

Heart and Lung Transplant Unit

Milpark Hospital

Assessment of Donor Lungs; Expanding the Pool

Dr Paul G Williams

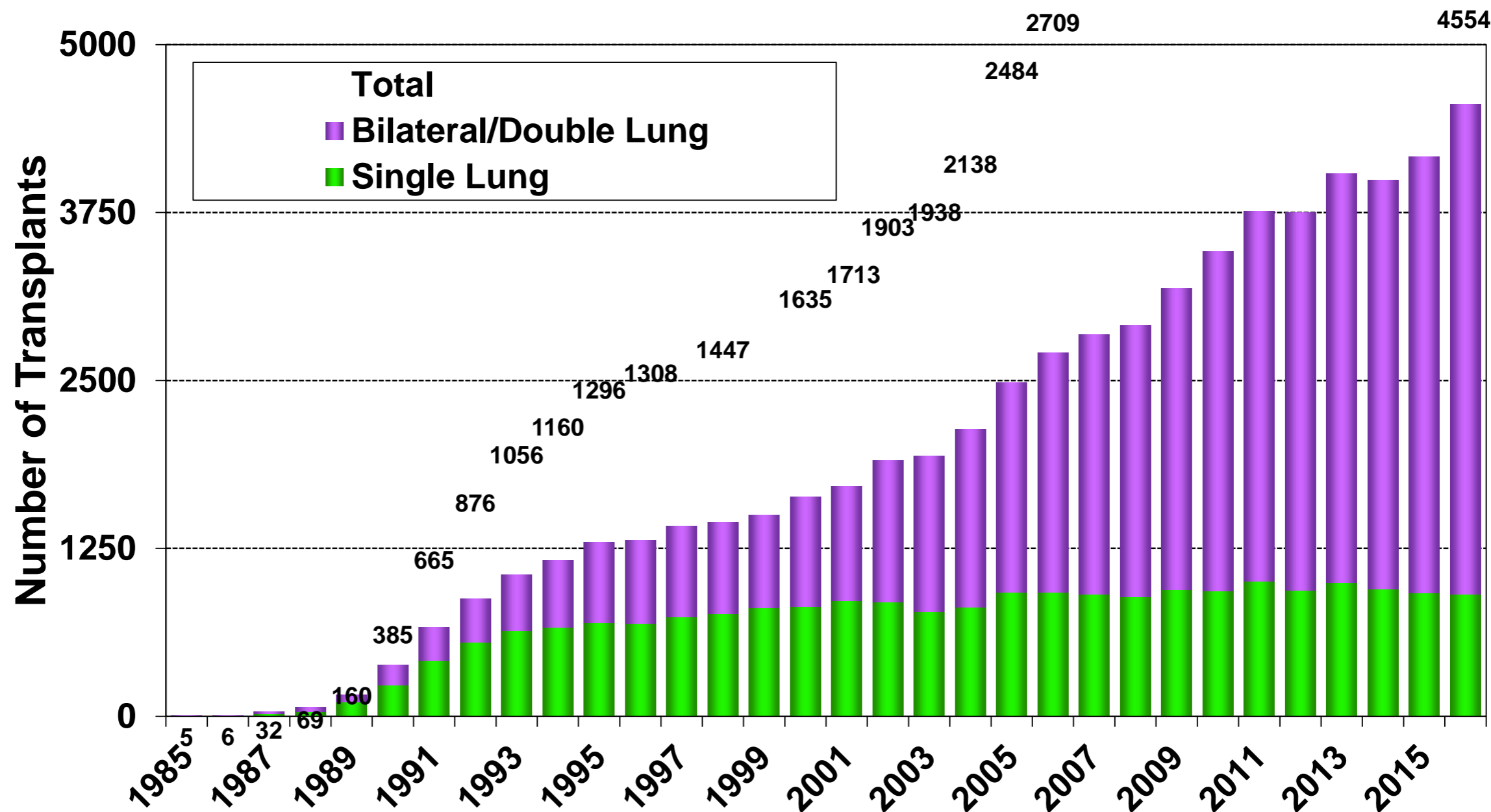
Disclosures

Dr Paul G Williams

None

Adult Lung Transplants

Number of Transplants by Year and Procedure Type



NOTE: This figure includes only the adult lung transplants that are reported to the ISHLT Transplant Registry. As such, this should not be construed as representing changes in the number of adult lung transplants performed worldwide.

ISHLT Transplant Registry Quarterly Reports for Lung in Africa

Characteristics for Transplants performed between January 1, 2016 and June 30, 2017 and
Survival Rates for Transplants performed between January 1, 2013 and December 31, 2016

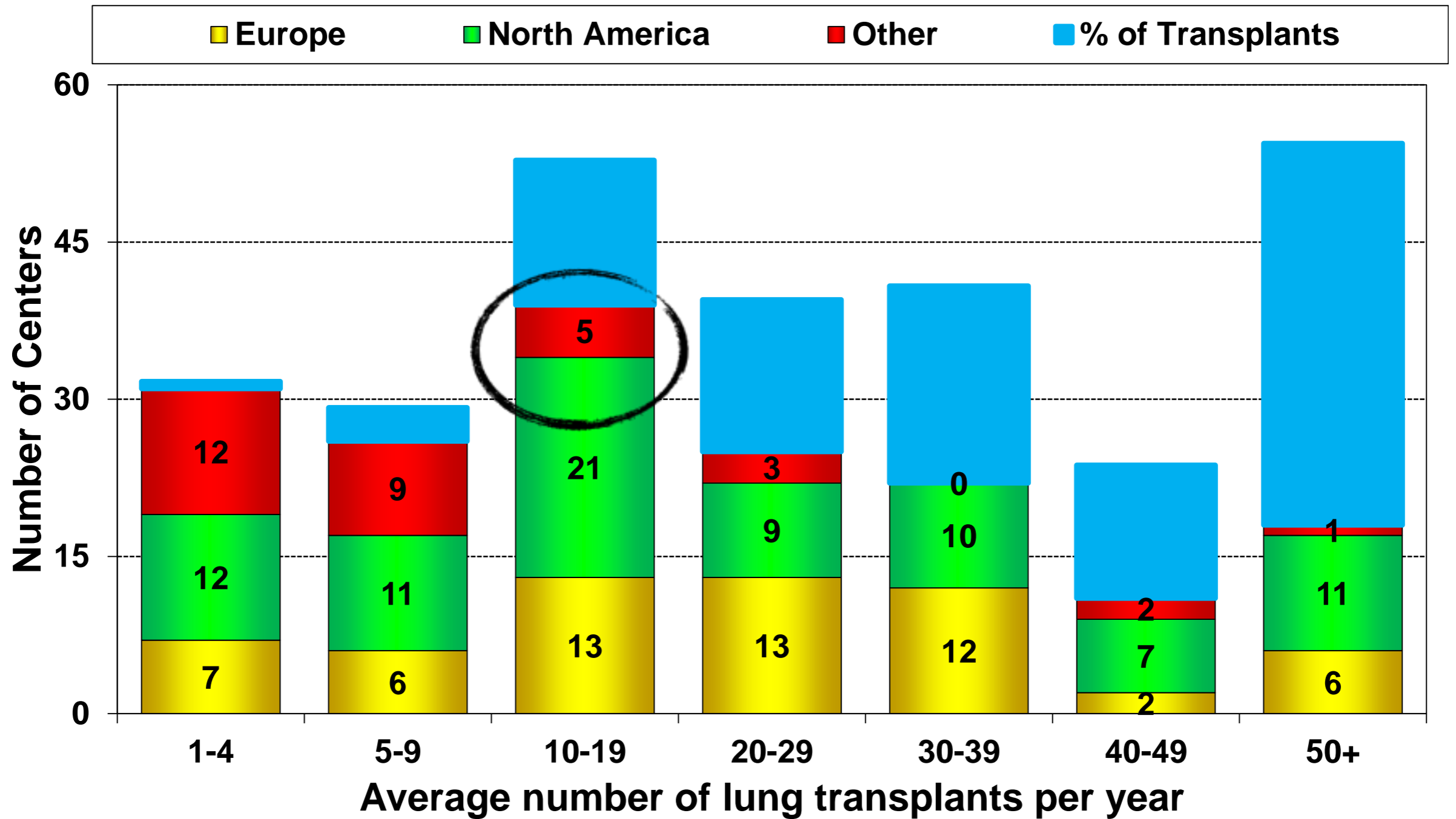
Based on UNOS/ISHLT data as of January 5, 2018

