Critical illness -
A new co-morbidity?

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Critical illness—
“What doesn’t kill you makes you weaker”

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Trying to answer the question-

“Weren’t they like this before they came into ICU?”
Trying to answer the question—
“Isn’t it all just (accelerated) old age”
Trying to answer the question—

“Isn’t it just being in hospital that’s bad for you”
Spurious Inferences about Long-Term Outcomes
The Case of Severe Sepsis and Geriatric Conditions

Theodore J. Iwashyna\textsuperscript{1,2,3}, Giora Netzer\textsuperscript{4,5,6}, Kenneth M. Langa\textsuperscript{1,2,3}, and Christine Cigolle\textsuperscript{1,7,8}

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**TABLE 1. DESCRIPTIVE STATISTICS FOR THE COHORT**

<table>
<thead>
<tr>
<th>Male, %</th>
<th>45.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at sepsis, yr</td>
<td>76.9 (SD, 8.8)</td>
</tr>
<tr>
<td>Black, %</td>
<td>20.5</td>
</tr>
<tr>
<td>Hispanic, %</td>
<td>7.1</td>
</tr>
<tr>
<td>Length of stay, d</td>
<td>10.6 (SD, 10.0)</td>
</tr>
<tr>
<td>Mechanical ventilation, %</td>
<td>19.7</td>
</tr>
<tr>
<td>Dialyzed, %</td>
<td>4.3</td>
</tr>
<tr>
<td>Underwent major surgery, %</td>
<td>30.4</td>
</tr>
<tr>
<td>Used critical care, %</td>
<td>43.2</td>
</tr>
<tr>
<td>Organ dysfunction score</td>
<td>1.1</td>
</tr>
</tbody>
</table>

N = 623 hospitalizations.
Spurious Inferences about Long-Term Outcomes
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**TABLE 4. ASSOCIATION OF SEVERE SEPSIS WITH PREVALENCE OF GERIATRIC CONDITIONS WHEN FULL LONGITUDINAL DATA ARE CONSIDERED**

<table>
<thead>
<tr>
<th>Pre-sepsis Trajectory</th>
<th>Effect of Severe Sepsis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR per yr (95% CI)</td>
</tr>
<tr>
<td>Incontinence</td>
<td>1.21 (1.07–1.37)</td>
</tr>
<tr>
<td>Low BMI</td>
<td>1.09 (0.78–1.51)</td>
</tr>
<tr>
<td>Poor hearing</td>
<td>1.23 (1.07–1.41)</td>
</tr>
<tr>
<td>Poor vision</td>
<td>1.25 (1.11–1.40)</td>
</tr>
<tr>
<td>Severe pain</td>
<td>1.15 (1.01–1.30)</td>
</tr>
<tr>
<td>Fall</td>
<td>1.19 (1.06–1.33)</td>
</tr>
</tbody>
</table>
Is critical illness a co-morbidity?

Effects on survival
Survival after critical illness

Survival over Years after ICU admission

General population

ICU survivors

Wright et al
Survival after critical illness

Years after ICU discharge

General population

ICU survivors

Williams et al
Survival after critical illness

Series 1

Series 2

ICU survivors

General population

Years after ICU admission

Survival

Cuthbertson et al
Risk of death after critical illness

Williams et al

Follow-up (years)

Observed/expected deaths

95% Upper CI

95% Lower CI
“Weren’t they like this before they came into ICU?”
Trajectory of mortality around critical illness

ICU and 5 yr follow-up

ICU patient

control
Onset of critical illness

Trajectory of mortality around critical illness

You are Here!

Onset of critical illness

ICU patient
Is it the diagnosis that determines mortality?
Is it the severity of illness that drives mortality?
“Isn’t it just all (accelerated) old age?”
Is it age that drives mortality?
Predictors of long term mortality:

- Age
- Co-morbidity
- Pre-morbid quality of life
- Organ failure
- Severity of illness
- Primary diagnosis

Severity of illness
Predictors of long term mortality

- Age
- Co-morbidity
- Primary diagnosis
- Severity of illness
Is critical illness a co-morbidity?

