Community acquired pneumonia and direct hospital cost

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ÖZET

Toplum kökenli pnömoni ve hastane maliyeti

Türkiye'de toplum kökenli pnömoni (TKP)'nin direkt ve indirekt maliyeti ile ilgili veriler yetersizdir. Bu çalışmada, TKP olgularının klinik, laboratuvar ve radyolojik özelliklerini, direkt hastane maliyetini ve buna etki eden faktörleri belirlemek amaçlanmıştır. Olguların gruplanması ve maliyetin incelenmesinde pnömoni ağırlık skoru (PSI) ve Türk Toraks Derneği TKP Rehberi kullanılmıştır. Yaş ortalaması 70.9 olan 114 olgunun verileri retrospektif olarak incelendi. Ortalama hastanede yatış süresi 11.0 ± 6.6 gündü. Türk Toraks Derneği TKP rehberine göre grup IIIb'de yer alan ve PSI skor ortalaması 102.7 olan 3 olgu ölümle sonuçlandı. Ortalama ilaç maliyeti 484.59 Euro, radyoloji maliyeti 65.38 Euro, laboratuvar maliyeti 329.38 Euro ve toplam maliyet 1630.77 Euro idi. Grup IIIb'de yer alan olgularda ilaç maliyeti ve toplam maliyet diğer gruplara göre yüksekti. Radyolojik, laboratuvar ve toplam maliyet açısından başlangıç tedavisi rehbere uygun olan ve olmayan olgular arasında farklılık saptanmadı (p> 0.05). Cinsiyet ve ileri yaşın (≥ 65 yaş) toplam maliyet üzerine etkisi saptanmadı (p> 0.05). Ek hastalık varlığının toplam maliyeti artırdığı belirlendi (p= 0.003). PSI skorlamasına göre toplam maliyet düşük risk grubunda 1274.60 Euro, yüksek risk grubunda 1929.49 Euro idi. TKP'ye bağlı hastane mortalitesi %2.6 idi.

Anahtar Kelimeler: *Toplum kökenli pnömoni, maliyet, direkt hastane maliyeti, mortalite, hastanede kalma süresi.*

SUMMARY

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In Turkey, there is inadequate data about the direct or indirect cost of community acquired pneumonia (CAP). This study aims to identify the clinical, laboratory, and radiological properties, direct hospital costs of CAP, and the factors that affect these costs. Grouping of the subjects and cost analysis were evaluated in accordance with Pneumonia Severity Index (PSI) and 'Turkish Thoracic Society (TTS) CAP Guideline'. 114 cases with an average age of 70.9 were analyzed retrospectively. Average hospital stay was 11.0 ± 6.6 days. Three of the cases that appeared to be in group IIIb in accordance with TTS CAP Guideline, and that had a PSI score of 102.7 died. Average costs of medicine was 484.59 Euro, radiology costs were 65.38 Euro, laboratory costs were 329.38 Euro and the total cost was 1630.77 Euro. In group IIIb cases, costs of medicine and the total costs were higher than other groups. Radiological, laboratory and the total costs were not determined to be different among cases that did or did not conform to initial treatment guidelines (p> 0.05). There were no effect of gender and advanced age (≥ 65 years) on total cost (p> 0.05). Existence of a comorbid disease was detected to have increased the total cost (p= 0.003). Total costs according to PSI scoring were 1274.60 Euro in low-risk group, and 1929.49 Euro in high-risk group (p= 0.04). Hospital mortality due to CAP was 2.6%.

Key Words: *Community acquired pneumonia, cost, direct hospital cost, mortality, lenght of stay in hospital.*

Respiratory tract infections that necessitate hospital stay, recurrence of chronic obstructive pulmonary disease (COPD) exacerbation, community acquired pneumonia (CAP), and nosocomial pneumonia are among the leading causes of death that develops due to CAP infections in industrial countries (1). Its annual incidence is 1.6-14/1000 and it is frequently seen in aged persons (2-4). Every year, 3-4 million people in United States of America (USA) are diagnosed CAP and one million are admitted to hospitals (4-6). The annual costs of CAP treatment show different data as 8.4-9.7 billion USD and 23 billion USD (1,5). It is estimated in Germany that total direct costs due to CAP are 983 million USD and indirect costs are 656 million USD (3). There are factors that affect costs such as patient conformity, effectiveness, length of stay in hospital, and admission to intensive care unit (ICU) (1,3).

