AusHSI Australian Centre for Health Services Innovation

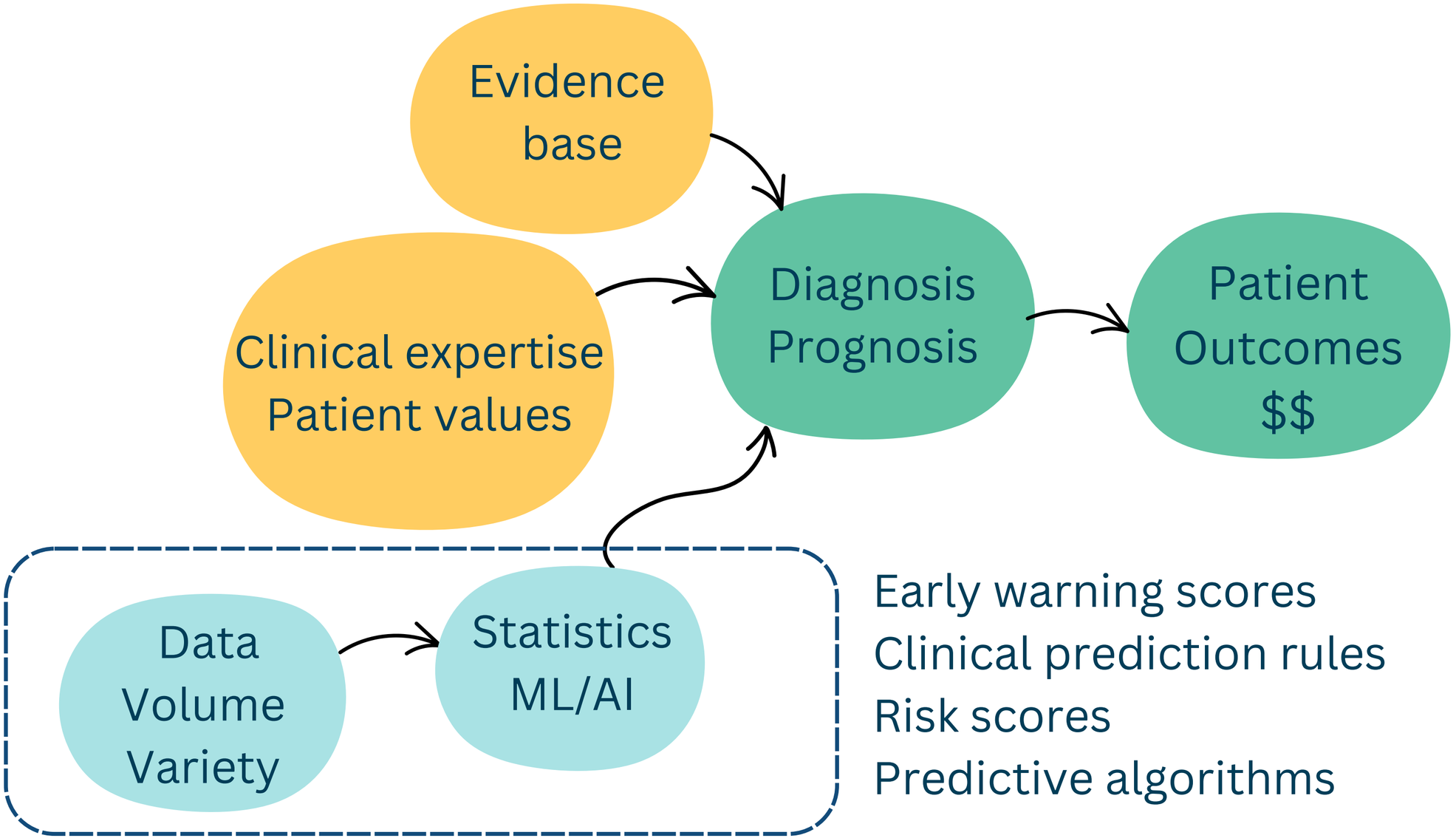
QUT

(Non-)publication bias in clinical prediction modelling and the role of health services research

Nicole White

Collaborators: Rex Parsons, David Borg, Gary Collins & Adrian Barnett

Why clinical prediction models?



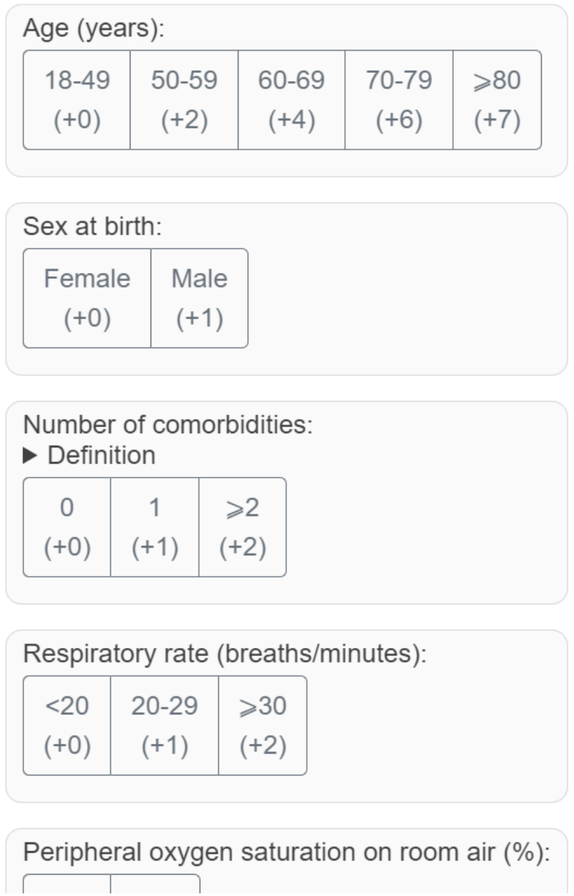
Why clinical prediction models?

