

# Trapianto del polmone: cosa c'è di nuovo?



Dott.ssa Letizia Corinna MORLACCHI

U.O.C. Pneumologia, Dipartimento di Medicina Interna.  
Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico di Milano.  
Università degli Studi di Milano.

# Agenda

- Introduzione
- Referral & Lista
- Complicanze
- Modulatori CFTR
- La telemedicina

\*\*\* Nessun conflitto di interesse per questa presentazione\*\*\*

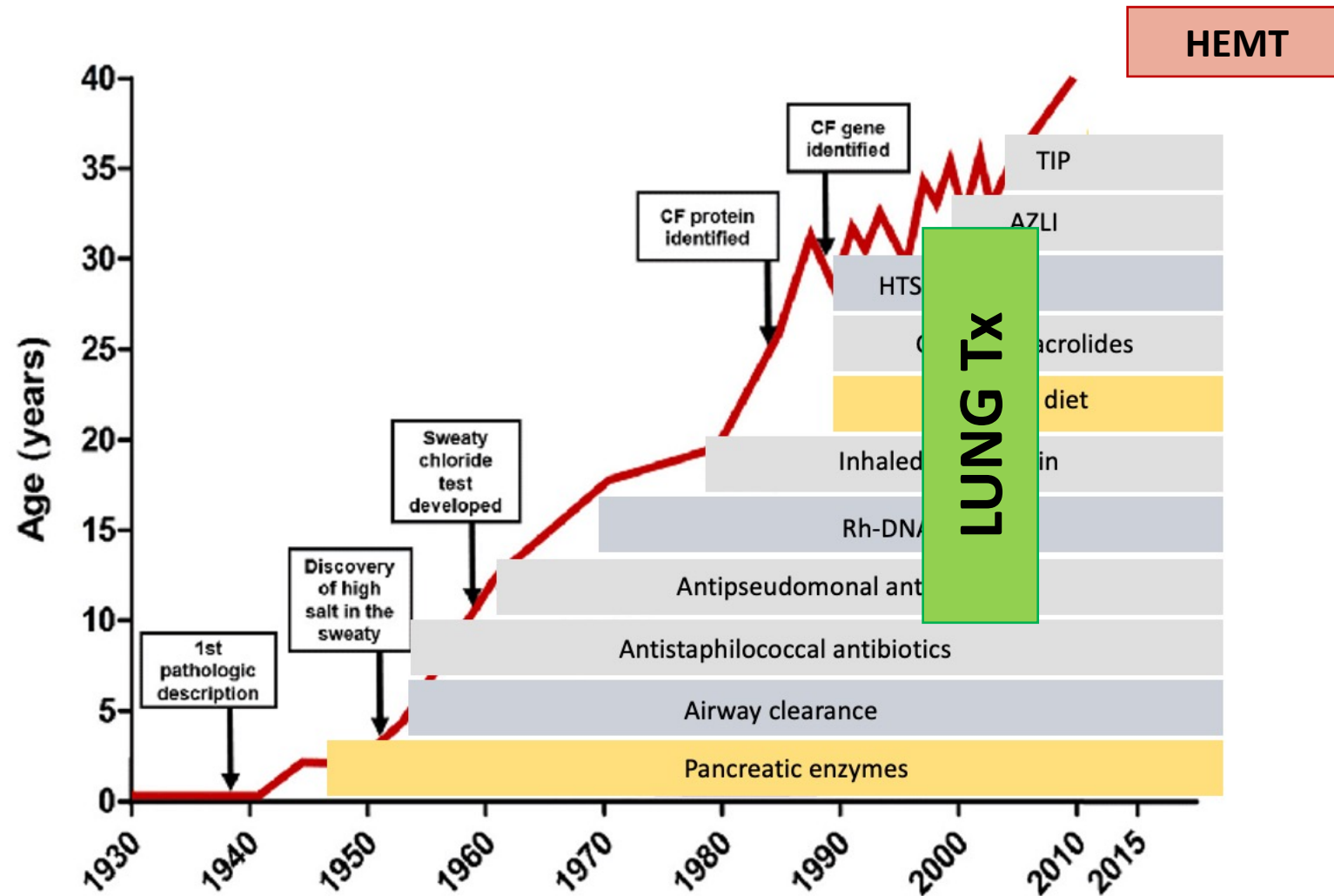


LIFC  
Lega Italiana  
Fibrosi Cistica

# LuTx per FC

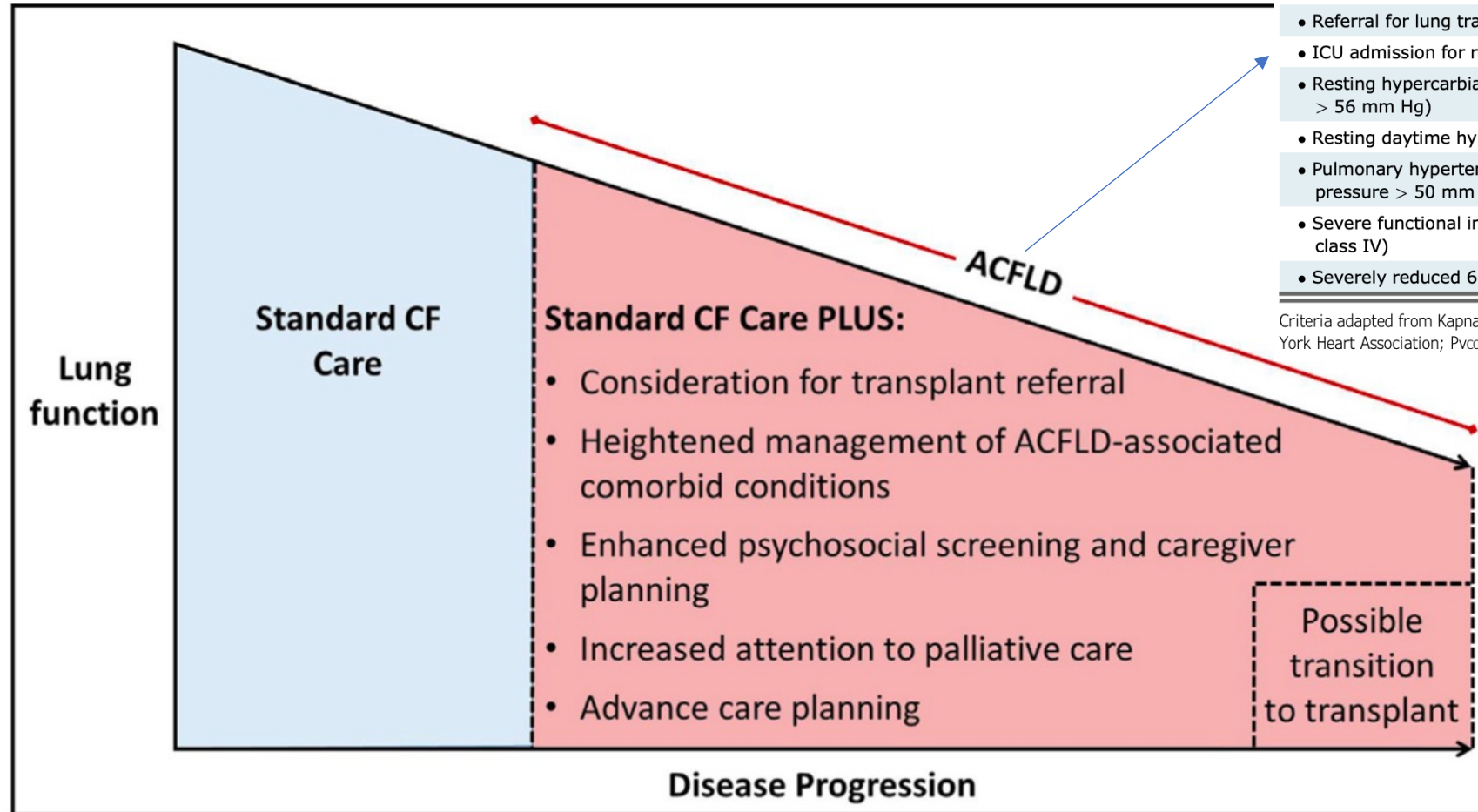
Introduzione

# FC: un paradigma terapeutico in costante evoluzione



Modified from  
 Elborn S, 2013

# Advanced CF lung disease (ACFLD)

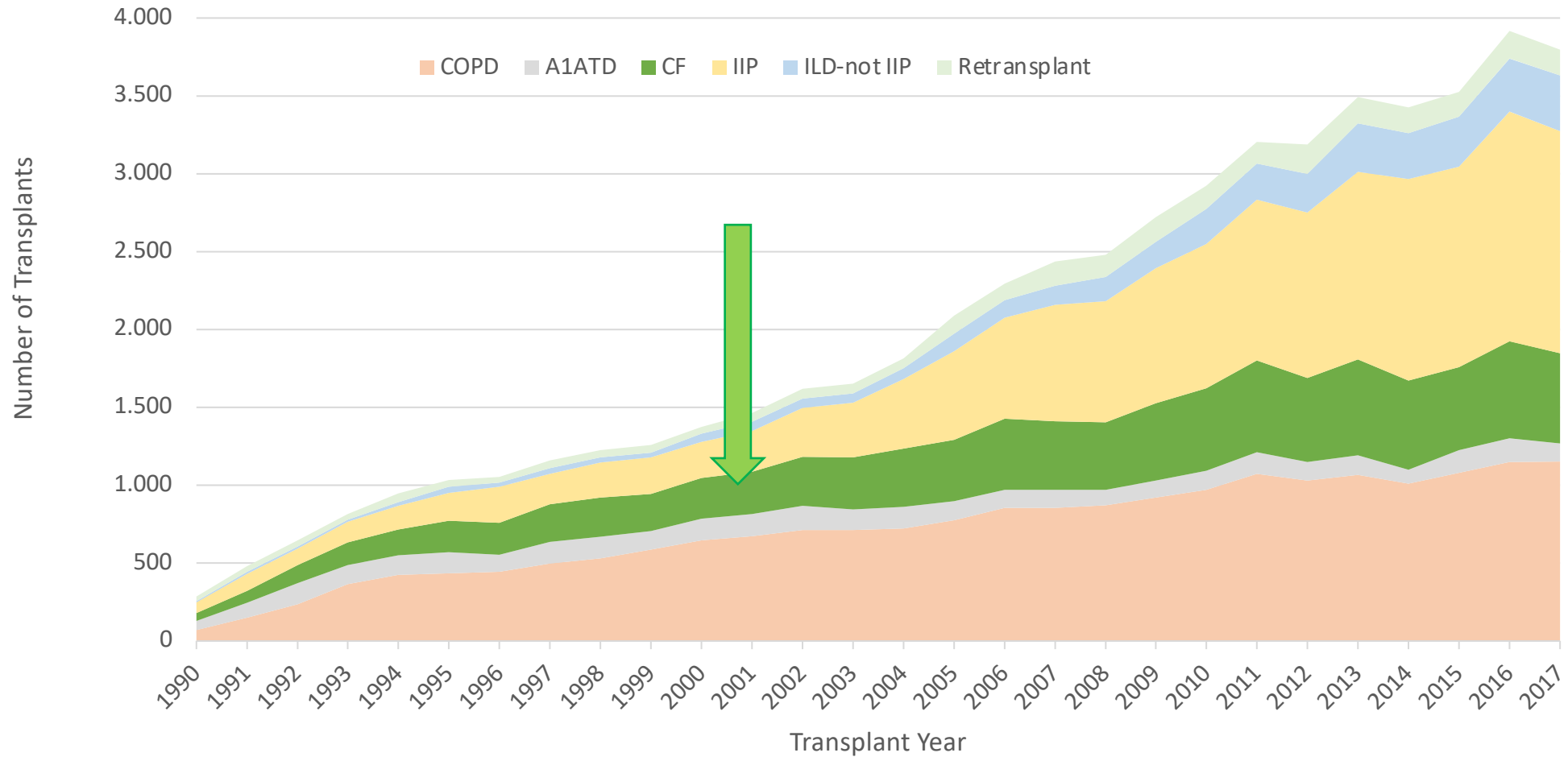


**TABLE 2 ] Defining Advanced CF Lung Disease**

Any of the following criteria
• FEV <sub>1</sub> < 40% predicted
• Referral for lung transplant evaluation
• ICU admission for respiratory failure
• Resting hypercarbia (Paco <sub>2</sub> > 50 mm Hg or Pvc <sub>o2</sub> > 56 mm Hg)
• Resting daytime hypoxemia
• Pulmonary hypertension (pulmonary arterial systolic pressure > 50 mm Hg on echocardiogram)
• Severe functional impairment (NYHA functional class IV)
• Severely reduced 6-min walk distance (< 400 m)

