



# Enfermedades Infecciosas y Microbiología Clínica

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## Effect of the inadequacy of antibiotic therapy in the Emergency Department on hospital stays<sup>☆</sup>

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### ABSTRACT

**Introduction:** The main objective of the study was to determine the frequency of patients receiving inappropriate empiric antibiotic therapy and to assess the impact in terms of increase length of hospital stay, 30-day re-admissions, and 30-day mortality.

**Methods:** An observational retrospective cohort study was conducted over a one-month period that included all patients hospitalised from an Emergency Department (ED) due to infection. Demographic variables, comorbidity, multi-resistance risk factors, site of infection, microbiological findings, and antibiotic prescribed in ED were collected. Outcomes were length of hospital stay, 30-day re-admissions, and 30-day mortality.

**Results:** A total of 376 patients were included, with a mean age of 71.1 (SD 21) years. The most frequent causes were respiratory (45.7%) and urine (23.9%) infections. The number of patients with length of stay over the median ( $\geq 9$  days) was 165 (46.1%), with re-admissions 74 (19.7%), and mortality at 30 days 44 (11.7%). There was inappropriate antibiotic treatment in 42 (11.2%) cases. After adjusting for demographic data, comorbidity, risk factors for multidrug resistant organism, presence of sepsis criteria in ED, and site of infection, inappropriate treatment was associated with an extended length of hospital stay (OR 2.22; 95% CI; 1.07–4.60;  $p = 0.032$ ), but did not to an increase in mortality ( $p = 0.271$ ) or re-admission ( $p = 0.784$ ) at 30 days.

**Conclusion:** The inappropriate empirical antibiotic therapy in patients admitted from the ED leads to an extended hospital stay, but did not increase mortality or readmission.

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## Efecto de la inadecuación de la antibioterapia en Urgencias sobre la eficiencia en la hospitalización

### RESUMEN

**Introducción:** El objetivo principal fue determinar la frecuencia de pacientes que reciben terapia antibiótica inapropiada y evaluar los resultados en términos de estancia media, reingreso y mortalidad a 30 días.

**Métodos:** Estudio observacional de cohortes retrospectivo que incluyó a todos los pacientes ingresados por infección desde un Servicio de Urgencias (SU) durante un mes. Se recogieron variables demográficas, comorbilidad, factores de riesgo de multirresistencia, foco de infección, resultados microbiológicos y

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antibiótico prescrito en el SU. Las variables de resultado fueron el tiempo de estancia, y la mortalidad y el reingreso a 30 días.

**Resultados:** Se incluyeron 376 pacientes con una edad media de 71,1 (DE 21) años. Las infecciones más frecuentes fueron respiratoria (45,7%) y urinaria (23,9%). El número de pacientes con una estancia superior a la mediana ( $\geq 9$  días), reingreso y mortalidad a los 30 días fue de 165 (46,1%), 74 (19,7%) y 44 (11,7%) pacientes, respectivamente. La prescripción inapropiada del tratamiento antibiótico en el SU se produjo en 42 (11,2%) casos. Tras ajustar por los datos demográficos, la comorbilidad, los factores de riesgo para patógenos resistentes, la presencia de sepsis en el SU y el foco de infección, la prescripción inapropiada se asoció a una estancia prolongada (OR 2,22; IC95% 1,07-4,60;  $p=0,032$ ), pero no a un aumento de la mortalidad ( $p=0,271$ ) o de los reingresos ( $p=0,784$ ) a los 30 días.

**Conclusión:** La prescripción inapropiada del tratamiento antibiótico empírico en los pacientes ingresados por un proceso infeccioso desde el SU provoca una estancia prolongada, pero no un incremento de la mortalidad o del reingreso.

