

# The burden of drowning

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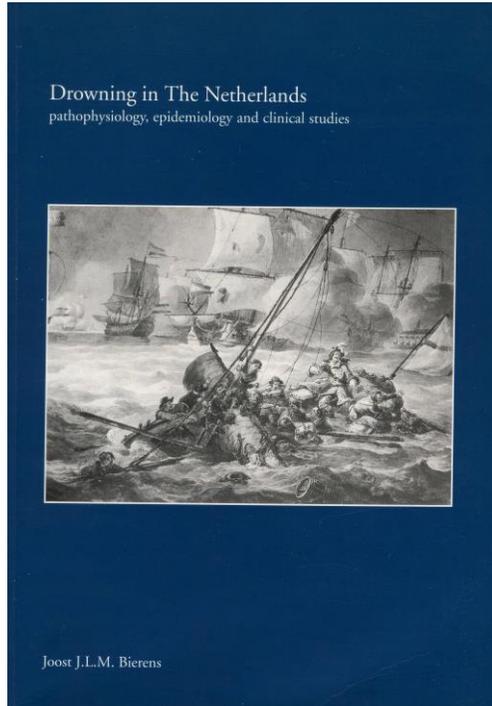


**HLR2023**  
om drunkning och hypotermi  
TYLÖSAND 13-14 JUNI 2023

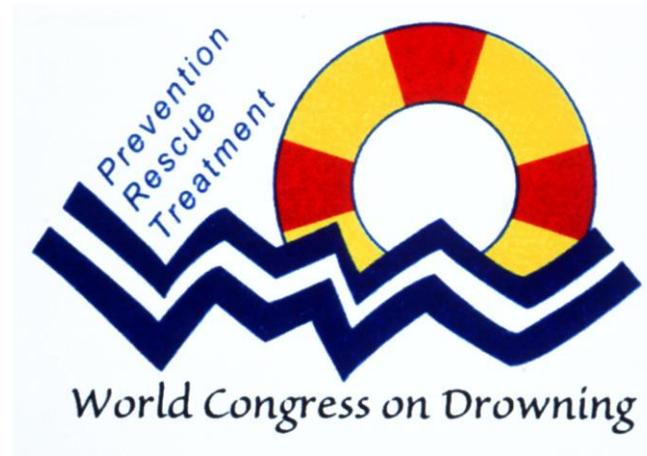


1974 - 1981



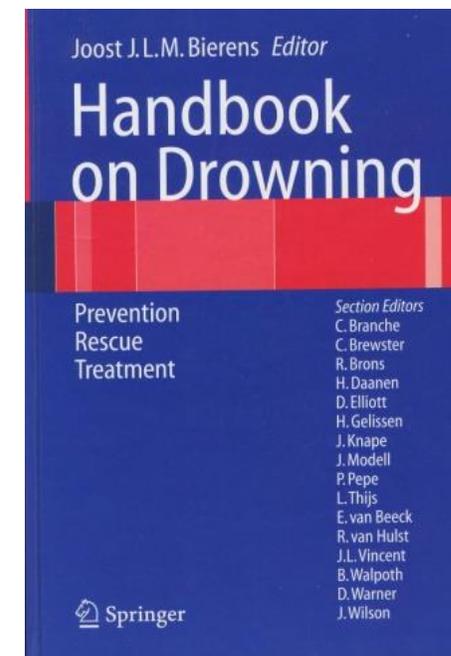


1996

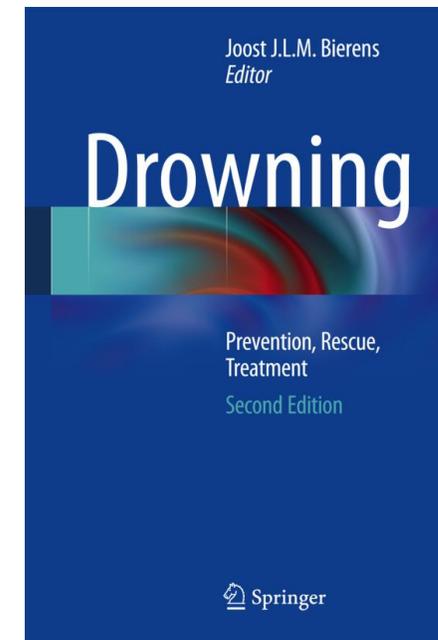


2002

2004



2014

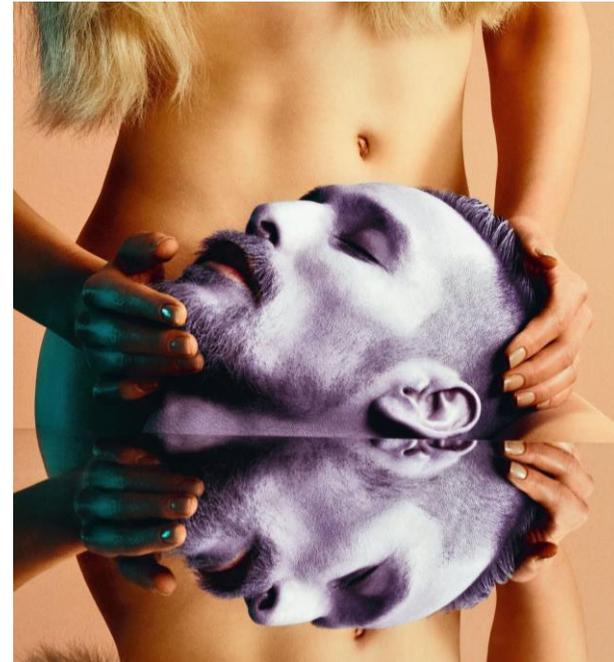


# Content of presentation

- What is drowning: to be or not to be drowned
- The many ways measuring the burden of drowning
- WHO leading role in reducing the burden of drowning
- Counter effects by climate change and migration
- Personal scream to start more research

# Formal world-wide used definition of drowning

Drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid



# Drowning pathophysiology

- At least 16 mechanism may interact
- Each drowning is different
- Common final pathway in drowning is

# hypoxia

## REVIEWS

PHYSIOLOGY 31: 147–166, 2016. Published February 17, 2016; doi:10.1152/physiol.00002.2015

### Physiology Of Drowning: A Review

Drowning physiology relates to two different events: immersion (upper airway above water) and submersion (upper airway under water). Immersion involves integrated cardiorespiratory responses to skin and deep body temperature, including cold shock, physical incapacitation, and hypovolemia, as precursors of collapse and submersion. The physiology of submersion includes fear of drowning, diving response, autonomic conflict, upper airway reflexes, water aspiration and swallowing, emesis, and electrolyte disorders. Submersion outcome is determined by cardiac, pulmonary, and neurological injury. Knowledge of drowning physiology is scarce. Better understanding may identify methods to improve survival, particularly related to hot-water immersion, cold shock, cold-induced physical incapacitation, and fear of drowning.

