



## 2015 - Annotated BTS Guideline for the management of CAP in adults (2009) Summary of recommendations

### Introduction to the annotated edition

The BTS guideline for CAP in adults was published in 2009 <sup>(1)</sup>. NICE published guideline 191 on Pneumonia in December 2014 <sup>(2)</sup>. Recognising differences in the scopes of the two guidelines, this annotated edition of the BTS guideline indicates where recommendations remain valid, and where overlaps exist.

The NICE guideline 191 has 27 recommendations, of which 3 relate to hospital acquired pneumonia and one to lower respiratory tract infections including CAP. The remaining 23 relate specifically to CAP. The BTS guideline has 137 recommendations all relating to CAP.

The guidelines were compared by a small working group under the auspices of the BTS Standards of Care Committee.

Of the 24 NICE Guideline recommendations relating to CAP, 4 covered subjects not included in the BTS guideline (NICE recommendations 1.1.1, 1.2.12, 1.2.21, 1.2.22).

Of the 137 BTS recommendations, 101 were not within the scope of the NICE guideline, 31 overlapped but with no major differences and 5 overlapped with some differences. Each BTS recommendation is annotated with one of the following symbols to indicate the current status:

**Green circle** (101): Not included in NICE guideline 191 – recommendation remains valid.

**Blue square** (31): Overlap between the BTS and NICE recommendations but no major difference exists – recommendation remains valid.

**Orange triangle** (5): Overlap between BTS and NICE recommendations, some difference exists and is highlighted in the annotated guideline (BTS recommendation numbers 27, 28, 59, 60, 106).

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The full copy of the annotated BTS guidelines for community acquired pneumonia in adults is available here:

<https://www.brit-thoracic.org.uk/guidelines-and-quality-standards/community-acquired-pneumonia-in-adults-guideline/annotated-bts-guideline-for-the-management-of-cap-in-adults-2014/>

# BTS guidelines for the management of community acquired pneumonia in adults: update 2009

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## Synopsis of recommendations

A summary of the initial management of patients admitted to hospital with suspected community acquired pneumonia (CAP) is presented in fig 8. Tables 4 and 5, respectively, summarise (1) the relevant microbiological investigations and (2) empirical antibiotic choices recommended in patients with CAP.

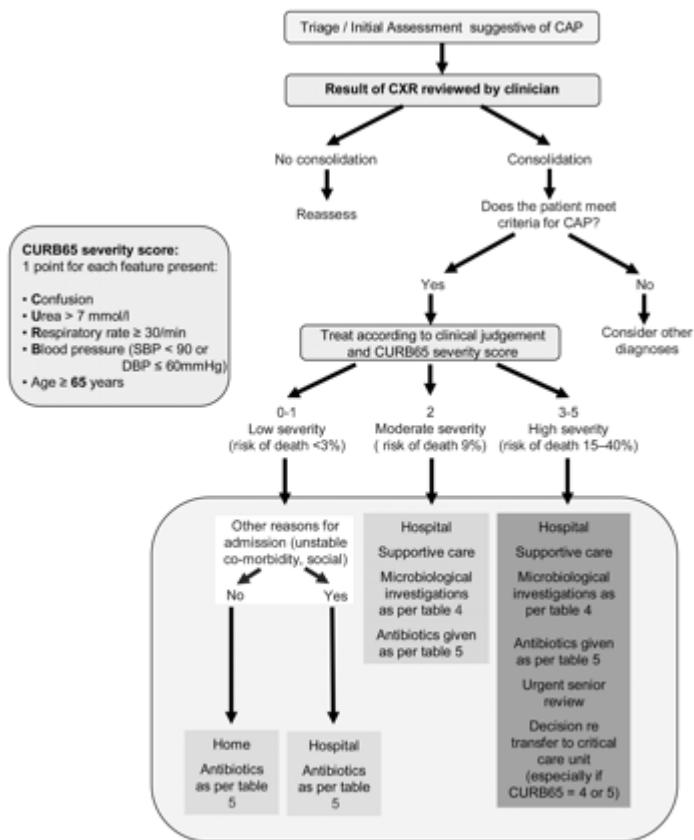


Figure 8

Hospital management of community acquired pneumonia (CAP) in the first 4 h. CXR, chest x ray; DBP, diastolic blood pressure; SBP, systolic blood pressure.

## Investigations (Section 5)

### When should a chest radiograph be performed in the community?

1. It is not necessary to perform a chest radiograph in patients with *suspected* CAP unless:
  - o The diagnosis is in doubt and a chest radiograph will help in a differential diagnosis and management of the acute illness. [D] ●
  - o Progress following treatment for *suspected* CAP is not satisfactory at review. [D] ●
  - o The patient is considered at risk of underlying lung pathology such as lung cancer. [D] ●

### When should a chest radiograph be performed in hospital?

2. All patients admitted to hospital with *suspected* CAP should have a chest radiograph performed as soon as possible to confirm or refute the diagnosis. [D] The objective of any service should be for the chest radiograph to be performed in time for antibiotics to be administered within 4 h of presentation to hospital should the diagnosis of CAP be confirmed. ■