Turkish Thoracic Society (TTS) published a CAP guidline in 2002. According to this guide, CAP cases are categorized based on the existence of risk factors and weighing factors (Group I, II, IIIa, IIIb, IVa, IVb). In this guideline possible microorganism, initial treatment and follow-up are determined in accordance with the groups. While Group I and II cases are treated as outpatients, group IVa-IVb cases are followed in intensive care unit (www.toraks.org.tr).

In order to determine the 30-day mortality in CAP cases admitted to hospital Pneumonia Severity Index (PSI) was defined by Fine in 1997. According to the index, cases are divided into 5 groups by scoring them based on age, gender, existence of a comorbid disease, physical examination, and laboratory findings, then the lowest score is attributed to the least severe patient group. Based on this grouping, necessity for the patients whether to get treatment as an in-patient, outpatient, or in intensive care unit, and an expected 30-day mortality are determined (5,6,8). Bauer et al evaluated the effect of PSI scoring over the costs, and determined that the costs increased in C I and C II but not in C III and C IV (3).

In Turkey, there is inadequate data about direct or indirect cost of CAP. In this study we aimed to identify the clinical, laboratory, and radiological properties, direct hospital costs of CAP, and the factors that affect these costs.

MATERIALS and METHODS

All cases with diagnosed as CAP and hospitalized to pulmonary medicine department between January 2004 and December 2005 in a 925 bed university hospital included to the study. The treatment of pneumonia in ICU is a more complicated and more expensive processthan treatment out of ICU. Therefore we did not include the pati-

ents who were admitted to ICU directly. Demographic properties, comorbid diseases, and costs were evaluated retrospectively. Chest X-rays, laboratory examinations, blood gas analyses at the time of admission to hospital, and culture findings within the first 72 hours were recorded.

Initial treatment and the conformity of this treatment to TTS CAP Guideline were examined. During the follow-up, the necessity for intensive care and treatment change at the 72nd hour, also the time to stay at the hospital were determined. Cases were assessed at the 24th hour, on the 7th day, and on the 15th day for mortality reasons. Direct hospital costs of the cases were determined by going through the bills belonging to the period of stay. Direct hospital costs were detailed as laboratory, radiology, medicine, and total costs. Bed, nursing, and physician services costs were evaluated within the total costs. The cost analysis of treatment before the hospital admission and after discharge were not examined.

Additionally, PSIs of the cases were determined, and this scoring was compared to TTS CAP Guideline classification. Based on the PSI scoring, C I, C II, and CIII cases were at low-risk, and C IV and C V cases were at high-risk group.

The obtained data were analyzed in SPSS 10.0 software. Differences between the groups were studied via chi-square and Student's t test. $p< 0.05$ was considered to be a significant difference.

RESULTS

A total of 114 cases with an average age of 70.9 were examined. 80 (70.2%) of cases were male and 34 (29.8%) female. 97 (85.1%) of the cases referred from their homes, 7 (6.1%) of them were from nursing homes, and 10 (8.8%) of them referred from another hospital. 96 (84.2%) cases admitted from emergency room. The mean age of patients who were evaluated as group II according to TTS CAP Guideline but treated in hospital were higher than others. These cases were thought to be hospitalized because of their ages and comorbid diseases. 94 (82.5%) cases had comorbid diseases, the most common were neurological diseases, diabetes mellitus, and COPD. Cough (63.2%), fever (62.3%), dyspnea (51.8%), and sputum (50.9%) were the most frequent complaints.

The classification of cases according to TTS CAP Guideline and PSI are seen in Table 1.

While the infiltration in the lung graphs was most frequent in the right lower zone (39.5%), left lower zone (20.2%), and in right middle zone (19.3%), consolidation was observed in multiple zones in 40.4% of the cases. Pneumonic infiltration was bilateral in 17.5% of the cases, and pleura fluid was observed in 18.4% of the cases.

Average white blood cells were 15.2/dL and %PNL= 79.8, and C-reactive protein= 169.6 mg/dL. The artery blood gas examination of the cases (n= 87) showed an average of PaO_2= 64.8 ± 14.6 mmHg, $PaCO_2$= 34.0 ± 10.4 mmHg and SpO_2= %91.9 ± 5.4. Hypoxemia was detected in 35.6% of the cases. A microbiological study carried out on 56.1% of the cases, and the microbiological agent was detected in 17.1% of them. Fiberoptic bronchoscopic examination was performed to the patients who had abundant secretion and to the patients who had clinical worsening for

Table 1. Comparison of Turkish Thoracic Society CAP guideline and PSI.

