Early Rehabilitation in Critical Care – A UK perspective

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What do we know…

- Muscle atrophy (2% loss per day)
- VO_2 Max (↓ 0.9% per day)
- Bone demineralisation (6mg/day calcium) = Approx 2% bone mass/month (Up to 2 years to recover)
- ↑ HR (required to maintain resting VO_2)
- ↓ SV (Approx 28% after 10 days bed rest)
  (Compensated by ↑ Ejection Fraction)

* Note all these results involve healthy individuals, disease, malnutrition, sedatives, paralytics and sepsis all have the potential to increase these responses

Long Term Effects - Physical

- Prolonged ventilation in critical care is associated with impaired health related quality of life up to 3 years after discharge, even when patients are living independently at home

  (Coombes *et al* 2003)

- Persistent functional disability demonstrated over 5 years following discharge in ARDS patients

  (Herridge *et al* 2003 & 2008)

One-year outcomes in survivors of ARDS

Outcome	3 Months	6 Months	12 Months
Distance walked in 6 min			
No. evaluated	80*	78†	81†
Median — m	281	396	422
Interquartile range — m	55–454	244–500	277–510
Percentage of predicted value§	49	64	66
Returned to work — no./total no. (%)¶	13/83 (16)	26/82 (32)	40/82 (49)
Returned to original work — no./total no. (%)	10/13 (77)	23/26 (88)	31/40 (78)

