



Lung Transplant Referrals and Optimization of the Recipient

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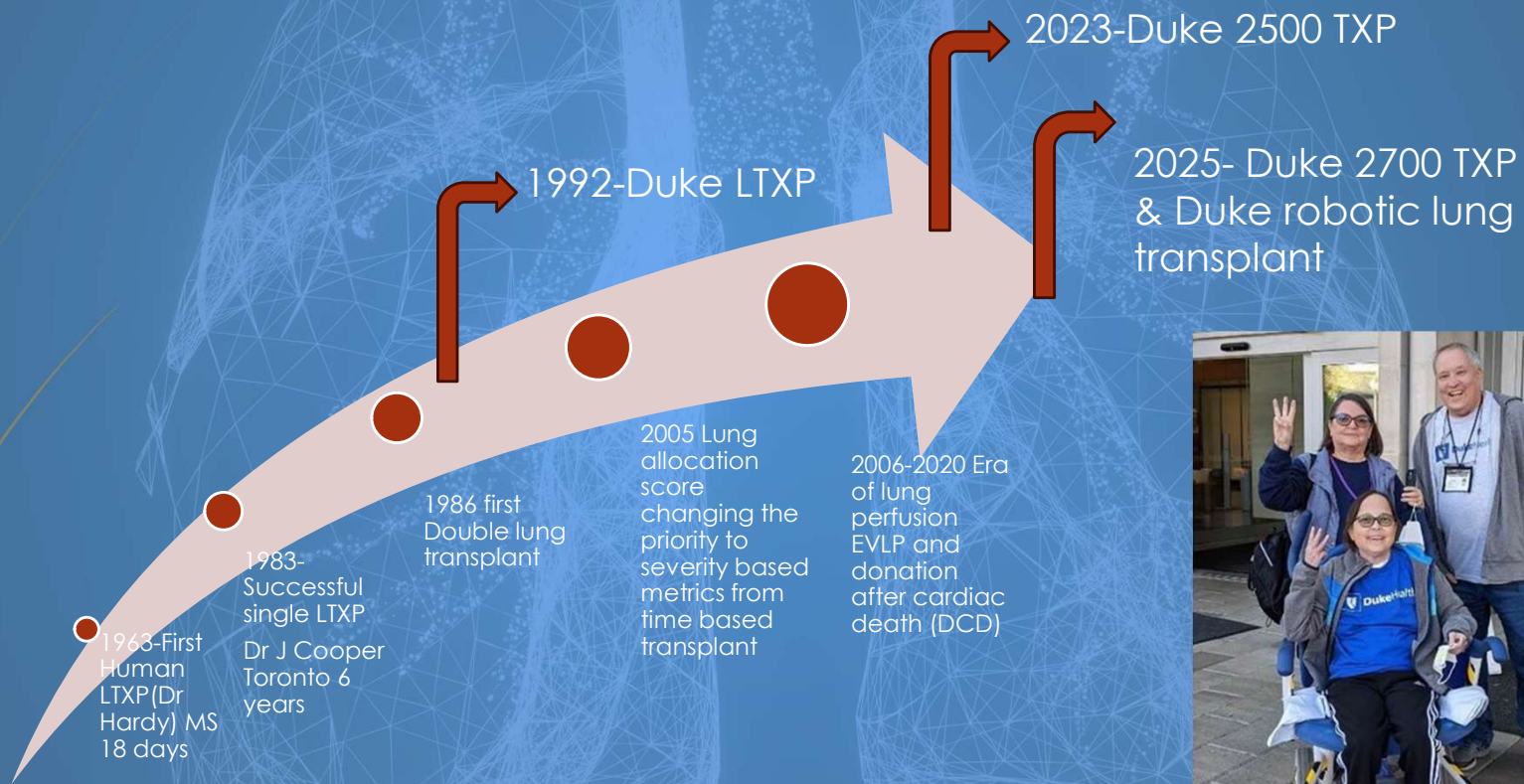
Duke Transplant Center



Goals and Objectives

1. Identify referral criteria for lung transplant consideration
2. Recognize modifiable and non-modifiable risk factors affecting post-transplant outcomes
3. Recognize opportunities for optimization of the pre-transplant patient
4. Identify ways to supply high oxygen for exercise
5. Recognize general lung transplant patient experience
6. Recognize new technologies expanding access to lung transplant

MILESTONES OF LUNG TRANSPLANTATION



Indications for Lung Transplantation

Adults with end-stage lung disease who meet the following general criteria:

- **1. High (>50%) risk of death** from lung disease within 2 years
- **2. High (>80%) likelihood of 5-year survival post-transplant** from a general medical perspective provided that there is adequate graft function.



COPD

**Cystic
Fibrosis**

Bronchiectasis

ILD

**Pulmonary
Arterial
Hypertension**

Sarcoidosis

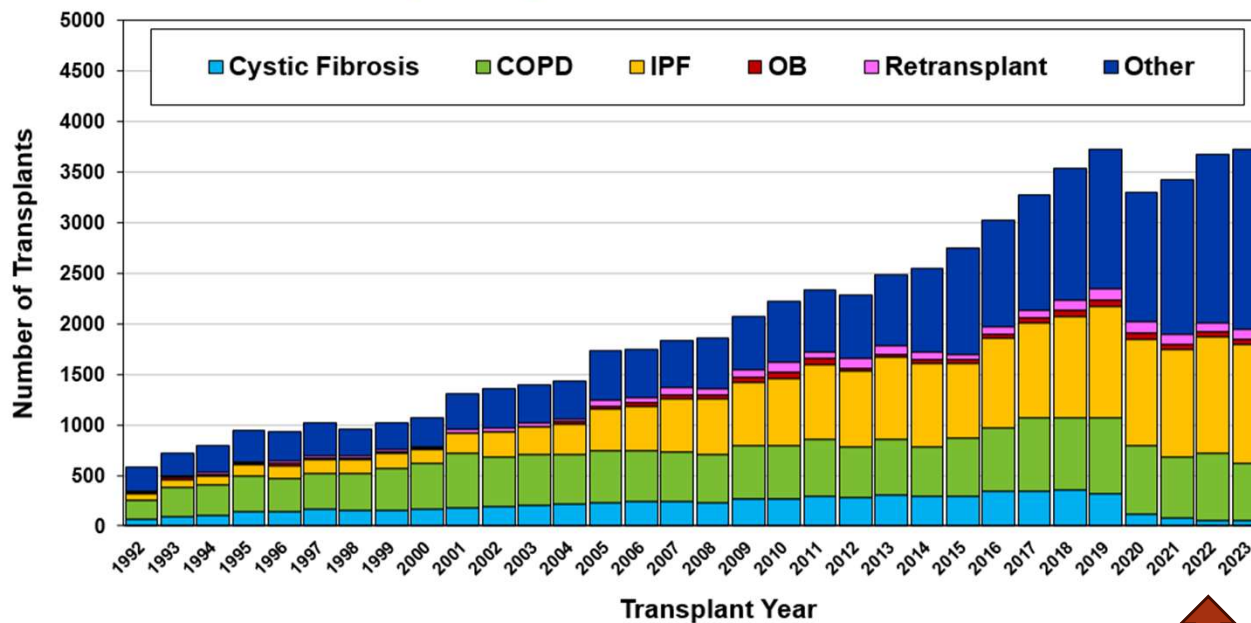
Pulmonary Graft vs Host Disease

IPF- Pulmonary Fibrosis

Lymphangiomyomatosis (LAM)

Lung Transplant by Diagnosis

Annual Number of Adult Lung Transplants by Diagnosis, 1992-2023



More transplants for folks with IPF

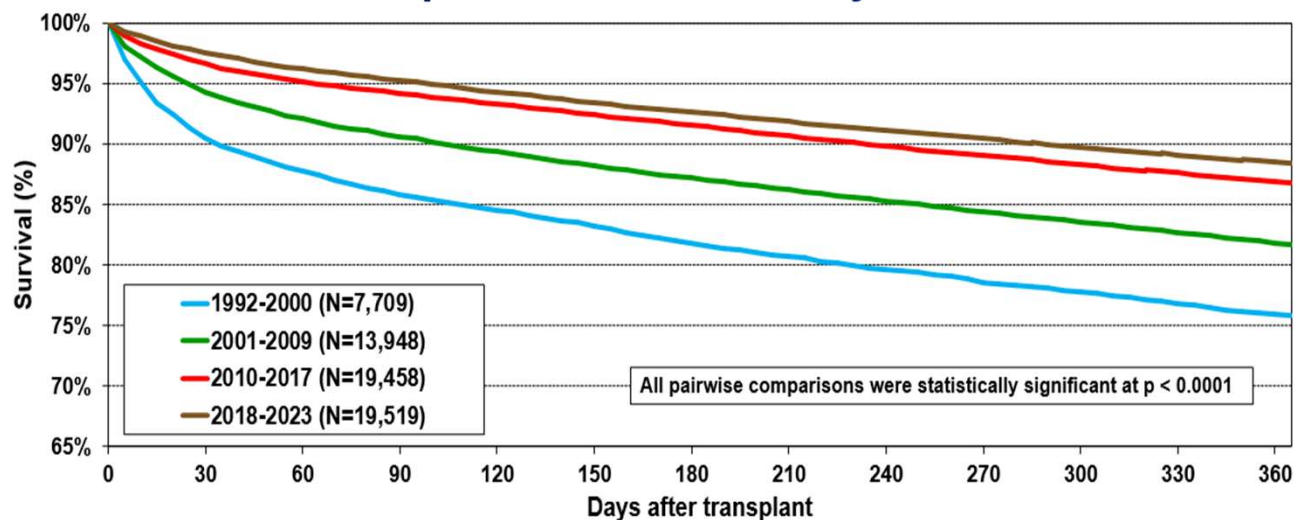


Fewer transplants needed for folks with CF d/t new CF drugs



Survival Outcomes Improving

**Adult Primary Lung Alone Transplants, 1992-2023
Kaplan-Meier Survival by Era**



**Recent
advancements=
more transplants +
better survival**

Note: The Y-axis was truncated to better highlight the differences in survival rates.

