Management of Aspiration Pneumonia
The 16th National Congress of Indonesian Society of Respirology –
The 1st Indonesia Chronic Lung Disease International Meeting (ICLIME)
Friday, 1 September 2021

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Aspiration Pneumonia Management in Flood Victims

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Positions:
- Chief Staff of Pulmonologist, RS Univ Indonesia Depok/RSUI (2021 - present)
- Chief of COVID-19 Task Force, RSUI (2020 - present)
- Pulmonologist (Sp.P), Mayapada Hospital Kuningan Jakarta (2020 - present)
- SpP, RSUI (2019 - present)
- SpP, RSUD Tarakan Jakarta (2019 - present)
- Faculty member, Department of Pulmonology and Respiratory Medicine, Faculty of Medicine Universitas Indonesia/FKUI (2019 - present)
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Educational Background:
- SpP(K) Indonesian College of Pulmonology and Respiratory Medicine (2020)
- SpP FKUI (2018)
- Ph.D Hiroshima University Japan (2017)
- M.D. FKUI (2008)

Academics:
Co-supervisor:
- Doctoral student, FKUI: 1
- Postgraduate student, Universitas IPB: 1

Research Subjects:
- Collaborative COVID-19 researches
- *Indoor Air Pollution*, FKUI – Kementerian PUPR – Hiroshima University

Interests: pulmonology and respiratory medicine, website, big data, artificial intelligence, genomics

Presentation Outline

- Flood: Current Situation and Future Projection of the Indonesian Archipelago
- Drowning and Its Sequential Events to Aspiration Pneumonia
- Aspiration Pneumonia in Flood Victims
- Management of Aspiration Pneumonia in Flood Victims
- Summary

Flood: Current Situation and Future Projection of the Indonesian Archipelago

Distribution of Major Disaster Type and Death Victim in Indonesia (1815-2014)

No	Type of Disasters	Event	Victims
1.	Earthquake	297	15,518
2.	Earthquake and Tsunami	10	167,779
3.	Eruption	126	78,627
4.	Floods	5,204	18,860
5.	Floods and Landslide	411	2,294
6.	Landslides	2,254	2,035
7.	Strong Wind	2,879	292
8.	Conflict	108	6,010
9.	Forest Fire	191	10
10.	Drought	1,692	2
	Total	13,172	291,427

Francis Danby, “The Deluge” (1840)

http://dx.doi.org/10.1088/1755-1315/235/1/012012

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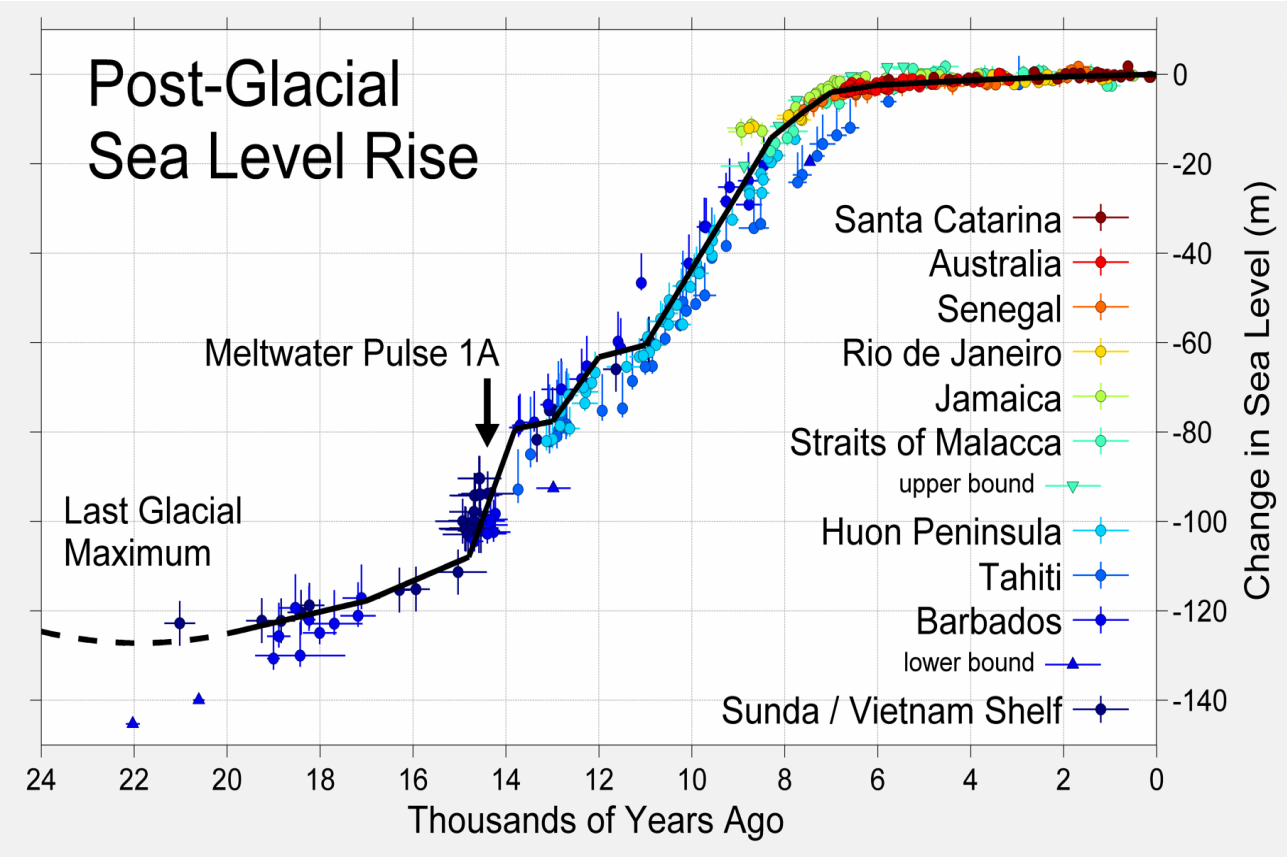
Flood: Current Situation and Future Projection of the Indonesian Archipelago



The Potential Tsunami Map is made based on tsunami event which occurred Indonesia since 1629. About 110 the significant tsunami occurred in Indonesia Since 1629 until 2017 and 100 tsunami caused by tectonic earthquake, 9 tsunami Caused by volcanic activity in the sea and 1 tsunami caused by landslide in the sea. North of West and Central Java is read line is caused by Krakatau explosion on 1883

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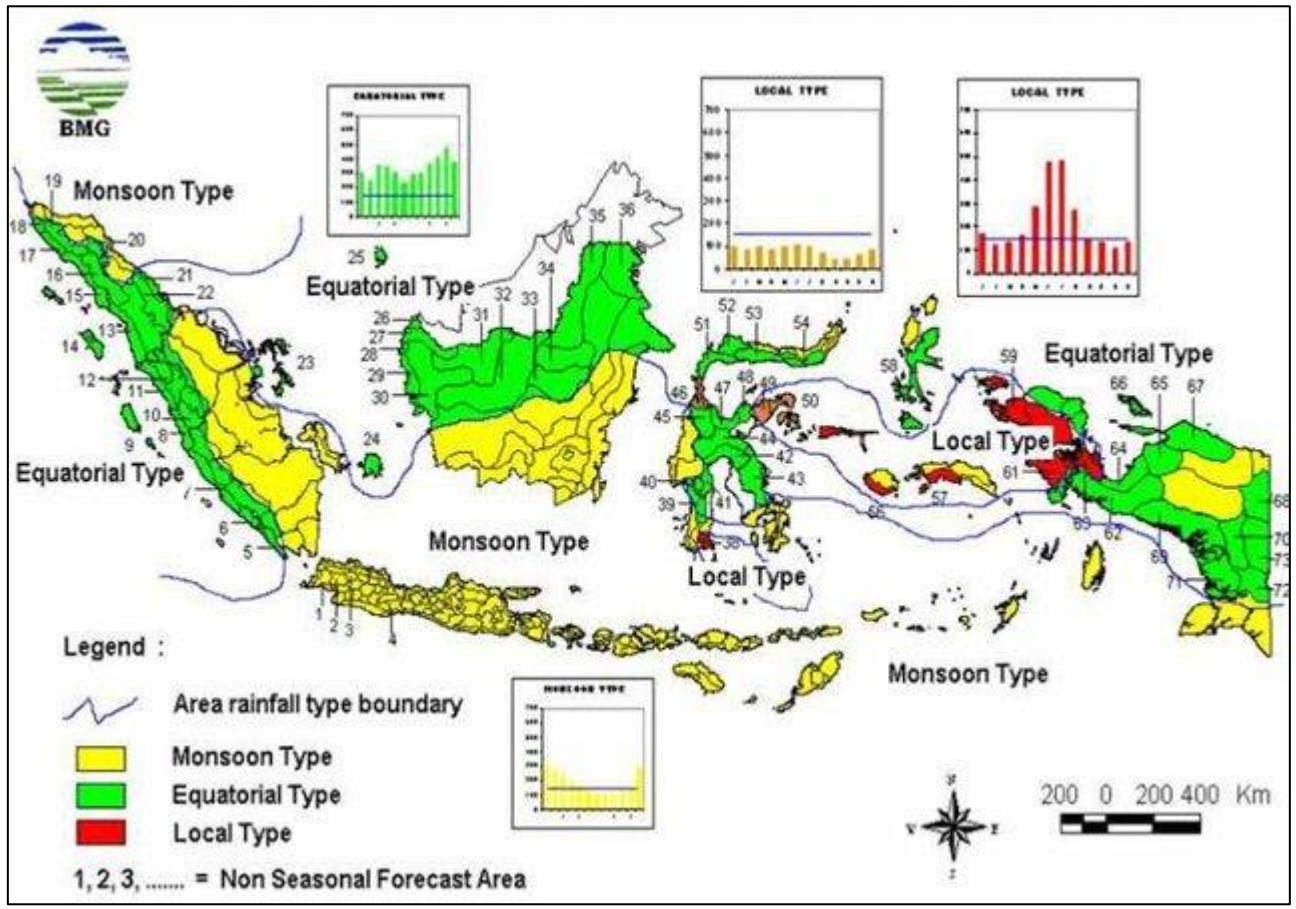
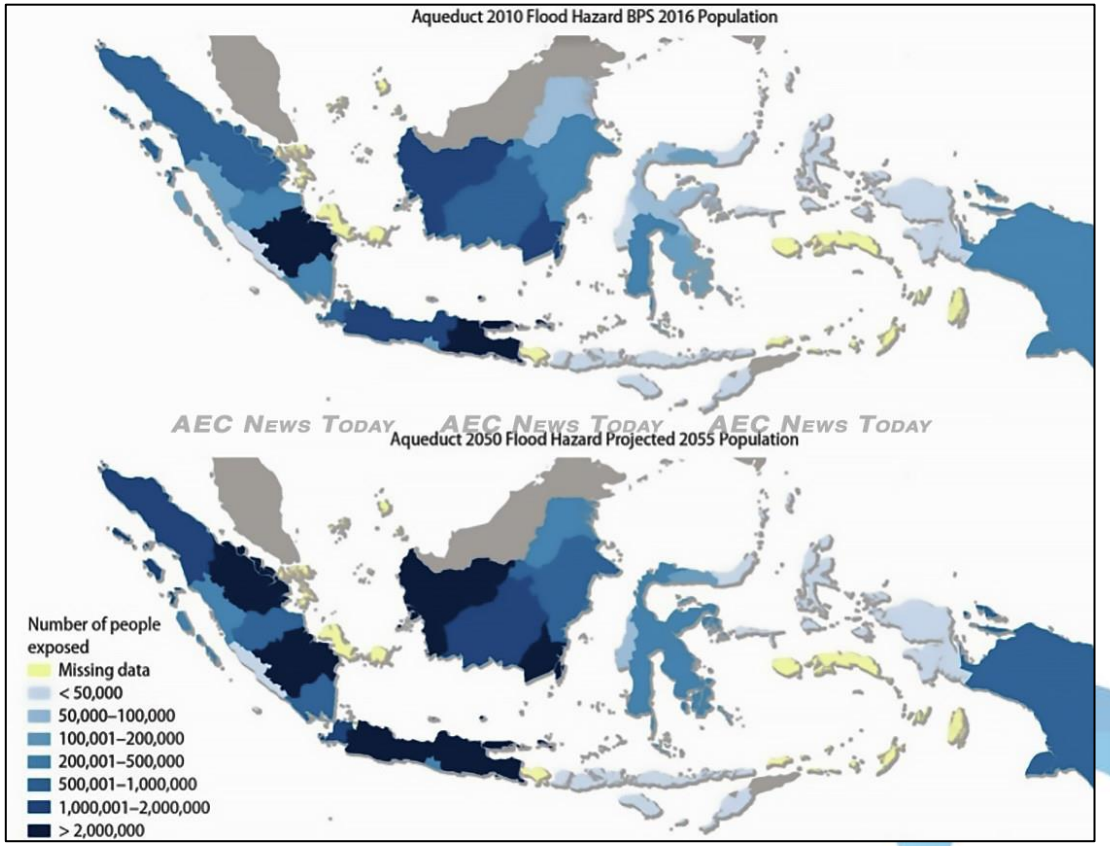


