A scoping review of guidelines on quality assessment and reporting of mathematical modelling studies for infectious disease dynamics

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Importance

- Mathematical models help guide public health policy decisions

- Reporting guidelines help ensure that studies are comprehensively and transparently reported

- Quality assessment tools enable readers to assess a study's quality and credibility

- We were unaware of there being any widely accepted or used quality assessment tools and reporting guidelines specifically for infectious disease modelling studies

What tools and guidelines exist for infectious disease modelling studies or adjacent fields of research?

What common themes/topics are found in these tools and guidelines?

Scoping Review

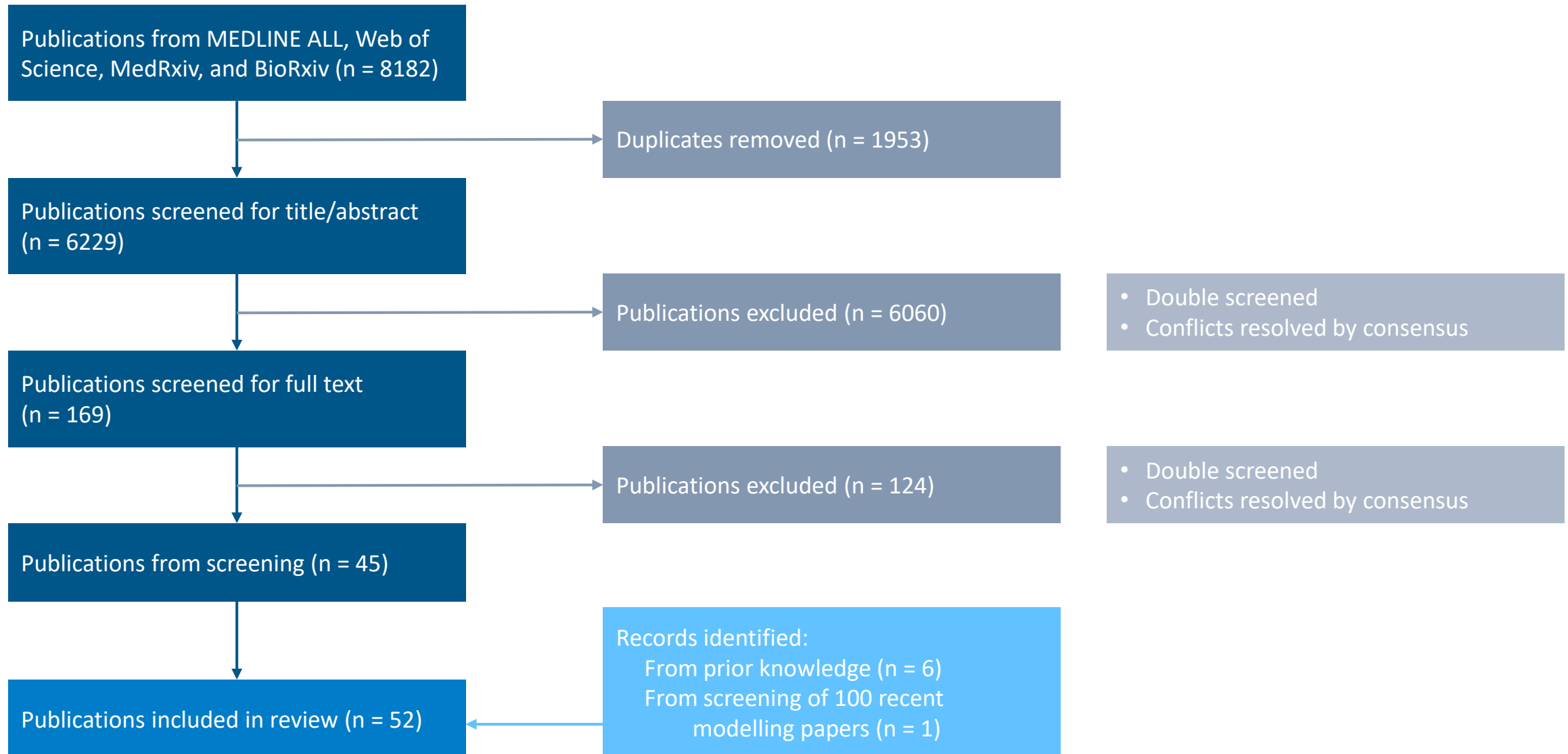1. Developed search strategies for:
   - MEDLINE
