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ISPOR Report

Mapping the Landscape of Open Source Health Economic Models: A Systematic Database Review and Analysis: An ISPOR Special Interest Group Report

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ABSTRACT

Objectives: Health economic models are crucial for health technology assessments to evaluate the value of medical interventions. Open-source models (OSMs), in which source code and calculations are publicly accessible, enhance transparency, efficiency, credibility, and reproducibility. This study systematically reviewed databases to map the landscape of available OSMs in health economics.

Methods: A systematic database review was conducted, informed by guidance from ISPOR's OSM Special Interest Group. Eleven databases and specific OSM repositories were searched using predefined terms. Identified models were screened and duplicates were removed.

Results: The search yielded 8664 hits, resulting in 182 unique OSMs. GitHub hosted the majority (74%), followed by Zenodo (11%). R was the predominant software platform (64%). Infectious disease was the most common application domain (29%). Markov models were the most frequent model type (49%). Licensing with Creative Commons was typical. Government and academic institutions were the primary sponsors, although many models lacked clear sponsorship.

Conclusions: This review highlights the diversity and availability of open-source models (OSMs) in health economics, predominantly hosted on GitHub and developed using R. The models span various medical fields, with a strong focus on infectious diseases, oncology, and neurology. Ensuring clear licensing and standardized reporting is crucial to maximizing their impact. A combined approach of repository searches and traditional literature reviews provides a comprehensive method for identifying OSMs. Future efforts should enhance search strategies, improve reporting standards, and leverage OSMs to inform health policy decisions.

Keywords: health economic models, open source models, reproducibility, systematic database review, transparency.

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Highlights

- This study addresses the evidence gap in the accessibility, transparency, and reproducibility of health economic models by systematically reviewing databases to identify available open-source models.
- The review highlighted discoverability and reporting challenges, emphasizing the need for standardized documentation, licensing clarity, and improved metadata.
- Improving discoverability and standardization would ensure that open-source models are more accessible, fostering their integration into health technology assessments and enabling more robust, transparent, and informed policymaking.

Introduction

Health economic models underpin health technology assessment (HTA), which is used to assess the value of an intervention for a given disease. A subset of health economic models is open-source models (OSMs), which are defined variably as models that are fully transparent, providing unrestricted access to the model's source code along with permission for open use[1] or that are publicly accessible, along with their underlying code and a detailed report outlining the model's objectives, methods, structure, and results.[2] A common theme in these varying definitions is that OSMs have openly available source code and underlying calculations, often accompanied by additional materials, such as data and supporting documentation.[3,4] Previous publications have advocated for the widespread adoption of OSMs to increase transparency, efficiency, credibility, and reproducibility in health economic modeling.[1,5-7] The rationale is that researchers can access, use, and build upon existing models, reducing redundancy and promoting knowledge sharing.[8-10] Additionally, OSMs provide transparency in model development, assumptions, and calculations if the code is properly documented and structured. This transparency is crucial for evaluating the fitness for purpose of economic models, especially in the context of health policy decision making.[11] Access to OSMs can significantly reduce the cost and time required to develop new health economic models because researchers can leverage existing models as templates, which is particularly valuable in resource-constrained settings.

OSMs reside in various internet databases, primarily because of a lack of standardized storage/hosting recommendations. However, although efforts to improve code sharing have been supported by public repositories, achieving reproducibility in modeling remains challenging because of varying practices and technological dependencies. For example, some databases do not have functionality for a digital object identifier (DOI) generation.[12] Additionally, not all models that are consistent with the concept of open source are labeled as such[13] or are made available upon reasonable request.[14] Identifying OSMs requires searching for any health-economic model and checking manually whether they are consistent with the definition of OSMs. Databases, such as GitHub, supporting open access to code, potentially reduce the effort needed to identify OSMs but referencing a GitHub repository lacks precision because it does not specify the exact version of the code used in a publication. Additionally, GitHub does not guarantee the permanence of hosted content because repositories can be modified or deleted by the owner at any time.

