

PICU Care - Does more care equate to better outcomes?

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Structure of the talk

- Input-outcome relationship
- Why does more care not necessarily improve outcome?
- How can we detect overtreatment?
- How much care ist best?



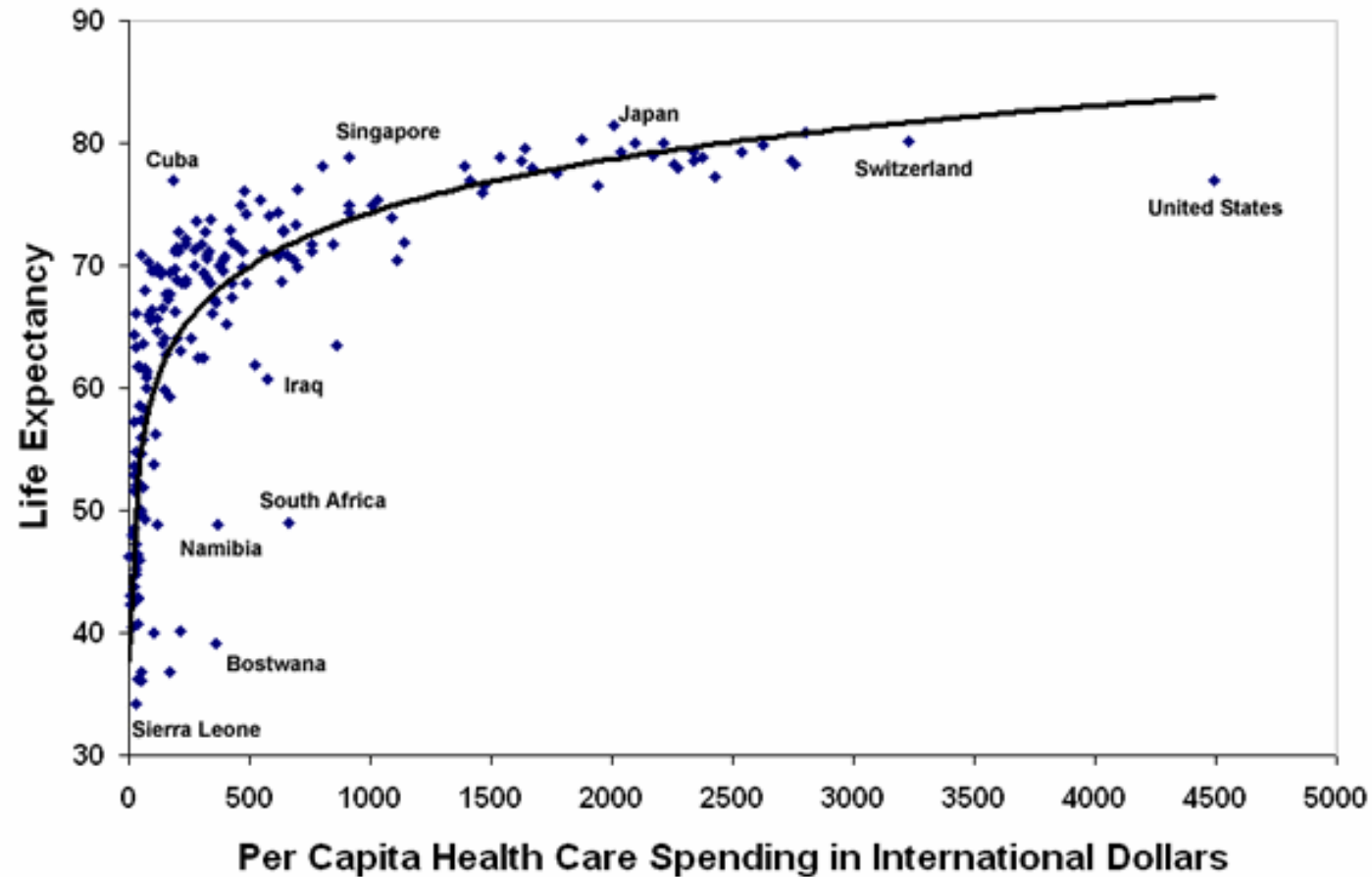


Input - outcome relationship



Input-outcome relationship

Life expectancy vs. spending



