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Designing an optimal model of blood logistics management with the possibility of return in the three-level blood transfusion network

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Abstract

Background Inventory managers in the blood supply chain always endeavor to provide their clients with prompt and appropriate responses. On the other hand, timely and regular blood deliveries to consumers are essential since ineffective delivery and transportation practices promote shortages, returns, blood loss. The paper attempted to develop an extensive and integrated optimal model of blood transfusion network logistics management by blood type to reduce the cost of losses, returns, and blood shortages given the relevance of this for the blood transfusion network.

Methods The regional blood transfusion network in Khorasan Razavi, which contains one main base, six central bases, and 54 hospitals, should be constructed using the optimal model for blood inventory management and distribution. A reusable simulation process was used to identify the optimal behavior for the inventory of all participants in the region (central bases as suppliers and hospitals as consumers), and the demand of hospitals as consumers has been calculated using artificial neural networks. This will lead to a significant reduction of returned blood units by consumers, optimal management of suppliers' and consumers' inventory to prevent waste and shortages. The routing method was used to proceed with the designed model and look into the optimal strategy to distribute blood requested by the consumers. with the aim of reducing the cost and increasing the speed of transportation.

Results The model's solution allowed for the estimation of the amount of consumers' demand, the optimal amount of target stock, the central bases and hospitals' reorder points, as well as the method of distributing blood from the supplier to its consumers. Implementing the model leads to outcomes such as reducing the time of blood transfer from the central bases to their consumers, increasing the speed of blood delivery to the consumers, increasing the average stock of blood in the central bases, reducing the accumulation of distribution machines at the location of the central bases, the amount of stock, the method for requesting, consuming, and storing blood, and the performance of the central bases' consumers all affect how much control they have over them.

Keywords Blood logistics management, Three-level blood transfusion network, Simulation, Neural network

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