# IL PETALO FILM – THOR

FACTORS INFLUENCING LIBERATION FROM MECHANICAL VENTILATION IN THORACIC TRAUMA PATIENTS

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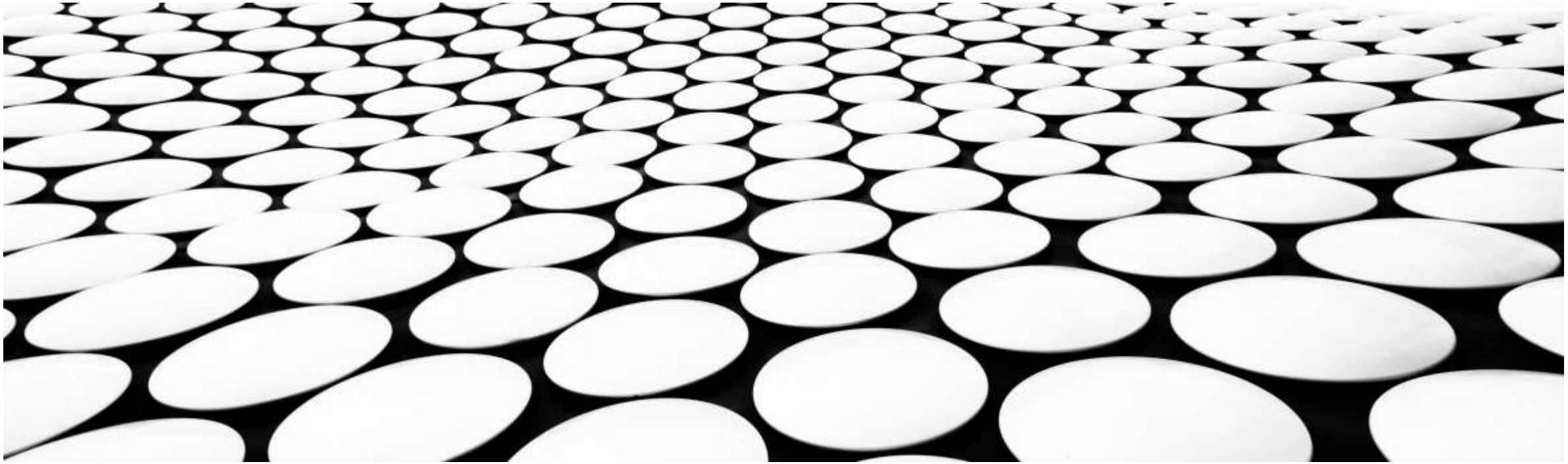


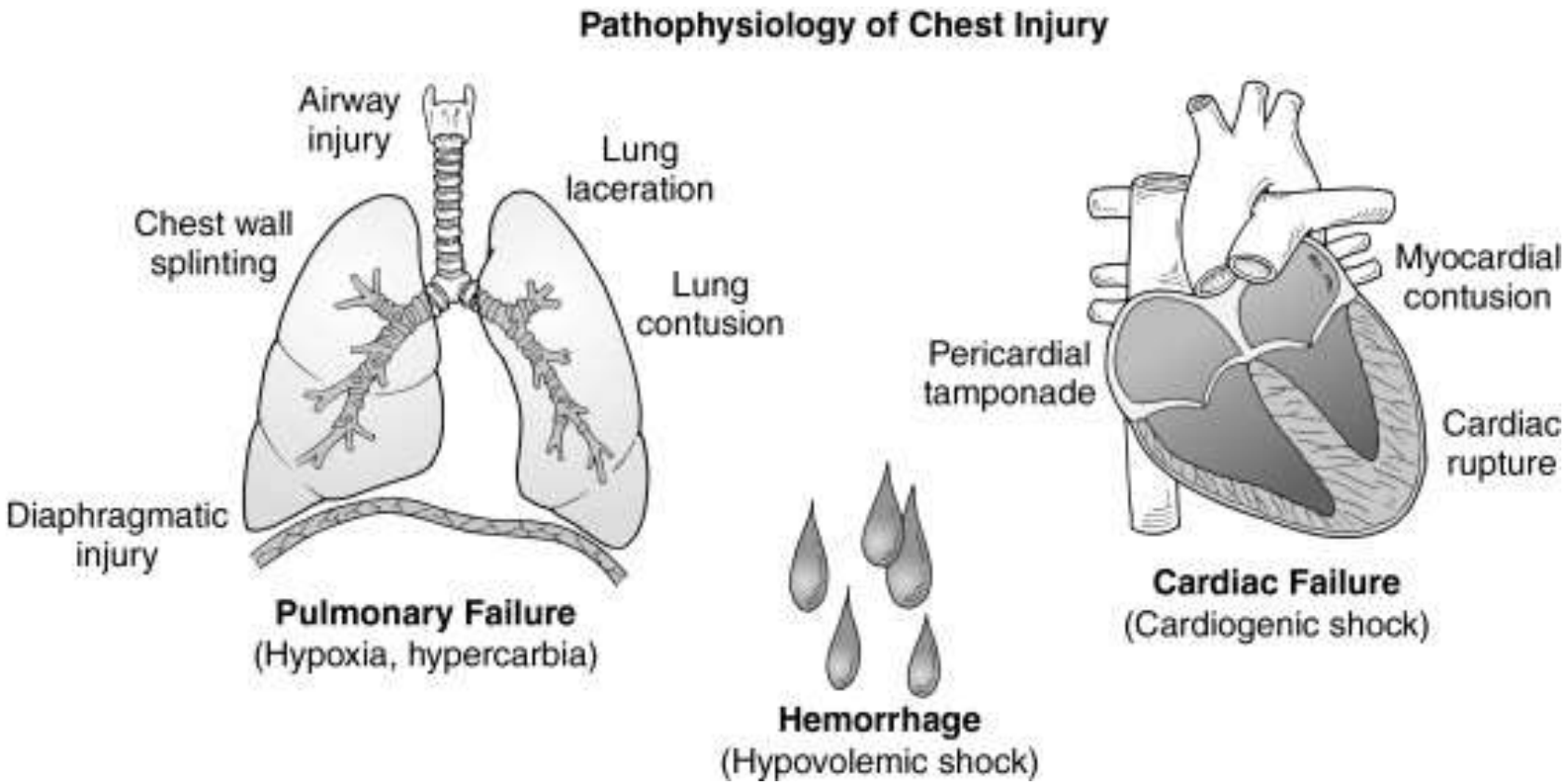
# MAIN POINTS

- Background e razionale
- Research questions
- Variabili raccolte
- Risultati preliminari

