

Quality of investigation and treatment of community-acquired pneumonia

- a comparative study between departments of internal medicine in NU-sjukvården and swedish departments of infectious diseases

Master thesis in medicine

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Abstract

Community-acquired pneumonia is a common disease which yearly affects 1 of 100 persons and it is the most common infection diagnosis in all in-patient hospital care. The Swedish Society of Infectious Diseases has set up a number of targets regarding the quality of pneumonia care in departments of infectious diseases. The targets mean that CRB65-score (=a prognostic tool that takes into account the presence of confusion, the respiratory rate, blood pressure and age) should be calculated and noted for at least 50 % of patients with suspected pneumonia, blood cultures and airway cultures should be taken from all these patients and at least 75 % of the patients should have PcV or PcG as initial treatment. The result of target accomplishment is documented in a national quality register (NQPR).

The majority of patients who is treated for community-acquired pneumonia in inpatient hospital care is however treated in departments of internal medicine. Therefore, it is interesting to investigate the target accomplishment in these departments and compare the results with the results from departments of infectious diseases.

The aim with this master thesis in medicine is to compare patients who have been treated for community-acquired pneumonia in departments of internal medicine with patients who have been treated in departments of infectious diseases, with respect to antibiotic treatment, the use of CRB65-score for therapy choice and the use of cultures.

100 medical records from patients treated for community-acquired pneumonia in departments of internal medicine in NU-sjukvården during 2012 were examined and the results were compared with data from the national pneumonia register.

The result shows that CRB65-score was not mentioned in any enrollment record, and enough information to calculate the CRB65-score was missing in 51 % of the records. Blood cultures were taken in 83 % (91.3 % in the NQPR) and airway cultures were taken in 21 % of the patients (76.3 % in the NQPR). 74 % received PcV or PcG as initial antibiotic, which is a higher number than in the NQPR.

Conclusion: The target to treat at least 75 % with PcV or PcG was almost achieved in the departments of internal medicine, as 74 % got these antibiotics. The other targets were not achieved neither in departments of internal medicine, nor in departments of infectious diseases.

1. Introduction

1.1 Background

Community-acquired pneumonia is a common disease that is potentially life-threatening. [1]. The annual incidence is 1 of 100, and pneumonia primarily affects elderly. [2].

The Swedish Society of Infectious Diseases has set up a number of targets regarding the quality of pneumonia care for patients treated in departments of infectious diseases. These targets mean that blood culture and some kind of airway culture must be taken from all patients with suspected pneumonia. Further, the CRB-65-score (=a prognostic tool that takes into account the presence of confusion, the respiratory rate, blood pressure and age), should be documented for at least 50 % of the patients at time for enrollment and for the patients with CRB-65-score 0-2 at least 75 % should be given PcV (fenoximethyl penicillin) or PcG (benzyl penicillin) as initial treatment. The reason for this is to counteract too much use of broad-spectrum antibiotics, as this contributes to the development of resistant bacteria. The result of target accomplishment is documented in a national pneumonia register.

The majority of patients who is treated for community-acquired pneumonia in inpatient hospital care is however treated in departments of internal medicine. Therefore, it is interesting to investigate the target accomplishment in these departments and compare the results with the results from departments of infectious diseases.

1.2 Concepts and abbreviations

Pneumonia: the definition of pneumonia is symptoms of lower respiratory tract infection, such as fever, cough, dyspnoea, sudden fatigue, respiratory correlated chest pain and/or abnormal breath sounds combined with typical radiological findings.[2]

Community-acquired pneumonia (CAP): hereby means pneumonia acquired outside hospital or long-time nursing home. Pneumonia is not considered as community-acquired if the patient has been treated in inpatient hospital care or long-time nursing home for the last month.

The national pneumonia register (NQPR): an annual report that contains data from patients treated in all departments of infectious diseases in Sweden. Patients treated in departments of internal medicine are thus not included.

CRB-65-score: a prognostic score which is used when making decisions about the care of patients with suspected pneumonia, for example which level of in-hospital care (intensive care unit or common ward) the patient needs, and which antibiotic treatment to use initially. Parameters that are investigated are confusion, respiratory rate, blood pressure and age. Presence of confusion, respiratory rate > 30, systolic blood pressure < 90 or diastolic blood pressure < 60, and age > 65 years gives one point each. Thus we get a total CRB-65 result between 0 and 4.[3]

However, CRB-65-score has some weaknesses. It is best used for predicting the mortality rate on population level, and it is not enough in the management of patients with suspected pneumonia. For example, information about oxygen saturation is not taken into account. A recent Spanish study proposes a modification called CORB-75, where CRB-65 is completed with measurement of oxygen saturation, and the age criteria is changed to 75 years. [4]

PcV and PcG: with PcV means fenoximethyl penicillin and with PcG means benzyl penicillin.

COPD: hereby means chronic obstructive pulmonary disease.

MS: hereby means multiple sclerosis.

ICU: hereby means intensive care unit.

1.3 Etiology

S. pneumoniae (pneumococci) is the most common pathogen that causes pneumonia among patients who requires in-hospital care. The next most common pathogen in this patient group is *H. Influenzae*, followed by *M. Pneumoniae* (mycoplasma). It is noteworthy that *H. Influenzae* is a more common pathogen among patients with CRB-65 2-4, while mycoplasma is more common among patients with CRB-65 0-1. There is also an age difference as mycoplasma mainly affects younger persons under 50 years, while pneumococci and *H. Influenzae* affects all age groups.

Outside of the bacterial pathogens above, viruses are also a common cause of community-acquired pneumonia, primarily influenza viruses during the influenza season, but also respiratory syncytial virus (RSV) and adenoviruses. More uncommon pathogens are *Legionella*, *S. Aureus*, *Clamydophila psittaci*, *Clamydophila pneumoniae* (TWAR), *M. catarrhalis* and gram-negative enteric bacterias such as *E. Coli*. [5]

1.4 Diagnostics

There is not one single test that alone can tell if the patient has pneumonia. Several different tests and investigations are necessary. Clinical examination should include heart and lung auscultation, lung percussion, calculate respiratory rate, measuring pulse, blood pressure, temperature and oxygen saturation [3].

Blood sample should be taken for chemical analysis. Hb, leukocytes trombocytes, CRP, creatinine, albumin, sodium, potassium and ALAT should be analysed for all patients with suspected pneumonia. In some cases an arterial blood gas analysis should be done: patients with CRB-65 2-4, impaired conciousness, smokers, COPD-patients and if the oxygen saturation is under 92% .[2]

Legionella and pneumococci antigens can be detected in a urine sample.

Radiological methods that can be used are plain X-ray and CT scan. Plain X-ray gives in most cases enough information to establish the diagnosis, and differential diagnoses such as pneumothorax, pleural fluid and tuberculosis can be seen with this method. Lung embolism is another important differential diagnosis, this is however more difficult to detect with a plain X-ray and typically requires a CT scan.

Cultures and PCR are very important in the management of patients with suspected pneumonia. It is the only way to verify which pathogen has caused the disease, and thus choose the right therapy. By choosing a targeted antibiotic treatment we decrease the risk of resistance development. Since there is a high incidence of bacteremia among these patientes, blood cultures should be taken before antibiotic treatment starts.

Airway cultures should also be taken. There are different types of airway cultures. Nasopharyngeal culture and sputum culture are the most common. Nasopharyngeal culture is quick and easy to take, but it is important to take into account that it shows which bacterias that are found in the pharynx, and not in the lower airways. Sputum culture indicates which bacterias that are in the lower airways, but it always becomes contaminated with pharynx- and mouth flora. It can be difficult for the patient to produce a sputum culture, especially for seriously ill patients [3].

Other ways to get an airway culture is through bronchoscopy with a protected brush or by broncho-alveolar lavage. These are more invasive methods that requires special personnel, takes longer time and causes more discomfort for the patient than the methods mentioned above. The advantage is that we get a culture from the right location, free from pharynx- and mouth flora.

There are also typical clinical findings that can give us an indication about the ethiology. A sudden onset and affected general condition is typical för pneumococci. Other findings that are typical for

pneumococci are yellow-green expectoration, high leukocytes (> 15) and high CRP. A COPD-patient (a patient with chronic obstructive pulmonary disease) with gradually increased cough and reduced oxygen saturation should make us think about H. influenzae as a possible cause. A young, relatively unaffected patient with coughing attacks and normal breath sounds may be caused by mycoplasma, especially if there is an ongoing mycoplasma epidemic. [6]. After all, the only way to be sure about the etiology is through the use of cultures or PCR (poly chain reaction).

