British Thoracic Society
Adult Community Acquired Pneumonia (CAP) Audit Report
National Audit Period: 1 December 2014 – 31 January 2015
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Audit Period: 01/12/2014 to 31/01/2015
Number of records submitted: Part 1 = 6786, Part 2 = 2211
Number of participating institutions: Part 1 = 158, Part 2 = 115

Summary/Abstract

This report summarises the results of the 5th British Thoracic Society (BTS) national audit in community acquired pneumonia (CAP) in adults. The audit period was between 1st December 2014 and 31st January 2015. Audit submissions closed on 31 May 2015. The audit had three parts: Part 1 collected data on adult CAP admissions that met inclusion criteria; Part 2 collected information on coding and diagnosis; and Part 3 related to audit processes within participating institutions.

Part 1 data were collected from 158 participating institutions; 6786 records were submitted. This represents the largest national audit of adult CAP conducted by the BTS. Part 2 data were collected from 115 institutions and 2211 records were submitted.

The main findings from this audit were:

- A continued improvement in the proportion of patients (59% in this audit) receiving antibiotics for the treatment of CAP within 4 hours of admission, since 2009.
- A sustained reduction in in-patient mortality in patients admitted with CAP, to a current level of 17.7%.
- Low concordance with antimicrobial recommendations at both national and local levels:
    - 30% of patients with moderate and severe CAP received β-lactam monotherapy (as opposed to combination β-lactam and macrolide therapy)
    - In 40% of cases, the antibiotics administered were not in line with local antibiotic/CAP guidelines.
- High levels of miscoding of the diagnosis of pneumonia; about a third of patients coded for pneumonia did not have clinico-radiographic changes consistent with CAP (as defined by inclusion into Part 1 of the audit).

National Improvement Objectives: ***(to be achieved by the time of local re-audit in 2015/2016)***

1) Demonstrate an increase in the proportion of adults with CAP, who have a chest radiograph within 4 hours of admission. (Target in 3 years: 90%)

2) Demonstrate an improvement in the proportion of adults with CAP who receive the first dose of antibiotic therapy within 4 hours of admission. (Target in 3 years: 85%)

3) Demonstrate an improvement in the proportion of adults with moderate and high severity CAP administered combination β-lactam and macrolide antibiotic therapy. (Target in 3 years: 85%)

4) Demonstrate an improvement in the proportion of coded cases of pneumonia, who have CXR-confirmed pneumonia. (Target in 3 years: 85%)

Standards/guidelines/evidence base

This audit examines the patient profile, processes of care and outcomes relating to hospitalisation with an episode of community acquired pneumonia (CAP) in the UK. The audit standards were derived from the BTS Guidelines for the management of community acquired pneumonia in adults.[1]

Background

The British Thoracic Society audit in adult CAP was first conducted over the winter months of 2009-2010. The audit has subsequently been run over 2 months (December to January) of each calendar year, except in 2013/2014 (**Table 1**). The audit was designed to capture 'real-world' care in the UK for patients with CAP, a disease that continues to contribute to a large proportion of the acute take and cause significant mortality and morbidity to affected individuals. In light of the ageing population demographic, with more at-risk individuals, it is important that efforts are taken to describe current care processes so that strategies to improve care can be appropriately targeted and implemented. The 2014/2015 CAP audit has been included as a key audit for NHS Trusts' Quality Accounts report in England.

Table 1 –Participation in BTS CAP audit, by year of audit.

Year	Number of institutions	Total number of submitted records
2009/2010	64	2749
2010/2011	76	3570
2011/2012	129	5435
2012/2013	132	5652
2014/2015	158	6786

2014/2015 supplementary CAP diagnosis audit (Part 2 of the audit)

Coding databases are used to generate pneumonia related outcomes which are used as institution specific performance indicators, for example the Dr Foster Hospital Guide.[2] However, there is considerable variation in the accuracy of coding for CAP, and these variations in diagnostic coding practices are recognised to impact on reported outcomes.[3] Therefore, a voluntary supplementary audit was included in 2014/2015 to assess the level of miscoding/misdiagnosis of CAP nationally.

Aims and objectives

The aim of the 2014/2015 audit was to examine the quality of care and outcomes in a nationally representative cohort of patients admitted with a diagnosis of CAP, and compare it to the national standards.

The key objectives were:

1. To examine baseline demographics of patients hospitalised with a primary diagnosis of CAP.
2. To examine processes of care and outcomes measures associated with the management of CAP.
3. To identify key areas for improvement in the management of CAP.
4. To determine the magnitude and nature of miscoding of pneumonia nationally.

