The current status and future of HIV D+/R+ heart and lung transplantation

Vagish Hemmige
Professor, Albert Einstein College of Medicine
Staff Physician, Division of Infectious Diseases, Montefiore Medical Center
2025-10-9

Montefiore
DOING MORE℠

Disclosures

- Research funding from Merck to study pneumococcal vaccine response in LVAD recipients

Overview

- Overview of end stage organ disease and transplantation in people with HIV
- HIV D-/R+ heart transplantation
- HIV D-/R+ lung transplantation
- Overview of HIV D+/R+ transplantation
- HIV D+/R+ heart transplantation
- HIV D+/R+ lung transplantation

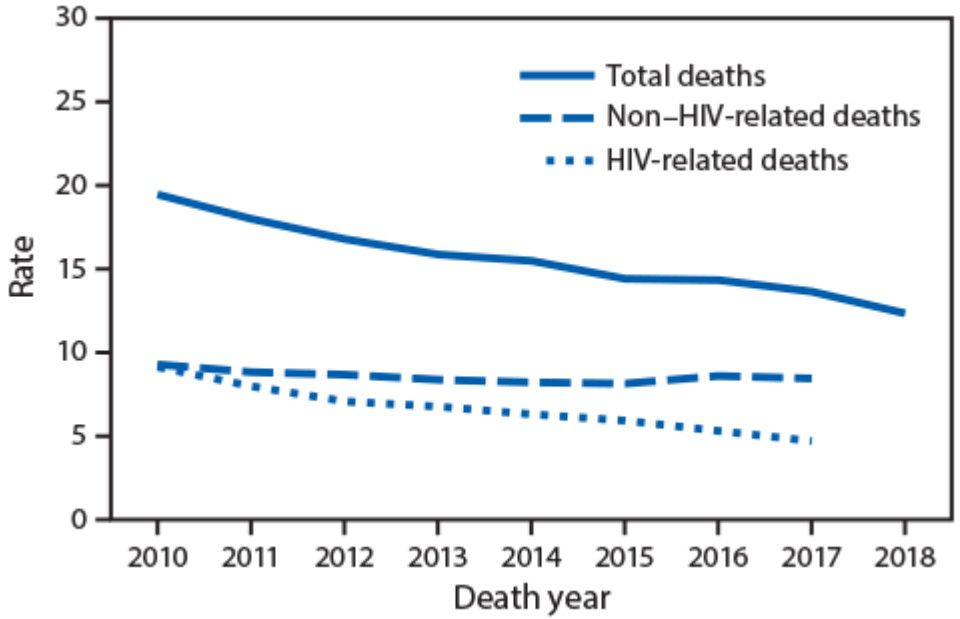
Objectives

- Review outcomes to date in thoracic transplants with HIV from donors with and without HIV
- Discussed the "nuts-and-bolts" steps of implementing a HIV D+/R+ transplant program, from approvals to establishing a protocol
- Identify potential barriers to HIV D+/R+ thoracic transplantation

OVERVIEW OF HIV D-/R+ TRANSPLANT

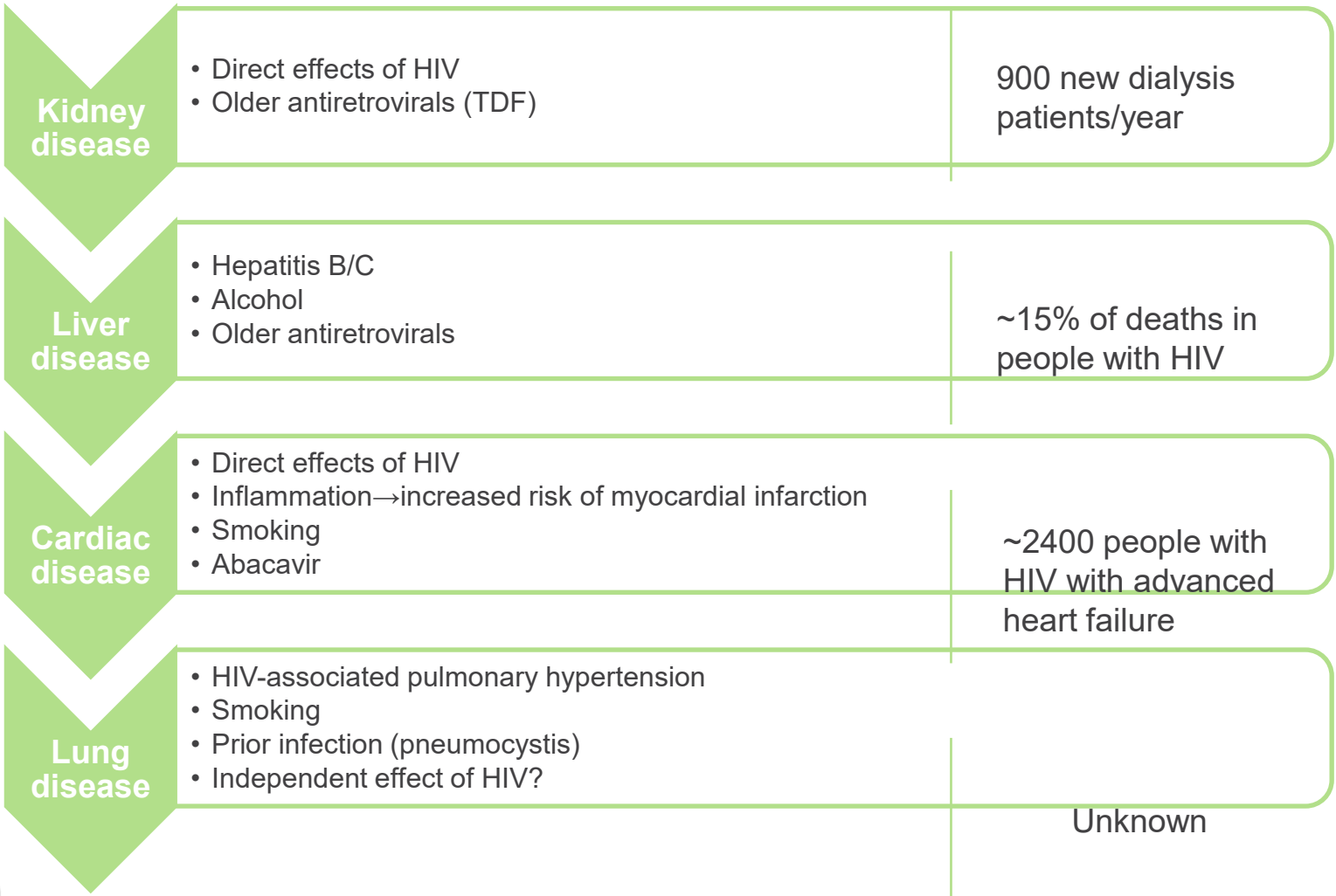
Introduction

- Antiretrovirals have transformed HIV into a chronic disease
- In the modern era, the majority of people living with HIV die from non-HIV comorbidities



MMWR Morb Mortal Wkly Rep 2020;69:1717–1724.

HIV is a risk factor for end-organ disease



J Heart Lung Transplant. 2014 Sep;33(9):924-30.
Clin J Am Soc Nephrol. 2017 Mar 7; 12(3): 467–475.
Arch Intern Med. 2006 Aug;166(15):1632-41.

HIV and end-organ disease

- People with HIV are *more* likely to die once they develop end organ disease

- They are *less* likely to be:
  - Referred to a transplant center by their providers
  - Listed for transplant once referred
  - Transplanted once listed

Clin J Am Soc Nephrol. 2017 Mar 7;12(3):467-475.

Early experience with HIV and transplant

- Studies in the early 2000s demonstrated that people living with HIV with suppressed viral loads could safely receive kidney and liver transplants under select conditions:
  - CD4 count 200+ cells/µL for kidney, 100+ cells/µL for liver
  - Viral load under 75 copies/mL (except for “blips”). Note: this requirement can be waived under appropriate circumstances.
  - No history of opportunistic infection for which prophylaxis does not exist (e.g. PML)

Transplantation. 2003 Jul 27;76(2):370-5.
N Engl J Med. 2010 Nov 18; 363(21): 2004–2014.

Early experience with HIV and transplant

Early challenges

- ***Ritonavir*** and ***cobicistat*** interact strongly with transplant medications
- Providers did not provide enough ***immunosuppression***, leading to rejection and transplanted organ failure
- Patients with HIV and ***hepatitis C*** demonstrated poorer survival after transplant

Changes in management

- Use of ***modern integrase inhibitors*** to avoid boosting agents
- More comfort with immunosuppression
- ***Better treatment*** for hepatitis C

Clin Microbiol Rev. 2024 Mar 14;37(1):e0011122.

Evaluation of the pre-transplant PLWH for transplant candidacy

- Patient should be on a stable regimen. Note: patients have undergone liver transplant with this requirement waived due to the predicted ability to obtain viral suppression post-transplant
- Traditionally, CD4+ lymphocyte count should be over 200 cells/µL.
  - Acute illness can suppress CD4+ lymphocyte count, and measurements taken in the setting of acute illness should be evaluated with caution.
  - Some centers have waived this requirement
- Viral suppression prior to transplant
  - Modern assays can quantify viral loads as low as 20 copies/mL, but a viral load in the 20-50 range is of no consequence for transplant if the patient is adherent
  - Patients may experience non-sequential transient “viral blips” in the 50-200 range; the test merely needs to be repeated
- HIV/ID specialist should review regimen. Integrase regimen preferred to avoid drug interactions
- Previous opportunistic infection is not necessarily a contraindication, but should prompt an evaluation of the need to revise the post-transplant prophylaxis strategy

Clin Microbiol Rev. 2024 Mar 14;37(1):e0011122.

Contraindications

- Active opportunistic infection
- History of CNS process such as PML, lymphoma
- Visceral Kaposi's Sarcoma or active malignancy (exception anal/cervical dysplasia)
- Inadequately treated fungal or mycobacterial process
- Multidrug resistant virus is less of an issue given newer and more potent agents

Clin Microbiol Rev. 2024 Mar 14;37(1):e0011122.

Evaluating the pre-transplant opportunistic infection history

Infection History	Comments
Pneumocystis jirovecii	• No active disease • Evidence of immune reconstitution
Candidiasis, esophageal or oral	• No active disease • Evidence of immune reconstitution
Herpes Simplex infection	• No active disease • Easy suppression with antivirals
Mycobacterial disease (tuberculosis, MAC)	• Patients must have completed treatment prior to transplant evaluation • No evidence of disease
Cutaneous Kaposi sarcoma	• No evidence of disease • Evidence of resolution following immune reconstitution

Post-transplant management

- Prophylactic and other management strategies typically the same regardless of HIV status unless history of OI
  - PJP prophylaxis a traditional exception
- Data from kidney suggest better outcomes in PLWH who receive lymphocyte depleting therapy as induction
- **Lessons from kidney and liver emphasize the importance of close teamwork:**
  - Transplant team
  - Transplant ID
  - HIV specialists if Transplant ID lacks familiarity with modern antiretroviral regimens
  - Pharmacy

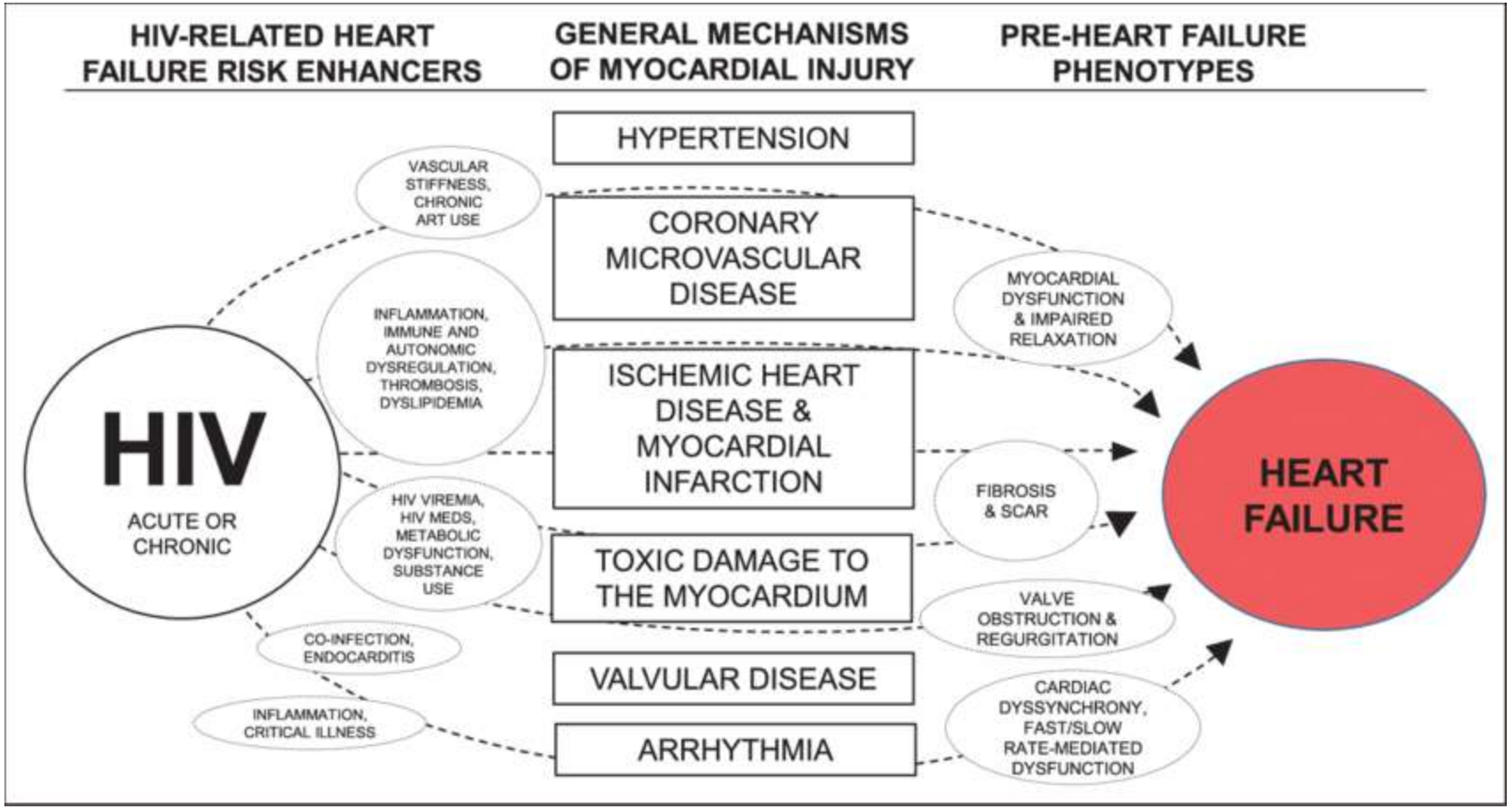
Am J Transplant. 2016 Aug;16(8):2368-76.

Customizing prophylaxis

Opportunistic Infection	Prophylaxis
Pneumocystis	TMP/SMX Alternates: atovaquone, dapsone
CMV	Valganciclovir
History of cryptococcus Successful treatment With immune reconstitution	Fluconazole
Mycobacterium avium complex with successful treatment and immune reconstitution	Azithromycin
Toxoplasmosis	TMP/SMX

HIV D-/R+ HEART TRANSPLANT

HIV doubles the risk of advanced heart failure

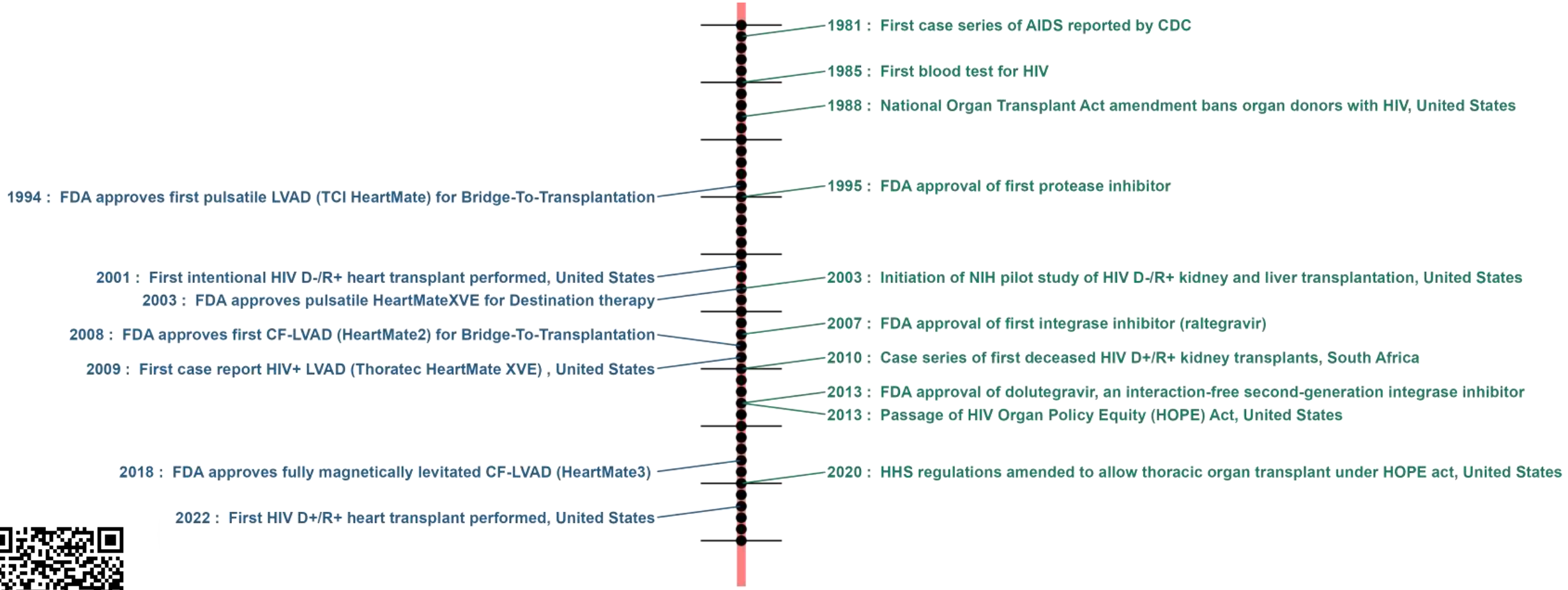


Circulation. 2019 Jul 9;140(2):e98-e124.

Albert Einstein College of Medicine

Montefiore DOING MORE℠

Progress in advanced heart failure care for PLWH has tracked general advances in HIV care



J Heart Lung Transplant. 2023 Sep;42(9):1194-1196.

ISHLT guidelines have evolved to support heart transplant in PLWH

- Pre-2014: HIV considered an **absolute** contraindication
- 2014-2024: HIV considered a **relative** contraindication
- 2024-present: Well-controlled HIV no longer an impediment to cardiac transplantation

J Heart Lung Transplant. 2024 Oct;43(10):1529-1628.e54.

More centers willing to offer heart transplant to PLWH

- 187 HIV D-/R+ heart transplants to date performed in US as of 2024, including 2 heart-lung recipients
  - Half of transplants performed at 16 centers; most have performed none
  - The UNOS database reached this number of D-/R+ kidney and liver transplants over 15 years ago
  - Currently 30+ transplants/year

Figure 1. Number and percent of HIV R+ HT in the United States from 1/1/2005 to 12/1/2024. Non-parametric test of trend p-value<0.001.

