

# Community-acquired pneumonias in SARS-CoV-2 negative patients admitted at Mater Dei Hospital and their subsequent follow-up

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## Background

Community-acquired pneumonia refers to an acute infection of the lung parenchyma acquired within the community, and its management depends on the severity of symptoms and method of presentation. The aim of this audit is to evaluate community-acquired pneumonias in SARS-CoV-2 negative patients admitted at Mater Dei Hospital and their subsequent follow-up.

## Methods

In this observational audit, demographic data was collected from 200 patients between June and September 2020.

Follow-up of these patients was audited to assess whether local current practice is being adhered to as per British Thoracic Society recommendations.

## Results

From our sample of 200 patients, 25.5% who were being treated for community-acquired pneumonia passed away during their admission. The age range of our patients varied from 18 to 99 years with the majority being over the age of 75. 31 out of 149 surviving patients (20.8%) had both imaging and medical outpatient follow-up booked, 18 patients (12.08%) had only a chest x-ray follow-up whilst 19 patients (12.75%) had medical outpatient follow-up only. In total 68 patients (45.63%) had imaging or medical outpatient follow-up, or both.

## Conclusion

Any patient admitted and treated for a community-acquired pneumonia should receive a follow-up appointment to assess for resolution of symptoms, and/or follow-up imaging to assess for resolution of changes. Non-resolution of these changes may necessitate discussion at a multi-disciplinary level to conclude how to further investigate such a patient.

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## INTRODUCTION

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Community-acquired pneumonia (CAP) refers to an acute infection of the lung tissue. This is acquired outside of the hospital setting within the community as the name implies, and management depends on the severity of symptoms and method of presentation. Patients may be treated within the community itself by their general practitioner or may require admission to hospital for further intensive care.

There are several risk factors which make patients more likely to acquire a CAP and which may increase the morbidity and mortality rate. These include: age >65 years, multiple co-morbidities including chronic lung disease (CLD), active malignancy, immunosuppression and smoking.

Assessing severity and identifying which patients require hospital-based care is crucial. Local and current practice involves using the CURB-65 score which is based upon five factors. These include confusion (based upon a specific mental test or new disorientation to person, place, or time), urea 7 mmol/L (19 mg/dL), respiratory rate  $\geq 30$  breaths/minute, blood pressure (systolic  $< 90$  mmHg or diastolic  $\leq 60$  mmHg) and age  $\geq 65$  years. One point is assigned for each criterion that is met. For patients with a score of 1 or 2 (unless the score of 1 is due to age  $\geq 65$  with no major co-morbidities), hospital admission may be warranted. Scores higher than 3 will require hospitalisation, and scores higher than 4 may need admission to a high dependency unit (HDU) or intensive care unit (ICU).<sup>1</sup> This wide spectrum of presentation and the number of complications resulting from such an infection makes CAP a leading cause of morbidity and mortality worldwide.

Current recommendations as per the British Thoracic Society (BTS) guidelines for the management of CAP issued in 2009, (annotated 2015), suggest that once patients finish their treatment, whether it is within the community or within the hospital setting, a clinical review should be arranged around 6-8 weeks post-treatment. This review can be either with the patient's own general practitioner or in a hospital outpatient clinic.

This practice is well known and has been practiced for a number of years both locally and internationally. In addition, previous guidelines also suggested that repeat imaging should be performed as non-resolving pneumonias may be the first presentation of a primary or secondary malignancy, infection with an atypical pathogen, or subsequent complications from the original pneumonia.

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## MATERIAL AND METHODS

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Approval to carry out this audit was obtained from the Data Protection Office at Mater Dei Hospital (MDH). A search was performed on the medical

admissions list between the months of June and September 2020 for the following keywords; shadowing, opacity, pneumonia, lower respiratory tract infection (LRTI) and consolidation/s.

200 patients with a confirmed consolidation on chest radiography were included in this audit. The imaging together with their reports were reviewed using iSOFT Clinical Manager® (ICM®) and Universal Viewer® to obtain this information.

