

The costs of surviving intensive care

Nazir Lone
University of Edinburgh



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Increasing demand for critical care

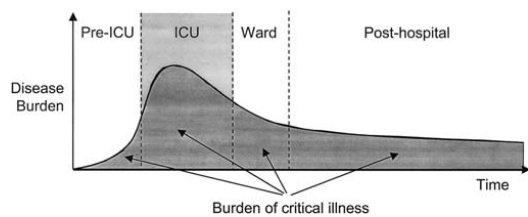
- Projected increase
 - Ageing population
 - Multimorbidity
 - Rising expectations



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Surviving Intensive Care



Angus DC and Carlet J (2003) *Intensive Care Med* 29:368-377



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Burden of ICU survivorship

Survivors of acute respiratory distress syndrome: Relationship between pulmonary dysfunction and long-term health-related quality of life

Concise Definitive Review Section Editor, Jonathan E. Sevransky, MD, MHS

Long-term complications of critical care

Sanjay V. Desai, MD; Tyler J. Law, BHSc; Dale M. Needham, MD, PhD

Desai et al. (2011) *Critical Care Medicine* 39:371.

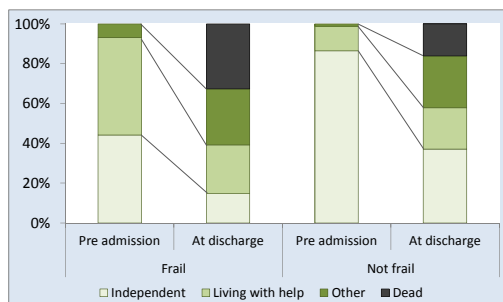
of Severe Sepsis Functional Disability 5 Years after Acute Respiratory Distress Syndrome



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Dependence after ICU



Bagshaw et al. (2014) *CMAJ* 186(2) E95.



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Prospective cohort studies and trials

- Benefits
 - Detailed outcome measurement
- Drawbacks
 - Selection bias at recruitment
 - Loss to follow up



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'Big data' approach

- Population-level coverage
 - ICNARC and SICSAG
- Data linkage to other national databases
 - HES/SMR01
 - Death records
- Unbiased estimates of incidence and outcomes
- Selection bias and loss to follow up minimised



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The costs of surviving ICU

- How many ICU survivors are there in the UK?
- How many ICU survivors die in the years after critical illness? How many deaths are attributable to critical illness?
- How much do ICU survivors cost the health service after an episode of critical illness? How much is attributable to critical illness?
- How much do pre-existing factors compared with acute factors influence costs?

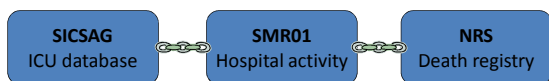


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Big data approach

- Retrospective cohort study
- Databases



- Data linkage undertaken by ISD Scotland using probabilistic algorithm
- Linkage accuracy > 97%



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ICU cohort

- ICU survivor cohort
 - Resident in Scotland
 - Aged 16 years or older
 - Admitted to general ICUs & combined units and survived to hospital discharge
 - First ICU admissions only in 2005

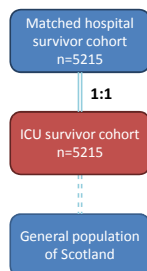


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Matched control cohort

- Matched hospital survivor cohort
 - Age, sex
 - Admission type
 - Discharge date
 - Regression methods
- General population 'cohort'
 - Age and sex directly standardised



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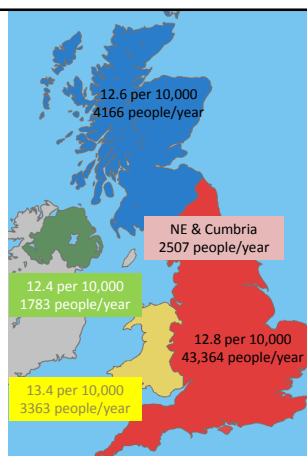