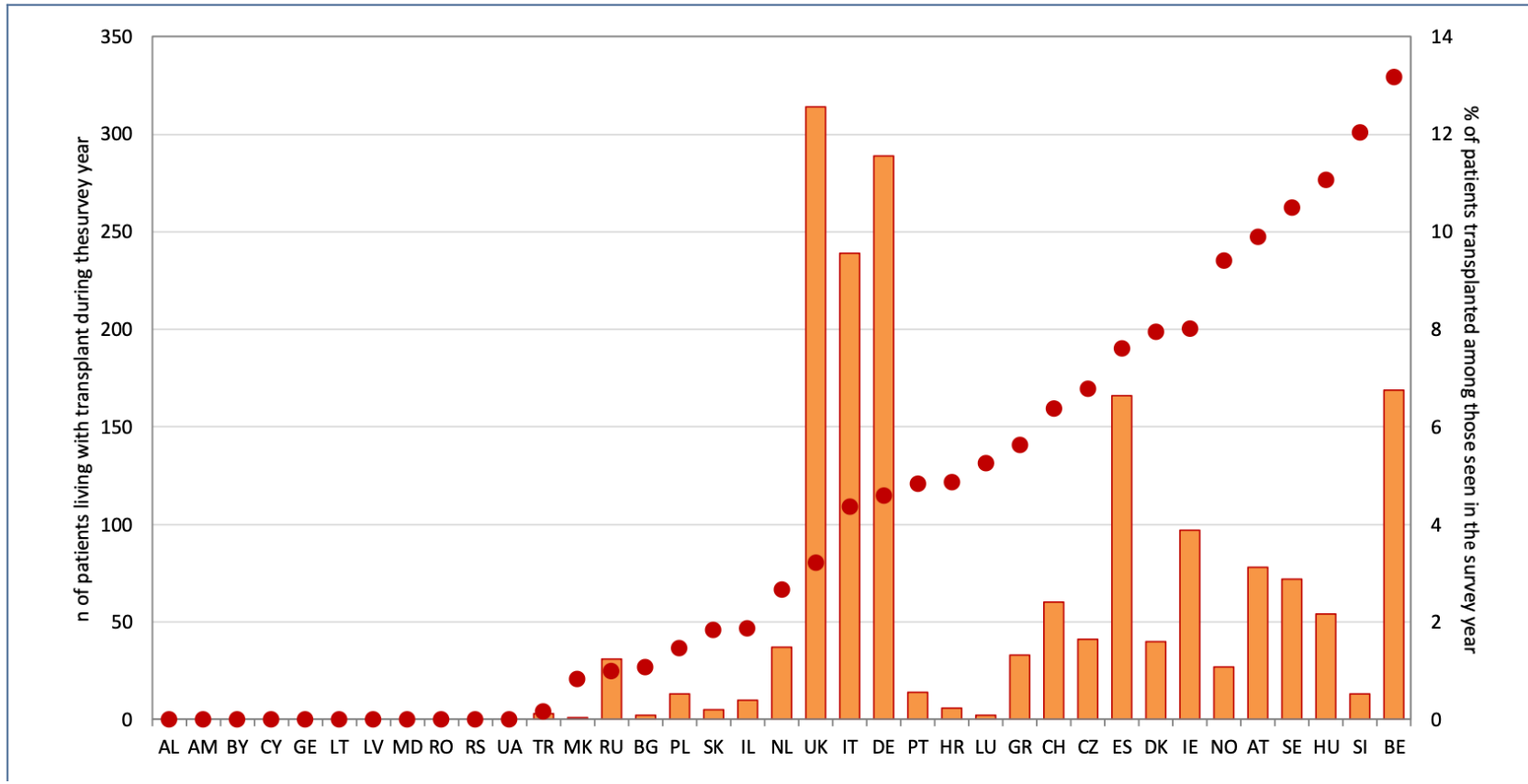
Criteria adapted from Kapnadak et al.<sup>30</sup> CF = cystic fibrosis; NYHA = New York Heart Association; Pvc<sub>o2</sub> = partial pressure of CO<sub>2</sub> in venous blood.

# LuTx (adulti) - indicazioni



# LuTx (adulti) per FC – dati per ECFSPR

Figure 8.1 Number of patients living in 2018 with transplanted lungs, by country.





LIFC  
Lega Italiana  
Fibrosi Cistica

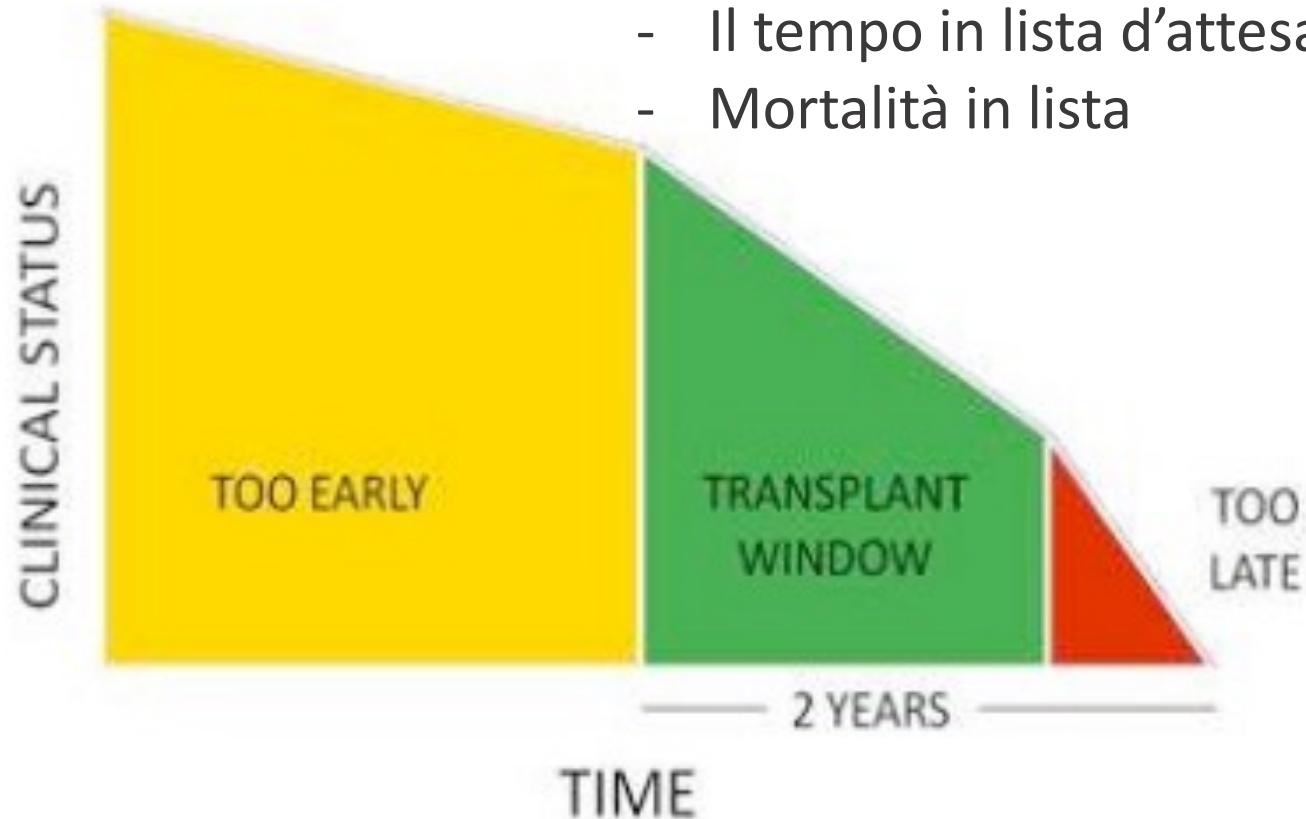
# Referral & Listing

Cos'è cambiato negli ultimi anni; il ruolo dei modulatori



# La finestra trapiantologica

- Il listing richiede tempo
- Il tempo in lista d'attesa può essere (molto) lungo
- Mortalità in lista



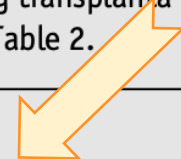
### Indicazioni generali - Adulti con end stage lung disease con i seguenti criteri:

- Alto rischio di mortalità (> 50%) nei successivi 2 anni
- Alta probabilità (>80%) di sopravvivenza a 5 anni da un eventuale trapianto in caso di adeguata funzione del graft polmonare.

**Table 2** Risk factors for poor post-transplant outcomes

Risk factors can change over time and may not be a contraindication for referral, but when present at the time of listing or while listed for lung transplantation may increase risk for poor transplant outcomes. There was 100% consensus (24 committee members) for the content of the entirety of Table 2.

#### **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/1.73m<sup>2</sup> 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
- 

# Candidati al LuTx per FC



## Consensus document for the selection of lung transplant candidates: An update from the International Society for Heart and Lung Transplantation

The Journal of  
Heart and Lung  
Transplantation

<http://www.jhltonline.org>

Lorriana E. Leard, MD,<sup>a</sup> Are M. Holm, MD, PhD,<sup>b</sup> Maryam Valapour, MD, MPP,<sup>c</sup>

**Referral for lung transplantation should occur for an individual with CF meeting any of the following criteria despite optimal medical management including a trial of ELX/TEZ/IVA if eligible:**

- FEV1 < 30% pred (o < 40% in children)
- FEV1 < 40% pred (o < 50% in children) and any of the following:
  - 6MWT distance < 400 mt
  - pCO<sub>2</sub>>50mmHg
  - Hyooxemia
  - Pulmonary hypertension (PAPs > 50 mmHg on echocardiogram or evidence of right ventricular dysfunction)
  - Worsening nutritional status despite supplementation
  - 2 exacerbations per year requiring IV antibiotics
  - Massive hemoptysis (>240 mL) requiring bronchial artery embolization
  - Pneumothorax
- FEV1 < 50% pred + rapidly declining based on PFT or progressive symptoms
- Any exacerbation requiring positive pressure ventilation

# Referral: un flusso di informazioni



- Stato funzionale (ultime PFR disponibili e andamento nel tempo)
- Accertamenti per valutazione scambi gassosi
  - EGA
  - 6MWT e SN
- Dati microbiologici:
  - Batteri
  - Miceti
  - NTM
- Storia di riacutizzazioni
- Precedenti embolizzazioni e/o PNX
- Ecocardio
- TC torace con immagini
- Comorbilità e stato nutrizionale

# Referral & Listing: il ruolo del fisioterapista

- Passaggio di consegne dal centro di provenienza
- Disostruzione
- Fabbisogno di O<sub>2</sub>tp sotto sforzo
- Ottimizzazione ventiloterapia non invasiva
- ALLENAMENTO!

