

# Re-deconstructing delirium

**Mark Borthwick**  
**Consultant Pharmacist in Critical Care**  
Oxford University Hospitals NHS FT





# Re-deconstructing delirium


Mark Borthwick  
Critical Care Pharmacist, Oxford



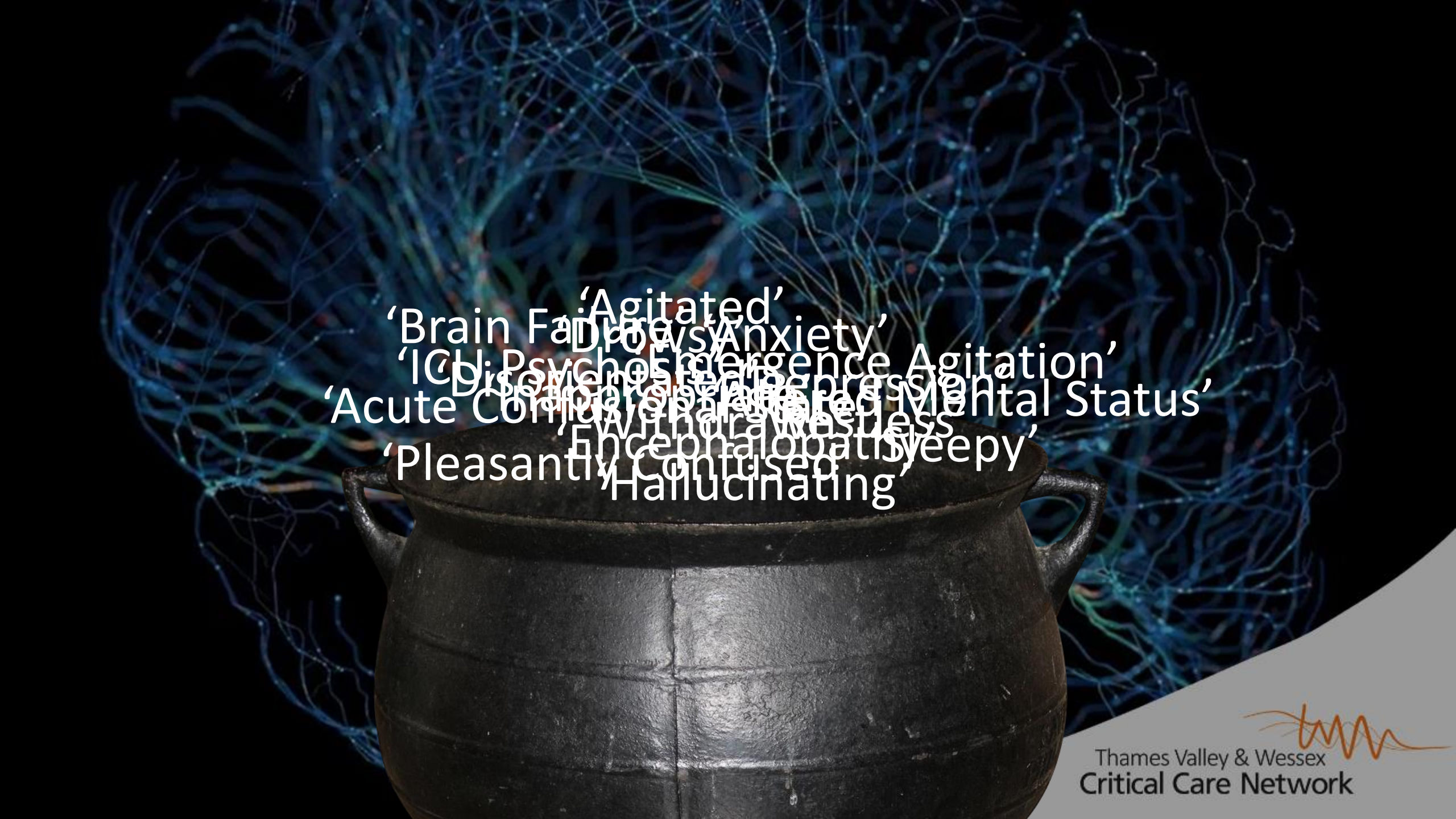
Thames Valley & Wessex  
Critical Care Network



'Brain Failure'      'Drowsy'      'Altered Mental Status'  
'Anxiety'      'Emergence Agitation'  
'ICU Psychosis'      'Depression'  
'Agitated'      'Disorientated'      'Inappropriate'  
'Acute Confusional State'      'Withdrawn'  
'Pleasantly Confused'      'Encephalopathy'  
'Sleepy'      'Hallucinating'      'Restless'



'Agitated'  
'Brain Failure'  
'Anxiety'  
'ICU Psychomotor Emergence Agitation'  
'Disorientation', 'Depression', 'Acute Confusion', 'Generalized Mental Status', 'Withdrawal', 'Encephalopathy', 'Pleasantly Confused', 'Hallucinating', 'Sleazy'



'Agitated'  
'Brain Failure', 'Anxiety'  
'ICU Psychomotor Emergence Agitation'  
'Disorientation, Depression'  
'Acute Confusion', 'Altered Mental Status'  
'Encephalopathy', 'Restless', 'Withdrawal'  
'Pleasantly Confused', 'Sleepy'  
'Hallucinating'



# Delirium

## Acute onset cognitive disorder

**A:** Generalised disturbance in attention / awareness

**B:** The disturbance develops over a short period of time, represents an acute change, may fluctuate

**C:** An additional disturbance in cognition

**D:** Disturbances in **A** and **C** are not explained by another pre-existing, established, or evolving neurocognitive disorder and do not occur in the context of a severely reduced level of arousal, such as coma

**E:** Evidence from history, physical examination, laboratory findings that the condition is a direct consequence of

- Medical Condition

- Substance Intoxication or withdrawal (abuse or medication)

- Exposure to a toxin

- Multiple aetiologies





## Acute onset **cardiovascular disorder**

**A:** Generalised disturbance in **systemic blood pressure**

**B:** The disturbance develops over a short period of time, represents an acute change, may fluctuate

**C:** An additional disturbance in **heart rate**

**D:** Disturbances in **A** and **C** are not explained by another pre-existing, established, or evolving **cardiovascular** disorder and do not occur in the context of a severely reduced level of **CO**, such as **ventricular fibrillation**

**E:** Evidence from history, physical examination, laboratory findings that the condition is a direct consequence of

- Medical Condition

- Substance Intoxication or withdrawal (abuse or medication)

- Exposure to a toxin

- Multiple aetiologies



# Pressuria

# Pressuria

Septic

Anaphylactic

Hypovolaemic

Cardiogenic

Neurogenic



# Pressurria



# Delirium

# Delirium





# PRIMER



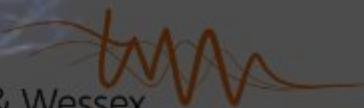
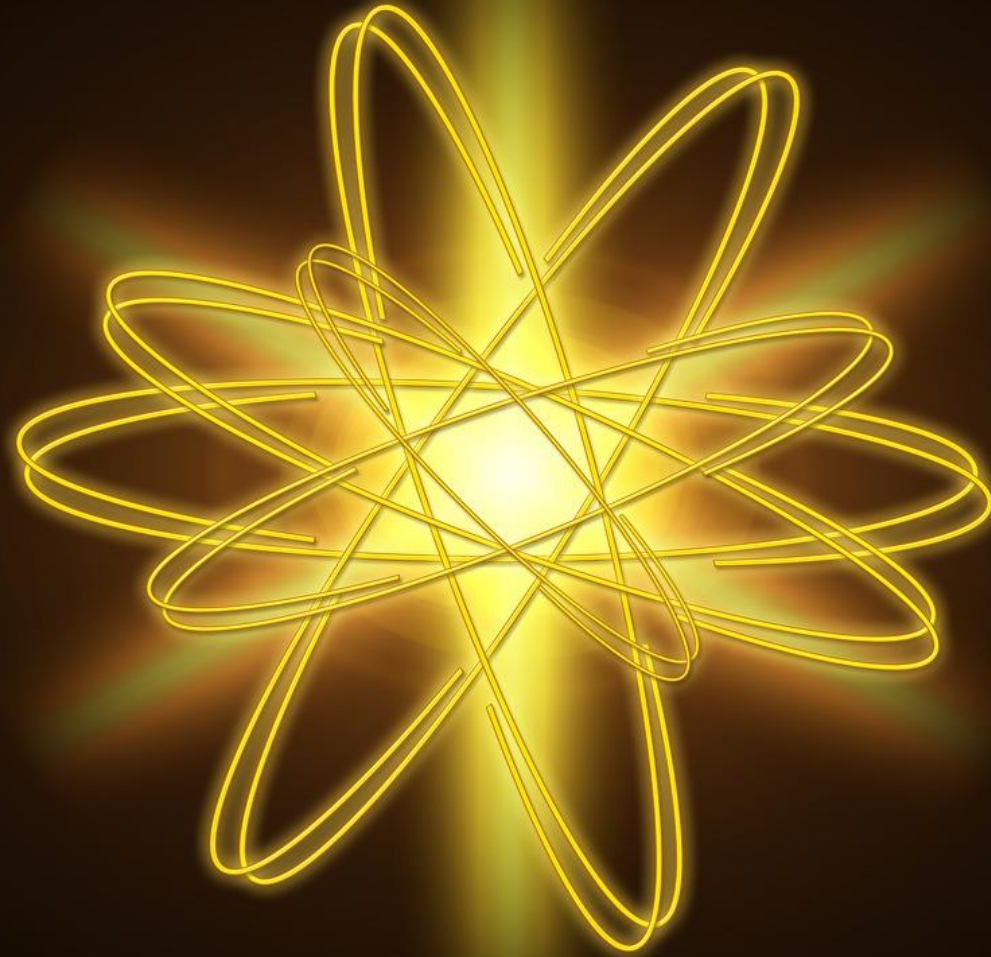
## Delirium

*Jo Ellen Wilson<sup>1,2</sup>✉, Matthew F. Mart<sup>1,3</sup>, Colm Cunningham<sup>4</sup>, Yahya Shehabi<sup>5,6</sup>, Timothy D. Girard<sup>1,7</sup>, Alasdair M. J. MacLulich<sup>8</sup>, Arjen J. C. Slooter<sup>9</sup> and E. Wesley Ely<sup>1,3,10,11</sup>*

Abstract | Delirium, a syndrome characterized by an acute change in attention, awareness and cognition, is caused by a medical condition that cannot be better explained by a pre-existing neurocognitive disorder. Multiple predisposing factors (for example, pre-existing cognitive impairment) and precipitating factors (for example, urinary tract infection) for delirium have been

