Egyptian Journal of Chest Diseases and Tuberculosis (2016) 65, 143–155

HOSTED BY

The Egyptian Society of Chest Diseases and Tuberculosis

Egyptian Journal of Chest Diseases and Tuberculosis

www.elsevier.com/locate/ejcdt
www.sciencedirect.com

ORIGINAL ARTICLE

# Study of prescription patterns of antibiotics in treating lower respiratory tract infections at Sohag Chest Hospital

**Mona M. Ahmed** [a,1], **Ashraf A. ELMaraghy** [a,*], **Engy W. Andrawas** [b,2]

[a] *Chest Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt*
[b] *Sohag Chest Hospital, Sohag, Egypt*

Received 27 February 2015; accepted 26 April 2015
Available online 23 June 2015

**KEYWORDS**

Lower respiratory tract infections;
Antibiotics;
Sohag Chest Hospital

**Abstract** *Background:* Most people will develop an acute respiratory tract infection (RTI) every year. RTIs are also the commonest acute problem dealt with in primary care – the 'bread and butter' of daily practice. Management of acute RTIs in the past concentrated on advising prompt antibiotic treatment of presumptive bacterial infections.

*Objective:* To study the prescription patterns of antibiotics in treating lower respiratory tract infections at Sohag Chest Hospital.

*Patients and methods:* This study included 50 adult in-patients with lower respiratory tract infections admitted at Sohag Chest Hospital and 20 chest physicians working at the same hospital. The study depended upon collecting data from a questionnaire directed to the chest physicians. The 50 patients were subjected to full medical history and examination, chest X-rays and antibiotics received as regards the route of administration, duration of treatment and possible switch therapy.

*Results:* Forty percent of the physicians considered text books and thirty percent of the physicians considered pharmaceutical companies as a main source of information about antibiotics. Ninety-five percent of physicians used to prescribe AB empirically. Sixty percent of physicians considered their own experience as a reference for empirical AB prescription. Almost all of the physicians considered the presence of co-morbid diseases during AB prescription. Eighty percent of physicians considered the severity of infection as the most important factor affecting the route of AB administration. The results also showed that forty-five percent of physicians considered quinolones as the most common AB prescribed for empirical therapy. Fifty percent of physicians considered the 4–7 day duration for empirical therapy. Sixty-five percent of physicians considered improvement of general condition as the most important factor in determining the efficacy of

* Corresponding author. Mobile: +20 1001770702.
E-mail addresses: tarerkabdo@hotmail.com (M.M. Ahmed), ashrafelmaraghy@yahoo.com (A.A. ELMaraghy), engywahby@yahoo.com (E.W. Andrawas).
[1] Mobile: +20 123983481.
[2] Mobile: +20 1223852229.

Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

http://dx.doi.org/10.1016/j.ejcdt.2015.04.012

AB prescribed. Forty percent of physicians considered 2–3 day duration was enough to assess the efficacy of AB prescribed. Fifty percent of physicians included in the study changed the AB group in case the prescribed AB was ineffective. The study showed that a majority of physicians used to make sure that the prescribed AB was the one actually given to the patient. Most of the physicians used to ask the patient before prescribing the AB if he was sensitive to a certain AB. Seventy-five percent of physicians used to ask the patient about AB history in the last 3 months. As regards fifty percent of physicians, their AB prescription decision might be sometimes affected by the patient.

*Conclusions:* AB prescription practices need to be well evaluated in order to formulate an acceptable rationale aiming at improving the global situation of antibiotic use. Many points have to be taken into consideration such as increasing awareness of physicians about different widely accepted guidelines.



## Introduction

Antibiotics are of the oldest discovered drugs that combat specific micro organisms like bacteria and fungi. Although there are several classification schemes for antibiotics, based on bacterial spectrum (broad vs. narrow) or route of administration (injectable vs. oral vs. topical), or type of activity (bactericidal vs. bacteriostatic), the most useful is based on the chemical structure. Antibiotics within a structural class will generally show similar patterns of effectiveness, toxicity and allergic potential [1].

Antibiotics are the most frequently prescribed drugs among hospitalized patients and there are reported concerns about the continuous indiscriminate and excessive use of antimicrobial agents that promote the emergence of antibiotic-resistant organisms [2].

The global spread of antimicrobial resistance has become a pressing problem, with a focus on the ICU due to the increasing administration of ineffective antimicrobial regimens associated with greater morbidity and mortality [3].

Antibiotics are often thought to be the first line treatment in lower respiratory tract infections; however, these are not indicated in viral infections. It is important to use an appropriate antibiotic selection based on the infecting organism and to ensure this therapy changes with the evolving nature of these infections and the emerging resistance to conventional therapies [4].

There are a number of acute and chronic infections that can affect the lower respiratory tract. The two most common infections are bronchitis and pneumonia [5].

Acute respiratory infections (ARIs) are common and cause significant morbidity and contribute significantly to the overall disease load on the community [6].

In addition to their important social impact, ARIs are frequent causes of medical care and consumption of antibiotics [7].

## Patients and methods

This study included 50 adult in-patients with lower respiratory tract infections admitted at Sohag Chest Hospital and 20 chest physicians working at the same hospital.

The study depended upon collecting data from:

*First questionnaire*

Directed to 20 chest physicians working at Sohag Chest Hospital:

1. What is your medical education?

☐MB.,B.Ch ☐Diploma ☐Master

2. Years of experience:

☐ < 5 years ☐6–10 years ☐11–15 years
☐16–20 years ☐21 years

3. Do you frequently deal with patients with lower respiratory tract infections?

☐Yes ☐No

4. If yes → Number of patients with LRTIS/week?

☐1–5 ☐6–10 ☐ >11

5. Most frequent LRTIS you deal with: (please number them in a descending manner)

☐COPD, AIE ☐CAP ☐HAP ☐Bronchiectasis ☐IPF, AIE ☐Others (please state)

6. Main source of your information about antibiotics (ABs):

☐Text Book ☐Internet ☐Pharmaceutical companies ☐Medical journals ☐Lectures

7. In case you prescribe Abs, this is usually:

☐Empirical ☐According to culture and sensitivity

8. If empirical → it's according to what?

☐Own experience ☐International guidelines ☐National guidelines ☐Local guidelines

9. Does the presence of co-morbid disease affect your AB prescription?

☐Yes ☐No

10. What is the most frequent co-morbid disease you see with LRTIs? (Please number them in a descending order)

☐Chronic lung diseases ☐DM ☐Hypertension
☐Cardiac diseases ☐Liver diseases ☐Renal diseases
☐Alcoholism ☐Malignancies ☐Cerebrovascular diseases
☐Other (please state)

11. Decision of AB selection is usually according to:(you can choose more than one)

☐Site of infection ☐Presence of co-morbidities
☐Severity of infection ☐Price of ABs
☐Efficacy of Abs ☐Availability of ABs
☐Age of the patient ☐AB side effects

