OPTN

Public Comment Proposal

Refit Kidney Donor Profile Index without Race and Hepatitis C Virus

OPTN Minority Affairs Committee

Prepared by: Kelley Poff
UNOS Policy Department

Contents

OPTN

Refit Kidney Donor Profile Index without Race and Hepatitis C Virus

Affected Policies: *8.4.B: Deceased Donor Classifications*
Sponsoring Committee: *Minority Affairs*
Public Comment Period: *January 23, 2024- March 19, 2024*

Executive Summary

The Kidney Donor Profile Index (KDPI) is a measure that combines deceased donor factors including clinical parameters and demographics to summarize the quality of deceased donor kidneys into a single number.[1] Lower KDPI scores are associated with longer estimated organ function, while higher KDPI scores are associated with shorter estimated organ function and an increased chance of organ non-use.[2] Currently, kidneys from African American/Black and Hepatitis C virus (HCV) positive deceased donors have an increased KDPI of up to 20% for each factor.[3] Race is a poor proxy for human genetic variation and due to innovations in treatment, post-transplant outcomes for HCV positive deceased donor kidney transplants are similar to that of HCV negative donor kidneys.[4,5] These factors inflate the KDPIs of deceased donor kidneys from African American/Black and HCV positive donors. The OPTN Minority Affairs Committee (the Committee) proposes refitting the KDRI (Kidney Donor Risk Index) and subsequently the KDPI calculation without race or HCV donor factors to better reflect the likelihood of graft failure for kidneys from African American/Black and HCV positive deceased donors.[6]

[1] Organ Procurement and Transplantation Network. April 19, 2023. A Guide to Calculating and Interpreting the Kidney Donor Profile Index (KDPI). Retrieved November 10, 2023, from https://optn.transplant.hrsa.gov/media/j34dm4mv/kdpi_guide.pdf.
[2] Kadatz M, Gill J, Gill J. Lan J, McMichael L, Chang D, Gill J (2023). The Benefits of Preemptive Transplantation Using High-Kidney Donor Profile Index Kidneys. Clinical Journal of the American Society of Nephrology. 18(5):p 634-643 doi: 10.2215/CJN.0000000000000134.
[3] Rao P, Schaubel D, Guidinger MK, Andreoni KA, Wolde RA, Merion RM, Port FK, Sung RS. (2009) A Comprehensive Risk Quantification Score for Deceased Donor Kidneys: The Kidney Donor Risk Index. Transplantation, 88(2), 231–6.doi: 10.1097/TP.0b013e3181ac620b.
[4] Ibid.
[5] Miller J, Lyden GR, McKinney WT, Snyder JJ, Israni AK. (2023). Impacts of removing race from the calculation of the kidney donor profile index. American Journal of Transplantation, 23(5):636-641. https://doi.org/10.1016/j.ajt.2022.12.016.
[6]See OPTN Minority Affairs Committee meeting summary. September 18, 2023. https://optn.transplant.hrsa.gov/media/wogcgpiq/20230918_mac_summary.pdf.

Purpose

The Committee proposes refitting the KDRI calculation without race or HCV and re-mapping to KDPI to better reflect the likelihood of graft failure for kidneys from African American/Black and HCV positive deceased donors.[7]

Background

The KDPI is a measure that combines deceased donor factors including clinical parameters and demographics to summarize the quality of deceased donor kidneys into a single number.[8]

In 2009, Rao et al. proposed KDRI as an improvement to Expanded Criteria Donor (ECD).[9] Before the use of KDRI, kidneys were considered ECD if:

1. the donor age was more than or equal to 60 years **or**
2. the donor age was 50 to 59 years, with at least **two** of the following criteria:
    a. serum creatinine more than 1.5 mg/dL
    b. death due to cerebrovascular accident
    c. history of hypertension

In the development of KDRI, Rao et al. sought a more granular tool to assess the risk associated with deceased donor organs with varying characteristics, including those known to influence graft failure.[10] All donor factors potentially associated with graft failure rates were included in the initial model. These factors included:

- age
- race
- sex
- height
- weight
- cause of death
- donation after cardiac death
- serum creatinine
- diabetes
- hypertension
- cigarette use
- hepatitis C virus (HCV) positivity
- pulsatile perfusion
- cold ischemia time
- organ sharing (local, regional, and national)
- human leukocyte antigen (HLA) mismatch score

[7] See OPTN Minority Affairs Committee meeting summary. September 18, 2023. https://optn.transplant.hrsa.gov/media/wogcgpiq/20230918_mac_summary.pdf.
[8] Organ Procurement and Transplantation Network. April 19, 2023. A Guide to Calculating and Interpreting the Kidney Donor Profile Index (KDPI). Retrieved November 10, 2023, from https://optn.transplant.hrsa.gov/media/j34dm4mv/kdpi_guide.pdf.
[9] Rao P, Schaubel D, Guidinger MK, Andreoni KA, Wolde RA, Merion RM, Port FK, Sung RS. (2009) A Comprehensive Risk Quantification Score for Deceased Donor Kidneys: The Kidney Donor Risk Index. Transplantation, 88(2):231–6.doi: 10.1097/TP.0b013e3181ac620b.
[10] Ibid.

- year of transplant
- en bloc
- double transplant
- ABO compatibility.

After analysis, the model was refined to exclude donor factors with non-significant effects on graft failure.[11] The remaining factors included:

- age
- weight
- height
- race
- serum creatine
- history of Hypertension
- history of Diabetes
- cause of death
- HCV status
- HLA mismatch/transplant parameter
- cold time
- en bloc transplant
- double kidney transplant.

Each factor's hazard ratio for graft failure was assigned by comparison with a reference donor.[12] A hazard ratio describes the chance of the event occurring for one group versus another. A hazard ratio of 1 means that the chance of graft failure is the same, but a hazard ratio > 1 means that the risk of the event, graft failure, is higher. The model was compared to the rate of graft failure for a "reference donor", that was representative of a healthy 40-year-old deceased donor. Based on this comparison, a hazard ratio of 1.20 was assigned to African American/Black deceased donor kidneys and a hazard ratio of 1.27 was assigned to HCV positive deceased donor kidneys. The authors of the study concluded that characteristics that influence graft outcomes into one metric conferred major advantages over its binary predecessor, ECD.

KDPI in OPTN Policy

The OPTN started using KDPI in 2014 as part of the implementation of the Kidney Allocation System (KAS).[13] Currently, the OPTN KDPI calculator includes ten donor factors: [14, 15]

- age

[11] Rao P, Schaubel D, Guidinger MK, Andreoni KA, Wolde RA, Merion RM, Port FK, Sung RS. (2009) A Comprehensive Risk Quantification Score for Deceased Donor Kidneys: The Kidney Donor Risk Index. Transplantation, 88(2): 231–6.doi: 10.1097/TP.0b013e3181ac620b.

[12] Characteristics of the reference donor included: 40-year-old, non- African American race, serum creatinine 1.0 mg/dL, non-hypertensive, non-diabetic, cause of death other than cerebrovascular accident, height 170 cm, weight more than or equal to 80 kg, brain dead donor (not donation after cardiac death), and HCV negative.

[13] Organ Procurement and Transplantation Network. September 17, 2014. The New Kidney Allocation System (KAS) Frequently Asked Questions. Retrieved November 10, 2023, from https://optn.transplant.hrsa.gov/professionals/by-topic/guidance/the-new-kidney-allocation-system-kas-frequently-asked-questions/#bookmark5.

[14] The KDPI displayed on the OPTN calculator, is the scaled, donor-only version of the KDRI. As explained in Rao, et al, several factors pertaining to the recipient and/or transplant procedure (cold ischemic time, degree of HLA mismatching, single vs. double vs. en-bloc kidneys) can also be used to calculate a "full" KDRI.

[15] Organ Procurement and Transplantation Network. KDPI calculator. Retrieved November 11, 2023, from https://optn.transplant.hrsa.gov/data/allocation-calculators/kdpi-calculator/.

