Quantifying the Gap Between Radiotherapy in the Elderly and the Demand for Age-Agnostic Treatment

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What is Malthus?
The Malthus model is a radiotherapy demand prediction tool for NHS England, commissioned by the National Cancer Action Team/Department of Health4. Figure 1 illustrates the operation of the model.

Key Features of the Malthus Model:
• Based around evidence-based clinical decision trees
• Discrete event simulation
• Utilises Monte Carlo methods
• Contains a virtual patient generator which creates statistically representative patient cohorts
• Created ab initio for adaptability to new simulation scenarios
• Simulates both national demand and local level demand
• The modular architecture allows the model to be adapted to different healthcare systems and treatment indications

The Study Methodology
This study evaluates the utilisation of radiotherapy actually in the elderly, and estimates the difference to a truly age-agnostic practice. A direct comparison was made between Malthus and RTDS2 (Figure 2). Table 1 shows details of current treatment in ages 65+.

The three realistic scenarios modelled are:
1. Increasing the number of fractions prescribed to the elderly, an effect of switching towards more radical treatments (80-84: 12.5%>15% and 85+: 8.7%>13%)
2. Increasing the percentage of elderly receiving radiotherapy, a shift in clinical evidence base or patient uptake (80-84:28%>32% and 85+:20%>28%)
3. Combining both scenarios together

Results
Figure 2. shows the difference between modelled demand and delivered treatment. There is a small fall-off in the number of fractions prescribed per incidence in the 75-79 group and a more marked drop-off above 80, shown in Table 1. However, the access rate appears to be declining steadily for ages 55 and above.

What if changes occur in treatment paradigm of the elderly?
Increasing the average attendance per episode
+52,000 fractions per year
Increasing access rate
+42,000 fractions per year
Increase both access rate and fractionation increase
+110,000 fractions per year

Implications for NHS England
The elderly represent a large cohort of cancer patients, and numbers will continue to increase. Therefore, any change as to how the elderly cohort is treated can have significant repercussions on a healthcare system. The potential impact caused by a shift in treatment paradigm, while quantified in a few scenarios here for England, is sufficient to require extra investment in services.

Minor increases to fractionation and access to RT equates to 14 new machines worth of extra treatments throughout England (assuming a machine throughput of 8,000 fractions per annum)

References

Table 1. Delivered fractionation as a percentage of evidence-based demand, actual attendance per episode and access rate for England, broken down by elderly age groups.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>% Modelled fraction demand actually delivered</th>
<th>Recorded attendance per episode</th>
<th>Access rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>95%</td>
<td>15.19</td>
<td>42%</td>
</tr>
<tr>
<td>70-74</td>
<td>94%</td>
<td>15.19</td>
<td>40%</td>
</tr>
<tr>
<td>75-79</td>
<td>86%</td>
<td>14.53</td>
<td>36%</td>
</tr>
<tr>
<td>80-84</td>
<td>82%</td>
<td>10.71</td>
<td>28%</td>
</tr>
<tr>
<td>85+</td>
<td>82%</td>
<td>7.48</td>
<td>20%</td>
</tr>
</tbody>
</table>

Figure 1. Malthus discrete event simulation. Users can select the population and tumour types for simulation. Results presented on this poster are the aggregated demand for 23 tumour types across the whole of England.