A Guide to the Australian Kidney Donor Profile Index (KDPI)

What is the KDPI?
The Kidney Donor Profile Index (KDPI) was originally described by The United Network for Organ Sharing (UNOS) in the USA. It is a score that combines various donor factors including clinical parameters, to estimate the prognosis of deceased donor kidneys relative to other deceased donor kidneys. (https://optn.transplant.hrsa.gov/resources/allocation-calculators/kdpi-calculator/)

What is the Australian KDPI?
This is a simplified version of the UNOS KDPI, using less parameters but the concept is exactly the same. It has been validated in the Australia / New Zealand donor population using transplant outcomes in ANZDATA (1). It is designed predominantly to predict the expected functional quality of a deceased donor kidney and to predict a kidney's relative risk of failure over time.

How does the KDPI scoring system work?
A score of 1-100% is derived from a raw index score (the KDRI or Kidney Donor Risk Index). The scores are based on the outcomes of kidneys that were transplanted in Australia in the previous 3 years. The KDRI is converted to a percentile to become the KDPI.

The formula for the Australian KDRI is:
Exp(-0.0194 x minimum(donor age - 18, 0) + 0.0128 x (donor age - 40) + 0.0107 x maximum(donor age - 50, 0)
+ 0.126 if donor has a history of treated hypertension
+ 0.130 if donor has a history of diabetes
+ 0.220 x ((creatinine/88.4) - 1)
- 0.209 x (creatinine/88.4) - 1.5) if (creatinine/88.4)>1.5
+ 0.0881 if cause of death stroke (including spontaneous intracranial haemorrhage)
- 0.0464 x ((height - 170)/10)
- 0.0199 x ((weight - 80)/5) if weight<80kg
+ 0.133 if planned donation pathway is DCD)

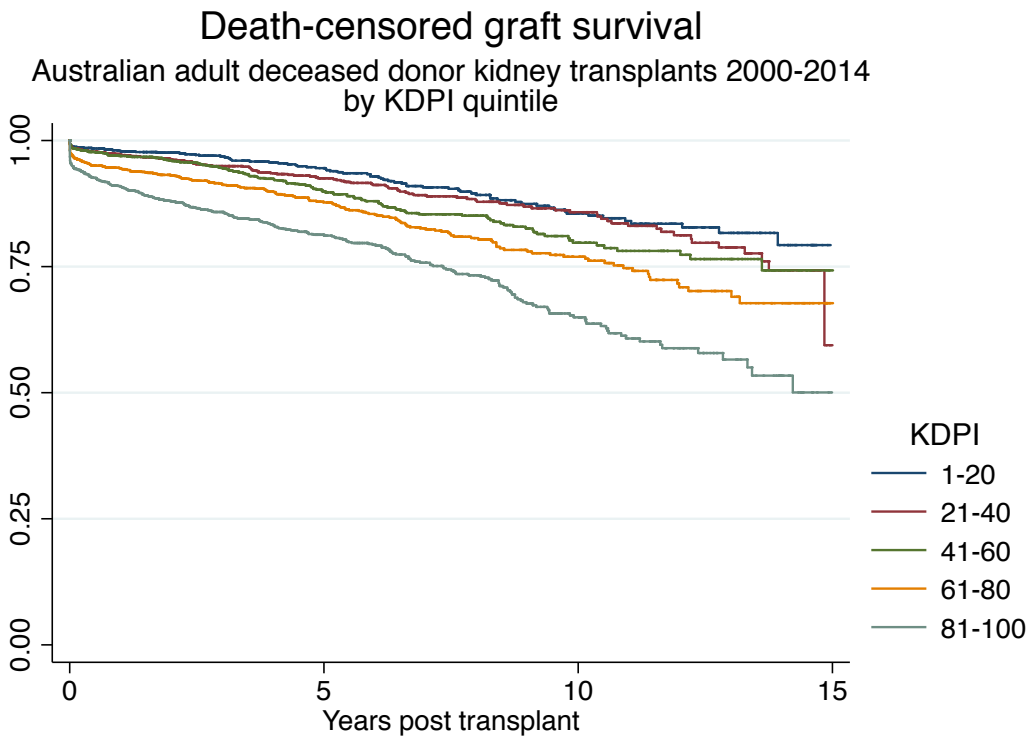
A KDPI of 1% is at the best end of the spectrum
A KDPI of 100% is at the worst end of the spectrum
A KDPI of 50% is the median score (equivalent to an "average" donor over the preceding 3 years)

A score of 20% indicates that the kidney has a relative risk of failure that is worse than only 20% of kidneys utilised for transplantation in the preceding 3 years (i.e. better than 80% of other transplanted kidneys). In other words, it is perceived to be among the best 20% of acceptable kidneys and is therefore better than the average kidney.