Who is lung transplant for?

- ▶ Are they sick enough to justify the risks of the transplant surgery?
- ▶ Will lung transplant help their our Quality of Life?
 - ▶ Do they have other medical problems that might get worse with transplant?
 - ▶ Or do they seem relatively healthy except for their lung disease?
- ▶ Are they physically and emotionally strong enough?
- ▶ Do they have the caregiver support?
- ▶ Do they have reasonable financial resources or social support for fundraising?



Contraindications for transplant:

ABSOLUTE CONTRAINDICATIONS:

- Candidates with these conditions are considered too high risk to achieve successful outcomes post lung transplantation.
- Factor or condition that significantly increases the risk of an adverse outcome post-transplant and /or would make transplant most likely harmful for a recipient.
- Most lung transplant programs should not transplant patients with these risk factors except under very exceptional or extenuating circumstances.



1. Lack of patient willingness or acceptance of transplant
2. Malignancy with high risk of recurrence or death related to cancer
3. Glomerular filtration rate < 40 mL/min/1.73m² unless being considered for multi-organ transplant
4. Acute coronary syndrome or myocardial infarction within 30 days (excluding demand ischemia)
5. Stroke within 30 days
6. Liver cirrhosis with portal hypertension or synthetic dysfunction unless being considered for multi-organ transplant
7. Acute liver failure
8. Acute renal failure with rising creatinine or on dialysis and low likelihood of recovery
9. Septic shock
10. Active extrapulmonary or disseminated infection
11. Active tuberculosis infection
12. HIV infection with detectable viral load
13. Limited functional status (e.g. non-ambulatory) with poor potential for post-transplant rehabilitation
14. Progressive cognitive impairment
15. Repeated episodes of non-adherence without evidence of improvement (Note: For pediatric patients this is not an absolute contraindication and ongoing assessment of non-adherence should occur as they progress through different developmental stages.)
16. Active substance use or dependence including current tobacco use, vaping, marijuana smoking, or IV drug use
17. Other severe uncontrolled medical condition expected to limit survival after transplant

***Patient desire**

***Malignancy/ cancer (in last 2 years/ prefer 5 years free)**

***untreatable other organ system dysfunction**

***non-curable chronic infections**

***Limited functional status (eg. Non-ambulatory)**

***Nonadherence**

***Psychiatric/ cognitive condition that impairs care or adherence**

***Active substance use or dependence**

***absence of social support**

High Risk Factors to consider:

RISK FACTORS WITH HIGH OR SUBSTANTIALLY INCREASED RISK:

- Candidates with these conditions may be considered in centers with expertise specific to the condition.
- We may not have data to support transplanting patients with these risk factors or there is substantially increased risk based upon the currently available data, and further research is needed to better inform future recommendations.
- When more than one of these risk factors are present, they are thought to be possibly multiplicative in terms of increasing risk of adverse outcomes.
- Modifiable conditions should be optimized when possible.



1. Age > 70 years
2. Severe coronary artery disease that requires coronary artery bypass grafting at transplant
3. Reduced left ventricular ejection fraction < 40%
4. Significant cerebrovascular disease
5. Severe esophageal dysmotility
6. Untreatable hematologic disorders including bleeding diathesis, thrombophilia, or severe bone marrow dysfunction
7. BMI > 35 kg/m²
8. BMI < 16 kg/m²
9. Limited functional status with potential for post-transplant rehabilitation
10. Psychiatric, psychological or cognitive conditions with potential to interfere with medical adherence without sufficient support systems
11. Unreliable support system or caregiving plan
12. Lack of understanding of disease and / or transplant despite teaching
13. *Mycobacterium abscessus* infection
14. *Lomentospora prolificans* infection
15. *Burkholderia cenocepacia* or *gladioli* infection
16. Hepatitis B or C infection with detectable viral load and liver fibrosis
17. Chest wall or spinal deformity expected to cause restriction after transplant
18. Extracorporeal life support
19. Retransplant <1 year following initial lung transplant
20. Retransplant for restrictive CLAD
21. Retransplant for AMR as etiology for CLAD

*Age > 70

*CAD requiring bypass grafting

*EF < 40%

*severe esophageal dysmotility

*untreatable hematological disorders

*BMI > 35 or < 16

*limited functional status/ frailty

*psychological or cognitive conditions that may interfere with adherence

*Unreliable caregiver support

*certain respiratory infections

*skeletal chest wall or spinal deformity expected to cause post-tpx restriction

*on ECMO

*Retransplant

Modifiable conditions should be optimized

Mild Risk Factors to consider:

RISK FACTORS:

- Risk factors with unfavorable implications for short and / or long-term outcomes after lung transplant.
- While acceptable for lung transplant programs to consider patients with these risk factors, multiple risk factors together may increase risk for adverse post lung transplant outcomes.



1. Age 65-70 years
2. Glomerular filtration rate 40-60 mL/min/1.73m²
3. Mild to moderate coronary artery disease
4. Severe coronary artery disease that can be revascularized via percutaneous coronary intervention prior to transplant
5. Patients with prior coronary artery bypass grafting
6. Reduced left ventricular ejection fraction 40-50%
7. Peripheral vascular disease
8. Connective tissue diseases (scleroderma, lupus, inflammatory myopathies)
9. Severe gastroesophageal reflux disease
10. Esophageal dysmotility
11. Thrombocytopenia, leukopenia, or anemia with high likelihood of persistence after transplant
12. Osteoporosis
13. BMI 30-34.9 kg/m²
14. BMI 16-17 kg/m²
15. Frailty
16. Hypoalbuminemia
17. Diabetes that is poorly controlled
18. Edible marijuana use
19. *Scedosporium apiospermum* infection
20. HIV infection with undetectable viral load
21. Previous thoracic surgery
22. Prior pleurodesis
23. Mechanical ventilation
24. Retransplant >1 year for obstructive CLAD

Abbreviations: AMR, antibody mediated rejection; BMI, body mass index; CLAD, chronic lung allograft dysfunction.

- *Age 65-70
- *mild to moderate CAD
- *severe CAD amenable to stent placement
- *hx of CABG *EF 40%-50%
- *GFR 40-60
- *PVD
- *severe GERD
- *esophageal dysmotility
- *thrombocytopenia, leukopenia, or anemia
- *osteoporosis
- *BMI 30-35 or 16-17
- *frailty
- *hypoalbuminemia
- *poorly controlled diabetes
- *edible marijuana use
- *easily treatable respiratory infections
- *HIV with undetectable viral load
- *prior chest surgery or pleurodesis
- *on ventilator

Modifiable conditions should be optimized

COPD

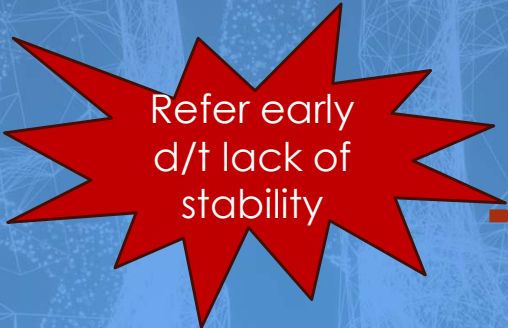
Referral Criteria

- FEV1 < 40 and/or DLCO < 30%
- Oxygen dependence
- Hypercarbia
- Frequent acute exacerbations
- Bode Score 5-6 and increasing >1 over past 24 months
- Clinical deterioration despite maximal treatment –medical + devices
- Poor QOL unacceptable to the patient

Listing Criteria

- BODE score 7-10
- FEV₁ < 20% predicted
- Presence of moderate to severe pulmonary hypertension
- History of severe exacerbations
- Chronic hypercapnia

ILD



Refer early
d/t lack of
stability

Referral

- ▶ FEV1 < 80% and/or DLCO < 40%
- ▶ Any dyspnea related to lung disease
- ▶ Any form of pulmonary fibrosis with decline in FVC 10%, decline in DLCO 15%, or decline in FVC 5% in past 2 years.
- ▶ Any O₂ requirement, even if only during exertion
- ▶ Clinical deterioration despite maximal treatment
- ▶ Poor QOL unacceptable to the patient
- ▶ For evidence of UIP, refer at time of diagnosis.
- ▶ For inflammatory ILDs, refer at progression of disease.
- ▶ For connective tissue disease or familial pulmonary fibrosis, refer early to assess extrapulmonary manifestations

Listing

- ▶ Any form of pulmonary fibrosis with decline in FVC 10%, decline in DLCO 10%, or decline in FVC 5% in past 6 months.
- ▶ Desaturation to < 88% on 6 minute walk test.
- ▶ > 50 m decline in 6 minute walk test distance in the past 6 months
- ▶ Pulmonary hypertension on right heart catheterization or 2-D ECHO
- ▶ Hospitalization because of respiratory decline, pneumothorax, or acute exacerbation.

