

AI-ENABLED MEDICAL DEVICES (FOR MENTAL HEALTHCARE)

**P r o g r e s s •
P o t e n t i a l • C h a l l e n g e s**

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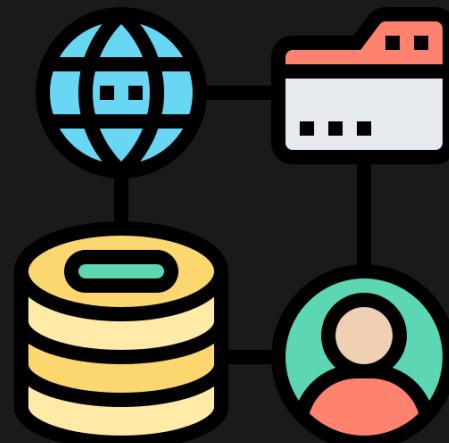
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A WAY FORWARD: AI-INFORMED LEARNING
HEALTHCARE SYSTEMS



DEFINITIONS



AI-CDSS for mental healthcare

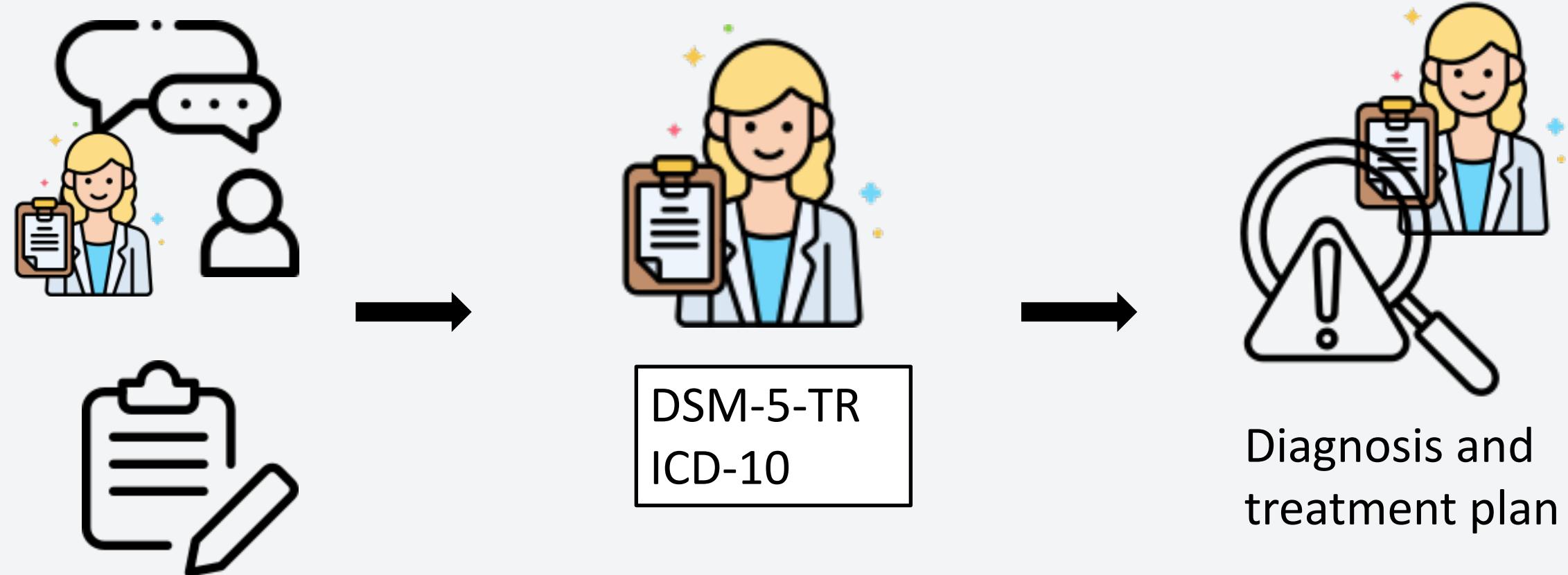
- AI-enabled Clinical Decision Support System
- Assisting mental health professionals in diagnosing and treating mental health conditions
- Using machine learning algorithms to provide the most effective treatment recommendations based on individual patient data

AI software as clinical support tool

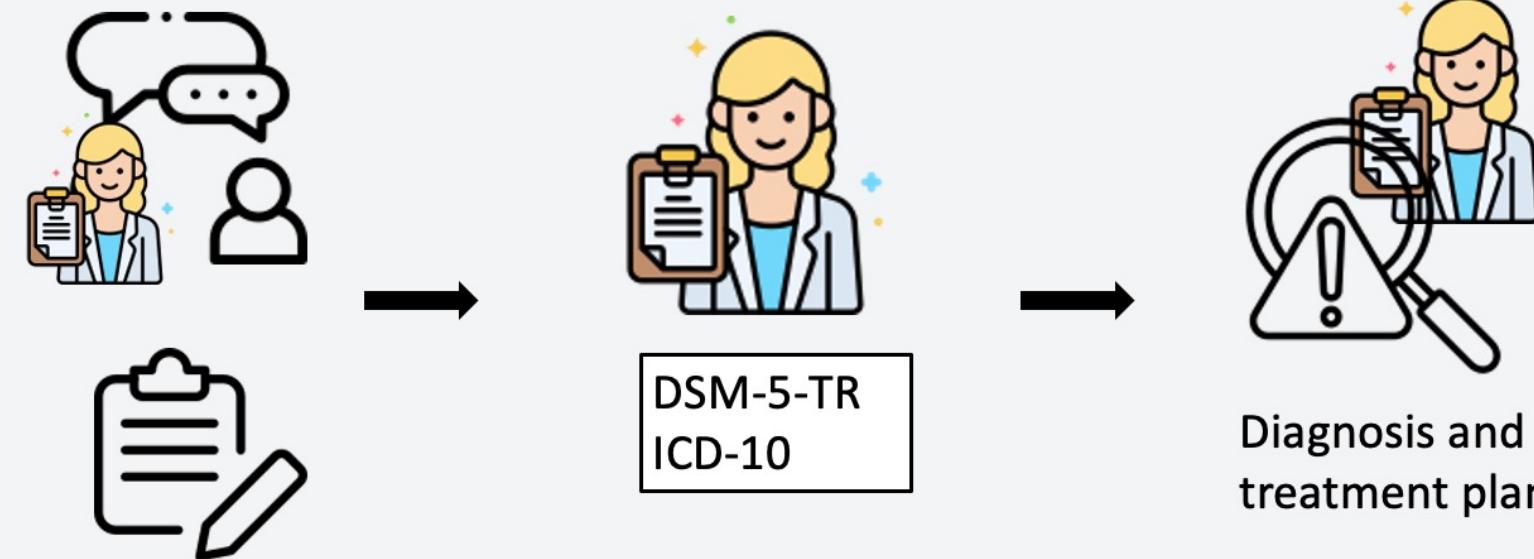
- Embedded within the Clinical Decision Support System
- Analyzing patient data, aiding in diagnosis, suggesting treatment options, and continuously learning and improving suggestions based on new data and outcomes



CLINICAL DECISION-MAKING IN MENTAL HEALTHCARE: THE CONVENTIONAL APPROACH



CLINICAL DECISION-MAKING IN MENTAL HEALTHCARE: THE CONVENTIONAL APPROACH

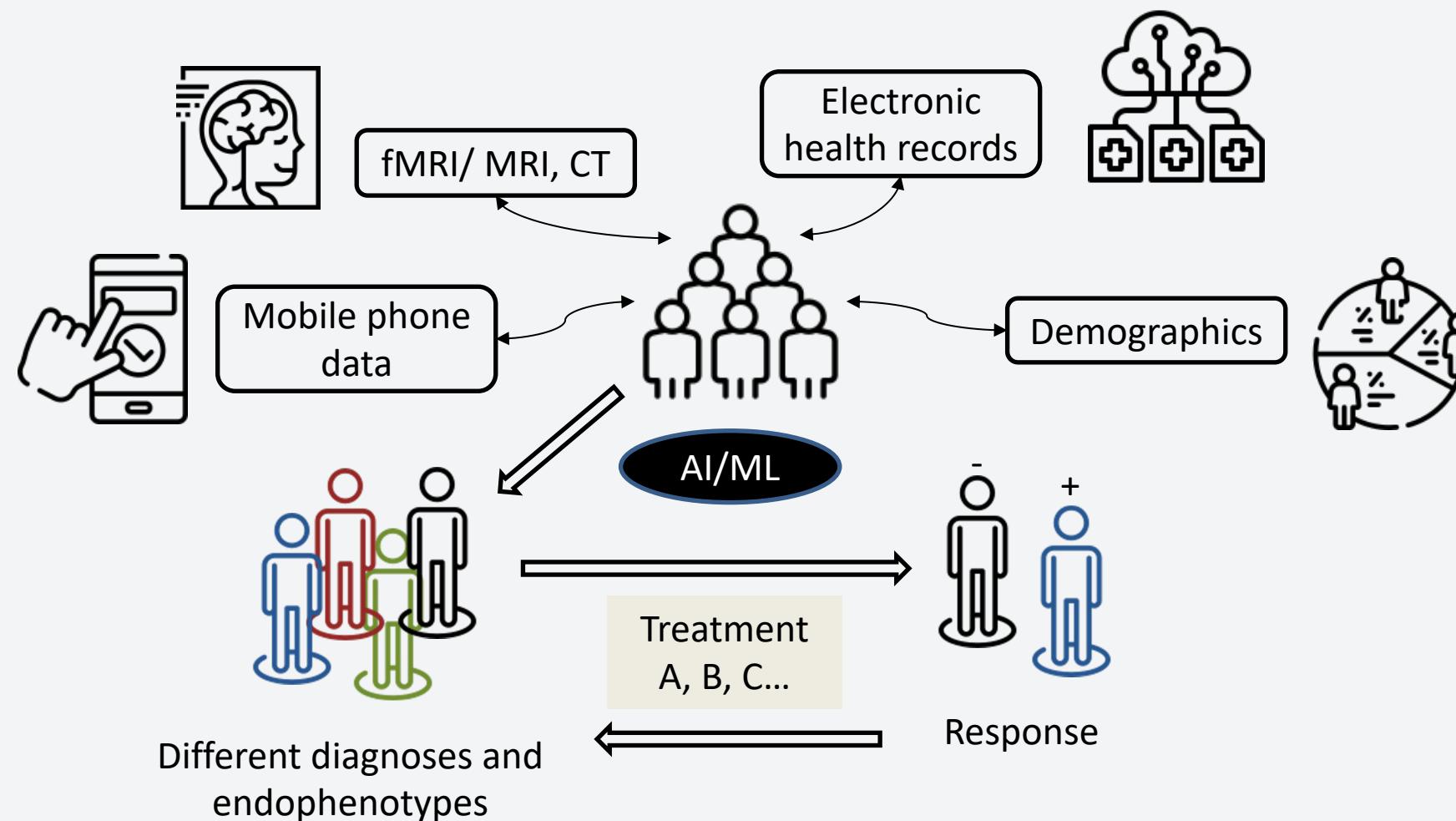


Disease course, symptom intensity, and treatment responses vary



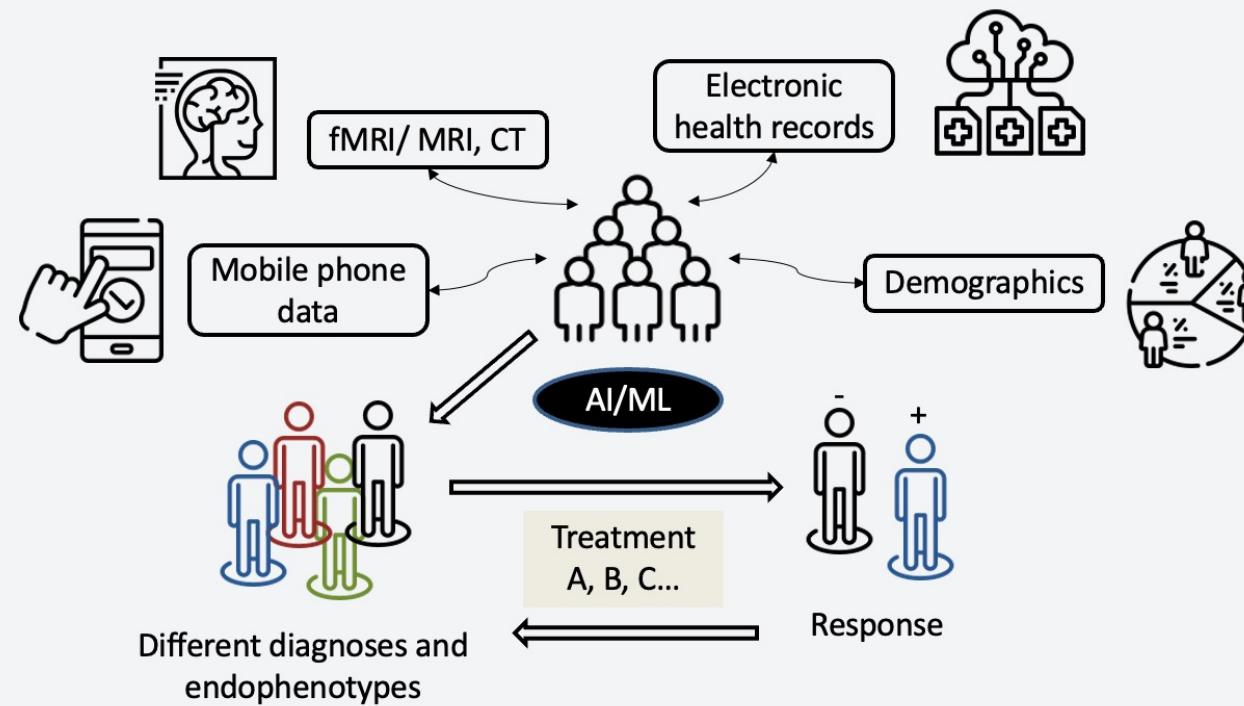
Burden of deriving “correct decision” on practitioner

CLINICAL DECISION-MAKING IN MENTAL HEALTHCARE: THE AI/ML APPROACH



Fernandes et al., 2017

CLINICAL DECISION-MAKING IN MENTAL HEALTHCARE: THE AI/ML APPROACH



Potentially more precise..

