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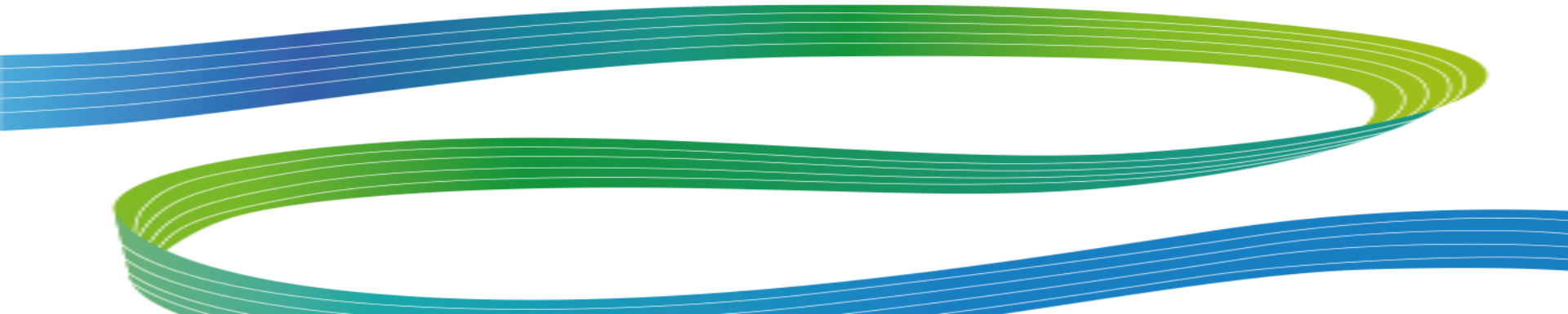
HEALTH · EDUCATION · RESEARCH صحة · تعليم · بحوث
Institute for Healthcare Improvement
Middle East Forum on Quality and Safety in Healthcare
Collaborating for Excellence in Patient Care
29 - 31 May 2015 QNCC, Doha, Qatar

Safer Care of the Mechanically Ventilated Patient



Dr. Bill Andrews
Deputy Chair for Quality,
Department of Anesthesia, ICU and Perioperative Medicine
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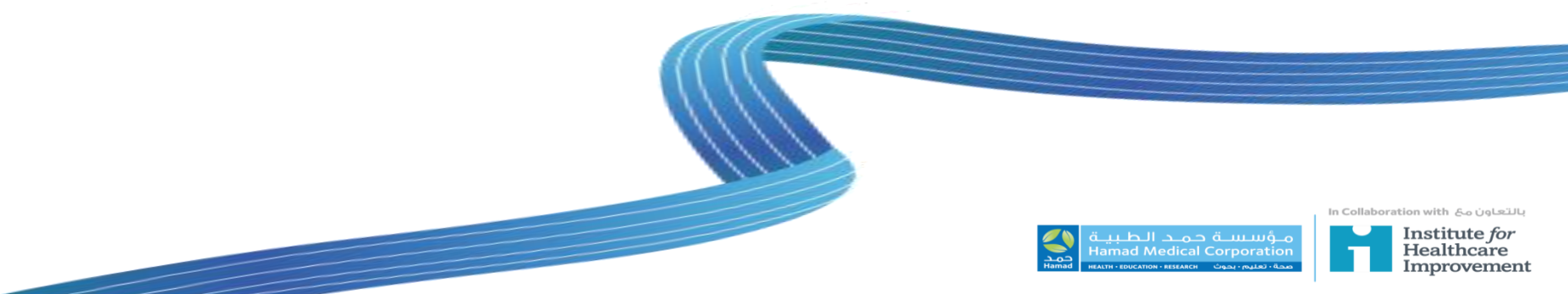
Quality Lead Coordinator (A) Surgical Intensive Care Unit
Hamad General Hospital



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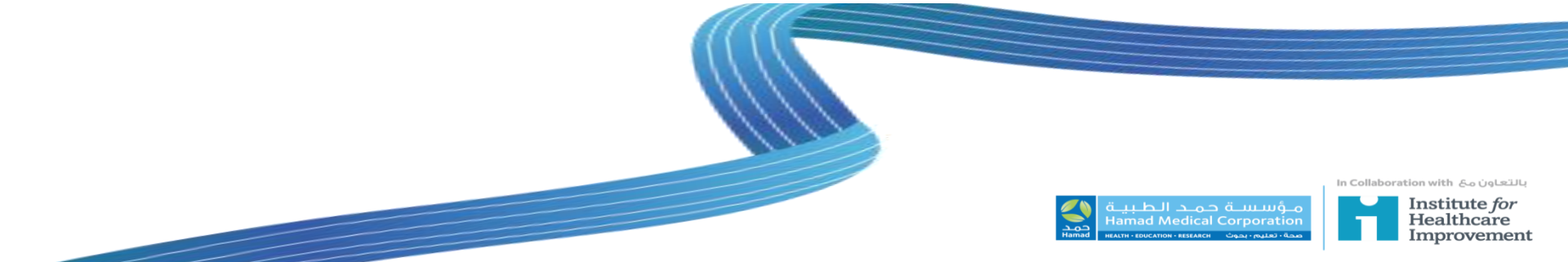
We have no conflicts of interest



Have you observed the changes in the Health Care ?

Restraint
Sedation
Mobility
Delirium

Who is more Vulnerable?

How can we keep our Patients Safe while they are on a Mechanical Ventilator?

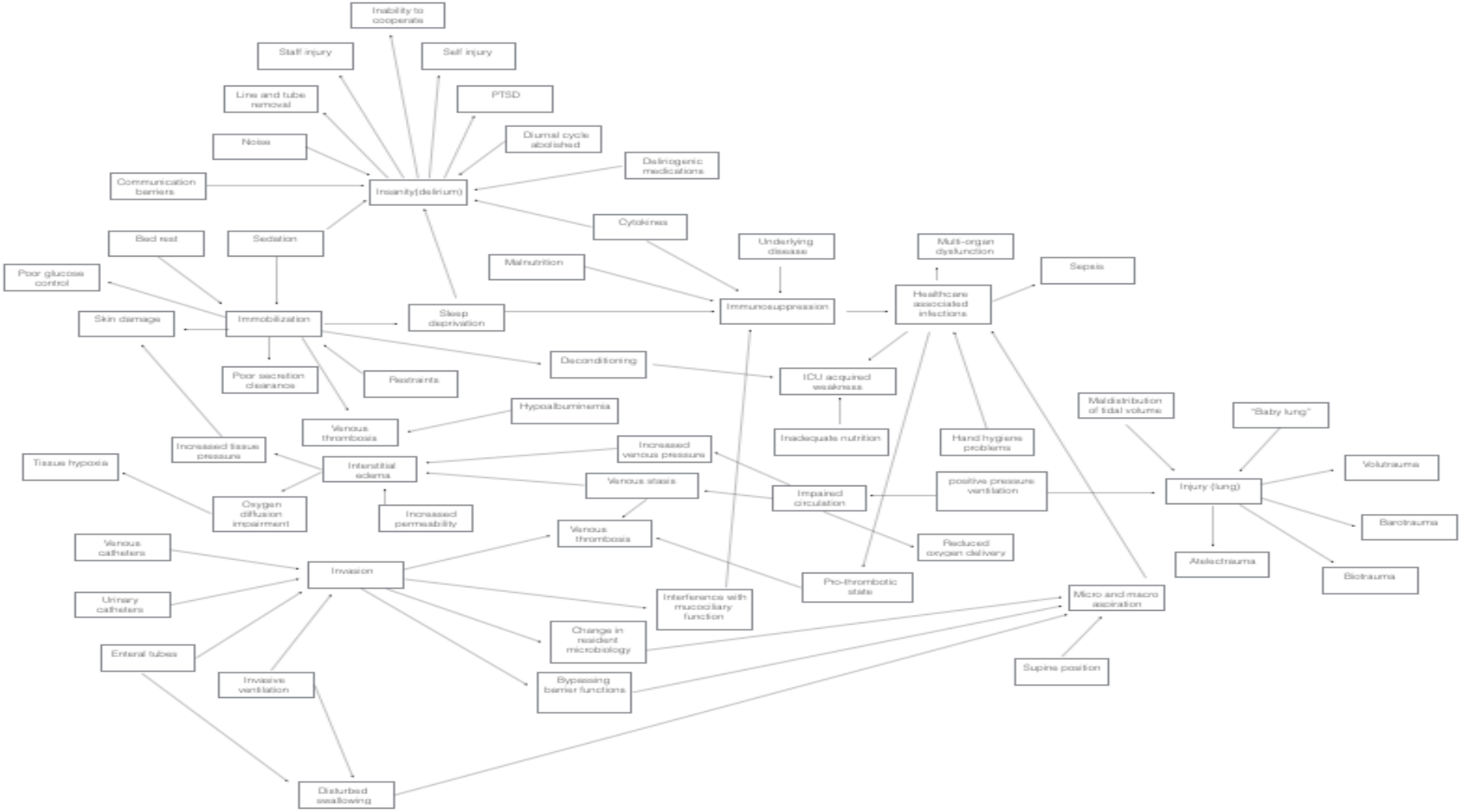
What makes Mechanically Ventilated Patient Most Vulnerable?

1. Immo[illegible] [illegible]uppression
2. Invas[illegible]
3. Inters[illegible]
   Edem[illegible]
4. Injury[illegible] [illegible]n

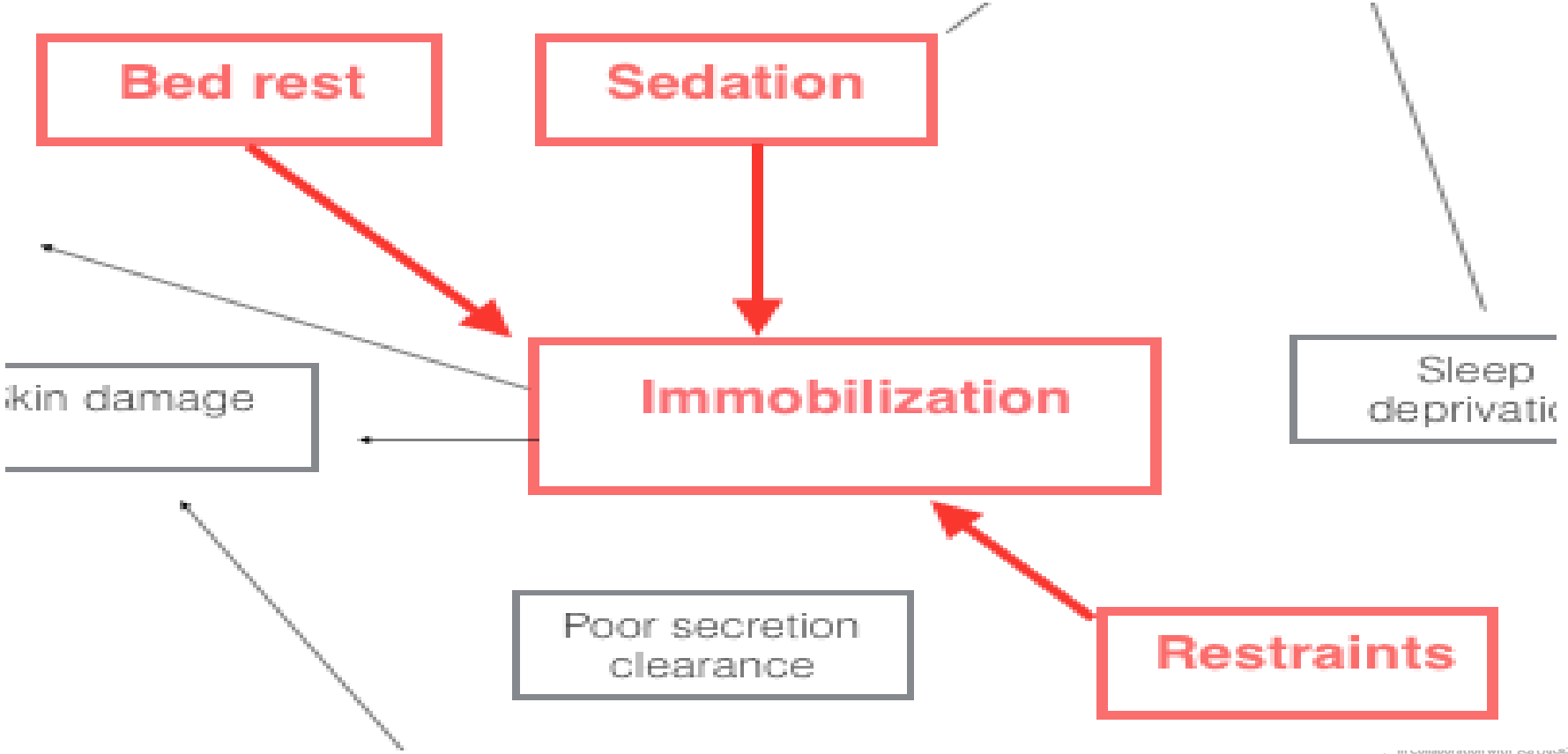
8 I's

Dr. Bill Andrews

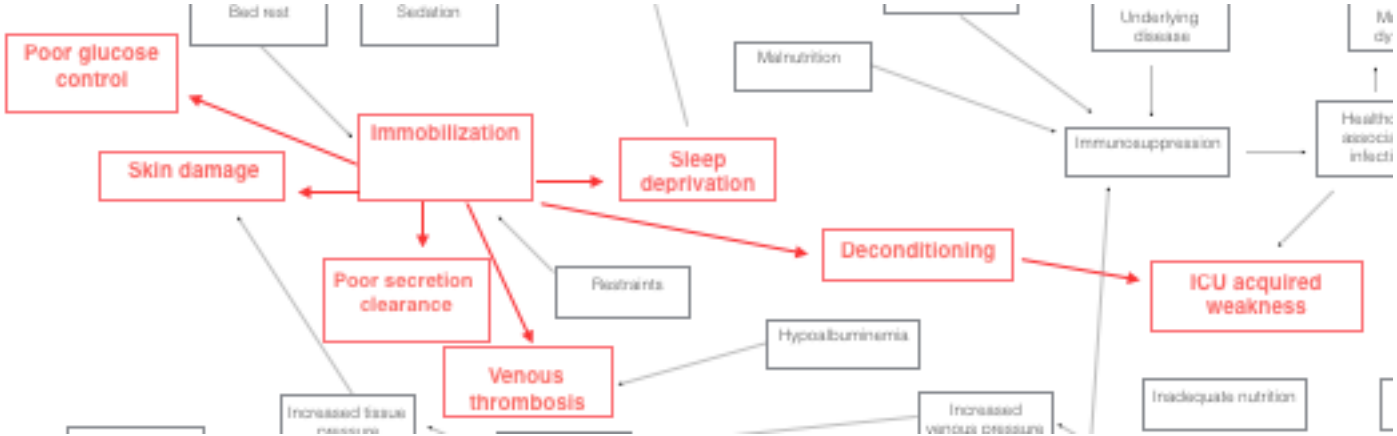
Ventilated Patients are Vulnerable!


