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Considerable Variability Among Transplant Nephrologists in Judging Deceased Donor Kidney Offers

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Introduction: Transplant clinicians may disagree on whether or not to accept a deceased donor kidney offer. We investigated the interobserver variability between transplant nephrologists regarding organ acceptance and whether the use of a prediction model impacted their decisions.

Methods: We developed an observational online survey with 6 real-life cases of deceased donor kidneys offered to a waitlisted recipient. Per case, nephrologists were asked to estimate the risk of adverse outcome and whether they would accept the offer for this patient, or for a patient of their own choice, and how certain they felt. These questions were repeated after revealing the risk of adverse outcome, calculated by a validated prediction model.

Results: Sixty Dutch nephrologists completed the survey. The intraclass correlation coefficient of their estimated risk of adverse outcome was poor (0.20, 95% confidence interval [CI] 0.08–0.62). Interobserver agreement of the decision on whether or not to accept the kidney offer was also poor (Fleiss kappa 0.13, 95% CI 0.129–0.130). The acceptance rate before and after providing the outcome of the prediction model was significantly influenced in 2 of 6 cases. Acceptance rates varied considerably among transplant centers.

Conclusion: In this study, the estimated risk of adverse outcome and subsequent decision to accept a suboptimal donor kidney varied greatly among transplant nephrologists. The use of a prediction model could influence this decision and may enhance nephrologists' certainty about their decision.

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Deceased donor organs are scarce, and it is of great importance that available organs are used optimally. In the Netherlands, the average waiting time for a deceased donor kidney is currently almost 3 years.[1] Organs of presumed suboptimal quality are often considered for transplantation, because transplantation of marginal kidneys still provides a survival benefit over remaining on dialysis.[2-6] Furthermore, transplanting a deceased donor kidney of any currently accepted quality proved to be cost-effective compared to staying on a waiting list.[7]

The subjective judgment of the transplant physician on-call will eventually determine a donor kidney's fate. Different doctors may consider different donor and recipient factors concerning the acceptance of suboptimal organs, but no reliable metrics can be found in the literature on the actual degree of agreement between decision-making doctors.

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The decision on whether or not to accept a donor kidney of suboptimal quality may be supported by prediction models based on donor and recipient characteristics. Several regression-based models exist that aim to predict the outcome of a kidney transplant. One of the most commonly used mathematical tools to predict graft survival is the kidney donor risk index or kidney donor profile index, a percentile version of the kidney donor risk index.[8] This model has been implemented in the United States allocation system but is less commonly used in Europe. In addition, personalized risk models for kidney offers have been developed to estimate the probability of a kidney offer in the upcoming year, or to estimate patient survival after accepting or declining a particular kidney offer.[9-12]

Recently, a prediction model was developed on a European population of deceased donors aged 50 years and older.[13] Discrimination of this model was moderate in external validation (C-statistic 0.63), which is the highest level of discrimination obtained so far, compared to similar existing models (including kidney donor risk index in the same European data set). This model could assist transplant clinicians in Europe in deciding whether to accept a kidney from an older donor. Although such models have been designed to predict a certain clinical outcome, it remains to be investigated to what degree clinicians will allow their professional decision to be influenced by prediction models and what the potential impact on recipient outcomes would be when a model is also considered in the evaluation of a kidney offer.

We hypothesized that there may be relevant differences among transplant physicians and transplant centers in how deceased donor kidney offers are judged. Our study aimed to investigate the interobserver variability among transplant nephrologists regarding the acceptance of kidneys from suboptimal donors. Furthermore, we evaluated whether the use of a prediction model could influence their decision-making and whether it affected how certain they felt about this decision.

METHODS

Case-based Survey

We developed an online observational survey consisting of 6 unique cases, selected from real donor kidney offers to actual Dutch waitlisted recipients between January 1 and December 31, 2019. To be included as a case, donor age had to be 50 years or older with kidneys of subjectively judged suboptimal quality. We did not use a specific definition of suboptimal quality. Considered factors were decreased renal function, medical history of hypertension and/or diabetes mellitus, or for example a prolonged cardiopulmonary resuscitation of the donor.

All selected donors and recipients had blood group O and none of the recipients were human leukocyte antigen sensitized. Human leukocyte antigen mismatch (A-B-DR) was standardized to 1-1-1 for all cases. The (expected) ischemia times were standardized to 15 minutes of warm ischemia in donation after circulatory death donors and 10 hours of cold ischemia in both donation after circulatory death and donation after brain death donors.

