Physical Activity Levels, Primary Care Costs and Quality-Adjusted Life Years (QALYs) in Survivors of Critical Illness

A. McNelly1, R. Maharaj2, J. Rawal1, P. Chan1, N. Hopkinson3, J. Moxham4, S. Harridge5, N. Hart4, H. Montgomery6, Z. Puthucheary2,7

1 Institute of Health and Human Performance, University College London, UK; 2 Department of Anaesthesiology, King’s College Hospital NHS Foundation Trust, UK; 3 NHRI Respiratory Biomedical Research Unit at Royal Brompton and Harefield NHS Foundation Trust and Imperial College London, UK; 4 Department of Respiratory Medicine, King’s College London, UK; 5 Centre for Human and Aerospace Physiological Sciences, King’s College London, UK; 6 Lane Fox Clinical Respiratory Physiology Unit, Guy’s and St Thomas’ NHS Foundation Trust, London, UK; 7 Division of Respiratory and Critical Care Medicine, University Medicine Cluster, National University Health Systems, Singapore

Aims
- Daily physical activity (PA) appears commonly limited in Intensive Care Unit (ICU) survivors.
- We assessed this using both subjective and objective methods, also recording primary care costs (PCC) and deriving Quality-Adjusted Life Years (QALYs) 18 months post-ICU discharge.

Methods
- Subjects were drawn from the MUSCLE-UK Study1 being (i) invasively ventilated for >48 hours and (ii) on ICU >7 days. At 18 months post-ICU discharge we determined:
  - Daily step count (Senswear activity monitors)
  - Health-related quality of life (SF-36 survey)
  - Clinical Frailty Scale Score2 (Table 1)
  - QALYs; PCCs and Cost Utility Ratios (CURs)

Results - Physical Function
- Twenty-seven patients were studied [14 female; age 55.3 years (95%CI 48.3 - 62.3); post-ICU discharge 573 days (95%CI 539 - 614)]
- Mean SF-36 Physical Component Summary score ± SD for ICU survivors (39 ± 13) was lower than that of norm population (50 ± 10)
- Median CFS was significantly higher in ICU survivors compared to age-matched controls: 4 [Interquartile Range (IQR) 2] versus 2 [IQR1]; p=0.002
- Mean daily step count was lower than that in normal controls, and worse in those with pre-existing chronic disease than without (Figure 1)

Results - Cost-Effectiveness Analysis
- At 18-months post-ICU discharge:
  i. Cumulative PCC (mean ± SEM) were 5-fold higher for ICU survivors than for normal controls (£1210 ± 274, £238 ± 11; p=0.003), and
  ii. QALYs (mean ± SEM) were significantly lower (0.92 ± 0.045, 1.16 ± 0.01; p=0.000)
- CFS was the only independent variable to contribute significantly to variation in QALYs (r²=0.38; p=0.001).
- The strong correlation between loss of daily step count and CUR, was influenced by the degree of pre-morbidity (at 100-80% of normal population values) (Table 2; Figure 2)

Results - Pre-Morbid Health on Cost Utility Ratio and Loss of Daily Step Count
At 85% pre-morbid baseline health of ICU survivors vs. controls, there was:
- i. A difference in QALYs of 0.072
- ii. A cost per QALY lost (CUR) of £13,502
- iii. A loss of 107 daily steps

Table 1: Clinical Frailty Scale2
A measure of frailty in geriatric and critically ill patients (Score - Frailty grade)
1 - Very fit
2 - Well
3 - Managing well
4 - Vulnerable
5 - Mildly frail
6 - Moderately frail
7 - Severely frail
8 - Very severely frail
9 - Terminally ill

Table 2: Quality Adjusted Life Years (QALYs) and Cost Utility Ratios (CURs) in ICU survivors compared to non-ICU survivors for varying permutations of pre-morbid health.

<table>
<thead>
<tr>
<th>% Pre-Morbid Baseline Health of ICU Survivors vs. Controls</th>
<th>QALY Difference Between ICU Survivors and Controls</th>
<th>CUR (£)</th>
<th>Loss of Daily Step Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.247</td>
<td>3935</td>
<td>31</td>
</tr>
<tr>
<td>90</td>
<td>0.120</td>
<td>7465</td>
<td>59</td>
</tr>
<tr>
<td>85</td>
<td>0.072</td>
<td>13502</td>
<td>107</td>
</tr>
<tr>
<td>80</td>
<td>0.014</td>
<td>70577</td>
<td>587</td>
</tr>
</tbody>
</table>

Conclusion
- Subjective and objective measures show that PA and QALYs are reduced 18 months after ICU admission.
- This model may inform the design of future rehabilitation trials in ICU patients.

Acknowledgements:
Dr McNelly was supported by the Batchworth Trust; Dr Puthucheary by a National Institute of Health Research (NIHR) doctorate fellowship.

References: