

## **Evaluation of intensive care for the tiniest infants**

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## **Evaluating Neonatal Intensive Care**

efficacy  $\Rightarrow$  effectiveness  $\Rightarrow$  efficiency  $\Rightarrow$  availability

### **Efficacy**

- **Can intensive care, or its components, work under ideal circumstances?**

### **Effectiveness**

- **Does intensive care work under normal, or “field”, conditions?**

### **Efficiency**

- **Is neonatal intensive care worth implementing?**

### **Availability**

- **Is neonatal intensive care reaching those who need it?**

### **Evaluating Neonatal Intensive Care**

- **Sinclair et al (1981)**  
“... The overall effectiveness of these programs has not been tested experimentally.”  
“We conclude that neonatal intensive care programs require further evaluation with rigorous scientific methods.”

### **Evaluating Neonatal Intensive Care**

- **Should be evaluated within the region being served by the program.**

### **Efficacy**

- **Antenatal steroids**
- **Exogenous surfactant**

### **Efficacy**

- **Antenatal steroids**
- **Exogenous surfactant**
- **Kitchen et al (1971)**
- **Intensive care “package” 1000 – 1500 g BW**
  - mortality 35% to 18%
  - increased “handicap” in survivors

### **Evaluating Neonatal Intensive Care**

- **Victoria**
- **1/4 Australia’s population**
- **60,000 – 75,000 births/year**
- **4 level-III units (3 perinatal)**
- **Philosophy of *in utero* referral from mid-1970s**

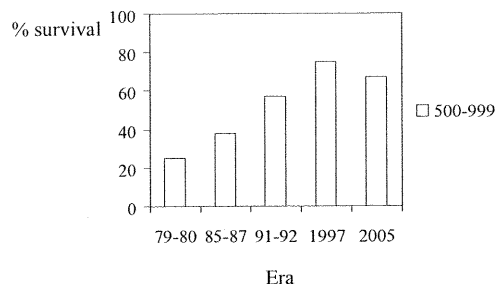
### **Evaluating Neonatal Intensive Care**

- **Victoria**
- **ELBW infants (500-999g)**
- **1979-80, 1985-87, 1991-92, 1997, 2005**

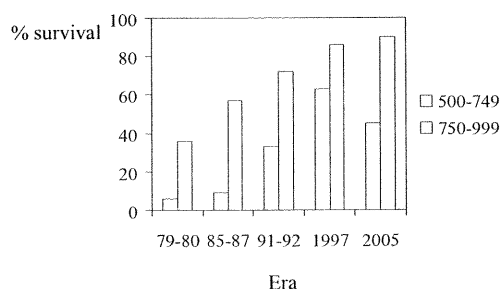
### Victoria - ELBW infants (birthweight 500-999 g)

1979-80 n=351 (3.03/1000 livebirths) 175/yr  
 1985-87 n=560 (3.06/1000 livebirths) 187/yr  
 1991-92 n=429 (3.29/1000 livebirths) 215/yr  
 1997 n=233 (3.77/1000 livebirths) 233/yr  
 2005 n=257 (3.88/1000 livebirths) 257/yr

### Survival



### Survival



### Effectiveness

- Survival - 2 years of age
- Neurosensory assessment
  - cerebral palsy
  - blindness
  - deafness
  - developmental delay (on Bayley Scales relative to NBW controls)

### Effectiveness

- NBW controls
  - original Bayley
    - 1981 MDI = 106
    - 1991-92 MDI = 115
  - Bayley II
    - 1997 MDI = 99
  - Bayley III
    - 2005 Cognitive=109
    - Language=108

### Effectiveness

DQ score  

$$\frac{\text{child's score} - \text{mean score NBW}}{\text{SD}}$$

## Effectiveness

### Disability

Severe - severe CP, Blind, DQ <-3SD

Moderate - mod CP, Deaf, DQ -3 SD to <-2 SD

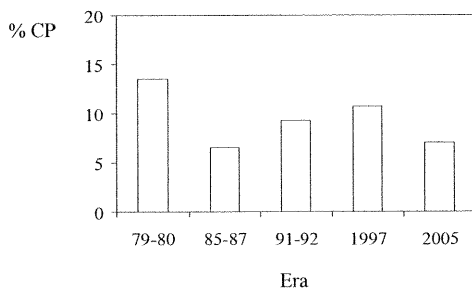
Mild - mild CP, DQ - 2 SD to <-1 SD

Nil

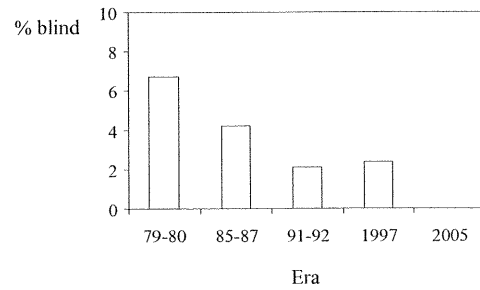
## Follow-up rates

	79-80	85-87	91-92	1997	2005
survivors	n=89	212	241	170	172
assessed	n=89	212	237	168	165
	100%	100%	98%	99%	96%

