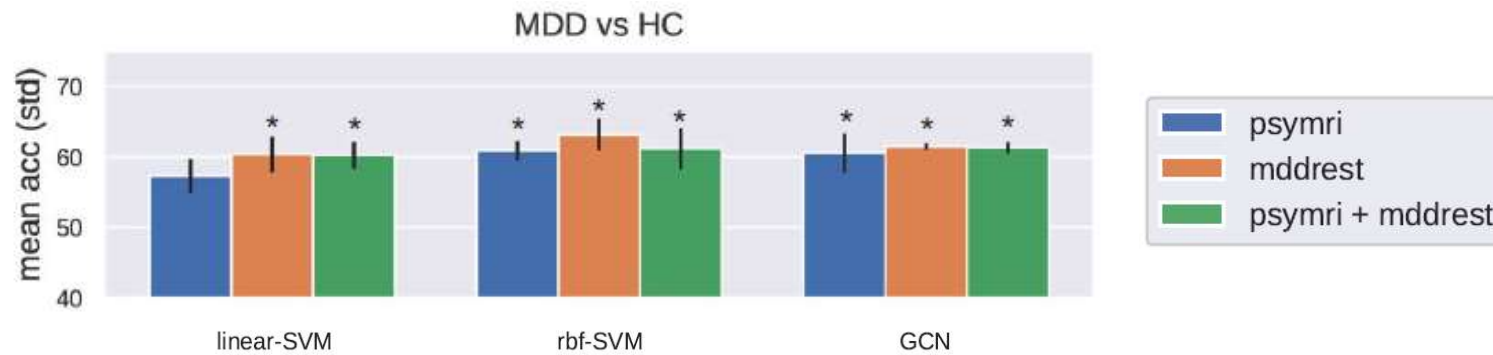
- Neuroimaging biomarker for depression
- Europe: PsyMRI consortium
23 research centers
531 patients, 508 healthy controls
- China: REST-MDD consortium
25 research centers
1255 patients, 1083 healthy controls