12. Route of AB administration is usually according to:

☐Severity of infection ☐Availability of ABs
☐Cost of AB ☐Site of care

13. What is the most frequently prescribed AB for empirical therapy for LRTIs?

☐Broad spectrum penicillin ☐Aminoglycosides
☐Antipseudomonal penicillin ☐Macrolides
☐Macrolides
☐Cephalosporin ☐Clindamycin
☐Quinolones ☐Tetracyclines
☐Carbapenems ☐-Others (please state)

14. How long is the period of empirical therapy you give to your patients with LRTIs?

☐1–3 days ☐7–10 days
☐4–7 days ☐ > 10 days

15. What is the most frequently modified AB based on culture?

☐Broad spectrum penicillin ☐Aminoglycosides
☐Antipseudomonal penicillin ☐Macrolides
☐Cephalosporin ☐Clindamycin
☐Quinolones ☐Tetracyclines
☐Carbapenems ☐Others (please state)

16. What is the most frequently prescribed AB for CAP?

☐Broad spectrum penicillin ☐Aminoglycosides
☐Antipseudomonal penicillin ☐Macrolides
☐Cephalosporin ☐Clindamycin
☐Quinolones ☐Tetracyclines
☐Carbapenems ☐Others (please state)

17. What is the most frequently prescribed AB for HAP?

☐Broad spectrum penicillin ☐Aminoglycosides
☐Antipseudomonal penicillin ☐Macrolides
☐Cephalosporin ☐Clindamycin
☐Quinolones ☐Tetracyclines
☐Carbapenems ☐Others (please state)

18. What is the most frequently prescribed AB for COPD, AIE?

☐Broad spectrum penicillin ☐Aminoglycosides
☐Antipseudomonal penicillin ☐Macrolides
☐Cephalosporin ☐Clindamycin
☐Quinolones ☐Tetracyclines
☐Carbapenems ☐Others (please state)

19. Decision of AB prescription is usually based on:

☐A-Clinical condition.
☐B-Lab (leucocytosis-CRP-Sputum for gram)
☐C-Radiological data.
☐A + B
☐B + C
☐A + C
☐A + B + C

20. If the decision of AB prescription is based on clinical assessment, the most important symptom is:

☐Fever ☐Amount of sputum ☐Dyspnea
☐Purulence of sputum ☐Other (please state)

21. If the decision of AB prescription is based on lab data, the most important is:

☐Leucocytosis ☐CRP ☐ESR
☐Sputum gram stain ☐Sputum C&S

22. How do you usually judge the efficacy of AB prescribed?

☐Improvement of general condition
☐Decrease of white blood count
☐Change of sputum character (↓ volume & ↓ purulence)

23. Duration after which you decide that the prescribed AB is ineffective:

☐ < 2days ☐2-3days
☐3-5days ☐ > 5days

24. In case you judge that prescribed AB is ineffective you usually:

☐Change AB group ☐Change AB dose
☐Order C&S examination of sputum ☐Revise the diagnosis

25. Do you usually make sure that the AB prescribed is that the one actually given to the patient?

☐Yes ☐No

26. Do you ask the patient about AB history in the last 3 months?

☐Yes ☐No

27. Does the patient sometimes influence your AB prescription decision?

☐Yes ☐No

28. Do you ask the patient before prescribing the AB if he is sensitive to certain AB?

☐Yes ☐No

COPD, AIE = Chronic Obstructive Pulmonary Disease, Acute Infective Exacerbation; CAP = Community Acquired Pneumonia; HAP = Hospital Acquired Pneumonia; IPF, AIE = Interstitial Pulmonary Fibrosis, Acute Infective Exacerbation; LRTIs = Lower Respiratory Tract Infections [8].

The 50 patients were subjected to the following:

1. Full medical history and examination.
2. Chest "X" ray.
3. Antibiotics received:

- Antibiotics prescribed on admission.
- Route of AB administration.
- Duration of ABs given.
- If there is switch from parenteral to oral therapy.
- If there is change of ABs group or not.
- If yes → which group? Duration and cause of such change.

*Statistical methodology*

The statistics of this thesis was done using the *IBM-SPSS* software (version 19) and *Microsoft EXEL* (version2013).

Quantitative data were expressed as mean ± SD, and qualitative data were expressed as number and percentages.

As this study is descriptive, no analytical statistics were needed.

## Results

*Patients*

Table 1 shows that 32 patients (64%) were males, while 18 (36%) were females.

Table 2 shows that the age group of the patients included in the study ranged from 21 years to 80 years, with a mean 56.78 years ±12.989 (see Fig. 1).

Table 3 shows that 15 patients (30%) were ex-smokers, never smoking were 13 (26%), 9 (18%) were current cigarette smokers, 9 (18%) were Shisha and Goza smokers and 4 (8%) were passive smokers.

Seventy-six percent (76%) of the patients included in the study had no history of taking antibiotics 3 months before admission, while (24%) of patients had such history.

Table 4 shows that the most common clinical symptom in the studied cases was cough and expectoration in 47 patients

**Table 1** Sex distribution.

| | Number | Percent |
|---|---|---|
| Female | 18 | 36.0 |
| Male | 32 | 64.0 |
| Total | 50 | 100.0 |

**Table 2** Age description.

| | |
|---|---|
| Mean | 56.78 |
| Median | 57.00 |
| Std. Deviation | 12.989 |
| Minimum | 21 |
| Maximum | 80 |

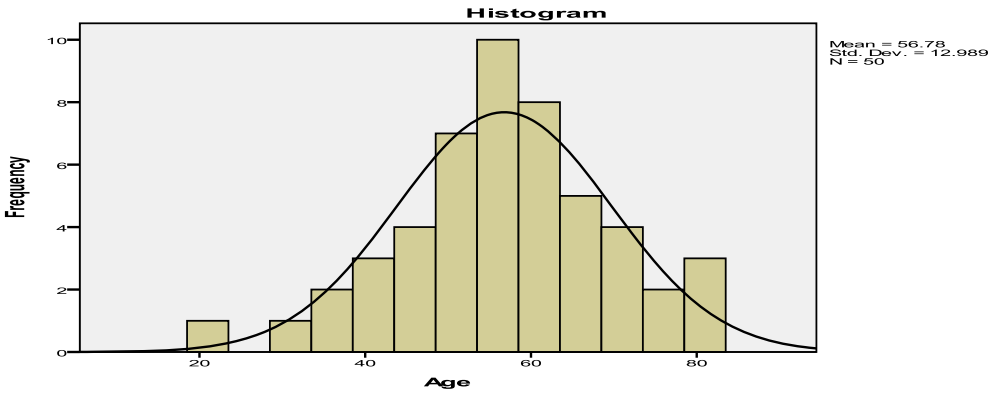


**Figure 1** Age description.

**Table 3** Special habits.

| | Number | Percent |
|---|---|---|
| Never smoking | 13 | 26.0 |
| Passive smoking | 4 | 8.0 |
| Ex-smoker | 15 | 30.0 |
| Current cigarette smoking | 9 | 18.0 |
| Shisha and Goza | 9 | 18.0 |
| Total | 50 | 100.0 |