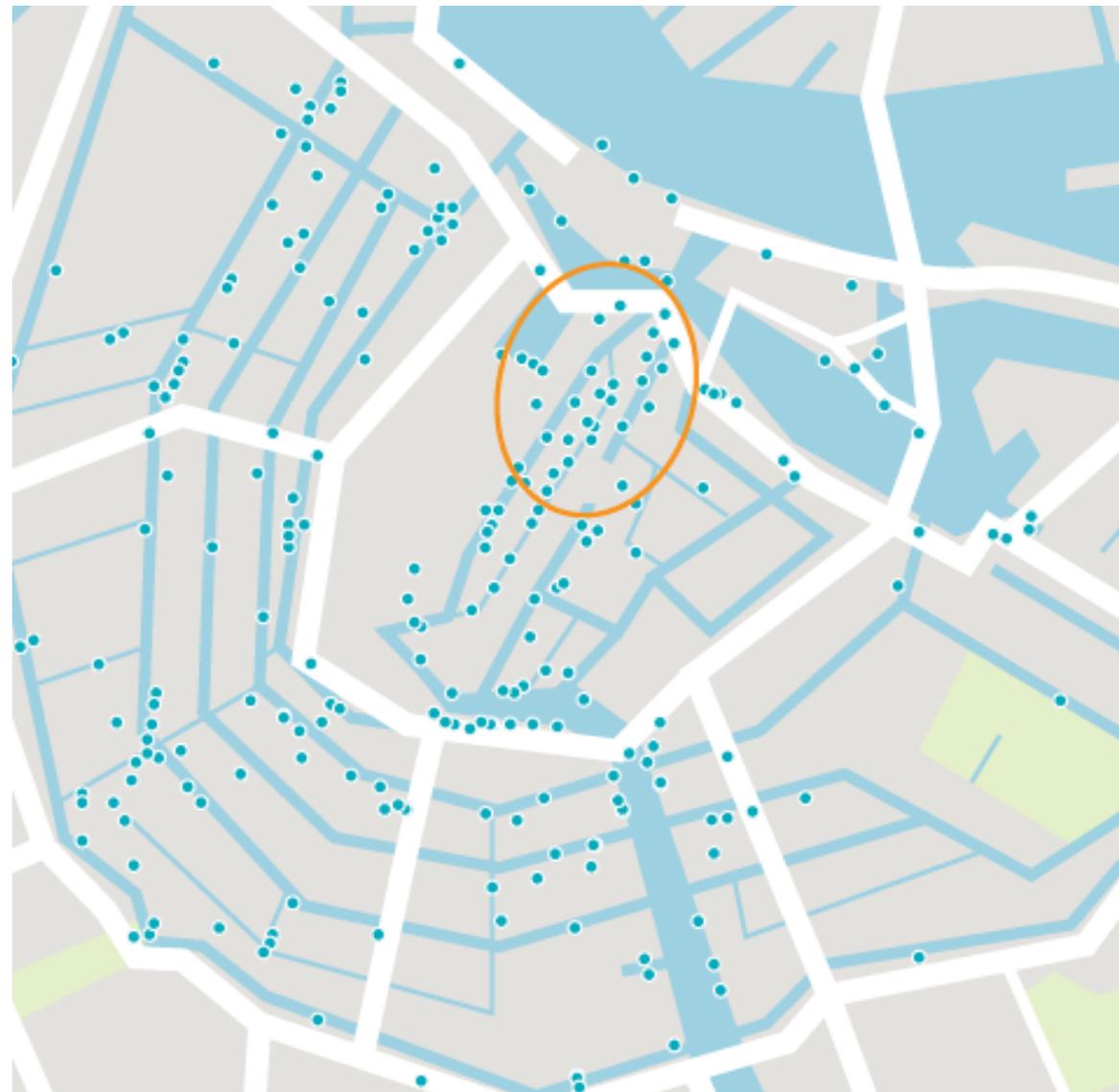
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David S. Warner<sup>4</sup>

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# Drowning in the canals of Amsterdam

What is drowning ?  
not: falling in water

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A variety of event can happen in water but not all are drowning

- Warning to person outside the water
- Warning to person inside the water
- Assistance to person in water – not immediate dangerous situation
- Assistance to person in water – may become dangerous situation
- Assistance to person in water – dangerous situation
- Assistance to person in water – life threatening situation
  
- Often the actual drowning process has not yet started

# Drowning: a process that can end fatal or non-fatal

- Fatal = dead
- Non-fatal = surviving
  - With morbidity: complications such as neurological, pulmonary, hypothermia, coagulopathy, heart
  - Without morbidity: no complications
- What is the minimal criterium to be included as drowning ?

**Involuntarily distressed coughing**

# Non-fatal drowning categorisation framework

## Severity category of respiratory impairment after drowning process stopped

1. Mild impairment – involuntary distressed coughing and fully alert
2. Moderate impairment – sustained difficulty breathing and/or disoriented but conscious
3. Severe impairment – not breathing and/or unconscious