### When should the chest radiograph be repeated during recovery?

3. The chest radiograph need not be repeated prior to hospital discharge in those who have made a satisfactory clinical recovery from CAP. [D] ●
4. A chest radiograph should be arranged after about 6 weeks for all those patients who have persistence of symptoms or physical signs or who are at higher risk of underlying malignancy (especially smokers and those aged >50 years) whether or not they have been admitted to hospital. [D] ●
5. Further investigations which may include bronchoscopy should be considered in patients with persisting signs, symptoms and radiological abnormalities at around 6 weeks after completing treatment. [D] ●
6. It is the responsibility of the hospital team to arrange the follow-up plan with the patient and the general practitioner for those patients admitted to hospital. [D]

### What general investigations should be done in the community?

7. General investigations are not necessary for the majority of patients with CAP who are managed in the community. [C] Pulse oximeters allow for simple assessment of oxygenation. General practitioners, particularly those working in out-of-hours and emergency assessment centres, should consider their use. [D] ●
8. Pulse oximetry should be available in all locations where emergency oxygen is used. [D] ●

### What general investigations should be done in a patient admitted to hospital?

9. All patients should have the following tests performed on admission:
  - o Oxygenation saturations and, where necessary, arterial blood gases in accordance with the BTS guideline for emergency oxygen use in adult patients. [B+] ●
  - o Chest radiograph to allow accurate diagnosis. [B+] ●

- Urea and electrolytes to inform severity assessment. [B+] ●
- C-reactive protein to aid diagnosis and as a baseline measure. [B+] ■
- Full blood count. [B-] ●
- Liver function tests. [D] ●

## Why are microbiological investigations performed?

10. Microbiological tests should be performed on all patients with moderate and high severity CAP, the extent of investigation in these patients being guided by severity. [D] ■
11. For patients with low severity CAP the extent of microbiological investigations should be guided by clinical factors (age, comorbid illness, severity indicators), epidemiological factors and prior antibiotic therapy. [A-] ●
12. Where there is clear microbiological evidence of a specific pathogen, empirical antibiotics should be changed to the appropriate pathogen-focused agent unless there are legitimate concerns about dual pathogen infection. [D] ●

## What microbiological investigations should be performed in the community?

13. For patients managed in the community, microbiological investigations are not recommended routinely. [D] ■
14. Examination of sputum should be considered for patients who do not respond to empirical antibiotic therapy. [D] ●
15. Examination of sputum for *Mycobacterium tuberculosis* should be considered for patients with a persistent productive cough, especially if malaise, weight loss or night sweats, or risk factors for tuberculosis (eg, ethnic origin, social deprivation, elderly) are present. [D] ●
16. Urine antigen investigations, PCR of upper (eg, nose and throat swabs) or lower (eg, sputum) respiratory tract samples or serological investigations may be considered during outbreaks (eg, Legionnaires' disease) or epidemic mycoplasma years, or when there is a particular clinical or epidemiological reason. [D] ●

## What microbiological investigations should be performed in hospital?

### Blood cultures

17. Blood cultures are recommended for all patients with moderate and high severity CAP, preferably before antibiotic therapy is commenced. [D] ■
18. If a diagnosis of CAP has been definitely confirmed and a patient has low severity pneumonia with no comorbid disease, blood cultures may be omitted. [A-] ■

### Sputum cultures

19. Sputum samples should be sent for culture and sensitivity tests from patients with CAP of moderate severity who are able to expectorate purulent samples *and* have not received prior antibiotic therapy. Specimens should be transported rapidly to the laboratory. [A-] ■
20. Culture of sputum or other lower respiratory tract samples should also be performed for all patients with high severity CAP or those who fail to improve. [A-] ■

21. Sputum cultures for *Legionella* spp should always be attempted for patients who are legionella urine antigen positive in order to provide isolates for epidemiological typing and comparison with isolates from putative environmental sources. [D] ●

## Sputum Gram stain

22. Clinicians should establish with local laboratories the availability or otherwise of sputum Gram stain. Where this is available, laboratories should offer a reliable Gram stain for patients with high severity CAP or complications as occasionally this can give an immediate indicator of the likely pathogen. Routine performance or reporting of sputum Gram stain on all patients is unnecessary but can aid the laboratory interpretations of culture results. [B-] ●

23. Samples from patients already in receipt of antimicrobials are rarely helpful in establishing a diagnosis. [B-] ●

24. Laboratories performing sputum Gram stains should adhere to strict and locally agreed criteria for interpretation and reporting of results. [B+] ●

## Other tests for *Streptococcus pneumoniae*

25. Pneumococcal urine antigen tests should be performed for all patients with moderate or high severity CAP. [A-] ■

26. A rapid testing and reporting service for pneumococcal urine antigen should be available to all hospitals admitting patients with CAP. [B+] ●

## Tests for Legionnaires' disease

27. Investigations for legionella pneumonia are recommended for all patients with high severity CAP, for other patients with specific risk factors and for all patients with CAP during outbreaks. [D] ▲

↑ This recommendation overlaps with NICE recommendation 1.2.7: Consider testing for Legionella in **moderate** and high severity CAP.