Transplantation. 103(9):e220–e238, SEPTEMBER 2019  
DOI: 10.1097/TP.00000000000002806, PMID: 31461743  
Issn Print: 0041-1337  
Publication Date: September 2019



## Exercise for Solid Organ Transplant Candidates and Recipients: A Joint Position Statement of the Canadian Society of Transplantation and CAN-RESTORE

Tania Janaudis-Ferreira;Sunita Mathur;Robin Deliva;Nancy Howes;Catherine Patterson;Agnès Räkel;Stephanie So;Lisa Wickerson;Michel White;Yaron Avitzur;Olwyn Johnston;Norine Heywood;Sunita Singh;Sandra Holdsworth;

Transplantation. 101(9):1967–1968, SEPTEMBER 2017  
DOI: 10.1097/TP.00000000000001784, PMID: 29633979  
Issn Print: 0041-1337  
Publication Date: September 2017



## The Emerging Importance of Skeletal Muscle Function in Assessing Candidates for Transplantation

James Walsh;Daniel Chambers;Peter Hopkins;

**Clinical TRANSPLANTATION**  
The Journal of Clinical and Translational Research

COMMENTARY

## Sarcopenia in lung transplant candidates: A novel biomarker to estimate skeletal muscle mass

James R. Walsh, Peter M. A. Hopkins

First published: 03 March 2018 | <https://doi.org/10.1111/ctr.13200>

# RESPIRATORY CARE

Home Content Authors Reviewers CRCE Open Forum Podcast

Research Article | Original Research

## The 1-Minute Sit-to-Stand Test in Lung Transplant Candidates: An Easy-to-Use Alternative to the 6-Minute Walk Test?

Dario Kohlbrenner, Christian Benden and Thomas Radtke

Respiratory Care October 2019, respcare.07124; DOI: <https://doi.org/10.4187/respcare.07124>

# Lista d'attesa – allocazione degli organi

## Ethical Principles for the Allocation of Donor Lungs

<i>Principle</i>	<i>Application to organ allocation</i>
<b>UTILITY</b>	To maximize net benefit (e.g., using years of survival gained to prioritize allocation)
<b>JUSTICE</b>	To distribute the benefits and burdens of organ allocation system in a fair way (e.g., using medical urgency to prioritize allocation, allowing special consideration for candidates for whom it is difficult to find a suitable organ)
<b>RESPECT FOR PERSONS</b>	To treat persons as autonomous with the right for self-determination (e.g., the right to give or withhold informed consent for a lung transplant)

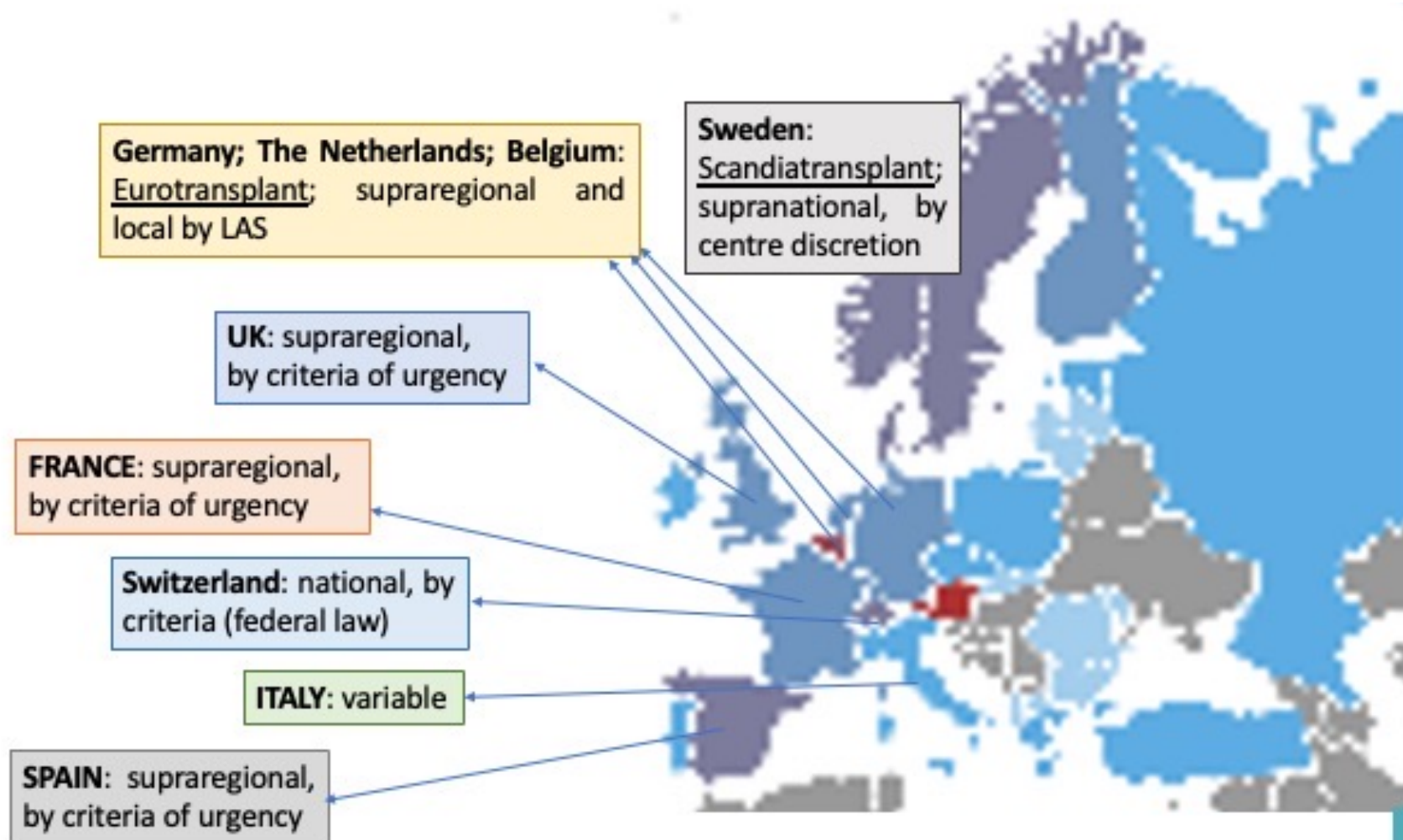
Modified from:

Leard LE et al., JHLT 2021;

<https://optn.transplant.hrsa.gov/resources/ethics/ethical-principles-in-the-allocation-of-human-organs/>



# Eterogenità nell'allocazione degli organi



# Lista d'attesa – LAS (Lung Allocation Score)

Goal: **net benefit of the transplant to the candidate as well as clinical urgency**, and it is calculated using a series of pretransplant clinical diagnostic data that analyses revealed to be predictive of both pre- and posttransplant outcomes.

Range 0-100, the higher, the better (or worse?) >> the higher the more urgent to be transplanted/the better (expected) after LuTx.

- >> decrease in WL mortality
- >> decrease in time on WL
- >> improved survival after LuTx

Egan TM et al, AmJT 2006

Egan TM et al, JHLT 2016

*Table 1. Lung Allocation Score Components<sup>a</sup>*

Waiting list urgency parameters	
Age	O <sub>2</sub> requirement at rest
Body mass index	Diabetes mellitus
Diagnosis	Six-minute walk distance <150 ft
Functional status (no assistance, some assistance, total assistance)	Continuous mechanical ventilation
FVC (% predicted)	Partial pressure of CO <sub>2</sub>
Pulmonary artery systolic pressure	Increased P <sub>CO2</sub> of 15% for 6 months
Posttransplant survival variables	
Age	Continuous mechanical ventilation
Functional status	Diagnosis
FVC (% predicted)	Pulmonary capillary wedge pressure

<sup>a</sup> Lung allocation score (LAS) calculated from difference between expected 1-year posttransplant survival and waiting list urgency. Score is standardized with range of 0–100 [5].

FVC = forced vital capacity; P<sub>CO2</sub> = partial pressure of carbon dioxide.

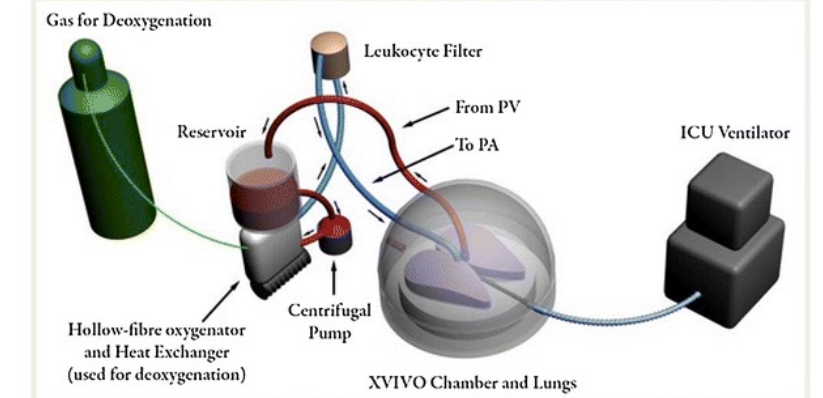
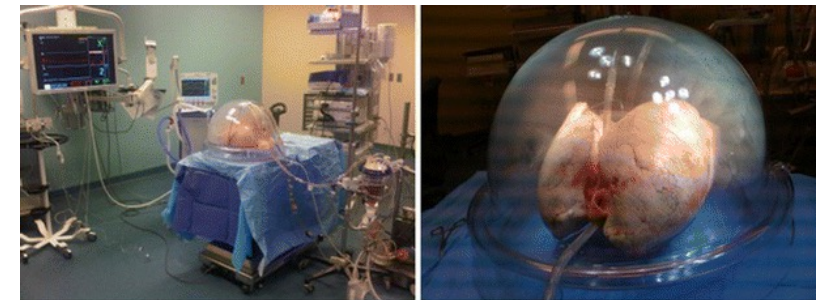


# Strategie per aumentare il pool di donatori

Medium percentage of solid organ use for transplantation	
	% utilized donors
Kidney	74%
Liver	78%
Heart	36%
Lung	18,6%

## Strategies to expand donor pool:

- Extended criteria – «marginal» donor
- Living lobar
- Ex Vivo Lung Perfusion (EVLP)
- Organ Care System (OCS)
- Donation after cardiocirculatory death (DCD)