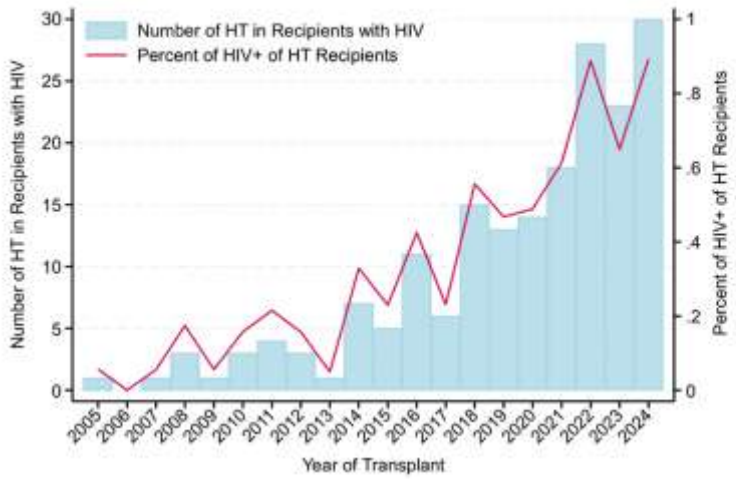
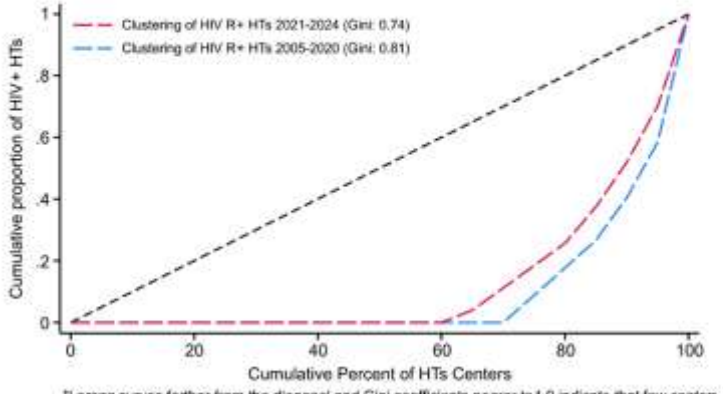


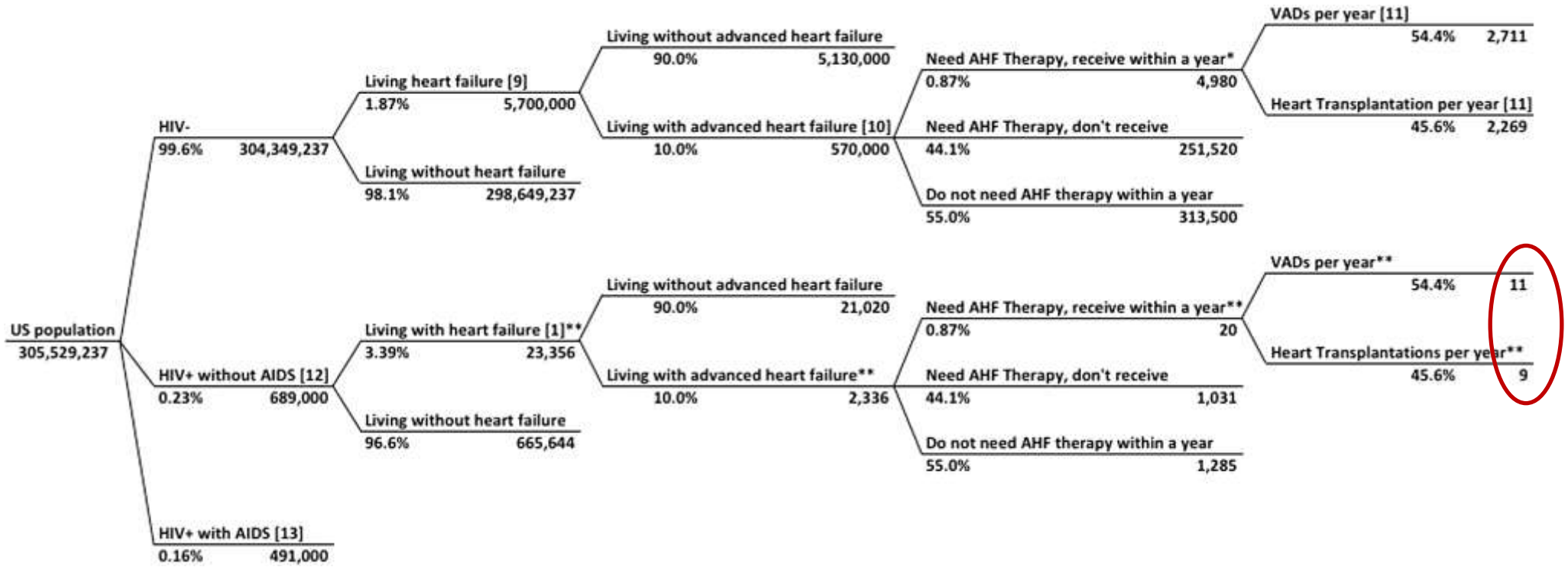
Figure 2. Center-level clustering of HIV R+ HT performed according to era of transplant



*Lorenz curves farther from the diagonal and Gini coefficients nearer to 1.0 indicate that few centers performed a large share of HIV+ HTs, while a value near 0 indicates more equitable distribution of the practice across centers.

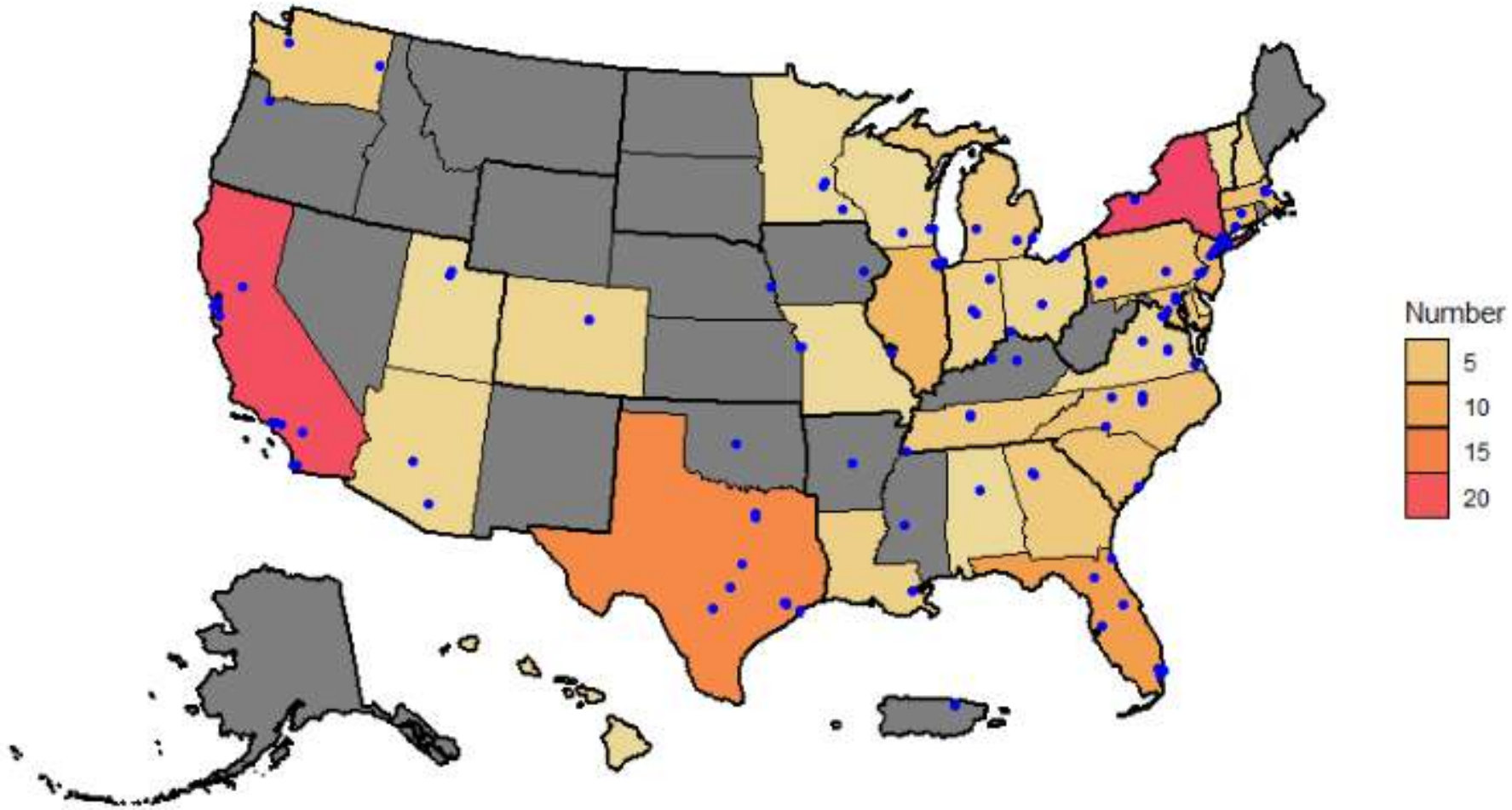
WTC 2025.

Does the current rate and pattern of transplant in the United States meet the need?



J Heart Lung Transplant. 2014 Sep;33(9):924-30.

Does the current rate and pattern of transplant meet the need?



Unpublished.

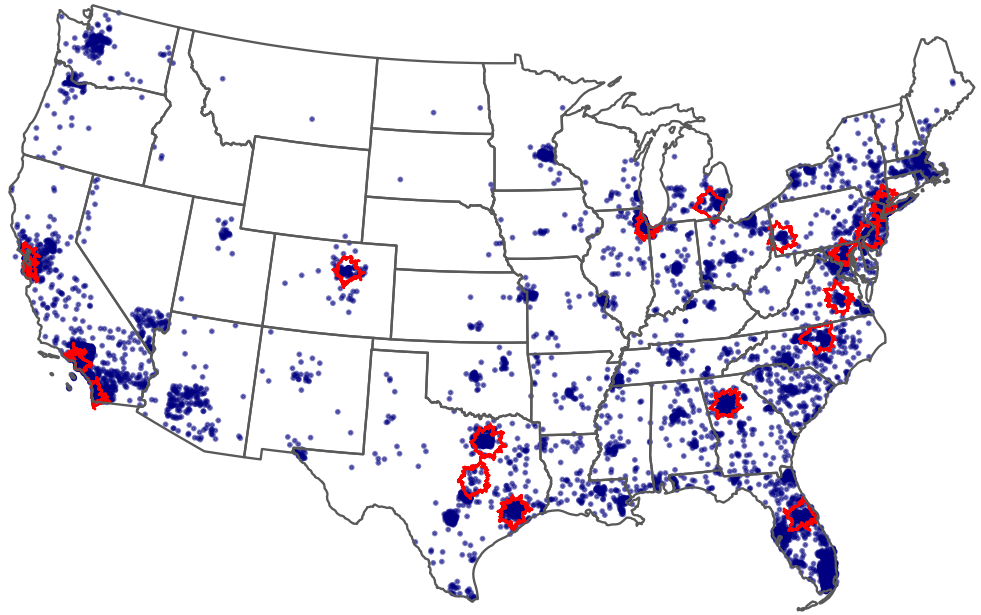
Improving access to heart transplant centers willing to offer transplant

Active HIV R+ heart transplant center, 60 mins

2017

PLWH: 47.4%

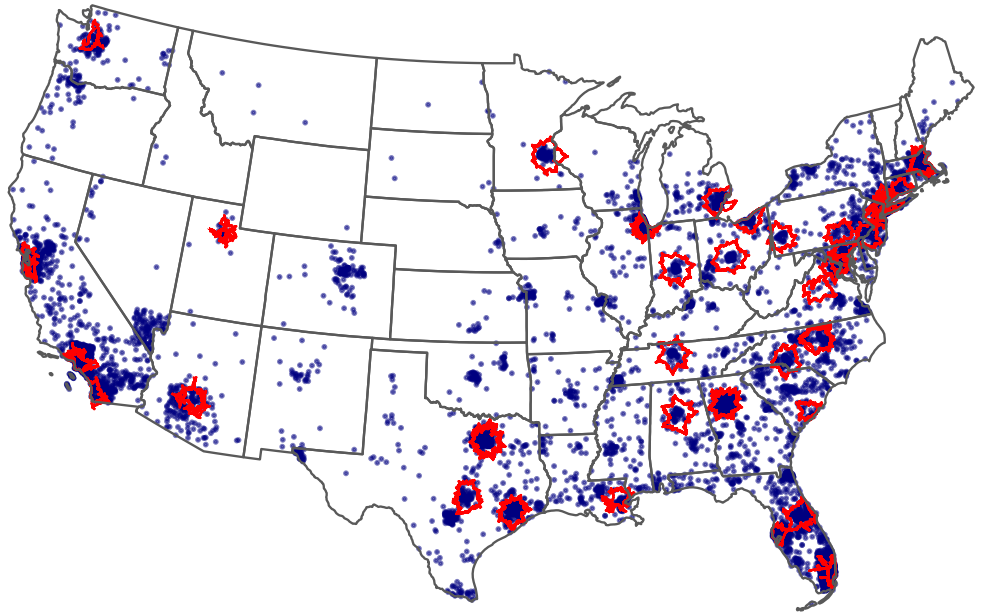
448,090 / 945,321



2022

PLWH: 65.9%

699,617 / 1,061,178



Unpublished.

HIV D-/R+ heart outcomes in the United States

No difference

- Survival
- Malignancy
- Graft vasculopathy

Higher rates in PLWH

- Acute rejection prior to primary discharge (38.7% versus 17.7%)
- Antirejection treatment administration (26.7% versus 10.4%)

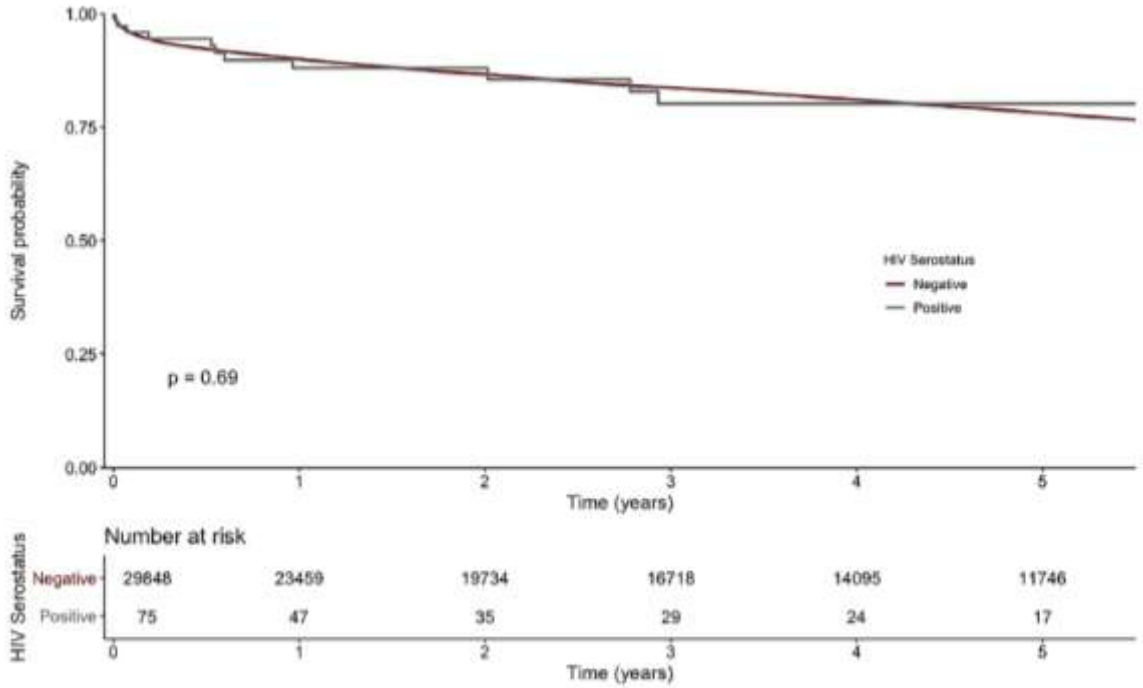


Figure 1. Kaplan-Meier curve for orthotopic heart transplant patients stratified by recipient HIV status: negative (red line), or positive (gray line). The P value represents the two-sided log-rank test. Numbers at risk are provided at the bottom of the graph.

Ann Thorac Surg. 2021 May;111(5):1465-1471.

Experience outside of the United States limited to case reports or case series

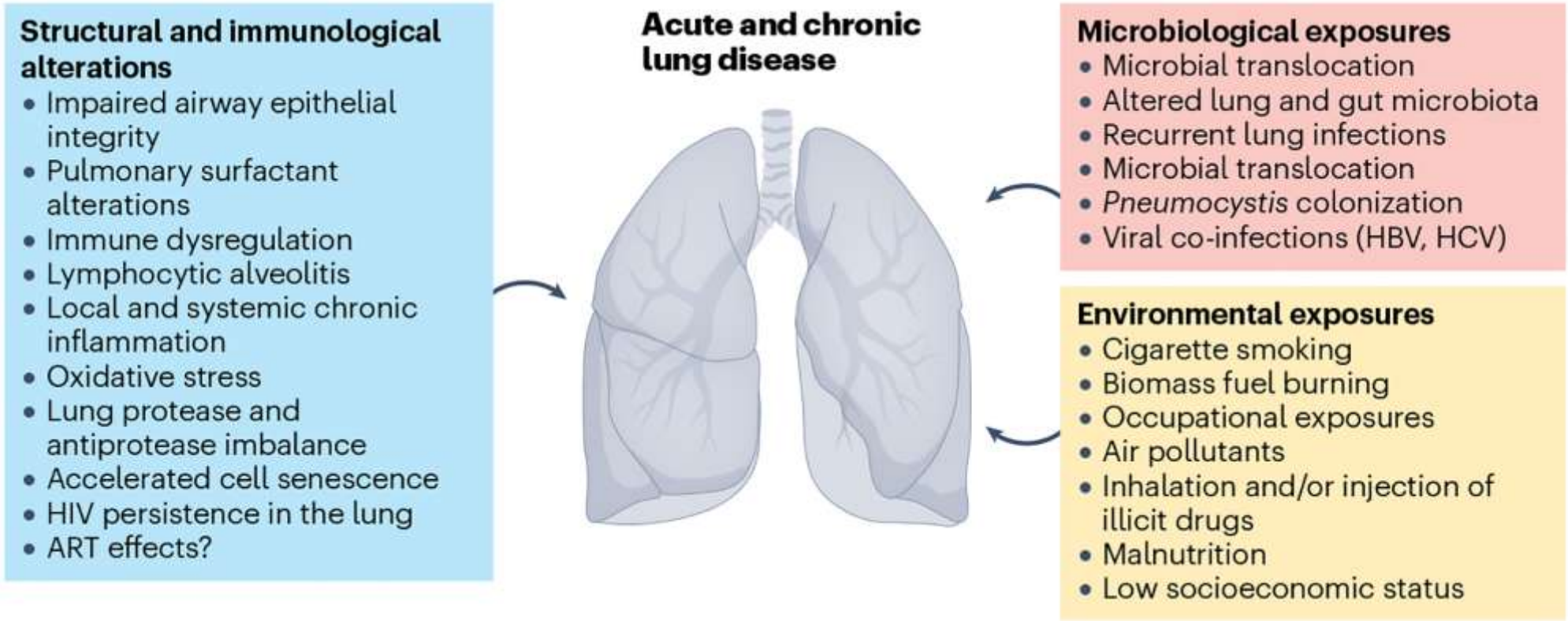
- Koval *et al* included international cases in a seminal series of 21 cases
- Other individual case reports from Taiwan and Europe
  - Acceptable survival rates
  - High rates of rejection (>60%)

J Heart Lung Transplant. 2019 Dec;38(12):1296-1305.

J Microbiol Immunol Infect. 2022 Oct;55(5):982-984.

HIV D-/R+ LUNG TRANSPLANT

HIV is a risk factor for end-stage lung disease



Nat Rev Dis Primers. 2023 Jul 27;9(1):39.

Accelerated COPD development in PLWH who smoke

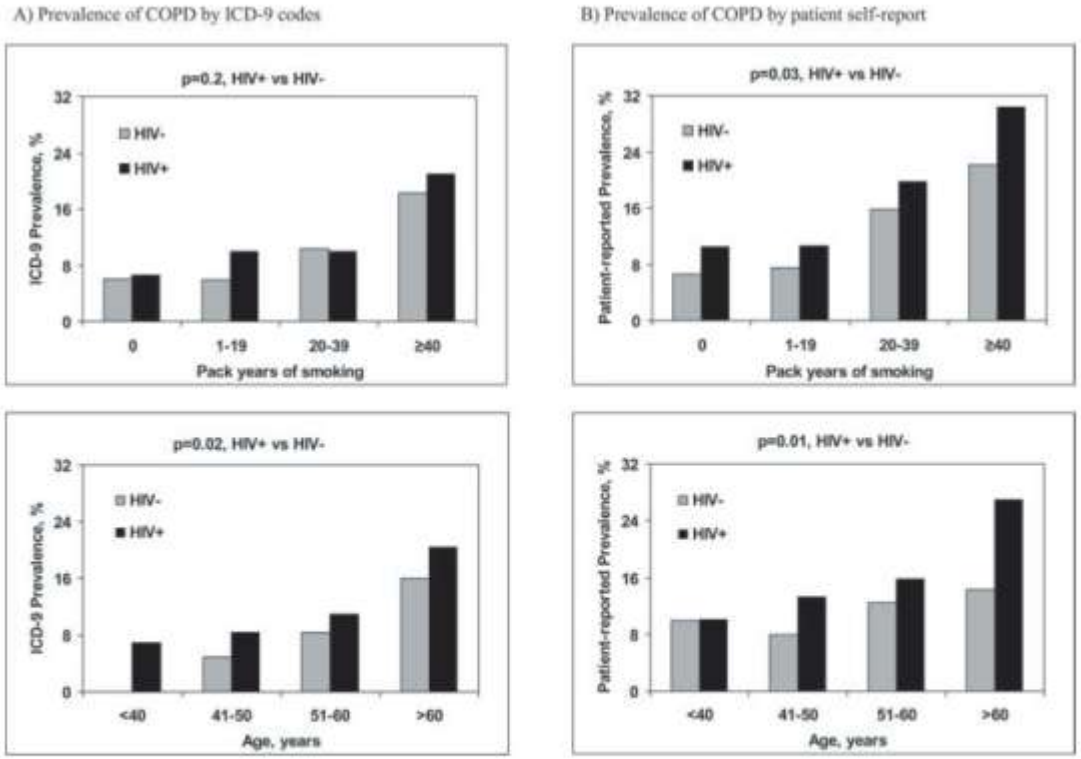


FIGURE 1. Prevalence of COPD among HIV-positive and HIV-negative subjects stratified by number of pack-years of smoking or age. *Left top* and *bottom*, *A*: the prevalence of COPD as diagnosed by ICD-9 codes. *Right top* and *bottom*, *B*: the prevalence of COPD as diagnosed by patient self-report. The p values are given for the likelihood of COPD in HIV-positive subjects vs HIV-negative subjects adjusted for either age or smoking group. HIV+ = HIV-positive; HIV− = HIV-negative.