**Table 4** Clinical manifestations.

| Variable | Yes | | No | |
|---|---|---|---|---|
| | No. | Percent | No. | Percent |
| Fever | 26 | 52 | 24 | 48 |
| Cough/expectoration | 47 | 94 | 3 | 6 |
| Haemoptysis | 10 | 20 | 40 | 80 |
| Worsening of dyspnea | 34 | 68 | 16 | 32 |
| Co-morbid diseases | 10 | 20 | 40 | 80 |
| Increased temperature | 24 | 48 | 26 | 52 |
| High respiratory rate | 26 | 52 | 24 | 48 |
| Antibiotics in the last 3 months | 12 | 24 | 38 | 76 |
| Consolidation | 12 | 24 | 38 | 76 |
| Sonorous ronchi | 40 | 80 | 10 | 20 |
| Coarse crepitations | 26 | 52 | 24 | 48 |

**Table 5** Chest X-ray findings.

| | Number | Percent |
|---|---|---|
| Normal | 19 | 38.0 |
| Patchy opacity | 12 | 24.0 |
| Hyper-inflation | 15 | 30.0 |
| Bronchiectatic changes | 4 | 8.0 |
| Total | 50 | 100.0 |

(94%), followed by worsening of dyspnea in 34 patients (68%), fever in 26 patients (52%) and haemoptysis in 10 patients (20%). As regards the clinical signs, sonorous ronchi were heard in 40 patients (80%), coarse crepitations in 26 patients (52%) and signs of consolidation were found in 12 patients (24%).

Table 5 shows that 19 (38%) of chest X-rays included in the study were normal, 15 (30%) of them showed hyper-inflation, 12 (24%) of them showed patchy opacity and 4 (8%) of them showed bronchiectatic changes.

**Table 6** Diagnosis of patients.

| | Number | Percent |
|---|---|---|
| Community-acquired pneumonia | 12 | 24.0 |
| COPD, AE | 34 | 68.0 |
| Bronchiectasis | 4 | 8.0 |
| Total | 50 | 100.0 |

**Table 7** Antibiotics prescribed on admission.

| | Number | Percent |
|---|---|---|
| Broad spectrum penicillins and cephalosporins | 16 | 32.0 |
| Cephalosporins | 21 | 42.0 |
| Cephalosporins and macrolides | 3 | 6.0 |
| Broad spectrum penicillins and aminoglycosides | 6 | 12.0 |
| Broad spectrum penicillins, aminoglycosides and metronidazole | 2 | 4.0 |
| Cephalosporins and metronidazole | 2 | 4.0 |
| Total | 50 | 100.0 |

**Table 8** Route of antibiotic administration.

| | Number | Percent |
|---|---|---|
| Parenteral | 41 | 82.0 |
| Oral and parenteral | 9 | 18.0 |
| Total | 50 | 100.0 |

Table 6 shows that the majority of patients included in the study had COPD, AE 34 (68%), 12 (24%) had CAP and 4 (8%) of them had bronchiectasis.

Table 7 shows that the majority of patients included in the study received cephalosporins (42%), combination of broad spectrum penicillins and cephalosporins (32%), combination of broad spectrum penicillins and aminoglycosides (12%), and combination of macrolides and cephalosporins (6%) on admission.

Table 8 shows that the patients included in the study (82%) received the AB prescribed on admission via parenteral route, while only (18%) via oral and parenteral routes.

**Table 9** Duration of antibiotic therapy on admission.

| | Number | Percent |
|---|---|---|
| 5 days | 30 | 60.0 |
| 7 days | 15 | 30.0 |
| 10 days | 5 | 10.0 |
| Total | 50 | 100.0 |

**Table 10** Change of AB group.

| | Number | Percent |
|---|---|---|
| No | 49 | 98.0 |
| Yes | 1 | 2.0 |
| Total | 50 | 100.0 |

Table 9 shows that most of the patients included in the study received the AB prescribed on admission for 5 days (60%), followed by 7 days (30%) and 10 days (10%).

Table 10 shows that the AB group prescribed on admission was changed only in (2%) of the patients, while in (98%) of them, no change was done. This case changed antibiotics to cephalosporins for (5) days and quinolones for (10) days because there was no complete clinical improvement and the appearance of another patch in the chest X-ray.

**Doctors**

Table 11 shows that (25%) of the physicians included in the study had master's degree, (50%) had diploma, (25%) had M.B., B.Ch.

Table 12 shows that(55%) of the physicians included in the study had 6–10 years of experience, (25%) of them had 21 years of experience, (10%) of them had 11–15 years of experience and (10%) of them had < 5 years of experience

*Do you frequently deal with patients with lower respiratory tract infections?*

All doctors answered with (Yes)

**Table 11** What is your medical education?

| | Frequency | Percent |
|---|---|---|
| M.B., B.Ch | 5 | 25.0 |
| Diploma | 10 | 50.0 |
| Master | 5 | 25.0 |
| Total | 20 | 100.0 |

**Table 12** Years of Experience.

| | Frequency | Percent |
|---|---|---|
| < 5 years | 2 | 10.0 |
| 6–10 years | 11 | 55.0 |
| 11–15 years | 2 | 10.0 |
| 21 years | 5 | 25.0 |
| Total | 20 | 100.0 |

**Table 13** Number of patients with LRTIS/week?

| | Frequency | Percent |
|---|---|---|
| 1–5 | 1 | 5.0 |
| 6–10 | 2 | 10.0 |
| > 11 | 17 | 85.0 |
| Total | 20 | 100.0 |

Table 13 shows that the majority of physicians (85%) included in the study dealt with more than 11 patients with LRTIS per week, (10%) of them dealt with 6–11 patients with LRTIS per week, (5%) of them dealt with 1–5 patients with LRTIS per week.

Table 14 shows that 40% of the physicians included in the study depended on text books, 30% of them depended on pharmaceutical companies, and 20% on lectures, while 5% depended on the internet and 5% on medical journals as a main source of information about antibiotics.

**Table 14** Main source of your information about antibiotics (ABs).

| | Frequency | Percent |
|---|---|---|
| Textbooks | 8 | 40.0 |
| Internet | 1 | 5.0 |
| Pharmaceutical companies | 6 | 30.0 |
| Medical journals | 1 | 5.0 |
| Lectures | 4 | 20.0 |
| Total | 20 | 100.0 |

**Table 15** In case you prescribe ABS, this is usually:

| | Frequency | Percent |
|---|---|---|
| Empirical | 19 | 95.0 |
| According to culture and sensitivity | 1 | 5.0 |
| Total | 20 | 100.0 |

**Table 16** If empirical, it's according to what?

| | Frequency | Percent |
|---|---|---|
| Own experience | 14 | 70.0 |
| International guidelines | 4 | 20.0 |
| National guidelines | 2 | 10.0 |
| Total | 20 | 100.0 |

**Table 17** Route of AB administration is usually according to:

| | Frequency | Percent |
|---|---|---|
| Severity of infection | 16 | 80.0 |
| Availability of Abs | 2 | 10.0 |
| Cost of AB | 1 | 5.0 |
| Site of care | 1 | 5.0 |
| Total | 20 | 100.0 |

Table 15 shows that almost all physicians included in the study (95%) used to prescribe AB empirically, while only 5% of them used to prescribe AB according to culture and sensitivity.

