Integrated location and inventory decisions in healthcare logistics: review, model and first results

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January 2025

Healthcare institutions, including hospitals and retirement homes, face various challenges [5]. First, they struggle with tight budgets due to government savings. Second, they experience rising costs due to factors such as the COVID-19 pandemic, energy crisis, and inflation. Third, they deal with a shortage of care staff due to high workloads, forcing them to make an effort to relieve non-care tasks (i.e., logistics tasks). These challenges put significant pressure on healthcare institutions. To address these challenges, healthcare institutions aim to reduce costs and improve healthcare logistics while ensuring high-quality care [3,4].

One key strategy for improving healthcare logistics is consolidating inventory across healthcare institutions [3,4]. This entails healthcare institutions within a network pooling their inventory from individual warehouses into one or a few central care hubs [1]. Decision support for inventory pooling is facilitated by integrated decision-making on location and inventory management, known as the location-inventory problem (LIP) in the academic literature [2]. An LIP simultaneously addresses two main supply chain decisions: (1) location, including determining the number and locations of central care hubs, assigning healthcare institutions to these central care hubs, and (2) inventory decisions, such as determining optimal inventory parameters. By adopting this integrated decision-making, healthcare institutions can cut costs and enhance logistics, all while maintaining or improving quality of service.

This research investigates the location-inventory problem (LIP) within the healthcare context, providing decision support to improve healthcare logistics by integrating location and inventory decisions. To become familiar with the current state of LIP research, we conducted a comprehensive literature review of LIP across various sectors, like manufacturing, healthcare, spare parts, and so on. Building on the insights from this review, we developed a mathematical model tailored to a healthcare setting. The model aim to minimize total costs – including location, transportation and inventory-related costs – while respecting relevant constraints. Key healthcare-specific features incorporated in the model include multiple product types and a maximum allowable distance between central care hubs and healthcare institutions.

This talk will highlight the key findings from our new literature review, which covers 45 new papers across various contexts, building on the review presented in [2]. Moreover, the mathematical model is discussed, including the objective and constraints. Currently, this model is tested on small instances, and preliminary results are discussed.

References

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