

How long will my child have to wait for their kidney transplant?

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Introduction and aims

- How long will my child wait for their kidney transplant is a frequently asked question in paediatric nephrology.
- The UK DBD Kidney Allocation Scheme used to prioritise patients and allocate kidneys considers a number of clinically relevant factors and is complex in design. For this reason it can be extremely difficult for patients and clinicians to understand and manage expectations concerning waiting times to kidney transplantation.
- Although some information on average waiting times was provided by NHS Blood and Transplant, it was recognised that this was of insufficient detail for an individual patient.
- The aim was to create a tool to overcome this issue.

Data and Methods

- Data was obtained from the UK Transplant Registry on 619 paediatric patients registered for a kidney only transplant on the National Kidney Transplant List between 3 April 2006 and 31 March 2012. If the patient was registered multiple times during this period, the earliest registration was selected.
- Data was randomised into two datasets: one for model selection (n=413) and the other for model validation (n=206)
- A Cox proportional hazards regression model¹ was used to determine the factors which influenced waiting time to a DBD kidney transplant for a paediatric patient in the UK.

Results

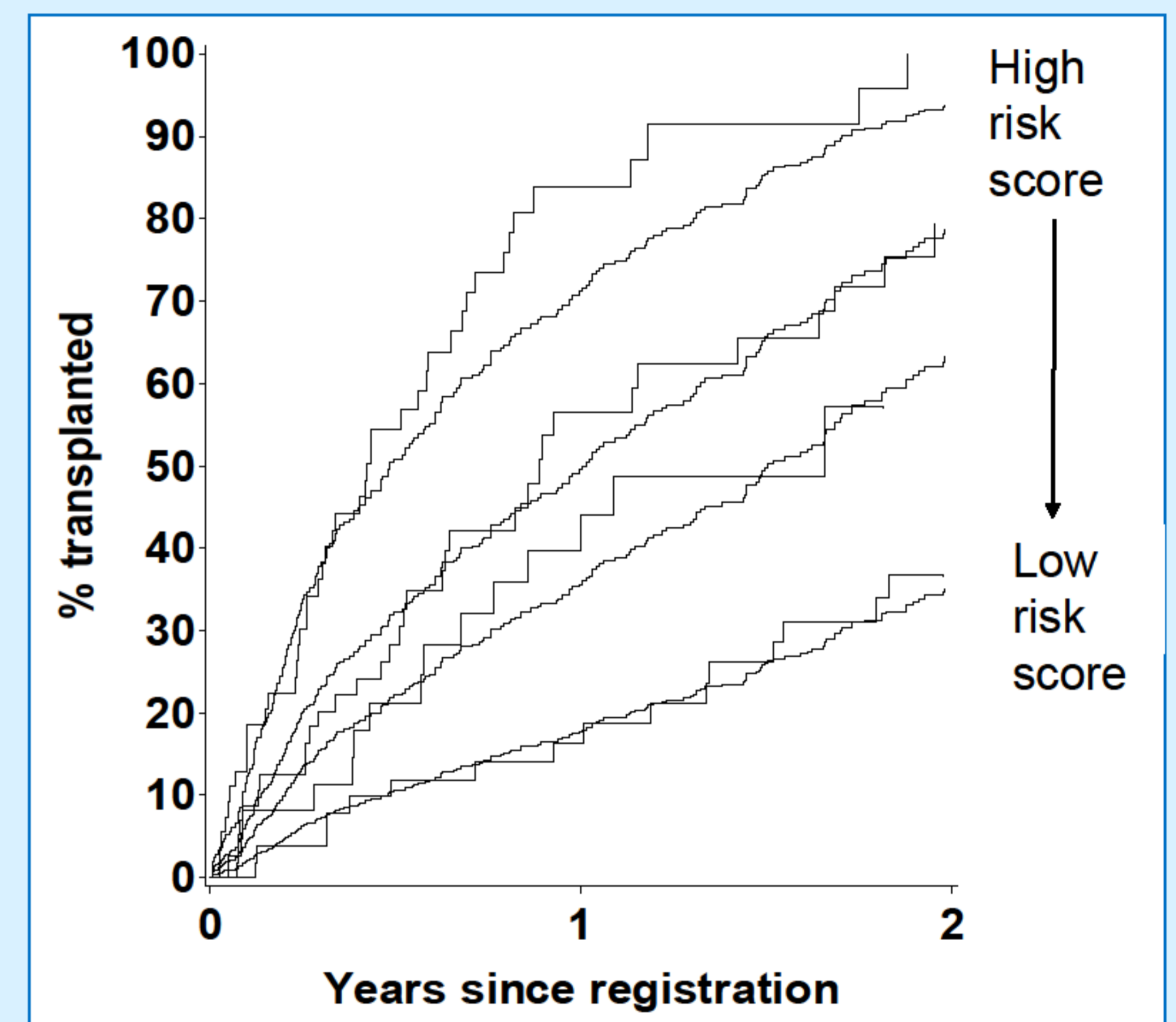
Factors influencing waiting time

- Five factors were found to be significant at the 5% level (Table 1). An improved chance of transplant was associated with:
 - Easy to HLA match (access to a larger donor pool)
 - No or low levels of sensitisation (access to a larger donor pool)
 - HLA-A heterozygous children (no priority for homozygous patients unlike for HLA-B and DR equivalents)
 - White patients (due to commonality of donor HLA)
 - Older children (due to donor to recipient age matching)

Table 1: Cox proportional hazards regression model for chance of paediatric DBD kidney transplant within 2 years

Parameter	Level (baseline)	N	Hazard ratio (95% C.I.)	p-value
Matchability	Easy	153	1.00	
	Moderate	177	0.53 (0.39-0.70)	<0.0001
	Difficult	83	0.33 (0.21-0.53)	<0.0001
HSP	(No)	387	1.00	
	Yes	26	0.29 (0.12-0.73)	0.008
HLA-A homozygous	(No)	343	1.00	
	Yes	70	0.62 (0.42-0.92)	0.02
Ethnicity	(White)	293	1.00	
	Non-white	120	0.69 (0.51-0.95)	0.02
Registration age (years)	Linear	413	1.06 (1.03-1.09)	<0.0001

Figure 1: Observed (solid line) and estimated (dotted line) time to transplant, by risk group



Predictive ability of the model

- The model was found to have good predictive ability. Using the validation dataset, a Gönen and Heller² concordance statistic of 0.71 was obtained.
- **Figure 1** compares the observed and estimated time-to-transplant functions by four risk groups. For each risk group, the estimated time-to-transplant function is generally in agreement with the observed proportions of transplants over time. Equally the model adequately separated and classified well patients according to their relative chance of transplant: those with a high chance of transplant score were in reality transplanted more quickly than those with a low chance of transplant score.

