Rapidly managing pneumonia in older people during a pandemic

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Rationale

The current COVID-19 pandemic has highlighted the risk faced by older adults, who are more susceptible to complications, including acute respiratory distress syndrome, usually as a result of pneumonia. Comorbidities, impaired immunity and frailty, including a reduced ability to cough and to clear secretions from the lungs, can all contribute to this complication. Older people are therefore more likely to develop severe pneumonia, suffer from respiratory failure, and die.

Viruses are thought to cause about 50% of cases of pneumonia. Viral pneumonia is generally less severe than bacterial pneumonia but can act as a precursor to it. Preventing *any* pneumonia in older adults is preferable to treating it.

Identification of the early stages of pneumonia in older patients can prove difficult. Traditional symptoms and signs, including fever, may be absent. Limited evidence suggests that many tests that are useful in younger patients do not help diagnose infections in older adults. The onset of pneumonia in elderly people can often be rapid, and the prognosis is poor in severe pneumonia: as many as one in five will die. The older you are, the more prevalent severe pneumonia becomes.

Patients in nursing homes appear to fare even worse, as they often have several comorbidities and poor nutritional status and are often physically inactive. [5] In-hospital mortality is significantly higher, even after adjusting for age and sex.

Common causative organisms in elderly people admitted to hospital with pneumonia include *Streptococcus pneumoniae* and *Mycoplasma pneumoniae*. Less commonly, *Haemophilus influenzae* and *Staphylococcus aureus* may be responsible. In severe pneumonia, *S. aureus*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* are common causative organisms. In community acquired pneumonia, the causative agent is often not known.

Older patients may have polymicrobial infections, which could be a factor in those who do not respond to initial antimicrobial treatment. Sputum cultures are often not

reliable, as the microbial aetiology of severe pneumonia based on invasive diagnostic techniques often differs from the organisms found in the sputum.

Assessment of 12,945 US Medicare in-patients with pneumonia, aged over 65, showed that initial treatment with a second-generation cephalosporin plus a macrolide, or a non-antipseudomonal third-generation cephalosporin plus a macrolide, or a fluoroquinolone alone lowered 30-day mortality. And an analysis of 101 patients aged > 75 (mean and SD, 82 ± 5.5) admitted to an intensive care unit reported significantly higher mortality in those who received inadequate antimicrobial therapy (39% versus 4%; P = 0.007).

Viral infections increase pneumococcal adherence to the local epithelium, facilitating bacterial infection. Adhesion of *Streptococcus pneumoniae* to epithelial cells, for example, is significantly enhanced by human coronavirus HCoV-NL63 infection. Coronavirus causes inflammatory damage in the lungs, preventing clearance of bacteria. Secondary bacterial infection worsens prognosis. Most deaths in the influenza pandemics of 1918, 1957, and 1968 were caused by secondary bacterial infections. Concurrent bacterial pneumonia was highlighted as a particular problem in elderly people in the 2003 SARS outbreak.

Early use of antibiotics in older adults
Non-response to initial antimicrobial therapy increases mortality, and so the initial selection of antimicrobials is critical. According to NICE, to cover atypical and multiple pathogens in older patients with pneumonia and at risk of severe complications, the recommended choices of antibiotics in the community are:

Amoxicillin with	500 mg 3 times a day (higher doses can be used – see BNF) for 5 days
Clarithromycin	500 mg twice a day for 5 days