Data collection involved taking into account several factors including: age, gender, active malignancy, CLD, smoking history and a negative SARS-CoV-2 real time polymerase chain reaction (RT-PCR) nasal swab test - taken on all patients admitted to MDH as per local protocol. The CURB-65 score was calculated as well from the emergency documents and investigations which were found on ICM®. Whenever the respiratory rate (RR) was not documented on the admission notes, an oxygen saturation below 94% was taken into account and given a point accordingly instead.

Furthermore, ICM® was used to check any microbiology cultures from blood, sputum and respiratory screens, and whether the patient was given follow-up imaging and/or a follow-up medical outpatient (MOP) appointment. All this data was collected from Universal Viewer®, ICM®, and electronic case summary® (ECS®).

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## RESULTS

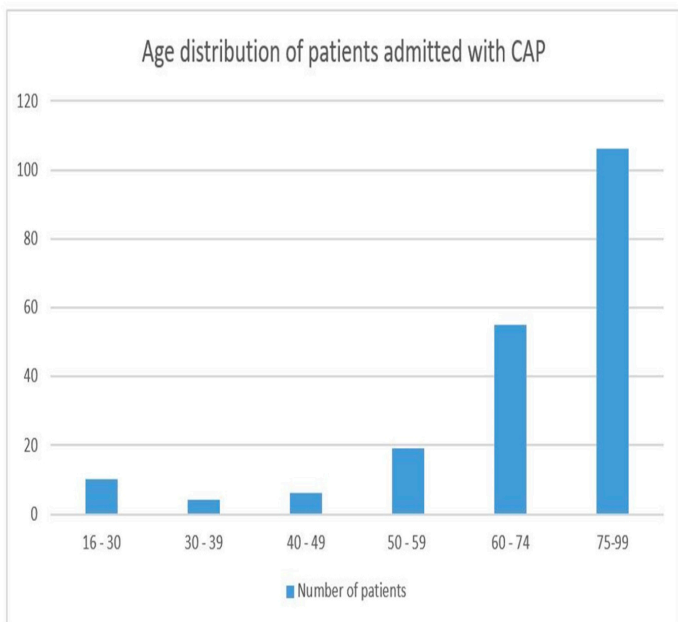
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From our sample of 200 patients, 53% were male and 47% were female. A total of 51 patients (25.5%) who were being treated for CAP passed away during their admission at MDH. The age range of our patients varied from 18 years to 99 years. The majority of patients admitted with this pathology (106 patients; 53%) were over the age of 75 (Figure 1).

44 patients (22%) had a history of CLD. CLDs that were taken into account were asthma, chronic obstructive pulmonary disease, bronchiectasis and interstitial lung disease. In addition, 47 patients (23.5%) were known cases of active malignancy.

196 patients had a chest x-ray (CXR) on admission whilst the other 4 patients underwent a computerized tomography (CT) scan in the first instance. 47% of patients (94 patients) had a CT performed after a CXR which confirmed a consolidation. In 20 of these patients, a CT was performed after their initial CXR did not show any evidence of consolidation, but was later confirmed on CT imaging. The remaining 102 patients (51%) did not have a CT during their admission but only a CXR.

The CURB-65 score was calculated using the emergency admission documents and investigations. Whenever the RR was not documented or assessed, an oxygen saturation less than 94% was assumed to