For each case, the risk of adverse outcome was calculated by a recently developed and validated prediction model for deceased donors aged 50 years and older, which included 14 different donor, recipient, and organ preservation characteristics.[13] Adverse outcome in this model was defined as graft failure, death, or poor graft function equivalent to an estimated glomerular filtration rate <30 ml/min per 1.73 m^2 within 1 year after transplantation. An online calculator based on this prediction model is available at https://pre-image.eu/calculator/. A brief summary of this prediction model and a link to the online publication was provided to all respondents in the introduction of the survey. This information included the C-statistic of this particular model and a short explanation of the interpretation of C-statistics.

For each case, a summary of all available relevant information on the donor and recipient was presented. The donors, matched recipients, and questionnaire are available in the online supplement.

Nephrologists were first asked to estimate the risk of adverse outcome within 1 year if this kidney would be transplanted to the indicated recipient (0%–100%). Then, they were asked whether they would accept the kidney offer for this patient and how certain they were of this decision (yes/no and 0%–100%, respectively). If they chose to decline the offer for the selected patient, respondents were asked whether they would accept this kidney for a patient of their own choice within their center (yes/no). Next, we presented the risk of adverse outcome calculated by the prediction model (0%–100%), after which the questions were repeated. In the online survey, the order in which the cases were presented was randomized per respondent to avoid bias due to order and survey fatigue.

Respondents

The survey was promoted in all 7 Dutch transplant centers' departments of nephrology. All transplant nephrologists (who take the initial decision on a kidney offer in the Netherlands) and nephrology residents were approached. Respondents provided information on their transplant center, years of experience as

medical specialist or resident, and years of experience with kidney offers. It was stated that center-specific results would be published anonymously.

Statistics

Online data collection was performed with SurveyMonkey (Momentive Inc., San Mateo, CA). Normal distribution was evaluated with P-P and Q-Q plots and the Kolmogorov-Smirnov test. Non-skewed data are expressed as means ± SD, and skewed data as median and interquartile range.

Intraclass correlation coefficients were calculated with a 2-way mixed model, with absolute agreement on single measures. Interobserver variability in kidney offer acceptance was expressed as Fleiss kappa. Comparisons between the difference in the acceptance rate before and after providing the additional information from the prediction model were performed with the McNemar test, and the difference in the degree of certainty among respondents was analyzed with the Wilcoxon signed-rank test. The degree of certainty between residents and nephrologists was compared with the Mann-Whitney U test. Correlation between years of clinical experience and estimated risk of an adverse outcome as well as the degree of certainty was expressed as Spearman rho correlation coefficients. Multivariate logistic regression was used to analyze the association between clinical experience, estimated risk of adverse outcome and transplant center, with kidney acceptance. Per variable, we adjusted only for variables that could potentially influence that particular variable; therefore, clinical experience was adjusted for center, estimated risk of adverse outcome was adjusted for center and years of clinical experience, and transplant center was adjusted for years of clinical experience and estimated risk of adverse outcome.

Statistical tests were performed with SPSS 26 (IBM, Armonk, NY). P values less than 0.05 were assumed to indicate statistical significance.

RESULTS

Respondents

All active transplant nephrologists ($n = 99$) from the 7 Dutch kidney transplant centers were invited to participate. Sixty nephrologists responded to our survey, resulting in a response rate of 61%. Four of them did not complete the whole survey but completed at least 1 full case. The respondents had a median of 10 (interquartile range 6–18) years of experience as a medical specialist and 11 (6–17) years of experience judging kidney offers. The response rate per center varied from 33% to 89%. Each center had at least 5 respondents.

In addition, we invited all nephrology residents ($n = 40$) affiliated to Dutch transplant centers to complete the survey. Seventeen were excluded, because they were not participating in the evaluation of donor kidney offers. Of the remaining 23 residents, 10 completed the survey, leading to a 43% response rate. Their level of experience was normally distributed, with a mean of 5.5 (±3.0) years of clinical experience since the start of their residency and 1.2 (±0.8) years of experience with kidney offers.

Estimating the Risk of Adverse Outcome

Per case, respondents were asked to estimate the risk of adverse outcome (defined as graft failure, death, or chronic kidney disease stage 4 or 5 within 1 year after transplantation) for the selected recipient (Table 1). There was very little agreement among nephrologists on the estimated adverse outcome risk, reflected by an intraclass correlation coefficient of 0.20 (CI 95% 0.08–0.62).