Gallo, El-Gazzar et al. 2023, Mol Psychiatry

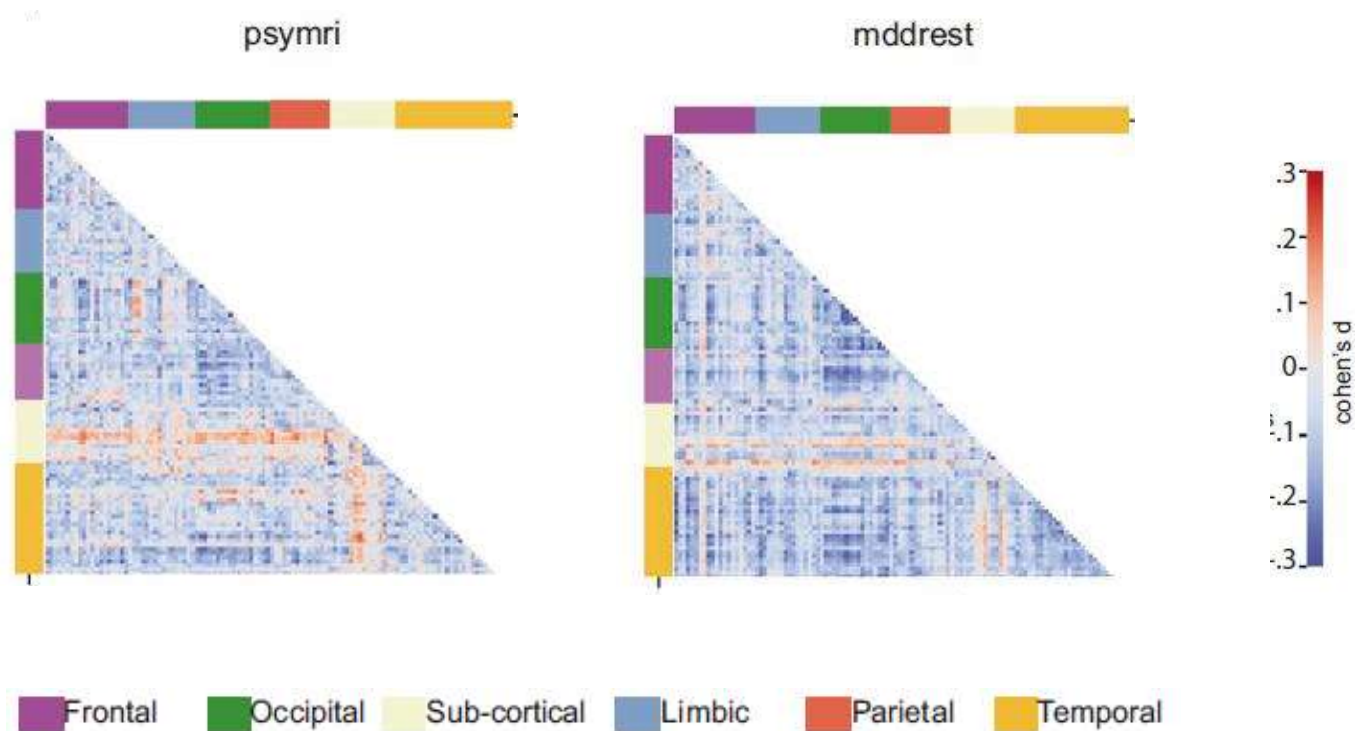


Poor classification accuracy





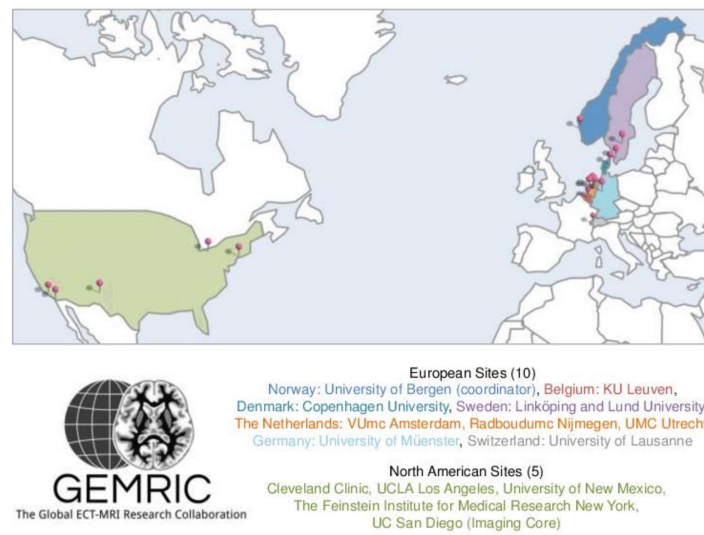
Univariate effect sizes





