Reduced Intensive Care Workload but Higher Technology Dependency - Resulting Impacts on Health Authorities and Intensive Care Physicians

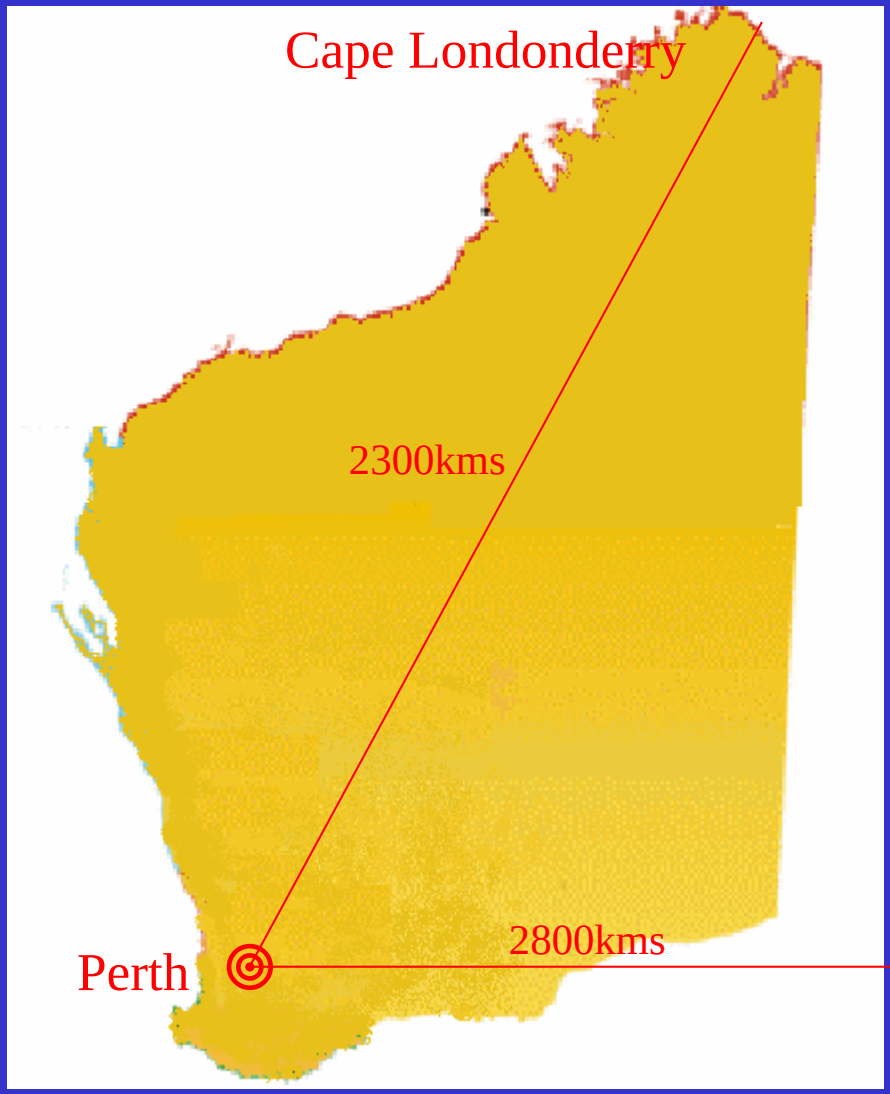
Acknowledgements

Derek Angus
Andrew Argent
Richard Brilli
Kathleen Culver
Thomas Green
Mary Hartman
John Kellum
Barry Markovitz
Carol Nicholson

ANZPICR (Tony Slater)

Margaret Parker
Steven Pon
Matthew Scanlon
Frank Shann
David Todres
Edwin van der Voort
Scott Watson
Carl Weigle
Randall Wetzel

ANZICS PSG
(Simon Erickson)



Population 2.1 million

Metro 1.5 million

Indigenous 2%

- Up to 10% of PICU admissions
- Developing world problems

The past matters more than we realise….

We walk on it's ground, and if we don't know the soil we are lost

William David Williams

(Courtesy David Todres)

Where have we come from?

How did we get here?

What are the challenges?

What does the future hold?

1960's

From humble beginnings….

- Recovery rooms
- Anaesthesia
- Prolonged nasal intubation
- Astrup apparatus

1970's

"Age of ingenuity"

- Adapted ventilators
- Invasive monitoring
- Specialised equipment
  - -Dinamap
  - -Infant ventilators
  - -Blood gas analysers
- Training programs

1970's

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1980's

"Age of technology"

- Non-invasive monitoring
  - Oximetry, capnography
- Imaging
  - CT, echocardiography
- Life support technology
  - Haemofiltration
  - ECMO
  - HFOV
- Retrieval services

1990's

"Search for the magic bullet"

- Pharmacology
  - –Nitric oxide
    - 1991 Molecule of the Year
- Molecular biology
  - –Cytokines
- Home ventilation
- Internet