28. Legionella urine antigen tests should be performed for all patients with high severity CAP. [B+] ▲

↑ This recommendation overlaps with NICE recommendation 1.2.7: Consider testing for Legionella in **moderate** and high severity CAP.

29. A rapid testing and reporting service for legionella urine antigen should be available to all hospitals admitting patients with CAP. [B+] ●

30. As the culture of legionella is very important for clinical reasons and source identification, specimens of respiratory secretions, including sputum, should be sent from patients with high severity CAP or where Legionnaires' disease is suspected on epidemiological or clinical grounds. [D] The clinician should specifically request legionella culture on laboratory request forms. ●

31. Legionella cultures should be routinely performed on invasive respiratory samples (eg, obtained by bronchoscopy) from patients with CAP. [D] ●

32. For all patients who are legionella urine antigen positive, clinicians should send respiratory specimens such as sputum and request legionella culture [D]. This is to aid outbreak and source investigation with the aim of preventing further cases. ●

### Tests for *Mycoplasma pneumoniae*

33. Where available, PCR of respiratory tract samples such as sputum should be the method of choice for the diagnosis of mycoplasma pneumonia. [D] ●
34. In the absence of a sputum or lower respiratory tract sample, and where mycoplasma pneumonia is suspected on clinical and epidemiological grounds, a throat swab for *Mycoplasma pneumoniae* PCR is recommended. [D] ●
35. Serology with the complement fixation test and a range of other assays is widely available, although considerable caution is required in interpretation of results. [C] ●

### Tests for *Chlamydophila* species

36. *Chlamydophila* antigen and/or PCR detection tests should be available for invasive respiratory samples from patients with high severity CAP or where there is a strong suspicion of psittacosis. [D] ●
37. The complement fixation test remains the most suitable and practical serological assay for routine diagnosis of respiratory *Chlamydophila* infections. [B-] There is no currently available serological test that can reliably detect acute infection due to *C pneumoniae*. ●

### PCR and serological tests for other respiratory pathogens

38. Where PCR for respiratory viruses and atypical pathogens is readily available or obtainable locally, this is preferred to serological investigations. [D] ●
39. Where available, paired serology tests can be considered for patients with high severity CAP where no particular microbiological diagnosis has been made by other means (eg, culture, urine antigen, PCR) and who fail to improve, and/or where there are particular epidemiological risk factors. [D] The date of onset of symptoms should be clearly indicated on all serological request forms. [D] ●
40. Serological tests may be extended to all patients admitted to hospital with CAP during outbreaks and when needed for the purposes of surveillance. The criteria for performing serology tests in these circumstances should be agreed locally between clinicians, laboratories and public health. [D] ●

### Severity assessment (Section 6)

#### What severity assessment strategy is recommended?

41. Clinical judgement is essential in disease severity assessment. [D] ●
42. The stability of any comorbid illness and a patient's social circumstances should be considered when assessing disease severity. [D] ●

## Severity assessment of CAP in patients seen in the community

43. For all patients, clinical judgement supported by the CRB65 score should be applied when deciding whether to treat at home or refer to hospital. [D] 
44. Patients who have a CRB65 score of 0 are at low risk of death and do not normally require hospitalisation for clinical reasons. [B+] 
45. Patients who have a CRB65 score of 1 or 2 are at increased risk of death, particularly with a score of 2, and hospital referral and assessment should be considered. [B+] 
46. Patients who have a CRB65 score of 3 or more are at high risk of death and require urgent hospital admission. [B+] 
47. When deciding on home treatment, the patient's social circumstances and wishes must be taken into account in all instances. [D] 

## Severity assessment of CAP in patients seen in hospital

48. For all patients, the CURB65 score should be interpreted in conjunction with clinical judgement. [D] 
49. Patients who have a CURB65 score of 3 or more are at high risk of death. These patients should be reviewed by a senior physician at the earliest opportunity to refine disease severity assessment and should usually be managed as having high severity pneumonia. Patients with CURB65 scores of 4 and 5 should be assessed with specific consideration to the need for transfer to a critical care unit (high dependency unit or intensive care unit). [B+] 
50. Patients who have a CURB65 score of 2 are at moderate risk of death. They should be considered for short-stay inpatient treatment or hospital-supervised outpatient treatment. [B+] 
51. Patients who have a CURB65 score of 0 or 1 are at low risk of death. These patients may be suitable for treatment at home. [B+] 
52. When deciding on home treatment, the patient's social circumstances and wishes must be taken into account in all instances. [D] 

## Reviewing severity status after initial assessment

53. Regular assessment of disease severity is recommended for *all* patients following hospital admission. The "post take" round by a senior doctor and the medical team provides one early opportunity for this review. [D] 
54. All patients deemed at high risk of death on admission to hospital should be reviewed *medically* at least 12-hourly until shown to be improving. [D] 

## General management (Section 7)

### General management strategy for patients treated in the community

55. Patients with suspected CAP should be advised to rest, to drink plenty of fluids and not to smoke. [D] 
56. Pleuritic pain should be relieved using simple analgesia such as paracetamol. [D] 
57. The need for hospital referral should be assessed using the criteria recommended in section 6. [C] 

58. Pulse oximetry, with appropriate training, should be available to general practitioners and others responsible for the assessment of patients in the out-of-hours setting for the assessment of severity and oxygen requirement in patients with CAP and other acute respiratory illnesses. [D] ●

## Review policy for patients managed in the community

59. Review of patients in the community with CAP is recommended after 48 h or earlier if clinically indicated. Disease severity assessment should form part of the clinical review. [D]



↑ This recommendation overlaps with NICE recommendation 1.2.13 and 1.2.23:  
advise **patients or carers** to seek advice if symptoms do not improve, or worsen, after **3 days** of antibiotic therapy.