   - Web of Science
   - MedRxiv and BioRxiv
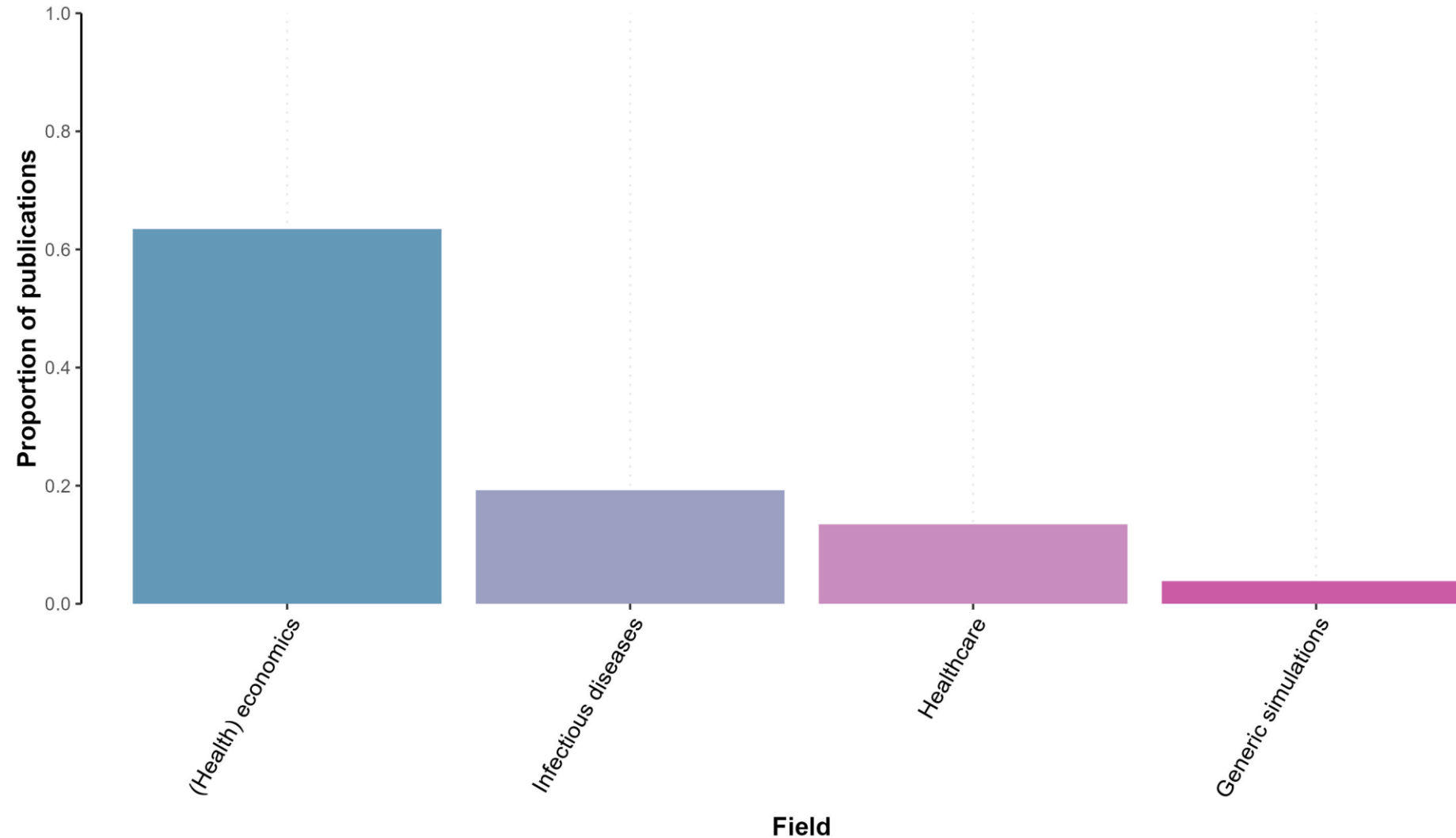2. Used COVIDENCE for title/abstract screening and full text review
   - Inclusion criteria:
     - **Reporting and best practice** guidelines for dynamic models or decision-analytic models
     - **Quality assessment** tools for dynamic models or decision-analytic models
   - Exclusion criteria:
     - Guidelines for **clinical course** models and **drug or treatment** assessments
     - **Non-generalisable** country-specific guidelines
     - **Literature reviews** unless they make suggestions of their own (checked references for further articles)
     - **Individual** cost-effectiveness or modelling studies
3. Data extraction: extracted recommendations for quality assessment or reporting
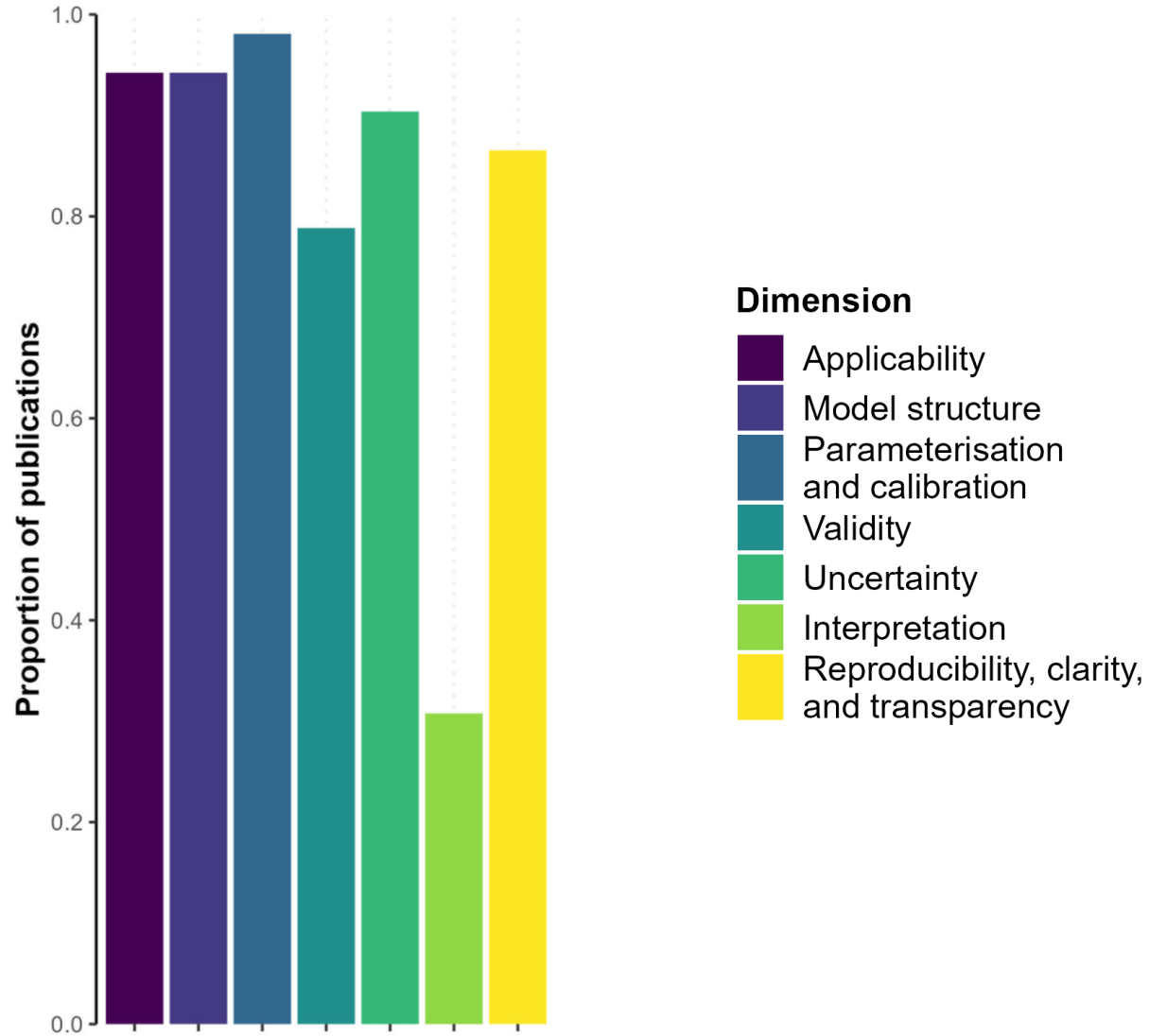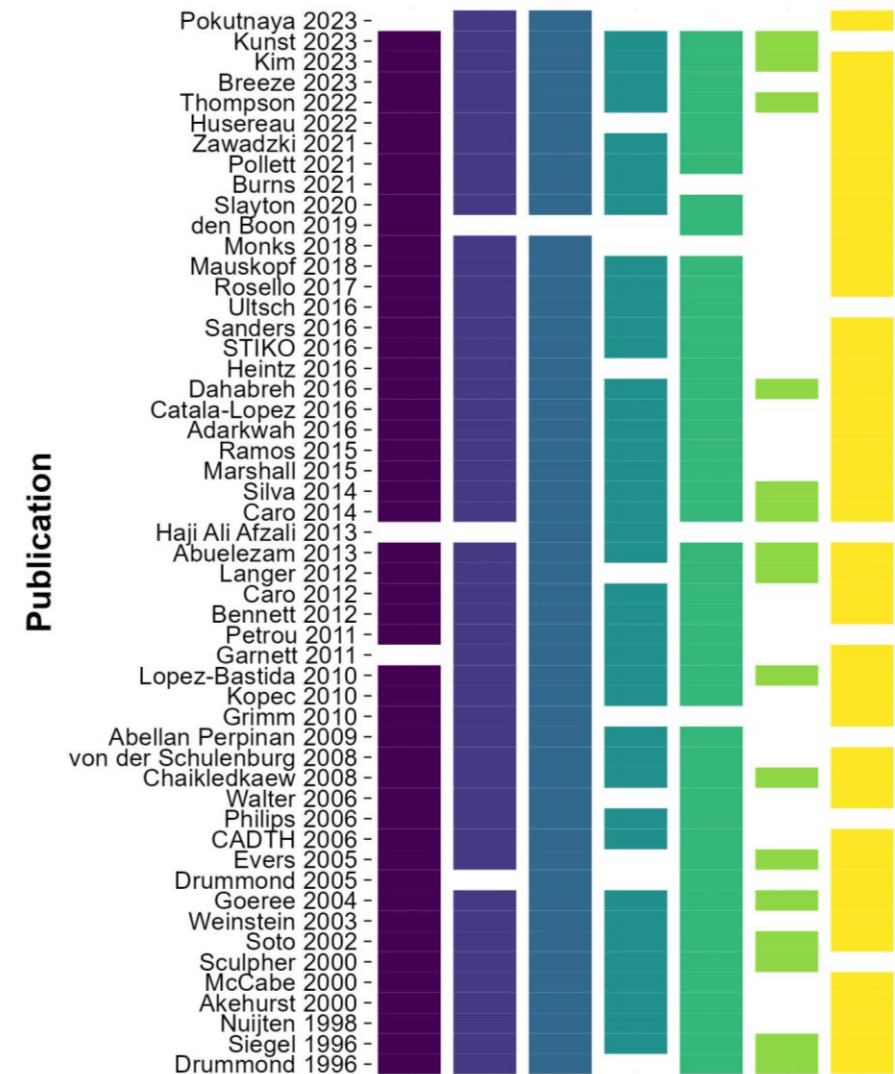
Included publications