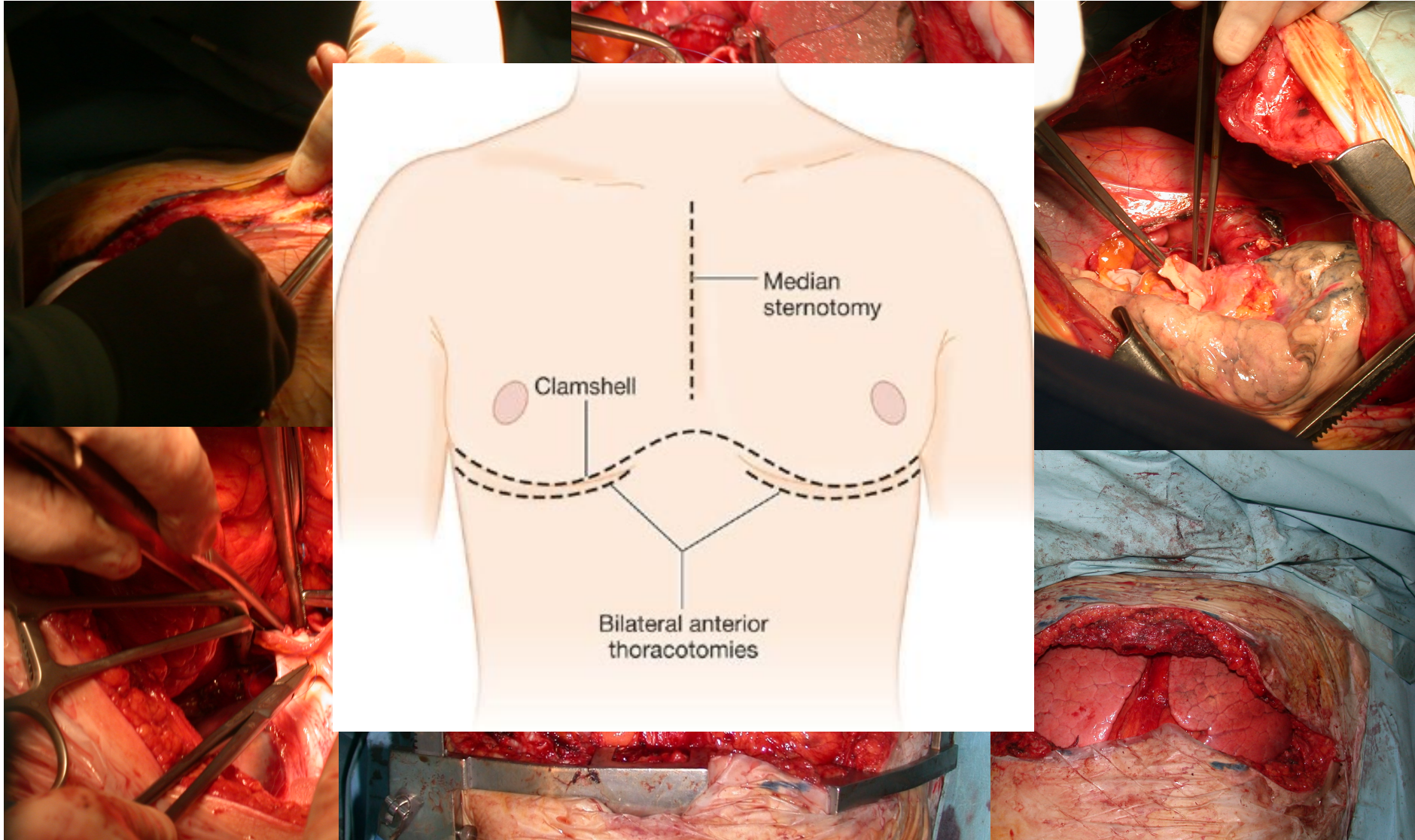


LIFC  
Lega Italiana  
Fibrosi Cistica

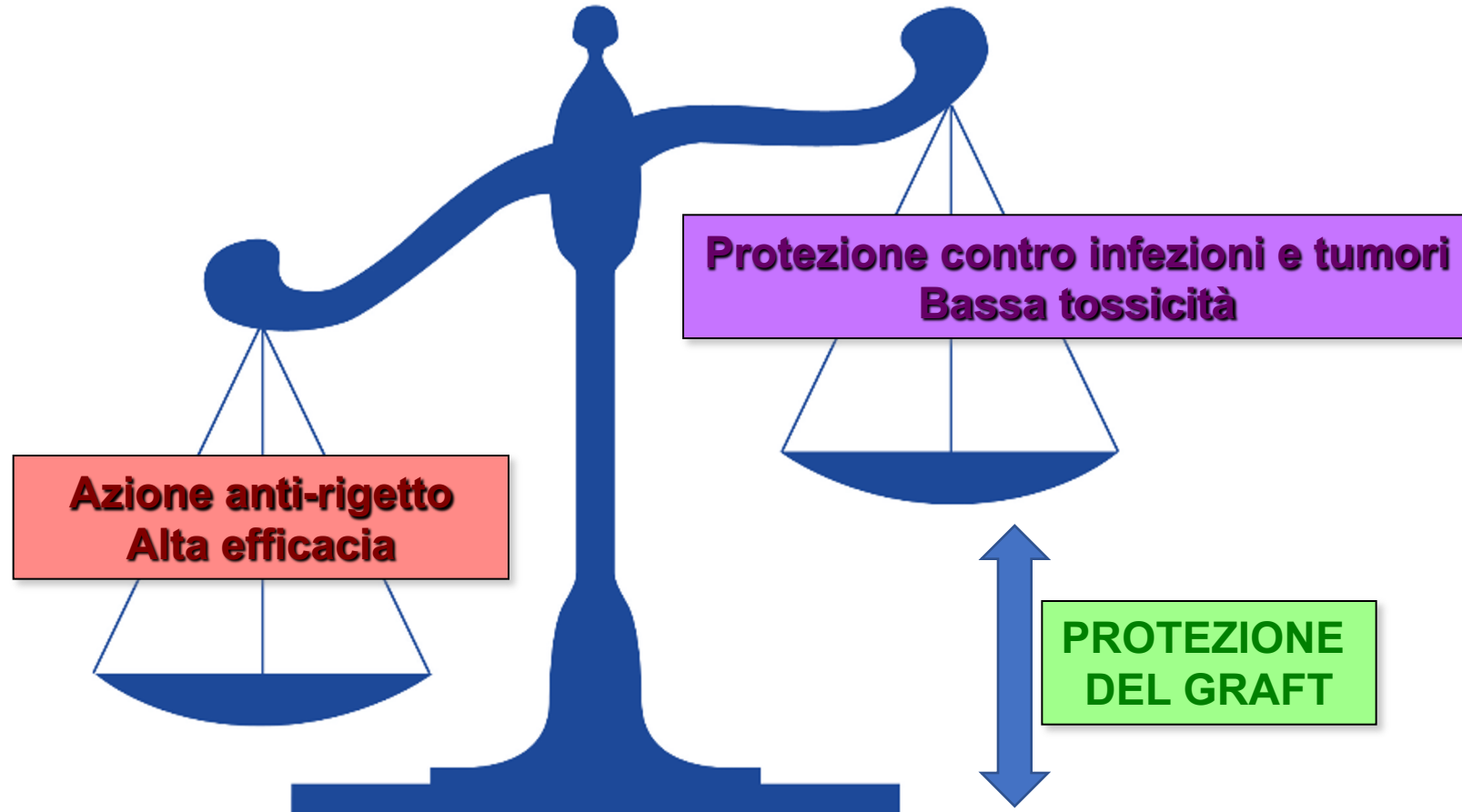
# Il trapianto

Sorveglianza, terapie e complicanze

# #Pneumi♥chirurghi

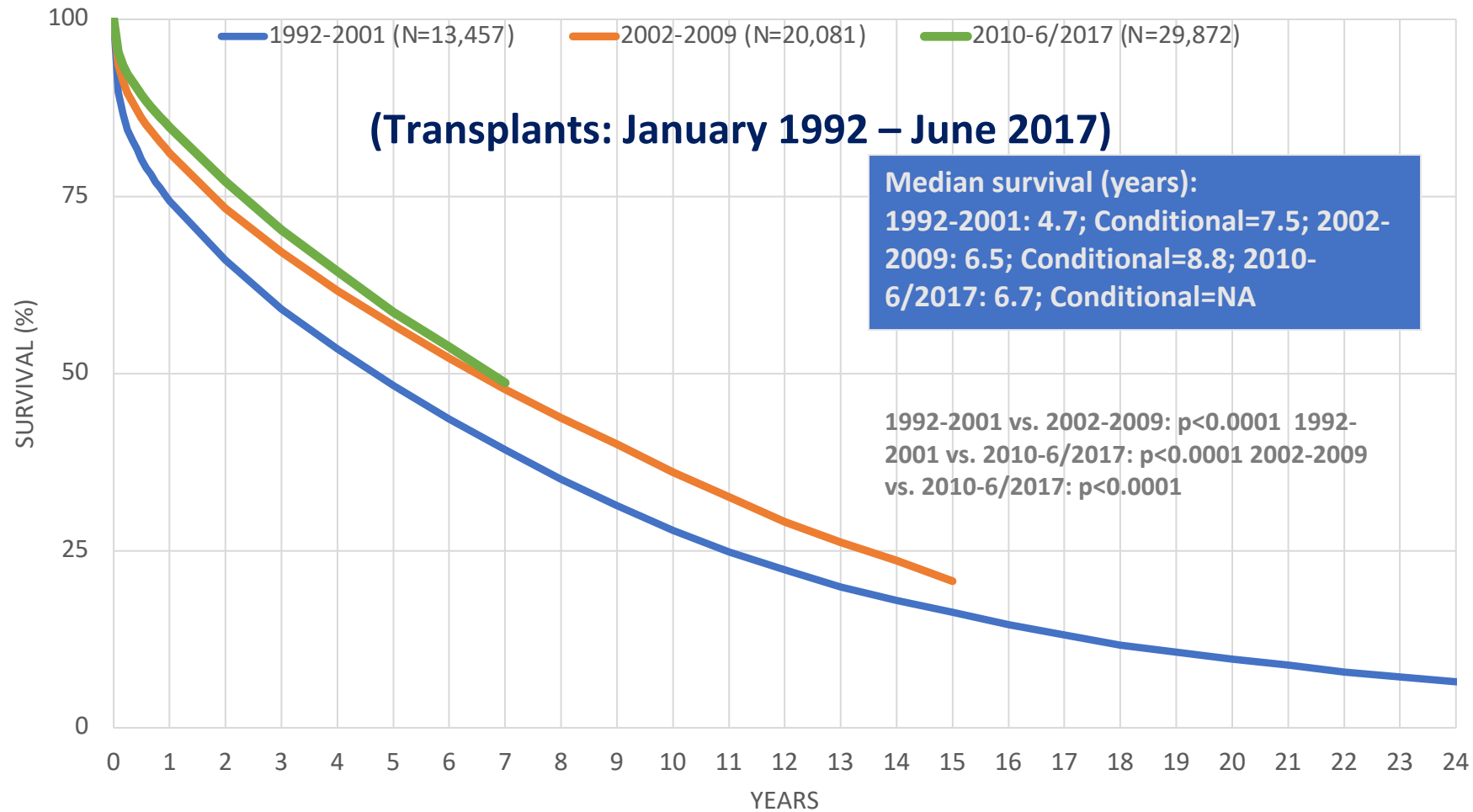


# Terapia immunosoppressiva - RAZIONALE

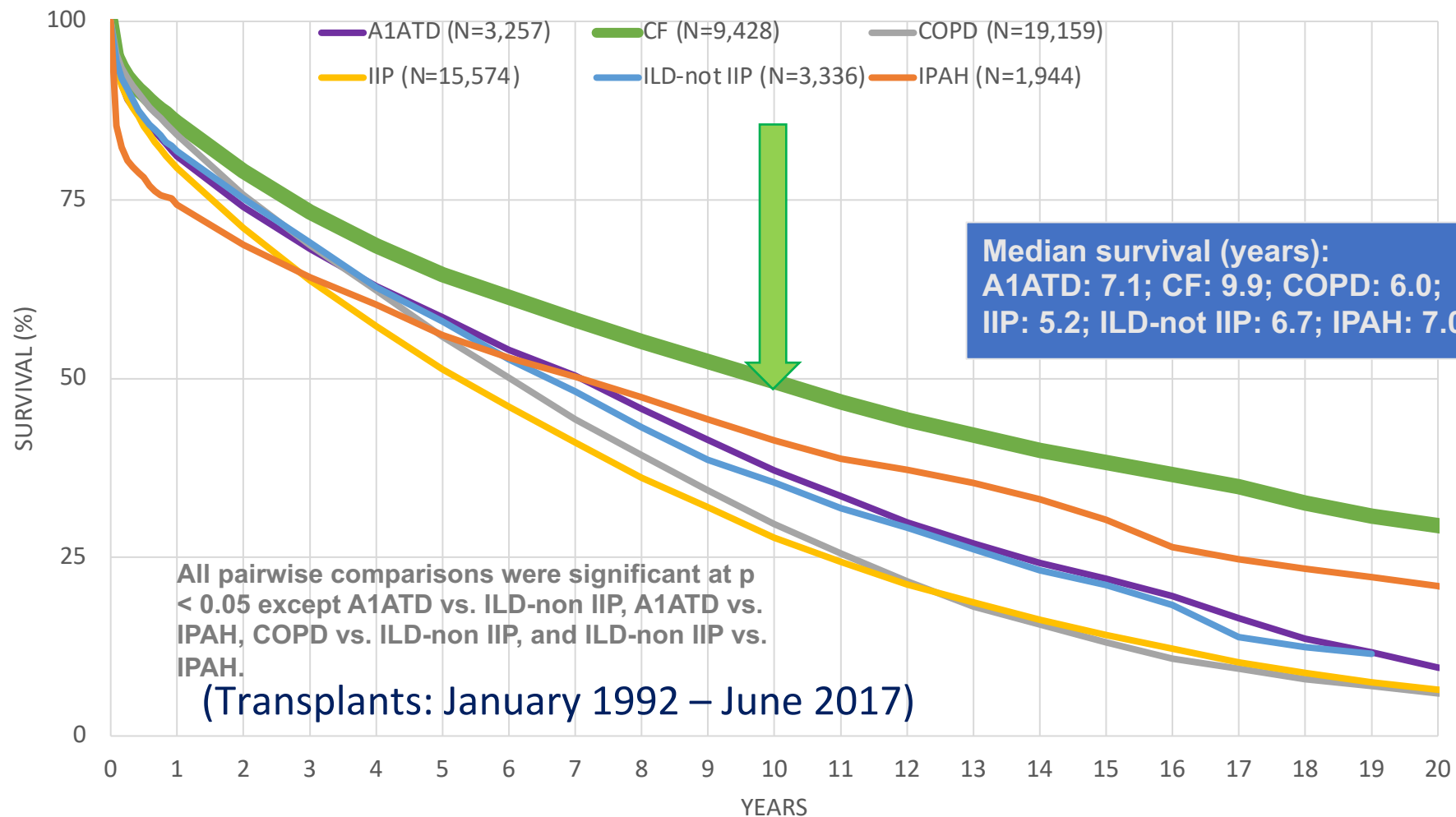


*Successful outcomes following lung transplantation depend on our ability to pharmacologically manipulate the immune system to prevent rejection of the lung allograft.*