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## Introduction

The term “appropriate treatment” is used widely in the medical literature to refer to therapy that is active against an infection-causing pathogen. If the dose, duration and route of administration are also appropriate, and if it follows current external or local treatment guidelines, it is considered a suitable treatment.<sup>1</sup> Numerous studies have shown empirical antibiotic treatment to be inappropriate in a high proportion of cases, estimated at around 50%.<sup>2-5</sup> In an emergency setting, the studies suggest that prescribing errors occur most frequently in elderly patients and patients with urinary infections.<sup>6-8</sup>

A recent epidemiological study found an increased prevalence of infections diagnosed in emergency departments (ED) over the last decade, mostly affecting elderly patients, patients with more comorbidities and more risk factors for multidrug-resistant strains, and patients with more serious conditions.<sup>9</sup> However, despite the changing profile of patients being treated and the increased resistance reported in recent years of pathogens that tend to cause community infections, a proportional increase in the use of antibiotics against less common or resistant pathogens has not been seen.<sup>9</sup>

The inappropriate prescribing of antibiotics could have numerous consequences. Firstly, it could result in increased healthcare costs owing to treatment failure, increased length of hospital stay, increased number of complementary tests performed or the need for admittance to the intensive care unit.<sup>10,11</sup> Secondly, one of the main causes of multiple drug resistance is the inappropriate use of antimicrobials, which leads to increased resistance to the antimicrobials prescribed. Resistance can spread from one bacterium to another and from one host to another, who has often not been previously exposed to those antimicrobials. Finally, it may affect the patient's long-term prognosis as it may lead to diminished survival rates in patients with severe sepsis or septic shock.<sup>12</sup>

In light of the above and of the importance of the issue, a study has been conducted to determine the rate of inappropriate antibiotic prescribing and to assess its consequences in terms of increased mean length of hospital stay, readmittance and short-term mortality of patients, against the need to modify antibiotic treatment or not once admitted.

## Methodology

### Patient enrolment

*Observational, retrospective cohort study.* All patients  $\geq 18$  years of age admitted due to infection to the ED of a tertiary university hospital between 1 and 31 October 2014 were included. The patients

were identified through a hospital administrative database. All patients with any diagnosis of infection at discharge who had been admitted to the ED during the study period were enrolled. Only the first episode to occur during the study period was considered. The study was approved by the Independent Ethics Committee of Hospital Universitario Clínico San Carlos.

### Study site

The Hospital Clínico San Carlos is an urban tertiary university hospital with a catchment area of approximately 500,000 patients in the Autonomous Community of Madrid. The ED treats 350 patients per day on average, 15% of which are treated due to signs of infection.

### Variables

The following variables were collected from the patients' medical records and recorded on a standardised electronic form: demographic variables (age, gender), the degree of comorbidity according to the Charlson index,<sup>13</sup> risk factors for multidrug resistance (immunosuppressive treatment, chronic corticosteroid therapy, surgery in the last month, if the patient had a urinary or central venous catheter, previous hospital admissions in the last 3 months, use of antibiotics for more than 7 days in the last month and referral from a long-term care institution or nursing home), the type of diagnosed infection (respiratory, urinary, intra-abdominal, skin, soft tissue and other), whether the patient met the clinical criteria of sepsis, severe sepsis or septic shock, the antibiotic prescribed in the ED, if this antibiotic was modified during the patient's hospital stay and, if so, the day it was modified and the reason (poor progression, antimicrobial susceptibility) and the results of the microbiological studies conducted. The variable ‘change of antibiotic for any reason’ was also defined, which included those patients whose antibiotic was changed both due to poor progression as well as due to the antimicrobial susceptibility of the isolate. The variable ‘multi-resistant microorganism’ was defined when the anti-microbial susceptibility test demonstrated resistance to 3 or more families or groups of antimicrobials commonly used to treat the corresponding pathogen. The antibiotic treatment was deemed to be inappropriate when it was changed as a result of a lack of sensitivity of the isolated microorganism to the antimicrobial prescribed in the ED. Antibiotics that were descaled or changed as part of sequential treatment were not deemed to be inappropriate. The following were considered to be broad-spectrum antibiotics: ceftazidime, cefepime, carbapenems, piperacillin/ tazobactam, vancomycin, teicoplanin, daptomycin, linezolid and tigecycline. Rifampicin, isoniazid, pyrimethamine and ethambutol were considered to be tuberculostatic treatment.

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