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Joint-optimization of inventory policies on a multi-product multi-echelon pharmaceutical system with batching and ordering constraints

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Résumé en anglais	This paper presents a methodology to find near-optimal joint inventory control policies for the real case of a one-warehouse, n-retailer distribution system of infusion solutions at a University Medical Center in France. We consider stochastic demand, batching and order-up-to level policies as well as aspects partic- ular to the healthcare setting such as emergency deliveries, required service level rates and a new con- straint on the ordering policy that fits best the hospital's interests instead of abstract ordering costs. The system is modeled as a Markov chain with an objective to minimize the stock-on-hand value for the overall system. We provide the analytical structure of the model to show that the optimal reorder point of the policy at both echelons is easily derived from a simple probability calculation. We also show that the optimal policy at the care units is to set the order-up-to level one unit higher than the reorder point. We further demonstrate that optimizing the care units in isolation is optimal for the joint multi- echelon, n-retailer problem. A heuristic algorithm is presented to find the near-optimal order-up-to level of the policy of each product at the central pharmacy; all other policy parameters are guaranteed optimal via the structure provided by the model. Comparison of our methodology versus that currently in place at the hospital showed a reduction of approximately 45% in the stock-on-hand value while still respecting the service level requirements.
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