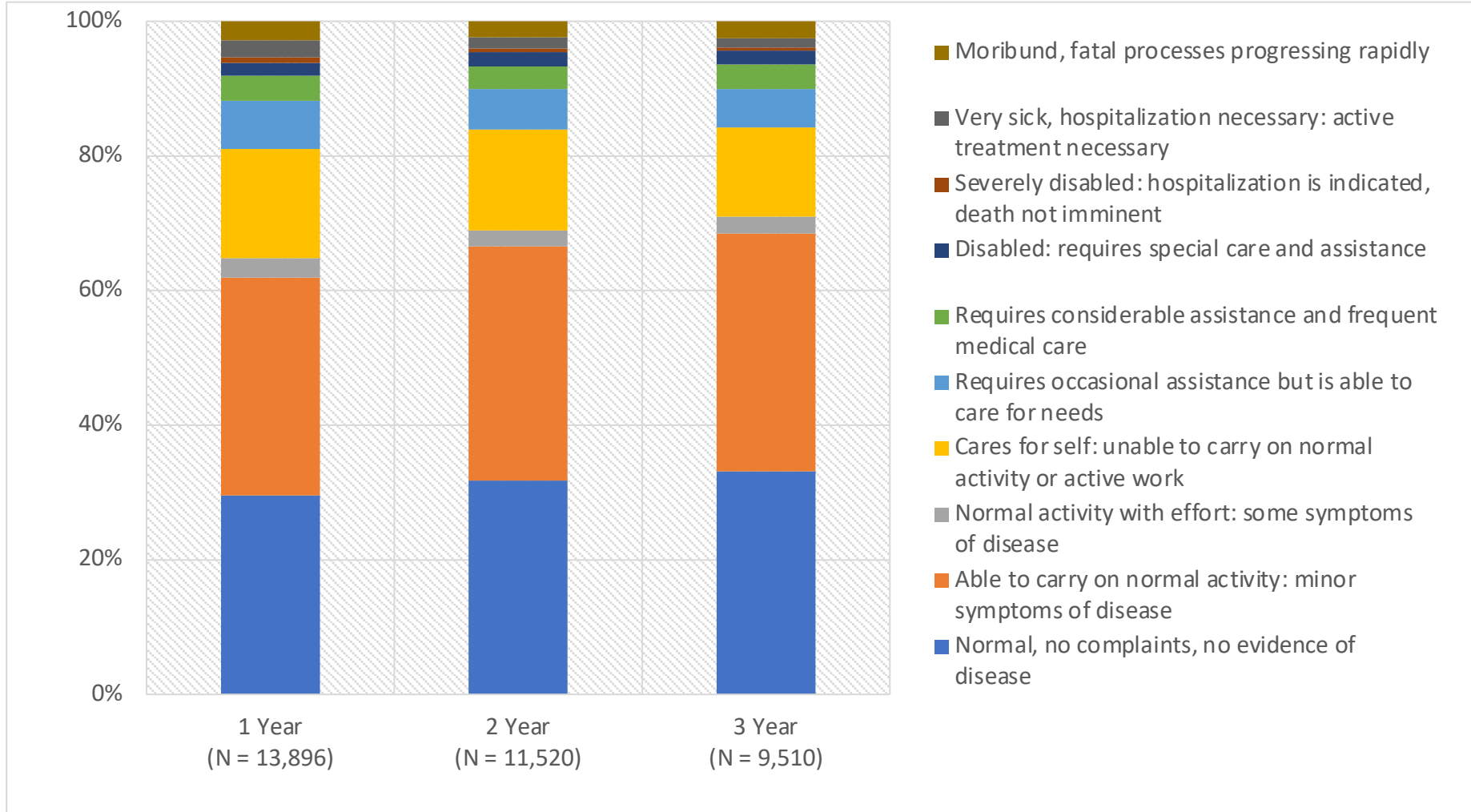
# LuTx (adulti) – sopravvivenza per era



# LuTx (adulti) – sopravvivenza per indicazioni

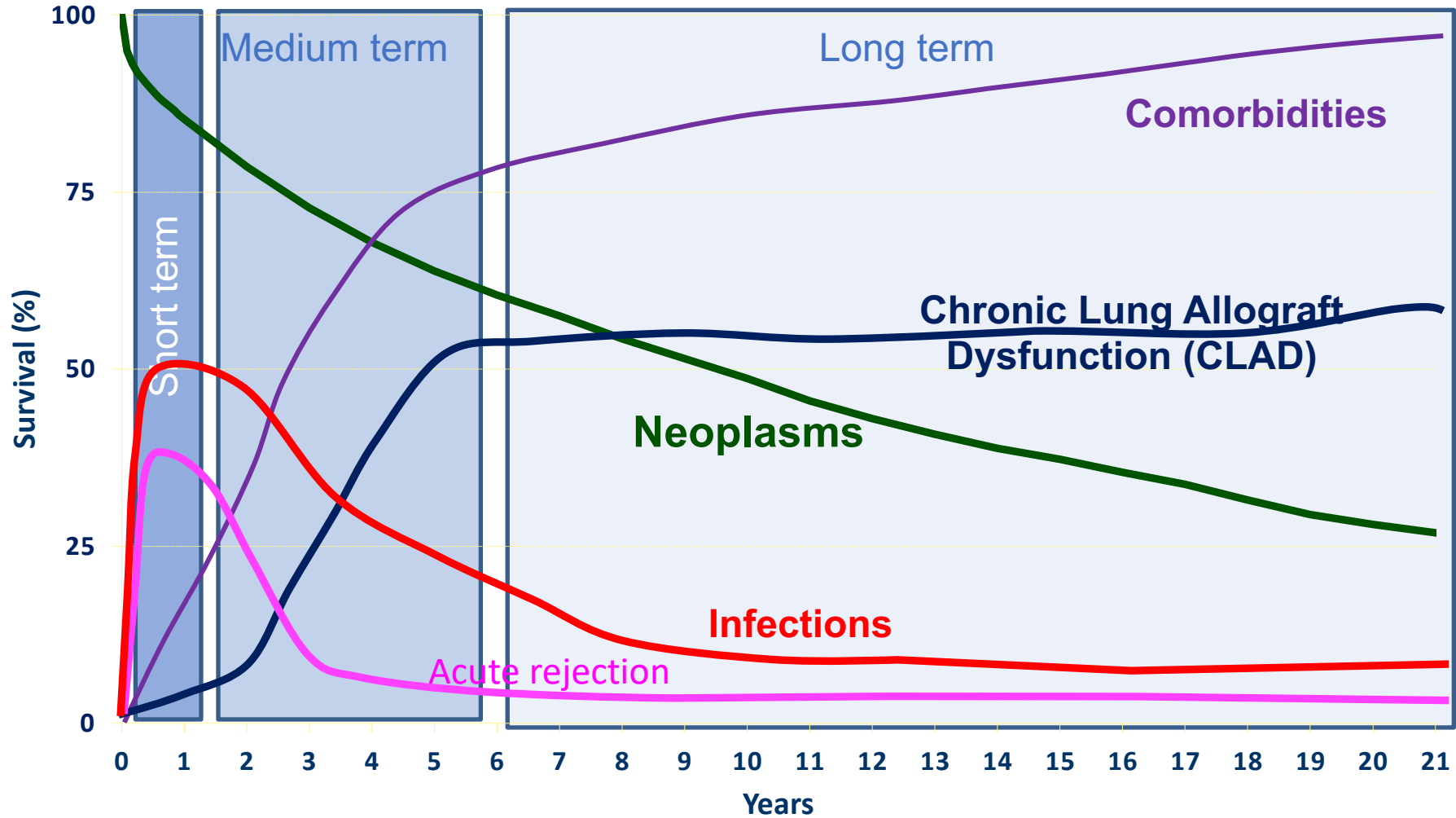


# LuTx (adulti) – come si vive dopo?





# LuTx - complicanze



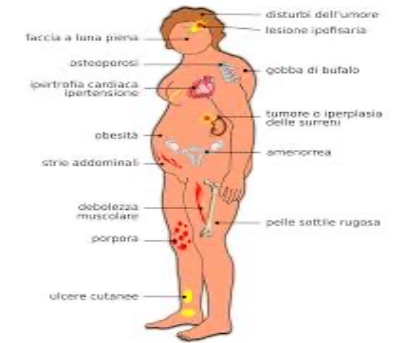


# Sorveglianza del paziente e del graft

- Visite di routine in ambulatorio, comprensive di esami del sangue, PFR, RX torace, EGA arterioso e 6MWT
- TC torace e TBB/FBS almeno una o due volte l'anno
- Screening per DSA de-novo (anticorpi specifici del donatore)
- Riferimento ad altri specialisti per la gestione delle comorbidità e delle complicanze extrarespiratorie

# Effetti collaterali delle terapie post LuTx

- Ipertensione arteriosa
- Obesità
- Dislipidemia
- Diabete
- Osteoporosi
- Cataratta
- Ritardata guarigione delle ferite
- Distimie
- **Nefrotossicità**
- **Epatotossicità**
- **Fototossicità**
- **Neurotossicità**
- **Mielotossicità**



Outcome	Within 1 Year	Within 5 Years	Within 10 Years
Hypertension	51.7%	80.7%	
Renal Dysfunction	22.5%	53.3%	71.9%
<i>Abnormal Creatinine ≤ 2.5 mg/dl</i>	15.7%	35.3%	41.4%
<i>Creatinine &gt; 2.5 mg/dl</i>	5.0%	14.3%	18.7%
<i>Chronic Dialysis</i>	1.7%	3.0%	7.3%
<i>Renal Transplant</i>	0.1%	0.8%	4.6%
Hyperlipidemia	26.2%	57.9%	
Diabetes	23.0%	39.5%	
Bronchiolitis Obliterans Syndrome	9.3%	41.1%	64.6%

# Terapia immunosoppressiva in FC

- Molto farmaci sono epatotossici → **epatopatia** preesistente FC relata
- Difficoltà a mantenere triplice tp IS nei pazienti con difficile controllo dello **stato infettivo** (germi multiR)
- Difficile controllo glicemico in paziente già affetti da **CF-RD**
- Difficoltà a mantenere TIS nel corretto range in caso di **malassorbimento**
- Leucopenia: AZA/MMF + Bactrim/valganciclovir
- FDR per PTLD