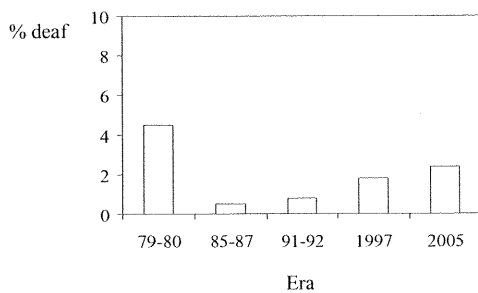
## Cerebral Palsy



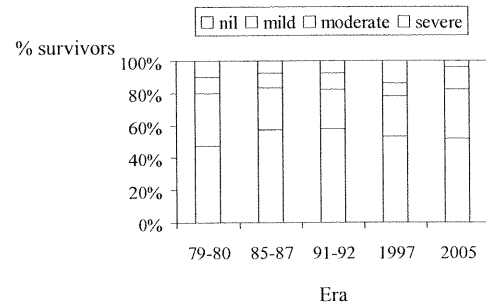
## Blindness



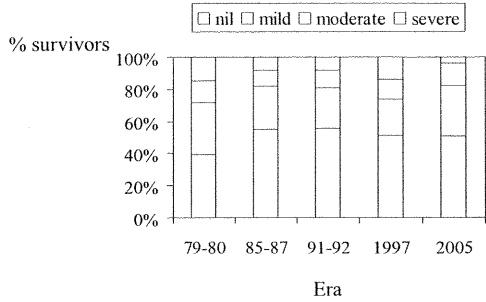
## Deafness



## Cognitive Delay



### Disabilities



### Effectiveness

#### Utilities

Dead	0
Severe disability	0.4
Moderate disability	0.6
Mild disability	0.8
Nil	1

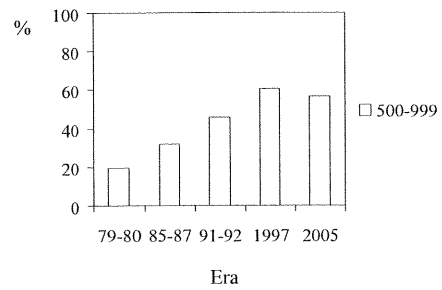
multiply for multiple disabilities  
 e.g. blind, DQ <-3SD, severe CP  
 = 0.4x0.4x0.4  
 = 0.064

### Effectiveness

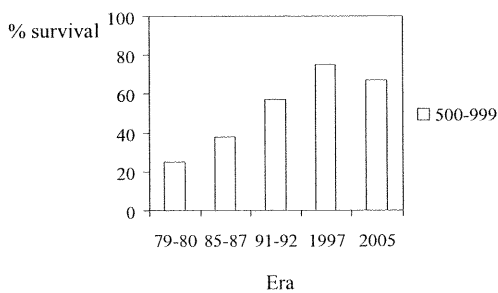
#### Quality-adjusted survival rate

$$\frac{\sum \text{utilities}}{\text{number of livebirths}}$$

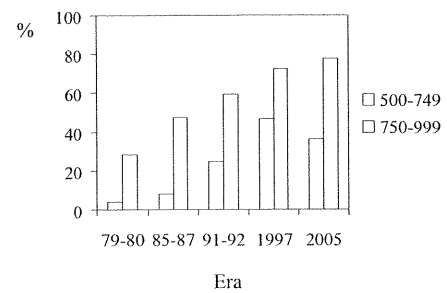
### Quality-adjusted survival



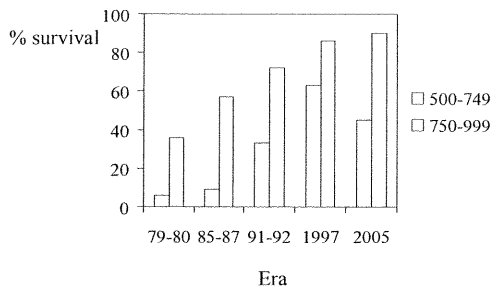
### Survival



### Quality-adjusted survival



## Survival



## Effectiveness

- Neonatal intensive care in Victoria is increasingly effective
- large increases in
  - survival
  - quality-adjusted survival

## Efficiency

- Is neonatal intensive care worth implementing?
- Consider both costs and consequences (outcomes)
- Cost-effectiveness
- Cost-utility

## Reasons for economic evaluations

- Are neonatal intensive care resources are being consumed efficiently?
- “Opportunity cost” - health outcomes achievable by an alternative program that has been forgone.

