

# Paediatric Drowning

A photograph of four children playing in shallow, clear water. The children are smiling and appear to be enjoying themselves. The water is light blue and reflects the sky. The children are wearing colorful clothing: a pink shirt, a white and pink outfit, a blue shirt, and a blue Superman t-shirt. The background shows the sandy beach and the water extending to the horizon.

**Evidence into  
practice**

Mike Shepherd  
March 2008

# Introduction

- Evidence based practice
- Recent drowning research
  - Will include description of gaps in evidence
- Evidence based drowning (and injury) prevention

# Evidence-based world

- We have limited resources
- We should be able to justify our approach and measure our success
- Therefore
  - Injury prevention should be lead by robust evidence
  - Research should be used to target injury prevention
  - Research should be used to guide injury prevention
  - Research should be used to assess success

# Evidence-based world

- But
  - How does this work in practice?
  - Research uses up resources too
    - Money
    - People
  - It takes a long time
  - It may not answer the question
  - We can't wait

# Evidence about drowning?

- Definitions
- Epidemiology
- Prevention
- Clinical
  - Scene
  - Initial medical management

# Definition

- Drowning is a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium.
- Unifying process is liquid exposure to patient's airway
- *Abandoned*
  - *Dry*” or *“wet”* drowning
  - *“Active”* or *“Passive”* or *“Silent”* drowning
  - *“Secondary”* drowning
  - *“Near-drowning”*

# Definition

- Does it matter?
  - Yes
  - If we accept that research is necessary (at whatever level)
- Injury prevention workers should be able to communicate clearly and simply (including internationally).

# Epidemiology

“...as we know, there are known knowns;  
there are things we know we know.

We also know there are known unknowns;  
that is to say we know there are some  
things we do not know.

But there are also unknown unknowns -  
the ones we don't know we don't know.”

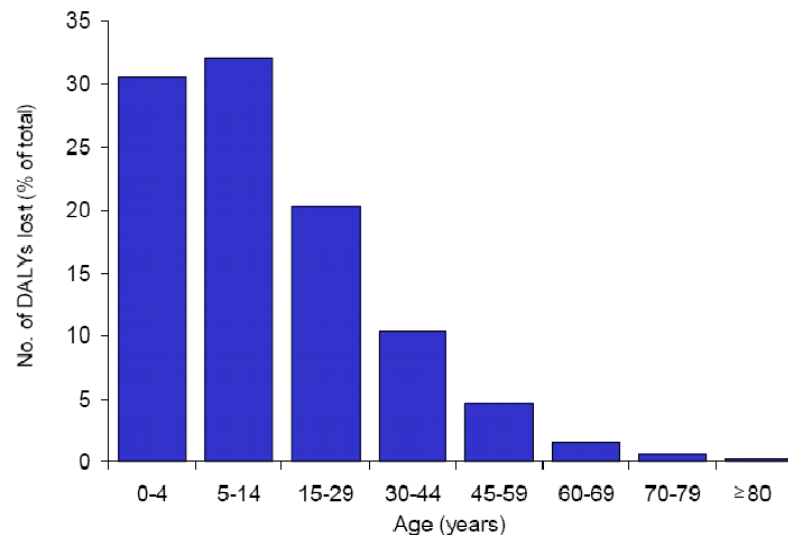
Donald Rumsfeld



# World

- Drowning is the second most common cause of unintentional injury death in the world (does not include drowning following natural disasters).
- Over half of this mortality occurs among children less than 15 years