		Transplants Performed During 1/1/2016 - 12/31/2016			
		Continent Specific		Entire ISHLT Registry	
		N	%	N	%
Age	< 1 Years			6	0.1%
	1-5 Years			12	0.3%
	6-10 Years			12	0.3%
	11-17 Years			77	1.7%
	18-34 Years	2	14.3%	601	12.9%
	35-49 Years	6	42.9%	693	14.9%
	50-64 Years	4	28.6%	2328	49.9%
	65+ Years	2	14.3%	932	20.0%
	Not Reported				
Gender	Male	7	50.0%	2719	58.3%
	Female	7	50.0%	1942	41.7%
	Unknown				
ABO	A	7	50.0%	1997	42.8%
	B	1	7.1%	527	11.3%
	AB	1	7.1%	188	4.0%
	O	5	35.7%	1949	41.8%
	Unknown				
Diagnosis Category	Emphysema/COPD	2	14.3%	1152	24.7%
	Cystic Fibrosis	3	21.4%	690	14.8%
	Retransplant/Graft Failure	1	7.1%	101	2.2%
	Congenital Heart Disease			5	0.1%
	Other	1	7.1%	150	3.2%
	Not Reported			56	1.2%
Previous Transplant	No	14	100.0%	4485	96.2%
	Yes			164	3.5%
	Not Reported			12	0.3%

Adult Lung Transplants

Average Center Volume by Location

(Transplants: January 2009 – June 2017)



ISHLT Transplant Registry Quarterly Reports for Lung in Africa

Characteristics for Transplants performed between January 1, 2016 and June 30, 2017 and
Survival Rates for Transplants performed between January 1, 2013 and December 31, 2016

Based on UNOS/ISHLT data as of January 5, 2018

Lung Donor Demographics

		Transplants Performed During 1/1/2016 - 12/31/2016			
		Continent Specific		Entire ISHLT Registry	
		N	%	N	%
Age	< 1 Years			8	0.2%
	1-5 Years			6	0.1%
	6-10 Years			21	0.5%
	11-17 Years	3	21.4%	274	5.9%
	18-34 Years	5	35.7%	1537	33.0%
	35-49 Years	3	21.4%	1181	25.3%
	50-64 Years	3	21.4%	1082	23.2%
	65+ Years			246	5.3%
	Not Reported			306	6.6%
Gender	Male	8	57.1%	2613	56.1%
	Female	6	42.9%	2048	43.9%
	Unknown				



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A Society that Includes Basic Science, the Failing Heart and Advanced Lung Disease.

ISHLT Transplant Registry Quarterly Reports for Lung in Africa

Characteristics for Transplants performed between January 1, 2016 and June 30, 2017 and
Survival Rates for Transplants performed between January 1, 2013 and December 31, 2016

Based on UNOS/ISHLT data as of January 5, 2018

Gender	Male	8	57.1%	2613	56.1%
	Female	6	42.9%	2048	43.9%
	Unknown				
ABO	A	7	50.0%	1817	39.0%
	B	1	7.1%	465	10.0%
	AB	1	7.1%	94	2.0%
	O	5	35.7%	2277	48.9%
	Unknown			8	0.2%
Donor Type	Living				
	Cadaveric: Anoxia/Cardiac Arrest	1	7.1%	682	14.6%
	Cadaveric: Cerebrovascular/Stroke	4	28.6%	1037	22.2%
	Cadaveric: Head Trauma	6	42.9%	1084	23.3%
	Cadaveric: CNS Tumor	1	7.1%	14	0.3%
	Cadaveric: Other COD	2	14.3%	635	13.6%
	Cadaveric: COD Not Reported			1209	25.9%
	Donor Type Not Reported				

Data subject to change based on future data submission or correction.