60. Those who fail to improve after 48 h of treatment should be considered for hospital admission or chest radiography. [D] ▲

↑ This recommendation overlaps with NICE recommendation 1.2.13 and 1.2.23:  
advise **patients or carers** to seek advice if symptoms do not improve, or worsen, after **3 days** of antibiotic therapy.

## General management strategy for patients treated in hospital

61. All patients should receive appropriate oxygen therapy with monitoring of oxygen saturations and inspired oxygen concentration with the aim to maintain arterial oxygen tension (Pao<sub>2</sub>) at  $\geq 8$  kPa and oxygen saturation (Spo<sub>2</sub>) 94–98%. High concentrations of oxygen can safely be given in patients who are not at risk of hypercapnic respiratory failure. [D] ●

62. Oxygen therapy in patients at risk of hypercapnic respiratory failure complicated by ventilatory failure should be guided by repeated arterial blood gas measurements. [C] ●

63. Patients should be assessed for volume depletion and may require intravenous fluids. [C] ●

64. Prophylaxis of venous thromboembolism with low molecular weight heparins should be considered for all patients who are not fully mobile. [A+] ●

65. Nutritional support should be given in prolonged illness. [C] ●

66. Medical condition permitting, patients admitted to hospital with uncomplicated CAP should sit out of bed for at least 20 min within the first 24 h and mobility should be increased each subsequent day of hospitalisation. [A-] ●

67. Patients admitted with uncomplicated pneumonia should not be treated with traditional airway clearance techniques routinely. [B+] ●

68. Patients should be offered advice regarding expectoration if there is sputum present. [D] ●

69. Airway clearance techniques should be considered if the patient has sputum and difficulty with expectoration or in the event of a pre-existing lung condition. [D] ●

## Monitoring in hospital

70. Temperature, respiratory rate, pulse, blood pressure, mental status, oxygen saturation and inspired oxygen concentration should be monitored and recorded initially at least twice

daily and more frequently in those with severe pneumonia or requiring regular oxygen therapy. [C]

71. C-reactive protein should be remeasured and a chest radiograph repeated in patients who are not progressing satisfactorily after 3 days of treatment. [B+]
72. Patients should be reviewed within 24 h of planned discharge home, and those suitable for discharge should not have more than one of the following characteristics present (unless they represent the usual baseline status for that patient): temperature  $>37.8^{\circ}\text{C}$ , heart rate  $>100/\text{min}$ , respiratory rate  $>24/\text{min}$ , systolic blood pressure  $<90 \text{ mm Hg}$ , oxygen saturation  $<90\%$ , inability to maintain oral intake and abnormal mental status. [B+]

## Critical care management of CAP

73. Patients with CAP admitted to ICUs should be managed by specialists with appropriate training in intensive care working in close collaboration with specialists in respiratory medicine. [D]
74. Neither non-invasive ventilation (NIV) nor continuous positive airways pressure (CPAP) support is routinely indicated in the management of patients with respiratory failure due to CAP. [A-]
75. If a trial of non-invasive support is considered indicated in CAP, it must only be conducted in a critical care area where immediate expertise is available to enable a rapid transition to invasive ventilation. [D]
76. Steroids are not recommended in the routine treatment of high severity CAP. [A+]
77. Granulocyte colony stimulating factor is not routinely recommended as an adjunct to antibiotics. [A+]

## Follow-up arrangements

78. Clinical review should be arranged for all patients at around 6 weeks, either with their general practitioner or in a hospital clinic. [D]
79. At discharge or at follow-up, patients should be offered access to information about CAP such as a patient information leaflet. [D]
80. It is the responsibility of the hospital team to arrange the follow-up plan with the patient and the general practitioner. [D]

## Antibiotic management (Section 8)

### Empirical antibiotic choice for adults treated in the community

81. For patients treated in the community, amoxicillin remains the preferred agent at a dose of 500 mg three times daily. [A+]
82. Either doxycycline [D] or clarithromycin [A-] are appropriate as an alternative choice, and for those patients who are hypersensitive to penicillins.
83. Those with features of moderate or high severity infection should be admitted urgently to hospital. [C]

## Should general practitioners administer antibiotics prior to hospital transfer?

84. For those patients referred to hospital with suspected CAP and where the illness is considered to be life-threatening, general practitioners should administer antibiotics in the community. [D] Penicillin G 1.2 g intravenously or amoxicillin 1 g orally are the preferred agents. ●
85. For those patients referred to hospital with suspected high severity CAP and where there are likely to be delays of over 6 h in the patient being admitted and treated in hospital, general practitioners should consider administering antibiotics in the community. [D] ●

## When should the first dose of antibiotics be given to patients admitted to hospital?

86. A diagnosis of CAP should be confirmed by chest radiography before the commencement of antibiotics in the majority of patients. Selected patients with life-threatening disease should be treated based on a *presumptive clinical diagnosis* of CAP. In such instances, an immediate chest radiograph to confirm the diagnosis or to indicate an alternative diagnosis is indicated. [D] ●
87. All patients should receive antibiotics as soon as the diagnosis of CAP is confirmed. [D] This should be before they leave the initial assessment area (emergency department or acute medical unit). The objective for any service should be to confirm a diagnosis of pneumonia with chest radiography and initiate antibiotic therapy for the majority of patients with CAP within 4 h of presentation to hospital. [B-] ■

## Empirical antibiotic choice for adults hospitalised with low severity CAP

88. Most patients with low severity CAP can be adequately treated with oral antibiotics. [C] ●
89. Oral therapy with amoxicillin is preferred for patients with low severity CAP who require hospital admission for other reasons such as unstable comorbid illnesses or social needs. [D] ■
90. When oral therapy is contraindicated, recommended parenteral choices include intravenous amoxicillin or benzylpenicillin, or clarithromycin. [D] ●

## Empirical antibiotic choice for adults hospitalised with moderate severity CAP

91. Most patients with moderate severity CAP can be adequately treated with oral antibiotics. [C] ●
92. Oral therapy with amoxicillin and a macrolide is preferred for patients with moderate severity CAP who require hospital admission. [D] ■
  - Monotherapy with a macrolide may be suitable for patients who have failed to respond to an *adequate* course of amoxicillin before admission. Deciding on the adequacy of prior therapy is difficult and is a matter of individual clinical judgement. It is therefore recommended that combination antibiotic therapy is the preferred choice in this situation and that the decision to adopt monotherapy is reviewed on the “post take” round within the first 24 h of admission. [D] ●

93. When oral therapy is contraindicated, the preferred parenteral choices include intravenous amoxicillin or benzylpenicillin, together with clarithromycin. [D] ●
94. For those intolerant of penicillins or macrolides, oral doxycycline is the main alternative agent. Oral levofloxacin and oral moxifloxacin are other alternative choices. [D] ●
95. When oral therapy is contraindicated in those intolerant of penicillins, recommended parenteral choices include levofloxacin monotherapy or a second-generation (eg, cefuroxime) or third-generation (eg, cefotaxime or ceftriaxone) cephalosporin together with clarithromycin. [D] ●

## Empirical antibiotic choice for adults hospitalised with high severity CAP

96. Patients with high severity pneumonia should be treated immediately after diagnosis with parenteral antibiotics. [B-] ●
97. An intravenous combination of a broad-spectrum  $\beta$ -lactamase stable antibiotic such as co-amoxiclav together with a macrolide such as clarithromycin is preferred. [C] ■
98. In patients allergic to penicillin, a second-generation (eg, cefuroxime) or third-generation (eg, cefotaxime or ceftriaxone) cephalosporin can be used instead of co-amoxiclav, together with clarithromycin. [C] ●

## When should the intravenous or the oral route be chosen?

99. The oral route is recommended in those with low and moderate severity CAP admitted to hospital provided there are no contraindications to oral therapy. [B+] ●

## When should the intravenous route be changed to oral?

100. Patients treated initially with parenteral antibiotics should be transferred to an oral regimen as soon as clinical improvement occurs and the temperature has been normal for 24 h, providing there is no contraindication to the oral route. Pointers to clinical improvement are given in box 4. [B+] ●
101. The choice of route of administration should be reviewed initially on the “post take” round and then daily. [D] ●
102. Ward pharmacists could play an important role in facilitating this review by highlighting prescription charts where parenteral antibiotic therapy continues. [D] ●

## Which oral antibiotics are recommended on completion of intravenous therapy?

103. The antibiotic choices for the switch from intravenous to oral are straightforward where there are effective and equivalent oral and parenteral formulations. [C] ●
104. In the case of parenteral cephalosporins, the oral switch to co-amoxiclav 625 mg three times daily is recommended rather than to oral cephalosporins. [D] ●
105. For those treated with benzylpenicillin + levofloxacin, oral levofloxacin with or without oral amoxicillin 500 mg–1.0 g three times daily is recommended. [D] ●

## How long should antibiotics be given for?

106. For patients managed in the community and for most patients admitted to hospital with low or moderate severity and uncomplicated pneumonia, 7 days of appropriate antibiotics is recommended. [C] 

↑ This recommendation overlaps with NICE recommendation 1.2.10 and 1.2.15: offer a **5 day** course of antibiotic therapy for patients with low severity CAP; consider a **7-10 day** course of antibiotic therapy for patients with moderate **and high severity** CAP.