## Reasons for economic evaluations

- Not all benefit equally
- Larger & more mature infants might suffer
- Other infants may be denied access
- Consequences of neonatal intensive care last much longer

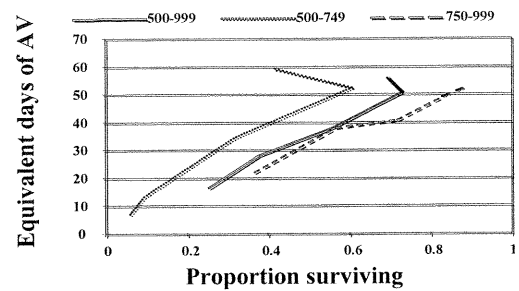
## Costs

- Patient-days of assisted ventilation (AV)
- Non-AV days = 1/3 day AV
- Include re-hospitalisation after discharge
- Dose surfactant = 1/3 day AV
- Day AV = \$1630 (\$Aus 1997)
- Cost of long-term care = \$27800/year  
= 17 days AV

## Consequences (Outcomes)

- Survival
  - life-years
- Quality-adjusted survival
  - quality-adjusted life years (QALYs)

## Costs vs. Outcomes



## Cost-effectiveness Analysis

$$\frac{\text{Additional Costs Per Livebirth}}{\text{Additional Life Years}}$$

## Cost-effectiveness Analysis

$$\frac{\Delta \text{ Costs (Later era – 1979-80)}}{\Delta \text{ Life Years (Later era – 1979-80)}}$$

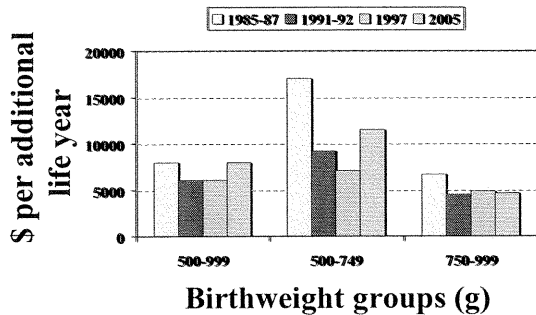
## Cost-utility Analysis

$$\frac{\text{Additional Costs Per Livebirth}}{\text{Additional Quality-adjusted Life Years}}$$

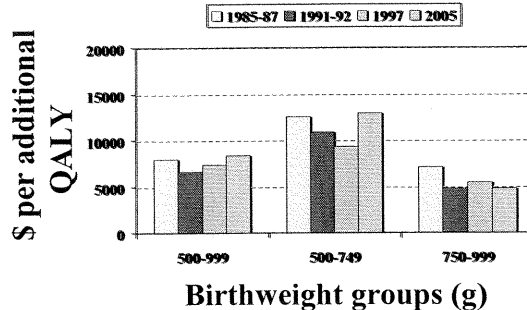
## Cost-utility Analysis

$$\frac{\Delta \text{ Costs (Later era – 1979-80)}}{\Delta \text{ QALYS (Later era – 1979-80)}}$$

### Cost-effectiveness

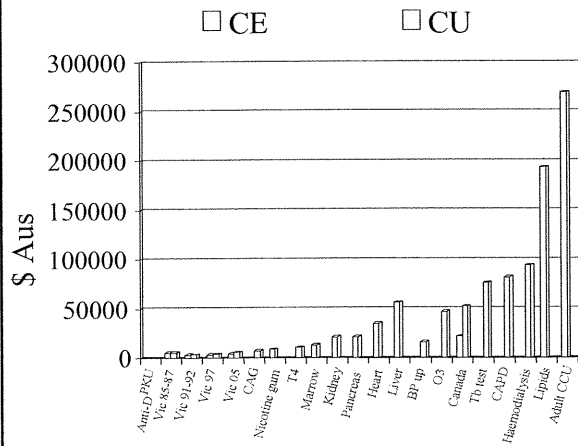


### Cost-utility



## Neonatal Intensive Care Vs Other Health Care Programs

How does neonatal intensive care compare with other health care programs?



