"Open Source Modelling in Health Economics: R and GitHub at the Forefront"

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Conflict of Interest Disclosure

- I am employed by **Salutem Insights Ltd**, a health economics and outcomes research (HEOR) consultancy based in Ireland
- **This presentation and the work it is based on were conducted independently** and do not reflect the views or involve the resources of Salutem Insights Ltd
- **No financial or commercial interests** influenced the content, methods, or conclusions presented

Abbreviations

- **OSM** – Open Source Model
- **HTA** – Health Technology Assessment
- **SDR** – Systematic Database Review
- **SLR** – Systematic Literature Review
- **DCEA** – Distributional Cost-Effectiveness Analysis
- **DES** – Discrete Event Simulation
- **PSM** – Partitioned Survival Model
- **SEIR** – Susceptible-Exposed-Infected-Recovered (epidemiological model)
- **BSD** – Berkeley Source Distribution (software license)
- **GPL** – General Public License
- **MIT** – Massachusetts Institute of Technology License
- **PDM** – Public Domain Mark
- **DOI** – Digital Object Identifier

Why Open Source Models Matter

- Transparency and reproducibility in HTA
- Enables scrutiny, adaptation, and reuse
- Definitions:
  - Open Source Model: code freely available, modifiable, redistributable
  - Open Access Model: proprietary software, only inputs/outputs shared

Study Objectives

- Map the landscape of Open Source Models (OSMs) in health economics
- Identify dominant software and repositories
- Explore trends and domains of use

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Methods Overview

- SDR and SLR approach
- 11 repositories searched: GitHub, Zenodo, Figshare, etc.
- 8,664 results screened, 213 models uncovered,182 unique OSMs identified

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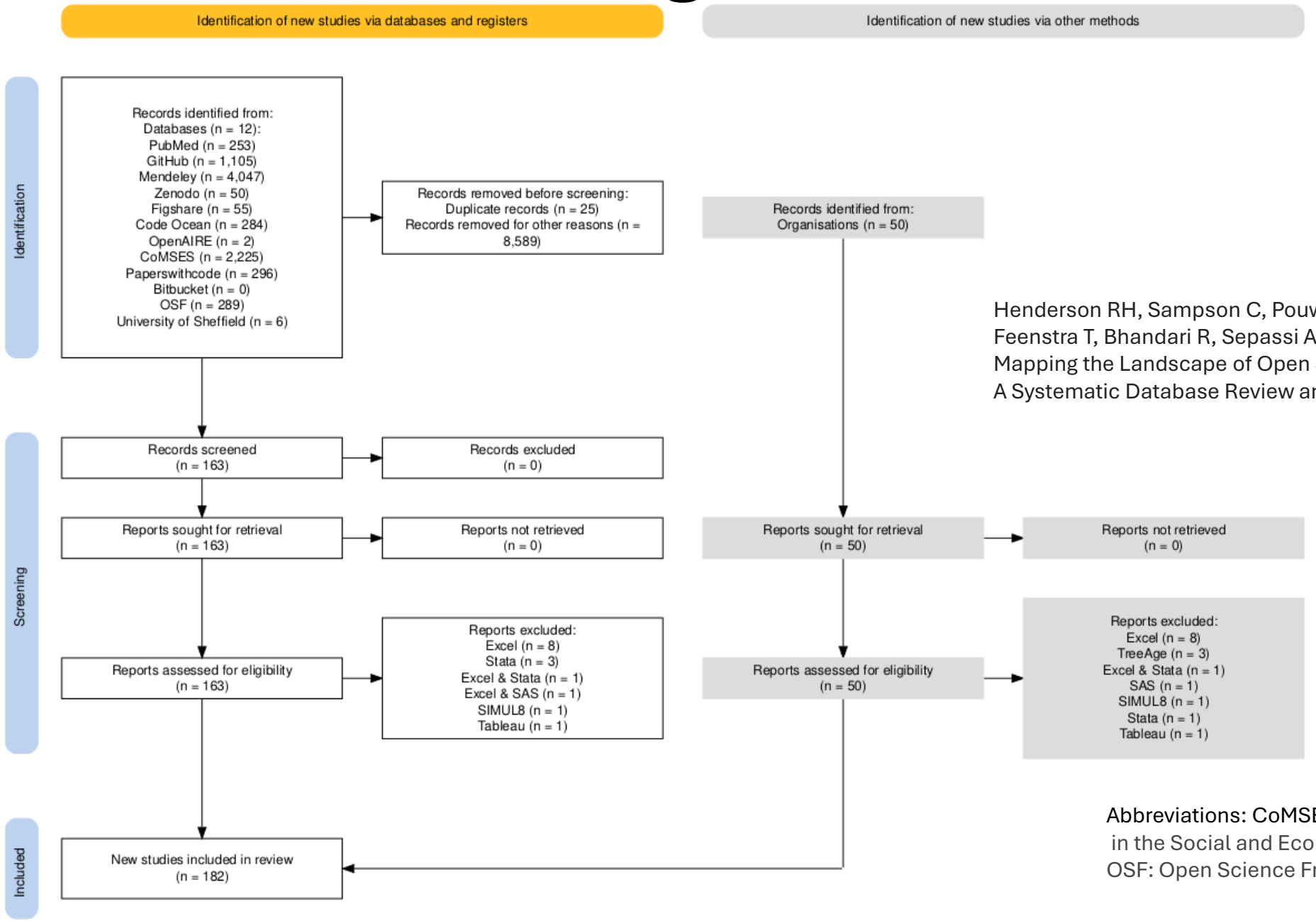
PRISMA Flow Diagram