A score of 90% indicates that the kidney has a relative risk of failure that is worse than 90% of kidneys utilised for transplantation in the preceding 3 years (i.e. better than only 10% of other transplanted kidneys). In other words, it is perceived to be among the worst 10% of acceptable kidneys and is therefore worse than the average kidney.

The KDPI can be calculated manually using the KDPI calculator available on the TSANZ website:
http://www.tsanz.com.au/standalonepages/document-download.asp

Kaplan-Meier curves for graft survival rates for KDPI quintiles derived from ANZDATA analyses are shown in the graph below (courtesy Phil Clayton):



Parameters in the Australian KDPI formula

The Australian KDPI uses: Age, height, weight, current creatinine, mode of death (CVA or not), donor pathway (brain death vs circulatory death), history of hypertension, and history of diabetes in the formula. **The calculator (as an excel spreadsheet) is available for download on the TSANZ website:** http://www.tsanz.com.au/standalonepages/document-download.asp

Additional parameters in the UNOS formula are race (African American) and risk of Hepatitis C (in order to direct kidneys to older recipients in their allocation system). These factors are excluded in the Australian KDPI due to the lack of African American donors in Australia, and the alternative allocation rules for Hepatitis C positive donors.

Why are we implementing the ability to measure and report KDPI?

In the last few years the spectrum of kidneys has increased significantly. The KDPI provides a calculated measure of the expected survival of an organ and therefore this parameter will be extremely useful both currently and in the future. For example:

- It allows review of donor characteristics, changing patterns, acceptance practices, etc. for audits.
- It provides an objective measure of kidney quality when making decisions on organ acceptance.
- It can be used in our future kidney allocation algorithms. For example:
    - To optimise life years gained from kidneys expected to survive longer than other kidneys.
    - To streamline offers of marginal (high KDPI) kidneys to those with lower expected survival.

How will the KDPI be reported?
The KDPI will be provided at the time of organ allocation with the NOMS information. Donor co-ordinators will provide the clinical parameters to the tissue typing laboratory who will then derive the KDPI and enter this into NOMS. This needs to work with current workflow practices and therefore the information from the donor co-ordinators will occur as a "one-off" event at a certain point in the donor pathway.

If parameters change (eg. the creatinine or the donation pathway changes) there will not be an update to the KDPI that was derived at the time of donor work up and allocation. **Organ donor co-ordinators should not be asked to calculate, recalculate or interpret the KDPI. Similarly, lab staff will perform the calculation and enter the KDPI into NOMS but they are not expected to provide any other support for this information.**

How will KDPI affect kidney allocation?
The KDPI will not be used to change any of the national allocation processes that are currently in place. However, it will help us with changes that are very likely to follow at a later date. In the future, an allocation system that considers "Survival Matching" may be implemented (i.e. the donor kidney's risk of failure is compared and allocated, based partly on the recipient's expected survival).

Important Caveats
Other factors still need to be considered. It does not replace the need for this usual process. For example, the KDPI does not take into account high risk donor behaviours, malignancy, infection, proteinuria, biopsy findings, estimated ischaemia time, or the quality of immune matching between donor and recipient.

It is a predicted score. The c-statistic is approximately 0.7. i.e the KDPI can only correctly differentiate graft survival around 70% of the time. This is due to the lack of important information being included in the score, the contributions of recipient factors to graft survival (such as compliance) and the sometimes unpredictable nature of transplantation.

The KDPI is calculated by comparing the donor's KDRI with the KDRI of actual kidney donors, not potential donors. Thus, for example, a score of 99 might be off-putting, but around 1% of kidneys in the previous 3 years had a similar risk profile and were transplanted into patients.

Useful Links:
Australian KDPI calculator: (see the TSANZ website – Document Download page):
http://www.tsanz.com.au/standalonepages/document-download.asp

UNOS KDPI information:
https://optn.transplant.hrsa.gov/resources/allocation-calculators/
https://optn.transplant.hrsa.gov/resources/allocation-calculators/kdpi-calculator/

Contact for queries or questions. Please email:
John Kanellis, chair of RTAC (Renal Transplant Advisory Committee): john.kanellis@monash.edu, or
Phil Clayton, ANZDATA representative on RTAC Allocation Subcommittee, phil@anzdata.org.au

References:
1. Clayton P, White S, McDonald S, Chadban S. VALIDATION OF THE KIDNEY DONOR RISK INDEX (KDRI) IN THE AUSTRALIAN AND NEW ZEALAND KIDNEY TRANSPLANT POPULATION. Nephrology (Carlton, Vic). 2015 Sep;20:36–6.