Methodology

Data were acquired for patients admitted to participating sites between the 1st December 2014 and 31st January 2015. Data entry through the secure BTS audit system website was open between 1st December 2014 and 1st June 2015. There were 3 parts to this audit.

Part 1 represented the main audit dataset.

Participating institutions were requested to enter all cases of adults hospitalised with a diagnosis of CAP during the audit period.

Case identification was prospective or retrospective according to local arrangements. Where cases were identified retrospectively via routine clinical coding data, the following codes were recommended:

Any of:

i. J12 – Viral pneumonia
ii. J13 – Pneumonia due to *S pneumoniae*
iii. J14 – Pneumonia due to *H influenzae*
iv. J15 – Bacterial pneumonia, not elsewhere classified
v. J16 – Pneumonia due to other infectious organism
vi. J17 – Pneumonia in diseases classified elsewhere
vii. J18 – Pneumonia: organism unspecified

Inclusion and exclusion criteria were applied to identify cases eligible for the CAP audit.

Inclusion criteria were:

- Individuals over 16 years with new infiltrates on chest radiograph, **AND**
- signs and symptoms of lower respiratory tract infection (LRTI), **AND**
- who had not been discharged from hospital within the preceding 10 days of index admission, **AND**
- who were not immunocompromised.

Patients with aspiration pneumonia were excluded.

Part 2 represented the CAP diagnosis audit dataset.

Institutions were requested to enter the data for those individuals who had been identified as cases by coding diagnosis but who did not meet all the inclusion criteria for entry into Part 1.

Part 3 represented institution-specific data.

Each participating institution entered a single record for Part 3 of the audit on audit process.

Results/Findings

PART 1 – Adult CAP audit

Patient demographics

The mean age of admitted patients was 74 years (range between 16 – 108 years); over half of the cohort were female (53.3%). The 2 most prevalent co-morbid illnesses were chronic obstructive pulmonary disease (23.2%) and chronic heart disease, excluding hypertension (21.3%). 16% of patients were admitted from a care facility (of which about two-thirds were admitted from a nursing home and the remaining third admitted from a residential home). The average length of stay was 5 days.

At presentation to hospital, pneumonia severity (based on CURB65 criteria) was classified as low, moderate and high in 40%, 30% and 30% of cases respectively.

Processes of care

Most patients (75%) were admitted via the emergency department. CXR was performed within 4 hours in 74% of individuals. The majority of individuals (59%) received the first dose of antibiotic therapy within 4 hours of admission. Antibiotics were administered prior to a CXR being taken in 24% of patients. Antibiotics were administered prior to the CXR being *reviewed* in 31% of patients.

Although only half of patients (48%) were hypoxic at admission (with oxygen saturations <94% or <88% in COPD patients), over half of patients (59%) received supplementary oxygen therapy.

Antibiotic use and microbiological diagnosis

Antibiotics were prescribed in line with local guidelines for the management of CAP in 55% of cases. For individuals with moderate and high severity disease, dual therapy with β-lactam and macrolide antibiotics were administered in 55% whilst β-lactam monotherapy was administered in 32%.

In cases with moderate and high severity CAP, urinary antigen testing was performed for pneumococcal and legionella antigens in 11% and 12% respectively.

Patient outcomes

17.7% of in-patients died during their admission. Critical care admission occurred in 5% of cases with 73% of those individuals receiving inotropic and/or ventilatory support.

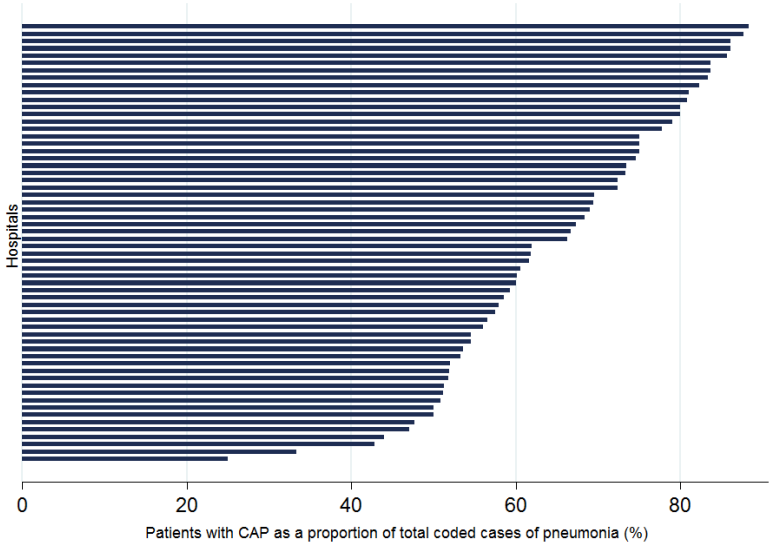
10% of individuals were re-admitted within 30 days of discharge from their index admission with CAP.