Publications from MEDLINE ALL, Web of Science, MedRxiv, and BioRxiv (n = 8182)

Duplicates removed (n = 1953)

Publications screened for title/abstract (n = 6229)

Publications excluded (n = 6060)

- Double screened
- Conflicts resolved by consensus

Publications screened for full text (n = 169)

Publications excluded (n = 124)

- Double screened
- Conflicts resolved by consensus

Publications from screening (n = 45)

Records identified:
   From prior knowledge (n = 6)
   From screening of 100 recent
      modelling papers (n = 1)

Publications included in review (n = 52)

What types of publications were included?

Assessment/Reporting Criteria	Subdimension	Dimension
Is there a clear statement of the aim/decision problem?	Decision problem	Applicability
Is the perspective (i.e. scope (e.g. societal or a specific economics/healthcare system) considered in the model) of the study clearly stated and/or relevant?	Perspective	
Is the study design clearly stated and/or applicable to the decision problem?	Study design	
Is the population clearly stated and/or applicable to the decision problem?	Population	
Is there a comprehensive consideration of the interventions and/or comparators?	Interventions	
Are the outcomes clearly stated and/or applicable to the decision problem?	Outcomes	
Is the context/setting clearly stated and/or applicable to the decision problem?	Context/Setting	
Are structural and methodological assumptions clearly stated and reasonable?	Structural assumptions	Model Structure
Is the model as simple as possible but as complex as necessary?	Parsimony	
Is the time horizon and/or time step clearly stated and appropriate?	Time	
Are parameter values transparent and reasonable? Are data sources and their translation into parameter values transparent and justified?	Parameters	Parameterisation and calibration
If applicable, has the methodology used to elicit expert opinion for parameterisation been sufficiently described?	Expert opinion	
If applicable, were methods and data sources used for calibration described in sufficient detail? Were the subsequent results presented clearly?	Calibration	
Has evidence of the mathematical soundness and correctness of model implementation been given?	Internal validity	Validity
Has the model been validated against independent data sources?	External validity	
Has the ability of the model to predict future events been shown?	Predictive validity	
Is the model structure plausible? Have any counterintuitive results been explained?	Face validity	
Has the model been validated against similar models?	Cross-model validity	
Have the methods used to assess uncertainty surrounding parameters been clearly described?	Parameter uncertainty	Uncertainty
Have the methods used to assess uncertainty arising from structural assumptions been clearly described?	Structural uncertainty	
Have the methods used to assess uncertainty stemming from choice of methodology been clearly described?	Methodological uncertainty	
Have the methods used to assess variability in results across subgroups been clearly described?	Heterogeneity	
Is the presented interpretation of the results reasonable, fair, and/or balanced?	Interpretation	Interpretation
Are the code/model/data available?	Code availability	Reproducibility, clarity, and transparency
Are methods described transparently and in enough detail that they can be reproduced?	Description of methods	
Has the choice of software been stated and justified?	Implementation	
Is there sufficient non-technical documentation and description?	Interpretability	
Are limitations clearly described?	Limitations	
Is the type of study clearly identified in the title or abstract? Has the model developer been stated?	Publication details	
Are the funding sources and the role of the funder in the study clearly stated?	Funding sources	
Are there any potential conflicts of interest?	Conflicts of interest	

