Title: Integrated decision-making for medium-term home health care planning: a matheuristic approach

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Abstract:

Home health care (HHC) may be defined as care workers visiting patients following predefined schedules in order to provide medical services in their homes. It involves various planning and scheduling decisions at different decision levels, with literature mostly focuses on optimizing operational decisions for a daily or weekly planning horizon. In this work, we take a broader perspective by also addressing medium-term HHC decisions (e.g., nurse rostering) over a four-week planning horizon.

We propose an integrated decision-making approach in which multiple decisions at the tactical and operational levels are optimized simultaneously. These decisions include nurse rostering, service pattern selection and routing. At the same time, our model accounts for numerous realistic problem aspects (e.g., continuity of care and working time regulations).

A mathematical model is proposed and some attempts to optimally solve the problem are presented. Next, we present a matheuristic solution algorithm to address real-life based problem instances of up to 3000 patient visits over the planning horizon. This algorithm first finds an initial solution using a tailored k-means heuristic and a binary integer linear programming model. Then, the initial solution is improved by a large neighborhood search heuristic while periodically solving a mathematical model. Finally, the efficiency gains of tackling the medium-term HHC planning problem in an integrated manner instead of sequentially is demonstrated, and experiments conducted to derive insights for the practical organization of HHC are discussed.