Inability to cooperate
Staff injury
Self injury
Line and tube removal
PTSD
Noise
Diurnal cycle abolished
Communication barriers
Insanity(delirium)
Deliriogenic medications
Cytokines
Bed rest
Sedation
Underlying disease
Multi-organ dysfunction
Malnutrition
Sepsis
Poor glucose control
Immunosuppression
Healthcare associated infections
Skin damage
Immobilization
Sleep deprivation
Deconditioning
Poor secretion clearance
Restraints
ICU acquired weakness
Maldistribution of tidal volume
"Baby lung"
Hypoalbuminemia
Venous thrombosis
Inadequate nutrition
Hand hygiene problems
Increased tissue pressure
Increased venous pressure
Tissue hypoxia
Interstitial edema
Volutrauma
Venous stasis
positive pressure ventilation
Injury (lung)
Oxygen diffusion impairment
Impaired circulation
Barotrauma
Increased permeability
Venous thrombosis
Venous catheters
Reduced oxygen delivery
Atelectrauma
Invasion
Pro-thrombotic state
Biotrauma
Urinary catheters
Interference with mucociliary function
Micro and macro aspiration
Change in resident microbiology
Enteral tubes
Supine position
Invasive ventilation
Bypassing barrier functions
Disturbed swallowing

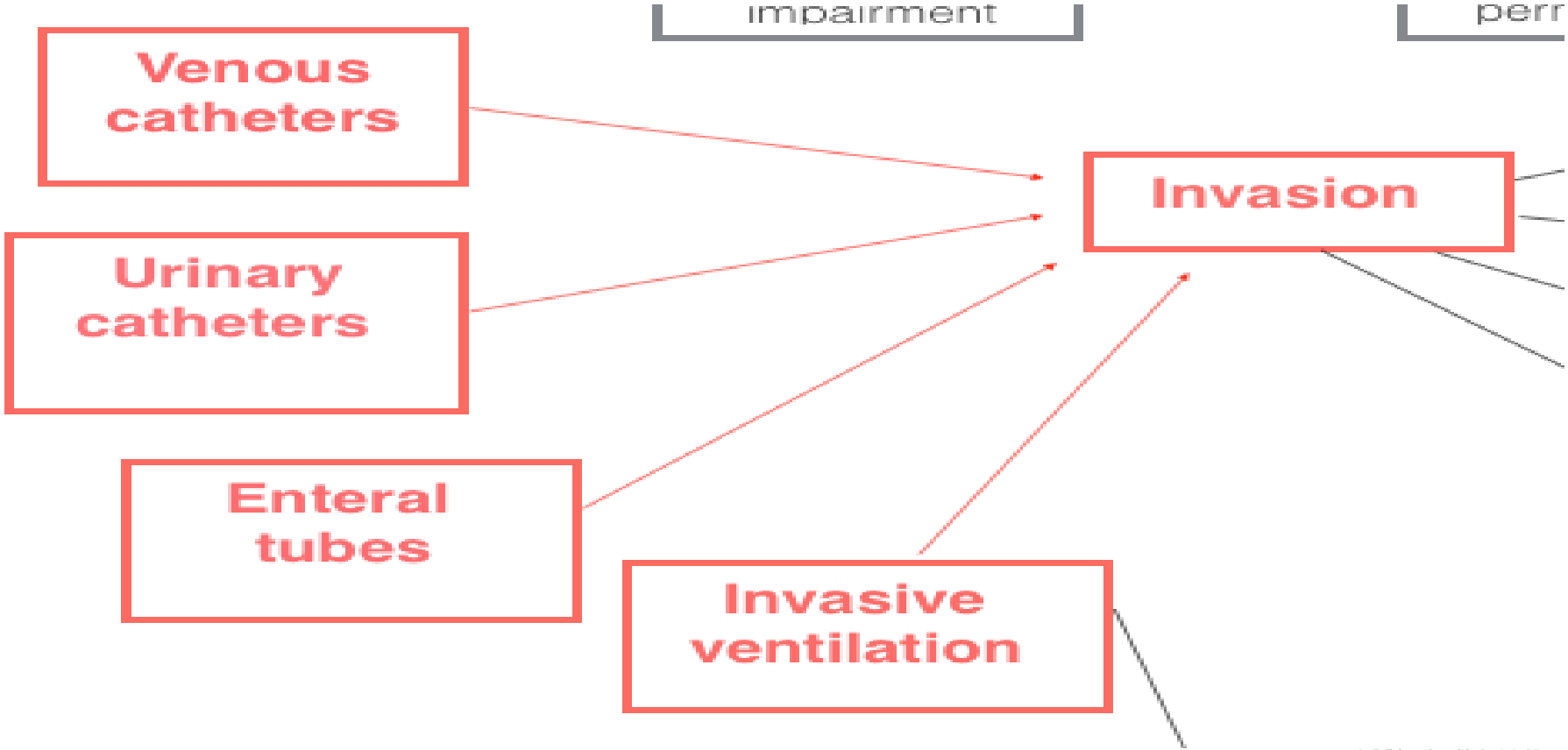
Immobilization - Causes



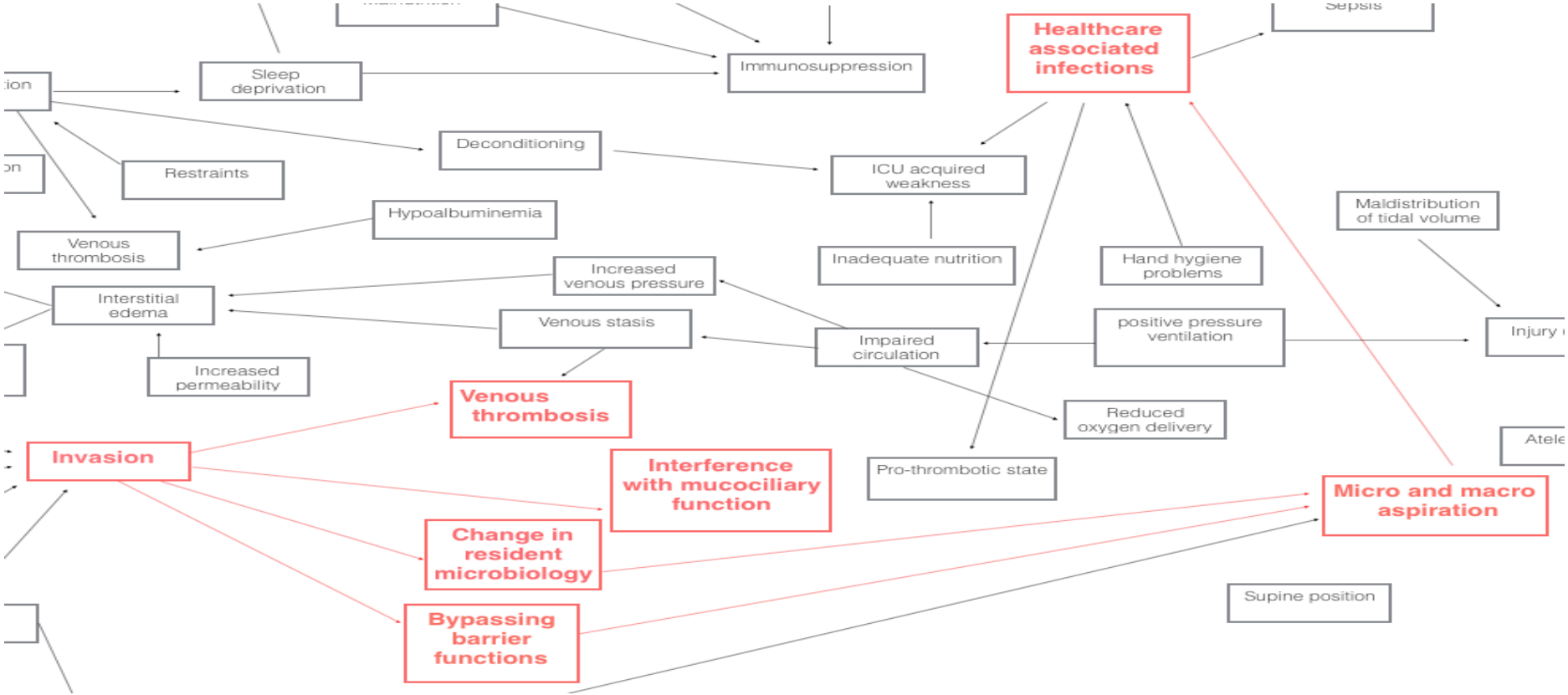
Immobilization - Effects