Med Age 45yrs Med ICU LOS 25 days Med Hosp LOS 47 days

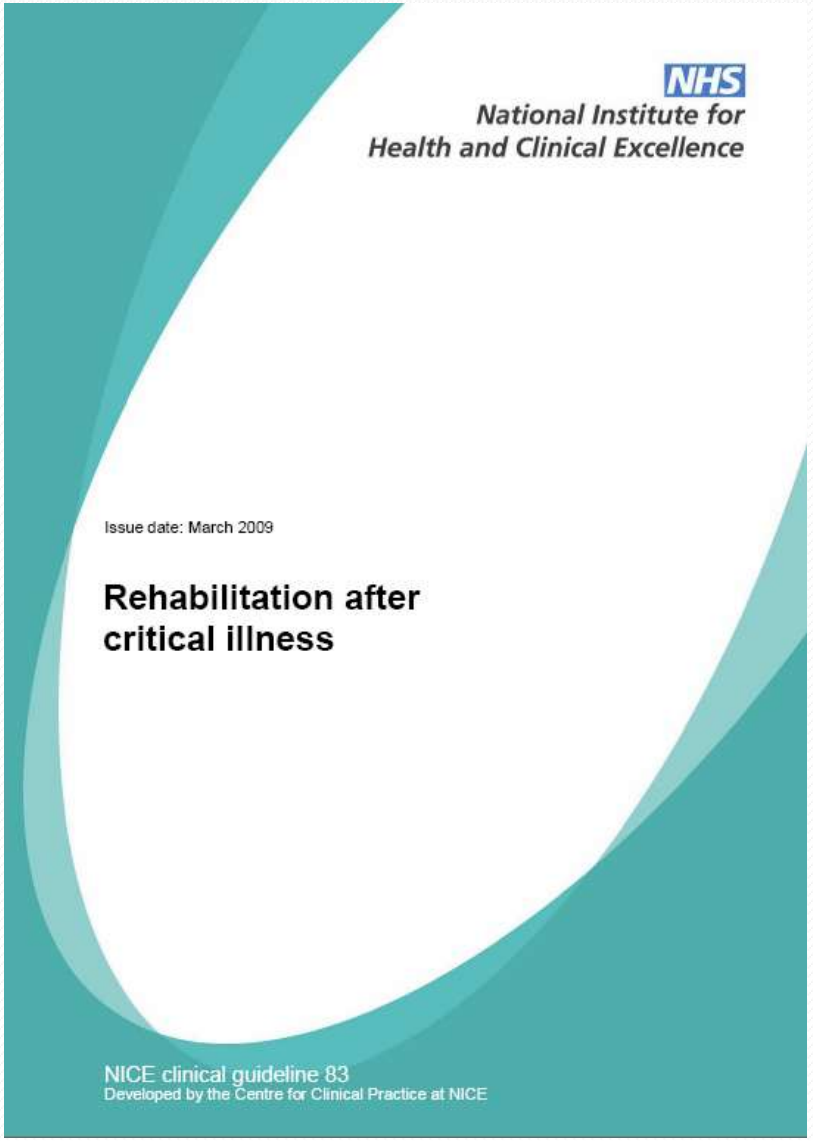
Herridge et al NEJM 2003;348:683

The negative effects of intensive care may take months to recover and are more likely with prolonged ICU stays and longer hours of ventilation

.....EVERY DAY COUNTS!!

NICE CG83

- Advocated early and structured rehabilitation programmes for patients admitted to critical care
- Importance of Key workers
- MDT working / Communication
- Closer links to ward and community



The evidence

Morris et al (2008)

Early intensive care unit mobility therapy in the treatment of acute respiratory failure

Peter E. Morris, MD; Amanda Goad, RN; Clifton Thompson, RN; Karen Taylor, MPT; Bethany Harry, MPT; Leah Passmore, MS; Amelia Ross, RN, MSN; Laura Anderson; Shirley Baker; Mary Sanchez; Lauretta Penley; April Howard, RN; Luz Dixon, RN; Susan Leach, RN; Ronald Small, MBA; R. Duncan Hite, MD; Edward Haponik, MD

- University Medical ICU in USA
- Does mobility protocol increase proportion of patients receiving physical therapy
- 330 subjects recruited and randomised
- An ICU Mobility team initiated protocol within 48 hours of mechanical ventilation

Morris et al - Early Therapeutic Mobility Protocol.

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4

Unconscious	**Conscious**	**Conscious**	**Conscious**
Turn every 2hr	Turn every 2hr	Turn every 2hr	Turn every 2hr
Passive ROM exercises	Sitting position min 20 minutes 3x daily	Sitting position min 20 minutes 3x day.	Sitting position min 20 minutes 3x day. Sitting on edge of bed with Physical therapist
	Active resistance range of motion (ROM) with physical therapy or RN daily	Sitting on edge of bed with Physical therapist	Active Transfer to Chair (OOB) with Physical Therapist Minimum 20 minutes

Can move arms against gravity

Can move legs against gravity

Results

Outcome	Protocol	Control	P Value
Proportion of patients receiving physical therapy	80%	47%	p<0.001
Therapy initiated on ICU	91%	13%	p<0.001
Ventilator days	8.8	10.2	p=0.163
ICU LOS (days)	5.5	6.9	p=0.025
Hospital LOS (days)	11.2	14.5	p=0.006

Schweickert et al (2009)

Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

William D Schweickert, Mark C Pohlman, Anne S Pohlman, Celerina Nigos, Amy J Pawlik, Cheryl L Esbrook, Linda Spears, Megan Miller, Mietka Franczyk, Deanna Deprizio, Gregory A Schmidt, Amy Bowman, Rhonda Barr, Kathryn E McCallister, Jesse B Hall, John P Kress

- >18 years
- Ventilated <72hrs but expected to cont >24hrs

- Randomly assigned to:
  - Intervention (PT & OT with daily sedation holds) n=49
  - Control (Physician ordered sedation holds and therapy sessions) n=55

Schweickert et al (2009)

- Primary endpoints
  - No. of patients returning to Indep function at hosp d/c

  (Defined as ability to perform 6 ADL's incl. dressing and grooming as well as ability to walk Indep)
- Secondary
  - Duration of delirium
  - Ventilator free days in 1st 28 days of admission

Results

	Intervention (n=49)	**Control (n=55)**	**p value**
Time from intubation to first OT / PT session	1.5 days (1.0 – 2.1)	7.4 days (6.0 – 10.9)	<0.0001
Return to independent functional status at hospital discharge	29 (59%)	19 (35%)	0.02
Barthel Index score at hospital discharge	75 (75-95)	55 (0-85)	0.05
Duration of delirium	2.0 days	4.0 days	0.02
Ventilator free days	23.5 (7.4–25.6)	21.1 (0.0-23.8)	0.05
Length of stay in ICU (days)	5.9 (4.5-13.2)	7.9 (6.1-12.9)	0.08
Hospital mortality	9 (18%)	14 (25%)	0.53

Data are n (%), median (IQR), or mean (SD).