107. For those with high severity microbiologically-undefined pneumonia, 7–10 days of treatment is proposed. This may need to be extended to 14 or 21 days according to clinical judgement; for example, where *Staphylococcus aureus* or Gram-negative enteric bacilli pneumonia is suspected or confirmed. [C] 

## Failure of initial empirical therapy

108. When a change in empirical antibiotic therapy is considered necessary, a macrolide could be substituted for or added to the treatment for those with low severity pneumonia treated with amoxicillin monotherapy in the community or in hospital. [D] 

109. For those with moderate severity pneumonia in hospital on combination therapy, changing to doxycycline or a fluoroquinolone with effective pneumococcal cover are alternative options. [D] 

110. Adding a fluoroquinolone is an option for those with high severity pneumonia not responding to a β-lactam/macrolide combination antibiotic regimen. [D] 

## Avoiding inappropriate antibiotic prescribing

111. The diagnosis of CAP and the decision to start antibiotics should be reviewed by a senior clinician at the earliest opportunity. There should be no barrier to discontinuing antibiotics if they are not indicated. [D] 

112. The indication for antibiotics should be clearly documented in the medical notes. [D] 

113. The need for intravenous antibiotics should be reviewed daily. [D] 

114. De-escalation of therapy, including the switch from intravenous to oral antibiotics, should be considered as soon as is appropriate, taking into account response to treatment and changing illness severity. [D] 

115. Strong consideration should be given to narrowing the spectrum of antibiotic therapy when specific pathogens are identified or when the patient's condition improves. [D] 

116. Where appropriate, stop dates should be specified for antibiotic prescriptions. [D] 

## Optimum antibiotic choices when specific pathogens have been identified

117. If a specific pathogen has been identified, the antibiotic recommendations are as summarised in table 6. [C] 

## Specific issues regarding the management of Legionnaires' disease

118. As soon as a diagnosis of legionella pneumonia has been made, the clinician should liaise with the clinical microbiologist to confirm that the local Health Protection Unit has been

informed. The Health Protection Unit is responsible for promptly investigating the potential sources of infection. [D] ●

119. The clinician should assist, where appropriate, in the gathering of clinical and epidemiological information from the patient and their relatives to aid the source investigation. [D] ●
120. Sputum or respiratory secretions should be sent off specifically for legionella culture in proven cases, even after appropriate antibiotics have started. [D] ●
121. For low and moderate severity community acquired legionella pneumonia, an oral fluoroquinolone is recommended. In the unusual case when this is not possible due to patient intolerance, a macrolide is an alternative. [D] Antibiotics are not required for the non-pneumonic self-limiting form of legionellosis—pontiac fever. [D] ●
122. For the management of high severity or life-threatening legionella pneumonia, a fluoroquinolone is recommended. For the first few days this can be combined with a macrolide (azithromycin is an option in countries where it is used for pneumonia) or rifampicin as an alternative. [D] Clinicians should be alert to the potential small risk of cardiac electrophysiological abnormalities with quinolone-macrolide combinations. ●
123. Duration of therapy should be as for microbiologically-undefined CAP (for those with low to moderate severity pneumonia, 7 days treatment is proposed; for those with high severity pneumonia, 7–10 days treatment is proposed—this may need to be extended to 14 or 21 days) and should be guided by clinical judgement. [D] ●

### Specific issues regarding Panton-Valentine Leukocidin-producing *Staphylococcus aureus* (PVL-SA)

124. PVL-SA infection is a rare cause of high severity pneumonia and can be associated with rapid lung cavitation and multiorgan failure. Such patients should be considered for critical care admission. [D] ●
125. If PVL-SA necrotising pneumonia is strongly suspected or confirmed, clinicians should liaise urgently with the microbiology department in relation to further antibiotic management and consider referral to the respiratory medicine department for clinical management advice. [D] ●
126. Current recommendations for the antibiotic management of strongly suspected necrotising pneumonia include the addition of a combination of intravenous linezolid 600 mg twice daily, intravenous clindamycin 1.2 g four times a day and intravenous rifampicin 600 mg twice daily to the initial empirical antibiotic regimen. As soon as PVL-SA infection is either confirmed or excluded, antibiotic therapy should be narrowed accordingly. [D] ●

### Complications and failure to improve (Section 9)

#### Failure to improve in hospital

127. For patients who fail to improve as expected, there should be a careful review by an experienced clinician of the clinical history, examination, prescription chart and results of all available investigation results. [D] ●
128. Further investigations including a repeat chest radiograph, C-reactive protein and white cell count and further specimens for microbiological testing should be considered in the light of any new information after the clinical review. [D] ●
129. Referral to a respiratory physician should be considered. [D] ●

## Common complications of CAP

- 130. Early thoracocentesis is indicated for all patients with a parapneumonic effusion. [D] ●
- 131. Those found to have an empyema or clear pleural fluid with pH <7.2 should have early and effective pleural fluid drainage. [C] ●
- 132. The British Thoracic Society guidelines for the management of pleural infection should be followed. [D] ●
- 133. Less usual respiratory pathogens including anaerobes, *S aureus*, Gram-negative enteric bacilli and *S milleri* should be considered in the presence of lung abscess. [D] ●
- 134. Prolonged antibiotic therapy of up to 6 weeks depending on clinical response and occasionally surgical drainage should be considered. [D] ●