Cystic Fibrosis

Referral

- FEV₁ < 40%
- Oxygen dependence
- Hypercarbia
- Secondary pulmonary hypertension
- Frequent exacerbations
- Progressive decline in lung function, requiring ICU care
- Recurrent or refractory pneumothorax
- Six-minute walk distance < 400 meters
- Massive hemoptysis (>240 mL)
- Clinical deterioration despite maximal treatment

Regular communication between CF and transplant centers is encouraged

Listing

- FEV₁ < 25% predicted
- Rapid decline in lung function
- Frequent and/or lengthy hospitalizations
- Any exacerbation requiring mechanical ventilation
- Chronic respiratory failure with hypoxemia or hypercapnia
- Presence of moderate to severe pulmonary hypertension
- Worsening nutritional status
- Recurrent massive hemoptysis
- Chronic hypercapnia

Non-CF Bronchiectasis

Same as with CF though providers should recognize that prognosis is variable with many patients experiencing a more stable course.

Referral

- FEV₁ < 40%
- Oxygen dependence
- Hypercarbia
- Secondary pulmonary hypertension
- Frequent exacerbations
- Progressive decline in lung function, requiring ICU care
- Recurrent or refractory pneumothorax
- Six-minute walk distance < 400 meters
- Massive hemoptysis (>240 mL)
- Clinical deterioration despite maximal treatment

Listing

- FEV₁ < 25% predicted
- Rapid decline in lung function
- Frequent and/or lengthy hospitalizations
- Any exacerbation requiring mechanical ventilation
- Chronic respiratory failure with hypoxemia or hypercapnia
- Presence of moderate to severe pulmonary hypertension
- Worsening nutritional status
- Recurrent massive hemoptysis
- Chronic hypercapnia

PAH- Pulmonary Hypertension

Referral

- REVEAL risk score 8 despite appropriate PAH therapy
- Significant RV dysfunction despite therapy
- Need for IV or SC prostacyclin therapy
- Progressive disease (or hospitalization) despite appropriate therapy
- Known or suspected high-risk variants
- Signs of secondary liver or kidney dysfunction due to PAH
- hemoptysis

Listing

- REVEAL risk score >10 on appropriate therapy, including IV or SC prostacyclin analogues
- Progressive hypoxemia, especially in patients with PVOD or PCH
- Presence of moderate to severe pulmonary hypertension
- Progressive, but not end-stage, liver or kidney dysfunction due to PAH
- Life-threatening hemoptysis

Lymphangiomyomatosis (LAM)

Referral

- Referral for any individual with LAM who has any of the following despite mTOR inhibitor therapy:
- Severely abnormal lung function (e.g. FEV1 < 30% predicted)
- Exertional dyspnea (NYHA class III or IV)
- Hypoxemia at rest
- Pulmonary hypertension
- Refractory pneumothorax

Listing

- Meets the referral criteria and has evidence of disease progression despite mTOR inhibitor therapy.
- Cessation of mTOR inhibitor therapy at the time of transplant but not required for wait-listing (d/t impaired wound healing)

Sarcoidosis

Referral

- FEV1 < 50%
- Oxygen dependance
- Hypercarbia
- Secondary pulmonary hypertension

Listing

- Meets the referral criteria and has evidence of disease progression despite mTOR inhibitor therapy.
- Cessation of mTOR inhibitor therapy at the time of transplant but not required for wait-listing (d/t impaired wound healing)

Retransplant, Pulmonary Graft vs Host Disease, ARDS, & Other Lung diseases

Referral

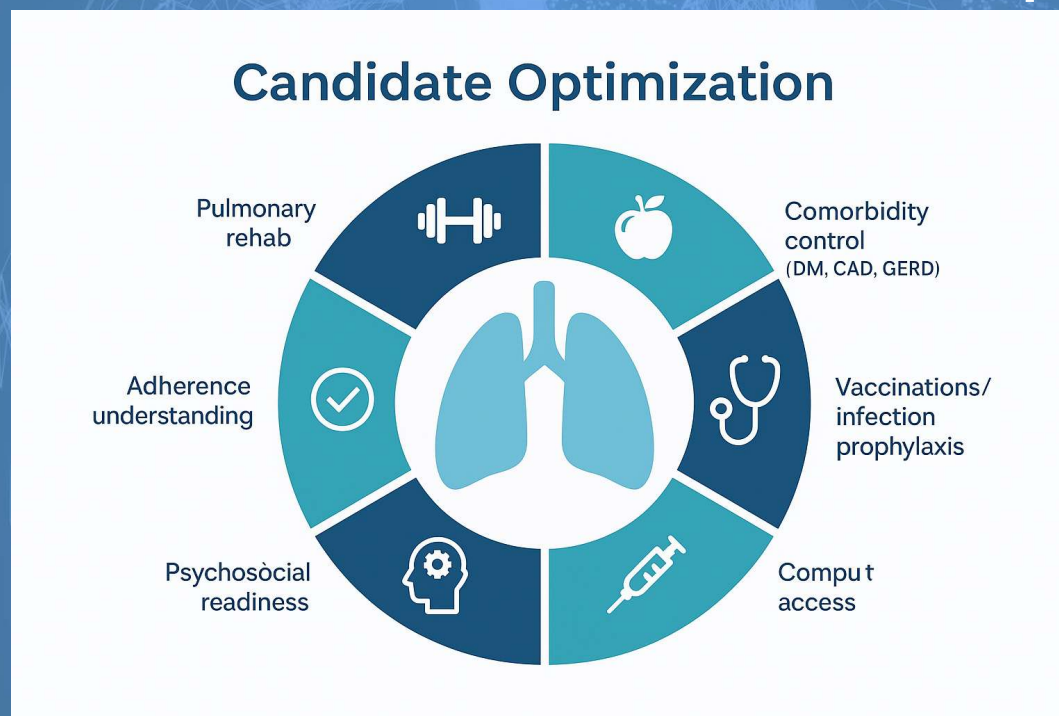
- Survival after re-transplant is inferior.
- For patients being considered for lung re-transplant, emphasize understanding the possible reasons for the initial transplant graft failure, such as alloimmunization, poor adherence, gastroesophageal reflux, or repeated infections
- Hypoxia
- Hypercarbia
- Clinical deterioration despite maximal treatment

Listing

- Worsening lung function or clinical deterioration.
- Persistent requirement for mechanical ventilatory support and /or ECLS without expectation of clinical recovery and with evidence of irreversible lung destruction.

When should patients be referred for lung transplant?

Early referral allows time for candidate optimization



Role of Local Care Team Providers in the Pre-Transplant Phase (you & primary pulmonologist)



- Recognize signs of worsening lung function or disease progression
- Ask patients if they have thought about lung transplant as treatment option
- Support and encourage work on modifiable risk factors (frailty/ strength, nutrition, substance use, fundraising, social/psych support, self-education, comorbidities, and vaccinations)
- Communicate directly or encourage patients to communicate with transplant team esp when lung disease progresses

Lung transplant Guidelines—Change over time with more data

1990

*Focus on Age limits

Heart Lung -55 years

Single lung -65 years

Bilateral Lung -60 years

(Older patients=worse survival)

2021

* No absolute age limit

*focus on frailty

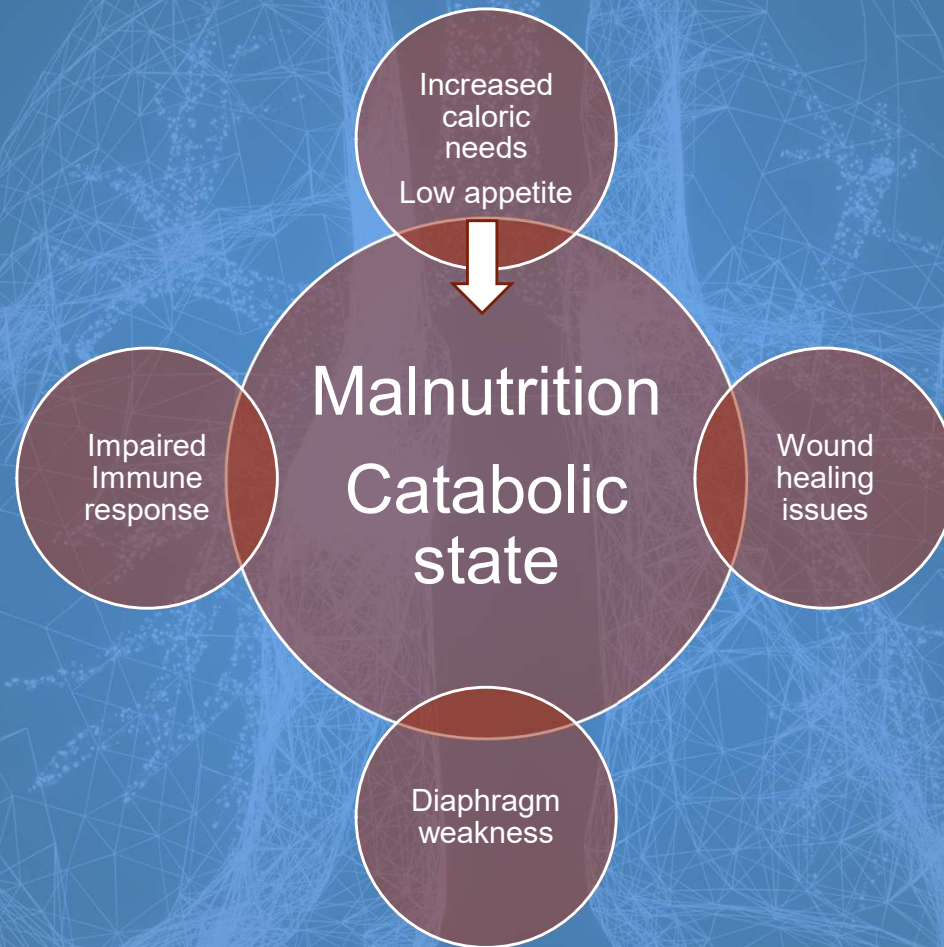
*focus on nutrition

Weill, David, et al. "A consensus document for the selection of lung transplant candidates: 2014—an update from the Pulmonary Transplantation Council of the International Society for Heart and Lung Transplantation." *The Journal of Heart and Lung Transplantation* 34.1 (2015): 1-15.