Table 16 shows that own experience as a reference for empirical AB prescription was 70%, followed by international guidelines (20%), while the national guidelines was 10%.

*Does the presence of co-morbid disease affect your AB prescription?*

All doctors answered with (Yes).

Table 17 shows that the route of AB administration is usually according to severity of infection (80%), followed by availability of Abs (10%), then site of care (5%) and cost of AB (5%).

Table 18 shows that quinolones were the most common ABs prescribed for empirical therapy (45%), followed by broad spectrum penicillins (25%), cephalosporins (10%), broad spectrum penicillins and aminoglycosides (5%), amoxicillin and clavulanic acid (5%), broad spectrum penicillins and cephalosporins (5%), and quinolones and macrolides (5%).

**Table 18** What is the most frequently prescribed AB for empirical therapy for LRTIs?

| | Frequency | Percent |
|---|---|---|
| Broad spectrum penicillins | 5 | 25.0 |
| Cephalosporins | 2 | 10.0 |
| Quinolones | 9 | 45.0 |
| Amoxicillin and clavulanic acid | 1 | 5.0 |
| Broad spectrum penicillins + aminoglycosides | 1 | 5.0 |
| Broad spectrum penicillins + cephalosporins | 1 | 5.0 |
| Quinolones and macrolides | 1 | 5.0 |
| Total | 20 | 100.0 |

**Table 19** How long is the period of empirical therapy you give to your patients with LRTIs?

| | Frequency | Percent |
|---|---|---|
| 4–7 days | 10 | 50.0 |
| 7–10 days | 10 | 50.0 |
| Total | 20 | 100.0 |

**Table 20** What is the most frequently modified AB based on culture?

| | Frequency | Percent |
|---|---|---|
| Cephalosporins | 3 | 15.0 |
| Quinolones | 6 | 30.0 |
| Carbapenems | 1 | 5.0 |
| Missing | 10 | 50.0 |
| Total | 20 | 100.0 |

Missing system = 10 physicians refusing answering this question.

Table 19 shows that 50% of the physicians included in the study preferred 4–7 days as durations for empirical therapy and the other 50% preferred 7–10 days.

Regarding the most frequently modified AB based on culture, Table 20 shows that Quinolones were 30%, followed by cephalosporins 15%, and carbapenems at about 5%.

Table 21 shows that quinolones were the most frequently prescribed ABs for CAP (65%), followed by cephalosporins (20%), and broad spectrum penicillins (15%).

Table 22 shows that quinolones were the most frequently prescribed ABs for HAP (40%), followed by cephalosporins (20%), and aminoglycosides (5%).

Table 23 shows that quinolones were the most frequently prescribed ABs for COPD, AE (70%), followed by broad spectrum penicillins (10%) cephalosporins (10%), tetracyclines (5%) and amoxicillin and clavulanic acid (5%).

Table 24 shows that the majority of physicians included in the study (55%) depended on clinical and radiological findings for AB prescription, 25% depended on clinical, radiological findings and laboratory data, 15% depended on clinical condition only, and 5% depended on radiological findings only.

Regarding the most important symptom when AB prescription was based on clinical assessment, purulence of sputum represented 55%, fever represented 30%, while progression of dyspnea represented 15% (see Table 25).

**Table 21** What is the most frequently prescribed AB for CAP?

| | Frequency | Percent |
|---|---|---|
| Broad spectrum penicillins | 3 | 15.0 |
| Cephalosporins | 4 | 20.0 |
| Quinolones | 13 | 65.0 |
| Total | 20 | 100.0 |

**Table 22** What is the most frequently prescribed AB for HAP?

| | Frequency | Percent |
|---|---|---|
| Aminoglycosides | 1 | 5.0 |
| Cephalosporins | 4 | 20.0 |
| Quinolones | 8 | 40.0 |
| Missing | 7 | 35.0 |
| Total | 20 | 100.0 |

Missing system = 7 physicians (35%) refusing answering this question

**Table 23** What is the most frequently prescribed AB for COPD?

| | Frequency | Percent |
|---|---|---|
| Broad spectrum penicillins | 2 | 10.0 |
| Cephalosporins | 2 | 10.0 |
| Quinolones | 14 | 70.0 |
| Tetracyclines | 1 | 5.0 |
| Other(amoxicillin and clavulanic acid) | 1 | 5.0 |
| Total | 20 | 100.0 |

**Table 24** Decision of AB prescription is usually based on:

| | Frequency | Percent |
|---|---|---|
| Clinical condition | 3 | 15.0 |
| Radiological data | 1 | 5.0 |
| Clinical condition + radiological data | 11 | 55.0 |
| Clinical condition + laboratory data + radiological data | 5 | 25.0 |
| Total | 20 | 100.0 |

**Table 25** If the decision of AB prescription is based on clinical assessment, the most important symptom is:

| | Frequency | Percent |
|---|---|---|
| Fever | 6 | 30.0 |
| Progression of dyspnea | 3 | 15.0 |
| Purulence of sputum | 11 | 55.0 |
| Total | 20 | 100.0 |

**Table 26** If the decision of AB prescription is based on lab data, the most important is:

| | Frequency | Percent |
|---|---|---|
| Leucocytosis | 1 | 5.0 |
| ESR | 2 | 10.0 |
| Sputum gram stain | 4 | 20.0 |
| Sputum C&S | 13 | 65.0 |
| Total | 20 | 100.0 |

Regarding the most important laboratory finding if AB prescription was based on laboratory data, sputum culture and sensitivity represented 65%, sputum gram stain 20%, and ESR 10%, while leucocytosis represented 5% (see Table 26).

Table 27 shows that 65% of the physicians included in the study considered improvement of general condition as the most important factor in determining the efficacy of AB prescribed, 30% considered change of sputum character, while 5% considered decrease of white blood cells count.

Table 28 shows that 40% of the physicians included in the study decided that the prescribed AB was ineffective after 2–3 day duration, 30% after 3–5 day duration, while 30% after more than 5 day duration.

50% of the physicians included in the study changed the AB group, 30% ordered sputum culture and sensitivity and 20% revised the diagnosis in case the prescribed AB was ineffective (see Table 29).

The majority of the physicians included in the study 85% used to make sure that the prescribed AB was the one actually given to the patient, while 15% of them did not (see Table 30).

75% of the physicians included in the study used to ask the patient about AB history in the last 3 months, while 25% of them did not (see Table 31).