21st C

Models of care

Quality and safety

EBM

Family expectations

Changes in technology

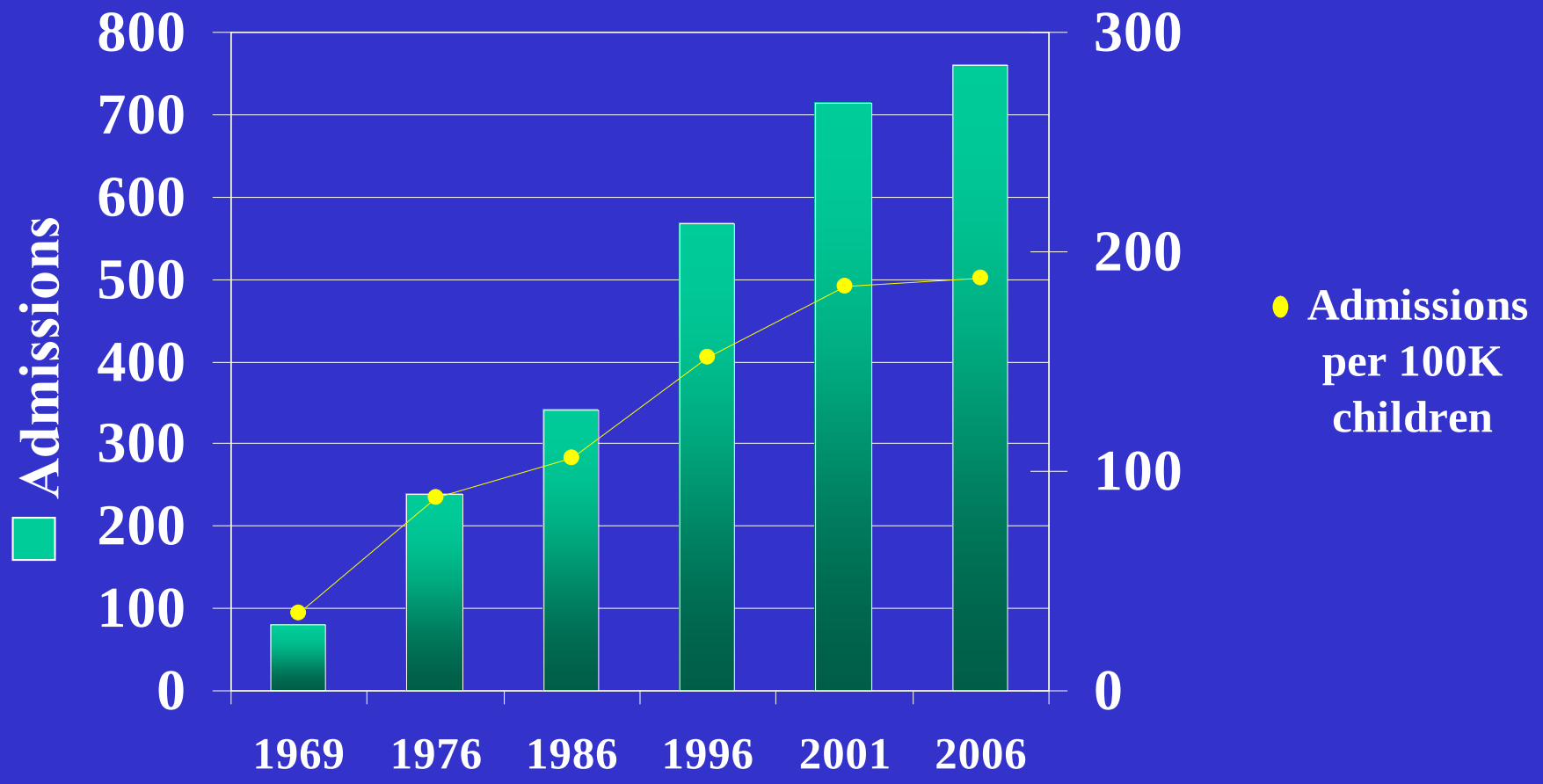
but also in utilisation

casemix

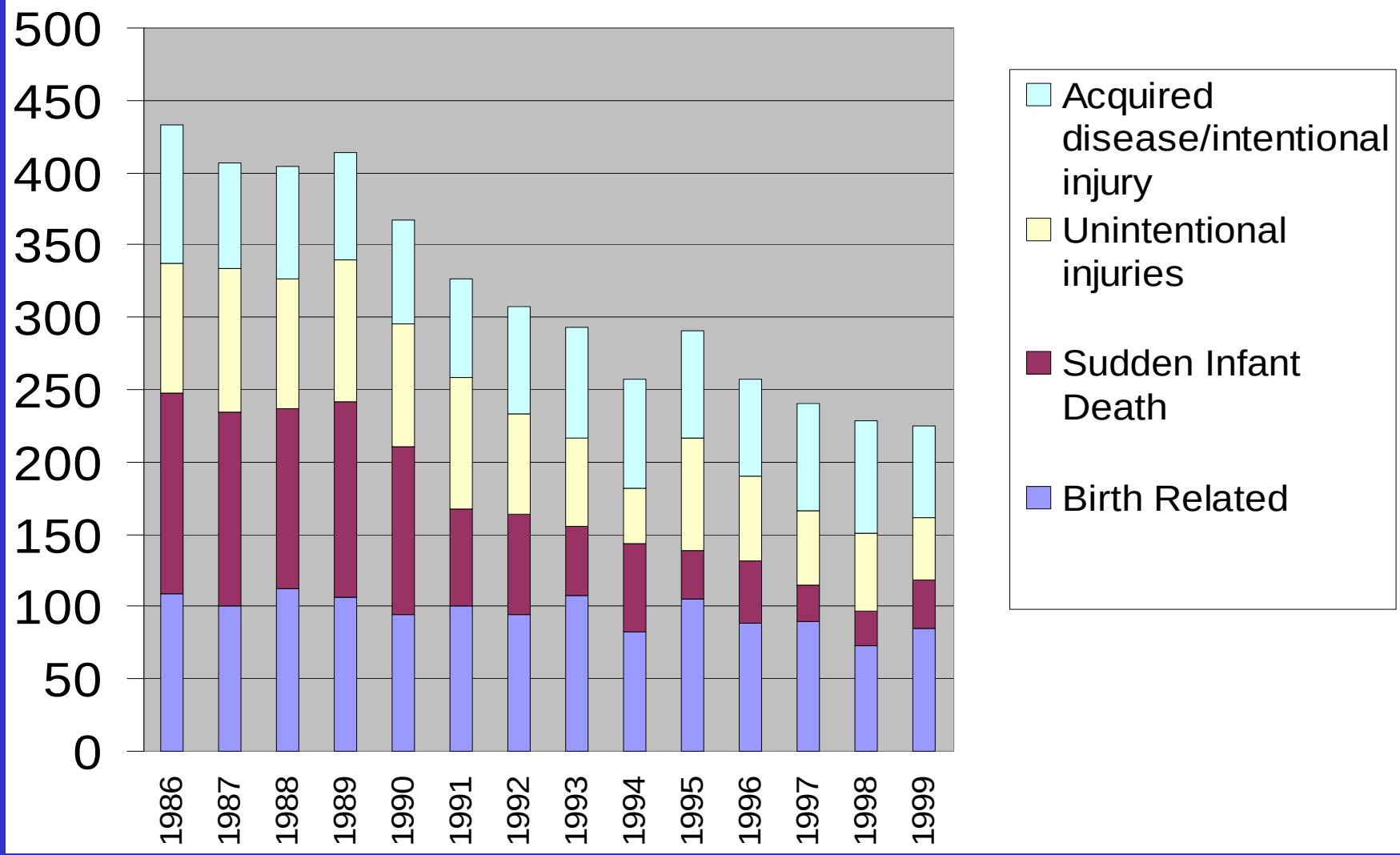
outcomes

process

Utilization

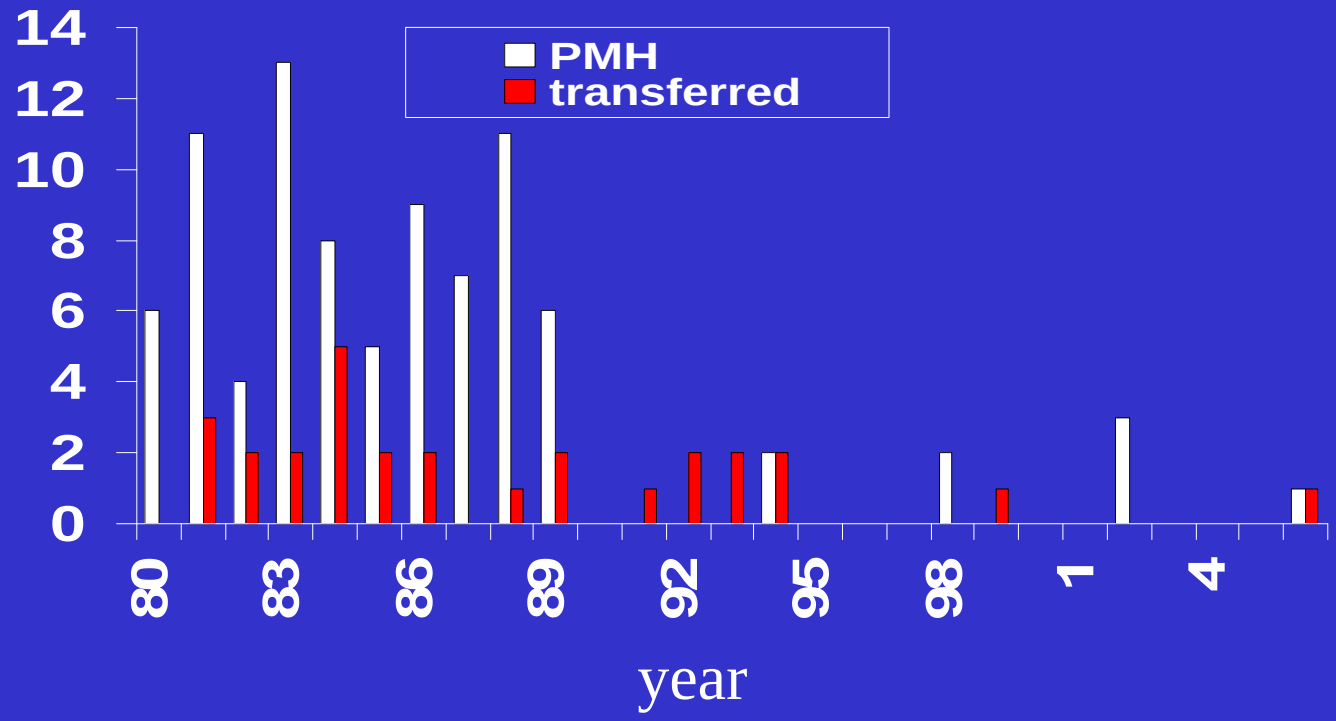