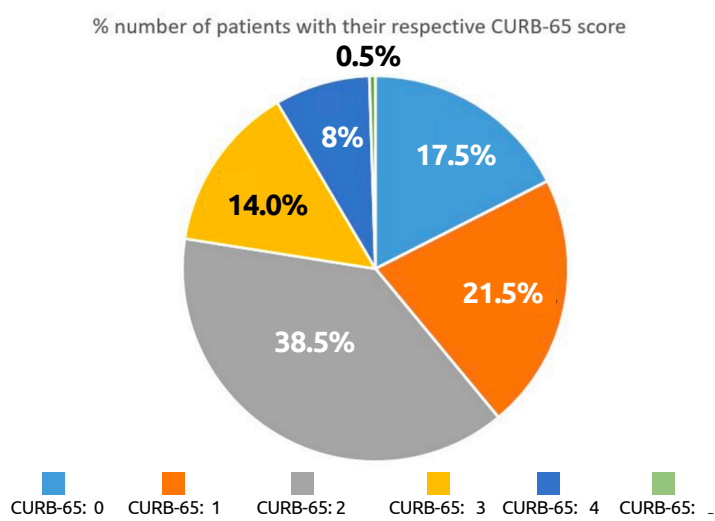


**Figure 1** Age distribution of patients admitted with CAP

be equivalent to an elevated RR with the patient needing oxygen requirements. 17.5% and 21.5% of patients had a CURB-65 score of 0 and 1 respectively. A larger proportion of patients had a score of 2 (38.5%). Only 8.5% of patients had a score of 4 or higher (Figure 2).

With respect to follow-up imaging and/or MOP, the results showed that 31 patients out of 149 surviving patients (20.8%) had both imaging and MOP follow-up booked, 18 patients (12.08%) had only a CXR follow-up whilst 19 patients (12.75%) had MOP follow-up only. In total 68 patients (45.63%) had MOP or imaging follow-up, or both (Figure 3).

Microorganisms cultured from different media were also noted. Blood cultures, respiratory screen and sputum for microscopy, culture and sensitivity were



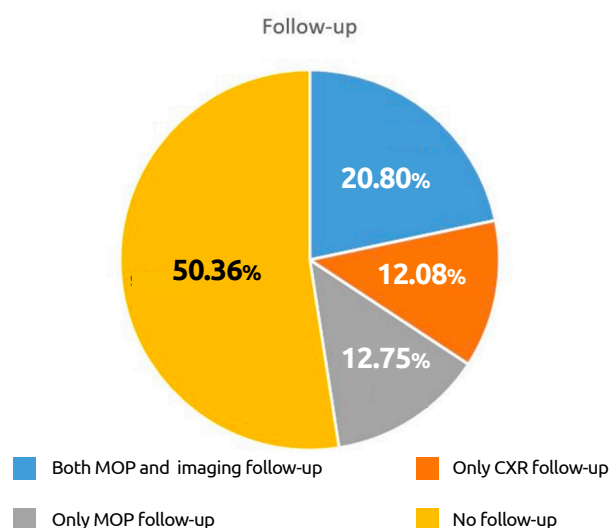
**Figure 2** Percentage number of patients with their respective CURB-65 score

assessed and the pathogens grown taken into account. 22 patients had negative sputum cultures whilst 9 patients had positive growth on their samples. 169 patients did not have any sputum samples taken. One main reason for such samples not being taken could be the lack of sputum production by the patient or not ordered in the first place by their caring physicians. Blood cultures were taken in 94 patients, positive in 9 of them only, with *Staphylococcus aureus* being the most prominent bacterium cultured. In 97 patients, blood cultures were not taken. Lastly, 15 positive respiratory screens from a total of 86 samples were yielded. In Figure 4 one can find the different pathogens cultured on the different mediums mentioned.