Map of rainfall distribution in Indonesia (source: BMKG, 2015)



Projection of flood hazard map of Indonesia (source: BPS, 2016)

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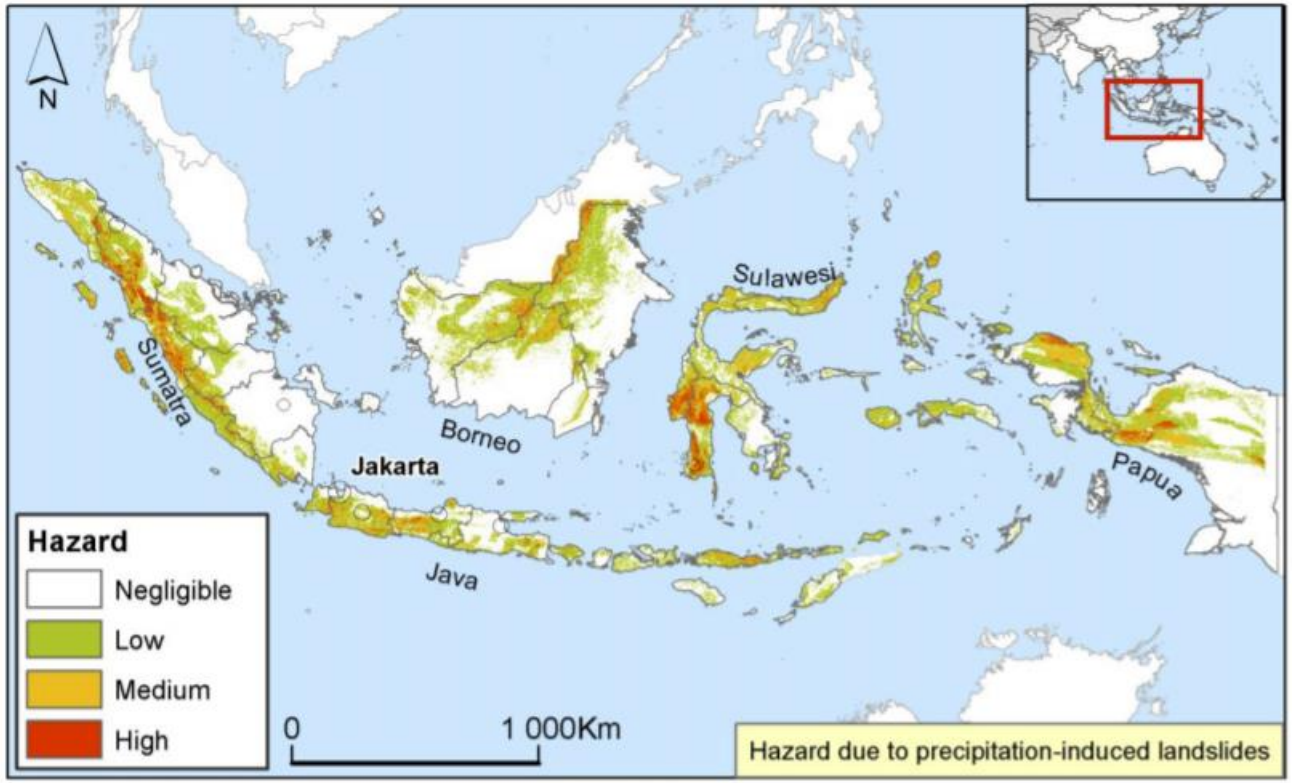

Figure 4. Map of precipitation-triggered landslides hazard distribution for Indonesia.

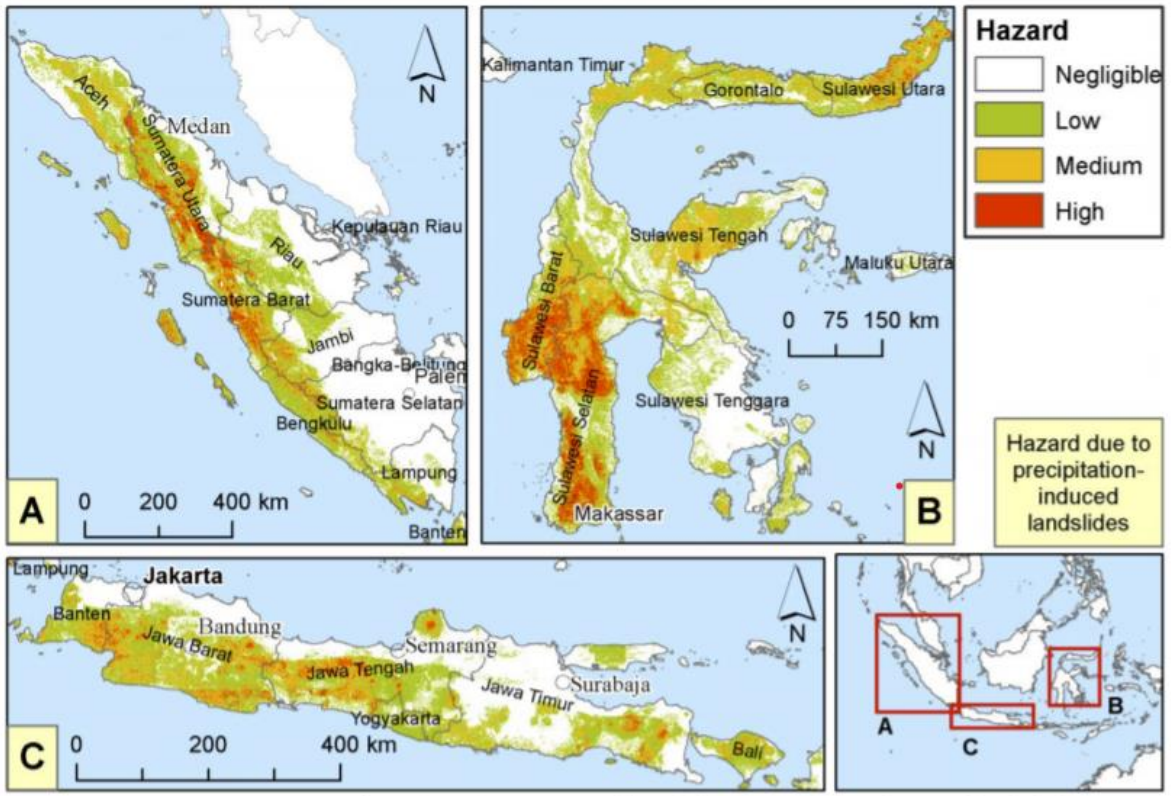

Figure 5. Maps of precipitation-triggered landslides hazard distribution for: (A) Sumatra, (B) Sulawesi, and (C) Java and Bali.