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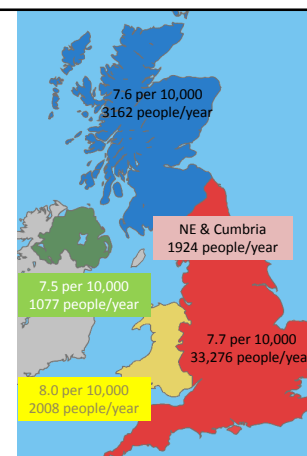
Incidence of ICU survivorship

- All general ICU survivors in Scotland
- 12.6 per 10,000 population ≥ 16 years
- Age-sex standardised rates
- Total UK ICU survivor population – 65,781 per year



Incidence of ICU survivorship

- Ventilated during admission
- Total UK ventilated ICU survivor population
 - 39,534 per year
- NE and Cumbria CCGs – 5.7% English population



- ICU survivorship common
 - Ventilated 39,534
 - Lung cancer 43,463
 - Bowel cancer 41,581
- Who needs further help after discharge?

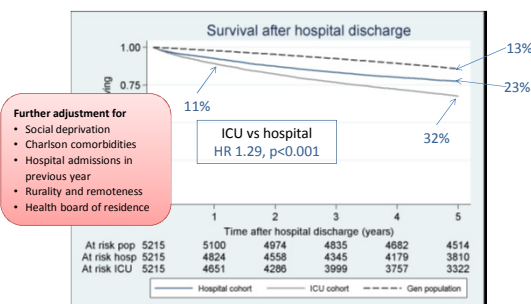
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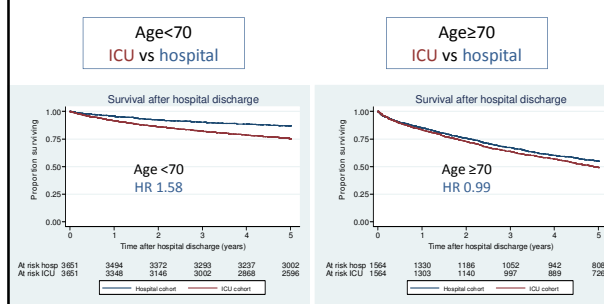
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Survival after hospital discharge compared with control populations



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Survival after hospital discharge stratified by age



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- ICU survivorship is associated with increased mortality
- Younger survivors have higher 'excess' mortality
- Can the 29% relative increase in mortality be attributed to critical illness?



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Cost outcomes

- Five years post-index hospital discharge resource use
 - Number of hospital admissions
 - Costs of hospital admissions
 - From Scottish NHS Costs Book 2013¹
 - Time to first readmission
 - Derived from linkage to SMR01 hospital database

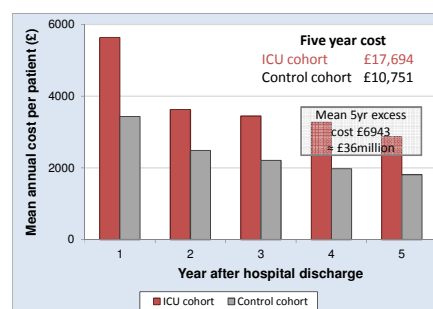
¹<http://www.isdscotland.org/Health-Topics/Finance/Costs>



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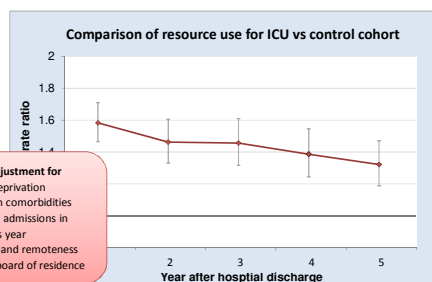
Comparison of hospital costs per year of follow up