## Morbidity category at the time of measurement

- a. No morbidity
- b. Some morbidity
- c. Severe morbidity

## Examples

1 - a

3 - c

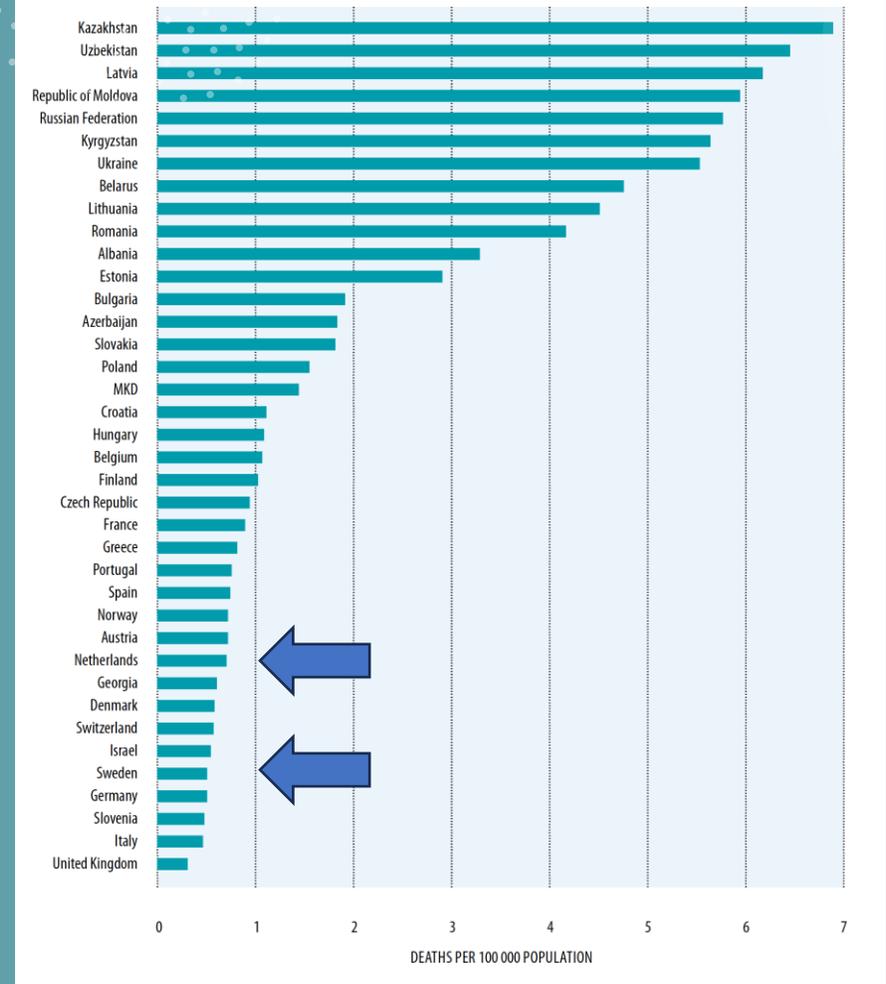
3 - a

2 - ?

? - 3

# The incidence of accidental drownings in Europe

**Fig. 4.1**  
Average standardized mortality rates for drowning in children aged 0–19 years in the WHO European Region, 2003–2005 or most recent three years



# The total burden : all causes of drowning

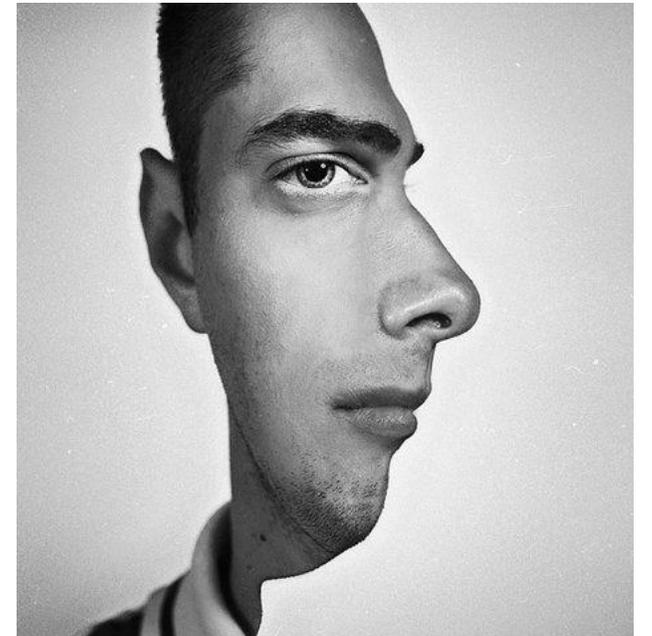
- Accidental drowning : this is where most statistics are based on
- Traffic
- Suicide
- Homicide
- Health related
- Floods
- Migration
- Shipping disasters

# Other problems when measuring the full burden of drowning

- Low-quality registries
- Data exist but no one asked for them
- Organisation do not register in the same way
- Different ways to describe the number of drownings

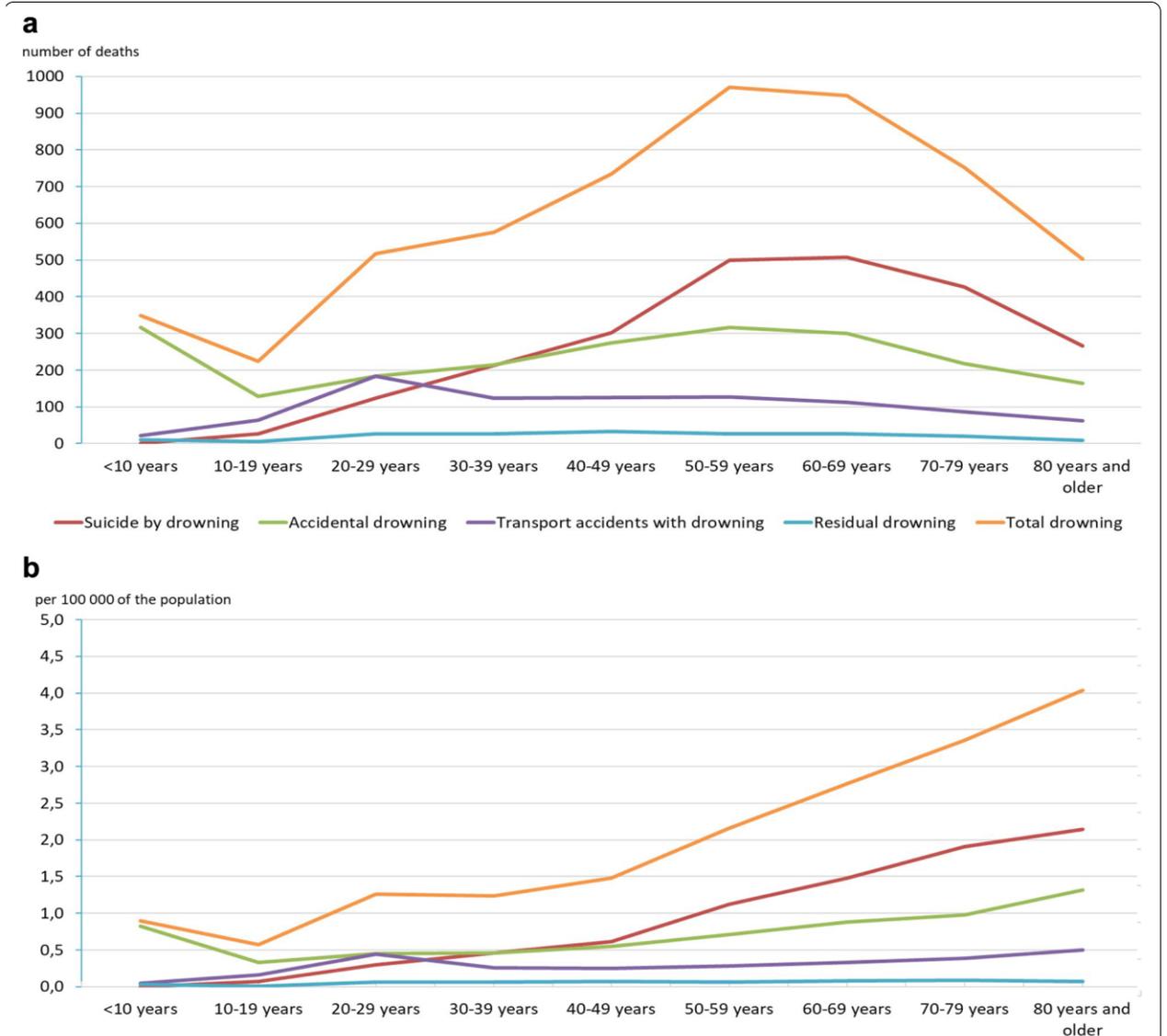
# How to describe the burden changes the picture