To identify OSMs via databases supporting open access to code and assess the current state of available OSMs, we conducted a systematic database review (SDR), applying systematic search methods to identify, select, and extract characteristics from OSMs meeting prespecified criteria.[15] The goals of the search were to (1) establish a resource for researchers to identify OSMs for health economic evaluation that meet their needs, (2) create a framework for OSM discovery via databases supporting open access to code, and (3) emphasize a lesser-explored area of health economic modeling, namely model identification.

Methods

Informed by guidance from ISPOR's OSM Special Interest Group, we conducted searches across 11 databases anticipated to host OSMs, from inception up to September 9, 2024. These included GitHub,[16] Zenodo,[17] Mendeley data,[18] FigShare,[19] Code Ocean,[20], OpenAIRE,[21] CoMSES,[22] Paperswithcode,[23] Bitbucket,[24] Open Science Framework (OSF),[25] and University of Sheffield (Online Research Data); see Table 1 for additional descriptions.[26] We used the search strings Health Economics, Economic Evaluation, Cost-Effectiveness Analysis, Cost-Benefit Analysis, Cost-Utility Analysis, Cost-Minimization Analysis, or Cost-Consequence Analysis. For GitHub, the search strings were left wide, whereas for the remaining databases, the fields were narrowed to search only among the coding repositories. Additionally, except for GitHub and Mendeley data, search strings were restricted to an exact match. Further restriction was placed on the Code Ocean database to search only within the medical sciences and economics sections. OSMs were also extracted from specific health economic OSM databases: EpiGear,[27] Open Source Models Clearinghouse,[28] Innovation and Value Initiative,[29] Peer Models Network,[30] Pharmacoeconomics-Open,[31] and ProbModXML; see Table 1 for additional descriptions.[32] Additionally, a PubMed search was conducted to complement our database search (see Box 1 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019) and get an indication of the sensitivity of the search term "open source" combined with recommended terms for identifying health economic evaluation. Articles were identified and filtered by C.S., R.A., R.B., R.H., R.H.H., S.H., and X.P. using Rayyan, an intelligent systematic review tool.[33]

First, models were classified as open source or open access. We defined open source as the code, structure, assumptions, and input data (or their specifications) being made freely accessible to the public and open access as meaning that the model can be used freely via a specific (proprietary) software, but not all underlying code is accessible, for example, models built-in software such as Excel. We retained open-access models in the online supplemental data but did not include them in the majority of the descriptive statistics. As GitHub, Zenodo, Mendeley data, FigShare, Code Ocean, OpenAIRE, CoMSES, Paperswithcode, Bitbucket, OSF, and Online Research Data databases were searched, OSMs were identified, and intra- and interdatabase duplicates were removed sequentially. Because we were interested in all OSMs, we departed from a traditional systematic literature review in that no population, intervention, comparator, outcome, or study design were defined.[15] Identified models had their data extracted as described in Appendix Table 1 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019. OSMs were further categorized into either an instructional domain, covering a part of health economic decision modelers' needs (ie, tutorials on aspects of health economic modeling or tools for subtasks of modeling) or a decision support domain. To analyze the landscape of OSMs, we focused on describing (1) databases that currently host OSMs, (2) software platforms on which the models run, (3) domains to which the models are relevant, and (4) type of OSM, as defined by the model developers. Additionally, the supplemental file described (1) search terms, (2) data extraction fields, (3) repositories where OSMs are archived, (4) number of OSMs released per year, (5) model's sponsoring organization, and (6) license used.

Results

Our search generated 8664 results, which, after deduplication and screening, resulted in 213 health economic open source or open-access models (see online supplemental data in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019). However, an exception was made for models hosted in MATLAB because compatible freeware, such as Octave, allows these models to be accessed and run without requiring a MATLAB license. After applying these criteria, a total of 182 OSMs were included in the analysis (Fig. 1).[34] GitHub stored 134 (74%) of the OSMs, followed by 20 (11%) in Zenodo, 7 (5%) in OSM Clearinghouse, 5 (3%) in Mendeley, and 4 (2%) in FigShare. The remaining databases contained 3 or fewer OSMs (see Appendix Table 2 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019). Three of the OSMs did not reside in a repository, and the link to their code was found in the supplementary material of their online publication.[35-37] Many of the results for health economic OSMs within GitHub were repositories in which the OSMs had been registered but not completed; thus, they were repositories that were left empty. The earliest found OSM in our search was from 2009. OSMs were found to be increasingly more common with time, from one found in 2009 to 43 in 2023 (see Appendix Fig. 1 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019).