As regards 50% of the physicians included in the study, their AB prescription decision might be sometimes affected by the patient and for the other 50%, their AB prescription decision was not affected (see Table 32).

**Table 27** How do you usually judge the efficacy of AB prescribed?

| | Frequency | Percent |
|---|---|---|
| Improvement of general condition | 13 | 65.0 |
| Decrease of white blood count | 1 | 5.0 |
| Change of sputum character | 6 | 30.0 |
| Total | 20 | 100.0 |

**Table 28** Duration after which you decide that the prescribed AB is ineffective:

| | Frequency | Percent |
|---|---|---|
| 2–3 days | 8 | 40.0 |
| 3–5 days | 6 | 30.0 |
| > 5 days | 6 | 30.0 |
| Total | 20 | 100.0 |

**Table 29** In case you judge that prescribed AB is ineffective you usually:

| | Frequency | Percent |
|---|---|---|
| Change AB group | 10 | 50.0 |
| Order C&S examination of sputum | 6 | 30.0 |
| Revise the diagnosis | 4 | 20.0 |
| Total | 20 | 100.0 |

**Table 30** Do you usually make sure that the AB prescribed is that the one actually given to the patient?

| | Frequency | Percent |
|---|---|---|
| Yes | 17 | 85.0 |
| No | 3 | 15.0 |
| Total | 20 | 100.0 |

**Table 31** Do you ask the patient about AB history in the last 3 months?

| | Frequency | Percent |
|---|---|---|
| Yes | 15 | 75.0 |
| No | 5 | 25.0 |
| Total | 20 | 100.0 |

**Table 32** Does the patient sometimes influence your AB prescription decision?

| | Frequency | Percent |
|---|---|---|
| Yes | 10 | 50.0 |
| No | 10 | 50.0 |
| Total | 20 | 100.0 |

**Table 33** Do you ask the patient before prescribing the AB if he is sensitive to certain AB?

| | Frequency | Percent |
|---|---|---|
| Yes | 16 | 80.0 |
| No | 4 | 20.0 |
| Total | 20 | 100.0 |

Most of the physicians included in the study (80%) used to ask the patient before prescribing the AB if he was sensitive to a certain AB, while 20% did not (see Table 33).

## Discussion

Most people will develop an acute respiratory tract infection (RTI) every year. RTIs are also the commonest acute problem dealt with in primary care – the 'bread and butter' of daily practice. Management of acute RTIs in the past concentrated on advising prompt antibiotic treatment of presumptive bacterial infections. This advice was appropriate, in an era of high rates of serious suppurative and non-suppurative complications, up to and including the immediate post-war period. However, in modern developed countries, rates of major complications are now low. In addition, there is no convincing evidence, either from international comparisons or from evidence within countries, that lower rates of prescribing are associated with higher rates of complications. Therefore, much of the historically high volume of prescribing to prevent complications may be inappropriate. After a fall in antibiotic use in the late 1990s, antibiotic prescribing in the UK has now reached a plateau and the rate is still considerably higher than the rates of prescribing in other northern European countries. Most people presenting in primary care with an acute uncomplicated RTI will still receive an antibiotic prescription – with many doctors and patients believing that this is the right thing to do. There may be several problems with this. First, complications are now much less common, so the evidence for symptomatic benefit should be strong to justify prescribing; otherwise many patients may have unnecessary antibiotics, needlessly exposing them to side effects. Second, except in cases where the antibiotic is clinically necessary, patients, and their families and friends, may get the message from healthcare professionals that antibiotics are helpful for most infections. This is because patients will understandably attribute their symptom resolution to antibiotics, and thus maintain a cycle of 'medicalizing' self-limiting illness. Third, international comparisons make it clear that antibiotic resistance rates are strongly related to antibiotic use in primary care. This is potentially a major public health problem both for our own and for future generations; unless there is clear evidence of benefit, we need to maintain the efficacy of antibiotics by more judicious antibiotic prescribing [9].

The aim of this study was to evaluate the prescription practices of antibiotics in lower respiratory tract infections at Sohag Chest Hospital. The study had questionnaires that included antibiotics prescription pattern among physicians who were responsible for prescribing antibiotics for patients with lower respiratory tract infections. Twenty physicians were included in this study.

In the present study, 40% of physicians included depended on text books as their main source of information and 30% of them depended on pharmaceutical companies as their main source of information. These results match with the study done by Vancelik et al. [10], who found that the most frequent resources used in the case of any problems in prescribing process were drug guides of pharmaceutical companies (73.7%), medical books (48.7%) and the documents of pharmaceutical companies other than drug guides (33.6%). Also, the results match with those of the study done by McGettigan et al. [11], who performed their study upon 200 general practitioners and 230 hospital doctors. They stated that pharmaceutical companies, therapeutics bulletin and medical journals were the main sources of information about antibiotics. On the other hand, the results match with those of the study done by Khaliq et al. [12], who performed their study upon 304 doctors. They stated that the source of medical information, which is used most commonly, is medical books. This was affirmed by 185 (71.4%) doctors. 131 (50.6%) doctors answered in positive about reading electronic journals to keep themselves updated. A cross-sectional, exploratory survey was performed among 152 GPs working in the primary health centers and hospitals in the Erzurum province of Eastern Turkey in 2006. The study done by Abbas et al. [8] showed that text books were the main source of information about antibiotics for the physicians included in the study.

In the present study, 60% of the physicians included depended on their own experience. These results matched with the study done by Bugnon-Reber et al. [13], who found that AB misuse was 47% with improper implantation of international guidelines, but the study done by Giammarino et al. [14], performed one year after the introduction of local guidelines, demonstrated a generally good adherence to local AB guidelines (71%). Similarly, Lutters et al. [15] showed in an interventional cohort study that, after an intensive intervention period consisting of physicians' educational program, the guidelines were correctly implemented in 75% of surveyed patients. Also, the study done by Mazzaglia et al. [16] showed that a survey was carried out, in order to describe the prescriptive behavior among Sicilian general practitioners (GPs) in choosing an empirical antibiotic regimen for LRTIs in adult patients and began an educational process which involved the same GPs in decisions regarding their prescriptions and in performing local guidelines. The results of the present study did not match with those of the study done by Abbas et al. [8], where 62% of the physicians included in the study depended on the international guidelines as a reference for empirical AB prescription. This difference might be due to the fact that the study done by Abbas et al. [8] was performed on 100 physicians, fifty-seven of them were from Chest Department and the other 43 were from Internal Medicine Department and worked at Ain Shams University Hospital.

In the present study, all physicians included took into consideration the presence of co-morbid diseases during AB prescription. This result matched with IDSA/ATS Guidelines, [17] that stated that the presence of co-morbid diseases should influence the choice of AB group. Also, this result matched with the study done by Abbas et al. [8], who found that (97%) of physicians took into consideration the presence of co-morbid diseases during AB prescription.