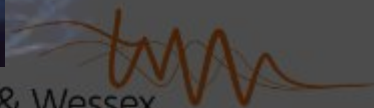
<https://www.nature.com/articles/s41572-020-00223-4>

# Delirium – Bioenergetic insufficiency?





# Delirium – Inflammation?



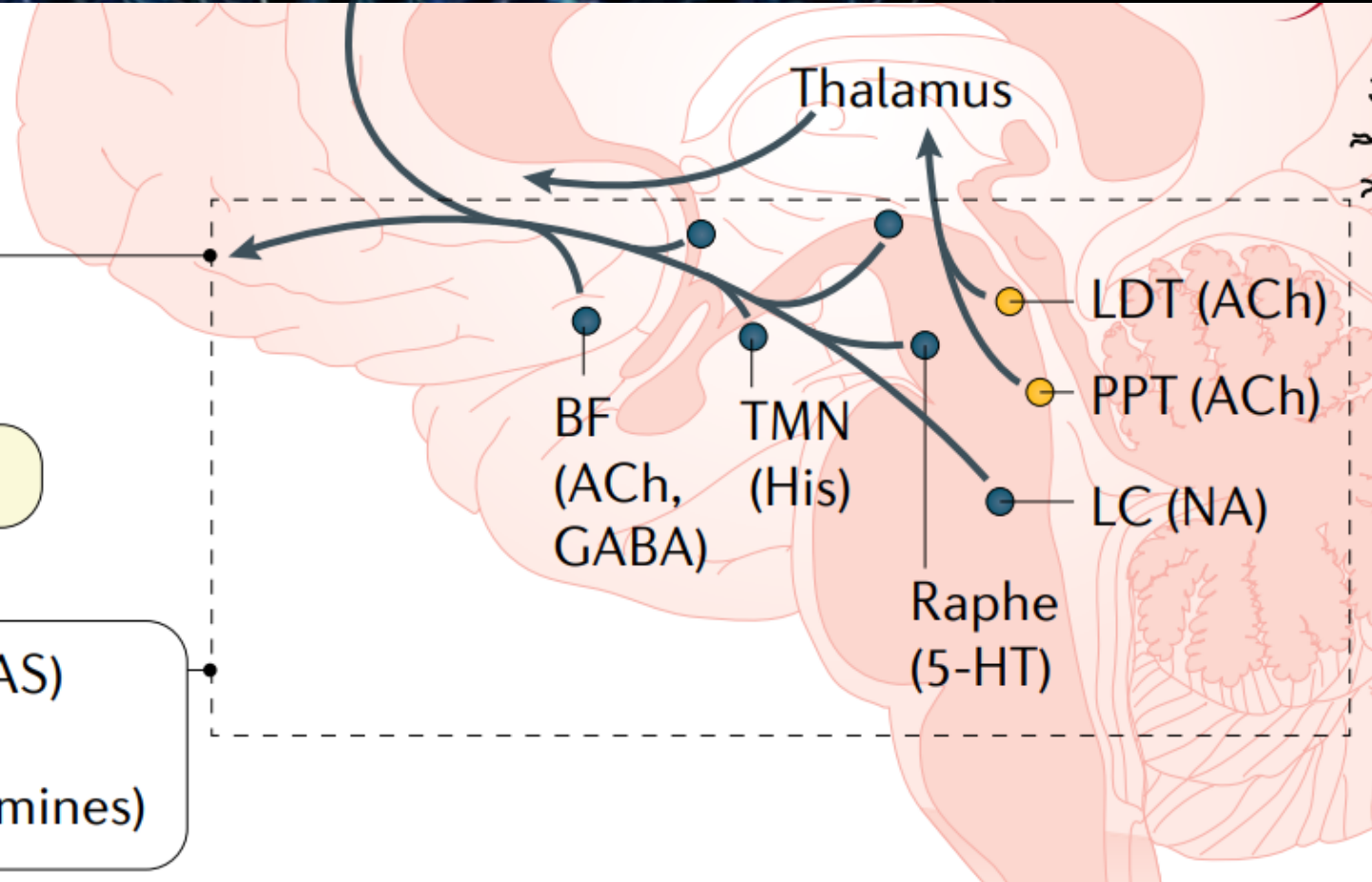
# Delirium – Neurotransmitter?

## Drugs

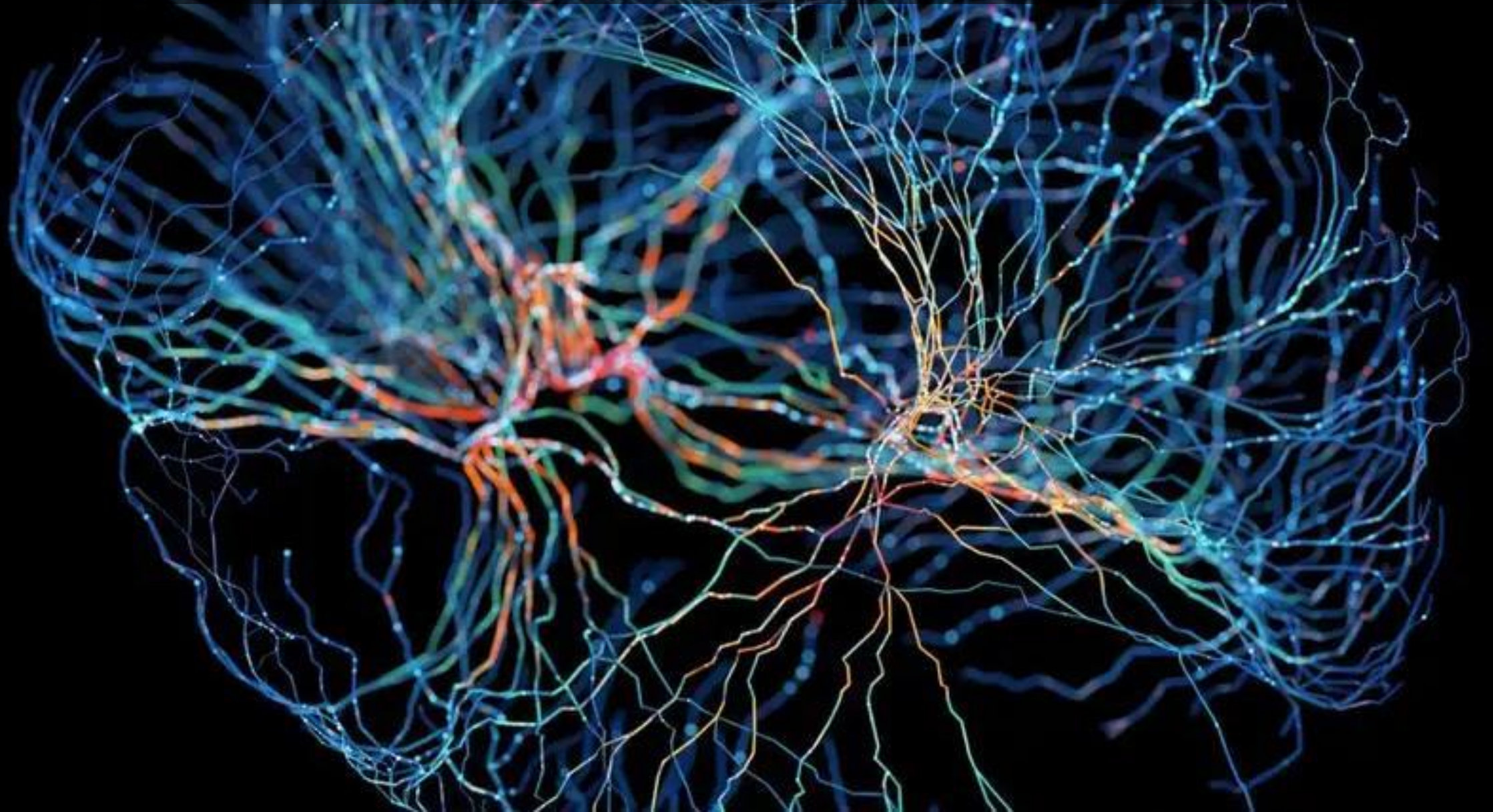
- GABAergic sedatives
- Anticholinergic drugs
- Antihistamine drugs

## Neurotransmitter disturbance

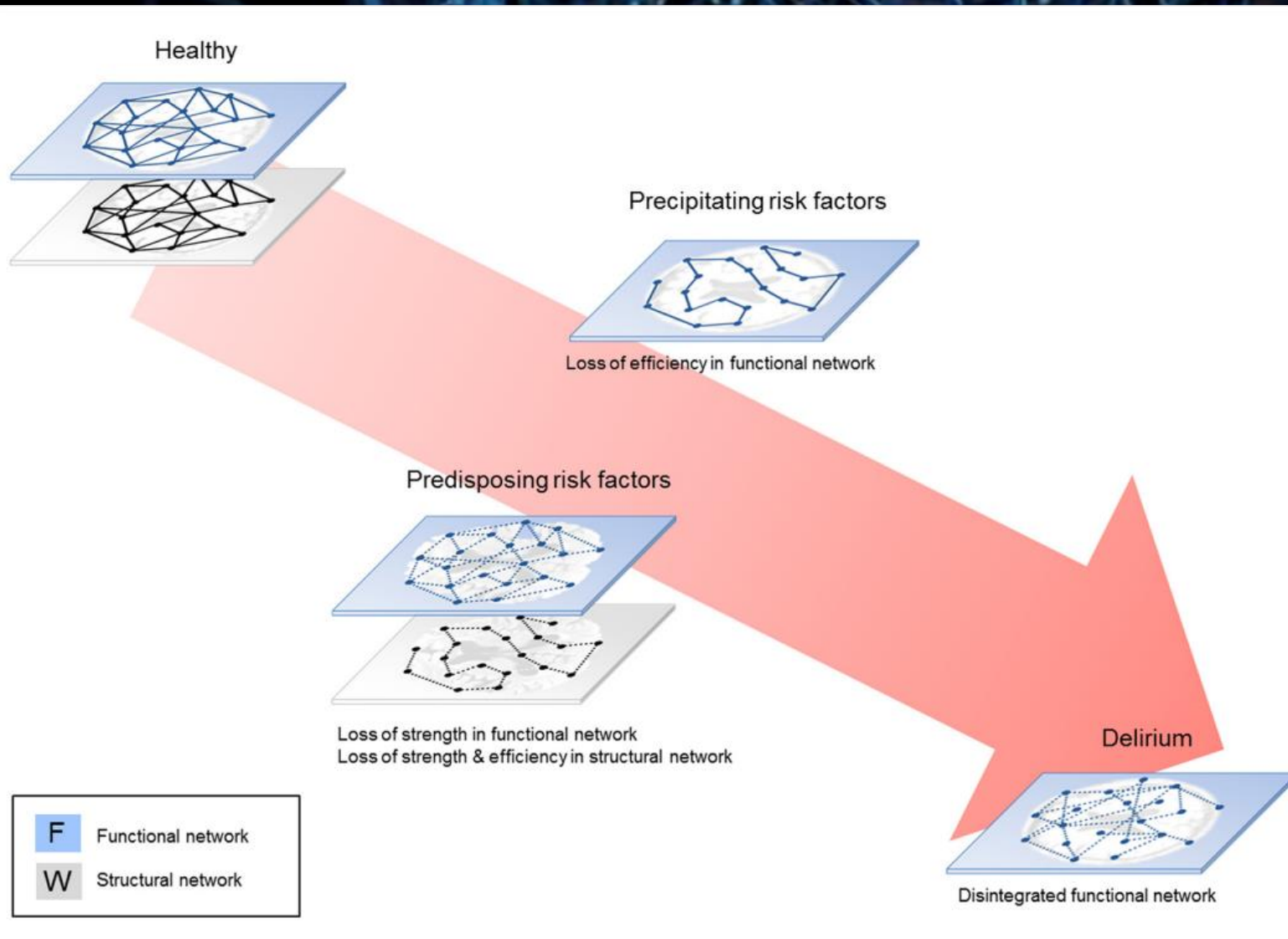
- Reticular ascending arousal system (RAS)
- Thalamocortical activation (ACh)
- Cortical integration (NA, other monoamines)