Viruses as a cause to pneumonia is also important to keep in mind, especially during influenza season. Common airway viruses like influenza viruses A and B, adenoviruses, rhinoviruses, parainfluenza viruses and corona viruses can cause pneumonia. A patient with viral pneumonia often have cough, myalgia and headache, whereas pleuritic pain is less common than in patients with pneumococcal pneumonia. The CRB-65-score is usually lower than with bacterial etiology. The etiology can also be mixed, with both viruses and bacterias. Mixed etiology is often a cause to more severe illness. Since viruses are not detected in cultures, PCR test is necessary to establish a viral etiology. [7]

Older patients (> 65 years) may present with atypical symptoms. Cough, fever, expectoration and dyspnoea may be missing, and the patient may instead be confused or show a high respiration rate [8].

1.5 Treatment

Pneumonia is one of the airway infections that normally shall be treated with antibiotics. This is because pneumonia is a serious disease which is potentially fatal, and bacterias is the most common cause of the disease [9]. Since pneumococci is the most common pathogen, and also the most dangerous, it must be covered by the empirical treatment.

A betalactam antibiotic like phenoxymethyl penicillin (PcV) for oral administration or benzyl penicillin (PcG) for parenteral administration covers pneumococci. This should be the first choice, as most pneumococci are sensitive for these antibiotics. Another advantage is that the side effects are mild, and mainly consists of nausea, diarrhea and skin eruptions. Cephalosporins are other kinds of beta-laktam antibiotics, which are effective against pneumococci. These are however more likely to cause evolution of resistant bacterias. [10]

A lot of research have been done regarding the antibiotic treatment of community-acquired pneumonia, as if atypical pathogens should be covered routinely. A swedish multi-center study in 2002 showed that the narrow treatment with penicillin as monotherapy did not lead to increased mortality or increased length of hospital stay. [11]

A multinational meta-analysis consisting of 18 research studies with totally 6749 patients compared the usage of betalactam antibiotics with treatment effective against atypical pathogens among patients with non-severe pneumonia in primary care and out-patient hospital clinics. The research question was if the coverage of atypical pathogens led to decrease in therapy failure compared with betalactam antibiotics. The result showed no difference in therapy failure depending on which treatment was given. When the material was divided into subgroups according to etiology, there were a statistically significant increase in therapy failure among the patients who had pneumonia caused by legionella when they were treated with only betalactam antibiotics. [12]

Another multinational meta-analysis consisting of 24 research studies analyzed in total 5015 patients who were hospitalized because of community-acquired pneumonia. It compared treatment with atypical coverage with treatment without atypical coverage (mainly beta-actam antibiotics) with respect to mortality, clinical improvement, bacterial eradication and side effects. The result showed no difference in mortality. The clinical improvement was higher when treatment with atypical coverage was given. There was no difference in bacterial eradication. Side effects (mainly abdominal pain and diarrhea) were more common among patients who received treatment without atypical coverage. [13]

The Swedish guidelines for pneumonia treatment recommend PcV or PcG as first choice for normal patients when CRB-65-score is 0-1. With normal patient means a immunocompetent patient with no severe underlying lung disease and no allergy to penicillin. When CRB-65-score is 2, PcV or PcG is also the first choice, if nothing inspires suspicion about atypical pathogenesis. Factors that should make us suspect atypical pathogenesis are for example if the patient has recently been abroad (increased risk for legionella) or if there is an ongoing mycoplasma epidemic. If we suspect an atypical etiology, normal patients should have erythromycin or doxycycline [6].

When CRB-65-score is 3-4, it is according to the guidelines, necessary to choose a therapy with broader spectrum. For normal patients this means a third-generation cephalosporin like cefotaxim, combined with erythromycin. An alternative is high-dose PcG combined with a quinolone. [6]

During influenza season it is recommended to take PCR test for influenza viruses if the anamnesis and clinical examination raise a suspicion about viral pathogenesis. If influenza viruses are detected, treatment with oseltamivir is recommended for patients belonging to a risk group or if the disease is severe. Risk groups are patients older than 65 years, pregnant women in the second or third trimester, immunosuppressed patients, obese patients with a body mass index (BMI) > 40 and patients with any of the following chronic diseases: heart- or lung disease, unstable diabetes, asthma, liver- or renal failure or a neurological disease that affects breathing [14]. Oseltamivir treatment decreases risk for death and reduce the need for unnecessary antibiotic treatment if the etiology has been proven to be influenza viruses A or B. [15]

The recommended treatment time is 7 days for both mild and severe pneumonia. Exception is if the cause is legionella, then 10 days treatment is recommended [1].

1.6 Antibiotic resistance

Since the etiology is most often unknown when the treatment starts, it is necessary to choose antibiotics empirically. Then it might be tempting to choose an unnecessarily broad antibiotic just to be sure not to miss any pathogen. This is however not a sustainable strategy, since the use of broad-spectrum antibiotics is driving the development of resistant bacteria.

Compared with other European countries, Sweden has less problems with resistant bacteria [16]. However, it is an increasing problem, especially in hospital environment. Between 1995 and 2004, pneumococci with decreased sensitivity to penicillin increased from 4 % to 6 % in nasopharyngeal cultures, and there were also an increase in resistance to erythromycin, tetracycline and trimethoprim-sulfa among pneumococci. This development took place despite a general decrease in antibiotic prescription during this time. [17]

Antibiotic resistance can occur through four different mechanisms; reduced penetration of the antibiotic through the bacteria cell wall, decreased binding, bacterial enzymes that break down antibiotics, and finally through increased outflow of antibiotic from the bacteria. The bacteria can exhibit one or more of these mechanisms. [10]

The two most important mechanisms for beta-lactam antibiotic resistance are either when the bacteria produce beta-lactamase, or by change of the penicillin-binding proteins (PBP) on the bacteria surface. Increased efflux or reduced permeability are also occurring mechanisms, but these are less common.

Beta-lactamase is an enzyme that hydrolyzes, and thereby destroys, the beta-lactam ring in the antibiotic. Thus, the bacteria become resistant to penicillin, and even against some cephalosporins. There are several kinds of beta-lactamases, which explains why the resistance pattern may look different among different bacteria. Beta-lactamases can be either chromosomal or plasmid-borne. The plasmid-borne beta-lactamases have an extended spectrum and the bacteria become resistant to more kinds of cephalosporins and also carbapenems. These beta-lactamases are called ESBL (=extended spectrum beta-lactamase), and are typically found in *E. coli* and *Klebsiella* species [18].

ESBL producing bacterias are the type of resistant bacterias that are increasing most in Sweden. Between 2007 and 2012, ESBL producing bacterias increased from about 2000 cases to over 7000 cases. [19]

There are however ways to counter the beta lactamase. Clavulanic acid and tazobactam inhibits beta lactamase and are therefor used as a supplement to betalactam antibiotics when treating bacterias that produce beta lactamase. Clavulanic acid is often used together with amoxicillin for oral distribution, and tazobactam is often used together with piperacillin for parenteral distribution [20].

Change of the penicillin-binding proteins decreases the affinity for, and thereby causes resistance to, penicillin and cephalosporins among pneumococci, H. Influenzae and S. Aureus. There are several kinds of changes in the PBP, and that is why bacterias can be resistant to some antibiotics but not to others. Some S. aureus have a PBP-change that makes them resistant to all kinds of betalactam antibiotics. These are called MRSA (meticillin resistant S. Aureus) [18].

SwedRes is an annual report on antibiotic prescribing and resistance in Sweden. According to this report, pneumococci with decreased sensibility for penicillin were found in 5 % of blood cultures and 6.6 % of airway cultures 2012. The presence of these bacteria have not increased during the recent years. On the contrary, it can be seen a small reduction between 2007 and 2012. [19]

H.influenzae has especially developed resistance against betalactam antibiotic and trimetoprim-sulfa. In 2011, 18 % of H.influenzae found in airway cultures were producing beta lactamase. [21]

2. Aim and research questions

2.1 Aim

The aim is to compare patients who have been treated for community-acquired pneumonia in departments of internal medicine with patients who have been treated in departments of infectious diseases, with respect to antibiotic treatment, the use of CRB-65-score for choice of treatment and the use of cultures.

2.2 Research questions

- Which was the median age of the patients treated in departments of internal medicine?
- How many were men and how many were women?
- Was any airway culture taken, and if so, which kind of airway culture?
- Were blood cultures taken?
- Were there enough information to calculate the CRB-65-score at the time for enrollment?
- Was the CRB-65-score documented in the enrollment record?
- Which infection parameters were investigated at enrollment?
- Was urine sample for pneumococcal antigen and legionella antigen taken?
- Was PCR test for mycoplasma and viruses taken?
- Was any radiological method used for diagnostics?
- What antibiotics were used initially?
- What antibiotics were used after 72 hours?
- What antibiotics were used as follow-up treatment?
- How many days lasted the antibiotic treatment (iv and total)?
- For how long did the patients stay in hospital?
- Were patients treated in ICU, with respirator or CPAP/BiPAP?
- What was the mortality rate during hospital stay and within 30 days?
- Was any palliative decision taken, such as restrict or end treatment?
- Was a decision about no CPR taken?