- height
- weight
- race
- history of hypertension
- history of diabetes
- cause of death
- serum creatinine
- HCV Status from serological or NAT testing
- donation after circulatory death (DCD) status

The KDPI is derived by first calculating the KDRI for a deceased donor, as KDPI is a mapping of the KDRI into a cumulative percentage scale. The KDRI is an estimate of the relative risk of post-transplant kidney graft failure for a given donor compared to the median/reference kidney donor. KDRI is translated into a KDPI percentage from 0 – 100% for the purposes of OPTN allocation.[16] Lower KDPI scores are associated with longer estimated function, while higher KDPI scores are associated with shorter estimated function. For example, a donor with a KDPI of 9% has a higher expected risk of graft failure than 9% of all kidney donors recovered last year. A donor with a KDPI of 82% has a higher expected risk of graft failure than 82% of all kidney donors recovered last year.

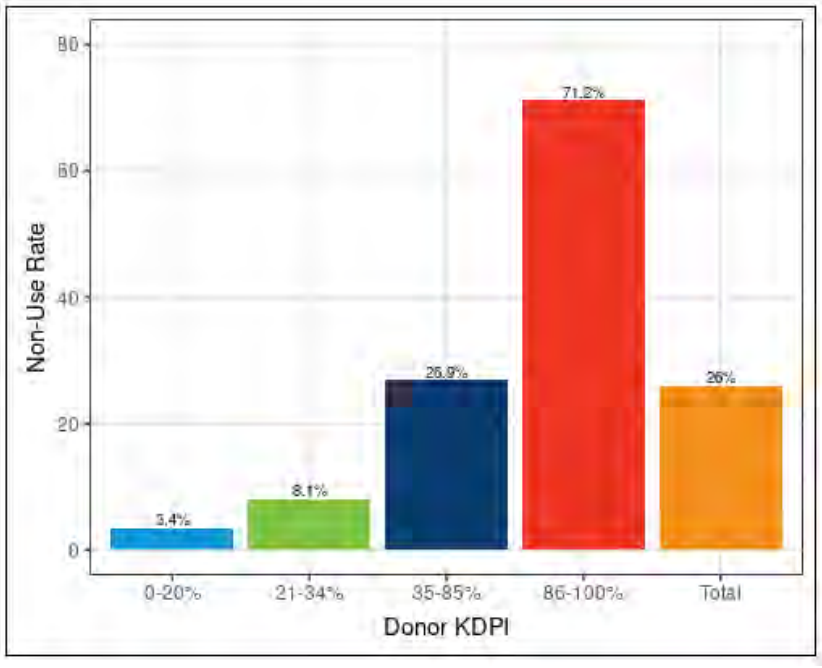
There are four KDPI categories, known as allocation sequences:

- Sequence A: 0-20%
- Sequence B: 21-34%
- Sequence C: 35-85%
- Sequence D: 86-100%

These KDPI sequences are used to allocate deceased donor kidneys to candidates based on candidate clinical information outlined in *OPTN Policy: 8.4 Kidney Allocation Classifications and Rankings.* Kidneys in Sequence D (86-100% KDPI) can be more challenging to place and have a greater chance of non-use.[17] **Figure 1** shows the non-use of deceased donor kidneys from 03/15/2021 – 03/15/2023 by KDPI sequence. 26% represents the percent of all recovered kidneys that were recovered for transplant, but not ultimately transplanted. 71.2% represents the number of 86-100% kidneys that were recovered for transplant but were ultimately not transplanted. This means 26% can be described as the overall non-use rate for kidneys and 71.2% is the non-use rate for kidneys with 86-100% KDPI.

[16] Organ Procurement and Transplantation Network. April 19, 2023. A Guide to Calculating and Interpreting the Kidney Donor Profile Index (KDPI). Retrieved November 10, 2023, from https://optn.transplant.hrsa.gov/media/j34dm4mv/kdpi_guide.pdf.
[17] Kadatz M, Gill J, Gill J. Lan J, McMichael L, Chang D, Gill J (2023). The Benefits of Preemptive Transplantation Using High-Kidney Donor Profile Index Kidneys. Clinical Journal of the American Society of Nephrology. 18(5):p 634-643 doi: 10.2215/CJN.0000000000000134.

Figure 1. Non-use of deceased donor kidneys from 03/15/2021 - 03/15/2023 by KDPI



Transplant professionals use the KDPI to help make informed decisions about donor organ suitability for their candidates.[18] The KDPI serves as a tool for evaluating organ quality when deceased donor kidney offers are made but is not intended to serve as the only metric for determining donor suitability.[19] *OPTN Policy 5.3.C: Informed Consent for Kidneys Based on KDPI Greater than 85%* requires transplant programs to obtain written, informed consent from each kidney candidate willing to receive offers for kidneys in allocation Sequence D.

Race

Recently the medical field and kidney patient advocacy groups have called for the removal of race in algorithms and calculators, asserting that race is a poor proxy for human genetic variation because it is a social construct that lacks biological meaning.[20, 21] Racial identity fluctuates from person to person, making it neither discrete nor measurable when used as a variable in medicine.[22] Including race factors in medical calculations reinforces beliefs regarding the inferiority of minoritized groups and contributes to inequities and healthcare disparities.[23]

[18] Organ Procurement and Transplantation Network. September 17, 2014. The New Kidney Allocation System (KAS) Frequently Asked Questions. Retrieved November 10, 2023, from https://optn.transplant.hrsa.gov/professionals/by-topic/guidance/the-new-kidney-allocation-system-kas-frequently-asked-questions/#bookmark5.
[19] Ibid.
[20] Vyas DA, Einstein LG, Jones DS. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. The New England Journal of Medicine. 2020. 383(9): 874-882.
[21] Delgado, C., Baweja, M., Crews, D. C., Eneanya, N. D., Gadegbeku, C. A., Inker, L. A., et al.Powe, N. R. (2022, February). A unifying approach for GFR estimation: Recommendations of the NKF-ASN task force on reassessing the inclusion of race in diagnosing kidney disease. Am J Kidney Dis, 79(2), 268–288.e1. 10.1053/j.ajkd.2021.08.003.
[22] AMA J Ethics. 2022;24(3):E226-232. doi: 10.1001/amajethics.2022.226.
[23] Farouk S. (2022). Reenvisioning the Kidney Donor Risk Index without Race. Kidney News Online. 14(1) p:9-10. Retrieved November 11, 2023, from https://www.kidneynews.org/view/journals/kidney-news/14/1/kidney-news.14.issue-1.xml.

When KDRI was developed in 2009, race was often used as a proxy for genetic difference.[24] The contemporary medical understanding acknowledges that using race in KDRI and subsequently KDPI, inflates the KDPI of African American/Black donor kidneys, making them appear of lower quality.[25]

Currently, the race coefficient in the KDRI increases the hazard ratio for graft failure by 1.2 and the KDPI by up to 20%, making African American/Black donor grafts appear less suitable for transplant.[26] Kidneys that appear less suitable for transplant are more challenging to place and have a higher risk of nonuse.[27] There are eight race selections available when prompted by the KDPI calculator.[28] When all other donor characteristics remain the same, African American/Black is the only race that increases the KDPI of a deceased donor kidney.[29] In **Figure 2** two kidneys with the same KDPI calculator inputs differ only by race, with one kidney from a deceased African American/Black donor and the other as White. As a result of this coefficient, the kidney from the deceased African American/Black donor has KDPI that is 13% greater, placing it in allocation Sequence D.

[24] Rao P, Schaubel D, Guidinger MK, Andreoni KA, Wolde RA, Merion RM, Port FK, Sung RS. (2009) A Comprehensive Risk Quantification Score for Deceased Donor Kidneys: The Kidney Donor Risk Index. Transplantation, 88(2): 231–6.doi: 10.1097/TP.0b013e3181ac620b.

[25] Doshi M, Schaubel D, Xu Y, Rao P, Sung R. (2022). Clinical Utility in Adopting Race-free Kidney Donor Risk Index. Transplantation Direct. 8(7):p e1343 doi: 10.1097/TXD.0000000000001343.