In the current study, the most frequently prescribed ABS for empirical therapy were quinolones (45%) followed by

broad spectrum penicillins (25%) and cephalosporins (10%). This result did not match with that of the study done by Mazzaglia et al. [16], who found that the most frequently used antibacterial agents were cephalosporins (55.0%), penicillins (11.7%), fluoroquinolones (11. 4%), and macrolides (10.1%) and combinations of penicillins with beta-lactamase inhibitors (7.9%), together, represented 41.1% of the remaining antibiotic prescriptions. Also, there is a mismatch with the results of the study done by Giammarino et al. [14], who stated that the most frequently prescribed ABs for empirical therapy were amoxicillin/clavulanic acid (51%), followed by cefepime (43%), ciprofloxacin (30%) and clarithromycin (17%). This difference with the previously mentioned studies might be due to the fact that they depended on local guidelines rather than the current study. Again, the results of the present study did not match with those of the study done by Abbas et al. [8] that showed that broad spectrum penicillins (33%), followed by cephalosporins (17%) were the most frequently prescribed ABs for empirical therapy. This difference might be due to the fact that the study done by Abbas et al. [8] included 100 physicians; double the number enrolled in the present study and the fact that fifty-seven of them were from the Chest Department, and the other 43 were from the Internal Medicine Department.

In the current study, 50% of the physicians included preferred 4–7 days as duration for empirical therapy and 50% preferred 7–10 days. This matched with IDSA/ATS Guidelines, [17] that mentioned that the duration of empirical antibiotics therapy should be a minimum of 5 days and the patient should be afebrile for 48–72 h. Also, the results of the study done by Abbas et al. [8] revealed that 55% of the physicians preferred 4–7 days as the duration for empirical therapy.

In the current study, the most frequently prescribed ABS for CAP was quinolones (65%), followed by cephalosporin (20%) and broad spectrum penicillin (15%). This matched with IDSA/ATS Guidelines, [17] that stated that respiratory fluoroquinolones are indicated as the first choice for outpatient treatment with the presence of co-morbidities and inpatient non ICU. Macrolides are indicated as the first choice for outpatient treatment without risk factors and previously healthy but a combination of $A_{\beta}$ lactam (as ceftrixone) plus either fluoroquinolones or azithromycin is the first choice for inpatient, ICU treatment. The study done by Abbas et al. [8] found that the most frequently prescribed ABs for CAP were broad spectrum penicillins (32%), followed by macrolides (18%). The difference between that study and the present study could be due to the fact that the study done by Abbas et al. [8] included 100 physicians, fifty-seven of them were from Chest Department, and the other 43 were from Internal Medicine Department.

In the current study, the most frequently prescribed ABs for HAP were quinolones (40%), followed by cephalosporins (20%) and aminoglycosides (5%). This matched with ATS Guidelines for HAP, VAP and HCAP [18], where quinolones (levofloxacin, moxifloxacin, or ciprofloxacin) or cephalosporins (ceftriaxone) are indicated for initial empirical antibiotic therapy for hospital-acquired pneumonia or ventilator-associated pneumonia in patients with no known risk factors for multidrug-resistant pathogens, early onset and disease severity. Also, antipseudomonal fluoroquinolones (ciprofloxacin or levofloxacin) or aminoglycosides (amikacin, gentamicin, or tobramycin) plus anti pseudomonal cephalosporin (cefepime, ceftazidime) or anti pseudomonal carbapenem (imipenem or meropenem) or (β-lactam/β-lactamase inhibitor (pi peracillin–tazobactam) plus linezolid or vancomycin are indicated for the initial empirical antibiotic therapy for hospital-acquired pneumonia, ventilator-associated pneumonia and healthcare-associated pneumonia in patients with late-onset of disease, risk factors for multidrug-resistant pathogens and all disease severity. The study done by Abbas et al. [8] found that the most frequently prescribed ABs for HAP were quinolones (21%), followed by cephalosporins (16%).

In the current study, the most frequently prescribed ABs for COPD, AE were quinolones (70%), followed by broad spectrum penicillin (10%), cephalosporins (10%), tetracyclines(5%) and amoxicillin and clavulanic acid (5%). This result generally agrees with that of the study done by Siempos et al. [19], who stated that the treatment success in microbiologically evaluable patients was lower for macrolides compared with quinolones. Fewer quinolone-recipients experienced a recurrence of ABECB after resolution of the initial episode compared with macrolide-recipients during the 26-week period following therapy. Adverse effects in general were similar between macrolides and quinolones. Administration of A/C was associated with more adverse effects (mainly diarrhea) than quinolones. Macrolides, quinolones and amoxicillin/clavulanate may be considered equivalent for the treatment of patients with an acute bacterial exacerbation of chronic bronchitis in terms of short-term effectiveness. Quinolones are associated with better microbiological success and fewer recurrences of acute bacterial exacerbation of chronic bronchitis than macrolides, while amoxicillin/clavulanate is associated with more adverse effects than both comparators. Another match of this result is encountered with that of the study done by Dimopoulos et al. [20], who stated that, the first-line antibiotics (i.e., amoxicillin, ampicillin, pivampicillin trimethoprim/sulfamethoxazole, and doxycycline) were associated with a lower treatment success compared to second-line antibiotics (i.e., amoxicillin/clavulanic acid, macrolides, second-generation or third-generation cephalosporins, and quinolones) in the clinically evaluable patients. There were no differences among the compared regimens regarding mortality or treatment success in microbiologically evaluable patients, or adverse effects in general or diarrhea in particular. Compared to first-line antibiotics, second-line antibiotics are more effective, but not less safe, when administered to patients with AECB. The available data did not allow for stratified analyses according to the presence of risk factors for poor outcome, such as increased age, impaired lung function, airway obstruction, and frequency of exacerbations; this fact should be taken into consideration when interpreting the findings of this meta-analysis. The study done by Abbas et al. [8] found that, the most frequently prescribed ABs for COPD, AE were broad spectrum penicillins (39%), followed by cephalosporins (24%). This difference might be due to the fact that this study was performed on 100 physicians, fifty-seven of them were from the Chest Department and the other 43 were from the Internal Medicine Department.

The majority of physicians included in the study (85%) used to make sure that the AB prescribed is that the one actually given to the patient. As failure of the treatment might be due to the fact that some patients might receive another AB group, sub therapeutic dose or another route of administration. This matched with the study done by Abbas et al. [8] that

found that 80% of the physicians included used to make sure that the prescribed AB was the one actually given to the patient.

In the current study, 55% of the physicians depended on clinical and radiological findings for AB prescription, 25% of them depended on clinical, radiological and laboratory data, 15% of them depended on clinical condition and 5% of them depended on radiological findings only. The results did not match the study done by Abbas et al. [8] that showed that 61% of the physicians depended on clinical, laboratory and radiological findings for AB prescription. The difference could be due to the study which included larger number of physicians (100), 57 of them were from the Chest Department and the other 43 were from the Internal Medicine Department.