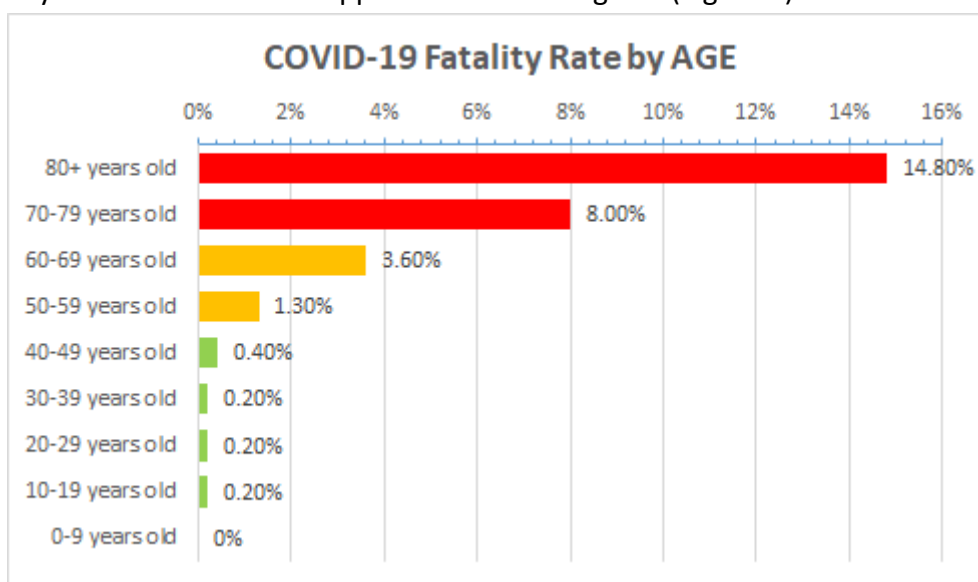| Alternative oral antibiotics for penicillin allergy, if the pneumonia is of moderate intensity; treatment should be guided by microbiological results when available	
Doxycycline with	200 mg on the first day, then 100 mg once a day for a further 4 days (5-day course in total)
Clarithromycin	500 mg twice a day for 5 days

The intensity of pneumonia in the community can be assessed using the CRB65 score; each factor scores one point:

- confusion (abbreviated Mental Test score 8 or less, or new disorientation in person, place, or time);
- a raised respiratory rate (30 breaths per minute or more);
- a low blood pressure (diastolic 60 mmHg or less, or systolic less than 90 mmHg);
- age 65 years or over.

Score 1 or 2: intermediate risk (1-10% mortality risk).
Score 3 or 4: high risk (more than 10% mortality risk).

NICE recommends that anyone with a score of 2 should be admitted to hospital. NICE's approach, however, doesn't account for the high risk in very elderly people. The mortality rate from COVID-19 approaches 15% at age 80 (Figure 1).

COVID-19 Fatality Rate by AGE

Age	Fatality Rate
80+ years old	14.80%
70-79 years old	8.00%
60-69 years old	3.60%
50-59 years old	1.30%
40-49 years old	0.40%
30-39 years old	0.20%
20-29 years old	0.20%
10-19 years old	0.20%
0-9 years old	0%

Source data: https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/ (accessed 13 March 2020)

Current NICE guidance requires starting antibiotic treatment as soon as possible after establishing a diagnosis of community-acquired pneumonia, and certainly within 4 hours. This strategy is supported by the results of a US multicenter retrospective cohort study, a medical record review of 14,069 patients aged over 65 years and hospitalized with pneumonia. A lower 30-day mortality was associated with antibiotic administration within 8 hours of hospital arrival (odds ratio = 0.85; 95% CI = 0.75-0.96).

However, this may not be possible within the constraints of an overstretched service in a pandemic. If antibiotics have to be taken within 4 hours of onset, there needs to be in place a self-management strategy that permits rapid access to the right antimicrobial treatment. Nursing homes could hold stocks of antibiotics for rapid

deployment. Health professional confirmation could then be used to facilitate timely self-prescribing for those most at risk.

Examination strategy

The least amount of equipment that is clinically appropriate should be used to assess a patient who might have COVID-19. This should include a pulse oximeter, a thermometer, and a stethoscope. The 'eyeball' test, incorporating information on temperature, oxygen saturation, and pulse rate, should be sufficient to assess severity and cut down significantly on contact time. The absence of any individual chest examination finding has little effect on the probability of diagnosing pneumonia. Assessing blood pressure significantly increases contact time and should be considered only in those in whom it contributes to the decision to admit or not. We recommend documenting that a 'limited examination' was performed.

In assessing patients, carry antibiotics in a pre-sealed bag, to cut down entry and exit times from the person's home or nursing home.

COVID Monitoring Service (CMS)

Patients at high risk deemed to be managed at home require monitoring, to ensure that they do not deteriorate. This is essential for nursing homes, where the potential for further spread in their patient population is significant. Telephone monitoring services can follow up patients to determine whether deterioration occurs, and to detect spread in nursing homes**.**

Based on evolving NHS England guidance we recommend the following pathways

Category 1: May require admission

When it is uncertain that safe care can be provided in the community and the patient is deteriorating.

Clinical pathway: Start antibiotics immediately; discuss management with a designated hospital admitting consultant.