- Younger age
- Lower pack-year history

Table 3—*Predictors of COPD in HIV-Positive and HIV-Negative Subjects

Predictors	COPD Diagnosis	
	ICD-9 Codes	Patient Self-Report
HIV status	1.47 (1.01–2.13)†	1.58 (1.14–2.19)†
Age, per 10 yr	1.57 (1.29–1.87)†	1.17 (1.00–1.37)
Black	0.77 (0.53–1.13)	0.63 (0.46–0.87)†
Hispanic	1.13 (0.67–1.90)	0.80 (0.50–1.27)
Smoking, per 10 pack-yr	1.12 (1.07–1.18)†	1.16 (1.11–1.22)†
IDU	1.44 (0.99–2.12)	1.56 (1.13–2.16)†
Alcohol abuse	2.24 (1.54–3.25)†	1.52 (1.09–2.12)†

*Values are given as the OR (95% CI).
†Significant at $p \leq 0.05$.

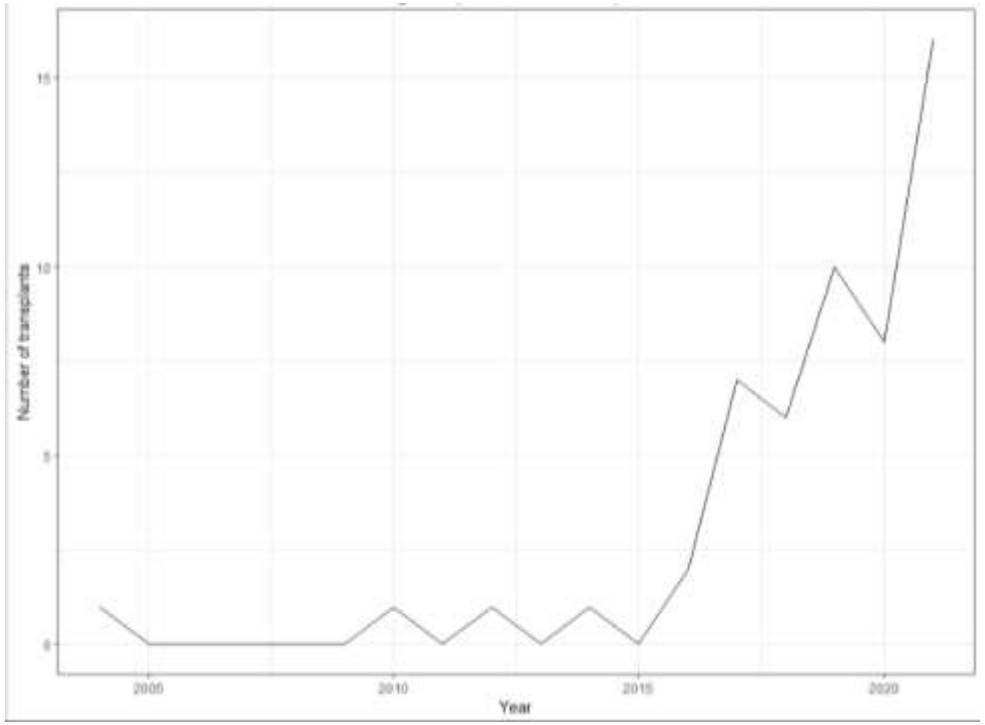
CHEST 2006; 130:1326 –1333.

Albert Einstein College of Medicine

Montefiore DOING MORE℠

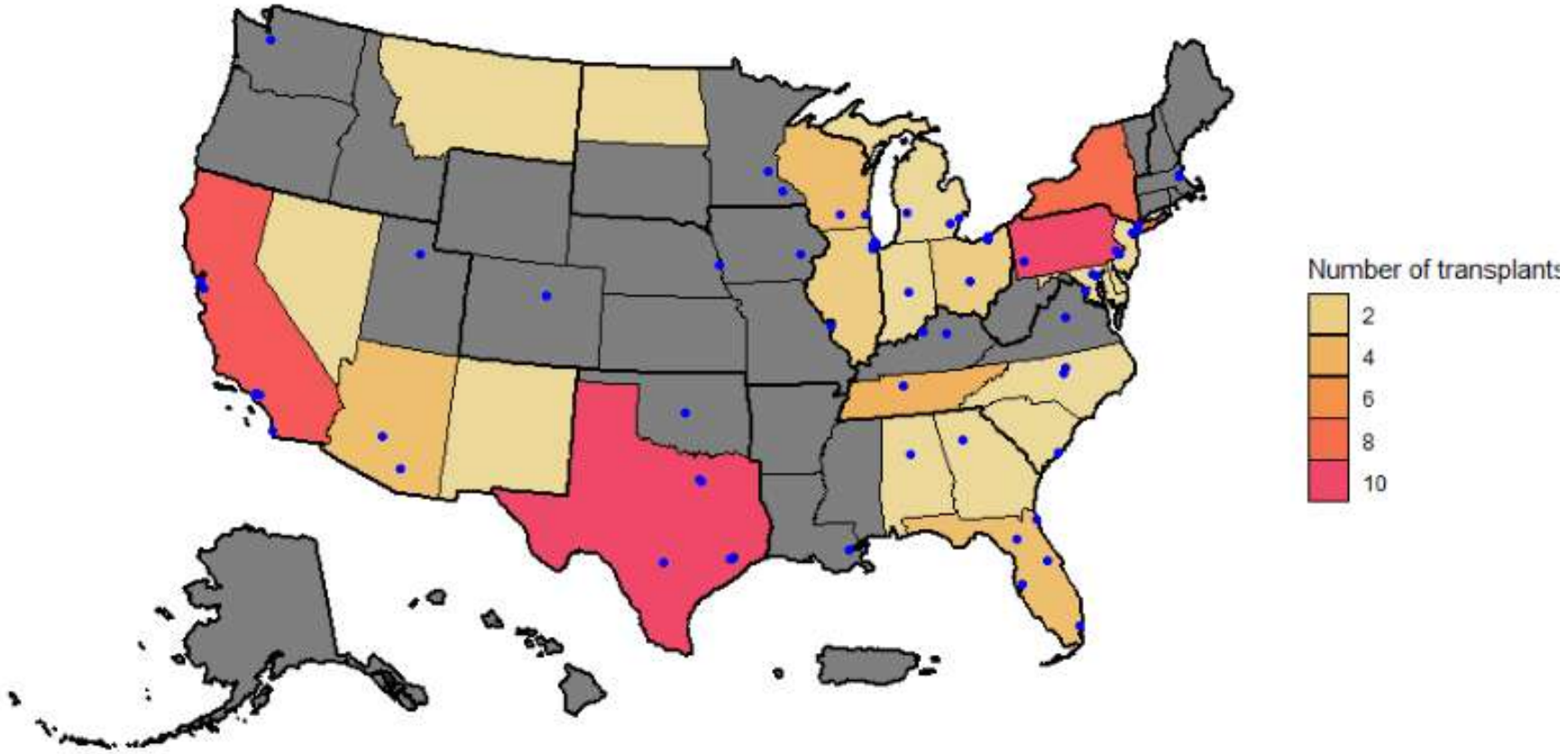
Increasing numbers of HIV D-/R+ lung transplant

- As of 2024, 96 HIV D-/R+ lung transplants to date performed in US as per the SRTR, including the two aforementioned heart-lung transplants
  - The UNOS database reached this number of D-/R+ kidney transplants 20 years ago
- Well over half performed since 2019
- Four centers responsible for 50+% of transplants
- Recipient selection criteria an open question



Transpl Infect Dis. 2025 Aug 8:e70090.

The geography of HIV D-/R+ lung transplant in the US



ATC 2023, abstract 279

Albert Einstein College of Medicine

Montefiore DOING MORE℠

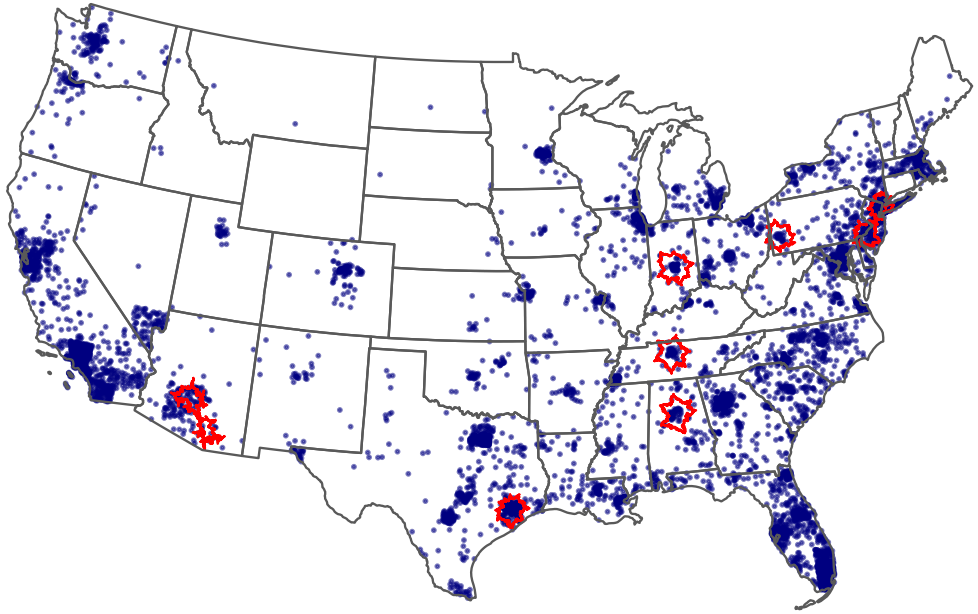
Increasing access to lung transplant for PLWH, 2017-2022

Active HIV R+ lung transplant center, 60 mins

2017

PLWH: 23%

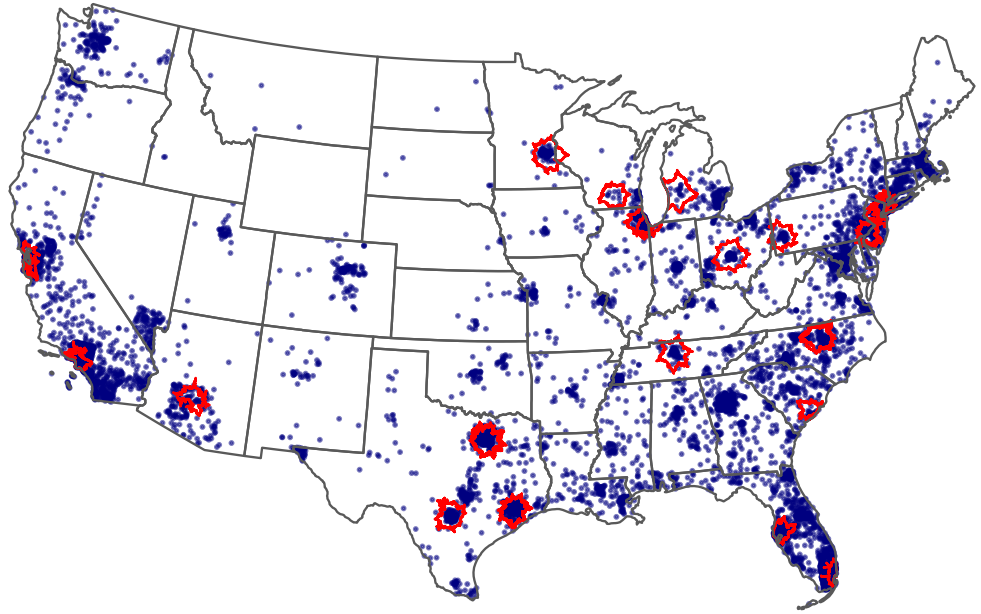
217,336 / 945,321



2022

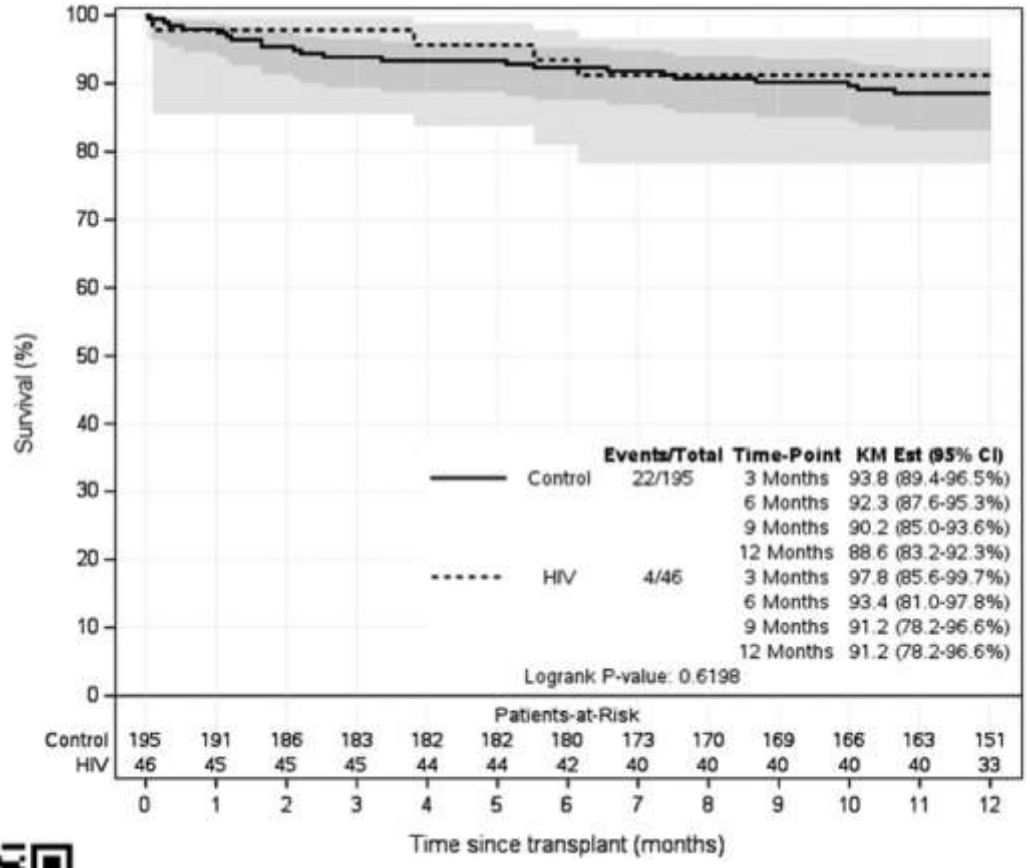
PLWH: 44.7%

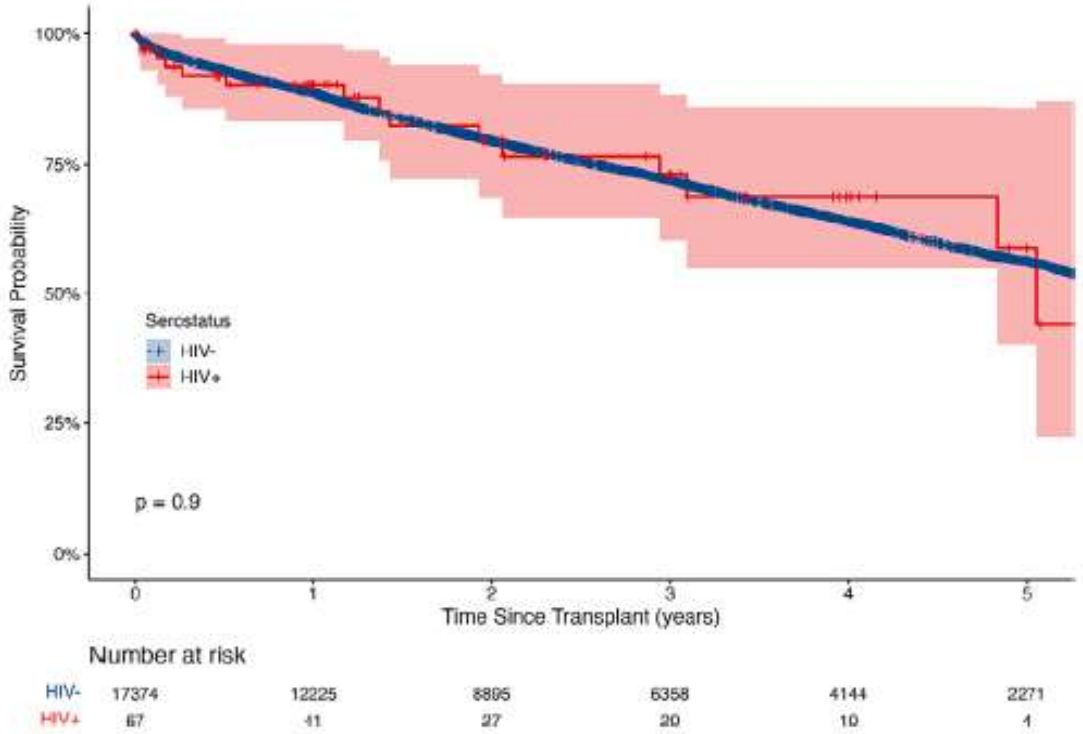
473,923 / 1,061,178



Unpublished.

Equivalent survival in lung transplant recipients with HIV





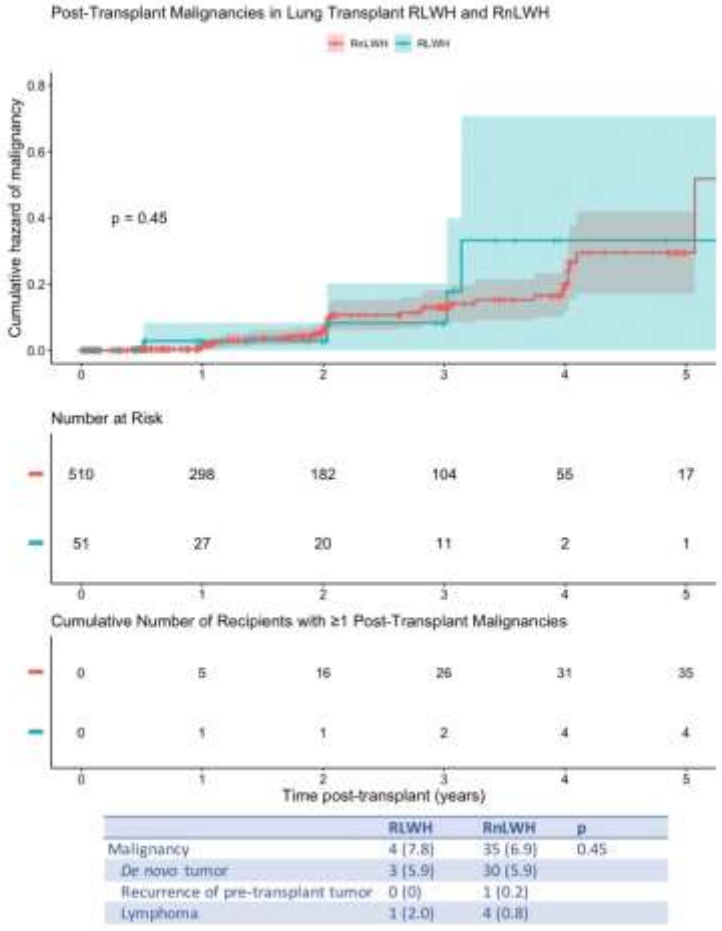
Transplantation 2024. Apr 1;108(4):1015-1020

Clin Transplant 2024 Jan;38(1):e15246.