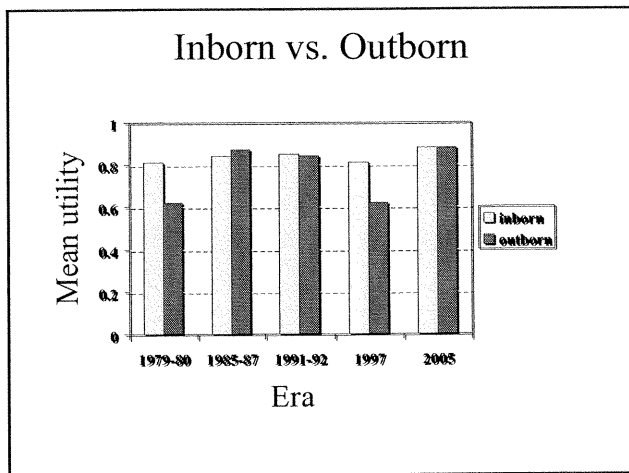
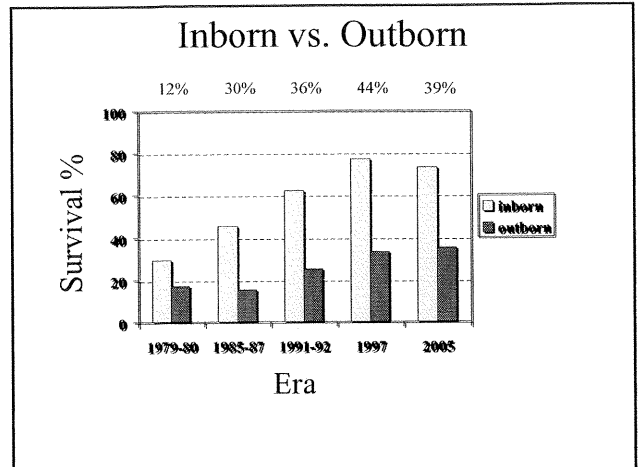
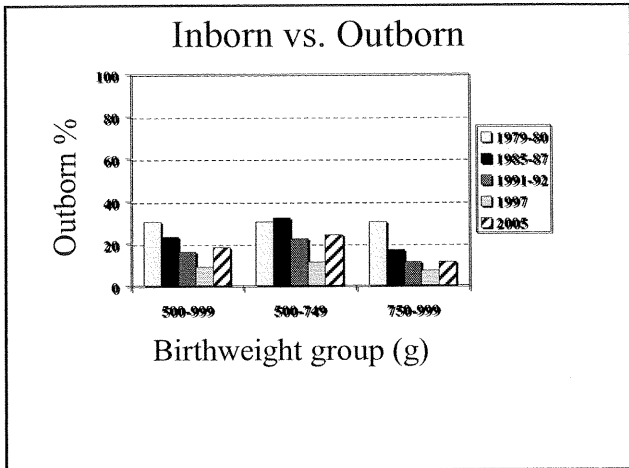
### Efficiency

- Neonatal intensive care in Victoria is relatively efficient
- Efficiency is stable over time
- Efficiency compares favourably with many other health care programs

### Availability

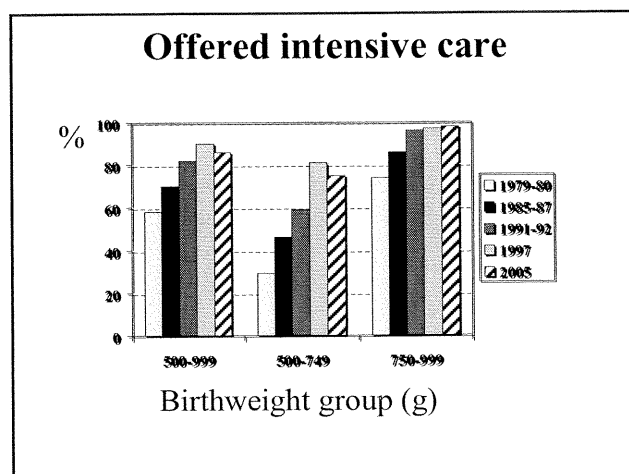
- Place of birth (inborn vs. outborn)
  - Consequences of place of birth
    - survival
    - quality of survival
- Offered intensive care





### Availability

- Outborn doubly jeopardised
  - higher mortality
  - higher sensorineural morbidity



### Conclusions

Neonatal intensive care for ELBW infants in Victoria is :

- increasingly effective, but even more so for the smallest babies
- relatively efficient (+ stable?)
- increasingly available
  - until 2005