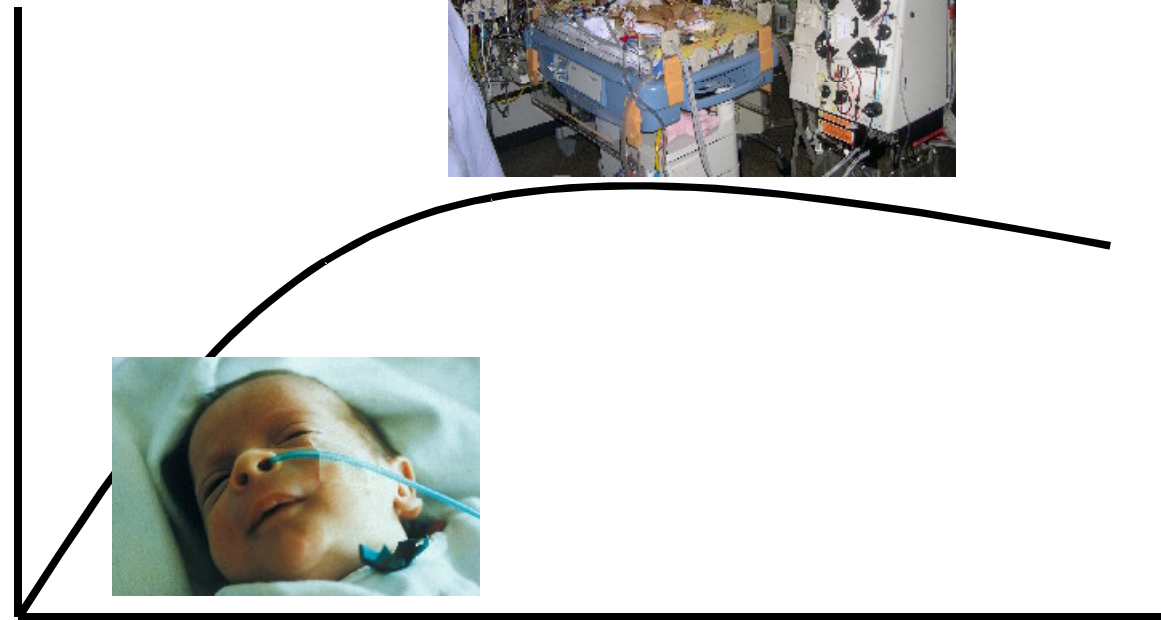
<http://ucatlas.ucsc.edu>



Input-outcome relationship

The law of diminishing returns

Benefit



Inputs of Medical Care →

Fisher ES, JAMA, 1999



PICU: Input and outcome

- Input:
 - Staff
 - diagnostic and therapeutic procedures

- Outcome
 - ICU mortality (Standardised mortality ratio, SMR)
 - Neurodevelopmental outcome
 - Quality of life