Orens, Jonathan B., et al. "International guidelines for the selection of lung transplant candidates: 2006 update—a consensus report from the Pulmonary Scientific Council of the International Society for Heart and Lung Transplantation." *The Journal of heart and lung transplantation* 25.7 (2006): 745-755.

Valapour et al. *OPTN/SRTR 2021 Annual Data Report: Lung. Am J Transplant.* 2023 Feb;23(2 Suppl 1):S379-S442

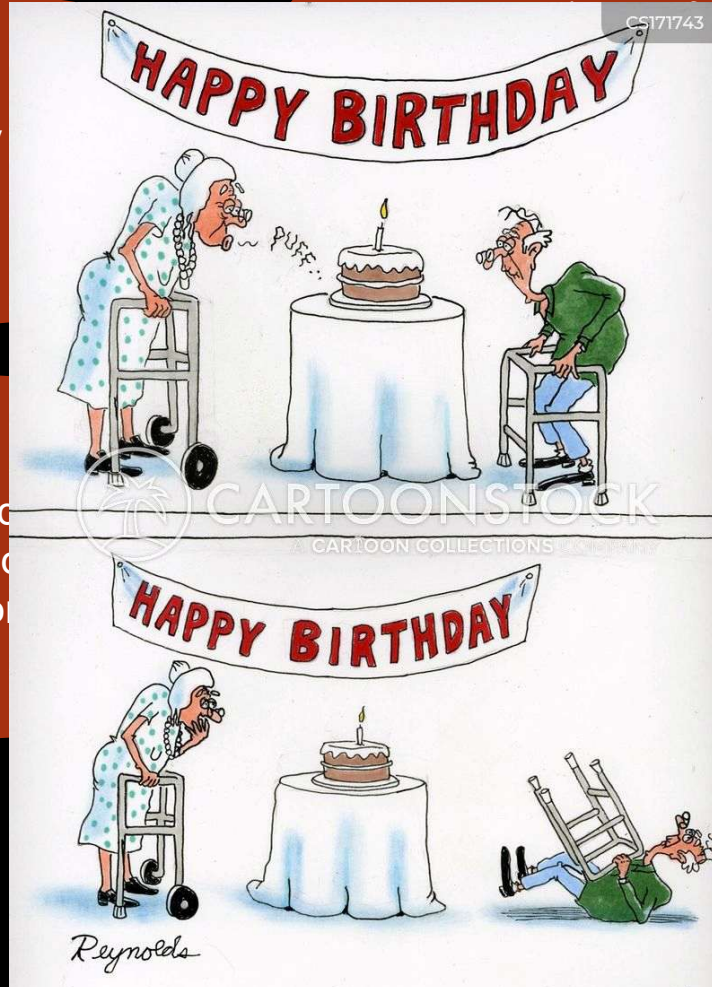
Adverse effects of poor nutrition



Adverse effects of frailty

Frailty reflects disability
comorbidity

Frailty reflects increased
to external stressors and
outcomes, including more
admissions, and falls



ffects decline in multiple
cal systems impairing
ual's cellular repair
ms and homeostasis
nce.

ffects age-related
n which can result in
nitations and susceptibility
outcomes

ment in research and clinical practice: A review

Multiple

Frailty Measurements



Measuring Frailty: Short Physical Performance Battery(SPPB)

SPPB/4MGS predicts risk
--Readmission for COPD
exacerbation

Predicts
Mortality in IPF
patients



Balance



Gait speed



Sit to stand

Balance

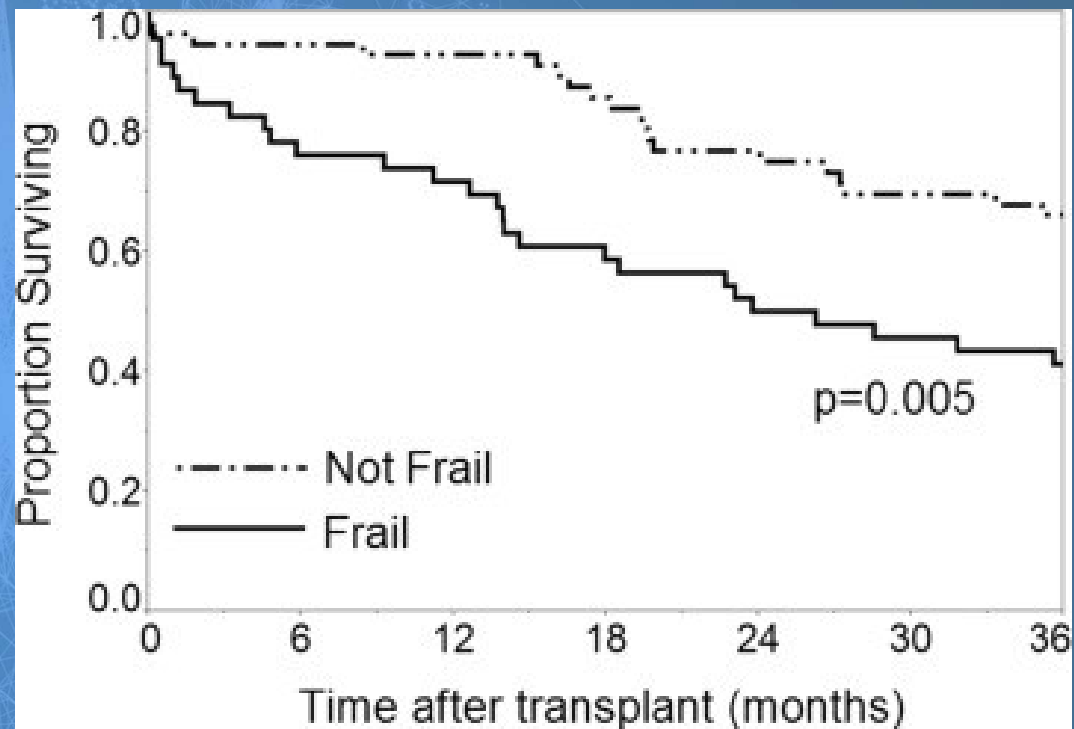
4 m walk speed

5x Sit to stand

- Kon SS, et al.: Gait speed and readmission following hospitalization for acute exacerbations of COPD: a prospective study. *Thorax* 2015, 70:1131–1137.
- Nolan CM, et al: Gait speed and prognosis in patients with idiopathic pulmonary fibrosis: a prospective cohort study. *Eur Respir J* 2019, 53.
- www.Sppbguide.com

Poor outcomes in frail patients

Prevalence =45%
 For a ratio of 0.25 HR for
 death=2.28



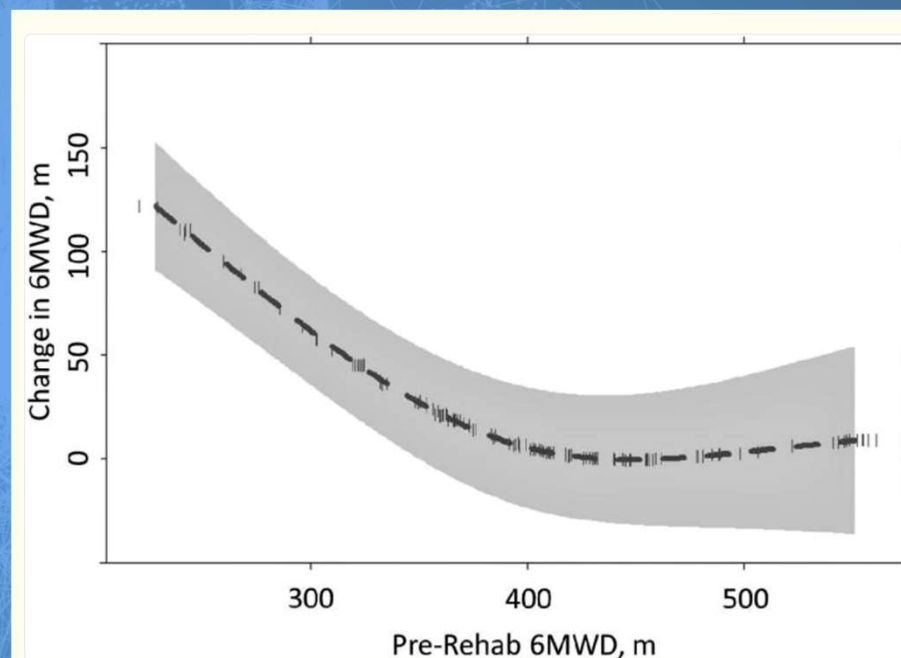
Wilson ME, et al: Pre-transplant frailty is associated with decreased survival after lung transplantation. *Journal of Heart and Lung Transplantation* 2016, 35:173–178

Benefits of rehabilitation prior to transplant

*Improved exercise capacity

*decreased Depressive symptoms

*increased QOL.



