

mKEP - Models and optimisation algorithms for multi-country kidney exchange programmes

Open call for post-doctoral grant: https://www.inesctec.pt/ip-en/work-with-us/bolsas-inescporto/concurso-para-a-atribuicao-de-1-bolsa-de-pos-doutoramento-projeto-mkep?set_language=en&cl=en

End-stage kidney disease

End-stage kidney disease (ESKD) affects a considerable number of people in the world and is a major threat to public health: more than 615,000 Americans are receiving treatment for ESKD, the 9th leading cause of deaths in the United States - more than breast or prostate cancer each year.

Compared to dialysis, kidney transplant brings much better quality of life to the patient but the kidneys available for transplants can only meet a tiny fraction of the existing demand.

Kidney Exchange Programmes

Kidney Exchange Programmes (KEPs) provide a new option for patients to get transplants from living donors. For a patient with a willing donor of one kidney but physiologically incompatible for transplant, the patient-donor pair can join many other such incompatible pairs in a pool for potential exchange. In its simplest form, for two incompatible pairs, KEP facilitates kidney exchange if the donor in one pair is compatible with the patient in the second pair and viceversa. The concept behind this 2exchange extends to kexchange when $k > 2$ incompatible pairs are involved.

Combinatorial optimisation

The underlying combinatorial optimisation problem associated to a KEP can be modelled as a vertexdisjoint cycle packing in a digraph, where vertices represent incompatible pairs and arcs indicate compatibility of donor in one pair and patient in another pair. For the current size of national pools, if adequately modelled, the problem can be solved by commercial optimisation solvers.

Multi-country kidney exchange programmes

KEPs are successfully running in several countries (e.g. UK, USA, Portugal and the Netherlands) on national or regional basis. However, there is evolving impetus in Europe to consider the possibility of creating international pools in which different countries can participate in a multi-country KEP(mKEP). This joint collaboration would lead to programmes with many more incompatible pairs in a common pool, a factor that can certainly help to increase the number of total possible transplants.

This new paradigm of mKEP poses enormous challenges for new research and investigation, especially for truly reflecting the characteristics of the new problem as well as for the outcomes and the results to be viable and acceptable to all participants. An optimisation model addressing mKEP must consider different market rules and yet ensure equitable results for all participants concerned. Additionally, the existence of multiple conflicting objectives among participants and the need of accepting trade-off solutions must be studied.

The overall research aspects of mKEP project will strive to create of a decision-making tool that will be amenable for European as well as global adoption.

Presentation

A [presentation](#) on kidney exchange programmes where we refer to research lines explored/to be explored by the project team.

Project team

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