Well-known examples used in practice

- Framingham risk score
- Nottingham Prognostic Index
- ISARIC 4C score

Uses information available at point of decision-making

Easy-to-use and interpret



4C Mortality Score	Mortality/%
1	0.3
2	0.8
3	2.3
4	4.8
5	7.5
6	7.8
7	11.7
8	14.4
9	19.2
10	22.9
11	26.9
12	32.9
13	40.1
14	44.6
15	51.6
16	59.1
17	66.1
18	75.8
19	77.4
20	82.9
21	87.5

Source: https://isaric4c.net/risk/v2/

Current state

Systematic review highlights high risk of bias of clinical prediction models for blood transfusion in patients undergoing elective surgery

Paula Dhiman [1], Jie Ma [2], Victoria N Gibbs [3], Alexandros Rampotas [4], Hassan Kamal [5], Sahar S Arshad [2], Shona Kirtley [2], Carolyn Doree [4], Michael F Murphy [6], Gary S Collins [7], Antony J R Palmer [8]

Prognostic models in obstetrics: available, but far from applicable

C Emily Kleinrouweler [1], Fiona M Cheong-See [2], Gary S Collins [3], Anneke Kwee [4], Shakila Thangaratinam [5], Khalid S Khan [5], Ben Willem J Mol [6], Eva Pajkrt [6], Karel G M Moons [7], Ewoud Schuit [8]

The majority of 922 prediction models supporting breast cancer decision-making are at high risk of bias

Tom A Hueting [1], Marissa C van Maaren [2], Mathijs P Hendriks [3], Hendrik Koffijberg [1], Sabine Siesling [4]

Systematic review finds "spin" practices and poor reporting standards in studies on machine learning-based prediction models

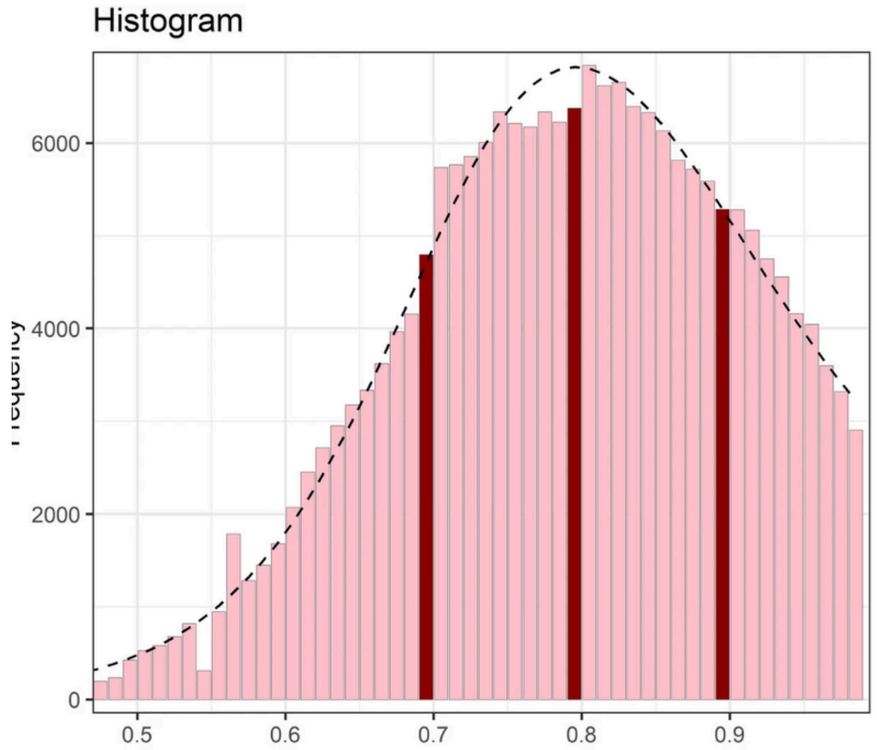
Constanza L Andaur Navarro [1], Johanna A A Damen [2], Toshihiko Takada [3], Steven W J Nijman [3], Paula Dhiman [4], Jie Ma [5], Gary S Collins [4], Ram Bajpai [6], Richard D Riley [6], Karel G M Moons [2], Lotty Hooft [2]

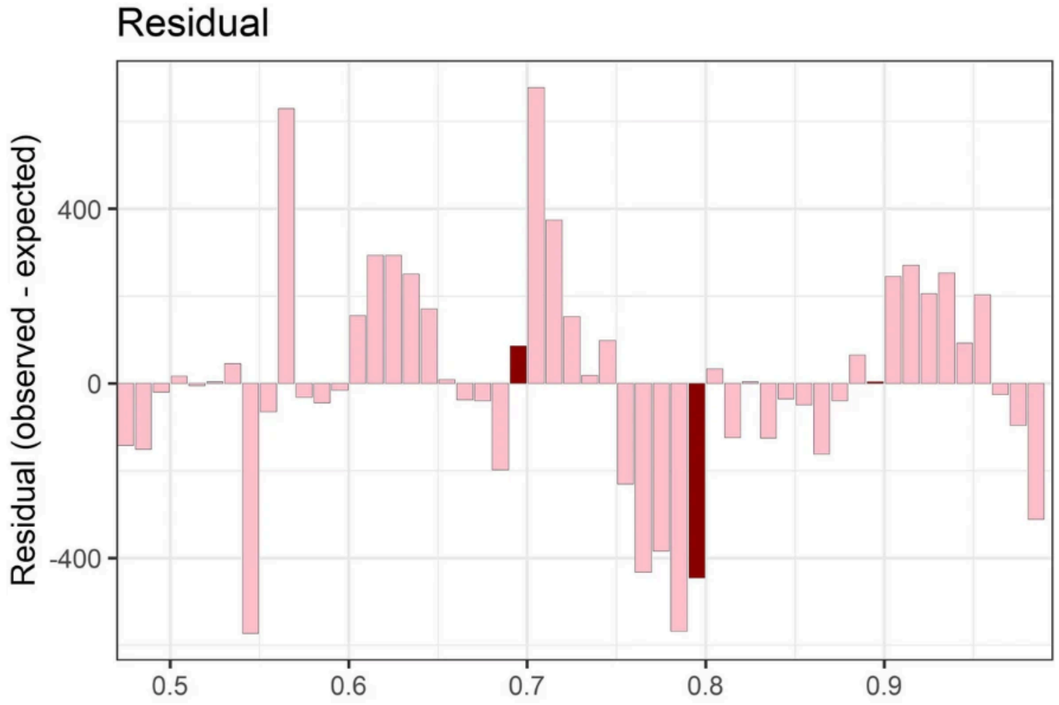
Impact of publication bias

RESEARCH ARTICLE Open Access

Evidence of questionable research practices in clinical prediction models

Nicole White[1], Rex Parsons[1], Gary Collins[2] and Adrian Barnett[1*]





If publication bias exists in the clinical prediction model literature...

Are there models that have been planned but not completed or completed but not published?