Table 2 displays the distribution of software platforms in use before exclusion of strictly open-access health economic models. The predominant choice of software for building open source or open-access health economic models was R, accounting for 136 (64%), followed by Excel with 16 models (8%), and Python with 13 models (6%) (Table 1).

OSMs were found to model interventions in a diverse range of clinical practice areas (Table 3). Infectious diseases represented the most prevalent field, with 52 (29%) models. Oncology (24, 13%) and neurology (16, 9%) were also common domains of application. Furthermore, OSMs were used in healthcare categories, including cardiology, respiratory, surgery, autoimmune disorders, reproductive health, diabetes, obesity, genetic disorders, gastroenterology, smoking, orthopedics, nephrology, and nutrition, with each of these areas contributing to this diverse landscape with 5 models or less. Instructional applications were the second most prevalent, with 41 (23%) results. Modeling tools, critical for various purposes, such as decision support, accounted for 19 (10%).

The sponsorship of OSMs spanned a varied landscape, as outlined in Appendix Table 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019. Notably, 77 OSMs (42%) had no specified sponsor. Government entities funded 32 OSMs (18%), highlighting public-sector support. Academic institutions

Table 1. Repositories and databases searched.

Repository/ database	Description	Strengths	Weaknesses
GitHub	A widely used platform for code sharing and collaboration with version control.	Large user base, strong community support, excellent version control, extensive integration with development tools.	Not specifically designed for academic publishing or data set archiving. Limited support for metadata.
Mendeley	A reference manager that allows researchers to share and discover data sets and code.	Strong in reference management and academic networking, allowing DOI creation. Supports data set sharing and collaboration.	Primarily a reference manager; limited features specifically for code. Sharing is usually less extensive than code-specific repositories.
Zenodo	A research repository by CERN that hosts code, data sets, and articles. Supports DOI generation for shared materials.	Open access, free DOI creation, integration with GitHub for code archiving, recognized by academic institutions.	Limited version control for collaborative coding.
Figshare	A platform for sharing research outputs, including data sets, code, and publications.	DOI assignment, supports various research outputs, good visibility in academia.	Limited version control; not optimized for collaborative coding projects.
Code Ocean	A platform for sharing code, data sets, and workflows in executable capsules.	Supports containerized code execution, facilitates reproducibility, integrates with cloud resources.	Limited free access; some features are behind a paywall.
OpenAIRE	An EU-supported platform for open science that indexes various research outputs, including code repositories.	Good for European open science compliance, aggregates content from various repositories, supports Open Access. Indirect DOI assignment.	Primarily an aggregator rather than a direct hosting site; limited features for direct code collaboration.
CoMSES	Repository focused on computational modeling for social and ecological sciences.	Designed specifically for computational models; promotes sharing in social and ecological sciences. DOI assignment.	Specialized focus mean it is not as popular for general code sharing; limited version control features.
Papers with Code	Links academic articles with code implementations, often used in machine learning and computer science.	Highly popular in machine learning; strong emphasis on reproducibility.	Mostly limited to machine learning and computer science; limited support for data sets or detailed metadata.
Bitbucket	A Git-based source code repository hosting service primarily used for managing and sharing code with support for both Git and Mercurial repositories (until 2020). Popular among teams due to its integration with Atlassian tools like Jira.	Strong integration with Atlassian ecosystem (Jira, Confluence). Built-in CI/CD with Bitbucket Pipelines. Supports private repositories for free (up to 5 users). Fine-grained permission control	Limited community support compared with GitHub. Interface may be complex for beginners. Some advanced features require paid tiers
OSF	Open-source platform for managing research projects, sharing code, data sets, and workflows.	Comprehensive project management, DOI assignment, integrated version control, supports various file types.	Interface can be complex for beginners; less known for code than GitHub.
University of Sheffield	Institutional repository for research outputs, including code and data sets.	Provides visibility for affiliated researchers; integrates with academic platforms. Allows DOI assignment.	Limited to affiliated researchers; not widely used outside the institution.
Health economic OSMs only			
OSM Clearinghouse	Repository for open-source models in health economics and related fields.	Centralized access to health economic models, promotes model transparency.	Limited user base compared with larger repositories.
Peer Models Network	Network sharing economic models to promote peer collaboration in health research.	Facilitates peer review and collaboration on health economic models.	Less established than larger repositories; limited to health economics.
PharmacoEconomics	Repository for pharmacoeconomic models, focusing on cost-effectiveness and value-based assessments.	Specializes in pharmacoeconomic and health cost-effectiveness models, well regarded in the field.	Primarily for pharmacoeconomics; less diversity in research fields.