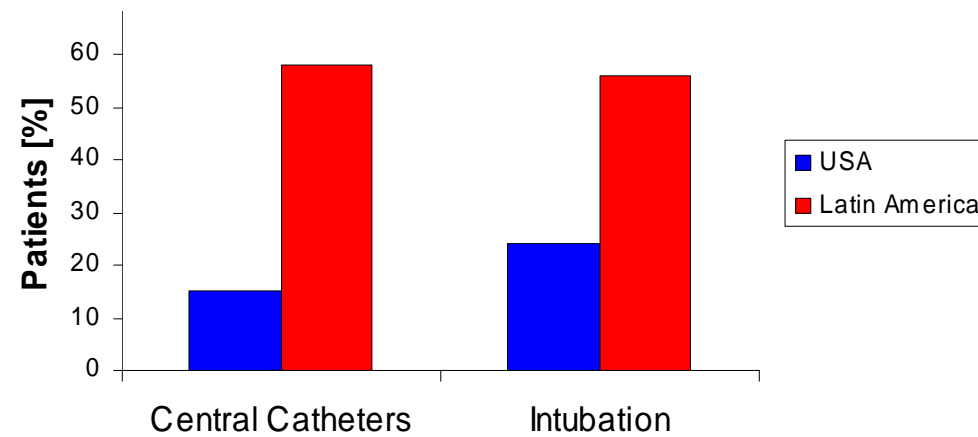
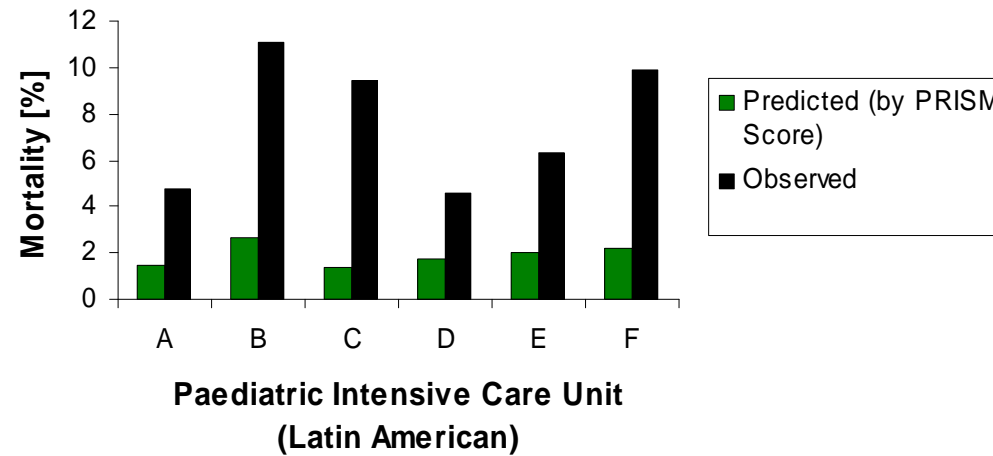
Input-outcome relationship

More care may equate to worse outcome

Author	Setting	Input	Outcome parameter
Earle M,1997	PICUs in Mexico, Ecuador, USA	Intubation, CVL	Adjusted mortality
Wilson D,1996	PICU, USA, RSV	Invasive monitoring, inotropes, blood, paralysis, antibiotics, parenteral nutrition	LOS, nosocomial inf., mortality, hospital charges
Bednarek F,1998	NICU, USA	arterial lines	blood transfusions
Callaghan L,2003	NICU, Australia	staff to infant ratio	adjusted mortality
Lacroix J,2007	PICUs, Canada, USA, UK, Belgium	Transfusion threshold (9.5 vs. 7g/dl)	Mortality, MODS



Invasive therapies and mortality



Earle M, 1997




Overdiagnosis and overtreatment

Inappropriate use of diagnostic and therapeutic procedures

- The mere availability
- Financial incentives
- Pressure to treat asymptomatic conditions
- Bad expertise





**Why does more
care not
necessarily
improve outcome?**



Why does more care not improve outcome?