55% of the physicians included in the study decided that the most important symptom when AB prescription was based on clinical assessment is purulence of sputum. This matched with Coenen et al. [21], who stated that the patients presenting with acute cough in primary care who have discolored sputum are more likely to be prescribed antibiotics than those not producing sputum or producing white sputum. This confirms previous findings that physicians are more likely to prescribe antibiotics to patients with presumed respiratory tract infections (RTIs) who produce purulent sputum. They analyzed data from 72 Flemish general practitioners (GPs) on the management of 1448 patients with acute cough. The presence of sputum was associated with an increased risk of antibiotic prescription independent of patient and clinician characteristics. The study done by Fischer et al. [22] directly observed 30 GPs in Germany managing 237 patients with RTIs. Purulent sputum was associated with an increased chance of antibiotic prescription. The study done by Abbas et al. [8] found that the most important symptom when AB prescription was based on clinical assessment was purulence of sputum (59%).

In the current study, the most important laboratory finding if AB prescription was based on laboratory data was sputum culture and sensitivity represented 65%, sputum gram stain 20%, and ESR 10% while leucocytosis represented 5%. This matched with the study done by Abbas et al. [8] that showed the most important laboratory finding if AB prescription was based on laboratory data was sputum culture and sensitivity represented 47%.

In the current study, improvement of general condition was the most important factor in determining the efficacy of AB prescribed (65%) followed by change of sputum character (30%) and white blood cell count (5%). The results matched with the study done by Abbas et al. [8] that stated that 45% of the physicians considered improvement of general condition as the most important factor in determining the efficacy of AB prescribed.

40% of the physicians included in that study decided that the prescribed AB was ineffective after 2–3 day duration and (30%) after 3–5 day duration. This matched with IDSA/ATS Guidelines, [17] recommendations, that mentioned that no response can be defined as absence of or delay in achieving clinical stability (Temperature $\leqslant$ 37.8 °C, Heart rate $\leqslant$ 100 beats/min, Respiratory rate $\leqslant$ 24 breaths/min, Systolic blood pressure $\geqslant$ 90 mmHg, Arterial oxygen saturation $\geqslant$ 90% or pO2 $\geqslant$ 60 mmHg on room air, ability to maintain oral intake and normal mental status). When these criteria were used, the median time to achieve clinical stability was 3 days for all patients. Deterioration and development of respiratory failure or hypotension $>$ 72 h after initial treatment is often related to intercurrent complications, deterioration in underlying disease, or development of nosocomial super infection. The results also matched with the study done by Abbas et al. [8], who decided that 57% of the physicians included in the study showed that the prescribed AB was ineffective after 2–3 day duration, 33% after 3–5 day duration.

50% of the physicians included in the study changed the AB group in case the prescribed AB was ineffective, 30% of them ordered sputum culture and sensitivity and 20% of them revised the diagnosis. The results did not match with the study done by Abbas et al. [8], that showed that 59 of the physicians included in the study (59%) ordered sputum culture and sensitivity in case the prescribed AB was ineffective, 28 changed the AB group, 11 revised the diagnosis, while 2 changed the AB dose. That difference might be due to the fact that the study done by Abbas et al. [8] included 100 physicians, fifty-seven of them from the Chest Department and the other 43 from the Internal Medicine Department, working at Ain Shams University Hospital and depended on international guidelines.

The majority of the physicians included in the study (75%) used to ask the patient about the AB history in the last 3 months. This matched with IDSA/ATS Guidelines, [17] recommendations, as recent AB taking in the last 3 months should influence the choice of AB group. In such a case, an alternative from a different class should be selected. Also, recent AB therapy increases the likelihood of infection with drug-resistant streptococcal pneumonia. This result matches also with the study done by Abbas et al. [8], who showed that 73% of the physicians used to ask the patients about the AB history in the last 3 months.

Most of the physicians included in the study (80%) used to ask the patient before prescribing the AB if he was sensitive to a certain AB. In 50% of the physicians, their AB prescription decision might be sometimes affected by the patient. These two factors are very important. They might contribute to the failure of AB prescription practice, besides decreasing the possibility of unnecessary complications. The results match with those of the study done by Abbas et al. [8], who showed that 81% of physicians used to ask the patient before prescribing the AB if he was sensitive to certain AB.

In the current study, 50 patients were included, 68% of the patients admitted at Sohag Chest Hospital with COPD, AE followed by 24% of the patients admitted with CAP and 8% with bronchiectasis. This matched with a study done by Murray et al. [23] that included 281 patients (121 exacerbations of COPD, 94 pneumonias, 24 exacerbations of asthma and 42 LRTI/bronchitis or other chest infections).

In the current study, LRTIS were more prevalent in males (64%) than in females (36%). This matched with a study done by Kelsey et al. [24], who showed that the prevalence was greater in males than in females.

Cephalosporins (42%) followed by a combination of broad spectrum penicillins and cephalosporins (32%), a combination of broad spectrum penicillins and aminoglycosides (12%) followed by a combination of macrolides and cephalosporins (6%) were prescribed on admission for the patients included in the study in comparison to a similar survey study performed by Mazzaglia et al. [16], who stated that the most frequently used antibacterial agents were cephalosporins (55.0%) and penicillins (11.7%). The results did not match with the study

done by Abbas et al. [8], who detected that broad spectrum penicillins (24%) and combination of macrolides and cephalosporins (24%) were prescribed on admission for the patients. This difference could be due to the fact that Abbas et al' study included 50 patients, 25 patients were admitted at the RICU and the other 25 patients were admitted at the ward.

In the current study, the duration of AB prescribed on admission was 5 days' duration (60%) and seven days' duration (30%). These results were consistent with the previous results obtained by the questionnaire of physicians included in the study regarding the duration of the empirical therapy. These results also matched with the recommendations of different international guidelines as IDSA/ATS Guidelines, [17], where 5 days' duration appears to be the minimal overall duration of the empirical therapy documented to be effective. Still, few exceptions exist as in the case of the presence of extra pulmonary infection, such as meningitis or endocarditis. Putting in mind that some antibiotics (such as azithromycin) are administered for a short time yet they have a long half-life at respiratory sites of infection. Also, a similar study was done by Dunbar et al. [25], who stated that a high-dose (750 mg) levofloxacin therapy for 5 days was equally successful and resulted in more afebrile patients by day 3 than did the 500-mg dose for 7–10 days. Also, Rizzato et al. [26] stated that; in trials of antibiotic therapy for CAP. Azithromycin has been used for 3–5 days as oral therapy for outpatients, with some reports of single-dose therapy for patients with atypical pathogen infections. This also matched with the study done by Abbas et al. [8], who showed that the duration of AB prescribed on admission was 5 days (38%) and seven days (34%).

In the current study, almost all of the patients included in the study (82%) received the AB prescribed on admission via parenteral route, while (18%) via oral and parenteral routes. A similar survey study performed by Giammarino et al. [14] among 129 patients at Swiss hospital found that 63% of admitted patients received parenteral therapy as initial AB treatment. This also matched with the study done by Abbas et al. [8] who showed that 98% of patients received the AB prescribed on admission via parenteral route.