McWilliams & Pantelides (2008)

Objectives:

- To identify limiting factors to early mobilisation & facilitate methods to decrease these

- To identify whether sitting patients on the edge of the bed or out in a chair within the first 5 days of admission decreases length of stay on ITU

- 65 Patients admitted to ICU from 20th Jun - 20th Sept 2005

(Exclusions: Patients ventilated on ITU for < 48 hours)

Results

- 17 patients sat on edge/ out by day 5 on ITU (26%)
- 48 did not

So what?

Reason for not sitting out	Number of cases (n=48):	Percentage:
Unwell/ Sedated/ paralysed	22	46%
Decreased staffing	8	17%
Fractures	4	8.5%
Weekend	4	8.5%
Reason not stated	2	4%
Decreased GCS	2	4%
On Noradrenaline	2	4%
CVS unstable	2	4%
Agitated ++	1	2%
Deranged Clotting	1	2%

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*Approx 30% easily reversible

Results

	Met standard	***Met Standard***	***Did not meet standard***
Mobilisation took place	By the 5th day	Not by 5th day	Not by the 5th day
No. of cases	17/65 (26%)	14/65 (22%)	34/65 (52%)
Mean LOS	5.7 days	12.9 days	21.1 days
Range (LOS)	2-18 days	3-29 days	5-86 days

Conclusion

- Small numbers
- Numerous variables

BUT

- Significant difference for those patients mobilised (approx 7 days)
- 7 days = £10,000
- 14 pts = £140,000 over 3 months

= £560,000 p/a potentially avoidable with ↑ staff/ resources

But…..

- What does early really mean and how can we measure it?????

Time To Mobilise

Time To Mobilise

Morris et al 2008

- 1st day out of bed
- Day 5 vs day 11 ($p<0.001$)
- Doesn't then however show ongoing rehab level acheived

Schweickert et al (2009)

	Intervention (n=49)	Control (n=55)	p value
Time from intubation to first PT/OT session (days)	1·5 (1·0–2·1)	7·4 (6·0–10·9)	<0·0001
Independent ADLs total at ICU discharge	3 (0–5)	0 (0–5)	0·15
Independent ADLs total at hospital discharge	6 (0–6)	4 (0–6)	0·06
MRC examination score at hospital discharge	52 (25–58)	48 (0–58)	0·38
Grip strength at hospital discharge (kg-force)	39 (10–58)	35 (0–57)	0·67
Gait: walking distance at hospital discharge (m)	33·4 (0–91·4)	0 (0–30·4)	0·004
Time from intubation to milestones achieved (days)			
Out of bed	1·7 (1·1–3·0)	6·6 (4·2–8·3)	<0·0001
Standing	3·2 (1·5–5·6)	6·0 (4·5–8·9)	<0·0001
Marching in place	3·3 (1·6–5·8)	6·2 (4·6–9·6)	<0·0001
Transferring to a chair	3·1 (1·8–4·5	6·2 (4·5–8·4)	<0·0001
Walking	3·8 (1·9–5·8)	7·3 (4·9–9·6)	<0·0001

Data are median (IQR). ADLs=activities of daily living. ICU=intensive care unit. MRC=Medical Research Council. PT/OT=physical therapy and occupational therapy. MRC examination scale 0–60.