Age distribution of the global drowning injury burden (DALYs lost), 2000



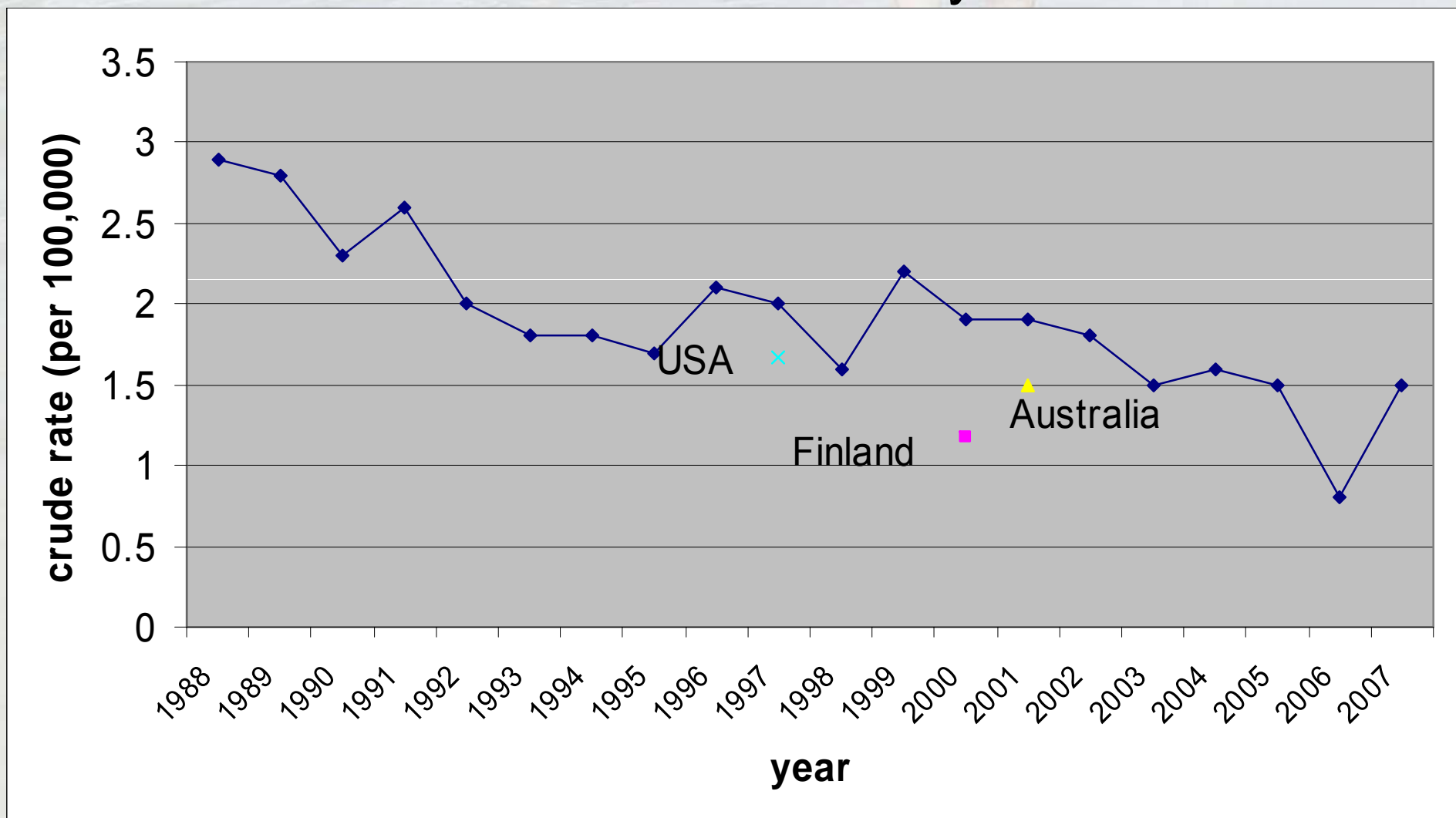
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# New Zealand Drowning Deaths

- 3<sup>rd</sup> most common cause of injury death – all ages
- Most common cause of death in 1 to 4 year age group
- Significant morbidity also
  - Brain injury

