

## 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:** UK-Hungarian collaboration on simulations involving the UK KEP

**STSM start and end date:** 19/03/2018 to 23/03/2018

**Grantee name:** Dr William Pettersson

### PURPOSE OF THE STSM/

The purpose of this STSM is the collaboration between Dr William Pettersson from the University of Glasgow and Dr Péter Biró from Corvinus University of Budapest, as well as the introduction of students Márton Gyetvai and Réka Kis-Benedek to new approaches in the study of kidney exchange programmes. The main outcomes of this collaboration were the development and extension of dynamic kidney exchange simulations which could utilise the data available from the UK scheme to model various options for the optimisation problem inherent in kidney exchange programmes - options which were devised through the combined knowledge of, and discussion between, all participants of the mission.

### DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

The most fruitful aspects of the mission were the discussions between participants throughout the week. The sharing of knowledge, especially between members from different countries with kidney exchange programmes (KEPs) in different stages of development, introduced many facets of kidney exchange programmes which had not been thoroughly investigated by all members.

Discussions of data formats used by the software led to the investigation of recovering blood types from either one or multiple donor compatibility graphs. This is a new idea in the field, and with recent public interest in privacy and the re-identification of private data may prove to be very forward looking.

Other discussions examined at preliminary reports by Dr David Manlove and James Trimble, looking for features or aspects which could add positively to any such report. These discussions led to improvements in the parameters reported by the simulation software, such as average waiting times per blood type, and number of cross matches performed.

A recent paper on dynamic KEP simulation by Santos, Tubertini, Viana and Pedroso was also read for more inspiration on features to add, and what aspects may or may not be interesting to anyone studying the software or its output.

### **DESCRIPTION OF THE MAIN RESULTS OBTAINED**

The main result from this collaboration is the extension of existing software to support all of the parameters discussed during the week. This software will be able to simulate a dynamic KEP using all of these options, and also extend the analysis presented by said software to also give counts of the number of cross matches performed, as well as the number of positive cross matches. Actual running of these simulations depends on receiving input data from NHSBT, and as such is still forthcoming, but running these simulations is now simply a matter of starting the application. Some of the new features which can be studied are:

- the effect that the scoring formula has on the final solutions,
- the effect of altering the waiting time bias in the score formula,
- the effect of encouraging donations between donors and patients with the same blood type,
- the effect of encouraging bridge donors with O type blood, and
- whether improved transplant counts that come with improved matching run frequencies are due to an increase in lab cross match tests, or whether there is an actual and significant positive improvement strictly from reducing the time between matching runs.

### **FUTURE COLLABORATIONS (if applicable)**

The obvious future collaboration involves discussions and publications of the results from the simulation, which themselves may lead to new collaborations.

This mission also raised a new possible direction in future research relating to KEPs. The compatibility graph of a KEP is a graph which indicates which donors are compatible with which patients. Often the exact blood types of donors or patients is kept separate to protect the privacy of the individuals involved, however the compatibility graph by definition does contain some information about which donors and patients have compatible blood types. Future research could look into whether it is possible to re-identify patient blood types from the compatibility graph, which could possibly involve the proportions of blood groups present in the general population, as well as numerous instances of compatibility graphs where the same donor or patient may be present more than once, and may be identified as such.