Postneonatal infant and child deaths by major cause, Victoria 1986-99

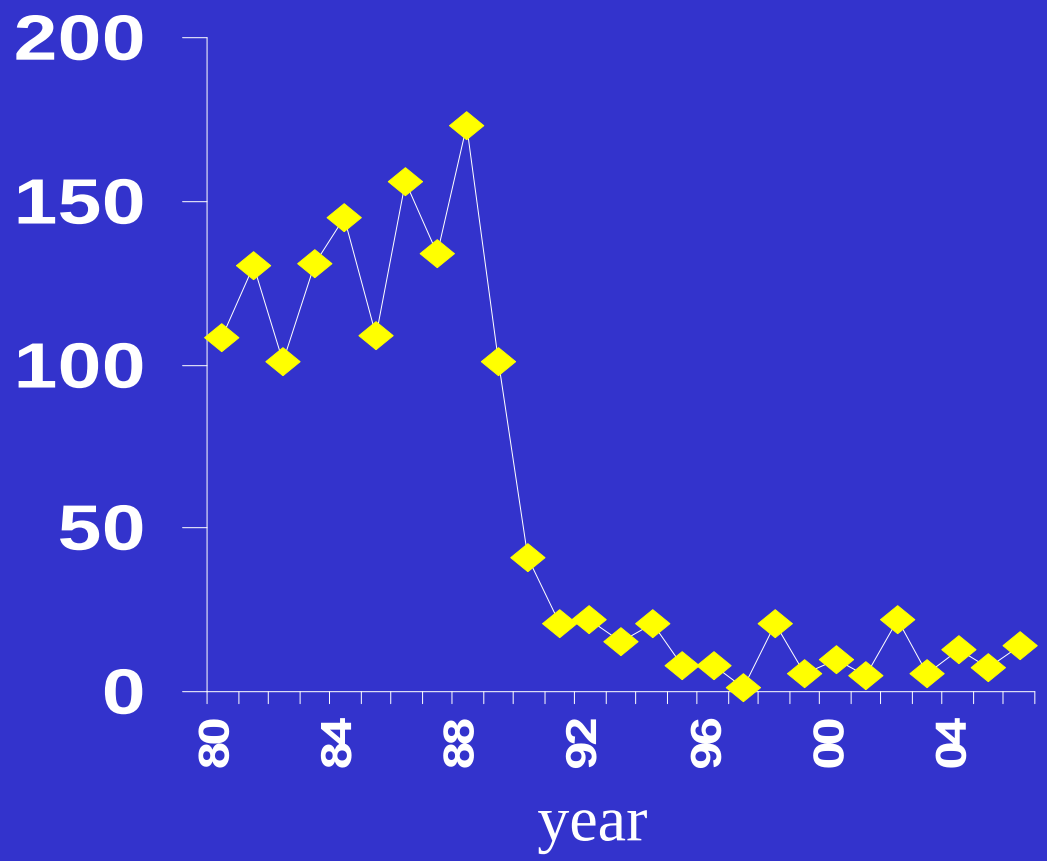


Children intubated with croup 1980-2006 PMH

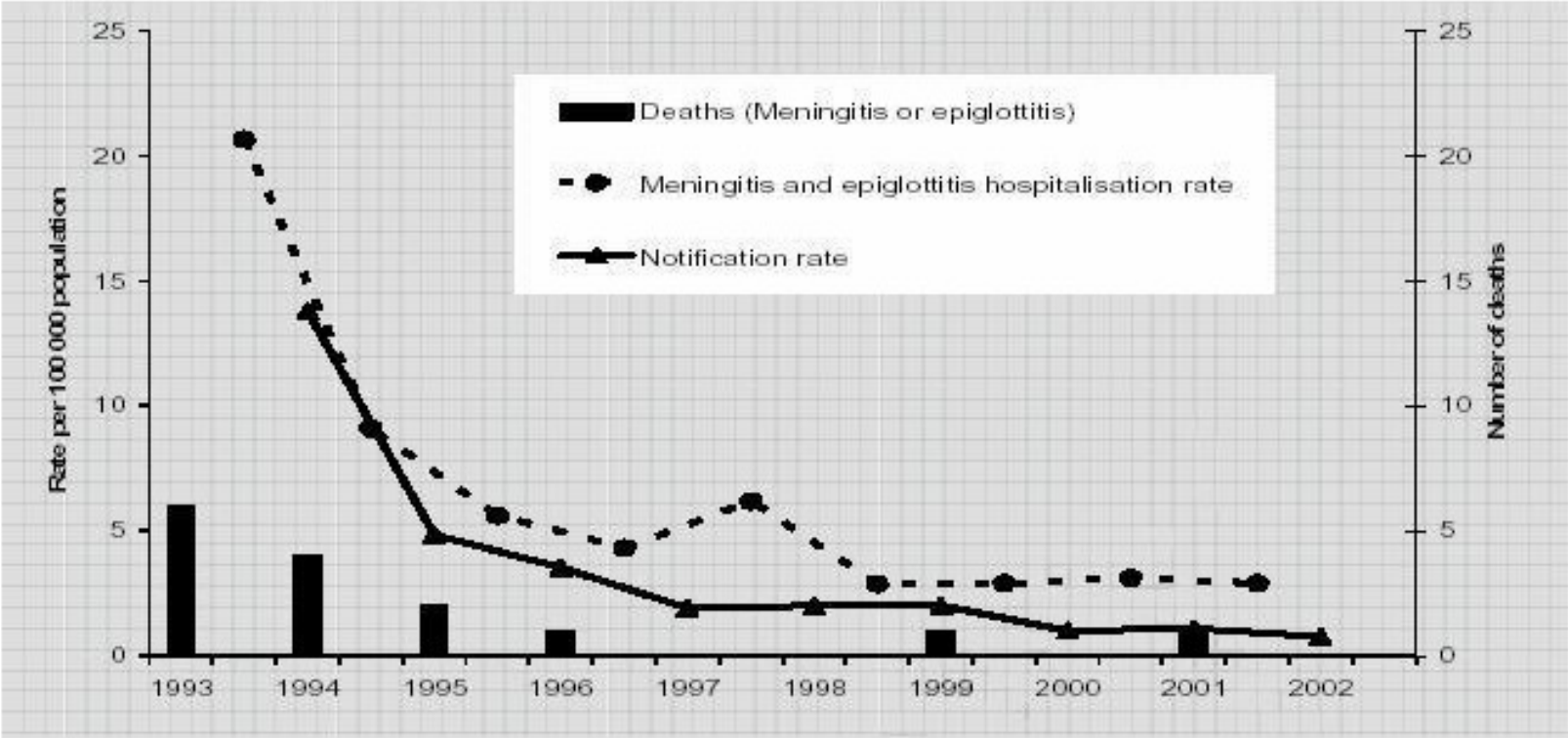
- steroids used from late 1989

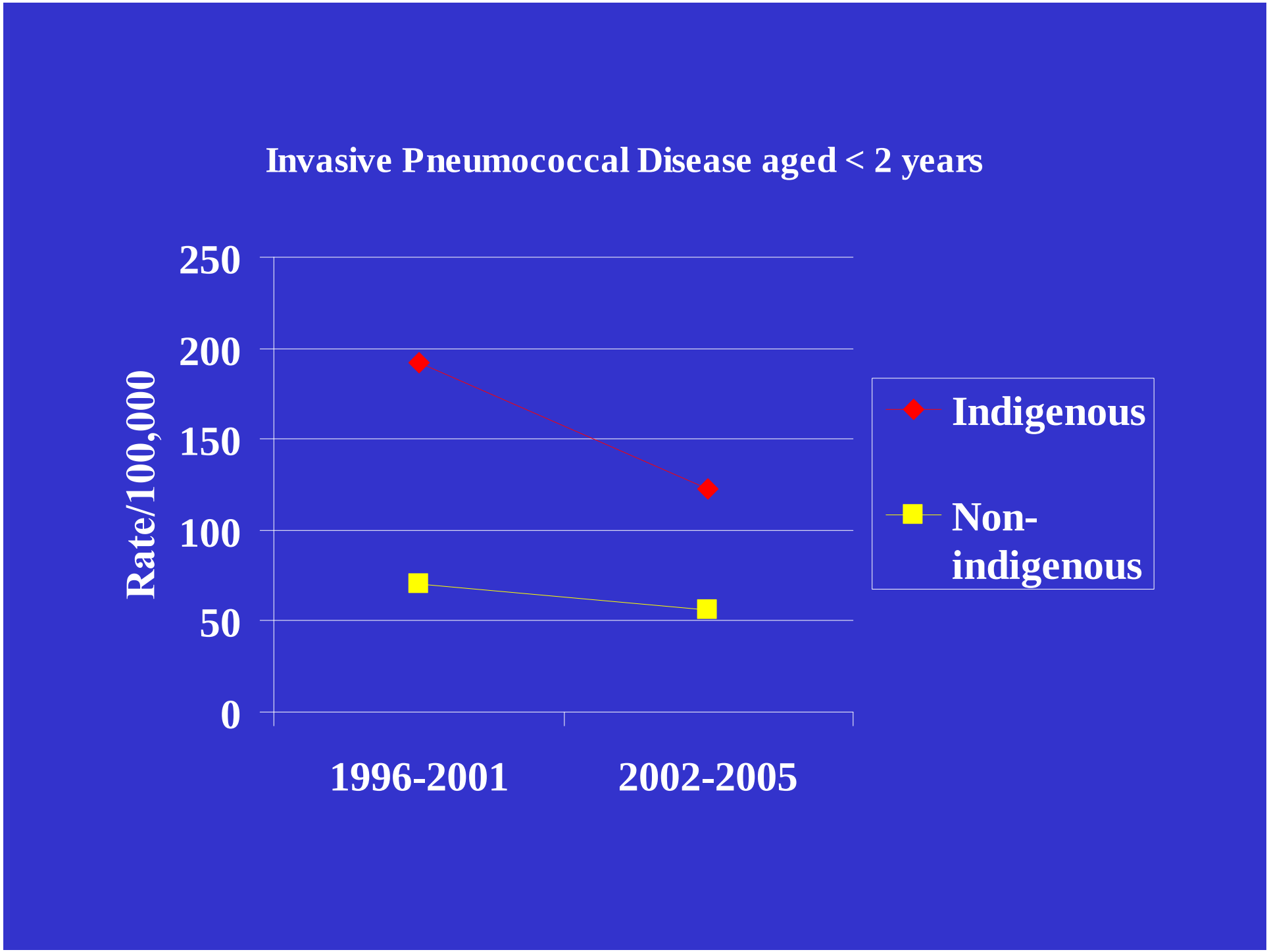