1. Abnormal physiology may be protective

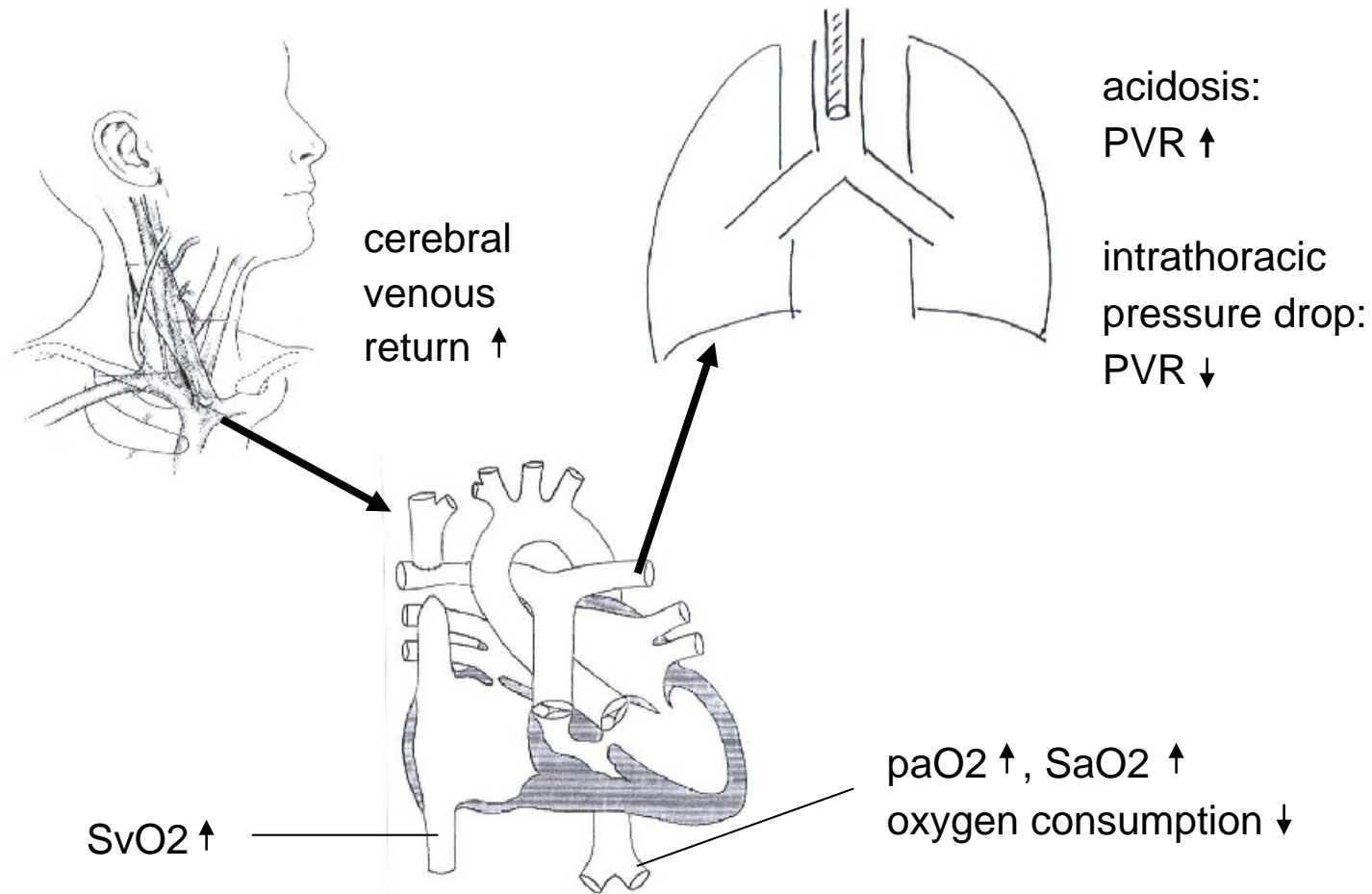
Author	Physiological variable	Protective effects
Russell PM, 2003	Fever in sepsis	Increased survival
Shibata K, 1998	Hypercapnic acidosis in ALI	Attenuation of ALI
Pepe PE, 2002	Blood pressure in trauma: less aggressive support	Decreased mortality
Hoskote A, 2004	Hypercapnic acidosis after BCPA	Increased SaO ₂ , decreased O ₂ -consumption

Kavanagh BP, 2005



Why does more care not improve outcome?

