

SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

The STSM applicant submits this report for approval to the STSM coordinator

Action number: CA15210 (European Network for Collaboration on Kidney Exchange Programmes)

STSM title: Modelling and optimisation for international kidney exchange programmes

STSM start and end date: 29/10/2018 to 02/11/2018

Grantee name: Márton Gyetvai

PURPOSE OF THE STSM/

From the Hungarian side the visit involved Márton Gyetvai (junior researcher at the Hungarian Academy of Sciences). Alex Popa was the hosts and his PhD student, Radu Stefan Mincu also participated in the collaboration that had started with an STSM to Budapest by Popa and Mincu in April 2018.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

In this STSM, we continued the collaboration that we started in April 2018. In this research, we focus on international KEPs, where the participant countries have different attributions. Such as the participant countries' constraints, size and aims can differ.

Before this STSM, we have already discussed possible models, what we can use for this problem. To solve the different constrains problem, we linked two Integer Programming (IP) models, one where we consider the possible cycles as variables (Cycle formalisation), and the other, where we consider the transplants as variables (Edge formalisation). Before this STSM we determined some possible constrains regarding the within country cycles and chains and also on the international cycles and chains, which should be implemented with IP models.

In this STSM, we extended the previously described IP models to deal with the above mentioned constrains. We also conducted some simulations on generated data, to validate these IP formulations, and we discussed some possible plans for other possible simulations.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

In this STSM, we could show how to implement all the possible constraints with the linked IP model. In addition, we figured out how we can optimise the international KEP using only the Cycle formulation IP or the Edge formulation IP. With the latter results, we can solve larger problems more efficiently, as our preliminary simulations suggest.

We conducted some simulations, where we tested the two IPs. We considered three KEPs with equal pool sizes, but with different constraints on the length of the cycles or the number of international transplants. In addition, we discussed some possible modifications of these simulations, where the sizes of the KEP pools are different, and some additional extensions of the IP models.

This research topic is directly related to the goal of WG3, in particular to the two goals described in the COST Action proposal: “(ii) propose generic mathematical models for transnational markets; and (iii) propose methodologies to tackle the optimisation problem.”. Our results may well also have practical relevance when solving the international KEPs that are being created across Europe and in our region in particular.

FUTURE COLLABORATIONS (if applicable)

We have submitted a 6-page scientific paper to be published in the proceedings of VOCAL 2018, a regional OR conference, and we will also write an extended journal version for a special issue of that conference.