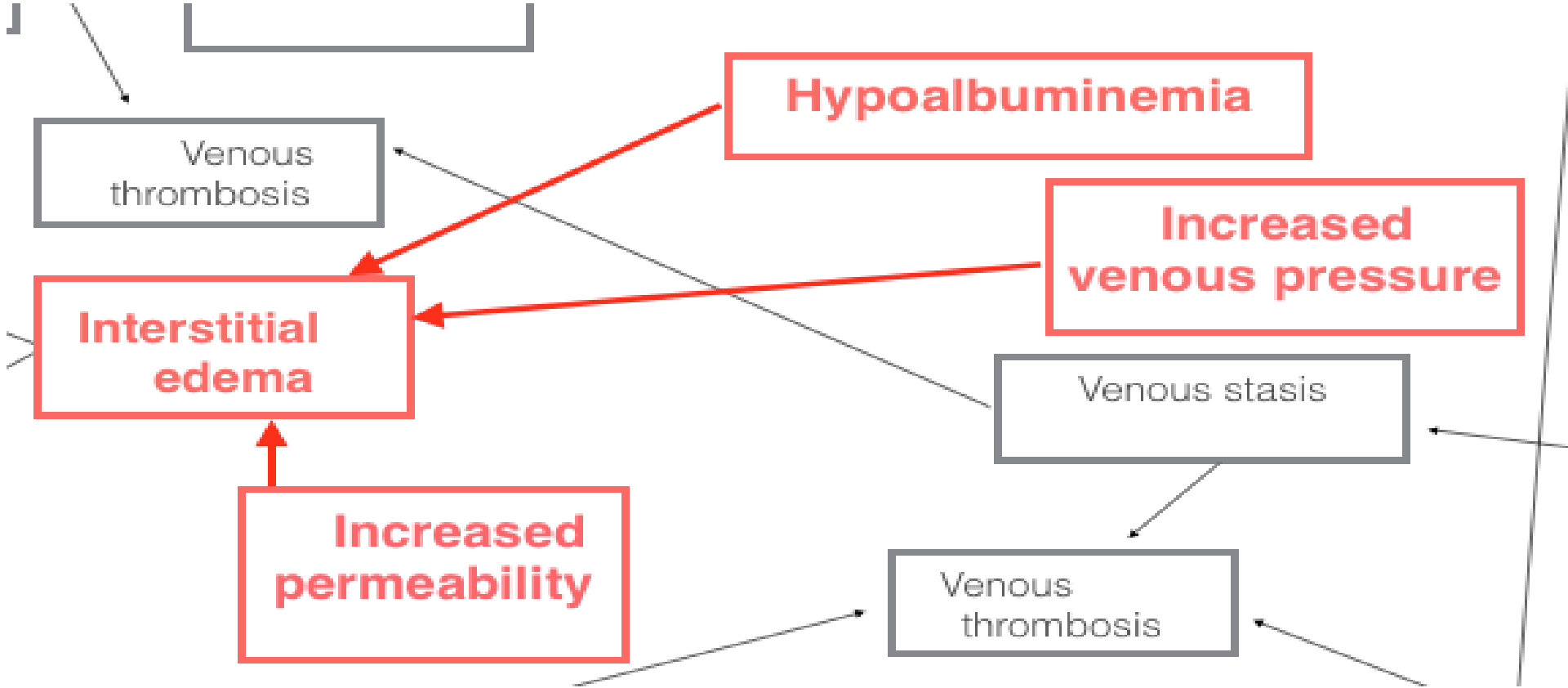
Invasion - Causes



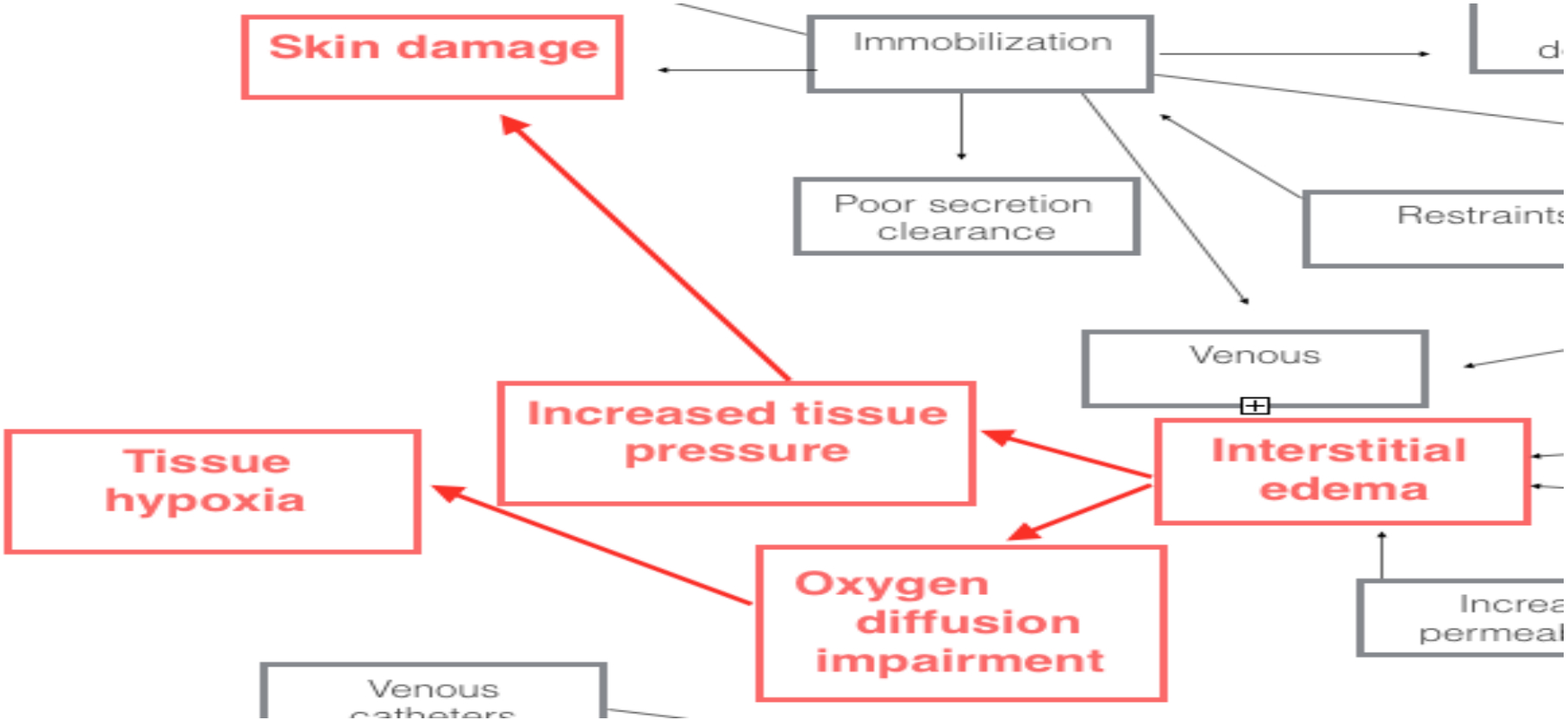
Invasion - Effects



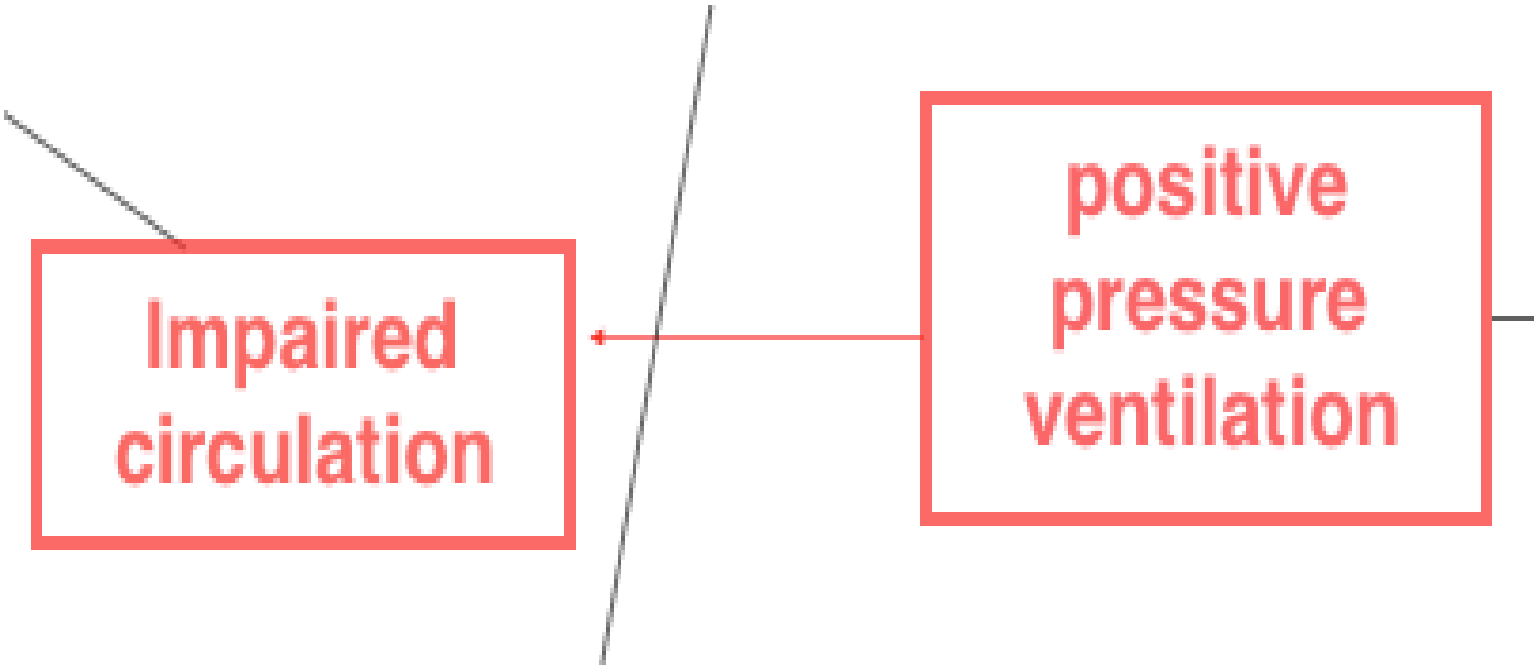
Interstitial Edema - Causes



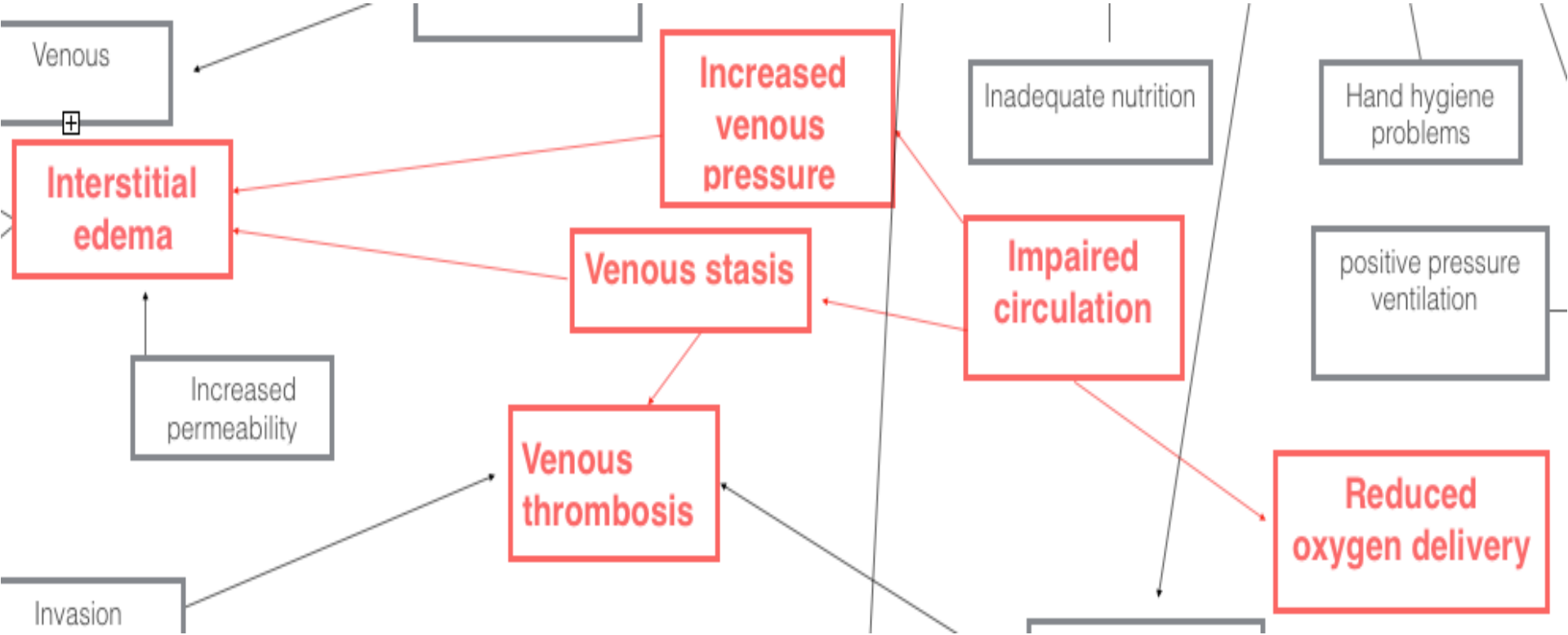
Interstitial Edema - Effects



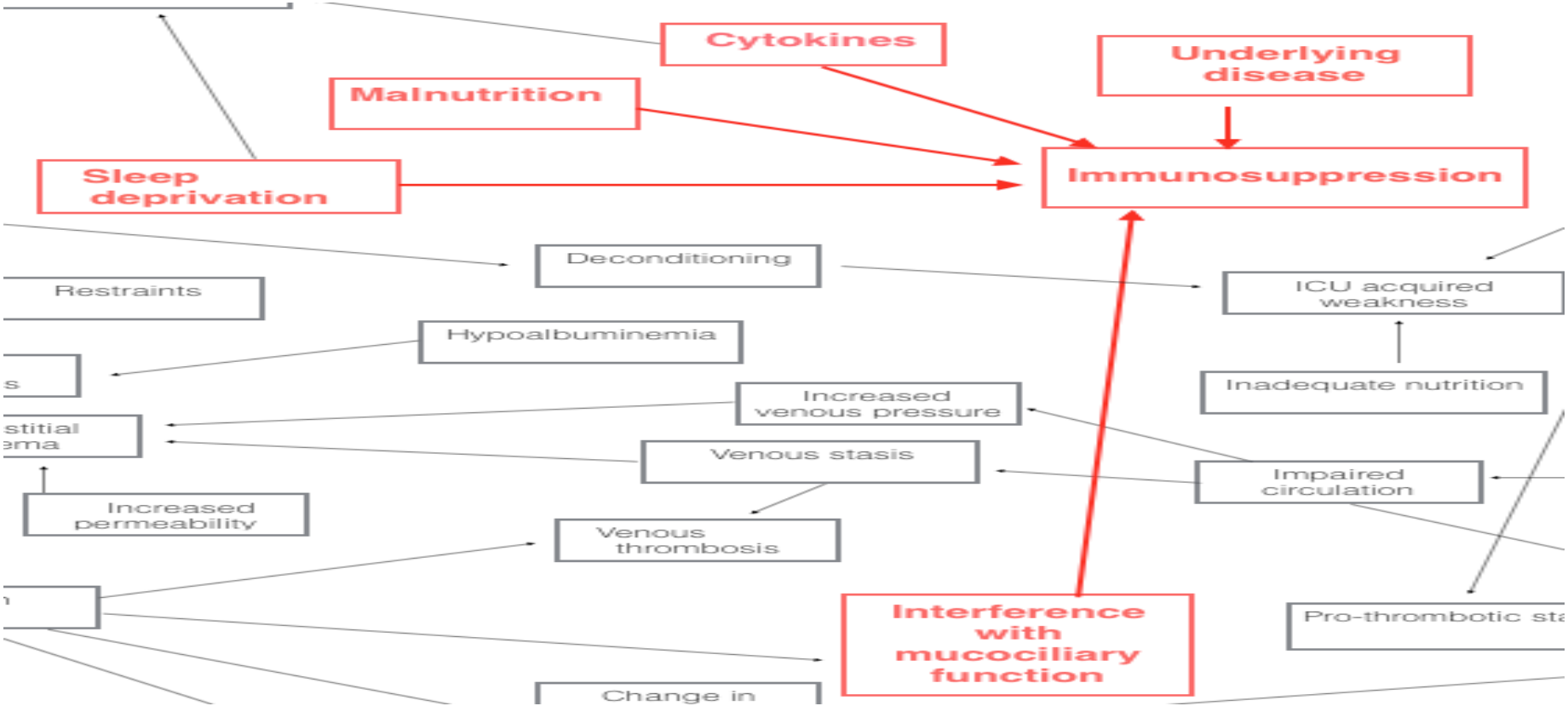
Impaired Circulation - Causes



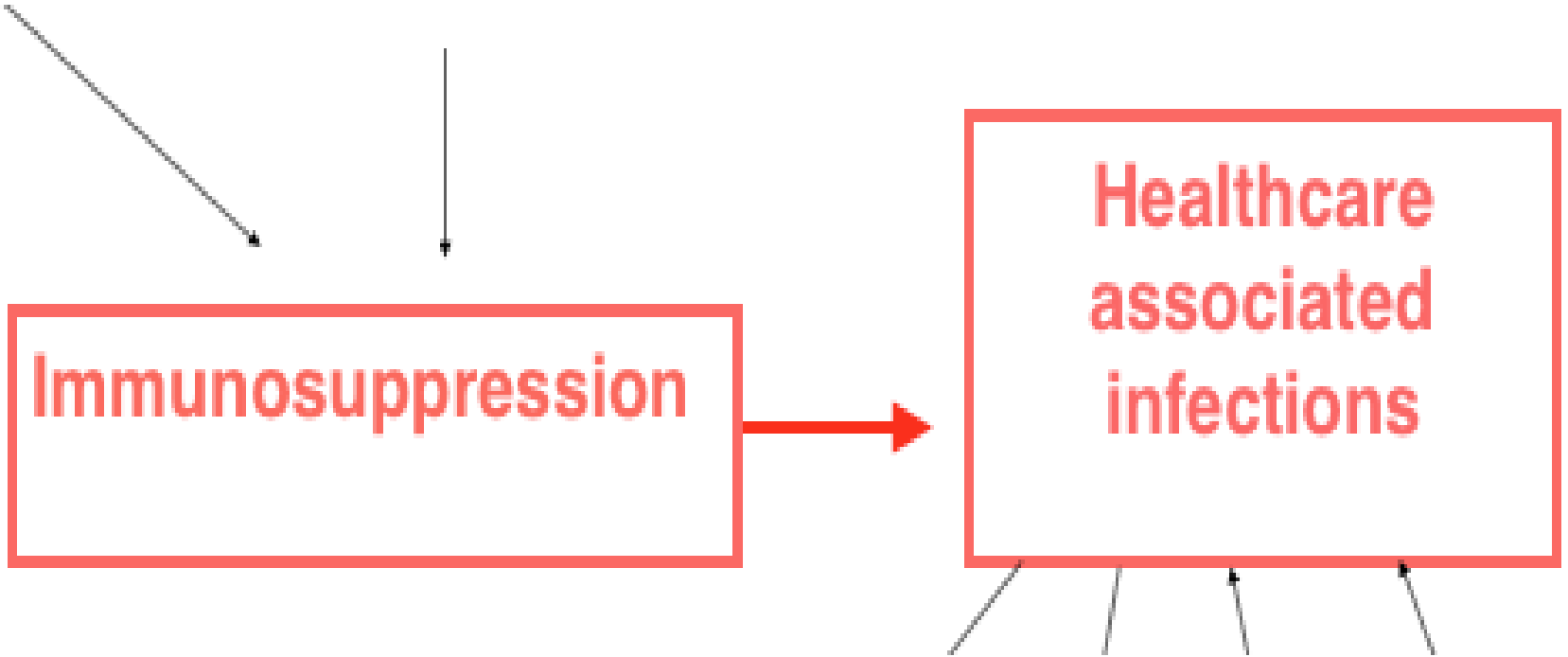
Impaired Circulation - Effects



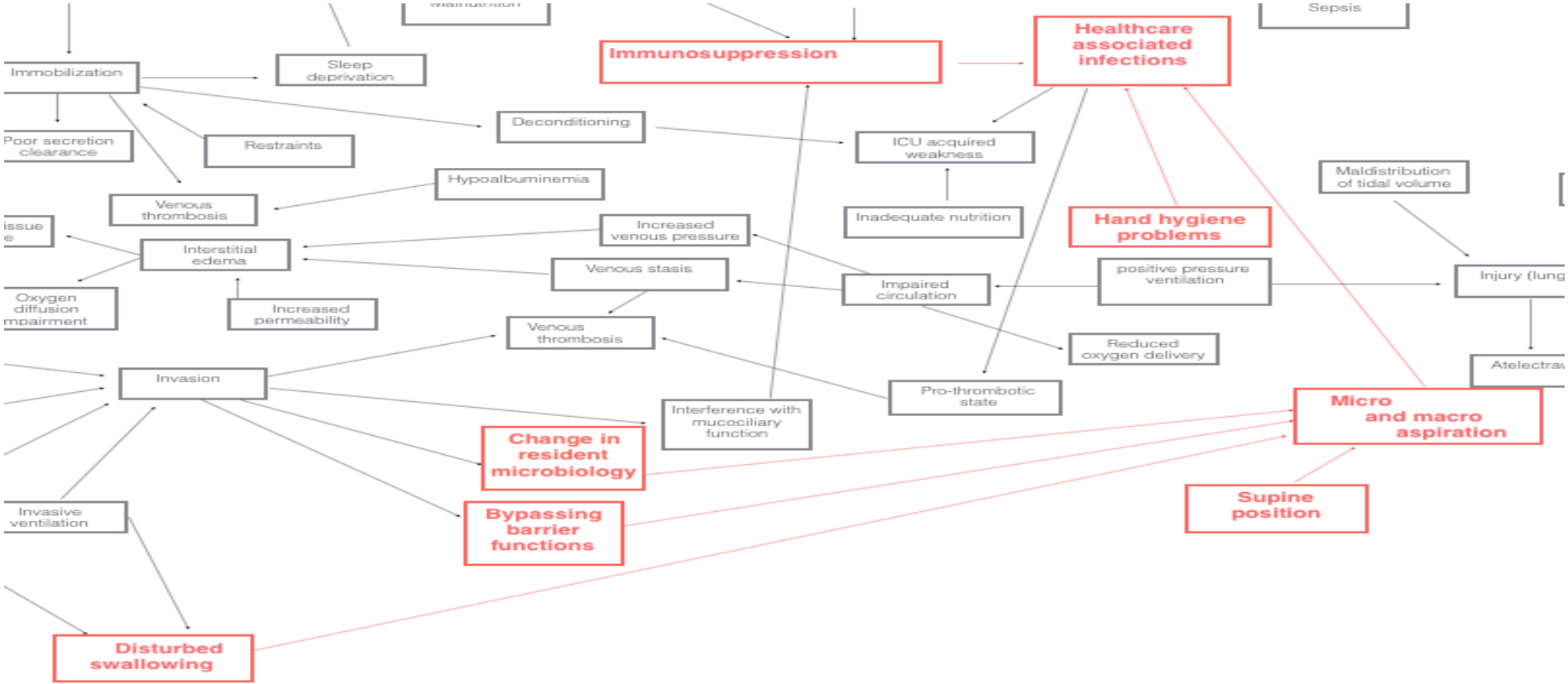
Immunosuppression - Causes



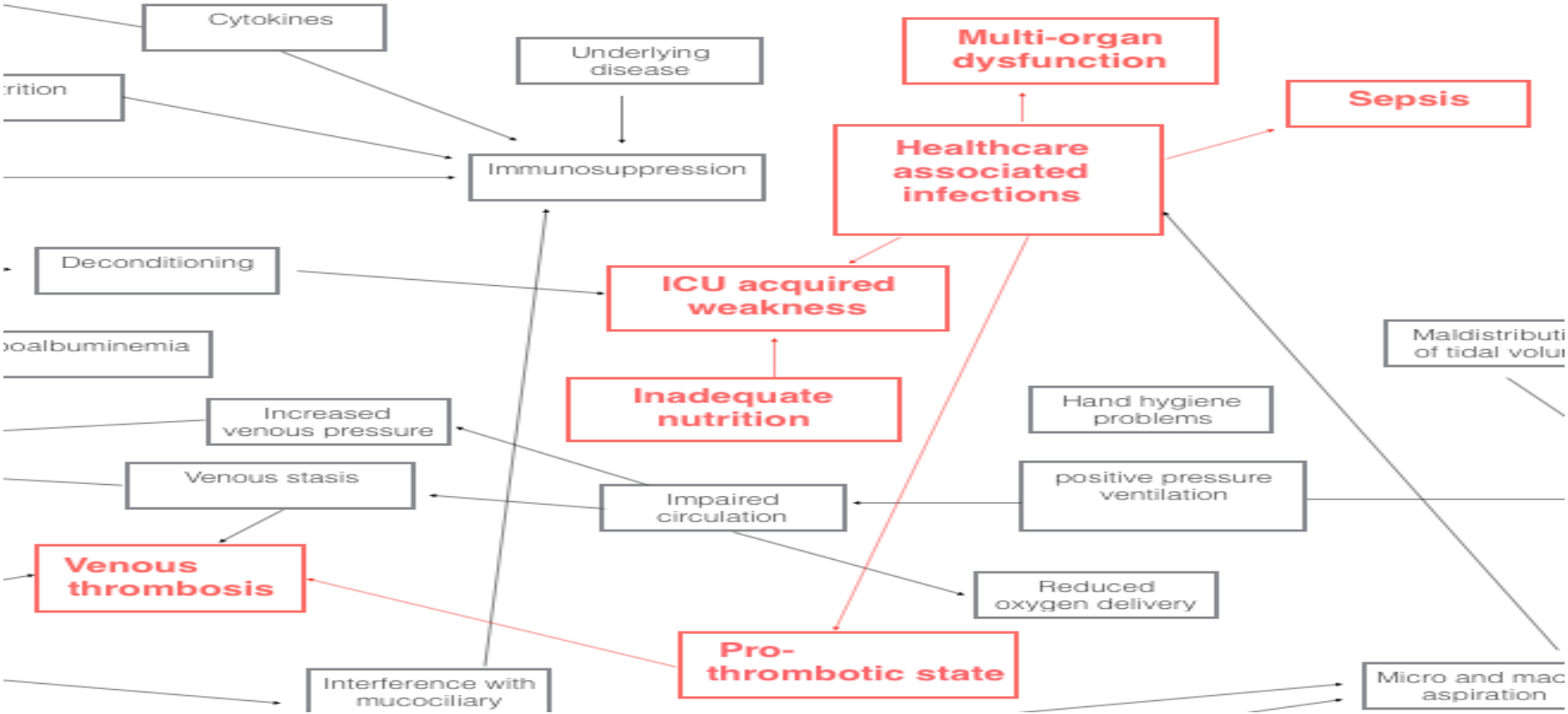
Immunosuppression - Effects



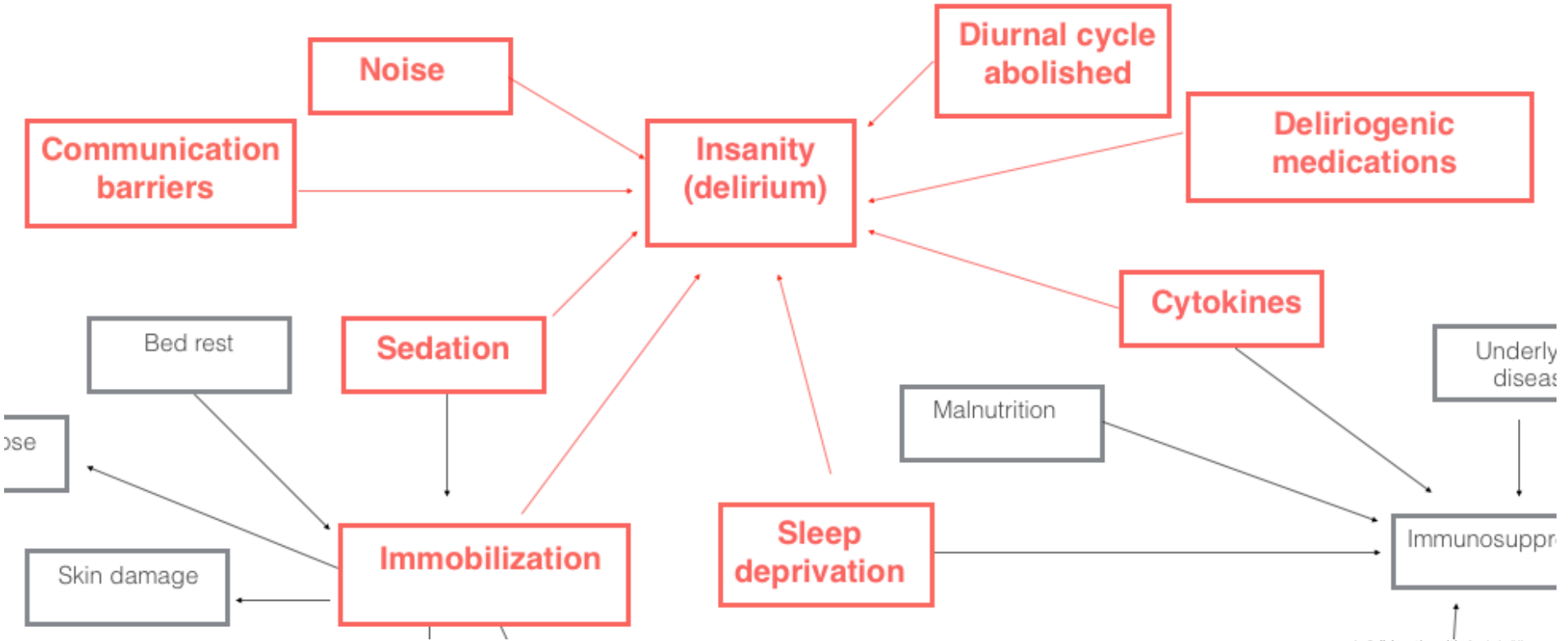
Infection - Causes