For all cases combined, we found a significant negative correlation between the estimated risk of adverse outcome among nephrologists and their years of experience as medical specialists (correlation coefficient −0.14, $P = 0.011$).

Acceptance of Kidney Offers

In the 6 cases presented, the acceptance rate varied from 13.6% to 66.1%. In 2 cases, the acceptance rate significantly changed after the additionally provided information of the prediction model (Table 1). In case 1, the risk as estimated by nephrologists (41%) was much higher than that calculated by the prediction model (23%), leading to an increase in acceptance rate from 58.9% to 76.8% ($P < 0.001$) after revealing the outcome of the prediction model. In case 6, nephrologists estimated a lower risk of adverse outcome (43%) compared to the prediction model (55%), resulting in a decline in acceptance rate from 66.1% to 44.6% ($P < 0.001$) after the risk calculated by the prediction model had been revealed. Whenever nephrologists were given the option to accept the kidney for a recipient of their own choice within their center, total acceptance rate increased, especially in case 4 (Figure 1).

Interobserver variability in kidney offer acceptance was calculated for all nephrologists who completed all cases ($n = 56$). Fleiss kappa was 0.130 (95% CI 0.129–0.130) (Table 2), representing an interobserver variability only slightly better than flipping a coin, because the degree of agreement with a kappa of zero is the same as would be expected by chance. The Fleiss kappa after revealing the additional information provided by the prediction model was 0.185 (95% CI 0.184–0.186).

Table 1. Estimated and predicted risk of adverse outcome, kidney acceptance rate, and the degree of certainty among nephrologists and nephrology residents

	Risk Adverse Outcome (%)		Acceptance Rate Kidney Offer (%)			Certainty Decision (%)		
Case	Risk estimated by physician	Risk calculated by prediction model	Basic information	Basic information + information risk prediction model	*P*-value	Basic information	Basic information + information risk prediction model	*P*-value
				Nephrologists				
1 ($n = 56$)	41 (±21.0)	23	58.9	76.8	<0.001	71 (60–80)	80 (66–89)	0.034
2 ($n = 57$)	58 (±19.3)	41	26.3	28.1	0.73	75 (65–81)	75 (60–82)	0.84
3 ($n = 59$)	47 (±18.9)	43	47.5	50.8	0.73	70 (60–81)	72 (56–85)	0.30
4 ($n = 59$)	46 (±20.6)	47	28.8	20.3	0.063	80 (68–90)	84 (70–91)	0.046
5 ($n = 59$)	67 (±19.2)	54	13.6	10.2	0.63	82 (70–95)	80 (70–95)	0.67
6 ($n = 56$)	43 (±15.4)	55	66.1	44.6	<0.001	75 (62–80)	75 (59–87)	0.70
				Residents nephrology				
1 ($n = 10$)	40 (±30.2)	23	70	90	0.50	56 (32–76)	60 (34–83)	0.31
2 ($n = 10$)	54 (±18.1)	41	40	50	1.00	61 (36–73)	67 (33–82)	0.55
3 ($n = 10$)	43 (±17.1)	43	60	60	1.00	56 (28–69)	66 (30–77)	0.44
4 ($n = 10$)	42 (±27.6)	47	10	10	1.00	65 (39–82)	75 (57–80)	0.36
5 ($n = 10$)	64 (±15.2)	54	0	0	n.a.	70 (55–74)	68 (63–78)	0.55
6 ($n = 10$)	41 (±22.4)	55	70	30	0.13	52 (35–80)	45 (26–70)	0.51

n.a., not available.
Estimated risk physician: mean (±SD). Certainty decision: median (interquartile range).

Overall, in all cases combined, 13.9% of the nephrologists changed their initial decision on organ acceptance after the outcome of the prediction model had been provided. Specifically, 6.1% changed from declining to accepting the kidney offer and 7.8% changed from accepting to declining for the selected recipient (Table 3).

In a logistic regression model, years of clinical experience as nephrologists, years of experience with kidney offers, the estimated risk of adverse outcome, and the transplant center were significantly associated with kidney acceptance (Table 4).