# BACKGROUND

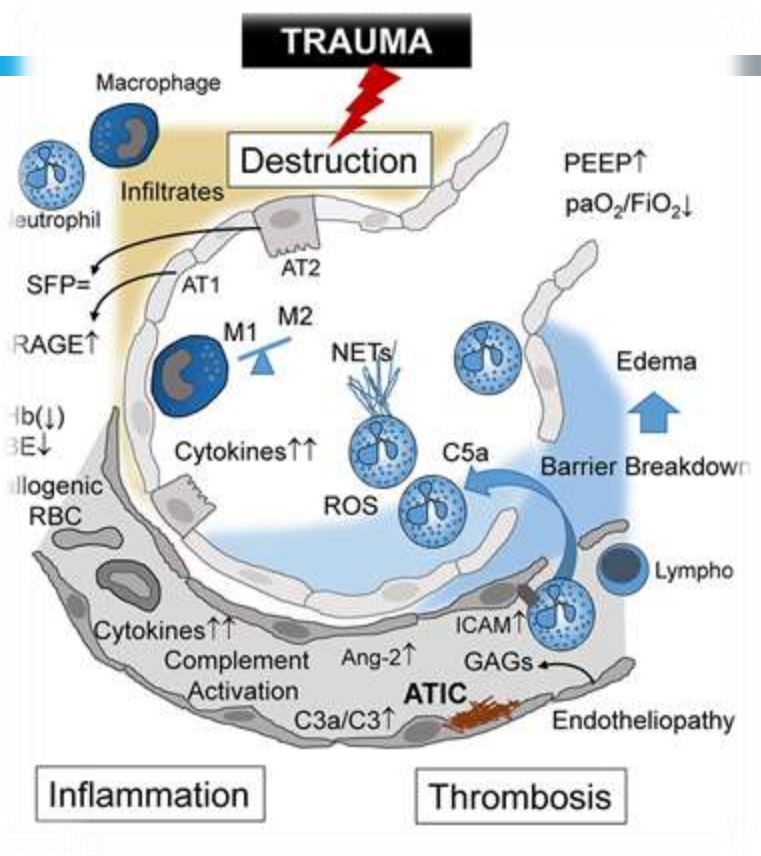
- Trauma toracico causa fino al 25% della mortalità per trauma
- Causa di ammissione in TI di fino a 1/3 dei pazienti ammessi per trauma
- ARDS complica traumi toracici nel 10-25%dei casi
- Polmonite – incidenza polmonite 25-30%

# TRAUMA TORACICO – LE COMPONENTI



# FISIOPATOLOGIA IN BREVE

- Meccanismi infiammatori locali e sistemici
- Dolore
- Modifiche nella meccanica toracica (flail chest)
- Trasfusioni



# PROBLEMI APERTI T-ARDS

Table 2. Organizational and Patient Factors Associated With Clinician Recognition of ARDS in Invasively Ventilated Patients

| | ARDS Recognized, No./Total No. (%) | Absolute Difference (95% CI) | Bivariate OR (95% CI) | P Value[a] | Multivariable OR (95% CI) | P Value[b] |
|---|---|---|---|---|---|---|
| No. of patients/staff physician, for each additional patient | | −1.20 (−0.74 to −1.66)[c] | 0.960 (0.945 to 0.976) | <.001 | 0.959 (0.942 to 0.977) | <.001 |
| No. of patients/nurse, for each additional patient | | −0.34 (−0.55 to −0.13)[c] | 0.911 (0.860 to 0.957) | <.001 | 0.920 (0.870 to 0.968) | .002 |
| Age, per year | | −4.03 (−5.43 to −2.65)[c] | 0.985 (0.980 to 0.990) | <.001 | 0.987 (0.980 to 0.993) | <.001 |
| Predicted body weight per kg | | −1.27 (−2.18 to −0.36)[c] | 0.989 (0.980 to 0.997) | .006 | 0.984 (0.974 to 0.993) | <.001 |
| Nonpulmonary SOFA per point | | 0.81 (0.48 to 1.12)[c] | 1.054 (1.031 to 1.077) | <.001 | 1.057 (1.030 to 1.085) | <.001 |
| $Pa_{O_2}$:$Fi_{O_2}$ ratio, per mm Hg | | −30.0 (−35.5 to −24.4)[c] | 0.993 (0.992 to 0.995) | <.001 | 0.993 (0.992 to 0.995) | <.001 |
| Medical or surgical Admission with trauma | | | | | | |
| No | 1477/2274 (65.0) | | 1 [Reference] | | 1 [Reference] | |
| Yes | 48/103 (46.6) | −18.4 (−28.7 to −8.0) | 0.471 (0.316 to 0.700) | <0.001 | 0.539 (0.334 to 0.868) | .011 |
| Neoplastic or immune or hematologic disease | | | | | | |
| No | 1173/1892 (62.0) | | 1 [Reference] | | 1 [Reference] | |
| Yes | 352/485 (72.6) | 10.6 (6.0 to 15.1) | 1.623 (1.305 to 2.027) | <.001 | 1.396 (1.079 to 1.816) | .012 |
| Pneumonia | | | | | | |
| No | 440/1002 (43.9) | | 1 [Reference] | | 1 [Reference] | |
| Yes | 963/1375 (70.0) | 26.1 (22.2 to 30.0) | 1.830 (1.544 to 2.170) | <.001 | 1.339 (1.073 to 1.670) | .01 |
| Pancreatitis | | | | | | |
| No | 844/2328 (36.3) | | 1 [Reference] | | 1 [Reference] | |
| Yes | 41/49 (83.7) | 47.4 (36.9 to 58.0) | 2.915 (1.436 to 6.733) | .006 | 3.506 (1.439 to 10.543) | .01 |
| ARDS risk factors | | | | | | |
| Yes | 1454/2187 (66.5) | | 1 [Reference] | | 1 [Reference] | |
| No | 71/190 (37.4) | −29.1 (−36.3 to −22.0) | 0.301 (0.220 to 0.408) | <.001 | 0.408 (0.280 to 0.591) | <.001 |
| With heart failure | | | | | | |
| No | 1347/2027 (66.5) | | 1 [Reference] | | 1 [Reference] | |
| Yes | 178/350 (50.9) | −15.6 (−21.2 to −10.0) | 0.522 (0.415 to 0.657) | <.001 | 0.496 (0.377 to 0.652) | <.001 |

Abbreviations. ARDS, acute respiratory distress syndrome; $Pa_{O_2}$/Fio2; partial pressure of oxygen to fraction of inspired oxygen; SOFA, Sequential Organ Failure Assessment.

[a] Bivariate analysis.