# NZ Drowning Fatality

1998 to 2003 0 to 14 years

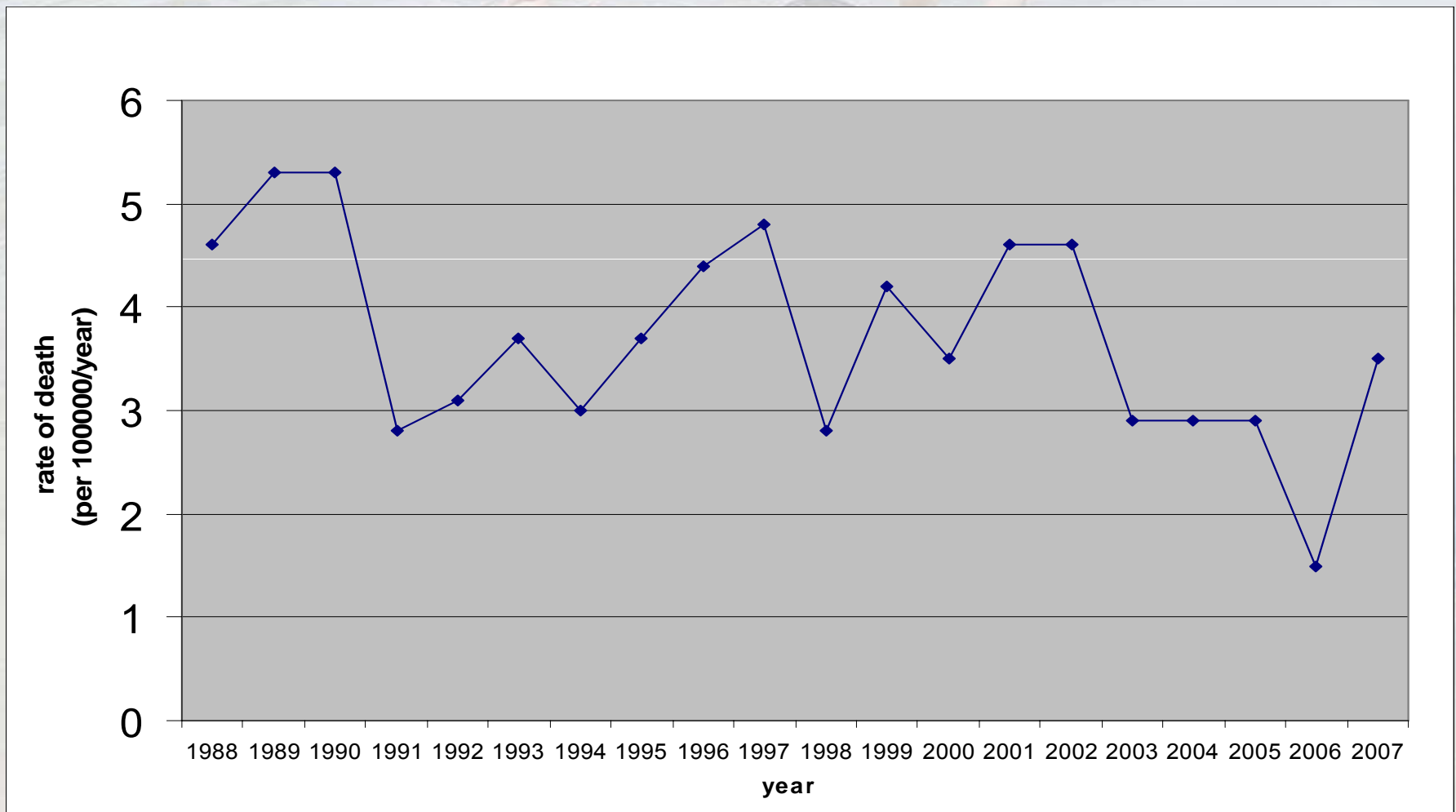


from IRPU

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# NZ Drowning Fatality