ICU croup days 1980-2006

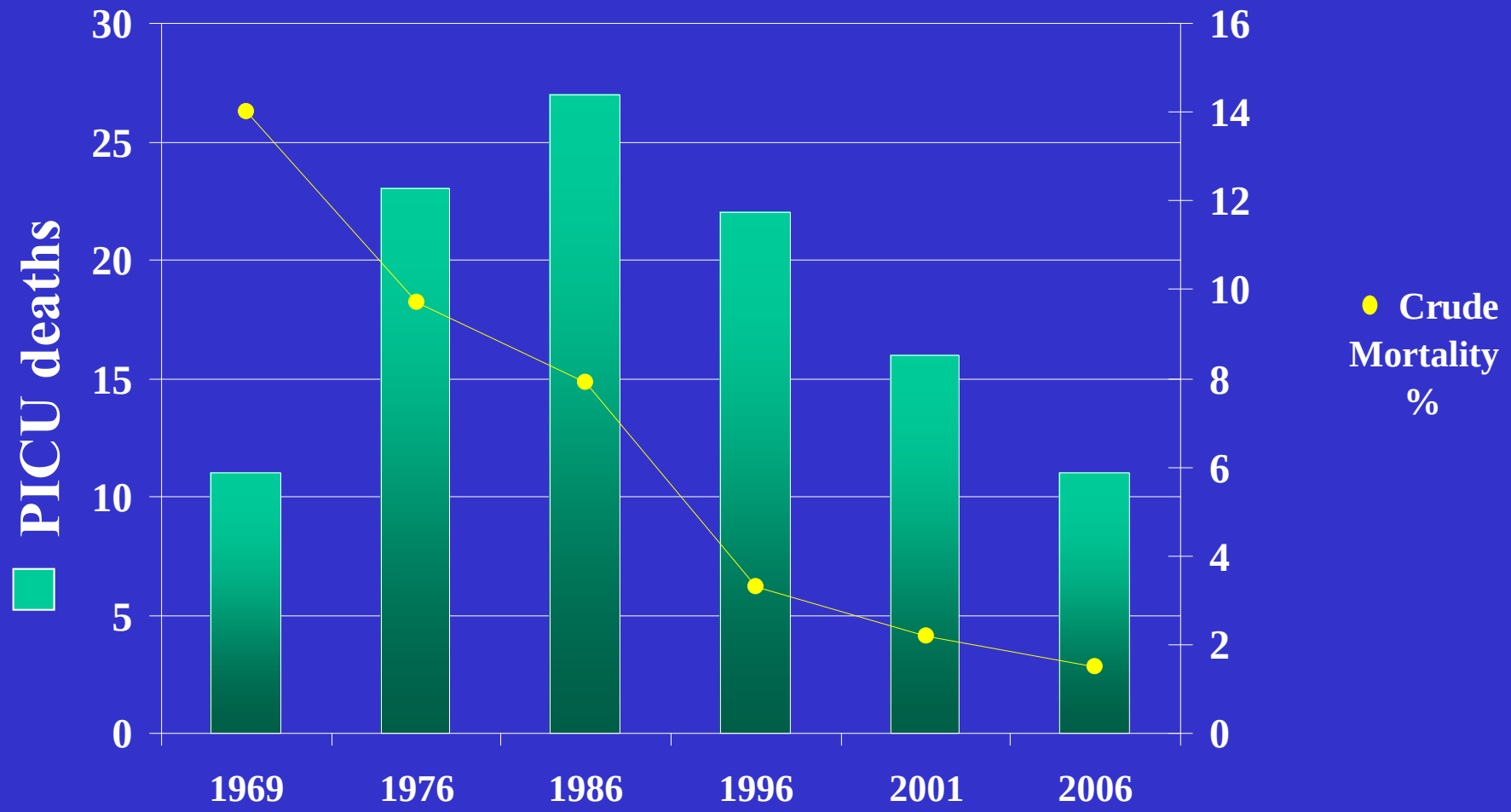


H. influenzae **type b (Hib) notifications, presumed Hib hospitalisations* and deaths of children aged 0 to 4 years from Hib, Australia 1993 to 2002.†**

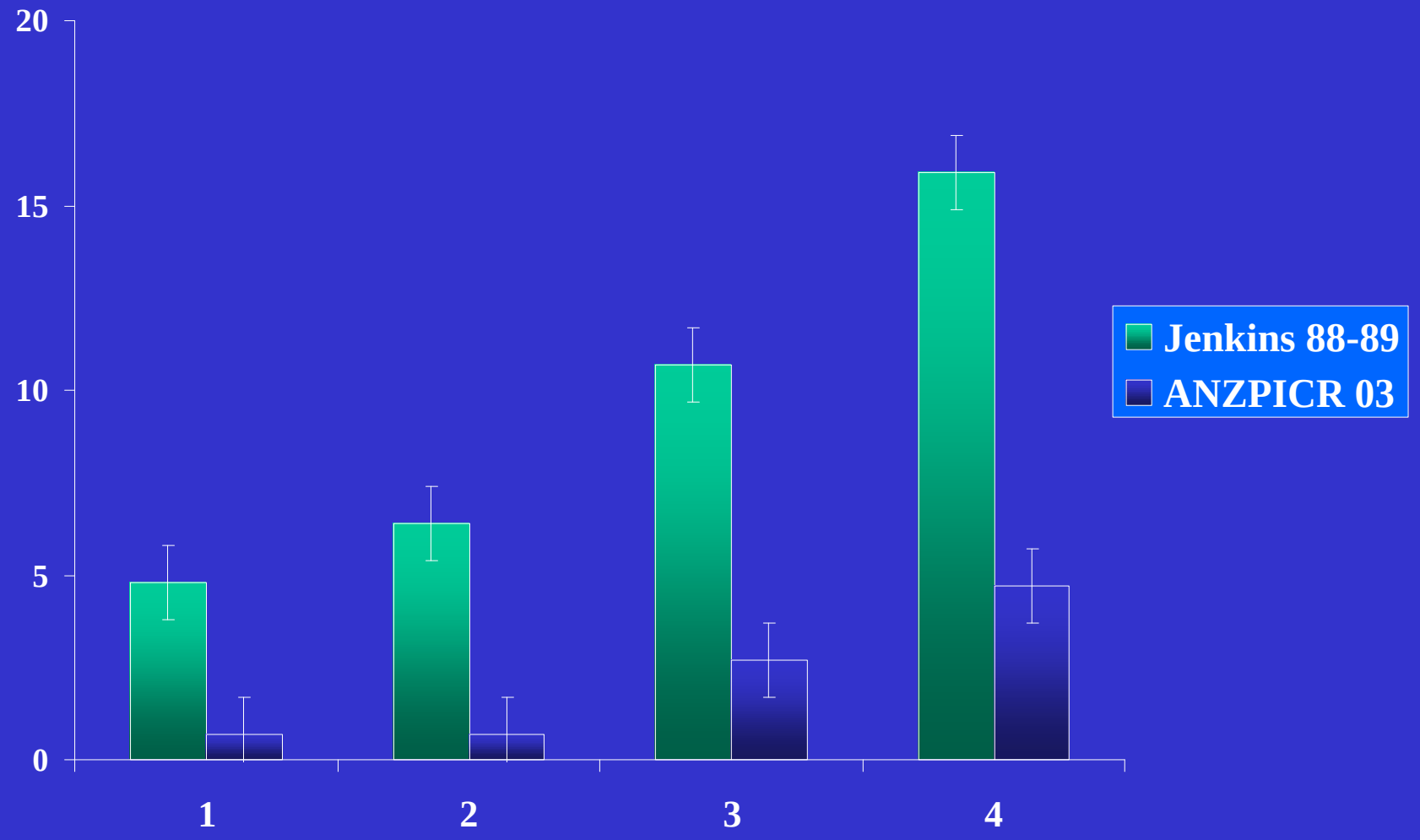



