

# ESOT Transplant Fellowship 2023 – Final detailed report

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## **Experience**

The ESOT basic science fellowship opened multiple opportunities that contributed to my professional and academic development, the most important of which was my collaboration with NHS Blood and Transplant (NHS-BT) and their Cardiothoracic Advisory Group for Lung Transplantation (CTAG-L). This collaboration has evolved over the past year: at first the goal was to validate the simulation engine that was being developed to evaluate the impact of potential new UK lung donor allocation policies. Next, we surveyed clinical and patient stakeholders with respect to lung transplantation (i.e., lung transplant candidates, recipients, carers, transplant physicians, cardiothoracic surgeons etc.) and applied methods from the field of operations research to identify which of the simulated policies aligned with the goals and values of each group of stakeholders.

This collaboration has now evolved to the point where I have been able to draft an implementation pathway for optimisation of donor lung allocation in the UK. Initially the goal is to develop an allocation score for non-urgent candidates, with potential in the future to expand this to a national level process, replacing the centre-based allocation system that is currently in place with a national lung transplant waiting list.

My fellowship also allowed me to visit the NHS-BT operations hub in Bristol, where I was able to present and discuss feedback on my research with statisticians, the head of organ donation and transplantation (ODT) studies, and the assistant director of statistics and clinical research. In addition, I was permitted to enter the workspace where all deceased donor organ offers are coordinated nationally, observe how offering and allocation work in practice, and discuss the practical limitations of any potential allocation policies in the future. This experience was invaluable as it validated the soundness of my methodology, and ensured the direction of my research was in line with the goals of NHS-BT and opened the door for the real-world implementation of my research.

I was also honoured to be an invited speaker at the British Transplantation Society (BTS) congress in Harrogate and had the opportunity to present my research findings and answer a wide range of questions from experts in the field of transplantation. I also

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attended the International Society for Heart and Lung Transplantation (ISHLT) conference where I presented a poster summarising the benefits and drawbacks of single lung transplantation (SLT) compared to bilateral lung transplantation (BLT) in recipients with interstitial lung disease (ILD). The most valuable session I attended was focused solely on lung allocation and the implementation of the new composite allocation score in the US. I have been invited by one of the speakers from that session to collaborate on a paper where we will investigate the impact of diverting adult lungs to paediatric candidates where surgically feasible.

## **Outcomes**

The main outcome of this fellowship comes from the collaboration with NHS-BT and CTAG-L: this research is not simply a theoretical exercise or data-analysis project, but rather laid the foundation for real-world implementation and impacting how lung allocation is performed in the UK. I will be a member of a small working group on lung allocation being constituted by NHS-BT with a pathway to delivery.

For this to be possible, a large amount of time was dedicated to the validation of the simulation engine. This involved ensuring the code for the simulation engine was correct, the data used for survival analyses were of a high quality, documenting any assumptions that were made in the process of simulating and evaluating lung allocation policies, and checking those assumptions were sound. This resulted in the sequential refinement of the simulation engine over the period of the fellowship.

Although this was time consuming due to the necessity of re-running simulations and re-analysing results with each refinement step, the simulation engine is now of a much higher quality than before the fellowship. Not only this, but the methods can be applied more generally – although the engine was applied to the problem of lung allocation, it could be applied to other organ allocation systems, other healthcare resource allocation problems, and resource allocation problems more generally.

This has allowed me to investigate the impact of preferentially allocating single lungs to candidates with ILD. Although post-transplant outcomes aren't as optimal with SLT compared to BLT, there are more factors at play that were evaluated with the help of the simulation engine:

- (1) Allocating two single lungs to two separate recipients results in a very substantial decrease in waiting list mortality, with our simulations predicting a reduction amongst the ILD population of 95% (from 45 per year to 2.2 per year)
- (2) There is a secondary effect of having two ILD candidates being removed from the list with one donor offer: there is an overall reduction in demand for subsequent

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donor lungs. This resulted in waiting list mortality also decreasing by 10% to 30% for candidates with other diagnoses.

- (3) Not accepting a single-lung offer in hopes of receiving a lung pair in the future results in there being a risk of dying on the waiting list before receiving another offer. For each candidate that dies on the waiting list, there is some amount of additional lifespan they could have gained, but didn't – this is conceptually similar to "opportunity cost". When looking at the overall population survival of ILD candidates and recipients, utilising SLT resulted in an 8% increase in population-level survival.

Overall, I am extremely thankful to ESOT for providing me with this opportunity that has allowed me to progress as an early career researcher and allow my research to progress towards adoption by NHS-BT to improve the experience and outcomes of individuals requiring lung transplantation.