- diagnoses,
- prognoses,
- treatment recommendations

Advancing Mental Healthcare with AI-Enabled Tools: An Implementation Problem?

“Despite the potential of AI-enabled precision psychiatry, **the use of AI in mental healthcare is still at its infancy**”

(Benjamins et al., 2020)

"The global precision psychiatry market is anticipated to observe impressive growth [...]. The major factors include **rise in incidences of mental health and technological advancements**"

(Research and Markets, Nov 2022)



Reasons for the lack of implementation of AI tools in mental healthcare

Enter a word

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25

You can submit multiple responses

Submit

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AI-ENABLED DEVICES FOR MENTAL HEALTHCARE: THE IMPLEMENTATION PROBLEM



AVAILABILITY

What AI products are currently available for mental health practitioners?

What are their use cases?

Are they effective and efficient?



PRACTITIONER ATTITUDES

How do mental health practitioners perceive AI tools for mental healthcare?

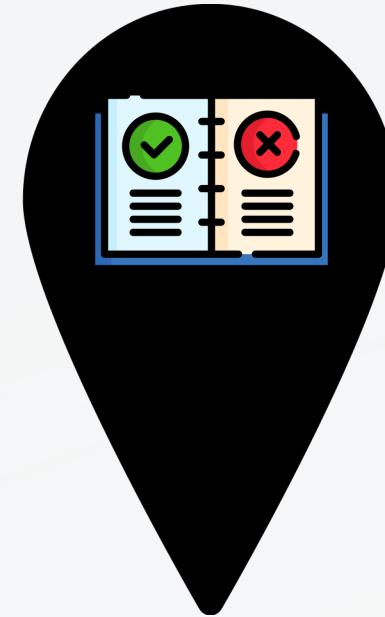
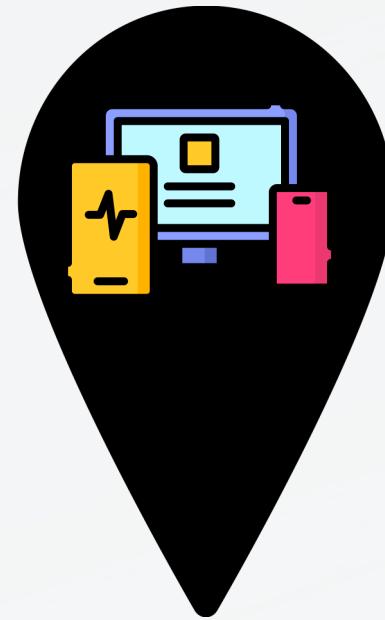
Why are they (not) willing to use them?



PRODUCT REGULATION

How are AI-enabled devices for mental healthcare regulated?

What difficulties come up in regulating AI-CDSS?



**Attitudes Towards
the Adoption of AI-
Enabled Mental
Health Tools**

**Mental Health Care
with AI-Enabled
Precision
Psychiatry Tools:
A Patent Review**

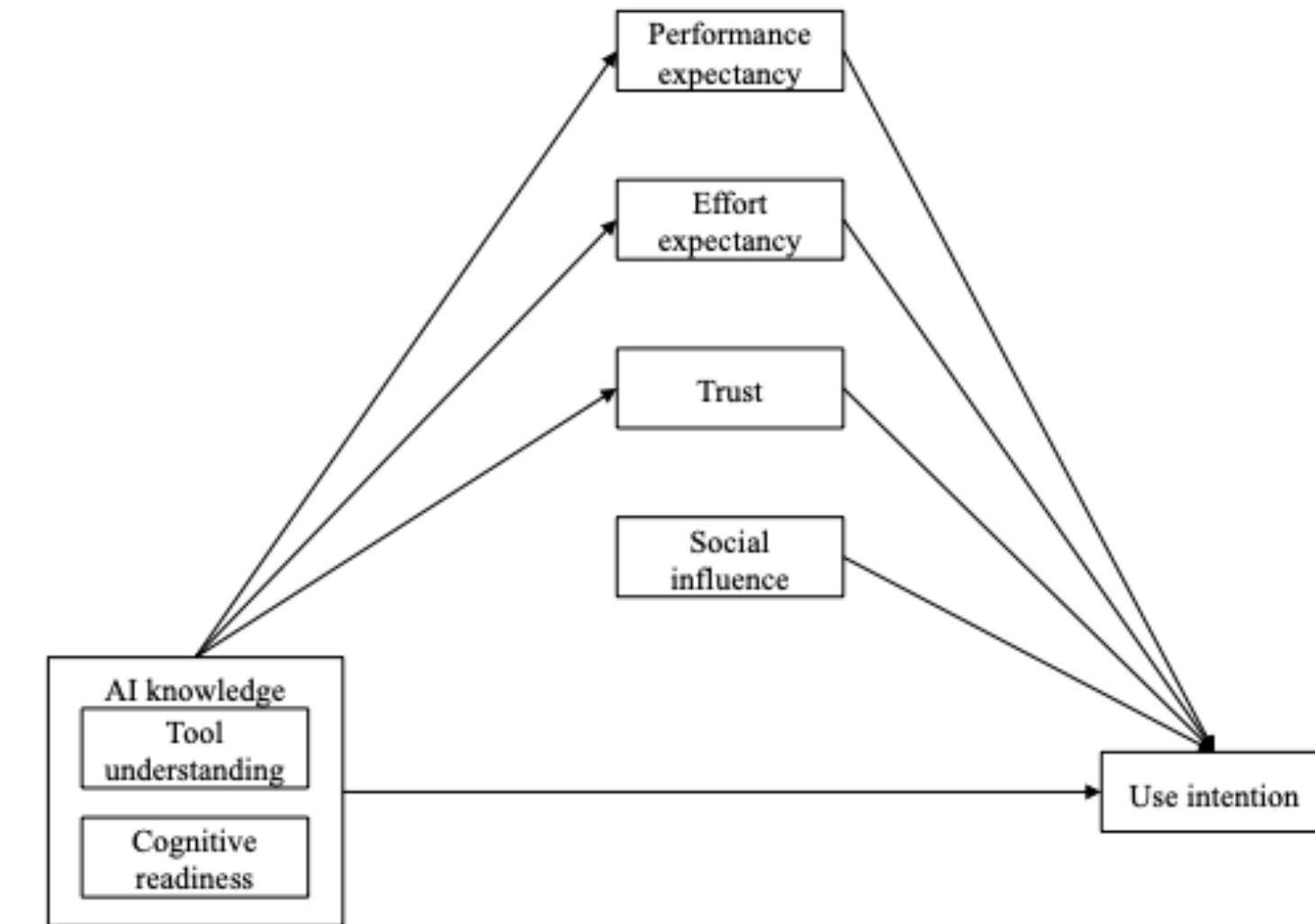
**AI-Enabled Software
Medical Devices: A
Product Review**

**AI-informed
learning
health-care
system**

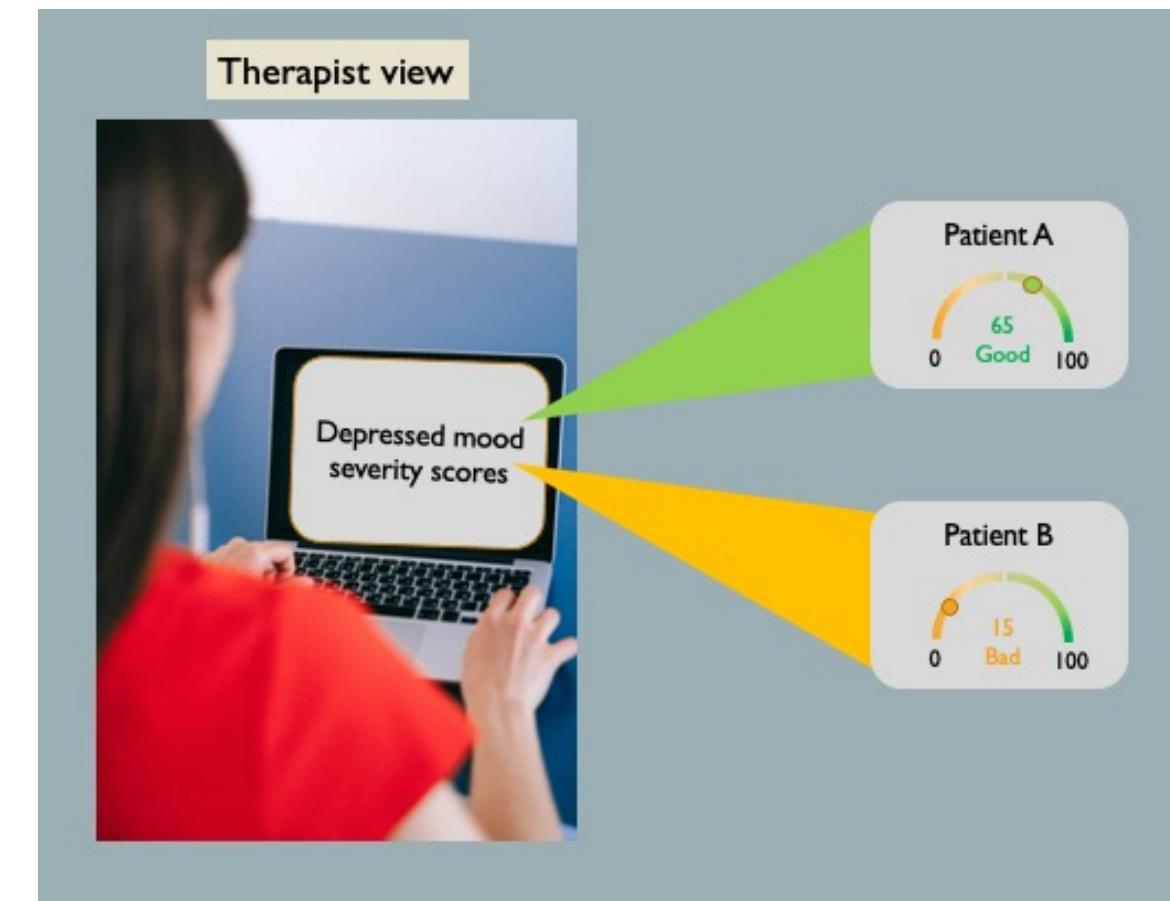
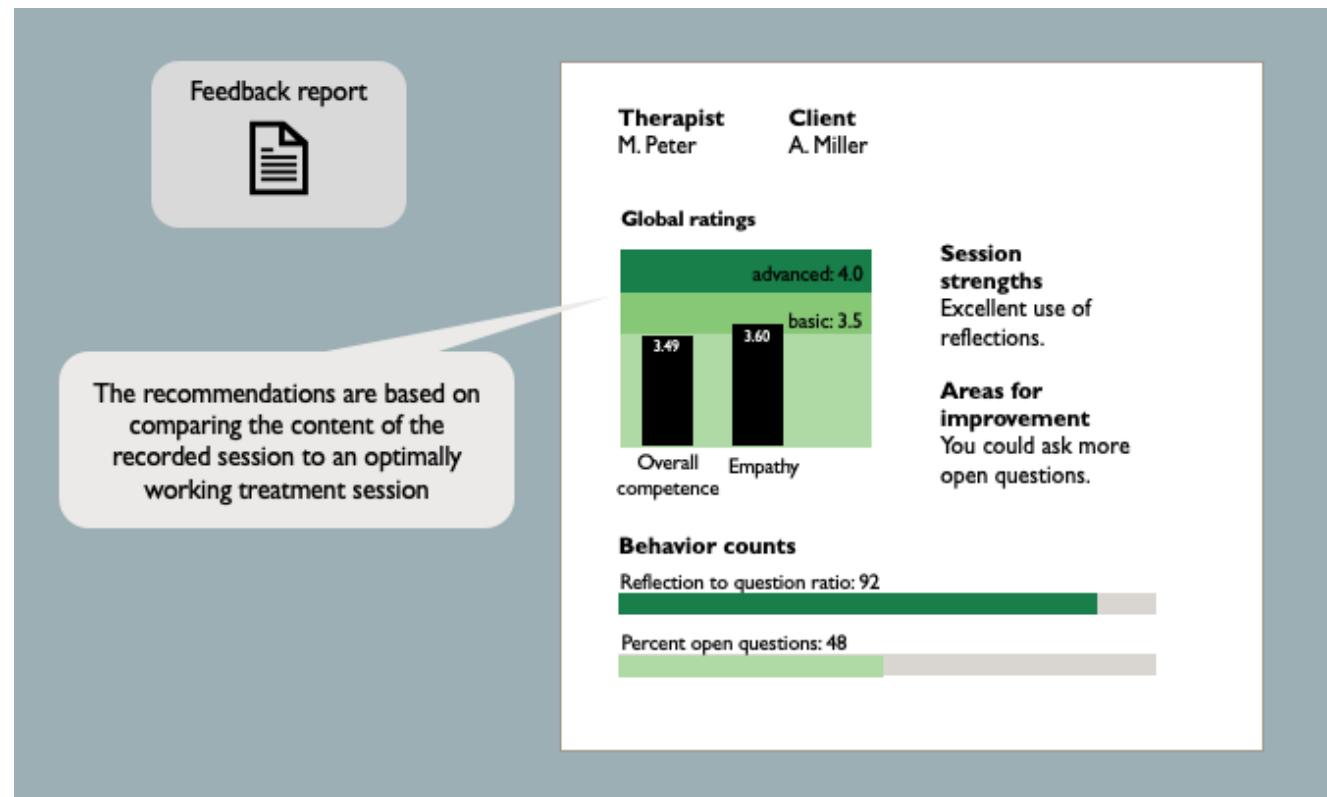
Attitudes Toward the Adoption of Artificial Intelligence-Enabled Mental Health Tools Among Prospective Psychotherapists