National Library of Medicine
National Center for Biotechnology Information

ClinicalTrials.gov

Targeted keyword search

“Prediction model”
“Risk score”
“Machine Learning”
“Artificial Intelligence”

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Targeted keyword search

Assess record eligibility

“Prediction model”
“Risk score”
“Machine Learning”
“Artificial Intelligence”

Development
Validation
Prognosis
Diagnosis

National Library of Medicine
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PubMed®

Targeted keyword search

Assess record eligibility

Peer-reviewed publication matching

“Prediction model”
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Development
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Diagnosis

National Clinical Trials (NCT) number
Machine Learning classifier

National Library of Medicine
National Center for Biotechnology Information

ClinicalTrials.gov

PubMed®

Targeted keyword search

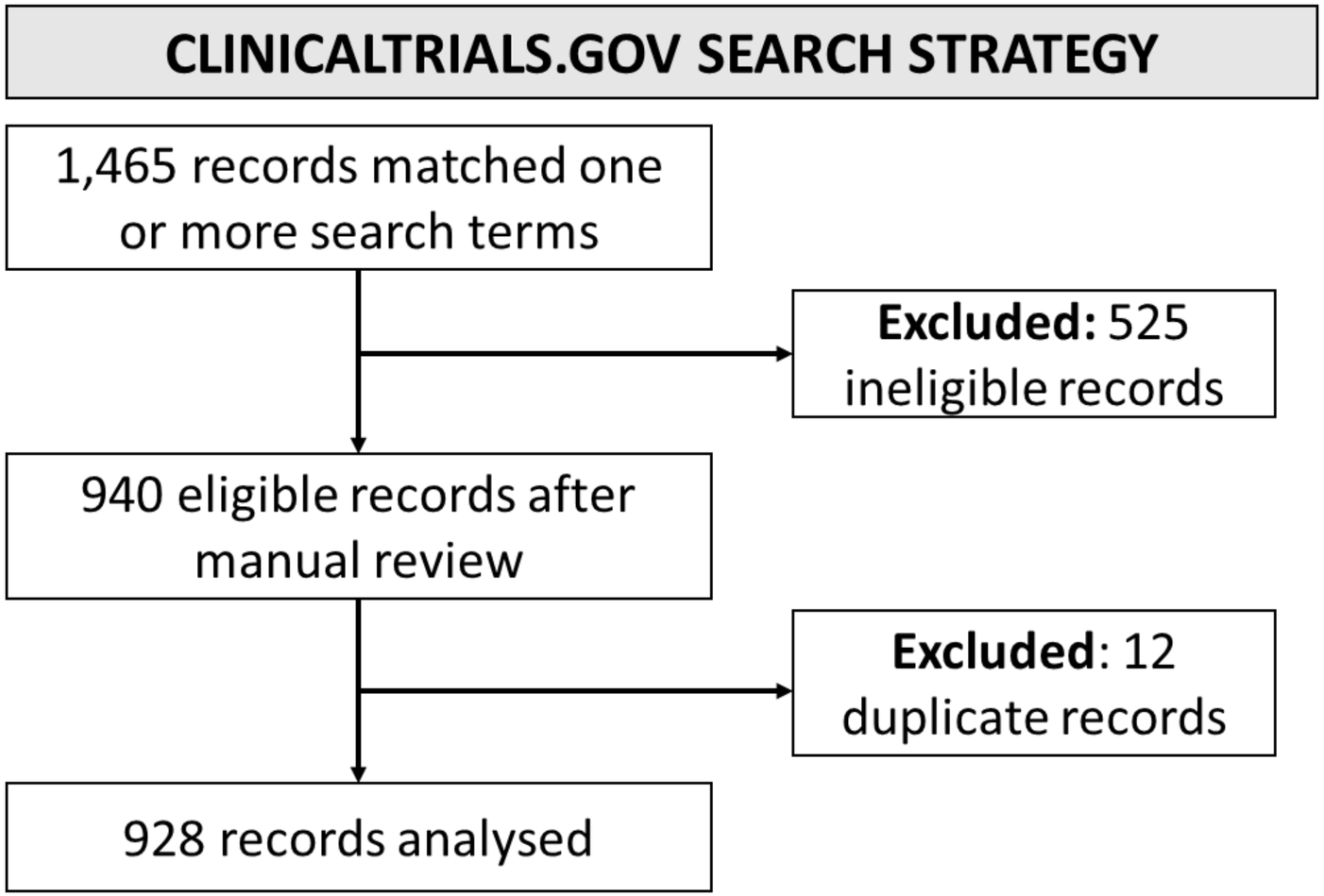
Assess record eligibility

Peer-reviewed publication matching

Record and publication searches completed in R: `XML`, `rentrez`