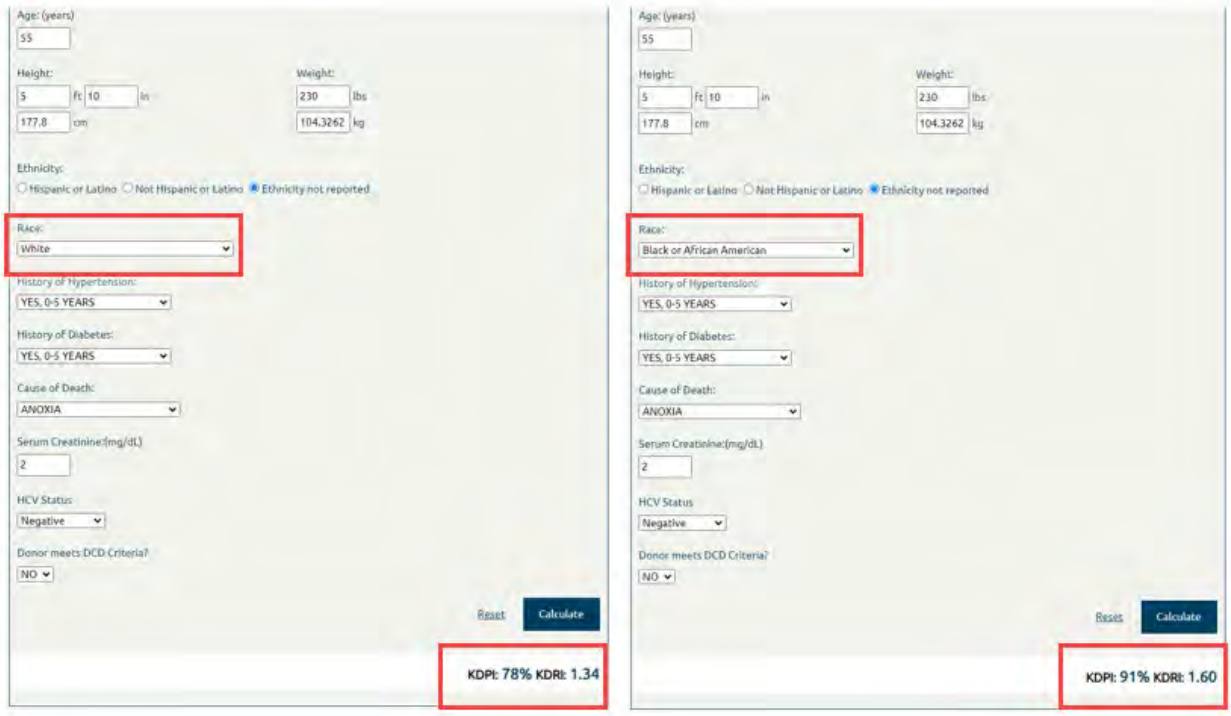
[26] Ibid.

[27] Kadatz M, Gill J, Gill J. Lan J, McMichael L, Chang D, Gill J (2023). The Benefits of Preemptive Transplantation Using High-Kidney Donor Profile Index Kidneys. Clinical Journal of the American Society of Nephrology. 18(5):p 634-643 doi: 10.2215/CJN.0000000000000134.

[28] American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Multi Racial, Race Not Reported.

[29] Organ Procurement and Transplantation Network. KDPI calculator. Retrieved November 11, 2023, from https://optn.transplant.hrsa.gov/data/allocation-calculators/kdpi-calculator/.

Figure 2. Difference in KDPI by Race



When compared the original KDRI, recalculation with the race-free KDRI results in the shift of African American/Black donor kidneys into a lower KDPI allocation sequence.[30] Excluding race from the KDPI shifts how risk is attributed to these clinical risk factors but has no impact on the calculation's predictive ability.[31] The Scientific Registry of Transplant Recipients (SRTR) also conducted a study in which the KDRI model was refitted without the race coefficient.[32] The study resulted in a decrease of Black donors in KDPI Sequence D, from 31.09% to 17.75%, which is closer to the 15.68% in Sequence D among non-Black donors. The authors note that KDPI is a zero-sum measure, so the number of Black donors moving out of the top KDPI sequence would be offset by an almost equal number of non-Black donors moving into it. Their conclusion states that medical algorithms contribute to systematic bias by overemphasizing differences between groups and recommends the removal of race from the KDPI model to improve equity.

Evidence also suggests that it is not race, but the presence of the APOL1 gene 1 and gene 2 that confers a worse kidney allograft outcome.[33] Individuals who identify as Black, African American, Afro- Caribbean and Latinx are more likely to have APOL1 gene mutations, but they are only present in 13% of African Americans in the United States. Not everyone who has two copies of APOL1 genetic mutations will get

[30] Doshi M, Schaubel D, Xu Y, Rao P, Sung R. (2022). Clinical Utility in Adopting Race-free Kidney Donor Risk Index. Transplantation Direct. 8(7):p e1343 do: 10.1097/TXD.0000000000001343.
[31] Chong K, Litvinovich I, Chen, S, Zhu, Y, Argyropoulos C, Ng Y. (2021). Reconsidering Donor Race in Predicting Allograft and Patient Survival Among Kidney Transplant Recipients. Kidney360 2(11):p 1831-1835| doi: 10.34067/KID.0002932021.
[32] Miller J, Lyden GR, McKinney WT, Snyder JJ, Israni AK. (2023). Impacts of removing race from the calculation of the kidney donor profile index. American Journal of Transplantation, 23(5):636-641. https://doi.org/10.1016/j.ajt.2022.12.016.
[33] NephCure. (2023). Understanding APOL1 Kidney Disease Among Black Americans. Retrieved on November 12, 2023, from https://nephcure.org/understanding-apol1-kidney-disease-among-black-americans/.

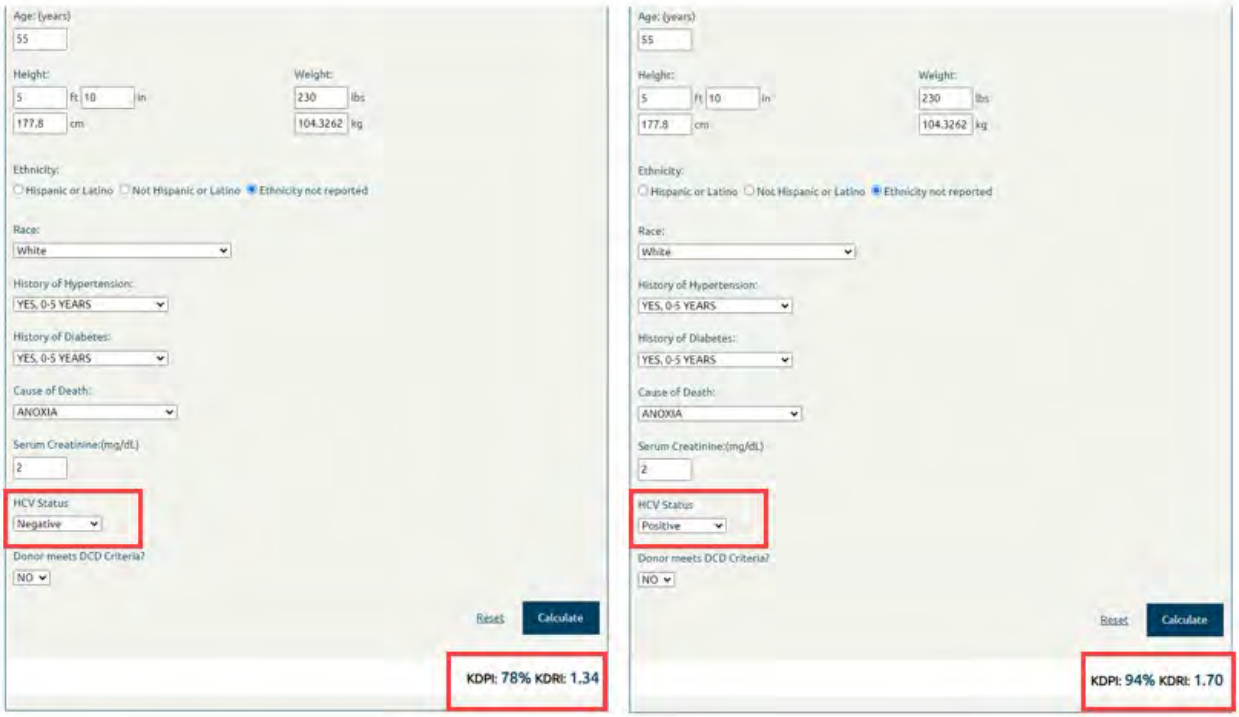
kidney disease; there is a 1 in 5 chance that an individual with two copies of APOL1 will go on to develop kidney disease.[34] The National Institutes of Health (NIH) developed the APOL1 Long-term Kidney Transplantation Outcomes (APOLLO) Consortium and began enrolling participants in 2019.[35] This study will prospectively observe the effects of renal-risk variants (RRVs) in the apolipoprotein L1 gene (APOL1) on kidney outcomes from donors with recent African ancestry and the recipients of their kidneys, after deceased- and living-donor renal transplantation.[36] The results from the APOLLO study have the potential to provide evidence for the replacement of race with APOL1 in the KDRI calculation.[37] The APOLLO study's estimated completion date is Fall 2025.[38]