PART 2 – CAP diagnosis audit (supplementary audit for 2014/15)

Relevant results from Part 3 of the audit are included in this section for ease of reporting.

79 (61%) of 130 institutions reported both (1) total cases identified by discharge coding and (2) total cases eligible for inclusion into Part 1 of the audit. Using these data (excluding outliers of <10% and >90%, to allow for data errors), the median proportion of cases with a clinical and radiological diagnosis of CAP (as defined by eligibility into Part 1 of the audit) out of the cases identified by coding criteria was 64% (IQR, 53-76%) **(Figure 1).**

Figure 1 – Percentage of patients with CAP (as defined by entry into Part 1 of audit) of all coded cases of pneumonia, by institution



Reasons for exclusion from Part 1 of audit

The commonest reason that cases identified though coding were ineligible for Part 1 of the audit was an absence of new radiographic changes on CXR **(Table 2**):

Table 2 – Reasons for failing to meet the inclusion criteria for Part 1

Reasons for non-inclusion in Part 1	Number (%) of cases *(n=2211)*
NO new infiltrates on CXR	1534 (69)
NO signs and symptoms of LRTI	513 (23)
Prior hospitalisation in preceding 10 days	332 (15)
Immunocompromised	241 (11)

Patient demographics

The mean age of admitted patients was 76 years (range between 16 – 103 years); over half of the cohort were female (52.5%). The 2 most prevalent co-morbid illnesses were chronic heart disease, excluding hypertension (22.5%) and chronic obstructive pulmonary disease (20%). 16% of patients were admitted from a care facility. The average length of stay was 6 days.

Radiographic findings

CXR findings in these patients were variable (**Table 3)**.

Table 3 – CXR findings in patients with a primary discharge diagnosis of pneumonia, excluded from Part 1 of audit

CXR findings	Number (%) of cases *(n=2060)*
Normal	712 (30)
Consolidation	614 (26)
Chronic changes	227 (10)
Pleural effusion	175 (8)
Cardiomegaly	173 (7)
Lung mass (suggestion of neoplasm)	64 (3)
Other*	340 (15)

** Other - included atelectasis, pulmonary oedema, pleural plaques and changes suggestive of pulmonary fibrosis*

Antibiotic use

1783/2211 (81%) individuals were treated with antibiotics at admission. Of these 1783 individuals, initial antibiotics were prescribed for management of CAP in 54% (963/1783) of cases. Antibiotics were administered for the treatment of non-pneumonic LRTI in a further 27% (473/1783) of cases. The remaining 20% of cases were prescribed antibiotic therapy for other diagnoses including urinary tract infections, sepsis of non-specified source and hospital-acquired pneumonia.

Other aspects of in-patient care and progress

Care for the majority of these individuals was provided by a non-respiratory physician (over 70% of cases with an identified treating physician). The median oxygen saturation at admission was 95% (IQR 92-97); 28% of patients were provided with supplementary oxygen at admission.

40% of patients were diagnosed and treated for an alternative condition (to that diagnosed at presentation) within 48hrs of admission. These alternative diagnoses are summarised in **Table 4.**

Table 4 – Alternative diagnosis in patients with a primary discharge diagnosis of pneumonia, excluded from Part 1 of audit

Alternative diagnosis in 1st 48hrs of admission	Number (%) of cases *(n=885)*
Congestive cardiac failure	129 (15)
Chronic obstructive pulmonary disease	100 (11)
Urinary tract infection	89 (10)
Acute kidney injury	71 (8)
Atrial fibrillation	73 (8)
Other*	376 (43)

**Other –included asthma, PE, acute coronary syndrome; data missing in 48 (5%) of cases*

Patient outcomes

In-patient mortality was 19%. Of those who died, pneumonia was recorded as the cause of death in over half (57%) of cases. Critical care admission occurred in 3% of cases with a quarter of those (24-27%) individuals receiving inotropic support and/or ventilatory support. 7% of individuals were re-admitted within 30 days of discharge from their index admission.