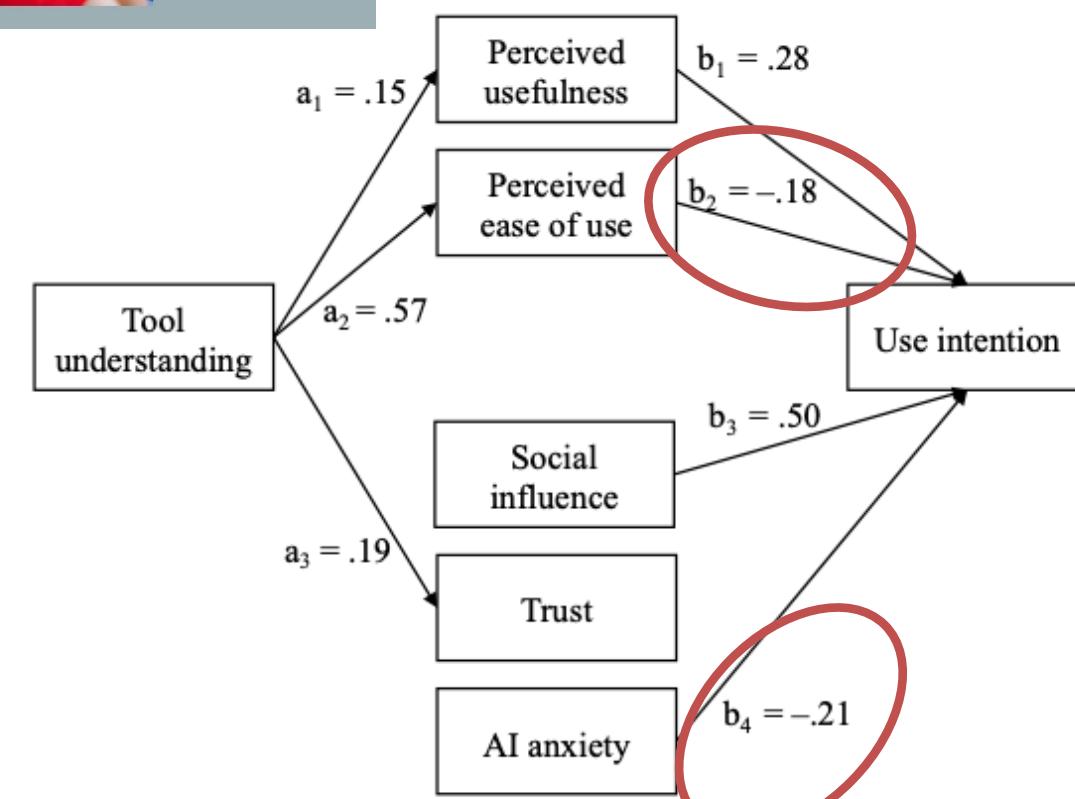
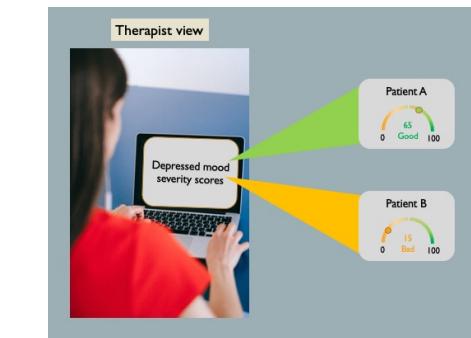
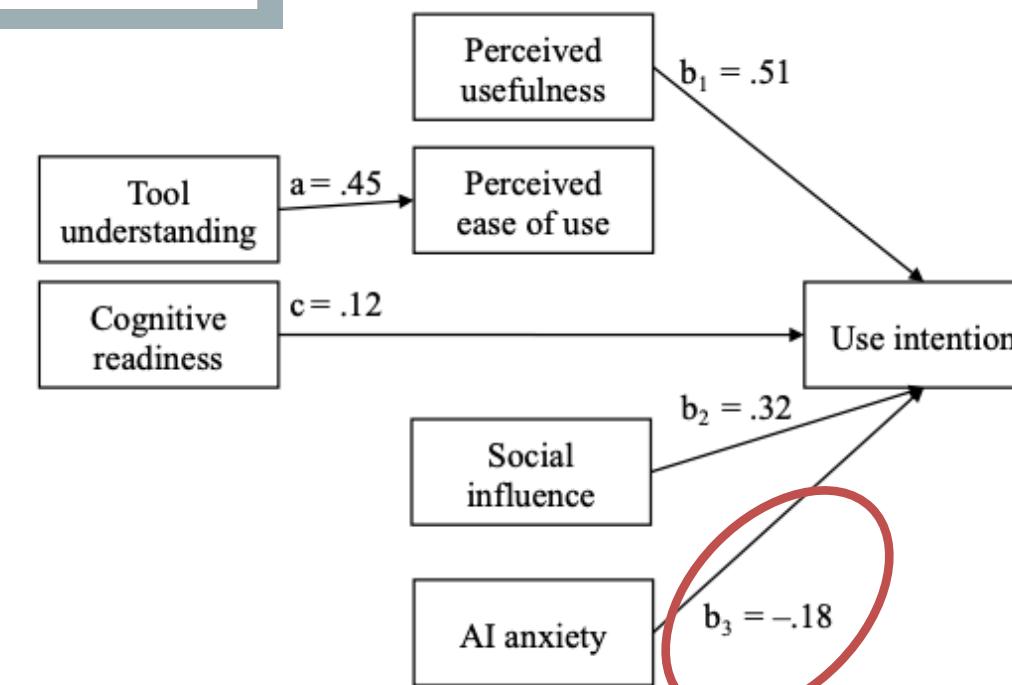
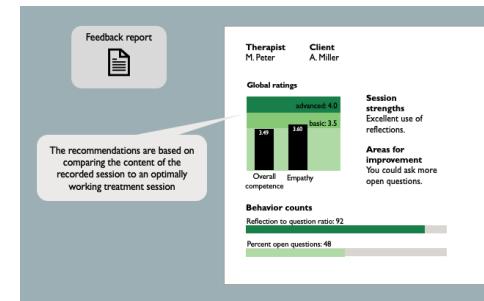
R e s e a r c h m o d e l : T h e U n i v e r s a l T h e o r y o f A c c e p t a n c e a n d U s e o f T e c h n o l o g y



The tools



Results



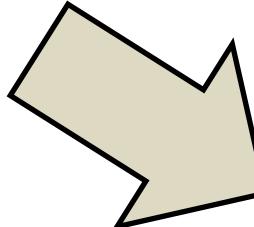


*Advancing Mental Health Care with
AI-Enabled Precision Psychiatry
Tools: A Patent Review*