Glenn: hypercapnia and acidosis



Hoskote A, 2004



Why does more care not improve outcome?

2. The intervention is too risky

Physiologic variable	Intervention	Risk of intervention
Hypokalemia	K-infusion	Cardiac arrest
Hypotension	Blood pressure guided therapy after cardiac surgery	Increased cardiac work, side effects of catechol.
SIRS without infection	Broad spectrum antibiotics	Resistant bacteria



Why does more care not improve outcome?

(The intervention is too risky)

Author	Physiologic variable	Intervention	Risks of intervention
Dreyfuss D, 1998	SaO ₂ and paCO ₂	Ventilation to normal levels	Aggravation of lung injury
Skippen P, 1997	paCO ₂	Hyperventilation in TBI	Cerebral ischemia
Tin W, 2001	SaO ₂ in premature infants	Keep SaO ₂ >88%	More retinopathy, less weight gain, longer ventilation





**How can we
detect
overtreatment?**



How can we detect overtreatment?

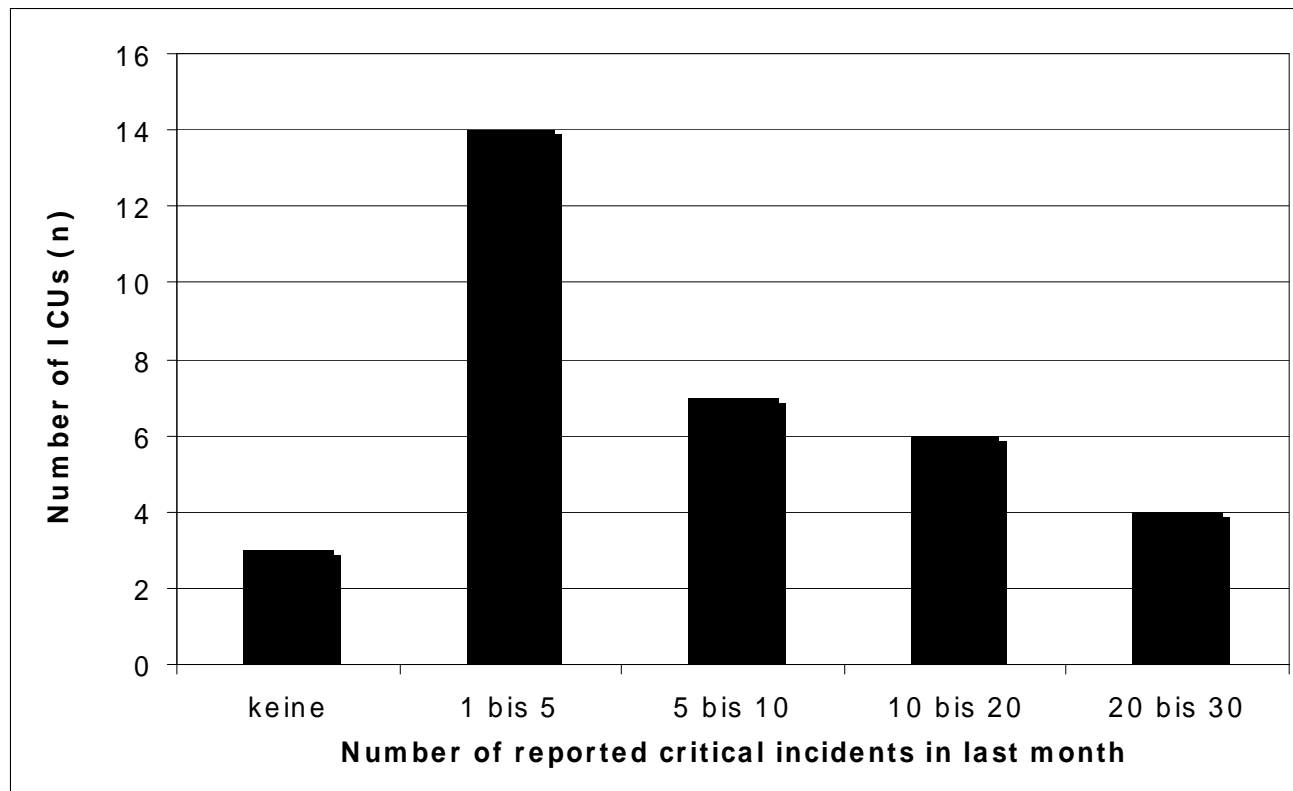
On a local level

- Critical incident monitoring
- Calculation of Standardised Mortality Ratio
- Comparison between number of invasive procedures and adjusted mortality
- Mortality-morbidity conferences (audits)
- Medical record review (Dunn KL, 2006)



How can we detect overtreatment?

Critical incident monitoring in Swiss ICUs



How can we detect overtreatment?

Standardised mortality ratio (SMR)

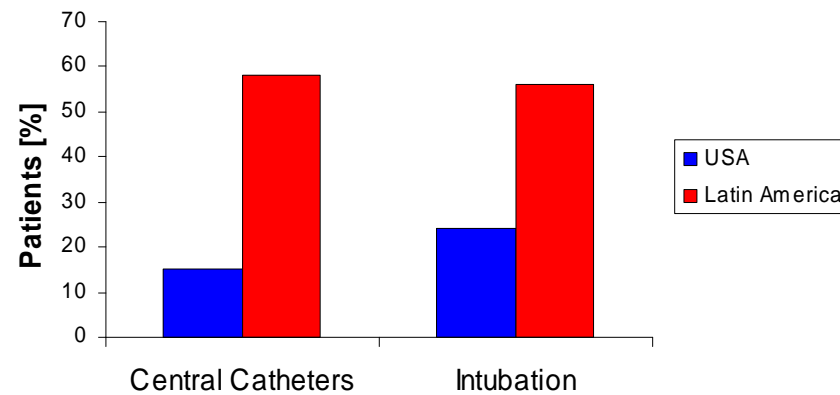
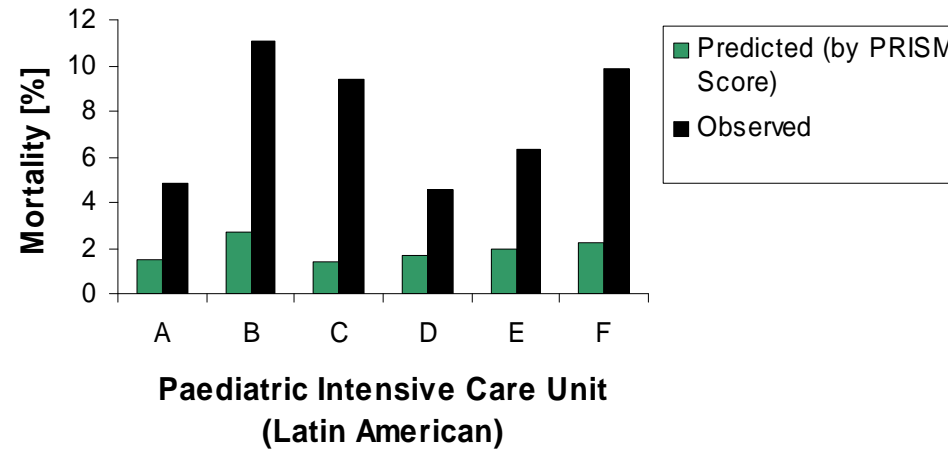
$$\text{SMR} = \frac{\text{Observed mortality}}{\text{Expected mortality}}$$

$$\text{e.g. SMR} = \frac{3.7\%}{3.1\%} = 0.84 \text{ (95\% CI 0.6 - 1.1)}$$



How can we detect overtreatment?

