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Short communication

Cost–utility analysis of pharmacist-led medication review in high-risk cardiovascular polypharmacy patients

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Introduction

Cardiovascular polypharmacy is associated with medication-related problems (MRPs), adverse drug events (ADEs), avoidable hospitalizations and increased healthcare expenditure, particularly among older adults with multimorbidity (Verma et al., 2023). Pharmacist-led medication review (MR) services represent structured pharmaceutical care interventions aimed at identifying drug-related problems, optimizing therapy and improving medication safety (Chambers et al., 2024). However, pharmacoeconomic evidence regarding medication review services in Southeast Europe remains limited.

This study aimed to evaluate the cost-effectiveness of a pharmacist-led medication review service compared with usual care in patients with cardiovascular polypharmacy.

Materials and methods

A pharmacoeconomic model combining a decision tree and Markov framework was developed to evaluate long-term economic and clinical outcomes of medication review versus usual care from the healthcare payer perspective. The model simulated transitions between stable health state, medication-related problems, adverse drug events, post-ADE condition and death. Clinical probabilities, utility values and epidemiological assumptions were primarily derived from data obtained through the authors' own observational research on cardiovascular polypharmacy patients, supplemented by published literature and expert assumptions where necessary.

Key probabilities for MRPs, recommendation acceptance, DDI resolution and ADEs were derived from observational and published data. (Verma et al., 2023; McGrory et al., 2025). Direct medical costs included medication review services, monitoring, follow-up and ADE-related hospitalization costs associated with acute kidney injury, bleeding and arrhythmia/syncope events. Health-state utility values ranged from 0.55 for ADE states to 0.75 for stable patients. Costs were expressed in Macedonian denars (MKD).

Base-case cost-effectiveness analysis, one-way sensitivity analysis and probabilistic sensitivity analysis (PSA) were performed. PSA was conducted using Monte Carlo simulations to evaluate overall model uncertainty (Briggs et al., 2006).

Results and discussion

In the base-case analysis, medication review demonstrated superior economic and clinical outcomes compared with usual care. The intervention generated total costs of 8,030 MKD and 9.09 quality-adjusted life years (QALYs), whereas

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usual care generated higher total costs of 29,549 MKD and lower effectiveness of 8.97 QALYs.

Medication review was therefore dominant, providing both lower costs and improved health outcomes. Incremental analysis demonstrated cost savings of 21,520 MKD and a QALY gain of 0.12 compared with usual care. The intervention additionally improved life expectancy (12.17 versus 10.61 life years), reduced medication-related problems (0.26 versus 1.10 events), decreased adverse drug events (0.07 versus 0.49 events) and lowered ADE-related hospitalization costs (2,560 versus 18,332 MKD).

Net monetary benefit was higher for medication review compared with usual care (446,440 versus 418,810 MKD), supporting the economic attractiveness of the intervention.

One-way sensitivity analysis demonstrated that the model was most sensitive to utility parameters, particularly utilities associated with post-ADE condition, stable health state and MRP state. Age, recurrent ADE probability and baseline MRP incidence also influenced model outcomes. Cost parameters, including medication review cost and post-ADE management costs, had comparatively smaller effects on ICER estimates.

Despite variation across plausible parameter ranges, medication review remained economically favorable in nearly all tested scenarios, indicating good model robustness.

Probabilistic sensitivity analysis confirmed the stability of the findings. Monte Carlo simulations demonstrated that 82.5% of iterations were located in the southeast quadrant of the cost-effectiveness plane, indicating that medication review was both more effective and less costly than usual care. Approximately 17.5% of simulations also remained cost-saving despite smaller effectiveness differences, while virtually no simulations suggested economic inferiority of the intervention.

The findings are consistent with recent international evidence demonstrating that structured pharmacist interventions improve medication safety and reduce healthcare resource utilization among high-risk multimorbid populations (Carollo et al., 2024; McGrory et al., 2025). Importantly, this study provides pharmacoeconomic evidence contextualized to the healthcare setting of North Macedonia and incorporates real-world inputs generated from the authors' own clinical research.

Conclusion

Pharmacist-led medication review services in patients with cardiovascular polypharmacy were associated with lower healthcare costs, improved quality-adjusted survival and fewer adverse clinical events compared with usual care. These findings support broader implementation of structured medication review services as clinically beneficial and economically sustainable pharmaceutical care interventions in high-risk polypharmacy populations.

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