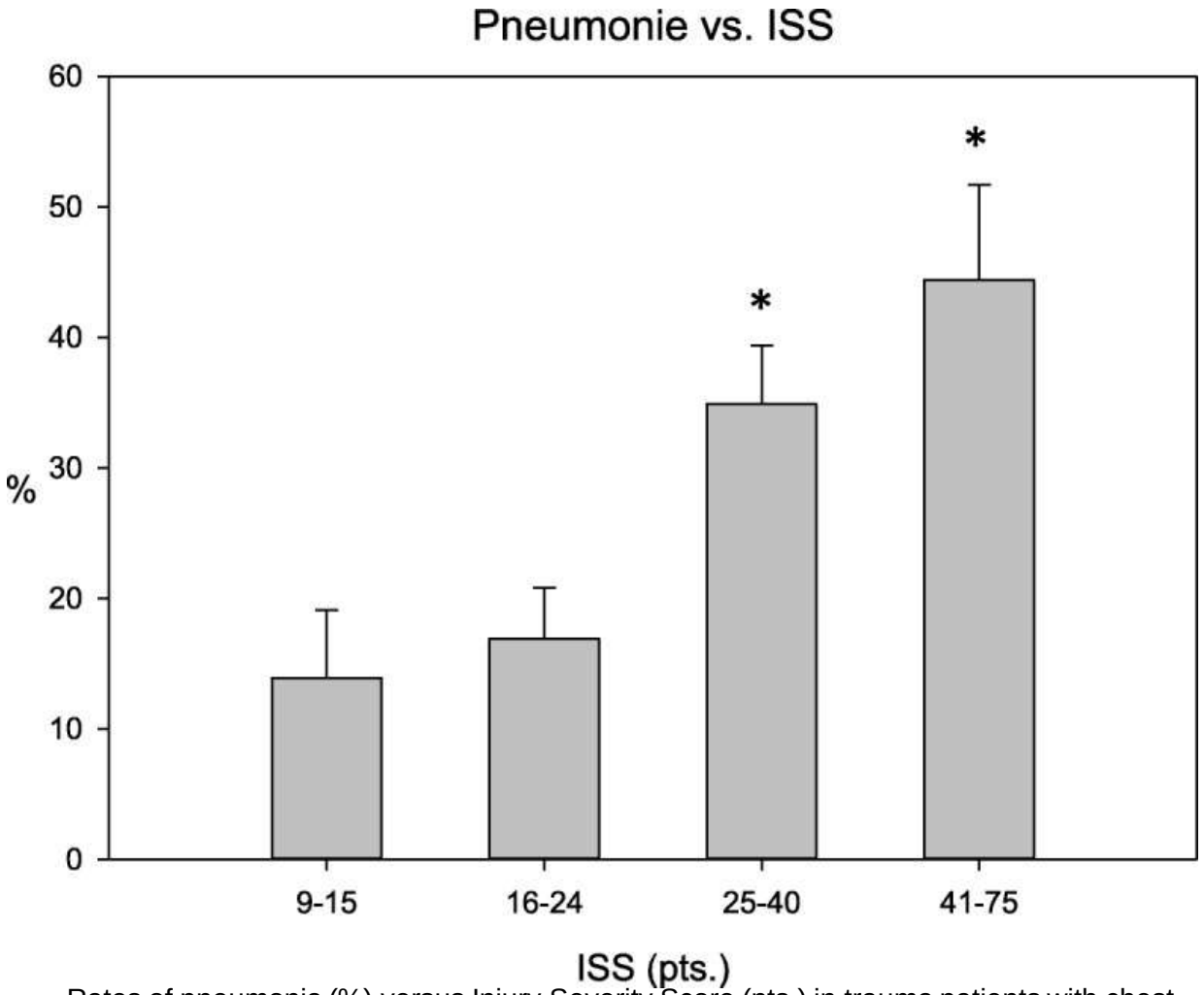
[b] All variables included in the multivariable analysis are reported in this Table.

[c] These values are the mean difference (95% CI).

Bellani G, Laffey JG, Pham T, et al. Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries. *JAMA.* 2016;315(8):788–800. doi:10.1001/jama.2016.0291