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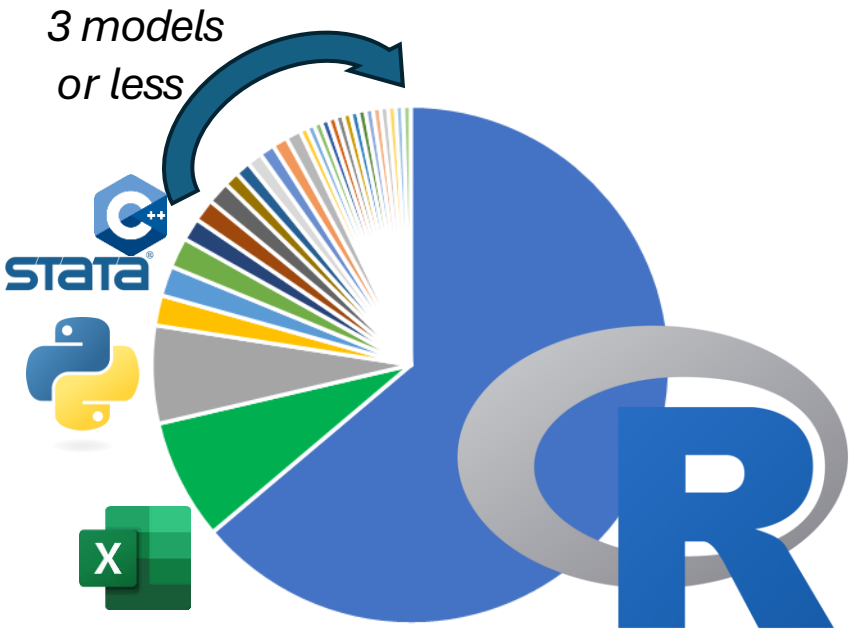
Abbreviations: CoMSES: Computational Modeling in the Social and Ecological Sciences;
OSF: Open Science Framework

Key Finding – R is the Leading Software

- Analysis before exclusion of open access models
- 64% of OSMs use R (136/213 software observations)
- Advantages of R:
  - Open source, free
  - Reproducible workflows
  - Active community & packages (heemod, hesim, dampack)