		Turkish Thoracic Society CAP Guideline			
		Group II	**Group IIIa**	**Group IIIb**	**Total**
PSI	**C I**	1	4	1	6
	C II	7	4	6	17
	C III	7	1	21	29
	C IV	1	2	38	41
	C V	-	-	21	21
	Total	**16**	**11**	**87**	**114**

CAP: Community acquired pneumonia, PSI: Pneumonia severity index.

the purpose of aspiration of secretion as well as obtaining materials for microbiologic tests. The analyzed culture materials and reproduction rates are shown in Figure 1.

Treatment was changed due to the inability to get a fever response from 9 cases at the 72nd hour, and 6 cases showed a necessity for ICU. The data associated with treatment modification because of fever in 72nd hours were not included in the patient charts. Average hospital stay of all the cases was 11.0 ± 6.6 (3-47) days. When classified according to TTS CAP guide, 18 (14.0%) of the cases were in Group II, 11 (9.6%) were in Group IIIa, and 87 (76.3%) were in Group IIIb. Average age was 71.7 in Group II, 46.0 in Group IIIa, and 70.9 in Group IIIb. Hospital stay was 7.5 days in Group II, 11.7 days in Group IIIa, and 11.5 days in Group IIIb.

Parenteral treatment was started in all cases, mostly 6 g/day sulbactam-ampicillin + 1 g/day clarithromycin treatment was preferred (Table 2). Treatment of 69.3% of the cases were conformal with the TTS CAP Guideline. The hospital stays of the cases were 10.8 ± 7.5 days while conforming to the initial treatment to guideline and the cases not conforming to the guideline were 11.0 ± 6.2 days. The difference between them was not significant (p> 0.05). No exitus was observed in the first 24 hours; 2 cases during 1-7 days and 1 case during 7-15 days resulted in exitus, making a total of 3 (2.6%) cases. All died cases were in Group IIIb according to TTS CAP Guideline.

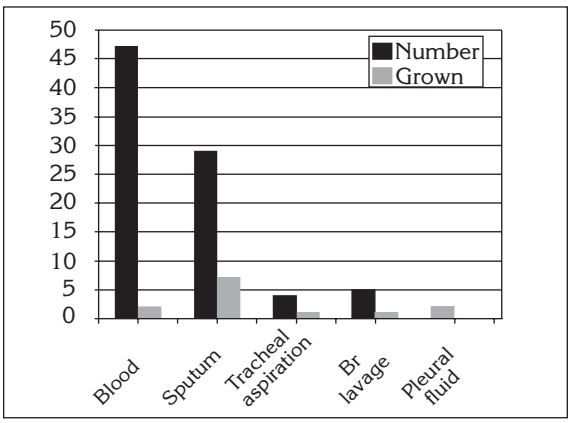

Figure 1. Studied materials for pathogen microorganism.

In accordance with PSI scoring, 6 (5.3%) of the cases were in C I, 17 (14.9%) in C II, 29 (25.4%) were in C III, 41 (36.0%) were in C IV, and 21 (18.4%) of the cases were in C V. Groups according to TTS CAP guideline and PSI's scoring are seen in Table 1. 52 (45.6%) cases were in low-risk group, and 62 (54.4%) cases were in high-risk group based on the PSI scoring. Average ages were 43.8 in C I, 59.4 in C II, 70.5 in C III, 75.8 in C IV, and 77.2 in C V, respectively. Again, the age average was 63.8 in low-risk group, 76.2 in high-risk group, and their difference proved to be statistically significant (p= 0.000). A gender difference was not established among the groups. 50.0% of female cases and 56.3% of male cases were in high-risk group (p= 0.54). The average PSI scoring of all the cases was 98.1 ± 33.7 (26-178). Their hospital stays were C I= 8.3, C II= 8.8, C III= 10.2, C IV= 10.9, and CV= 13.1. PSI scoring of three exitus cases was 102.7, and 1 was in C III, 1 in C IV, and 1 in C V category.

Average costs of medicine was 484.59 Euro, radiology costs were 65.38 Euro, laboratory costs were 329.38 Euro and the total cost was 1630.77

Table 2. Antibiotic treatment.

	n	%
Sulbactam-Ampicillin + Macrolide	78	78.4
Levofloxacin	18	15.8
Amoxicillin/Klavulanate/SAM/Cefuroxime Axetil	12	10.6
Piperacillin/Tazobactam + Amikacin/Ciprofloksacin	3	2.7
III./ IV. Generation Cephalosporins + Ciprofloksacin	2	1.8
SAM + Ciprofloksacin	1	0.9
TOTAL	114	100

Table 3. Mean costs according to groups (Euro).