# Delirium – Network connectivity?

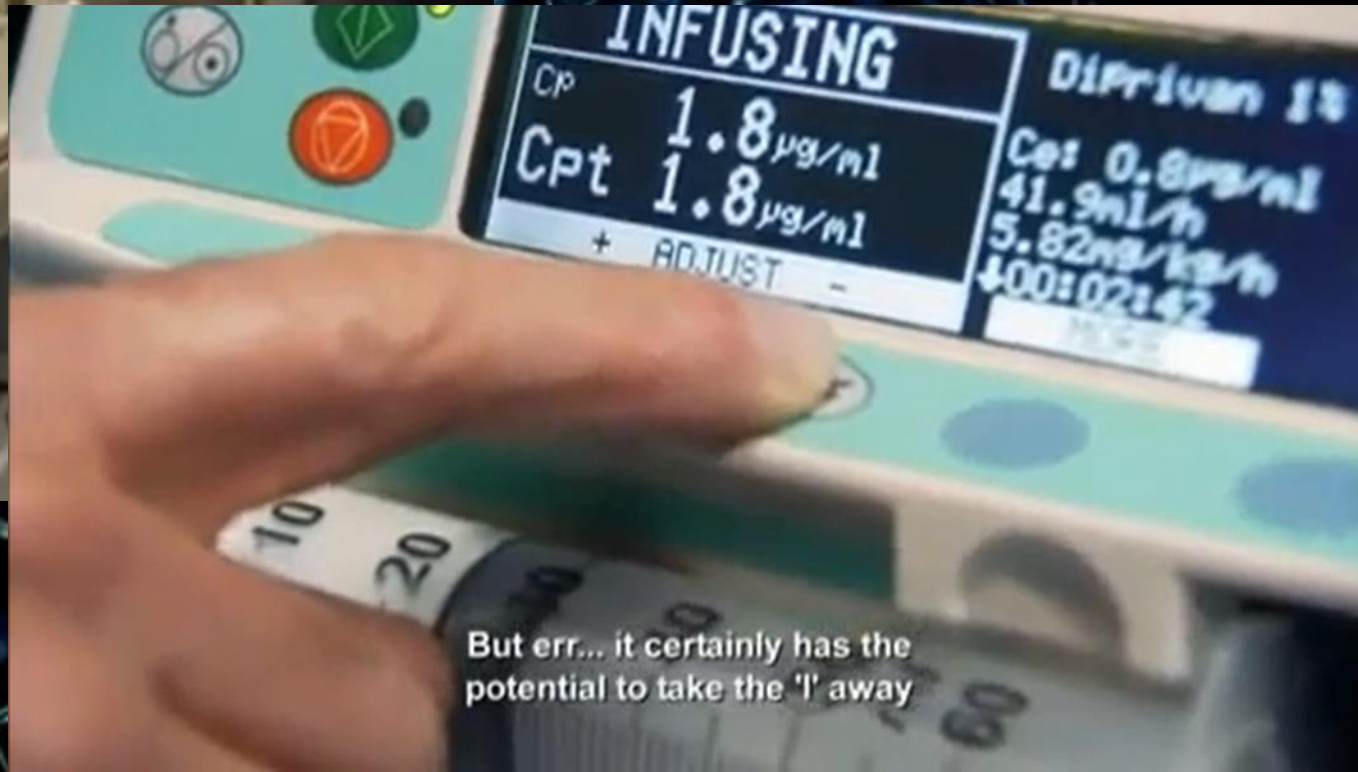


# Delirium – Network connectivity?



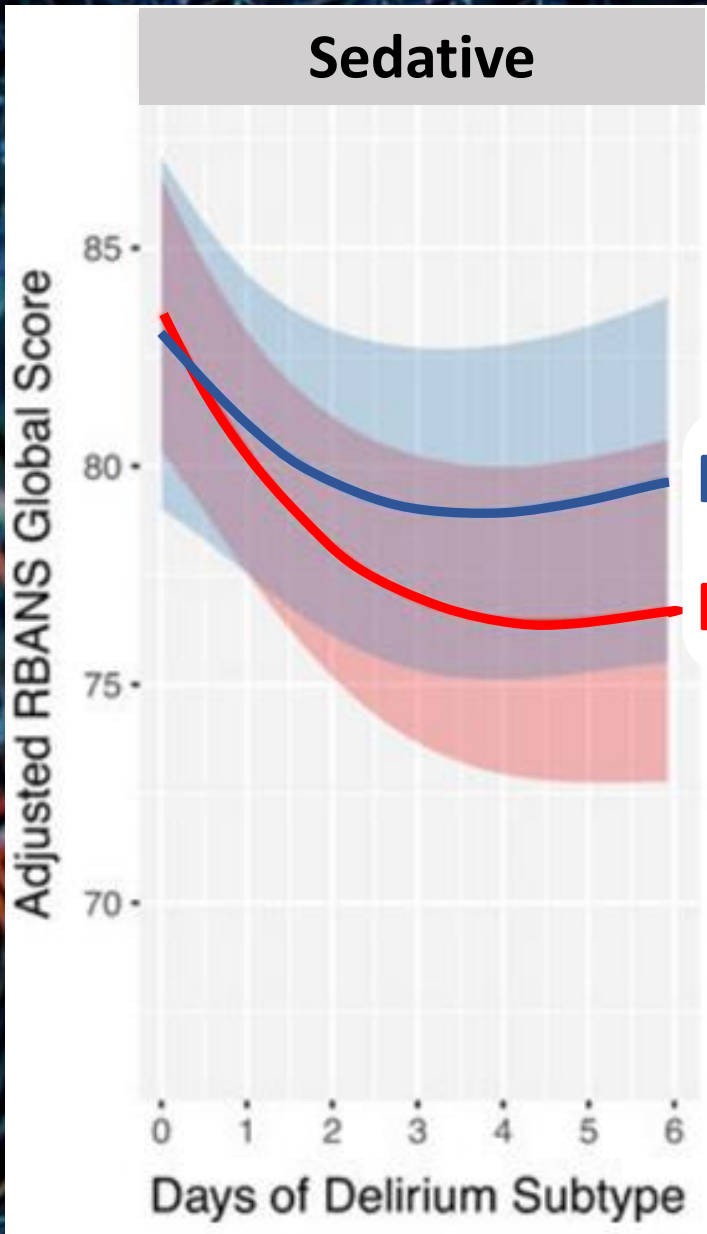
Included precipitating risk factors for delirium: coma; renal failure; sedation; neurotrauma  
Included predisposing risk factors for delirium: aging; cognitive impairment; dementia; depression; hearing impairment; (history of) stroke; visual impairment





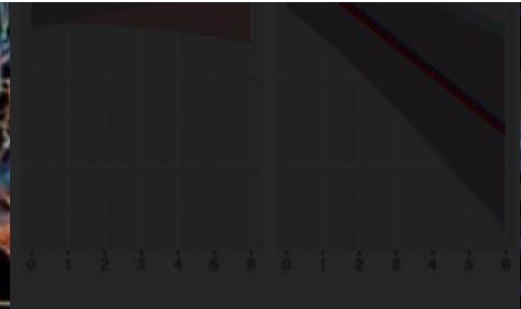
But err... it certainly has the potential to take the 'l' away