Table 4: **Function and muscle strength outcomes according to study group**

What about overall level achieved…

- Needham et al. Early Physical Medicine and Rehabilitation for Patients With Acute Respiratory failure: A Quality Improvement Programme. Arch Phys Med Rehabil Vol 91, April 2010

- McWilliams DJ, Westlake EV. The effect of a structured rehabilitation programme for patients admitted to critical care. Intensive Care Med. 2011 Sep;37 (Supp)

Needham et al, 2010

57 patients ventilated ≥ 4 days at a MICU in USA

Objectives. MDT focussed on

1. reducing deep sedation and delirium to permit mobilization, (2)
2. increasing the frequency of rehabilitation consultations and treatments to improve patients' functional Mobility
3. evaluate effects on length of stay.

Table 4: Hospital Administrative Data for All MICU Patients: Treatments and LOS

Outcome Measure	Control Period* (May–August 2006)	QI Period (May–August 2007)	Relative Change (%)	*P*
Physical and occupational therapy				
Total consultations	215	548	↑ 154	.040
Total treatments	210	810	↑ 286	<.001
Data for MICU patients				
Number of admissions	262	314	↑ 20	
MICU average LOS, d	7.0	4.9	↓ 30	.020
Hospital average LOS, d	17.2	14.1	↓ 18	.030
In-hospital mortality (%)	23.3	21.0	↓ 10	.550

Abbreviations: ↑, increase; ↓, decrease.
*The same 4-month period from the prior year was used as a control period for comparison with the QI period when using hospital administrative data to evaluate the effect of the QI project on all MICU patients. A prior year comparison period was used, rather than the months immediately preceding the QI period, in order to control for known seasonal effects in the number of MICU admissions and length of stay.

Table 3: PM&R Outcomes

Outcome Measure	Pre-QI Period	QI Period	P*
Patient data	Patients (n=27)	Patients (n=30)	
Received physical and/or occupational therapy in MICU	19 (70)	28 (93)	.040
Number of treatments per patient (median [IQR])	1 (0–3)	7 (3–15)	<.001
Number of treatments per day (mean ± SD)	0.33±0.38	0.83±0.45	<.001
Consultations			
Physical therapy	16 (59)	28 (93)	.004
Occupational therapy	20 (74)	27 (90)	.170
Physiatry	0 (0)	26 (87)	<.001
Neurology	1 (4)	7 (23)	.050
Functional mobility during a PT or OT treatment	Treatments (n=50)	Treatments (n=294)	
Supine to sit	19 (38)	212 (72)	.003
Sitting at the edge of the bed	27 (54)	225 (77)	.020
Transfer from bed to chair	3 (6)	113 (38)	.005
Transfer from sit to stand	12 (24)	145 (49)	.050
Walking	2 (4)	39 (13)	.240

NOTE. Values are n (%) or as otherwise indicated.
Abbreviation: IQR, interquartile range.
*Fisher exact test was used to compare the proportion of patients that received any physical and/or occupational therapy and by type of therapy across the pre-QI and QI periods. For measures recorded on multiple days in the MICU, *P* values were estimated using logistic regression models adjusting for within-subject correlation using a robust variance estimate.

Results

- There were a greater median number of rehabilitation treatments per patient (1 vs 7, *P.001)*
- *with a higher level of functional mobility (treatments* involving sitting or greater mobility, 56% vs 78%, *P.03)*.
- *Hospital* administrative data demonstrated that across all MICU patients,
  - there was a decrease in intensive care unit and hospital length of stay by 2.1 and 3.1 days, respectively
  - 20% increase in MICU admissions compared with the same period in the prior year

McWilliams & westlake, 2011

- A more structured programme of rehabilitation was implemented at CMFT the beginning of 2008.
- This was achieved through
  - Use of rehab keyworkers
  - structured and documented rehabilitation plans
  - weekly goal setting meetings
  - specific MDT training and education sessions.

Methods

- All patients admitted > 5 days and surviving to ICU discharge between 1st June and 30th September from 2007 to 2010 were included in the study.