Degree of Certainty About Decision

In 2 cases, the degree of certainty for nephrologists increased significantly after providing the additional information of the prediction model (Table 1). In one of those cases, the acceptance rate increased significantly, in the other case the difference in acceptance rate was not significant. The overall degree of certainty among nephrologists after receiving this extra information also increased significantly (median 79 vs. 75, $P = 0.038$) (Figure 2).

There was no significant correlation between nephrologists' degree of certainty and the years of experience as a medical specialist or years of experience with kidney offers among nephrologists, both before and after the additional information of the prediction model had been revealed.

Variability Between Transplant Centers

Percentages of accepting or declining a kidney offer are displayed per center in Figure 1. Acceptance rates for each selected recipient were surprisingly heterogeneous between transplant centers. In some cases, the acceptance rate of one center was >80%, whereas other centers had a decline rate of >80%. Interobserver variability of the decision on whether or not to accept the kidney offer within individual centers was diverse, with a Fleiss kappa ranging from −0.04 to 0.31 (Table 2).

This heterogeneity was also observed if the kidney was secondarily offered to a recipient free of choice within a respondent's own center (e.g., cases 3, 4, and 6), eliminating the potential influence of characteristics of a specifically selected recipient, and therefore solely judging the offer on presumed aspects of donor kidney quality.

The mean estimated risk of adverse outcome by all nephrologists who accepted kidney offers for the selected recipient was 35% (±15.2%) and 61% (±17.7%) for those who declined the offer, but there was remarkable overlap in the estimated risk of adverse outcome between nephrologists accepting or declining a kidney. The range of the estimated risk within which nephrologists would still accept a kidney offer was very diverse between the centers (Figure 3). Although some centers seemed confident to accept kidneys with an estimated risk of adverse outcome between 40% and 60%, 1 center never accepted any kidneys when they estimated a risk higher than 35%.

Subanalysis of Nephrology Residents

The predicted risk of adverse outcome, kidney acceptance rate, and the degree of certainty among nephrology residents are shown in Table 1. There were