# LIMITATO NUMERO DI STUDI

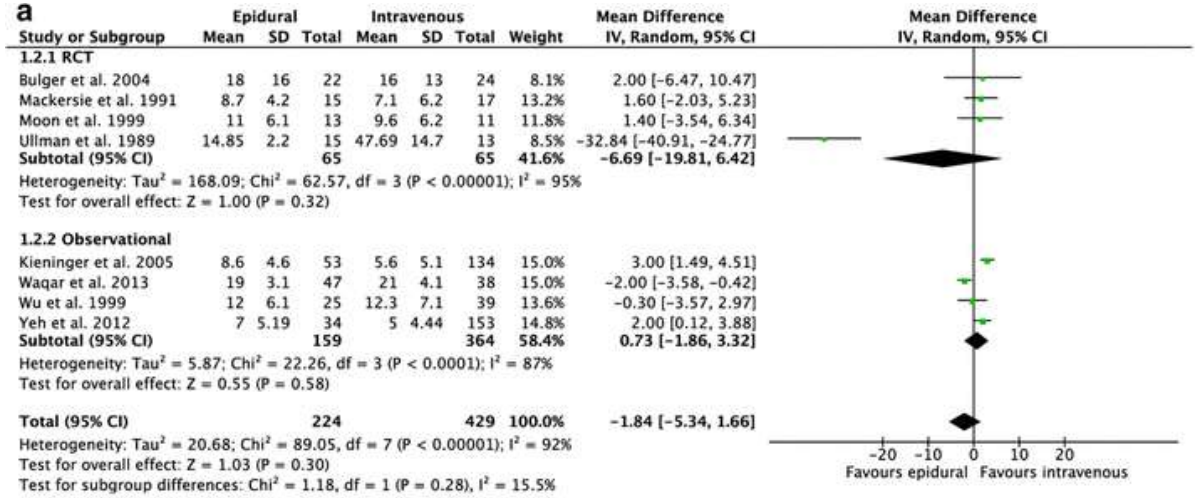
- definizione di Berlino

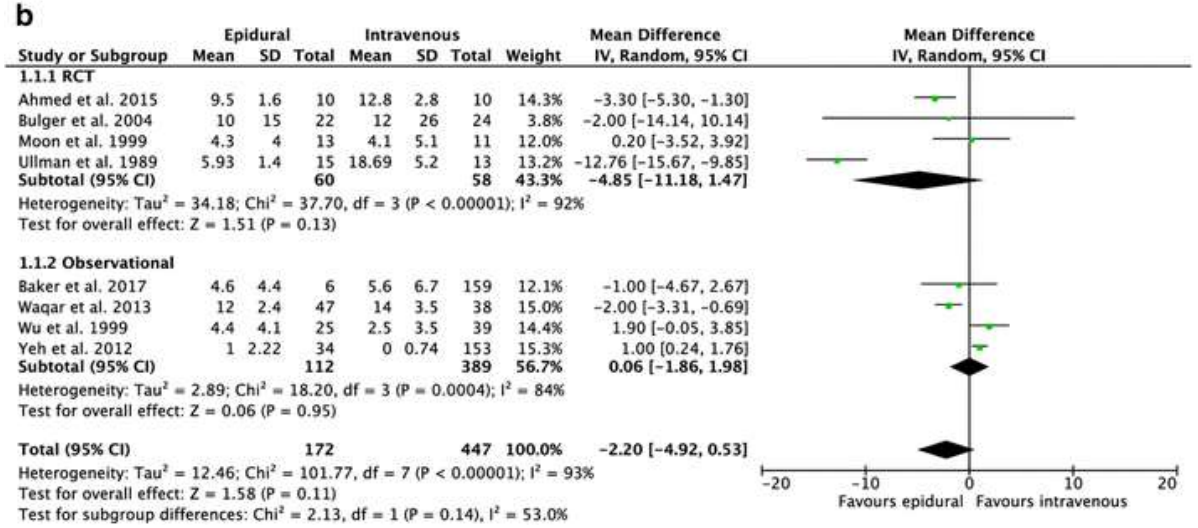


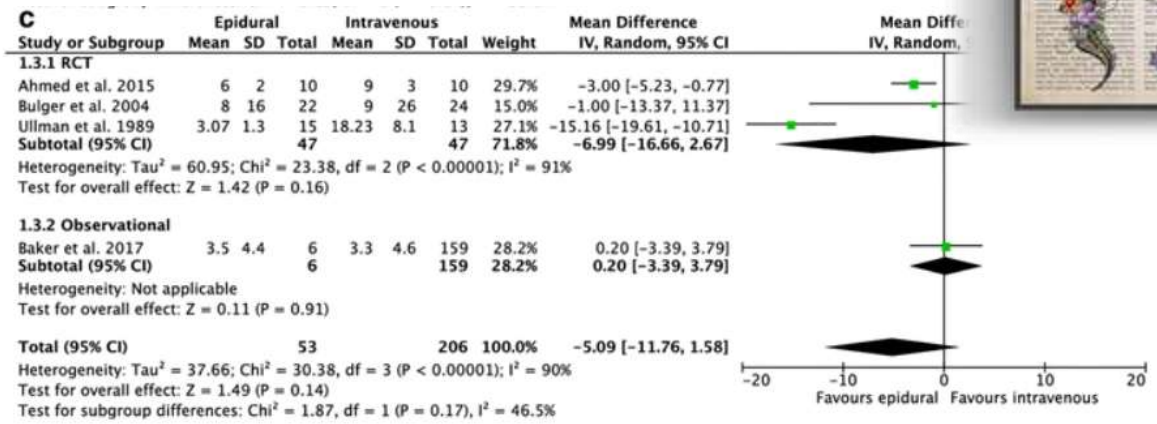

Rates of pneumonia (%) versus Injury Severity Score (pts.) in trauma patients with chest injury (AISThorax 3), 95% CI are shown, p overall < 0.001; * = significant increase to left datapoint.

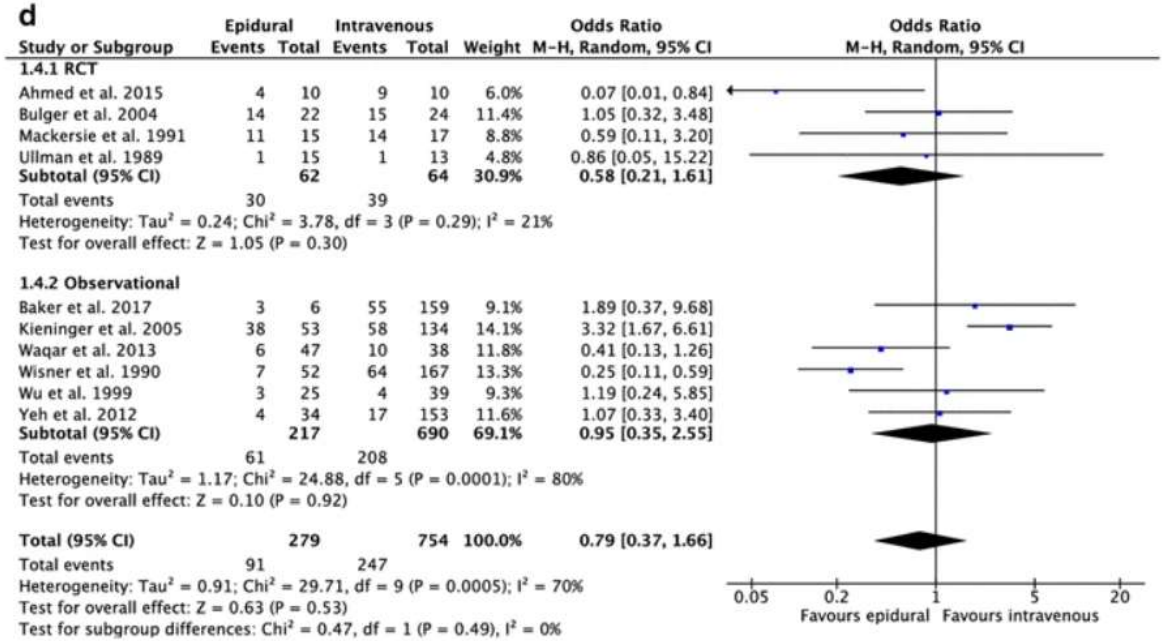
From Wutzler S et al. Pneumonia in severely injured patients with thoracic trauma: results of a retrospective observational multi-centre study. Scand J Trauma Resusc Emerg Med. 2019 Mar 14;27(1):31. doi: 10.1186/s13049-019-0608-4. PMID: 30871601; PMCID: PMC6419484.

# ANALGESIA




Forest plot of the length of **a** hospital stay **b** intensive care unit stay **c** mechanical ventilation (epidural vs intravenous). **d** forest plot of the pulmonary complications (epidural vs intravenous)

# GESTIONE EMODINAMICA

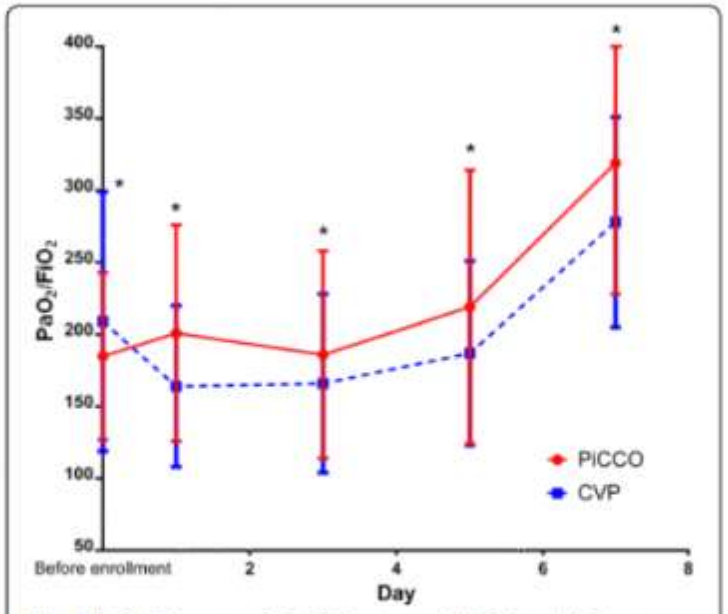



**Fig. 2** $PaO_2/FiO_2$ curve. $PaO_2/FiO_2$ values of PiCCO and CVP groups were collected from before enrollment to day 7. * $PaO_2/FiO_2$ ratio increased over time in both groups, with a sharper increase in the PiCCO group (Repeated measures ANOVA-analysis $P = 0.002$)

**Table 2 Comparison of outcomes between the PiCCO and CVP groups**

| Outcome variables | PiCCO group ($n = 126$) | CVP group ($n = 138$) | $P$ |
|---|---|---|---|
| $PaO_2/FiO_2$ | | | |
| Before enrollment | 185 ± 58 | 209 ± 90 | 0.038* |
| 1 day after enrollment | 201 ± 75 | 164 ± 56 | 0.022* |
| 3 day after enrollment | 186 ± 72 | 166 ± 62 | 0.047* |
| 5 day after enrollment | 219 ± 95 | 187 ± 64 | 0.037* |
| 7 day after enrollment | 319 ± 91 | 278 ± 73 | 0.042* |
| Days on MV, days, median (IQR) | 3 (1–6) | 5 (2–9) | 0.002 |
| Length of stay in EICU, days, median (IQR) | 6 (4–8) | 11 (6–16) | 0.004 |
| EICU cost for monitoring and treatment (RMB: yuan) | 8.23 ± 3.25 | 12.87 ± 4.61 | <0.001 |
| 28-day mortality, $n$ (%) | 4 (3.2) | 5 (3.6) | 0.841 |

