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Accuracy of consultations performed by infectious diseases trainees and factors associated with adherence to them[☆]

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Summary

Objectives: Infectious diseases (ID) trainees should be familiar with duties relevant to consultation practice. In this study we aimed to analyze the ID trainee night/weekend shift consultation process in terms of consultant characteristics, types of recommendations, and compliance with recommendations.

Methods: All consultations performed by ID trainees on the night shift and at the weekends between 10 June and 10 August 2004 were recorded prospectively on standardized forms. Infectious diseases specialists assessed the appropriateness of recommendations the day after each consultation. Recommendations were considered complied with if they were carried out within 72 hours of the consultation.

Results: Of 440 consultations, 163 were for a clinically diagnosed infection (without specific antibiotic request) and 79 were for treatment continuation. Overall, 152 consultations were for requesting specific antibiotic(s), and 327 antibiotics were recommended or approved in 270 consultations. Eight of these recommendations were inappropriate. Overall compliance to ID recommendations was 75.3% (418/555). In univariate analysis, the compliance rate to non-treatment recommendations (microbiologic cultures, radiology, biochemistry, etc.) was found to be lower than the rate of compliance to antibiotic recommendations (186/308 vs. 232/247, $p < 0.05$). In addition, compliance to recommendations made by the first-year trainees was lower than to the recommendations made by the other trainees. In logistic regression analysis only

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recommendations including antibiotic treatment was associated with higher compliance ($p = 0.0001$, odds ratio = 10.2, 95% CI = 5.7–18.3).

Conclusions: ID trainees are capable of evaluating patients and recommending appropriate antibiotics. Methodologies to improve the compliance to non-treatment-based recommendations and optimizing antibiotic selection seem to be necessary.

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Introduction

The role and duties of infectious diseases specialists (IDSs) in hospitals, and what is expected of them, are increasing steadily worldwide.^{1–13} Consultations comprise a major part of the daily practice of IDSs,^{1,2,6–8,10–13} and infectious diseases trainees should be familiar with the duties relevant to consultation practice.² The evaluation of training and the giving of feedback are important in all education settings, and particularly in medical education; it is of major importance to evaluate the quality of specialist training.³ Although the efficacy of the recommendations of IDSs have been analyzed,^{6,12} there are no data on the efficacy of and compliance to ID trainee recommendations. In this study we aimed to analyze the ID trainee night/weekend shift consultation process in terms of consultant characteristics, types of recommendations, and factors associated with compliance.

Methods

Our hospital is a 1788-bed tertiary care educational hospital, 77 of which are in intensive care units (ICUs). The total number of inpatients in 2003 was 52 979. The Department of Infectious Diseases and Clinical Microbiology of our university was founded in 1963. By the end of 2005 more than 70 IDSs had finished their training in the department and more than 25 have been academics at different universities across Turkey and the world. The infectious diseases and clinical microbiology clinic has 29 beds.

The consultations were performed by a total of seven trainees; two of them were first-year trainees, two were third-year trainees, one was a fourth-year trainee and two were fifth-year trainees. Trainees begin to take consultations after a formal education of 20 hours (including basic laboratory skills and basic information about nosocomial infections and community-acquired infections); they accompany the senior IDSs during the morning consultation process for two months before they begin night shifts.

This study was performed between 10 June and 10 August 2004. All consultations performed by ID trainees on duty for the night shifts and at the weekends during that period, except for informal 'curbside' or telephone consultations, were included in the study.

Standardized data collection forms including sections for name, age, sex of the patient, hospital ward, antibiotic use, purpose of consultation, and diagnosis of the patient, were used by the trainees for recording information on the day of the consultation. In addition other aspects of the consultations were analyzed: (1) whether recommendations were discussed verbally with the patient's primary care physician

or not; (2) the format, organization and legibility of the consultation sheet; (3) the characteristics of the ID trainee including the number of years since he/she began training in ID; (4) characteristics of the recommendations (therapeutic, diagnostic); these were included on the data collection form.⁶ A panel of four IDSs judged the format and legibility of the consultation sheets using a 5-point scale (5 points the best, 1 point the worst).⁶

Consultations were analyzed in terms of consultation type as: (1) continuation of a treatment regimen started earlier by an IDS; (2) consultation for surgical antibiotic prophylaxis; (3) consultation for a microbiologically confirmed infection with/without a request for a specific antibiotic; (4) consultation for a clinically diagnosed infection (either with or without a request for a specific antibiotic); or (5) consultation for evaluation of fever.