HCV

Like the race coefficient, HCV positive donor kidneys are automatically designated a higher KDPI which can increase the likelihood the graft will not be used. Currently, the HCV coefficient in the KDRI calculation has a hazard ratio of 1.27 and increases the KDPI by up to 20%.[39] In **Figure 3** below two kidneys with the same KDPI calculator inputs differ only by HCV status, with one kidney from a deceased HCV negative donor and the other a deceased HCV positive donor. As a result of this coefficient, the kidney from the HCV positive donor has KDPI that is 16% greater, placing it in allocation Sequence D.

[34] NephCure. (2023). Understanding APOL1 Kidney Disease Among Black Americans. Retrieved on November 12, 2023, from https://nephcure.org/understanding-apol1-kidney-disease-among-black-americans/.
[35] NIH US Clinical Library of Medine. June 5, 2023. APOL1 Long-term Kidney Transplantation Outcomes Network (APOLLO). Retrieved on November 12, from https://classic.clinicaltrials.gov/ct2/show/NCT03615235.
[36] Ibid.
[37] Freedman BI, Moxey-Mims MM, Alexander AA, Astor BC, Birdwell KA, Bowden DW, Bowen G, Bromberg J, Craven TE, Dadhania DM, Divers J, Doshi MD, Eidbo E, Fornoni A, Gautreaux MD, Gbadegesin RA, Gee PO, Guerra G, Hsu CY, Iltis AS, Jefferson N, Julian BA, Klassen DK, Koty PP, Langefeld CD, Lentine KL, Ma L, Mannon RB, Menon MC, Mohan S, Moore JB, Murphy B, Newell KA, Odim J, Ortigosa-Goggins M, Palmer ND, Park M, Parsa A, Pastan SO, Poggio ED, Rajapakse N, Reeves-Daniel AM, Rosas SE, Russell LP, Sawinski D, Smith SC, Spainhour M, Stratta RJ, Weir MR, Reboussin DM, Kimmel PL, Brennan DC. (2019) APOL1 Long-term Kidney Transplantation Outcomes Network (APOLLO): Design and Rationale. Kidney Int Rep. 13;5(3):278-288. doi: 10.1016/j.ekir.2019.11.022.
[38] NIH US Clinical Library of Medine. June 5, 2023. APOL1 Long-term Kidney Transplantation Outcomes Network (APOLLO). Retrieved on November 12, from https://classic.clinicaltrials.gov/ct2/show/NCT03615235.
[39] Sibulesky L, Kling CE, Limaye AP, Johnson CK. Is Kidney Donor Profile Index (KDPI) Valid for Hepatitis C Aviremic Kidneys? Ann Transplant. (2017)6;22:663-664. doi: 10.12659/aot.905428.

Figure 3. Difference in KDPI by HCV Status



Including HCV positive donor kidneys as a risk factor aligns with earlier literature that suggests these grafts have inferior survival outcomes.[40] Studies completed before 2014 associated HCV positive donor kidneys and HCV infection with hepatic complications including cirrhosis and hepatocellular carcinoma (HCC) along with extrahepatic complications, including glomerulonephritis.[41, 42] Before 2014 treatments for HCV were poorly tolerated and had limited efficacy.[43]

In 2014, interferon-free direct-acting antivirals (DAAs) were approved by the FDA as treatment for HCV.[44] These drugs revolutionized HCV management as they can be taken orally, usually have few side effects, and cure more than 95% of people in 8-12 weeks.[45] When compared to HCV positive donor

[40] Abbott KC, Bucci JR, Matsumoto CS, Swanson JS, Agodoa LYC, Holtzmuller KC, Cruess DF, Peters TG. (2003) Hepatitis C and Renal Transplantation in the Era of Modern Immunosuppression. Journal of the American Society of Nephrology 14(11):p 2908-2918, doi: 10.1097/01.ASN.0000090743.43034.72 x.

[41] Kevin PH, Esther-Lee M, Ran T. (2005) Chronic Hepatitis C Virus Infection in Older Adults, Clinical Infectious Diseases, Volume 41(11):p 1606-12 Pages 1606–1612, https://doi.org/10.1086/497597.

[42] Johnson RJ, Gretch DR, Yamabe H, Hart, J, Bacchi CE, Hartwell P, Couser WG, Corey , Wener MH, Alper CE, Willson R (1993). Membranoproliferative Glomerulonephritis Associated with Hepatitis C Virus Infection. N Engl J Med 1993; 328:465-470 doi: 10.1056/NEJM199302183280703.

[43] D.A. Axelrod, M.A. Schnitzler, T. Alhamad, F. Gordon, R.D. Bloom, G.P. Hess, H. Xiao, M. Nazzal, D.L. Segev, V.R. Dharnidharka, A.S. Naik, N.N. Lam, R. Ouseph, B.L. Kasiske, C.M. Durand, K.L. Lentine. (2018). The impact of direct-acting antiviral agents on liver and kidney transplant costs and outcomes, American Journal of Transplantation, 18(10):p 2437-82. https://doi.org/10.1111/ajt.14895.

[44] Welch CM. March 10, 2020. Hepatitis C Treatment History Timeline. Retrieved on November 12, 2023, from https://www.hepmag.com/blog/hepatitis-c-treatment-history timeline#:~:text=1991%3A%20FDA%20approved%20the%20first,be%20the%20only%20treatment%20available.

[45] S. Department of Health and Human Services. November 30, 2022. Hepatitis C Basic Information. Retrieved on November 12, 2023, from https://www.hhs.gov/hepatitis/learn-about-viral-hepatitis/hepatitis-c-basics/index.html#:~:text=Effective%20Treatments%20Are%20Available%20for%20Hepatitis%20C,-New%20medication%20to&text=These%20treatments%20are%20much%20better,in%208%20to%2012%20weeks.

kidneys pre-development of DAAs, HCV positive donor kidneys from post-development of DAAs have similar 1 year patient and graft survival to HCV negative donor kidneys.[46] Since 2015, HCV positive donor kidneys transplanted into HCV negative recipients show excellent function at 12 months post-transplant.[47] In its current state, the KDRI calculation overestimates risk and underestimates quality of HCV positive deceased donor kidneys.[48, 49]

Overview of Proposal

The Committee proposes removing the aforementioned race and HCV coefficients by refitting the KDRI model and re-mapping it to KDPI.[50] The removal of race and HCV aims to improve the KDRI calculation by more accurately reflecting the quality and post-transplant survival of kidneys from deceased donors who are African American/Black or HCV positive.[51] A more accurate determination of KDPI supports candidates being matched with donor kidneys that aligns with the priority rankings outlined in OPTN Policy. To develop this proposal, the OPTN Minority Affairs Committee convened the Refit KDPI without race and HCV Workgroup (the Workgroup) which consisted of experts and stakeholders with representation from the OPTN Kidney Transplantation, Disease Transmission Advisory (DTAC), and Patient Affairs Committees (PAC) in addition to members of the National Kidney Foundation (NKF) and the American Society of Nephrology (ASN). This Workgroup developed a data request for the SRTR, reviewed results, and made the following recommendations to the OPTN Minority Affairs Committee.