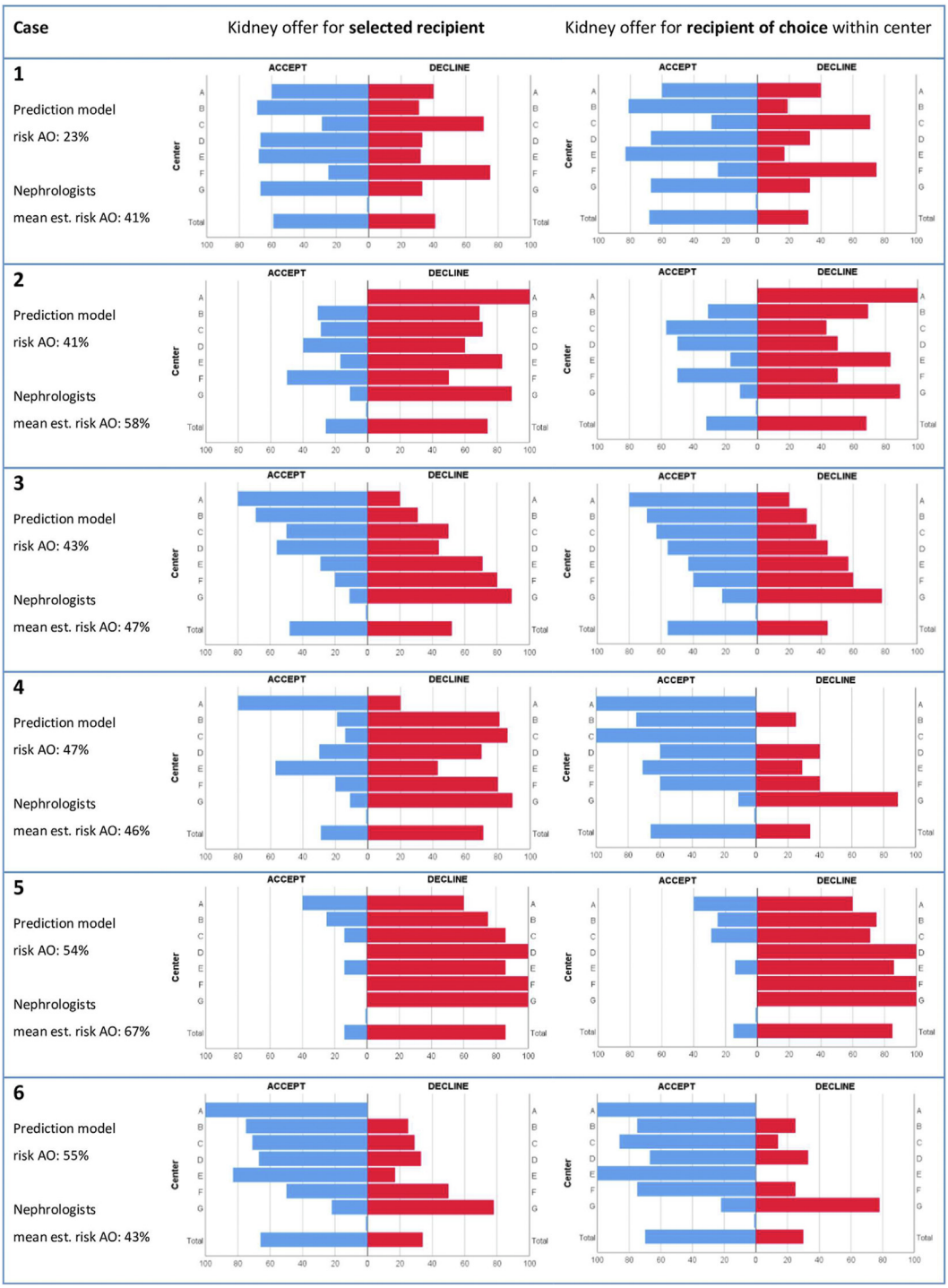

Figure 1. Kidney acceptance rate among nephrologists ($n = 60$) per transplant center. These data show the acceptance rate per individual transplantation center for the allocated recipient (first column) and – if the offer was not accepted–whether one would accept the kidney for a recipient of choice within their own center (second column), based on the basic information as usually provided by the allocation organization. risk AO: risk of an adverse outcome for corresponding kidney offer for the selected recipient.

no significant differences in the estimated risk between the medical specialist and the residents. The acceptance rate before and after the additionally provided information of the prediction model was not significantly different in each case, but the trends in the increase or decrease of acceptance rate were in line with those of the nephrologists. Nephrologists were overall more confident about their decision than residents (all cases combined), both in the first decision (median 75 vs. 60, $P < 0.001$) and in the second decision (median 79 vs. 65, $P < 0.001$) (Figure 2).

DISCUSSION

In our nationwide study, nephrologists and nephrology residents completed an online survey

Table 2. Interobserver variability before and after the use of the prediction model

	Interobserver Variability (Fleiss Kappa) and Acceptance Rate (%)			
	with basic information		with basic information + information risk prediction model	
	For selected recipient	For recipient free of choice	For selected recipient	For recipient free of choice
Total respondents	0.13 (40%)	0.14 (51%)	0.19 (38%)	0.16 (49%)
Center A	0.31 (60%)	0.43 (63%)	−0.11 (70%)	−0.02 (73%)
Center B	0.17 (48%)	0.15 (60%)	0.18 (49%)	0.17 (67%)
Center C	0.04 (34%)	0.06 (61%)	0.10 (23%)	0.18 (39%)
Center D	0.15 (43%)	0.13 (52%)	0.27 (39%)	0.22 (46%)
Center E	0.10 (44%)	0.31 (54%)	0.19 (46%)	0.31 (55%)
Center F	−0.04 (26%)	-0.01 (41%)	0.00 (19%)	−0.01 (37%)
Center G	0.20 (20%)	0.17 (22%)	0.30 (17%)	0.30 (17%)

consisting of kidney offers from 6 suboptimal deceased donors aged 50 years and older. Agreement on whether or not to accept an organ offer as well as on the estimated risk of adverse outcome was remarkably poor. Considering that we deliberately presented donors of older age, we had expected conflicting opinions about organ quality among transplant professionals, but the low agreement metrics that we found surprised us. It should be considered, however, that if the actual donor pool, including younger donors without comorbidities, had been presented in our survey, agreement might have been higher. Our results are therefore not representative of all deceased donor kidney offers in the Netherlands but only reflect variability in judging kidney offers from deceased donors aged 50 years and older with additional risk factors for adverse outcome.

In our study, the use of a prediction model led to a significant change in kidney acceptance rate in 2 of 6 cases. In 2 other cases (cases 2 and 5), where the risk calculated by the model was considerably lower than the estimated risk by the nephrologists, their acceptance rate did not change significantly. This might be because even though the predicted risk was lower than the estimated risk, it could still be considered high in absolute terms. Interobserver agreement improved (higher kappa) after the use of the prediction model, both on a national level, and in almost every single center. Furthermore, the overall degree of certainty about the decision among nephrologists increased after using the model.