Invasive Pneumococcal Disease aged < 2 years
Rate/100,000
250
200
150
100
50
0
1996-2001
2002-2005
Indigenous
Non-indigenous

Outcome

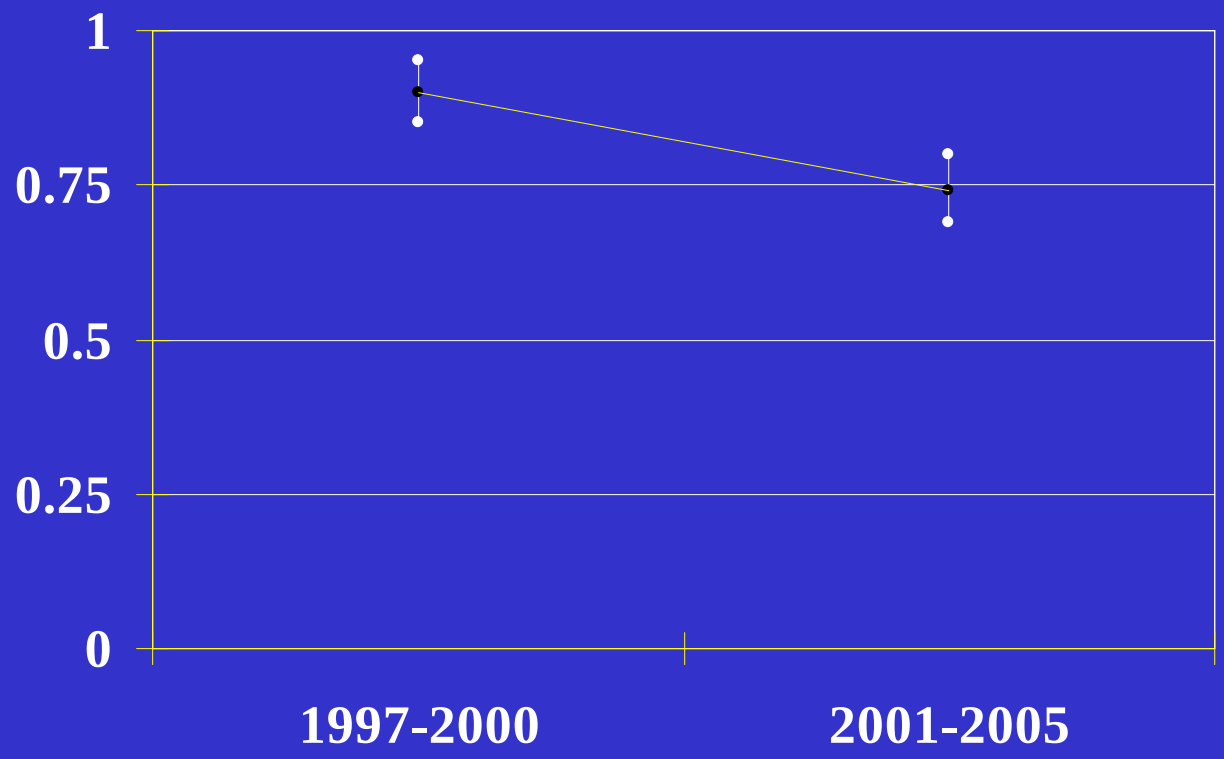

PICU deaths
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
1969
1976
1986
1996
2001
2006
Crude Mortality %