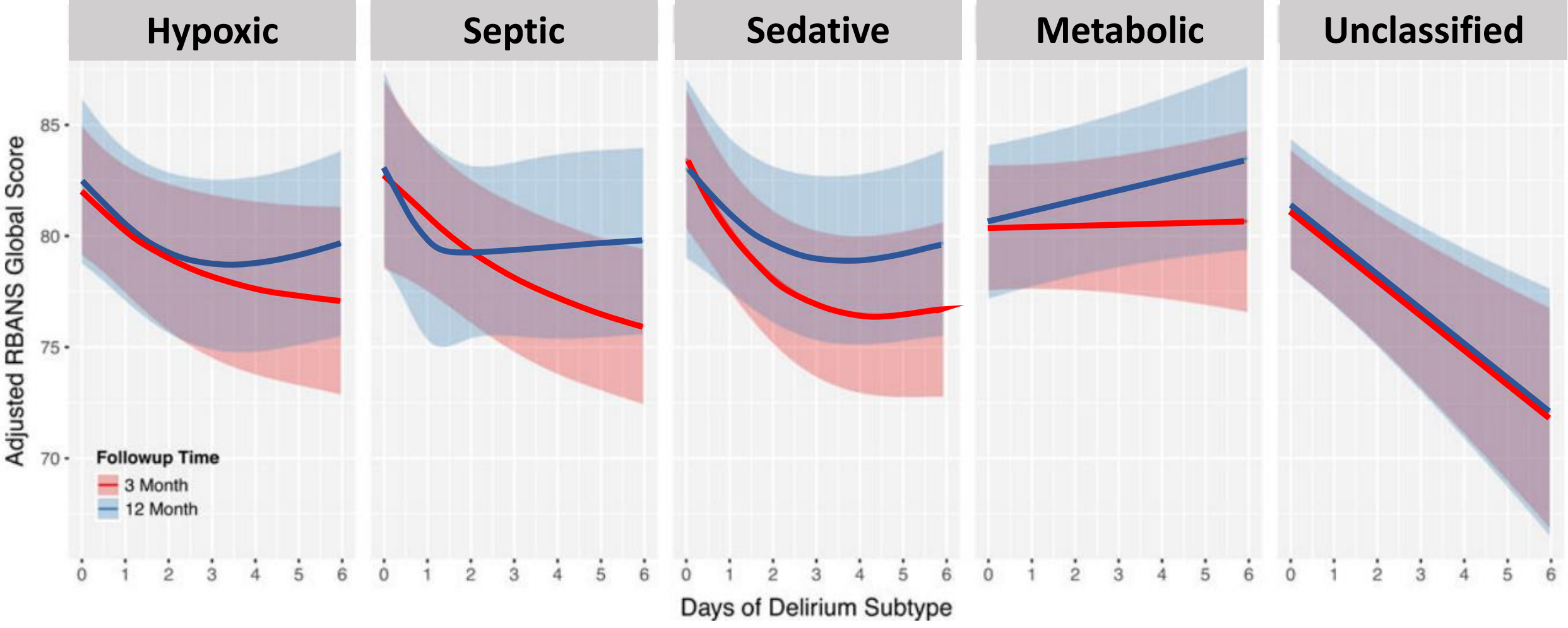
“The Secret You”  
Horizon BBC2  
20 October 2009



**RBANS at 12 months**

**RBANS at 3 months**

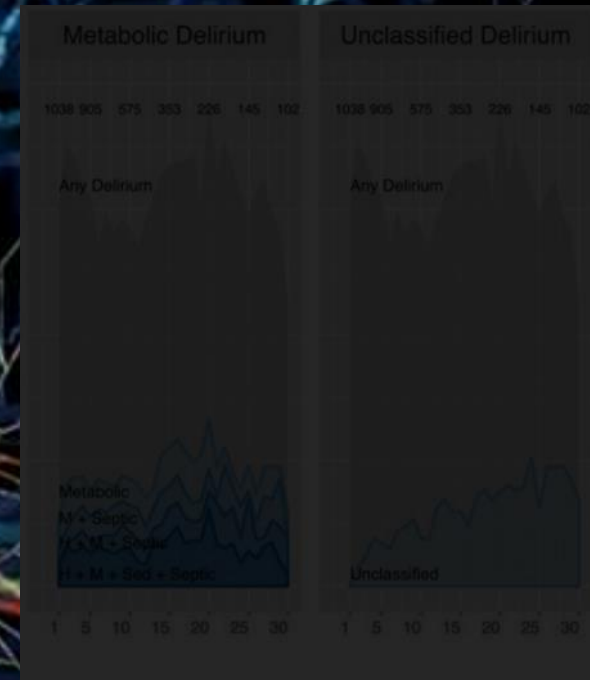
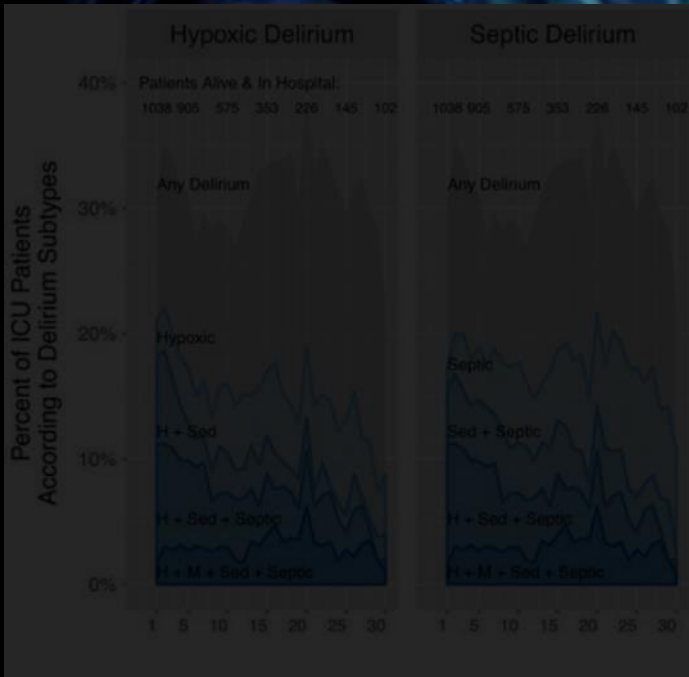
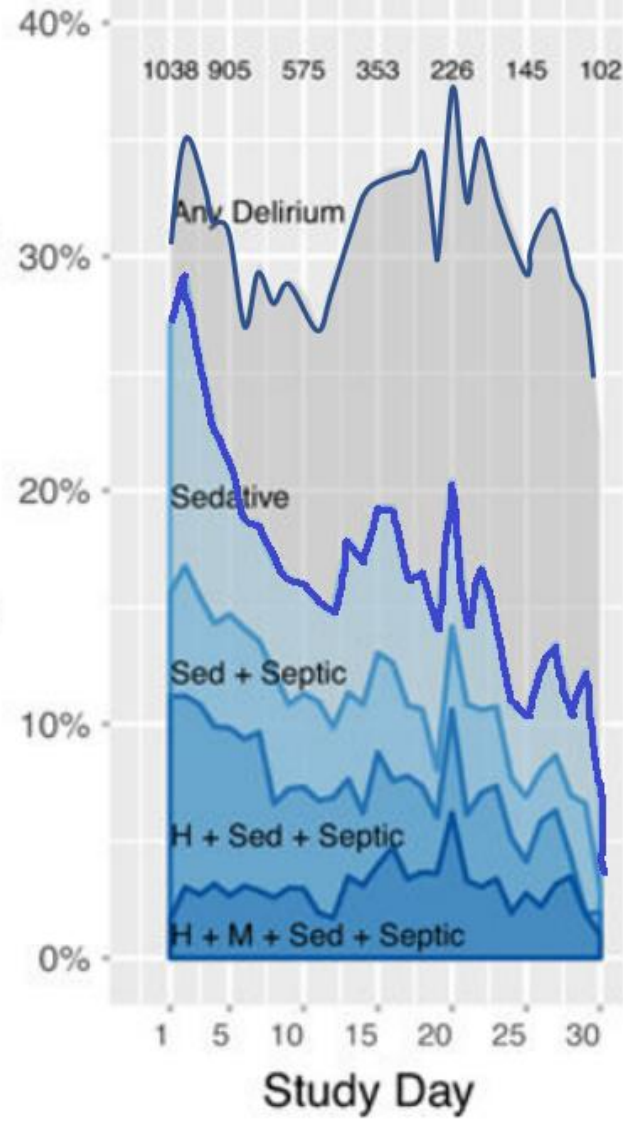






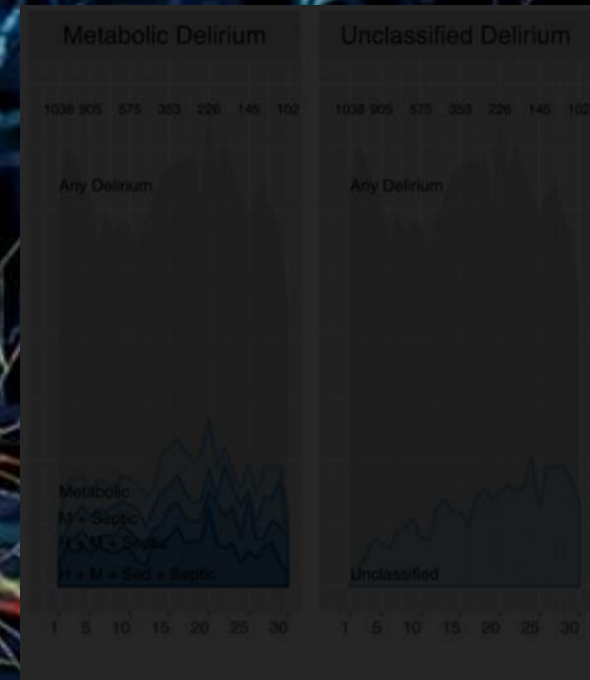
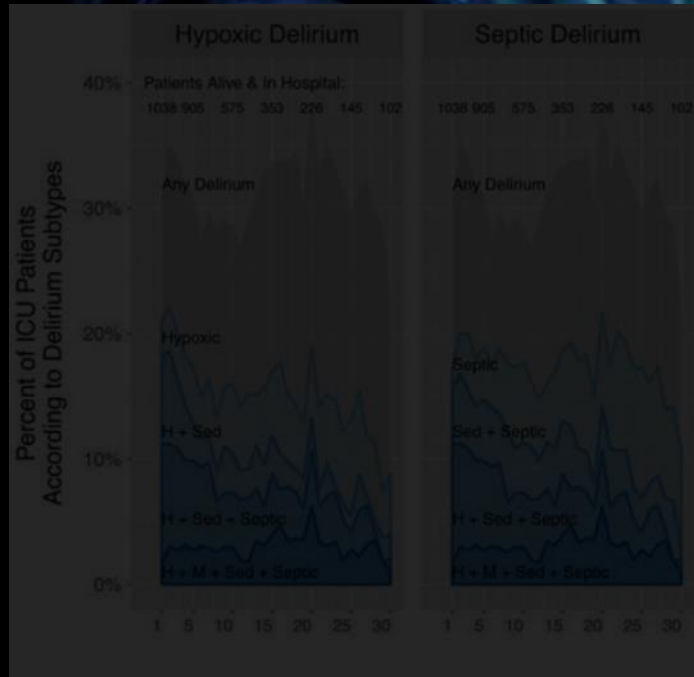
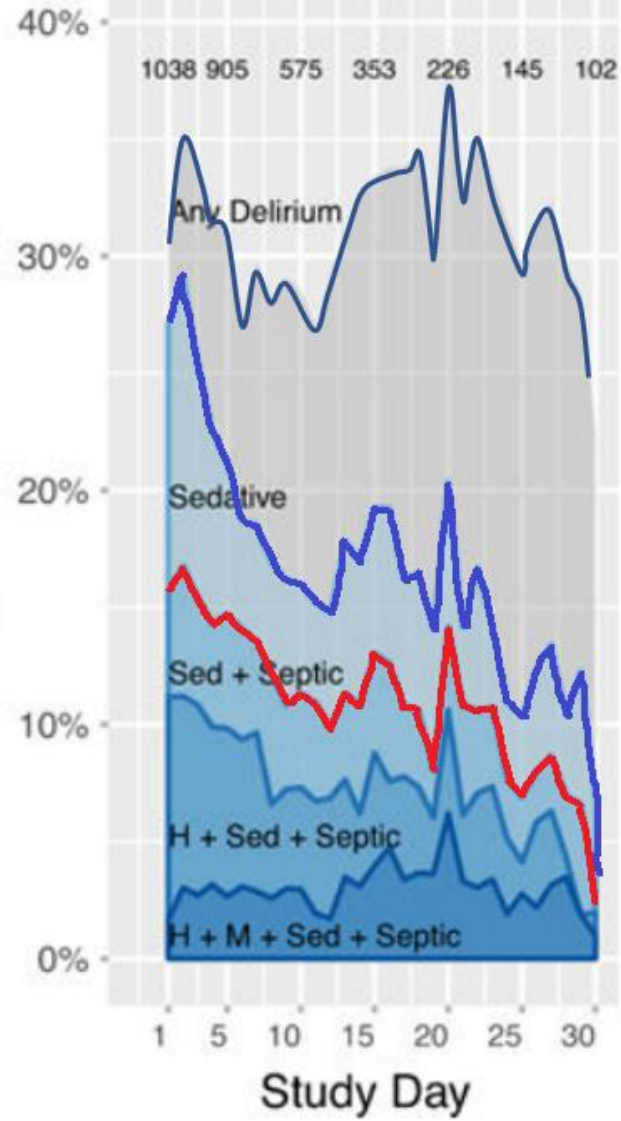
# Sedative