Table 3. Change of decision after additional information had been provided about the risk of adverse outcome calculated by the prediction model

		Decision 2: After Additional Information Risk on Adverse Outcome Calculated by the Prediction Model		
		Accept	Decline	Total
Decision 1: based on basic information on donor and recipient	Accept	111 (32.1%)	27 (7.8%)	138 (39.9%)
	Decline	21 (6.1%)	187 (54.0%)	208 (60.1%)
	Total	132 (38.2%)	214 (61.8%)	346 (100%)

This table shows the responses from all nephrologists ($n = 60$) added up for all 6 cases. The total number of decisions adds up to 346 (instead of 360) because of some incomplete surveys.

It remains to be investigated, however, to what extent more uniformity in decision making, increased acceptance rates, or better feeling of certainty about a decision, actually improves the clinical outcome after this decision. However, in the comments section at the end of the survey, many respondents indicated that they had become curious about the possible implementation of the model in clinical practice. Our survey could serve as a steppingstone for a prospective clinical impact study in which acceptance rates and transplant outcome are compared with and without the use of a validated prediction model.

Nevertheless, so far, the implementation of certain metrics calculated by such tools (e.g., kidney donor profile index or Public Health Service "Increased Risk") has had an unexpected adverse effect on kidney utilization.[3,14,15] In our study, we found a mild decrease in kidney acceptance rate from 39.9% to 38.2% after the use of the prediction model, but an actual clinical impact study on kidney utilization has yet to be performed.

Table 4. Multivariate logistic regression analysis identifying factors associated with kidney acceptance by transplant nephrologists ($n = 60$)

	Kidney Acceptance Selected Recipient		Kidney Acceptance Recipient Free of Choice	
Variable	Odds ratio (95% CI)	*P*-value	Odds ratio (95% CI)	*P*-value
Clinical experience as a nephrologist (yrs)	1.05 (1.02–1.08)	0.003	1.05 (1.02–1.08)	0.001
Estimated risk of adverse outcome for selected recipient (%)	0.89 (0.87–0.92)	<0.001	NA	
Transplant center (A–G)				
Center A	35.7 (8.1–157.1)		45.8 (10.0–209.8)	
Center B	8.7 (2.9–27.0)		20.5 (6.3–66.9)	
Center C	1.1 (0.3–3.7)		7.4 (2.1–26.0)	
Center D	10.1 (3.0–34.7)		19.6 (5.4–70.4)	
Center E	15.8 (4.1–60.5)		35.5 (8.5–147.9)	
Center F	4.4 (1.0–20.2)		15.5 (3.4–71.2)	
Center G	NA (reference)	<0.001	NA (reference)	<0.001

NA, not applicable.
Adjusted for relevant variables per independent variable. Clinical experience adjusted for center, estimated risk adverse outcome adjusted for center and years of clinical experience, transplant center adjusted for years of clinical experience and estimated risk adverse outcome.