Refit KDPI

The Committee proposes the KDRI calculation be refit without the race and HCV donor characteristics.[52]

The Committee considered three options:

- Refit the KDRI model without race and HCV
- Zero out race and HCV in the KDRI model
- Replace race in KDRI model with APOL1

Refitting KDRI without race or HCV involves removing these two coefficients and recalculating the model as though they were never included. When the model is refit, the weights of the eight remaining donor characteristics will shift to account for the absence of race and HCV. This reweighting of donor characteristics may help mediate the effects of confounding variables and will show the true weight of

[46] Cannon RM, Locke JE, Orandi BJ, Anderson DJ, Davis EG, Mackelaite L, Dave H, Eng M, Jones CM. (2020). Impact of Donor Hepatitis C Virus on Kidney Transplant Outcomes for Hepatitis C-positive Recipients in the Direct-acting Antiviral Era: Time to Revise the Kidney Donor Risk Index? Transplantation. 104(6):1215-28. doi: 10.1097/TP.0000000000002949.

[47] Potluri VS, Goldberg DS, Mohan S, Bloom RD, Sawinski D, Abt PL, Blumberg EA, Parikh CR, Sharpe J, Reddy KR, Molnar MZ, Sise M, Reese PP. (2019). National Trends in Utilization and 1-Year Outcomes with Transplantation of HCV-Viremic Kidneys. J Am Soc Nephrol.(10):1939-51. doi: 10.1681/ASN.2019050462.

[48] Cannon RM, Locke JE, Orandi BJ, Anderson DJ, Davis EG, Mackelaite L, Dave H, Eng M, Jones CM. (2020). Impact of Donor Hepatitis C Virus on Kidney Transplant Outcomes for Hepatitis C-positive Recipients in the Direct-acting Antiviral Era: Time to Revise the Kidney Donor Risk Index? Transplantation. 104(6):1215-28. doi: 10.1097/TP.0000000000002949.

[49] Potluri VS, Goldberg DS, Mohan S, Bloom RD, Sawinski D, Abt PL, Blumberg EA, Parikh CR, Sharpe J, Reddy KR, Molnar MZ, Sise M, Reese PP. (2019). National Trends in Utilization and 1-Year Outcomes with Transplantation of HCV-Viremic Kidneys. J Am Soc Nephrol.(10):1939-51. doi: 10.1681/ASN.2019050462.

[50] See OPTN Minority Affairs Committee meeting summary. September 18, 2023. https://optn.transplant.hrsa.gov/media/wogcgpiq/20230918_mac_summary.pdf.

[51] Ibid.

[52] Ibid.

each donor characteristic and its relation to others in the KDRI calculation. The Committee also considered using the "zero out" method to remove race. Removing race and HCV coefficients from the KDRI calculation with the "zero out" method involves changing the hazard ratios associated with race and HCV status to zero but keeping all ten variables in the model, with their hazard ratios unchanged.

The Committee briefly discussed the possibility of replacing the race variable in the KDRI model with APOL1.[53] While the results of the APOL1 Long-term Kidney Transplantation Outcomes (APOLLO) Consortium have potential to provide evidence for the replacement of race with APOL1, the completion of the study is not expected until Fall 2025.[54] The Committee determined that currently there is not enough evidence regarding APOL1's efficacy to include it in this policy, but expressed interest in reassessing it as an option when additional data is available.[55]

The Committee discussed that while some of the reviewed literature used the "zero out" method, a refit of the model, which would account for confounding variables, would be the most thorough of the three options.[56] Additionally, supporting literature by Miller et al. used SRTR data to recalculate KDRI without race using the refit method demonstrating that the option the Committee found to be the most comprehensive was also feasible from a modeling perspective.[57]

Impact of Removing Race and HCV on KDPI Calculation

In the early stages of the project, the Committee sought to understand what, if any greater impact refitting the model without race and HCV variables would have on the KDPI calculation. Before proceeding the Committee confirmed that their proposed changes would not alter the scale of KDRI or KDPI. This means that KDRI will still map to 100% and the number of donors in each KDPI sequence will be roughly the same, but which donors are in each KDPI sequence will change. For example, the number of donors moving to KDPI < 85% would be offset by an almost equal number of donors moving to KDPI > 85%. The result of this policy will not impact the overall meaning of KDPI percentages. A kidney with a KDPI of 86% today reflects that the kidney has a worse estimated graft survival than 86% kidneys recovered from the previous year's donors and this will not change with this update.

SRTR KDPI Modeling Data Request

The Workgroup requested the SRTR recalculate the coefficients used to calculate KDPI, excluding the Black race and HCV positive donor variables, using an updated cohort of transplants.[58] The Workgroup's request to the SRTR was grouped into three categories: cohort, change in coefficients, and donor movement between KDPI sequences (**Table 1**).

[53] See OPTN Minority Affairs Committee meeting summary. February 27, 2023. https://optn.transplant.hrsa.gov/media/13pkeofk/20230227_mac_summary.pdf.
[54] NIH US Clinical Library of Medine. June 5, 2023. APOL1 Long-term Kidney Transplantation Outcomes Network (APOLLO). Retrieved on November 12, from https://classic.clinicaltrials.gov/ct2/show/NCT03615235.
[55] See OPTN Minority Affairs Committee meeting summary. February 27, 2023. https://optn.transplant.hrsa.gov/media/13pkeofk/20230227_mac_summary.pdf.
[56] Ibid.
[57] Miller J, Lyden GR, McKinney WT, Snyder JJ, Israni AK. (2023). Impacts of removing race from the calculation of the kidney donor profile index. American Journal of Transplantation, 23(5):636-641. https://doi.org/10.1016/j.ajt.2022.12.016.
[58] See Refit KDPI without Race and HCV Workgroup summary. July 27, 2023. https://optn.transplant.hrsa.gov/media/tcml4nuq/20230727_kdpi_summary.pdf.

Table 1. Summary of SRTR KDPI Modeling Data Request

Cohort	Change in Coefficients	Donor movement between KDPI sequences
• **Cohort dates** • **Cohort size** • **Donor and recipient demographics**	• **New coefficients** • **Coefficients with biggest change** • **Most heavily weighted coefficient** • **Model fit and summary statistics**	• **General demographics of each KDPI sequence for refit KDPI and original KDPI** • **Average change in KDPI per donor** • **Total number or percent of people moving between KDPI sequences**

Cohort

The Workgroup requested the SRTR identify the cohort of transplants used for calculating the updated KDRI coefficients. Specifically, the Committee requested information interested in cohort dates, size, and donor and recipient demographics. The Committee suggested the SRTR might consider the innovation and increased availability of HCV treatment in 2017 when selecting the cohort.[59]

Change in coefficients

The Workgroup requested the SRTR analysis include the weight shift for the remaining donor characteristics when the KDRI model is refit without race and HCV.[60] The Workgroup posed questions regarding which coefficients displayed the biggest change and are the most heavily weighted. The Committee also asked for model fit and summary statistics.

Donor movement between KDPI sequences

The Workgroup requested the SRTR analysis include the donor movement between KDPI sequences. This includes general demographics of each KDPI sequence for the refit KDPI and the original KDPI, average change in KDPI per donor, and the total number or percent of donors moving between KDPI sequences. The Committee had particular interest in donor movement in the top two KDPI sequences given n increased risk of graft non-use for donor kidneys with KDPI > 85%.[61]

[59] See Refit KDPI without Race and HCV Workgroup summary. July 27, 2023. https://optn.transplant.hrsa.gov/media/tcml4nuq/20230727_kdpi_summary.pdf.
[60] Ibid.
[61] Ibid.