continued on next page

Table 1. Continued

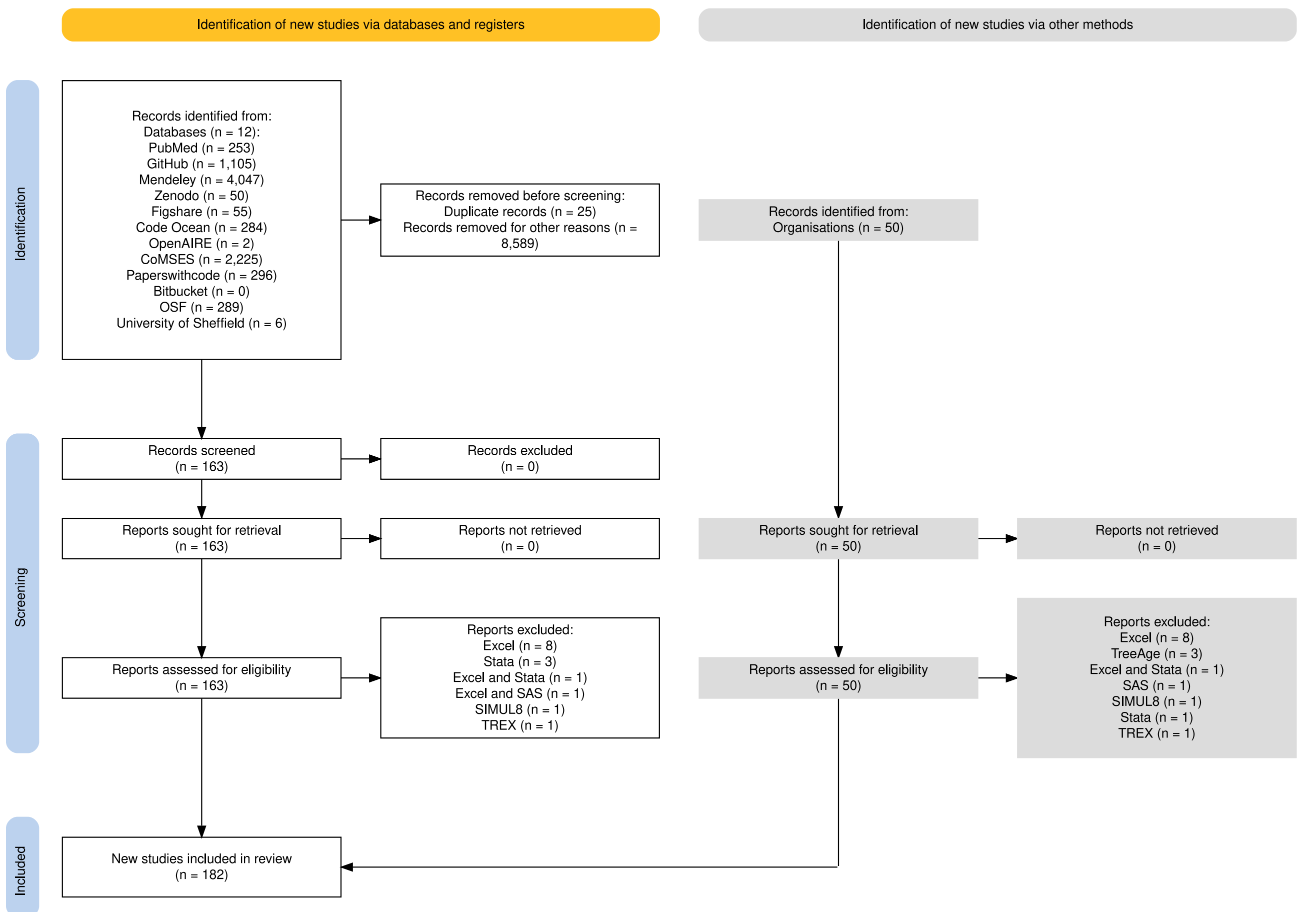
Repository/ database	Description	Strengths	Weaknesses
EpiGear	Provides software and models for epidemiological and pharmacoeconomic evaluations.	Focused on epidemiology and pharmacoeconomics, offers downloadable software and tools.	Less versatile for general economic models; may require licenses for advanced features.
ProbModelXML	XML-based standard for probabilistic models in health and decision sciences.	Supports standardized probabilistic modeling, XML format for interoperability.	Specialized XML format ; may require additional learning curve for beginners.
IVI	Health economics initiative that provides OSMs for assessing value in healthcare.	Emphasis on transparent, OSMs; widely recognized in health economics.	Limited focus on US-based models; may require adaptation for other healthcare systems.