IDSs assessed the accuracy of the diagnosis and appropriateness of antibiotic recommendations the day after the consultation. Appropriate antimicrobial therapy was defined as the use of antibiotics that had in vitro activity against the infecting agents isolated, or that had clinically proven efficacy, and that were given by an appropriate route and at an adequate dose. Empirical antibiotic treatment was evaluated according to the patient's clinical condition, possible source of infection, and place of acquisition.¹ The decision of 'inappropriate antibiotic use' was made by at least three of the four IDSs according to a modification of the criteria of Kunin et al.^{10,14}

The following categories were used to describe inappropriate antibiotic use:¹⁰

1. Agree with choice of antibiotic, but dosage was inappropriate according to the literature.
2. Agree with choice of antibiotic, but loading dose was not administered.
3. Agree with choice of antibiotic, but dosage was not altered for the patient's current renal or hepatic functions.
4. Agree with choice of antibiotic, but disagree with the duration (extended surgical prophylaxis).
5. Disagree with choice of antibiotic because it was ineffective against the isolated pathogen based on culture and sensitivity tests.
6. Disagree with choice of antibiotic because of toxicity or allergy.
7. Disagree with choice of antibiotic because of the deteriorating clinical status of the patient.
8. Disagree with choice of antibiotic because the spectrum of the antibiotics overlapped.
9. Disagree with choice of antibiotic because the spectrum was not broad enough.
10. Disagree with choice of antibiotic because the spectrum was too broad.

Table 1 Distribution of the aim of the consultations

Consultation type	Frequency % (n)
Consultations not for specific antibiotic request	
Consultation for a clinically diagnosed infection	37.0 (163)
Consultation for a microbiologically diagnosed infection	8.4 (37)
Other	2.0 (9)
Consultations for specific antibiotic request	
Consultation for surgical antibiotic prophylaxis with a request for a specific antibiotic	16.8 (74)
Consultation for a clinically diagnosed infection with a request for a specific antibiotic	15.7 (69)
Consultation for a microbiologically diagnosed infection with a request for a specific antibiotic	2.0 (9)
Continuation of a treatment regimen started earlier by an IDS	18.0 (79)

IDS, infectious diseases specialist.

11. Disagree with choice of antibiotic because an equally suitable drug was available at a lower cost.

12. Disagree with the need for an antibiotic.

IDSs assessed compliance to recommendations three days after the consultation.⁵ Recommendations were considered complied with if they were carried out within 72 hours of the consultation. Compliance was not evaluated when an IDS had been called during the consultation or when consultation was for a request for surgical antibiotic prophylaxis. In addition, compliance to antibiotherapy-based recommendations in the emergency service could not be evaluated, since it was not possible to check if the antibiotherapy recommendations were complied with or not following the discharge of the patients from the emergency service. Data on compliance to other recommendations in the emergency service were extracted from the hospital database.

The cost of antibiotic recommendations in consultations in which there was a specific antibiotic request was compared with the antibiotic(s) suggested by ID trainees assuming that 1 euro = 1.9 YTL (Yeni Türk Lirası (New Turkish Lira)).

Data were analyzed with Chi-square tests, Student's *t*-tests and logistic regression analysis using SPSS 11.0 software. Binary logistic regression was performed using the enter method in SPSS 11.0 and using compliance to recommendation as the dependent variable and the following variables as covariates: type of recommendation (treatment-based and other); number of recommendations per consultation (up to four, or five and more); seniority of the trainee (first-year trainee and other); recommendations discussed verbally with the patient's primary care physician or not; if the consultation was performed before or after midnight. A *p* value of less than 0.05 was considered significant.

Results

Of 440 consultations, 163 were for a clinically diagnosed infection (without specific antibiotic request), 79 were for treatment continuation and 74 were for prophylactic antibiotics (Table 1).