Percent of ICU Patients  
According to Delirium Subtypes



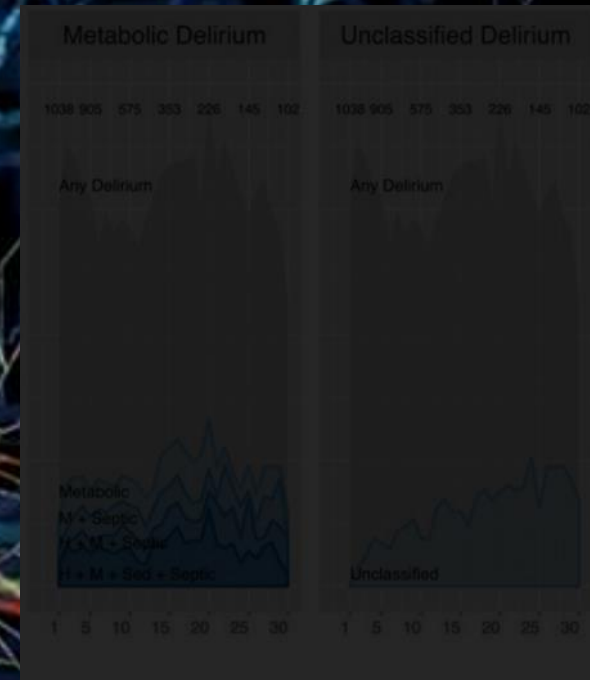
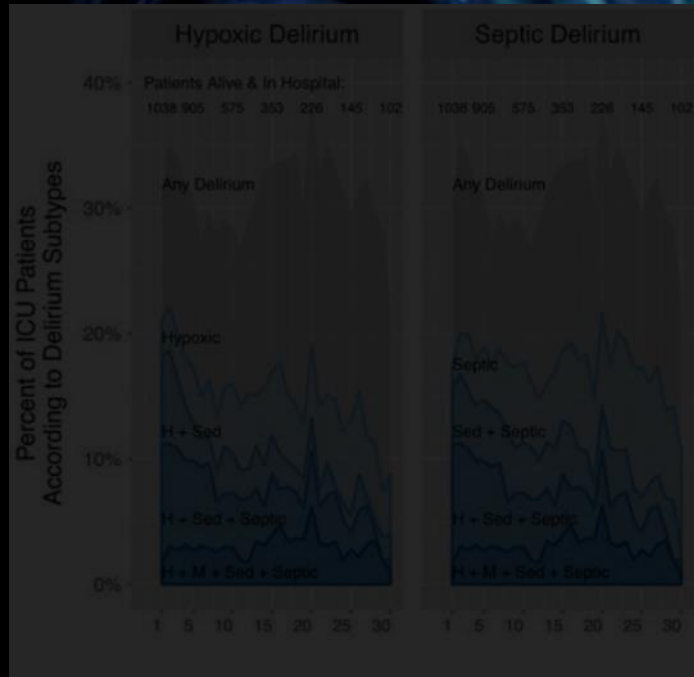
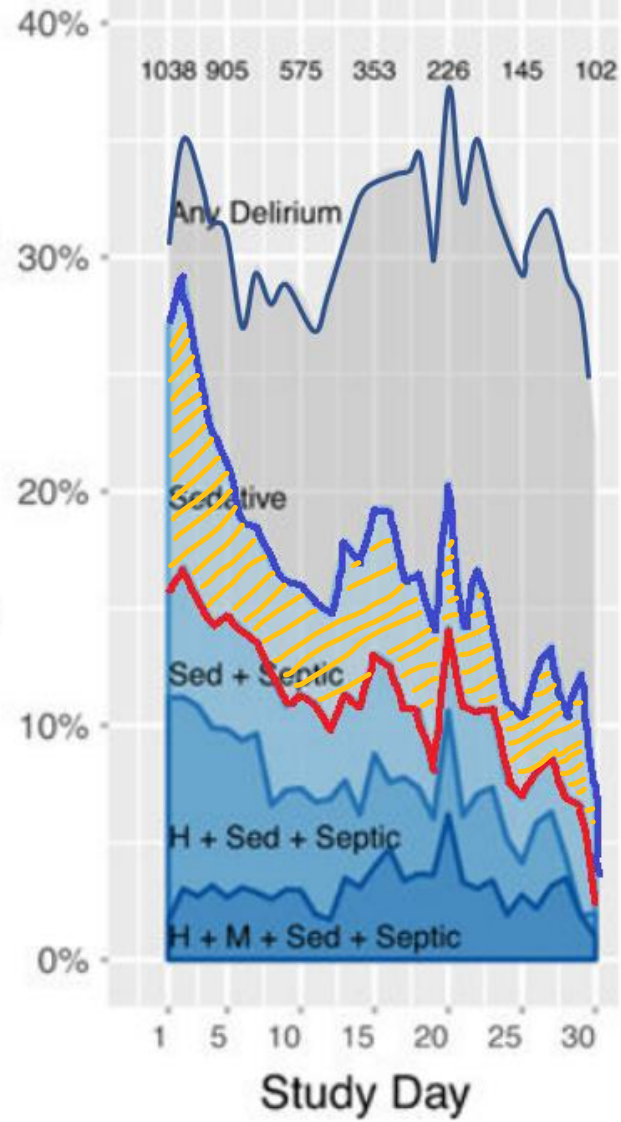
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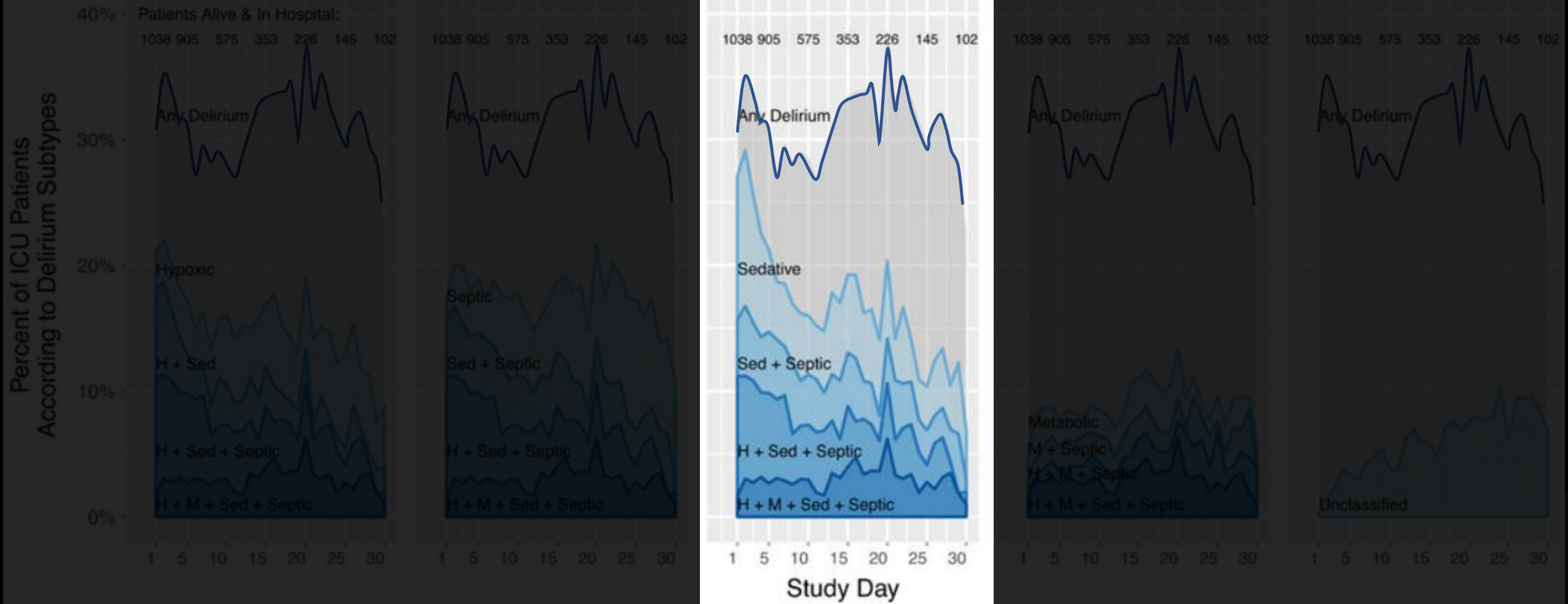
## Hypoxic