SRTR KDPI Modeling Data Results

Cohorts

Using exclusion criteria similar to the original (Rao 2009) analysis, this updated KDRI model was fit on adult, deceased donor, kidney alone, first transplants from January 1, 2018, to December 31, 2021, and applying the additional exclusion criteria from the original analysis. The model fit cohort was chosen to only include the era after HCV+ donor to HCV– recipient transplants became more common. Therefore, the cohort window is only 4 years, compared to the 11-year window in the original analysis. A sensitivity analysis was conducted calculating model coefficients and global model fit statistics on a 10-year cohort to ensure that coefficient inferences were not substantially changed.

Table 2 displays the model fitting cohort which included 50,769 kidney transplants between January 1, 2018, and December 31, 2021. The mean donor age among these transplants was 40.06 years, 13.44% of donors were Black and 10.72% of donors were HCV positive (either antibody, NAT, or both).

Table 2. Model Fitting Cohort Characteristics

Variable	
n	50769
Dates	2018-01-01 to 2021-12-31
Donor Age (years): mean (sd)	40.06 (14.89)
Donor Race: n (%)	
Asian	1281 (2.52%)
Black	6824 (13.44%)
Hawaiian/Pacific Islander	137 (0.27%)
Native	396 (0.78%)
White	41904 (82.54%)
Multiracial	227 (0.45%)
Donor HCV Status: n (%)	
Positive: NAT and Antibody	3206 (6.31%)
Positive: NAT Only	103 (0.2%)
Positive: Antibody Only	2139 (4.21%)
Not Positive	45321 (89.27%)
Recipient Age (years): mean (sd)	54 (13.24)
Recipient HCV: n (%)	1904 (3.75%)
Recipient Race: n (%)	
Asian	4053 (7.98%)
Black	17830 (35.12%)
Hawaiian/Pacific Islander	288 (0.57%)
Native	484 (0.95%)
White	27658 (54.48%)
Multiracial	456 (0.9%)

Global Model Fit

Global model fit was calculated using discrimination (concordance, also known as the C-statistic) and calibration (Brier score). Discrimination describes what percent of the time that a patient is compared that had graft failure to one that didn't, would the patient with graft failure have a higher risk estimate from the model. A C- statistic of 1 means that the model correctly classifieds outcomes 100% of the time, while .5 means the model correctly classifieds outcomes 50% of the time. Calibration describes if the model is used to estimate or predict when a certain patient would have graft failure, how far is that estimate from when the patient actually had graft failure.

Global model fit results showed that concordance and Brier scores do not change substantially in either the HCV era cohort (transplants from 2018 through 2021) or the 11-year cohort (transplants from 2011 through 2021). Model concordance for HCV positive donors, which is particularly poor in the 11-year cohort, is substantially improved when using the 2018 through 2021 HCV era cohort. Among African American/Black donors, the concordance is lower in the HCV era cohort than in the 11-year cohort, but this difference is small when compared to the improvement in concordance among HCV positive donors in moving from the 11-year to the HCV era cohort. The Committee and the SRTR agreed that when comparing the two cohorts, a greater concordance in the HCV era supported using this cohort for estimating updated KDRI coefficients. They also discussed that in the HCV cohort overall, internal concordance was about 0.6 and did not change substantially when race and HCV status variables were removed from the model fitting.

Change in Coefficients

When recalculating the original KDRI models on the HCV era cohort (transplants from 2018 through 2021), the donor Black race coefficient was only slightly lower. Donor HCV positive status coefficient was substantially lower and became slightly protective (had a negative coefficient) but was not statistically significant. This non-significance of HCV status can be attributed to the change in treatment of recipients of HCV positive kidneys. When the donor Black race and donor HCV status variables were removed, only the two HLA DR mismatch coefficient changed more than 10% (making a change from 0.0103 to 0.0139). All coefficients for donor specific variables that would be used in the calculation of allocation KDRI changed less than 10%.

Table 3 displays the variables retained in the final model, compared to the original coefficients calculated by Rao (2009), donor diabetes status and donor DCD status were notably stronger in the HCV era (2018 through 2021) cohort. The donor diabetes status and donor DCD status coefficients were not as strong in the updated 11-year cohort (2011 through 2021).

Table 3. Original and updated KDRI coefficients

Variable	Original Coefficients	Recreation of Original Coefficients	Recreation without Race and HCV Variables	Percent Change without Race and HCV
Donor Age Less than 18 spline	-0.0194	0.0125	0.0113	-9.68
Donor Age	0.0128	0.0097	0.0092	-5.41
Donor Age greater than 50 spline	0.0107	0.0063	0.0067	5.87
Donor Black Race	0.1794	0.1534		
Donor Creatinine	0.2198	0.1962	0.2128	8.43
Donor Creatinine greater than 1.5 spline	-0.2093	-0.2027	-0.2199	8.48
Donor Hypertension	0.1262	0.1017	0.1106	8.82
Donor Diabetes	0.1301	0.2528	0.2577	1.91
Cause of Donor Death: Stroke	0.0881	0.0685	0.0743	8.53
Donor Height	-0.0464	-0.0571	-0.0557	-2.37
Donor Weight less than 80 spline	-0.0199	-0.0332	-0.0333	0.35
Donation after Cardiac Death	0.1329	0.2022	0.1966	-2.77
Donor HCV Positive	0.2403	-0.0405		
Zero HLA-B mismatches	-0.0766	-0.0693	-0.0759	9.43
One HLA-B mismatch	-0.0610	-0.0543	-0.0542	-0.19
Zero HLA-DR mismatches	-0.1300	-0.0683	-0.0698	2.14
Two HLA-DR mismatches	0.0765	0.0103	0.0139	33.96
Cold Ischemia Time	0.0055	0.0094	0.0093	-0.53
Enbloc Transplant	-0.3640	-0.1915	-0.1925	0.53
Double Kidney Transplant	-0.1480	-0.2338	-0.2208	-5.56

Donor movement between KDPI sequences

Table 4 shows that among Black donors, the probability of being classified as KDPI < 20 increased notably and the probability of being classified as KDPI > 85 decreased notably when the Black race and HCV variables were removed from the model. Among HCV positive donors, there were notable decreases in the probability of being classified as KDPI < 20 when the Black race and HCV variables were removed from the model.

The Committee discussed that movement of African American/Black donors out of the KDPI >85 group into lower KDPI groups was an expected result that reflects the over- representation of African

American/Black and HCV positive deceased donor kidneys in high KDPI sequences. When looking at the results for HCV positive donors, the Committee discussed the movement of HCV positive kidneys from the KDPI <20 group into higher sequences reflects what happens when HCV is included in the model with a more recent cohort and then removed.

Overall, the results of the data request found that coefficients from an updated KDRI model refit on transplants from 2018 through 2021 and removing the donor HCV status and donor Black race variables resulted in more racially equitable KDPI distributions. Based on review of these results, the Committee confirmed the presented evidence provided substantial rationale to move forward with this proposal to refit KDPI without race or HCV.

Table 4. Donor characteristics by KDPI sequence for the original coefficients and fit without race.