- Absolute numbers
- Incidence per 100.000
- Exposure (risk groups, length land-water interface, per km<sup>2</sup> water)
- Years of life lost or years lived with disabilities
- Financial impact:
  - out-of-hospital; rescue, dispatch, transport
  - in hospital: ED, ICU
  - society



# Absolute numbers vs incidence per 100.000

Data from the Netherlands





## Description based on exposure

Below sea level	24% (6.8meter)
Rivers	650 km
Streams	6200 km
Ditches	330.000 km
Canals	6500 km
Lakes	2500 km <sup>2</sup>
Swimming pools	1583
Salt water	62000 km <sup>2</sup>

# Description by number of years of life lost

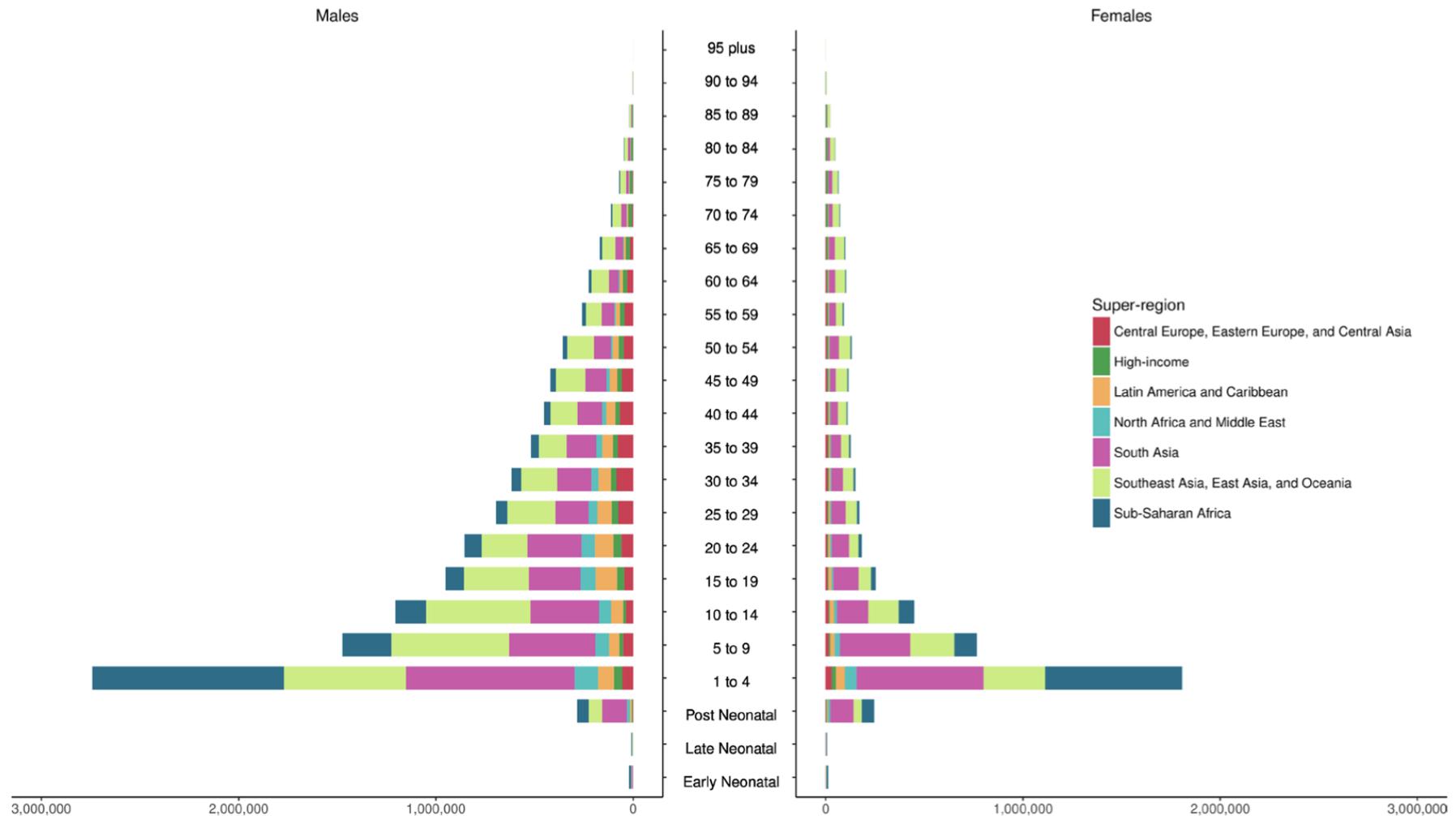


Figure 5 Years of life lost to unintentional drowning by age group, sex and super-region in 2017.

# In Europe : many different small risk groups

- Pre-swim age
- Older population
- Foreigners
- Migrants
- Water recreation
- Alcohol
- Car in water
- Floods