## Septic

## Sedative

## Metabolic

## Unclassified



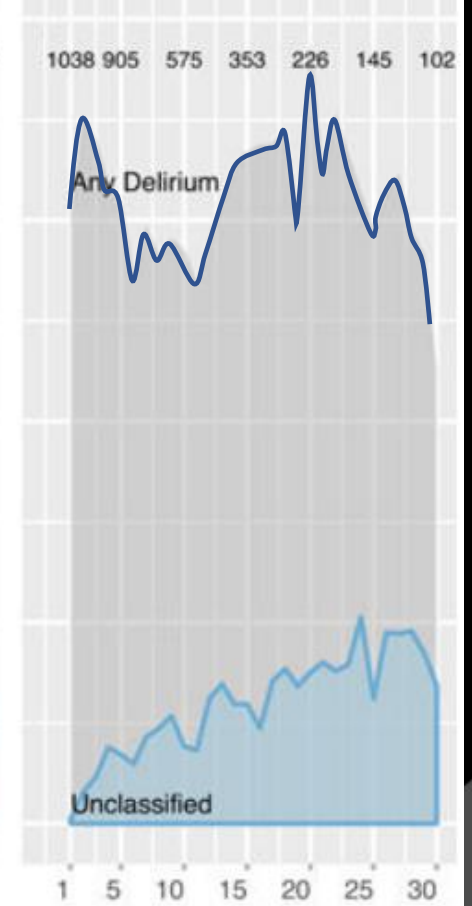
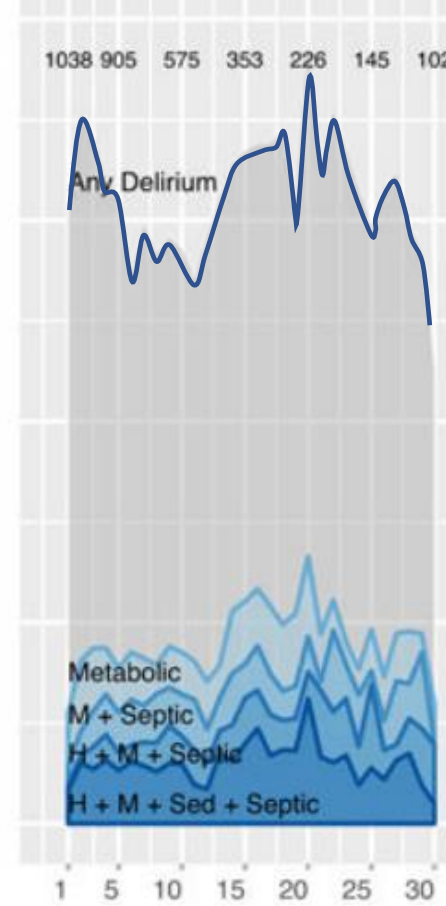
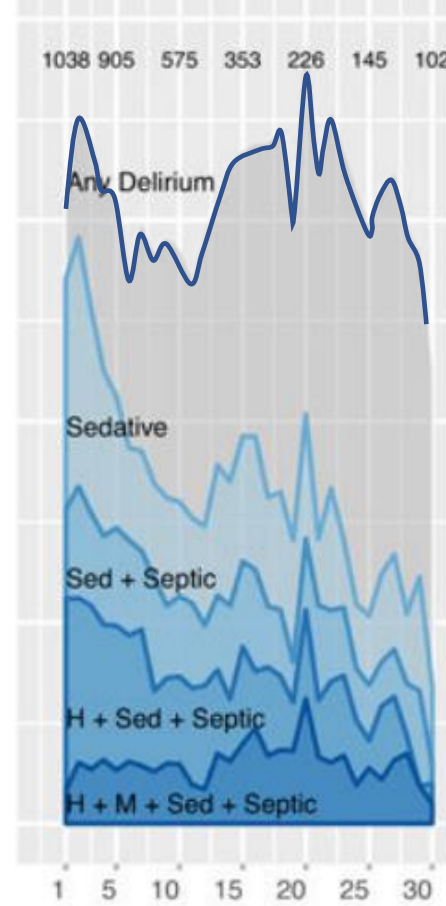
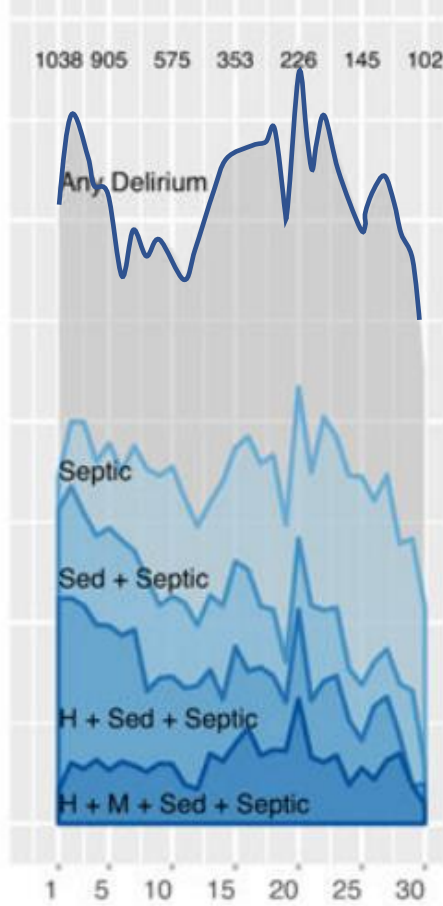
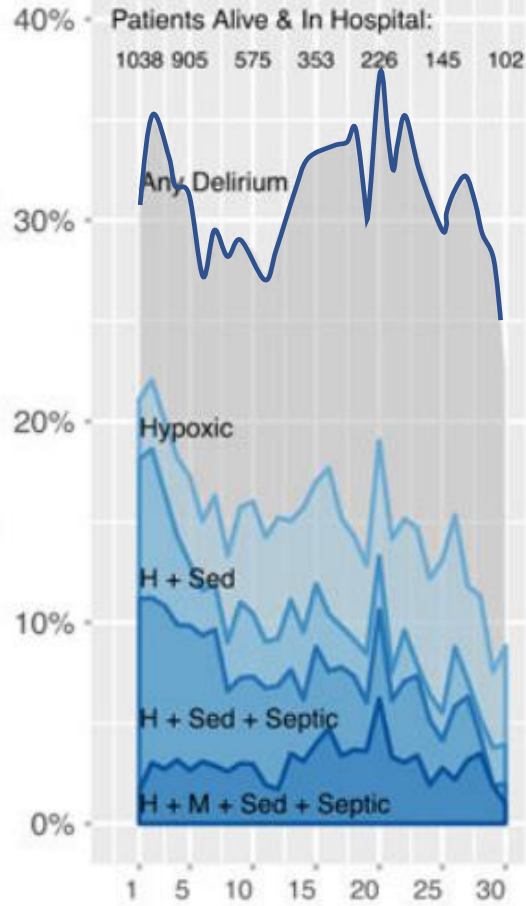
## Hypoxic