Variable	Recreation of Original Coefficients: Mean KDRI	Recreation without Race and HCV Variables: Mean KDRI	Recreation of Original Coefficients, KDPI <= 20: n (%)	Recreation without Race and HCV Variables, KDPI <= 20: n (%)	Recreation of Original Coefficients, KDPI 21 to 35: n (%)	Recreation without Race and HCV Variables, KDPI 21 to 35: n (%)	Recreation of Original Coefficient, KDPI 36 to 85: n (%)	Recreation without Race and HCV Variables, KDPI 36 to 85: n (%)	Recreation of Original Coefficients, KDPI > 85: n (%)	Recreation without Race and HCV Variables, KDPI > 85: n (%)
Overall	1.325393	1.303475	8451 (18.31%)	8451 (18.31%)	6606 (14.31%)	6598 (14.29%)	23484 (50.88%)	23445 (50.79%)	7618 (16.5%)	7665 (16.61%)
Race										
Black Donor	1.494399	1.296553	448 (6.58%)	1455 (21.36%)	907 (13.32%)	949 (13.93%)	3501 (51.4%)	3205 (47.06%)	1955 (28.7%)	1202 (17.65%)
Non-Black Donor	1.296139	1.304673	8003 (20.34%)	6996 (17.78%)	5699 (14.48%)	5649 (14.36%)	19983 (50.79%)	20240 (51.44%)	5663 (14.39%)	6463 (16.43%)
HCV Status										
HCV NAT and Antibody Donor	1.169778	1.202222	735 (27.27%)	481 (17.85%)	601 (22.3%)	606 (22.49%)	1160 (43.04%)	1390 (51.58%)	199 (7.38%)	218 (8.09%)
HCV NAT Only Donor	1.112407	1.144338	34 (36.96%)	25 (27.17%)	17 (18.48%)	18 (19.57%)	37 (40.22%)	45 (48.91%)	4 (4.35%)	4 (4.35%)
HCV Antibody Only Donor	1.311541	1.297358	262 (14.2%)	239 (12.95%)	330 (17.89%)	314 (17.02%)	994 (53.88%)	1024 (55.5%)	259 (14.04%)	268 (14.53%)
HCV Not Positive	1.336580	1.310671	7420 (17.87%)	7706 (18.56%)	5658 (13.62%)	5660 (13.63%)	21293 (51.28%)	20986 (50.54%)	7156 (17.23%)	7175 (17.28%)

NOTA and Final Rule Analysis

The Committee submits this proposal for consideration under the authority of the National Organ Transplant Act of 1984 (NOTA) and the OPTN Final Rule. NOTA requires the Organ Procurement and Transplantation Network (OPTN) to "establish…medical criteria for allocating organs and provide to members of the public an opportunity to comment with respect to such criteria."[62] The OPTN Final Rule states the OPTN "shall be responsible for developing…policies for the equitable allocation for cadaveric organs."[63] The proposal to refit KDPI without race or HCV affects allocation in that a more accurate reflection of the quality and

[62] 42 USC §274(b)(2)(B).
[63] 42 CFR §121.4(a)(1).

post-transplant survival of kidneys from deceased donors who are African American/Black or HCV positive may impact which candidates receive the offers of these kidneys. If the KDPI of these donor kidneys is more accurate, candidates are more likely to get the kidney that best aligns with their priority ranking.

The Final Rule requires that when developing policies for the equitable allocation of cadaveric organs, such policies must be developed "in accordance with §121.8," which requires that allocation policies "(1) Shall be based on sound medical judgment; (2) Shall seek to achieve the best use of donated organs; (3) Shall preserve the ability of a transplant program to decline an offer of an organ or not to use the organ for the potential recipient in accordance with §121.7(b)(4)(d) and (e); (4) Shall be specific for each organ type or combination of organ types to be transplanted into a transplant candidate; (5) Shall be designed to avoid wasting organs, to avoid futile transplants, to promote patient access to transplantation, and to promote the efficient management of organ placement;…(8) Shall not be based on the candidate's place of residence or place of listing, except to the extent required by paragraphs (a)(1)-(5) of this section."[64] This proposal:

- **Is based on sound medical judgment[65]** because it is an evidence- based change relying on the following evidence:
    - Data showing the high efficacy of DAAs as treatment for HCV [66]
    - Literature showing that KDPI overestimates risk and underestimates quality of HCV positive deceased donor kidneys [67, 68]
    - Published literature showing that race should not be used in clinical decision making because it is not a proxy for genetic difference[69]
    - Literature showing that the APOL1 gene, not African American/Black race, had an increased risk of graft failure[70]
    - Modeling and analysis estimating that a refit of KDPI without race of HCV donor characteristics would result in more racially equitable KDPI distributions
- **Seeks to achieve the best use of donated organs[71]** by ensuring organs are allocated and transplanted according to medical urgency.
    - This proposal intends to increase the accuracy of KDPI for African American/Black and HCV positive deceased donors. Deceased donor kidneys that were previously mischaracterized with a higher KDPI due to these donor factors, will have a lower KDPI that is more reflective of their quality, post-transplant survival, and suitability for

[64] 42 CFR §121.8(a).
[65] 42 CFR §121.8(a)(1).
[66] Welch CM. March 10, 2020. Hepatitis C Treatment History Timeline. Retrieved on November 12, 2023, from https://www.hepmag.com/blog/hepatitis-c-treatment-history timeline#:~:text=1991%3A%20FDA%20approved%20the%20first,be%20the%20only%20treatment%20available.
[67] Cannon RM, Locke JE, Orandi BJ, Anderson DJ, Davis EG, Mackelaite L, Dave H, Eng M, Jones CM. (2020). Impact of Donor Hepatitis C Virus on Kidney Transplant Outcomes for Hepatitis C-positive Recipients in the Direct-acting Antiviral Era: Time to Revise the Kidney Donor Risk Index? Transplantation. 104(6):1215-28. doi: 10.1097/TP.0000000000002949.
[68] Potluri VS, Goldberg DS, Mohan S, Bloom RD, Sawinski D, Abt PL, Blumberg EA, Parikh CR, Sharpe J, Reddy KR, Molnar MZ, Sise M, Reese PP. (2019). National Trends in Utilization and 1-Year Outcomes with Transplantation of HCV-Viremic Kidneys. J Am Soc Nephrol.(10):1939-51. doi: 10.1681/ASN.2019050462.
[69] Vyas DA, Einstein LG, Jones DS. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. The New England Journal of Medicine. 2020. 383(9): 874-882.
[70] NephCure. (2023). Understanding APOL1 Kidney Disease Among Black Americans. Retrieved on November 12, 2023, from https://nephcure.org/understanding-apol1-kidney-disease-among-black-americans/.
[71] 42 CFR §121.8(a)(2)

transplant. As such, these kidneys may be offered to candidates with higher priority rankings, which aligns with the best use of a donated organ.

- **Is designed to…promote patient access to transplantation[72] by** giving similarly situated candidates' equitable opportunities to receive an organ offer
    - Due to HLA matching, African American/Black donor kidneys are more likely to match with African American/Black recipients. Decreases in the KDPI of African American/Black donor kidneys could result in more of the lower KDPI donor kidneys being available for African American/Black candidates. These lower KDPI donors kidneys may have a greater chance of being accepted by transplant programs for their African American/Black candidates and contribute to a decrease in the waiting time disparity.[73]

Although the proposal outlined in this briefing paper addresses certain aspects of the Final Rule listed above, the Committee does not expect impacts on the following aspects of the Final Rule:

- Shall be designed to avoid wasting organs, to avoid futile transplants, promote the efficient management of organ placement
- This proposal is not based on the candidate's place of residence or place of listing

Implementation Considerations

Member and OPTN Operations

This proposal would impact transplant hospitals, Organ Procurement Organizations, and the OPTN but would not impact histocompatibility laboratories.

Operations affecting the OPTN

The OPTN would need to update the OPTN Computer System with the refit KDPI calculator so that appropriate values display in the OPTN Donor Data and Matching System and the OPTN Waiting List.

Operations affecting Organ Procurement Organizations

While no action is required by OPOs, members would need to be aware of the changes to the KDPI calculator.

Operations affecting Transplant Hospitals

While no action is required by transplant hospitals, members would need to be aware of the changes to the KDPI calculator.

Operations affecting Histocompatibility Laboratories

This proposal is not anticipated to affect the operations of histocompatibility laboratories.

[72] 42 CFR §121.8(a)(2).
[73] Miller J, Lyden GR, McKinney WT, Snyder JJ, Israni AK. (2023). Impacts of removing race from the calculation of the kidney donor profile index. American Journal of Transplantation, 23(5):636-641. https://doi.org/10.1016/j.ajt.2022.12.016.