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Expanding the Pool

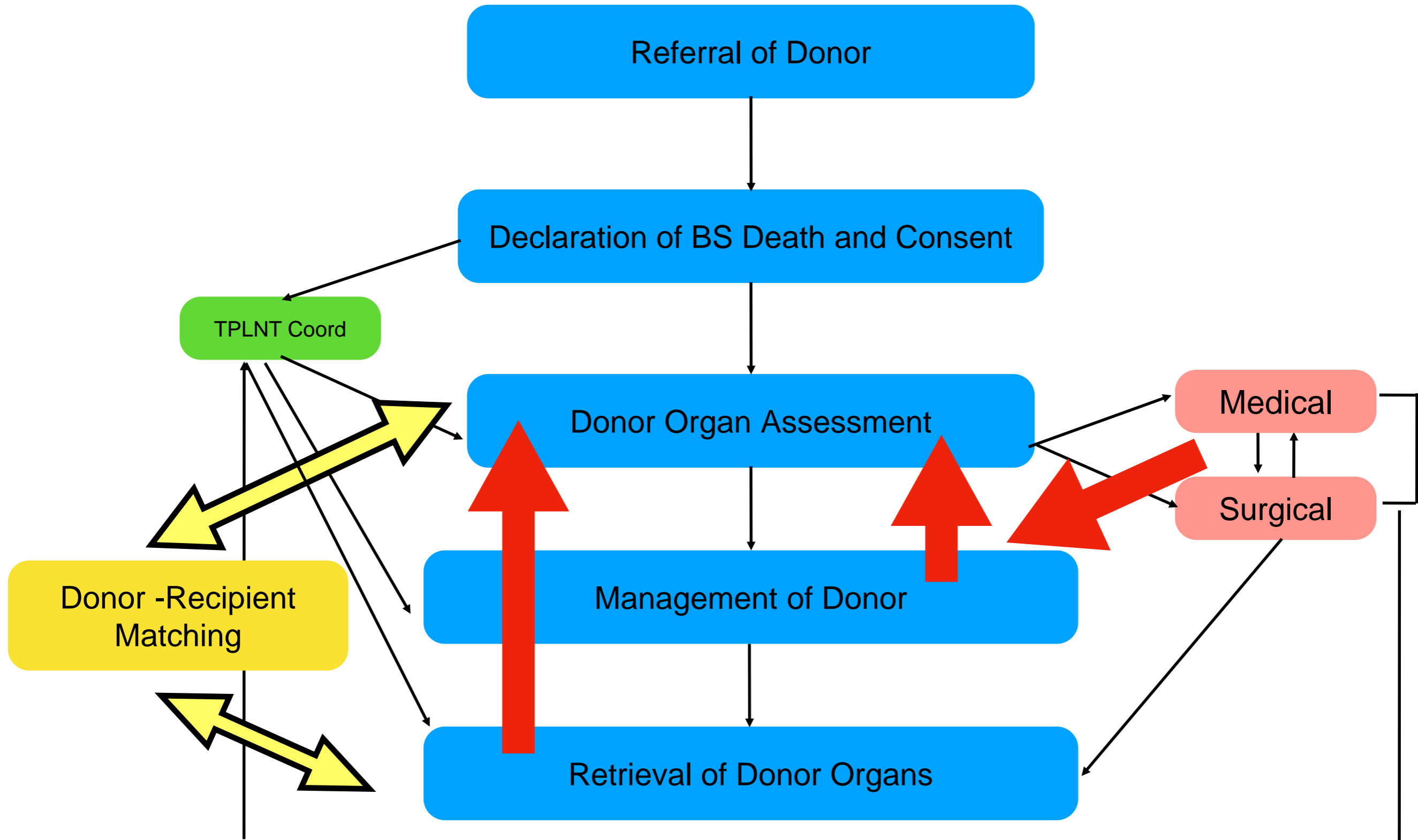


Brainstem death criteria (DBD)

Non Heart-beating Donors (DCD)

Ex-vivo reconditioning of lungs

Donor Assessment



Evaluation of Donor Lung

Thorough history from records and family

Detailed history of cause and mechanism of death

Focus on Habits and High Risk behaviour

Infectious Disease history or risk

History of past or current malignancies

Table 7.7 Standard lung donor criteria

Age <55 years

Clear chest radiograph

Pao₂ >300 mm Hg (Fio₂ 1.0, PEEP 5 mm Hg)

History of smoking <20 pack-years

Absence of chest trauma

Absence of microbiologic endobronchial organisms

Absence of malignancy

Absence of purulent secretions or signs of endobronchial aspiration

Inconspicuous virology

Source: From Frost AE. Donor criteria and evaluation. Clin Chest Med 1997;18:231-237.

Note: PEEP, positive end-expiratory pressure.

Libera Expan Adver Lung

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Background: availability. Al
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Methods: In t
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Results: Sixty
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group; $p = n.s$
groups, respect
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Conclusions:
after lung tran

From the Division of Pulm
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Submitted February 7, 2000; a
Reprint requests: Sangeeta M
Program, Loyola University



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Extended criteria donor lungs do not impact recipient outcomes in pediatric transplantation

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KEYWORDS:

pediatric lung transplantation;
extended criteria donor lungs;
marginal donor lungs;
donor selection;
standard donor criteria;
non-standard donor criteria

BACKGROUND: Pediatric lung transplantation remains the only curative treatment option for some end-stage lung diseases in childhood. Recipient numbers outnumber potential donor organs, and therefore a broader group of donor organs must be considered for pediatric lung transplantation. Herein we describe the outcome of utilizing extended criteria donor organs in pediatric lung transplantation.

METHODS: A retrospective analysis was performed on all pediatric lung transplantations performed at the Hannover Medical School between April 2010 and December 2016. Donors were assigned to a group fulfilling standard donor criteria (International Society for Heart and Lung Transplantation [ISHLT] 2003) or not. Recipients' early- and mid-term morbidity and mortality were recorded.

RESULTS: A total of 57 pediatric lung transplantations were performed: 27 donors fulfilled standard donor criteria (standard criteria donor [SCD] group) and 30 donors were extended criteria donors not fulfilling standard donor criteria (extended criteria donor [ECD] group). Pre-operative recipient characteristics, including age (median [IQR]: 14 [10–15] vs 13 [10.8–15] years, $p = 0.71$), underlying disease, admission to intensive care unit (37.0% vs 50%, $p = 0.42$), mechanical ventilation (14.8% vs 10.0%, $p = 0.70$), and extracorporeal membrane oxygenation (ECMO) support (11.1% vs 23.3%, $p = 0.30$) of both groups were similar. In the ECD group, more atypical volume reductions of the allograft were performed (0% vs 16.7%, $p = 0.05$), yet incidence of post-operative ECMO support was similar for the 2 groups. ECD recipients spent significantly less time on mechanical ventilation (median [IQR]: 2 [1–2] vs 1 [1–2] days, $p = 0.04$) after surgery, but total intensive care unit stay and total hospital stay were similar between groups. Pulmonary function testing results at discharge from initial hospital stay, after 1 year, and at last assessment were also similar. Freedom from chronic lung allograft dysfunction at 1 and 5 years after transplantation showed no significant differences between groups. Survival rates up to 5 years (67.9% vs 90.5%, $p = 0.35$) after transplantation were comparable between groups, yet, counterintuitively, long-term survival in the ECD group showed superior trends compared with the SCD group.

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Transplantation

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Not Be Used for

K. Kirklin, MD,^a
D,^a Katherine Hart, BS,^a

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a median intubation of 14.2
airway complication.