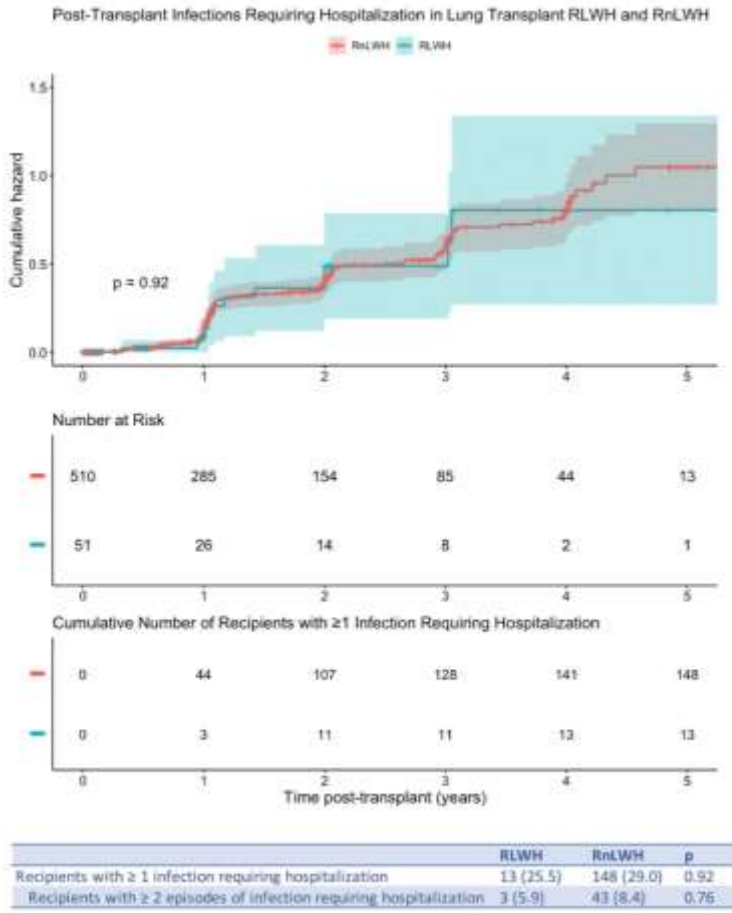
Albert Einstein College of Medicine

Montefiore DOING MORE℠

Equivalent malignancy rate and infection hospitalization rates in lung tx recipients with HIV



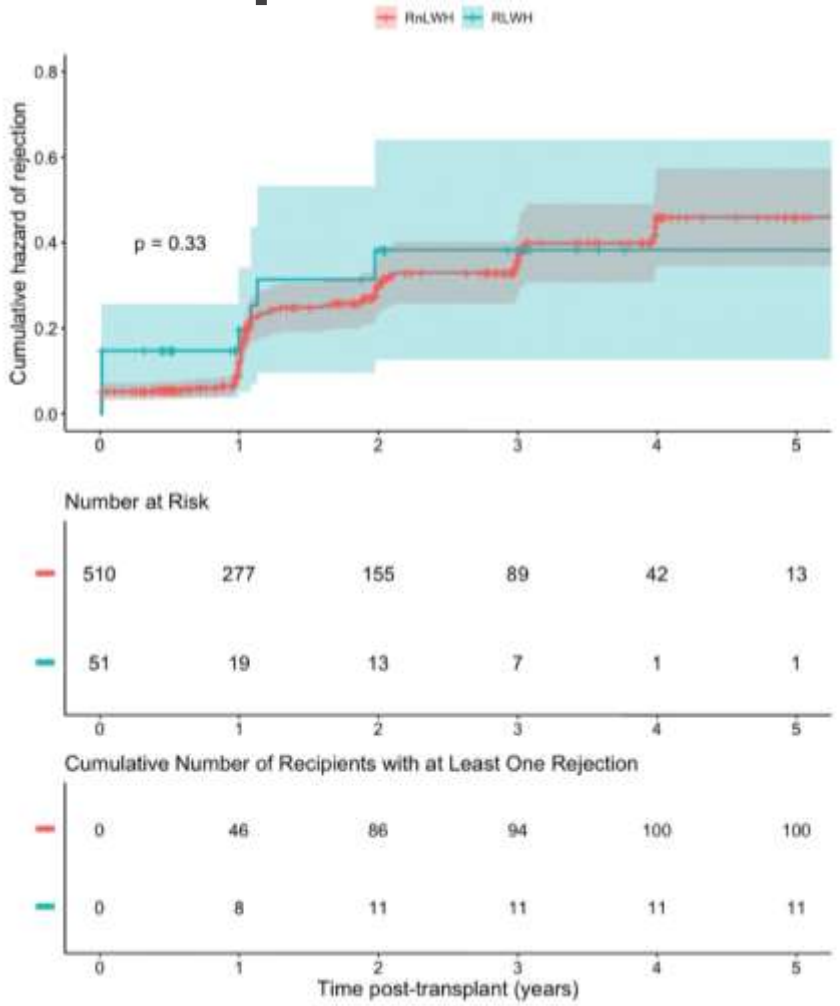
	RLWH	RnLWH	p
Malignancy	4 (7.8)	35 (6.9)	0.45
De novo tumor	3 (5.9)	30 (5.9)	
Recurrence of pre-transplant tumor	0 (0)	1 (0.2)	
Lymphoma	1 (2.0)	4 (0.8)	



	RLWH	RnLWH	p
Recipients with ≥ 1 infection requiring hospitalization	13 (25.5)	148 (29.0)	0.92
Recipients with ≥ 2 episodes of infection requiring hospitalization	3 (5.9)	43 (8.4)	0.76

ATC 2022, abstract 357

Increased rejection during the initial hospitalization in lung transplant recipients with HIV



	RLWH	RnLWH	p
Recipients with ≥1 episode of acute rejection requring changes in IS	11 (21.6)	100 (19.6)	0.33
Recipients with acute rejection during index admission	7 (13.7)	26 (5.1)	0.022
Recipients with two or more episodes of rejection	4 (7.8)	19 (3.7)	0.24

Immunosuppressant	RnLWH	RLWH	p
n	47	440	
Corticosterioids	44	387	0.338
Basiliximab	41	361	0.373
Thymoglobulin	0	24	
Rituximab	1	2	
Alemtuzumab	0	19	

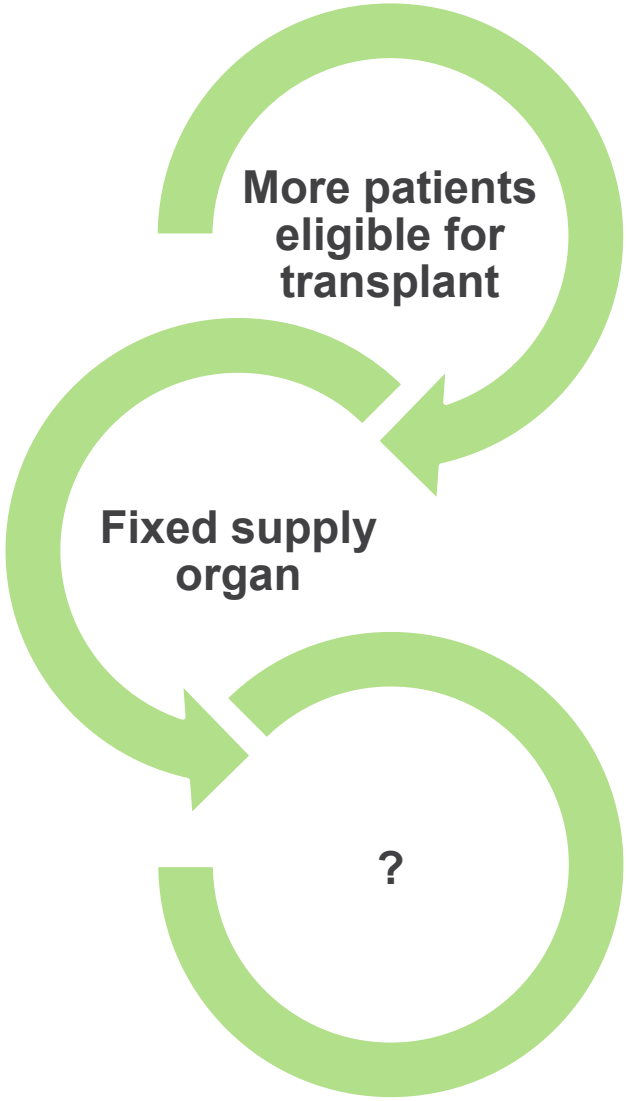
ATC 2022, abstract 357

Similar outcomes in European experience (case series without control)

Post-operative outcome		
Infections requiring hospitalisation during first year (n=20)	8 (40)	
Acute cellular rejection (n=19)	7 (37)	
Antibody-mediated rejection (n=19)	2 (11)	
Chronic lung allograft dysfunction at last follow-up (n=19)	5 (26)	
Malignancy (n=21)	3 (14)	
Estimated glomerular filtration rate ($mL \cdot min^{-1}$ per 1.73 m^2)		0.02
Before transplantation	90 (80–111)	
After transplantation[+]	73 (53–90)	

Eur Respir J. 2022 Jul 13;60(1):2200189.

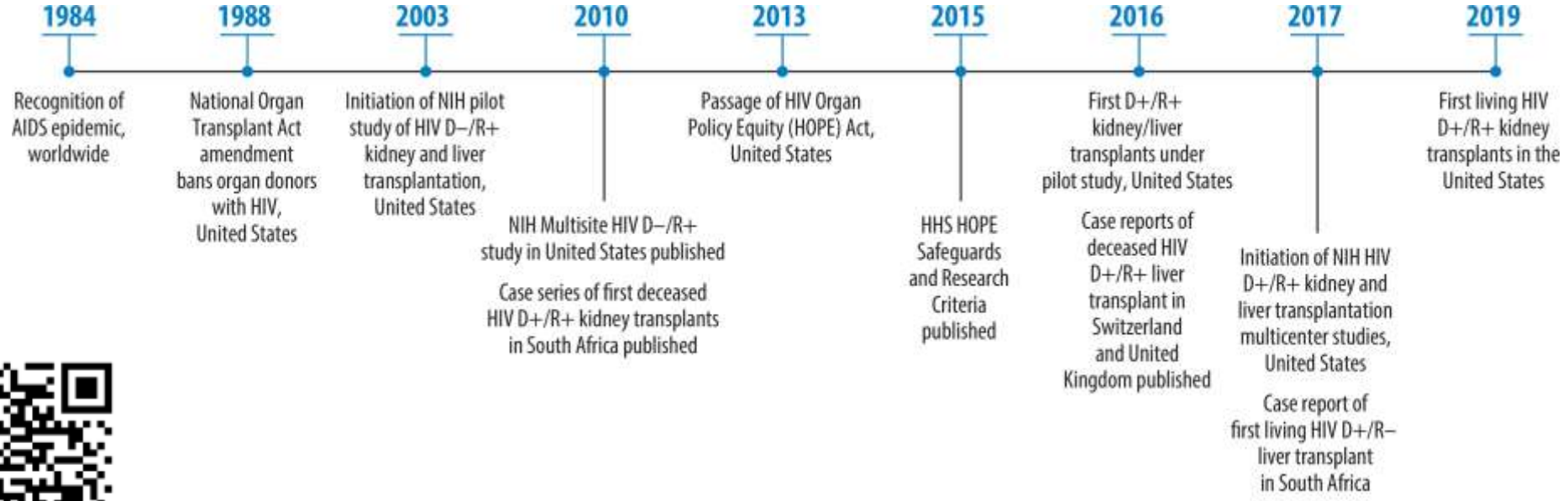
Increasing the donor supply



OVERVIEW OF HIV D+/R+ TRANSPLANT

Federal law

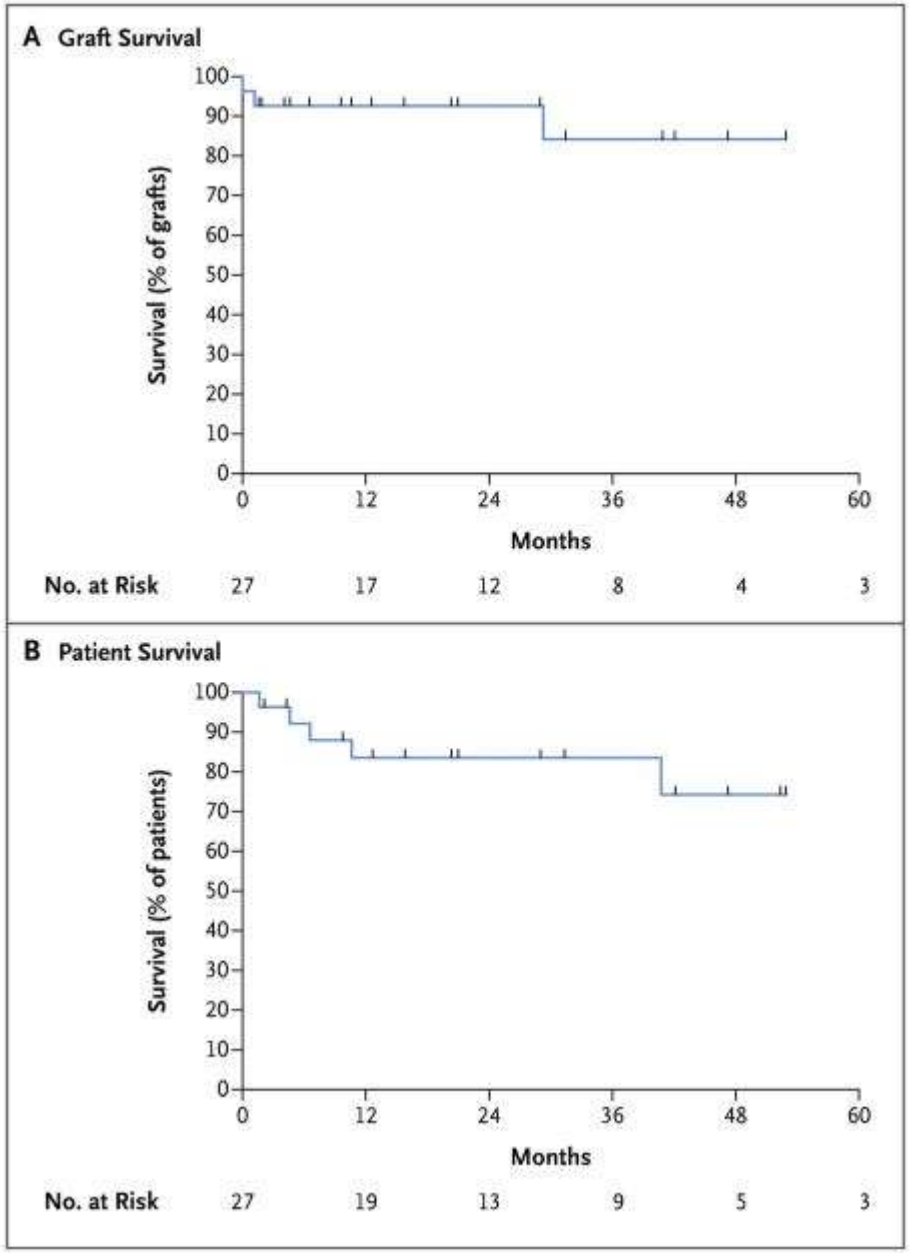
- Transplantation of organs from donors who test positive for HIV was banned by the National Organ Transplant Amendments (NOTA) Act of 1988, which reflected the poor outcomes of transplant-associated HIV in an era without effective treatments for HIV



Annu Rev Med. 2021 Jan 27:72:107-118.

First HIV-to-HIV transplants

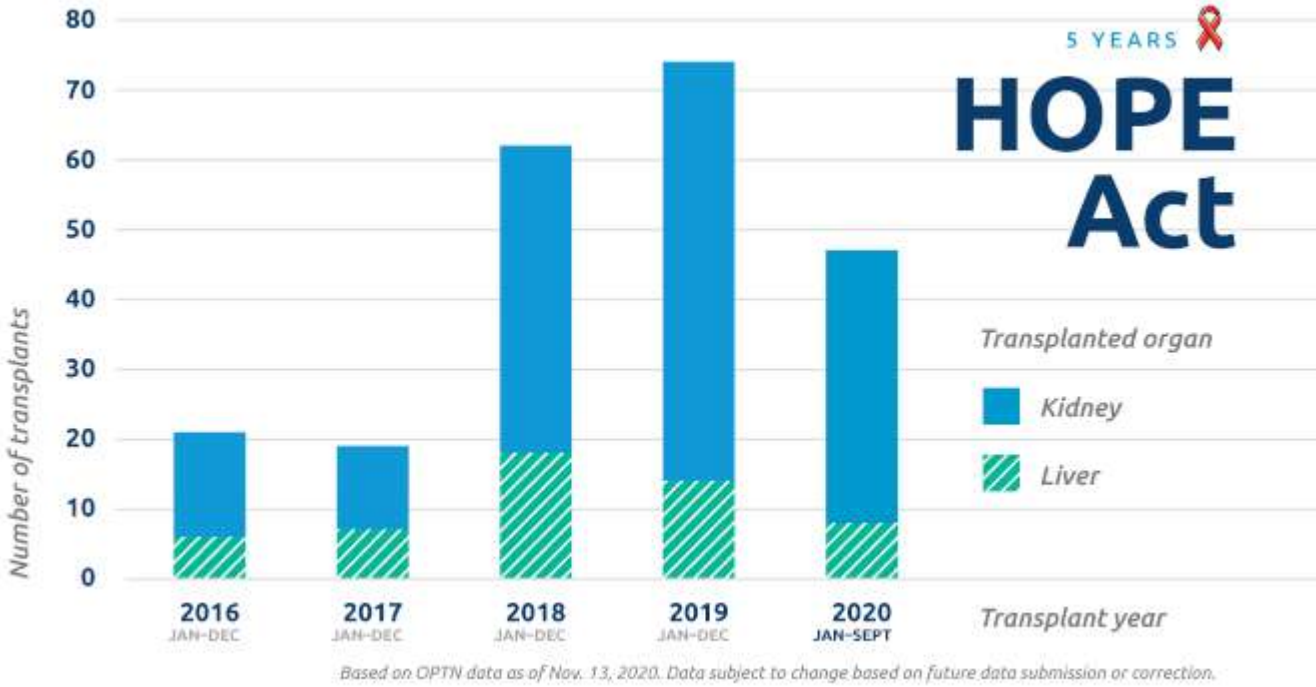
- The first study of HIV D+/R+ transplant was done in South Africa
  - Limited access to dialysis
  - High prevalence of HIV



N Engl J Med. 2010 Jun 17; 362(24): 2336–2337.
N Engl J Med. 2015 Feb 12; 372(7): 613–620.

The HIV Organ Policy Equity Act (the HOPE Act)

- Federal law signed 21 Nov 2013
- Permits transplantation of kidneys and livers from HIV+ donors (D+) into HIV+ recipients (R+) ***under research protocols***
- On 7 Jun 2020 amended to include other organs
- Program initially required to have organ-specific experience with 5 HIV D-/R+ to perform D+/R+



Why is HIV D+/R+ different? What are the concerns?

Resistance

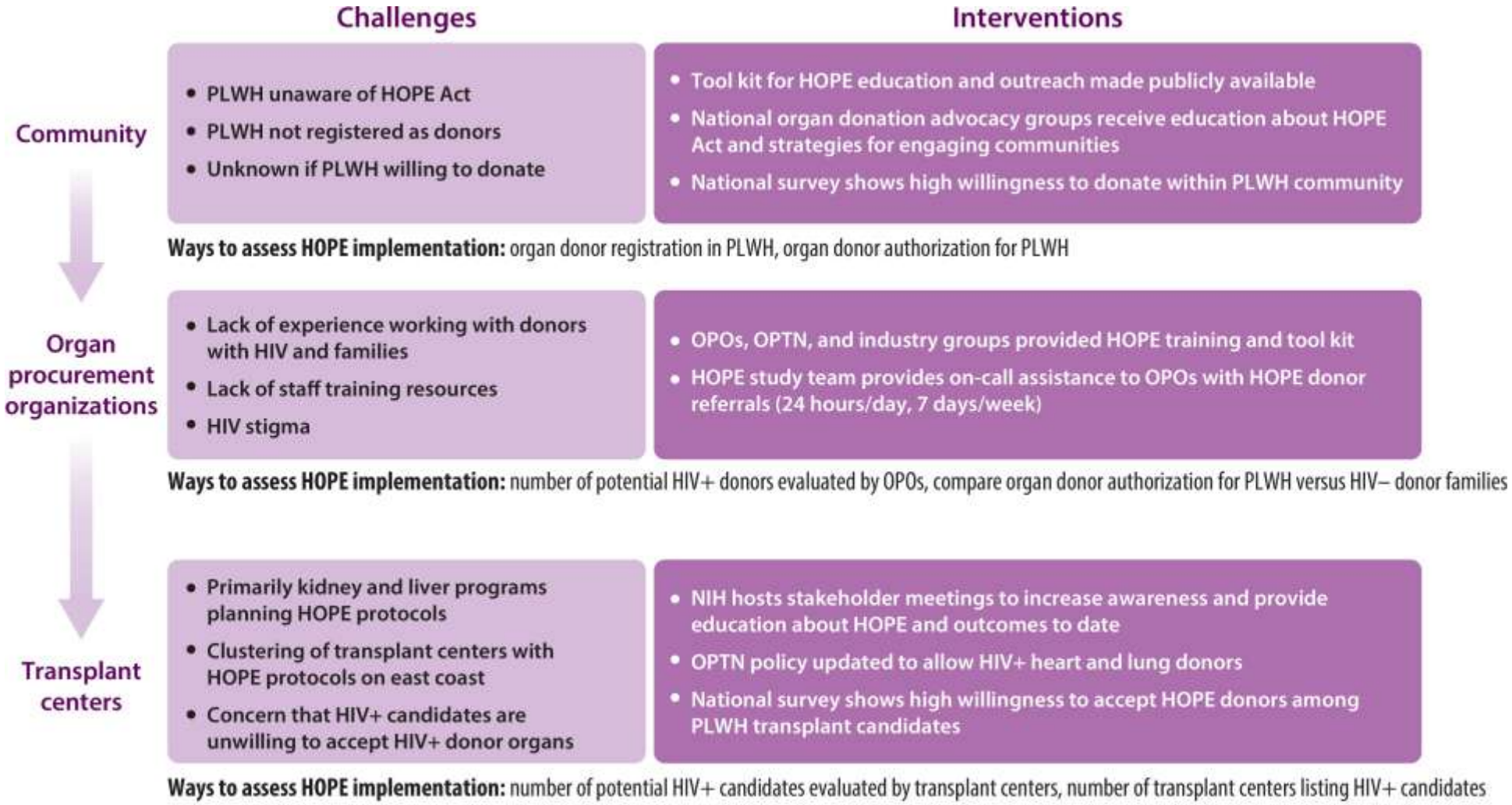
Infection

Malignancy (especially lymphoma)

Rejection

Of note, only rejection has been an issue in actual practice.