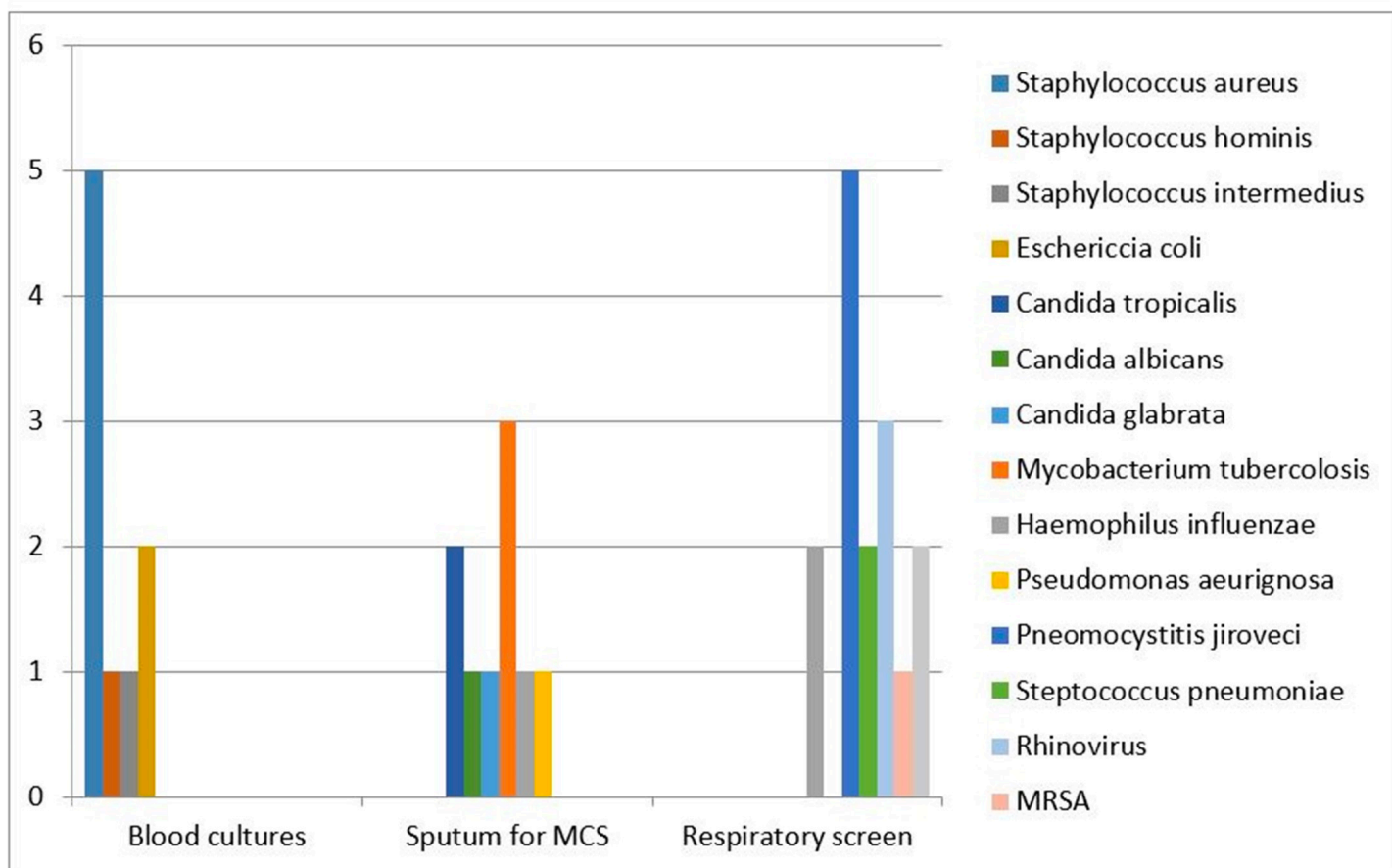
## DISCUSSION

For hospitalized patients with a negative CXR and suspected CAP, the Infectious Disease Society of America (IDSA)/American Thoracic Society (ATS) guidelines consider it reasonable to initiate empiric antimicrobial therapy and repeat a chest radiograph in 24 to 48 hours.<sup>2</sup> Alternatively, a CT scan may be performed as it provides further radiographic detail and information. CT imaging should not be used routinely due to its high costs, additional radiation exposure and risk of contrast-induced kidney injury. Thus, a chest radiograph is the preferred method of initial imaging.<sup>3-4</sup>

The CURB-65 score should be used as a guideline to assess whether the patient can be treated within the community, or guide the caring physician whether to admit the patient to a normal ward or HDU/ICU. Our data showed that 35 patients (17.5%), were admitted with a CURB-65 score of 0. Retrospectively, it is difficult to assess if the patient needed admission or not whilst in the emergency department, however one might argue that the results show a substantial



**Figure 3** Follow-ups at MOP and/or imaging



**Figure 4** Pathogens cultured on different mediums

number of admissions which may have been prevented, and hence decreasing health care related costs and health care related adverse events. The CURB-65 score also does not take into account radiographic severity of CAP.