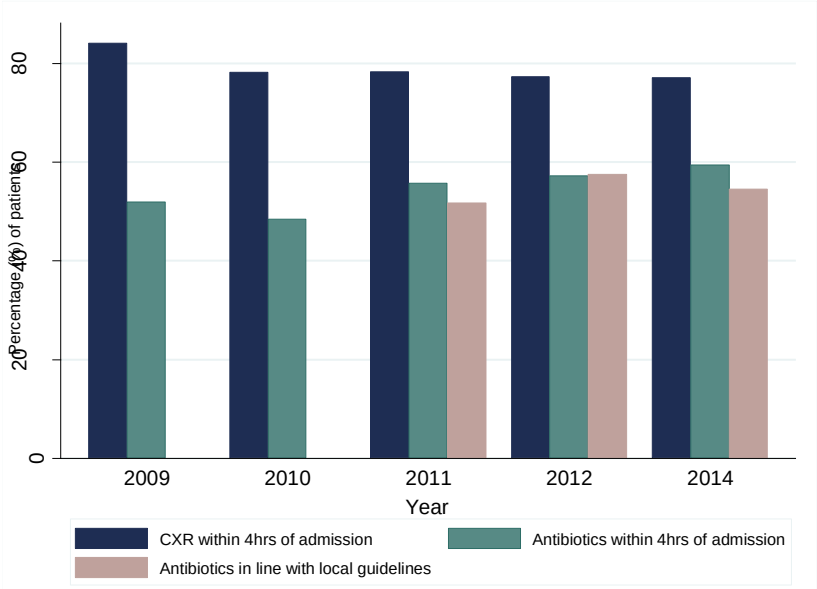
Comparison with previous audits

Baseline patient demographics and co-morbidities appear to be unchanged from previous years.

Processes of care

Since 2010, there has been a continued increase in the proportion of patients who receive antibiotics within 4 hours of admission. Over the same period, there has been a small decrease in the proportions of patients who have a CXR within 4 hours (**Figure 2**).

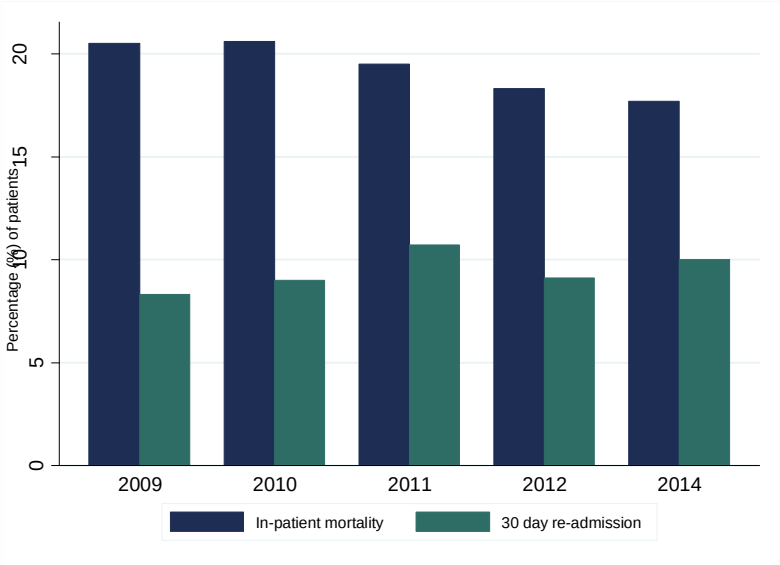
Figure 2 – Adherence to processes of care: 2009 to 2015



Outcomes

There has been a continued decrease in inpatient mortality since 2010 **(Figure 3)**. Over the last 3 years, the proportion of survivors re-admitted to hospital within 30 days of discharge has been around 10%.

Figure 3 – Mortality and re-admission rates: 2009 to 2015



Conclusions/Observations

The key finding is of a continued decrease in the observed mortality of patients hospitalised with a diagnosis of CAP. There is a corresponding increase in the proportions of patients who received their first dose of antibiotic within 4 hours of admission. These observations are consistent with published evidence describing an association of earlier antibiotics with a better prognosis in patients with CAP. However, the reductions in mortality are unlikely to be entirely due to earlier administration of antibiotics. It is possible that earlier antibiotic administration is also serving as a quality marker for other processes of care which are less easily measured. A Hawthorne effect cannot be discounted either. In practice, elucidating the exact mechanisms for the improvements in mortality may not be as important as the use of early antibiotic administration as a driver for improvements in clinical outcome.

