Platelet Inventory Management with Demand and Supply Uncertainty and Variable Pricing Considerations

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Abstract

Managing the inventory of blood products is a crucial operation in hospitals owing to the significance of blood in medical treatment. At the same time, blood is characterized by unique attributes, such as perishability and the unpredictable nature of its supply and demand. While mathematical models have been developed to optimize the complex process of blood inventory management, gaps in literature exist in terms of considering the possibility of variable pricing and extensively accounting for uncertainties in the supply chain. In this light, the present study proposes a stochastic multi-period mixed integer linear programming cost minimization model that determines the optimal inventory plan for a hospital purchasing platelets, assuming that prices fluctuate along with the blood center's supply. To implement uncertain supply and demand, the model considers a discrete set of scenarios for each parameter and decides based on expected values. A hypothetical case study was performed on the model, and the results indicate a promising direction for the research as total inventory costs decreased relative to models without the new considerations. To further improve the proposed model, future studies may view the blood supply chain from a macroscopic perspective and provide a more accurate model of price fluctuations.

Keywords
Blood supply chain, inventory model, variable pricing, stochastic optimization, mixed integer linear programming

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Dr. Jayne Lois San Juan is an Associate Professor in the Department of Industrial and Systems Engineering at De La Salle University, where she also obtained her PhD degree in Industrial Engineering. She graduated with a Bachelor's and Master's degree in Industrial Management Engineering under the ladderized BS/MS program with Summa Cum Laude honors from the same university. She was awarded the special citation in the Magsaysay Future

Engineers/Technologists Award of the National Academy of Science and Technology (NAST) Philippines in 2018. Since then, she has been involved in several research projects in the Center of Engineering and Sustainable Development Research, and has published in Scopus-indexed journals and presented at national and international conferences. Her research interests are on optimization under uncertainty and simulation modeling, and their applications to supply chains and energy networks.