Dimensions

Overall mention of dimensions

Dimensions by publication

Dimensions

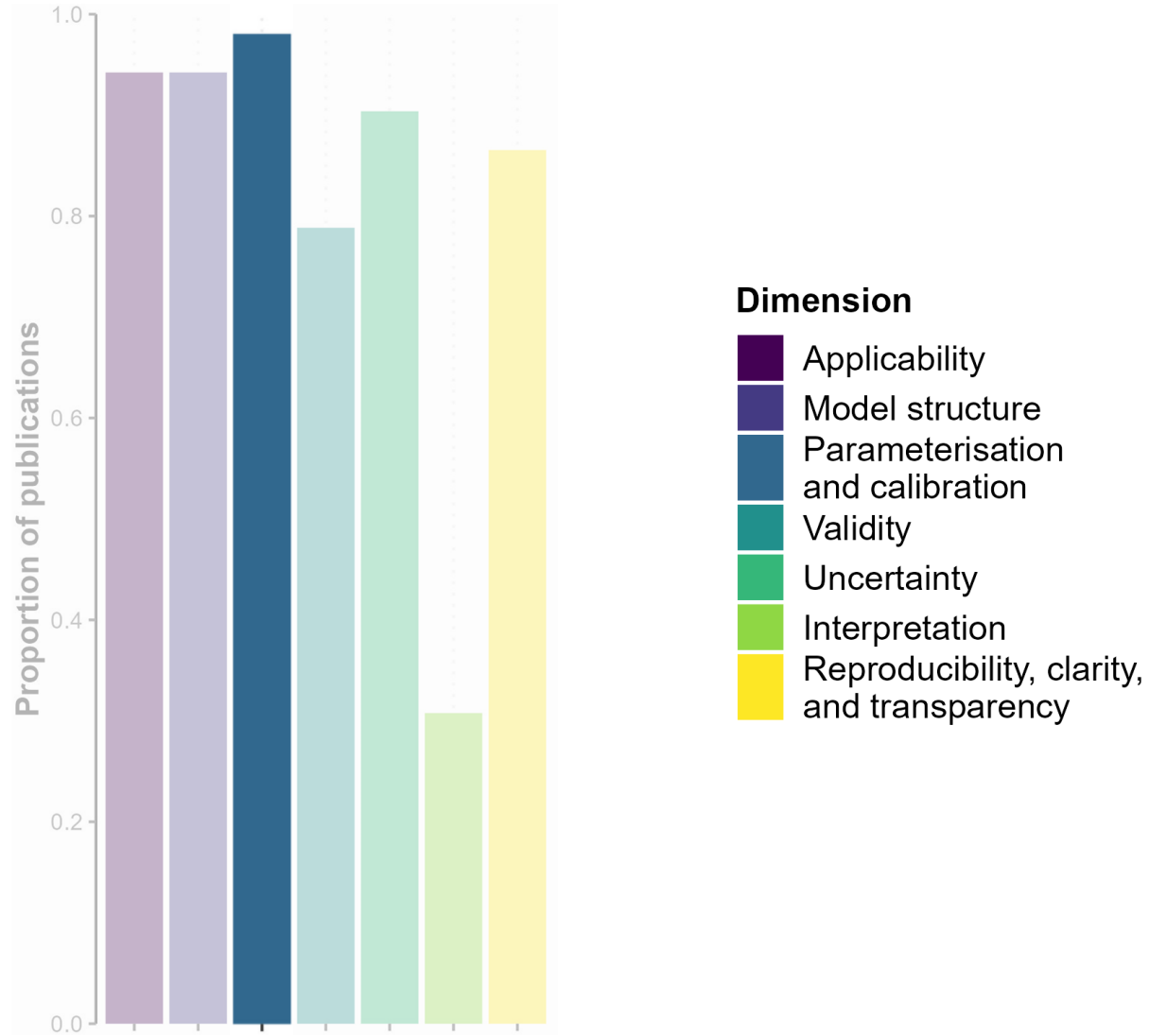