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The fine line between life and death: Strategic location of public-access defibrillators

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In an emergency or disaster, rapid response may be the difference between life and death. Accordingly, strategic resources/facilities are proactively deployed for emergency preparedness. While citizens increasingly participate in response and recovery in crisis situations, little attention has been given to incorporating volunteer engagement in placing emergency facilities. The uncertainties in supply (e.g., volunteers) and in demand (e.g., emergencies) make emergency facility deployment decisions extremely challenging. With the advances in data availability and big data, it is now possible to develop realistic location models that account for both emergency and volunteer uncertainties. This proposal focuses on optimizing the location of facilities under demand and supply uncertainty, and can make significant contributions to location theory. The difficulty with proposed double uncertainty models is their size and corresponding computational complexity. I propose developing a comprehensive data-driven modeling framework for emergency facility deployment, leveraging optimization, metaheuristics and data science. My models will analyze the spatiotemporal trends in demand and supply, estimate response rates using machine learning and historical data, and optimize locations of emergency facilities under double uncertainty using neighborhood search. The models will be applied to Dutch cardiac arrest and defibrillator data to reduce response time and increase survival in an emergency