http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Cepeda_et_al._2010.pdf

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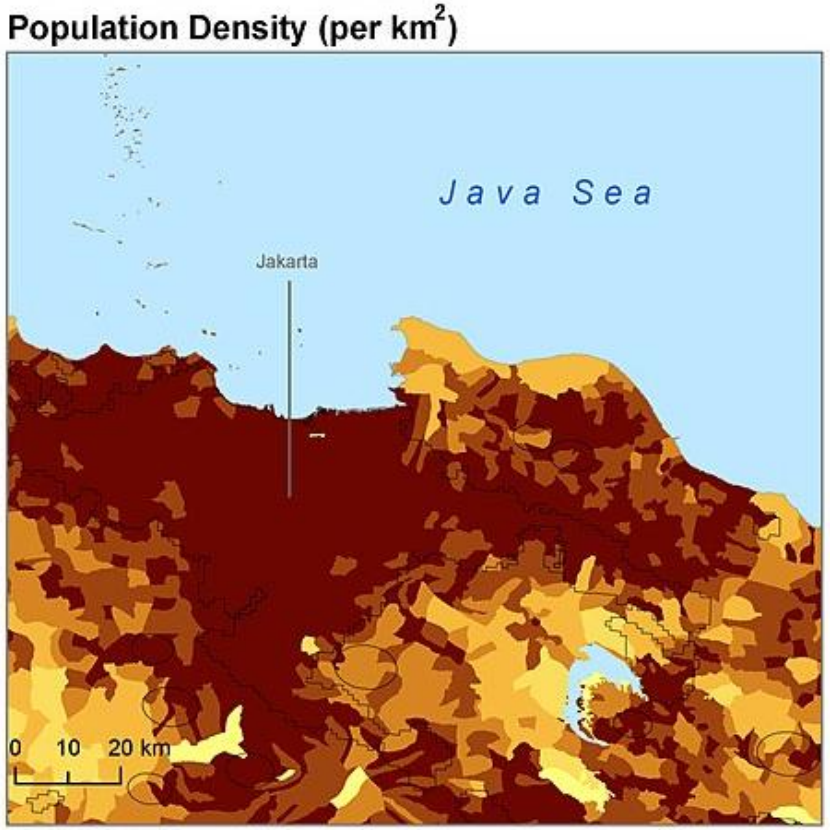

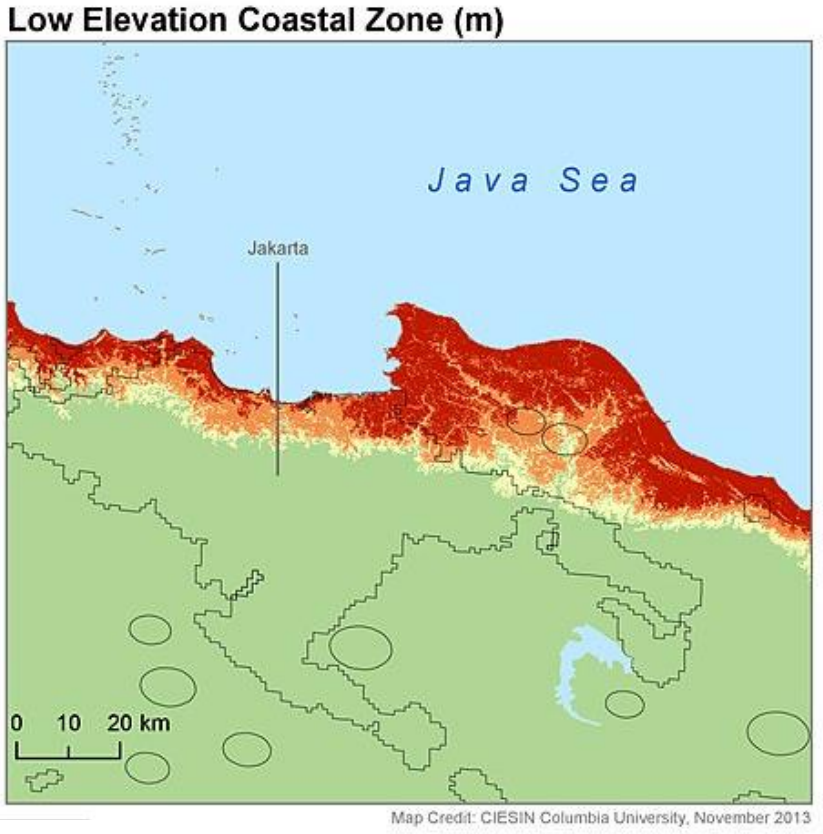

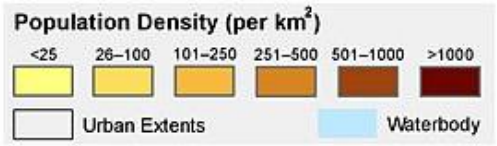

https://sedac.ciesin.columbia.edu/

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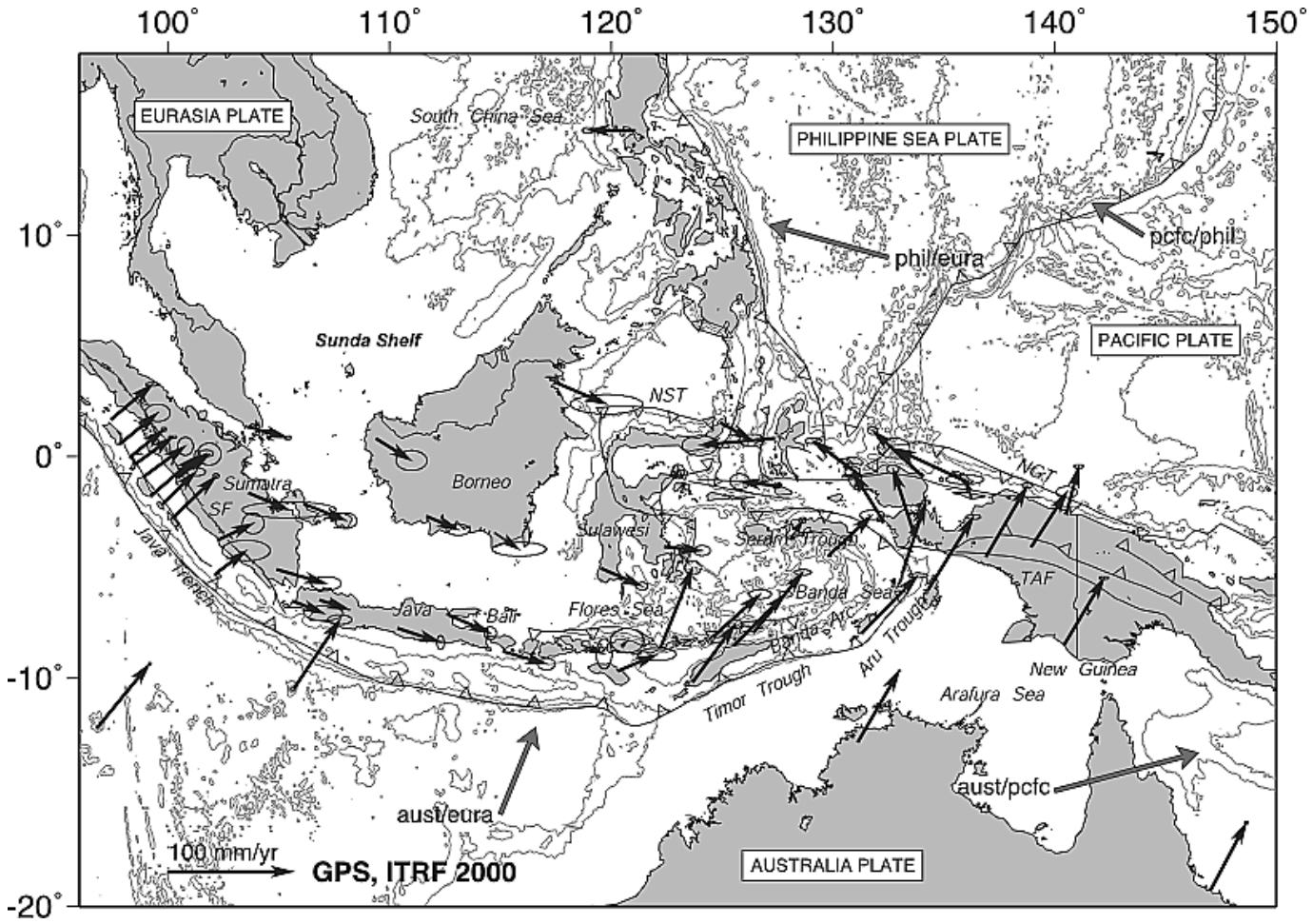