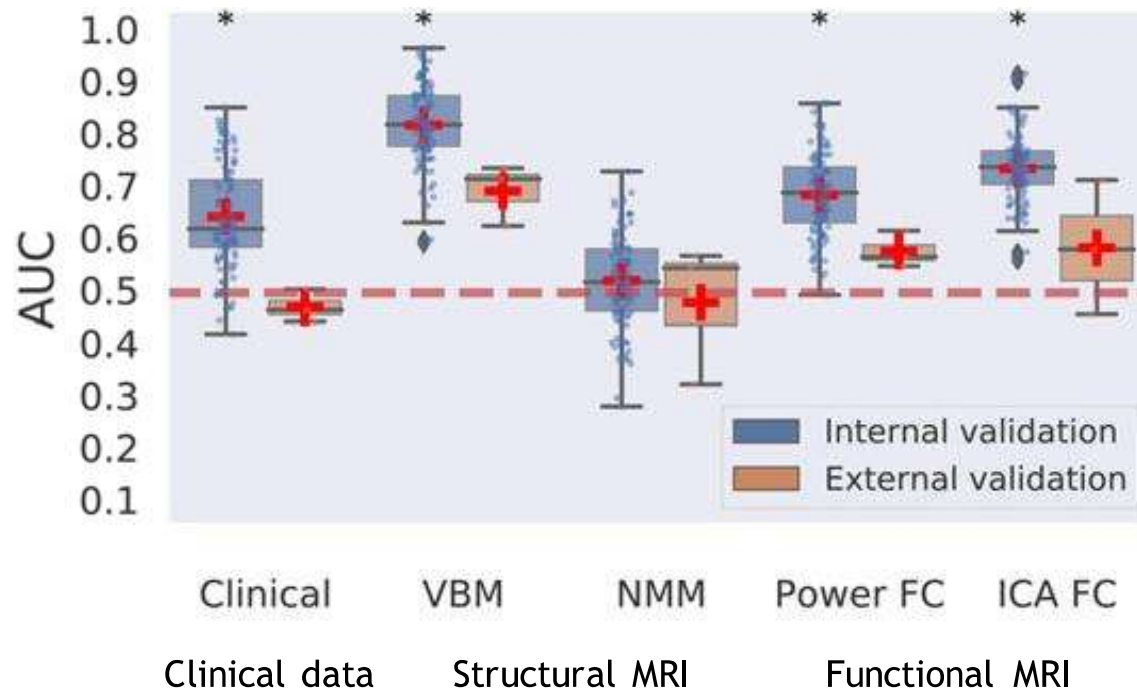
Problem 2: treatment outcome

- ECT consortium (GEMRIC)
- 109 patients with treatment-resistant depression
- 3 research centers with >20 functional MRI scans