# Il rischio neoplastico post LuTx

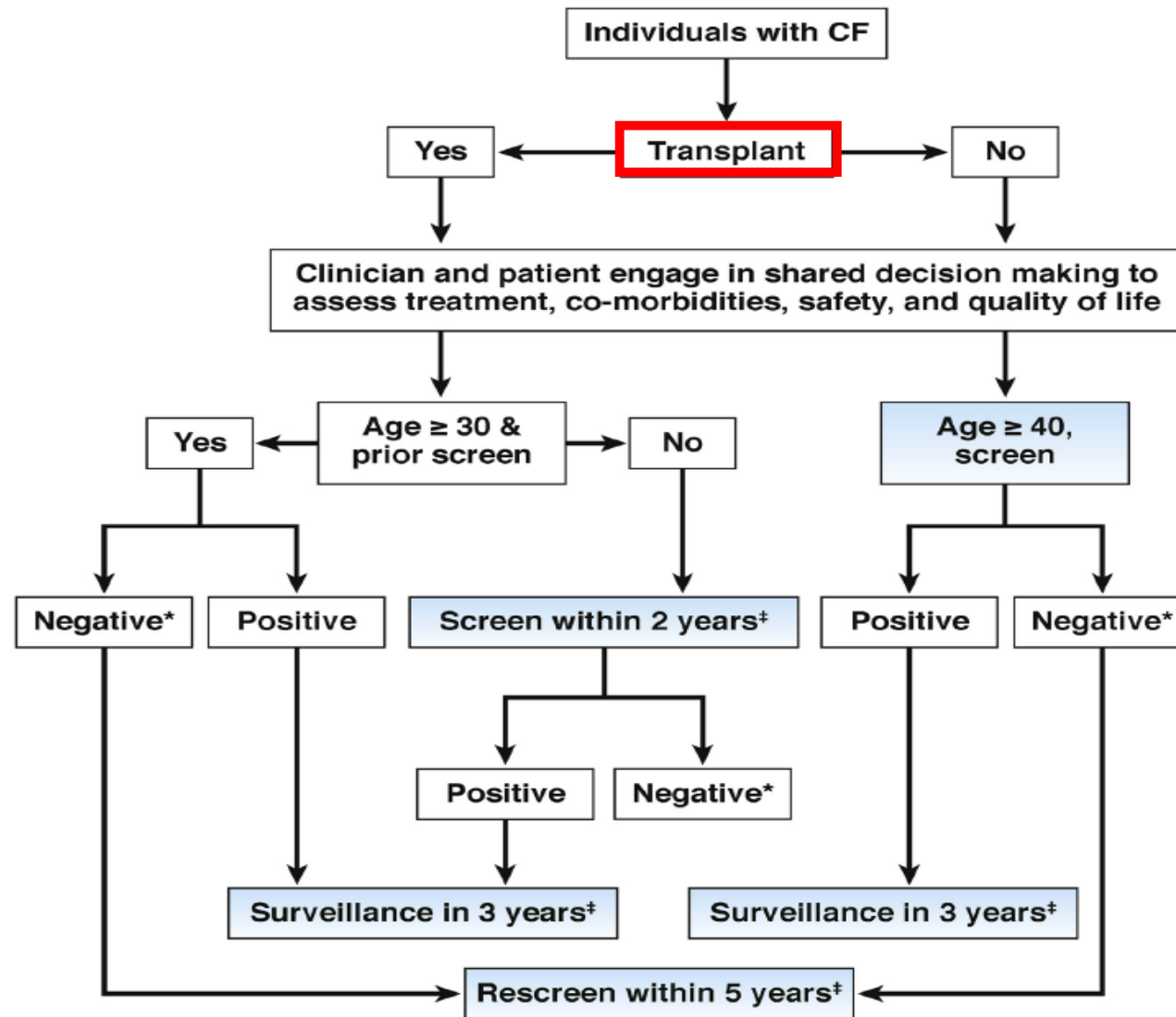
Cumulative Post Transplant Malignancy Rates in Survivors  
Transplants: July 2004 – June 2019

Malignancy/Type		1-Year Survivors	5-Year Survivors	10-Year Survivors
No Malignancy		23,654 (94.7%)	8,756 (80.4%)	2,297 (68.3%)
Malignancy (all types combined)		1,311 (5.3%)	2,134 (19.6%)	1,066 (31.7%)
Malignancy Type*	Skin	456	1508	809
	Lymphoma	250	163	76
	Other	575	583	286
	Type Not Reported	30	13	1

Other malignancies reported include: adenocarcinoma (2; 2; 1), bladder (2; 2; 1), lung (2; 2; 0), breast (1; 7; 3); prostate (0; 5; 2), cervical (1; 1; 0); and colon (0; 1; 0). Numbers in parentheses represent the number of reported cases within each time period.

\* Recipients may have experienced more than one type of malignancy; therefore, the sum of individual malignancy types may be greater than the total number with malignancy.

# Il rischio neoplastico post LuTx





# INFEZIONI

## – 4 possibili scenari ad alto rischio

- Infezioni del ricevente da parte di microorganismi acquisiti in comunità o in ospedale
- Colonizzazione delle vie aeree e/o di altri distretti (specialmente nei pazienti affetti da fibrosi cistica)
- Infezioni donor-derived
- Infezioni da germi opportunisti

Review Article

### Infections after lung transplantation

Mario Nosotti<sup>1</sup>, Paolo Tarsia<sup>2,3</sup>, Letizia Corinna Morlacchi<sup>2,3</sup>



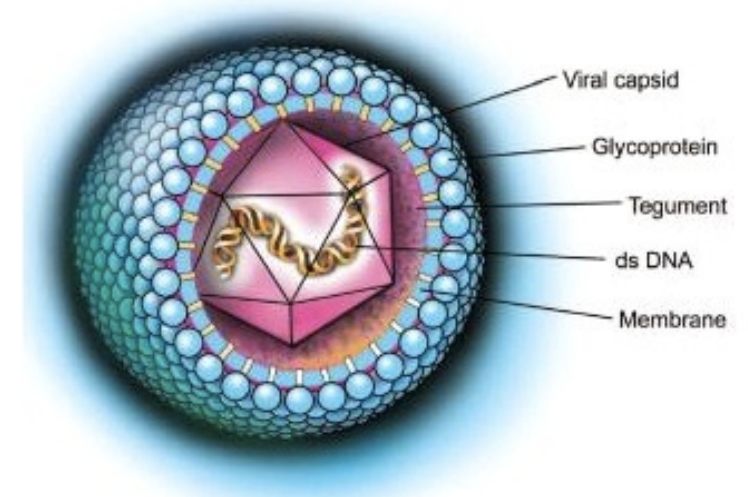
# Vaccinarsi è importante ... prima e dopo!



# Infezioni - CMV

Dopo il LuTx, l'infezione da CMV può verificarsi con differenti modalità:

- Trasmissione dal graft di un donore CMV sieropositivo
- Riattivazione di un'infezione latente in un ricevente CMV sieropositivo dall'epoca pre-Tx
- Contatto con un individuo infetto da CMV (infezione attiva >> contagio)
- Trasfusione di emocomponenti provenienti da un donatore di sangue CMV sieropositivo



HCMV Human Cytomegalovirus





# Infezioni - CMV

## Immunity to CMV during post-transplantation prophylaxis

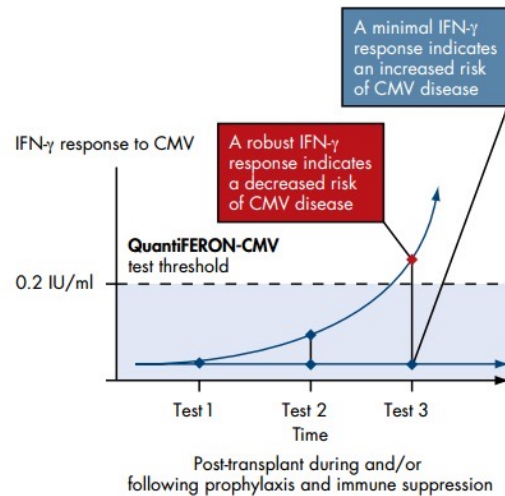


Figure 1. A theoretical model of QuantiFERON-CMV responses in a post-transplant setting during and/or following prophylaxis and immune suppression.

Review

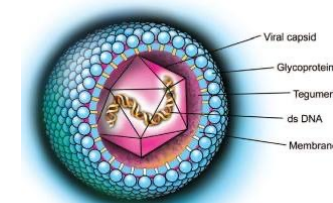
# Treatment and prevention of cytomegalovirus infection in heart and lung transplantation: an update

Luciano Potena , Paolo Solidoro, Filippo Patrucco & Laura Borgese

Pages 1611-1622 | Received 04 Mar 2016, Accepted 06 Jun 2016, Accepted author version posted online: 24 Jun 2016, Published online: 30 Jun 2016