Were there any differences with respect to the parameters above compared with patients treated in departments of infectious diseases?

3. Material and methods

The thesis is based on examination of 100 medical records regarding patients who were treated for community-acquired pneumonia in departments of internal medicine in NU-sjukvården (NÄL and Uddevalla hospital) during 2012, and comparison with data from the national pneumonia register (NQPR). The patients were selected by requesting a list of all patients who were discharged from departments of internal medicine during 2012 with any of the following ICD diagnoses:

J13 – J18 as main diagnosis, or as secondary diagnosis to bacteremia (ICD code A40, A41 or A49).

These diagnoses were choosed because they are the same diagnoses that are used in the national pneumonia register. Only adult patients (18 years or older) were included.

There are four medical clinics in NU-sjukvården: emergency medicine, specialist medicine, neuro-rehab and cardiology clinic. Only patients from emergency medicine were included in this study. There were from the beginning 598 patients, treated in five different wards (three wards in NÄL and two wards in Uddevalla hospital).

Patients who were treated in department of infectious diseases directly adjacent to the admission in departments of internal medicine were excluded. So were also patients who were treated in any in-hospital care for the last 30 days and patients who developed the first signs of pneumonia after 48 hours in hospital, since pneumonia is not considered as community-acquired in these cases. After the exclusion, 462 patients remained.

100 patients were selected with respect to the percentage distribution of main diagnoses among all 462 patients.

The lists contain patients chronologically arranged by enrollment date. Every fourth patient was selected to be included in the study.

The records were structurally examined and notes were made on a review template determined in advance (appendix 1). The information were then compiled in a data file.

Information about 30-days mortality was obtained from population register Västfolket.

4. Ethics

Ethical permission was asked for and given by the local ethic comittee (Etikprövningsnämnden). The patients were not asked for consent. All information has been treated confidential and personal data are not possible to trace. No personal data have been noted on the review template or in the data file. Each review template has insted been given a serial number. The study does not cause any risk or harm for the patients.

5. Result

5.1 Facts about the sample

54 % of the patients were men and 46 % were women (n=100). Thus, the gender ratio is almost the same as in the NQPR, where there were 53.4 % men and 46.6 % women (n=4843).

The patients were aged 19-97 years and the median age was 80 years (81 years for men and 79 years for women). The median age is therefore higher than in the NQPR, where median age was 67 years (67 years for men and 68 years for women).

Table 1. Distribution of main diagnoses according to the ICD-10 system among all patients who were treated for community-acquired pneumonia in emergency medicine departments, NU-sjukvården, during 2012. n=462

ICD code		Number of patients	Percentage
J18.9	Pneumonia, unspecified	253	54.7 %
J15.9	Bacterial pneumonia, unspecified	168	36.3 %
J13.9	Pneumonia caused by <i>S. pneumoniae</i>	10	2.10 %
J14.9	Pneumonia caused by <i>H. influenzae</i>	3	0.60 %
J15.2	Mycoplasma infection, unspecified site	1	0.20 %
J15.7	Pneumonia caused by <i>M. pneumoniae</i>	8	1.70 %
J15.8	Other specified bacterial pneumonia	3	0.60 %
J16.8	Pneumonia caused by other specified infectious organisms	1	0.20 %
J18.0	Bronchopneumonia, unspecified	7	1.67 %
J18.1	Lobar pneumonia, unspecified	4	1.50 %
A41.9	Sepsis, unspecified	3	0.60 %
A41.5	Sepsis caused by other gram-negative organisms	1	0.20 %

Table 2. Distribution of main diagnoses according to the ICD-10 system among the patients treated in departments of internal medicine who were included in the study. n=100

ICD code		Number of patients	Percentage
J18.9	Pneumonia, unspecified	55	55.0 %
J15.9	Bacterial pneumonia, unspecified	36	36.0 %
J13.9	Pneumonia caused by <i>S. pneumoniae</i>	2	2.00 %
J15.7	Pneumonia caused by <i>M. pneumoniae</i>	2	2.00 %
J18.0	Bronchopneumonia, unspecified	2	2.00 %
J15.2	Mycoplasma infection, unspecified site	1	1.00 %
J18.1	Lobar pneumonia, unspecified	1	1.00 %
J15.8	Other specified bacterial pneumonia	1	1.00 %

9 % of the patients (11 % of men and 6.5 % of women) died during hospital stay. This is a higher mortality than in departments of infectious diseases, where the mortality was 4.0 % (5.1 % among men and 2.7 % among women). 4 % more died within 30 days from enrollment day.

The average time of hospital stay was 7.5 days (6.9 days for men and 8.1 days for women) for patients who survived (ranging 2-36 days). This is longer than in the NQPR, where the average time of hospital stay was 4 days for both men and women.

Table 3. Co-morbidity among the patients treated in departments of internal medicine. n=100

Co-morbidity	Men	Women	Totally
Chronic heart disease	61.0 %	50.0 %	56.0 %
Chronic lung disease	24.0 %	26.0 %	25.0 %
Neurological disease	31.0 %	22.0 %	27.0 %
Chronic kidney disease	3.70 %	6.50 %	5.00 %
Malignancy	7.40 %	8.70 %	8.00 %
Immunosuppression	2.00 %	0.00 %	1.00 %

Chronic heart disease consisted of cardiac failure, atrial fibrillation, aortic stenosis and coronary artery disease.

With chronic lung disease means COPD and asthma.

With neurological disease means MS, Parkinsons disease and cerebrovascular lesions such as bleeding or infarction.

19 % had no co-morbidity.

In the NQPR there were less patients with chronic heart diseases (27.4 %) and neurological diseases (16.6 %). There were more patients with immunosuppression (11.3 %). The presence of chronic lung disease, chronic kidney disease and malignancy was about the same in both populations.

7 % of the patients were current smokers and 13 % were non-smokers. Information about smoking were missing in the enrollment note for 85 % of the patients. Corresponding number in the NQPR was 51.9 %. For 5 % there was information about smoking at any other place in the journal, but for 80 % it remained unclear whether the patient was a smoker or not.

At time for enrollment, pneumonia was either the most likely diagnosis, one of several diagnoses or not mentioned at all. The distribution looked as follows:

Table 4. The assessment at time for enrollment among patients treated in departments of internal medicine. n=100

Assessment	Men	Women	Totally
Primarily assessed as pneumonia	61.0 %	41.3 %	52.0 %
One of several possible diagnoses	20.4 %	26.0 %	23.0 %
Not mentioned in the primary assessment	18.5 %	32.6 %	25.0 %

In the NQPR, 66.7 % of the patients were primarily assessed as having pneumonia. In 20.3 % of the cases, pneumonia was one of several possible diagnoses and in 10.2 % pneumonia was not mentioned in the primary assessment. Information about this was missing in 2.9 % of the patients in the NQPR.

There were enough information to calculate the CRB-65-score for 49 % of the patients (52 % of men and 46 % of women). The CRB-65-score was however not mentioned in the enrollment note for any patient. This compares with the NQPR where there were enough information to calculate the CRB-65-score in 84.1 % of the patients and the score was mentioned in 8.5 % of the enrollment notes.

41 % had CRB-65-score 0-1, 8 % had CRB-65-score 2-4 and 51 % had an unknown score. In the NQPR, 28.2 % of the patients where the score could be calculated, had CRB-65-score 2-4.

Information about confusion was missing for 15 % of the patients (13 % of men and 17 % of women). Information about respiratory rate was missing for 47 % (46.3 % of men and 47.8 % of women). Information about age and blood pressure were noted for all patients.

9 % of the patients (11.1 % of men and 6.5 % of women) were treated with CPAP or BiPAP. The corresponding number in the NQPR was 4.9 %. Two patients, both women, were treated in ICU. One of them was treated in ICU for one day, and one of them was treated in ICU for four days. One of them died during hospital stay. In the NQPR, 6.9 % of the patients were treated in ICU. Treatment in respirator occurred in 1 % of patients from departments of internal medicine and 3 % of patients from departments of infectious diseases.

For 13 % of the patients (14.8 of men and 10.9 of women) was a decision about no CPR taken. For 6 of these patients were also a decision taken to end antibiotic treatment or to refrain from intensive care. For one patient it was decided to restrict treatment but decision about no CPR was not taken for this patient.

Contact with a specialist in infectious diseases was taken in 13 % of the cases. 9 % were phone contact and 4 % were visits.

5.2 Diagnostics

Radiology was used as diagnostic help in 97 % of the cases. There was a gender difference, with more radiological tests for women than for men. When CT was performed, there was usually an issue of pulmonary embolism.