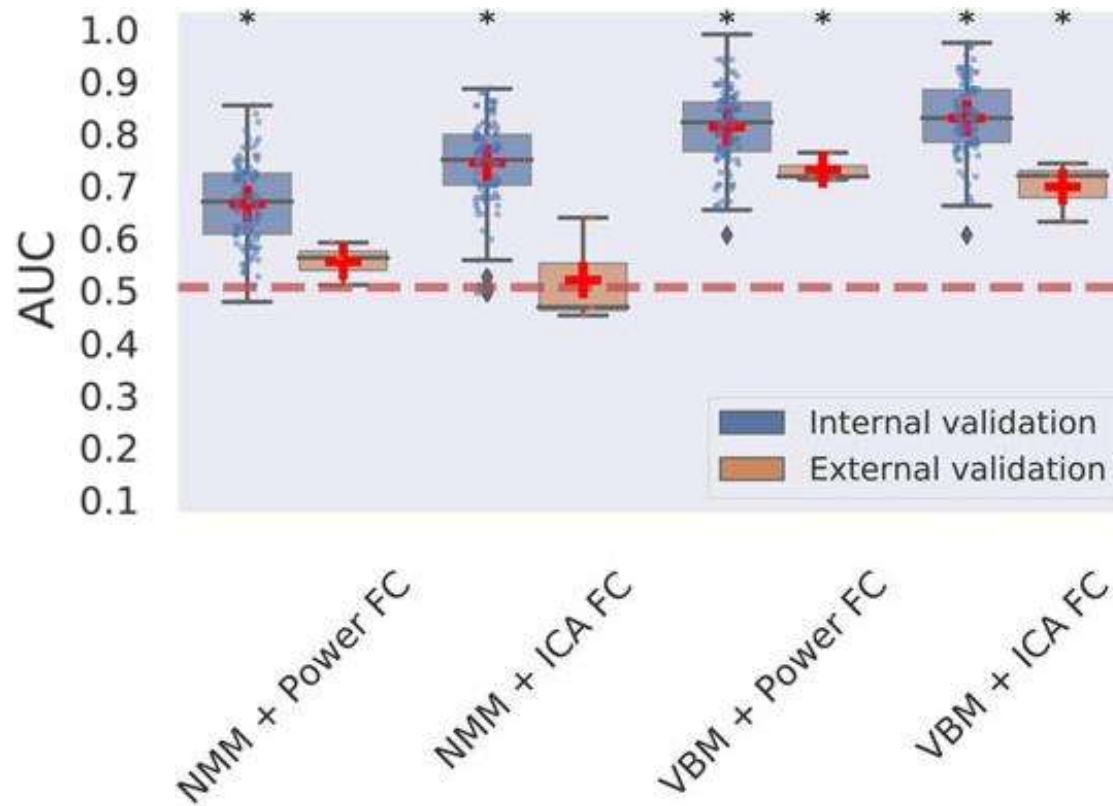


Remission prediction: unimodal





Remission prediction: multimodal





Meta-analysis MRI

rTMS

Drysdale rep, 2017
Drysdale, 2017
Cash, 2019
Siegle, 2012
Weighted Estimate

Psychotherapy

Queirazza, 2019
Costafreda, 2009
Weighted Estimate

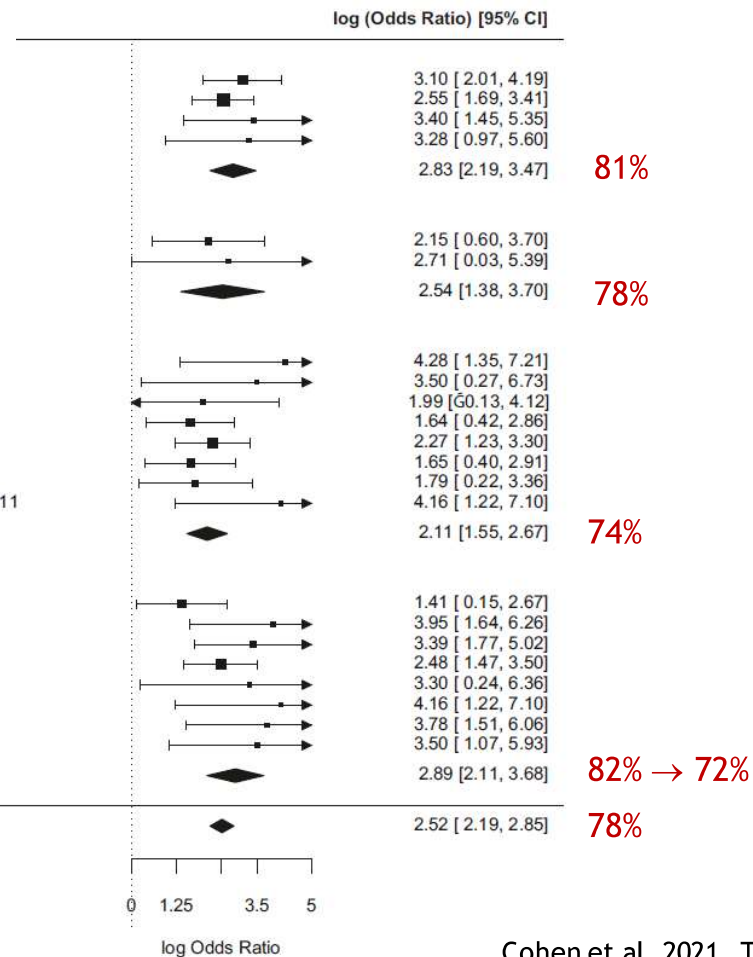
Pharmacotherapy

Patel, 2015
Meyer, 2019
Marquand, 2008
Karim, 2018
iSPOT trials, 2014-2018
Gong, 2011
Godlewska, 2018
Costafreda & Nouretdinov, 2009, 2011
Weighted Estimate