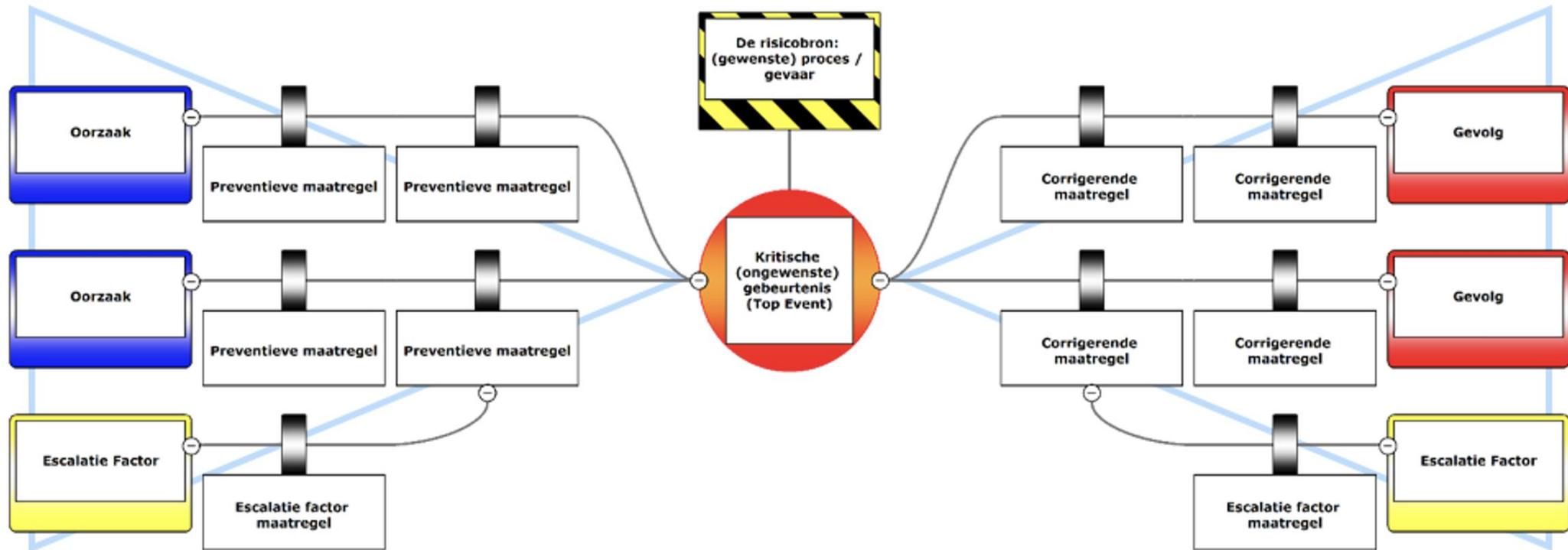
# Which parameters seem important to understand why people drown

- Risk groups
  - Gender – age
  - Ethnicity – migrants – country of origin
  - Socio-economic status – rural vs urban
  - Health and physical condition (ASA)
- Risk factors
  - Location
  - Season – holiday - weekend
  - Swimming competency



# An alternative way to understanding relevant factors

## Bow-tie analysis – one can learn from each drowning



Legal and ethical restrictions to contact the drowned persons and rescuers

The full global picture of the burden of drowning is incomplete



# Why is a complete registration relevant

- Quantify the issue – politicians and donors respond to indicators
- Understand cause – effect relationship
- Develop preventive measures
- Measure effects preventive measures
- Identify and follow-up of trends
- Create awareness
- Generate public and political support
- More money for drowning prevention, rescue and treatment

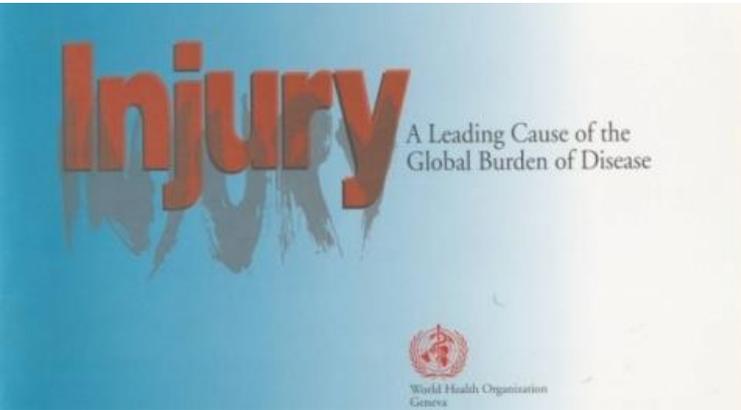
**FINAL GOAL TO REGISTER DROWNING IS  
TO REGISTER LESS DROWNING**

The burden of  
drowning: a  
paradigma shift  
causes new  
attention to  
drowning  
resuscitation