CERN indicates European Organization for Nuclear Research; CI/CD, Continuous Integration and Continuous Deployment; CoMSES, Computational Modeling in the Social and Ecological Sciences; DOI, digital object identifier; EU, European Union; IVI, Innovation Value Initiative; OSF, Open Science Framework; OSM, open-source model; US, United States; XML, eXtensible Markup Language.

sponsored 31 models (17%), highlighting the role of education and research in OSM development. Pharmaceutical companies contributed to 11 OSMs (6%), indicating private sector involvement and Foundations supported 9 OSMs (5%). The remaining organizations sponsored 3 or fewer OSMs.

We examined whether the models had a license permitting the rights to run, redistribute as is, modify or redistribute modified, or waive author liability from their repository or associated article. Appendix Table 4 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.01.019 shows the number and percentage of various licenses reported. Of the 182 OSMs, 45 (24%) had no evident license, 34 (19%) had a General Public License, 30 (17%) had a license from the Massachusetts Institute of Technology, 27 (15%) had a Creative Commons license, 12 (7%) had an Open license, 6 (3%) had an Apache license, and the remaining options for licenses were used by 5 or fewer models.

Figure 1. PRISMA flow diagram.[37]



CoMSES indicates Computational Modeling in the Social and Ecological Sciences; IVI, Innovation and Value Initiative; OSF, Open Science Framework; OSM, open source model.

Table 2. Software platforms used for health economic OSMs.

Software	*N* (%)
R	136 (63.9)
Excel*	16 (7.5)
Python	13 (6.1)
R and Excel	4 (1.9)
Stata*	4 (1.9)
C#	4 (1.9)
MATLAB	3 (1.4)
TreeAge*	3 (1.4)
XML	3 (1.4)
HTML	2 (0.9)
Excel and Stata*	2 (0.9)
TREX*	2 (0.9)
SIMUL8*	2 (0.9)
Julia	2 (0.9)
R and C++	2 (0.9)
C++	1 (0.5)
R and BUGS	1 (0.5)
C++, R	1 (0.5)
R and JAGS	1 (0.5)
Windows	1 (0.5)
R and Julia	1 (0.5)
NetLogo	1 (0.5)
R and MATLAB	1 (0.5)
Javascript	1 (0.5)
R and Stata	1 (0.5)
WinBUGS	1 (0.5)
SAS*	1 (0.5)
C, Python, and R	1 (0.5)
SAS and Excel*	1 (0.5)
Scilab	1 (0.5)
Grand total	213 (100)

N indicates number; OSM, open-source model.
*Open-access models, rather than OSMs, were removed from further analysis.