* Post hoc $p$ value in repeated measure of ANOVA

*MV* mechanical ventilation, *EICU* emergency intensive care unit, *IQR* interquartile range

Yuanbo, Z., Jin, W., Fei, S. et al. ICU management based on PiCCO parameters reduces duration of mechanical ventilation and ICU length of stay in patients with severe thoracic trauma and acute respiratory distress syndrome. Ann. Intensive Care 6, 113 (2016). https://doi.org/10.1186/s13613-016-0217-6

# PETALO FILM-THOR

- OBIETTIVI
  - Epidemiologici
    - Definizione dell'incidenza e dei fattori di rischio per ARDS con definizione di Berlino in una coorte di pazienti affetti da trauma toracico severo (T-AIS ≥ 3) e ricoverati in TI
    - Valutazione dell'incidenza e dei fattori di rischio per infezioni polmonari in pazienti affetti da Trauma toracico severo
    - Valutazione dei fattori di rischio per mortalità in pazienti affetti da trauma toracico severo
    - Valutazione dei fattori che influenzano la durata della ventilazione meccanica
  - Terapeutici
    - Descrizione dell'utilizzo dell'analgesia epidurale nella sottopopolazione affetta da trauma toracico severo isolato (T-AIS>= 3 e tutti altri < 3) e potenziali effetti sul tasso di intubazione orotracheale e durata della ventilazione meccanica
    - Descrizione dell'utilizzo dei monitoraggi emodinamici avanzati e del loro potenziale ruolo sulla sopravvivenza e durata della degenza in TI

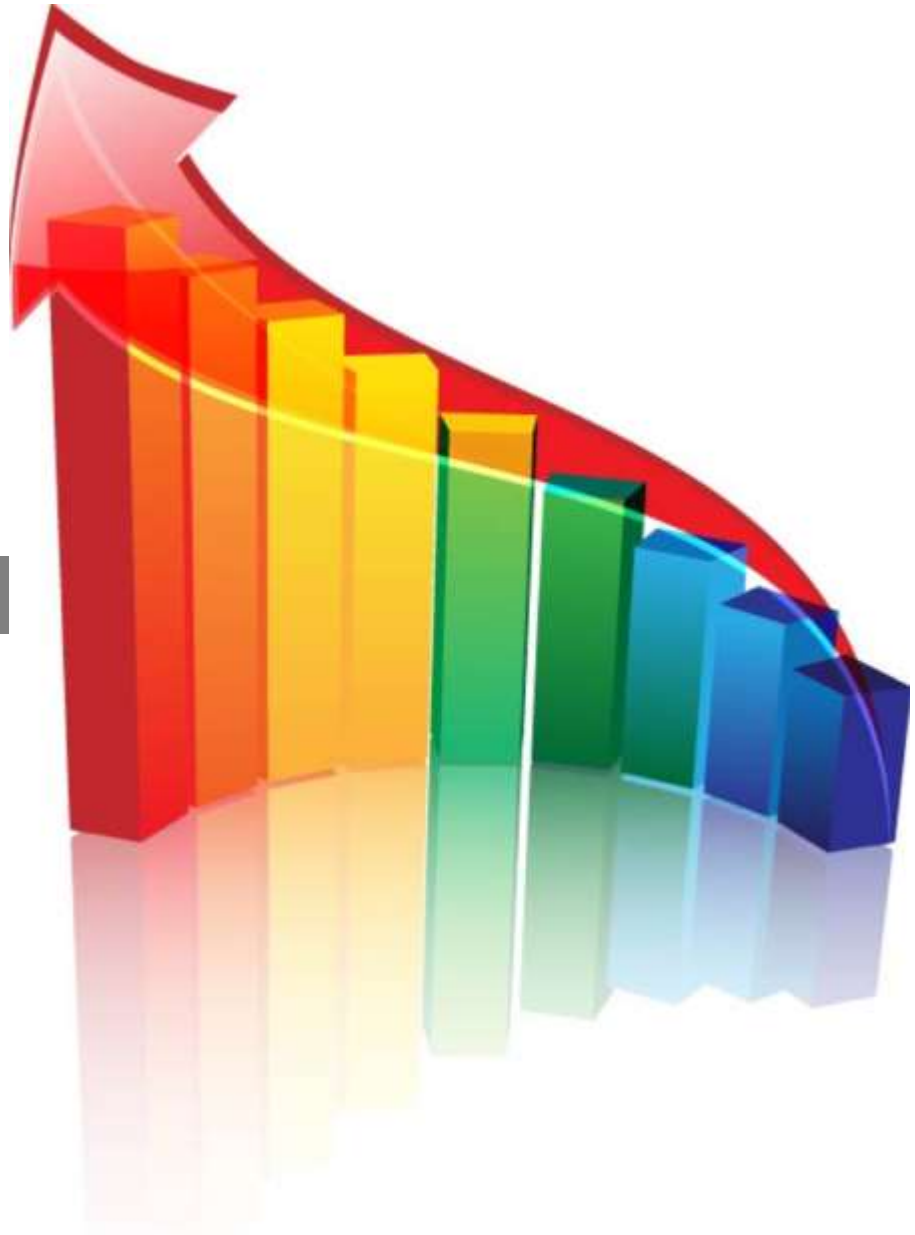
# CRITERI DI INCLUSIONE E SAMPLE SIZE

- Inclusion criteria
  - Age ≥ 17 years
  - Thoracic trauma with T-AIS ≥ 3
  - Admission to ICU