Quality of life
Physical quality of life

- Starts low
- Gets worse
- Rebounds
- Again deteriorates

Cuthbertson 2009

PreICU 3mths 6mths 1yr 2.5yrs 5yrs

Years after ICU admission

Physical QOL

1.5 SD below pop
Physical quality of life after ARDS after ICU admission

- Years after ICU admission:
  - 3mths
  - 1yr
  - 2yr
  - 3yrs
  - 4yrs
  - 5yrs

- Physical QOL:
  - 1 SD below population
  - 2.5 SD below population

Source: Herridge 2011
“Weren’t they like this before they came into ICU?”
Trajectory of QOL around critical illness

Morbidity gap
Trajectory of QOL around critical illness
Trajectory of QOL around critical illness
But look at these exercise tolerances.
Loss of muscle mass and physical quality of life

Months after ICU admission

- Body weight
- Months: 3 months, 6 months, 9 months, 12 months
“Isn’t it just being in hospital that’s bad for you”
Effect of aetiology of critical illness on quality of life

Years after ICU admission

- Sepsis
- Trauma
- ARDS
- General

1.5 SD below pop
Is there an exposure relationship?

Premorbid  | 1 mth | 3mths | 6mths | 1yr | 2.5yrs | 5yrs
---|---|---|---|---|---|---
Surgery
Critical illness
“Isn’t it just all (accelerated) old age?”
Affect of age on QOL

Years after ICU admission
Effect of age on QOL

Herridge et al 2011
Effect of age on QOL

Premorbid          | 3mths     | 6mths     | 1yr       | 2.5yrs    | 5yrs

Younger

Older

Age related deterioration

Cuthbertson 2009
“Weren’t they like this before they came into ICU?”
Functional trajectories before and after sepsis

Figure 3. Functional Trajectories by Baseline Functioning

- Limitations at baseline:
  - Severe
  - Mild to moderate
  - None

Mean Number of ADL and IADL Limitations

- Third Survey Before Sepsis
- Second Survey Before Sepsis
- Last Survey Before Sepsis
- First Survey After Sepsis
- Second Survey After Sepsis
- Third Survey After Sepsis

Iwashyna 2010
What are ADL deficits?

Severe limitations (n = 159)

- Walk
- Dress
- Bathe
- Eat
- Get into bed
- Toilet
- Prepare meal
- Grocery shop
- Use telephone
- Take medications
- Manage money

Fraction of Patients With Difficulty

Iwashyna 2010
Cognitive problems after sepsis

Iwashyna 2010
Trajectories for delirium after sepsis

Before sepsis

Moderate/Severe
Minor
None

After sepsis

Moderate/Severe
Minor
None

Dead
Trajectories for delirium after sepsis

Before sepsis

Moderate/Severe

Minor

None

After sepsis

Dead

Moderate/Severe

Minor

None
Predictors of poor physical QOL

- Age
- Co-morbidity
- Pre-morbid quality of life
- Organ failure
- Severity of illness
- ICU length of stay
- Organ failure
Psychological morbidity

- Fear of death
- Poor physical QOL
- Family consequences
- Societal consequences
- Neuropsychological trauma
- Previous psychiatric history
- Failure to identify
“What do these outcomes actually mean to our patients?”
Domains of Quality of life

- Physical quality of life
- Geriatric conditions
- Activities of daily living

What's this bit called?
Domains of quality of life

Physical quality of life

Geriatric conditions

Activities of daily living

Or this bit?
Domains of quality of life

Physical quality of life

Activities of daily living

Geriatric conditions

Or even this bit?
“Why does this all happen?”
Function (organ or holistic)

Function

ICU admission

Time

Failure

Death
“Can we conceptualise this?”
(Modified) Iwashyna conceptual model

Physical and mental / cognitive baseline status

Acute illness

Organ function impairment

Activity and functional limitation

Participation restrictions and disability

Quality of life
The destructive cycle

Previous acute illness → Physical QOL → Participation restriction → Limitation → Tissue pathology → Participation restriction → Index acute illness → Physical QOL → Limitation → Participation restriction → Tissue pathology → Physical QOL → Previous acute illness
The downward spiral