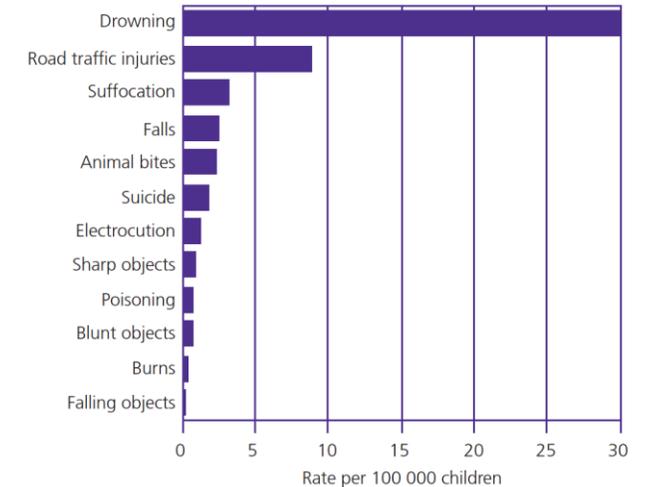
# Role of WHO

## 2000 – awareness that drowning is an issue

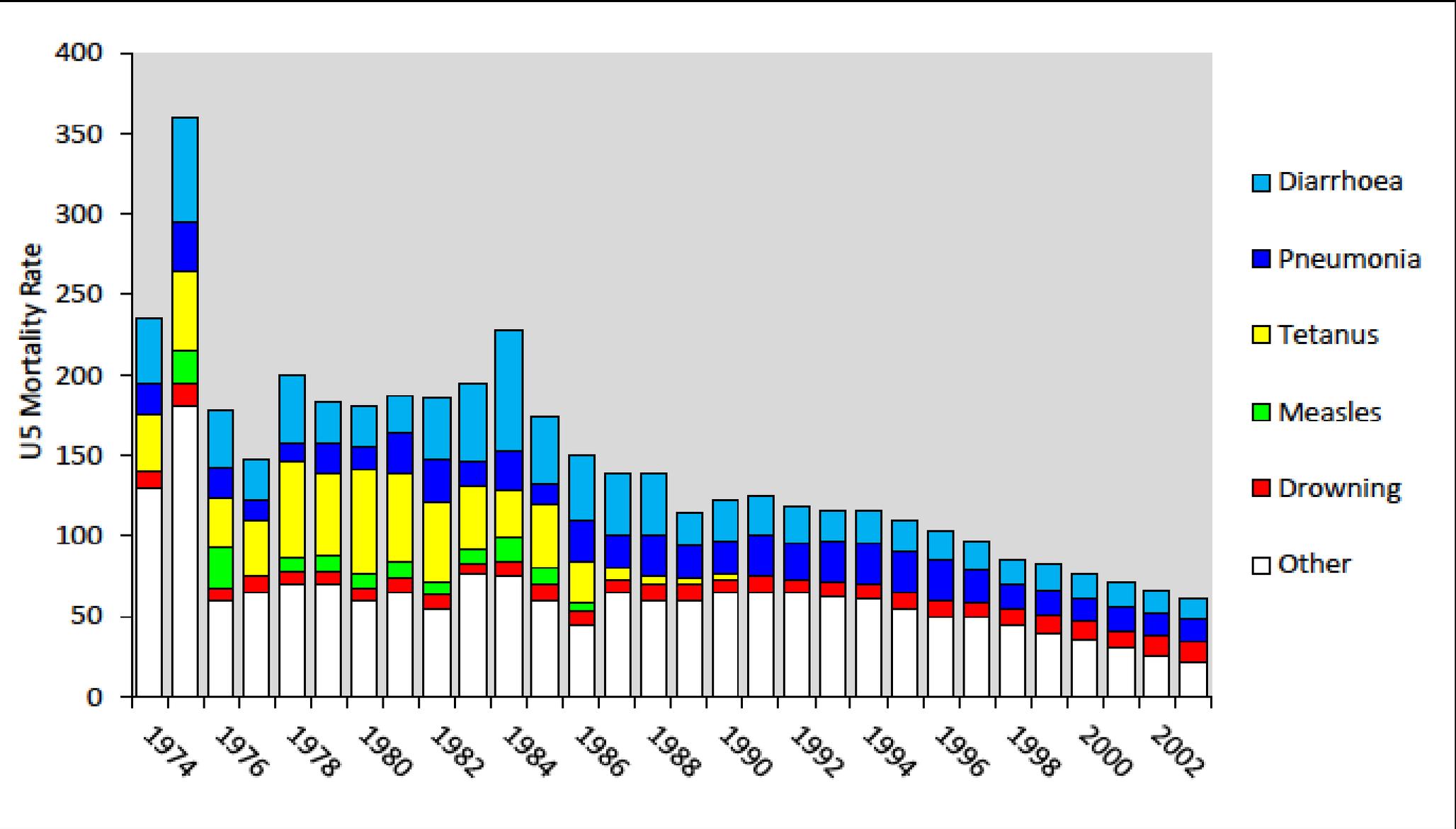


	<u>Both Sexes</u>	
	Number of Deaths	Mortality Rate (per 100,000)
All Injuries	5 764 825	97.9
Road Traffic Injuries	1 170 694	19.9
Suicide	947 697	16.1
Homicide	735 972	12.5
War	588 050	10.0
Drowning	495 463	8.4
Falls	315 633	5.4
Fires	282 178	4.8
Poisoning	251 881	4.3
Other injuries	977 259	16.6

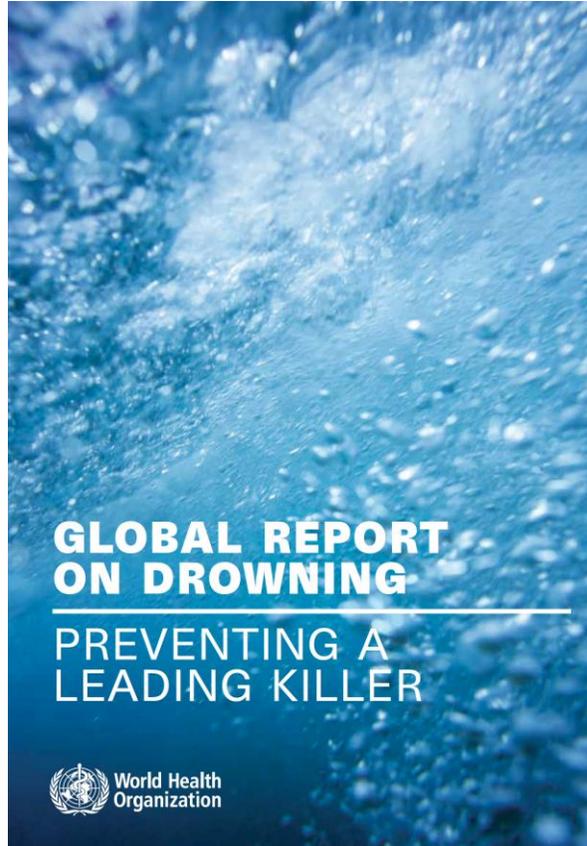
**Fatal injury rates per 100 000 children aged 0–17 years in five<sup>a</sup> Asian countries**



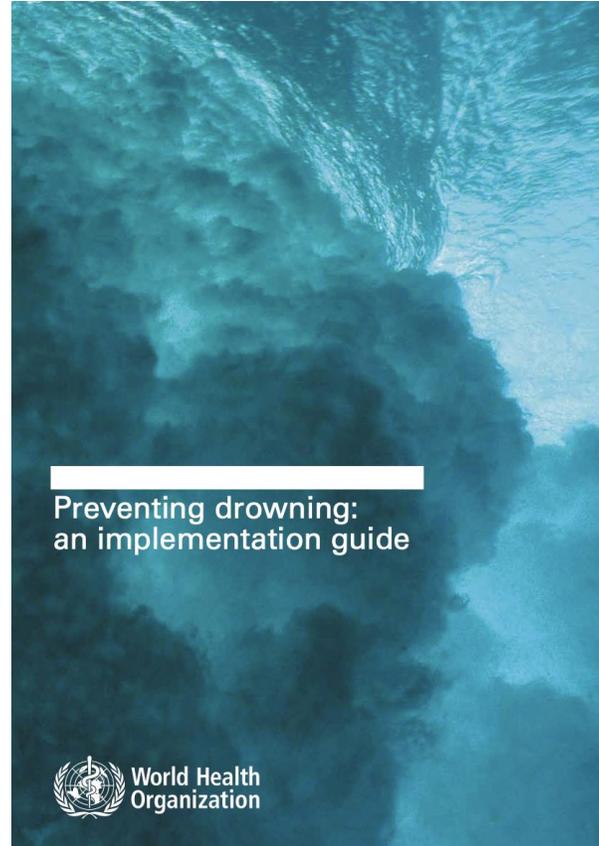
<sup>a</sup> Bangladesh, China (Beijing, Jiangxi), Philippines, Thailand, Viet Nam