We were able to discern that at least 154 (85%) of the OSMs were stand-alone models used for economic evaluation (Table 4). Table 4 provides an overview of the different types of OSMs utilized. Markov models constituted the most prominent category, with 75 instances (49%). Simulations, including discrete event simulation (DES), microsimulations, and agent-based simulations, accounted for 39 OSMs (25%). Susceptible-Exposed-Infectious-Recovered models accounted for 11 instances (7%). Other model types were also represented, including decision tree (8, 5%) and partition survival models (3, 2%). The remaining model types constituted 2 or less (Table 4). However, authors were not always explicit in describing their model type as per the Consolidated Health Economic Evaluation Reporting Standards statement (item 16; rationale and description of model), with 8 (5%) models not reporting this.[38]

The OSMs in Table 5 primarily serve as adjuncts to traditional health economic evaluation models and supplement HTA dossiers. The majority of these models support the mapping of health state utilities, whereas the remaining models represent 1 OSM apiece

Table 3. Domains of OSMs.

Domain	*N* (%)
Infectious disease	52 (28.6)
Instructional	41 (22.5)
Oncology	24 (13.2)
Modeling tools	19 (10.4)
Neurology	16 (8.8)
Cardiology	5 (2.7)
Surgery	5 (2.7)
Respiratory	4 (2.2)
Autoimmunity	3 (1.6)
Reproductive health	2 (1.1)
Diabetes	2 (1.1)
Obesity	2 (1.1)
Genetic disorder	2 (1.1)
Gastroenterology	1 (0.5)
Smoking	1 (0.5)
Orthopedics	1 (0.5)
Nephrology	1 (0.5)
Nutrition	1 (0.5)
Grand total	182 (100)

N indicates number; OSM, open-source model.

and include graphing incremental cost-effectiveness ratios, calculating disability-adjusted life-years, etc, or a budget impact model or cost-of-illness model.

Discussion

This systematic review is the first to explore databases likely to host health economic OSMs. Among the 182 OSMs analyzed, the predominant use of R stands out, likely attributed to its inexpensiveness, early acceptance within the medical community, shareware characteristics, and advocacy by Decision Analysis in R for Technologies in Health, a collaborative initiative spanning multiple institutions and universities.[39] Notably, a third of the OSMs incorporated tutorial or modeling tool aspects, reflecting the dynamic nature of health economic modeling and the desire among developers to create models that accurately depict healthcare pathways while promoting self-teaching among novices. The remaining models primarily served as decision-analytic tools, aimed at determining optimal interventions for specific medical needs. Infectious disease featured prominently among the domains of the identified OSMs, often used to strategize responses to outbreaks such as COVID-19, HIV, and respiratory syncytial virus, thereby highlighting their importance in addressing public health challenges.[40] Oncology and neurology were also well represented, likely reflecting the significant burden of disease in high-income and upper-middle-income countries. Notably, GitHub emerged as the dominant repository for these OSMs, likely because of its user-friendly interface, collaborative features, widespread adoption, and robust ecosystem support. Clear licensing frameworks are crucial for fostering collaboration and ensuring ethical use within the health economics field. Although licenses such as General Public License, Massachusetts Institute of Technology, and Creative

Table 4. Stand-alone health economic OSMs, model type as described in the README file.

Model type	N (%)
Markov	75 (48.7)
Simulation	17 (11.0)
SEIR	11 (7.1)
DES	10 (6.5)
Microsimulation	8 (5.2)
Decision tree	8 (5.2)
Not reported	8 (5.2)
Agent based	4 (2.6)
PSM	3 (1.9)
Microsimulation vs Markov vs DES	2 (1.3)
MGF vs microsimulation vs Markov vs DES	1 (0.6)
Clinical prediction	1 (0.6)
DCEA	1 (0.6)
Dynamic modeling	1 (0.6)
Multilevel Bayesian	1 (0.6)
CCA vs MILR/MIPMM vs BPA vs RMM	1 (0.6)
Supports PSM, Markov, Microsimulation, DES, and Custom	1 (0.6)
cDTSTMs, iCTSTMs, and PSMs	1 (0.6)
Grand total	154 (100)

