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Implementation of operational research methods in healthcare: protocol for a literature review

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OBJECTIVES

The implementation of the results of OR projects in healthcare has been a vexing problem for a long time. Literature reviews regularly show that only a fraction of published articles mention any level of impact on practice, typically below 10% (Brailsford and Vissers, 2011, Brailsford et al., 2009b).

Faced with this situation, several strategies have been proposed: better engagement with practitioners (Brailsford et al., 2009a, Pearson et al., 2013), OR training for healthcare professionals so they can develop their own interventions (Harper, 2020, Gartner et al., 2022), ‘researcher-in-residence’ programs (Marshall et al., 2014), multimethodological interventions that combine OR approaches (Holm et al., 2013)... These recommendations all have good face validity, but they are not rooted in evidence. Evaluation of OR projects is seldom performed (Lamé et al., 2022).

Others have looked at “barriers” to implementation of OR in healthcare (Brailsford et al., 2013, Lowery et al., 1994, Long et al., 2019), or the specificities of the healthcare sector for OR modellers (Tako and Robinson, 2014, Jahangirian et al., 2012).

Yet, a significant gap remains to be filled on what we consider as implementation, and what strategies have been used in successful projects. Organizational scientists have long since shown that the use of models in practice is an elaborate sociotechnical process (Hutchel and Molet, 1986, Langley, 1989, David, 2001). In healthcare, the recent movement of ‘implementation science’ seeks to promote the transfer of scientific evidence in clinical practice. Unfortunately, to this date, there seems to have been little interaction between OR and this field (Box 1).

In this review, we want to go further than simply quantifying how many articles discuss implementation. We want to look at the articles that do, and analyse what was implemented, how, with what impact, and how it was evaluated and reported. We also want to see if implementation science concepts and tools are used in healthcare OR.

Box 1. Rapid literature search on the intersection between implementation science and OR.

We carried the following search on the WebOfKnowledge on 12 December 2023:

- TS(("implementation science" OR "implementation research" or "implementation studies" OR "cfir" or "consolidated framework for implementation research" OR "theoretical domains framework" OR "cici" or "Context and Implementation of Complex Interventions" OR "RE- AIM")
- AND (health* or medic* or nurs* or hospit* or doctor* or physician* or clinic*)
- AND WC=(Operations Research & Management Science)

We obtained 6 results, from which only 2 were relevant.

METHODS

INCLUSION CRITERIA

We will include articles that report on the **implementation** of **OR** interventions in **health services**. These terms deserve clarification.

Operational research: we define OR as model-based attempts to improve organisational issues. This includes problem structuring methods and Soft OR, and represents the scope of the main European OR journals, e.g. JORS or EJOR. A strand of research in global health has defined “operational research” as “the search for knowledge on interventions, strategies, or tools that can enhance the quality, effectiveness, or coverage of programmes in which the research is being done”, which “involves three main types of method: descriptive (cross-sectional, if a strong analytic component is also present), case–control, and retrospective or prospective cohort analysis.” (Zachariah et al., 2009) These articles will be included only if they presented the results of a model-based intervention.

Health services: we will include only articles that discuss OR in health services, including prevention and public health services. Articles about the medical device and pharmaceutical industries will be excluded (e.g., production of medical devices, management of pharmaceutical plants, or inventory issues in pharmaceutical supply chains).

Implementation: we will include two types of articles on implementation. First, articles that report the implementation of the results of an OR intervention, e.g. (Monks et al., 2015), or articles that discuss unsuccessful attempts at implementation, e.g. (Connell, 2001). Second, articles that specifically study implementation, e.g. through surveys or interviews of practitioners (Brailsford et al., 2013).

The “implementation” of the results of OR interventions could mean anything from informing a decision (whether it follows the model’s insights or not) to a decision-support tool being installed in

the information system of a hospital (Pidd, 2010). However, for an article to be included, it needs to include specific elements on the impact of the intervention on stakeholders or the system being studied. We will only include articles that provide information on how stakeholders/clients reacted to the intervention and took it into consideration.

- Articles that only discuss implementation as a perspective in vague terms (“this model might help...”), articles that provide generic “managerial insights” (“our model provides invaluable managerial insights...” with no information on how these insights were received by managers) will be excluded.
- Similarly, we will exclude articles that only mention that the OR results were presented or shared in some way (e.g., “Several of our medical and health economic core results have been presented” (Heidenberger and Flessa, 1993)), without anything on what followed these presentations and reports.
- General statements by the authors on the proposed impact of their work are not enough to justify inclusion. E.g., with no further detail a comment like “the decision makers were able to identify the aspects that need to be prioritized to improve overall performance . . . The model enabled a better visualization of the hospital's logistics activities, allowing it to identify the main aspects that should be prioritized to achieve excellence in its internal logistics performance” (Longaray et al., 2018) is not enough to justify inclusion, because there is no connection to a decision or change in systems.
- Developing and making available a decision-support system, an online platform... without discussing if and how target users have used it in practice does not justify inclusion. For example, writing “The model has been implemented as a computer package within the Microsoft Excel environment, using Visual Basic for Applications. This allows the user (for example, a health care planner) to track the costs and benefits of screening a particular risk group or a number of risk groups for haemoglobinopathies” (Gallivan et al., 2006) shows the potential value of the system, but it does not provide any information on whether it was ever used.
- Articles that describe engagement with stakeholders during model-building but not what happened as a result of the intervention will be excluded.
- Articles that use of real-world data to build or validate the model will be excluded if no elements are provided on the impact of the intervention.
- Articles where the outcome of the intervention is a decision to do things differently, or a decision to investigate more, will be included.
- Articles that explicitly describe a lack of change as a result of the intervention (i.e. a decision is made not to change, rather than no decision is made) will be included.