	II	IIIa	IIIb	p
Laboratory	258.70	399.84	333.47	NS
Radiology	42.50	76.05	68.24	NS
Medicine	251.64	373.54	542.27	0.03
Total	826.24	1244.66	1827.55	0.02

Euro. In group IIIb cases, costs of medicine and the total costs proved to be higher compared to other groups (Table 3). Radiological, laboratory, medicine, and the total costs of the cases conforming to initial treatment Turkish Thoracic Society CAP Guideline were found to be lower compared to cases that are not in conformal with the guideline, but the difference was not significant (Table 4). Effect of gender (F= 1641.75 Euro, M= 1626.10 Euro) and age (≥ 65 years= 1540.45 Euro, < 65 years= 1895.51 Euro) was not established over the total costs. Existence of an comorbid disease was observed to have increased the total costs (yes= 1756.96 Euro, no= 1037.66 Euro, p= 0.003). The mean total cost of cases with pleural effusion and without pleural effusion was 1905.1 ± 1202.1 Euro and 1569.9 ± 1854.6 Euro (p= 0.068).

The 55.3% (n= 63) of cases were treated in winter (January, February, March, October, November, December) and the mean total cost of these cases was 1854.0 ± 2128.9 Euro (min: 380.0 Euro max: 13331.4 Euro). The 44.1% (n= 63) of cases were treated in summer (April, May, June, August, September) and the mean total cost of these cases was 1357.0 ± 1089.0 Euro (min: 206.4 Euro, max: 5756.1 Euro). There was no significant difference between the groups (p= 0.072).

While total costs of the low-risk group was 1274.60 Euro based on the PSI scoring, the total cost of the high-risk group was observed as 1929.49 Euro, their difference proved to be significant (p= 0.04). Laboratory and radiology costs were established to show no difference between the two groups, but the medicine cost increased significantly in the high-risk group (Table 5).

DISCUSSION

CAP is an important health issue observed around the world, and it is the most common cause of death due to infection diseases especially in industrialized nations (3). CAP is the sixth cause of mortality in Britain and the USA, and the first among deaths due to infections (9). In the last decade, many guidelines were published in order to evaluate and treat CAP cases, IDSA (Infectious Diseases Society of America), ATS (American Thoracic Society), CDC (Centers for Disease Control and Prevention) being the major publishers. In addition, similar treatment guides have been published in Britain, France, Spain, Germany, Japan, South America, Saudi Arabia, and South Africa (4,10). CAP Diagnosis and Treatment in Adults Guideline, published by TTS in 2002, is being used in Turkey.

Table 4. Accordance of antibiotherapy to CAP guideline.

	Yes (n= 79) Euro	No (n= 35) Euro	p
Laboratory	302.92	389.09	0.087
Radiology	62.74	71.36	0.423
Medicine	441.26	582.39	0.311
Total	1483.29	1963.65	0.311

Table 5. Mean costs according to PSI (Euro).

	Low	High	p
Laboratory	321.87	335.66	NS
Radiology	53.11	75.66	NS
Medicine	368.40	582.04	0.03
Total	**1274.60**	**1929.49**	0.04

Every year, 60 thousand patients with CAP are being admitted to hospitals in USA, and it makes up a major part of the health expenses (10,11). The cost for CAP treatments is $ 8.4-9.7 billion per annum (1). The cost of the inpatient treatment for CAP cases is 15-20 times higher compared to outpatient treatments (6). There are several factors that have an impact on costs such as patient conformity, effectiveness, treatment, and periods of hospital stay (1). The most important factor that affects the costs significantly is the length of hospital stay (3). Effects of the conformal treatments to the CAP guidelines have been studied for many years. As a result of the studies, most of which being retrospective, antimicrobial treatment was reported to decrease the hospital stay and related costs, and to have a significant impact on mortality. In one multi-centered, prospective, and randomized study, application to hospital, hospital stay, and costs were reported to have decreased significantly (10).