ECT

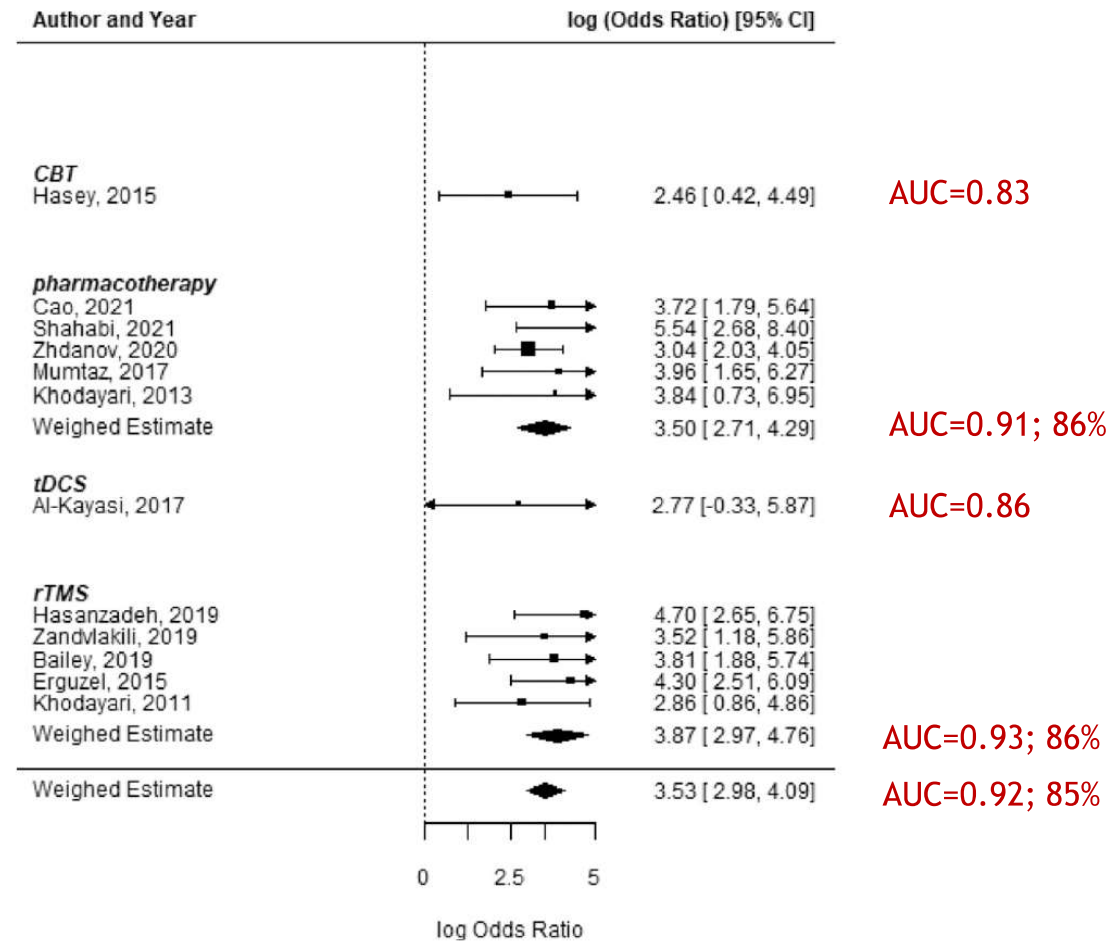
Wade & Leaver, 2017, 2018
Wade, 2016
Van Waarde, 2015
Sun, 2019
Redlich, 2016
Moreno-Ortega, 2019
Jiang, 2018
Cao, 2018
Weighted Estimate

Weighted Estimate





Meta-analysis EEG



Cohen et al. 2023, J Affective Disorders



What about clinical predictors?

Neuroimaging predictors

Al-Kaysi 2017c	9	10
Al-Kaysi 2017m	8	10
Bailey 2018	46	50
Costafreda 2009	12	16
Khodayari-Rostamabad 2013	19	22
Korgaonkar 2015	129	157
Liu 2012	14	17
Marquand 2008	13	20
Mumtaz 2017	30	34
Patel 2015	30	33
Redlich 2016	52	67
van Waarde 2014	38	45
Wade 2016	47	53
Random effects model	534	