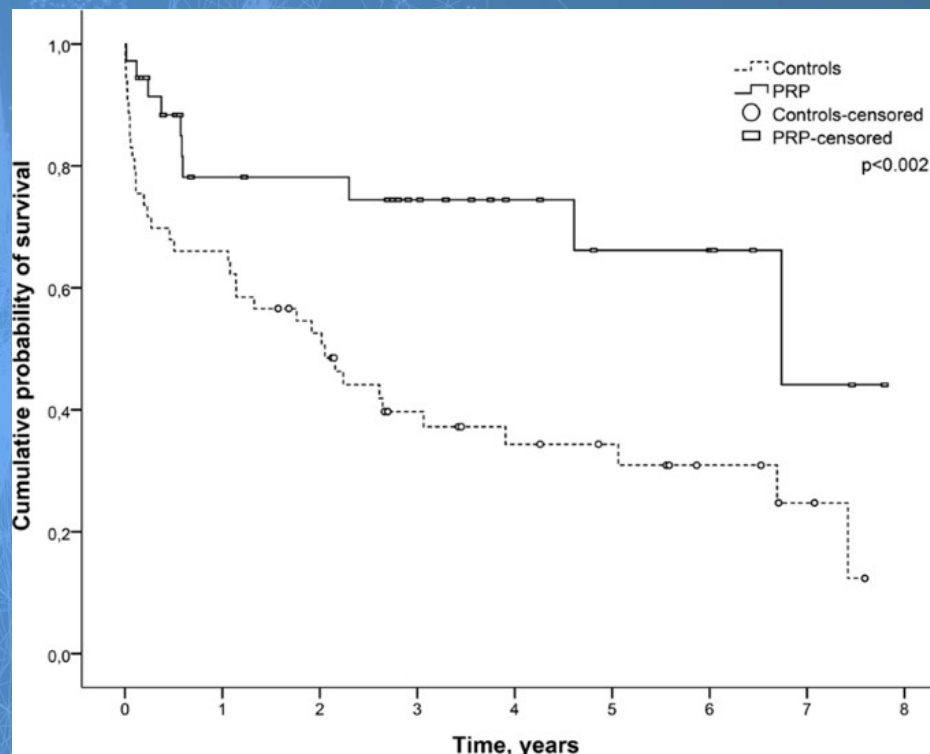
Byrd R, et al. A 1-Month Physical Therapy-Based Outpatient Program for Adults Awaiting Lung Transplantation: A Retrospective Analysis of Exercise Capacity, Symptoms, and Quality of Life. *Cardiopulm Phys Ther J.* 2019 Apr;30(2):61-69.

Benefits of rehabilitation prior to transplant

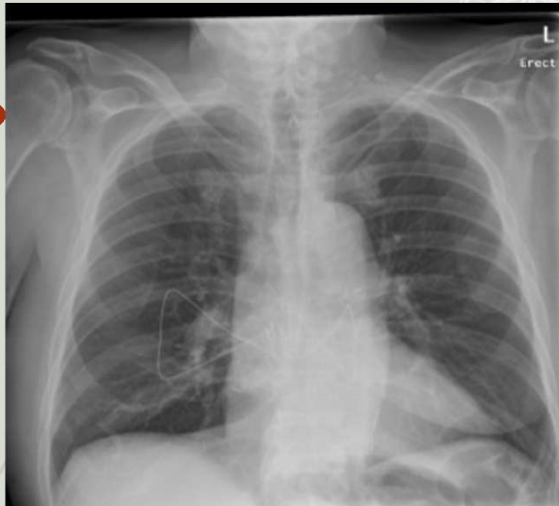
IPF patients completing 36 sessions = lower risk of death post txp

Rehabilitation = Better outcomes

Increased exercise capacity pre transplant = improved early outcomes



Florian J, Watte G, Teixeira PJZ, et al. Pulmonary rehabilitation improves survival in patients with idiopathic pulmonary fibrosis undergoing lung transplantation. *Sci Rep.* 2019;9:9347.





Opportunities for Optimization of the Pre-Transplant Patient

- Benefits of Pulmonary Rehabilitation
 - Improve exercise capacity, mood, and QOL
 - Address components of frailty
 - Lower risk of death post-surgery, improve early outcomes post-surgery
- Referral to Pulmonary Rehabilitation
 - COPD, ILD, PAH, CF, Bronchiectasis, etc.
 - Evaluation with Healthcare Team (i.e. Physical Therapist and Respiratory Therapist)
 - Comprehensive medical and exercise history, vital sign interpretation, strength testing
 - 6-Minute Walk Test (6MWT), Short Physical Performance Battery (SPPB), questionnaires
 - Plan of Care: includes frequency and duration of therapy, rehab goals

Rehab Before/During Referral Process

- Begin working on exercise capacity and activity tolerance through progressive endurance and resistance training
- Identify appropriate patients to refer for lung transplant*
- Provide education about basic breathing techniques and airway clearance
- Evaluate supplemental oxygen needs at rest vs activity (EOTT); MD update orders for home use



<https://www.homelifecare.com/wp-content/uploads/2016/10/O2-Tanks-400.jpg>



<https://www.lincare.com/-/media/Project/Lincare/Images/Oxygen/concentrators/Caire/CAIRE-NewLife-Intensity-10-774x574.jpg?h=574&iar=0&w=774&hash=F43786A461DFB70621A4E01A54F17708>



https://medicalsupplygroup.com/cdn/shop/products/hcs8708m-001_51bcd113-a14b-4a52-ad2b-d829aa590caa.jpg?v=1647007812&width=900



Rehab Before/During Referral Process

- ▶ Educate about appropriate oxygen use with activity
- ▶ Address specific barriers for transplant candidates
 - ▶ Smoking cessation/relapse prevention
 - ▶ Alcohol use
 - ▶ Weight loss, Nutrition
 - ▶ Psychosocial issues – weaning off anxiety medication, appropriate caregivers, fundraiser goals
- ▶ Work towards physical requirements for transplant including endurance training and strength training

Pre-transplant Rehabilitation

	Aerobic	Resistance	Flexibility
Frequency	2-5 d/wk	2-3 d/wk	3-5 d/wk
Intensity	50%-80% HR reserve Dyspnea > leg fatigue: Moderate to hard (3-5 on modified Borg scale) [48] SpO ₂ > 85%-90% Continuous or intermittent training ¹ : 60%-80% 6MWT speed for walking [41,49] 60% peak workload for cycling [39,43] or just above anaerobic threshold [40] Interval training ² : 100%: 0% peak work rate (cycle) [39]	30%-80% 1-RM or use 8-15- RM [125]	
Type	Walking (treadmill, corridor, Nordic poles) [42] Cycling (leg and/or arm ergometer)	Major muscle groups of upper and lower body (quadriceps, hamstrings, plantar flexors, gluteals, biceps, triceps, pectorals, latissimus dorsi) Training	Major muscle groups of upper and lower body Thoracic cage and chest wall mobility

	Aerobic	Resistance	Flexibility
Time/ Training Volume	Continuous: 15-30 min Intermittent: 5-10 min × 2-3 bouts Interval ² : 30 s exercise: 30 s rest (12-36 min) [39]	1-2 sets × 8-15 reps	Hold up to 10-30 s each, repeat 2-4 times
Progression	Progress time up to 20-30 min continuous Perform regular 6MWTs and adjust speed accordingly for treadmill training; and increase Watts on cycle Higher level patients may tolerate a treadmill incline of 1%-4%	Increase weights based on tolerance; (approximately 0.5 kg or 1 lb. per week, as tolerated) [41] Body weight exercises: Can add hand or ankle weights	Hold stretches to point of tightness/slight discomfort

Wickerson L., Mathur S. Physical rehabilitation for lung transplant candidates and recipients: An evidence-informed clinical approach. World J Transplant. 2016 Sep 24;6(3):517-31.

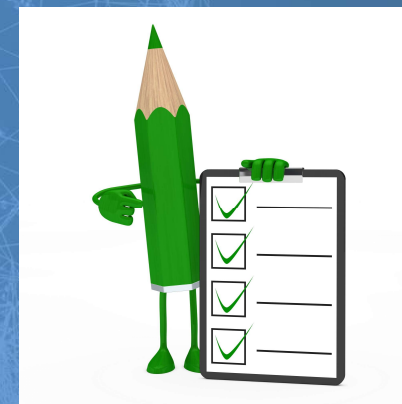
Duke Pulmonary Rehabilitation Program



- Approximately 23 session, 5 days per week
- Includes:
 - Walking 20-30 minutes
 - Biking 20 minutes
 - Strength training
 - Balance and flexibility exercises
 - Breathing retraining
 - Education lectures
- *Access to Dietician and Health Counselor
- *Required before and after lung transplant
- *Providers: PT, RT

Physical Requirements for Transplant

- ▶ Pre-Lung Transplant goals at Duke (varies by center):
 - ▶ Walk at least ½ mile in 20 minutes without a rest break, consistently
 - ▶ Bike for 20 minutes without a rest break
 - ▶ Resistance training for upper and lower extremities
 - ▶ Walk >1000 ft on 6MWT, without a rest break
 - ▶ Attend rehab 5 days per week
 - ▶ Educational sessions about transplant process





Exercise Considerations

- ▶ Continuous or intermittent monitoring of vital signs with various activity
 - ▶ SpO₂, HR, BP, EKG, RPE
- ▶ Modes of exercise
 - ▶ Consider safety and tolerance of each patient as they progress
- ▶ Restrictions
 - ▶ Vital signs, comorbidities (i.e. CAD, OP, PAH, pain, anxiety/depression), clinic/equipment related access
- ▶ Progression of disease
 - ▶ Oxygen requirements, changes in activity tolerance, signs of infection/exacerbation

Exercising with Increasing Oxygen Requirements

- Flow meters
- Partial Rebreather
- Forehead probe for pulse oximeter
- Headbands, Velcro straps
- Regulators with higher LPM capacity for home use