The three clinics where ID consultations were requested most frequently were the general surgery clinic (34.5%), the internal medicine clinic (18.8%) and the emergency service (17.0%) (Table 2).

Of the consultations, 12.1% were performed after midnight and 34.1% at the weekend (after Friday 16:00). In 2% of

all consultations trainees consulted an IDS. Median and mean legibility of the consultation papers were 3 and 3.29 ± 0.90 points, respectively.

Overall 152 (34.5%) consultations were for requesting specific antibiotic(s). Prophylactic antibiotics were approved in 68 of 74 consultations. An antibiotic was not recommended in 14 consultations. In six of 74 consultations for surgical prophylaxis, the antibiotic was changed for a clinically diagnosed infectious disease. In one of 79 consultations for antibiotic continuation, the antibiotic was changed due to lack of response to the given antibiotic; in the others the antibiotic continuation was approved.

Overall 327 antibiotics were recommended or approved in 280 consultations. Of these 327 recommended antibiotics, eight (2.4%) were inappropriate (four inappropriate choice, three inappropriate dosage, one antibiotic unnecessary). There was no discrepancy about the review of these 327 antibiotic prescriptions between IDSs.

Overall compliance to ID recommendations was 75.3% (418/555). When factors that may possibly affect the compliance to recommendations were subject to univariate

Table 2 Distribution of the clinics requesting consultation

Clinic	Frequency % (n)
General surgery	35.5 (156)
Internal medicine	18.2 (80)
Emergency service	18.2 (80)
Heart surgery	4.8 (21)
Neurology	4.5 (20)
Urology	4.5 (20)
Cardiology	2.7 (12)
Respiratory diseases	2.3 (10)
Obstetrics and gynecology	1.8 (8)
Orthopedics and traumatology	1.6 (7)
Anesthesiology and reanimation	1.6 (7)
Plastic surgery	1.1 (5)
Neurosurgery	0.9 (4)
Dermatology	0.4 (2)
Ear/nose/throat diseases	0.4 (2)
Ophthalmology	0.4 (2)
Physical therapy and rehabilitation	0.4 (2)
Radiation oncology	0.4 (2)
Total	(440)

Table 3 Univariate analysis of factors associated with compliance to recommendations

	Total	Complied % (n)	p
Antibiotic recommendation	247	93.9 (232)	<0.001
Other recommendations	308	60.4 (186)	
Upto four recommendations per consultation	446	76.9 (343)	0.079
Five or more recommendations per consultation	109	68.8 (75)	
Consultations in which antibiotic request was not totally approved	476	75.2 (358)	0.50
Other consultations	79	75.9 (60)	
Consultations performed at the weekend	215	76.7 (165)	0.535
Consultations performed on week days	340	74.4 (253)	
Consultations performed after midnight	67	74.6 (50)	0.889
Consultations performed before midnight	488	75.4 (368)	
Recommendations discussed verbally with the patient's primary care physician	367	23.2 (85)	0.245
Recommendations not discussed verbally with the patient's primary care physician	188	27.7 (52)	
Format of the consultation sheet is ≥ 3 points out of 5	528	75.4 (398)	0.791
Format of the consultation sheet is ≤ 2 points	26	73.1 (19)	
Legibility of the consultation sheet is ≥ 3 points out of 5	440	75.2 (331)	0.925
Legibility of the consultation sheet is ≤ 2 points	115	75.7 (87)	
First-year trainee	201	69.7 (140)	0.020
Other trainee	354	78.5 (278)	
Surgical clinics	205	77.1 (158)	0.462
Other clinics	350	74.3 (260)	

analysis, the compliance rate to non-treatment recommendations (microbiologic cultures, radiology, biochemistry, etc.) was lower than the rate of compliance to antibiotic recommendations (186/308 vs. 232/247, $p < 0.05$, Chi-square test). In addition compliance to recommendations made by the first-year trainees was lower than the recommendations made by the other trainees (Table 3). In logistic regression analysis only recommendations including antibiotic treatment was associated with higher compliance (Table 4, $p = 0.0001$, odds ratio = 10.2, 95% CI = 5.7–18.3).