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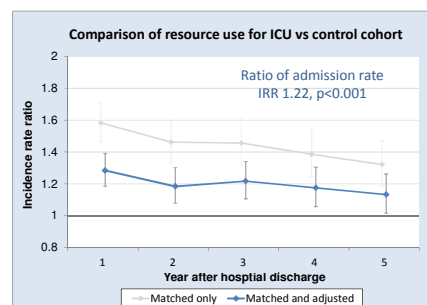
Comparison of ICU cohort with hospital inpatient cohort



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Comparison of ICU cohort with hospital inpatient cohort



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'Attributable' costs

- Assumptions rest on a 'counterfactual' approach to causal relationships
- 'What would the five-year costs have been had ICU patients not become critically ill?'
- Hospital control populations
- Alternative: self-controlled study design



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- ICU survivorship is associated with increased cost
- Some of this is attributable to critical illness
- How much is preventable through interventions in or after ICU?



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Predictors of resource use

	Hazard Ratio	LRT χ^2	p value
Inpatient admissions in previous year	1.14	180	<0.001
Comorbidities (20 groups)	*	101	<0.001
ICU admission diagnosis (28 groups)	*	90	<0.001
Health board of residence (11 groups)	*	35	<0.001
Age (quartiles)	1.2 to 1.3	30	<0.001
Social deprivation (most vs least)	1.18	4	0.04
SAPS II score (per 10 pts)	1.03	4	0.04
Organ support during ICU admission			
Mechanical ventilation	0.98	0.3	0.58
Renal replacement therapy	0.95	0.6	0.44
Vasoactive therapy	1.05	1.3	0.26

Acute illness factors



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- Pre-existing factors most strongly associated with subsequent health care costs
- Are these costs 'fixed' regardless of interventions in or after critical care?



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'Individual' patient trajectories

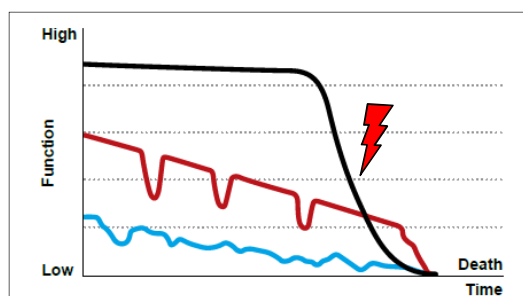
THE COSTS OF SURVIVING ICU



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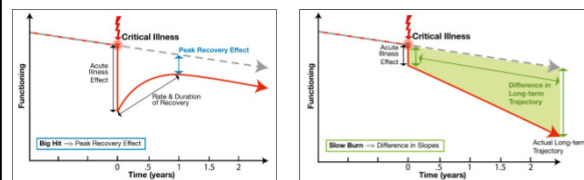
Patient trajectories



Murray et al. (2005) *BMJ* 330:1007.

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Critical illness trajectories

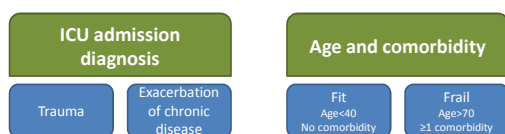


Iwashyna (2012) *AJCCM* 186: 302-304.

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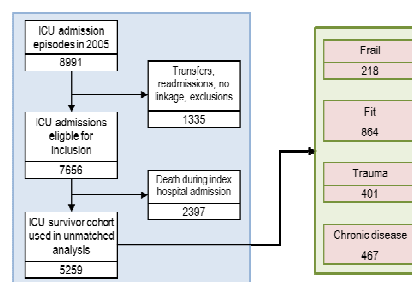
Subgroups

- Identification of more homogeneous patient sub-populations



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Cohort derivation



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- Within ICU populations, there are very different trajectories
- Could ICU care be cost-ineffective for some subgroups?

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Key messages

- ICU survivorship is common
- Survivorship carries a significant cost burden
- Pre-morbid factors have a stronger influence on costs compared with ICU-related acute factors
- A more nuanced approach to patient trajectories is needed to better understand ICU survivorship

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