



# **ARDS Berlin Definition.2011. Is more usefully ?**

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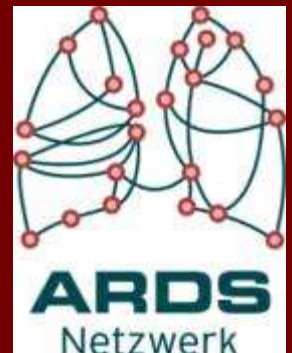


In 1994 Board consensus was achieved  
with publication of the American –  
European consensus conference(AECC)



# ***AECC DEFINITION***

	Timing	Oxygenation	Xr	PWP
ALI	Acute onset	PAO <sub>2</sub> /FIO <sub>2</sub> <300	Bilat infiltr	<18mm
ARDS	Acute onset	PAO <sub>2</sub> /FIO <sub>2</sub> <200	Bilat infiltr	<18mm



# Criticism of AECC definition

## *Chest Rx*

Inter observer reliability is only moderate even when applied by experts

Rubinfeld 1999, Meade 2000.



# Criticism of AECC definition

## *Hypoxia*

Pao<sub>2</sub> /Fio<sub>2</sub> ratio is not constant across a range of Fio<sub>2</sub> and may vary in response to ventilator setting , particularly PEEP.

Gowda 1997 ,Ferguson 2004, Villar 1994, Villar 2002

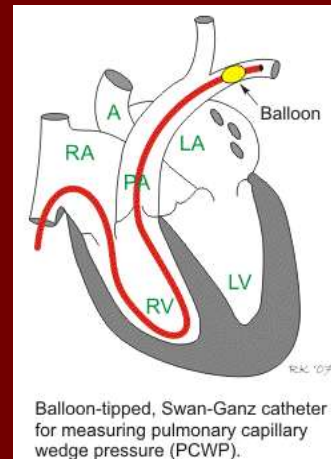


# Criticism of AECC definition

## *Wedge pressure*

Patients with ARDS may have an elevated PAWP ,often because of transmitted airway pressure and/or vigorous fluid resuscitation.

Ferguson 2002, ARDS NET 2006



# Criticism of AECC

When AECC criteria are compared with DAD sensitivity is 84% specificity is 51%

Esteban 2004 ,Ferguson 2005



# Criticism of AECC

*Perception of ALI as not severe as ARDS*

ARDS is under recognized by clinicians as defined using AECC criteria. This appears to be particularly true for ALI

Ferguson 2005, Kalhan 2006,  
Rubenfeld 2004



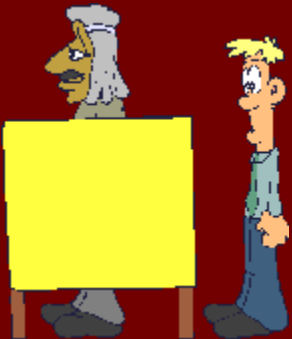


# Methods

ESICM convened an international panel of experts.

The objectives were to update ARDS definition using a synthetic analysis of:

- Current epidemiologic evidence
- Physiological concepts
- Results of clinical trials



# ARDS Task Force members

VM Ranieri, Gord D Rubenfeld, B Taylor Thomson ,L Brochard, L Gatinioni, A Esteban, J L Vincent,A Rhodes, A Slutski.



# Methods

**Variables that were included in the definition since were feasible**

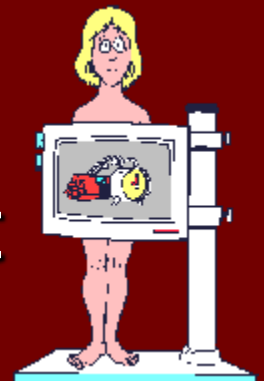
Timing

Hypoxemia

Origin of edema

Radiological abnormalities

Additional physiological derangement



# Reliability

It essential for reaserchers to identify the same of the patients across studies and for clinicians to apply therapies to the patients that benefit the most with the least risks definitions must be reliable as measured by inter observer agreement



# Validity

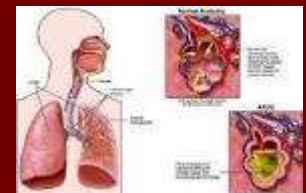


Is commonly evaluated as sensitivity and specificity in reference to gold standard.



# The conceptual model of ARDS

- ARDS is the type of acute lung injury associated with recognized risk factors characterized by inflammation leading to increased pulmonary vascular permeability and loss of aerated lung tissues.
- The hallmarks of clinical syndrome are hypoxemia and bilateral radiographic opacities on standard chest X-ray or CT scan.
- ARDS is associated with recognized risk factors characterized by inflammation.
- Physiological derangements includes: increased pulmonary venous admixture , increased physiological dead space, decreased pulmonary compliance
- Morphological hallmarks are: lung edema, inflammation ,hyaline membrane and alveolar hemorrhage.