Cardiac Surgery: ICU mortality by risk category



Standardised Mortality Rates

(ANZPIC Registry)



? Improved

- Therapy
- Processes

What can we conclude so far?

- Preventative measures highly effective
- PICU case load has stabilised
- Technology requirements have increased
- PICU outcomes have improved
- Case mix has changed

PIC: Changing case mix

- Cardiac surgery
- Surgery - cranio-facial, spinal
- Chronic URTO - OSD, airway reconstruction
- Ventilator dependency – CLD, SCI, SMA
- Chronic disease - cerebral palsy

ARDS: a forty year journey

Description	Ashbaugh et al	Lancet 1967
Therapy		
CPAP	Gregory et al	NEJM 1971
Optimum PEEP	Suter et al	NEJM 1975
VILI		
Barotrauma	Webb	Am Rev Resp Dis 1974
Volutrauma	Dreyfus	Am Rev Resp Dis 1988
Biotrauma	Tremblay	J Clin Invest 1997
Heterogeneity	Gattinoni	Am Rev Resp Dis 1987

ARDS

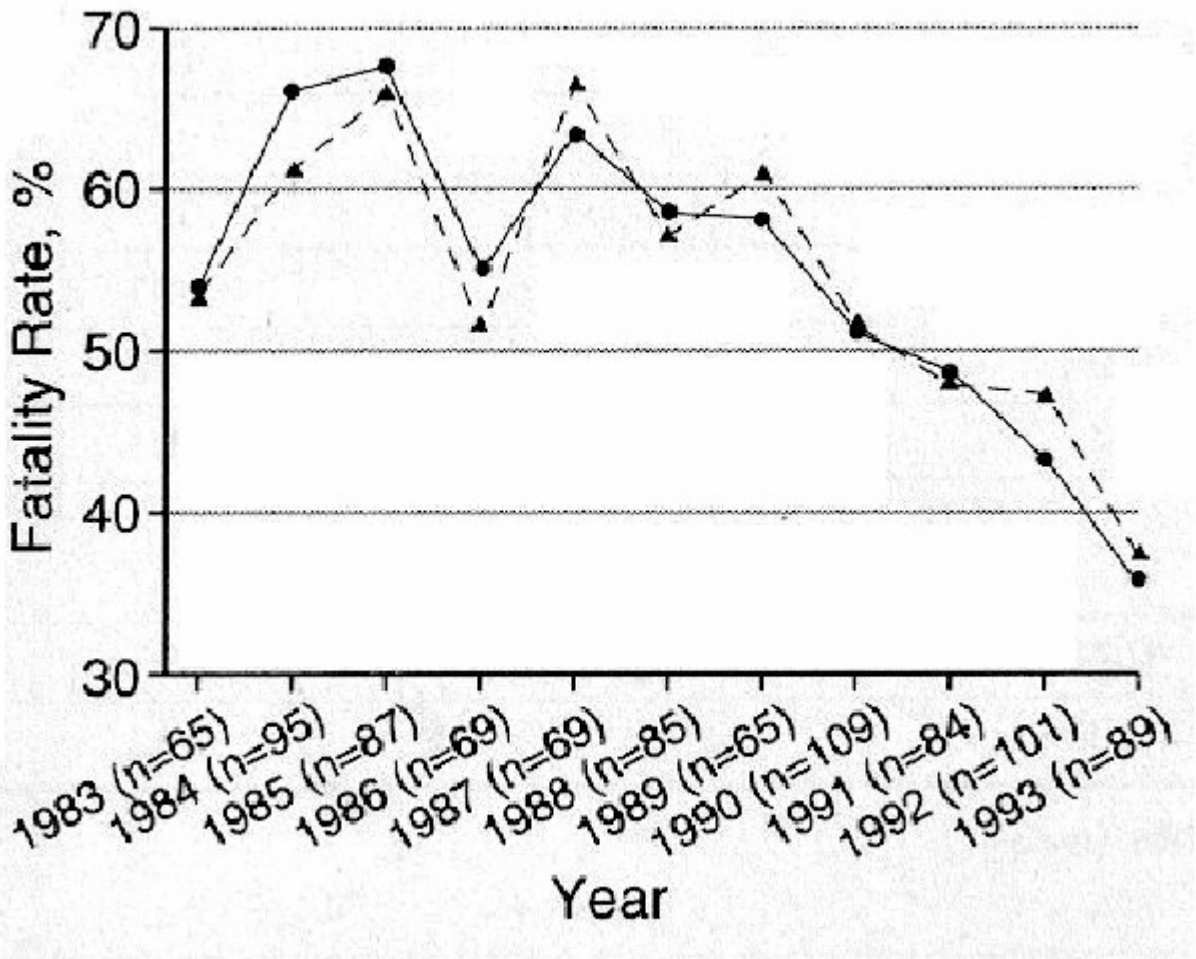
Strategies to prevent VILI

Permissive hypercapnia	Hickling	Intensive Care Med 1990
Protective ventilation	Amato	NEJM 1998
Low TV	ARDS network	NEJM 2000

Other strategies

Nitric oxide	Rossaint	NEJM 1993
NIV	Brochard	NEJM 1995
Surfactant	Anzueto	NEJM 1996
Prone position	Chathe	AmJ Resp CCM 1997
Steroids	Meduri	JAMA 1988