Derwent Innovation Patent Database

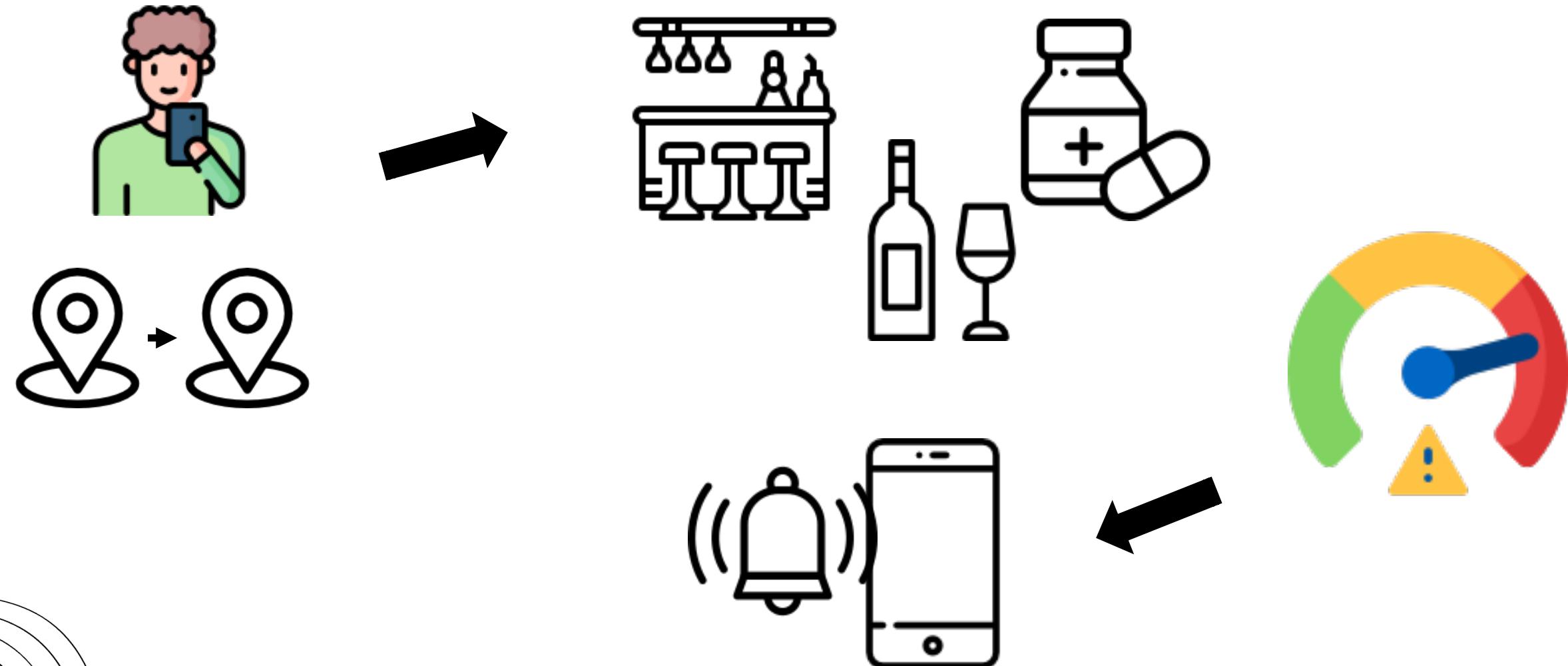


Diagnostic, treatment
prediction, prognostic AI-
enabled mental health tools

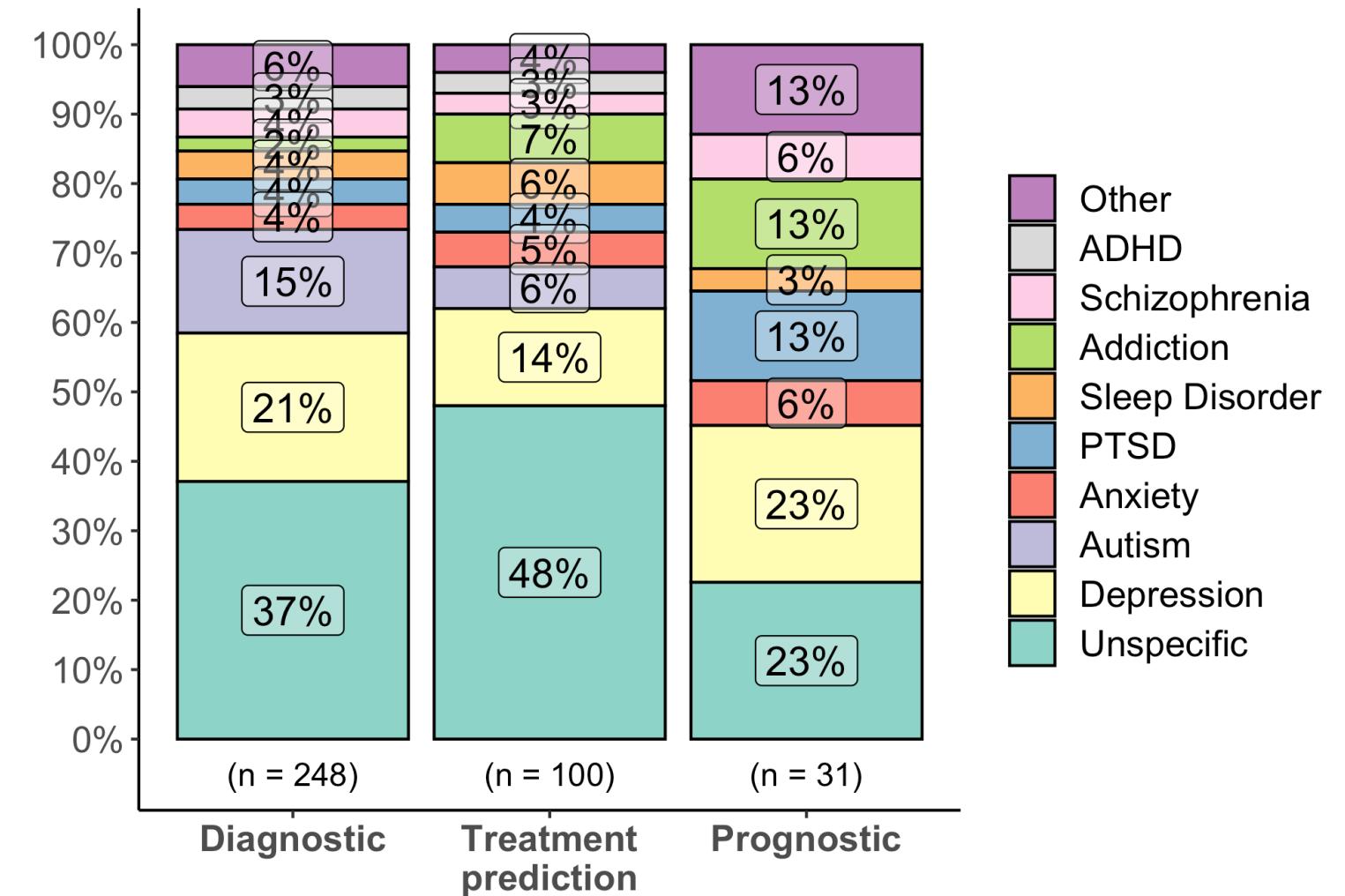


279 patents

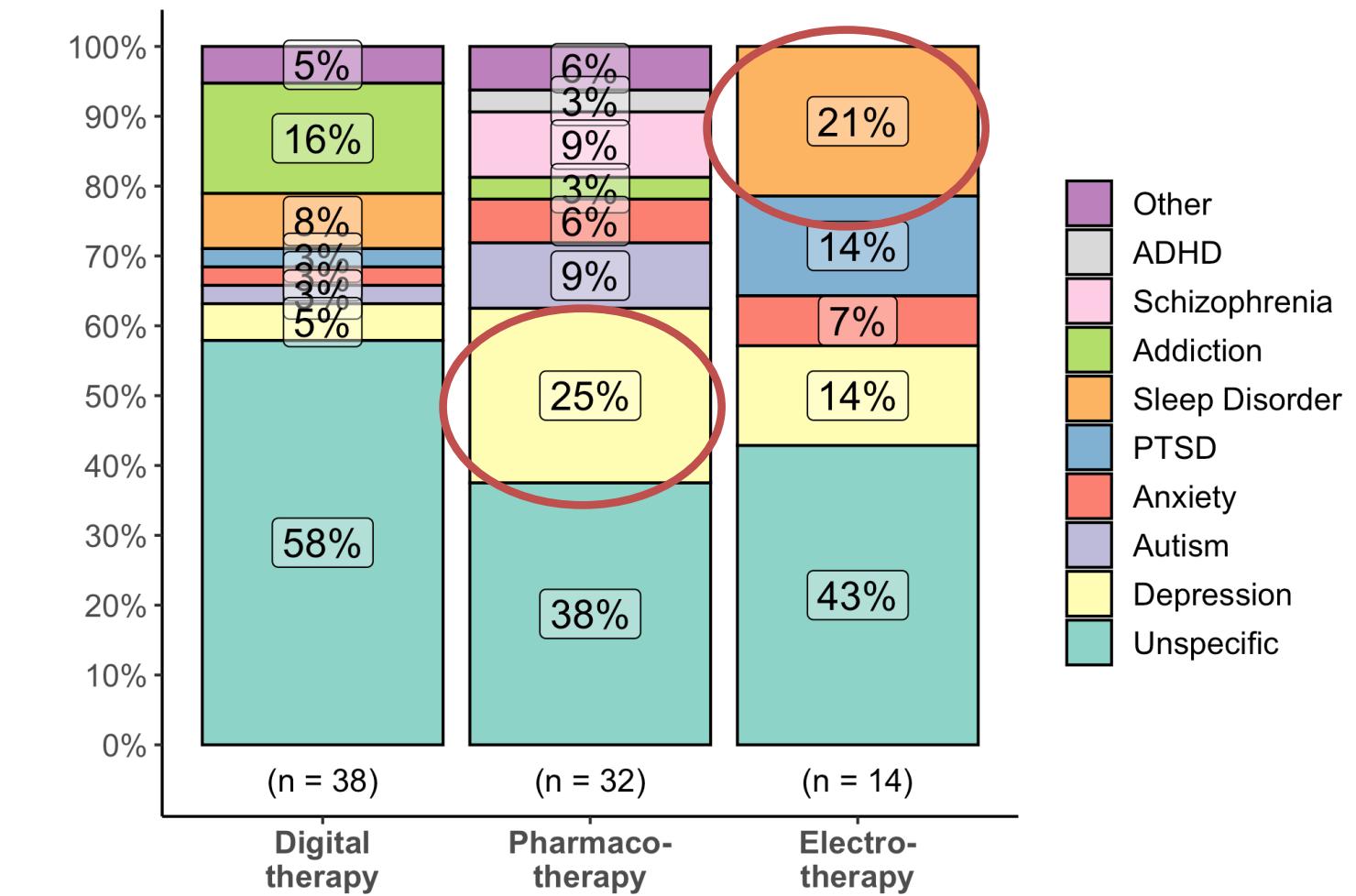
"Systems and methods of using wireless location, context, and/or one or more communication networks for monitoring for, preempting, and/or mitigating pre-identified behavior" (Williams et al., 2019)