Potential Impact on Select Patient Populations

This proposal has the potential to impact minority candidates. Those who identify as African American/Black make up 13% of the national population, but about 30% of the national waiting list. Since African American/Black patients are more likely to receive kidneys from African American/Black donors, removal of the race coefficient from KDRI could help to decrease the waiting time disparity for African American/Black candidates and non-use of organs from African American/Black deceased donors. The zero-sum nature of this policy change means that the number of donors moving between allocation sequence groups will be equal. For example, the number of African American/Black donors moving to KDPI < 85% would be offset by an almost equal number of non-African American/Black donors moving to KDPI > 85%. After implementation, there could be an increase of African American/Black kidney candidates transplanted and conversely, a decrease of non-African American/Black candidates transplanted. Since non-use may be impacted by many factors besides KDPI, and the degree to which each factor contributes to non-use is not well defined, the Committee was not able to estimate exactly how transplant rates may change based on race. During development, the Committee considered this an expected outcome, as the intent of this policy is to increase equity in access to transplant.

Projected Fiscal Impact

Projected Impact on Histocompatibility Laboratories

This proposal is not anticipated to have any fiscal impact on histocompatibility laboratories.

Projected Impact on Organ Procurement Organizations

This proposal is not anticipated to have any fiscal impact on OPOs.

Projected Impact on Transplant Hospitals

This proposal is not anticipated to have a fiscal impact on transplant hospitals.

Projected Impact on the OPTN

The OPTN contractor estimates that 2,295 hours would be needed to implement this proposal. Implementation would involve updates to the OPTN Computer System to refit the KDRI calculation without race or HCV and the KDPI calculation. Additionally, cross-department work on implementations, training, communication with members and the public. The refitted calculations would update to the appropriate values in the OPTN Donor Data and Matching System and the OPTN Waiting List. The OPTN contractor estimates 115 hours for ongoing support. Ongoing support includes post-implementation evaluation and answering member questions.

Post-implementation Monitoring

Member Compliance

The Final Rule requires that allocation policies “include appropriate procedures to promote and review compliance including, to the extent appropriate, prospective, and retrospective reviews of each transplant program's application of the policies to patients listed or proposed to be listed at the

program."[74]

This proposal will not change the current routine monitoring of OPTN members. The OPTN may review any data entered in the OPTN Computer System, and members must provide documentation as requested.

Policy Evaluation

The OPTN Minority Affairs Committee considers the non-use of kidneys and transplant rates the key metrics to assess the outcome of the proposed change to KDPI. Metrics will be compared pre- to post-implementation.

Metrics to be evaluated include:

- Demographics within each KDPI sequence, including race/ethnicity and HCV status
- Demographics of transplanted candidates, including race/ethnicity and HCV status
- Transplant rates by KDPI sequence, race/ethnicity, and HCV status
- Non-use of kidneys by KDPI sequence, race/ethnicity, and HCV status
- Delayed graft function by KDPI sequence
- Survival by KDPI sequence

These metrics will be reviewed at approximately six months, one year, and two years post-implementation. The transplant rates and survival will be provided only at one- and two-years post-implementation to allow for sufficient follow-up time.

Conclusion

The Committee confirms that modeling results from the SRTR, supplemented by peer-reviewed literature provide rational to refit the KDRI calculation without race and HCV donor characteristics. Removing these donor characteristics by refitting the KDRI and subsequently KDPI model aim to better reflect the likelihood of graft failure for kidneys from African American/Black and HCV positive donors.

Considerations for the Community

The Committee welcomes all comments on this proposal, but seek specific feedback on the following:

- Do community members support the Committee's proposal to refit the KDPI model rather than using the "zero out" method or APOL1 testing?
- Do transplant professionals believe this policy change will impact acceptance behavior when using KDPI to assess deceased donor kidneys for transplant?
- Do patients and donor families support the proposed solution?
- Do community members have feedback on the SRTR modeling results related to the updated cohort, change in coefficients, or donor movement between KDPI sequences?

[74] 42 CFR §121.8(a)(7).

Policy Language

Proposed new language is underlined (example) and language that is proposed for removal is struck through (~~example~~). Heading numbers, table and figure captions, and cross-references affected by the numbering of these policies will be updated as necessary.

8.4.B: Deceased Donor Classifications

Kidneys from deceased donors are classified according to the Kidney Donor Profile Index (KDPI). The KDPI score is derived directly from the Kidney Donor Risk Index (KDRI) score. The KDPI is the percentage of donors in the reference population that have a KDRI less than or equal to this donor's KDRI.

The donor characteristics used to calculate KDRI are provided in *Table 8-5* below.

Table 8-5: KDRI Factors

This deceased donor characteristic:	Applies to:	KDRI score component:
Age (integer years)	All donors	~~0.0128~~ 0.0092*(age-40)
	Donors with age < 18	~~-0.0194~~ 0.0113*(age-18)
	Donors with age > 50	~~0.0107~~ 0.0067*(age-50)
~~Race~~	~~African American donors~~	~~0.1790~~
Creatinine (mg/dL)	All donors	~~0.2200~~ 0.2128*(creatinine - 1)
	Donors with creatinine > 1.5	~~-0.2090~~ -0.2199*(creatinine -1.5)
History of Hypertension	Hypertensive donors	~~0.1260~~ 0.1106
History of Diabetes	Diabetic donors	~~0.1300~~ 0.2577
Cause of Death	Donors with cerebrovascular accident as cause of death	~~0.0881~~ 0.0743
Height (cm)	All donors	~~-0.0464~~ 0.0557*(height -170) / 10
Weight (kg)	All donors with weight < 80 kg	~~-0.0199~~ -0.0333*(weight - 80) / 5
Donor type	DCD donors	~~0.1330~~ 0.1966
~~HCV status~~	~~HCV positive donors~~	~~0.2400~~

To calculate KDRI, follow these steps:

1. Sum each of the applicable KDRI score components in *Table 8-5*
2. Apply the antilog (base e) function to this sum
3. Divide the KDRI by the median KDRI value of the most recent donor reference population
4. Determine the KDPI using the OPTN's KDRI-to-KDPI mapping table

The KDPI score is rounded to the nearest integer.

The KDPI used for allocation is based on the most recent values of donor characteristics reported to the OPTN before executing a match run.

The reference population used to determine the KDRI-to-KDPI mapping is reviewed annually by the Kidney Transplantation Committee and updated by the OPTN on or before June 1 of each calendar year.

#

Appendix A: Original and updated KDRI Coefficients, Miller et al.

Variable	Original coefficients	Closest recreation of original coefficients	Closest recreation without race variable	Coefficient percent change when removing race variable (%)
Donor age <18 spline	−0.019	−0.018	−0.019	4.68
Donor age	0.013	0.012	0.011	−4.97
Donor age >50 spline	0.011	0.012	0.012	−1.26
Donor Black race	0.179	0.201	NA	100
Donor creatinine	0.220	0.197	0.218	11.12
Donor creatinine >1.5 spline	−0.209	−0.200	−0.223	11.02
Donor hypertension	0.126	0.137	0.150	8.99
Donor diabetes	0.130	0.154	0.150	−1.98
Cause of donor death: stroke	0.088	0.090	0.096	7.32
Donor height	−0.046	−0.048	−0.047	−1.50
Donor weight <80 spline	−0.020	−0.021	−0.021	−0.94%
Donation after cardiac death	0.133	0.117	0.105	−9.88
Donor anti-HCV antigens	0.240	0.247	0.243	−1.75
Zero HLA-B mismatches	−0.077	−0.092	−0.096	4.58
One HLA-B mismatch	−0.061	−0.052	−0.051	−3.54
Zero HLA-DR mismatches	−0.130	−0.146	−0.147	0.79
Two HLA-DR mismatches	0.076	0.048	0.048	1.05
Cold ischemia time	0.005	0.004	0.004	−0.95
En bloc transplant	−0.364	−0.369	−0.363	−1.45
Double kidney transplant	−0.148	−0.161	−0.159	−1.00

HCV, hepatitis C virus; HLA, human leukocyte antigen.