

# Mortality of CAP reduced in the UK: is this enough?

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In 1930, pneumonia was the third most frequent cause of death in the USA. Now almost a century later, and despite the introduction of antibiotics in the 1950s, pneumonia remains the fourth most common cause of death worldwide.<sup>1</sup> Community-acquired pneumonia (CAP) represents a major burden in terms of morbidity, mortality and health cost, as well as days of work lost.

In the last 10 years, guidelines for management of CAP have been published.<sup>2–4</sup> One of the objectives of the guidelines is to improve outcomes (including mortality) when implemented. This was demonstrated, for example, by Dean *et al*,<sup>5</sup> showing a reduction in mortality from 14.2% to 11% in a series of hospitals in the USA after implementation of the 2001 American Thoracic Society CAP guidelines.

The British Thoracic Society (BTS) guidelines were published in 2009<sup>2</sup> and they advised three key points for CAP quality standards: (1) to perform a chest X-ray within 4 hours of presentation, (2) to perform a mortality risk assessment using the CURB65 score and (3) to administer the first dosage of antibiotics within the first 4 hours after emergency department (ED) arrival. In parallel with the 2009 publication the BTS started a CAP audit programme. The audit was conducted from 2009 to 2012 and then subsequently in 2014.<sup>6</sup> A total of 218 institutions submitted data for 24 187 adults hospitalised for CAP. The main result of the study was a significant reduction of adjusted 30-day mortality (adjusted odds ratio: 0.86). The authors claim that this was due to a significant increase in the proportion of patients who received the first dosage within the first 4 hours of admission (57%, 57%, 60.8%, 64.5% and 68.5% in 2009, 2010, 2011, 2012 and 2013, respectively). This was also associated with a significant increase in the proportion of patients who had a

chest X-ray within 4 hours of admission (76.5%–80% in 4 years). Other factors not reported by authors could have played a role such as time to taken to present in ED after onset of symptoms, diagnosis and treatment of influenza and availability of critical care bed for invasive and non-invasive mechanical ventilation among others.

Other recent studies have found decreases in CAP mortality, although in a lower number of patients. In a recent investigation from a single centre in Spain, Simonetti *et al*<sup>7</sup> observed a decrease in 30-day mortality (in the period 1995–1999) from 9.6% to 4.1% comparing 1995–1999 with 2010–2014. This decrease in mortality was observed despite patients being older and having a higher severity and more comorbidities in the second period.

A similar downward trend in mortality due to CAP has been reported in two previous studies<sup>8–9</sup> using US national databases, where mortality due to CAP fell from 8.9% in 1993 to 4.1% in 2005 ( $p < 0.001$ ) in hospitalised patients<sup>8</sup> and from 13.5% in 1987 to 9.7% in 2005 in a population of elderly inpatients and outpatients with CAP.<sup>9</sup>

Two case-control studies showed reductions in mortality among patients with CAP. One study,<sup>10</sup> which compared patients with CAP admitted to the intensive care unit in two periods (1995–2000 and 2005–2010), suggests that the decrease in mortality observed may be related to the follow-up of a sepsis management bundle derived from the Surviving Sepsis Campaign. In severe pneumococcal CAP, Gattarello *et al*<sup>11</sup> showed a decreased mortality with time. Most importantly, they observed an increase from 25% to 87.5% of patients receiving the first dosage within the first 3 hours.

It seems that earlier administration of the first dosage of antibiotics is a beneficial and logical measure in reducing mortality. Older studies in CAP<sup>12–13</sup> confirm this statement and this is a quality measure for ED.<sup>14</sup> However, we are not sure whether or not it is necessary for everybody with CAP. Menéndez *et al*<sup>15</sup> and Yahav *et al*<sup>16</sup> suggest that the beneficial effect on mortality when

administering an early dosage should be focused on patients with severe sepsis and CAP, which accounts for 40% of admitted patients. We believe that in CAP we should use the sepsis view and consider the application of the sepsis six care bundle with all actions completed in 1 hour (O<sub>2</sub> administration, intravenous fluids, monitoring urine output, measuring lactate, taking blood cultures and giving appropriate antibiotic). In sepsis, there is clear evidence that mortality has decreased independently of the source.<sup>17</sup>

What we do not know from the BTS audit is whether the administration of the first dosage was done only when the chest X-ray was available. If this was the case, obtaining a chest X-ray is a potential barrier for early treatment in crowded EDs. We think that using severe sepsis scores<sup>18</sup> or perhaps the recently published Quick SOFA score<sup>19</sup> (very similar to CRB65) could be used without waiting for a chest-X-ray. In other words, we should find a way to detect or suspect those patients with severe sepsis due to CAP before performing a chest X-ray. The quick SOFA score needs to be validated in CAP.

One concern regarding the evaluation of the results of this study is the inclusion of patients coinciding in time with the 2009 H1N1 pandemic and postpandemic season. Despite the authors discussing this limitation, it is important to note that some studies have reported an increased severity of influenza A (H1N1) 2009 pneumonia in the first postpandemic influenza season<sup>20</sup> or even an estimate of respiratory and cardiovascular mortality associated with the 2009 pandemic influenza A H1N1 15 times higher than reported laboratory-confirmed deaths.<sup>21</sup>

Although 30-day mortality was reduced from 18.4% to 17.3% in the BTS audit study, mortalities observed are still very high and higher compared with other recent studies (not superior to 10%) both in the overall population of CAP<sup>7</sup> and in bacteremic pneumococcal pneumonia.<sup>22</sup> Moreover, the rates of adherence to local antibiotic guidelines are low (55.6% – 57.3%) compared with previous studies.<sup>23–24</sup> The reasons for this high mortality and the low guideline adherences found in the BTS audit are unclear, but there is a good opportunity to study these findings and implement subsequent measures over the following years.

In summary, the results of the BTS audit are good news since they show a reduction in mortality probably due to a combined effect of both an increased implementation of chest-X-ray and first dosage of antibiotics before the first

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4 hours after ED arrival. Authors of the BTS audit have a great opportunity to further decrease mortality of hospitalised CAP in the ensuing years.

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