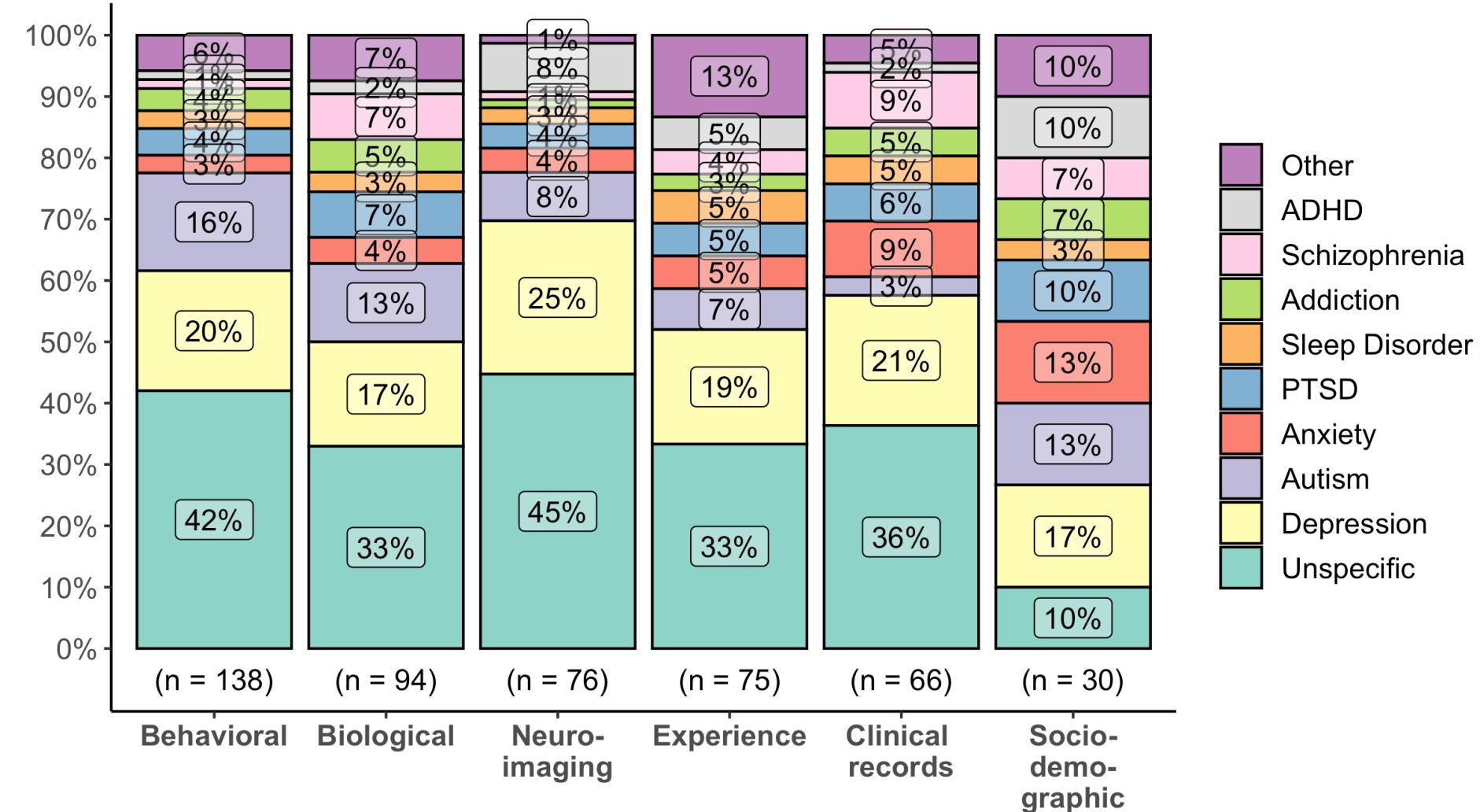
P r e d i c t i o n m o d e l s



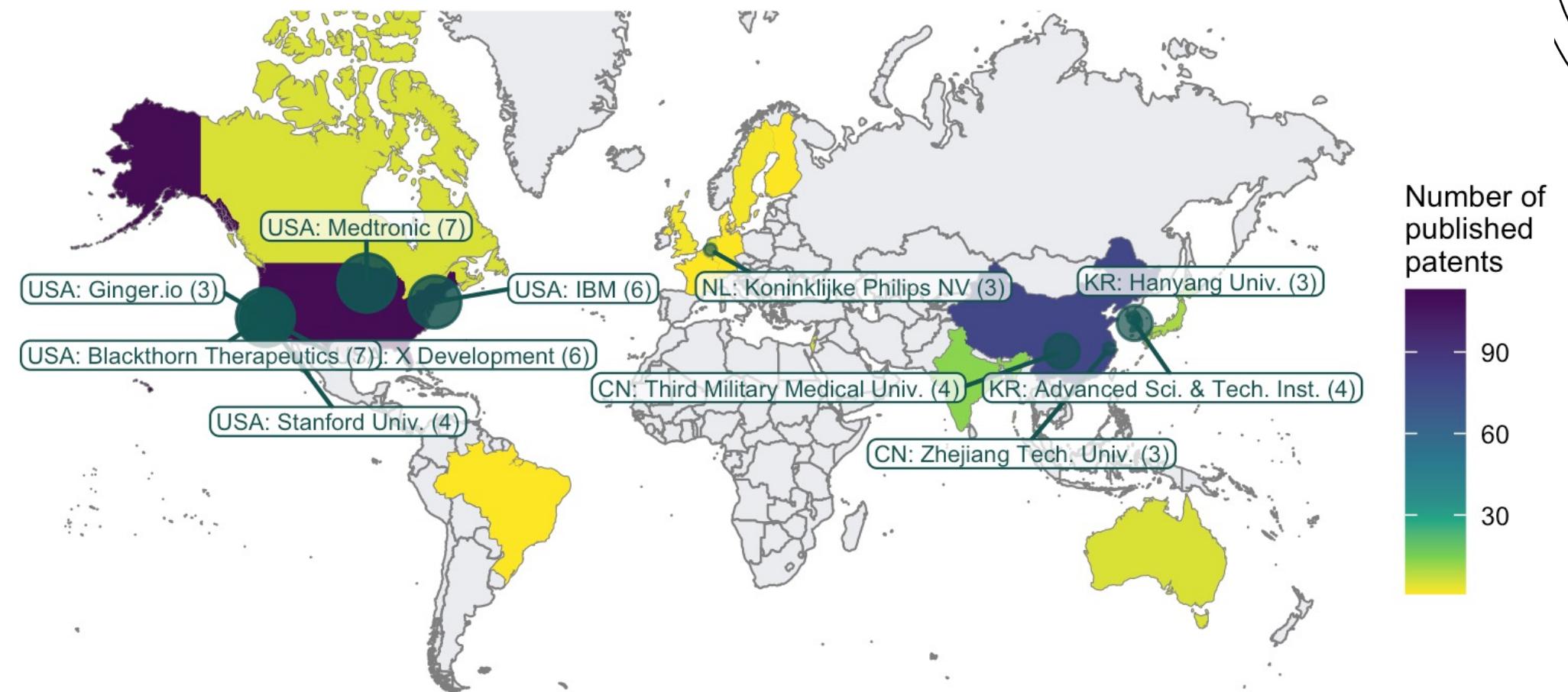
Treatment recommendations



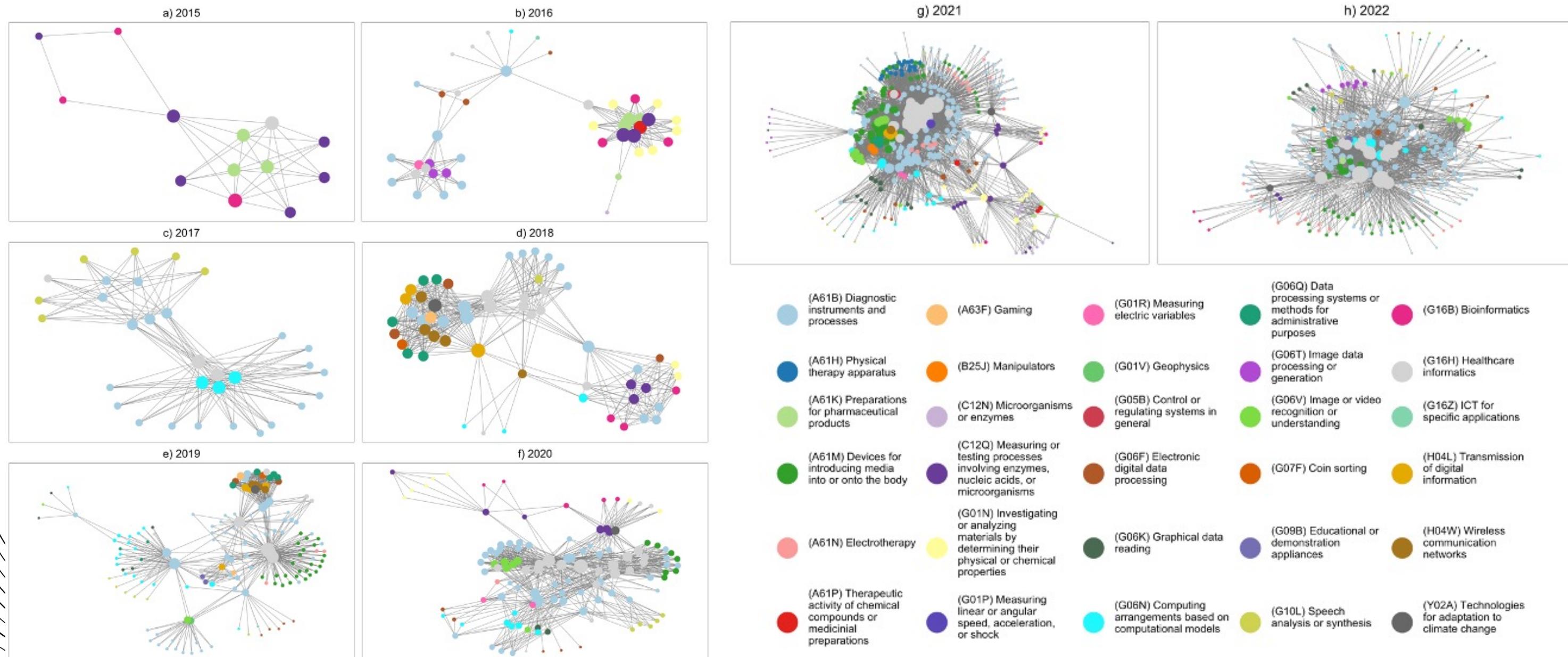
Data sources

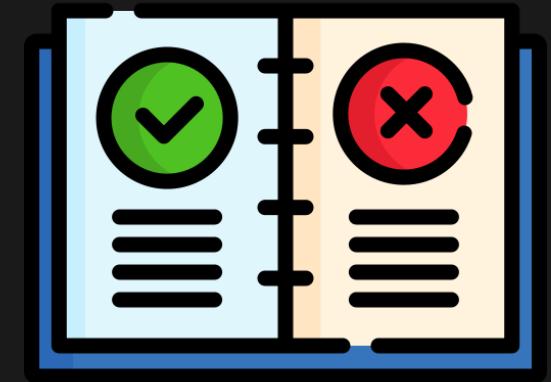


Regional distribution



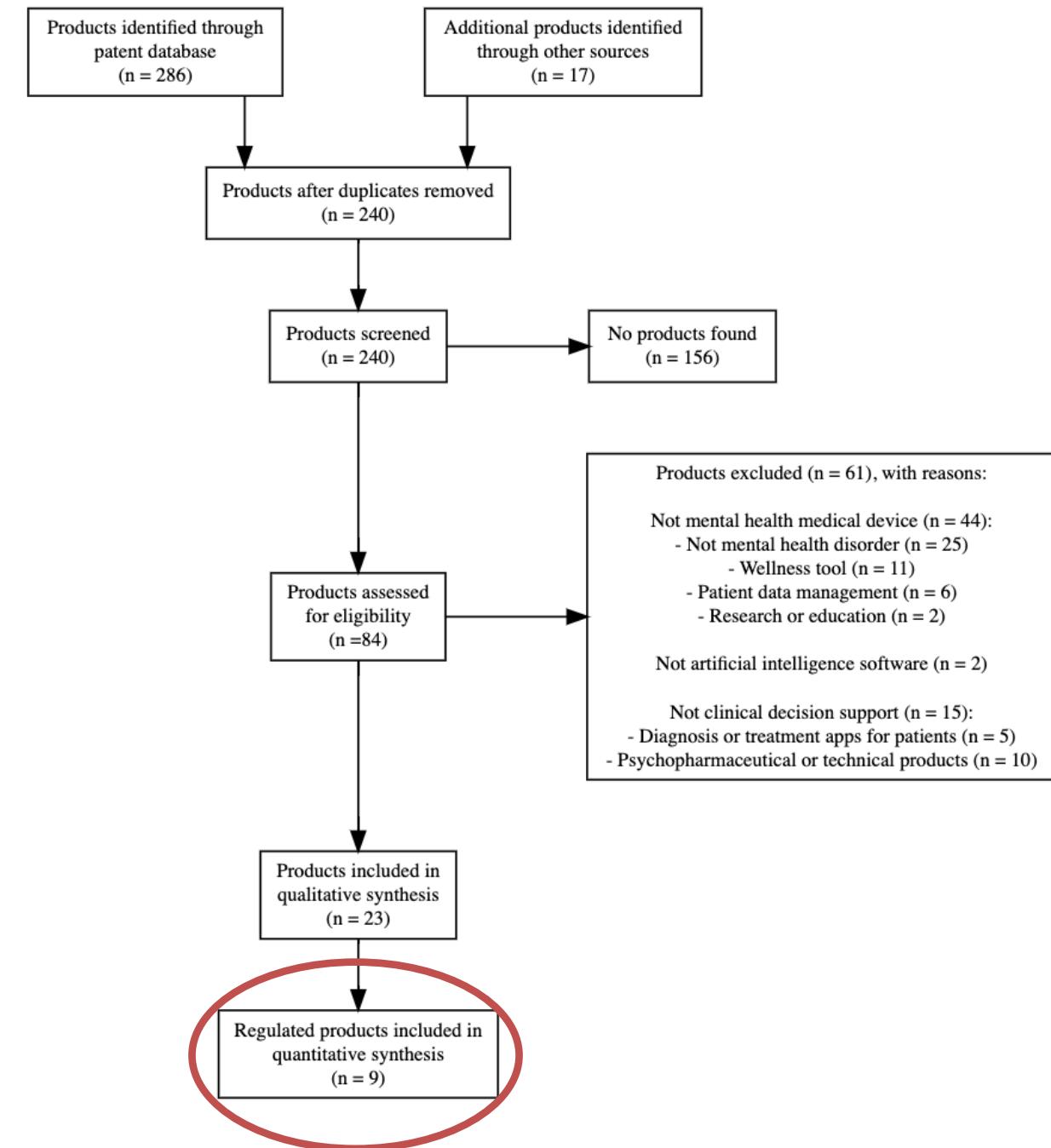
Technology convergence based on CPC codes



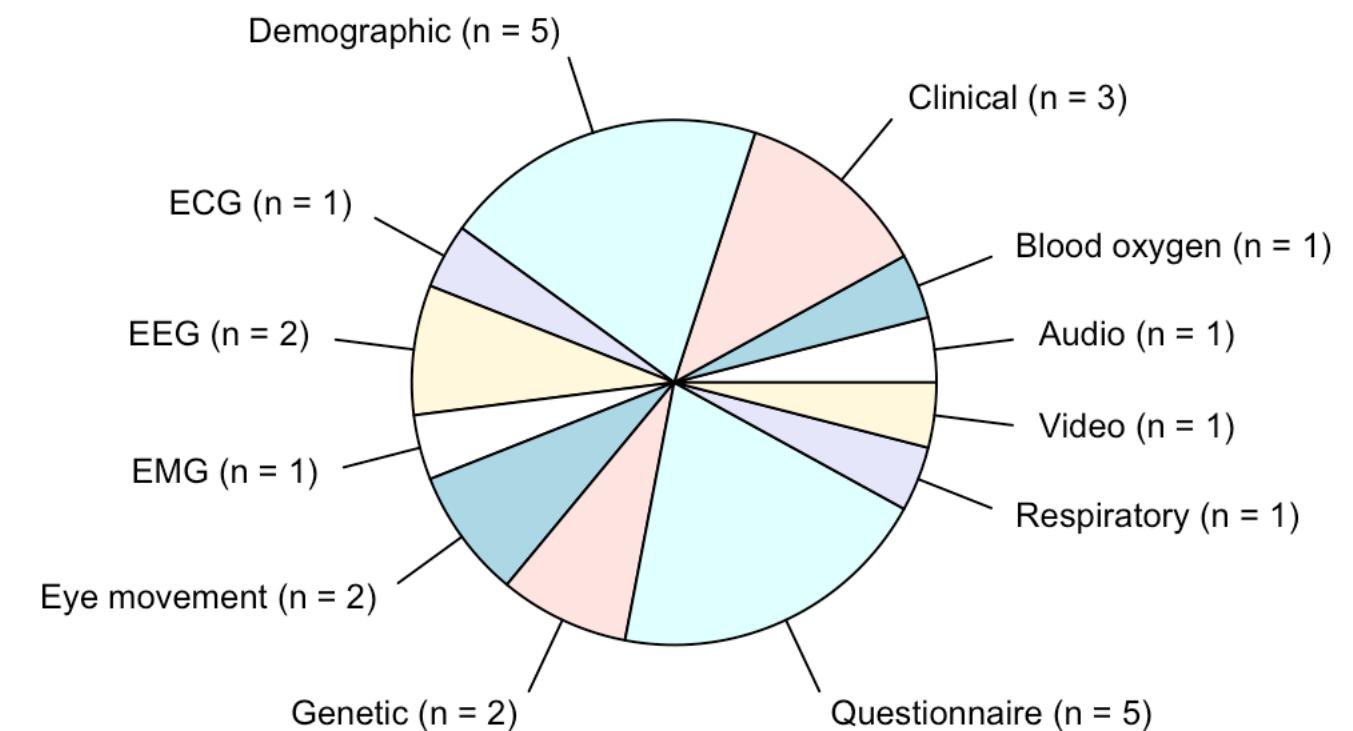
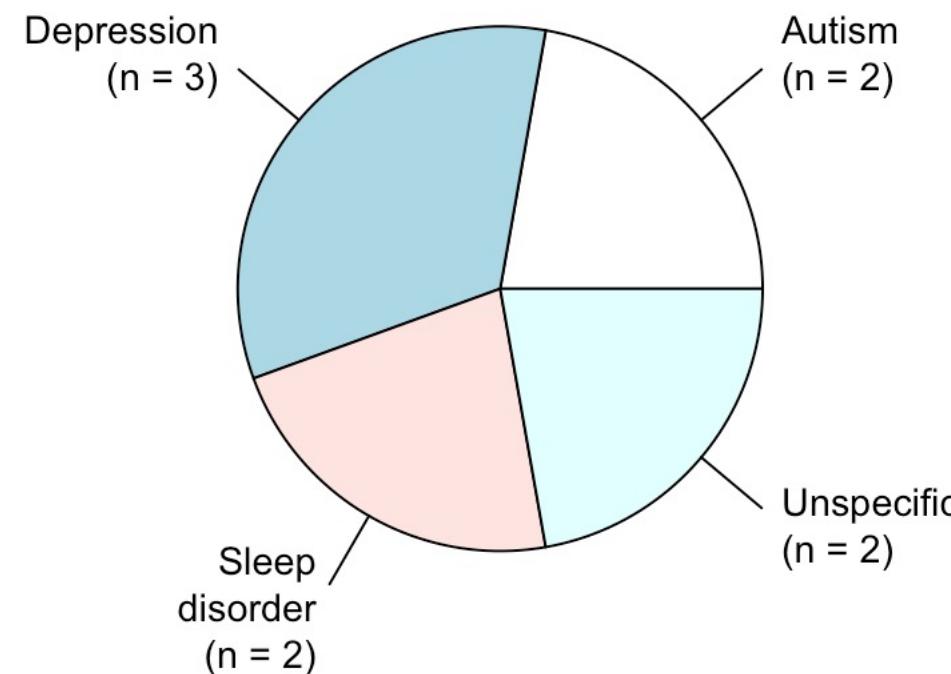