To be included, articles must be published in English, in peer-reviewed journals or conference proceedings. Opinion pieces, abstracts and letters will be excluded. We set no limits on the date of publication.

SEARCH STRATEGY

We will search three databases: MEDLINE, Scopus and the ISI WebOfKnowledge. Full queries are provided as an appendix.

After screening articles for inclusion, we will screen the references and track citations of included articles to identify additional sources.

Finally, we will include sources obtained through personal knowledge or serendipitous discovery (Greenhalgh and Peacock, 2005).

ARTICLE SELECTION PROCESS

Article selection will proceed in two stages. First, we will screen on title and abstract. Two reviewers will screen a random 10% sample of articles to check agreement, using Cohen's kappa and prevalence and bias adjusted Kappa (Byrt et al., 1993).

Then, two reviewers will independently assess each full text. Mismatches will be solved through mutual discussion.

We will use the online platform Rayyan to support the article selection process.

RISK OF BIAS AND QUALITY ASSESSMENT OF INDIVIDUAL STUDIES

We will not assess the risk of bias or the reporting quality of individual studies.

DATA EXTRACTION

One reviewer will extract information from each article. We will extract the following information:

- Article details (country of authors' affiliation, date of publication)
 - From EndNote
- Type of health service:
 - Primary care (including pharmacies)
 - Secondary care
 - Ward
 - Operating theatre
 - ICU
 - A&E
 - Hospital-wide
 - Other hospital departments (pharmacy, sterile processing department, imaging, labs, etc.)
 - Public health
 - National (including health policy)
 - Local
- Type of OR method:
 - Simulation (discrete-event, agent-based, system dynamics)
 - Multi-Criteria Decision Analysis
 - Soft OR and problem structuring methods (including concept mapping)
 - Statistical analysis (including forecasting)
 - Mathematical programming and optimisation (including heuristics)
 - Stochastic modelling (e.g., queueing theory, Markov models)
- Type of 'product':
 - One-off insights
 - Algorithm
 - Decision-support tool
- Level of implementation, with three levels:
 - A decision has been made based on the insights (including a decision not to change anything)

- Change has happened in the system
- Scaled-up change (change has been transferred somewhere else)
- Type of decision:
 - Decide to follow the insights (even partially)
 - Decide NOT to follow the insights (sometimes described as 'failure' to implement)
- Evaluation of change:
 - Yes / no / not mentioned
 - Pilot evaluation / evaluation of permanent implementation
 - Type of evaluation:
 - Controlled before-and-after study
 - Uncontrolled before-and-after study
 - Interrupted time-series
 - Randomized controlled study
 - Non-randomized controlled study
 - Qualitative evaluation
 - Other (describe)
- Engagement with stakeholders:
 - Yes / no / not mentioned
 - Type of engagement (multiple options possible):
 - Stakeholders as 'data sources'
 - Stakeholders involved in model-building (e.g. facilitated modelling)
 - Stakeholders involved in implementation
- Level to which implementation is described:
 - A short mention (two or three sentences at most)
 - More detailed description (one paragraph to one section)
 - Implementation is a key aspect of the article
- Use or citation of implementation science concepts:
 - Yes / no
 - If yes, concepts or sources
- Elements that favoured/hindered implementation according to the authors:
 - Qualitative: copy-paste or summarise

SYNTHESIS

We will provide a summary table of included studies, a narrative synthesis, and descriptive statistics.

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APPENDIX: SEARCH QUERIES

Our queries combine a generic search on [OR AND healthcare AND implementation] in all journals, with a specific search on [healthcare AND implementation] in the main OR journals and the few healthcare-focused OR journals.

WEB OF KNOWLEDGE

A generic search in all journals + a specific search for the main OR journals and healthcare-focused OR journals

Web of Science Search Strategy (v0.1)

Database: Web of Science Core Collection

Entitlements:

- WOS.SCI: 1945 to 2024

- WOS.AHCI: 1995 to 2024

- WOS.ESCI: 2019 to 2024

- WOS.ISTP: 1990 to 2024

- WOS.SSCI: 1995 to 2024

- WOS.ISSHP: 1990 to 2024

Searches:

1: TS=(("operational research" OR "operations research") AND (implement* OR impact OR adopt* OR evaluat* OR validat*) AND (health* OR medic* OR nurs* OR hospit* OR doctor* OR physician* OR clinic* OR pharmac*))

Date Run: Tue Jan 30 2024 14:17:14 GMT+0100 (heure normale d'Europe centrale)