Record eligibility and publication matches reviewed manually

We found almost 1,000 studies registered since 2000

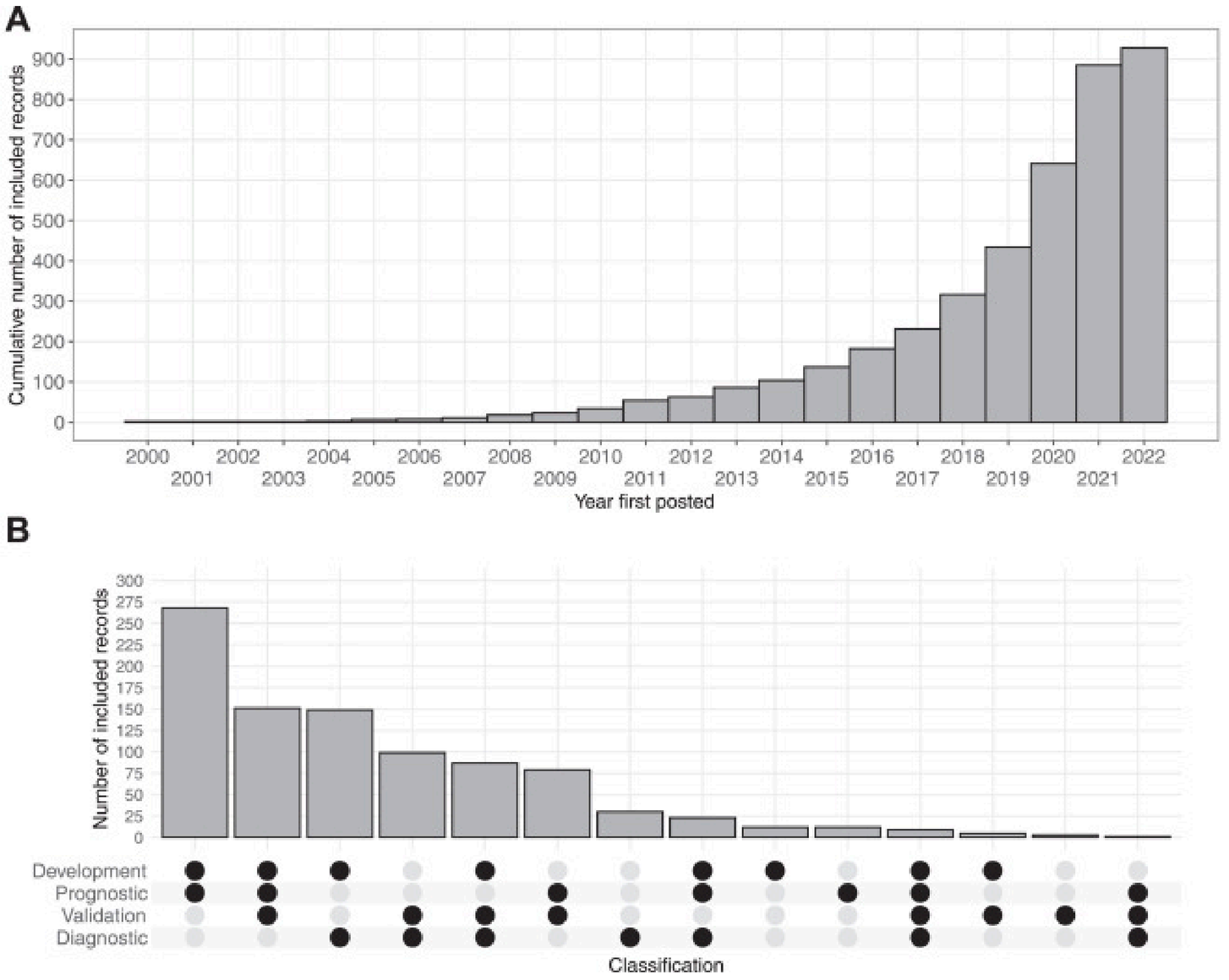


Record characteristics

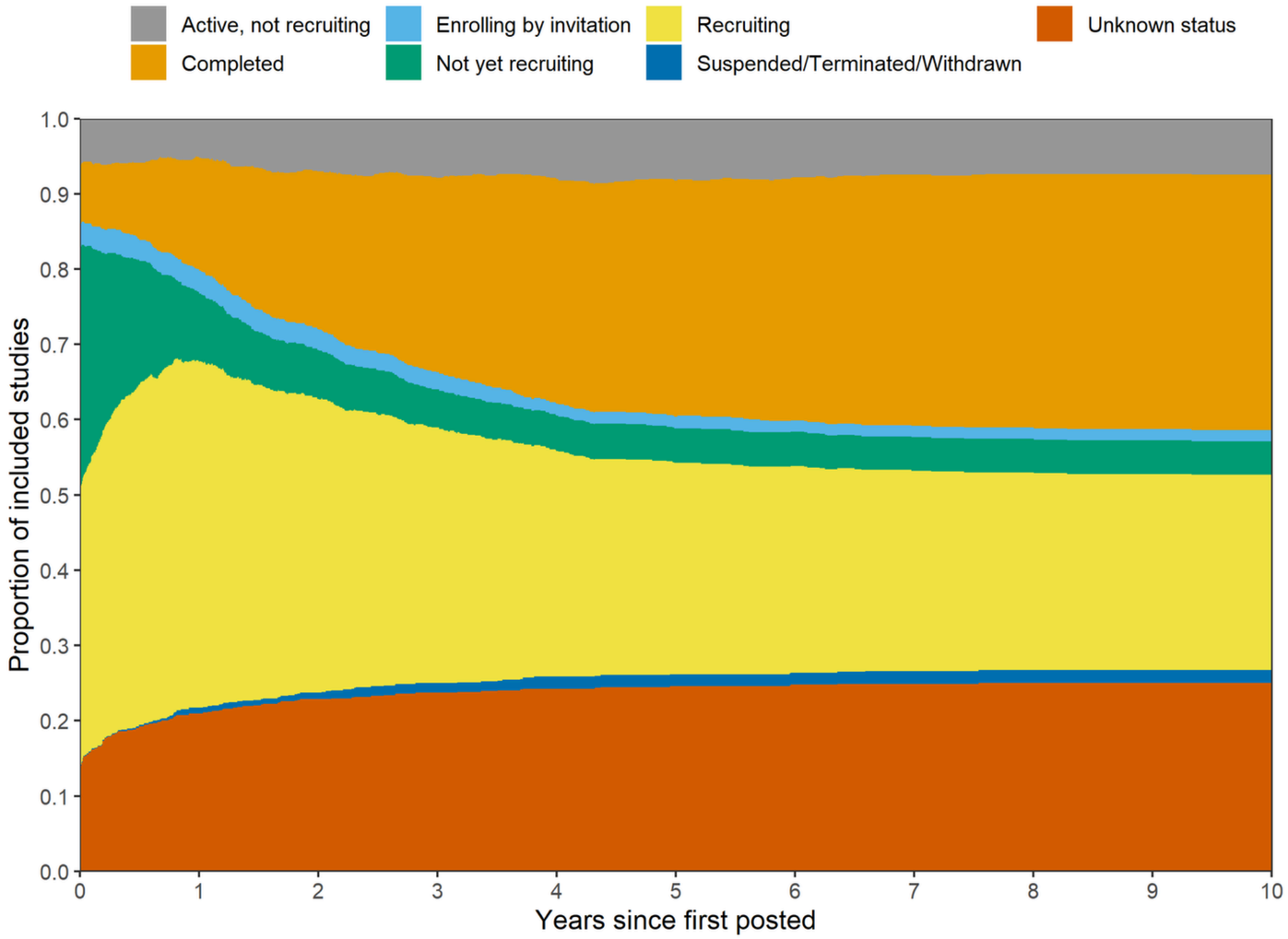
Developing new models more common than validating existing models

58% of records proposed prognostic models

4.5% of records reported grant funding



Planned but not completed?



Completed but ever published?

MeSH descriptor	clinicaltrials.gov records found	Matching publications	Publication rate (%)
Chest pain	11	5	46
Carcinoma, hepatocellular	8	3	38
Syndrome	19	7	37
Prostatic neoplasm	9	3	33
Heart failure	24	7	30
Coronary artery disease	29	6	21
Emergencies	21	4	19
Critical illness	11	2	18
Atrial fibrillation	20	3	15
Colorectal neoplasms	14	2	14

MeSH descriptor	clinicaltrials.gov records found	Matching publications	Publication rate (%)
Sepsis	14	2	14
Breast neoplasms	30	4	13
Diabetic retinopathy	8	1	13
Parkinson disease	9	1	11
Stomach neoplasms	9	1	11
COVID-19	46	5	11
Stroke	22	2	9
Atherosclerosis	11	1	9
Lung neoplasms	19	0	0
Acute kidney injury	13	0	0