Exercising with Increasing Oxygen Requirements



- Y-connectors
- Extra tubing and connectors
- Rollators with oxygen tank holder attachments (single or double)





Stable Waiting from Home Rehab Program

- After a patient completes initial pre-transplant rehab, their circumstances may qualify them to return home while they wait for an organ offer
 - Ideal for long expected wait times, financial constraints, and "stable" lung disease
- continue daily exercise
- log exercise in an app or on paper
- Independently monitor & log vital signs before and during exercise
- Weekly telephone call with PT to assess compliance, exercise progression, and health status
- monthly in person assessment with PT and transplant MD to ensure stability of lung disease (not getting sicker)
- Consistency and communication is key to success

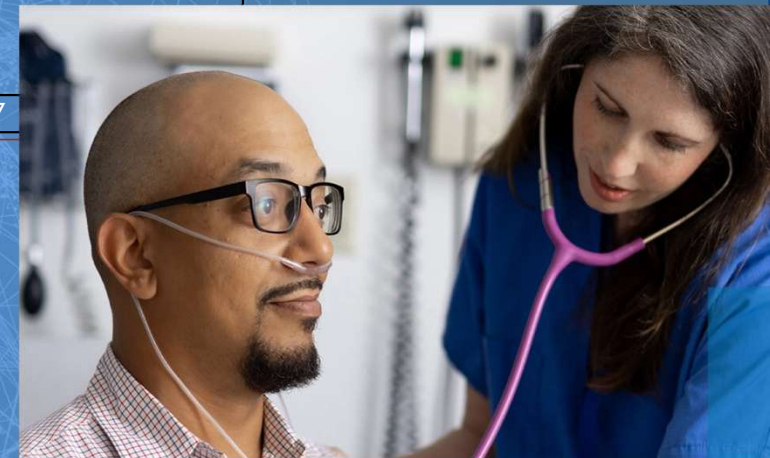
Stable Waiting from Home Rehab Program

- Considerations include:
 - Access to equipment at home or at local gym
 - Access to enough oxygen required for exercise
 - Meeting physical requirements for transplant center consistently
 - Travel time to Duke (< 2 hours)
 - expected wait time
 - Financial/ caregiver constraints (conserving resources for post op care)

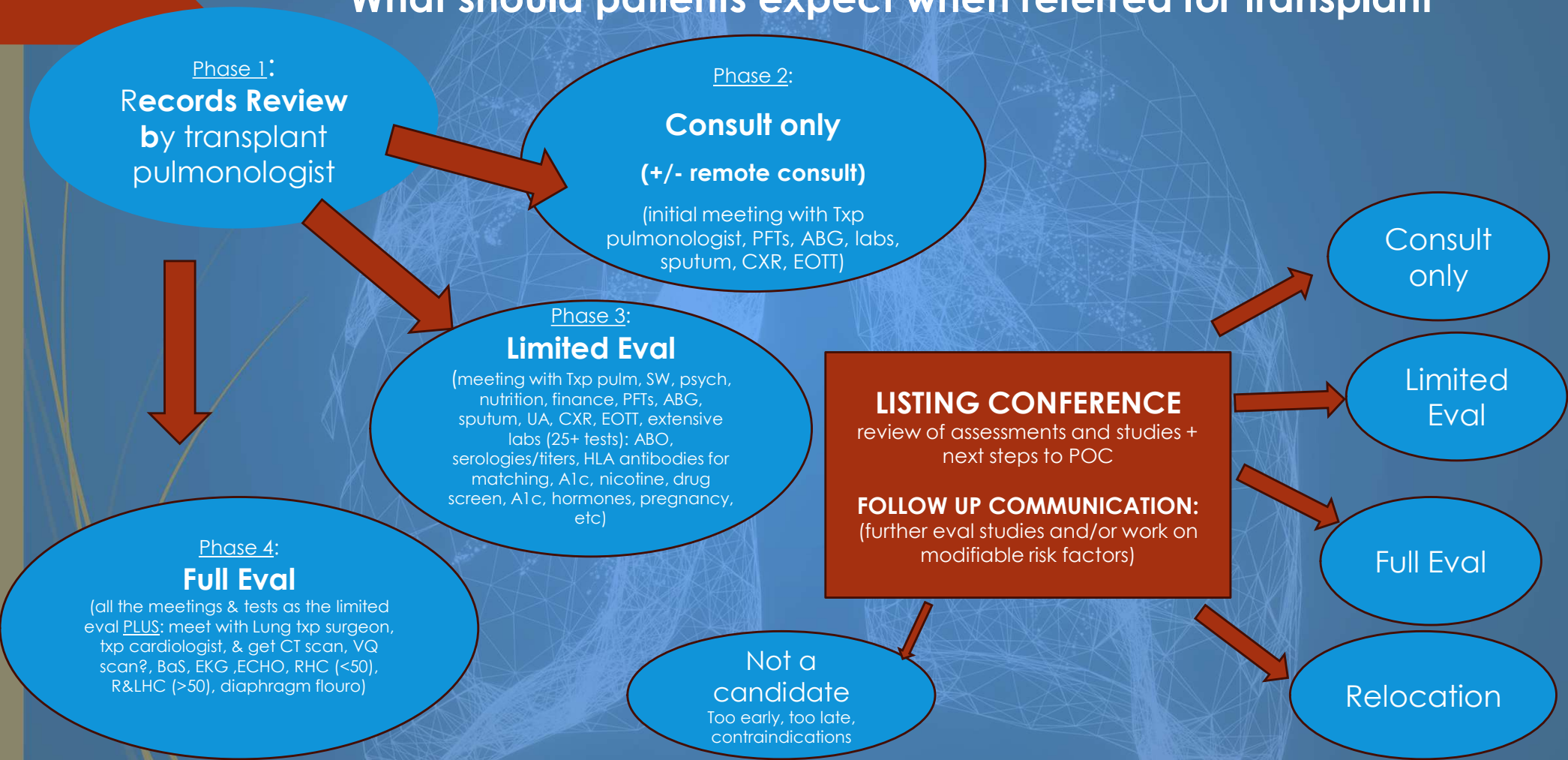


What should patients expect when referred for transplant

Records Review	Consult only (+/- remote consult)	Limited Eval	Full Eval	Relocation	Wait listing	Stable waiting from home
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
<p>On-going/ Weekly multidisciplinary listing conference discussion of patients in each phase:</p> <ul style="list-style-type: none"> * test & assessment results * current health status * and recommendations for future plan of care (modify risk factors and/or listing) 						
<p>Patient and referring MD receive follow up communications after listing conference discussion</p>						