## 1998 to 2007, 0 to 4 year olds

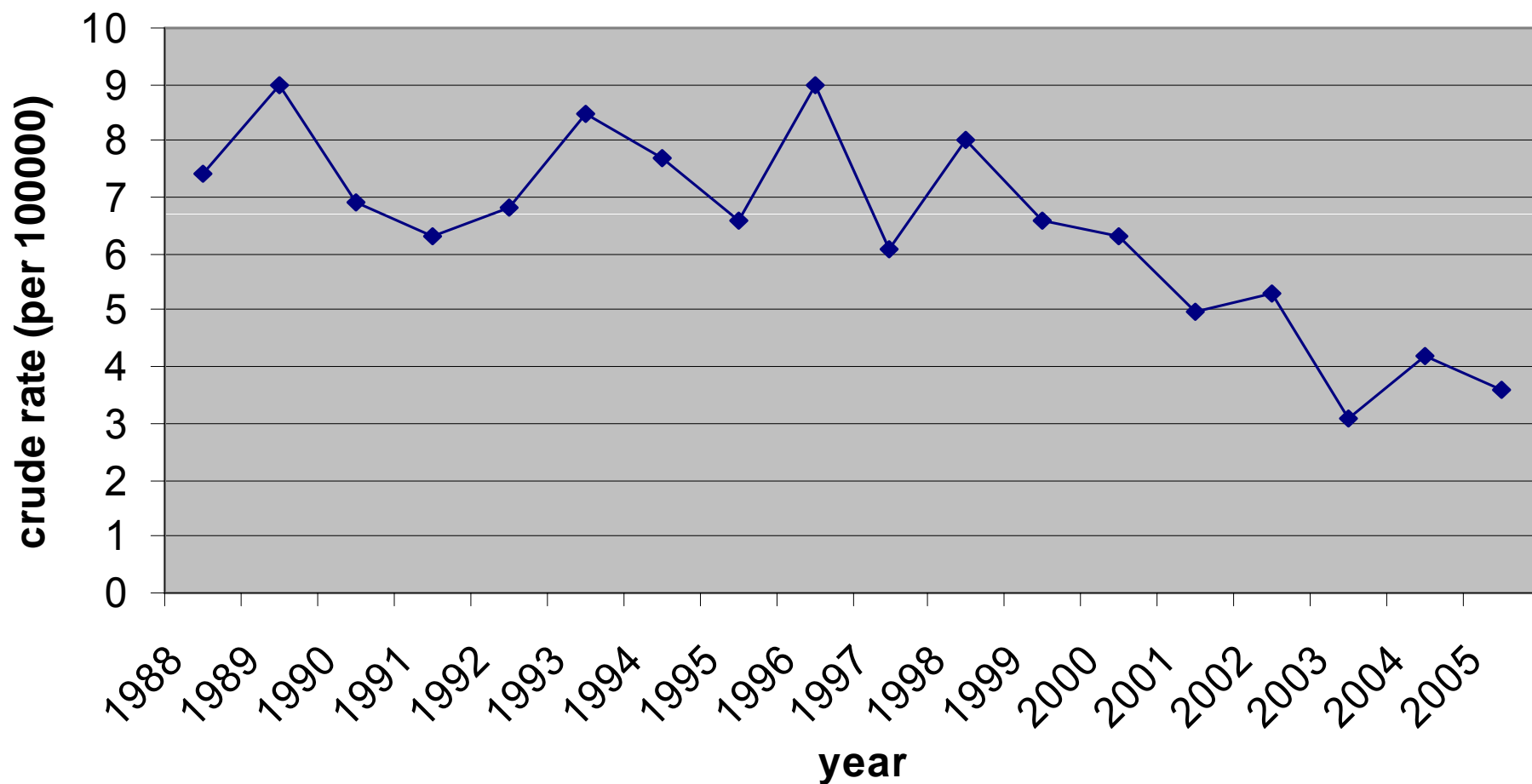


From Watersafe

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# New Zealand Public Hospital Admissions

1988 to 2005, 0 to 14 years.