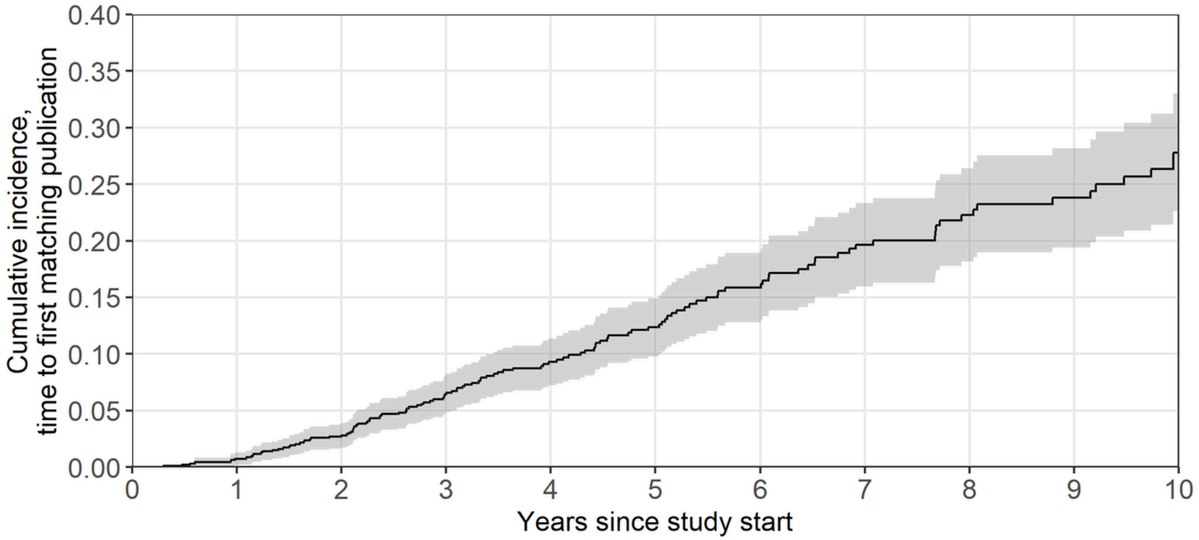
Completed but ever published?

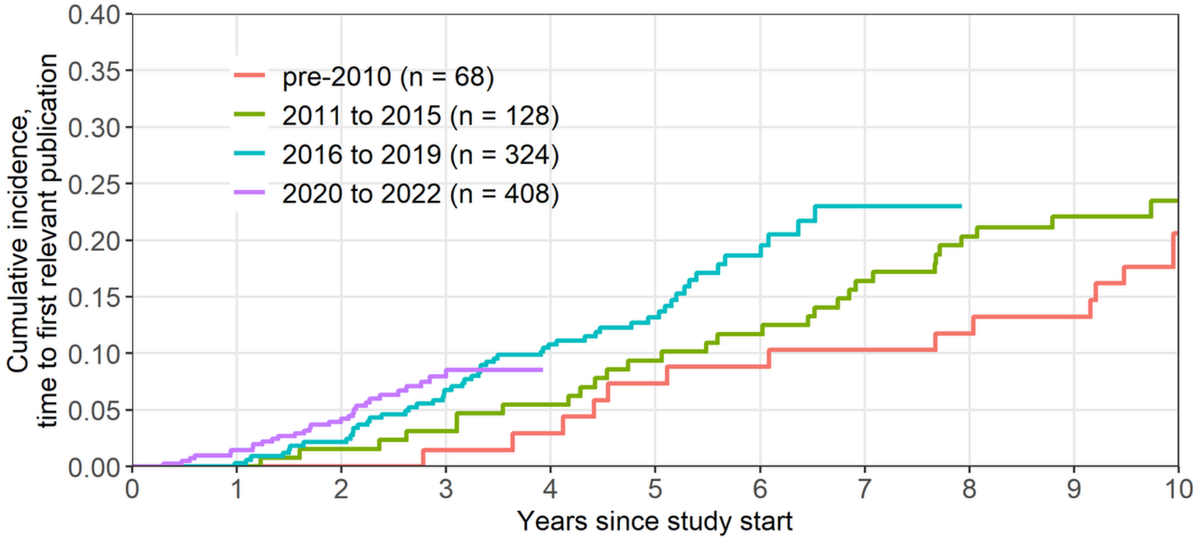
Estimate (95% Confidence Interval)

2 years: 2.8% (1.7% to 3.9%)

5 years: 12.3% (9.8% to 14.9%)

10 years: 27.8% (22.6% to 33.0%)





If publication bias exists in the clinical prediction model literature...

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Yes

Does the non-publication of clinical prediction models = research waste?