Heterogeneity: $I^2 = 5\%$, $\tau^2 = 0.0004$, $p = 0.40$

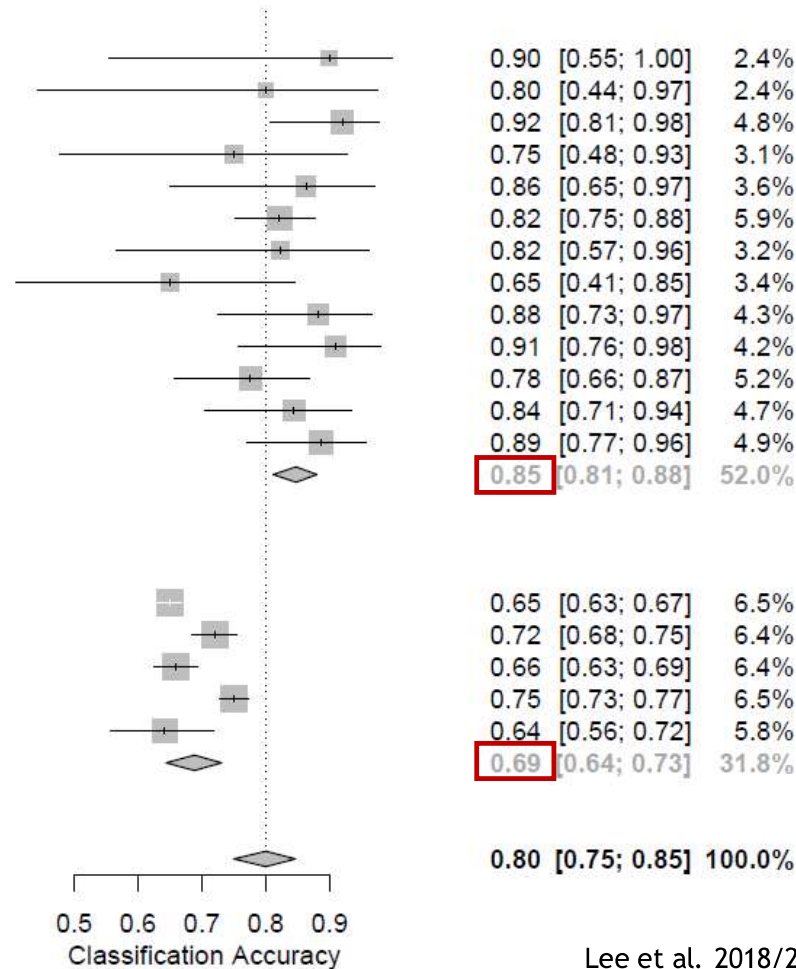
Clinical predictors

Chekroud 2016	1,543	2,374
Etkin 2015	479	665
Iniesta 2016	523	793
Kautzky 2017	1,057	1,409
Serreti 2007	93	145
Random effects model	5,386	

Heterogeneity: $I^2 = 92\%$, $\tau^2 = 0.0024$, $p < 0.01$

Random effects model **6,325**

Heterogeneity: $I^2 = 89\%$, $\tau^2 = 0.0134$, $p < 0.01$





AI for psychiatry?

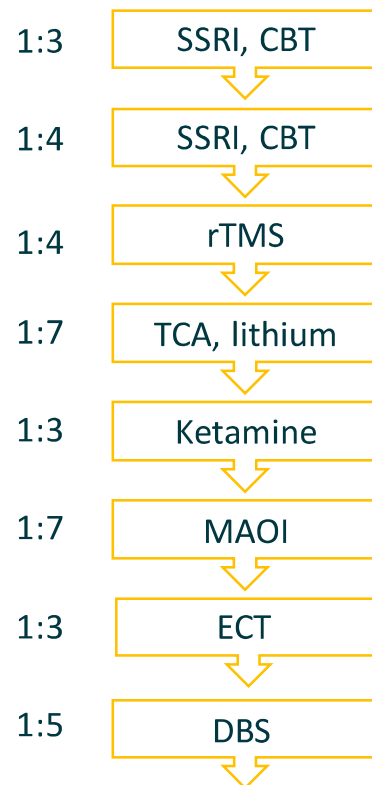
- Diagnostics: poor
Disease heterogeneity
No 'golden standard'
- Treatment outcome: good
Neuroimaging ~85%
Clinical variables ~68%
- Relapse: ?





Personalization of treatment

Remission

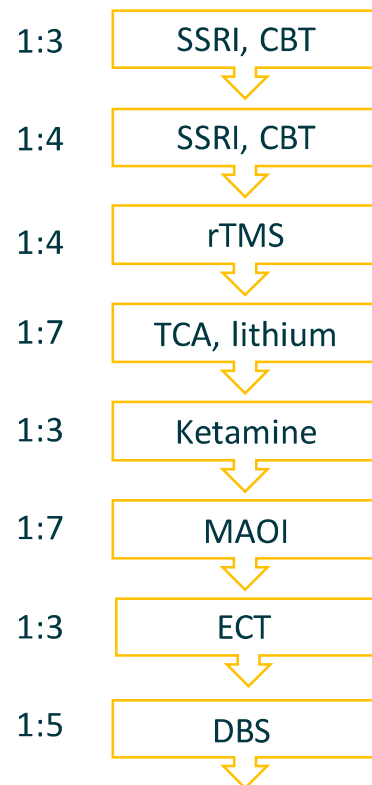


Rush et al. 2006; Carpenter et al. 2012; Bergfeld et al. 2016;
van Diermen et al. 2018; Fedgchin et al. 2019