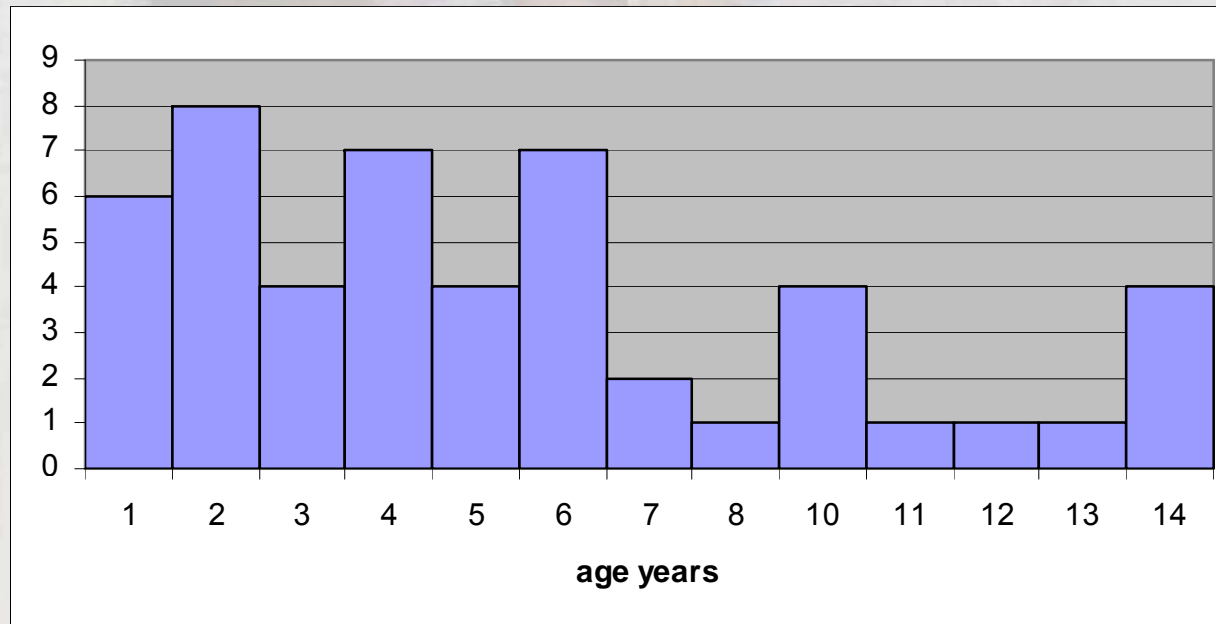


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# Starship ED

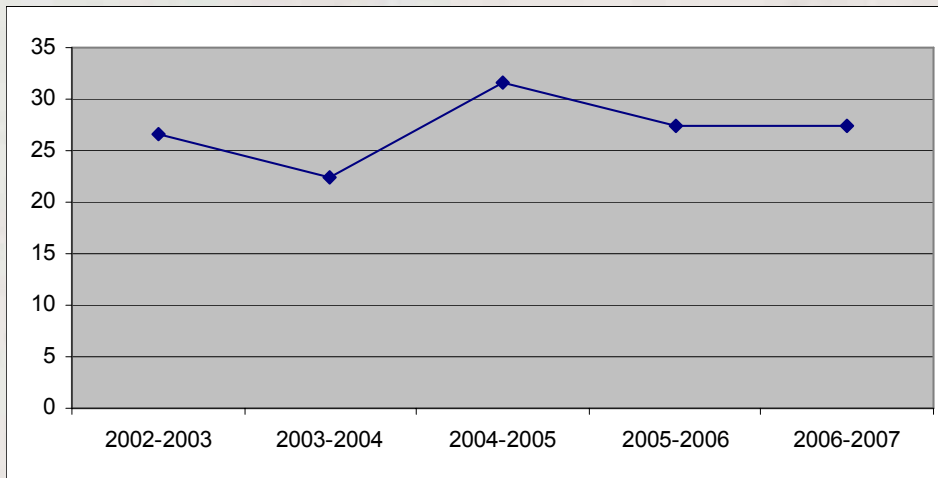
- Average of 10 presentation/yr to CED
- Uncertain data completeness
- No significant change over the last 5 years
- Around half get admitted
- 50% under 5 years