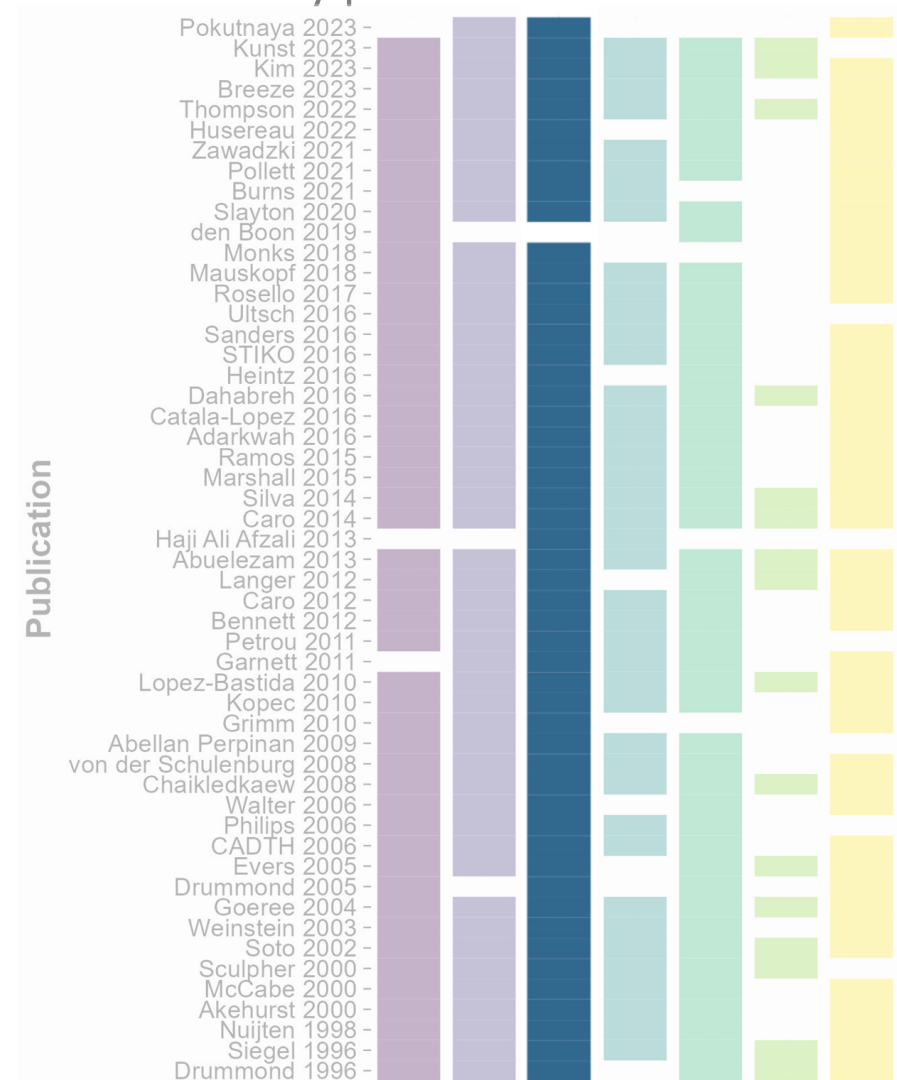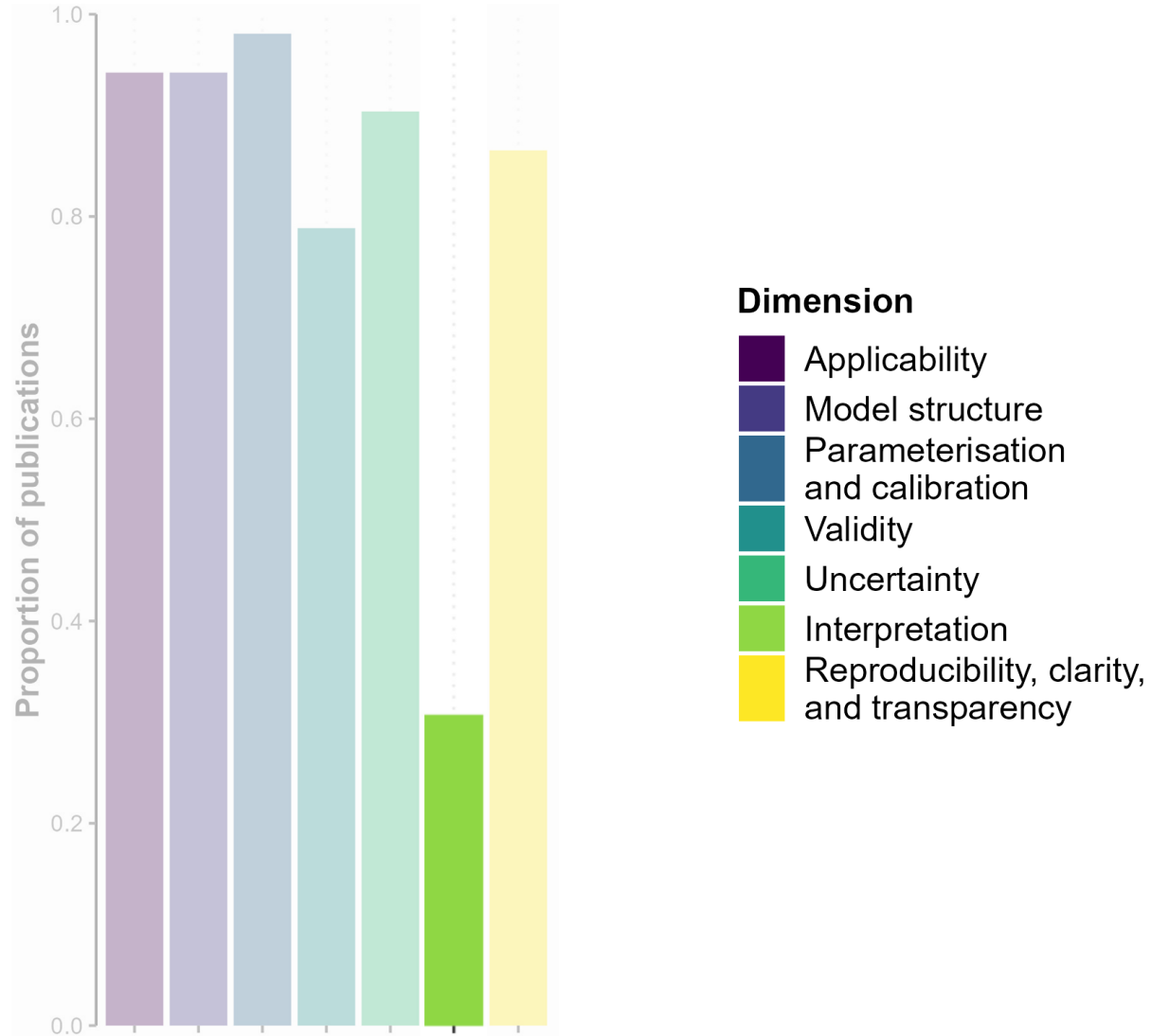