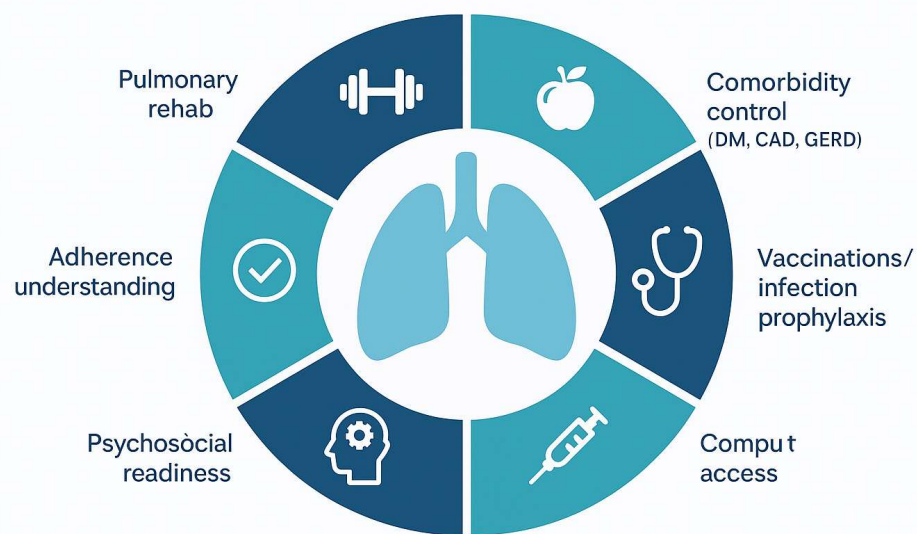


What should patients expect when referred for transplant

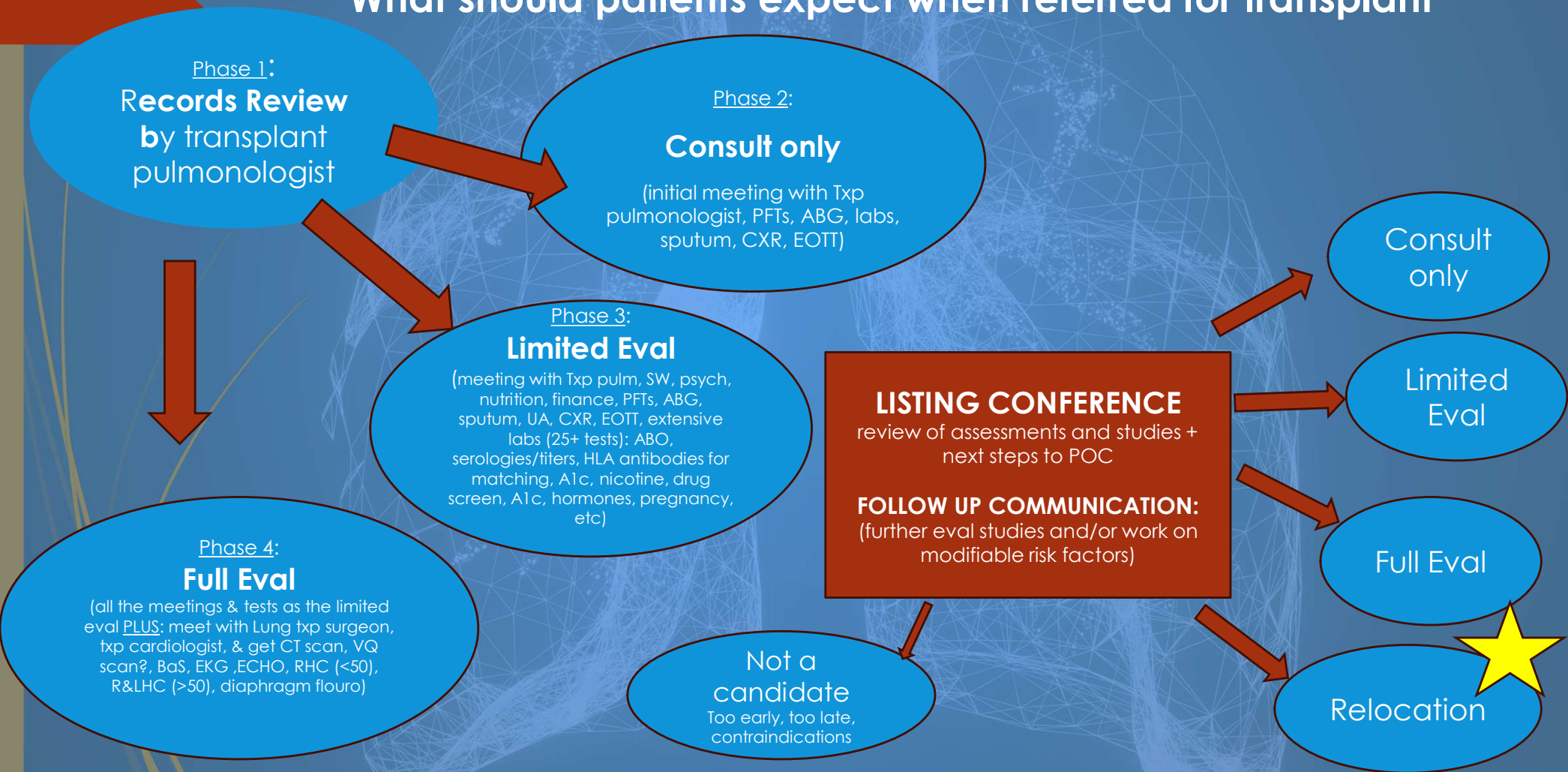


What to expect between evaluation appointments?

Candidate Optimization



What should patients expect when referred for transplant



Pretransplant Education Classes during Relocation

weekly via zoom & on demand
completed during Relocation phase

➤ Transplant Surgery Class #1

<https://cepd.warpwire.com/w/sy0AAA/>

➤ Transplant Medicine Class #2

<https://cepd.warpwire.com/w/uy0AAA/>

➤ Home Care After Discharge Class #3

<https://cepd.warpwire.com/w/ty0AAA/>

➤ Infections and Donors with Risk Criteria Class #4

<https://cepd.warpwire.com/w/vS0AAA/>

➤ Rejection Class #5

<https://cepd.warpwire.com/w/uS0AAA/>

➤ Transplant Long Term Care Class #6

<https://cepd.warpwire.com/w/tS0AAA/>



What should patients expect when Listed and Transplant

Phase 5:

Relocation

come to Durham and work out to get in tip top shape for surgery, participate in pre-tpx education classes. Meet again with Txp pulmonologist, Txp surgeon, pharmacy, nutrition, Txp cardiology,
Labs: 2nd ABO, HLA antibodies for matching, CBC, CMP, mag, PFT, ABG, CXR, sputum)

Phase 6:

Listing

Still working out to maintain strength
Awaiting donor match while living in Durham

Phase 7:

Listed/ Stable waiting from home Rehab

After completing pretransplant rehab, still working out to maintain strength
Awaiting donor match from home

Transplant Phase & hospital stay

(few weeks to months depending; support of TC)

Post transplant initial follow up & post-op rehab

(4-6 weeks of weekly clinic visits, bronch, endo, nutrition, SW, pharmacy, psych, GERD eval)
daily workouts with rehab
Post TC support

Relocation & lifelong f/u

Recovery from Transplant

- ▶ Regaining strength is slow process
 - ▶ Harder than people expect
 - ▶ Pre-transplant strength is important
- ▶ Complications are the norm:
 - ▶ blood clots, infections, rejection, feeding tube, diabetes, abnormal heart rhythms, airway issues
- ▶ Adjusting to medications and their side effects
- ▶ Stress, anxiety, depression
- ▶ Slowly return to normal activity and independence
- ▶ Heavy reliance on caregivers and staff for support at first



What should patients expect after transplant?

► Lifelong follow up

- Balance between preventing rejection with immunosuppression while preventing infections.

During first year:

- Weekly to monthly bloodwork to check IS drug levels
- Lung Txp MD visit & bronch q3mo
- Frequent trips to Durham



After first year:

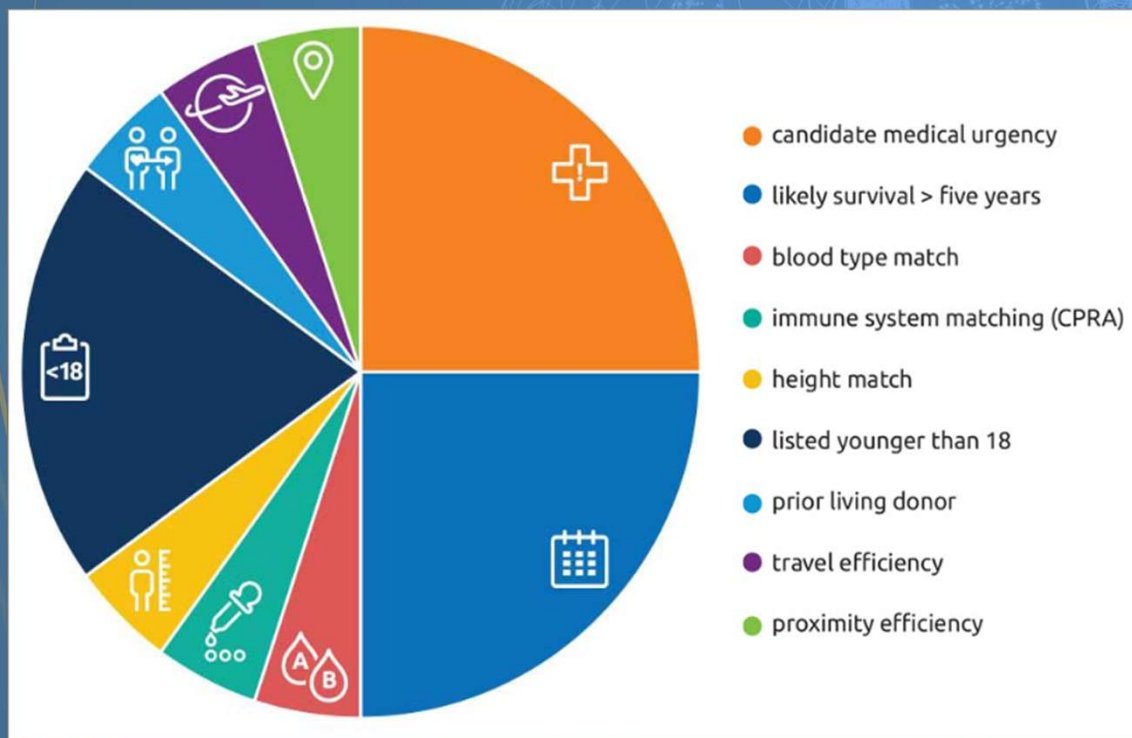
- Weekly to monthly bloodwork to check IS drug levels
- Lung Txp MD visit q4-6mo
- annual bronch
- dermatology q6mo
- treating any infection
- treating acute rejection
- treating & preventing CLAD- 40-45% of deaths between 1 and 10 years posttransplant are due to chronic lung allograft dysfunction)



Who get to the "top of the list?"

