

# Multifactorial modelling of waiting time to kidney transplant

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## Aim

- To determine which factors at both the patient and centre level significantly influence the length of time a patient waits for a transplant after being listed on the kidney transplant list.
- To determine whether there are any statistically significant differences in waiting time between centres after adjusting for patient mix and centre level factors.

## Data

- Adult patients who were listed for a kidney transplant between the introduction of the revised Kidney Allocation Scheme on 1 July 1998 and 30 June 2001.
- Patients who received a multi-organ or live donor transplant were excluded.
- For patients who were listed more than once during the three-year time period, only the earliest listing was included.
- The resulting cohort had 5,684 patients.

## Methods

- Patients were followed up for three years from the date of listing. Transplant was the end point of interest – any patients who were suspended, removed, died or were still waiting were censored.
- Cox regression was used to investigate the influence of the factors in a two-stage process:
  - Patient factors only.
  - Patient and centre factors.

## Factors investigated

### Factors investigated

Patient level factor	Significant at 5% level	Centre level factor	Significant at 5% level
Sensitisation (%PRA)	✓	Number of local cadaveric kidney donors	✓
Age at registration	✓	Average waiting list size	✓
Minimum match grade requirement	✓	Average balance of exchange	✓
Matchability points score	✓	Offer refusal rate	✓
Blood group	✓	Number of live donors	✗
Gender	✓	Presence of non-heartbeating donor programme	✗
HLA-DR homozygosity	✓		
Number of previous grafts	✓		
Ethnicity	✓		
Residual sensitisation	✗		
Primary diagnosis	✗		

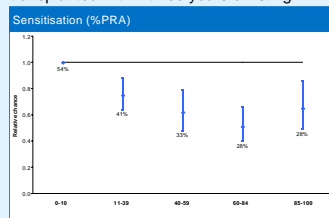
Results are presented in the form of hazard ratios.

A hazard ratio quantifies the relative chance of transplant for a patient with a given level of a factor, compared to a patient with the chosen baseline level of that factor.

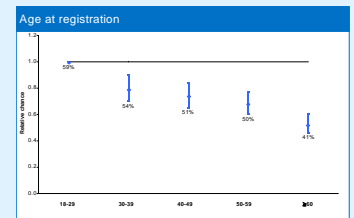
The hazard ratios for one factor are adjusted for the influence of the other factors.

## Patient level factors

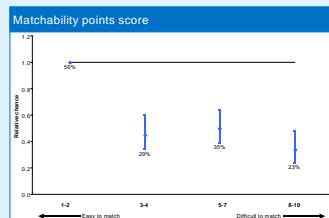
Note: The percentages given for each factor level are the unadjusted percentages of patients transplanted within three years of listing.



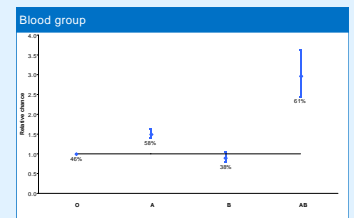
The chance of transplant declines with increase in %PRA.



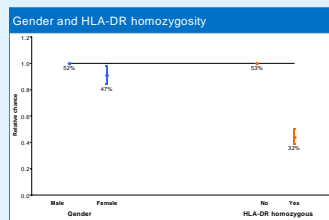
Pronounced reduction in the relative chance of transplant for patients listed at age 60 or over may be explained in part by the increased risk of removal from or death on the transplant list for these patients.



Patients whose tissue type is more difficult to match have a reduced chance of transplant.



Blood group B patients have a lower chance of transplant than patients of other blood groups.



Female patients have a lower chance of transplant compared to male patients. This may be explained in part by the significantly ( $p < 0.0001$ ) higher proportion of positive cross-matches among females (11%) than among males (7%).

Patients who are homozygous at the HLA-DR locus have a reduced chance of transplant compared to those who are heterozygous.

## Centre level factors

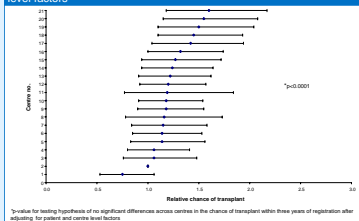
### Relative chance of transplant for centre level factors

Factor	Level	No. of centres	Relative chance of transplant	95% CI	p
Patient-specific score	Linear	21	2.58	2.42 – 2.75	<0.0001
Number of local cadaveric kidney donors	<60	6	0.69	0.56 – 0.84	0.0002
	61-100	8	0.96	0.84 – 1.09	0.5
	>100	7	1.00		
Mean active waiting list size	<140	8	1.42	1.21 – 1.65	<0.0001
	141 – 200	7	1.24	1.11 – 1.39	0.0001
	>200	6	1.00		
Mean balance of exchange	< 0	8	0.49	0.44 – 0.54	<0.0001
	0 – 12	6	0.60	0.52 – 0.68	<0.0001
	>12	7	1.00		
Offer refusal rate (%)	<27	7	1.32	1.19 – 1.47	<0.0001
	27 – 35	8	1.22	1.10 – 1.35	0.0002
	>35	6	1.00		

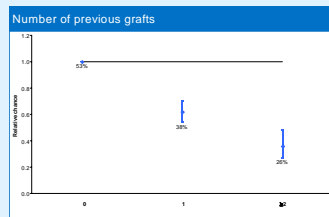
- Chance of transplant is greater for patients registered at a centre with a larger balance of exchange and a larger number of donors.
- Chance of transplant is lower for patients listed at a centre with higher offer refusal rates and larger transplant lists.
- The ratio of the number of waiting list patients to the number of local donors was also highly significant ( $p < 0.0001$ ), and indicated that the chance of transplant is considerably poorer for patients registered at centres with a large transplant list size relative to their local donor rate.

## Centre differences

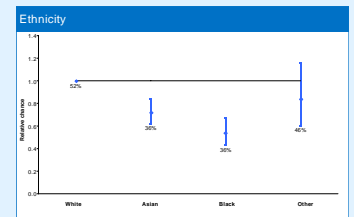
### Relative chance of transplant after adjusting for patient and centre level factors



While centre differences were much reduced after adjusting for patient and centre level factors, there remained statistically significant ( $p < 0.0001$ ) differences in the chance of transplant across centres.



The chance of transplant declines as the number of previous grafts increases.



Asian, Black and other minority ethnic patients have a reduced chance of transplant compared to White patients.

## Summary

- The chance of transplant declines as the level of sensitisation (%PRA), the matchability points score, the number of previous grafts and the age at registration all increase.
- Blood group B patients have a reduced chance of transplant compared to other blood groups and female patients have a lower chance of transplant than male patients.
- Asian, Black and other ethnic minority patients have a reduced chance of transplant compared to White patients and patients who are homozygous at the HLA-DR locus have a reduced chance of transplant compared to those who are heterozygous.
- There is an increased chance of transplant for patients registered at centres with a higher balance of exchange and a larger number of deceased adult donors.
- There are reduced chances of transplant for patients registered at centres with higher offer refusal rates and larger waiting lists. The chance of transplant declines as the number of waiting list patients relative to the number of local cadaveric donors increases.
- There were statistically significant differences in the chance of transplant across centres after adjusting for the patient and centre level factors investigated.