- Primary outcome measures used were
  - Mean physical function at ICU discharge, assessed via the Manchester Mobility Score (MMS),
  - Mean ICU LOS and post ICU LOS

- Baseline data for 2007 was obtained retrospectively, with annual figures presented for the three years following the introduction of the rehabilitation programme.

Manchester Mobility Score

- Developed due to a lack of robust / useful outcome measures in ICU
- Looks at stages of rehabilitation
- Quick and simple bedside measurement
- Uses
  - Monitoring rehab on unit
  - Benchmarking against other centres
  - Time to rehab
  - Predictor of outcome / Screening tool

Manchester Mobility Score

- 1 – Passive Movements, Active exercise, chair position in bed
- 2 – Sit on edge of bed
- 3 – Hoisted to chair (incl. standing Hoist)
- 4 – Standing practice
- 5 – Transfers with assistance
- 6 – Mobilising with or without assistance
- 7 – Mobilising > 30m
- A – Agitated
- U - Unwell

Observed Effects in Manchester

	2007	2008	2009	2010
n	26			
APACHE II	15.4			
Mean MMS	2.9			
ICU LOS	18.1			
Hospital LOS	53			

MMS
1 – Passive Movements, Active exercise, chair position in bed
2 – Sit on edge of bed
3 – Hoisted to chair (incl. standing Hoist)
4 – Standing practice
5 – Transfers with assistance
6 – Mobilising with or without assistance
7 – Mobilising > 30m

Results

- In the year prior to the introduction of the structured rehabilitation programme the mean MMS was 2.9, defined as being a sit on the edge of the bed or hoist transfer to the chair.
- In this year mean ICU and ward LOS were 18.1 and 53 days respectively.

Observed Effects in Manchester

	2007	2008	2009	2010
n	26	30		
APACHE II	15.4	15.9		
Mean MMS	2.9	3.3		
ICU LOS	18.1	17.5		
Hospital LOS	53	42.9		