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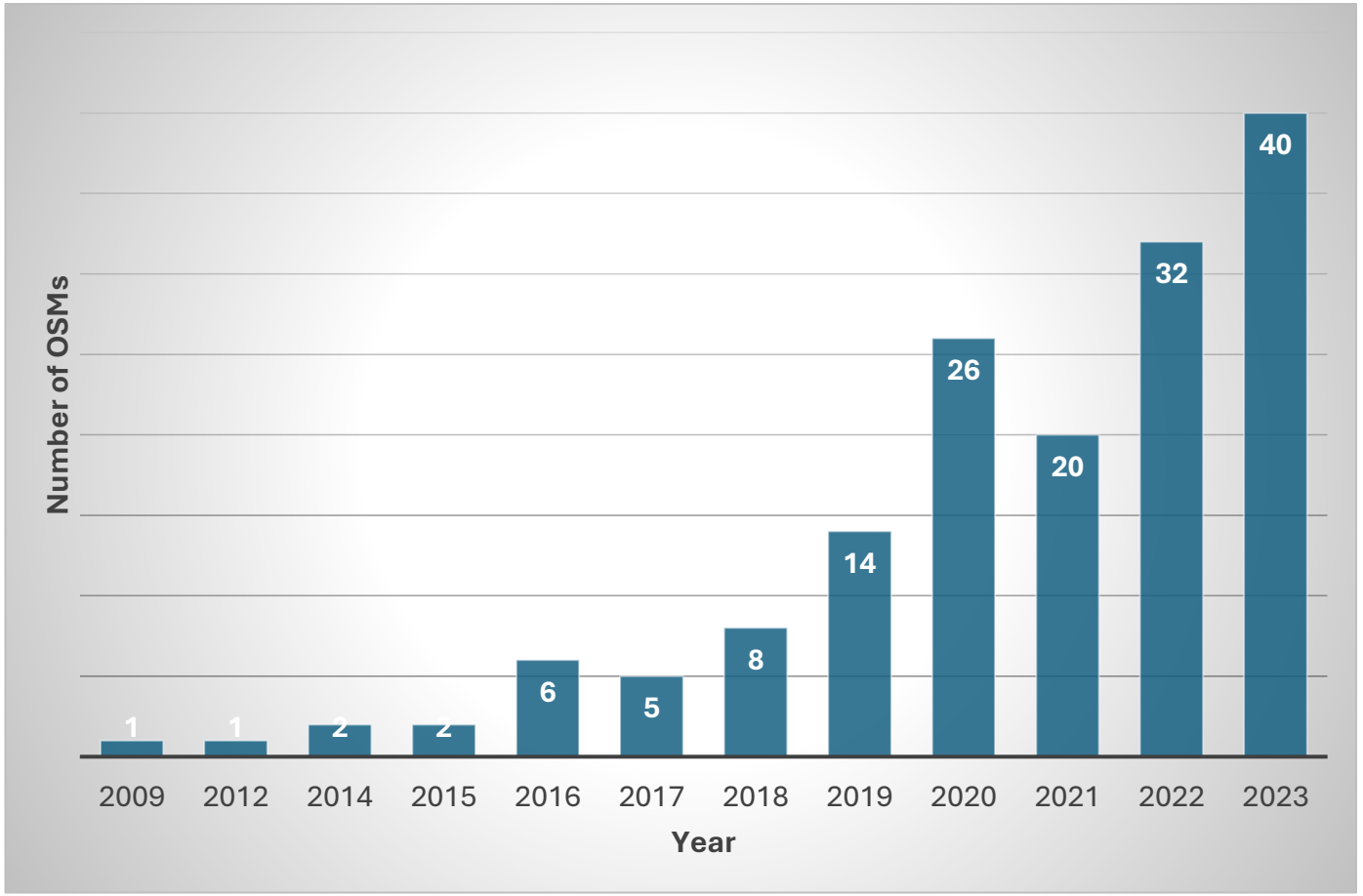
Trends over Time

OSMs have steadily increased since 2009, peaking in 2023.



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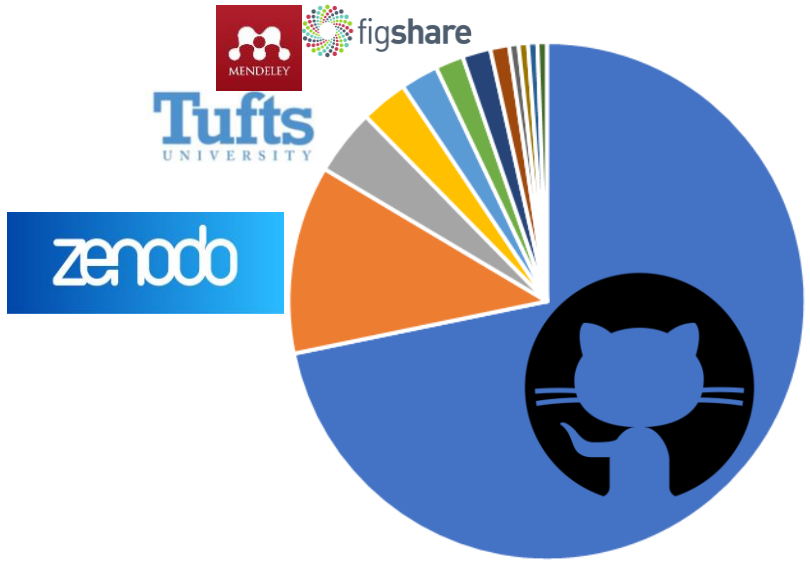
Repository Trends

