System for the urgent delivery of face shields during the first wave of the COVID-19 pandemic: use of tab search and multi-start framework

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SUMMARY

The speed by which the COVID-19 pandemic spread throughout the world caught some national and local governments unprepared. Healthcare systems found themselves struggling to increase capacity and procure key supplies, such as personal protective equipment. Protective face shields became essential for healthcare professionals. However, most hospitals and healthcare facilities did not have them in adequate quantities. The urgency of producing and delivering face shields increased as the number of COVID-19 cases rapidly multiplied. This was the situation that we encountered in the city and province of Burgos (Spain). Since there was no time to wait for a large manufacturer to produce face shields, private citizens and small companies volunteered to make them using technologies such as 3D printers. Nonprofits, citizens, and governments agencies volunteered to deliver materials to the face shield makers and to pick up and deliver the face shields to health centers and other locations where they were needed. This resulted in a vehicle routing problem with some special characteristics that made it different from models used for commercial purposes. We describe the development of a heuristic to find feasible and efficient routes for this problem. We highlight the advantages of using heuristics in an emergency context like the one triggered by the COVID-19 pandemic. In particular, the heuristic approach allowed us to design, implement, test, and delivery a routing system in less than one week from the time that the local government contacted us with what they described as a logistics nightmare.

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