 Download citation

 <https://doi.org/10.1080/14656566.2016.1199684>

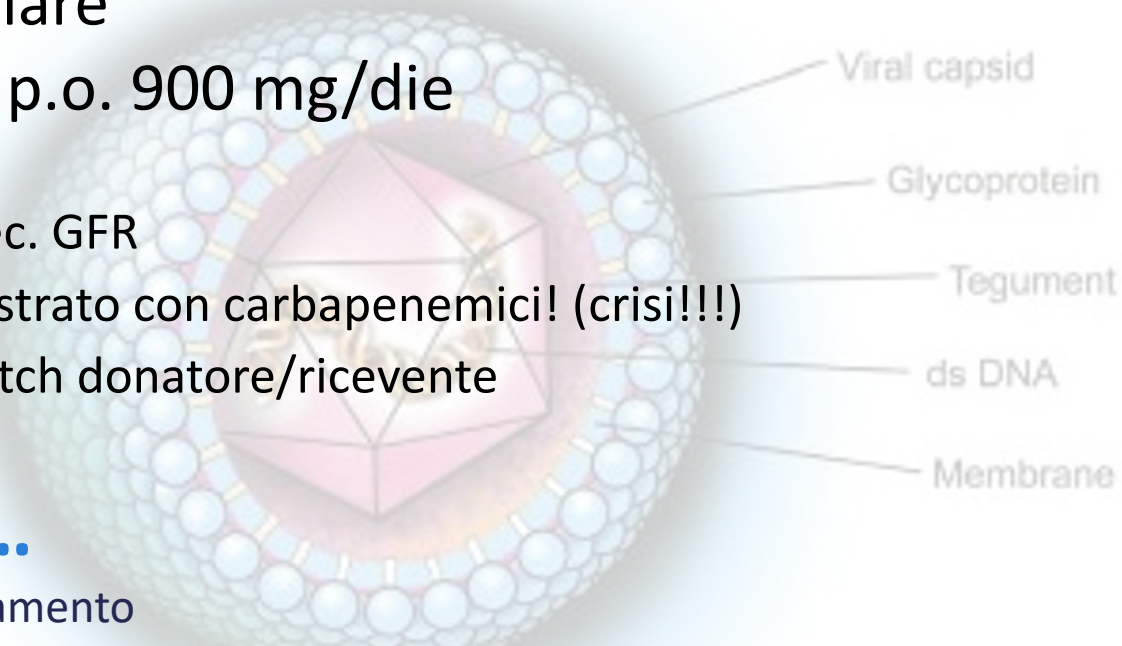


ement of

A; Transplantation

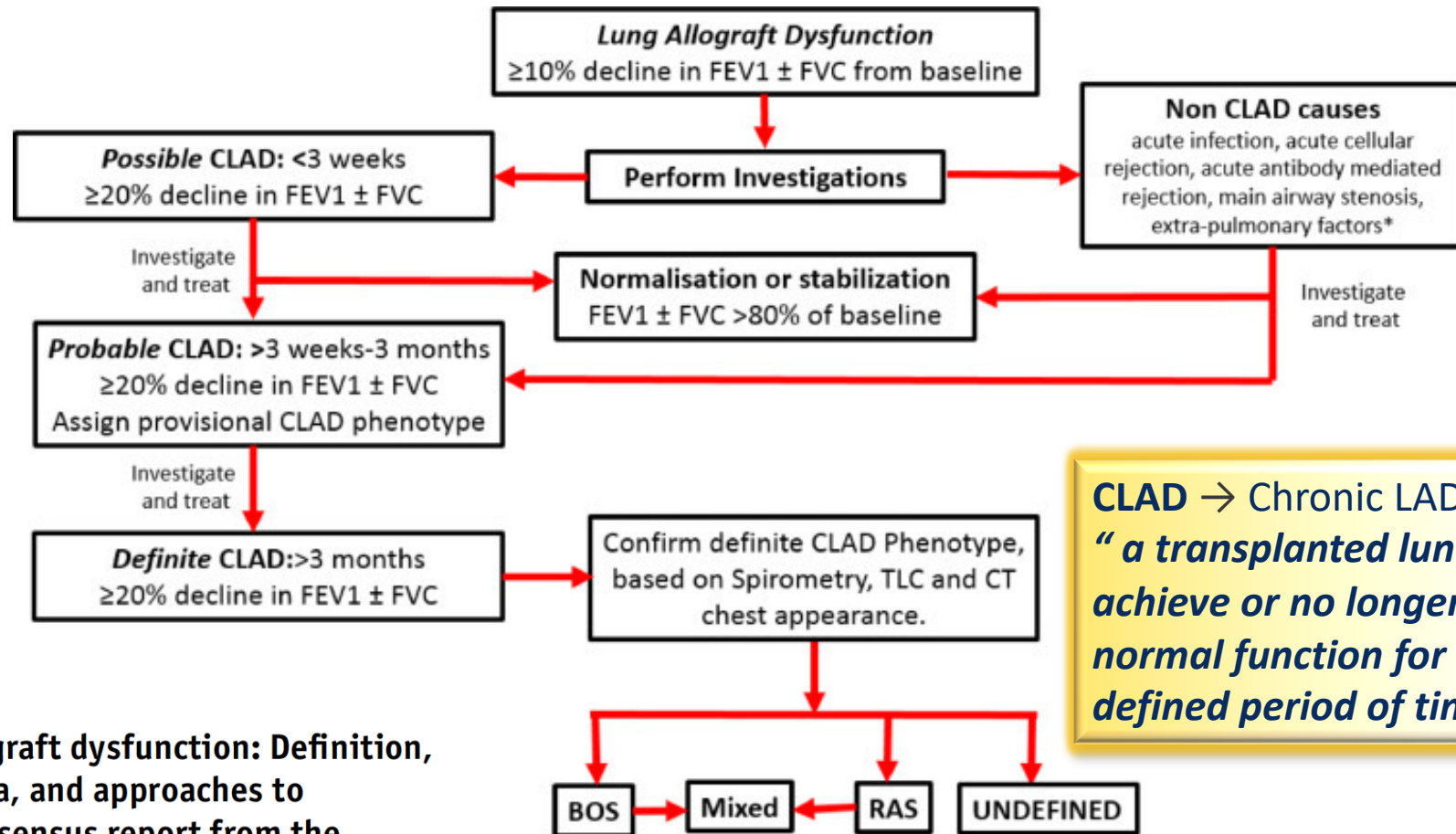
# Infezioni - CMV

- GANCICLOVIR e.v. 5 mg/kg ogni 12 ore; a seguire ogni 24 ore – impianto intraoculare
- VALGANCICLOVIR p.o. 900 mg/die
- Aggiustamento dose sec. GFR
- Attenzione se somministrato con carbapenemici! (crisi!!!)
- Durata secondo mismatch donatore/ricevente
- **ALTERNATIVE...**
  - Foscavir → per trattamento
  - Cidofovir → trattamento, estremamente tossico dal pdv renale
  - Letermovir ???
  - Vaccino antiCMV...
  - **Immunoglobuline antiCMV e.v.**



HCMV Human Cytomegalovirus

# CLAD – il nuovo nome del rigetto cronico



**CLAD** → Chronic LAD  
*“ a transplanted lung that does not achieve or no longer mantains normal function for an arbitrarily defined period of time”*

Chronic lung allograft dysfunction: Definition, diagnostic criteria, and approaches to treatment—A consensus report from the Pulmonary Council of the ISHLT



LIFC  
Lega Italiana  
Fibrosi Cistica

# L'arrivo dei modulatori CFTR

Prima. E anche dopo?



LIFC  
Lega Italiana  
Fibrosi Cistica



The line it is drawn  
The curse it is cast  
The slow one now  
Will later be fast  
As the present now  
Will later be past  
The order is  
Rapidly fadin'  
And the first one now  
Will later be last

For the times they are a-changin'.

# The times they are a-changing ...



REVIEW  
CYSTIC FIBROSIS



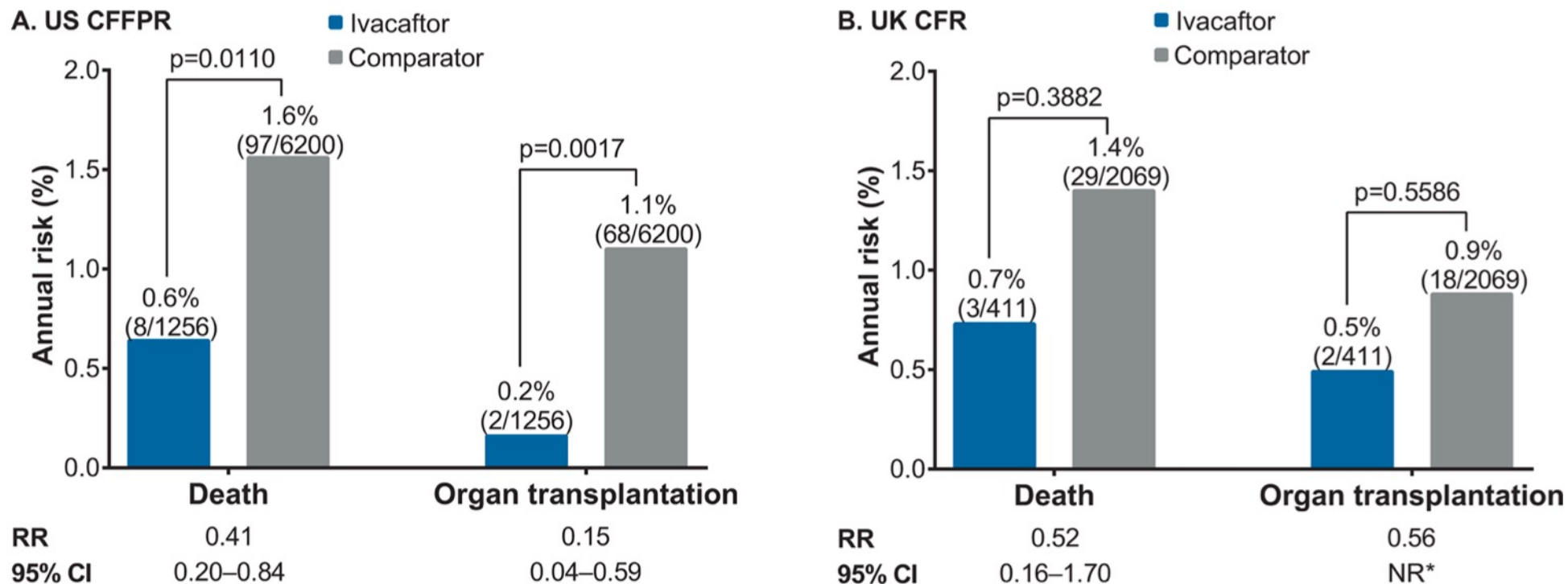
CrossMark

## Impact of CFTR modulator use on outcomes in people with severe cystic fibrosis lung disease

Michal Shteinberg <sup>1,2</sup> and Jennifer L. Taylor-Cousar<sup>3</sup>

The CFTR modulators IVA, LUM/IVA, TEZ/IVA and ELX/TEZ/IVA have a beneficial effect not only in individuals with mild to moderate CF, but also in individuals with advanced pulmonary disease, including candidates for lung transplantation. This beneficial impact was clearly demonstrated by randomised

# Ivacaftor & LuTx



**Figure 3** Death and organ transplantation, 2014 ivacaftor and comparator cohorts, (A) US CFFPR and (B) UK CFR. \*Fisher's exact p values are shown when the expected value is <5 in at least one cell of the contingency table. CFFPR, Cystic Fibrosis Foundation Patient Registry; CFR, Cystic Fibrosis Registry; NR, not reported; RR, relative risk.



LIFC  
Legg Italiana  
Fibrosi Cistica

# ELX/TEZ/IVA & LuTx

## American Journal of Respiratory and Critical Care Medicine



ATS Journals

### Rapid Improvement After Starting Elexacaftor-tezacaftor-ivacaftor in Patients with Cystic Fibrosis and Advanced Pulmonary Disease

Pierre-Régis Burgel ; Isabelle Durieu , Raphaël Chiron , Sophie Ramel , Isabelle Danner-Boucher , Anne Prevotat , Dominique Grenet , Christophe Marguet , Martine Reynaud-Gaubert , Julie Macey , Laurent Mely , Annlyse Fanton , Sébastien Quetant , Lydie Lemonnier , Jean-Louis Paillasseur , Jennifer Da Silva , Clémence Martin ; , French Cystic Fibrosis Reference Network study group... [Show less](#)

Burgel PR, et al. Blue J Feb 2021



# ELX/TEZ/IVA & LuTx

**Table 4. Numbers of lung transplantation in France by underlying disease comparing 2020 to 2018-2019.**

	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Variation 2020 vs 2018/2019</b>
<b>Cystic fibrosis</b>	72	80	33	-56.5 %
<b>Pulmonary hypertension</b>	29	22	24	-5.8 %
<b>Pulmonary fibrosis</b>	97	89	82	-11.8 %
<b>COPD</b>	127	136	90	-31.5 %
<b>Alpha 1 antitrypsin deficiency</b>	6	2	3	-25 %
<b>Other diseases</b>	27	36	33	+4.7%
<b>All indications</b>	358	365	265	-26.4%

**COPD: chronic obstructive pulmonary disease**

# Candidati al LuTx per FC



## Consensus document for the selection of lung transplant candidates: An update from the International Society for Heart and Lung Transplantation

The Journal of  
Heart and Lung  
Transplantation

<http://www.jhltonline.org>

Lorriana E. Leard, MD,<sup>a</sup> Are M. Holm, MD, PhD,<sup>b</sup> Maryam Valapour, MD, MPP,<sup>c</sup>

**Referral for lung transplantation should occur for an individual with CF meeting any of the following criteria despite optimal medical management including a trial of ELX/TEZ/IVA if eligible:**

- FEV1 < 30% pred (o < 40% in children)
- FEV1 < 40% pred (o < 50% in children) and any of the following:
  - 6MWT distance < 400 mt
  - pCO<sub>2</sub>>50mmHg
  - Hyooxemia
  - Pulmonary hypertension (PAPs > 50 mmHg on echocardiogram or evidence of right ventricular dysfunction)
  - Worsening nutritional status despite supplementation
  - 2 exacerbations per year requiring IV antibiotics
  - Massive hemoptysis (>240 mL) requiring bronchial artery embolization
  - Pneumothorax
- FEV1 < 50% pred + rapidly declining based on PFT or progressive symptoms
- Any exacerbation requiring positive pressure ventilation

# I candidati al LuTx stanno cambiando



*As a consequence, patients might only develop end-stage lung disease later in life, leading to a more elderly CF population being referred for lung transplantation. A change in referral demographics in patients with additional confounding factors, secondary to a different ageing-related profile, may have an adverse impact on transplantation outcomes.*