- GitHub was the predominant platform (72%) for hosting OSMs:
  - Easy collaboration
  - Transparent versioning
  - Forking and community feedback
- Limitations
  - No DOI
  - Weak ontology



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Breadth and Depth of OSMs Found

- 154 (82%) of OSMs identified were stand-alone health economic models
  - Markov models predominate (49%)
  - 25% are a simulation-based model
  - SEIR comprises 7%
  - 5% are decision trees
  - 3% are PSM

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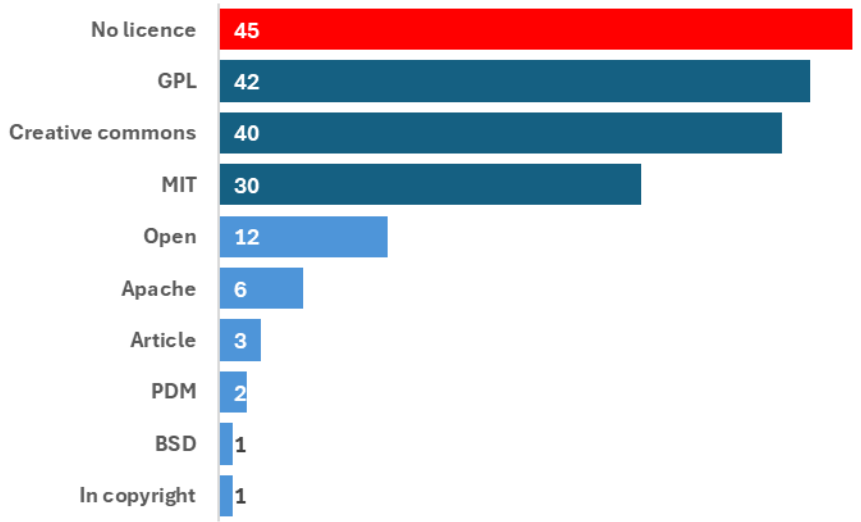
Abbreviations: DCEA: Distributional Cost-Effectiveness Analysis; DES: Discrete Event Simulation; PSM: Partition Survival Model; SEIR: Susceptible-Exposed-Infected-Recovered.

Licensing & Discoverability Challenges

- 24% lacked a license — these are not truly open
- GitHub dominates, but discoverability is weak without standards
- Call for metadata standards, CHEERS 2022 alignment



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Abbreviations: BSD: Berkeley Source Distribution; GPL: General Public License; MIT: Massachusetts Institute of Technology; PDM: Public Domain Mark

Why R & GitHub = Best Practice in Open HTA Modelling

- R facilitates model clarity (modular code, open packages, tutorials)
- GitHub ensures transparency (versioning, collaboration)
- Combined, they reduce redundancy and enable model reuse
  - Provided a licence exists.

“OSMs represent a move toward open science in HTA”

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Recommendations for Practice

- Use “open source”, model type, and disease area in metadata
- Upload to GitHub + Zenodo for DOI generation
- Use open licences (MIT, GPL)
- Structure and annotate code for modularity and reuse

Call to Action

- For researchers: Share models in R on GitHub
- For educators: Teach R as HTA software
- For policy-makers: Mandate open models where possible
- For all: Join the open-source movement in health economics

“Open science accelerates discovery, democratizes knowledge, and strengthens trust.”
— *Adapted from OECD Open Science Framework*

Sampson CJ, Arnold R, Bryan S, Clarke P, Ekins S, Hatswell A, Hawkins N, Langham S, Marshall D, Sadatsafavi M, Sullivan W. Transparency in decision modelling: what, why, who and how?. Pharmacoeconomics. 2019 Nov;37(11):1355-69.

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