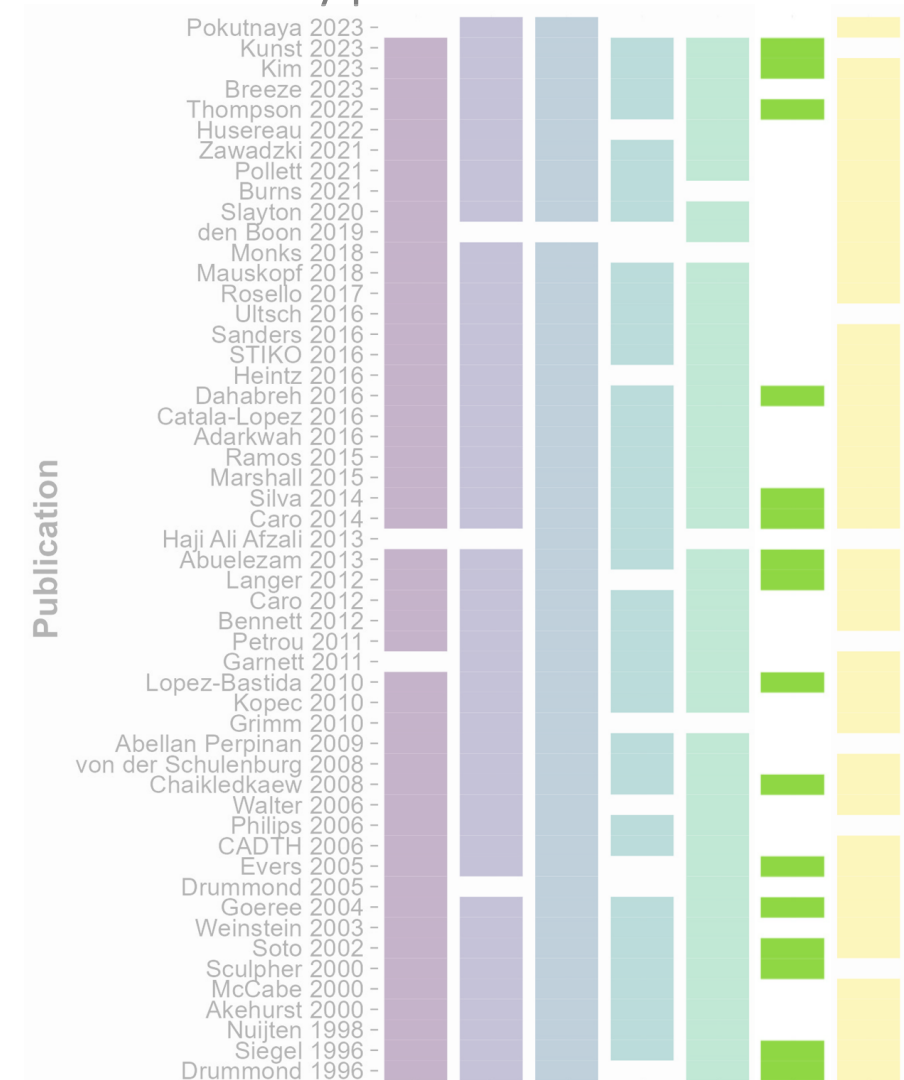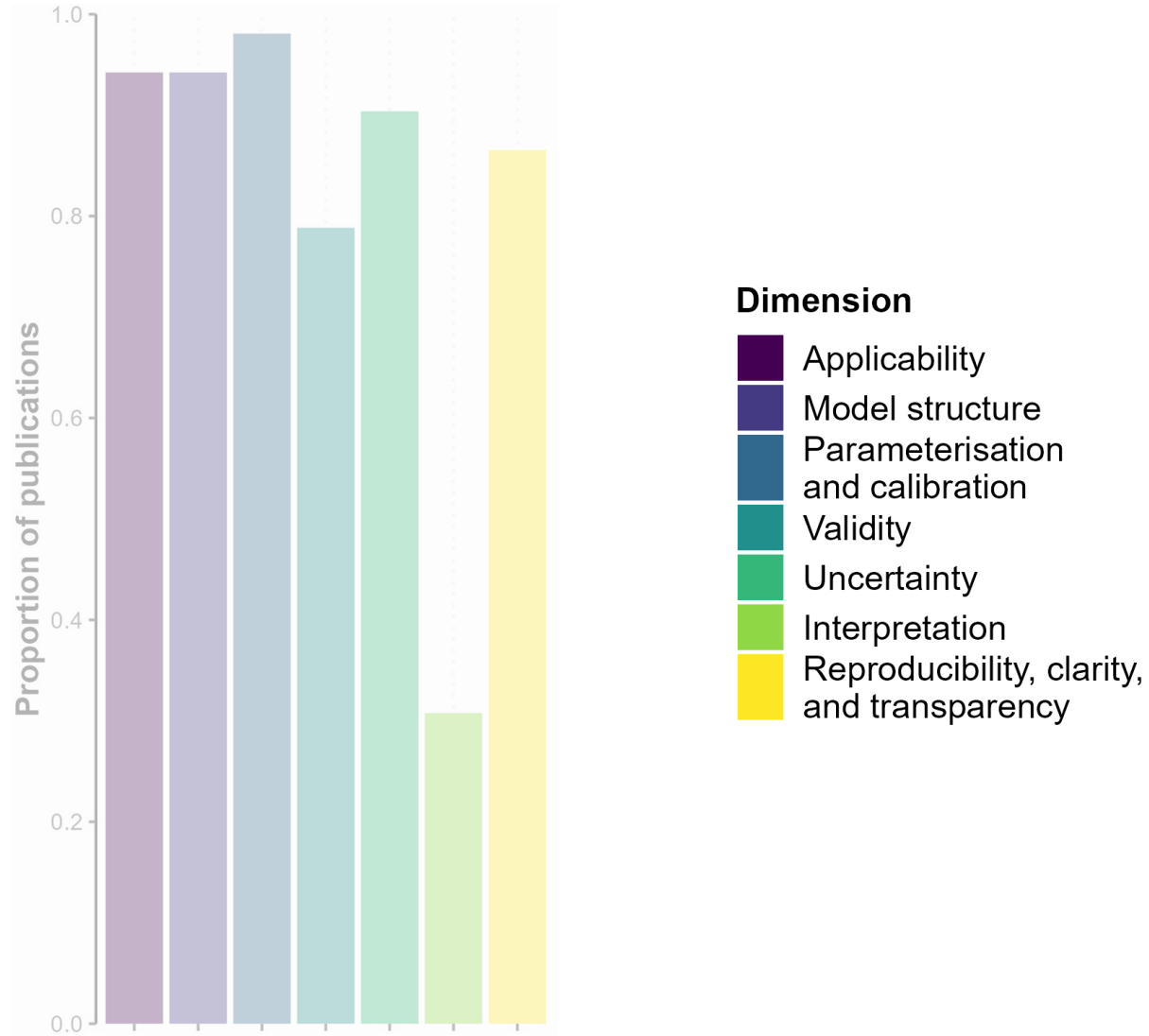## Overall mention of dimensions