Note. DCEA is used to model a bowel cancer screening program in the UK NHS. Microsimulations can also be DES, but no further explanation was provided in the repository or associated publication.
BPA indicates Bayesian parametric approach; CCA, complete-case analysis; cDTSTM, continuous discrete time state-transition model; DES, discrete event simulation; iCTSTM, individual continuous time state-transition model; MGF, moment-generating function; MILR, multiple imputation using linear regression; MIPMM, multiple imputation predictive mean matching; OSM, open-source model; PSM, partition survival modeling; RMM, repeated measures mixed model; SEIR, susceptible-exposed-infected-recovered.

Table 5. Adjunct to health economic models and HTA.

Model type	N (%)
Health utility	9 (32.1)
Score PROs	1 (3.6)
NMA	1 (3.6)
BIA	1 (3.6)
Digitizes KM curves	1 (3.6)
Sensitivity analysis	1 (3.6)
EVPPI	1 (3.6)
COI	1 (3.6)
Graph ICERs	1 (3.6)
Hamiltonian	1 (3.6)
PSA-ReD plot	1 (3.6)
Tornado plots and CE planes	1 (3.6)
QALY manipulation	1 (3.6)
Calculates DALYs	1 (3.6)
Decision curve analysis	1 (3.6)
Survival analysis	1 (3.6)
MAIC	1 (3.6)
Burden of disease	1 (3.6)
HTA tools	1 (3.6)
GUI for DALY calculation	1 (3.6)
Grand total	28 (100)

BIA indicates budget impact analysis; CE, cost-effectiveness; COI, cost-of-illness; DALY, disability-adjusted life-year; GUI, graphical user interface; ICER, incremental cost-effectiveness ratio; KM, Kaplan-Meier; MAIC, matching-adjusted indirect comparison; NMA, network meta-analysis; OSM, open-source model; PROs, patient-reported outcomes; PSA-ReD, probabilistic sensitivity analysis relative density; QALY, quality-adjusted life year.

Commons promote openness, the lack of a clear license for many models (ie, 45 OSMs) highlights a significant finding: these models are not truly open. Without a license, the authors retain copyright, and users lack the legal rights to run, reuse, modify, or redistribute the code, creating clear restrictions on adoption despite their availability on platforms such as GitHub. Addressing these issues is essential for enhancing collaboration, ensuring ethical practice, and maximizing the impact of OSMs in healthcare decision making.

Model types were also found to be very diverse among OSMs. Although the vast majority of OSMs were some form of health economic model (as opposed to adjunct modeling tools) it was not always straightforward from the database repository or accompanying publication as to whether it was a Markov model, partition survival model, discrete event simulation, or other. The remaining models were principally concerned with complementing different aspects of health economic models, such as health utilities, data visualization, Kaplan-Meier curves, or other features required of an HTA dossier, eg, budget impact model and economic burden study.

Strengths

Searching repositories offers several strengths compared with using PubMed for systematic literature reviews (SLRs) when identifying OSMs. Through this search, 19 models (plus 4 duplicates) were identified, compared with 163 OSMs identified by our search in code repositories. This result suggests that the term "open source" is inconsistently used in the title or abstract of health economic modeling studies, lacking specificity when searching for OSMs in PubMed. Possibly, OSMs have been described as "available upon reasonable request," but that requires a general search for health economic models and manually searching full text for its open-source nature. Therefore, repositories such as GitHub seem to provide a rich source of openly available software and have the potential to support model transparency and reproducibility by allowing users to track version histories and document change. However, unlike repositories such as Zenodo, Figshare, OSF, and CoMSES, a DOI is not assigned in GitHub (Table 1) in which code associated with a publication can be preserved.[10]

Limitations

Conducting an SDR to identify OSMs is challenging and leads to several limitations. Although there is some discoverability with descriptions, metadata, and tags, the ontologies for these database search engines are relatively weak when compared with Medline, Embase, Cochrane, or other databases used during a SLR. This makes for a much less effective search in which there is the potential to miss entries. Additionally, because the search results are presented in a nondownloadable format, duplicate removal is challenging and must take place while searching rather than downloading the search results for analysis. Furthermore, identified models were assessed only for the accessibility of their underlying data (ie, to verify whether the model was consistent with the definition of open source), and models were not downloaded and executed to assess their functionality. The lack of accessible input data, particularly when alternatives are difficult to substitute, poses a barrier to transparency—one of the key principles behind making a model openly available.