*A Review of Regulated AI
Software Medical Devices*

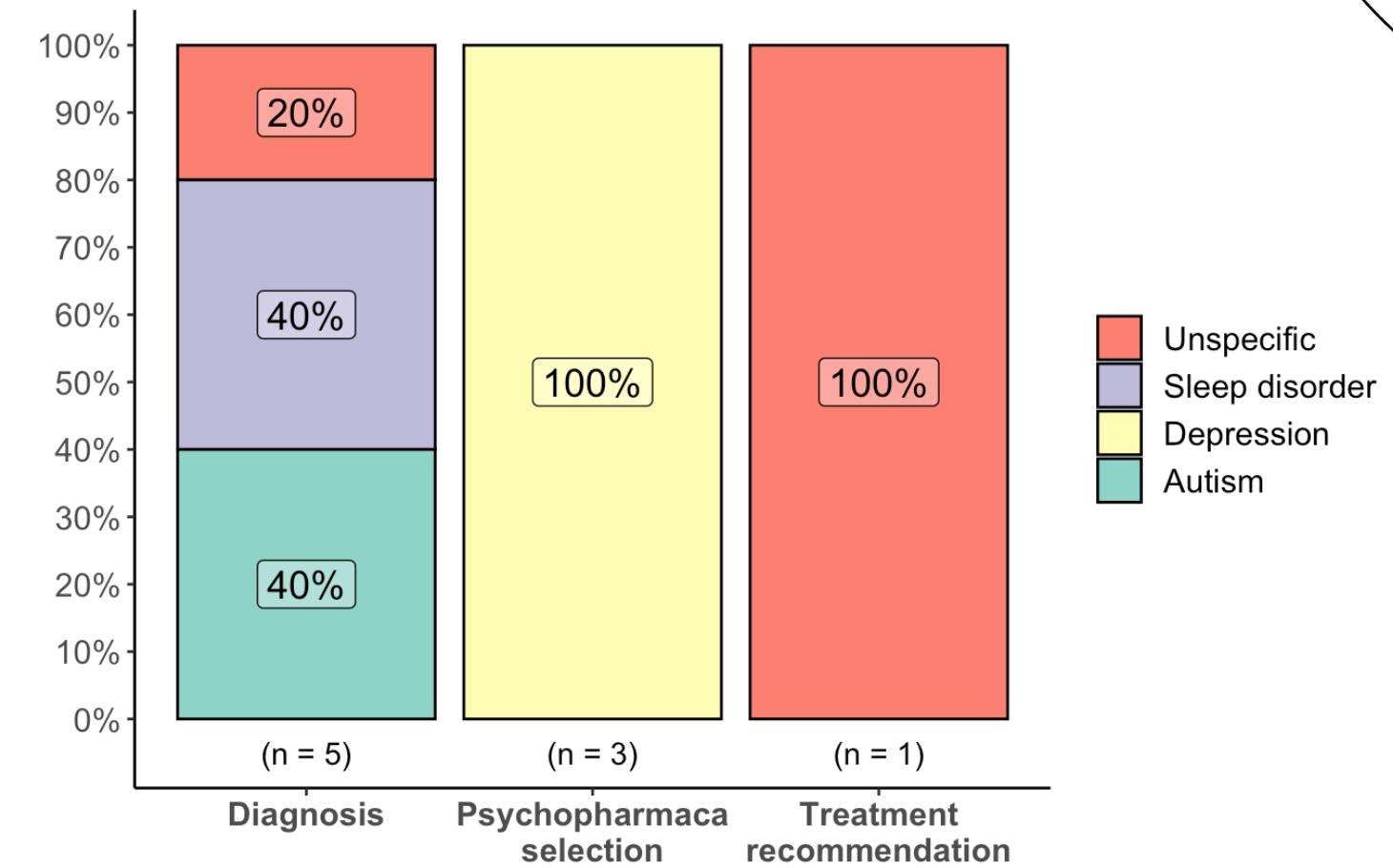
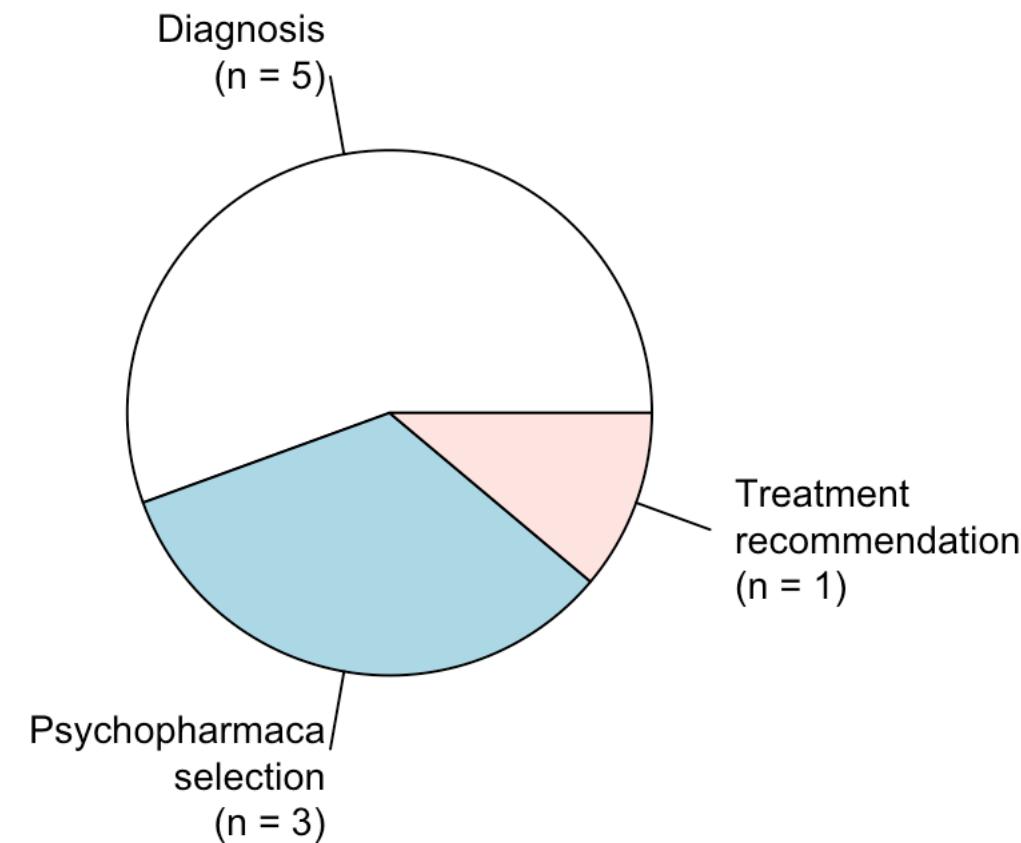
Search results



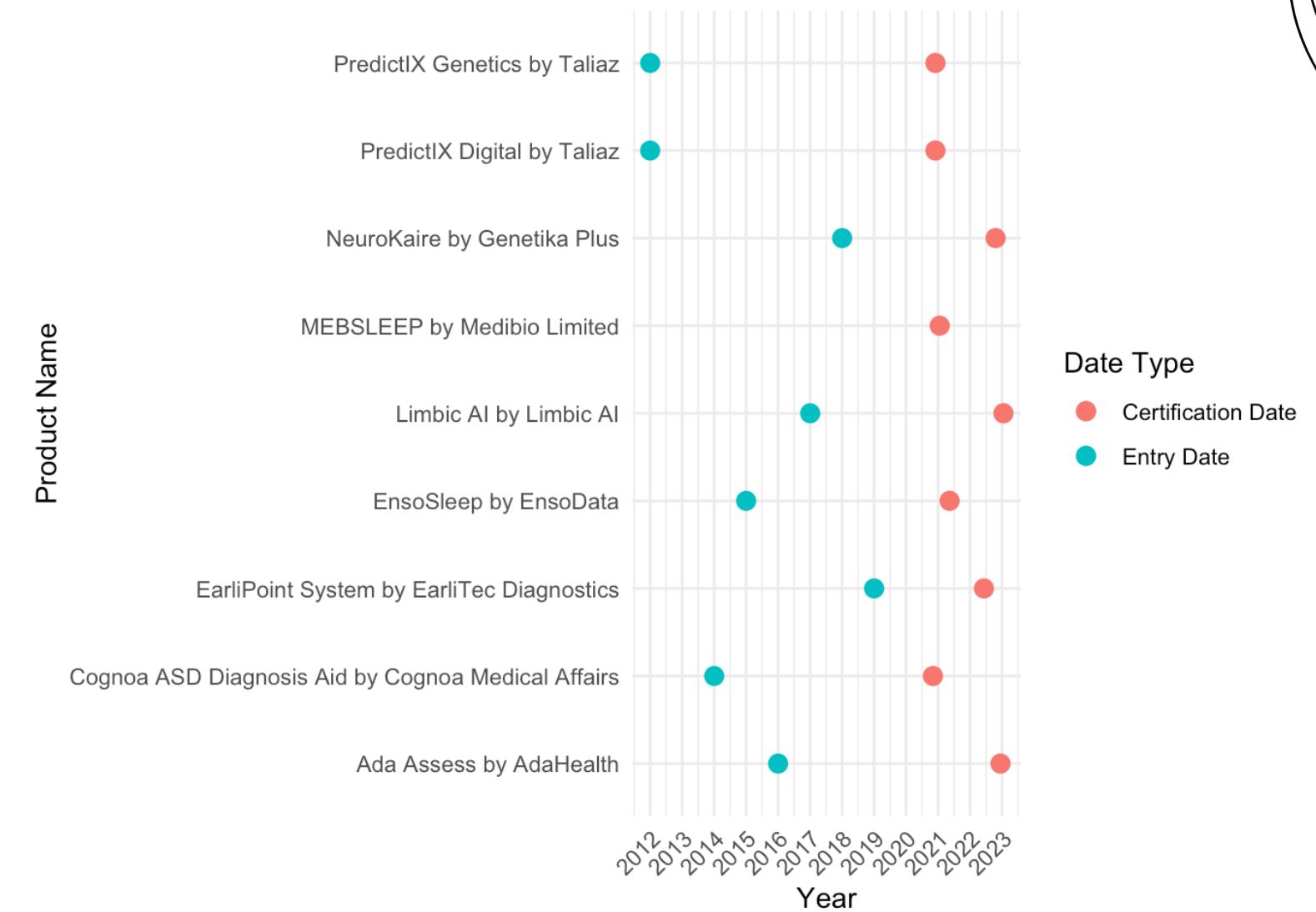
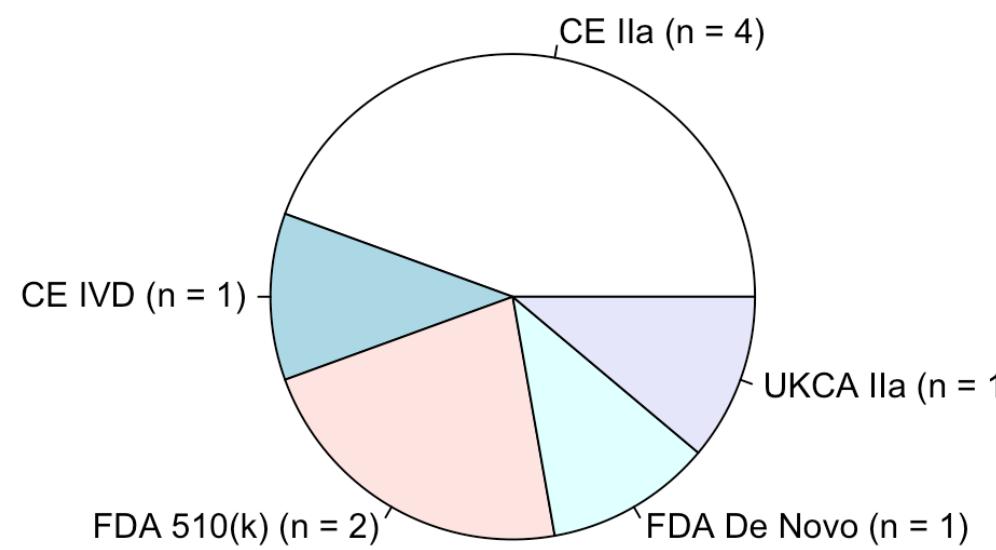
T a r g e t e d d i s o r d e r s a n d d a t a s o u r c e s



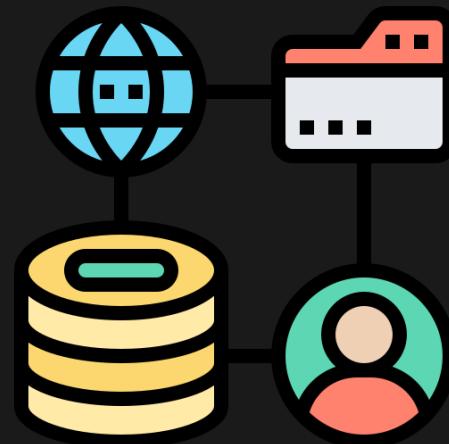
Outputs



Product regulation



WHAT WE HAVE LEARNED SO FAR



- Partly very critical attitudes towards these systems (e.g., AI anxiety as a negative predictor of use intentions)
- Some patented AI clinical support tools for mental healthcare (279 patents since 2015)
- **Very few available regulated products** (9 that are CE-marked or FDA-cleared as of July 2023)

REASONS FOR LOW AVAILABILITY

- Lack of available high-performing AI tools (e.g., due to lack of high quality training data)
- Regulatory difficulties
- Lack of demand





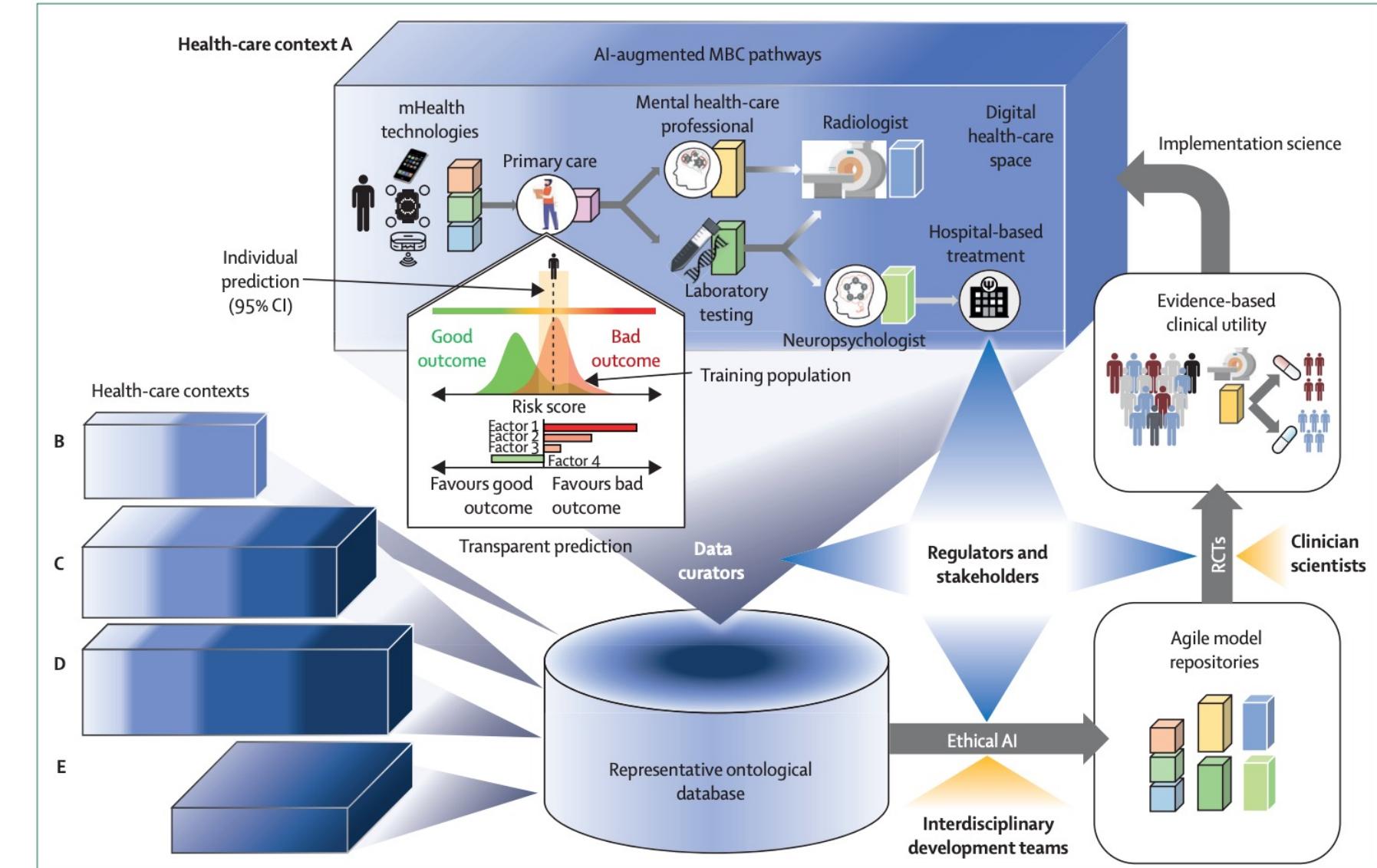
A Way Forward: AI-Informed Learning Healthcare Systems