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Dimension
- Applicability
- Model structure
- Parameterisation and calibration
- Validity
- Uncertainty
- Interpretation
- Reproducibility, clarity, and transparency

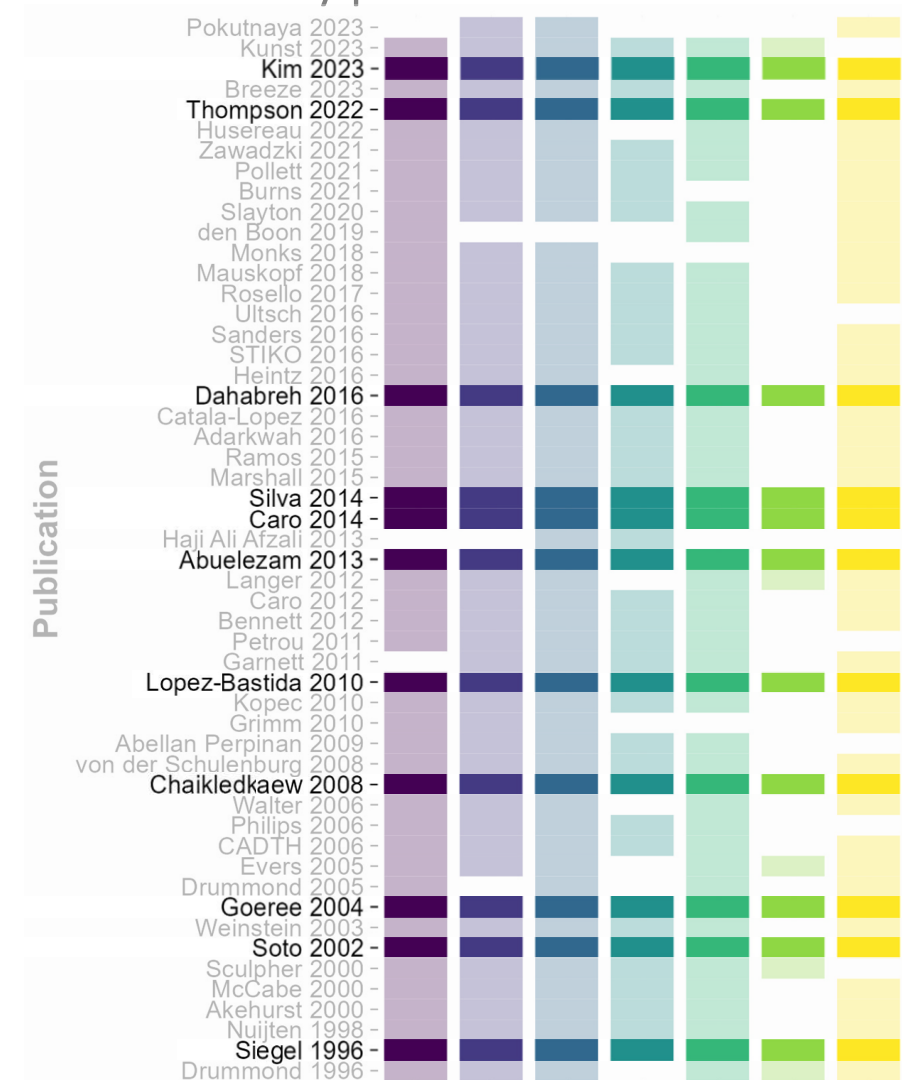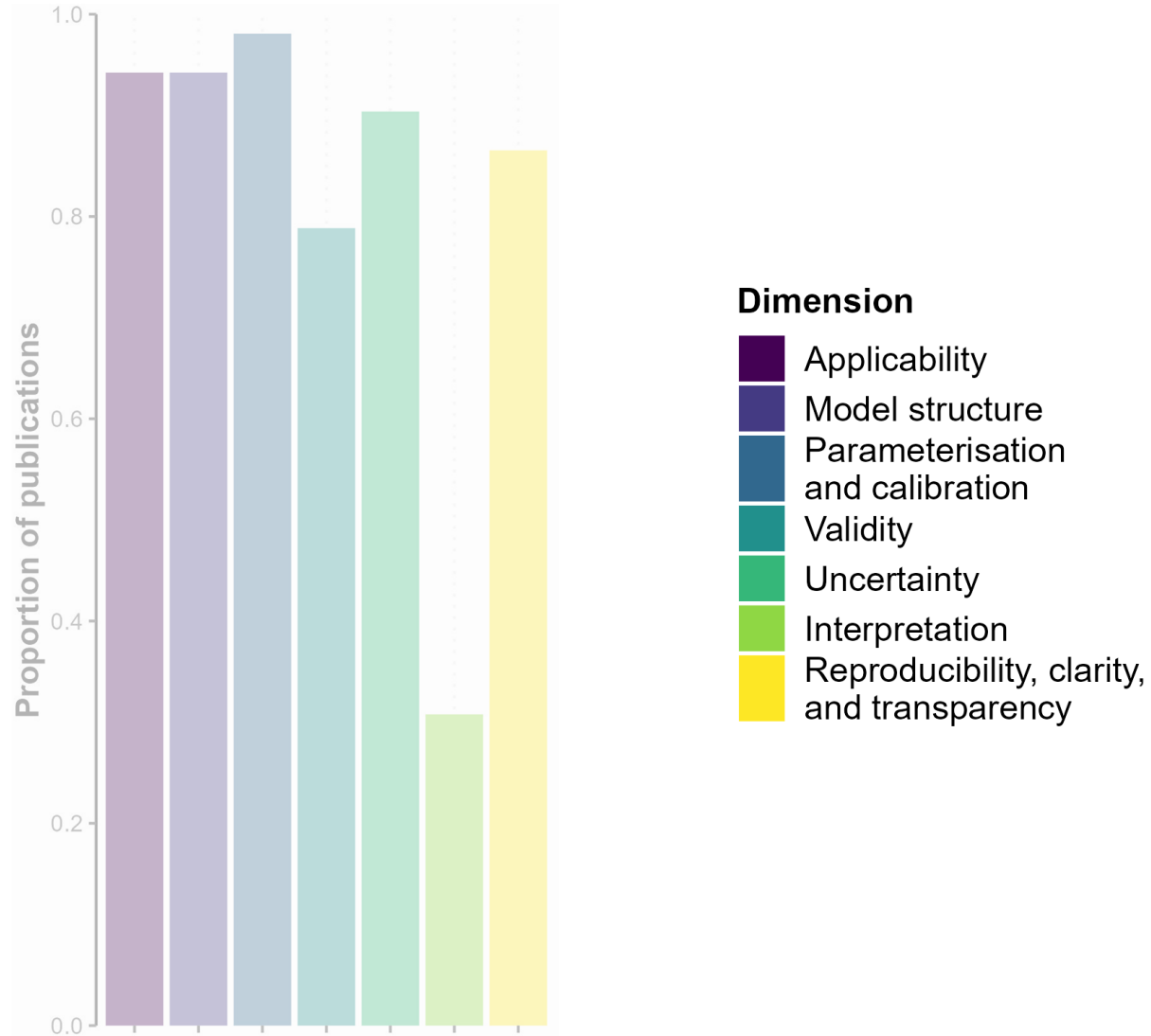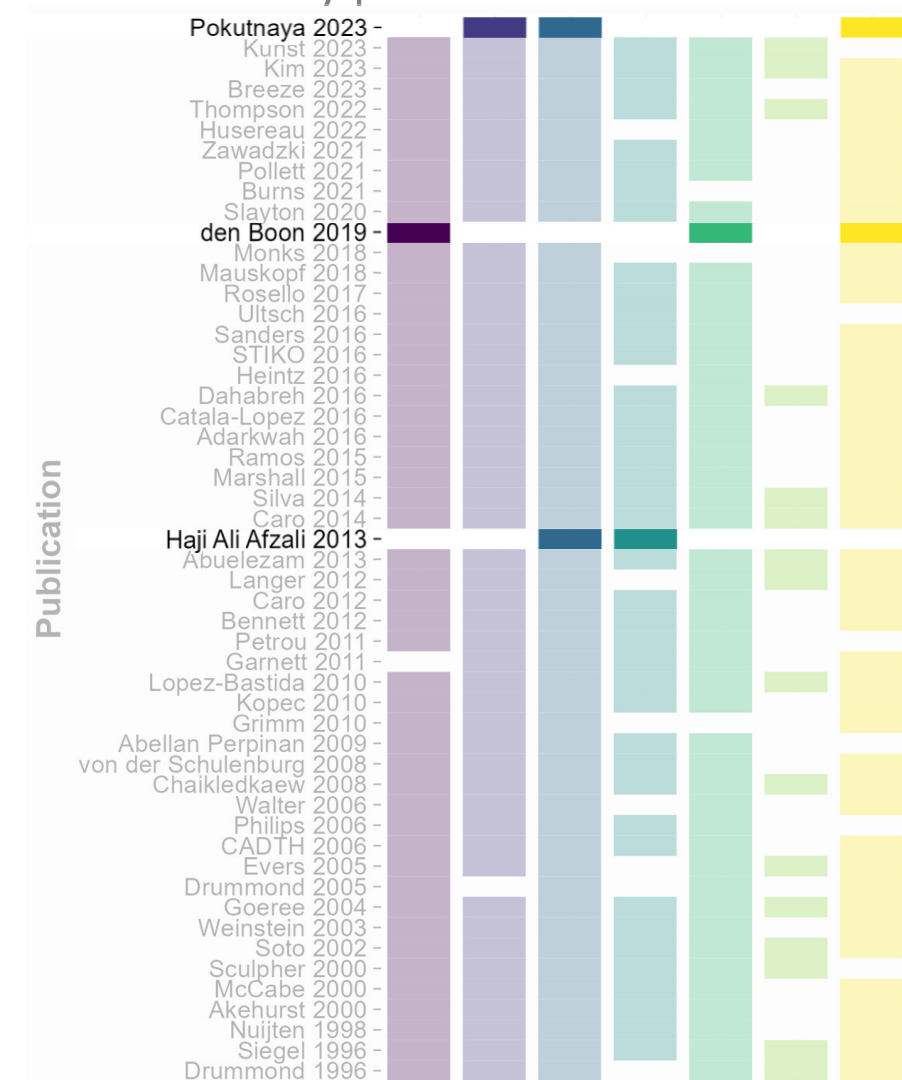# Dimensions

