An AI-based Procedure to Literature Review: an Application to Vaccine Supply Chains

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Index Terms

Vaccine Supply Chains, LLMs, Artificial Intelligence, Literature review

Abstract

This study presents an AI-assisted methodology for literature review applied to vaccine supply chains (VSC). We developed a five-stage approach combining AI tools with expert validation to analyze VSC research with an operations research perspective. From 219 papers (2000-2024), we identified 96 for comprehensive review, revealing three dominant problems: Allocation, Inventory Management, and Distribution—typically addressed through coverage and equity considerations requiring multi-objective approaches. Our contribution is both methodological (demonstrating AI's effectiveness in accelerating literature reviews while maintaining academic rigor) and substantive (synthesizing VSC research and identifying knowledge gaps). This framework offers a reproducible approach balancing technological efficiency with domain expertise in operations research.

I. INTRODUCTION

This research addresses both methodological and academic objectives. First, we leverage artificial intelligence (AI) tools to enhance the efficiency of academic literature reviews. Second, we respond to the growing interest in Vaccine Supply Chain (VSC) research that emerged following the COVID-19 pandemic.

Our study employs a mixed-methods approach, combining qualitative and quantitative research techniques to provide a comprehensive analysis of VSC literature. This approach facilitates the development of a conceptual framework supported by AI tools while accelerating the literature review process. Through this methodology, we identify key concepts and evaluate theories related to vaccine supply chains.

The methodology is designed with three core principles: systematic organization, research rigor, and reliable outcomes. To maintain scientific robustness and reproducibility, all AI-generated insights undergo validation by domain experts. This validation process ensures that technological efficiency does not compromise academic quality.

II. METHODS AND PRELIMINARY RESULTS

The proposed review follows five stages: (i) Search query and literature selection, (ii) AI-assisted information extraction, (iii) expert review and quantitative assessment, (iv) iterative evaluation with AI tools, (v) categorization and data synthesis.

The search was limited to the Science Direct, Scopus, and PubMed databases, focusing on papers published between 2000 and July 2024 related to VSC, Operations Management, and Operational Research. This search yielded 219 papers. Ryyan AI and SciSpace were then used to categorize the documents and extract key information, including the addressed problem, solution approach, methodology, findings, and practical implications. The extracted data were validated and evaluated using a scoring system, narrowing the review to 96 papers. Finally, VosViewer performed a cluster analysis, identifying six dominant themes: vaccine transportation, VSC, optimization, simulation, and allocation.

III. FINDINGS

The use of a pure AI approach highlighted the limitation of the LLM. It worked well to extract general ideas, but not to extract papers' contributions. Even though there were elements that matched the human extracted insights. These coincidences were of great value to refine the author's reasoning process for filtering and classifying papers. The panel of experts' opinion is crucial to define the classification of the literature, who identified a possible classification of the literature following the criteria of objectives, application, and solution methods Regarding VSC literature, three recurrent problems were identified: Allocation, Inventory Management, and Distribution. These problems are primarily addressed considering two aspects: coverage and equity. The nature of the problem inherently leads to multi-objective approaches.

IV. CONCLUSIONS

This work contribution is twofold. First, we aim to provide a review of the literature on VSC focusing on the contributions of OR into the field, with a special angle on the lessons learned from COVID-19. Second, we tested an approach to the review process using AI to validate and clarify the capabilities of the technology and to what extent its contribution could complement human work. This systematic approach combines AI-driven efficiency with expert validation, ensuring a robust and insightful review of vaccine supply chain research. By integrating quantitative and qualitative methods, the study provides a comprehensive analysis while maintaining scientific rigor and reproducibility.