## Prevention and vaccination (Section 10)

### Influenza and pneumococcal vaccination

- 135. Department of Health guidelines in relation to influenza and pneumococcal immunisation of at-risk individuals should be followed. [C] ●
- 136. All patients aged >65 years or at risk of invasive pneumococcal disease who are admitted with CAP and who have not previously received pneumococcal vaccine should receive 23-valent pneumococcal polysaccharide vaccine (23-PPV) at convalescence in line with the Department of Health guidelines. [C] ●

### Smoking cessation

- 137. Smoking cessation advice should be offered to all patients with CAP who are current smokers according to smoking cessation guidelines issued by the Health Education Authority. [B+] ●

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*Thorax* 2009 Oct; **64**(Suppl 3): 1-55.
2. NICE Guideline 191: Pneumonia: Diagnosis and management of community- and hospital-acquired pneumonia in adults <https://www.nice.org.uk/guidance/cg191>

**Table 4**

Recommendations for the microbiological investigation of community acquired pneumonia (CAP)

Pneumonia severity (based on clinical judgement supported by severity scoring tool)	Treatment site	Preferred microbiological tests
Low severity (eg, CURB65 = 0-1 or CRB-65 score = 0, <3% mortality)	Home	None routinely. PCR, urine antigen or serological investigations* may be considered during outbreaks (eg, Legionnaires' disease) or epidemic mycoplasma years, or when there is a particular clinical or epidemiological reason.
Low severity (eg, CURB65 = 0-1, <3% mortality) but admission indicated for reasons other than pneumonia severity (eg, social reasons)	Hospital	None routinely. PCR, urine antigen or serological investigations* may be considered during outbreaks (eg, Legionnaires' disease) or epidemic mycoplasma years, or when there is a particular clinical or epidemiological reason.
Moderate severity (eg, CURB65 = 2, 9% mortality)	Hospital	Blood cultures (minimum 20 ml)
		Sputum for routine culture and sensitivity tests for those who have not received prior antibiotics ( $\pm$ Gram stain†)
		Pneumococcal urine antigen test
		Pleural fluid, if present, for microscopy, culture and pneumococcal antigen detection
		PCR or serological investigations* may be considered during mycoplasma years and/or periods of increased respiratory virus activity.
		Where legionella is suspected‡, investigations for legionella pneumonia:
		(a) urine for legionella antigen
		(b) sputum or other respiratory sample for legionella culture and direct immunofluorescence (if available). If urine antigen positive, ensure respiratory samples for legionella culture
High severity (eg, CURB65 = 3-5, 15-40% mortality)	Hospital	Blood cultures (minimum 20 ml)
		Sputum or other respiratory sample for routine culture and sensitivity tests ( $\pm$ Gram stain†)
		Pleural fluid, if present, for microscopy, culture and pneumococcal antigen detection
		Pneumococcal urine antigen test
		Investigations for legionella pneumonia:
		(a) Urine for legionella antigen
		(b) Sputum or other respiratory sample for legionella culture and direct immunofluorescence (if available)
		Investigations for atypical and viral pathogens:**
		(a) If available, sputum or other respiratory sample for PCR or direct immunofluorescence (or other antigen detection test) for <i>Mycoplasma pneumoniae</i> , <i>Chlamydia</i> spp, Influenza A and B, parainfluenza 1-3, adenovirus, respiratory syncytial virus, <i>Pneumocystis jirovecii</i> (if at risk)
		(b) Consider initial and follow-up viral and "atypical pathogen" serology§

\*If PCR for respiratory viruses and atypical pathogens is readily available or obtainable locally, then this would be preferred to serological investigations.

†The routine use of sputum Gram stain is discussed in the text.

‡Consider obtaining lower respiratory tract samples by more invasive techniques such as bronchoscopy (usually after intubation) or percutaneous fine needle aspiration for those who are skilled in this technique.

§The use of paired serology tests for patients with high severity CAP is discussed in the text. If performed, the date of onset of illness should be clearly indicated on the laboratory request form.

¶Patients with clinical or epidemiological risk factors (travel, occupation, comorbid disease). Investigations should be considered for all patients with CAP during legionella outbreaks.

\*\*For patients unresponsive to  $\beta$ -lactam antibiotics or those with a strong suspicion of an "atypical" pathogen on clinical, radiographic or epidemiological grounds.

**Table 5**

Initial empirical treatment regimens for community acquired pneumonia (CAP) in adults