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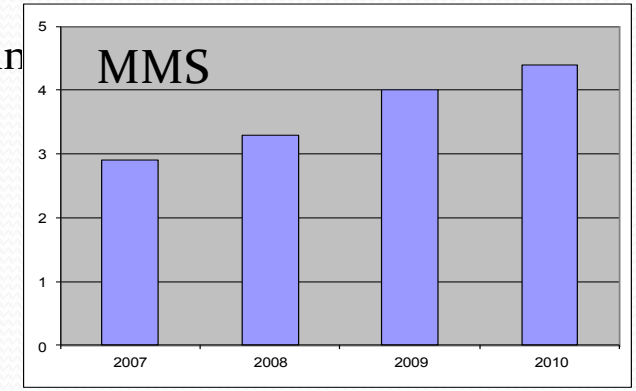
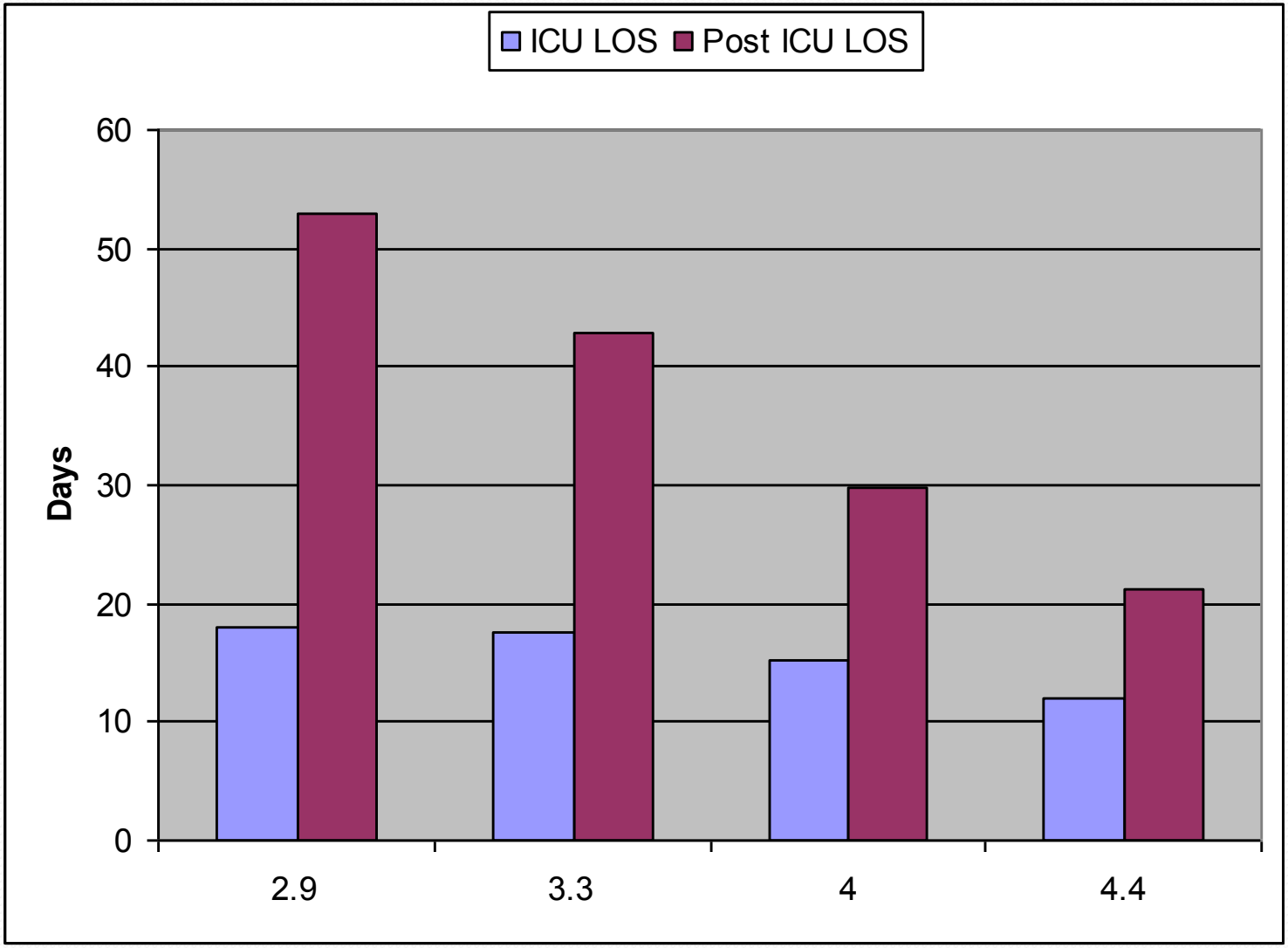


Results

- By 2010 the MMS had increased to 4.4, suggesting the average patient was now standing or transferring to a chair at ICU discharge.
- This was associated with significant reductions in both ICU (11.9 days, $p<0.01$) and post ICU LOS (21.2 days, $p< 0.01$).

LOS according to Mean MMS



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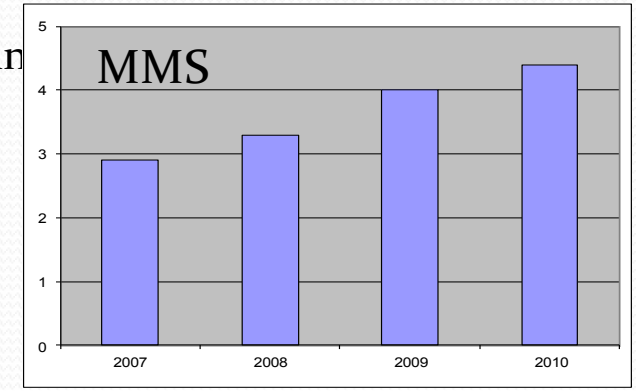

Conclusions

- Structured programmes of rehabilitation can significantly increase the functional status of patients at ICU discharge.
- This improvement was associated with a significant reduction in both ICU and ward length of stay.
- This is at a time when patient illness severity was observed to be higher with a yearly increase to APACHE II scores.

Any Questions