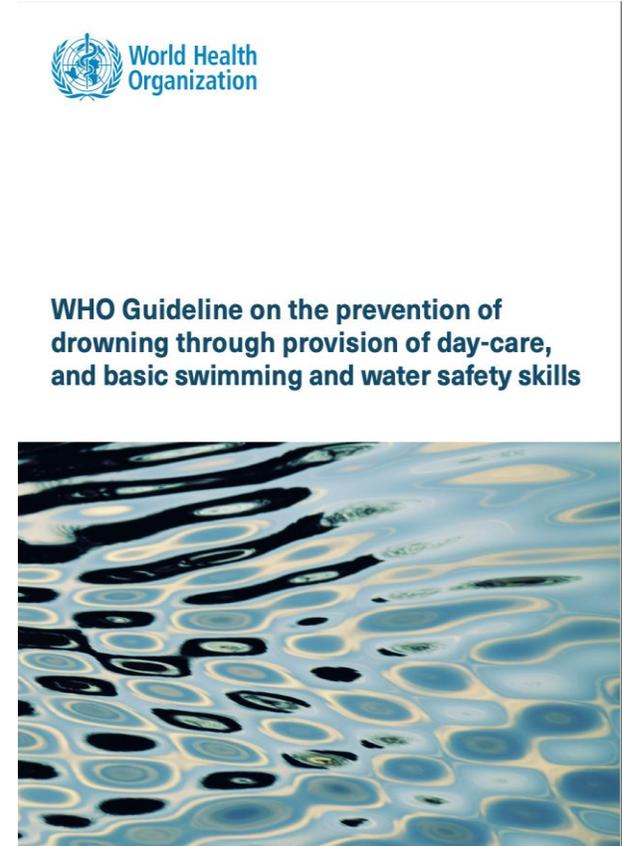
2014



2017



2021



## WHO-data drowning deaths per year (GBD)

2000: 449.000

2014: 372.000

2017: 295.000

2019: 236.000

**ADOPTED** ✓

The first-ever UN  
resolution on

Global Drowning  
Prevention

SUSTAINABLE  
DEVELOPMENT **GOALS**



World Health  
Organization

**ANYONE  
CAN DROWN  
NO ONE  
SHOULD**



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**1 All countries should implement proven drowning prevention strategies, tailored to their own circumstances and risk groups**

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**2 All countries should take steps to improve data about drowning**

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**3 All countries should aim to develop a national water safety plan**

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**4 A global partnership for drowning prevention should be established**

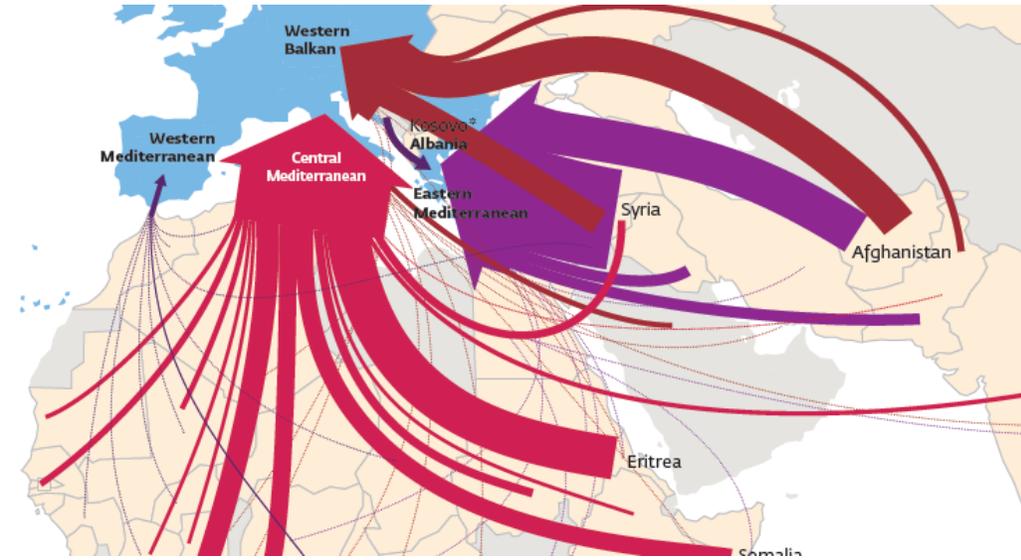
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# Impact climate change on drowning burden

- Raising sea level
- Extreme weather moments
  - Heat, cold, drought, rains
- More people recreate longer at unfamiliar locations
- Different aquatic peculiarities
- Migration (during, after)
- Regional and local differences



# Sea migrants and drowning



Historical average  
drowning death is  
2%.

Less migrants, more  
drownings

# Equity and respect ?



## More research is needed.

There are already many building blocks to start research

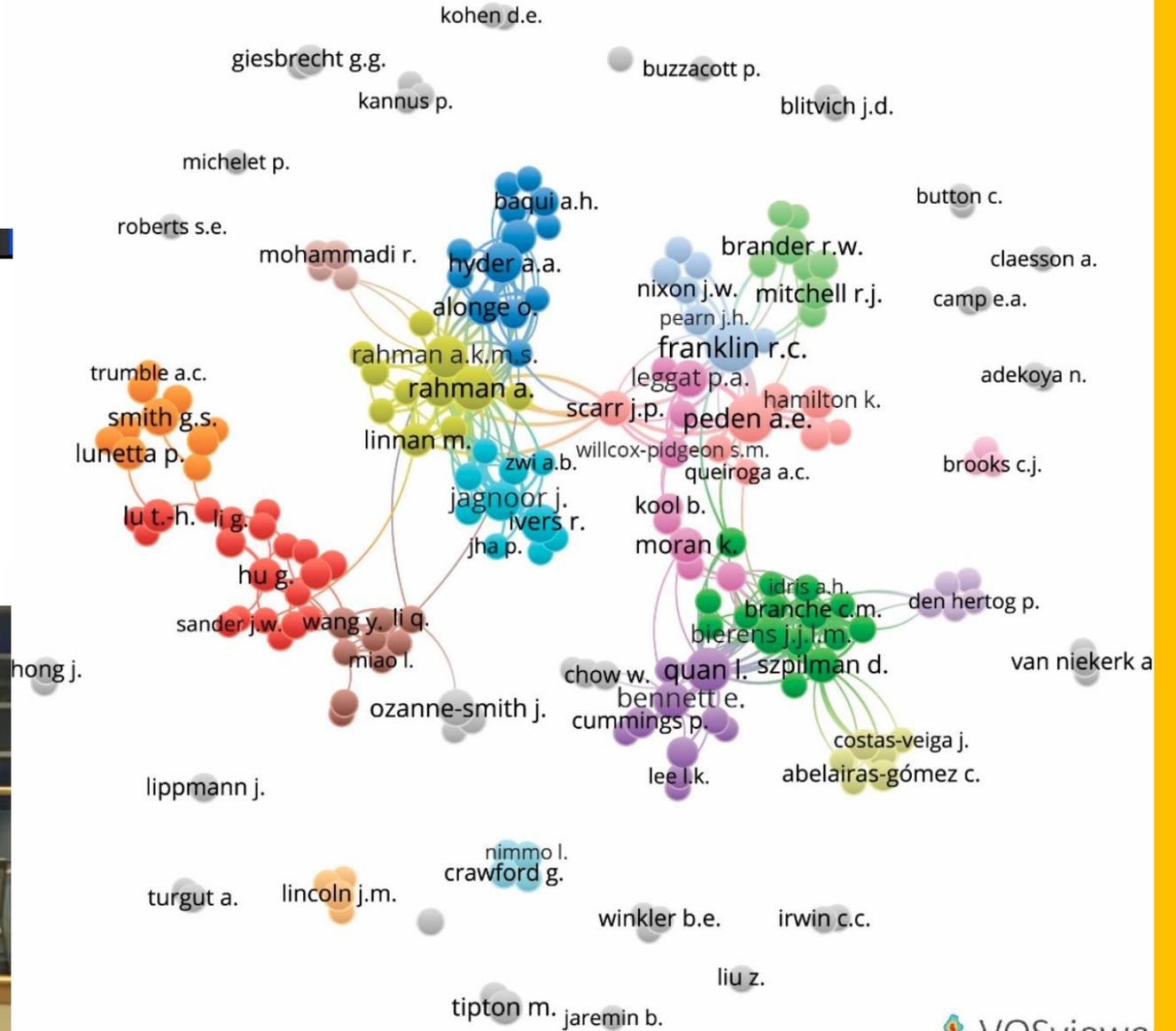
- Definition of fatal and non-fatal drowning
- Non-fatal drowning categorisation
- Drowning dictionary
- Utstein Template of drowning registrations
- Relevant items identified in systematic reviews and other studies
- Examples from collaborations