However, early antibiotic administration must not be pursued at the cost of good antimicrobial stewardship. The apparent decline in CXRs performed within 4 hours of admission is of some concern. In the 2014/15 period, antibiotics were administered before a CXR was obtained in 24% of patients. This raises the potential problem of inappropriate antibiotic use. In addition, about a third of patients with a discharge code of pneumonia did not have clinico-radiographic findings consistent with CAP (as defined by the inclusion criteria for Part 1 of the CAP audit) and ~40% of these patients received antibiotics for CAP. There are 2 potential risks associated with the administration of antibiotics for the wrong diagnosis – a) the patient's illness may remain untreated and/or b) there may be an overuse of antibiotics; both issues which may lead to poorer clinical outcomes.

The suggested recommendations for improvement are therefore aimed at striking a balance between improving clinical outcomes and avoiding inappropriate antibiotic use. This involves a focus on both the accurate diagnosis of CAP in the first instance, and the subsequent appropriate management of patients with CAP.

The 2014 NICE Pneumonia Guideline makes a recommendation to "consider" the use of urinary antigen tests in patients with moderate and high severity CAP. The NICE recommendation is based partly on a cost-effectiveness model which took into account the potential benefits from the use of narrow-spectrum antibiotics (including positive impacts downstream on antimicrobial resistance) consequent on a confirmed microbial aetiology. In the 2014/15 audit period, urinary antigen tests were performed in only 11 - 12% of relevant patients. Whilst this might be considered a suitable target for quality improvement, this aspect of care is not felt to be as important a driver for improved care at this point in time as other aspects detailed below.

Recommendations/Quality Improvement Plan

1) Demonstrate an increase in the proportion of adults with CAP, who have a chest radiograph within 4 hours of admission. (Target in 3 years: 90%)

2) Demonstrate an improvement in the proportion of adults with CAP who receive the first dose of antibiotic therapy within 4 hours of admission. (Target in 3 years: 85%)

3) Demonstrate an improvement in the proportion of adults with moderate and high severity CAP administered combination β-lactam and macrolide antibiotic therapy. (Target in 3 years: 85%)

4) Demonstrate an improvement in the proportion of coded cases of pneumonia, who have CXR-confirmed pneumonia. (Target in 3 years: 85%)

NOTES:
Items (1) to (3) are all components of the BTS CAP Care Bundle. In a national implementation project, the use of the BTS CAP Care Bundle was shown to be associated with lower 30-day in-patient mortality.[4] Local hospitals may wish to consider adopting the BTS CAP Care Bundle as part of their quality improvement programmes. If so, it would be good if the BTS could support such adoption, although this would have resource implications.

Item (1) applies more accurately to patients in whom CAP is *suspected*. However, the BTS CAP Audit only captures patients with CAP. Therefore, the recommended action reflects what is measurable by the audit although in practice, it would be applied to the wider group of patients with *suspected* CAP in whom an earlier accurate diagnosis would also be beneficial.

Item (4) is not directed at coding practices. Mostly, miscoding does not occur because of an administrative error by clinical coders, but arises from misdiagnosis at the clinical interface. The level of miscoding is a measurable reflection of the accuracy of diagnosis in this group of patients. To reduce miscoding, efforts would need to be directed at improving the accuracy of diagnosis in patients with *suspected* CAP. This will have beneficial impacts at an individual patient level and for high-level monitoring of quality improvement programmes.

30 November 2015

References

1. Lim WS, Baudouin SV, George RC, et al. Guidelines for the management of community acquired pneumonia in adults; an update 2009. *Thorax* 2009;64 (Suppl III):iii1-iii55.
2. Dr Foster. Hospital Guide. Secondary Hospital Guide. http://www.drfoster.com/innovation/hospital-guide/.
3. Lindenauer PK, Lagu T, Shieh MS, et al. Association of diagnostic coding with trends in hospitalizations and mortality of patients with pneumonia, 2003-2009. *JAMA* 2012;307(13):1405-13.
4. Lim WS, Rodrigo C, Turner AM, et al. British Thoracic Society community-acquired pneumonia care bundle: results of a national implementation project. *Thorax* 2015. Jul 21. pii: thoraxjnl-2015-206834. doi: 10.1136/thoraxjnl-2015-206834. [Epub ahead of print]

Clinical Audit Action Plan

Project title	

Action plan lead	Name:	Title:	Contact:

Ensure that the recommendations detailed in the action plan mirror those recorded in the "Recommendations" section of the report. The "Actions required" should specifically state what needs to be done to achieve the recommendation.

Recommendation	**Actions required** *(specify "None", if none required)*	**Action by date**	**Person responsible** *(Name and grade)*	**Evidence required to show recommendation has been implemented** (Training log, minutes, new documentation)