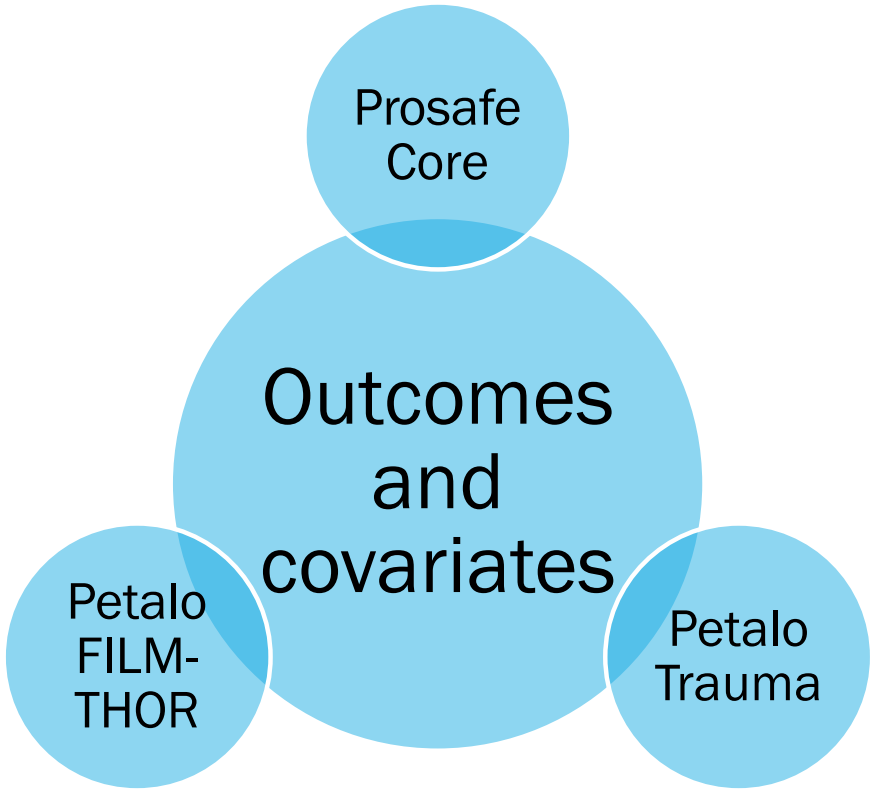
Sample size – 1000 pazienti

- Exclusion criteria
  - Mechanical ventilation at home

- Observation period
  - January 2020 – December 2023



# IL RUOLO DI PROSAFE



# DATI AGGIUNTIVI RACCOLTI

File Ricovero Help

Esci | Salva | Errori | Avvisi | Attenzione | Aggiorna status | Sintesi decorso clinico

- AIS
  - Testa
  - Torace
  - Addome
  - Colonna cervicale
  - Colonna toracica
  - Colonna lombare
  - Arti superiore
  - Arti inferiore
  - Esterni
  - Altro trauma
- Colonizzazioni
- Colture di sorveglianza
  - Colonizzazione all'Ammissione
    - Microrganismi isolati tramite tampone faringeo all'ammissione
      - Antibiogramma da tampone faringeo all'ammissione
    - Microrganismi isolati tramite aspirato bronco-tracheale all'ammissione
      - Antibiogramma da aspirato bronco-tracheale all'ammissione
  - Colonizzazione in Degenza
    - Microrganismi isolati tramite tampone faringeo durante la degenza
      - Antibiogramma da tampone faringeo durante la degenza
    - Microrganismi isolati tramite aspirato bronco-tracheale durante la deger
      - Antibiogramma da aspirato bronco-tracheale durante la degenza
    - Data di isolamento
    - Positività alla dimissione
- Infezioni - Light
  - Infezione all'Ammissione
  - Infezione in Degenza
- Infezioni - Full
  - Dettaglio gravità dell'infezione
    - SOFA Score peggiore nel giorno della gravità massima
  - Antibiotici in terapia empirica
  - Antibiotici in terapia mirata
  - Antibiotico profilassi
  - Antifungina in terapia empirica
  - Antifungina in terapia mirata
- FilmThor
  - Dettagli aggiuntivi

## Dettagli aggiuntivi

FilmThor->Dettagli aggiuntivi

**FilmThor**

Diagnosi di ARDS nei primi 7 giorni dal trauma

- ○ Si
- ○ No

| | | |
|---|---|---|
| Peggiore P/F nei primi 7 giorni dal trauma [0 - 600] | | ☐ Dato non disponibile |
| Sacche di globuli rossi trasfuse durante le prime 24h [0 - 50] | | ☐ Dato non disponibile |
| Plasma fresco congelato trasfuso durante le prime 24h [0 - 8000 ml] | | ☐ Dato non disponibile |
| PEEP esterna durante il peggiore valore di P/F [0 - 30 cmH2O] | | ☐ Dato non disponibile |

Tipo di trauma

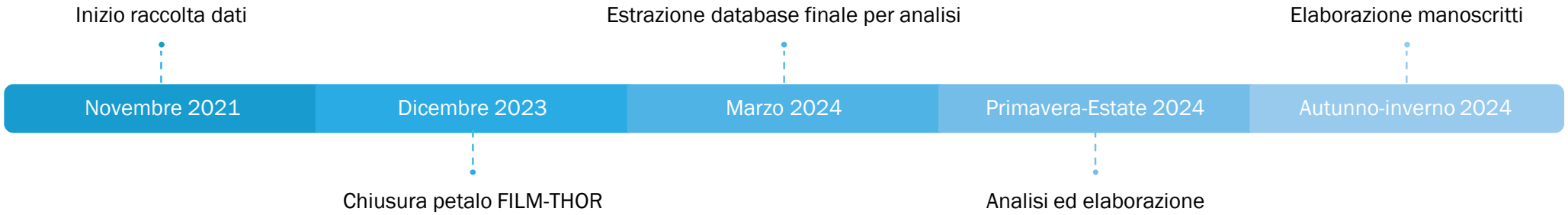
- ○ Chiuso
- ○ Penetrante

Modalità di ventilazione nei primi 7 giorni

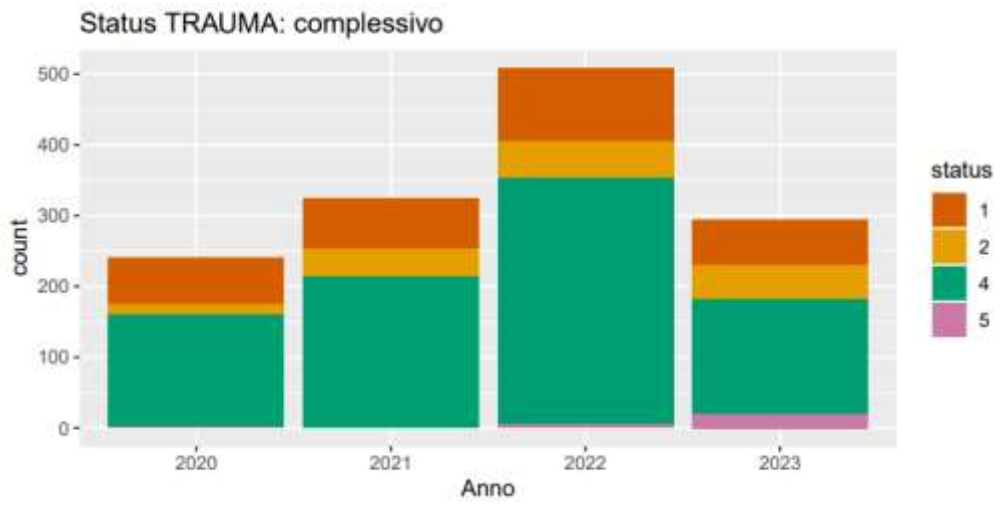
- ○ Ventilazione a volume controllato
- ○ Ventilazione a pressione controllata
- ○ Ventilazione assistita
- ○ APRV
- ○ Ventilazione assistita-controllata
- ○ Ossigeno terapia ad alti flussi
- ○ Non applicabile
- ○ Non disponibile