Many barriers exist to HIV D+/R+ transplant



Nambiar PH, et al. 2021
Annu. Rev. Med. 72:107–18

Are patients with HIV willing to accept HIV positive organs?

- Most pts willing to accept:
  - HIV+ living donor organs (87%)
  - HIV+ deceased donor organs (84%)
  - Increased infectious risk donor organs (70%)
- Thirty percent of patients expressed concerned about HIV superinfection and transmitted resistance, but even a majority (71%) of these pts would accept an HIV offer
- Other concerns that led them to decline enrollment:
  - HIV D+/R+ transplantation was safe (45% vs. 77%, $P = 0.02$),
  - HIV D+ organs would work similar to HIV D− organs (55% vs. 77%, $P = 0.04$)
  - Would receive an infection other than HIV from an HIV D+ organ (64% vs. 13%, $P < 0.01$).

J Acquir Immune Defic Syndr. 2020 Sep 1;85(1):88-92.

So, as a practical matter, what needs to happen for an HIV-positive donor?

- Organ offer received
- ID contacted EARLY IN THE PROCESS
- ID to review emails from Hopkins listserve and DonorNet
- ID to reach out to Hopkins (either via email or cell phone)
  - OPO is supposed to reach out to Hopkins, but frequently this does not happen
- Hopkins dedicated HOPE act coordinator can obtain pharmacy records and clinic notes (note, this typically has to happen during waking hours)
- Detailed review of all medical records and multidisciplinary discussion leading to decision to accept or reject

What does ID do when we get called about a potential HIV-seropositive donor?

Resistance	• Prior HIV genotypes • Treatment history
Opportunistic infection	• CD4+ count • Viral load • Medical records
Malignancy	• Medical records

False positive HIV tests

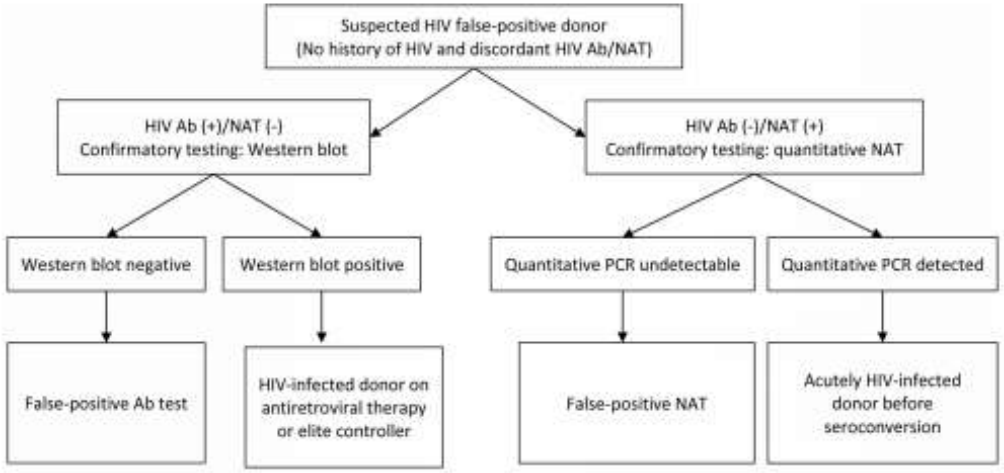


Figure 1. Suspected False-positive Donor Algorithm
Potential explanations for discordant HIV Ab and NAT testing in a potential donor with no prior history of HIV per the medical record or family history. In cases of a reactive Ab test (left), a Western blot or HIV Ag/Ab combination assay would be the preferred next test. If the Western blot is negative, this confirms result was a false-positive. If the Western blot is positive, the donor could be HIV-infected and taking effective antiretroviral therapy or have an effective immune response (i.e. elite controller). In cases of a nonreactive Ab test and a positive qualitative NAT (right), a quantitative viral PCR would be the preferred next test. If the quantitative PCR is undetectable, this confirms the qualitative NAT was a false-positive. If the quantitative PCR is positive this indicates the donor was recently HIV-infected and has not yet

Typically, organs from potential donors with suspected false positive HIV testing were discarded, but the HOPE act means that these organs can now be used.

These donors have reflected ~1/3 of organs transplanted under the HOPE Act.

Am J Transplant. 2018 Oct;18(10):2579-2586.

Can we take donors without knowing their full history?

Donor characteristics	HIV D+ (N = 15)	HIV FP (N = 14)	HIV D− (N = 28)
Age (Med [IQR])	30 (23, 33)	24 (20, 41)	29.5 (25, 37)
Female, no. (%)	4 (27%)	4 (29%)	11 (39%)
Race, no. (%)			
White	4 (27%)	7 (50%)	14 (50%)
Black	9 (60%)	5 (36%)	10 (36%)
Asian	0%	0 (0%)	1 (4%)
Other	2 (13%)	2 (14%)	3 (9%)
Ethnicity, no. (%)			
Hispanic	1 (7%)	2 (14%)	2 (7%)
Body mass index (Med [IQR])	23 (22, 26)	26 (20, 34)	26 (22, 30)
Brain death donor, no. (%)	15 (100%)	11 (79%)	28 (100%)
Increased infectious risk, no. (%)	12 (80%)	2 (14%)	16 (57%)
Kidney donor profile index	30 (20, 39)	30 (21, 58)	36 (29, 54)
Mechanism of death, no. (%)			
Anoxia	8 (53%)	1 (7%)	16 (57%)
Cerebrovascular/stroke	3 (20%)	5 (36%)	2 (7%)
Head trauma	4 (27%)	7 (50%)	10 (36%)
Other	0 (0%)	1 (7%)	0 (0%)
Hepatitis C RNA positive, no. (%)	0 (0%)	1 (7%)[a]	8 (29%)
HIV Ab positive, no. (%)	15 (100%)	12 (86%)	0 (0%)
HIV NAT positive, no. (%)	10 (67%)	2 (14%)	0 (0%)
CD4 count, median (IQR)	300 (142, 479)	ND	ND
New diagnosis of HIV, no. (%)	5 (33%)	N/A	N/A
On ART, no. (%)	9 (60%)	N/A	N/A
HIV RNA < 400 copies/mL	5 (56%)	N/A	N/A
Not on ART, no. (%)	6 (40%)	N/A	N/A
HIV RNA, median	183 326	N/A	N/A

Abbreviations: ART, antiretroviral therapy; NAT, nucleic acid test.
[a]Reactive nondiscriminated Procleix Ultrio in donor with negative HCV Ab, likely false positive.

Donors with HIV are frequently undiagnosed and not on medications

This is fine! Outcomes ***when the donors are carefully evaluated*** have been acceptable with no transmissions of any infection or resistant virus

Am J Transplant. 2021 May;21(5):1754-1764.

Nuts and bolts of the HOPE evaluation process

- No published guidelines as to what is or is not an acceptable donor.

- Much of this area is a completely evidence-free zone, so we frequently find ourselves hitting the “phone a friend” button
  - Internal group chat
  - Email with HOPE leadership

- Substantial center to center variation in acceptance criteria and in process

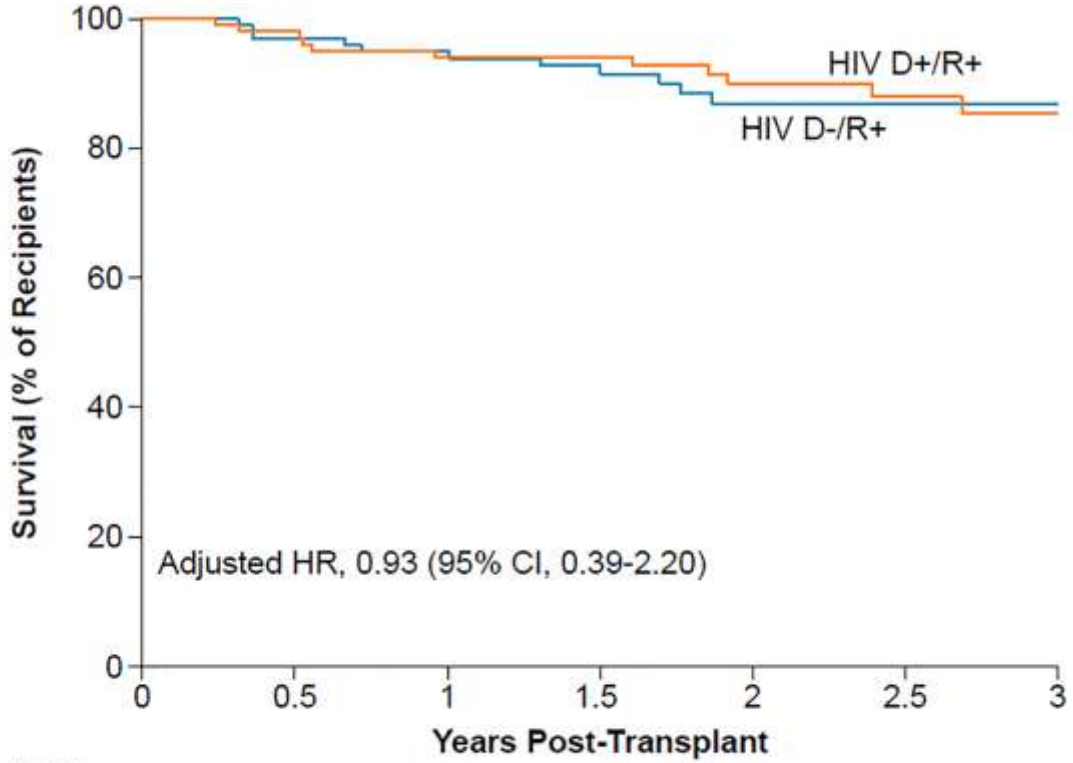
Nuts and bolts of the HOPE evaluation process

Barrier	Intervention
Concerns about resistant HIV in the donor	Presented data from HOPE trial and nationally about lack of resistance in donors without prior treatment history. Education regarding novel antiretrovirals and their outcomes in patients with drug resistant HIV
Lack of HIV-specific expertise among all transplant ID faculty	All transplant ID faculty joined the HOPE act email list. Designated transplant ID faculty who continued to provide HIV primary care as champions to be contacted with HIV-specific questions for each offer
Lack of colleague support for off-hours difficult cases. Fear of being the first to accept an offer in case of a less than positive outcome	Involvement of senior leadership in the multidisciplinary meetings to ensure that all clinicians felt comfortable with what senior leadership considered an acceptable offer. Practice at the meetings at “getting to yes”
Lack of continuity among accepting physician teams (no learning between cases)	Discussion of every organ offer at the monthly meeting to ensure that all providers could learn from each offer
Initial and downstream organ quality concerns, such as rejection risk	A research team member from the lead center of the NIH-funded multicenter HOPE study shared outcomes data with our group

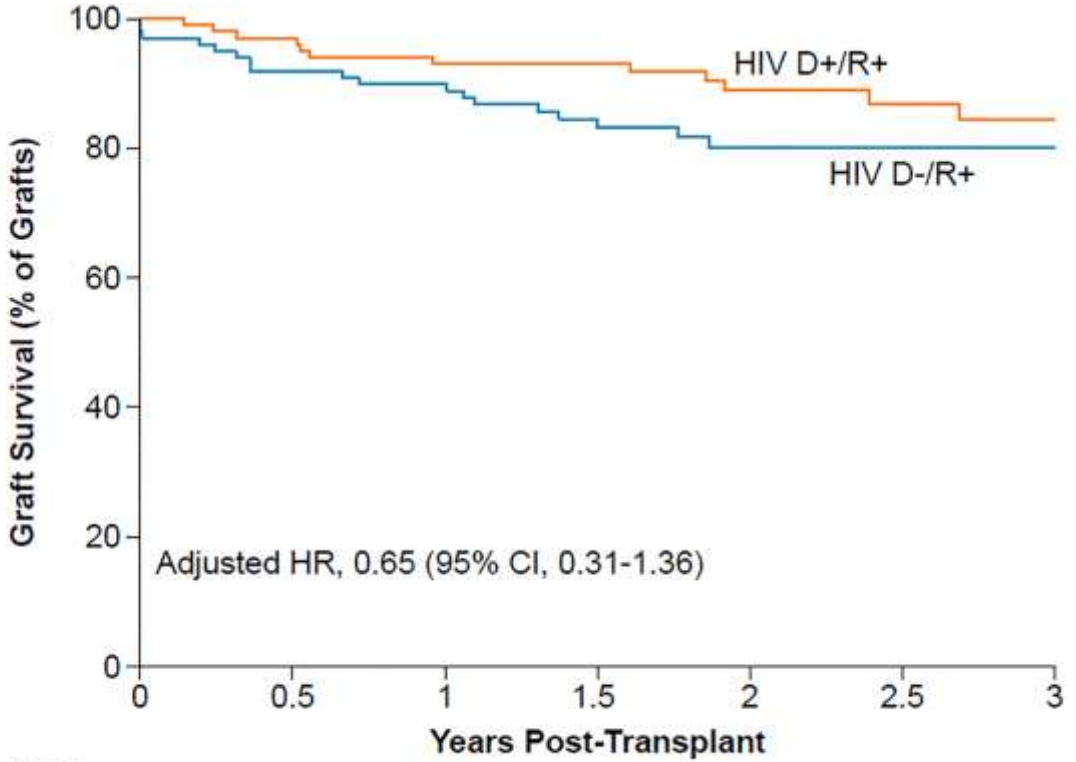
Substantial improvement in HOPE acceptance rates with a standardized approach including monthly case discussions

Transpl Infect Dis. 2025 Apr 20:e70039.

Outcomes in kidney transplant patients under the HOPE Act



No. at Risk							
HIV D-/R+	99	95	93	73	52	42	28
HIV D+/R+	99	97	93	88	59	40	29



No. at Risk							
HIV D-/R+	99	90	88	66	49	40	27
HIV D+/R+	99	96	92	87	58	39	28

N Engl J Med 2024;391:1390-1401.

EINSTEIN Albert Einstein College of Medicine | Montefiore DOING MORE℠

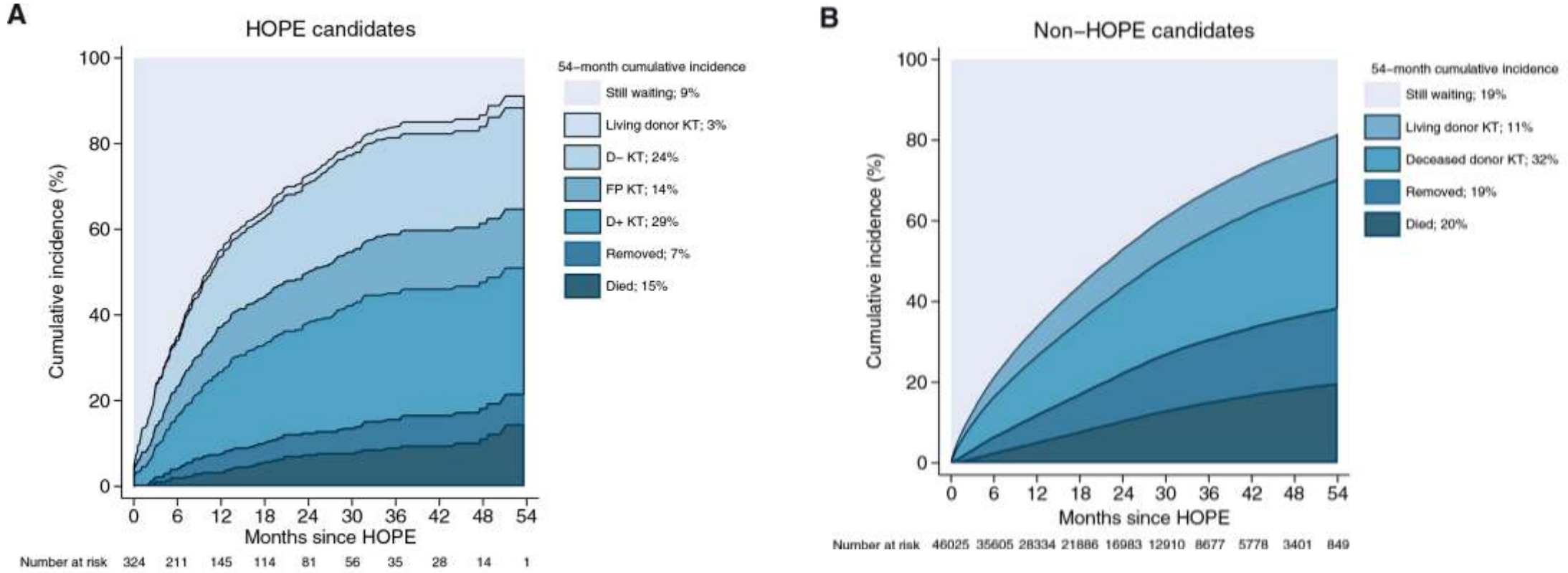
Outcomes in kidney transplant patients under the HOPE Act

Outcomes	HIV D+/R+ (n=99)		HIV D−/R+ (n=99)		Crude Incidence Rate Ratio (95% CI)
	Recipients with event — no./total no. (%)	*Total no. of event*	*Recipients with event — no./total no. (%)*	*Total no. of event*	
Serious adverse event	74/99 (75)	206	76/99 (77)	222	0.90 (0.74–1.08)
Allograft rejection	18/99 (18)	21	22/99 (22)	32	0.63 (0.37–1.10)
One-year allograft rejection	13/99 (13)	13	20/99 (20)	25	0.52 (0.26–1.01)
HIV-breakthrough	10/99 (10)	13	4/99 (4)	4	3.14 (1.02–9.63)
Persistent HIV failure	0/99 (0)	0	0/99 (0)	0	N/A
Any infection	81/99 (82)	273	71/99 (72)	229	1.15 (0.97–1.37)
Opportunistic infection	8/99 (8)	11	7/99 (7)	8	1.33 (0.53–3.30)
Any infection with hospitalization	43/99 (43)	94	43/99 (43)	97	0.94 (0.70–1.24)
Surgical or vascular complication	12/99 (12)	17	19/99 (19)	23	0.71 (0.38–1.34)
Cancer	8/99 (8)	9	6/99 (6)	6	1.45 (0.52–4.07)
De novo DSA at one year*	9/67 (13)	9	13/59 (22)	13	0.61 (0.28–1.33)

*32 participants in HIV D+/R+ group and 40 in HIV D−/R+ group had no DSA data at either Day 0 or one year.

N Engl J Med 2024;391:1390-1401.