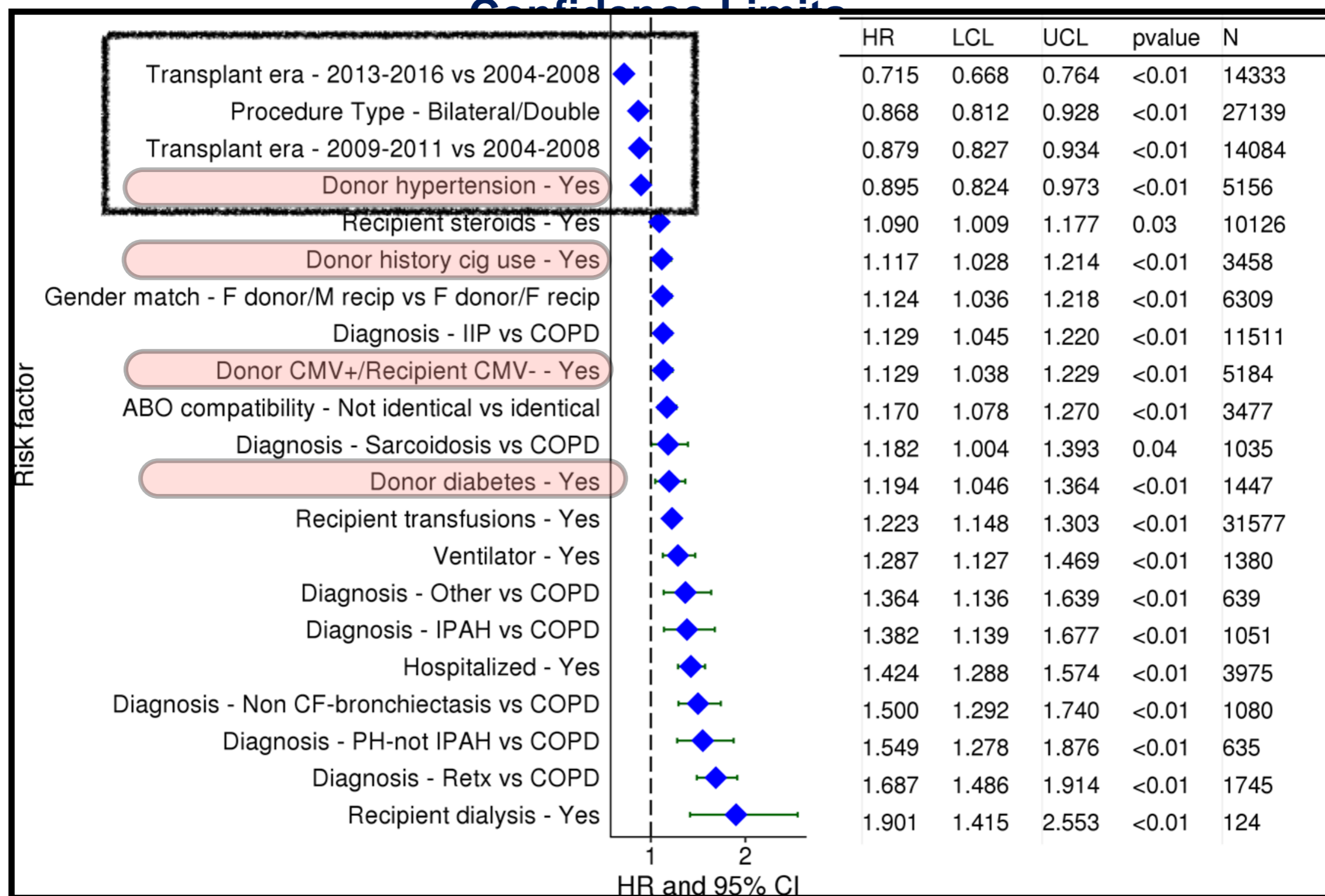
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Adult Lung Transplants (2004-6/2016)

Statistically Significant Risk Factors For 1 Year Mortality with 95% Confidence Limits



Adult Lung Transplants (2004-6/2016)

Statistically Significant Risk Factors For 1 Year Mortality

Continuous Factors (see figures)

Recipient age

Donor age

Recipient creatinine

Recipient FVC% predicted

Transplant center volume

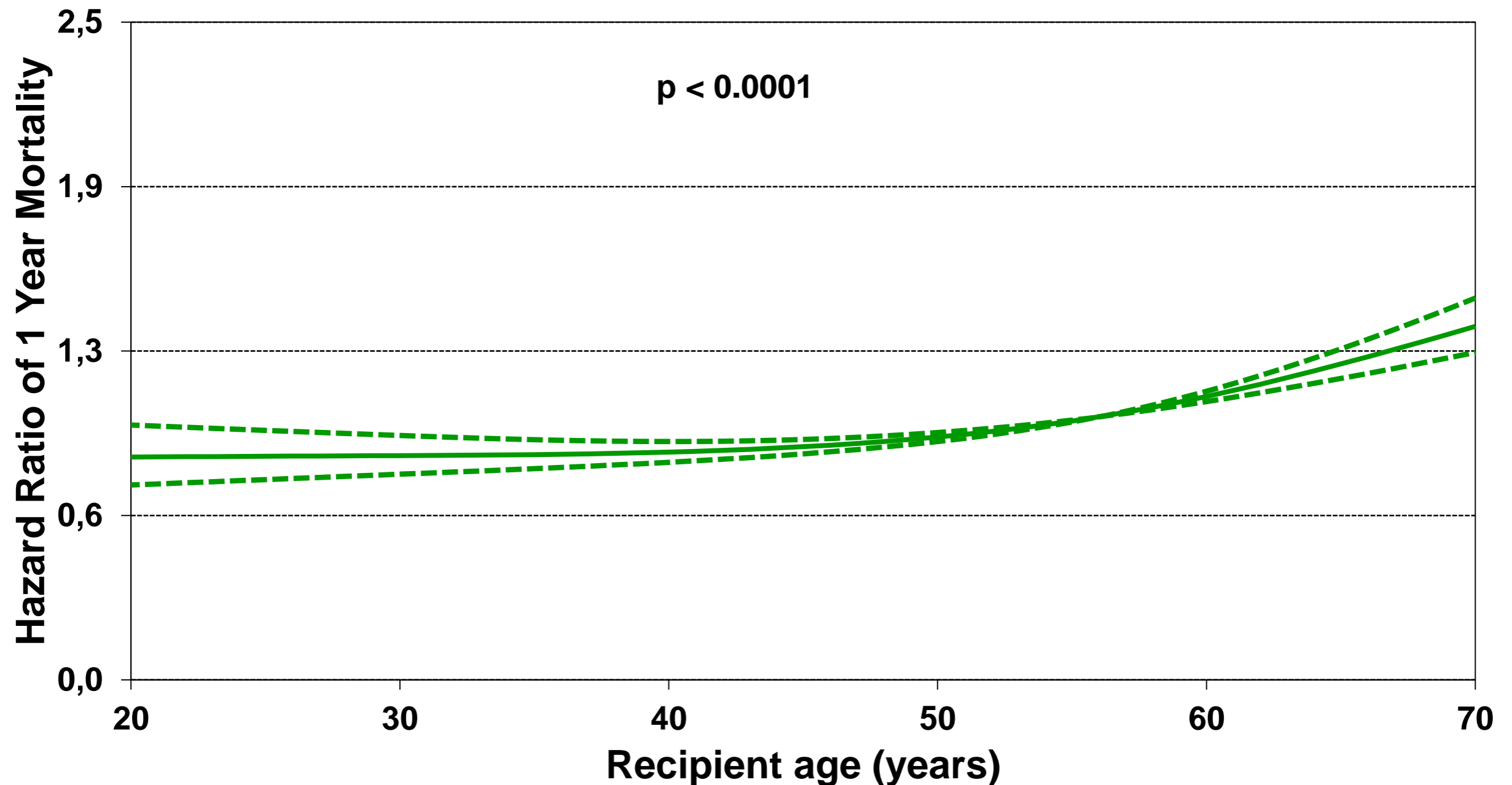
Ischemic time

Recipient bilirubin

Adult Lung Transplants (2004-6/2016)