Acute illness

Tissue pathology

Physical QOL

Limitation

Death
Conclusions

• Critical illness is associated with excess morbidity and mortality
• Some of this is due to underlying morbidity
• The interactions between underlying chronic and acute morbidity is complex
• We must be realistic about what we can achieve when rehabilitating these patients
The PRaCTICaL study of nurse led, intensive care follow-up programmes for improving long term outcomes from critical illness: a pragmatic randomised controlled trial

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ABSTRACT
Objectives To test the hypothesis that nurse led follow-up programmes are effective and cost effective in improving quality of life after discharge from intensive care.
Design A pragmatic, non-blinded, multicentre, randomised controlled trial.
Setting Three UK hospitals (two teaching hospitals and one district general hospital).
Participants 120 patients (60 randomised to follow-up and 60 to usual care) aged 18 years or older with a critical illness who were discharged home from critical care. 120 controls (aged 18 years or older with a critical illness who were discharged home from critical care).
Randomisation Randomisation (using simple randomisation) was stratiﬁed by centre and then presented to the nurse or doctor on duty at the time of discharge to ensure that patients allocated to the intervention group did not present with a more severe illness than those in the control group.
Blinding It was not possible to blind the participants to their group allocation as they were allocated to either follow-up or usual care. The outcome assessor was blinded to treatment allocation.
Outcomes Quality of life at 3, 6, and 12 months after discharge to home from critical care was assessed using the EQ-5D-3L, the 36-item Short Form (SF)-36, the European Organization for Research and Treatment of Cancer Core 30-question (EORTC QLQ-C30), the Critical Illness Core 13-item (CIC-13), the Hospital Anxiety and Depression Scale, the Nottingham Health Profile, coping strategy questionnaire, and the full set of the Improving Care for the Critically Ill (IMPROVE) physical and psychological health questionnaires, as well as social and environmental support and satisfaction.
Follow-up Time to death, any re-admissions to intensive care, and any re-presentations to critical care with subsequent admission to intensive care was recorded at 3, 6, and 12 months post-discharge. Each patient was followed up for 12 months, with a follow-up period of 3, 6, or 12 months.

INTRODUCTION
More than 140 000 patients are admitted to intensive care units in the United Kingdom each year, of whom more than 50 000 die within a year of admission.1,2 These patients have an excess long term risk of death compared with the general population matched for age and sex;3,4 and a substantial percentage continue to experience chronic health problems.5,6
Health-related quality of life and physical recovery after a critical illness: a multi-centre randomised controlled trial of a home-based physical rehabilitation program

Doug Elliott¹*, Sharon McKinley², Jennifer Alison³, Leanne M Aitken⁴, Madeleine King⁵, Gavin D Leslie⁶, Patricia Kenny⁷, Penny Taylor¹, Rachel Foley⁸ and Elizabeth Burmeister⁹

Abstract

Introduction: Significant physical sequelae exist for some survivors of a critical illness. There are, however, few studies that have examined specific interventions to improve their recovery, and none have tested a home-based physical rehabilitation program incorporating trainer visits to participants’ homes. This study was designed to test the effect of an individualised eight-week home-based physical rehabilitation program on recovery.

Methods: A multi-centre randomised controlled trial design was used. Adult intensive care patients (length of stay of at least 48 hours and mechanically ventilated for 24 hours or more) were recruited from 12 Australian hospitals between 2005 and 2008. Graded, individualised endurance and strength training intervention was prescribed over eight weeks, with three physical trainer home visits, four follow-up phone calls, and supported by a printed exercise manual. The main outcome measures were blinded assessments of physical function; SF-36 physical function (PF) scale and six-minute walk test (6MWT), and health-related quality of life (SF-36) conducted at 1, 8 and 26 weeks after hospital discharge.
The RECOVER Program
Phase I

towards RECOVER

Long-Term Outcomes and Needs Assessment in Survivors of Prolonged Mechanical Ventilation and Their Caregivers

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Co-Investigators: Susan Abbey, Neill Adhikari, Jane Batt, Deborah Cook, Claudia Dos Santos, Niall Ferguson, John Flannery, Rob Fowler, Jan Friedrich, General Leung, John Marshall, Andrea Matte, Hilary Meggison, Alan Moody, Sangeeta Mehta, Jill Rudkowskia, Gordon Rubenfeld, Damon Scales, Tasnim Sinuff, Arthur Slutsky, Catherine Tansey, George Tomlinson