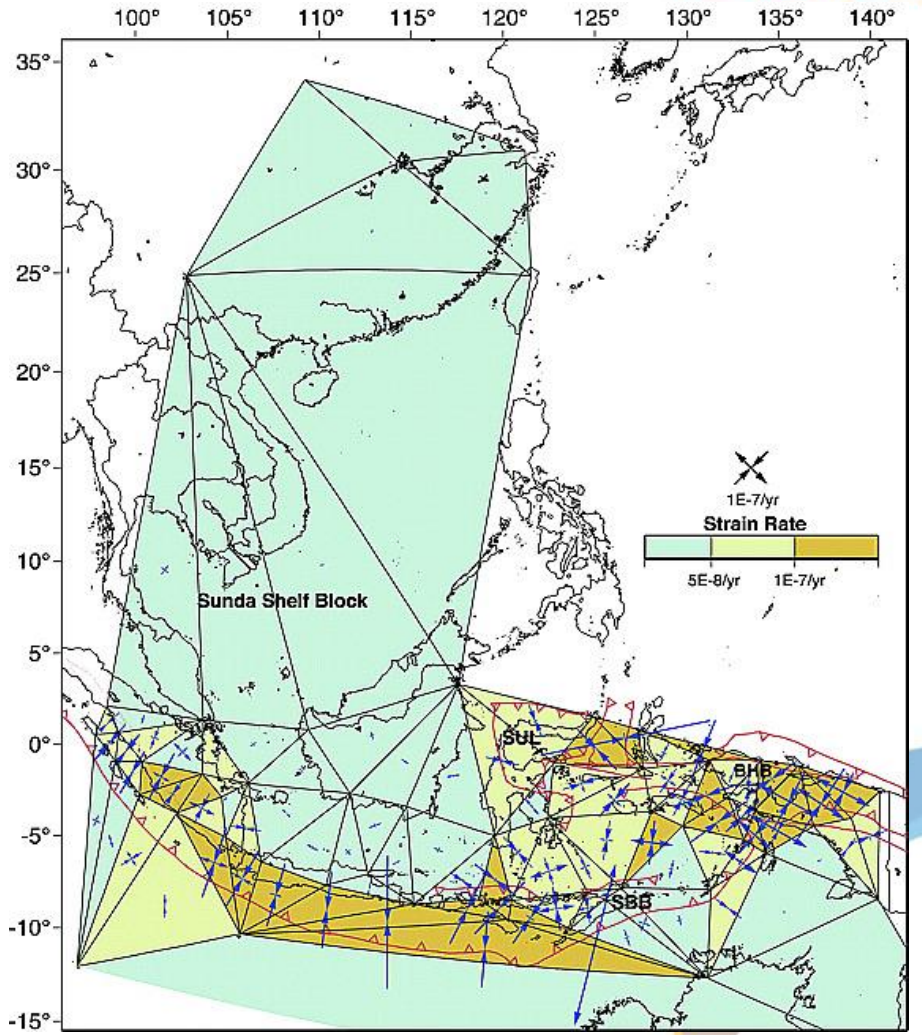

https://doi.org/10.1029/2001JB000324

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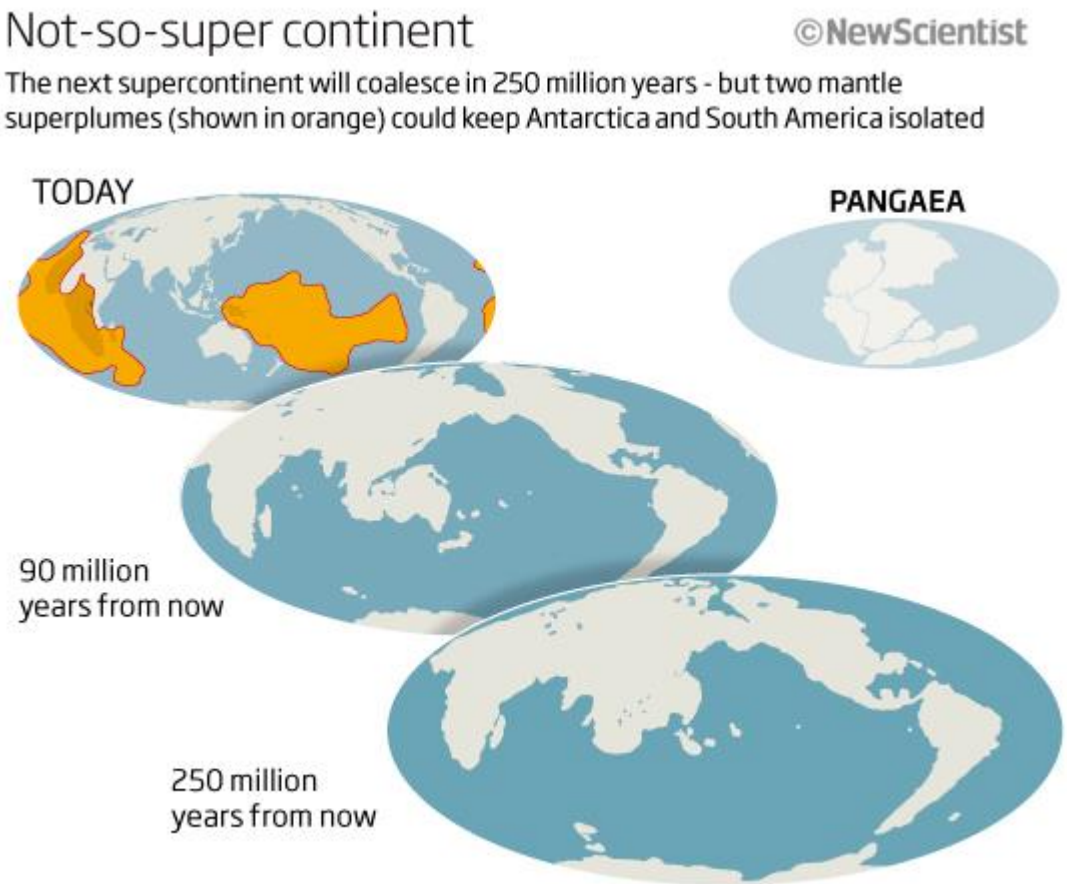
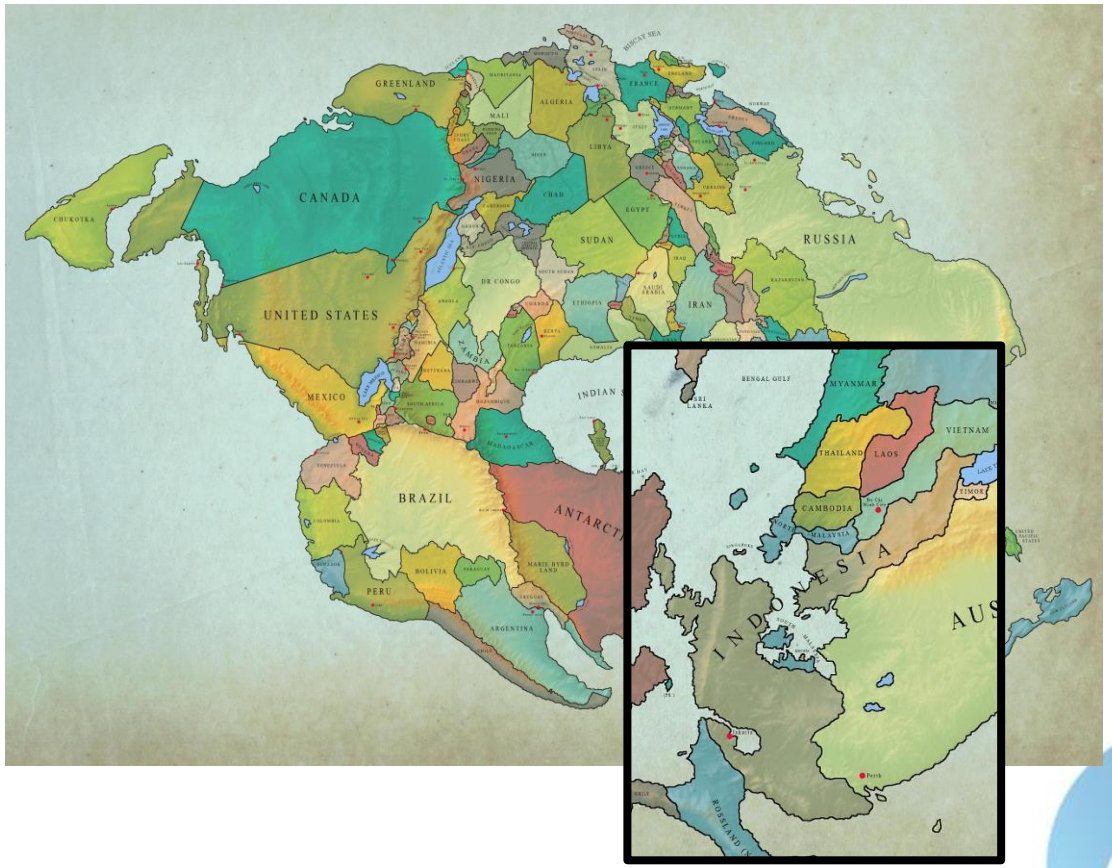
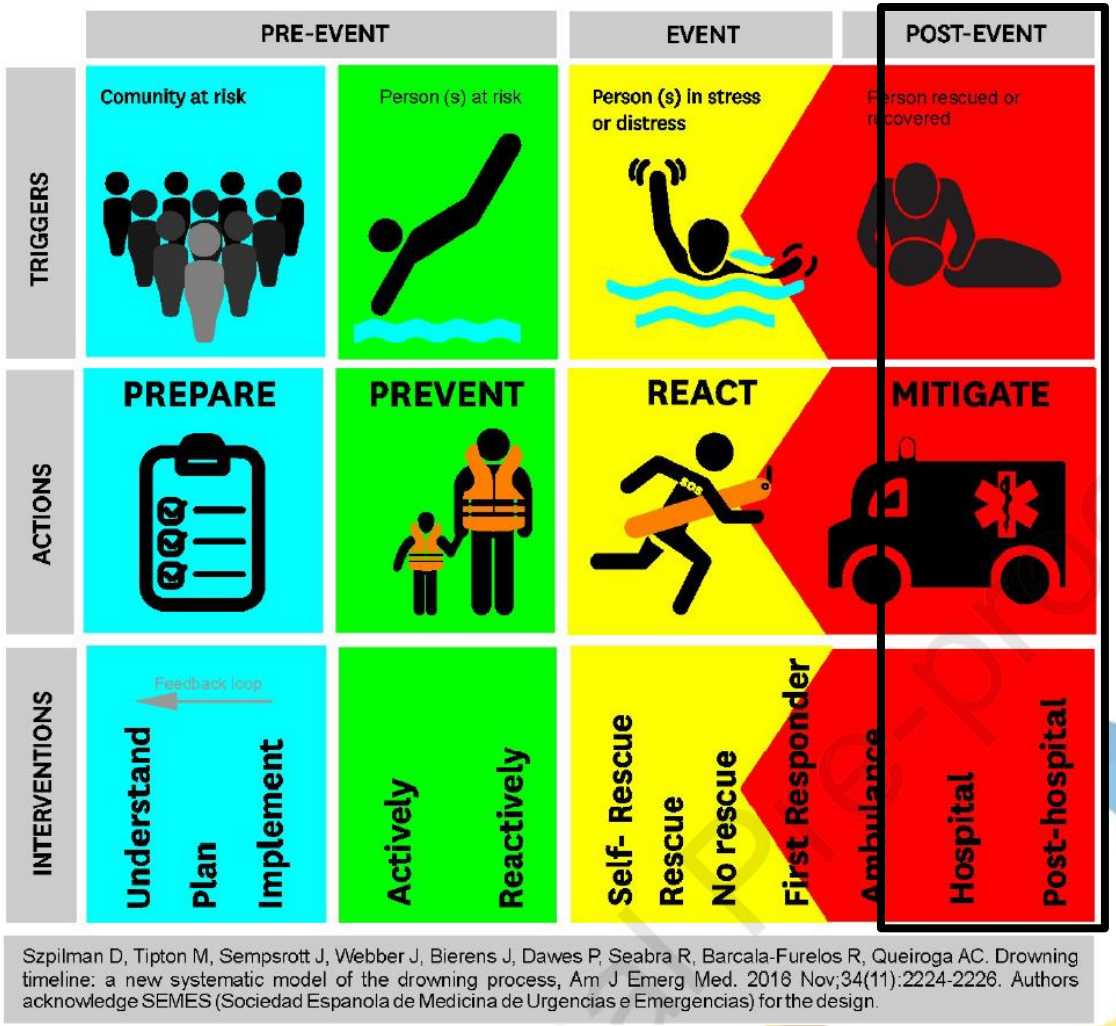