Results: 1163

2: (TS=((implement* or impact or adopt* or evaluat* or validat*) AND (health* or medic* or nurs* or hospit* or doctor* or physician* or clinic*))) AND SO=("European Journal of Operational Research" OR "Journal of the Operational Research Society" OR "Management Science" OR "Operations Research" OR "Omega" OR "Computers & OR" OR "International Transactions in Operational Research" OR "Annals of Operations Research" OR "IISE Transactions" OR "health systems" OR "Operations Research for Health Care" OR "health care management science" OR "iise transactions

on healthcare systems engineering" OR "interfaces" OR "informs journal on applied analytics" OR "iie transactions" OR "iie transactions on healthcare systems engineering")

Date Run: Tue Jan 30 2024 14:18:02 GMT+0100 (heure normale d'Europe centrale)

Results: 1713

3: #2 OR #1

Date Run: Tue Jan 30 2024 14:18:12 GMT+0100 (heure normale d'Europe centrale)

Results: 2677

4: (DT=(Proceedings Paper OR Letter OR Meeting Abstract))

Date Run: Tue Jan 30 2024 14:24:47 GMT+0100 (heure normale d'Europe centrale)

Results: 21263745

5: #3 NOT #4

Date Run: Tue Jan 30 2024 14:26:10 GMT+0100 (heure normale d'Europe centrale)

Results: 2524

MEDLINE

((("operational research"[Title/Abstract] OR "operations research"[Title/Abstract])

AND (implement*[Title/Abstract] OR impact[Title/Abstract] OR adopt*[Title/Abstract] OR
evaluat*[Title/Abstract] OR validat*[Title/Abstract]))

AND (health*[Title/Abstract] OR medic*[Title/Abstract] OR nurs*[Title/Abstract] OR
hospit*[Title/Abstract] OR doctor*[Title/Abstract] OR physician*[Title/Abstract] OR
clinic*[Title/Abstract] OR pharmac*[Title/Abstract]))

NOT (Abstracts[Publication Type] OR Letter[Publication Type] OR Editorial[Publication Type])

Run on 30 January 2024

1,025 results

SCOPUS

Scopus query 1

(TITLE-ABS-KEY ("operational research" OR "operations research")

AND

TITLE-ABS-KEY (implement* OR impact OR adopt* OR evaluat* OR validat*)

AND

TITLE-ABS-KEY (health* OR medic* OR nurs* OR hospit* OR doctor* OR physician* OR clinic* OR pharmac*))

AND

(EXCLUDE (DOCTYPE , "ed") OR EXCLUDE (DOCTYPE , "le") OR EXCLUDE (DOCTYPE , "bk") OR EXCLUDE (DOCTYPE , "ch") OR EXCLUDE (DOCTYPE , "er"))

Run on 30 January 2024

2,431 hits

Scopus query 2

TITLE-ABS-KEY(implement* or impact or adopt* or evaluat* or validat*)

AND

TITLE-ABS-KEY(health* or medic* or nurs* or hospit* or doctor* or physician* or clinic*)

AND

(LIMIT-TO (EXACTSRCTITLE,"European Journal Of Operational Research") OR LIMIT-TO (EXACTSRCTITLE,"Annals Of Operations Research") OR LIMIT-TO (EXACTSRCTITLE,"Journal Of The Operational Research Society") OR LIMIT-TO (EXACTSRCTITLE,"Computers And Operations Research") OR LIMIT-TO (EXACTSRCTITLE,"Management Science") OR LIMIT-TO (EXACTSRCTITLE,"Operations Research") OR LIMIT-TO (EXACTSRCTITLE,"Omega") OR LIMIT-TO (EXACTSRCTITLE,"International Transactions In Operational Research") OR LIMIT-TO (EXACTSRCTITLE,"Omega United Kingdom") OR LIMIT-TO (EXACTSRCTITLE,"Omega United States") OR LIMIT-TO (EXACTSRCTITLE,"Health Care Management Science") OR LIMIT-TO (EXACTSRCTITLE,"Ise Transactions") OR LIMIT-TO (EXACTSRCTITLE,"Health Systems") OR LIMIT-TO (EXACTSRCTITLE,"Operations Research For Health Care") OR LIMIT-TO (EXACTSRCTITLE,"Ise Transactions On Healthcare Systems Engineering") OR LIMIT-TO (EXACTSRCTITLE,"Iie Transactions On Healthcare Systems Engineering") OR LIMIT-TO (EXACTSRCTITLE,"Iie transactions") OR LIMIT-TO (EXACTSRCTITLE,"interfaces") OR LIMIT-TO (EXACTSRCTITLE,"Informs journal on applied analytics"))

AND

(EXCLUDE (DOCTYPE , "ed") OR EXCLUDE (DOCTYPE , "le") OR EXCLUDE (DOCTYPE , "bk") OR EXCLUDE (DOCTYPE , "ch") OR EXCLUDE (DOCTYPE , "er"))

Run on 30 January 2024

2,341 hits

After merging queries 1 and 2 and deduplication: 4,435 hits