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# Ambulance

- Average of 27 under 15 year olds per year in Auckland region
- Older age distribution
- Data incomplete
- Quite a few more that couldn't be found!
  - Presumably got better
- No significant change over the last 5 years



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# Gender/Ethnicity

- 65% boys
- Maori children
  - Slightly greater risk
- Pacific children in the 5-14 year age group appear to be at increased risk:
  - 7% of the child population aged 5-14 years
  - 15% of the drownings for this age group
  - No data on more specific ethnicity

# Circumstances of drowning

A faded background image showing several children playing in shallow water. One child in the foreground is wearing a blue Superman t-shirt and is smiling. Other children are visible in the background, some with their heads above water and some with their heads submerged.

- Under 1 – bath or container
- 1 to 4 – domestic pool or spa
- 5 to 14 – river, sea, lake

# Missing data

- We have a limited picture of drownings that do not result in death.
- This information is potentially very important
  - Why did they survive?
  - Why did they drown?
  - How were they treated?
  - How are they now?

# Other evidence

- So in NZ
  - Drowning deaths are collected
  - Non-fatal events are not well collected
- What is known about how to stop children drowning?

# Haddon Matrix

## Swimming Pool Drowning

	Individual (Child)	Agent (Swimming pool)	Physical environment	Social environment
Pre-event	<ul style="list-style-type: none"> <li>• Education about water safety</li> <li>• Age</li> </ul>	<ul style="list-style-type: none"> <li>• Attractive items in pool</li> <li>• Slippery edges</li> </ul>	<ul style="list-style-type: none"> <li>• 4 sided fence, child resistant fence</li> <li>• Self closing and latching gate</li> <li>• Direct adult supervision</li> </ul>	<ul style="list-style-type: none"> <li>• Legislation re: pool fencing</li> <li>• Enforcement of legislation</li> </ul>
Event	<ul style="list-style-type: none"> <li>• Swimming ability</li> </ul>	<ul style="list-style-type: none"> <li>• Water temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Supervision</li> <li>• Pool alarm</li> </ul>	<ul style="list-style-type: none"> <li>• Swimming lessons</li> </ul>
Post-event	<ul style="list-style-type: none"> <li>• Other medical problems</li> <li>• Physiological reserve</li> </ul>	<ul style="list-style-type: none"> <li>• Water quality</li> </ul>	<ul style="list-style-type: none"> <li>• Caregiver CPR training</li> </ul>	<ul style="list-style-type: none"> <li>• EMS response</li> <li>• Trauma services</li> </ul>

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# Home

- Bath seats may promote a false sense of safety
  - Evidence for actual increase in risk is weak
  - But – do not reduce risk or confer an advantage therefore we should discourage
- Containers of water
  - Anticipatory guidance (?successful)
- Active supervision is required in the bath
  - Anticipatory guidance (?successful)

# Pool barriers

- **Are effective**
  - The OR for the risk of drowning in a fenced pool compared to an unfenced pool is estimated at 0.27
  - This is likely to be a conservative figure
  - Works by preventing UNINTENDED access to the pool by 1 to 4 years olds.
- **Need to have**
  - A robust standard
  - Legislation
  - Enforcement

# Pool barriers need to have

- '4 sides'
  - The relative risk for a toddler immersion death with access occurring through a barrier with child resistant house doorset, compared to a barrier without child resistant house doorset (where the barrier is fully functional) is **10** (unpublished)
- Gate – Self closing, self latching, child resistant closure
- Fence construction– difficult to climb / child resistant