Table 5. Radiology as diagnostic help among patients treated in departments of internal medicine. *n*=100

Radiology	Men	Women	Totally
Plain X-ray	92.6 %	80.4 %	87.0 %
CT	1.9 %	10.9 %	6.00 %
Plain X-ray + CT	0.00 %	8.70 %	4.00 %
No radiology	5.50 %	0.00 %	3.00 %

Blood cultures were taken in 83 % of the cases (89 % among men and 76 % among women). The corresponding number in the NQPR was 93.1 % (93.7 % among men and 92.4 % among women).

Sputum cultures were taken from 12 % of the patients (16.7 % of men and 6.5 % of women). This was more common in the NQPR, where sputum cultures were taken from 26.8 %.

Nasopharyngeal cultures were taken from 10 % of the patients (5.5 % of men and 15.2 % of women). The corresponding number in the NQPR was 66 %. Any airway culture was taken from 21 % of the patients treated in departments of internal medicine. This is a much lower number than in the NQPR, where the corresponding number was 76.3 %.

Mycoplasma serology was taken in 6 % of the cases (7.4 % of men and 4.3 % of women).

PCR for influenza viruses was taken in 3 % of the cases (1.9 % of men and 4.3 % of women). The corresponding number in the NQPR was 15.9 %.

Urine sample for pneumococcal antigen detection was taken in 11 % of the patients (11.1 % among men and 10.9 % among women). The corresponding number in the NQPR was 32.3 %. Urine sample for legionella antigen detection was taken in 9 % of the patients (9.2 % of men and 8.7 % of women)

Despite microbiological tests, the etiology remained unclear in 93 % of the cases. The corresponding number in the NQPR was 61.6 %. Pneumococci and H. Influenzae was the etiology in 2 % each. M. Catharralis was detected in 3 % of the patients. It is noteworthy that the proven etiology did not always correspond with the diagnosis that was established. For example, one patient got the main diagnosis J15.2 (mycoplasma infection, unspecified site) even though no mycoplasma was found in any test, but H. Influenzae was found in a sputum culture from this patient.

5.3 Antibiotics

The initial antibiotic choice was distributed as follows for the entire population from departments of internal medicine (n=100):

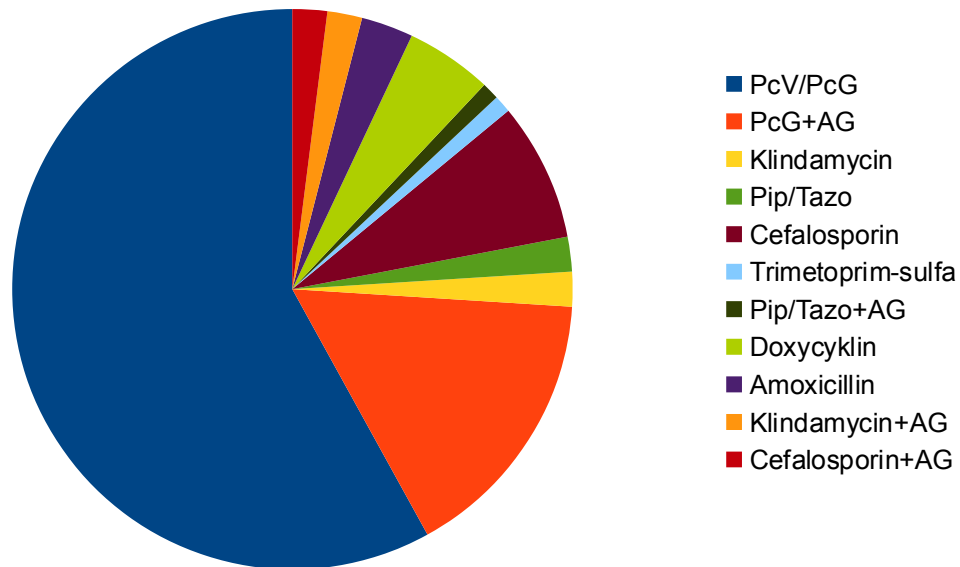


Figure 1. The initial antibiotic choice among patients treated in departments of internal medicine. n=100

58 % received PcV or PcG as initial antibiotic (53.7 % of men and 63 % of women). This is a higher number than in the NQPR, where the corresponding numbers were 46.7 %. Additional 16 % of the patients (14.8 % of men and 17.4 % of women) treated in departments of internal medicine received PcG combined with aminoglycoside (AG).

Cephalosporins were given in 10 % of the cases. 8 % received only cephalosporin and 2 % received cephalosporin combined with aminoglycoside. 6.5 % of women received cephalosporins. Cephalosporins were given to 9.2 % of men and cephalosporins combined with AG were given to 3.7 % of the men. Use of cephalosporins was therefore lower than in the NQPR, where 28.6 % received cephalosporins.

The use of PcV or PcG as initial treatment was thus higher for women than for men, and the use of cephalosporins was lower among women than among men in the population treated in departments of internal medicine.

The use of piperacillin with tazobactam also differed among the populations. In the NQPR, 8 % received this treatment, whereas only 2 % of the patients from departments of internal medicine received this kind of antibiotics.

Quinolones and macrolides were not used at all as initial treatment in departments of internal medicine. In the NQPR, 4.7 % got quinolones and 4 % received macrolides.

The following chart shows the percentage distribution of initial antibiotic choice in departments of internal medicine (n=100) and departments of infectious diseases (n=4843):

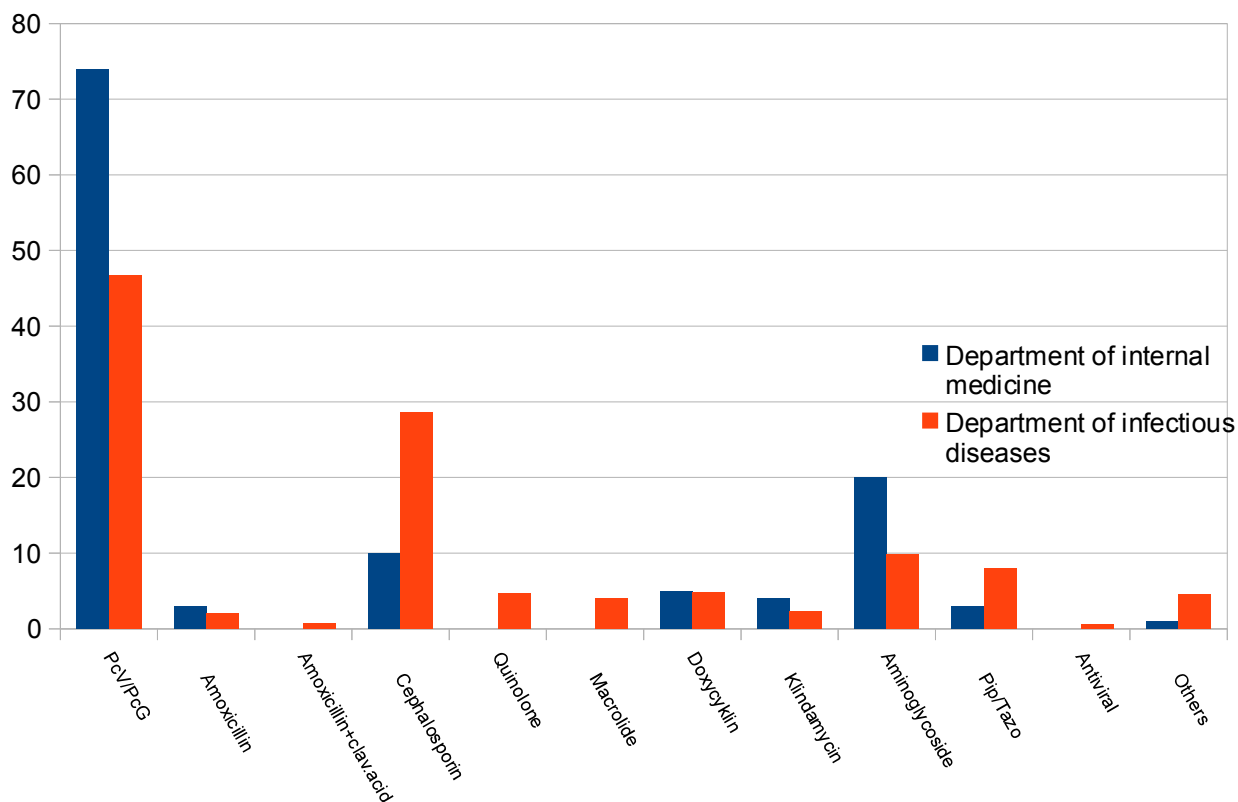


Figure 2. Percentage distribution of initial antibiotic choice among patients treated in departments of internal medicine (n=100) and among patients treated in departments of infectious diseases (n=4843)

Use of aminoglycoside is in the NQPR reported as a separate treatment and it is not possible to see which kind of antibiotics it was combined with.