Data collected showed out of 16 patients with a CURB-65 score of 4, 50% (8 patients) passed away during their admission, and 1 patient with a score of 5 that did not survive. This correlates well with the fact that patients with a score of 4 or higher, require HDU/ICU admission if possible due to their poor prognosis and higher risk of mortality. The majority of patients that did not survive were over the age of 65, making age a strong risk factor to the outcome of such a condition.

Literature shows that in many patients with CAP, even up to 62%, no pathogen is actually detected despite extensive microbiological testing. The most commonly identified causes of CAP can be grouped into typical bacteria such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Staphylococcus aureus*, Group A streptococci, Aerobic gram-negative bacteria such as *Klebsiella* spp or *Escherichia coli*, microaerophilic bacteria and anaerobes (associated with aspiration). The next group includes the atypical microorganisms such as *Legionella* spp, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, *Chlamydia psittaci*, and *Coxiella burnetii*. These organisms are termed atypical in view of their inability to be visualised on Gram

stain, or cultured using traditional techniques. Respiratory viruses include Influenza A and B, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and others such as rhinoviruses, parainfluenza viruses, adenoviruses, respiratory syncytial virus, human metapneumovirus and human bocaviruses. The prevalence of these pathogens varies with geography, pneumococcal vaccination rates, risk factors for CAP, seasonal changes, and pneumonia severity. While the list above details some of most common causes of CAP, more than 100 bacterial, viral, fungal, and parasitic causes have been reported.<sup>5-6</sup>

Follow-up of CAPs is essential for the detection of non-resolving pneumonias and associated complications. Persistence of consolidation on imaging should prompt the caring physician to investigate further. Additional investigations such as bronchoscopy might shed light onto the root cause of a non-resolving pneumonia. Our data shows that only 68 patients from a total population sample of 149 surviving patients were followed up. Follow-up as suggested by previous and current recommendations should be done at 6-8 weeks, to allow for complete resolution of the consolidation on imaging. This time frame should be adhered to, as literature shows that follow-up imaging earlier than recommended provides little to no additional information.<sup>7</sup> Follow-up should also be done to assess for symptom resolution. It is well known that symptoms such as cough and sputum production may persist for some

weeks. Studies show that as many as 87% of hospitalised patients suffer from persisting pneumonia related symptoms within 30 days of the original infection. These results are in keeping with the time frame mentioned above, to allow for resolution of these persisting complaints.<sup>8-9</sup>

### LIMITATIONS OF THE AUDIT

Mortality rate could not be attributed solely to complications from CAP as patients may have had other co-morbidities and other non-CAP related complications.

Most patients are over the age of 75, making follow-up for these patients difficult to set up especially if they reside in long-term care facilities or are dependent in their activities of daily living.

The large number of blood cultures, sputum samples and respiratory screen not taken could have been due to multiple factors, such as sputum not being available, or samples not ordered by the caring firms.

When a respiratory rate was not recorded in the patient's notes, an SpO<sub>2</sub> less than 94% was used instead to calculate the CURB-65 score. This was not necessarily accurate.

### SUMMARY BOX

- We recommend that any patient admitted and treated for a CAP should receive a follow-up appointment to assess for resolution of symptoms, and/or follow-up imaging to assess for resolution of CXR or CT changes. Further efforts should be made in this regard.
- Non-resolution of these changes may necessitate discussion at a multi-disciplinary level to conclude how to further investigate such a patient.
- The CURB-65 score is an important tool which helps the general practitioner or the emergency physician with the management plan.
- Risk factors need to be taken into account when admitting a patient and one should not rely on the CURB-65 only, as age and other risk factors will undoubtedly increase the mortality rate and affect prognosis.

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