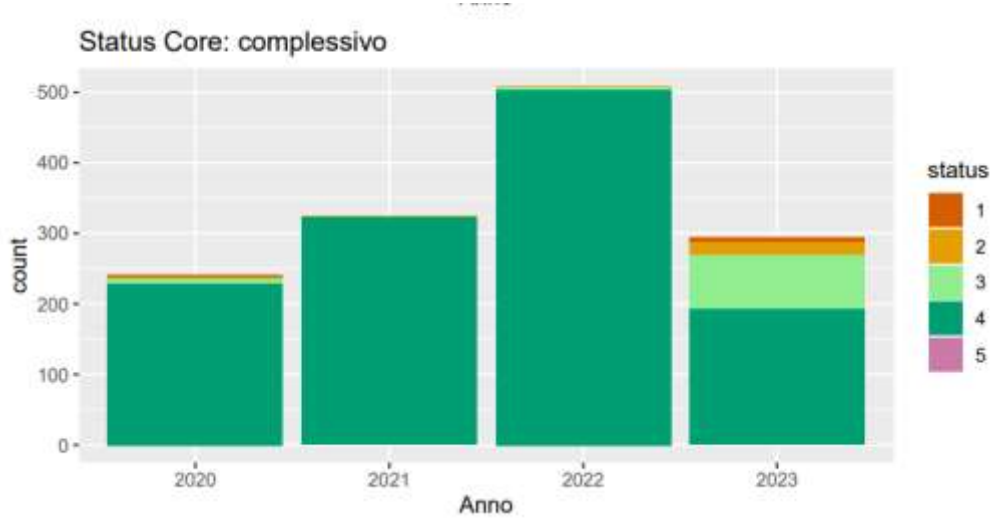
# CENTRI PARTECIPANTI E AVANZAMENTO

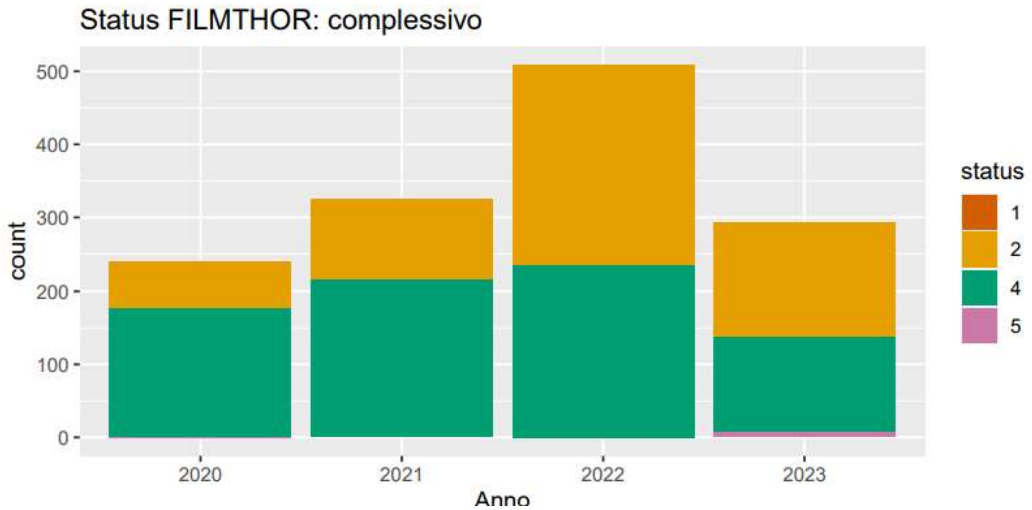
| Sede | Responsabile |
|---|---|
| Bologna | Lorenzo Gamberini |
| Milano Niguarda Neuro | Luca Bastia |
| Foggia | Michela Rauseo |
| Monza | Emanuele Rezoagli |
| Trento | Michela Zardin |
| Salerno | Giuseppe Calicchio |
| Legnano - Ria Generale | Davide Tommaso Andreis |
| Legnano - Ria postop | Davide Tommaso Andreis |
| Cesena | Emanuele Russo |
| Ferrara | Giuseppe Santoro |
| Pisa | Silvia Pini |
| Torino - Giovanni Bosco | Paola Berni |