On the third day in hospital care, it looked like this for the entire population treated in departments of internal medicine, that now consisted of 90 patients:

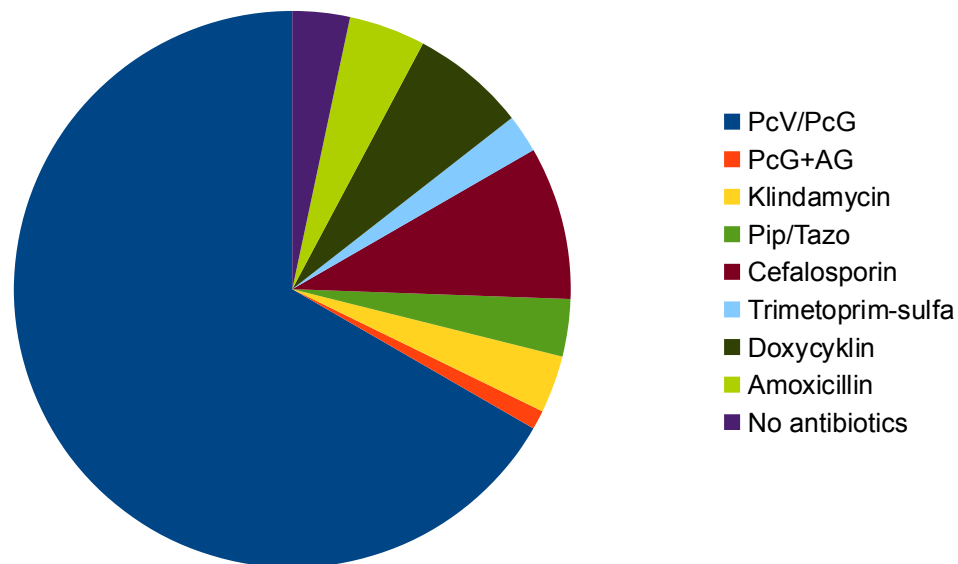


Figure 3. Antibiotic choice on the third treatment day among patients treated in departments of internal medicine. n=90

67 % (62 % of men and 72.5 % of women) received PcV or PcG. The corresponding number in the NQPR was 37.3 %. Patients who got PcG combined with aminoglycoside had decreased to only one patient (1.1 %). 8.9 % (10 % of men and 7.5 % of women) still received cephalosporins. This is however a lower number than in the NQPR, where 14.6 % of the patients received cephalosporins on the third day.

4.4 % of patients from departments of internal medicine received amoxicillin on the third day. The corresponding number in the NQPR was 12 %.

3.3 % (three patients) did not get any antibiotics on the third day. In two of these cases there was a palliative decision taken to end treatment because the patients were too ill, and these patients died later. In the third case, the patient received antibiotics again a few days later and the reason for the break in the treatment was not clear.

Like on the first day, there were a greater proportion of women than men who received PcV or PcG. Amoxicillin was also more common among women than among men (7.5 % compared with 2 %).

The following table shows the percentage distribution of antibiotic choice on the third day:
 Departments of internal medicine: (n=90)
 Departments of infectious diseases: (n=4843)

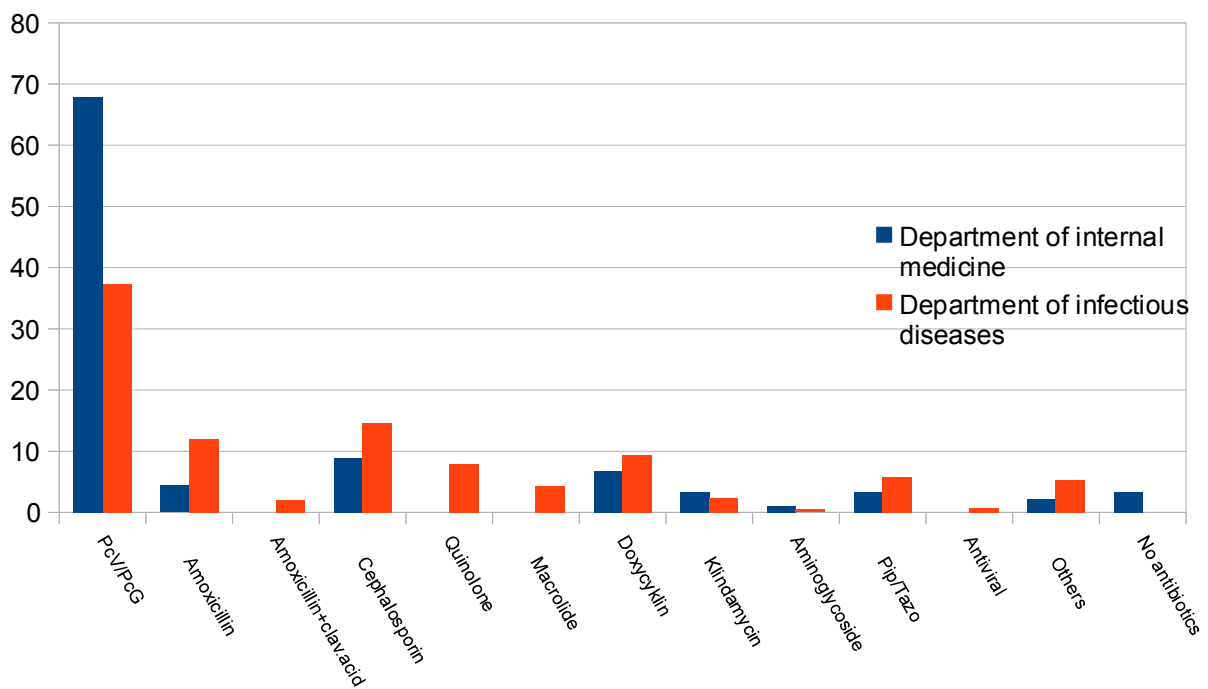


Figure 4. Percentage distribution of antibiotic choice on the third treatment day among patients treated in departments of internal medicine (n=90) and among patients treated in departments of infectious diseases (n=4843)

The final treatment in hospital or at home for the patients who survived (n=91) was distributed as follows for the entire population:

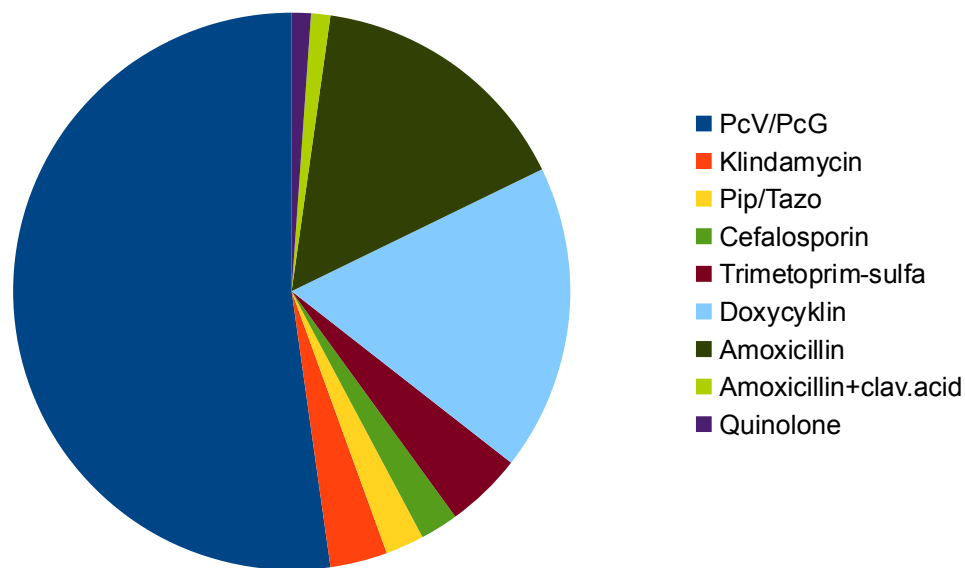


Figure 5. Final antibiotic treatment among surviving patients treated in departments of internal medicine. n=91

51.6 % (45.8 % of men and 58.1 % of women) received PcV, which is a higher number than in the NQPR, where 27.9 % got this final treatment. 2 % were still given cephalosporins, and the corresponding number in the NQPR was 1.3 %.

Use of doxycylin increased from 6.6 % on the third day to 17.6 % as final treatment (20.8 % of men and 14 % of women). 13 % of the patients from the NQPR got doxycylin as final treatment.

Use of amoxicillin increased from 4.4 % on the third day to 15.4 % (12.5 % of men and 18.6 % of women) as final treatment. 21.9 % in the NQPR received amoxicillin as final treatment. Quinolones were more common as final treatment in the NQPR, where 9.1 % got this, compared with only 1 % of the patients treated in departments of internal medicine.