Drowning and Its Sequential Events to Aspiration Pneumonia

https://doi.org/10.1016/j.chest.2020.10.007



Szpilman D, Tipton M, Sempsrott J, Webber J, Bierens J, Dawes P, Seabra R, Barcala-Furelos R, Queiroga AC. Drowning timeline: a new systematic model of the drowning process, Am J Emerg Med. 2016 Nov;34(11):2224-2226. Authors acknowledge SEMES (Sociedad Espanola de Medicina de Urgencias e Emergencias) for the design.

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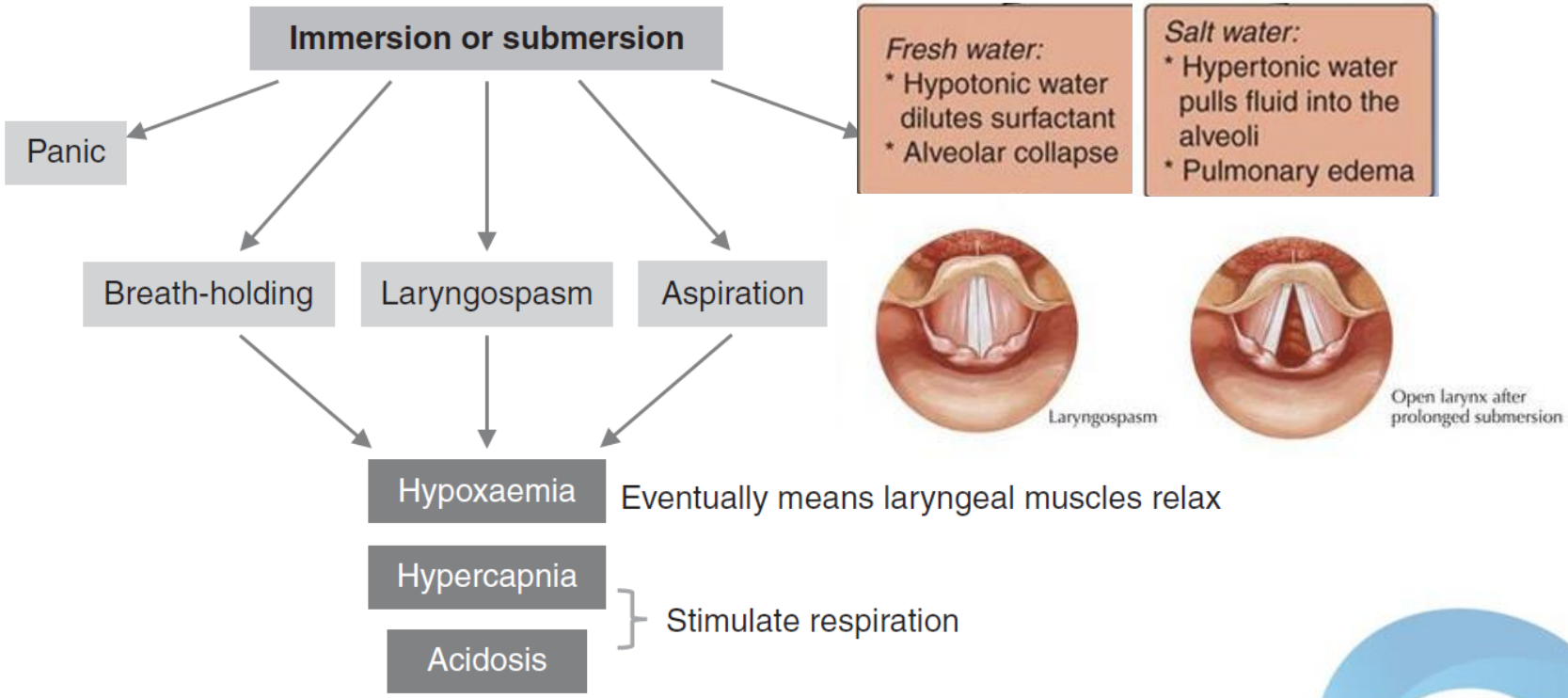
Drowning and Its Sequential Events to Aspiration Pneumonia

Drowning

Process of experiencing respiratory impairment from submersion or immersion in liquid.

If the victim is rescued at any time, the process of drowning is interrupted**: a *non-fatal drowning*.** If the victim dies at any time this is ***fatal drowning.***

Terms such as “near-drowning”, “dry or wet drowning” and “secondary drowning” should not be used.



https://doi.org/10.1017/9781108233712.034
https://doi.org/10.1016/j.chest.2020.10.007
https://doctorlib.info/pediatric/schafermeyers-pediatric-emergency-medicine/136.html

Drowning and Its Sequential Events to Aspiration Pneumonia

Incidence

Lee et al.:12 pulmonary infections among 102 drowning cases (11%)
Cerland et al.: 22 pulmonary infections among 144 drowning cases (15%)
Oakes et al.:16 pulmonary infections among 40 drowning cases 40%)
Kennedy et al.: 7 pulmonary infections among 13 drowning cases (54%)

Morbidity and Mortality

Common cases: males, children, and otherwise healthy subpopulation
Case fatality rate: **up to 60%**
Neurological sequelae exists

https://dx.doi.org/10.3390%2Fijerph14111402
https://doi.org/10.1097/00005373-198207000-00004
https://doi.org/10.1097/00006565-199206000-00002
https://doi.org/10.1086/515532
Ann Acad Med Singap. 1998;27(3):344-6

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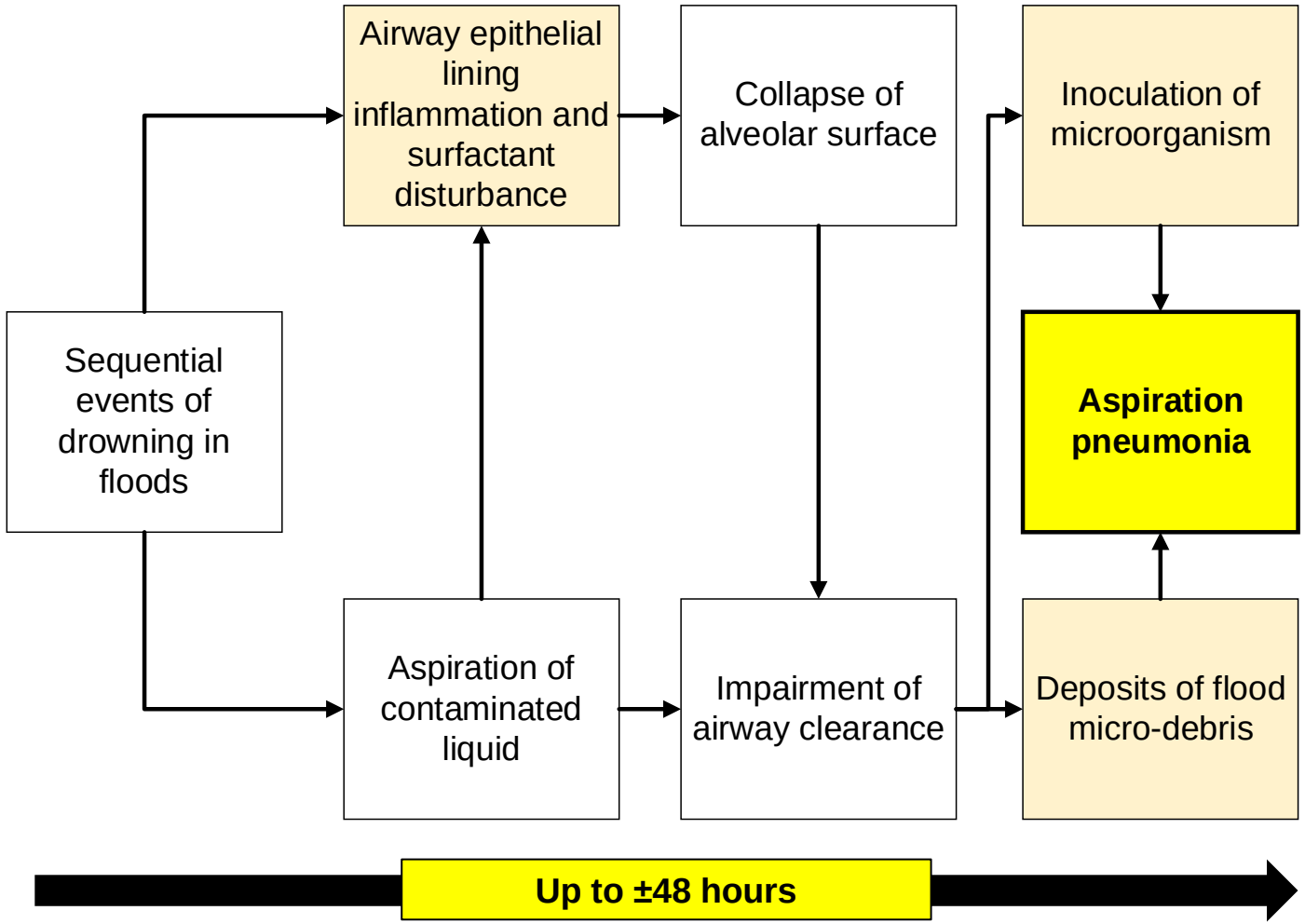