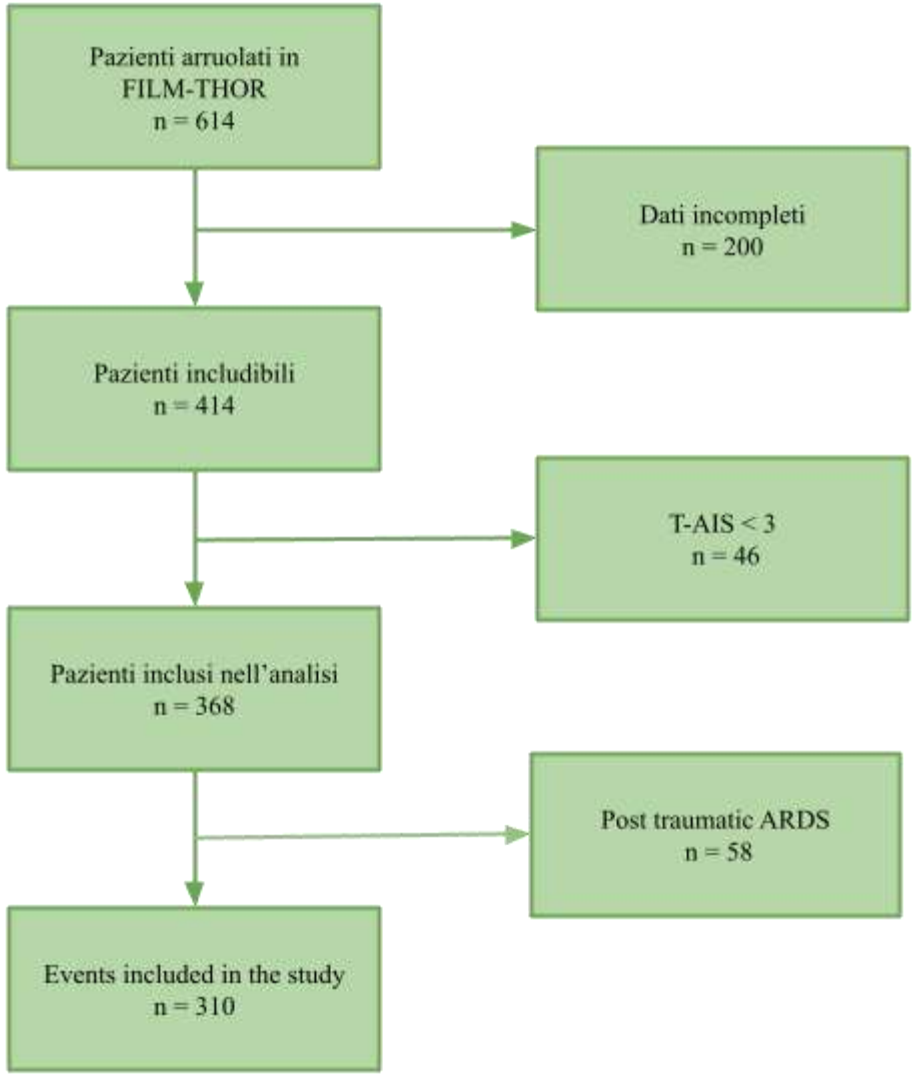
# STATO DI AVANZAMENTO DEL RECLUTAMENTO

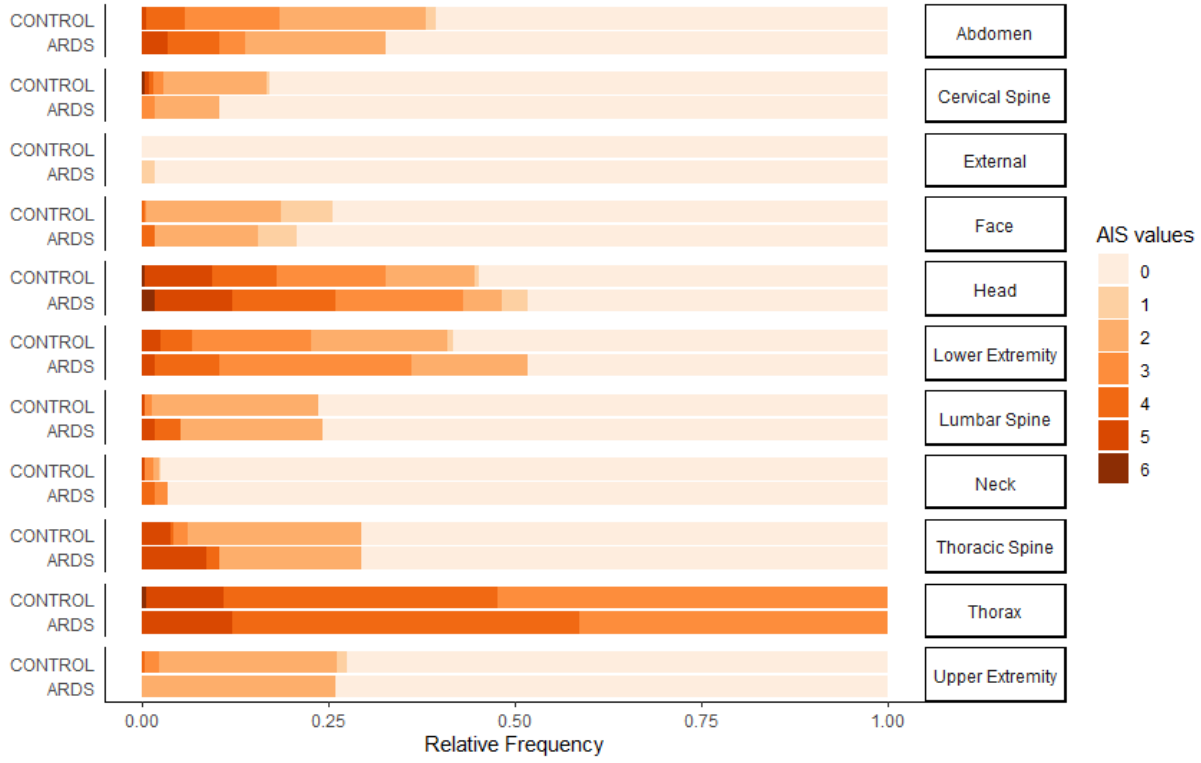
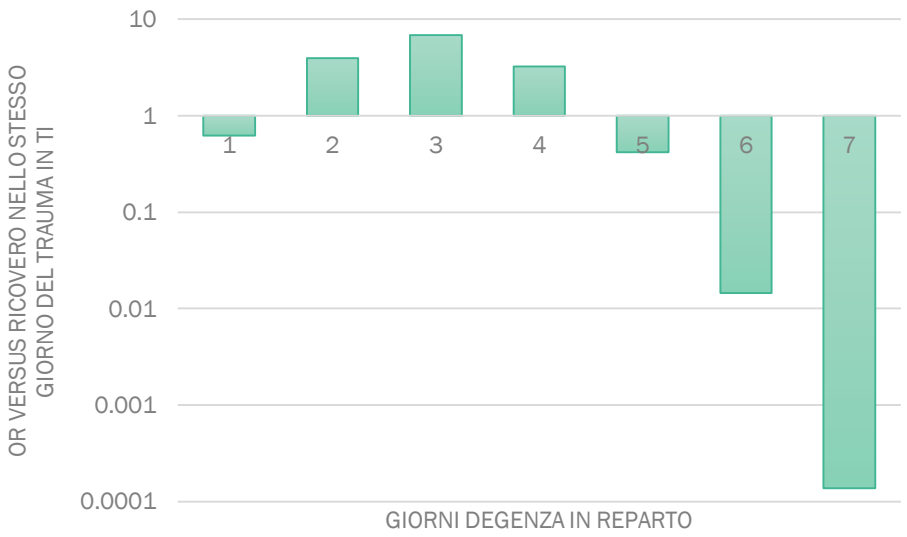
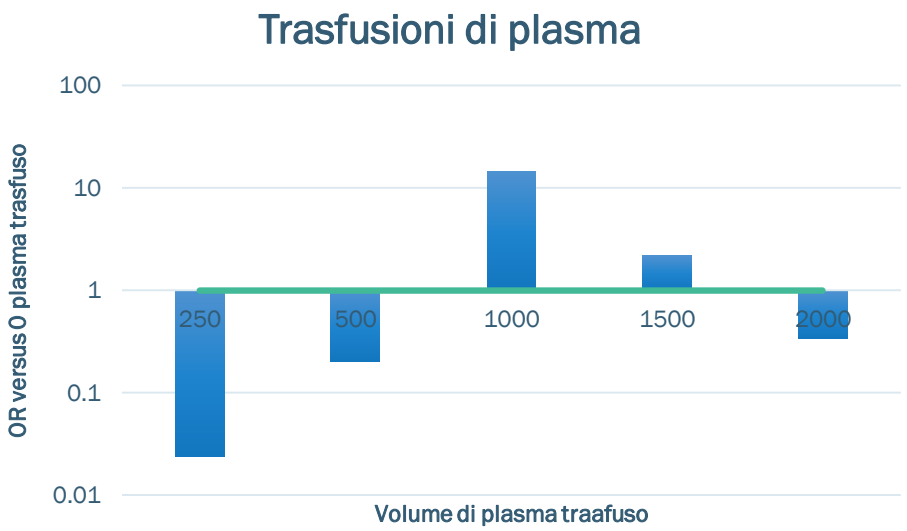


# DATI PRELIMINARI – OUTCOME ARDS - ANALISI 2022






| names | OR | OR_U | OR_L | Pr(>\|z\|) |
|---|---|---|---|---|
| Intercetta | 0.000544 | 0.013269 | 2.23E-05 | 4E-06 |
| PF<100 | 5.030547 | 11.54108 | 2.192724 | 0.000137 |
| Dopamina>15 OR Epi/Nepi>0.1 | 4.925919 | 10.63607 | 2.281357 | 4.9E-05 |
| Volet costale | 3.281127 | 7.767396 | 1.386024 | 0.006883 |
| scoreLowerExtremity>=3 | 4.863884 | 10.55244 | 2.241887 | 6.25E-05 |
| Emotorace traumatico e/o pneumotorace | 2.769846 | 5.890356 | 1.302476 | 0.008133 |
| min(age - 29, 0)) | 1.39416 | 1.882754 | 1.032362 | 0.030176 |
| Ammesso TI stesso giorno ospedale | 37.18263 | 706.8424 | 1.95595 | 0.016106 |
| degenzaGiornipreTI | 44.66404 | 760.0998 | 2.624493 | 0.008608 |
| degenzaGiornipreTI^2 | 0.521873 | 0.922086 | 0.295364 | 0.025136 |