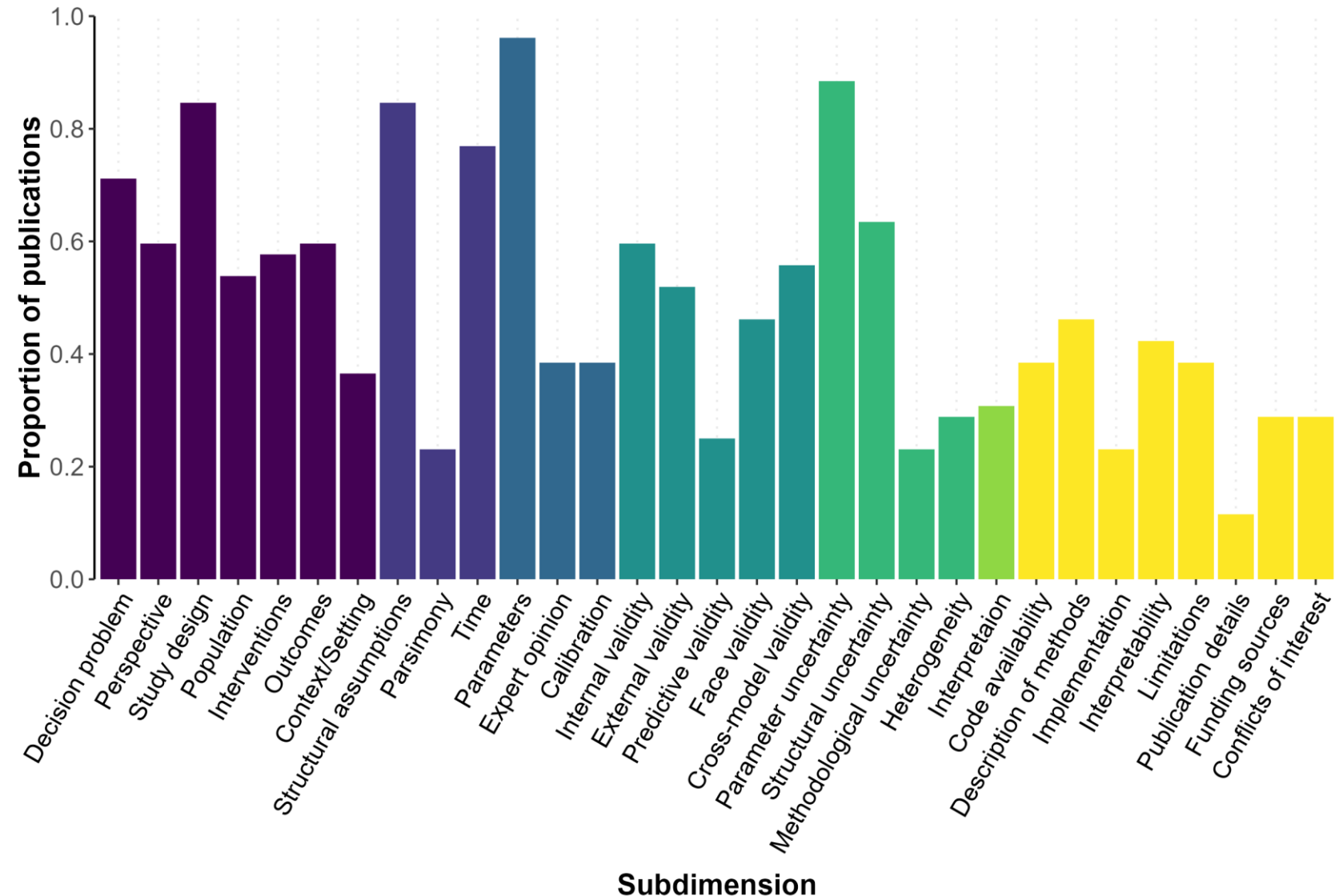Overall mention of dimensions

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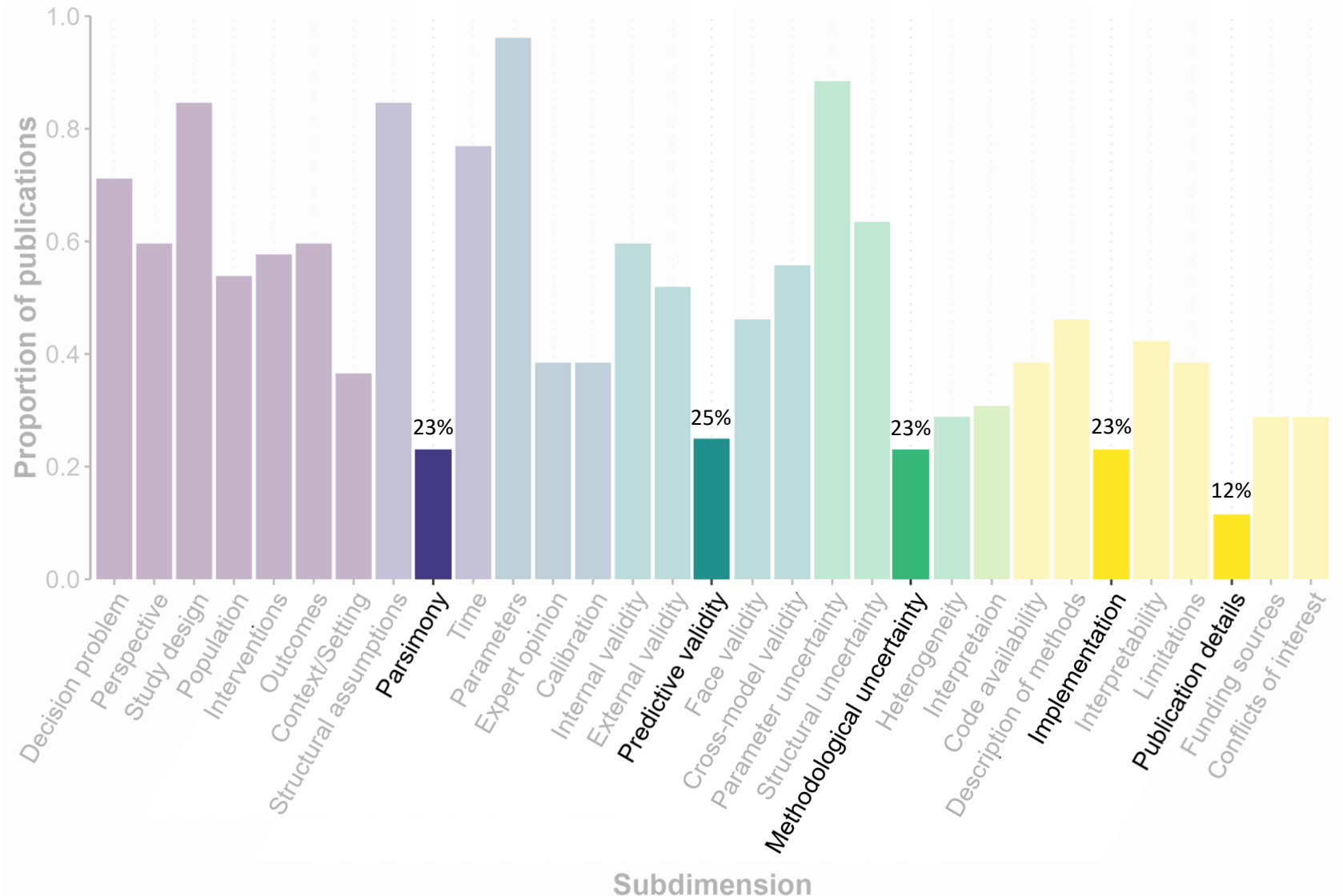- Model structure
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Subdimensions

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Applicability	Decision problem
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	Outcomes
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Key takeaways

There is large **heterogeneity** in the themes covered by **existing recommendations** on reporting and quality assessment for modelling studies

There appear to be **no widely-used tools or guidelines** specific to **infectious disease** modelling studies as a whole

→ **Next steps** will include **adapting** the identified dimensions and subdimensions to create a quality assessment tool and a reporting guideline for infectious disease studies

→ **We will be looking for feedback on these tools and guidelines in the future**

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Join the process!

If you would like to get involved with creating/reviewing quality assessment tools or reporting guidelines for infectious disease modelling studies, please get in touch!

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Or fill out our contact form!

Search strategy

Medline

1 exp Guidelines as topic/ or exp Guideline/
2 (guideline* or guidance or (practice adj2 (guide*1 or recommend* or standard*)) or ((good* or best*) and practi*)).ti.
3 (framework* or checklist* or recommend* or concept* or standard* or position paper or reporting or reported or report?).ti.
4 or/1-3
5 ((infecti* disease* or communicable disease* or transmission*) adj4 model*).tw.
6 (dynamic adj4 model*).ti.
7 (((economic* or cost?) adj2 evaluation*) or (cost? adj2 effectiveness)).ti.
8 ((decision? adj1 analy*) and model*).tw.
9 (model* adj8 stud*).ti.
10 or/5-9
11 4 and 10