# Research networks

## IDRA



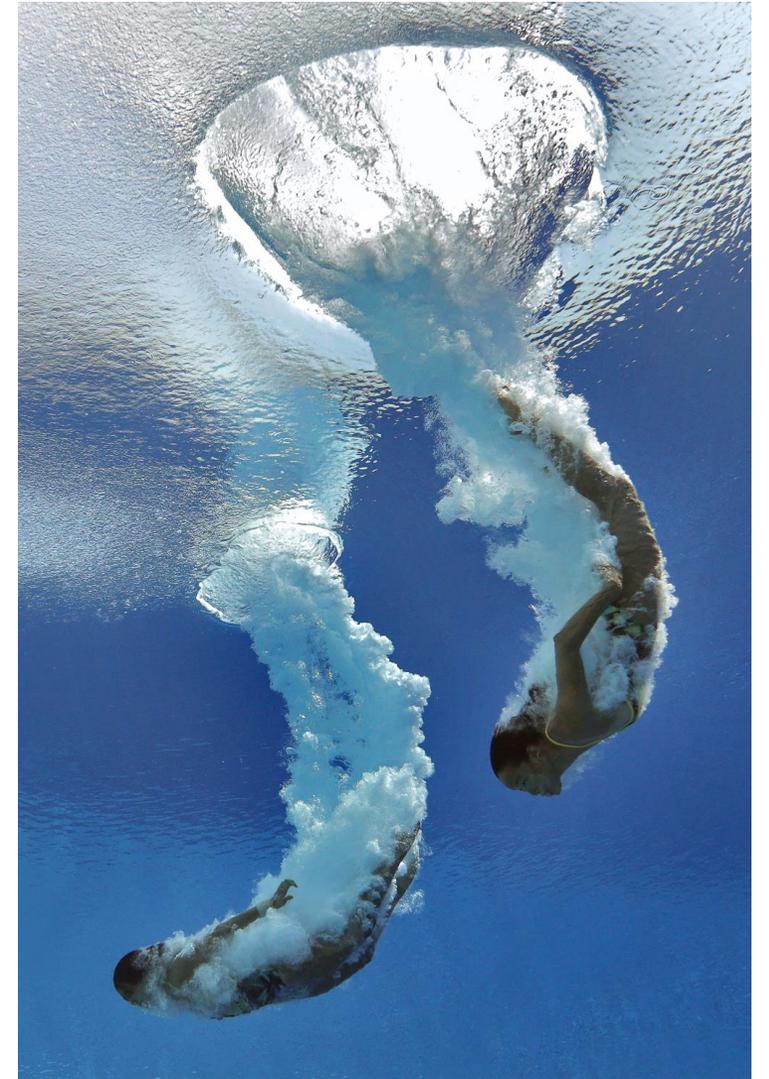
“...promoting safer aquatic environments through evidence-based research...”



# GAPS IN KNOWLEDGE

Define the perfect rescue: a gold standard

- What the relation between victim and rescuer
- Which rescue technique has been used
- What has been the impact on the rescuer





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journal homepage: [www.elsevier.com/locate/resuscitation-plus](http://www.elsevier.com/locate/resuscitation-plus)

## Review

### A systematic review of interventions for resuscitation following drowning



Joost Bierens<sup>a</sup>, Janet Bray<sup>b</sup>, Cristian Abelairas-Gomez<sup>c</sup>, Roberto Barcala-Furelos<sup>d</sup>, Stephen Beerman<sup>e</sup>, Andreas Claesson<sup>f</sup>, Cody Dunne<sup>g</sup>, Tatsuma Fukuda<sup>h</sup>, Muralidharan Jayashree<sup>i</sup>, Anthony T Lagina<sup>j</sup>, Lei Li<sup>j,k</sup>, Tom Mecrow<sup>l</sup>, Patrick Morgan<sup>a</sup>, Andrew Schmidt<sup>m</sup>, Jeroen Seesink<sup>n</sup>, Justin Sempstrott<sup>o</sup>, David Szpilman<sup>p</sup>, Ogilvie Thom<sup>q</sup>, Joshua Tobin<sup>r</sup>, Jonathon Webber<sup>s</sup>, Samantha Johnson<sup>t</sup>, Gavin D Perkins<sup>t,\*</sup>, on behalf of International Liaison Committee on Resuscitation (ILCOR) Task Force



GAPS IN KNOWLEDGE  
 Measure what you do  
 Understand prognostic factors  
 Study how resuscitation results can improve

The burden of drowning - more a concept than a number

”Drowning affects  
the poor, un-informed and badly prepared”  
Drowning is rarely sheer bad luck.

**WE ALL CAN DO BETTER**

# Questions ?

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