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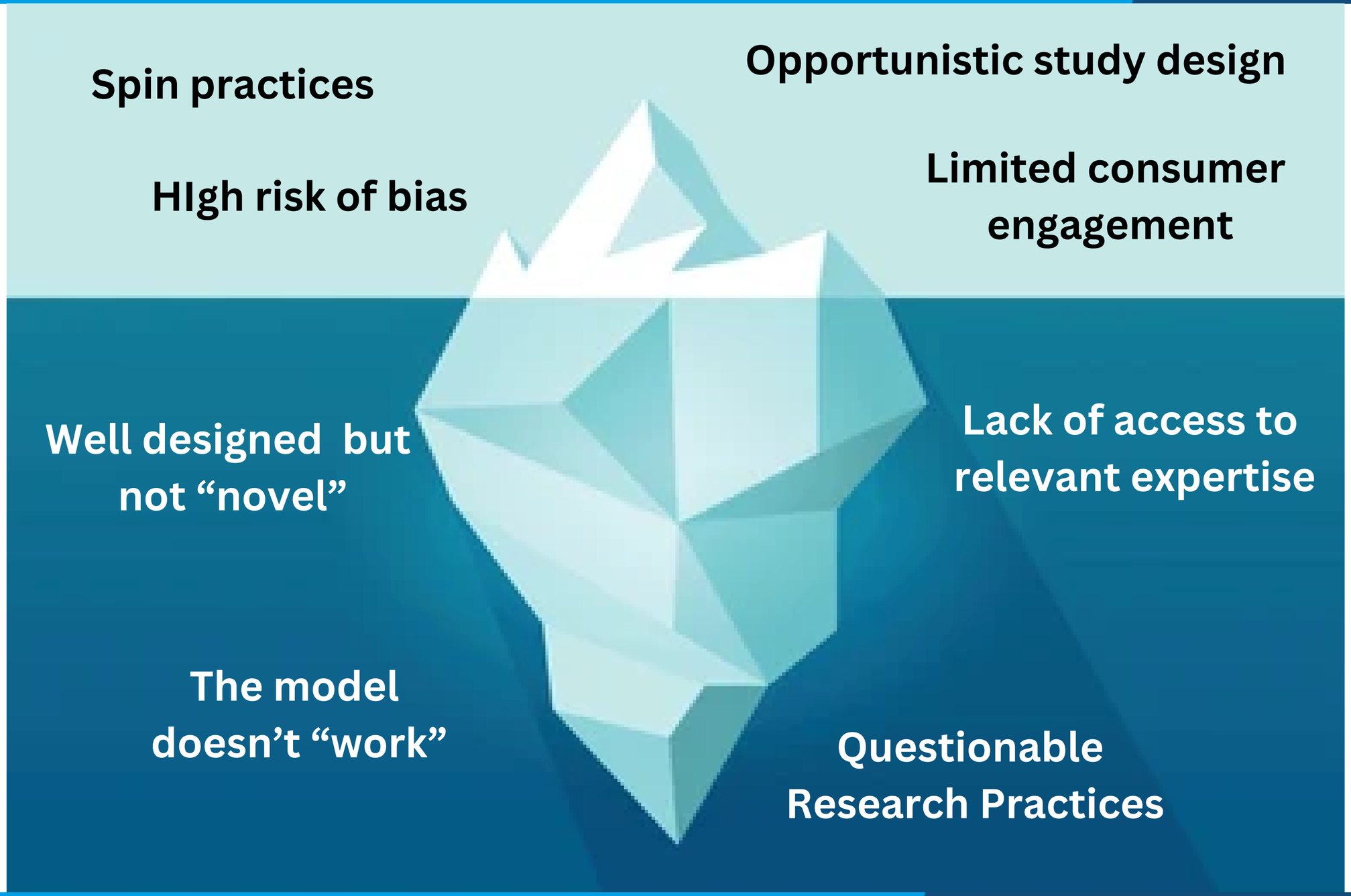
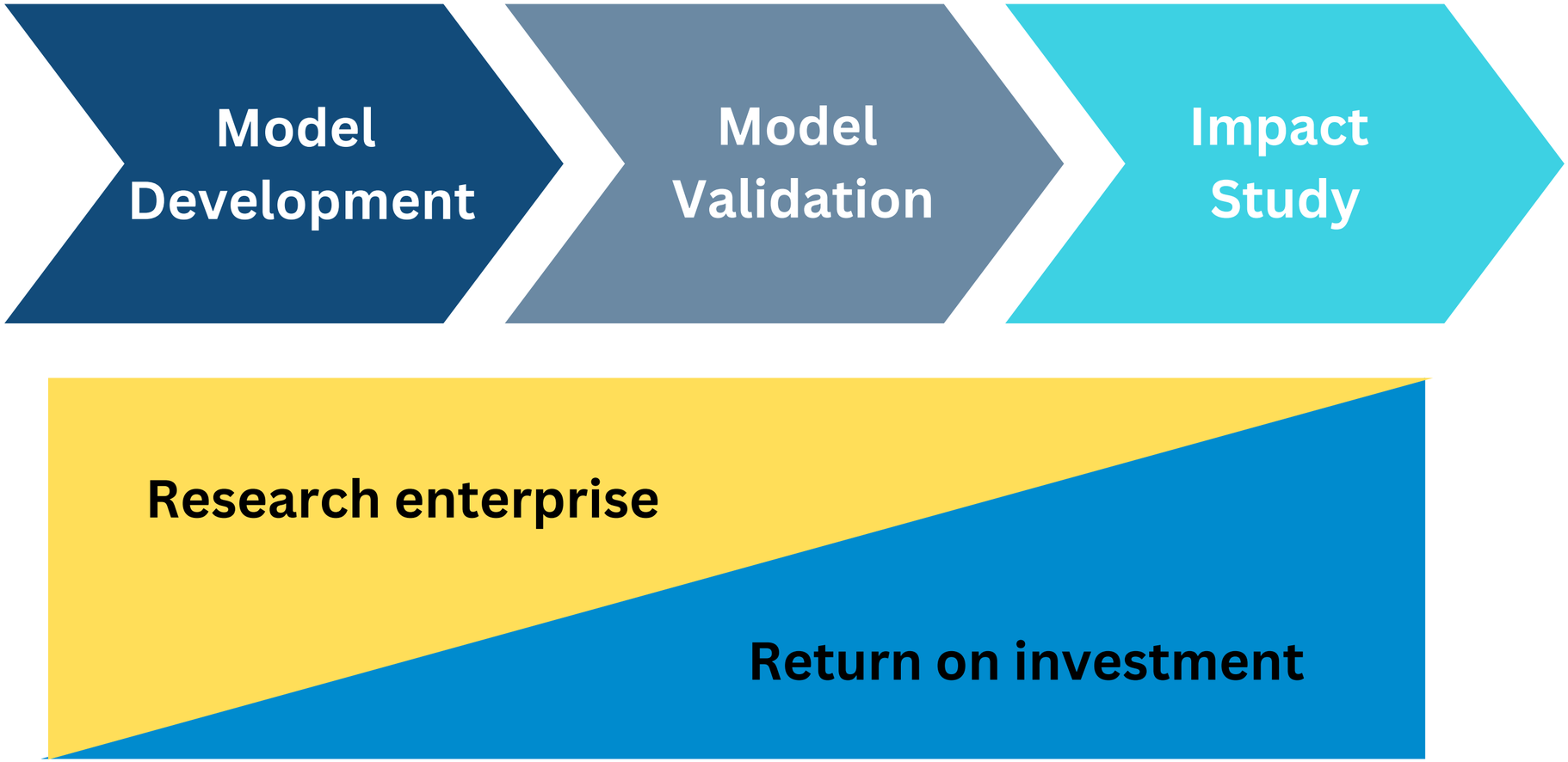
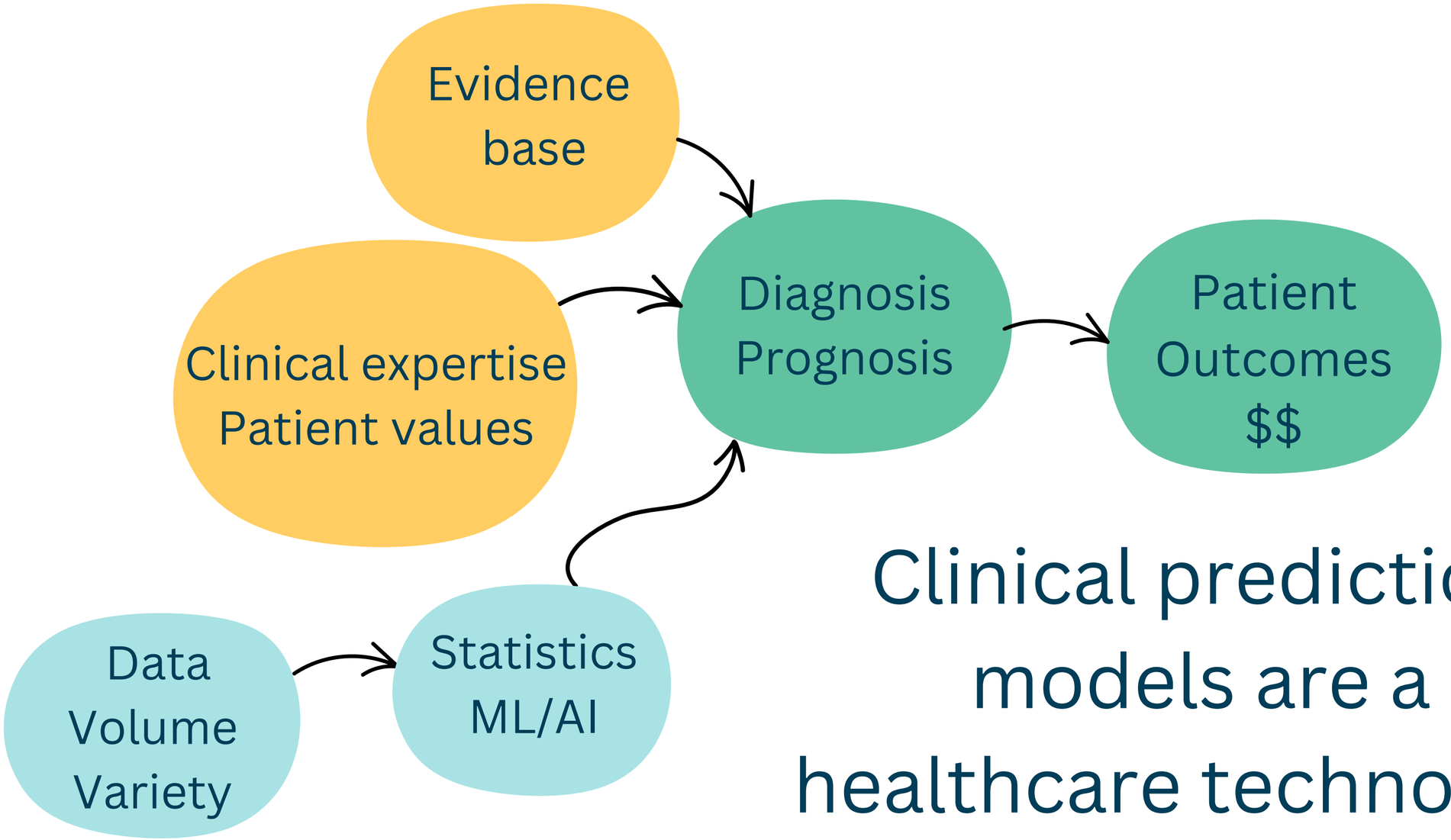

