Research work proposed for a PhD

(China Scholarship Council)

Title : Home Health Care Routing and Scheduling Problem (HHCRSP)

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Context and thesis topic

The aging of the population continues to lead to an increase in the number of people suffering from serious, acute or chronic pathologies which give rise to functional disabilities and handicaps. Patients undergoing treatment for these types of diseases want comprehensive and coordinated care for reasons of personal comfort and for a better quality of life in their family environment. Indeed, several structures for the comprehensive care of patients outside the walls of the hospital have developed in recent years. Among these structures, we can cite the Home Health care establishments (HHC), although they were created about fifty years ago, they have emerged as a potential lever for reducing spending in the health sector while maintaining a level of satisfactory quality of service. Our research aims to propose mathematical models, to study the properties of these models and thus to develop effective approaches to resolution allowing to reduce the expenses in the field of health while satisfying a good quality of service.

Planning for home care services is usually done manually by experienced managers. The role of these managers does not come down only to the assignment of caregivers to the different patients for the production and administration of medical and paramedical acts but also to the design of home care visit routes, a routing problem whose resolution consumes a lot of time, especially in the event of a large number of patients / caregivers or when certain complex constraints are taken into account.

This thesis subject aims to continue the work already started in collaboration with Hongying Fei and Wanlong Lin from the Laboratory of Operations Management at the University of Shanghai (See publications below) in order to design effective approaches to optimize the routing and scheduling problem, existing in the HAD. In collaboration with these Chinese researchers, we have developed efficient heuristic and matheuristic approaches to resolve routing and scheduling issues with particular constraints (such as time windows, synchronized visits, etc.). The results thus obtained are very promising.

The future candidate for this thesis subject will therefore continue to collaborate with the laboratory (Laboratory of Operations Management) (a 15-days stay is also planned as part of the mobility project for doctoral students). His mission will be to deepen the research in several aspects: consider uncertain parameters such as service time and travel time which allows to consider a resolution with stochastic programming. In addition, the matheuristic approach already developed can be improved with techniques derived from exact methods such as the column generation method.

Some collaborative publications related to the subject

- Liyang Xiao, Mahjoub Dridi, Amir Hajjam-El-Hassani, Hongying Fei, and Wanlong Lin. « An Improved Cuckoo Search for a Patient Transportation Problem with Consideration of Reducing Transport Emissions ». Sustainability 2018, 10(3), 793; doi:10.3390/su10030793, 2018
- Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. (2020). Mid-Term Home Health Care Planning Problem with Flexible Departing Way for Caregivers. In Nature Inspired Computing for Data Science (pp. 29-56). Springer, Cham.
- Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. A Home Health Care Planning Problem with Continuity of Care And Flexible Departing Way for Caregivers. 20th IFAC World Congress. Berlin, 2020 .
- [33] Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. A Mathematical Model for Medium-Term Home Health Care Planning Problem. 8th International Conference on Industrial Engineering and Systems Management. Shanghai, 2019, pp. 7–12.

- Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. Hybrid Metaheuristics for Solving a Home Health Care Routing and Scheduling Problem with Time Windows, Synchronized Visits and Lunch Breaks. Expert Systems with Application (IF 5.452). **Second review (submitted 27 February 2020)**
- Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. Solving a multi-period home health care routing and scheduling problem using an efficient matheuristic. Computers & Industrial Engineering (IF 4.135). **first review (submitted 18 August 2020)**
- Liu, W., Dridi, M., Fei, H., & El Hassani, A. H. Solving a home health care routing and scheduling problem with multiple time windows under time-dependent and fuzzy environments. International Journal of Production Research (IF 4.577). **Under review (submitted 30 November 2020)**