ARDS Outcome



Improved Outcome

? Therapy

? Technology

? Process

ARDS Prevalence: A-EEC criteria

Adults: 4.8-14.6/100,000

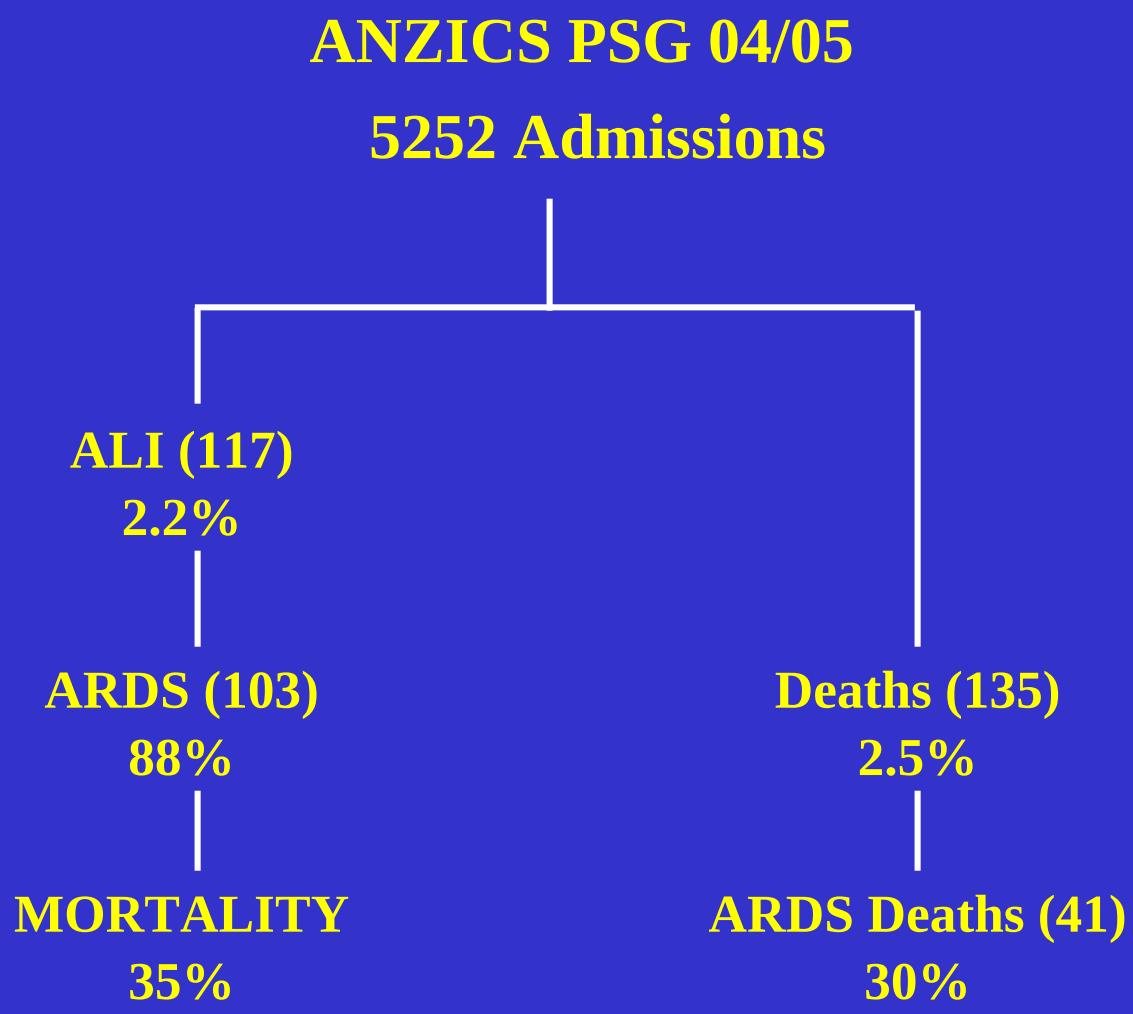
Children: 2/100,000

Bindl et al Crit Care Med 2005

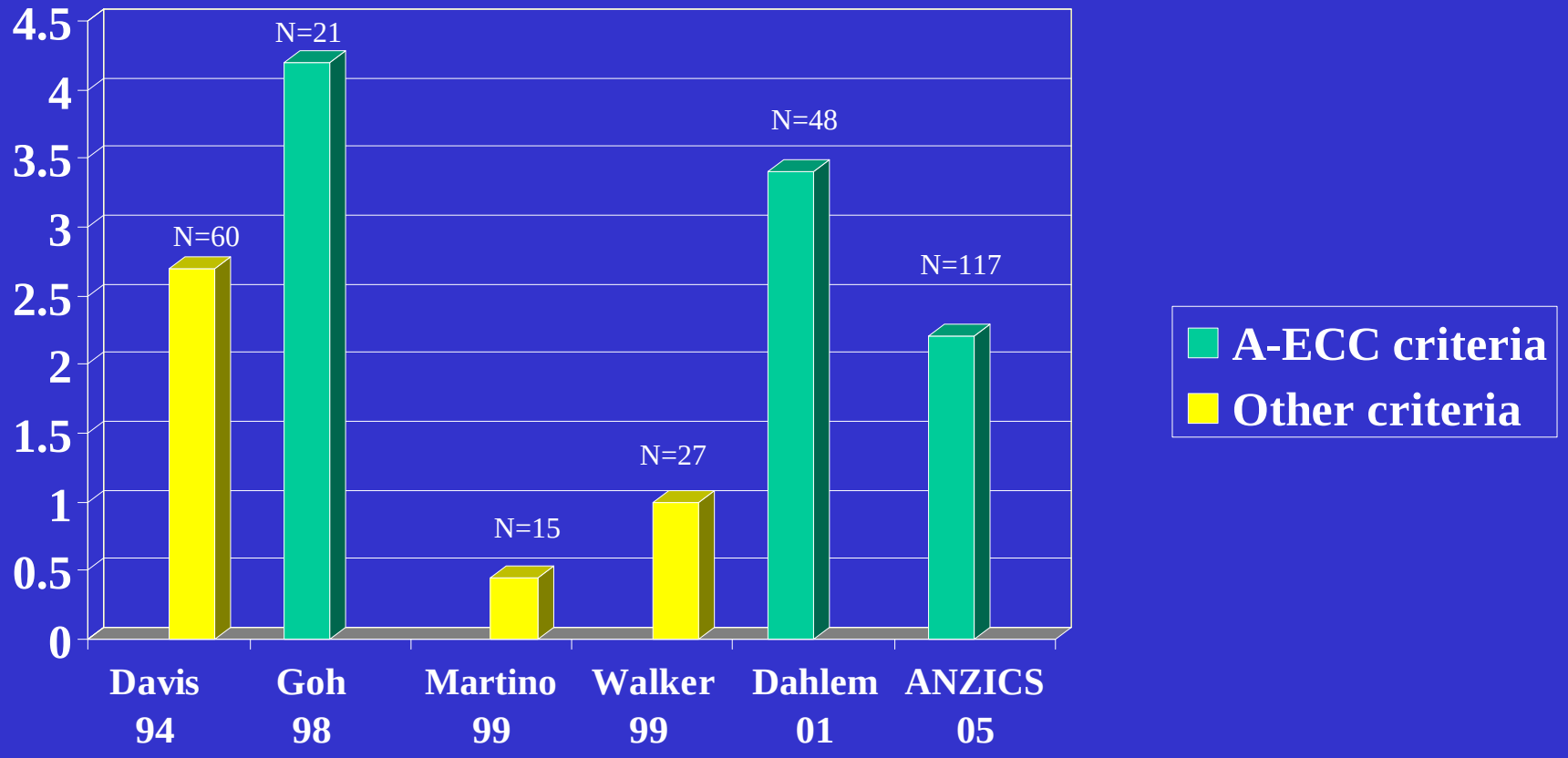
2.9/100,000

ANZICS PSG 2005

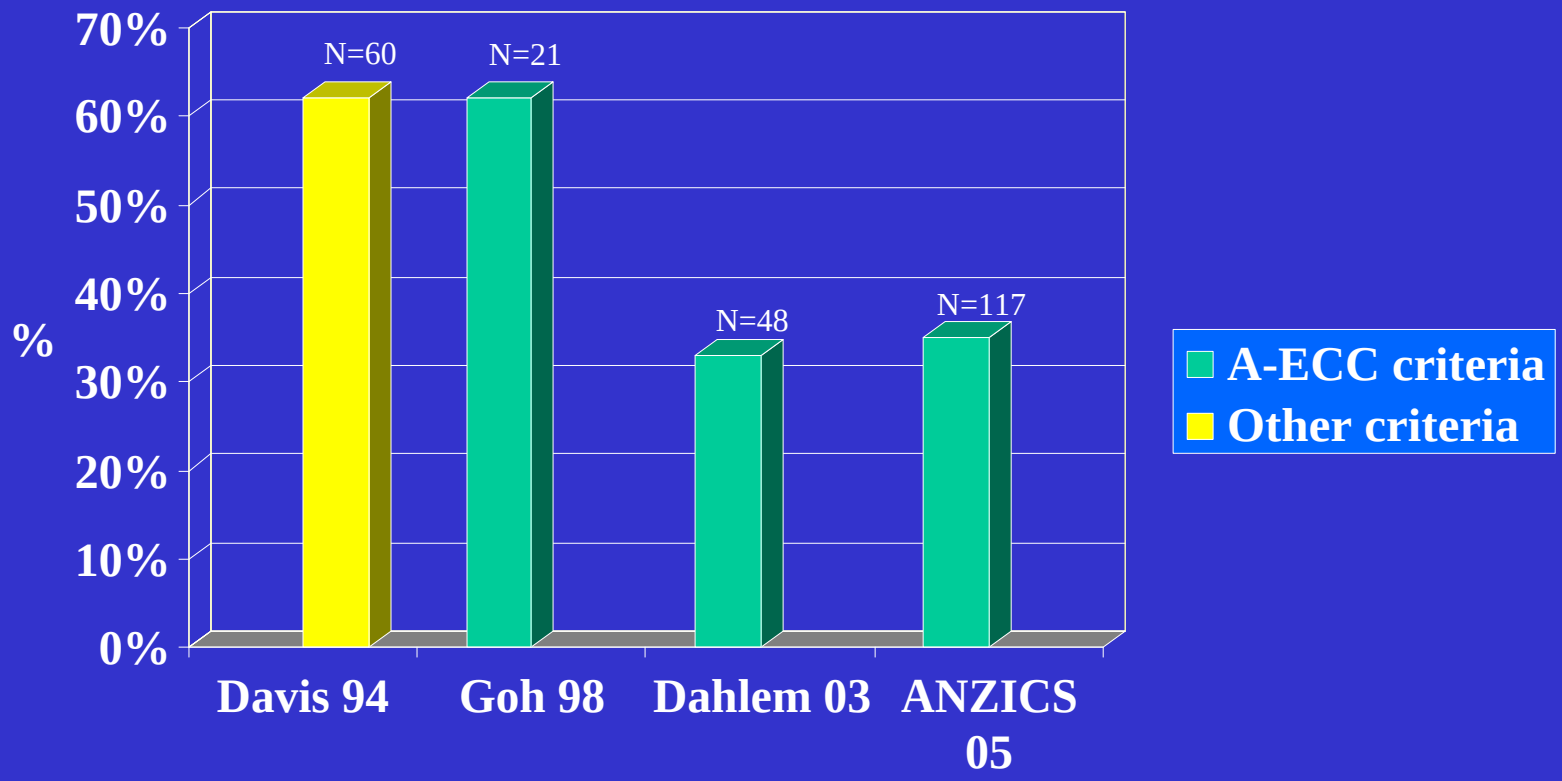
Paediatric ARDS



Paediatric ARDS
PICU admissions (%)



Mortality Paediatric ARDS



Paediatric ARDS

- Less common than adults
- High mortality
- Common cause of PICU death
- Challenges
  - Prevention
  - Protocol compliance
  - Optimal recruitment
  - CVVH or other strategies
- CTG’s : Large RCT’s

Where have the gains come from?

Advances in therapy, technology or maturation of specialty?

- organised service, training, certification

improved survival	Pronovost	JAMA 1999
fewer complications	Hanson	CCM 1999
shorter LOS		
and reduced cost	Dimick	CCM 2001

Organisational Issues

Staffing		
• physician	Pronovost	JAMA 2002
• nurses	Aiken	JAMA 2002
• pharmacists	Leape	JAMA 1999
Training	Pollack	CCM 1997
Patient volume	Pollack	CCM 1993
Protocols	Kollef	CCM 1997
Quality programs	Clemmer	CCM 1999

PIC: Challenges

Pain, suffering, palliative care

Family support, communication

Quality and safety

Cost containment

- utilization
- pre-emptive care

Research

Medical informatics

PIC: Research

“A fool is a man who never tried an experiment in his life”

Erasmus Darwin, 1792

Challenge - lack of a clearly defined body of knowledge unique to the specialty

Define - disease processes
patient populations
research efforts unique to PCCM

PIC: Research

“Endothelium - the organ of the intensivist”

- ARDS
- Sepsis
- Brain injury
- Myocardial dysfunction

Molecular biology
Multicentre trials:CTGs

Partnerships or
Sub-sub-specialisation

Medical Informatics

"Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information on it"

Samuel Johnson 1709-1784

There are known knowns. These are things that we know we know.

There are known unknowns. That is to say, there are things that we know we don’t know.

But there are also unknown unknowns. There are things we don’t know we don’t know.

Information Technology

- Computer based patient record (CIS)
  - charting, order entry, labs, trends