Thus, there was a gender difference as women received more PcV and amoxicillin, and less doxycylin than men received as final treatment.

The following table shows the percentage distribution of final antibiotic choice in departments of internal medicine and departments of infectious diseases:

Departments of internal medicine: (n=91)

Departments of infectious diseases: (n=4843)

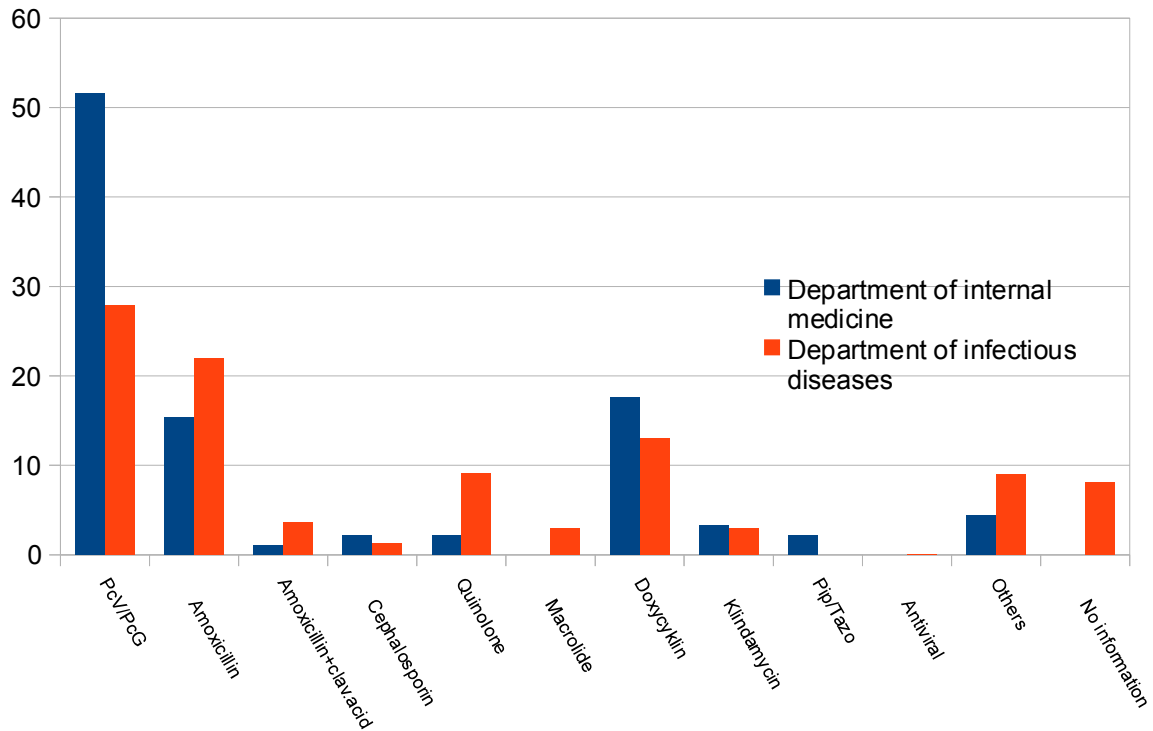


Figure 6. Percentage distribution of final antibiotic treatment among surviving patients treated in departments of internal medicine (n=91) and among patients treated in departments of infectious diseases (n=4843)

The average time for intravenous antibiotic therapy was 3.6 days (4 days for men and 3 days for women) for surviving patients treated in departments of internal medicine.

The total treatment time, including polyclinic treatment, exceeded in most cases the recommended seven days. 82.4 % of the patients who survived got antibiotics 8 days or longer (85.4 % of men and 79.1 % of women).

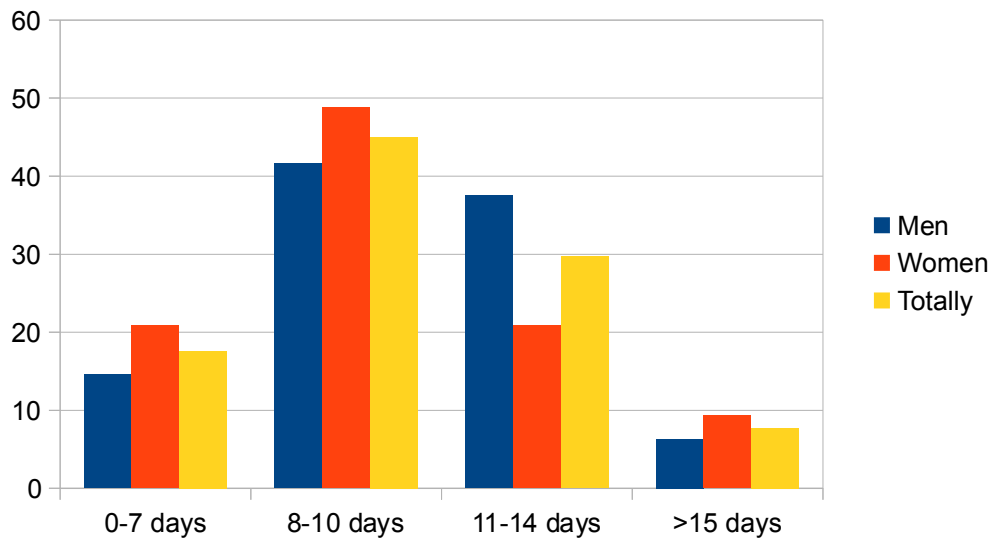


Figure 7. Total treatment time with antibiotics among surviving patients treated in departments of internal medicine. n=91

In the NQPR, 68.4 % got antibiotic treatment 8 days or longer.

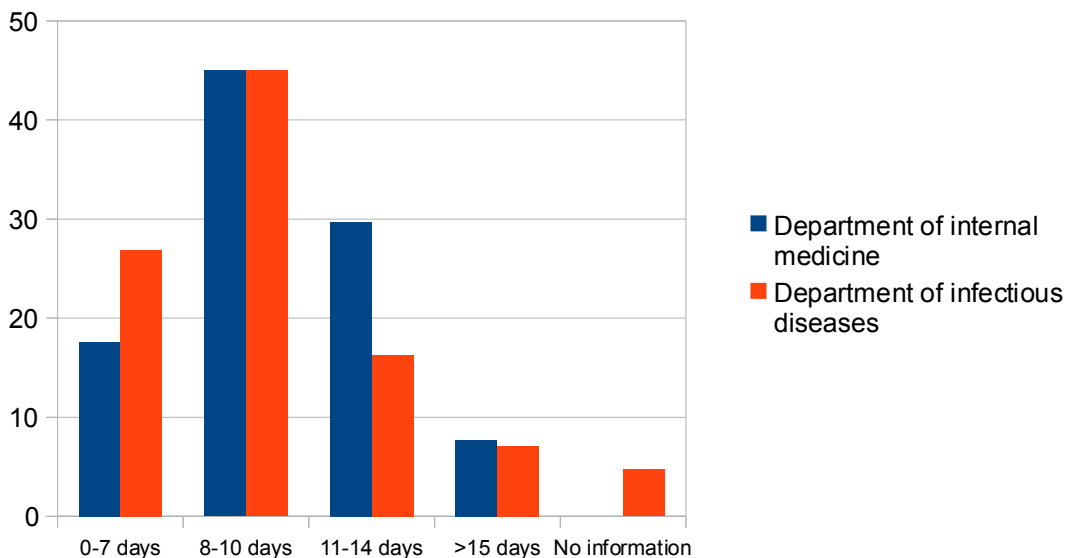


Figure 8. Total treatment time with antibiotics among surviving patients in departments of internal medicine (n=91) and departments of infectious diseases (n=4843)

Other factors that had an impact on the choice of initial antibiotic treatment was oxygen saturation, body temperature, CRP (C-reactive protein detected in blood sample) and co-morbidity.

Table 6. Selection of cephalosporins and PcG/PcV as initial treatment at various levels of oxygen saturation among patients treated in departments of internal medicine with a known oxygen saturation. n=99

Oxygen saturation, %	Cephalosporins	PcG/PcV	Other antibiotics
< 89 n=20	15.0 %	70.0 %	15.0 %
90-95 n=49	10.2 %	51.0 %	38.8 %
96-100 n=30	3.30 %	63.3 %	33.4 %

Table 7. The selection of cephalosporins and PcG/PcV as initial treatment at various levels of body temperature among patients treated in departments of internal medicine with a known body temperature. n=95

Body temperature	Cephalosporins	PcG/PcV	Other antibiotics
< 38.4 n=73	6.85 %	60.3 %	32.9 %
>38.5 n=22	13.6 %	45.5 %	40.9 %

Table 8. The selection of cephalosporins and PcG/PcV as initial treatment at various CRP levels among patients treated in departments of internal medicine. n=100

CRP	Cephalosporins	PcG/PcV	Other antibiotics
< 100 n=51	5.90 %	56.9 %	37.2 %
>101 n=49	10.2 %	59.2 %	30.6 %

The co-morbidity also had an impact on the choice of initial antibiotic treatment.

