Dave Collett
Director of Statistics and Audit
UK Transplant, NHSBT

SAS® HELPS NHS BLOOD AND TRANSPLANT OPTIMISE RESOURCES AND IMPROVE SURVIVAL RATES

Business Issue

Making the most effective use of a scarce and hugely precious resource, donated organs; ensuring equitable allocation UK-wide and the best match between donor and recipient.

Solution

SAS® for data extraction, manipulation and validation, using data from the National Transplant database, and for in-depth analyses to improve organ allocation, target resources, track outcomes, and monitor consent rates.

Benefits

The opportunity to enable more life-saving transplants; the accurate matching of donor to recipient prolongs life expectancy and improves quality of life for patients.

NHS
Blood and Transplant

"SAS is fundamental in optimising the use of very limited resources… SAS helps us increase the chances of survival and improve quality of life for hundreds of patients every year."

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THE POWER TO KNOW®

The big challenge facing the UK National Health Service (NHS) in transplantation is that demand for donor organs outstrips supply. In the UK, over 7,000 patients are on waiting lists while around 3,000 transplants are performed each year. For over a decade, SAS® data management and analytics have been helping increase chances of survival and improving quality of life for patients.

Organ transplantation is one of the great medical success stories of recent times. However, improved healthcare and road safety, plus falling numbers of people consenting to donations from relatives, have contributed to a reduction in the number of organs available.

UK Transplant is a division of NHS Blood and Transplant (NHSBT), a Special Health Authority set up in 2005. Supporting Transplant Units UK-wide, its tasks include allocating an organ such as a kidney, heart, lung or liver to patients: the accurate matching of donor to recipient prolongs life expectancy and improves quality of life. UK Transplant also provides information to its various Advisory Groups and clinicians to improve clinical practice and ensure equity and effectiveness in allocation. Central to this is maintaining the National Transplant Database that holds information about donors, recipients and transplants. Input comes from paper and electronic submissions from hospitals.

The work of Professor Dave Collett, Director of Statistics and Audit, and his team of 18 statisticians is fundamental in meeting the donor shortage, extracting and analysing information in the database to support more effective decision-making. "We work closely with the Advisory Groups," he says. "They must carefully study allocation schemes and adjust them to ensure optimum use of a very limited resource. Our job is to provide the evidence to guide decision-making, then monitor the effects of changes in policy."

For example, the Advisory Groups are interested to know what factors affect the outcome of a transplant. This is a complex issue since both donor factors and recipient factors are involved, plus operational issues such as the time between organ removal and subsequent transplantation. The Advisory Groups also need to know if certain groups of patients are waiting longer than others.

New science, new technology

Collett continues, "The science of transplantation is moving fast. The database therefore contains many variables and must allow for future developments. For example, until recently one organ could only be given to one recipient. Now, technology means a single liver can be split so more than one recipient can benefit. We have to accommodate such changes but must be absolutely certain the data we extract is accurate and that inferences based on our analyses are

robust." The database is constantly growing in size and scope.

UK Transplant uses SAS for data extraction, manipulation and validation, and for in-depth analyses. "We chose SAS 14 years ago because it was the best survival analysis tool on the market," says Collett. "SAS has kept pace with our needs, enabling us to fit complex models for patient survival time for example." Over the years, developments in SAS have helped UK Transplant refine its approaches: for example, the output delivery system revolutionised how summary reports on transplant activity were prepared.

Data quality

With lives at stake, the team only begins analyses when it's satisfied the data has been properly validated and corrected. This often involves looking at outliers revealed by SAS, following up queries with Transplant Units, and cross-referencing data against other sources. The analysis itself is complex. "We often perform multi-factorial analyses of what influences the survival of a patient and what factors influence waiting time for a transplant," says Collett. Achieving the right balance is tricky. The aim is to get a close match between recipient and donor to ensure a high chance of survival, but that means certain patients, such as those with a particular blood group and tissue type, may be put at a disadvantage.

Some research has broken new ground. For example, the team makes detailed comparisons between Transplant Units that take into account variation in their patient mix. "In this way we get a clearer and fairer picture," says Collett. "We use SAS to monitor performance in individual Transplant Units." The organisation can, for instance, look closely at the results from a unit if outcomes suggest a problem. "We can identify if something appears to be going wrong, investigate further and plan interventions. If you know your evidence is correct you have confidence in your results and can work with the units. An evidence-based approach is much to the fore, and we're confident the methods we use in SAS are accurate."

Accurate and equitable allocation

Programs identify the best match between any organ becoming available and the pool of patients awaiting transplant. Maximising the chances of success and fairness of allocation often involves weighing up probabilities and risks across many variables: blood group compatibility, size, waiting time, clinical need and, in the case of kidneys, tissue types. Ultimately, it is up to clinicians to make the judgment, but to do so they need to be supported by reliable insight.

A new Kidney Allocation Scheme was introduced in 2006 to improve tissue matching and reduce waiting time for adults with rare blood groups. "We used SAS to investigate over 30 simulation models for the allocation process before settling on the one to use," says Collett. The real-world impact of these changes is being tracked, with results showing the desired benefits are being achieved. Collett says the new scheme has made a real difference: "One consequence is that certain patients waiting a long time have now received a transplant. That's particularly gratifying, as they may have been on a list for years. The aim of the scheme was to improve equity of access in terms of both geographical area and demographics, ensuring patients have the same chance of access." An inevitable consequence has been to change the level of activity at different Transplant Units. "We use SAS to monitor impacts and so put arrangements in place to 'damp down' these impacts. We need to ensure theatre capacity and surgeons are available to enable some units to perform more transplants, for example, while others performing fewer need resources to provide their patients with dialysis." Results are provided to the relevant Advisory Group to enable decisions to be made.

With the shortage of organs continuing, UK Transplant is also undertaking a National Audit of deaths in all Intensive Care Units to identify potential donors and help establish obstacles to donation. SAS is used to explore the factors that affect whether consent will be granted by a relative. "We look at changing practices in consent rates," says Collett. "The rate has remained stubbornly constant for the last few years, with consent given in only about 60% of cases. There are lots of factors involved, and analysis of this highly structured data set requires multilevel logistic regression modelling. We're glad this can be carried out so easily using SAS and are obtaining very interesting results."

Another recent development is using SAS analytics to support 'paired donations': matching recipients with donors from UK couples who have offered organs to their partner but have an incompatible blood group or tissue match. Making the right matches amongst pairs, to enable 'swaps', means more transplants can go ahead more quickly. "We're looking at all possible pairs across the UK – it's a complex challenge to achieve the maximum number of transplants possible," says Collett. "SAS is used to identify and work out the algorithms required to facilitate allocation, and we carry out regular matching runs." Complications include the fact that one potential recipient might be paired with two or three potential donors; precious resources must be targeted in a way that is both equitable and represents the best chances of survival.

Collett concludes, "SAS is fundamental to our work in optimising the use of very limited resources. Indeed, SAS helps us increase the chances of survival and improve quality of life for hundreds of patients every year."

For information on UK Transplant and to join the Organ Donor Register go to: www.uktransplant.org.uk.

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