Length of hospital stay is an important variable affecting the treatment costs. The average time of a hospital stay reported in various studies is 10.8 ± 5.2, and 8.2 ± 5.4 in the USA (10). In our study, the average hospital stay for the all cases was established to be 10.9 days, 7.5 days in Group II, 11.7 days in Group IIIa, and 11.5 days in Group IIb. No significant difference observed between the cases whose initial antibiotic treatment did or did not conform to the guideline. The mean length of stay in hospital in cases who were treated in accordance with TTS CAP Guideline was 12.4 days and 14.8 days in others in Gökırmak and coworker's study. Likewise, there was no significant difference in groups in our study (y). It is previously reported that the hospital stay increased by the non-conformal antimicrobial treatment to the ATS guideline, and decreased in cases with conformal treatment according to IDSA (10).

Mortality was reported as 14% in CAP cases treated as inpatient (1). Mortality rate was shown to differ between 8-16% due to properties of the study group (2,3), but this rate reaches up to 50% in cases with the need for intensive care (12). The mortality rate was 1.0 % in Arbak and coworker's study. The mortality rate in Turkey in 2002 was 2.2% according to data of the Ministry of Health. The results in our study is in accordance with the second data (13). Mortality rate was established as 2.6% (n= 3) in our study. The reason for such a low rate might be that the Group IV cases admitted to intensive care unit were not included in the study, and Group II cases were admitted even though a hospital stay was not necessary according to TTS CAP Guideline . The main reason for hospitalisation in low risk (C I and C II) cases was comorbid diseases (43%) (6). The reason for such a low rate might be that the Group IV cases admitted to intensive care unit were not included in the study, and Group II cases were admitted even though a hospital stay was not necessary according to TTS CAP Guideline. The main reason for hospitalisation in low risk (Class I and II) cases was comorbid diseases (43%) (6). The main admittance reason for the Group II cases treated as an inpatient even though a stay was not necessary was the advanced age.

While the rate of non-conformal therapy to guidelines on the initial treatment was defined as 43.6%, this rate was 31.7% in our study. The nonconformity cause was reported as the age ≥ 65 and multilobar disease (10).

In a study by Arnold et al, the average hospital stay in C I cases was established as 4.6 days, and as 7.0 days in C II cases based on PSI scores (6). In our study, this was defined as 8.3 days in C I, 8.8 days in C II, 10.2 days in C III, 10.9 days in C IV, and 13.1 days in C V.

The average cost of treatment was 1630.77 Euro in our study. In Germany, the cost of CAP cases treated as an inpatient is $ 1333 (3). The length of hospital stay and the application for an intensive care are two of the most important factors that have an impact on the treatment costs. Daily cost of bed constitutes a great part of the total expenses, and the cost would decrease in case the hospital stay is shortened (10). Fine et al reported that the cost is at its highest on the first 3 days (4). The main factor that affected the total cost was the cost of medication in our study. This could be resulting from medical treatment for comorbid diseases. CAP cases are reported to become stabilized on the first 3 days, and reducing

one day from this amount also reduces the cost by $ 680 (7). PSI score also affects the total cost of treatment. Merchant et al found the mean costs as $ 9989 in C III, $ 12060 in C IV, $ 14670 in C V, and established that the costs tend to be much higher in severe cases (5). Bartolome defined the average cost of CAP as $ 1697 ± 592 and showed that the hospital stay was the independent variable of the total costs (3). These results proved to be higher than the costs indicated in our study. There was no significant difference in total cost between groups who were treated in accordance with guideline and who were not. But there is an approximate difference of 500 Euro between groups. This difference could be due to radiological and laboratory tests that were not recommended in the national guideline.

Inadequate antibiotics treatment, excessive or misuses of antibiotics are the events that increase the hospital stay mostly (1). Selection of antibiotics conforming to the guideline was proved to reduce mortality, cost, and hospital stay (5,12). In our study, the cost is higher with non-conformal treatment according to TTS CAP guideline, but the difference was not significant. We don't have any data about the consecutive treatment and the period of the treatment. Therefore we could not evaluate the effect of these factors on the direct hospital cost. This is the weak point of our study

Among the factors affecting the costs, only comorbid diseases were shown to have increased the costs significantly. The total cost was found to be higher in patients who had comorbid conditions. This could be related with the addition of costs treatments and consultations for the comorbidities and increased length of stay in the hospital. There are studies manifesting that being at younger age increase the costs (16). In our study, the costs of the young cases were found to be more than that of the old cases, but the difference between them was not significant. And also the period of the stay in intensive care unit directly increases the costs (5). Cases with the need for an intensive care were not assessed in our study.