Figure 2: A screenshot of the Paediatric Relative Chance of Transplant Tool

National DBD Donor Kidney Allocation Scheme
Relative Chance of DBD Donor Kidney Transplant Guide for Paediatric Patients (< 18 years at time of listing)

NHS Blood and Transplant

i. The information reflects the proportion of listed patients that receive a DBD donor kidney transplant in the absence of alternative treatments or removal from the list
 ii. Patients listed on the DBD donor kidney transplant list may instead receive an alternative treatment prior to receiving a DBD donor kidney transplant
 iii. Some patients may be removed from the list prior to receiving their transplant (e.g. through patient/parental choice or ill health)

Variable **Please select**

Matchability Moderate

Sensitisation (cRF%) 0 to < 85

HLA-A homozygous No

Ethnicity Non-white

Age at registration 3

Estimated proportion of paediatric patients who receive a DBD donor kidney transplant, by months listed (representative of the selected patient type only)

Months listed	Transplanted (%)	Not transplanted (%)
3	16	84
6	26	74
12	41	59
18	54	46
24	68	32

Percentiles

Percentile	year(s)	month(s)
25% transplanted within	0	5
50% transplanted within	1	3
75% transplanted within	> 2	

Disclaimer: The information is provided for guidance only and should be discussed in consultation with an appropriate transplant professional. Alternative treatment options may improve a patient's chance of transplant over and above the results shown above, although not all alternative treatments are suitable and/or viable for all patients. Alternative treatments may include: DCD or live donor kidney transplantation (including National Living Donor Sharing Scheme options) and ABO or HLA incompatible transplantation.

Application

- To make all the complex analysis accessible to all, the Relative Chance of Transplant Tool was created.
- Created in Microsoft Excel 2010, the tool allows the user to enter patient specific characteristics and then displays for that patient type, the estimated proportion of paediatric patients who receive a DBD donor kidney transplant by 3, 6, 12, 18 and 24 months (Figure 2). It also provides the median, 25th and 75th percentiles of the waiting time for the patient type.
- Knowledge gained from the tool can be used to assist with clinical decisions for individual patients.

¹Cox DR (1972) Regression models and life tables. *Journal of the Royal Statistical Society, B*, 74, 187-220.
²Gönen M and Heller G (2005) Concordance probability and discriminatory power in proportional hazards regression. *Biometrika*, 92 (4), 965-970.

Conclusions

This tool can be used to guide clinical decisions and allow the patient to better manage their expectations and lives. The tool is now widely being used in clinical practice throughout the UK. The tool is available to download at www.odt.nhs.uk/transplantation/guidance-policies/tools/