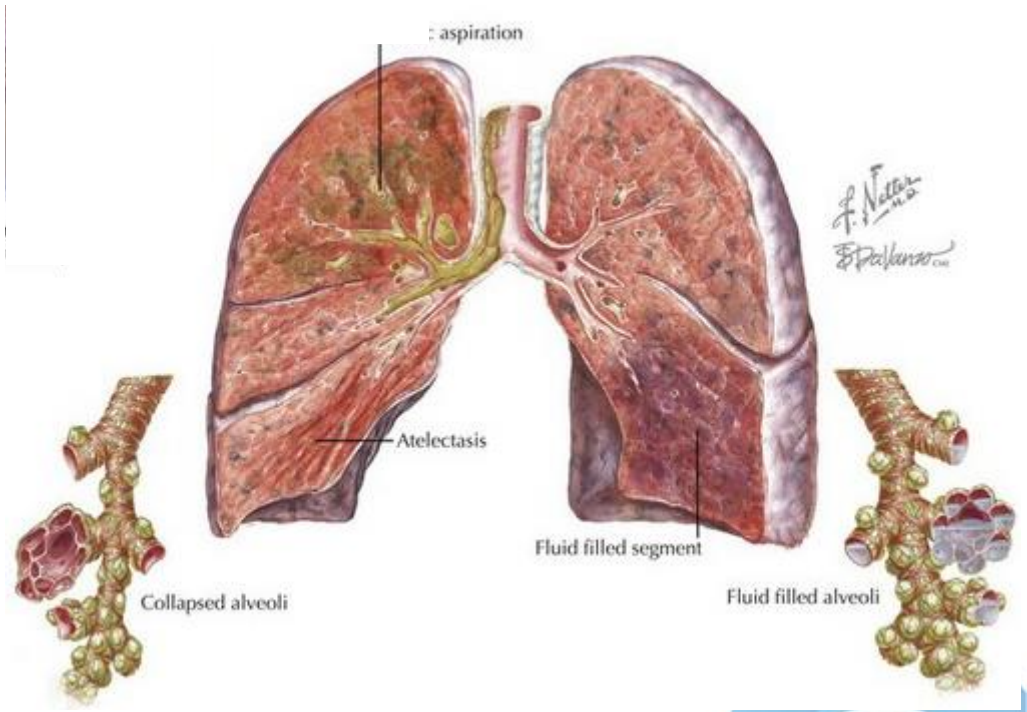

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https://www.ncbi.nlm.nih.gov/books/NBK430833/
https://doi.org/10.1038/s41572-021-00259-0
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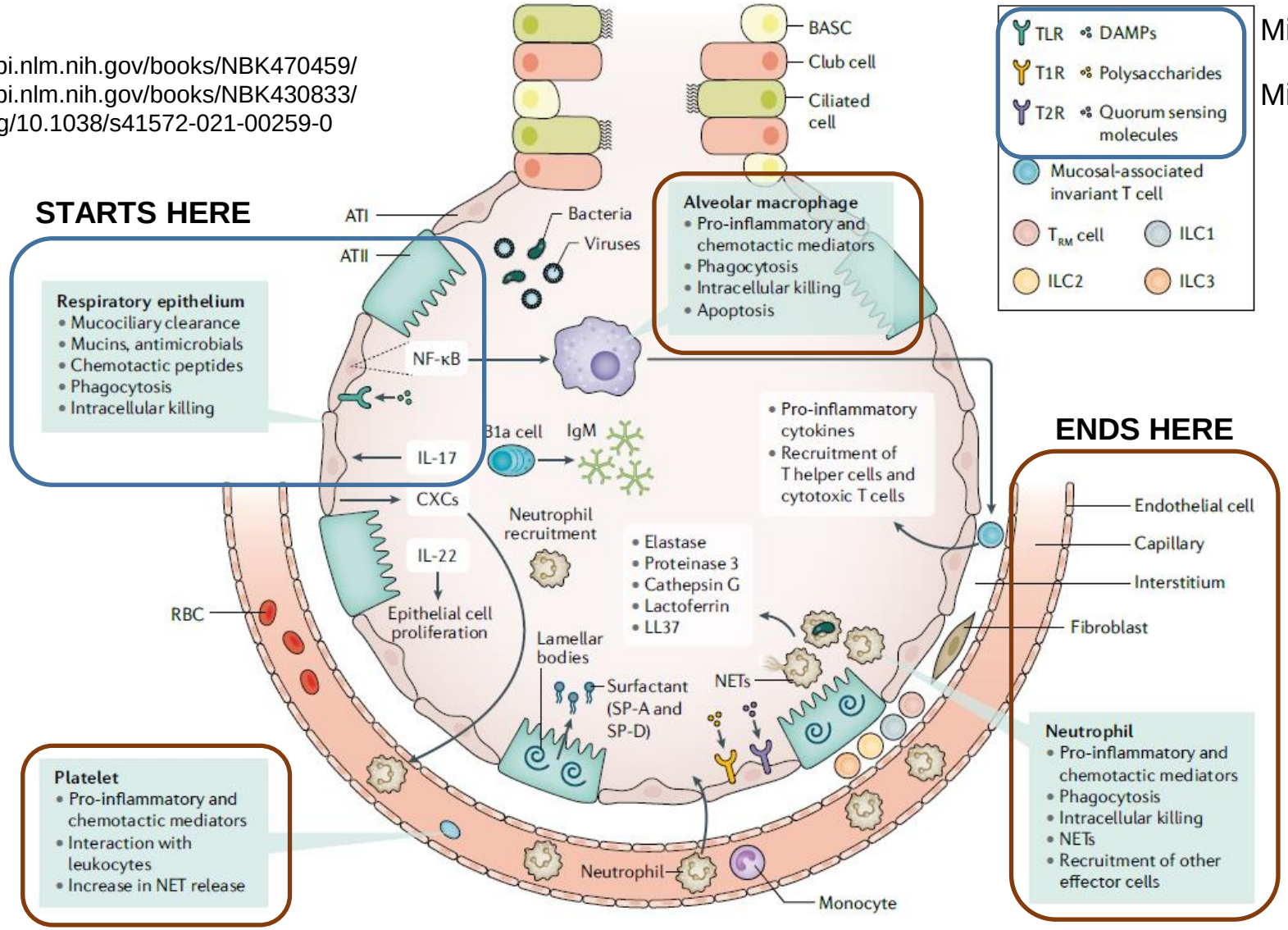
Micro-debris

Microorganisms



Increased capillary–alveolar permeability can result in decreased lung compliance, increased right-to-left shunting in the lungs, atelectasis, and alveolitis