Rang C et al.; ERJ 2020; 55: 1902443



# L'ultima frontiera: modulatori post SOT?



ELSEVIER

Contents lists available at [ScienceDirect](#)

Journal of Cystic Fibrosis

journal homepage: [www.elsevier.com/locate/jcf](http://www.elsevier.com/locate/jcf)

Review

Challenges in the use of highly effective modulator treatment for cystic fibrosis

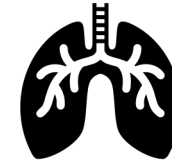
Kathleen J. Ramos<sup>a,\*</sup>, Joseph M. Pilewski<sup>b</sup>, Jennifer L. Taylor-Cousar<sup>c</sup>



OLT:

- PROs: improved respiratory conditions
- CONs: hepatotoxicity and therapeutic drug monitoring

Ramos KJ et al. JCF 2021



LUTX

- Possible role to improve:
  - Sinus disease
  - Malnutrition
  - GERD
  - Possible prevention of GIT malignancy and PTLD (CFTR protein has possible plays a tumour suppressor role)
- CONs: hepatotoxicity and therapeutic drug monitoring

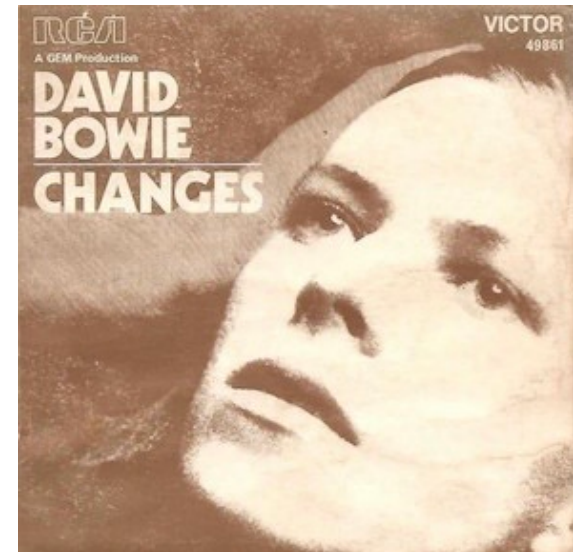
# La telemedicina

Un effetto collaterale della pandemia COVID19?

# L'impatto della pandemia sulla gestione dei pazienti

- Interruzione del regolare follow up c/o i Centri
- Annullamento o ritardo nell'esecuzione di procedure diagnostiche non essenziali
- Difficoltà nel raggiungere i centri di riferimento
- Impegno dei medici specializzati nelle unità dedicate al COVID19
- Paura dei pazienti nel frequentare gli ospedali

*Ch-ch-ch-ch-Changes  
(Turn and face the stranger)  
Ch-ch-Changes  
Just gonna have to be a different one*



# Nuove strategie per la cura e il follow up

**BJN** Journal Home | Current issue | Archive | Podcast | Events | Authors | Subscribe | More

British Journal of Nursing, VOL. 30, NO. 16 | Professional

## Providing post-lung transplant care during the time of COVID-19

Sara Winward, Iain Lawrie, Susan Talbot Towell, Nina Sheridan, Patricia Ging

Published Online: 11 Sep 2021 | <https://doi.org/10.12968/bjon.2021.30.16.976>


Tools | Share

**Abstract**

The COVID-19 pandemic is a public health emergency of international concern. Solid organ transplant recipients have been identified as being at high risk of acquiring the virus SARS-CoV-2 and having a more severe COVID-19 disease. This article describes the experience of the National Lung Transplant Centre in Ireland in changing established care pathways for lung transplant recipients during the pandemic. The innovations which were put in place to protect this clinically vulnerable group are discussed. With the advancement of technology and remote monitoring systems available, patient-focused strategies and community-based interventions were implemented. Additional strategies have been implemented so that the new model of care can be safely maintained.

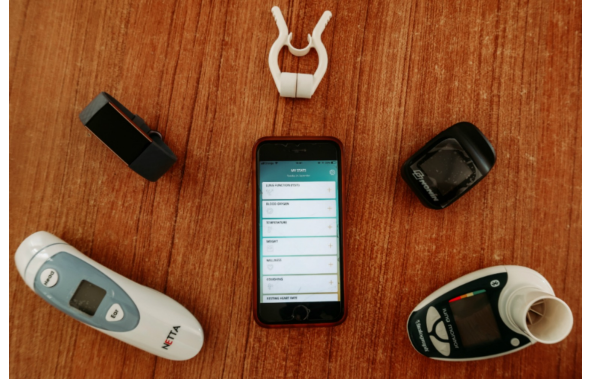
OUTLOOK · 29 JULY 2020

## The coronavirus pandemic has forced rapid changes in care protocols for cystic fibrosis



Jane Davies

Lockdowns have accelerated the drive towards telemedicine for people with cystic fibrosis – but the system needs critical appraisal.



**RESEARCH** **Open Access**

## Validation of the portable Bluetooth® Air Next spirometer in patients with different respiratory diseases

Konstantinos P. Exarchos\*, Athena Gogali, Agni Sioutkou, Christos Chronis, Sofia Peristeri and Konstantinos Kostikas



**RESEARCH ARTICLE** **Open Access**

## New strategies of physical activity assessment in cystic fibrosis: a pilot study

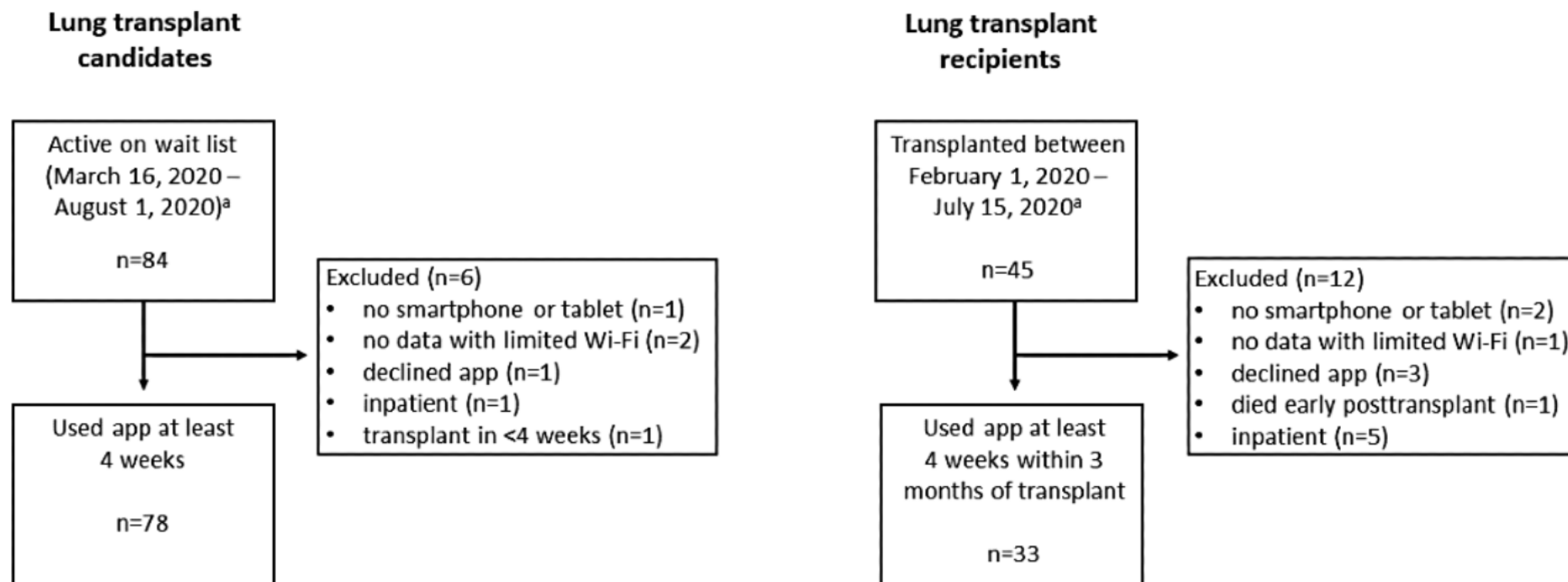
Daniela Savi<sup>1,2\*</sup>, Luigi Graziano<sup>1</sup>, Barbara Giordani<sup>3</sup>, Stefano Schiavetto<sup>1</sup>, Corrado De Vito<sup>1</sup>, Giuseppe Migliara<sup>1</sup>, Nicholas J. Simmonds<sup>2</sup>, Paolo Palange<sup>1</sup> and J. Stuart Elborn<sup>4</sup>



# Nuove strategie per la cura e il follow up

## Toronto & la teleriabilitazione

**Figure 1.** Flow and attrition of lung transplant candidates and recipients. <sup>a</sup>This time frame would permit at least 4 weeks of rehabilitation data to be entered into the app between March 16, 2020, and September 1, 2020, accounting for 2 weeks of hospitalization posttransplant.





# Nuove strategie per la cura e il follow up

## MHH & la telemedicina

**Table 1. Patient Assessment During Video Consultation**

PATIENT QUESTIONNAIRE	VITAL SIGNS
Quality of life (visual analog scale 0–10)	FEV1 home spirometry
General state of health: improved/stable/worsened	Respiratory rate
Coughing/sputum, yes/no, onset	Pulse, regular/irregular
Myalgia, malaise, yes/no, onset	Blood pressure
Runny or stuffy nose, yes/no, onset	Oxygen saturation
Sore throat, hoarseness, yes/no, onset	Body temperature
Fatigue, yes/no, onset	Body weight
Change in medication, yes/no, detail	
Physical fitness (flights of stairs without rest)	
Local laboratory report if available	
Current dose of calcineurin inhibitor	
Summary of medical history and vital signs gathered systematically during video consultation.	
FEV1, forced expiratory volume in one second.	

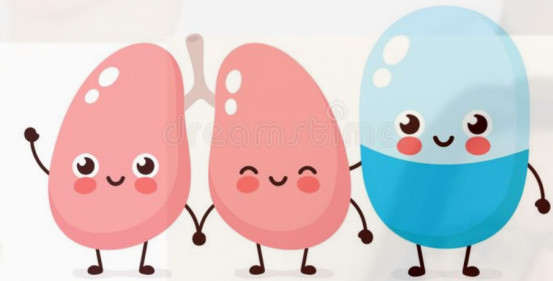
**Table 3. Summary of Video Consultations**

COMPLETED VCs (n = 75)	
Patient device, n (%)	
Laptop/computer	59 (79)
Tablet	3 (4)
Smartphone	13 (17)
Duration of contact, minutes	
Median (25, 75 quartile)	27 (19, 34)
Reason for consultation, n (%)	
Routine surveillance	24 (32)
Follow-up	27 (36)
Clinical indication	24 (32)
Availability of diagnostic parameters, n (%)	
Pulse oximetry	60 (80)
Respiratory rate	67 (89)
FEV1	66 (88)
Body temperature	57 (76)
Pulse	59 (79)
Patient diary	33 (44)
Outcome of consultation, n (%)	
Medication changed	27 (36)
Hospitalization	2 (3)
OSV	3 (4)
Visit local practitioner	14 (19)
No specific measures	28 (38)
Reported technical problems during consultation, n (%)	
e.g., poor sound and frozen picture	11 (15)
FEV1, forced expiratory one second capacity.	

*“Every accomplishment starts with a decision to try.” JFK*



Q&A



[letizia.morlacchi@unimi.it](mailto:letizia.morlacchi@unimi.it)  
[letizia.morlacchi@policlinico.mi.it](mailto:letizia.morlacchi@policlinico.mi.it)  
[trapiantipolmone@policlinico.mi.it](mailto:trapiantipolmone@policlinico.mi.it)

*#pneumilovechirurghi #pneumiloveSAR*