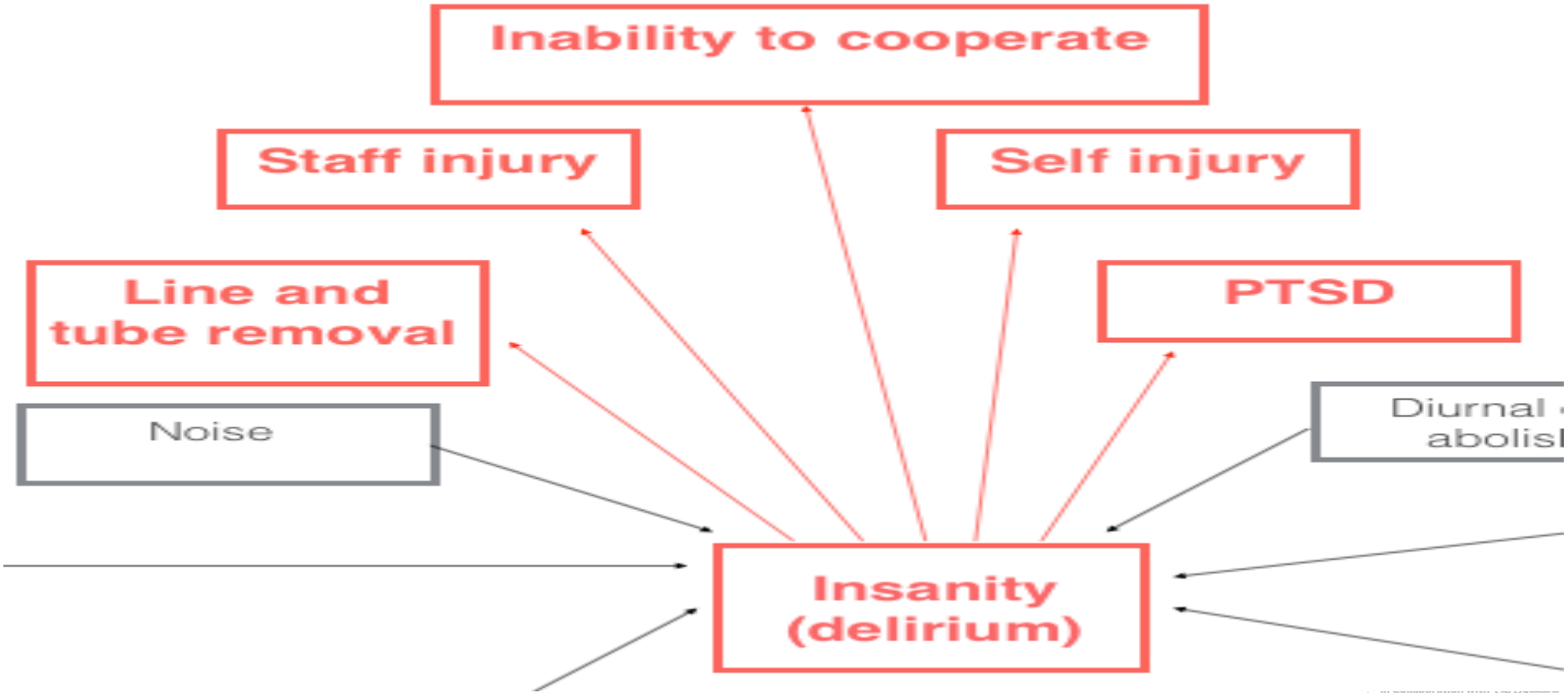
Infection - Effects



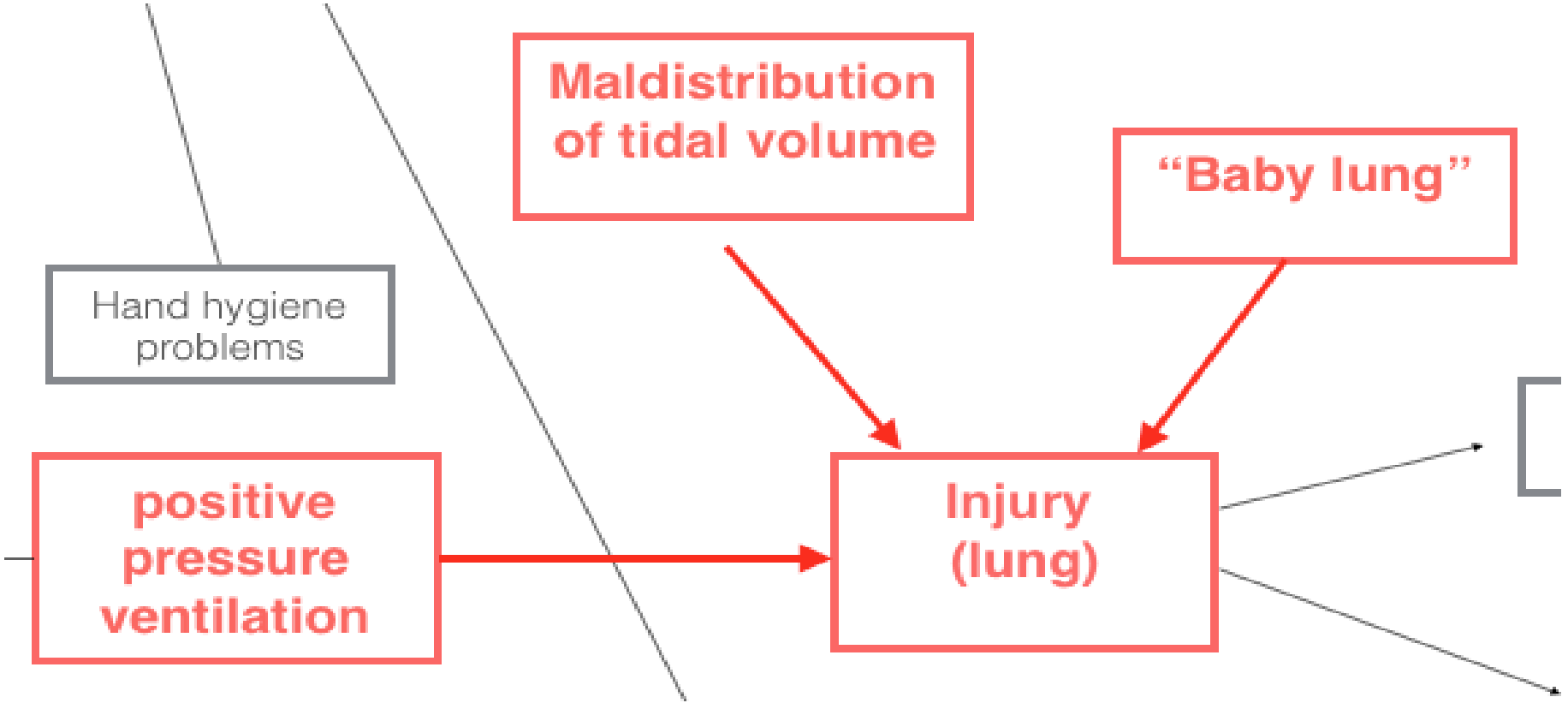
Insanity (Delirium) - Causes



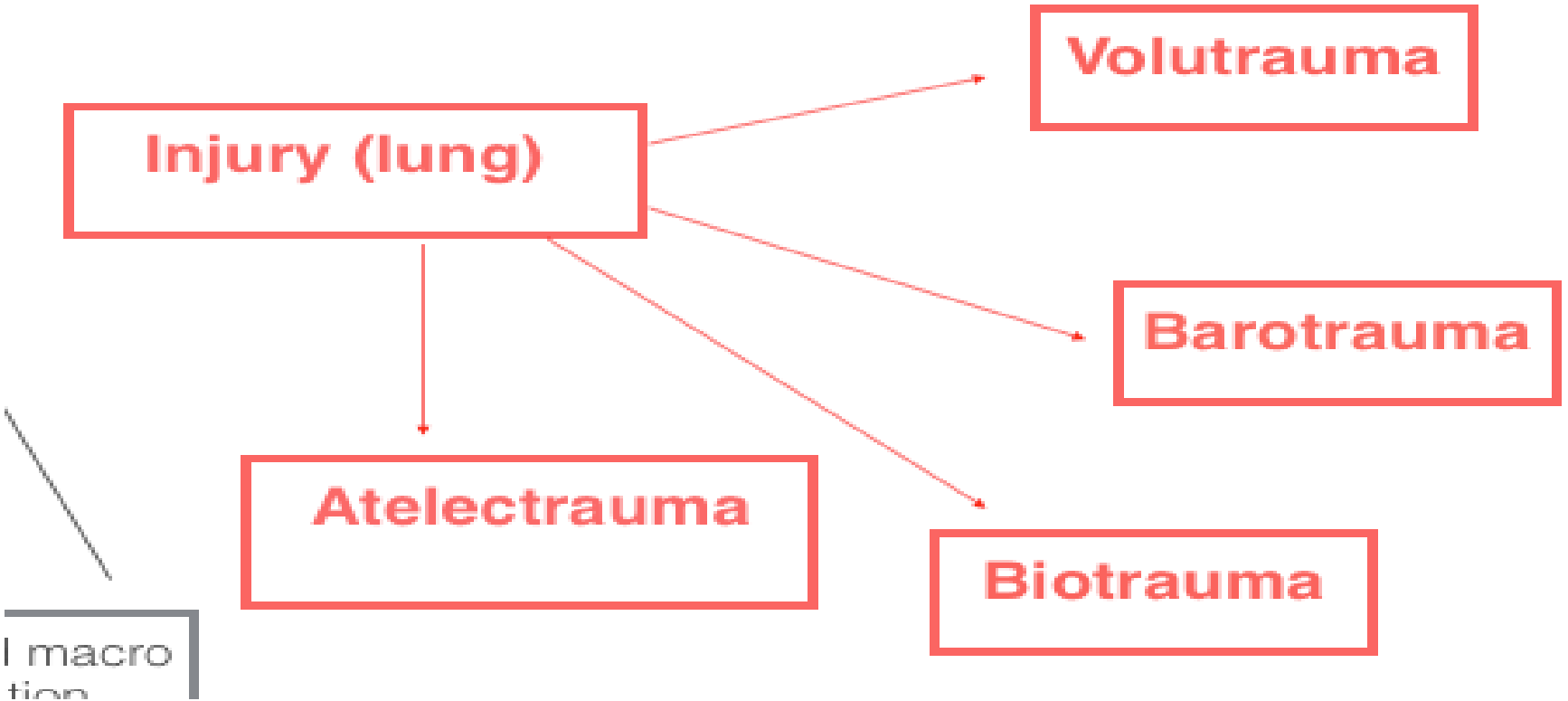
Insanity (Delirium) - Effects



Injury (Lung) - Causes



Injury (Lung) - Effects



Corazu M. Salta BSN.RN

Early Rehabilitation in the John Hopkins Hospital

Dr. Dale Needham

Early Rehabilitation in the Johns Hopkins MICU

What We Assume Sometimes is Totally the Opposite of What our Patient Really Feels.

Why Bundles?

- 5-3 *evidence based* interventions
  - Each with evidence that outcomes improve
- When done together, proven to improve outcomes*
  - Synergy?

