

A Stylistic Queueing-Like Model for the Allocation of Organs on the Public List

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Abstract

Allocating live organs for transplantation is a complex and intricate problem due to unsatisfied demand for live organs, physiological differences between candidates and donors, and the pursuit for equity amongst population groups with regard to waiting time and the likelihood of getting a transplant. Almost invariably, allocation rules world-wide are centered in the so-called "point system". This heuristic policy has never been validated mathematically. More sophisticated policies have failed to find favor within the medical community.

We present a simplified analytical model for the allocation system. The emphasis is on mathematical tractability and on establishing a platform for gaining insights into the complex dynamic candidate-donor system. We adopt a "utilitarian" objective function which maximizes clinical efficiency (life years beyond transplantation). Waiting time equity is provided by sorting the line of candidates by arrival time in the usual way, and then implementing the individually-optimal policy sequentially for these candidates. The model simplifies real-life in assuming only one "aggregate" genetic characteristic for each individual (recipient or donor), and in assuming a fixed, known, lifespan of a candidate under dialysis.

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