# Common risk factors for ARDS

## *Direct*

Pneumonia

Aspiration of gastric contents

Inhalational injury

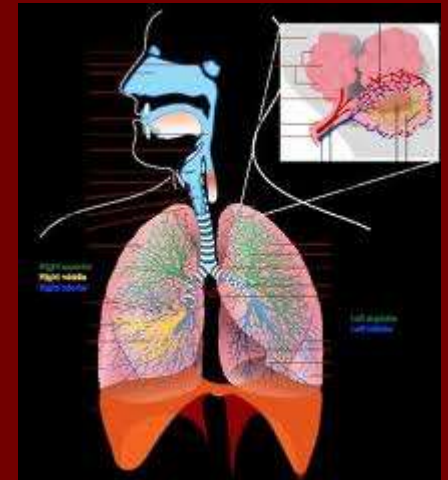
Near drowning



# Common risk factors for ARDS

## *Indirect*

- \* Non pulmonary sepsis
- \* Major trauma
- \* Multiple transfusions
- \* Severe burns
- \* Non cardiogenic shock
- \* Drug overdose
- \* Therapy directed at each underlying cause is high priority





# The ARDS Definition Task Force :The Draft Berlin Definition ,ESICM 24 th Annual Congress Berlin ,October 2011

## MILD

## MODERATE

## SEVERE

**TIMING**: Acute onset within one week of a known clinical insult of new or worsening respiratory symptoms.

## HYPOXEMIA

PAO<sub>2</sub>/FIO<sub>2</sub>  
201-300  
PEEP>5

PAO<sub>2</sub>/FIO<sub>2</sub>  
200-100  
PEEP>5

PAO<sub>2</sub>/FIO<sub>2</sub>  
<100  
PEEP>10

Respiratory failure not fully explained by **Cardiac failure** or fluid overload

## Rx Chest

BILATERAL OPACITIES

OPACITIES AT  
LEAST 3 QUAD

# Increased intensity of intervention

MILD

MODERATE

SEVERE

PAO<sub>2</sub>/FO<sub>2</sub> 300 250 200 150 100 75 60

PEEP Low Moderate Higher PEEP

Ventil. mode NIV Low tidal volume

HFO  
ECCO<sub>2</sub> –R  
INO  
Neuro musc. Block  
Prone  
ECMO



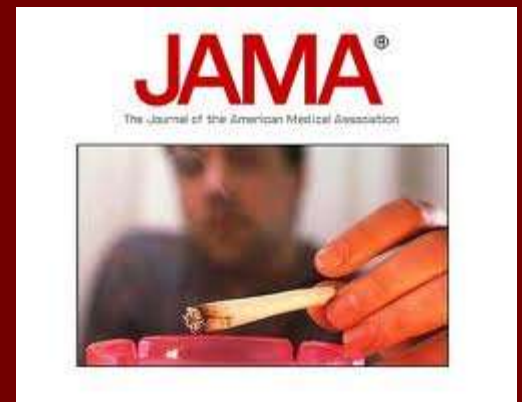
**A draft definition proposed 3 mutually exclusive categories of ARDS based on degree of hypoxemia:**

- ❑ **mild ( $200 \text{ mm} < \text{HgPaO}_2/\text{FIO}_2 < 300 \text{ mmHg}$ ),**
- ❑ **moderate ( $100 \text{ mmHg} < \text{PaO}_2/\text{FIO}_2 < 200 \text{ mmHg}$ ),**
- ❑ **severe ( $\text{PaO}_2/\text{FIO}_2 < 100 \text{ mmHg}$ )**
- ❑ **4 ancillary variables for severe ARDS:**  
**radiographic severity,**  
**respiratory system compliance ( $40 \text{ mL/cm H}_2\text{O}$ ),**  
**positive end expiratory pressure ( $>10 \text{ cm H}_2\text{O}$ ),**  
**corrected expired volume per minute ( $10 \text{ L/min}$  ).**



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**The draft Berlin Definition was empirically evaluated using patient level meta-analysis of 4188 patients with ARDS from 4 multicenter clinical data sets and 269 patients with ARDS from 3 single-center data sets containing physiologic information.**



JAMA, 2012

**The 4 ancillary variables did not contribute to the predictive validity of severe ARDS for mortality and were removed from the definition**