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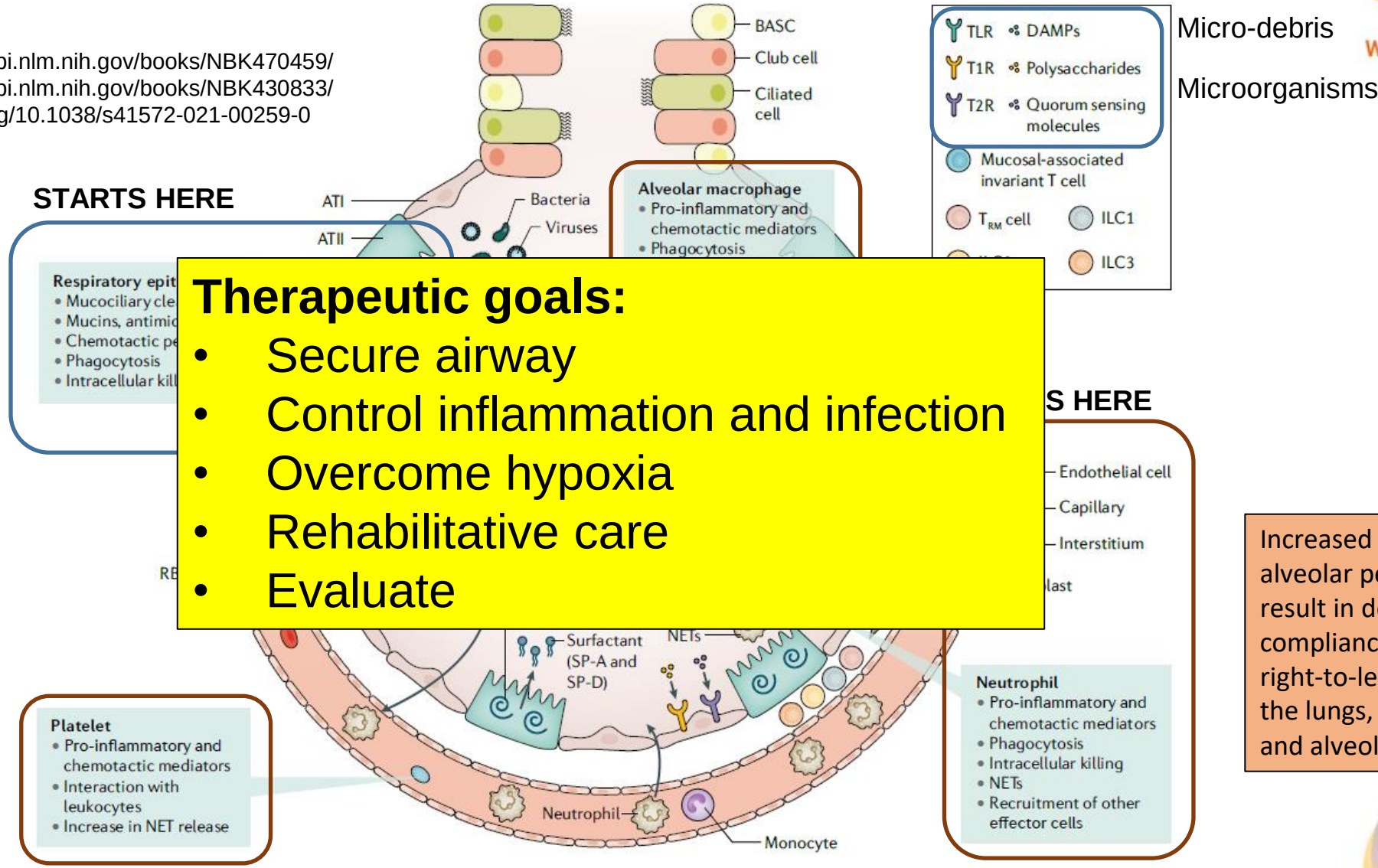

Therapeutic goals:

- Secure airway
- Control inflammation and infection
- Overcome hypoxia
- Rehabilitative care
- Evaluate

Increased capillary–alveolar permeability can result in decreased lung compliance, increased right-to-left shunting in the lungs, atelectasis, and alveolitis

Aspiration Pneumonia in Flood Victims

Type of organisms causing drowning associated pneumonia.

Organism	*n*
Aeromonas spp.	5[a]
Pseudomonas aeruginosa	3
Escherichia coli	2
Citrobacter koseri	1
Enterobacter cloacae	1
Haemophilius spp.	5
Streptococcus pneumoniae	3
Staphylococcus aureus	1
No germ	2
Oral flora	3
Multiple germs	5

[a] Two patients died of ARDS due to drowning associated pneumonia treated with the amoxicillin-clavulanate association.

http://dx.doi.org/10.1016/j.resuscitation.2011.08.023

Table 2. Type of environmental exposure related to organisms causing near-drowning-associated pneumonia.

Organism	Freshwater	Saltwater	Contaminated, stagnant water
Aerobic gram-negative bacteria			
Aeromonas species	+++	+	+
Burkholderia pseudomallei	++		+
Chromobacterium violaceum	++		++
Francisella philomiragia	?	++	
Klebsiella pneumoniae		+	
Legionella species	+		
Neisseria mucosa		+	
Pseudomonas aeruginosa	+	?	++
Shewanella putrefaciens		+	
Vibrio species	?	+	
Aerobic gram-positive bacteria			
Streptococcus pneumoniae	++	+	
Staphylococcus aureus	?	?	
Fungi			
Aspergillus species	?	+	+
Pseudallescheria boydii	?	?	+++

NOTE. Data are as follows: +++ = frequently reported; ++ = occasionally reported; + = rarely reported; and ? = Potential cause of illness on the basis of environmental isolation.

https://doi.org/10.1086/515532

Organism	No. of cases			Case fatality rate	Unique epidemiology or comorbid condition(s) (no. of patients)	Time of near-drowning to pneumonia (no. of patients)	Comments (no. of patients)[§]
	Definite*	Probable[†]	Possible[‡]				
Aerobic gram-negative bacteria							
Aeromonas species	8	3	0	7/11	Cirrhosis (1)	Within 24 h (8)	Bacteremia (8)
Burkholderia pseudomallei	6	0	0	5/6	Location, Southeast Asia (5)	All illnesses occurred within 2 w	Lung cavity (1); miliary (4) and focal consolidation (1); bacteremia (4)
Chromobacterium violaceum	0	2	2	0/3	Location, Florida (3)	Delayed onset, >1 mo (3/4)	Hepatic abscess (3); bacteremia (3)
Francisella philomiragia	0	3	2	1/5	. . .	Within 5 days (5)	Bacteremia (5)
Klebsiella pneumoniae	0	0	1	0/1	. . .	Within 4 days (1)	. . .
Legionella species	0	3	0	2/3	Chronic lymphocytic leukemia (1)	Within 4 days (2); delayed onset, 6 w (1)	. . .
Neisseria mucosa	0	1	0	1/1	Alcoholism (1)	Within 24 hours (1)	Bacteremia (1)
Pseudomonas aeruginosa	2	2	0	2/4	Near-drowning in hot tub (3)	Within 5 days (4)	Bacteremia (2)
Shewanella putrefaciens	0	0	1	0/1		Within 4 days (1)	. . .
Vibrio species	0	0	2	2/2		Within 4 days (2)	Bacteremia (1)
Aerobic gram-positive bacteria							
Streptococcus pneumoniae	3	0	2	3/3	All <11 y of age	Within 24 h (3)	Bacteremia (5)
Staphylococcus aureus	0	0	1	?			
Fungi							
Aspergillus species	0	1	0	0/1		Within 7 days (1)	. . .
Pseudallescheria boydii	5	4	1	8/10	Chronic liver disease (1); diabetes mellitus (1)	Onset delayed >1 mo (3)	Disseminated infection, most commonly CNS (9)

* Definite = chest radiographic evidence of pneumonia or histopathologic evidence of pneumonia and a positive culture of a specimen from a normally sterile site (blood, pleural fluid, or CSF) and a positive culture of an airway specimen (same organism isolated from the sterile sight).

[†] Probable = chest radiographic evidence of pneumonia or histopathologic evidence of pneumonia and a positive culture of a specimen from a normally sterile site (blood, pleural fluid, or CSF) or a positive culture of an airway specimen.

[‡] Possible = chest radiographic evidence of pneumonia or histopathologic evidence of pneumonia or a positive culture of a specimen from a normally sterile site (blood, pleural fluid, or CSF) or a positive culture of an airway specimen.

[§] Denominator reflects number of patients for which information was available.

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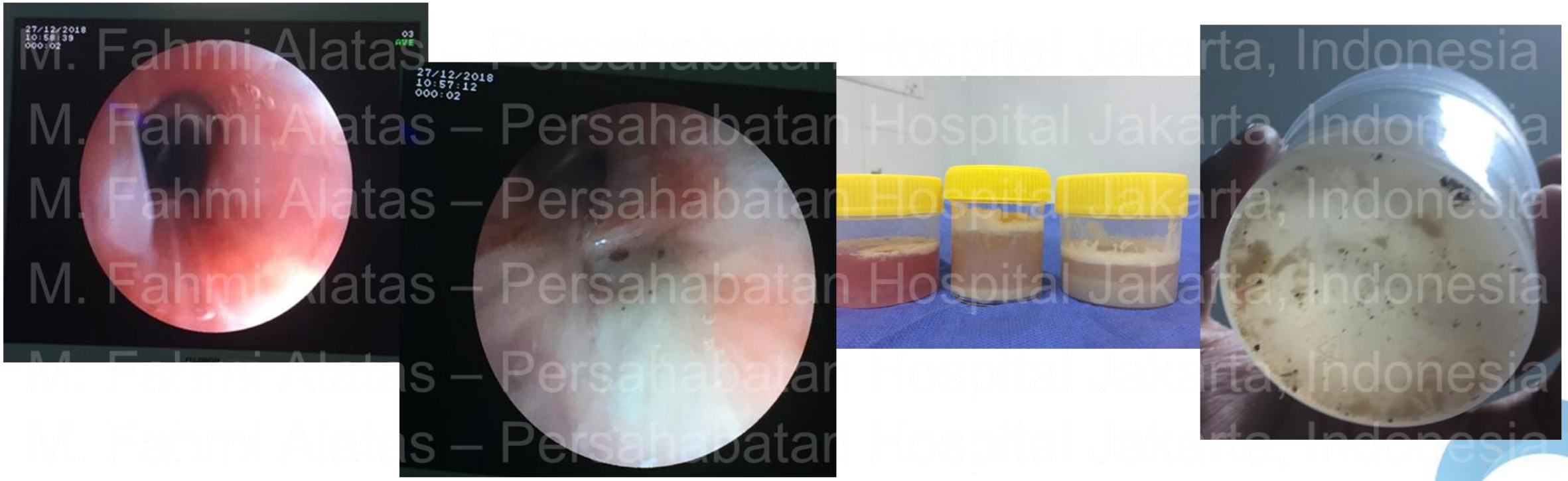
Aspiration Pneumonia in Flood Victims

Micro-debris deposits as observed and obtained using bronchoscopy



Courtesy of **M. Fahmi Alatas, M.D.** (National Respiratory Referral Hospital Persahabatan – Dept of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia)

Management of Aspiration Pneumonia in Flood Victims

History Taking (if possible, or from witnesses) **& Physical Exams**

- Incidence details, preexisting illness
- Symptoms & signs: cough, breathlessness, consciousness impairment, fever or hypothermia, shock, cyanotic appearance, lung sounds, apneic, etc