*Resar R, Pronovost P, Haraden C, Simmonds T, et al.
Using a bundle approach to improve ventilator care processes and reduce ventilator-associated pneumonia.
Joint Commission Journal on Quality and Patient Safety.
.248-243:(5)31;2005

Traditional Bundle

- Head of the bed 30^{O}
- Daily sedative interruption and daily assessment of readiness to extubate
- Daily oral care with chlorhexidine
- PUD prophylaxis
- DVT prophylaxis

Next Gen. Bundle

A - Awaken

B - Breathing (Allow Spontaneous)

C - Coordinate Awakening and Breathing

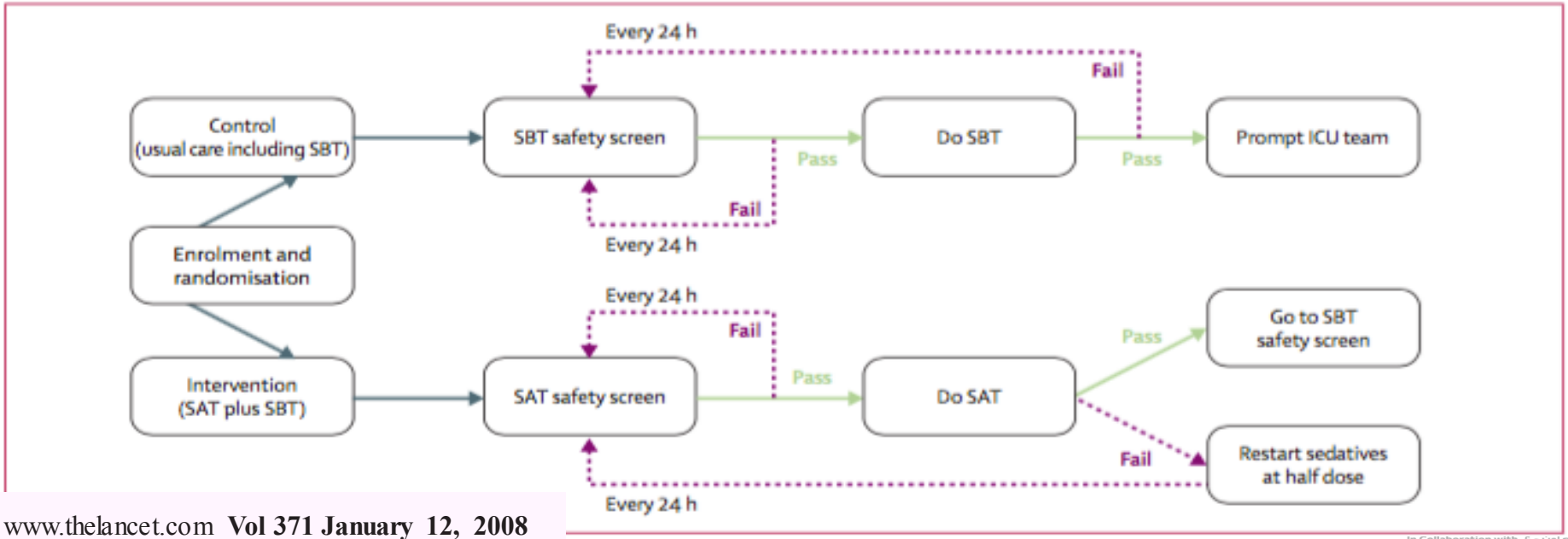
D - Delirium (Prevent, Detect and Manage)

E - Exercise and Promote Mobility

Dr. Bill Andrews

Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial

Timothy D Girard, John P Kress, Barry D Fuchs, Jason W W Thomason, William D Schweickert, Brenda T Pun, Darren B Taichman, Jan G Dunn, Anne S Pohlman, Paul A Kinniry, James C Jackson, Angelo E Canonico, Richard W Light, Ayumi K Shintani, Jennifer L Thompson, Sharon M Gordon, Jesse B Hall, Robert S Dittus, Gordon R Bernard, E Wesley Ely



www.thelancet.com **Vol 371 January 12, 2008**

Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial

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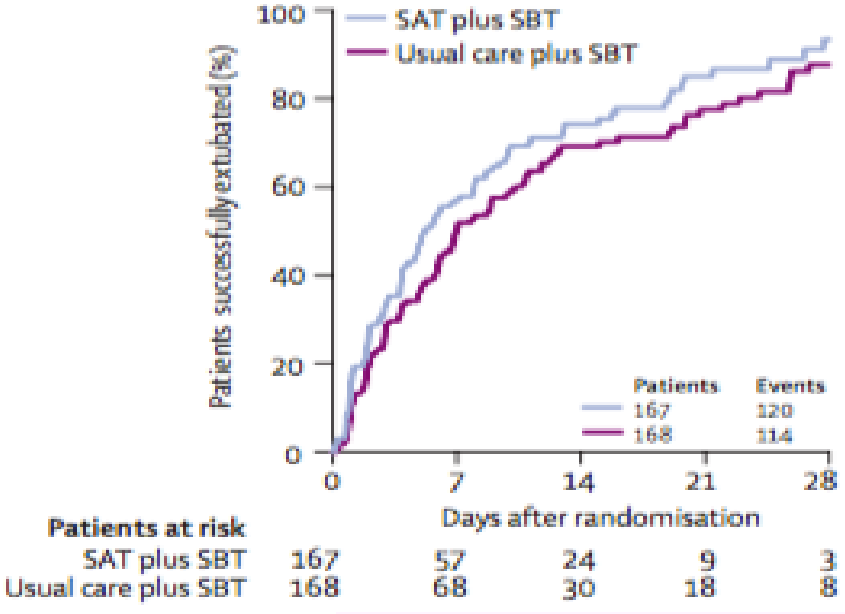
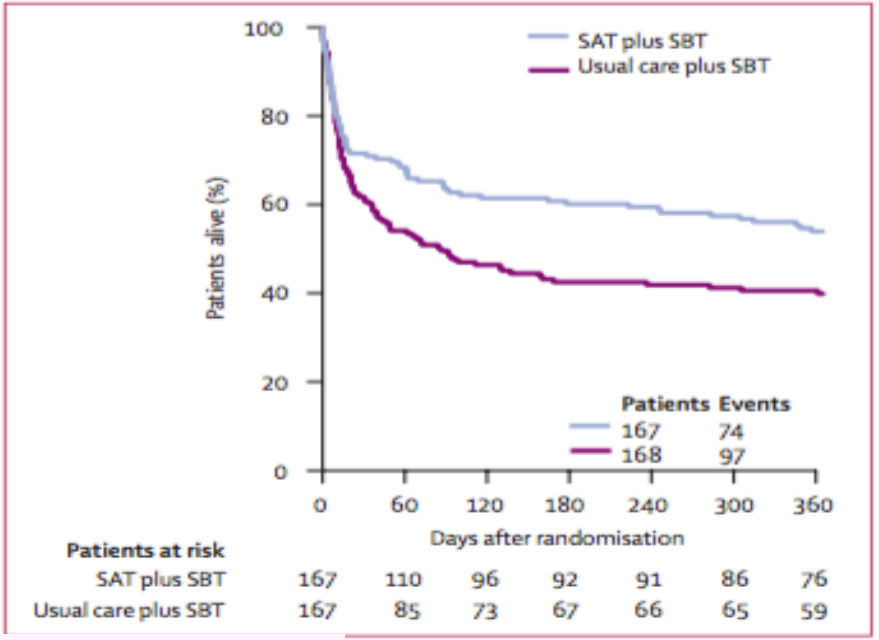
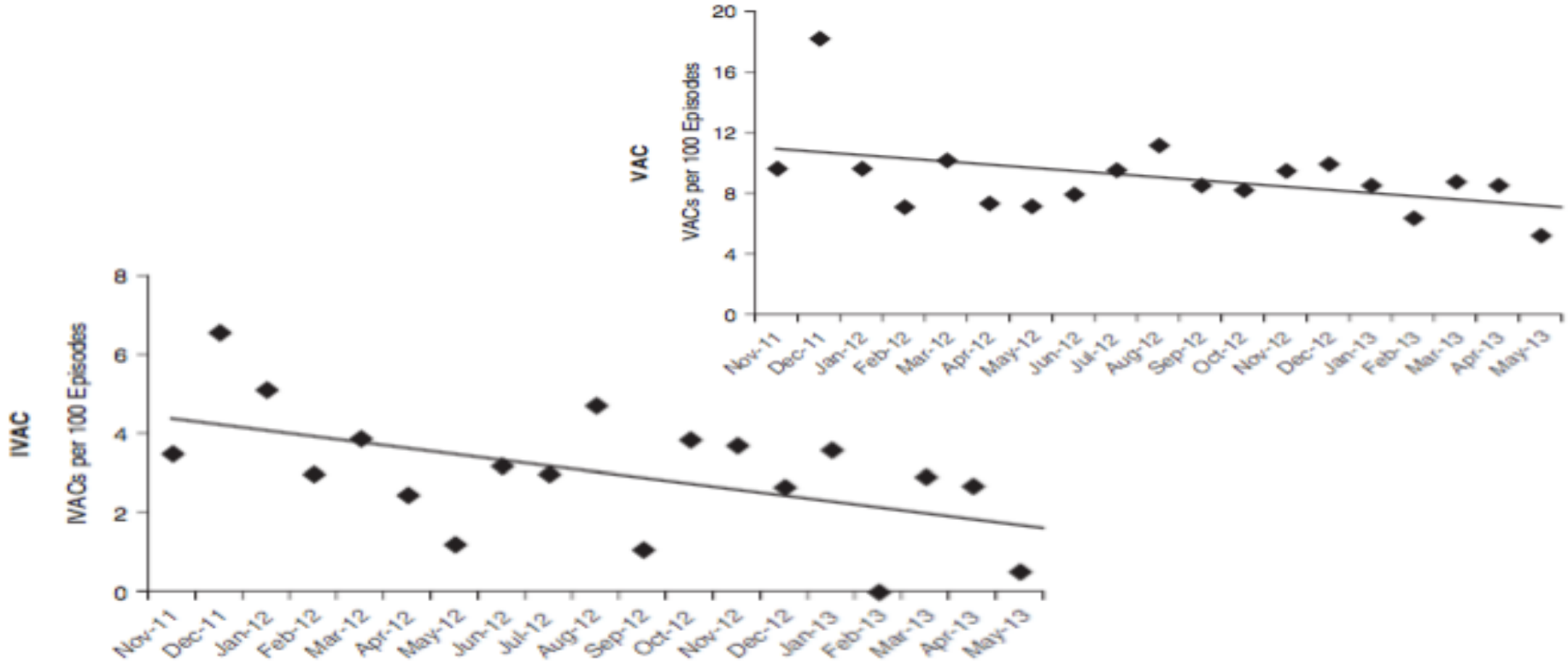




www.thelancet.com **Vol 371 January 12, 2008**

The Preventability of Ventilator-associated Events

The CDC Prevention Epicenters Wake Up and Breathe Collaborative



American Journal of Respiratory and Critical Care Medicine Volume 191 Number 3 | February 1 2015

Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

William D Schweickert, Mark C Pohlman, Anne S Pohlman, Celerina Nigos, Amy J Pawlik, Cheryl L Esbrook, Linda Spears, Megan Miller, Mietka Franczyk, Deanna Deprizio, Gregory A Schmidt, Amy Bowman, Rhonda Barr, Kathryn E McCallister, Jesse B Hall, John P Kress

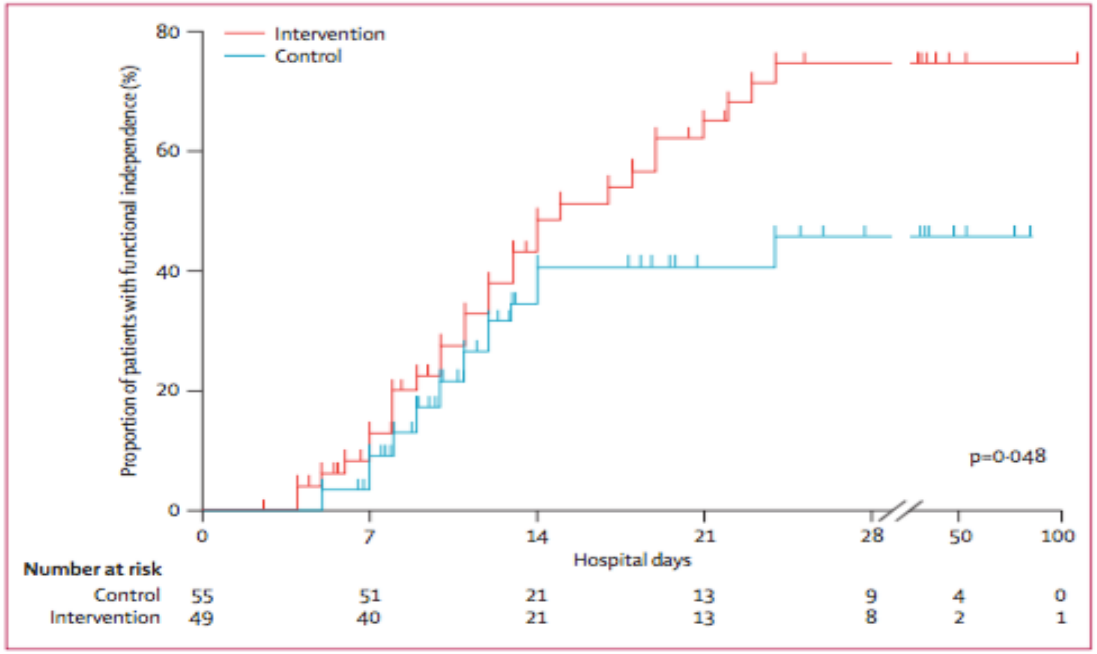


Figure 2: **Probability of return to independent functional status in intervention and control groups**