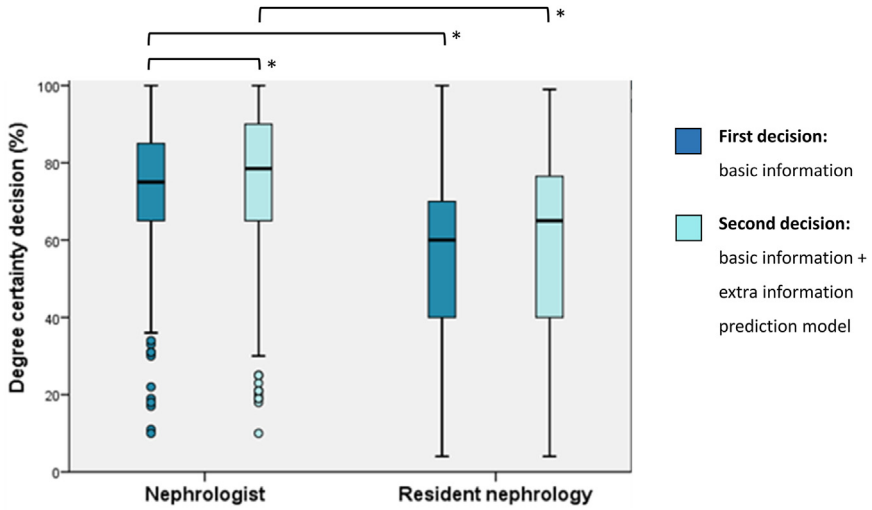

Figure 2. Degree of certainty about decision for nephrologists and residents ($n = 70$). Boxes represent IQR and median. Whiskers represent upper and lower quartiles, with a maximum of 1.5 times the IQR. Outliers are defined as >1.5 times the IQR above or below the edge of the IQR. *Indicating statistical significance with $P < 0.05$. With the standard basic information (first decision), the median degree of certainty was 75 (IQR 65–85) for nephrologists and 60 (40–70) for residents ($P < 0.001$). After the extra information of the prediction model had been provided (second decision), this became 79 (65–90) and 65 (40–77), respectively ($P < 0.001$). The overall degree of certainty was higher after revealing information from the prediction model (nephrologists [$P < 0.038$] and residents [$P = 0.26$]). IQR, interquartile range.

Furthermore, our data show that the transplant center is associated with acceptance of a suboptimal kidney. It seems that, consciously or unconsciously, transplant centers sometimes employ very different cut-off points in the estimated risk of adverse outcome, or in accepting or declining a kidney offer. A recent online survey with theoretical cases examined deceased kidney donor acceptance among Canadian kidney transplant specialists. They also noticed considerable variability in acceptance rates between centers, with an overall decline rate of 60.9% in the most conservative center and only 28.1% in the most aggressive center.[16]

In decisions on organ acceptance, transplant centers and physicians might be confronted with conflicting interests. Nephrologists from an Australian interviewing study based their decision on waitlisting patients and organ acceptance primarily on medical suitability and the potential for improved health outcomes, but they also perceived an obligation to maintain their center's reputation, by selecting only "good" patients for the waiting list. These nephrologists advocated that policymakers should feel more responsibility to address inequalities between centers.[17]

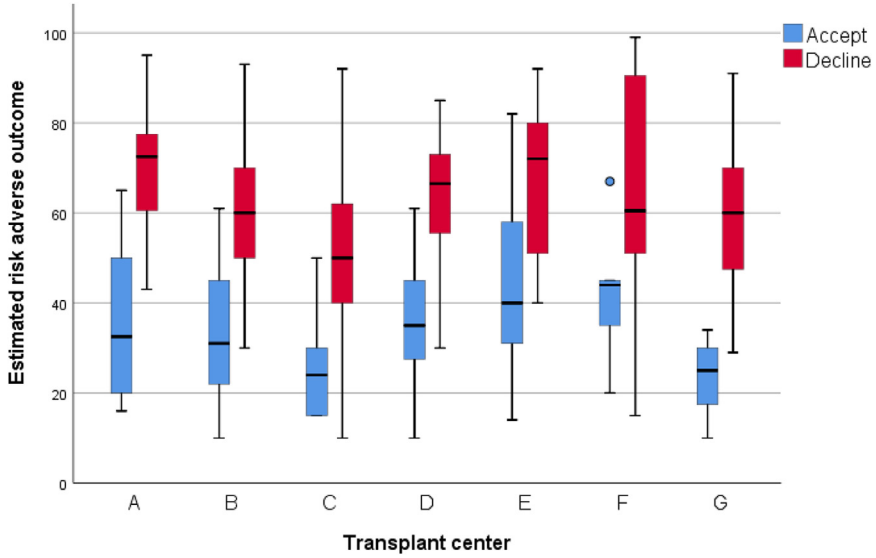

Figure 3. Estimated risk of adverse outcome by nephrologists ($n = 60$), stratified by whether they had decided to accept or decline the kidney and by transplant center (A–G). Boxes represent IQR and median. Whiskers represent upper and lower quartiles, with a maximum of 1.5 times the IQR. Outliers are defined as >1.5 times the IQR above or below the edge of the IQR.