Pneumonia severity (based on clinical judgement supported by CURB65 severity score)	Treatment site	Preferred treatment	Alternative treatment
<b>Low severity</b> (eg, CURB65 = 0–1 or CRB65 score = 0, <3% mortality)	Home	Amoxicillin 500 mg tds orally	Doxycycline 200 mg loading dose then 100 mg orally or clarithromycin 500 mg bd orally
<b>Low severity</b> (eg, CURB65 = 0–1, <3% mortality) but admission indicated for reasons other than pneumonia severity (eg, social reasons/unstable comorbid illness)	Hospital	Amoxicillin 500 mg tds orally if oral administration not possible: amoxicillin 500 mg tds IV	Doxycycline 200 mg loading dose then 100 mg od orally or clarithromycin 500 mg bd orally
<b>Moderate severity</b> (eg, CURB65 = 2, 9% mortality)	Hospital	Amoxicillin 500 mg –1.0 g tds orally <i>plus</i> clarithromycin 500 mg bd orally if oral administration not possible: amoxicillin 500 mg tds IV or benzylpenicillin 1.2 g qds IV <i>plus</i> clarithromycin 500 mg bd IV	Doxycycline 200 mg loading dose then 100 mg orally or levofloxacin 500 mg od orally or moxifloxacin 400 mg od orally*
<b>High severity</b> (eg, CURB65 = 3–5, 15–40% mortality)	Hospital (consider critical care review)	Antibiotics given as soon as possible Co-amoxiclav 1.2 g tds IV <i>plus</i> clarithromycin 500 mg bd IV (If legionella strongly suspected, consider adding levofloxacin†)	Benzylpenicillin 1.2 g qds IV <i>plus</i> either levofloxacin 500 mg bd IV or ciprofloxacin 400 mg bd IV OR Cefuroxime 1.5 g tds IV or cefotaxime 1 g tds IV or ceftriaxone 2 g od IV, <i>plus</i> clarithromycin 500 mg bd IV (If legionella strongly suspected, consider adding levofloxacin†)

bd, twice daily; IV, intravenous; od, once daily; qds, four times daily; tds, three times daily.

\*Following reports of an increased risk of adverse hepatic reactions associated with oral moxifloxacin, in October 2008 the European Medicines Agency (EMEA) recommended that moxifloxacin "should be used only when it is considered inappropriate to use antibacterial agents that are commonly recommended for the initial treatment of this infection".

†Caution – risk of QT prolongation with macrolide-quinolone combination.

**Table 6**

Recommended treatment of microbiologically documented pneumonia and aspiration pneumonia (local specialist advice should also be sought\*)

Pathogen	Preferred	Alternative
<i>S pneumoniae</i>	Amoxicillin 500 mg –1.0 g† tds orally or benzylpenicillin 1.2 g qds IV	Clarithromycin 500 mg bd orally or cefuroxime 0.75–1.5 g tds IV or cefotaxime 1–2 g tds IV or ceftriaxone 2 g od IV
<i>M pneumoniae</i> / <i>C pneumoniae</i>	Clarithromycin 500 mg bd orally or IV	Doxycycline 200 mg loading dose then 100 mg od orally or fluoroquinolone‡ orally or IV
<i>C psittaci</i> / <i>C burnetii</i>	Doxycycline 200 mg loading dose then 100 mg od orally	Clarithromycin 500 mg bd orally or 500 mg bd IV
<i>Legionella</i> spp	Fluoroquinolone orally or IV‡§	Clarithromycin 500 mg bd orally or IV (or, if necessary, azithromycin in countries where this antibiotic is used for managing pneumonia)
<i>H influenzae</i>	Non-β-lactamase-producing: amoxicillin 500 mg tds orally or IVβ-lactamase-producing: co-amoxiclav 625 mg tds orally or 1.2 g tds IV	Cefuroxime 750 mg –1.5 g tds IV or cefotaxime 1–2 g tds IV or ceftriaxone 2 g od IV or fluoroquinolone‡ orally or IV
Gram-negative enteric bacilli	Cefuroxime 1.5 g tds or cefotaxime 1–2 g tds IV or ceftriaxone 1–2 g bd IV	Fluoroquinolone‡ IV or imipenem 500 mg qds IV or meropenem 0.5–1.0 g tds IV
<i>P aeruginosa</i>	Ceftazidime 2 g tds IV plus gentamicin or tobramycin (dose monitoring)	Ciprofloxacin 400 mg bd IV or piperacillin 4 g tds IV, plus gentamicin or tobramycin (dose monitoring)
<i>S aureus</i>	Non-MRSA: flucloxacillin 1–2 g qds IV ± rifampicin 600 mg od or bd orally/IV	MRSA: vancomycin 1 g bd IV (dose monitoring) or linezolid 600 mg bd IV or teicoplanin 400 mg bd IV ± rifampicin 600 mg od or bd orally/IV
Aspiration pneumonia	Co-amoxiclav 1.2 g tds IV	Seek local microbiology advice

bd, twice daily; IV, intravenous; od, once daily; tds, three times daily.

\*Treatment can be modified once the results of sensitivity testing are available.

†A higher dose of 1.0 g tds is recommended for infections documented to be caused by less susceptible strains (minimum inhibitory concentration >1.0 mg/l).

‡Currently UK licensed and available suitable fluoroquinolones include ciprofloxacin, ofloxacin and levofloxacin. Moxifloxacin can be used for patients who cannot be treated or have failed treatment with other antibacterials.

§Specifically for legionella pneumonia, the large majority of published experience regarding the efficacy of fluoroquinolones is only with levofloxacin. For high severity or life-threatening legionella pneumonia, combination therapy including the preferred and an alternative antibiotic can be considered for the first few days (see text for further details). Rifampicin is not recommended on its own but could be considered as the second additional antibiotic.