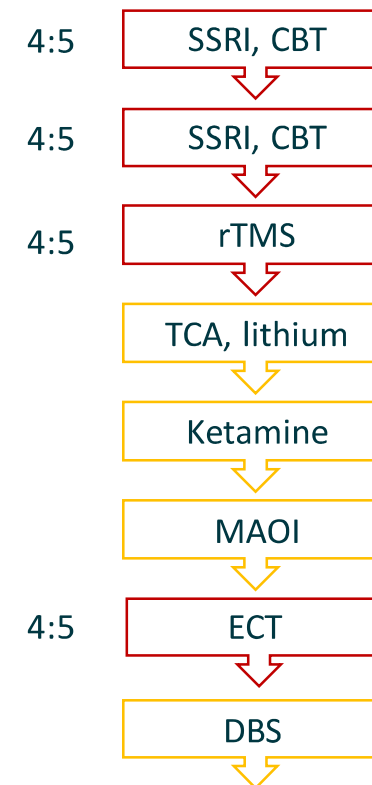


Personalization of treatment

Remission



Remission



Rush et al. 2006; Carpenter et al. 2012; Bergfeld et al. 2016;
van Diermen et al. 2018; Fedgchin et al. 2019



Personalization of psychotherapy

Depression

CBT or IPT

PTSD

EMDR or TF-CBT

GAD

CBT or ACT

BPD

DBT or MBT

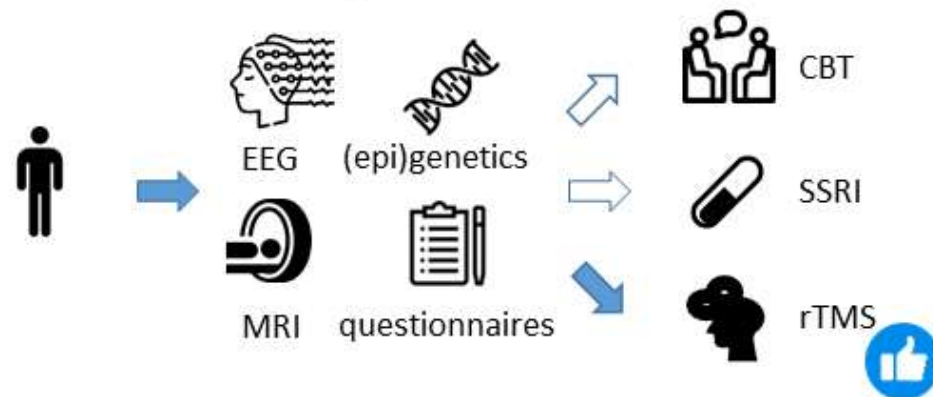


BOOST Depression consortium

Now: stepped care



Future: biomarker-guided treatment





BOOST Depression consortium



**nationale
wetenschaps
agenda**

Cooperation partners



Co-funders





Patient recruitment

- Inclusion
 - Primary MDD (DSM-5, MINI)
 - HRSD ≥ 15
 - Indication: SSRI, CBT, rTMS, esketamine, ECT
- Exclusion
 - Bipolar, psychotic, substance use disorders
- Treatment according to guidelines



Future?

- Clinical decision support system (CDSS)
- From stepped-care towards personalized treatment
“first time right”
- Faster recovery
 - Burden
 - Absenteeism
 - Waiting list
 - Workload
 - Costs





Thanks to?

Amsterdam UMC, AMC

- Willem Bruin
- Selene Gallo
- Ahmed El-Gazzar
- Sem Cohen
- Jasper Zantvoord
- Rajat Thomas

UMC Utrecht

- Annemieke Dols

UvA

- Steven Scholte

Rijnstate

- Jeroen van Waarde

Consortia

- GEMRIC
- PsyMRI
- REST-MDD

BOOST Depression