In addition to the interregional differences, even within centers, there was great variability between nephrologist in the acceptance of kidneys, reflected by Fleiss kappa's between 0 and 0.43. Differences between centers and/or individual physicians may be related to different values and definitions of a "successful" transplantation outcome. The model that we used in our survey predicts the risk of adverse outcome, defined as graft failure, death, or chronic kidney disease stage 4 or 5 within 1 year after transplantation. There is no unifying definition of a successful transplantation, and the risk of complications, such as primary nonfunction, (duration of) delayed graft function, or need for dialysis, might be a decisive factor in the decision-making process. Moreover, especially in an older renal patient population, transplantation outcomes with an estimated glomerular filtration rate between 15 and 29 ml/min per 1.73 m^2 (chronic kidney disease stage 4) could sometimes still be considered acceptable, if this allows an elderly patient to discontinue dialysis and thus gain quality of life.

In our view, it is important that transplant nephrologists are aware of the differences in kidney acceptance among their local colleagues and among the national centers. On a local level, all kidney offers (both accepted and declined) may be discussed on a regular basis. Similar meetings on a national level in which complex cases are discussed could lead to more insight and understanding of center-specific considerations in decision-making, and possibly more uniform acceptance guidelines on a national level. Furthermore, physicians dealing with kidney offers might benefit from educational efforts providing insight that for certain transplants, candidates accepting a suboptimal deceased donor kidney can result in a better outcome than remaining on dialysis. In addition to aligning opinions on risk and acceptance, it could be extremely useful to link the data from our research to actual center-specific outcomes, such as actual acceptance rates, number of transplants per year, insight on patients accepted and declined for the waiting lists, mortality on waiting lists, waiting time to transplant, graft and patient survival after transplant, etc. Currently, the Dutch national network of transplant nephrologists intends to develop quality markers and a visitation format for benchmarking the care they provide. Sharing and discussing regional differences among transplant centers, policymakers, and patients could lead to a better interpretation of regional kidney acceptance rates.

The decision-making process in deceased donor organ offers is complex. Observations from behavioral science may contribute to improving organ utilization and perhaps even transplant outcome.[18] In behavioral economics, individuals prefer certainty over uncertainty and decisions seem to be more influenced by the risk of loss rather than by potential gain. This loss aversion could translate into the discard of presumably suboptimal kidneys and might lead to a stricter policy on accepting high-risk patients to the waiting list.[19] It is suggested that if one puts the degree of risky behavior in transplantation medicine on a continuous scale, it may be that the best choice is not on the defensive side of the scale but rather somewhere in the middle.[20]

Our study has several limitations that should be addressed. First, the response to a theoretical case could be different than that to a real organ offer for a recipient known to the physician. Second, the time of day and the time pressure that typically accompanies a real organ offer may also play a role in decision-making, which is not fully addressed by an online survey. Third, the macroscopic organ quality analysis by the retrieval surgeon was not included in the information about the donor that we provided in this survey. In reality, these variables can sometimes contribute to decisions on donor kidney acceptance. Furthermore, in 1 case, the abdominal ultrasound stated a difference in size between the 2 kidneys and the medical history stated unilateral kidney stones. Several respondents mentioned that whether or not to have the first option to choose 1 of the 2 kidneys from this particular donor would have been decisive in their choice of acceptance. This could have influenced the estimated risk of an adverse outcome and the overall acceptance rate of this case.

The prediction model that we employed has relevant limitations. Most importantly, prediction models can only be constructed with and validated on outcome data of kidneys that have actually been transplanted. The characteristics of discarded kidneys are therefore inevitably not considered when composing such a prediction model; such models are intended to be used on this category of kidneys. Although the cases in our survey are part of the validated group in the prediction model, the model has not been validated separately on (clinical) suboptimal donors. Without external validation of such a subset, it remains unclear whether the performance of the model is similar. Moreover, the predictive value of the model should be interpreted with caution. Predicting the transplant outcome of a donor kidney has proven to be a complex task, reflected by prediction models with moderate discrimination at best. We would therefore like to emphasize that the model we used with a C-statistic of 0.63 should not weigh too heavily in the decision making process.

In conclusion, we observed a considerable variation in how nephrologists as well as individual transplant centers evaluate kidney offers from suboptimal

deceased donors. This finding once more highlights that decision-making in organ transplantation is a precarious and complex task, in which a decision is influenced by many variables. A prediction model translated into a practical online risk calculation tool can provide additional information to clinicians and patients and could play a supporting role in the decision-making process. Finally, we would encourage more discussion and transparency about acceptable risks between transplant centers and policymakers. This could lead to better mutual understanding and awareness and might serve as a platform for quality improvement.

DISCLOSURE

All the authors declare no conflicts of interest.

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SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Outline and content online survey.

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