Wait times in kidney transplant patients under the HOPE Act

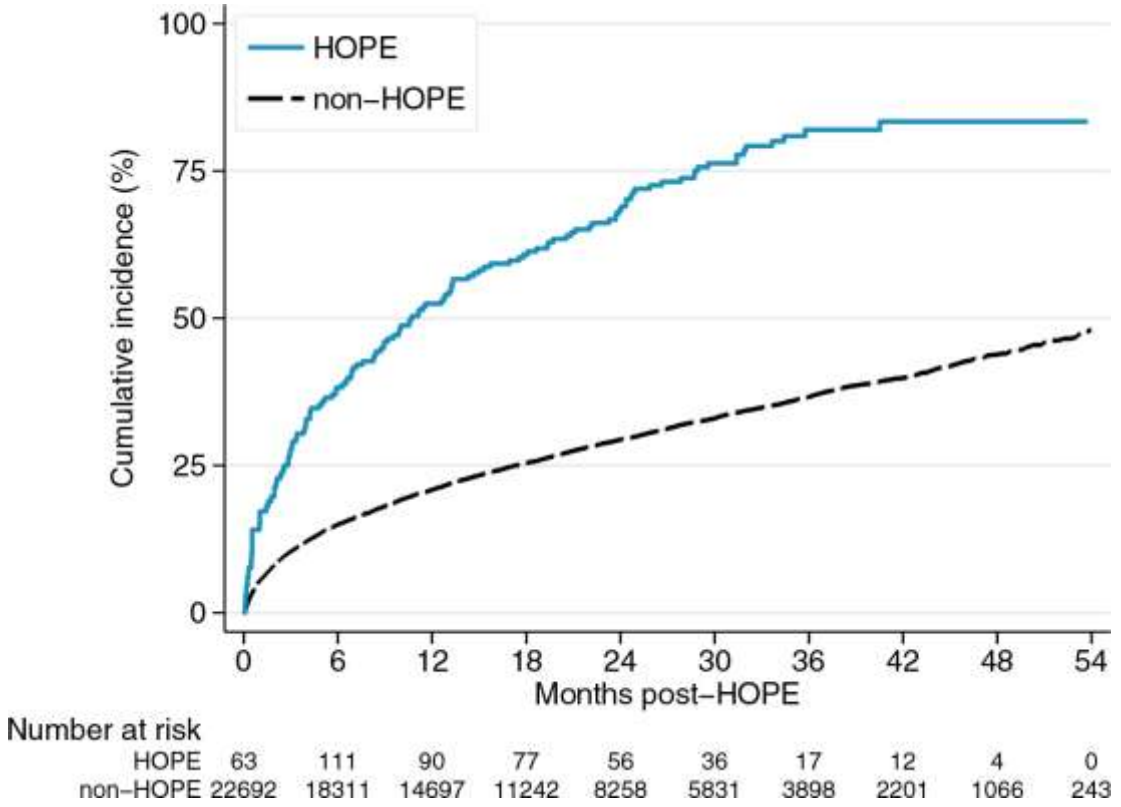


Transplantation. 2023 Nov 28;108(3):759–767.

Albert Einstein College of Medicine

Montefiore DOING MORE℠

Wait times in kidney transplant patients under the HOPE Act

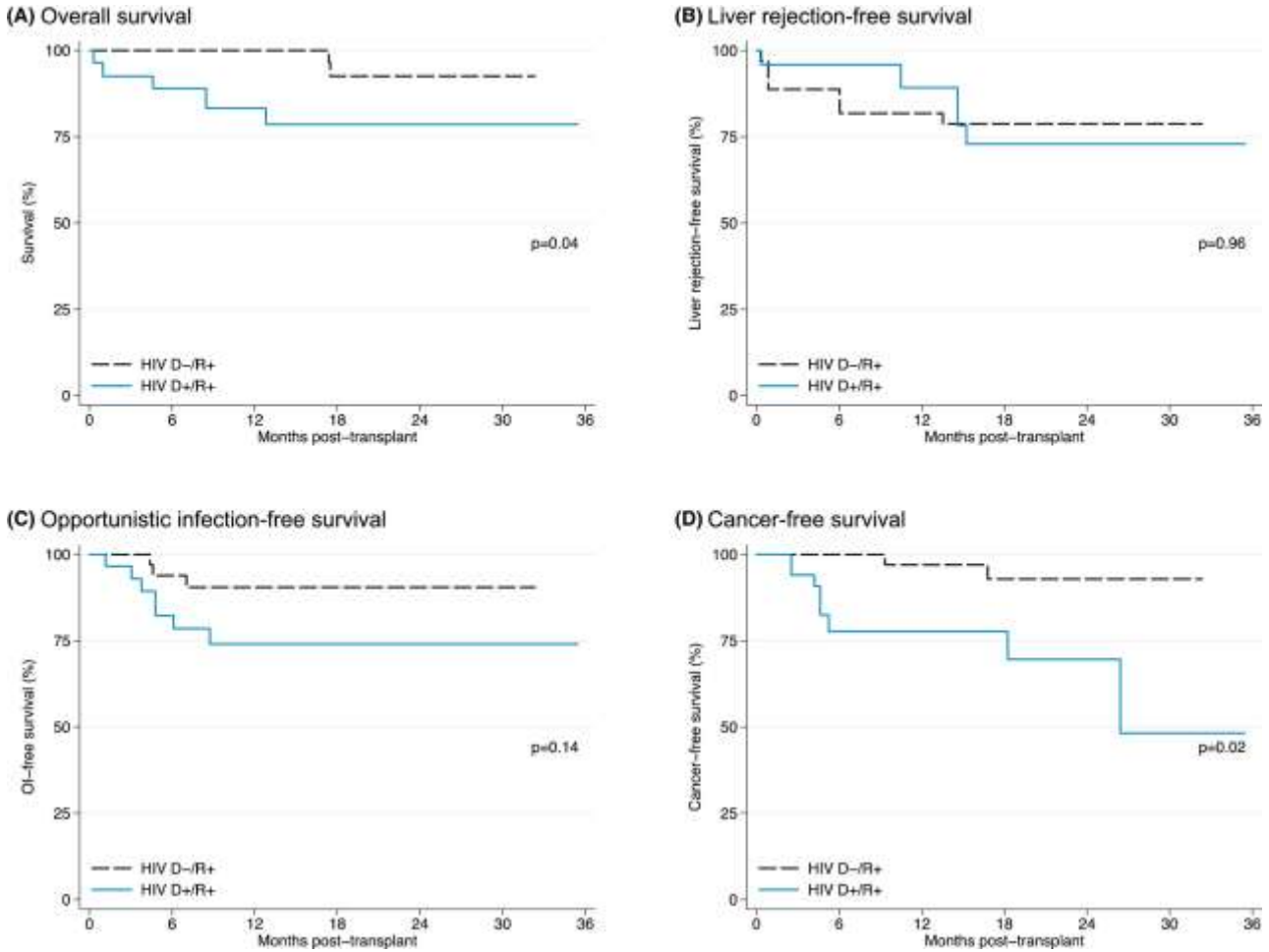


Transplantation. 2023 Nov 28;108(3):759–767.

Albert Einstein College of Medicine

Montefiore DOING MORE℠

Outcomes in liver transplant patients under the HOPE Act

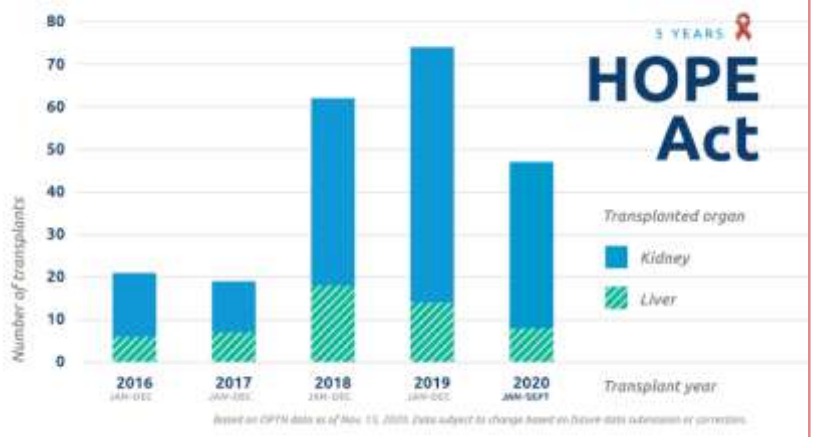


- At time of last analysis, 24 HIV D+/R+ transplants done to date
- Survival numbers acceptable but liver may have more infections and cancer, which needs to be balanced against risk of dying on liver transplant list

Am J Transplant. 2022 Mar;22(3):853-864.

HOPE Act

Despite the successes, volumes to date have been less than anticipated

Anticipated volume:	Actual volume:
500-600 transplants/year	

Am J Transplant. 2011 Jun; 11(6): 1209–1217.

Referral patterns

- There is no organized system to funnel patients with HIV and advanced organ failure to centers experienced with their care
- It's up to patients (and their providers) to navigate the system, find an appropriate transplant center, and navigate the transplant cascade of care

Changing legal requirements in the United States will improve access to HIV D+ transplantation

- United States:
  - Kidney and liver transplant: standard of care
  - Thoracic transplant: volume requirements replaced with proof of multidisciplinary expertise
    - Medicine
    - Surgery
    - HIV/Transplant
    - Pharmacy
- Canada: “exceptional distribution” requirements
- Australia: First HIV D+/R+ transplant 2021 (kidney).

https://journals.lww.com/transplantjournal/toc/2023/10001

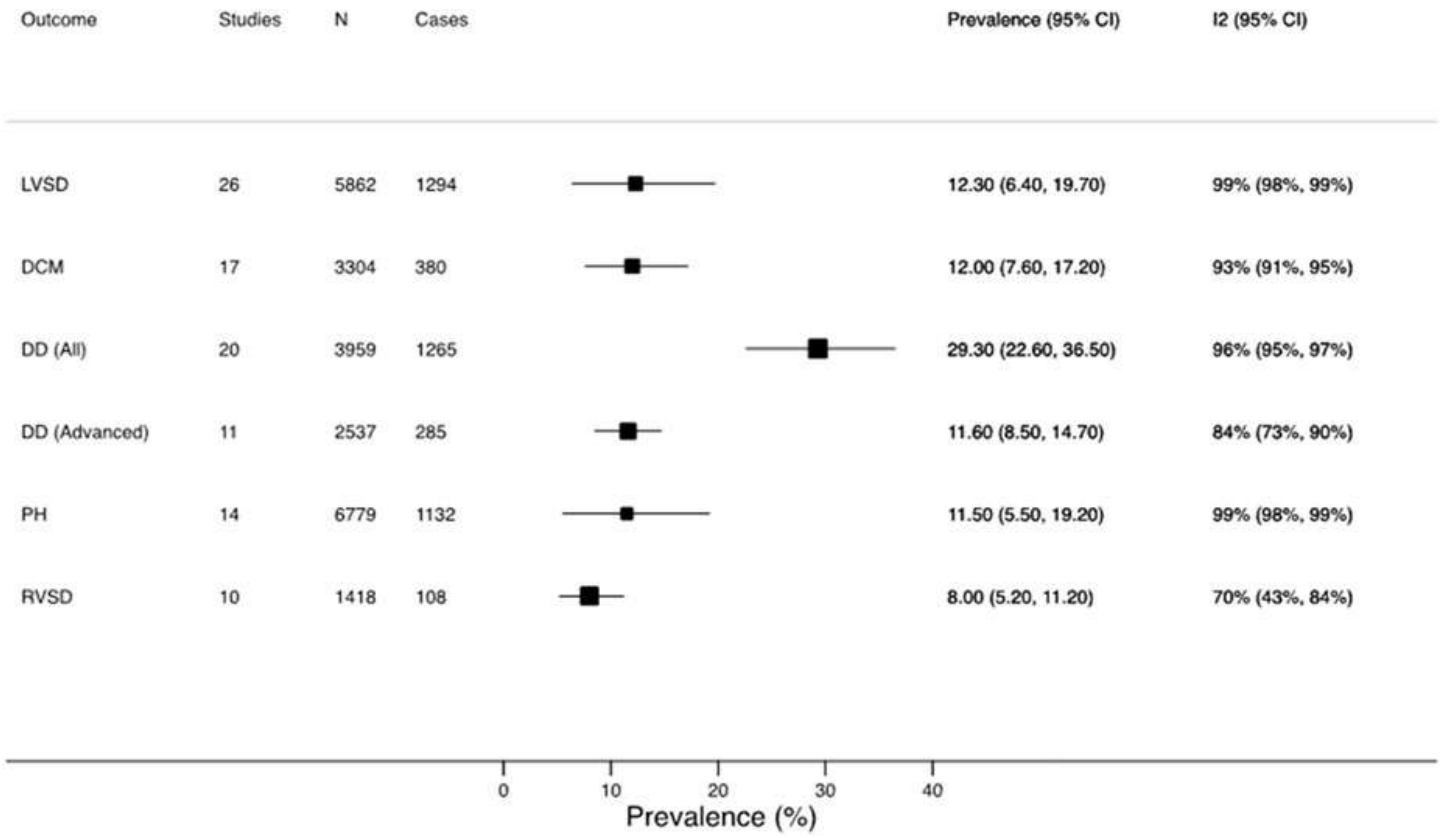
HIV D+/R+ HEART TRANSPLANT

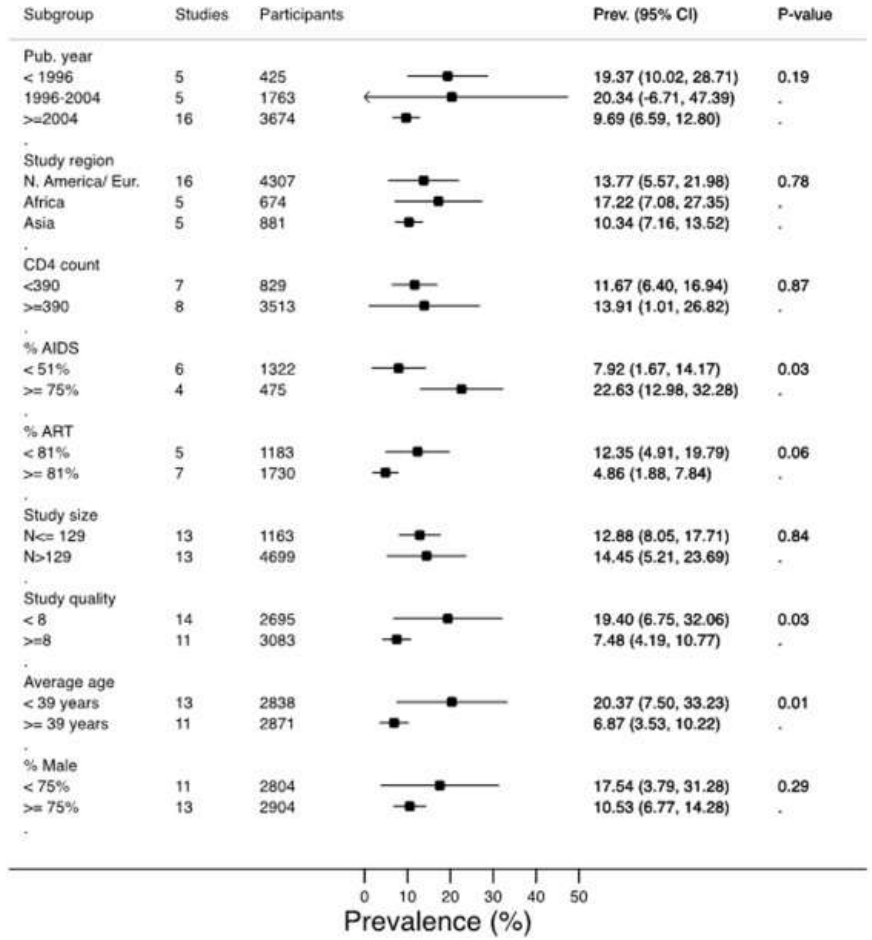
HIV D+ donors: what are non-rejection concerns for heart?

Systolic dysfunction/HFrEF	Diastolic dysfunction/HFpEF	Premature coronary artery disease
• Cumulative viremia • Nadir CD4 count	• Age • Traditional risk factors • Nadir CD4 count?	• Cumulative viremia • Tobacco • Inflammation • Specific ARVs?

Epidemiology. 2019 Jan;30(1):69-74.
J Am Heart Assoc. 2016 Jun 27;5(6):e003371.

High prevalence of cardiac disease in multiple studies globally



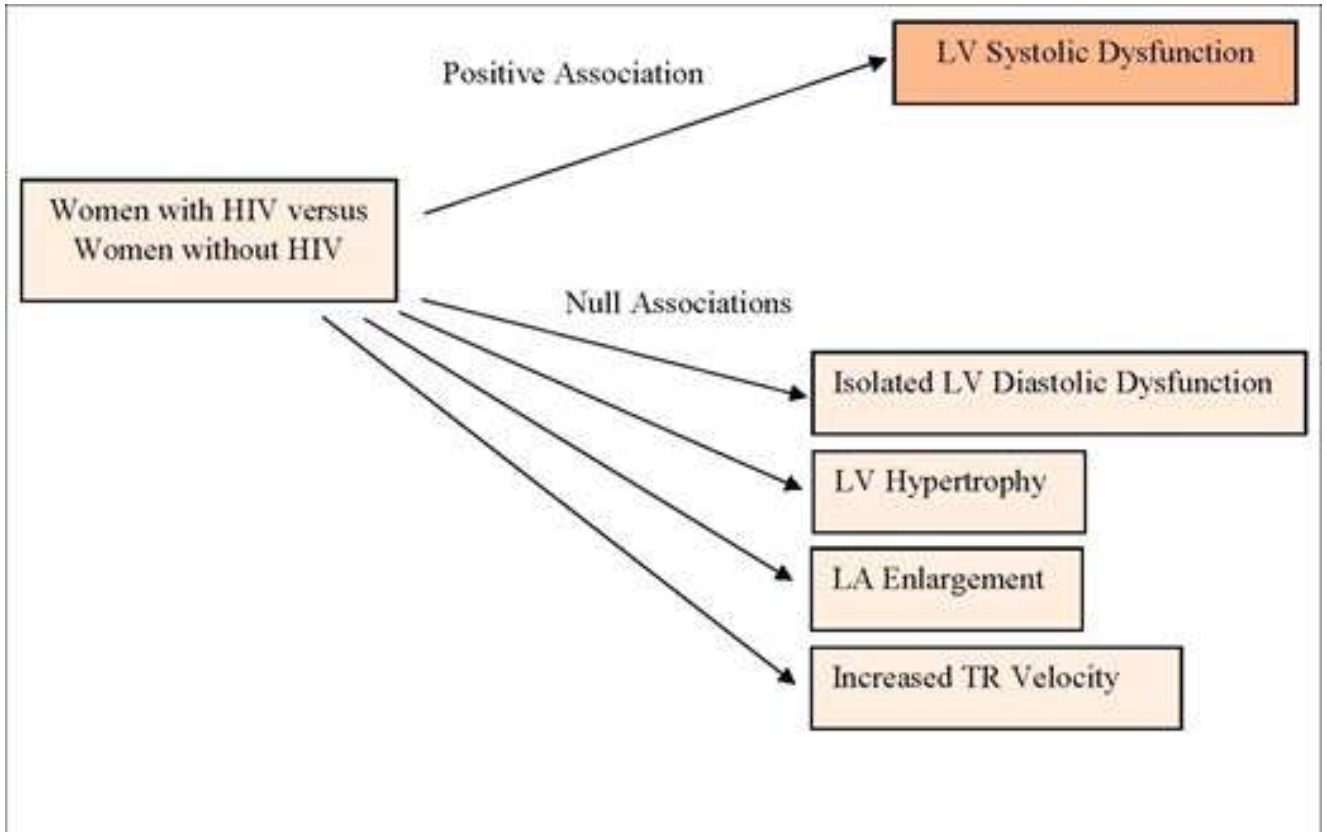


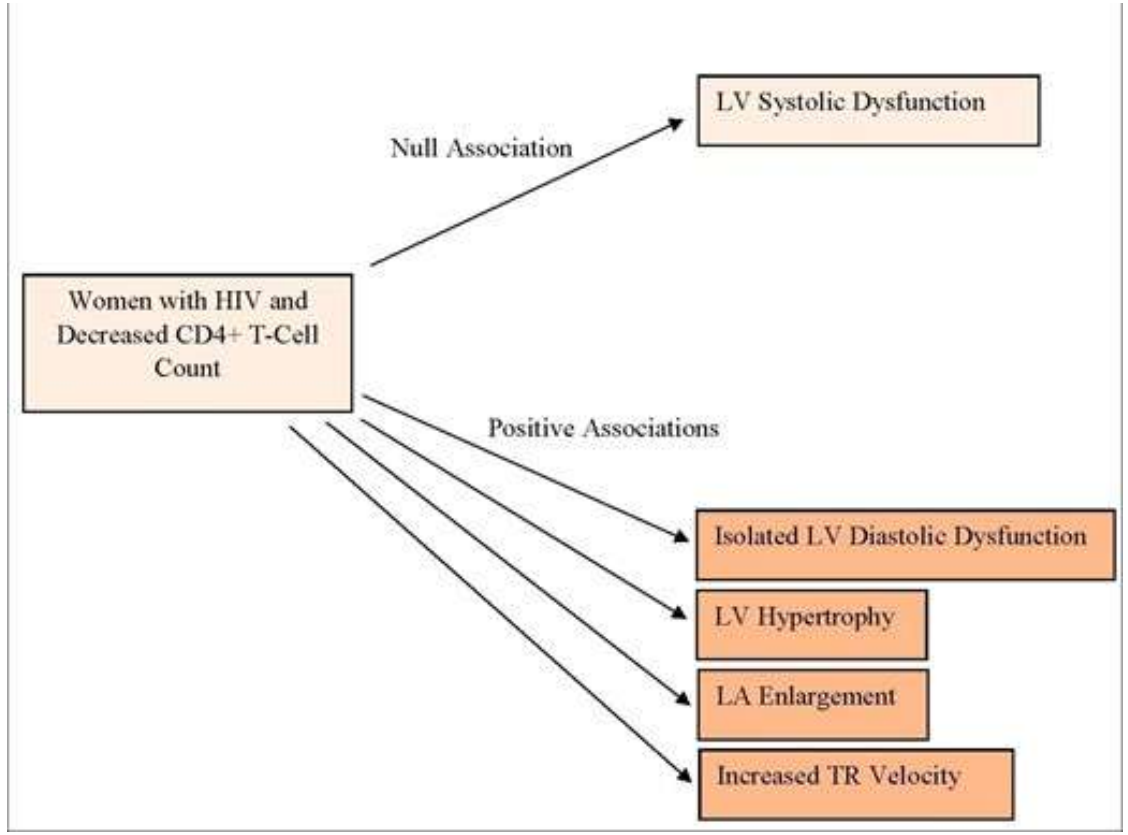
JACC Heart Fail. 2019 Feb;7(2):98-108.