Current System:

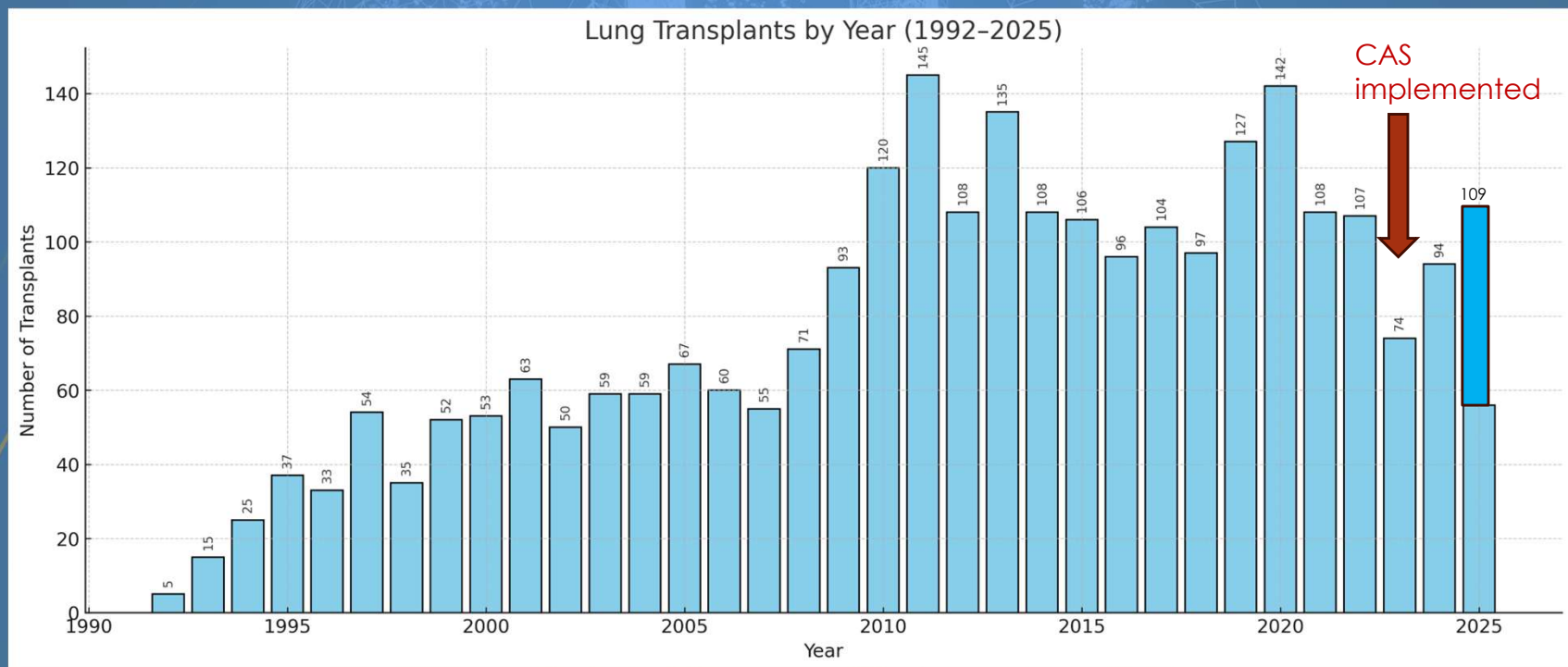
Composite Allocation Score (CAS) and Continuous distribution



*Composite Allocation Score
+ continuous distribution value

- 25 pts medical urgency
- 25 pts likelihood of surviving 5 years
- 15 pts matching challenges
- 20 pts listed prior to 18y
- 5 pts prior organ donor
- 10 pts continuous distribution value
- Continuous distribution value= based on distance of donor. More pts if donor closer to transplant hospital
- Avg ~ 20-25pt. High ~ 40-45pts
- Aim to help sickest patients be highest on the list

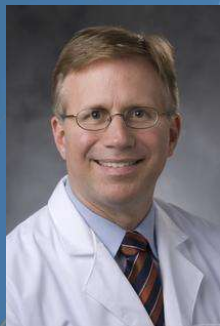
Duke Lung Transplants by Year (1992–2025)



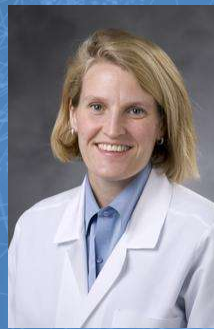
<https://optn.transplant.hrsa.gov/data/view-data-reports/center-data/>

Lung Transplant Team

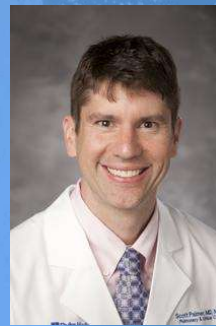
Transplant Pulmonologists



John Reynolds, MD
Medical Director



Laurie Snyder, MD
Associate Medical Director



Scott Palmer, MD
Scientific Director



Jamie Todd, MD



Hakim Azfar Ali, MD
Fellowship Director



Matt Pipeling, MD



Jordan Whitson, MD



Katherine Young, MD



Brandon Menachem, MD



Alexander Graham, MD



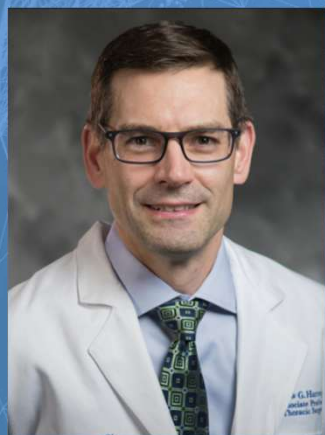
Deepika Kulkarni, MD



Lake Morrison, MD

Lung Transplant Team

Transplant Surgeons



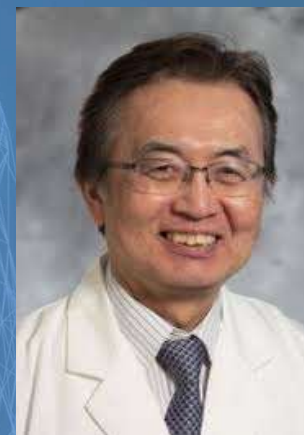
Matthew Hartwig, MD



Jacob Klapper, MD
Surgical Director



Kunal Patel, MD



Hiroshi Date MD

Expanding access through surgical innovation

Outcome comparison

Table 1. Advantages and disadvantages of living-donor lobar lung transplantation.

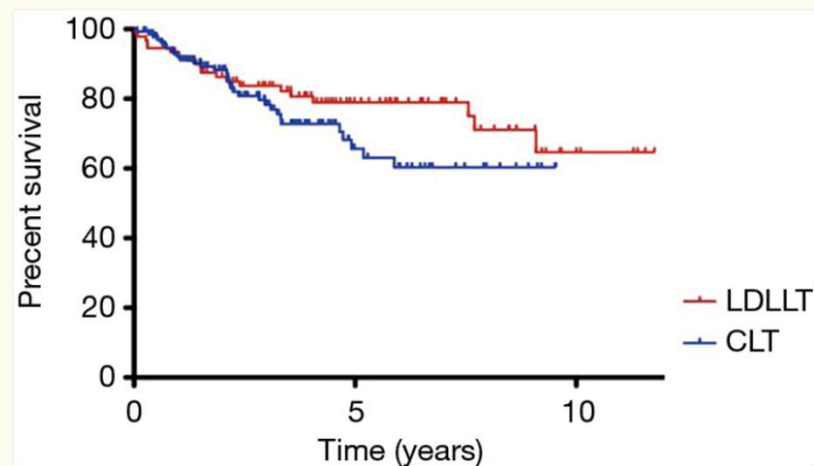
Advantages

- Short waiting time
- Short ischemic time
- Perfect graft with less injury and infection
- Scheduled operation
- Similar HLA

Disadvantages

- Lobectomy in healthy donor(s)
- Difficult size matching
- Three operating rooms for three teams (recipient and two donors)

Figure 4.

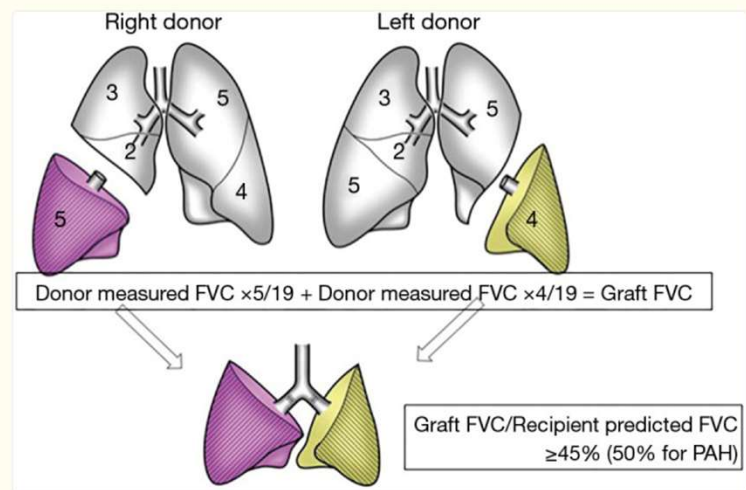


[Open in a new tab](#)

The 5- and 10-year survival rates after LDLLT and CLT in Kyoto University. LDLLT, living-donor lobar lung transplantation; CLT, cadaveric lung transplantation.

Expanding access through surgical innovation

Figure 5.



[Open in a new tab](#)

Date's formula for functional size matching between a living-donor lobar graft and a recipient. FVC, forced vital capacity; PAH, pulmonary arterial hypertension.

Expanding Access with Newer technologies

PARAGONIX

Patients & Caregivers Healthcare Professionals Products & Services Registries About

1

Rigid Outer Shell

Protective polystyrene material ensures internal environment will maintain temperature over 40 hours



2

SherpaCool Technology

Proprietary phase-change cooling formula that maintains optimal temperature conditions without use of 0°C ice



ARTICLE

Duke's First Fully Robotic Lung Transplant Offers Faster Recovery

Robotic lung transplant technologies improve surgery, speed healing
● Pulmonology, Transplant

Multidisciplinary Lung Transplant Team



Transplant pulmonologist, transplant surgeon
Transplant pharmacists
Transplant psychologist & transplant psychiatrist
Transplant Social Work
Transplant pharmacist
Transplant coordinators
Transplant Physical therapist
Transplant APPs
Transplant RN Care Coordinators
Transplant nutritionist
Transplant Infectious Disease MD
Transplant dermatology
Transplant Program Specialists
Transplant Medical Secretaries
Transplant Financial Care Coordinator

Expanding Access through community partnership

- Host Homes
- Open Arms Apartments
- Greystone Houses of Hope
- Stable Waiting from Home Rehab



Multiple Inpatient unit teams and clinic teams working together

CT Surgery ICU & Stepdown, 7800 with APPs, clinic 2f/2g, pulmonary rehab



Goal of Lung Transplant: enjoying life!







Questions?