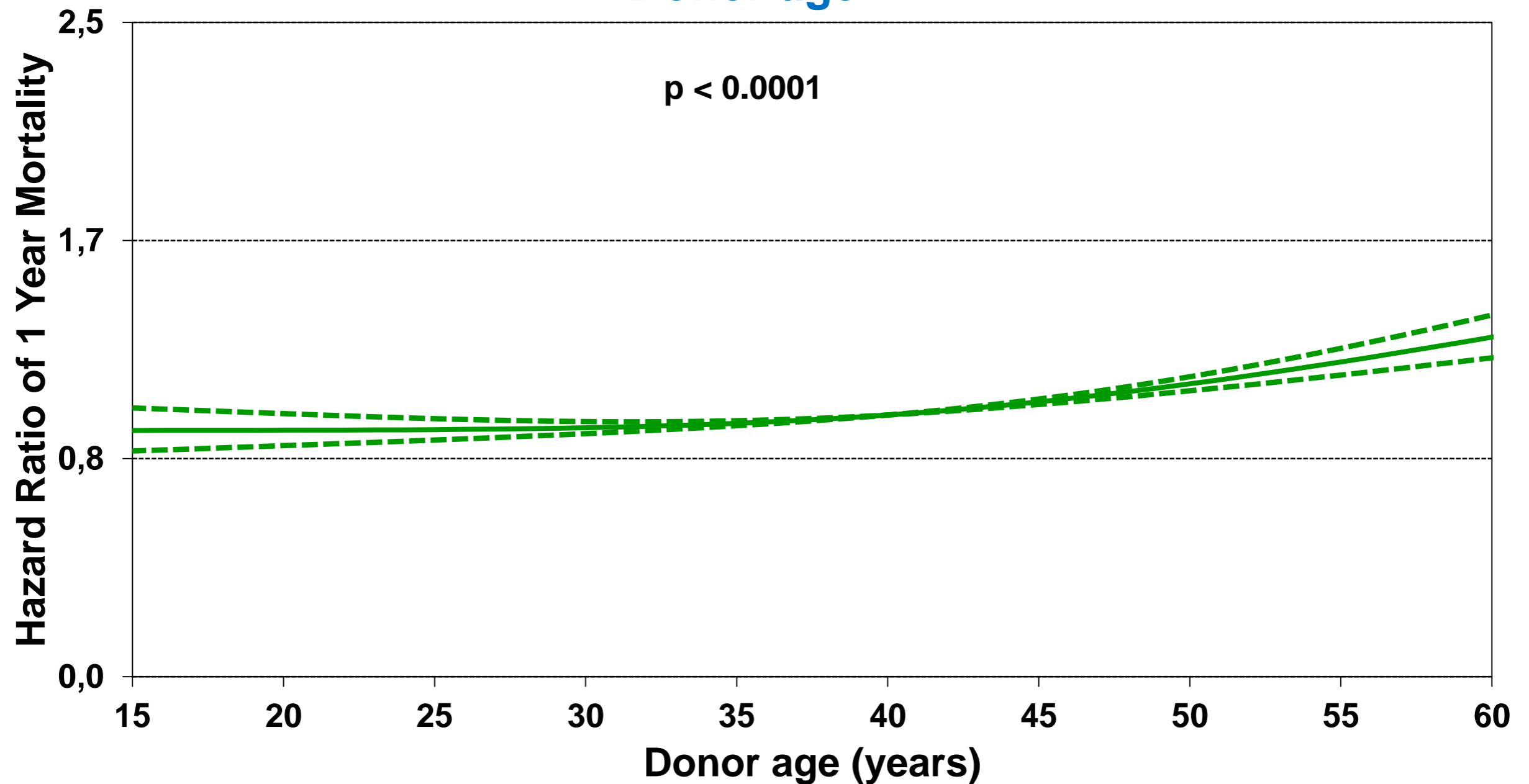
Risk Factors For 1 Year Mortality with 95% Confidence Limits

Recipient age



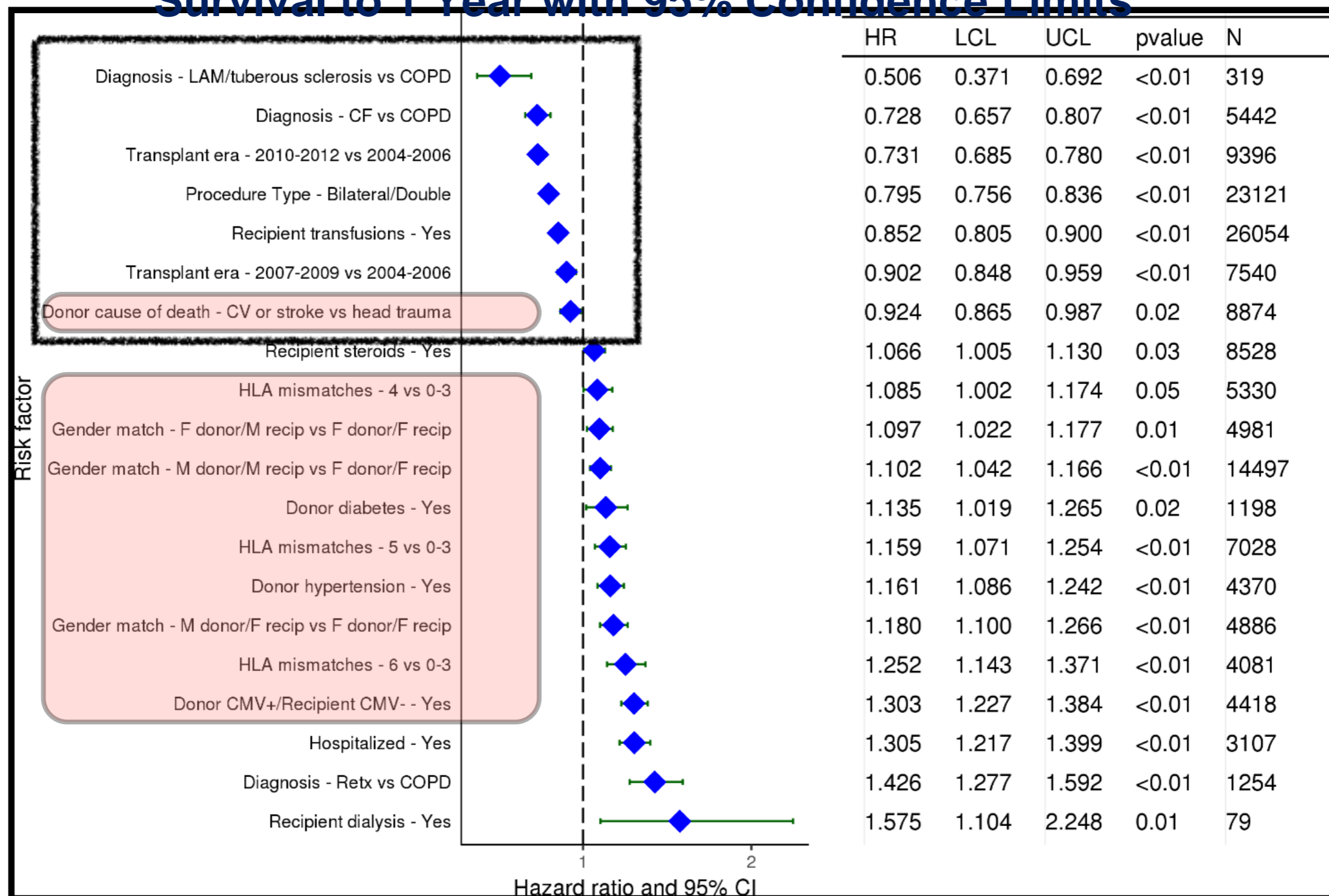
Adult Lung Transplants (2004-6/2016)