Recommendations

To advance the goals of open-source modeling initiatives, OSMs should be readily identifiable. Based on our findings, we would recommend that OSM developers use the terms "decision-analytic model" or "health economic model," use a term to describe the disease, use a term to describe the model type, such as "Markov" or "discrete event," according to Consolidated Health Economic Evaluation Reporting Standards item 16, and use the term "open source" as tags or words in the title or abstract when uploading or describing an OSM.[9,38] Additionally, developers should ensure OSM reusability through open-source licensing, well-documented code with clear comments and modular structure, and comprehensive testing data sets, promoting transparency, ease of understanding, and robustness. These practices facilitate collaboration and model reuse within the research community.[9]

Repositories such as those described here play a key role in fostering the reusability and improvement of OSMs in health economics as they facilitate continuous feedback and peer review from the wider community. This aligns with trends observed in other fields, in which open-code sharing has similarly led to iterative model refinement and error correction. However, as in other disciplines, effective reuse in health economics depends not only on code availability but also on comprehensive, clear documentation to enable understanding by external users. Studies in fields such as environmental modeling and computational biology also emphasize that adherence to best practices, such as standardized documentation frameworks, such as Transparent and Comprehensive Model Evaluation, enhances model transparency and usability by making assumptions and data requirements explicit.[9,10,41]

Our findings support these existing recommendations and align with the goals of frameworks such as Sharing Tools and Artifacts for Reusable Simulations, which advocates the use of open licenses, clear documentation, and persistent identifiers (such as DOIs) to ensure accessibility and reproducibility in shared models.[42] This suggests that, although OSMs in health economics share many of the same challenges and best practices seen in other domains, the increasing prevalence of health economic models on open platforms indicates a positive trend toward alignment with open science standards.

The high prevalence of R as a platform for OSMs points to possible standardization in modeling software, which could streamline the assessment and comparison of economic evaluations. Tutorials on state-transition models,[43] distributional cost-effectiveness analysis,[44] microsimulations,[45] and packaging in R[13] emphasize its adaptability and transparency, whereas tools such as Shiny further enhance accessibility, suggesting an active movement toward open science and shared best practices in health economic modeling.[46] The recent emphasis on modeling various aspects of the COVID-19 pandemic points to potential future applications of OSMs. In the future, OSMs could be adopted more widely in health research, helping to adapt models to inform emerging policy questions and enhancing model validation efforts. The identification of OSMs in areas such as oncology and neurology, which have a significant burden in high-income and upper-middle-income countries, highlights the focus areas for health economics. This outcome can guide resource allocation and policy decisions in these regions. The diversity of model types highlights the need for clear documentation and classification of models. The identification and accessibility of OSMs have the potential to transform the field of health economics research by promoting collaboration, transparency, efficiency, and evidence-based policymaking.

Future Research

Future research could focus on evaluating OSMs to assess their quality and functionality, developing standardized reporting guidelines to improve the findability, clarity, and reproducibility of OSMs, and metadata standards to improve their discoverability. As OSMs become more accessible and transparent, they can have a direct impact on health policy decisions. Policymakers can use these models to inform resource allocation, reimbursement decisions, and the development of cost-effective healthcare interventions.

Conclusions

Many OSMs were identified in this combined SDR/SLR in a variety of repositories, with the majority in R and the infectious, oncology, or neurology disease areas for decision-analytic purposes. Future directions should focus on addressing limitations in search capabilities, standardizing model reporting and discoverability, and leveraging OSMs for real-world health policy impact.

Author Disclosures

Author disclosure forms can be accessed below in the Supplemental Material section.

Supplemental Material

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