When the 78 consultations with an aim of specific antibiotic request for a clinically or microbiologically diagnosed infection were evaluated (69 consultations for a clinically diagnosed infection with a request for a specific antibiotic and nine consultations for a microbiologically diagnosed infection with a request for a specific antibiotic), it was found that in 48 cases the requested antibiotic was permitted. A different antibiotic to that requested was recommended in 24. In three no antibiotic was recommended and in three the requested antibiotic was permitted and an additional antibiotic was recommended. The cost of antibiotics

recommended in consultations in which the requested antibiotic was not approved, was lower than the cost of the requested antibiotics (47.3 ± 41.05 euro vs. 84.7 ± 118.9 euro, $p < 0.001$). Of these 78 consultations, 27 were from the internal medicine clinic, 20 from the general surgery clinic and seven were from the emergency service (Table 5).

Discussion

The evaluation of training and the giving of feedback are important in education, and particularly in medical education; it is important to evaluate the quality of specialist training.³ Infectious diseases trainees should be familiar with duties relevant to consultation practice.² To our knowledge there are no data about the quality of the consultations of ID trainees and no analysis of the factors associated with adherence to them.

In Turkey, medical education at medical school lasts six years, and the last year of this period (internship) is spent entirely in clinical practice in surgical and clinical wards. Infectious diseases and clinical microbiology is a nationally

Table 4 Results of logistic regression analysis

Covariate	Odds ratio	95% CI	p
Type of recommendation (treatment-based and other)	10.2	5.7–18.3	0.0001
Number of recommendations per consultation (up to four, or five and more)	1.0	0.6–1.7	0.874
Seniority of the trainee (first-year trainee and other)	0.7	0.4–1.1	0.129
Recommendations discussed verbally with the patient's primary care physician or not	1.4	0.8–2.2	0.145
If the consultation was performed before or after midnight	1.07	0.5–2.0	0.834

CI, confidence interval.

Table 5 Distribution of 78 consultations with an aim of specific antibiotic request for a clinically diagnosed infection

Clinic	Frequency % (n)
Internal medicine	34.6 (27)
General surgery	25.6 (20)
Emergency medicine	9.0 (7)
Anesthesiology ICU	6.4 (5)
Urology	5.1 (4)
Heart surgery	3.8 (3)
Respiratory diseases clinic	3.8 (3)
Obstetrics and gynecology	2.6 (2)
Ear/nose/throat	2.6 (2)
Dermatology	2.6 (2)
Neurology	2.6 (2)
Cardiology	1.3 (1)
Total	(78)

ICU, intensive care unit.

recognized specialty and training lasts five years. In order to start this training, it is obligatory to have graduated from a medical faculty and to have been successful in the national medical specialization and foreign language examination. It is estimated that there are about 20–40 infectious diseases specialists per million in Turkey.⁵

The fact that ID trainees called for an IDS in only 2% of consultations is of interest. In our setting IDSs are not called routinely during the night shift and this may be useful for improving ID trainee decision-making. The low rate of calling for an IDS may be explained by the fact that only two of the trainees were first-year trainees and they were on their ninth month of training during the study period. This period of nine months with a minimum seven night shifts each month, the two-month period of accompanying the IDS during consultations, and the formal education of 20 hours appears to be sufficient for the management of many cases.

Inappropriate antibiotic usage is a global and important problem.^{15–19} The ideal is to have all patients treated with the most effective, least toxic, and least costly antibiotic for the optimal time.¹⁷ IDS consultations may increase appropriate antibiotic usage, and antibiotics ordered by IDSs are less likely to be inappropriate.¹⁰ It has been reported that the requirement for approval of an IDS for the use of restricted antibiotics is the most effective method in reducing antibiotic consumption.¹⁸ In 2003 the Turkish government, which is responsible for paying over 90% of the Turkish population's health expenditure, chose this requirement of prior authorization by an IDS for the use of several antibiotics. Accordingly payment for parenteral vancomycin, teicoplanin, meropenem, imipenem, piperacillin/tazobactam, and ticarcillin/clavulanate has been restricted without the prior approval of an IDS. Payment for ceftriaxone, cefotaxime, ceftizoxime, cefoperazone, ceftazidime, cefoperazone/sulbactam, cefepime, ciprofloxacin, levofloxacin, netilmicin, amikacin and isepamicin has been unlimited when prescribed for the first 72 hours of treatment by all specialists (except general practitioners), but further usage requires IDS approval. Other antimicrobials can be prescribed without any restriction, by all medical doctors. The study presented herein was performed during this restriction period.