B R E A K (5 m i n s)



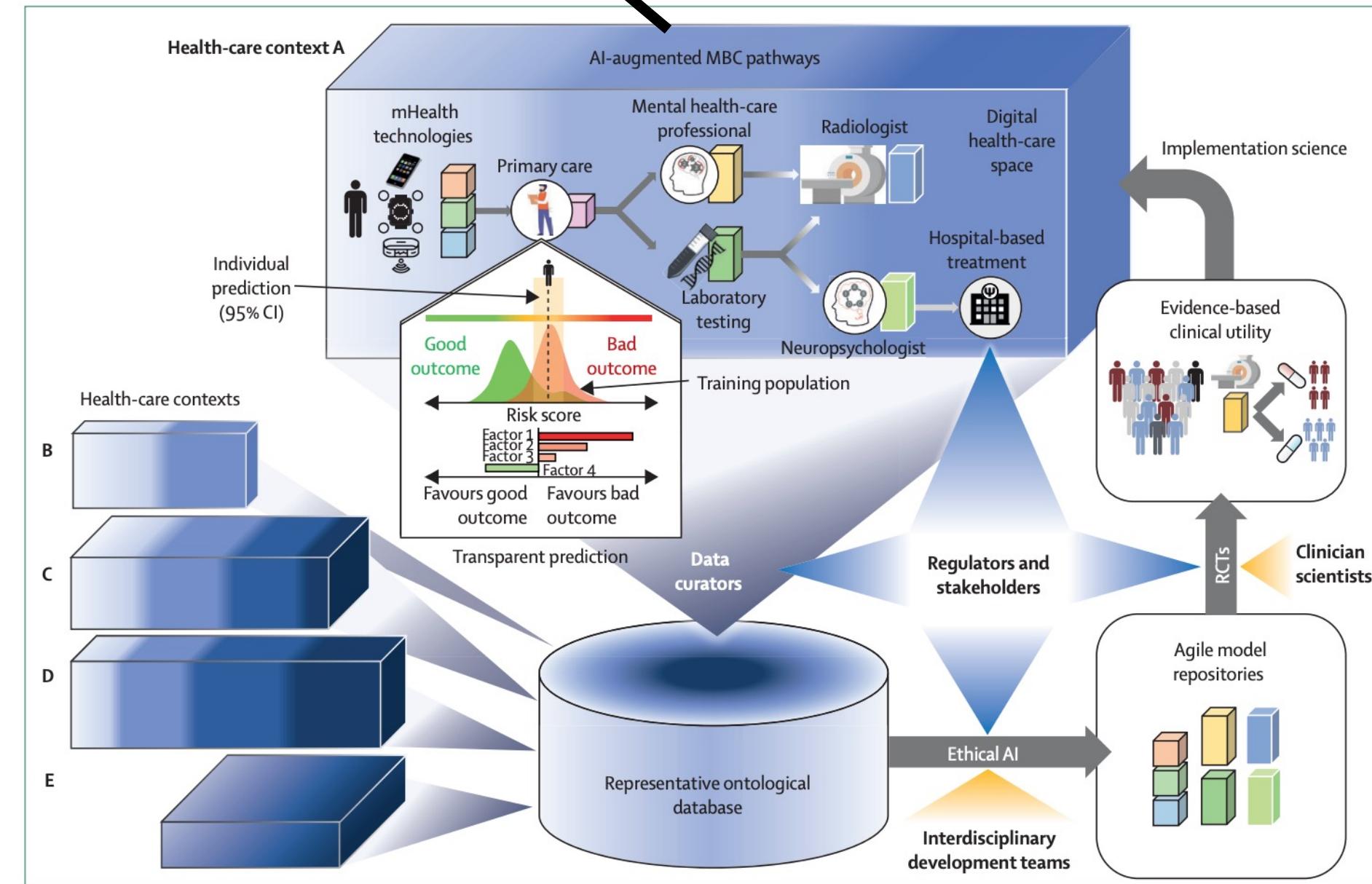
A Way Forward: AI-Informed Learning Healthcare Systems

Koutsouleris et al. (2022). From promise to practice: Towards the realisation of AI- informed mental health care

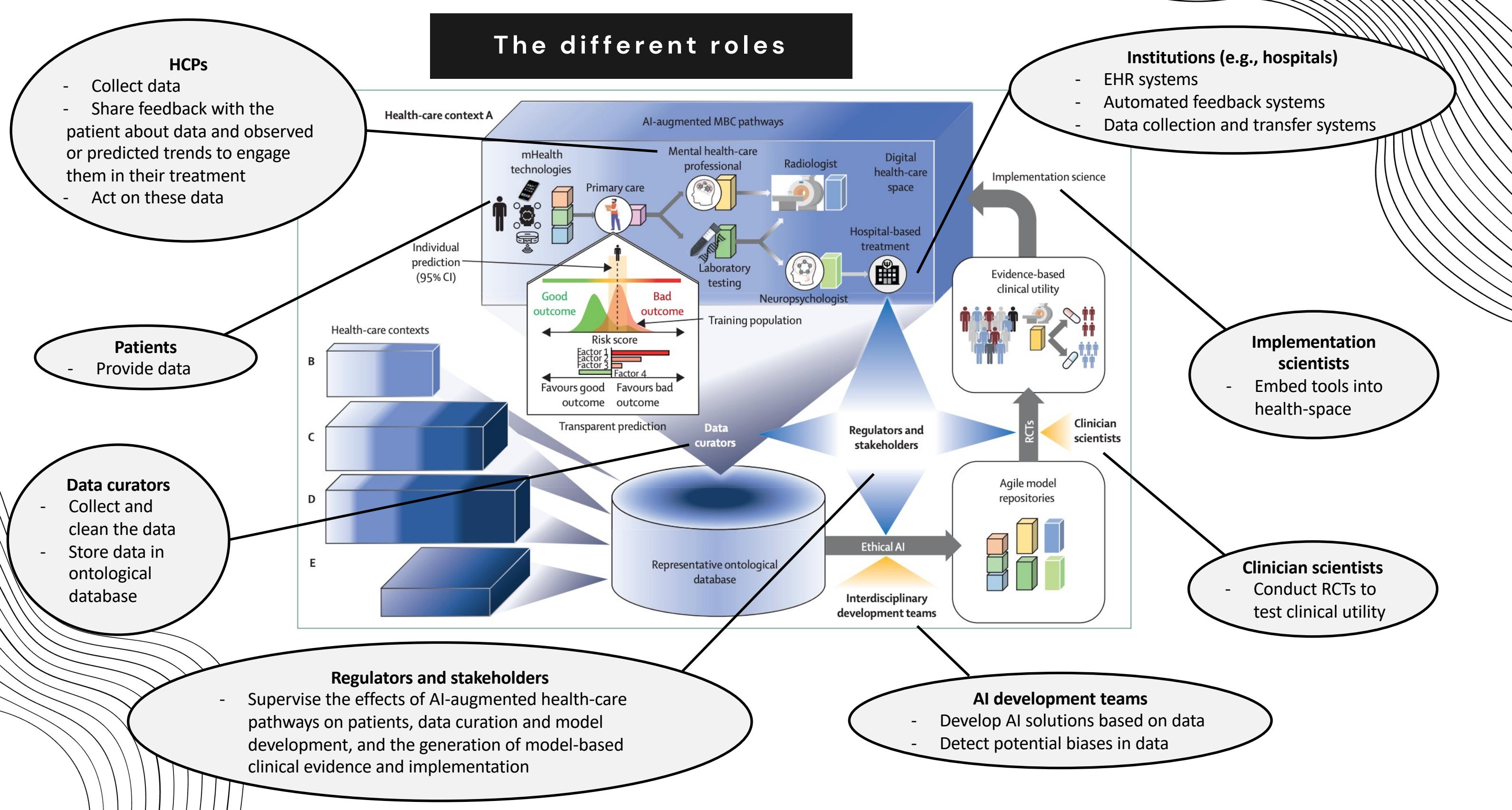


Measurement-based care (MBC)

- Evidence-based practice where care providers systematically assess patient symptoms and use that information to inform treatment decisions



The different roles



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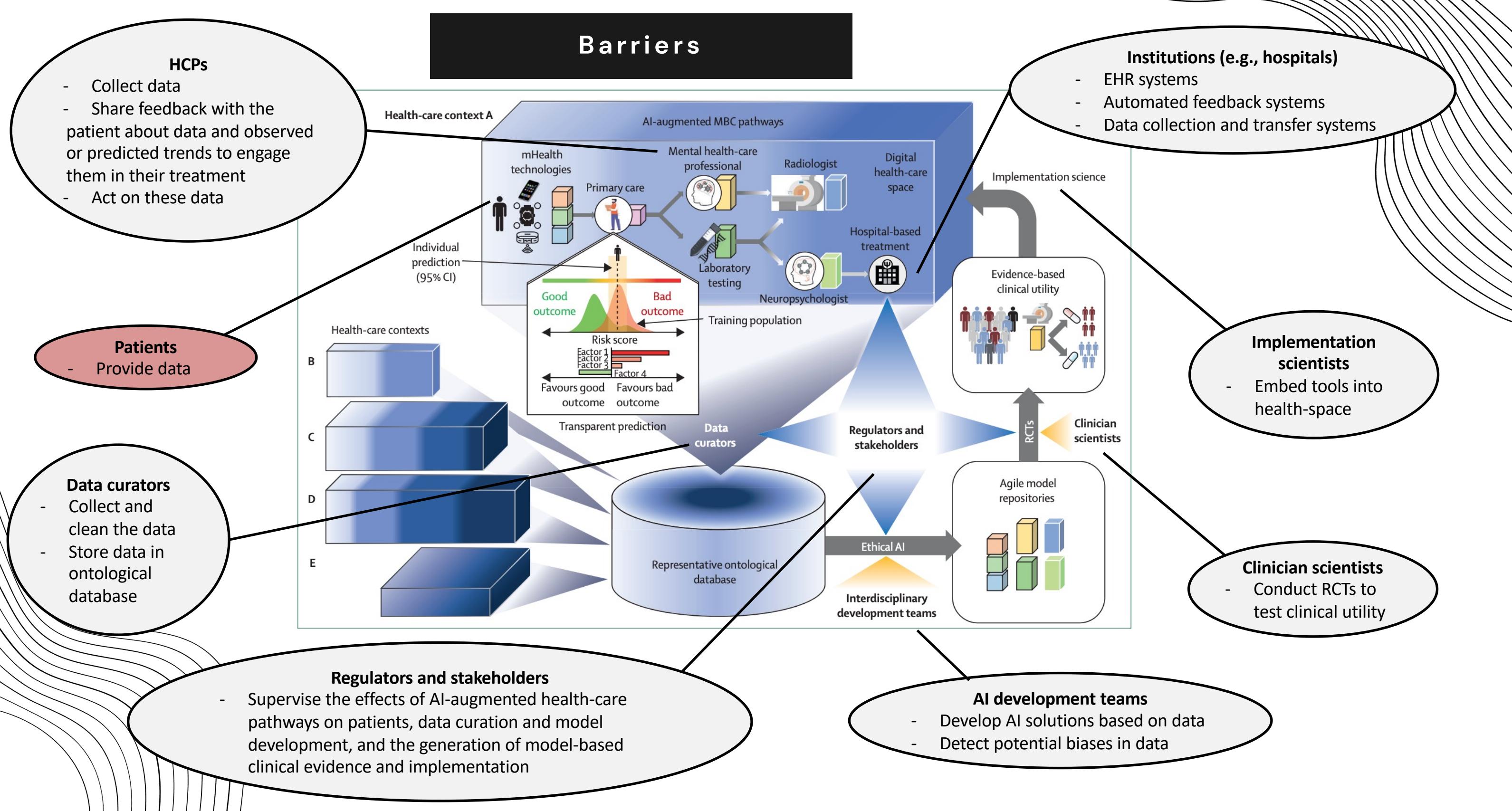
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Barriers



Your treating psychotherapists tells you that she wants to use an AI-CDSS to improve her care. What are your concerns?