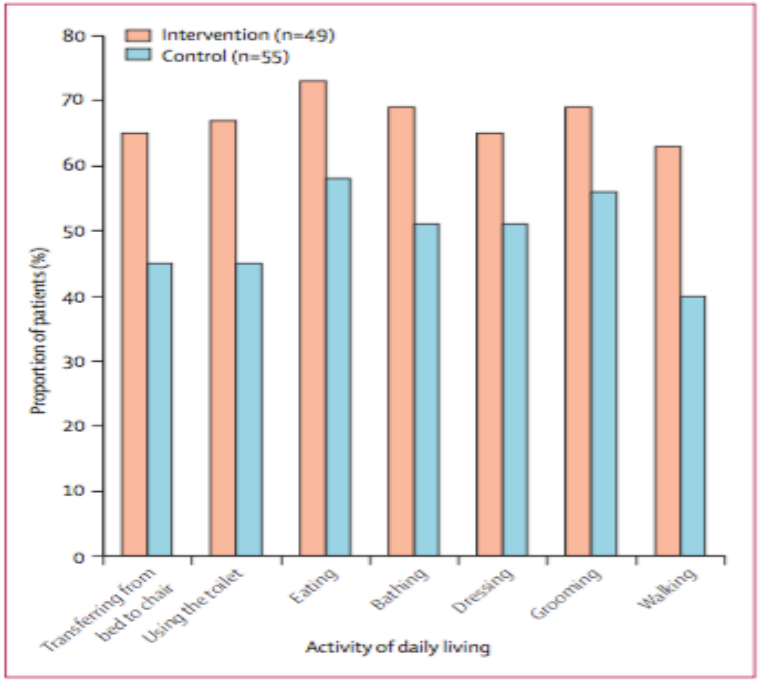
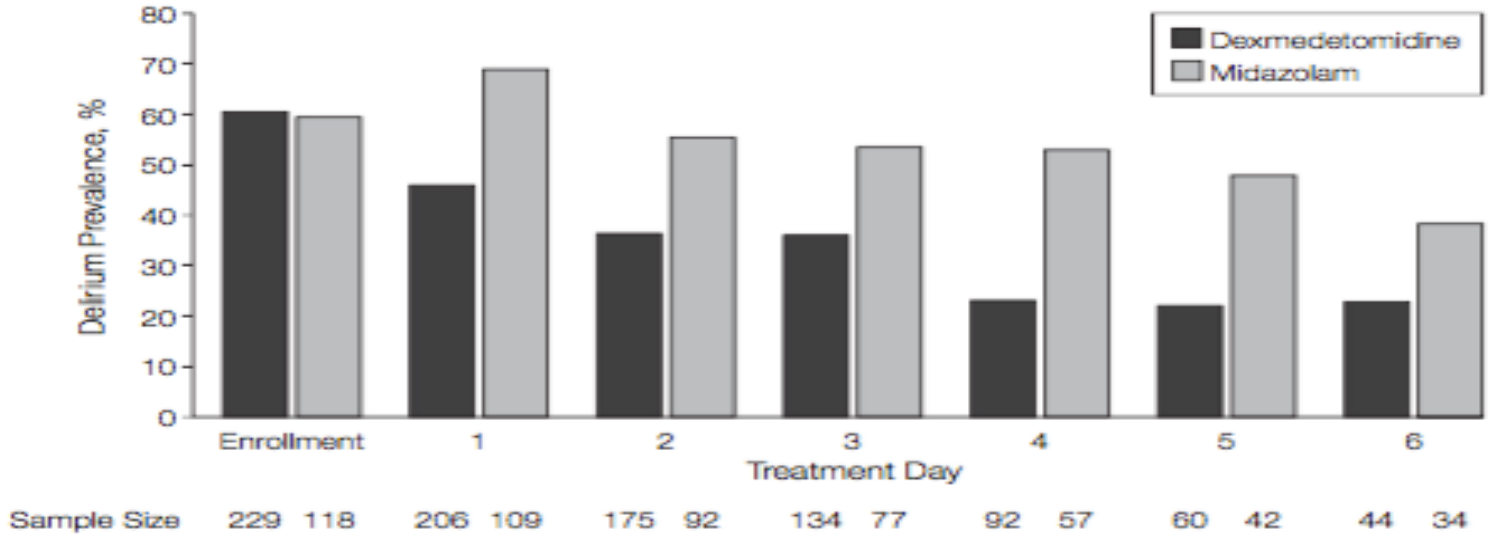


Figure 3: **Proportion of patients able to perform activities of daily living and to walk independently at hospital discharge**

Which sedative? Dexmedetomidine vs .Midazolam?

Dexmedetomidine vs Midazolam for Sedation of Critically Ill Patients
A Randomized Trial

Figure 2. Daily Prevalence of Delirium Among Intubated Intensive Care Unit Patients Treated With Dexmedetomidine vs Midazolam

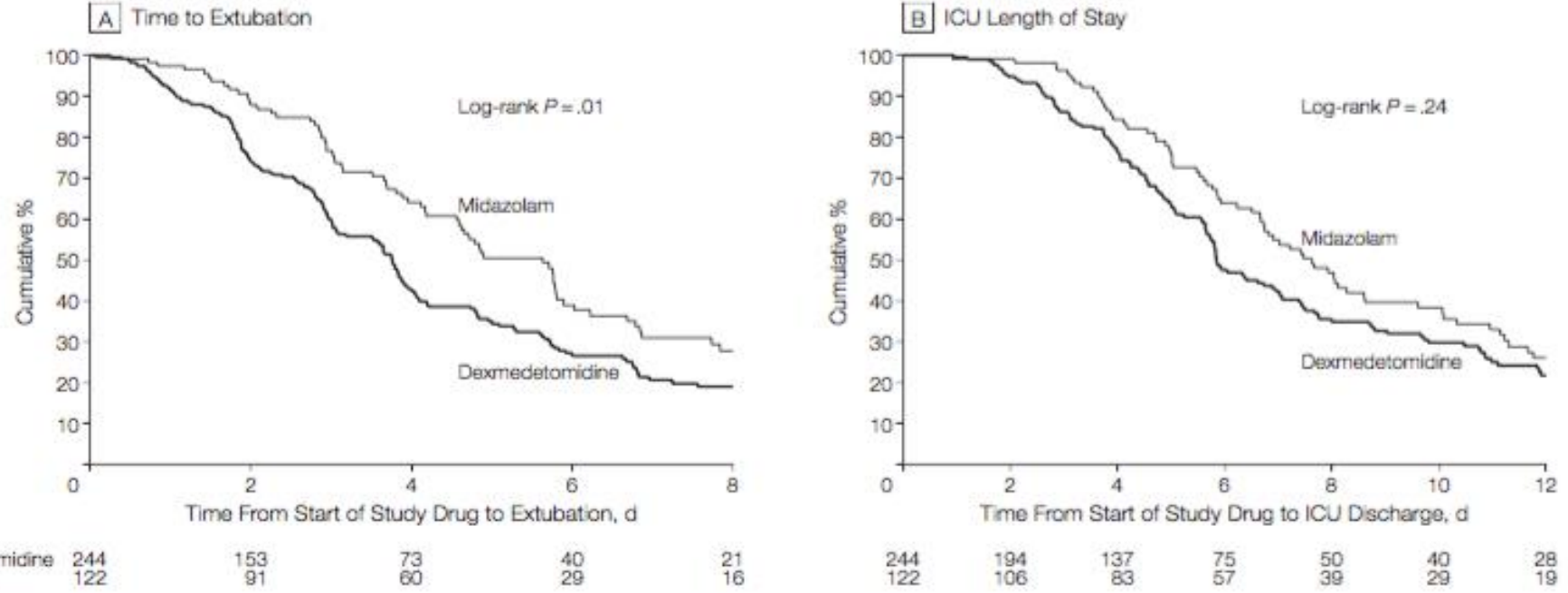


JAMA. 2009 Feb 4;301(5):.489-99

Dexmedetomidine vs Midazolam for Sedation of Critically Ill Patients

A Randomized Trial

Figure 3. Time to Extubation and Intensive Care Unit (ICU) Length of Stay Among Patients Treated With Dexmedetomidine vs Midazolam



No. at Risk							
Dexmedetomidine	244	153	73	40	21		
Midazolam	122	91	60	29	16		
	244	194	137	75	50	40	28
	122	106	83	57	39	29	19

JAMA. 2009 Feb 4;301(5):.489-99

- Long-term Cognitive and Psychological Outcomes in the Awakening and Breathing Controlled Trial – Jackson
  - Am J Respir Crit Care Med Vol 182. pp 183–191, 2010
- Daily sedation interruption in mechanically ventilated critically ill patients cared for with a sedation protocol: a randomized controlled trial. – Mehta
  - JAMA. 2012 Nov 21;308(19):1985-92
- A randomized trial of protocol-directed sedation management for mechanical ventilation in an Australian intensive care unit. – Bucknall
  - Crit Care Med. 2008 May;36(5): .1444-50

No Sedation?

A protocol of no sedation for critically ill patients receiving mechanical ventilation: a randomised trial

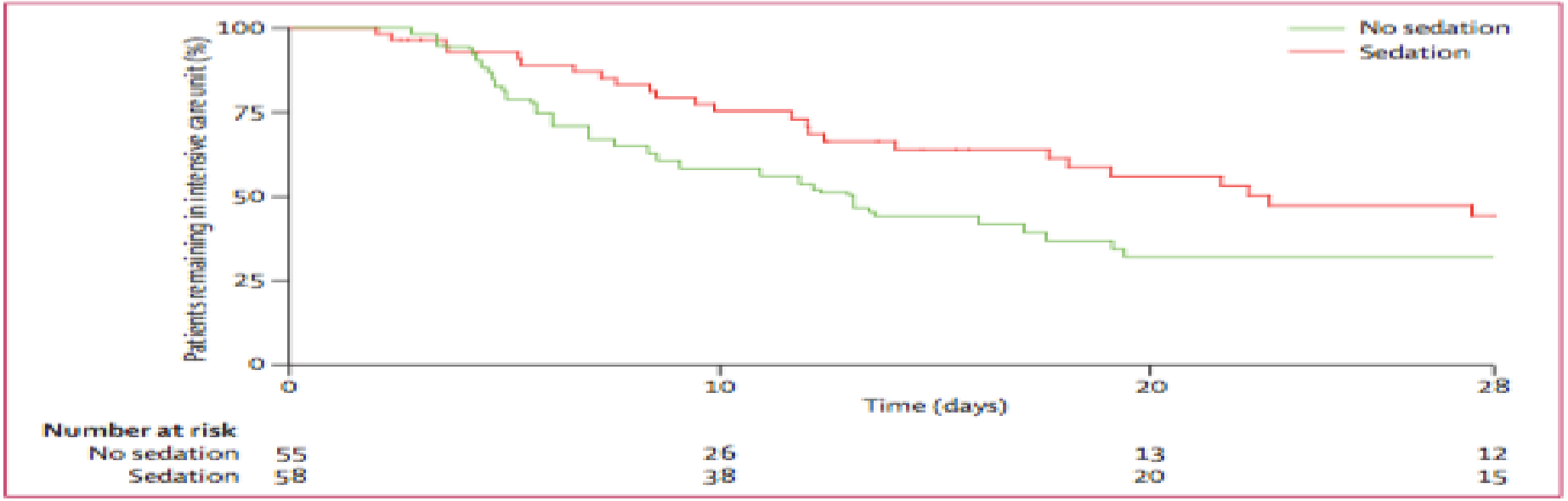


Figure 2: **Kaplan-Meier plot of length of stay in the intensive care unit and number at risk from admission to 28 days**

Lancet. 2010 Feb 6;375(9713):.475-80

Is Anything NEW Under the Sun?

What else can we do to keep our ventilated patients safe??

What's New?

- **Not much?…… in …..2015**
  - Probiotic prophylaxis to prevent ventilator associated pneumonia (VAP) in children on mechanical ventilation: an open-label randomized controlled trial.
  - Randomized controlled study of probiotics containing Lactobacillus casei (Shirota strain) for prevention of ventilator-associated pneumonia.
  - Significant reduction in ventilator-associated pneumonia with the Venner-PneuX System in high-risk patients undergoing cardiac surgery: the Low Ventilator-Associated-Pneumonia study.
  - Randomized intubation with polyurethane or conical cuffs to prevent pneumonia in ventilated patients.
  - The preventability of ventilator-associated events. The CDC Prevention Epicenters Wake Up and Breathe Collaborative.
  - The impact of abdominal massage administered to intubated and enterally fed patients on the development of ventilator-associated pneumonia: a randomized controlled study.
  - Prevention of ventilator-associated pneumonia and ventilator-associated conditions: a randomized controlled trial with subglottic secretion suctioning.