Albert Einstein College of Medicine

Montefiore DOING MORE℠

Systolic and diastolic dysfunction in women with HIV

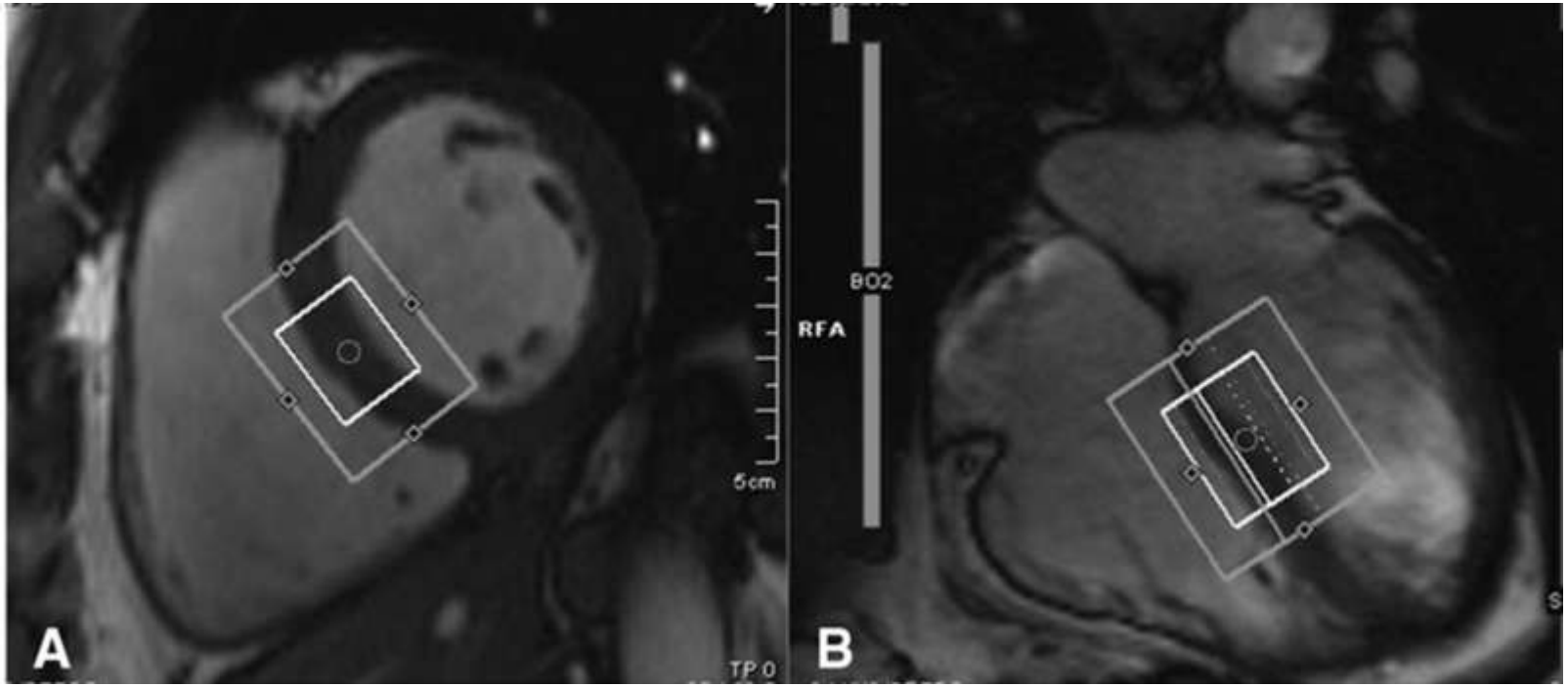




Clin Infect Dis. 2023 Jan 13;76(2):210-219.

Most people with HIV have abnormal cardiac MRI findings

Myocardial fibrosis in 76% of asymptomatic PLWH compared with 13% of control subjects (P<0.001)



Circulation. 2013 Aug 20;128(8):814-22.

HIV D+/R- heart transplants in the ARV era

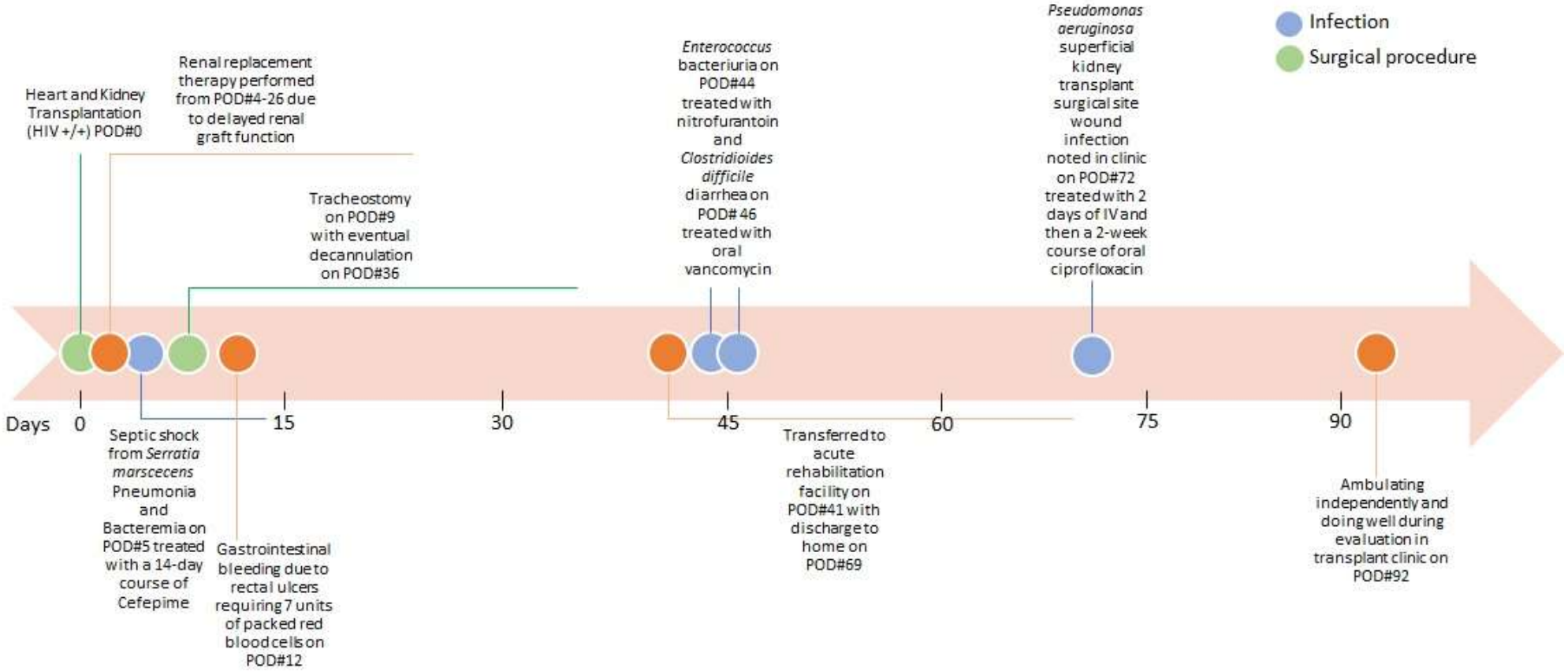
Chicago, 2006	Survived three years Death due to non-adherence	Mild rejection treated with oral prednisone
Taiwan, 2012	Well-functioning graft four years post transplant	Moderate rejection Coronary allograft vasculopathy

Am J Transplant. 2011 Jun;11(6):1218-25.

ATC 2016, abstract C292

HIV D+/R+ transplant

- Nine transplants performed at 3 centers in the United States, 2022-2025



J Heart Lung Transplant. 2023 Mar;42(3):406-408.

HIV D+/R+ vs HIV D-/R+: the Montefiore experience 2015-2025

	All Patients (n=10)	HIV (D+/R+) (n=4)	HIV (D-/R+) (n=6)	P value
Age at HT (y)	59 (55-62)	60 (54-67)	59 (55-61)	0.67
Female, n (%)	2 (20)	1 (25)	1 (16.7)	1.00
BMI (kg/m²)	25.4 (23.5-26.6)	25 (23.1-26.9)	25.4 (23.6-26.0)	1.00
Diabetes Mellitus, n (%)	5 (50)	2 (50)	3 (50)	1.00
Total waitlist time (d)	77 (21-114)	68 (23-112)	77 (20-117)	1.00
Immunosuppression				
Induction				0.33
ATG + steroids, n (%)	2 (20)	0 (0)	2 (33.3)	
Basiliximab + steroids n (%)	2 (20)	2 (50)	0 (0)	
Maintenance				
Prednisone, n (%)	10 (100)	4 (100)	6 (100)	1.00
Mycophenolate mofetil, n (%)	9 (90)	4 (100)	5 (83.3)	1.00
Tacrolimus, n (%)	10 (100)	4 (100)	6 (100)	1.00
HIV and co-infections				
CD4+ T cell count	472 (356-652)	504 (314-661)	472 (389-618)	1.00
HIV RNA <20 (copies / ml), n (%)	6 (60)	3 (75)	3 (50)	0.57
HBV core IgG positive, n (%)	5 (50)	2 (50)	3 (50)	1.00
HCV Ab positive, n (%)	0 (0)	0 (0)	0 (0)	.
Toxoplasmosis IgG positive, n (%)	0 (0)	0 (0)	0 (0)	.
Ebstein Barr Virus IgG postive, n (%)	10 (100)	4 (100)	6 (100)	1.00
ARV therapy				1.00
Dolutegravir/FTC/TAF, n (%)	3 (30)	2 (50)	1 (16.7)	
Bictegravir/FTC/TAF, n (%)	5 (50)	2 (50)	3 (50)	
Dolutegravir/Rilpivirine, n (%)	1 (10)	0 (0)	1 (16.7)	
Raltegravir/FTC/TDF, n (%)	1 (10)	0 (0)	1 (16.7)	

- Ten recipients with HIV (3 received simultaneous kidney transplantation.
- Divided into two groups:
  - Four HIV D+/R+
  - Six HIV D-/R+
- Outcomes: Survival, graft function, rejection, infection and dd-cfDNA

J Heart Lung Transplant. 2025 Sep 23:S1053-2498(25)02279-X.

Donor characteristics

	All Patients (n=10)	HIV (D+/R+) (n=4)	HIV (D-/R+)(n=6)	P value
Age at HT (y)	28 (26-31)	28 (27-30)	29 (25-36)	0.75
Female, n (%)	2 (20)	1 (25)	1 (16.7)	1.00
DCD Donor, n (%)	0 (0)	0 (0)	0 (0)	.
LVEF (%)	63 (55-65)	64 (57-73)	63 (55-65)	0.45
Ischemic time (h)	258 (200-343)	304 (194-353)	235 (200-260)	0.52
Donor cause of death, n (%)				1.00
Brain anoxia	5 (50)	2 (50)	3 (50)	
CVA / stroke	1 (10)	0 (0)	1 (16.7)	
Head Trauma	4 (40)	2 (50)	2 (33.3)	
HIV and co-infections				
HIV ab positive, n (%)	4 (40)	4 (100)	0 (0)	0.005
HIV NAAT positive, n (%)	2 (20)	2 (50)	0 (0)	0.13
HBV core IgG positive, n (%)	1 (10)	1 (25)	0 (0)	0.40
HBV sAg positive, n (%)	0 (0)	0 (0)	0 (0)	.
HCV NAAT positive, n (%)	1 (10)	0 (0)	1 (16.7)	1.00
HCV Ab positive, n (%)	1 (10)	0 (0)	0 (0)	1.00
Toxoplasmosis IgG positive, n (%)	1 (10)	0 (0)	0 (0)	1.00
Ebstein Barr Virus IgG postive, n (%)	9 (90)	4 (100)	5 (83.3)	1.00

J Heart Lung Transplant. 2025 Sep 23:S1053-2498(25)02279-X.

Outcomes

	All Patients (n=10)	HIV (D+/R+) (n=4)	HIV (D-/R+) (n=6)	P value
Alive at 3 months, n (%)	10 (100)	4 (100)	6 (100)	1.00
Severe PGD after HT, n (%)†	0 (0)	0 (0)	0 (0)	.
Normal heart graft function at 3 months, n (%)*	10 (100)	4 (100)	6 (100)	1.00
LVEF at 3 months (%)	60 (60-65)	60 (60-65)	63 (60-65)	0.71
Retrospective cross match positive after HT, n (%)**	2 (20)	1 (25)	1 (16.7)	1.00
Presence of donor specific antibodies, n (%)	4 (40)	1 (25)	3 (50)	0.57
Cell mediated rejection (ISHLT grade ≥2R)				
Patients with cell mediated rejection, n (%)	3 (30)	1 (25)	2 (33.3)	1.00
Episodes of cell mediated rejection	0 (0-1)	0 (0-0.5)	0 (0-1)	0.79
Antibody mediated rejection, n (%)	2 (20)	0 (0)	2 (33.3)	0.47
Infection episodes	0.5 (0-1)	0 (0-2.5)	1 (0-1)	0.49
CD4+ T cell count at 3 months	478 (178-527)	486 (316-580)	253 (178-527)	0.624
HIV viral load at 1 month after HT				0.13
Not detected, n (%)	8 (80)	2 (50)	6 (100)	
<20 RNA copies / ml, n (%)	2 (20)	2 (50)	0 (0)	
HIV viral load at 3 months after HT				0.44
Not detected, n (%)	8 (80)	3 (75)	5 (83.3)	
<20 RNA copies / ml, n (%)	1 (10)	1 (25)	0 (0)	
Donor derived cell free DNA (%)***				
1-month	0.26 (0.11-0.49)	0.14 (0.11-0.33)	0.28 (0.26-0.61)	0.15
3-month	0.16 (0.08-0.25)	0.14 (0.06-0.22)	0.36 (0.12-0.59)	0.35

- 100% survival in total cohort at median f/u of 1060 days (77-3630)
- HIV D+/R+: 312 days (77-1121)
- 70% of patients with ACR at 6 mos

J Heart Lung Transplant. 2025 Sep 23:S1053-2498(25)02279-X.

Unanswered questions

- Angiography indications for heart donors vary by center
  - **Age>40**
  - Hypertension
  - Diabetes
  - Tobacco
  - Hyperlipidemia
  - Family history of premature coronary artery disease
  - Cocaine use
- The extent to which these criteria could be relaxed for future transplants will need be determined
- Should HIV be an indication for, or affect the age limit for, angiography?

J Thorac Dis. 2021 Mar; 13(3): 1864–1868.

Unanswered questions

- Should immunosuppression strategies be changed?
  - Well-established in kidney literature that PLWH benefit from *more*, not less immunosuppression
  - Does the intensive monitoring that thoracic patients undergo change the risk/benefit calculation?
- Monitoring post-transplant?
  - Intensity?
  - Cell-free DNA vs biopsy?

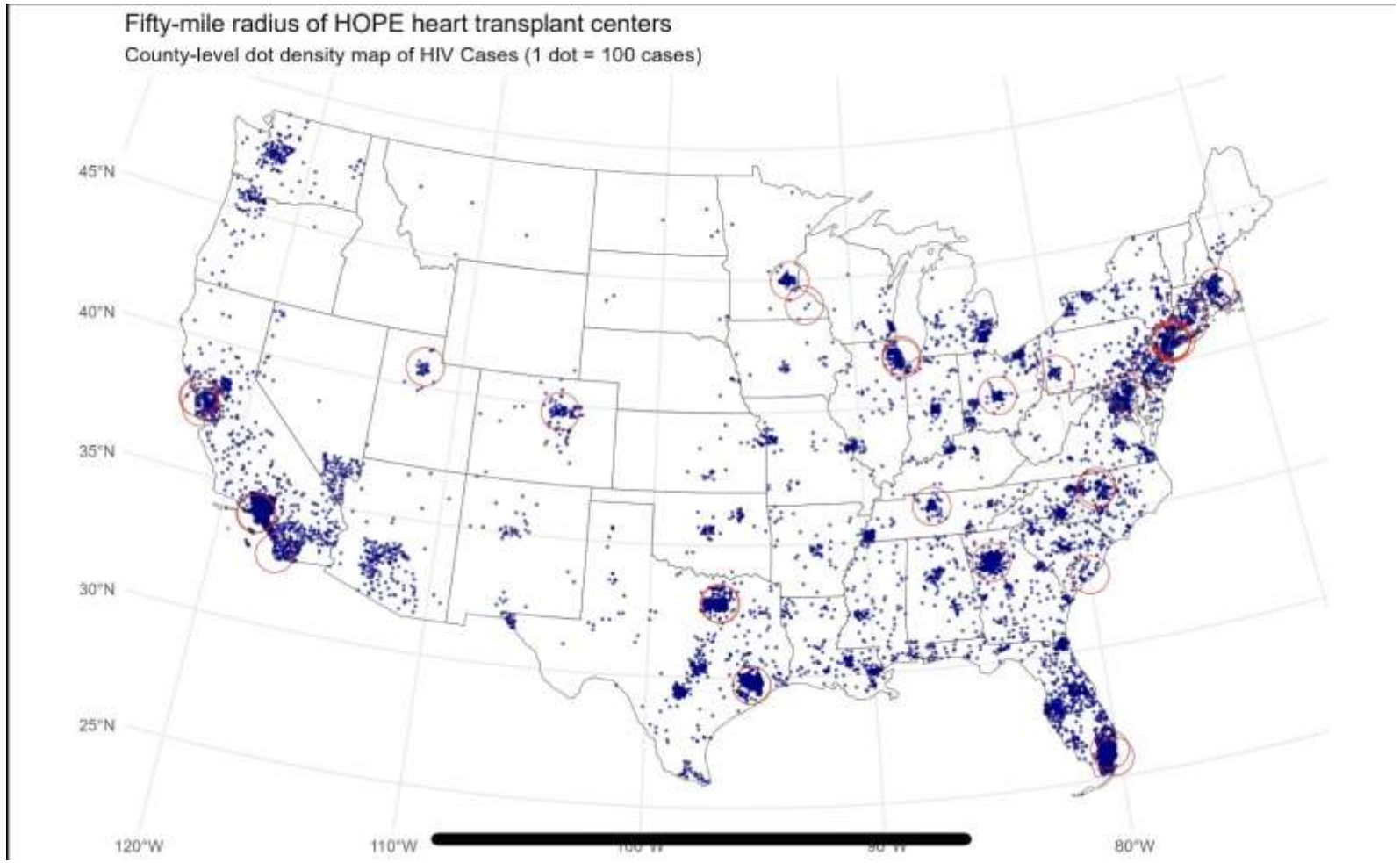
Am J Transplant . 2016 Aug;16(8):2368-76.

Next steps

- Single center pilots currently underway at multiple centers
  - IRB
  - UNOS variance
- Development of shared resources to facilitate the process
  - Email group
  - Template IRB
  - Template protocols
  - https://hope-thoracic.github.io/HOPE-Thoracic-repository/
- Future collaboration for retrospective analyses?