Category 2: Home isolation with active health monitoring

Higher risk group for severe COVID-19, with stable illness that can be managed in the community.

Clinical pathway: Signs of bacterial pneumonia--start antibiotics; active health monitoring (every other day calls and symptom monitoring) and point of contact if deteriorates. Nursing homes with active cases--daily calls to monitor individuals and case progression; patients should remain in isolation until 5 days after resolution of symptoms.

Category 3: Home isolation with health advice
Mild illness in a patient who can be managed safely in the community AND who is not in a higher risk group for complications.
Clinical pathway: Self isolate at home; health advice on how to identify deterioration; call CMS if more unwel**l.**

Oxygen
The use of oxygen in pneumonia is based on **expert opinion**. A Cochrane systematic review of the effectiveness of oxygen in adults with pneumonia highlights that the evidence is weak and limited owing to a small number of studies. The British Thoracic Society suggests that for patients with pneumonia not at risk of hypercapnic respiratory failure, it is appropriate to aim for an oxygen saturation of 94–98%. Very elderly patients may tolerate an abnormally low SaO2 at rest when clinically stable; however, COVID-19 pneumonia may significantly worsen SaO2. Access to oxygen therapy will be challenging at the height of a pandemic.

Corticosteroids
In the initial phase of pneumonia, elderly patients can present with wheezing and respiratory distress. It is not uncommon to consider corticosteroids at this stage, because of their anti-inflammatory effects. Corticosteroids were widely used during the 2002-3 SARS outbreak. However, in a subsequent systematic review, including 29 low quality studies of steroid use, 25 studies were inconclusive and four reported possible harm from steroid use. A further evidence review did not support corticosteroid treatment, reporting no evidence of net benefit with corticosteroids in "respiratory infection due to RSV, influenza, SARS-CoV, or MERS-CoV", and that corticosteroids probably impair clearance of SARS-CoV. In contrast to pneumonia, corticosteroids show much clearer benefit in patients with sepsis.

Potential harms of rapid deployment of antibiotics for pneumonia
The main disadvantage of this proposed strategy is that it would tend to drive increased bacterial resistance. However, in a pandemic with a high mortality rate in a specific subpopulation, in this case very elderly people, this needs to be weighed against the benefits of the policy. Apart from penicillin allergy, adverse reactions to the recommended antibiotics, e.g. macrolides, are generally mild and uncommon.

Conclusions
Interventions that affect mortality in pneumonia are of great significance for public health, particularly during the current pandemic. Rescue prescribing strategies, initiated by the patient at an early stage, could aid effective delivery of antimicrobials, significantly reduce hospital admissions, and reduce mortality. While reducing antimicrobial resistance should remain a global priority, the current pandemic

highlights the need for unprecedented management strategies. For example, in the current context, it may be entirely appropriate for nursing homes to have routine stockpiles of antibiotics, allowing rapid and appropriate prescribing decisions that could minimize morbidity and mortality, as well as reducing the impact of the pandemic on health services. Rapid interventions like this could be life-saving. A UK strategy of prospectively self isolating those over 70 is being considered. In this context, equipping patients with rescue antibiotics may be a legitimate strategy to consider. In patients with few physiological reserves, there is no room for error, and providing the right initial treatment, and rapidly, matters.

Disclaimer: the article has not been peer-reviewed; it should not replace individual clinical judgement and the sources cited should be checked. The views expressed in this commentary represent the views of the authors and not necessarily those of the host institution, the NHS, the NIHR, or the Department of Health. The views are not a substitute for professional medical advice.

Competing Interests

Carl Heneghan *is the Editor in Chief* BMJ EBM *and Professor of EBM, Centre for Evidence-Based Medicine in the Nuffield Department of Primary Care Health Sciences, University of Oxford*

Competing interests: CH is an NHS Urgent Care GP, has received expenses and fees for his media work. He holds grant funding from the NIHR, the NIHR School of Primary Care Research and the NIHR Oxford BRC. CH is also Director of CEBM, which jointly runs the EvidenceLive *Conference with the BMJ and the* Overdiagnosis Conference *with international partners, based on a non-profit making model.*

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The views expressed in this commentary represent the views of the authors and not necessarily those of the host institution, the NHS, the NIHR, or the Department of Health. The views are not a substitute for professional medical advice.