Risk Factors For 1 Year Mortality with 95% Confidence Limits Donor age



Adult Lung Transplants (2004-6/2012)

Statistically Significant Risk Factors For 5 Year Mortality Conditional on Survival to 1 Year with 95% Confidence Limits



Adult Lung Transplants (2004-6/2012)

Statistically Significant Risk Factors For 5 Year Mortality

Continuous Factors (see figures)

Recipient age

Donor age

Recipient creatinine

Oxygen requirement

Recipient FVC% predicted

Transplant center volume

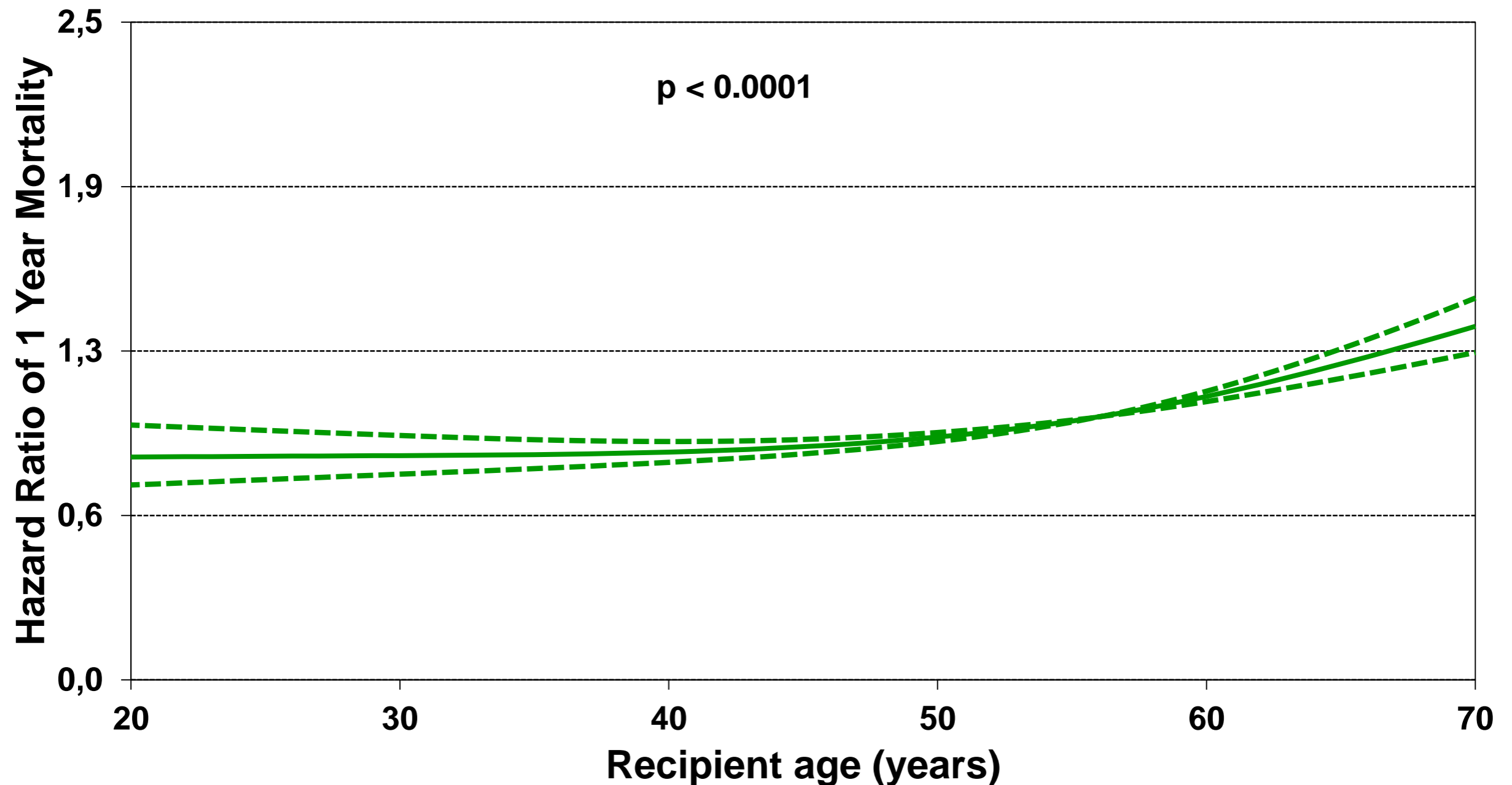
Recipient bilirubin

PRA

Adult Lung Transplants (2004-6/2016)

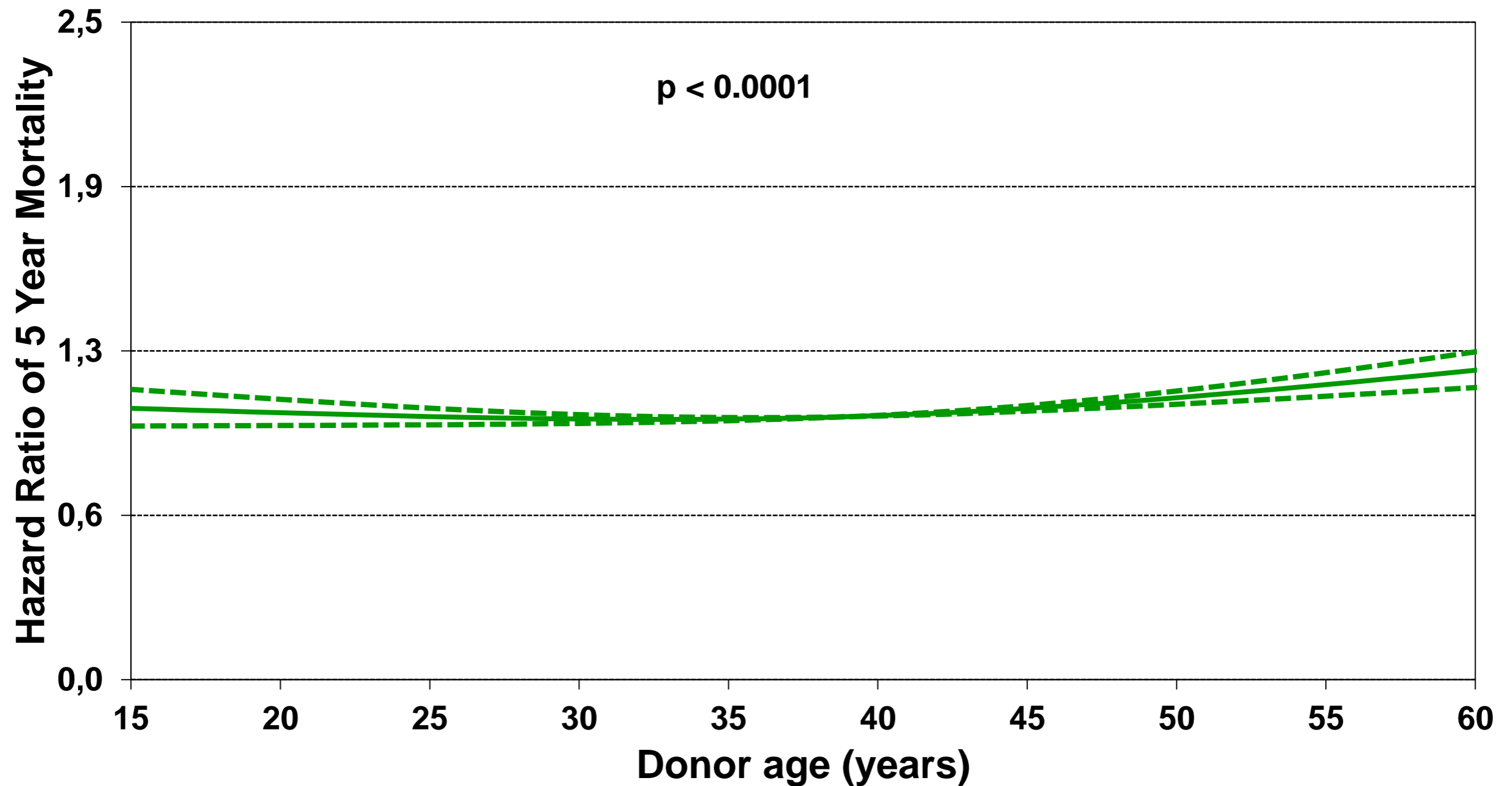
Risk Factors For 1 Year Mortality with 95% Confidence Limits