# JAMA ,2012

## Table 1 ARDS Definitive New Definition

**Table 3.** The Berlin Definition of Acute Respiratory Distress Syndrome

Acute Respiratory Distress Syndrome	
Timing	Within 1 week of a known clinical insult or new or worsening respiratory symptoms
Chest imaging <sup>a</sup>	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
Origin of edema	Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factor present
Oxygenation <sup>b</sup>	
Mild	$200 \text{ mm Hg} < \text{PaO}_2/\text{FiO}_2 \leq 300 \text{ mm Hg}$ with PEEP or CPAP $\geq 5 \text{ cm H}_2\text{O}$ <sup>c</sup>
Moderate	$100 \text{ mm Hg} < \text{PaO}_2/\text{FiO}_2 \leq 200 \text{ mm Hg}$ with PEEP $\geq 5 \text{ cm H}_2\text{O}$
Severe	$\text{PaO}_2/\text{FiO}_2 \leq 100 \text{ mm Hg}$ with PEEP $\geq 5 \text{ cm H}_2\text{O}$

Abbreviations: CPAP, continuous positive airway pressure;  $\text{FiO}_2$ , fraction of inspired oxygen;  $\text{PaO}_2$ , partial pressure of arterial oxygen; PEEP, positive end-expiratory pressure.

<sup>a</sup>Chest radiograph or computed tomography scan.

<sup>b</sup>If altitude is higher than 1000 m, the correction factor should be calculated as follows:  $[\text{PaO}_2/\text{FiO}_2 \times (\text{barometric pressure}/760)]$ .

<sup>c</sup>This may be delivered noninvasively in the mild acute respiratory distress syndrome group.

# JAMA 2012

**Table 5.** Predictive Validity of ARDS Definitions in the Physiologic Database

	Modified AECC Definition <sup>a</sup>		Berlin Definition ARDS <sup>a</sup>		
	ALI Non-ARDS	ARDS	Mild	Moderate	Severe
No. (%) [95% CI] of patients	66 (25) [19-30]	203 (75) [70-80]	66 (25) [20-30]	161 (59) [54-66]	42 (16) [11-21]
Mortality, No. (%) [95% CI] <sup>b</sup>	13 (20) [11-31]	84 (43) [36-50]	13 (20) [11-31]	62 (41) [33-49]	22 (52) [36-68]
Ventilator-free days					
Median (IQR)	8.5 (0-23.5)	0 (0-16.0)	8.5 (0-23.5)	0 (0-16.5)	0 (0-6.5)
Missing, No.	10	26	10	25	1
Duration of mechanical ventilation in survivors, median (IQR), d	6.0 (3.3-20.8)	13.0 (5.0-25.5)	6.0 (3.3-20.8)	12.0 (5.0-19.3)	19.0 (9.0-48.0)
Lung weight, mg <sup>c</sup>					
Mean (SD)	1371 (360.4)	1602 (508.1)	1371 (360.4)	1556 (469.7)	1828 (630.2)
Missing, No.	16	48	16	32	16
Shunt, mean (SD), % <sup>c,d</sup>	21 (21)	32 (13)	21 (12)	29 (11)	40 (16)

Abbreviations: AECC, American-European Consensus Conference; ALI, acute lung injury; ARDS, acute respiratory distress syndrome;  $\text{FiO}_2$ , fraction of inspired oxygen; IQR, interquartile range;  $\text{PaO}_2$ , arterial partial pressure of oxygen; PEEP, positive end-expiratory pressure.

<sup>a</sup>The definitions are the following for ALI non-ARDS ( $200 \text{ mm Hg} < \text{PaO}_2/\text{FiO}_2 \leq 300 \text{ mm Hg}$ , regardless of PEEP), ARDS ( $\text{PaO}_2/\text{FiO}_2 \leq 200 \text{ mm Hg}$ , regardless of PEEP), mild Berlin Definition ( $200 \text{ mm Hg} < \text{PaO}_2/\text{FiO}_2 \leq 300 \text{ mm Hg}$  with  $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$ ), moderate Berlin Definition ( $100 \text{ mm Hg} < \text{PaO}_2/\text{FiO}_2 \leq 200 \text{ mm Hg}$  with  $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$ ), and severe Berlin Definition ( $\text{PaO}_2/\text{FiO}_2 \leq 100 \text{ mm Hg}$  with  $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$ ).

<sup>b</sup>Eight patients are missing in the moderate Berlin Definition ARDS group.  $P = .001$  for difference in mortality across Berlin stages of ARDS.

<sup>c</sup>Comparisons of lung weight and shunt across categories of modified AECC (ALI non-ARDS and ARDS) and across categories of Berlin Definition (mild, moderate, and severe) are statistically significant ( $P < .001$ ).

<sup>d</sup>Only available at 1 site.



# Conclusion



Compared with the AECC definition, the final Berlin Definition had better predictive validity for mortality, with an area under the receiver operating curve of 0.577 (95% CI, 0.561-0.593) vs 0.536 (95% CI, 0.520-0.553;  $P < 0.001$ ).





THANK-YOU FOR LISTENING

and watching

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**APPLAUSE!**