Invasive procedures and mortality



How can we detect overtreatment?

On a multicenter level

- Comparing invasive with simple approaches
- Registers of invasive therapies (e.g. ECMO)





**How much care is
best?**



How much care is best?

...One of the greatest opportunities to improve patient outcomes comes not from discovering new treatments, but using existing therapies more effectively

Pronovost P, Lancet, 2004



How much care is best?

Maintenance of natural organ functions

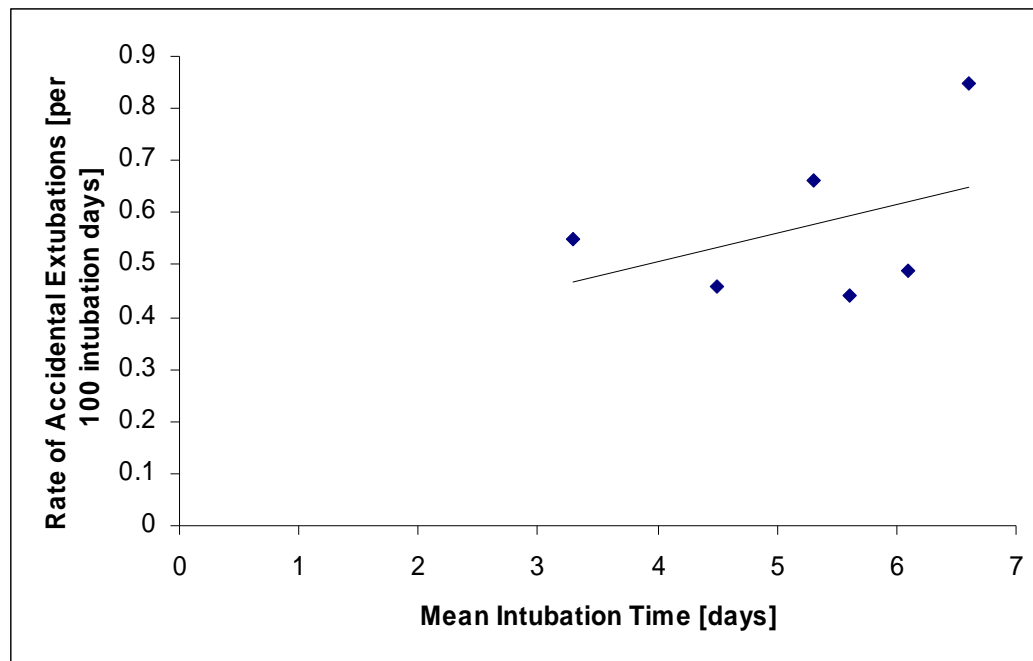
Author	Normal function	Artificial intervention	Risks of intervention
Marik P, 2003	Enteral nutrition	Parenteral nutrition	Atrophy of intestinal mucosa, infection, liver damage
Bhutani V, 1988	Spontaneous breathing in intubated patients	Muscle relaxation	Decrease of lung compliance increase of lung resistance critical illness neuropathy
-	Adaptation to anemia	Transfusion	Infection, bone marrow depression, GVH



How much care is best?

Safe and simple procedures for appropriate periods

- Limitation of the number of drugs
- Mechanical ventilation and CVL for short periods



Closed format PICU

- Decrease in admissions with very low severity
- Decrease in adjusted mortality



Guidelines

- Reducing physician practice variability
- Areas lacking evidence based guidelines
→ prone to overtreatment (e.g. transfusion)
- Simply „protocolising“ care without the introduction of any new intervention may improve outcome
(Morris AH, Am J Respir Crit Care Med, 1994)



Conclusion

- **Most PICU patients** can be managed with
 - simple, safe procedures, according to guidelines
- **A small proportion** can be saved with
 - extraordinary measures
 - appropriate selection!