# Pool barriers in NZ

- Further strengthening of the standard is supported by the literature
  - Four sided
    - Currently allow child resistant doorset
    - Allows non child resistant doorset if there is an automatic pool cover and pool alarm
      - There is no evidence of efficacy for this option
- Enforcement
  - Even when pool fencing legislation is in place less than 50% of pools may comply with the law
  - Should strongly discourage exemptions
  - Needs ongoing advocacy



# Swimming lessons

- Population groups reporting poorer swimming ability generally have higher drowning rates
- Swimming ability probably confers protection for older children and adults
  - Need to increase access to public swimming pools to promote learning to swim
- BUT
  - Drowning can occur even if able to swim
  - Swimming lessons may have some downside
    - Over-confidence, caregiver security, risky swimming
  - Will **not** help 1 to 3 year olds

# Lifeguards

- “Evidence suggests that lifeguard services benefit public safety by saving lives, lowering drowning rates, and preventing injuries in aquatic recreational environments.”
  - » CDC working group
- Few deaths occur on patrolled surf beaches.
- But little literature on the effectiveness of lifeguards and beach patrols as a preventive measure.
  - One Australian study showed
    - Resus between the flags = 95% “success”
    - Resus outside the flags = 62% “success”

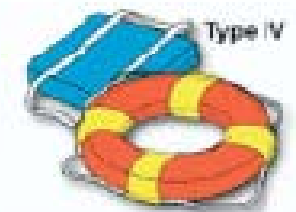
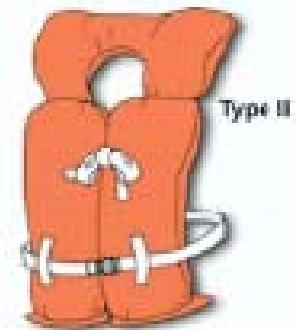


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# PFDs

- Many boating related drownings are thought to be preventable
  - 85% in the only easily accessible study (1993, USA)
  - But little prospective evaluation
- Likely to require
  - Robust legislation
  - Affordable supply

Pictures of PFDs



# Education

- CPR training
  - No published evidence documenting improved drowning outcomes
  - But
    - We know effective early resuscitation in cardio-pulmonary arrest results in better outcomes
  - Uncertain place as a public health measure
- School based education around water safety
  - Uncertain efficacy
  - Probably
  - In general - advice and education are the least successful interventions in injury prevention

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# Scene

- In-water resuscitation may be indicated
  - “Whenever possible, if a victim is found in the water, the rescuer should immediately establish whether spontaneous breathing is present and, if it is absent, initiate artificial ventilation.”

International Life Saving Federation
  - Unless
    - threats to the safety of the rescuer and victim
    - known submersion over 15 minutes
  - Some weak evidence supporting this, but also supported by theoretical considerations

# 'Evidence based' resuscitation

- Institute immediate CPR
- Don't try to clear airway
  - unless preceding episode of choking
- Don't attempt to drain fluid
- **PUSH HARD, PUSH FAST**
  - **Minimize interruptions**
- If alone – CPR for **2** minutes before going for help