Table 9. The selection of cephalosporins and PcG/PcV as initial treatment among patients with various types of co-morbidity treated in departments of internal medicine. n=100

Co-morbidity	PcG/PcV	PcG+AG	Cephalosporins	Cephalosporins+AG
Chronic heart disease n=56	55.3 %	16.0 %	7.10 %	3.60 %
Chronic lung disease n=25	50.0 %	23.0 %	7.70 %	7.70 %
Neurological disease n=27	59.3 %	14.8 %	14.8 %	3.70 %
Entire population n=100	58.0 %	16.0 %	8.00 %	2.00 %

6. Discussion and conclusion

6.1 Discussion

There were less patients with severe pneumonia among patients treated in departments of internal medicine than in the NQPR, but it is important to take into account the large number of patients where CRB-65-score could not be calculated. Where the CRB-65-score could not be calculated, no one can know how severely ill the patients actually were.

CRB-65-score were not used at all in the management of patients with suspected pneumonia. This might be because of the informal local procedures, or simply by lack of time. Another explanation could be that the doctors do not consider CRB-65-score as a good enough predictive tool. The CRB-65-score has nevertheless been criticized in some studies.

For example, a spanish study criticizes the method for not taking into account the patients oxygen saturation. The same study also indicates that an age limit of 65 years is not so good, especially among elderly patients, as it means that all elderly patients automatically gets one point for age in the score, regardless how ill they are. The authors conclude that, besides confusion, high respiratory rate and a low blood pressure, oxygen saturation < 90 % and age > 75 years are the best factors for predicting 30-day mortality [4]. Another spanish study concludes that changing the age criteria from 65 years to 75 years is better for predicting 30-day mortality, especially among elderly patients over 65 years. [22]

CRB-65 is however not the only tool that can be used for assessing the severity of pneumonia. Two other methods that are widely used abroad are PSI (Pneumonia Severity Index) and CURB-65. The PSI is primarily used in the US, and was originally developed to identify patients with mild pneumonia that could be treated in primary care. It takes into account both clinical findings, demographic factors such as age and sex, and laboratory findings [23]. It has been criticized for being too complex. CURB-65 is a easier method, that takes into account confusion, urea levels in blood, respiratory rate, blood pressure and age [24]. A chinese study containing 1016 pneumonia patients concludes that all three methods are equally good for assessing the severity of the disease. [25]

None of the methods mentioned above were used, however. When taking into account that CRB-65 is an even easier method, which is based only on clinical findings and do not require any laboratory tests, it is a little remarkable that it is not used more often.

Instead of CRB-65; temperature, oxygen saturation and CRP seemed to be the most important parameters when assessing illness severity and by that choose treatment. This was most evident regarding how many patients who received cephalosporins as initial treatment.

Several research studies has investigated the role of oxygen saturation in the management of patients with community-acquired pneumonia. A british study containing 467 patients examined the importance of oxygen saturation in predicting 30-day mortality and need of intensive care. The conclusion was that a saturation limit of 90 % was best for predicting these serious consequences. [26]

A canadian study containing 2923 patients also concluded that oxygen saturation <90 % was associated with more severe illness and increased 30-day mortality, and suggests 92 % as the best threshold value when assessing pneumonia severity. [27]

Chalmers et al studied the effects of CRP on the assessment of illness severity. The study contained 570 patients with community-acquired pneumonia and they concluded that a low CRP (<100) at time for admission was the most important factor for predicting 30-day mortality, need for ventilation support and/or complications such as abscesses and empyema. They also found that if

the CRP had not decreased with 50 % on the fourth day of illness, there was an increased risk for 30-day mortality, need for ventilation support and complications. The study concluded that a high CRP (>100) was correlated with severe disease, while a low CRP (<100) was not as strongly correlated with mild disease. [28]

Regarding CRP, it is however important to think about *when* the patient seeks medical care. CRP does not rise immediately when the illness starts. If the patient seeks medical care early, the CRP might not have started to rise yet, while other signs of severe illness, such as high body temperature, low oxygen saturation or high respiratory rate, can be present. That means, the physician can assess the illness as severe even though the patient has a low CRP.

If assuming the use of cephalosporins means that the disease was assessed as more severe, a similar result was found in the study in NU-sjukvården. A high CRP (>101) was in fact correlated with a higher incidence of cephalosporin use (see table 8), and the disease was thus more often considered to be severe. A low CRP (<100), however, was not as strongly correlated with the assessment of illness severity. If assuming that use of PcG or PcV means that the disease was assessed as less severe, one could see that the CRP did not have as much impact on the antibiotic choice. PcG and PcV were in fact chosen approximately equally regardless of whether the CRP was high or low.

The choice of only PcV or PcG as initial treatment is not so much influenced by the co-morbidity, but one can see that it was more likely to choose cephalosporins when the patient had an underlying neurological disease (see table 9). When taking into account both cephalosporins and cephalosporins combined with aminoglycoside, it is clear that both neurological disease and chronic lung disease increases the probability of choosing this treatment. When the patient has an underlying chronic lung disease, it is more likely to use aminoglycoside as a supplement to the initial penicillin or cephalosporin treatment.

Mortenson et al studied the causes of death among patients with community-acquired pneumonia, and they concluded that the three most important underlying factors for increased risk of death among these patients was lung cancer, ischemic heart disease and neurological conditions such as cerebro-vascular lesions, amyotrophic lateral sclerosis, Parkinsons disease, myasthenia gravis and multiple sclerosis. [29]

In the study in NU-sjukvården one could see a similar result regarding the underlying neurological diseases. They were more often treated with cephalosporins, assuming this means that the physician assessed the patients as more severe ill and ran a higher risk of dying from their disease. However, one could not see the same result regarding the underlying ischemic heart diseases (in table 9 reported under "chronic heart disease"). These patients did not get cephalosporins more often than the population as a whole. Regarding patients with chronic lung diseases, they received both cephalosporins and PcG/PcV in approximately the same extent as the population as a whole, but the difference was that these patients got added aminoglycoside more often. This can also be a sign that the physician assessed the disease as more severe.

Total antibiotic treatment time is recommended to be 7 days for patients with pneumonia. This was in most cases exceeded. Treatment time were longer in departments of internal medicine than in departments of infectious diseases (see figure 8). It seems like it is common to prescribe a seven day course of peroral antibiotics when the patient is discharged no matter how long the intravenous treatment had lasted. This may be because the number of tablets in the package often are adapted to seven days treatment. Another explanation may be that the physician considers a shorter course of treatment as less effective.

There has, however, been several studies showing that a treatment time of seven day or shorter is

not worse for the patient than a longer treatment time. An American meta-analysis contained in total 2796 patients with community-acquired pneumonia. The patients had received antibiotics for either less than seven days or more than seven days. The researchers concluded there were no difference between the two groups regarding mortality, eradication of bacteria or failure to achieve clinical improvement. [30] A Greek meta-analysis drew the same conclusion; there were no differences in mortality, clinical improvement, adverse events or relapses among the pneumonia patients who got a short antibiotic course compared with the patients who got a longer course. [31]

In the study in NU-sjukvården, one could see that among the patients who received antibiotics for seven days or less, the mortality was lower than among the patients who got antibiotics eight days or more. This applies both to in-hospital mortality and 30-day mortality, as all patients who got the shorter treatment time were alive after 30 days. It is however important to keep in mind that there were only 16 patients in this group, meaning one should be cautious in drawing firm conclusions from this.

Airway cultures were taken far too infrequently in relation to the set target. This might be because it is regarded as difficult to get a good airway sample that is not contaminated with mouth- and pharynx flora. Lack of time can be another explanation. Since it is difficult for the patient to produce a sputum sample, it is sometimes necessary to get help from a physiotherapist who can instruct the patient how he or she should do to produce a good sample. In practice this is often not possible, since patients generally seek medical care at the emergency department where physiotherapists are rarely available.

Another explanation may be that physicians consider the sputum culture has insufficient specificity and sensitivity to influence the treatment. A German study with 116 patients with community-acquired pneumonia concluded that it was difficult to get the sputum culture fast enough before antibiotic treatment was started. Further, only 36 % of the patients were able to produce any sputum at all, and only 9 % of the samples were representative for the lower airways. [32] There were much more airway cultures taken in infection clinics, and this may be because infection staff have a greater habit of taking cultures generally.