## Septic

## Sedative

## Metabolic

## Unclassified



Study Day

# Pressuria

Septic

Anaphylactic

Hypovolaemic

Cardiogenic

Neurogenic



# Delirium

# Delirium

Septic

Hypoxic

Metabolic

Sedative

Unclassified



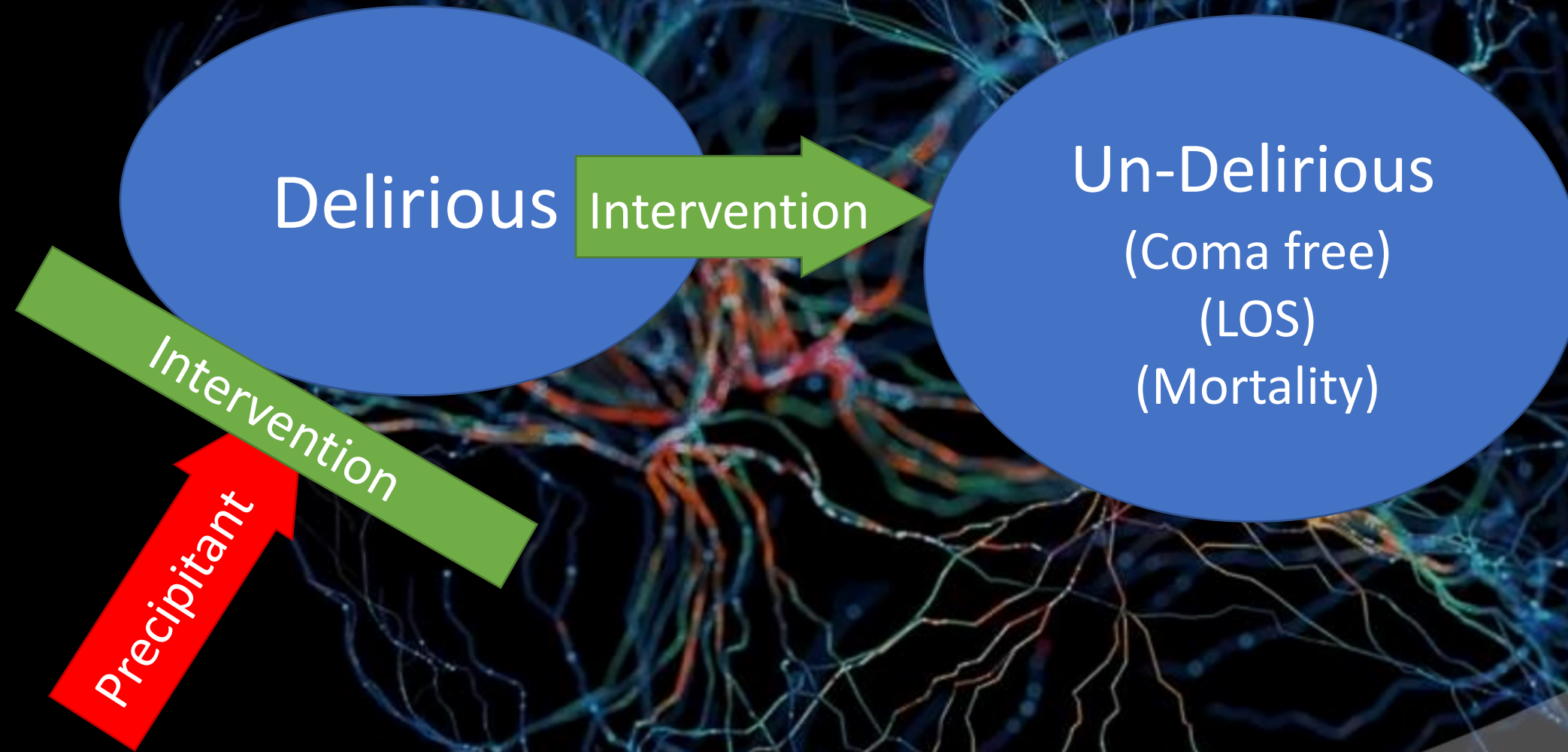
# Delirium

Septic  
Hypoxic  
Unclassified  
Sedative  
Metabolic

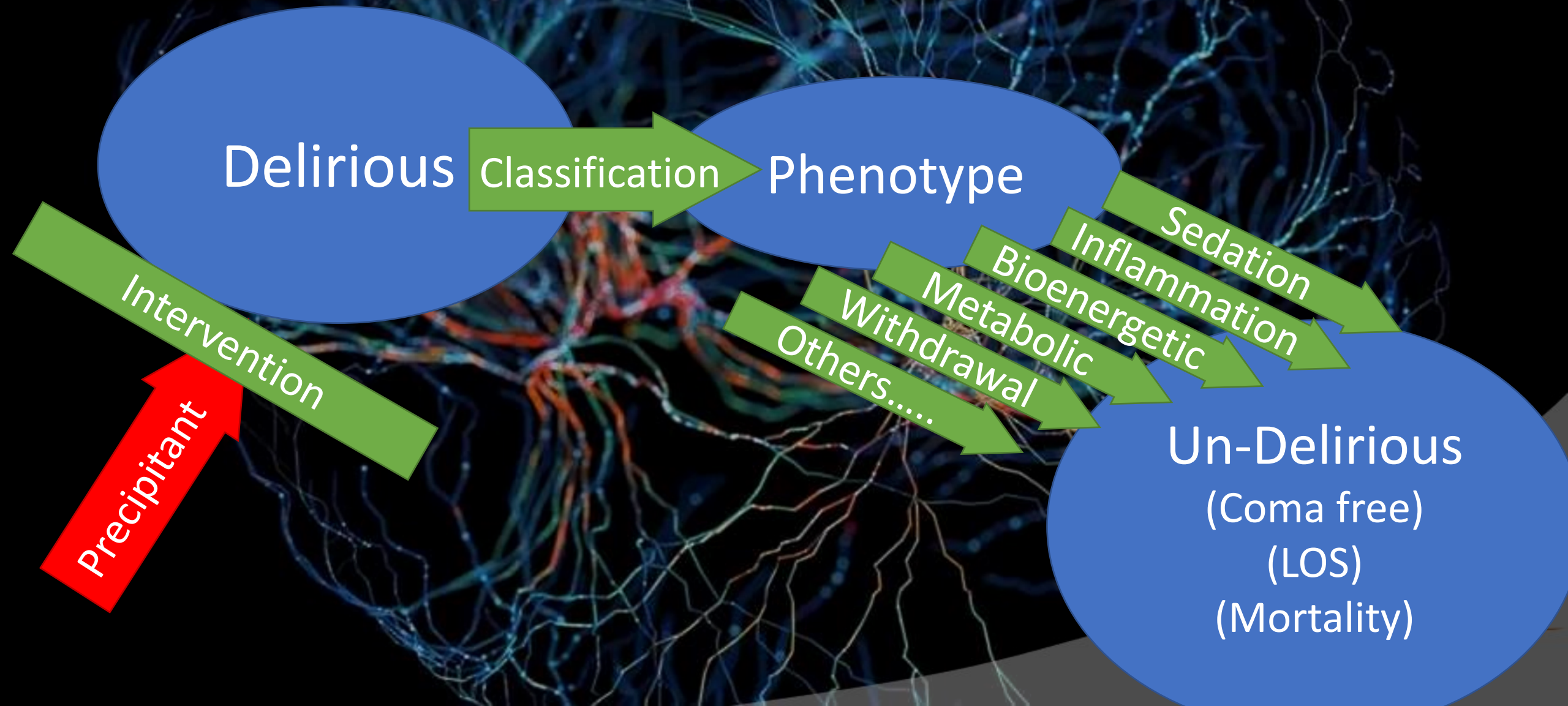
# Delirium



# Where does that leave us?



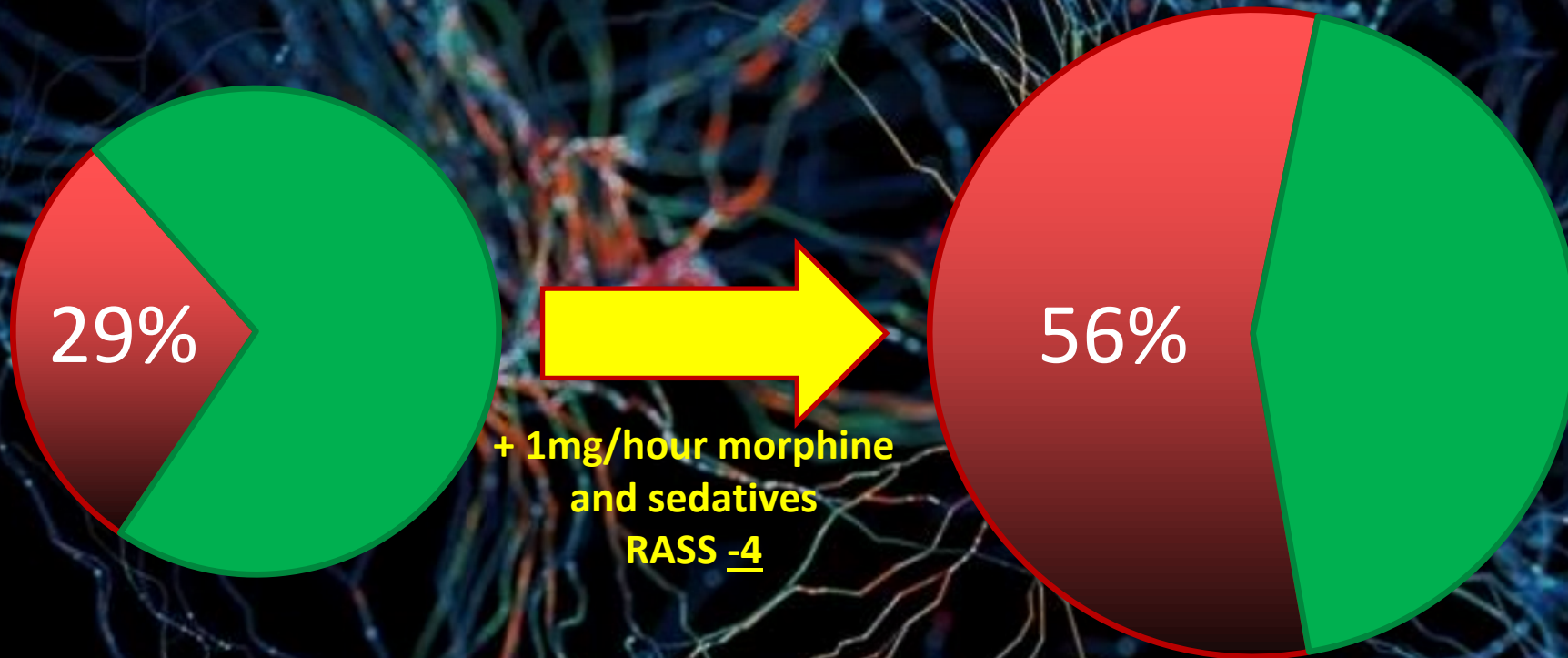
# Where does that leave us?