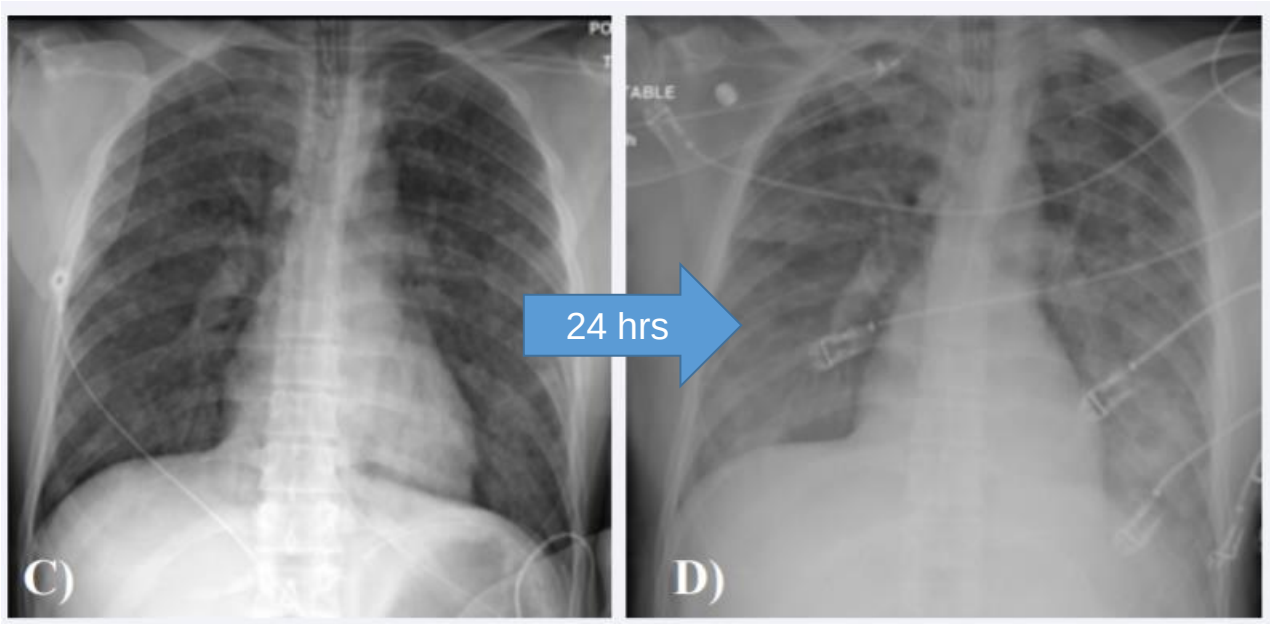
Severity of respiratory impairment after the drowning process stopped.		
(1) Mild	**(2) Moderate**	**(3) Severe**
• Breathing • Involuntary distressed coughing[a] AND • Fully alert	• Difficulty breathing AND • Disoriented but conscious	• Not breathing AND • Unconscious
Morbidity category (based upon any decline from previous functional capacity[b]) at the time of measurement.		
(A) No morbidity	**(B) Some morbidity**	**(C) Severe morbidity**
• No decline	• Some decline	• Severe decline

http://www.who.int/violence_injury_prevention/drowning/non-fatal-drowning/en/
https://doi.org/10.1161/HCQ.0000000000000024
https://doi.org/10.1016/j.chest.2020.10.007

Management of Aspiration Pneumonia in Flood Victims

Supportive Examination for Diagnostics (& Therapeutics)

- Blood test & BGA test: leukocytosis, neutrophilia, hypoxemia, etc
- Radiographic (CXR, CT-scan): consolidation, atelectasis; commonly involving right upper or lower lung lobe; may occurs later
- Bronchoscopic (bronchoalveolar lavage/BAL): purulent lavage
- Microorganism culture: bacterium and fungi



J Trauma Care. 2017;3(3):1026.

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https://doi.org/10.1038/s41572-021-00259-0
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Management of Aspiration Pneumonia in Flood Victims

Therapeutic goals:

- **Secure airway**
  Suction, bronchoscopic lavage, nasogastric tube, endotracheal/tracheostomy tube, inhalation therapy, 45° head-tilt position
- **Control inflammation and infection**
  Prompt antibiotics (empirical → definitive), avoid corticosteroid unless complication develops, nutrients
- **Overcome hypoxia**
  HFNC, CPAP, immediate intubation + mechanical ventilation, maintain hemodynamics
- **Rehabilitative care**
  Neuro-rehabilitation, chest physiotherapy
- **Evaluate**

https://www.ncbi.nlm.nih.gov/books/NBK430833/
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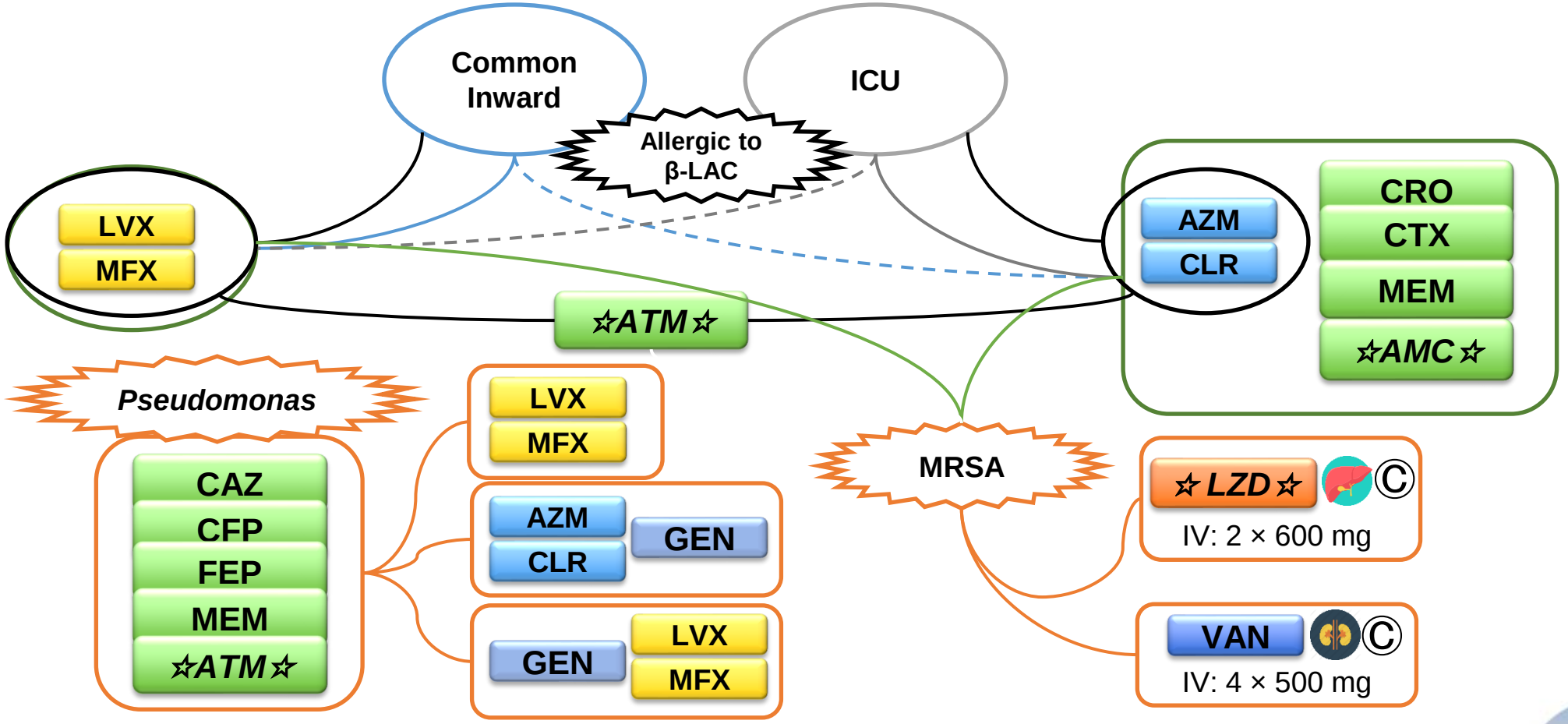

Pneumonia Komunitas. Pedoman Diagnosis & Penatalaksanaan di Indonesia (Edisi II). 2014;PDPI

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Management of Aspiration Pneumonia in Flood Victims

Clinical improvement (48 – 72 hrs):
- Temp ≤37,8°C
- HR ≤100×/min
- RR ≤24×/min
- SBP ≥90×/min
- SaO_2 ≥90% or PaO_2 ≥60 mmHg

PO well-tolerated
Improved GIT → ***Switching***

Sequential → LVX IV → LVX PO

Switch-over → CTX → CIP PO

Step-down → CTX → CFM

No improvement → **Mis-dx? Correct Dx → pts, th, microb (consider fungi)** → **Re-evaluate Escalation Refer**

Empirical AB → Definitive AB

Day: 0 IV 3 – 7 n

Microorganism culture → definitive AB

Individual,
Pseudomonas, MRSA

Pneumonia Komunitas. Pedoman Diagnosis & Penatalaksanaan di Indonesia (Edisi II). 2014;PDPI

Summary

- Given its geographical situation, the Indonesian archipelago is vulnerable to precipitation & tectonic activity-induced floods
  → pulmonologist **must familiarize** the **management in flood victims**
- Aspiration pneumonia, incidence ± 10 – 20% & CFR 60%, resulted from "early-to-late" onset of inflammation, induced by sequential events of contaminated flood aspirates
  → be aware of a **pneumonia in later days** during hospital stay
- Studies revealed Gram-negative is the main culprit of aspiration pneumonia in floods victim
  → prepare for bronchoscopy & **early "heavyweight" antibiotics**
- Therapeutic goals: **SCORE** (Secure airways, Control inflammation and infection, Rehabilitative Care, and Evaluate)

Thank You for Your Attention

#dirumahsaja

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