multidisciplinary or comprehensive rehabilitation as currently practised after myocardial infarction. We wonder whether we might use these columns to ask public health practitioners as well as cardiologists and rehabilitationists to encourage hospitals to randomize for a year to obtain a reliable estimate of the contribution of rehabilitation, before it is too late.

Further details may be obtained from and suitable hospitals may join the trial by arrangement with the undersigned at University of Wales College of Medicine [telephone Cardiff (01222) 743653].

References

Accepted on 1 July 1997

Yours faithfully

Robert West
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Issues in cost function specification for neonatal care: an inter-disciplinary perspective

Sirs,

While wholeheartedly applauding O’Neill and Largey’s contention¹ that models of the cost of neonatal services should be carefully interpreted, we would advocate an inter-disciplinary perspective and studies which relate costs to outcome.

O’Neill and Largey presented a double log model as an alternative to the quadratic model of Fordham et al.² in describing the relationship between costs, volume, and case mix in neonatal units in Trent. As they point out, starkly different implications for policy arise from these two models. However, although the double log model was based more explicitly on econometric theory, its clinical validity is in doubt.

Among the units in Trent,² annual volume ranged between 1168 and 6789 days of care and case mix (the proportion of days of intensive care) ranged between 0.02 and 0.56. Table 3 of the paper¹ predicts average daily costs for values of volume and case mix outside these extremes, for example, for as little as 1000 days per year and for a proportion of intensive care as high as 0.8. This is at variance with advice not to extrapolate models beyond the observed data.² It is also unlikely that neonatal units could provide such a high proportion of intensive care. The reversals in economies of scale predicted by the double log model when the proportion of intensive care days exceeded 0.64 should therefore be interpreted with caution. The fall in costs as the proportion of intensive care increases from 0.05 to 0.8 at a volume of 1000 days of care is similarly implausible.

Within this range both models predict that daily costs fall with increasing annual volume and a decreasing proportion of intensive care, except at an annual volume of 1391 days. At this volume the double log model predicts that an eight-fold increase in the proportion of intensive care from 0.05 to 0.4 leads to no increase in costs, which is counterintuitive.

Table 1 Estimates of average cost per day in £ obtained from the Fordham quadratic model²

<table>
<thead>
<tr>
<th>Total no. of days</th>
<th>0.05</th>
<th>0.1</th>
<th>0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1391</td>
<td>195.53</td>
<td>208.84</td>
<td>288.74</td>
</tr>
<tr>
<td>2000</td>
<td>166.33</td>
<td>179.64</td>
<td>259.54</td>
</tr>
<tr>
<td>3500</td>
<td>110.82</td>
<td>124.14</td>
<td>204.03</td>
</tr>
<tr>
<td>5000</td>
<td>78.66</td>
<td>91.98</td>
<td>171.88</td>
</tr>
</tbody>
</table>

Estimates of average cost per day in £ obtained from the double log model¹

<table>
<thead>
<tr>
<th>Total no. of days</th>
<th>0.05</th>
<th>0.1</th>
<th>0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1391</td>
<td>196.54</td>
<td>196.52</td>
<td>196.50</td>
</tr>
<tr>
<td>2000</td>
<td>160.36</td>
<td>169.47</td>
<td>189.28</td>
</tr>
<tr>
<td>3500</td>
<td>117.20</td>
<td>134.89</td>
<td>178.65</td>
</tr>
<tr>
<td>5000</td>
<td>95.87</td>
<td>116.62</td>
<td>172.20</td>
</tr>
<tr>
<td>5000</td>
<td>95.87</td>
<td>116.62</td>
<td>172.20</td>
</tr>
</tbody>
</table>

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Alongside the finding that the proportion of the variance in costs explained by the double log model \((R^2 = 0.65)\) was lower than that explained by the quadratic model \((R^2 = 0.76)\), there is good evidence that, for these data, the original quadratic model of Fordham et al.\(^2\) is more valid.

A more fundamental issue is the need to evaluate outcomes rather than costs alone. Clinical outcomes can differ between different types of neonatal unit\(^4\),\(^5\) so measuring economic or psychological costs without reference to outcome tells us little about how to allocate resources. O’Neill and Largey send a valuable message by stressing the need to consider alternative models of cost function. As more multicentre studies are undertaken it may be possible to test these and other cost functions\(^6\) and their interactions with clinical outcome\(^7\) independently.

**References**


**Reply**

Sirs,

Our colleagues make four substantive points in relation to our paper ‘Issues in cost function specification for neonatal care – the Fordham Case’.\(^1\) These are:

1. The analysis of cost relationships should be an interdisciplinary exercise combining the talents of those with a full understanding of the data being analysed with those possessing an understanding of how those data might be analysed.

2. Following from (1), extrapolation from sample data can be a dangerous exercise, especially if the individuals doing the extrapolating have a poor understanding of the reasonableness of the scenarios implicit in the exercise – i.e. it can result in conclusions being drawn which cannot be tested using the data.

3. The failure to relate outcomes to cost in the functions presented by us means that our analysis ‘tells us little about how to allocate resources’.

4. For this data set the Fordham model\(^2\) is ‘more valid’ and by implication superior to the double-log model argued by us to have been arrived at in a more theoretically consistent fashion.

In discussing these points it is important to recall that the Fordham data set consisted of only 17 observations on three variables, and, as stated in our original paper, it would be unwise to draw any policy implications from an econometric analysis based on this small data set.

Within this context, we respond to the points in turn.

1. We agree that meaningful analysis of cost data requires an understanding of the data and the methods by which those data may be analysed. By implication we support the contention that work such as this is best undertaken in an interdisciplinary fashion. At no point was our paper intended to suggest otherwise.