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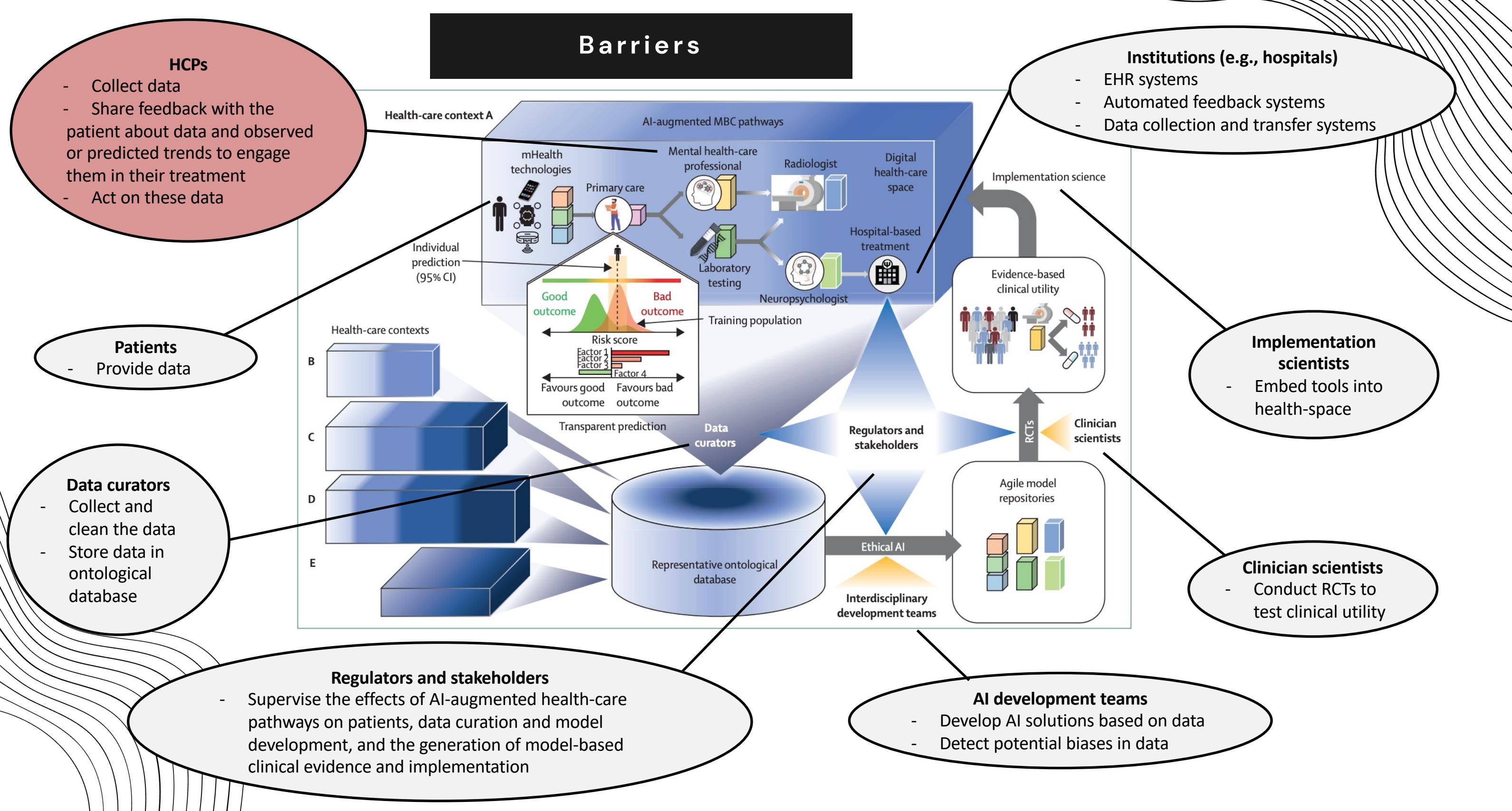
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Barriers



The clinic head tells you that they want to implement an AI-CDSS for treatment recommendations. What are your concerns as a psychotherapist?

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The clinic head tells you that they want to implement an AI-CDSS for treatment recommendations. What are your concerns as a psychotherapist?

Waiting for responses ..



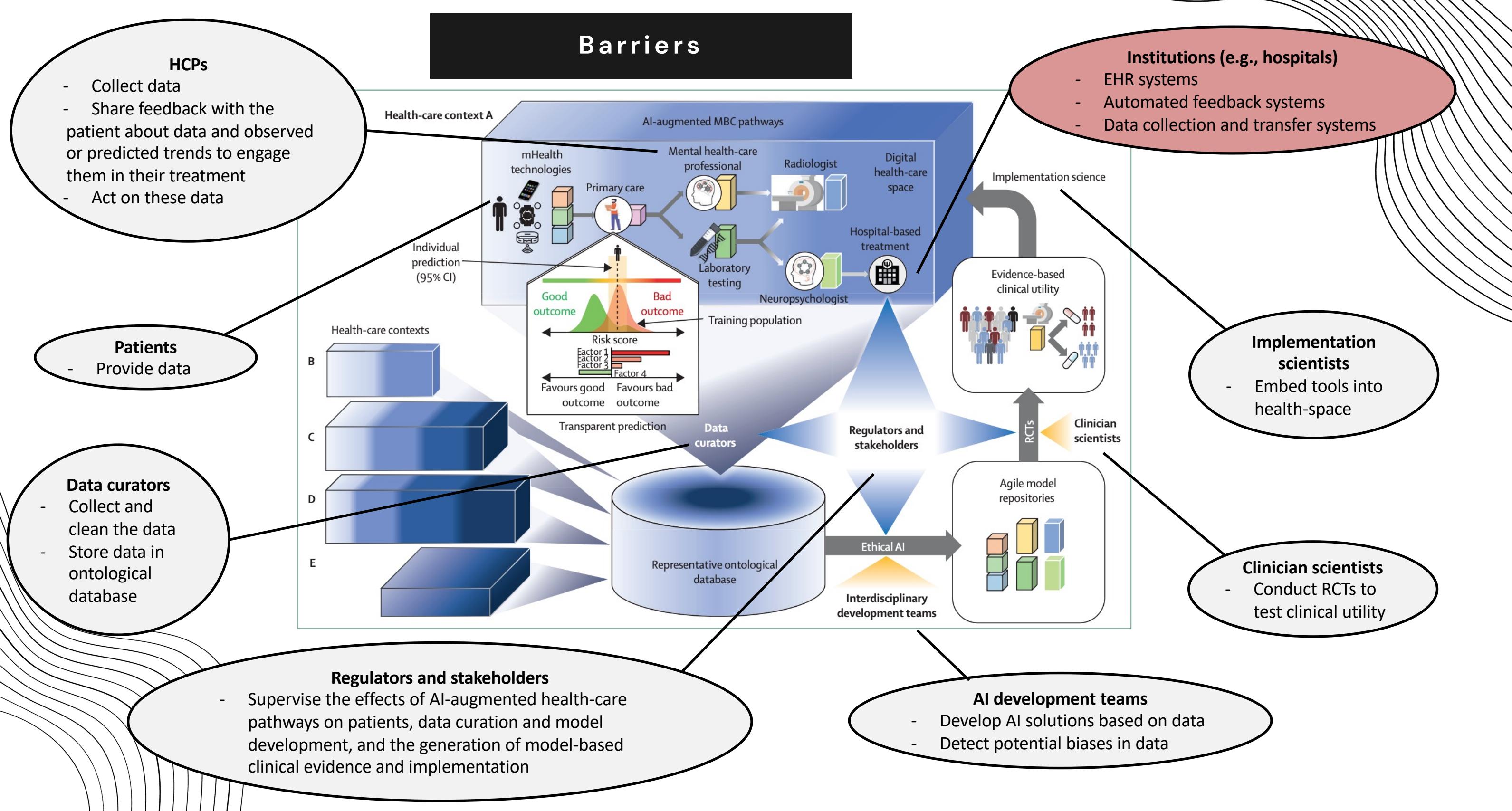
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Barriers



Imagine you are the head of a large psychiatry in Germany. You want to implement an AI-CDSS. But you have the following concerns:

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Barriers on the patient level

- “Data provider”: Perceived response burden, particularly if the measure does not seem relevant or if they do not receive feedback
- Unclear integration into treatment planning
- Data privacy and security concerns

Boswell et al. (2022)



Barriers on the HCP level

- Resources (e.g., time, effort, and costs) associated with implementing MBC and AI tools
- Negative attitudes regarding the effectiveness of MBC and AI tools
- Concerns about how the data might be used beyond informing individual patient care

Boswell et al. (2022)

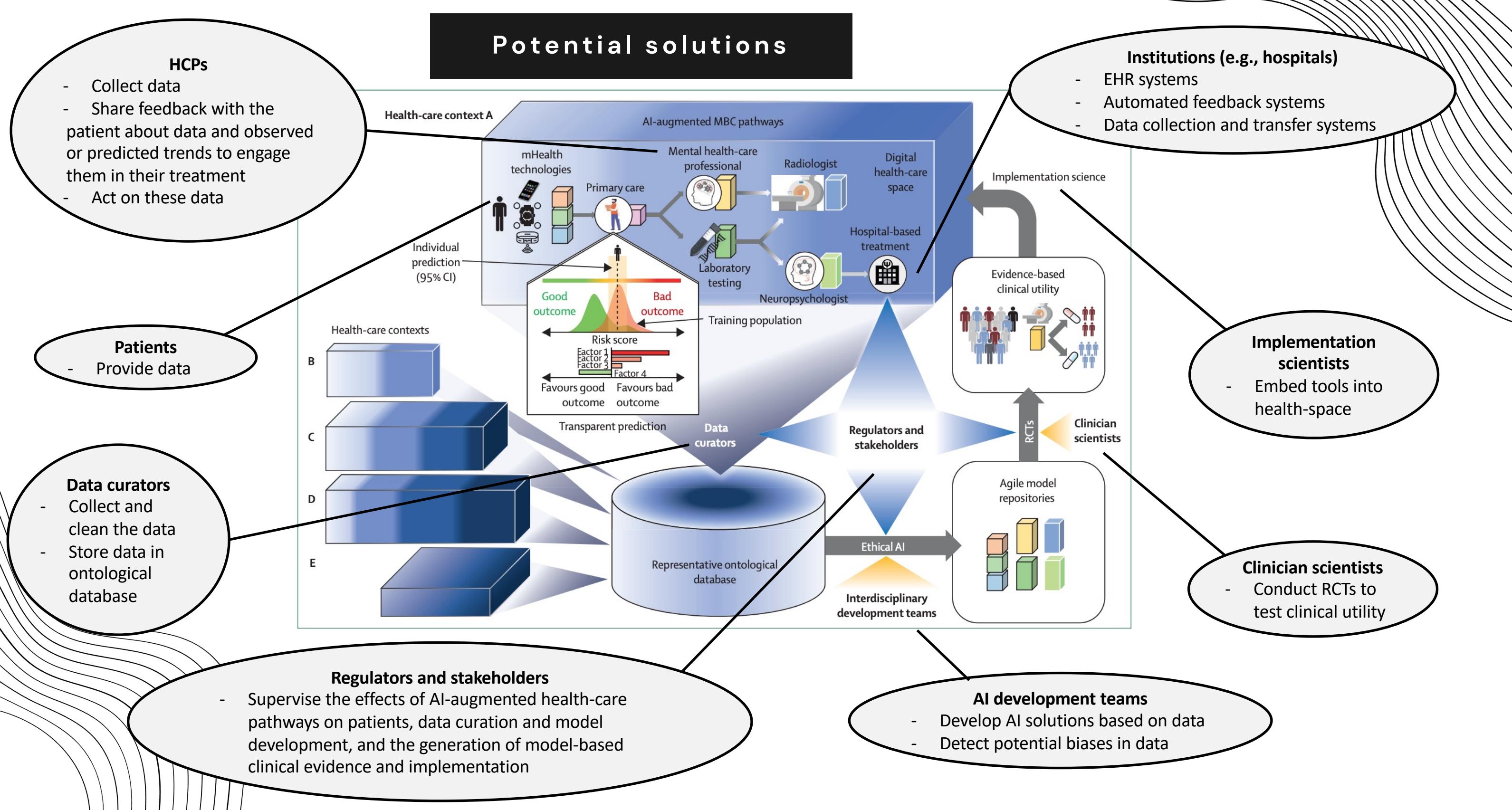


Barriers on the institutional level

- Availability of electronic health record (EHR) or automated feedback systems
- Costs of EHRs and automated feedback systems
- Limited training for providers and patients
- Lack of validation and regulation
- Turnover among staff
- Lack of support at the leadership level
- Lack of payment incentives for MBC and AI tools from third-party payors (e.g., insurances)



Potential solutions



Implementation science: The theory

Artificial Intelligence Implementation in Healthcare: A Theory-Based Scoping Review of Barriers and Facilitators

by  Taridzo Chomutare ^{1,*}   Miguel Tejedor ¹,  Therese Olsen Svenning ¹,  Luis Marco-Ruiz ¹ ,  Maryam Tayefi ¹,  Karianne Lind ¹,  Fred Godtliebsen ^{1,2},  Anne Moen ^{1,3} ,  Leila Ismail ^{4,5,6} ,  Alexandra Makhlysheva ¹  and  Phuong Dinh Ngo ¹ 



The practical implementation of AI technologies in medicine

Jianxing He , Sally L. Baxter, Jie Xu, Jim

Nature Medicine **25**, 30–36 (2019) | [Cite this article](#)

41k Accesses | 745 Citations | 67 Altmetrics

- Often remaining theoretical
- Identification of barriers and facilitators at different levels (ignoring system perspective)

Artificial Intelligence and the Implementation Challenge

James Shaw ^{1,2} ; Frank Rudzicz ³ ; Trevor Jamieson ^{1,4} ; Avi Goldfarb ⁵ 

Challenges for Artificial Intelligence in Health Care Practice:

James Shaw ^{1,2} ; Frank Rudzicz ³ ; Trevor Jamieson ^{1,4} ; Avi Goldfarb ⁵ 

Accelerating the impact of artificial intelligence in mental healthcare through implementation science

Per Nilsen , Petra Svedberg, [...], and Stephen Schueller  [View all authors and affiliations](#)

[All Articles](#) | <https://doi.org/10.1177/26334895221112033>

Implementation science: The practice

Too much theory and not enough practice? The challenge of implementation science application in healthcare practice

Frances Rapport PhD , James Smith PhD, Karen Hutchinson PhD, Robyn Clay-Williams PhD,
Kate Churruca PhD, Mia Bierbaum Master Public Health, Jeffrey Braithwaite PhD

Open Discussion:

How can we spur implementation science?

What are clever designs for implementation science?

What skillsets are needed among implementation scientists in practice?

THANK YOU!

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LMU Munich



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<https://www.clinaid-lab.com>
<https://www.annekathrinkleine.com>

RESOURCES

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