# PRE-DELIRIC II

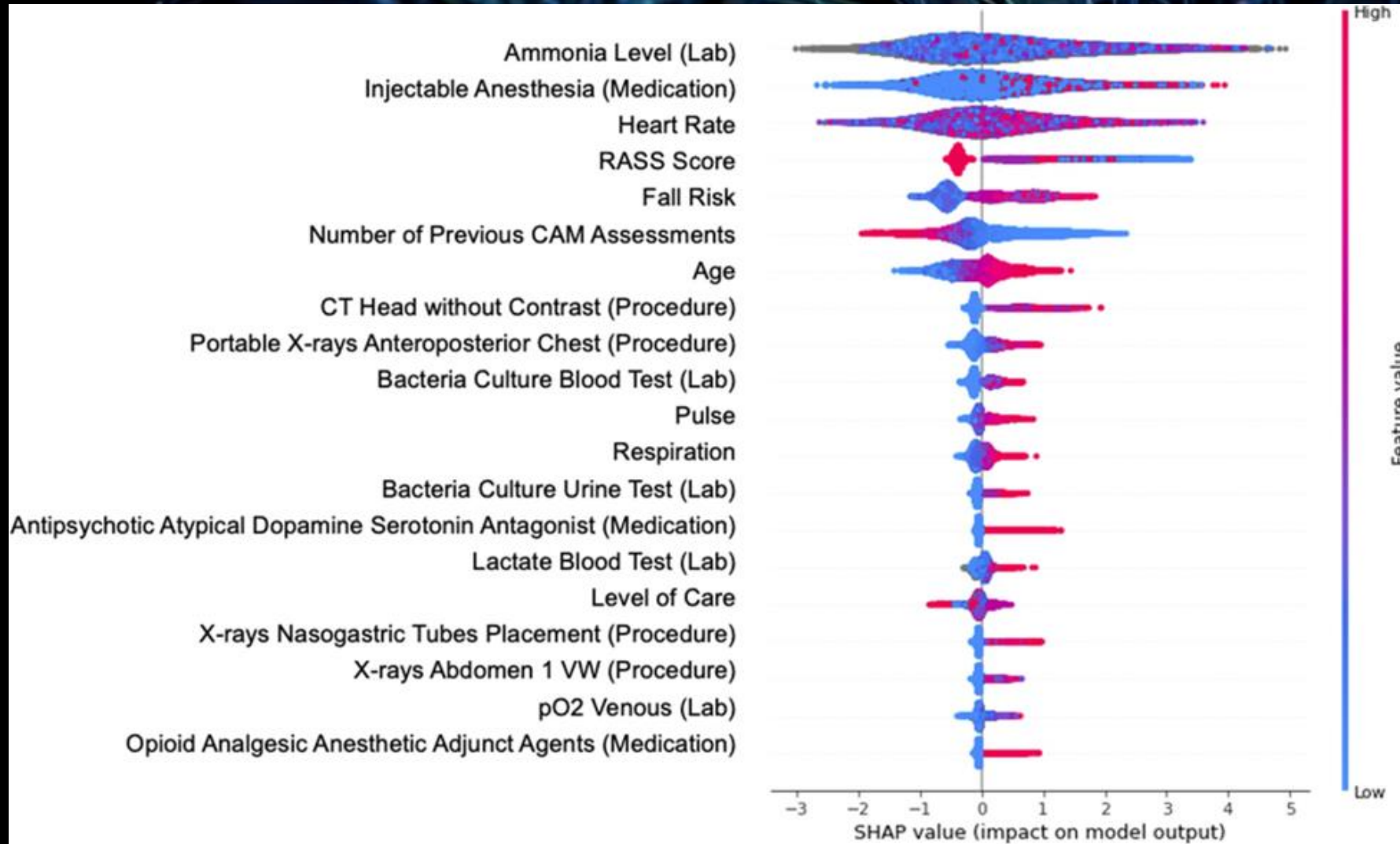


- 73M, Flu, APACHE II 25, RASS -3

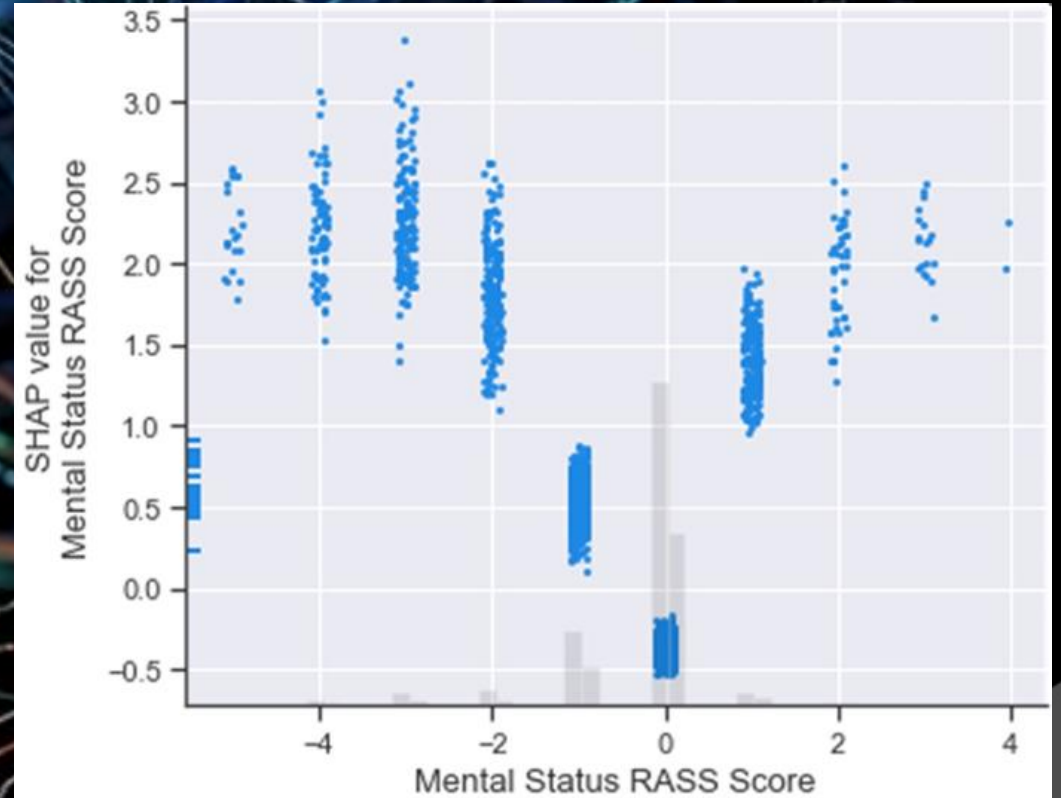
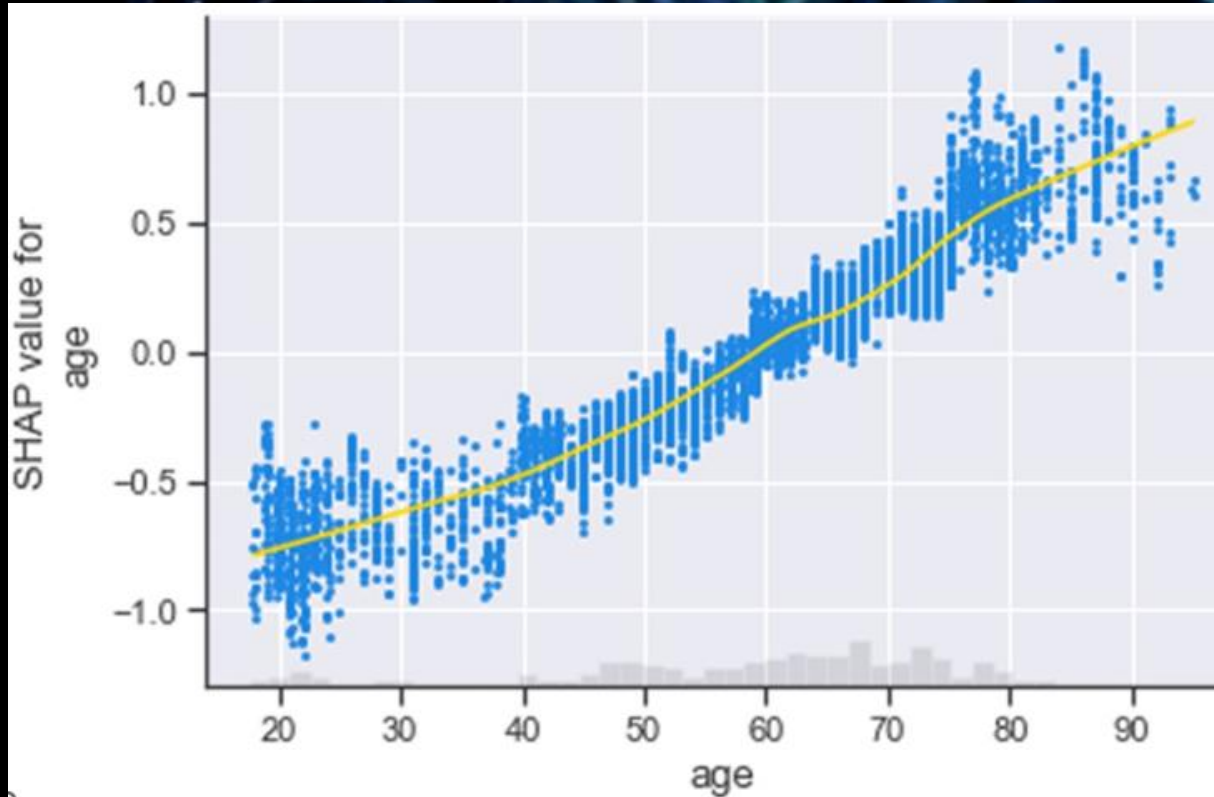




# Machine Learning

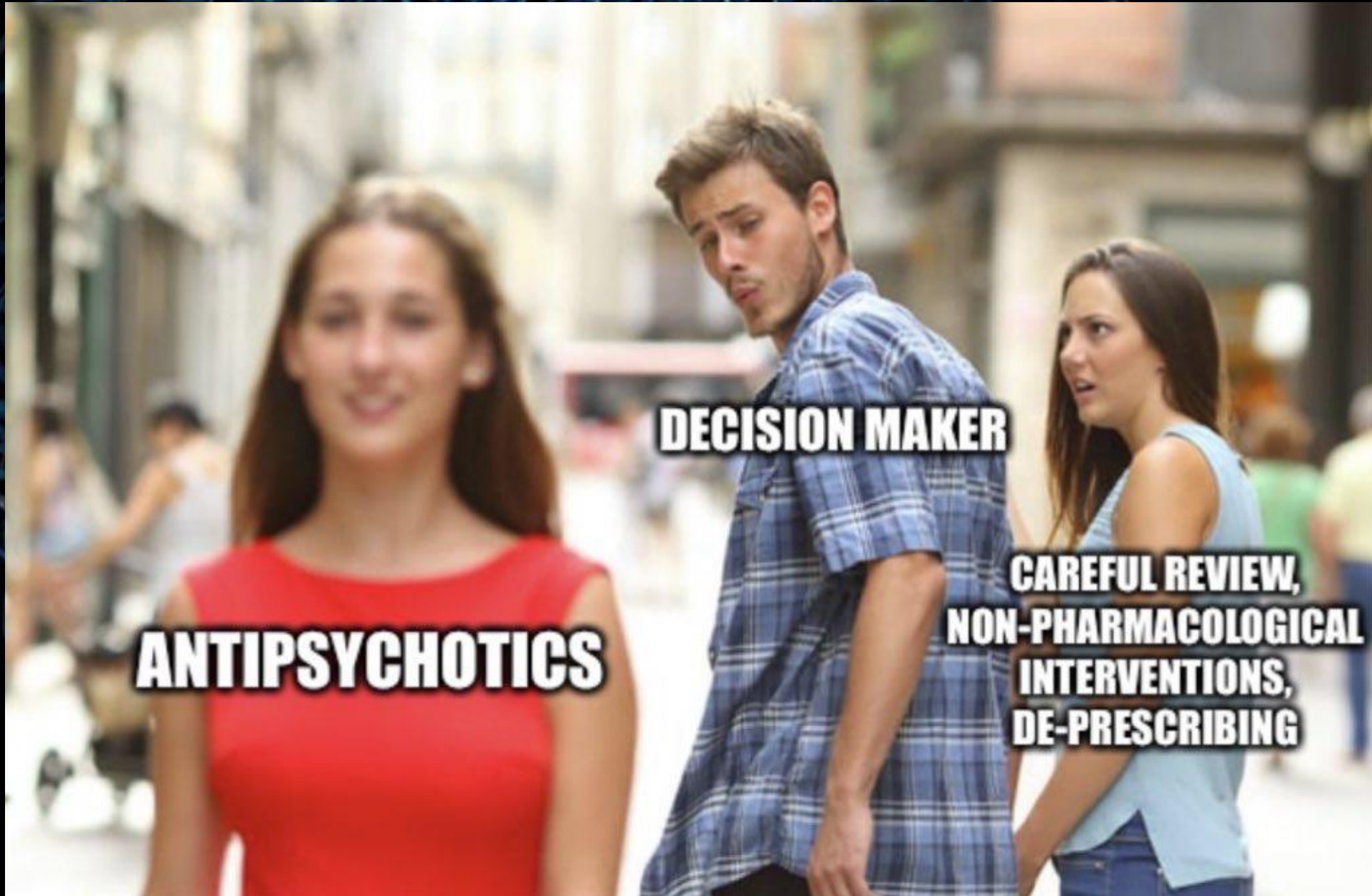


# Machine Learning









**ANTIPSYCHOTICS**

**DECISION MAKER**

**CAREFUL REVIEW,  
NON-PHARMACOLOGICAL  
INTERVENTIONS,  
DE-PRESCRIBING**