Probiotic prophylaxis to prevent ventilator associated pneumonia (VAP) in children on mechanical ventilation: an open-label randomized controlled trial

Variable	Probiotics group ($n = 70$)	Control group ($n = 72$)	p value
Incidence of VAP	12 (17.1 %)	35 (48.6 %)	<0.001*
VAP rates (per 1,000 ventilated days)	22	39	0.02
Duration of ICU stay (mean ± SD)	7.7 ± 4.60	12.54 ± 9.91	<0.001*
Duration of hospital stay (mean ± SD)	13.13 ± 7.71	19.17 ± 13.51	0.001*
Duration of mechanical ventilation (mean ± SD)	6.24 ± 3.24	10.35 ± 8.87	0.001*
Mortality	17 (24.2 %)	23 (31.9 %)	0.407

Intensive Care Med (2015) 41:677–685

Randomized controlled study of probiotics containing Lactobacillus casei (Shirota strain) for prevention of ventilator-associated pneumonia.

The incidence rates of VAP in the probiotics and control groups were 22.64 and 30.22 episodes per 1,000 ventilator-days, respectively)p = .(0.37

J Med Assoc Thai. 2015 Mar;98(3):.253-9

Significant reduction in ventilator-associated pneumonia with the Venner-PneuX System in high-risk patients undergoing cardiac surgery: the Low Ventilator-Associated-Pneumonia study†

- Subglottic suction
- Low pressure, low volume cuff, no creases
- Self adjusting tracheal seal monitor
- Non stick lining

	Standard ET tube	Venner-PneuX tube	*P*-value
Survival	99%	98%	0.2
VAP incidence, *n* (%)	25 (21%)	13 (11%)	0.03
VAP incidence density[c]	184	52	<0.01

S. Gopal et al. / European Journal of Cardio-Thoracic Surgery

Significant reduction in ventilator-associated pneumonia with the Venner-PneuX System in high-risk patients undergoing cardiac surgery: the Low Ventilator-Associated-Pneumonia study†

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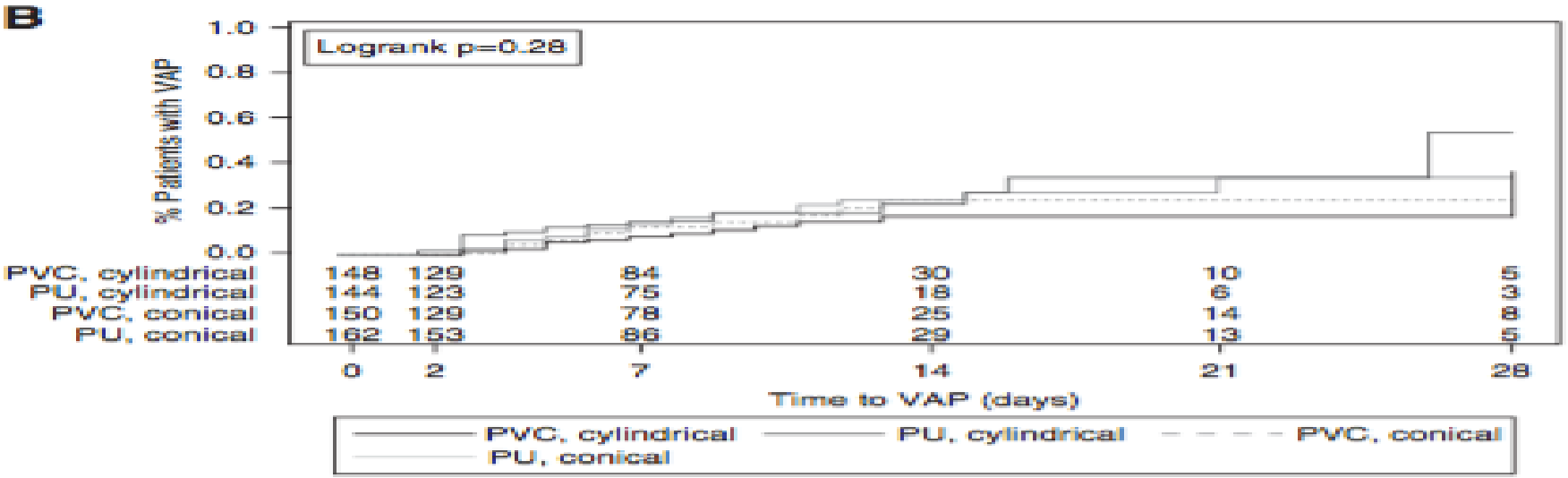
S. Gopal et al. / European Journal of Cardio-Thoracic Surgery

Randomized Intubation with Polyurethane or Conical Cuffs to Prevent Pneumonia in Ventilated Patients



Colonization Risk Factors

- Antibiotic therapy at inclusion HR=0.76 p=0.002
- Type of cuff HR=1.0 p=0.6

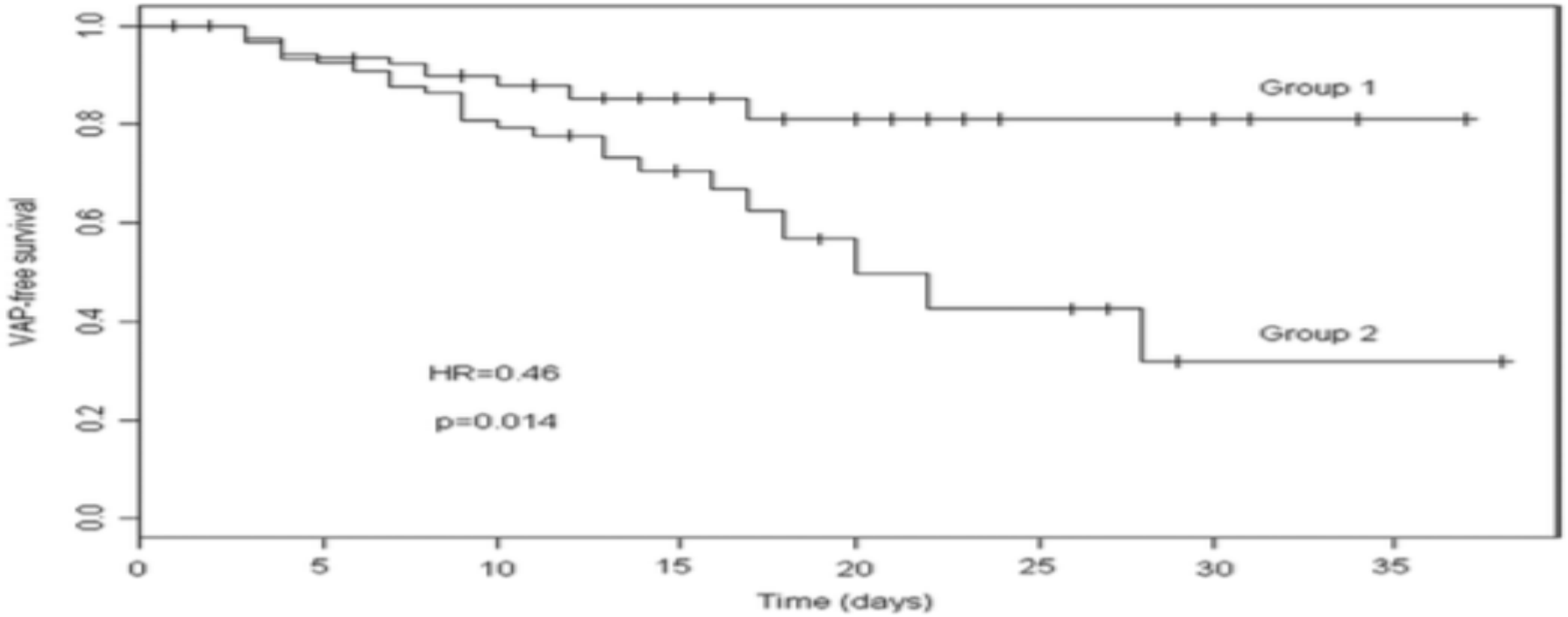
American Journal of Respiratory and Critical Care Medicine Volume 191 Number 6 | March 15 2015

The impact of abdominal massage administered to intubated and enterally fed patients on the development of ventilator-associated pneumonia: a randomized controlled study.

- Twice daily 15 minute abdominal massages
- Reduced gastric residual volumes ($p<0.05$)
- Reduced abdominal circumference
- Ventilator associated pneumonia reduced from 31.3% to 6.3% (NS)

Int J Nurs Stud. 2015 Feb;52(2):.519-24

Prevention of Ventilator-Associated Pneumonia and Ventilator-Associated Conditions: A Randomized Controlled Trial With Subglottic Secretion Suctioning*



Crit Care Med 2015; 43:22– 30

Other Individual Strategies

- Intermittent sedation
- Fluid management
- Avoiding restraints
- Avoiding unnecessary respiratory support
- Subglottic suction
- Better airway care
  - Cuff pressure control, no routine circuit changes
- Selective Digestive Decontamination
- Short course prophylactic antibiotic
- Hand hygiene

Corazu M. Salta BSN.RN

Time for a new Bundle?

Guidelines for the prevention of ventilator-associated pneumonia and their implementation. The Spanish "Zero-VAP" bundle.

They considered 35 potential prevention measures

Med Intensiva. 2014 May;38(4):.226-36

1. Functional 15 Elements

1. Semi-recumbent position
2. Strict hand hygiene with alcohol-based gels or solutions before airway management
3. Education and training in aspiration of bronchial secretions
4. Daily sedation vacation and assessment of weaning and extubation
5. Availability of weaning protocols
6. Early tracheostomy
7. Non-invasive mechanical ventilation
8. Microbiological surveillance of cross-contamination and infection
9. Instillation of normal saline prior to endotracheal suctioning
10. Ventilator tubing change
11. Route of endotracheal intubation. Orotracheal vs. nasotracheal
12. Type of airway humidification. Preference of heat moisture exchanger or heated humidifier
13. Physiotherapy
14. Positive end-expiratory airway pressure (PEEP) of 5–8cmH2O vs. Zero end-expiratory pressure (ZEEP) in patients without lung injury
15. Enteral feeding: route of administration and gastric residual volumes. Use of Prokinetics

2. Mechanical

13 Elements

1. Endotracheal tube cuff pressure monitoring
2. Subglottic secretion drainage
3. Polyurethane-cuffed endotracheal tubes
4. Polyurethane-cuffed endotracheal tubes with subglottic secretion drainage
5. Silver-coated endotracheal tubes
6. High-volume, low-pressure endotracheal tube cuff
7. Small caliber feeding tubes
8. Aspiration of tracheobronchial secretions with closed vs. open systems
9. Endotracheal tube biofilm removal device (Mucus Shaver®)
10. Kinetic bed therapy
11. Airway filters
12. Water-soluble gel lubrication of the endotracheal tube
13. Tooth brushing

3. Pharmacological 7 Elements

.1 Selective decontamination of the digestive tract

.2 Selective oropharyngeal decontamination

.3 Short course of intravenous antibiotic

.4 Oral hygiene with chlorhexidine

.5 Nebulized antibiotics

.6 Antibiotic cycling

.7 Probiotics

Strength of Evidence

Safety

Feasibility

Cost

Med Intensiva. 2014 May;38(4):.226-36

Now it's *YOUR* Turn!

15 minutes to do what the Spanish took months to do!

Rate each intervention on a 1-5 scale for:

Effectiveness, Safety, Feasibility, Cost

We don't have *real* data, so we are going to be creative

Choose 4-5 of the highest priority interventions

Dr. Bill Andrews

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Institute *for* Healthcare Improvement

Spanish Results

Table 3 Mean individual score of measures categorized as ''strong'' recommendation.

	Efficacy	Adverse events	Feasibility	Total
Aspiration of subglottic secretions	70	35	31	136
Avoid filter and tubing changes	76	38	39	153
Semi-recumbent positioning. Avoid 0°	56	36	34	126
Monitoring and control of cuff pressure	61	35	40	136
Oral hygiene with chlorhexidine	74	44	45	163
SDD	88	36	26	150
SOD	86	38	26	150
Short course of intravenous antibiotic	72	30	37	139

Med Intensiva. 2014 May;38(4):.226-36

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Table 4 Quality of evidence of individual components of the VAP prevention bundle. All interventions were categorized as ''highly recommended''.

Intervention	Quality of evidence
Basic mandatory	
1. Education and training in appropriate airway management	Moderate
2. Strict hand hygiene for airway management	Moderate
3. Cuff pressure control	Moderate
4. Oral hygiene with chlorhexidine	Moderate
5. Semi-recumbent positioning. Avoid 0°, if possible	Moderate
6. Promote procedures and protocols which safely avoid or reduce time on ventilator	Moderate
7. Avoid scheduled change of ventilator circuit, humidifiers and endotracheal tubes	High
Highly recommended measures	
1. Selective Decontamination of the Digestive Tract or Selective Decontamination of the Oropharynx	High
2. Aspiration of subglottic secretions	High
3. Short course of intravenous antibiotic	High

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Summary

1. Immobility
2. Invasion
3. Interstitial Edema
4. Injury
5. Immunosuppression
6. Infections
7. Insanity
8. Impaired Circulation

Summary – we can do *better*

How?

A - Awaken

B - Breathing (Allow Spontaneous)

C - Coordinate Awakening and Breathing

D - Delirium (Prevent, Detect and Manage)

E - Exercise and Promote Mobility

And more .....

It has been our pleasure!

Thank you all

In Collaboration with بالتعاون مع
مؤسسة حمد الطبية
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Institute for Healthcare Improvement