In Turkey there is inadequate data about the direct or indirect cost of CAP It is defined that the cost of Group 4 pneumonia was higher than Group 3 pneumonia in Kolsuz and coworker's study. (14). In our study total cost and the cost of medicine in Group IIIb cases were higher than other groups. In 2001 Yarkin et al, stated that age and co-morbid disease had no effect on the total cost of CAP. In our study, co-morbid diseases increased the total cost, but at higher ages (> 65 year) there was no effect on the total cost. In the study of Yarkin et al, winter season and existence of pleural effusion caused higher costs. But, in our study, there was no association between these factors (15).

Consequently, apart from the Group IV cases that need to stay in intensive care, the direct costs of hospital stay due to CAP is approximately 1630.77 Euro. The hospital costs increase in cases belonging to high-risk group according to TTS CAP Guideline and to PSI scoring and due to comorbid dieases. It should be kept in mind that treatment of patients in Group II according to TTS or low risk group in PSI in outpatient settings will decrease the total cost. Avarege lenght of stay in hospital are 11 days. Hospital mortality due to CAP is 2.6%.

REFERENCES

1. *Grossman RF, Rotschafer JC, Tan JS. Antimicrobial treatment of lower respiratory tract infections in the hospital setting. Am J Med 2005; 118: 29-38.*
2. *Marras TK, Chan CK. Use of guidelines in treating community-acquired pneumonia. Chest 1998; 113: 1689-94 .*
3. *Bauer TT, Welte T, Ernen C, et al. Cost analyses of community-acquired pneumonia from the hospital perspective. Chest 2005; 128: 2238-46.*
4. *Wasserfallen JB, Erard V, Cometta A, Calandra T, Lamy O. Cost-effectiveness of full-course oral levofloxacin in severe community-acquired pneumonia. Eur Respir J 2004; 24: 644-48.*
5. *S. Merchant, MBA, CD. Mullins, YCT. Shih. Factors associated with hospitalization costs for patients with community-acquired pneumonia. Clin Ther 2003; 25: 593-610.*
6. *Arnold FW, Ramirez JA, McDonald LC, Xia EL, Hospitalization for community-acquired pneumonia: The pneumonia severity index vs clinical judgment. Chest 2003; 124: 121-4.*
7. *Ston RA, Mor MK, Lave JR, Hough LJ, Fine MJ. Implementation of an inpatient management and discharge strategy for patients with community-acquired pneumonia. Am J Manag Care 2005; 11: 491-9.*

8. *Hirani NA, Macfarlane JT. Impact of management guidelines on the outcome of severe community acquired pneumonia. Thorax 1997; 52: 17-21.*

9. *Guest JF, Morris A. Community-acquired pneumonia: The annual cost to the the National Health Service in the United Kingdom. Eur Respir J 1997; 10: 1530-34.*

10. *Brown PD. Adherence to guidelines for community-acquired pneumonia does it decrease cost of care? Pharmacoeconomics 2004; 22: 413-20.*

11. *Gregory PS, David BM, James H, Jerome W. A.Cost minimization analysis compairing azithromycin based and levofloksasin based protocols for the treatment of patients hospitalized with community acquired pneumonia. Chest 2005; 128: 3246-54.*

12. *DW. Alves, MT. Kenned. Community-acquired pneumonia in casualty: Etiology, clinical features, diagnosis, and management (or a look at the "new" in pneumonia since 2002) .Curr Opin Pulm Med 2004; 10: 166-70.*

13. *Özlü T, Bülbül Y, Özsu S . Ulusal verilerle toplum kökenli pnömoniler. Tuberk Toraks 2007; 55: 191-212.*

14. *Kolsuz M, Üçgun Y, Metintaş M ve ark. Hastaneye yatarak veya yoğun bakımda tedavi görmesi gereken toplum kökenli pnömonilerde hastanede yatış süresini etkileyen faktörler ve maliyet. Toraks Derneği Yıllık Kongresi 2000. SS 022.*

15. *Yarkın T, Yazıcıoğlu Ö, Yaldız E ve ark. Hastanede yatırılarak tedavi edilen toplum kökenli pnömoni olgularında antibiyotik maliyeti. Toraks Dergisi 2002; 3(Ek 1): 120(SS 467).*

16. *Brown RB, Iannini P, Gross P, Kunkel M. Impact of Initial Antibiotic Choice on Clinical Outcomes in Community-Acquired Pneumonia Analysis of a Hospital Claims-Made Database.*