ADAPTING PRISMA FOR SYSTEM DYNAMICS MODELS IN HEALTHCARE

A Case Study of Aortic Valve Replacement in Canada

MSR140

BACKGROUND

System dynamics models (SDMs) are used by healthcare policymakers to simulate complex systems. Using a SDM enables informed decisions that optimize long-term health system outcomes.

Literature reviews are necessary to ensure all relevant research is considered for informing the structure and boundaries of a SDM.

PRISMA is the standard framework for systematic reviews in health sciences. PRISMA is designed to synthesize clinical evidence, excluding broader contextual and systems-level data that is required to build a high-quality SDM.

The lack of focus on systems-level data in traditional PRISMA reviews can lead to incomplete models that fail to capture the full complexity of healthcare systems.

OBJECTIVES

- Adapt the PRISMA approach for systematic reviews that aim to parameterize SDMs.
- Utilize the PRISMA checklist to establish a transparent and reproducible process.
- Identify and extract data that is relevant to SDM development.
- Apply the adapted approach to inform a SDM of the patient care pathway for Canadian aortic valve replacement (AVR) patients.

BIBLIOGRAPHY

1. Homer J, Hirsch GB eds. System Dynamics Models for Public Health and Health Care Policy. MDPI - Multidisciplinary Digital Publishing Institute. (2023). doi: 10.3390/books978-3-0365-7840-8
2. Darabi N, Hosseinichimeh N. System dynamics modeling in health and medicine: a systematic literature review. System Dynamics Review (2020) 36:29–73. doi: 10.1002/sdr.1646
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METHODS

Systematic literature searches adapt PRISMA to inform a SDM of severe symptomatic aortic stenosis (SSAS) and the AVR pathway. Multi-database searches (PubMed, Scopus, Embase) combine top-down clinical terms ("aortic stenosis," "TAVR") with bottom-up care delivery terms (¨echocardiography utilization¨, "cardiology referral," "heart team utilization"). Titles and abstracts are screened for SSAS epidemiology, progression, management (symptom detection, cardiology and diagnosis referrals), resource use, and SDM elements (feedback dynamics, non-linear temporal outcomes). Full-text articles meeting eligibility criteria prioritize quantifiable data, such as time-to-AVR, care stage transitions, and heart-team capacity and utilization. A customized data extraction tool captures variable definitions, study designs, data points, and limitations. The process is documented with a PRISMA flow diagram and decision logs, executed collaboratively with modelers and cardiology experts to address AVR pathway gaps.

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RESULTS

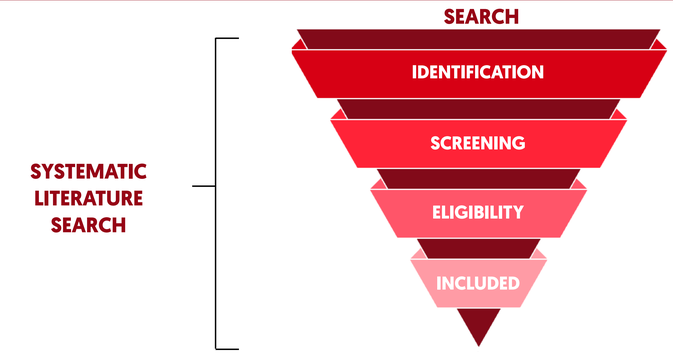
The adapted PRISMA approach yielded an implementation pathway with which to identify diverse studies for the AVR SDM, moving beyond traditional clinical evidence. It integrated broader data for modeling the AVR patient journey. The top-down (clinical) and bottom-up (care delivery) search strategies identifies quantifiable variables. This information will contribute to a more comprehensive understanding of the factors influencing early disease detection and referral patterns to AVR, ultimately leading to more robust model parameterization, calibration and validation

- The integration of diverse data sources allowed for a more holistic model of SSAS disease progression, the AVR patient journey, capturing both clinical and systemic factors.
- The use of both top-down and bottom-up search strategies enabled the identification of key variables that influence the care pathway to AVR, such as referral patterns and resource utilization.
- Reliable parameters used for calibration and validation processes will improve the accuracy and utility of the AVR SDM for healthcare decision-making.

CONCLUSIONS

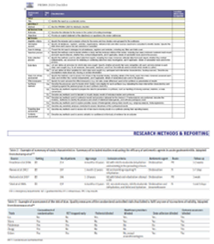
This adapted PRISMA framework supports structured, transparent searches for SDM development, enabling robust simulation models for decision-making. By incorporating healthcare systems-level data, the implementation framework ensures that SDMs are comprehensive and reflective of real-world healthcare dynamics. Its use for studying the AVR patient journey in Canada demonstrates the practical application and benefits of this approach, highlighting its potential for broader use in healthcare modeling. The framework enhances the ability of policymakers to make informed decisions based on robust simulation models that accurately represent complex healthcare systems.

IMPLEMENTATION PATHWAY



CLINICAL EVIDENCE SYNTHESIS

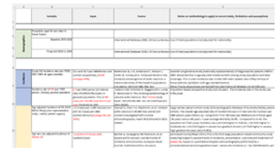
PRISMA Checklist



Systematic Literature Review / Meta-Analysis

SYSTEMS MODELS DEVELOPMENT

Data Collection Tool



Inputs for parametrisation of model variables

Dynamic Simulation Modeling

SCAN TO DOWNLOAD

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