Recipient age



Adult Lung Transplants (2004-6/2012)

Risk Factors For 5 Year Mortality with 95% Confidence Limits Donor age



Extended Donor Criteria

Age

Smoking History

Purulent Secretions

Atelectasis and contusion

Extended Recipient Criteria

Age

Medical and Surgical Co-morbidities

HIV

	Ideal donor	Extended donor
Age	20–45	18–64 no impact on PGD [21, 26]
PaO ₂ :FiO ₂	>350	Initial PaO ₂ not correlated with outcomes [23]
Smoking history	None	LTOG any smoking associated with PGD [22] UK registry small increase hazard [24]
Chest X-ray	Clear	Infiltrates clear >50% cases after adequate donor management [20]
Ventilation days	<5	–
Microbiology	Gram stain negative	Uniformly gram stains are positive [19]
Bronchoscopy	Clear	Purulent secretions are consistently present Continuous pooling during bronchoscopy may suggest pneumonia
Ischemic time	<4 h	UNOS analysis no correlation ischemic time and PGD [25]

LTOG Lung Transplant Outcomes Group, *UNOS* United Network Organ Sharing, *PGD* primary graft dysfunction, *UK* United Kingdom

Donor and Recipient Matching

HBsAg/IgG	Anti-HBc IgM	Anti-HBc IgG	Anti-HBsAb	Interpretation
+	–	–	–	Recent or active viral replication
+	+	–	–	Recent or active viral replication
–	+	–	–	"Window" phase, recent infection
–	–	+	+/–	Natural infection resolved
–	–	–	+	Vaccine immune response

Note: Anti-HBc IgG, IgG antibody against hepatitis B core antigen; Anti-HBc IgM, IgM antibody against hepatitis B core antigen; Anti-HBsAb, hepatitis B surface antibody; HBsAg/IgG, IgG antibody against hepatitis B surface antigen.

Anti-HCV IgM	Anti-HCV IgG	HCV-RNA	Interpretation
+	–	+	Active acute infection
–	+	–	Remote controlled infection
–	+	+	Remote infection, chronic active
–	–	+	Remote infection, patient or donor unable to make antibody

Note: Anti-HCV IgG, IgG antibodies against hepatitis C virus antigens; Anti-HCV IgM, IgM antibodies against hepatitis C virus antigens.

Table 7.5 Potential donor-derived malignancy transmissions reported to the OPTN, 2005-2009

Malignancy	No. donor reports ^a	No. recipients with confirmed transmission ^b	No. recipient deaths attributable to donor-derived malignancy ^c
Renal cell carcinoma	64	7	1 ^d
Lung cancer	12	4	3
Lymphoma	8	6	2
Thyroid carcinoma	7	0	0
Glioblastoma multiforme	7	1	1
Prostate	5	0	0
Liver cancer	3	1	0
Melanoma	5	2	1
Pancreatic cancer	2	3	0
Neuroendocrine cancer	4	2	2
Ovarian carcinoma	2	2	0
Other ^e	26	0	0
Total malignancies	145	28	10

Source: From Ison MG, Nalesnik MA. An update on donor-derived disease transmission in organ transplantation. Am J Transplant 2011;11:1123-1130.

^a Each report reflects a single donor but may involve multiple recipients.

^b Number of recipients with a confirmed malignancy transmission; transmission classified by the disease transmission advisory committee (DTAC) as either proven, probable, or possible.

^c Number of recipients with a confirmed malignancy transmission who died directly as the result of the transmitted malignancy.

^d One patient with probable or proven disease expired; final tumor assessment pending.

^e Other reported malignancies without confirmed transmission: astrocytoma, breast (3), colon cancer (2), dermatofibrosarcoma protuberans, Kaposi sarcoma, leukemia (chronic lymphocytic leukemia), lymphoma, myeloid sarcoma, pineoblastoma, liposarcoma, gastrointestinal stromal tumor, spindle cell carcinoma, and others not otherwise specified.

Absolute Contra-indication

Infections

Viral: HepBsA +ve, Active HSV, Active HVZ, CMV viremia, West Nile,

Rabies

Bacterial: TB, Meningitis, intra-abdo sepsis

Fungal: Cryptococcosis, Histoplasmosis, Aspergillosis (invasive)