Next steps

- Application scored for a 25-center NIH-funded clinical trial to answer questions about long-term safety of HIV D+/R+ heart transplant
- Target enrollment: 80 patients 2027-2032



EINSTEIN
Albert Einstein College of Medicine

Montefiore
DOING MORE℠

HIV D+/R+ LUNG TRANSPLANT

HIV D+/R+ lung transplant will pose unique challenges

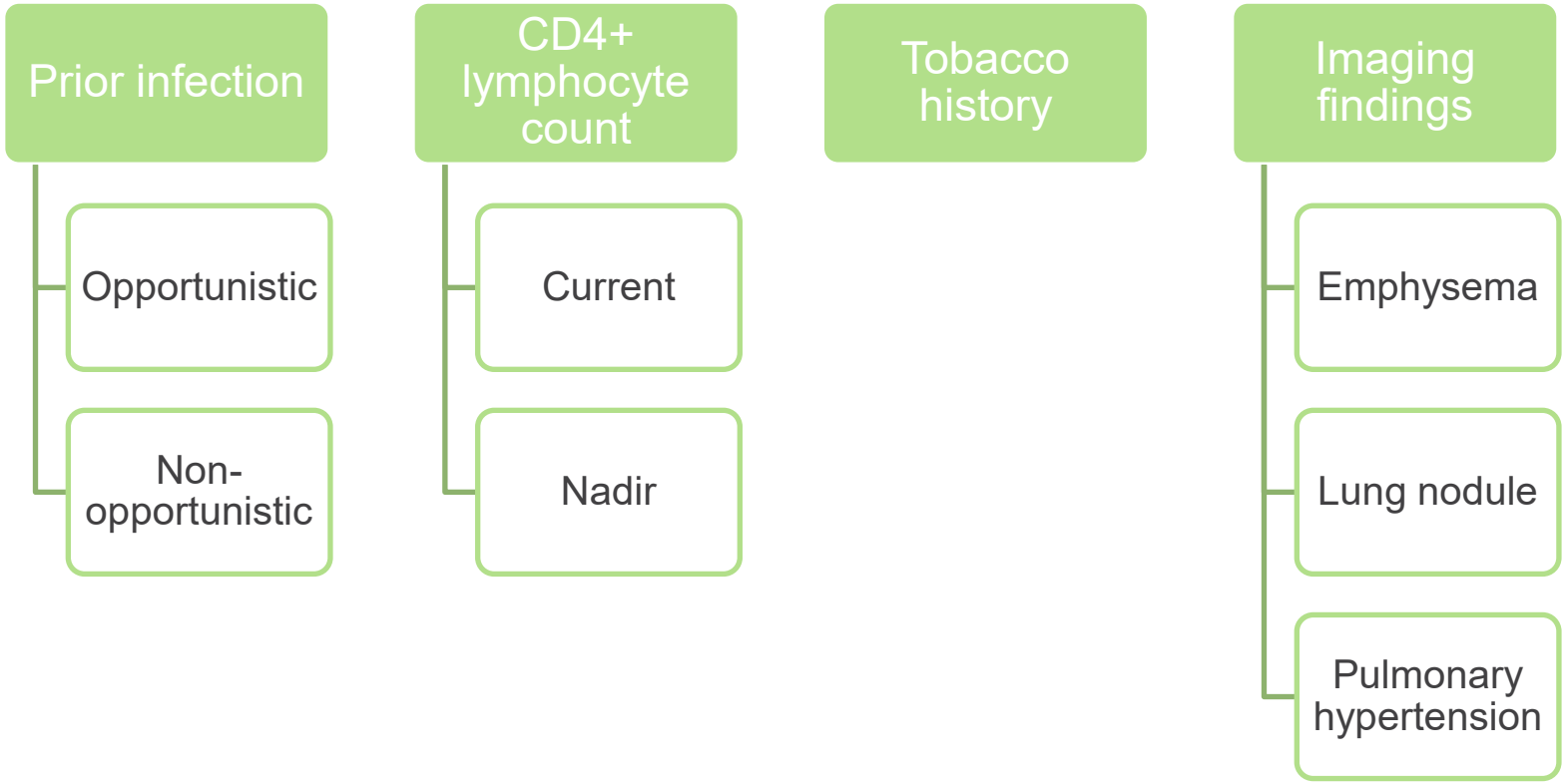
- Effects on the lung that may not show up on pre-transplant workup:
  - Laboratory testing
  - Imaging
  - Biopsies
- Hidden opportunistic infections
  - PJP (?mitigated by prophylaxis?)
  - *Mycobacterium avium* complex
  - Tuberculosis
  - Endemic fungi

HIV D+ lung experience

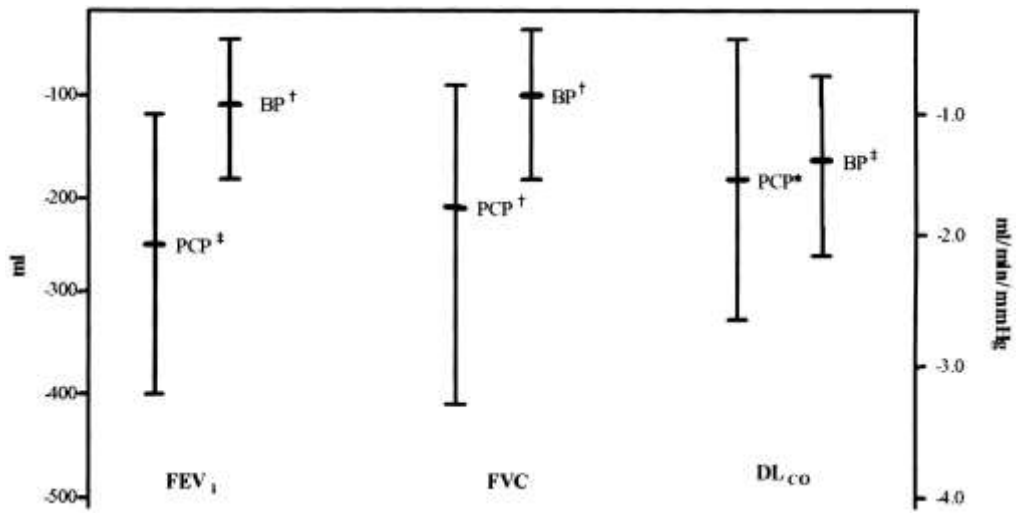
Taiwan, 2012	Well-functioning graft four years-post transplant	No complications reported

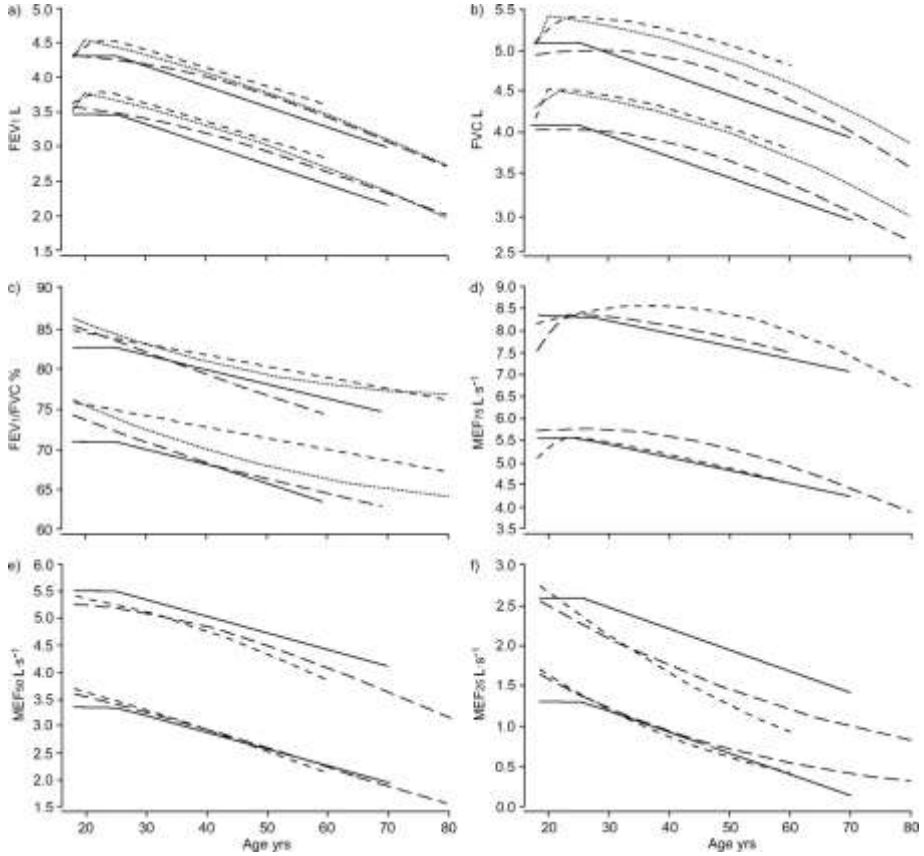
ATC 2016, abstract C292

Evaluating the HIV D+ lung donor



Long-term effects of pneumonia





- FEV_1 decrease after PJP the equivalent of aging ~8 years
- Decreases did not resolve with time in this pre-HAART era study

Am J Respir Crit Care Med. 2000 Aug;162(2 Pt 1):612-6.
European Respiratory Journal 2008; 31: 860-868.

People with HIV are more likely to smoke and more likely to experience medical complications from smoking

- High prevalence of smoking
- 2-5 fold higher rates of lung cancer; association persists after controlling for smoking rates (VACS study 1.5-1.7 IRR).
- Again, cumulative time with low CD4+ lymphocyte count may be predictive

Clin Infect Dis. 2013 Mar;56(5):727-34.
Curr Opin HIV AIDS. 2017 Jan; 12(1): 31–38.
AIDS. 2012 May 15; 26(8): 1017–1025.

Nodules are common in smokers with HIV

Table 2 Baseline results of selected American low-dose computed tomography lung cancer screening trials and the IELCAP trial

Variables	NLST (28,29)	ELCAP (30)	IELCAP (6)	Mayo[†] (31)	PLuSS[†] (5,32)
Participants					
Received CT screening	26,309	1,000	31,567	1,520	3,642
Age, mean (SD)[‡] or median (IQR)[§]	NA	67 (NA)[§]	62 (NA)[§]	59 (NA)[‡]	59 (NA)[‡]
Pack years, mean (SD)[‡] or median (IQR)[§]	NA	45 (NA)[§]	30 (NA)[§]	45 (NA)[§]	47 [33–62][§]
Nodule detection limit	≥4 mm	None reported[¶]	≥5 mm	None reported	None reported
Participants with lung cancer	270/26,309 (1.0%)[††]	27/1,000 (2.7%)	405/31,567 (1.3%)	31/1,520 (2.0%)	53/3,642(1.5%)
Participants with NCNs	7,041/26,309 (26.8%)	233/1,000 (23.3%)	4,186/31,567 (13.3%)	780/1,520 (51.3%)	1,477/3,642 (40.6%)

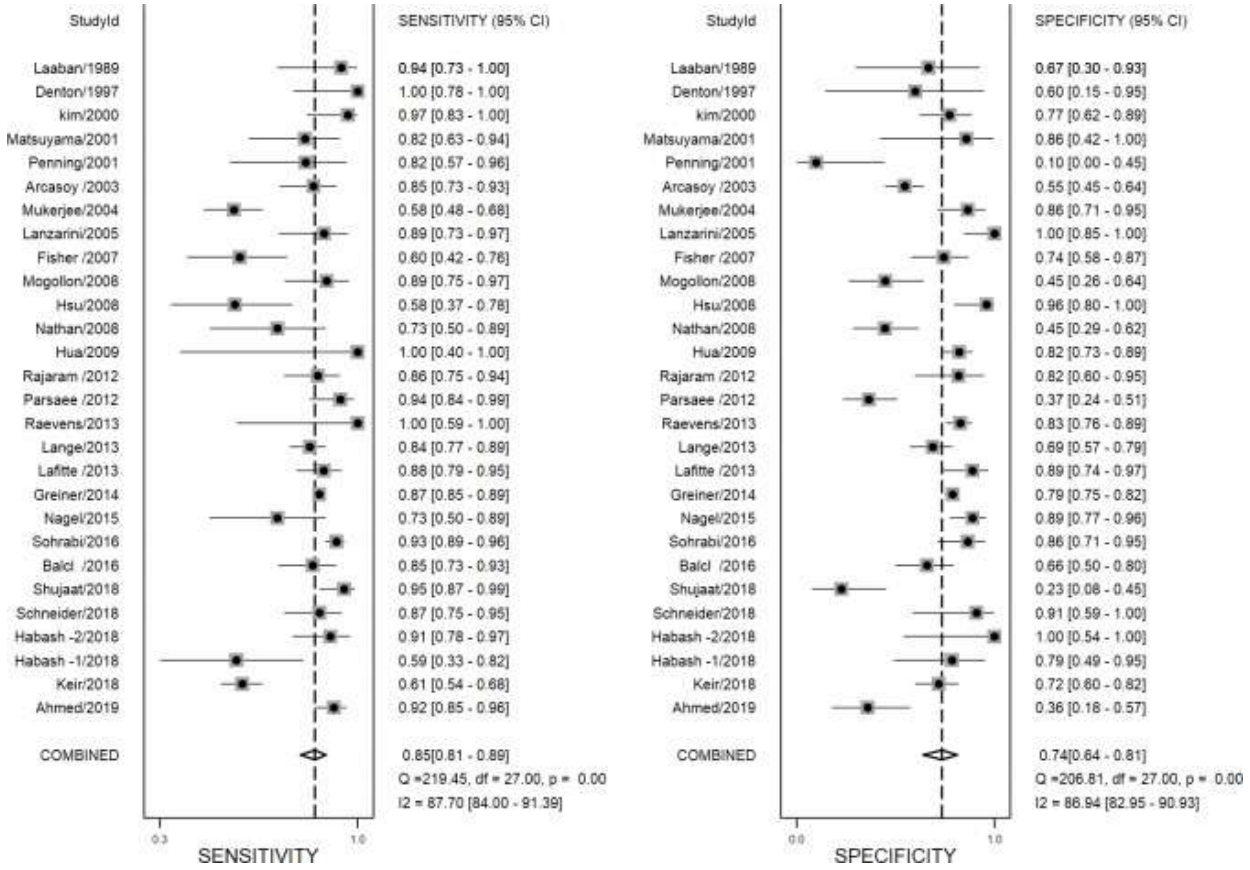
Transl Lung Cancer Res. 2017 Feb;6(1):42-51.

CD4 count and viral load are likely associated with chest CT findings

- EXHALE study (part of the VACS study):
  - noncalcified nodule>=4 mm in 55% of patients with CD4+ lymphocyte count<200/µL
  - 25% if CD4+ lymphocyte 200/µL or greater
- COCOMO study:
  - $CD4^+$ T lymphocyte count under 500 cells/µl and $CD4^+$ T lymphocyte nadir less than 200 cells/µl were each associated with increased odds of a positive image (OR) 2.32 (95% CI: 1.01–5.13, *P* = 0.04)
  - Previous history of PCP [OR 4.32 (95% CI: 1.34–11.9), *P* = 0.01] independently associated with abnormal CT chest

AIDS 2014, 28: 1007–1014.
AIDS 2017, 31: 1973-1977.

Pulmonary hypertension and HIV



- Ten-fold higher prevalence in people with HIV
- Sensitivity of echocardiography for diagnosing pulmonary hypertension ~80%.
- Our own center decided to opt for RHC if any HIV D+ organ is accepted

Lancet Healthy Longev. 2021 Jul;2(7):e389-e390.
BMJ Open. 2019 Dec 22;9(12):e033084.

Traditional vs. extended criteria for the lung donor without HIV.

Table 1
Criteria used to assess donor lung suitability, defining a "standard lung donor"

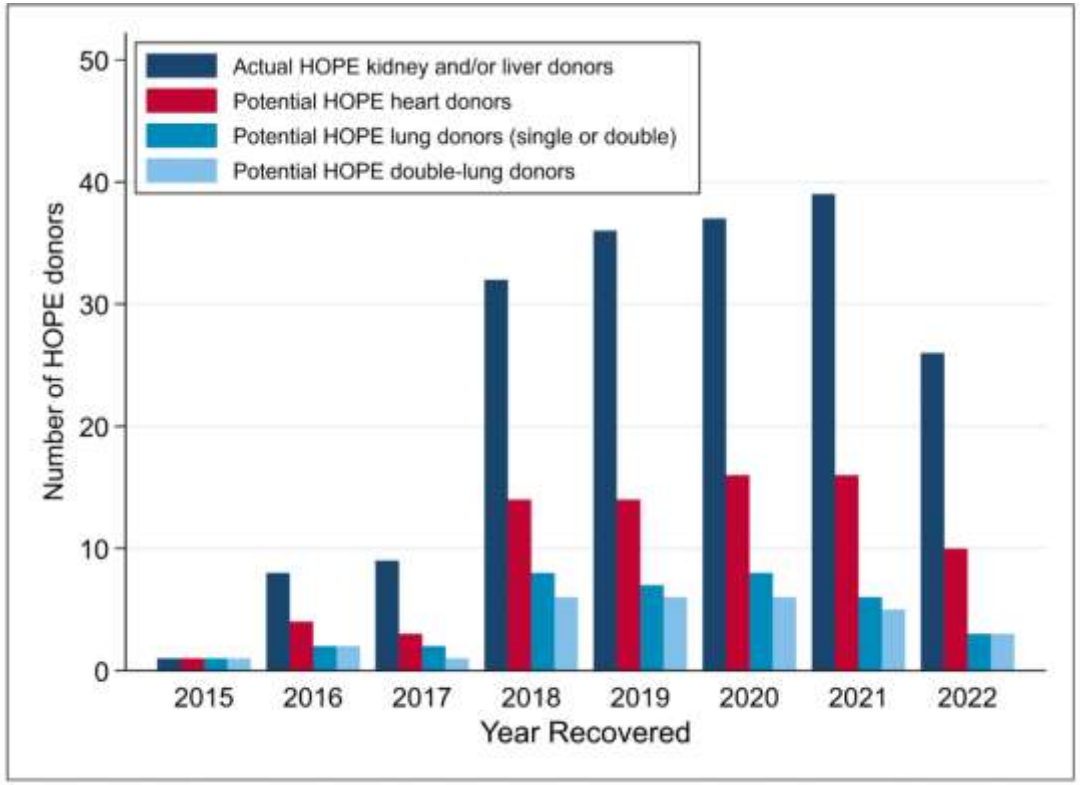
Traditional Criteria (Standard Donor)	Extended Criteria (Marginal Donors)
Age ≤55 y	Age >70 y
Clear chest X-ray	Minor diffuse and moderate focal chest radiograph changes acceptable
Pao_2 ≥300 on Fio_2 = 1.0 and positive end-expiratory pressure (PEEP) 5 cm H_2O	Pao_2/Fio_2 <300 mm Hg on PEEP 5 cm H_2O
Tobacco history ≤20 pack yr	Tobacco history <40 pack yr
Absence of chest trauma	Chest trauma not relevant if good pulmonary function
No history of primary pulmonary disease or active pulmonary infection	
No evidence of aspiration/sepsis	Aspiration/sepsis acceptable if good, stable/improving pulmonary function
Absence of pulmonary secretions at bronchoscopy	Purulent secretions not relevant if good, stable/improving pulmonary function
No evidence for human immunodeficiency virus, hepatitis B, hepatitis C, or any other relevant viral disease	
No history or evidence of malignant disease	
ABO compatibility	
Sputum Gram stains: absence of organisms	

- What is an acceptable treatment history for the HIV D+ lung donor?
- When should opportunistic infections exclude lung donation?
- What smoking history is acceptable?
- Single vs double?

Anesthesiology Clin 2019; 37:639–660.

The anticipated number of available thoracic HOPE donors may be less than demand

- Extrapolations from abdominal numbers under review, but do not account for:
  - Size matching needs
  - Geography
- Likely are an *upper bound* on the actual number of available thoracic donors via the HOPE program in the United States and internationally
- False positive donors will be the low-hanging fruit



ATC 2023, abstract 193

Acknowledgments

- Hope-in-Action Team
  - Christine Durand
  - Dorry Segev
- HIV and heart/lung disease
  - Maria Rodriguez-Barrada
  - Keith Sigel
  - Jonathan Shuter
- Former fellows
  - Jonathan Czeresnia
  - Neeraja Swaminathan
- ID leadership
  - Liise-anne Pirofski
  - Barry Zingman
- Heart transplant
  - Ulrich Jorde
  - Snehal Patel
  - Omar Saeed
  - Shivank Madan
- Lung transplant
  - Mohammed Abbasi
  - Ali Mansour
- Montefiore Transplant ID
  - Yoram Puius
  - Grace Minamoto
  - Victoria Muggia
  - Rachel Bartash
  - Daniel Burack
  - Helen Tsai
  - Margaret McCort

- vahemmig@montefiore.org

EINSTEIN
Albert Einstein College of Medicine

Montefiore
DOING MORE℠