Our findings show that the cost of antibiotics recommended in consultations in which the requested antibiotic was not approved was lower than the cost of the requested antibiotics ($p < 0.001$), and the overall inappropriate antibiotic recommendation rate was 2.4%. This is comparable with the 5.4% and 14% reported inappropriate antibiotic recommendation rates found by Erbay et al.¹⁰ and Azap et al.¹¹ in studies in which they evaluated the appropriateness of the antibiotic recommendations of IDSs in Turkey.

In our study the three clinics most frequently requesting consultations were general surgery, emergency medicine and internal medicine. In another study from Turkey, which involved 395 consultations performed between 2000 and 2002 in a tertiary level educational hospital (during the pre-governmental antibiotic restriction policy period), orthopedics, neurology and cardiology clinics were the clinics where ID consultations were most frequently requested.¹ The difference between these studies is probably due to the requirement for prior authorization of an IDS for several antibiotics. In our study the internal medicine, general surgery, emergency medicine, and anesthesiology and reanimation clinics were the four clinics from where consultations with an aim of specific antibiotic request for a clinically diagnosed infection were most frequent; in addition about half of the consultations requested from the general surgery clinic were for request for specific antibiotic(s) for surgical antimicrobial prophylaxis. The ID consultation process may be problematic especially in the presence of the antibiotic restriction policy currently used in Turkey.^{20,21} The act of requesting was nearer to a state of 'enforcing' in some of the consultations, hence trainees approved the 'requested' antibiotic due to 'enforcing' in 10 consultations. Arguments with the internists and anesthesiologists about the restriction policy still continue.^{20–22}

Data on adherence to the recommendations of IDSs are rare. In the study of Lo et al.⁶ adherence to all, treatment and isolation-based, and diagnostic recommendations were reported as 80%, 92% and 70%, respectively. In another recently published study, Pulcini et al.¹² reported 86% adherence to antibiotic recommendations, but they did not evaluate the adherence to diagnostic recommendations. In our

study, rates of adherence to all, treatment-based, and non-treatment based recommendations were 75.3, 94.0 and 60.4%, respectively, and are in concordance with the findings of Lo et al. and Pulcini et al.

Lo et al.⁶ analyzed the factors associated with better compliance to IDS recommendations. Type of recommendation (treatment-based recommendations better than others), legibility and organization of the consultation sheet, the type of primary service from which the consultation was requested (medical better than surgical clinics), the cruciality of the recommendation, the type of hospital (private hospital better than public), and pertinency of the recommendations were the reported factors affecting compliance. In the study presented herein, in univariate analysis, recommendations made by first-year trainees and non-treatment-based recommendations were found to be associated with less compliance. In logistic regression analysis, the type of recommendation was the only statistically significant factor associated with better adherence. We did not analyze the effect of the cruciality and pertinency of the recommendation. The most probable explanation of the lack of the effect of legibility and format of the consultation sheet on compliance to the recommendations in our study is the restriction policy.

Our study has several limitations. Informal consultations comprise a significant part of the daily practice of an IDS or ID trainee, but these consultations have been excluded since it would not be feasible to record them.¹³ In addition, the adherence rate to the recommendations made in the emergency service and follow-up data of the consulted patients could not be evaluated.

In conclusion ID trainees seem capable of evaluating patients and recommending appropriate antibiotics. Treatment-based recommendations are complied with much more than others. Methodologies to improve the compliance to non-treatment based recommendations, such as structured conferences that clarify the usefulness of the performance of appropriate microbiologic cultures and other laboratory and imaging techniques in a patient with a clinically diagnosed infectious disease, seem necessary. The means to further optimize the appropriateness of antibiotherapies to 100% need to be developed.

Conflict of interest: No conflict of interest to declare.

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