## Conclusions

1. AB prescription practices need to be well evaluated in order to formulate an acceptable rationale aiming at improving the global situation of antibiotic use.
2. Many points have to be taken into consideration like increasing awareness of physicians about different widely accepted guidelines.
3. Other items, including patient compliance, patient demand, financial causes, pharmaceutical companies, pressure and drug therapy use monitoring, should be put into consideration when prescribing antibiotics.

## Recommendations

1. There is an increasing need to improve accessibility to the widely accepted guidelines.
2. There is an increasing need for regular, updated and revised local guidelines.
3. Supporting the physician decision making, improving patients' compliance, control excessive patient demand and applying of monitoring of drug therapy use, may improve AB prescription practice.
4. Further studies on a larger scale to identify the contributing factors of the AB prescription practice problems are needed.

## Conflict of interest

None declared.

## References

[1] J. Mark. Antibiotics classification. http:// theantibioticsblog.com/antibiotic classification (2010).
[2] N. Krivoy, Y.B. Ahal, W.A.B. Lavie, S. Haddad, Antibiotic prescription and cost patterns in a general intensive care unit, Pharm. Pract. 5 (2007) 67–73.
[3] L. Morata, N. Cobos-Trigueros, J.A. Martinez, A. Soriano, M. Almela, F. Marco, H. Sterzik, R. Nunez, C. Hernandez, J. Mensa, Influence of multidrug resistance and appropriate empirical therapy on the 30-day mortality rate of *Pseudomonas aeruginosa* bacteremia, Antimicrob. Agents Chemother. 56 (2012) 4833–4837.
[4] R. Guthrie, Community-acquired lower respiratory tract infections: etiology and treatment, Chest 120 (6) (2001) 2021–2034.
[5] Antibiotic Expert Group, Therapeutic Guidelines: Antibiotics, thirteenth ed., Therapeutic Guidelines Ltd., North Melbourne, 2006.
[6] K. Leder, M.I. Sinclair, T.Z. Mitakakis, M.E. Hellard, A. Forbes, A community-based study of respiratory episodes in Melbourne, Australia, Aust. N. Z. J. Public Health 27 (2003) 399–404.
[7] Y. Shoham, R. Dagan, N. Givon-Lavi, Z. Liss, T. Shagan, O. Zamir, Community-acquired pneumonia in children: quantifying the burden on patients and their families including decreases in quality of life, Pediatrics 115 (2005) 1213–1219.
[8] A.M. Abbas, M.A. ELFaramawy, S.H. ELSharkawy. Evaluation of Prescription Practices of Antibiotics in Respiratory Tract Infections at Ain Shams University Hospital (thesis submitted for partial fulfillment of Master Degree in Chest Diseases and Tuberculosis), Ain Shams University, (2007).
[9] National Institute for Health and Clinical Excellence Issue. Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care (2008).
[10] S. Vancelik, N.E. Beyhun, H. Acemoglu, O. Calikoglu, Impact of pharmaceutical promotion on prescribing decisions of general practitioners in Eastern Turkey, BMC Public Health 7 (2007) 122.
[11] P. McGettigan, J. Golden, J. Fryer, R. Chan, J. Feely, Prescribers prefer people: the sources of information used by doctors for prescribing suggest that the medium is more important than the message, Br. J. Clin. Pharmacol. 51 (2) (2001) 184–189.
[12] M.F. Khaliq, M.M. Noorani, U.A. Siddiqui, M. Anwar, Physicians reading and writing practices: a cross-sectional study from Civil Hospital, Karachi, Pakistan, BMC Med. Inform. Decis Mak 12 (2012) 76.
[13] A. Bugnon-Reber, A. de Torrente, N. Troillet, D. Genne, Antibiotic misuse in medium-sized Swiss hospitals, Swiss Med. Wkly. 33–34 (2004) 481–485.

[14] Giammarino, F. Bihl, M. Bissig, B. Bernasconi, A. Cerny and E. Bernascon, Evaluation of prescription practices of antibiotics in a medium-sized Swiss hospital (2005).
[15] M. Lutters, S. Harbarth, J.P. Janssens, H. Freudiger, F. Herrmann, J.P. Michel, Effect of a comprehensive, multidisciplinary, educational program on the use of antibiotics in a geriatric university hospital, J. Am. Geriatr. Soc. 1 (2004) 112–116.
[16] G. Mazzaglia, V. Arcoraci, S. Greco, G. Cucinotta, M. Cazzola, A.P. Caputi, Prescribing habits of general practitioners in choosing an empirical antibiotic regimen for lower respiratory tract infections in adults in Sicily, Pharmacol. Res. 40 (1) (1999) 47–52.
[17] Infectious Disease Society of America and American Thoracic Society Guidelines. IDSA/ATS Guidelines for CAP in Adults. CID 44 (Suppl. 2) (2007) S63.
[18] American Thoracic Society Guidelines, ATS Guidelines for the management of adults with hospital-acquired, ventilator-associated and healthcare-associated pneumonia, Am. J. Respir. Crit. Care Med. 171 (2005) 388–416.
[19] I.I. Siempos, G. Dimopoulos, I.P. Korbila, K.G. Manta, M.E. Falagas, Macrolides, quinolones and amoxicillin/clavulanate for chronic bronchitis: a meta-analysis, Eur. Respir. J. 29 (2007) 1127–1137.
[20] G. Dimopoulos, I.I. Siempos, I.P. Korbila, K.G. Manta, M.E. Falagas, Comparison of first-line with second-line antibiotics for acute exacerbations of chronic bronchitis: a meta-analysis of randomized controlled trials, Chest 132 (2007) 447–455.
[21] S. Coenen, B. Michiels, D. Renard, Antibiotic prescribing for acute cough: the effect of perceived patient demand, Br. J. Gen. Pract. 56 (2006) 183–190.
[22] T. Fischer, S. Fischer, M.M. Kochen, Influence of patient symptoms and physical findings on general practitioners' treatment of respiratory tract infections: a direct observation study, BMC Fam. Pract. 6 (2005) 6.
[23] Murray, A. Shaw, R. Smith, S. Schembri and J.D. Chalmers. P23 A multidisciplinary intervention to reduce antibiotic duration in lower respiratory tract infections (2012).
[24] M.C. Kelsey, C.A. Mitchell, M. Griffin, R.C. Spencer and A.M. Emmerson. Prevalence of lower respiratory tract infections in hospitalized patients in the United Kingdom and Eire – results from the Second National Prevalence Survey (2000).
[25] L.M. Dunbar, R.G. Wunderink, M.P. Habib, High-dose, short-course levofloxacin for community-acquired pneumonia: a new treatment paradigm, Clin. Infect. Dis. 37 (2003) 752–760.
[26] G. Rizzato, L. Montemurro, P. Fraioli, Efficacy of a three day course of azithromycin in moderately severe community-acquired pneumonia, Eur. Respir. J. 8 (1995) 398–402.