Prion: Creutzfeldt- Jakob Disease

Parasitic: Trypanosomiasis, Leishmaniasis, Malaria, Strongyloidiasis

Malignancy

History of malignancy within 5 years

Primary CNS Malignancy

Any malignancy with current metastatic disease

History Of Melanoma or Haematological Malignancy

Collaborative practice	Phase I Referral	Phase II Declaration of brain death and consent	Phase III Donor evaluation	Phase IV Donor management	Phase V Recovery phase
<p>The following professionals may be involved to enhance the donation process.</p> <p><i>Check all that apply.</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Physician <input type="checkbox"/> Critical care RN <input type="checkbox"/> Organ Procurement Organization (OPO) <input type="checkbox"/> OPO Coordinator (OPC) <input type="checkbox"/> Medical Examiner (ME)/Coroner <input type="checkbox"/> Respiratory <input type="checkbox"/> Laboratory <input type="checkbox"/> Pharmacy <input type="checkbox"/> Radiology <input type="checkbox"/> Anesthesiology <input type="checkbox"/> OR/Surgery staff <input type="checkbox"/> Clergy <input type="checkbox"/> Social worker 	<ul style="list-style-type: none"> <input type="checkbox"/> Notify physician regarding OPO referral <input type="checkbox"/> Contact OPO ref: Potential donor with severe brain insult <input type="checkbox"/> OPC on site and begins evaluation Time ____ Date ____ <input type="checkbox"/> Ht ____ Wt ____ as documented <input type="checkbox"/> ABO as documented ____ <input type="checkbox"/> Notify house supervisor/charge nurse of presence of OPC on unit 	<ul style="list-style-type: none"> <input type="checkbox"/> Brain death documented Time ____ Date ____ <input type="checkbox"/> Pt accepted as potential donor <input type="checkbox"/> MD notifies family of death <input type="checkbox"/> Plan family approach with OPC <input type="checkbox"/> Offer support services to family (clergy, etc) <input type="checkbox"/> OPC/Hospital staff talks to family about donation <input type="checkbox"/> Family accepts donation <input type="checkbox"/> OPC obtains signed consent & medical/social history Time ____ Date ____ <input type="checkbox"/> ME/Coroner notified <input type="checkbox"/> ME/Coroner releases body for donation <input type="checkbox"/> Family/ME/Coroner denies donation—stop pathway—initiate post-mortem protocol—support family. 	<ul style="list-style-type: none"> <input type="checkbox"/> Obtain pre/post transfusion blood for serology testing (HIV, hepatitis, VDRL, CMV) <input type="checkbox"/> Obtain lymph nodes and/or blood for tissue typing <input type="checkbox"/> Notify OR & anesthesiology of pending donation <input type="checkbox"/> Notify house supervisor of pending donation <input type="checkbox"/> Chest & abdominal circumference <input type="checkbox"/> Lung measurements per CXR by OPC <input type="checkbox"/> Cardiology consult as requested by OPC (see reverse side) <input type="checkbox"/> Donor organs unsuitable for transplant—stop pathway—initiate post-mortem protocol—support family. 	<ul style="list-style-type: none"> <input type="checkbox"/> OPC writes new orders <input type="checkbox"/> Organ placement <input type="checkbox"/> OPC sets tentative OR time <input type="checkbox"/> Insert arterial line/2 large-bore IVs <input type="checkbox"/> Possibly insert CVP/Pulmonary artery catheter <input type="checkbox"/> See reverse side 	<ul style="list-style-type: none"> <input type="checkbox"/> Checklist for OR <input type="checkbox"/> Supplies given to OR <input type="checkbox"/> Prepare patient for transport to OR <ul style="list-style-type: none"> <input type="checkbox"/> IVs <input type="checkbox"/> O₂ <input type="checkbox"/> Peep valve <input type="checkbox"/> Transport to OR Date ____ Time ____ <input type="checkbox"/> OR nurse <ul style="list-style-type: none"> <input type="checkbox"/> reviews consent form <input type="checkbox"/> reviews brain death documentation <input type="checkbox"/> checks patient's ID band
Labs/Diagnostics		<ul style="list-style-type: none"> <input type="checkbox"/> Review previous lab results <input type="checkbox"/> Review previous hemodynamics 	<ul style="list-style-type: none"> <input type="checkbox"/> Blood chemistry <input type="checkbox"/> CBC + diff <input type="checkbox"/> UA <input type="checkbox"/> C & S <input type="checkbox"/> PT, PTT <input type="checkbox"/> ABO <input type="checkbox"/> A Subtype <input type="checkbox"/> Liver function tests <input type="checkbox"/> Blood culture X 2 / 15 minutes to 1 hour apart <input type="checkbox"/> Sputum Gram stain & C & S <input type="checkbox"/> Type & Cross Match _____ # units PRBCs <input type="checkbox"/> CXR <input type="checkbox"/> ABGs <input type="checkbox"/> EKG <input type="checkbox"/> Echo <input type="checkbox"/> Consider cardiac cath <input type="checkbox"/> Consider bronchoscopy 	<ul style="list-style-type: none"> <input type="checkbox"/> Determine need for additional lab testing <input type="checkbox"/> CXR after line placement (if done) <input type="checkbox"/> Serum electrolytes <input type="checkbox"/> H & H after PRBC Rx <input type="checkbox"/> PT, PTT <input type="checkbox"/> BUN, serum creatinine after correcting fluid deficit <input type="checkbox"/> Notify OPC for _____ PT > 14 _____ PTT < 28 _____ Urine output _____ < 1 mL/Kg/hr _____ > 3 mL/Kg/hr _____ Hct < 30 / Hgb > 10 _____ Na > 150 mEq/L 	<ul style="list-style-type: none"> <input type="checkbox"/> Labs drawn in OR as per surgeon or OPC request <input type="checkbox"/> Communicate with pathology: Bx liver and/or kidneys as indicated

Collaborative practice	Phase I Referral	Phase II Declaration of brain death and consent	Phase III Donor evaluation	Phase IV Donor management	Phase V Recovery phase
Respiratory	<ul style="list-style-type: none"> Pt on vent Suction q 2h Reposition 	<ul style="list-style-type: none"> Prep for testing: set FiO_2 @ 100% and anticipate need to increase rate if PCO_2 > 50 mm Hg 	<ul style="list-style-type: none"> Maximize ventilator settings to achieve SaO_2 98 – 99% PEEP = 5 cm H₂O challenge for lung protection FiO_2 @ 100% PEEP @ 5 cm H₂O ABGs as ordered VS q 1* 	<ul style="list-style-type: none"> Notify OPC BP < 90 mmHg systolic HR < 140 > 120 CVP < 12 > 11 PaO₂ > 100 mmHg SaO₂ > 95% 	<ul style="list-style-type: none"> Portable ventilator 100% FiO_2 for transport to OR Ambu bag with PEEP valve Move to OR
Treatments/ Ongoing care		<ul style="list-style-type: none"> Use warm blanket to maintain temperature at 36.5° C - 37.5 °C NG to low intermittent suction 	<ul style="list-style-type: none"> Check NO₂ level & output Obtain acetabulum & Wt _____ not previously obtained 		<ul style="list-style-type: none"> Set OR table as directed by OPC Post-mortal care at conclusion of case
Medications			<ul style="list-style-type: none"> Medication requested by OPC 	<ul style="list-style-type: none"> Fluid resuscitation—consider colloids, blood products DC meds & pressors Broad-spectrum antibiotic if not previously ordered Vasopressors to maintain BP > 90 mm Hg systolic Electrolyte balance: consider K⁺, O₄, Mg replacement Hyperglycemia consider insulin drip Oliguria: consider diuretics Diabetes consider insulin Paralytic administered for spinal reflex 	<ul style="list-style-type: none"> DC antidotes as needed Diuretics as needed 350 U heparin/kg or as directed by surgeon
Optimal outcomes	The potential donor is identified & a referral is made to the OPO.	The family is offered the option of donation & their decision is supported.	The donor is evaluated & found to be a suitable candidate for donation.	Optimal organ function is maintained.	All potentially suitable, consented organs are recovered for transplant.

Shaded areas indicate Organ Procurement Coordinator (OPC) activities.

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Milpark Hospital Thoracic Transplant Unit

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