- Internet references
- Picture archiving and communication system (PACS)
- Remote access - PACS, monitors, labs
- Telemedicine
- Education, simulation
- Decision support tools

Real-time Decision Support (artificial intelligence)

To improve process and outcome of decision making

1. Passive - physician requires help
- reference material (EBM), protocols
- databases

2. Active - alerted by pre-programmed rules
- drug allergies
- drug interactions, monitoring, dose adjustment
- critical incidents, quality indicators, audit
- pathways to diagnosis, therapy – “Map of Medicine”

PIC: Developed countries

"The best way to predict the future is to invent it"

Alan Kay

Incremental gains are long past

Future lies in

Research	-	Clinical Trials Groups partnerships
Process	-	reduce variability safety and quality medical informatics

PIC: Developing countries

Annual health expenditure: USD 21 v's 2702 per capita

Reduced overseas aid

99% childhood deaths

90% preventable

Ethical dilemma - different problems
different priorities
similar expectations

Application of basic technologies, standardised clinical guidelines (WHO)

POCKET BOOK
of
Hospital care for children

Guidelines for the Management of Common Illnesses with Limited Resources

World Health Organisation
2005

ISBN-13 9789241546706

http://who.int/bookorders/MDI book JPG/Book/11500626.jpg

PIC: Developing countries

- Quality and safety – reduce adverse factors (76%)
  unsafe medical equipment
  contaminated syringes
  lack of oxygen

- WHO Global Alliance for Patient Safety – “Clean care is safe care”

- Meet the unrealised vision of the UN Convention of the Rights of the Child: Article 26

PIC: Developing countries

"The future is here. It is just not widely distributed yet"

William Gibson 1948 -

The PICU of the future???

- Changing case mix
- Chronic conditions - technology dependent children
- Increased technology - monitoring, organ support
- Clinical information systems - passive and active decision support
- Outreach – “PICU without walls”

Health authorities Clinicians

Costs - medical technology
medical informatics
Rehabilitation
Hospital in the home

Family expectations
Chronic disease
Recruitment
Retention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