In the population treated in departments of internal medicine one could see some gender differences in both investigation and treatment of pneumonia. For example, both blood cultures and airway cultures were taken more frequently among men. Radiology was used more frequently as a diagnostic help among the female patients. It could be interesting to study this more and try to find an explanation to the differences.

6.2 Strengths and weaknesses

The medical records were selected systematic from a list of all patients arranged in chronological order by enrollment date. In this way, the sample reflected the distribution of patients during the year.

All patients, regardless sex, age or co-morbidity, had the same chance to be selected for the study. Thus, the sample reflects the whole population.

Since there were only 100 records in the study, it is important to be cautious in making conclusions about percentage differences in treatment. Especially when a kind of antibiotics is given to only a couple of patients, there will be big percentage differences if treatment is changed for one patient.

Information to count the CRB-65-score were often missing, and therefore it was not possible to divide the material into two groups and present patients with mild and severe pneumonia separately.

6.3 Conclusions

The target to count and note CRB-65-score for at least 50 % of the patients at time for enrollment was not achieved neither in departments of internal medicine nor in departments of infectious diseases, but there was a higher rate among the latter.

The target to take airway cultures from all patients with suspected pneumonia was not achieved in departments of internal medicine, and there were fewer airway cultures taken in these departments compared with departments of infectious diseases.

Blood cultures were also less in departments of internal medicine than in departments of infectious diseases, and the target to take blood cultures from all patients was not really achieved.

PcV or PcG was given alone or combined with aminoglycoside as initial treatment for 74 % of the patients in departments of internal medicine, regardless the CRB65-score. Thus, the target to treat at least 75 % with these antibiotics was almost achieved. The departments of internal medicine used more PcV/PcG than departments of infectious diseases.

7. Populärvetenskaplig sammanfattning

Lunginflammation är en vanlig sjukdom som förr i tiden ofta kunde leda till döden, men som nu för tiden ofta kan behandlas framgångsrikt med antibiotika. I takt med att användningen av antibiotika har ökat har vissa typer av bakterier utvecklat motståndskraft, så kallad resistens, mot en del typer av antibiotika. För att motverka resistensutvecklingen är det viktigt att använda rätt sorts antibiotika. Ett bra sätt att välja rätt antibiotika är att fastställa vilken typ av bakterie som orsakat sjukdomen. Detta kan göras genom att ta odlingar från exempelvis blod och luftvägar.

Svenska infektionsläkarföreningen har satt upp ett antal mål gällande vården av de patienter som vårdas inläggande för lunginflammation på sjukhusens infektionskliniker. Målen innebär att alla patienter ska blododlas och minst 75 % ska luftvägsodlas. Vidare ska man använda hjälpmedlet CRB-65 när man väljer antibiotika. CRB-65 är ett snabbt sätt att bedöma hur allvarligt sjuk patienten är, och därmed vilken antibiotika som bör väljas i första hand. CRB-65 tar hänsyn till patientens ålder, blodtryck, andningsfrekvens och ifall akut förvirring föreligger. Patienter som har låga poäng på CRB-65 anses inte vara allvarligt sjuka och skall behandlas med vanligt penicillin i första hand. Vanligt penicillin innebär endast en liten risk för resistensutveckling.

De flesta patienter som vårdas på sjukhus för lunginflammation vårdas dock inte på infektionskliniker utan på medicinkliniker. Det är därför intressant att undersöka i vilken utsträckning Infektionsläkarföreningens mål nås på medicinkliniker.

I den här studien har vi granskat 100 journaler från patienter som vårdades för lunginflammation på medicinklinik i NU-sjukvården (NÄL och Uddevalla sjukhus) 2012 och jämfört med data ur Infektionsläkarföreningens nationella register över patienter som vårdats för lunginflammation på infektionskliniker.

Studien visar att CRB-65 inte användes alls på medicinklinik. Det togs lite mindre blododlingar och mycket mindre luftvägsodlingar på medicinklinik än på infektionsklinik. Däremot var det en större andel av patienterna på medicinklinik som behandlades med vanligt penicillin.

8. Acknowledgements

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Appendix

Journalgranskningsmall

Mall för journalgranskning av utskrivna patienter med samhällsförvärd pneumoni enligt ICD10-diagnoserna J13-J18 (oavsett fjärde position). Pneumoni ska vara antingen huvuddiagnos, eller bidiagnos till bakteriemi (A40,A41 eller A49)

Löpnummer _____

Födelseår _____

Kön _____

ICD-10 diagnos _____

Antal vård dagar (Påbörjad dag=1dag,inskrivningsdag=1dag, utskrivningsdag=1dag, minus permission) _____

Avliden under vårdtiden JA NEJ

Avliden inom 30 dagar från och med inläggningsdag JA NEJ

Bakomliggande sjukdomar, enligt journal från vårdtillfället

Kronisk hjärtsjukdom (Hjärtsvikt, ischemisk hjärtsjukdom) JA NEJ

Kronisk lungsjukdom (måttlig-svår KOL/Astma eller dylikt) JA NEJ

Neurologisk sjukdom JA NEJ

Kronisk njursvikt JA NEJ

Aktiv tumörsjukdom JA NEJ

Immunkomprometterande sjukdom JA NEJ

(aktiv tumörsjukdom, HIV, Immunosuppressiv behandling)

Rökare JA NEJ OKÄNT

Finns uppgift om rökning i inskrivningsjournalen JA NEJ

Misstanke om pneumoni vid inläggningen, enligt inskrivningsjournalen

Primär inläggningsdiagnos En av flera differentialdiagnoser Pneumoni omnämns ej

CRB-65 vid ankomst till sjukhus (första värdet inom 24 h)

C: nytillkommen konfusion eller sänkt medvetandegrad JA NEJ EJ REGISTRERAD

R: respiration \geq 30/min JA NEJ EJ REGISTRERAD

B: blodtryck, systoliskt <90 mmHg eller diastoliskt \leq 60 mmHg JA NEJ EJ REGISTRERAD

Summa CRB-65 vid ankomst (0-4) 0 1 2 3 4 KAN EJ BERÄKNAS

Nämns CRB-65 poäng i inskrivningsjournalen? JA NEJ

Syrgasmättnad tagen vid ankomst? (ingår ej i CRB-65) JA NEJ

Syrgasmättnad mätvärde (första tagna värdet) _____

Infektionsparametrar

Kroppstemperatur tagen JA NEJ

Om ja, temperatur mätvärde (första tagna värdet)_____

CRP tagen JA NEJ

Om ja, CRP mätvärde (första tagna värdet)_____

LPK tagen JA NEJ

Om ja, LPK mätvärde (första taget värdet)_____

Infektionskonsult

Kontakt med infektionskonsult JA NEJ

Om ja, ange typ av konsultation TELEFON BESÖK

Lungröntgen

Är lungröntgen utförd? JA NEJ

Vilken typ av lungröntgen är utförd ?_____

Tolkar radiologen bilden som en pneumoni? JA NEJ

Tolkar klinikern bilden som en pneumoni? JA NEJ GÅR EJ ATT BEDÖMA

Diagnostik och Etiologi

Blododling tagen JA NEJ

Luftvägsodling på sputum tagen JA NEJ

Luftvägsodling på nasofarynxsekret tagen JA NEJ

Luftvägsodling BAL/skyddad borste tagen JA NEJ

PCR för luftvägsagens JA NEJ

PCR för Mycoplasma JA NEJ

PCR för Legionella JA NEJ

PCR för Virus JA NEJ

Pneumokockantigen i urin JA NEJ

Legionellaantigen i urin JA NEJ

Mikrobiologiskt agens påvisat? JA NEJ

Om ja, ange :

Pneumokocker H. influenzae Mykoplasma C. pneumoniae Legionella

S. aureus Annan bakterie Influensavirus Annat virus

Hur ställdes den etiologiska diagnosen (ett eller flera val)?

Blododling Luftvägsodling (sputum) Luftvägsodling (nasopharynx)

Luftvägsodling (BAL/borste) PCR Urinantigen Serologi Annat

Pågående antibiotikabehandling vid ankomst till sjukhus JA NEJ

Initialt antibiotikaval på sjukhuset (ett eller flera val)

Penicillin V eller G Amoxicillin Amoxi/Clav

Cefalosporin Kinolon Makrolid

Doxycyklin Klindamycin Aminoglykosid

Pip/tazo Karbapenem Övrig antibiotika

Antiviral beh. mot influensa Ingen antibiotika

Antibiotikaval dag 3 på sjukhuset (ett eller flera val)

Penicillin V eller G Amoxicillin Amoxi/Clav

Cefalosporin Kinolon Makrolid

Doxycyklin Klindamycin Aminoglykosid

Pip/tazo Karbapenem Övrig antibiotika

Antiviral beh. mot influensa Ingen antibiotika

Utskriven med/avslutande antibiotikabehandling:

Penicillin V eller G Amoxicillin Amoxi/Clav

