The Selective Vehicle Routing Problem for a Bloodmobile System

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Abstract. Bloodmobiles are widely used nowadays in healthcare logistics to increase the number of donors, donation frequency, and the matching of blood demand and collection. Bloodmobiles have the advantage of a greater reach than blood drives at fixed donation venues and are preferable for people with limited time and means of transportation. Thus, several studies have focused on increasing the effectiveness of a bloodmobile donation system, which consists of bloodmobiles stationed at pre-determined locations and shuttles that visit a bloodmobile location to collect the donated blood and deliver it to the blood center within a prescribed time. This problem belongs to a class of Vehicle Routing Problem (VRP) called the Selective Vehicle Routing Problem with Integrated Tours (SVRPwIT).

This paper extends SVRPwIT and presents the mathematical optimization model of Selective Vehicle Routing Problem for the Bloodmobile System (SVRP-BM) by considering: (i) multiple shuttles, (ii) multiple blood types, and (iii) a shuttle's capacity. From a numerical study, we present the solution of SVRP-BM using a dataset adopted from that of a real-life case of Surabaya City Red Cross. Moreover, a comparative study is presented to demonstrate a model with the use of shuttles versus a model without shuttles; to analyze the impact of the number of bloodmobiles, shuttles, and stay-overs to the collected demand per blood type and overall cost.

Keywords: Selective Vehicle Routing Problem, Mobile Blood Collection, Healthcare Logistics.