Spin practices
Opportunistic study design
HIgh risk of bias
Limited consumer engagement
Well designed but not “novel”
Lack of access to relevant expertise
The model doesn’t “work”
Questionable Research Practices

The role of health services research in clinical prediction modelling



The role of health services research



Clinical prediction models are a healthcare technology

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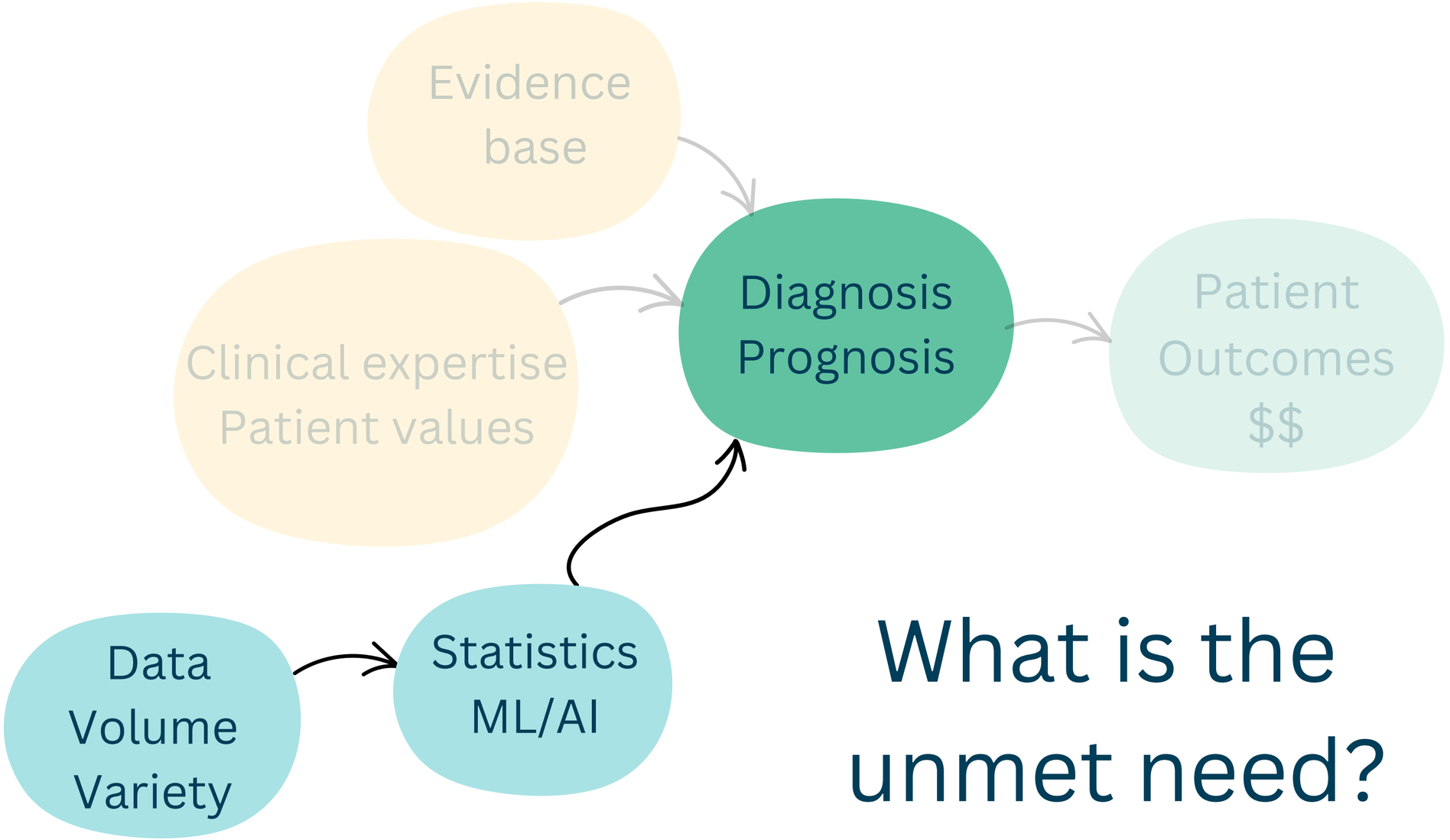
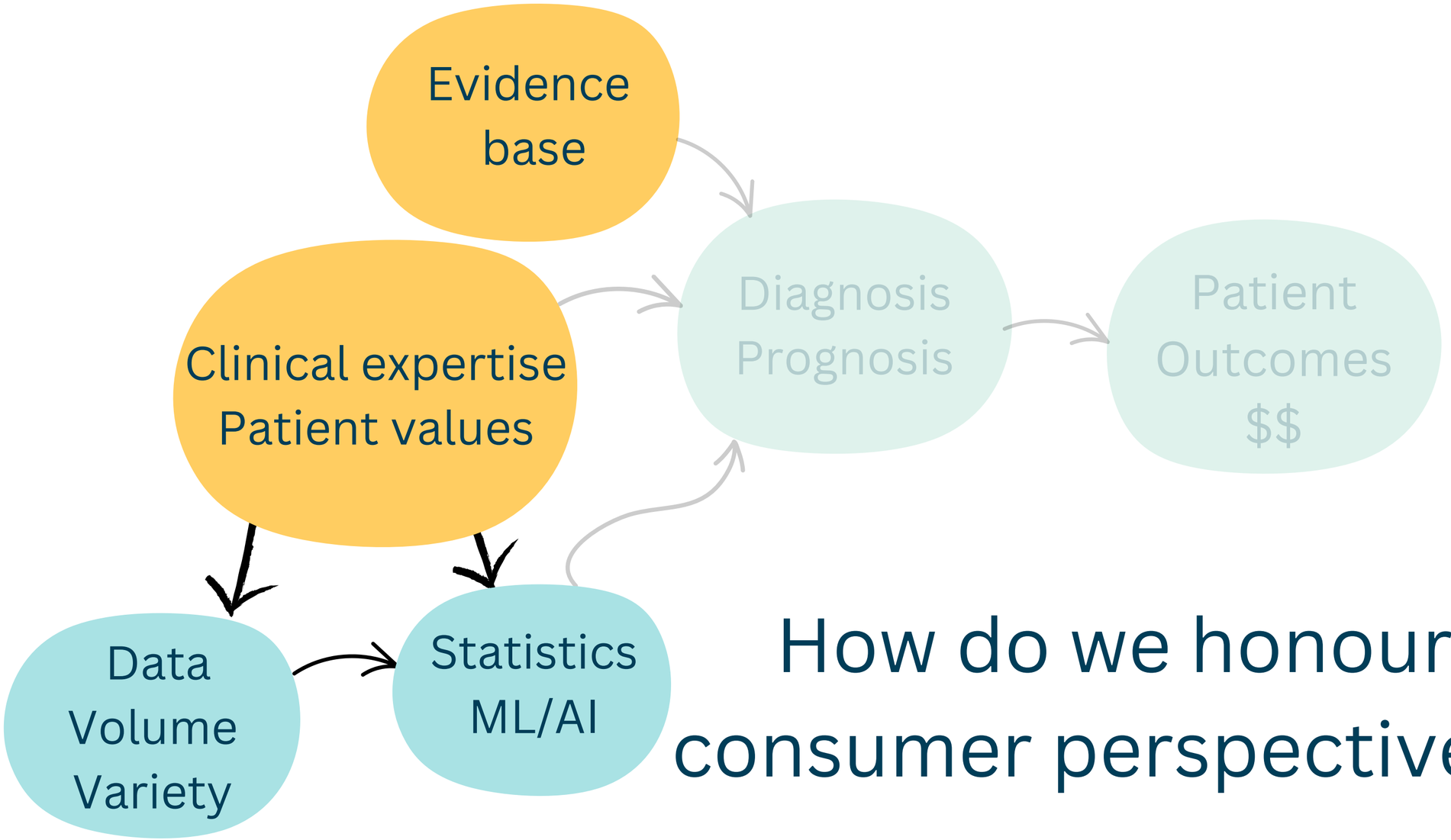