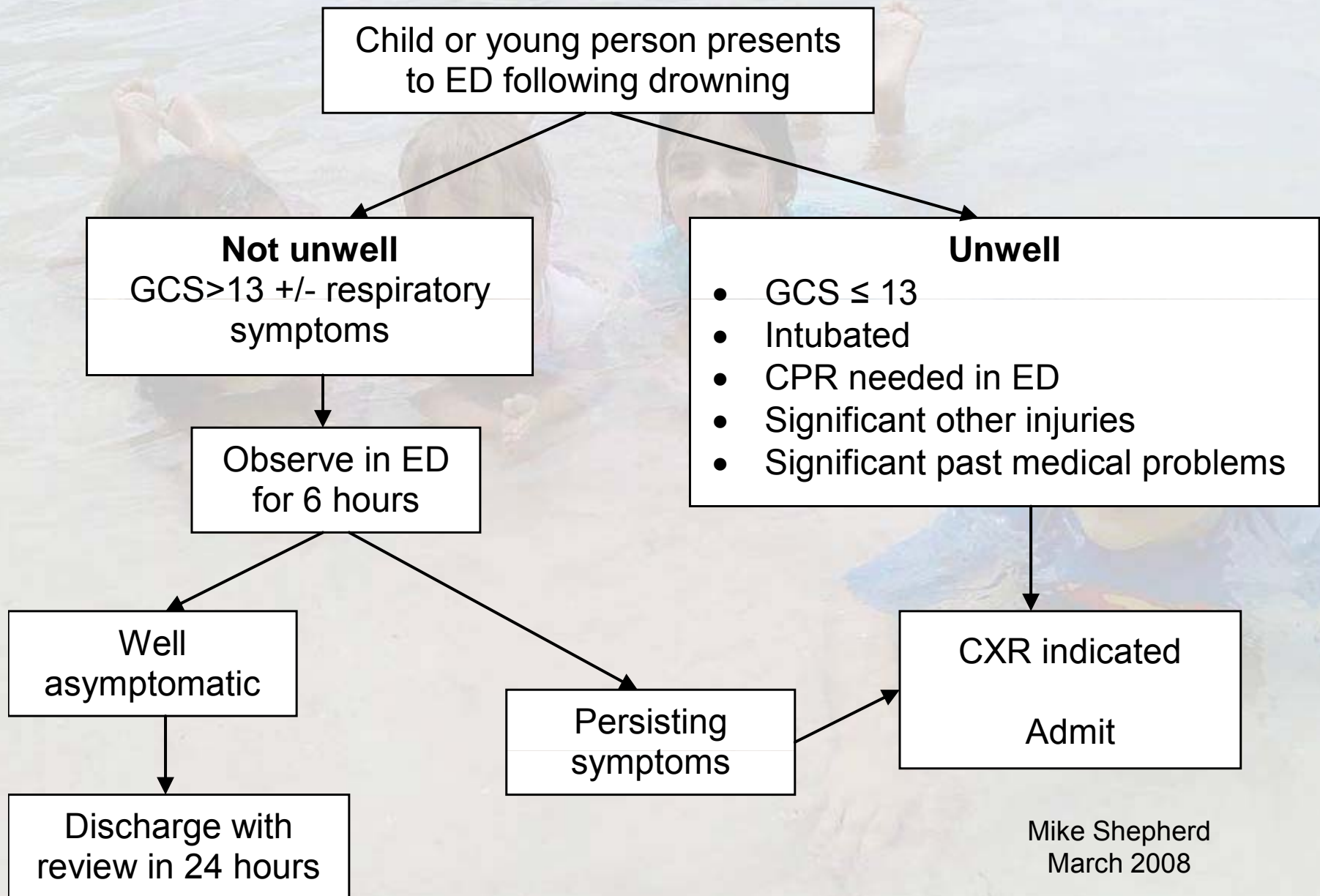
©2001



*"SAVE the patient you idiot! I said we've got to do whatever we can to SAVE the patient!"*

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# Evidence based medical management



# So....

- Preventing paediatric drowning
  - Uniform use of new definition
  - Collection of nonfatal drowning data
  - Definitely
    - Better pool fencing, more PFDs/lifejackets (legislation, education and reduced cost)
  - Possibly
    - More swimming lessons, more lifeguards, less bath seats, more advice re supervision, more education, better resuscitation, better medical management
  - Use of data to measure outcomes

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# Real world research

- Use already available data sources
- Use already available research
- Ensure collaboration with others – national and international
- If seeking funding, include outcome measurement
- Involve experienced/trained researchers

# Practical points

- If something is proven – we need to advocate for it extremely strongly
  - Proving things in injury prevention has been difficult
- Data is precious – we need to gain access to better data
  - ACC data may be a useful source
- Look carefully for other successes or failures
- The measurement and dissemination of results needs to be part of injury prevention
- Keep at it 😊