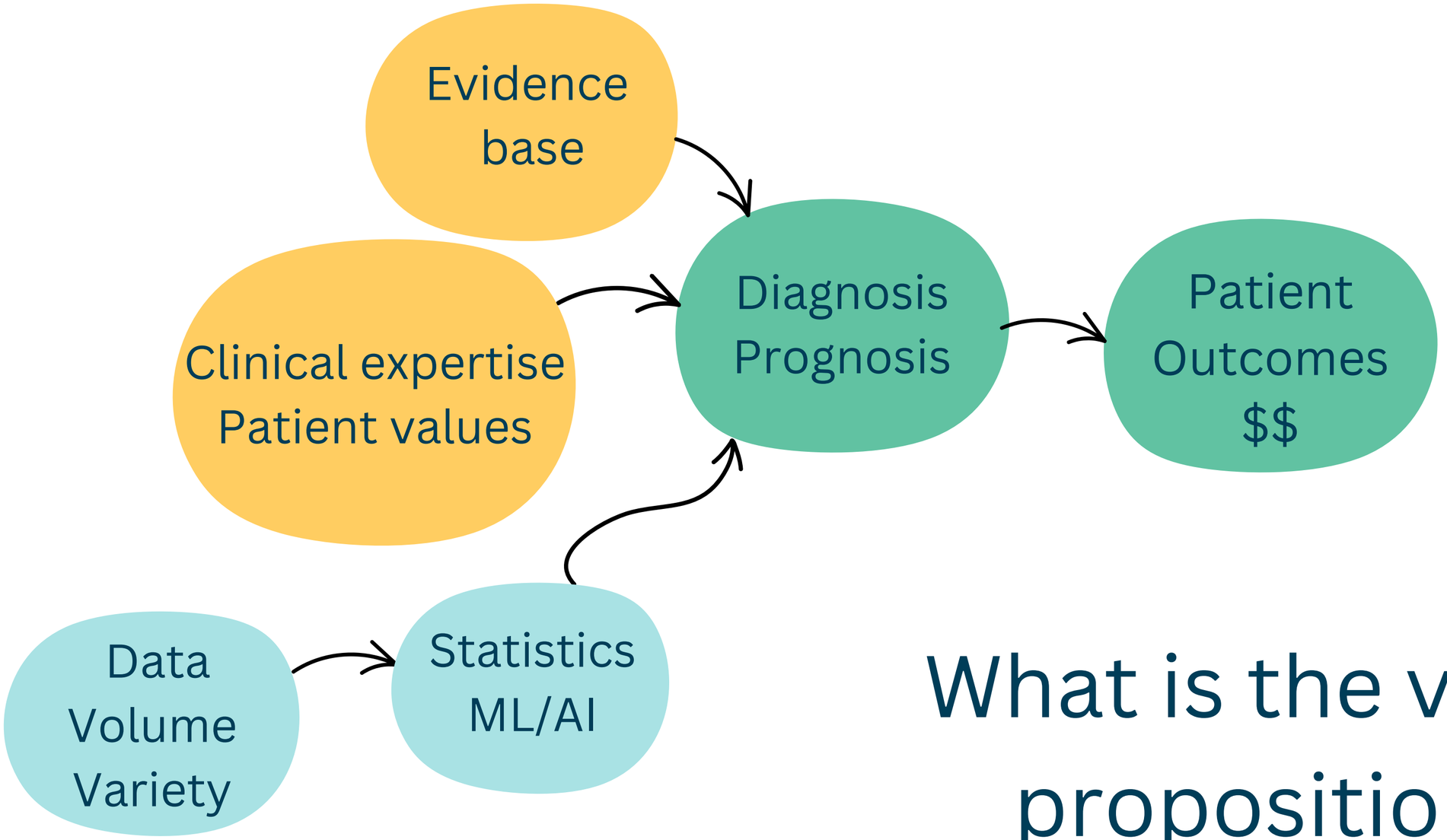
What is the unmet need?

Clinical prediction models are a healthcare technology



How do we honour consumer perspectives?

Clinical prediction models are a healthcare technology



What is the value proposition?

Interested in collaborating?
Let’s chat!

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Slides + Papers