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# Use of antibiotics at a University Clinic Hospital: effect of protocolized antibiotic treatment in the evolution of hospital patients with infections

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## ABSTRACT

**Objectives.** To analyse factors associated to "failure" in patients under antibiotic (AB) treatment at a third level hospital.

**Patients and methods.** All patients receiving an AB treatment along April 2012 were prospectively observed and factors associated to failure were analyzed. Failure was defined as clinical or microbiological failure, relapse or death. Statistically significance was established as p<0.05

**Results.** 602 of 1,265 admitted patients during the study month included an AB in their medical prescriptions, being 178 considered as prophylactic AB prescriptions, 342 empirical treatments and 82 directed treatments as empiric treatments. Ceftriaxone and levofloxacin were the most used AB; choice of empirical and directed treatments were in line with protocols in 71% (242 of 342 cases) and 67% (55 of 82), respectively. Of all the patients receiving antibiotics for therapy (n=424), 402 had infection criteria (in 22 cases antibiotic treatment was deemed unnecessary since the patient showed no infectious process). Of these, 292 (72%) showed a good evolution, while the others were considered as failed therapies, either because of microbiological persistence in 49 (12.8%), relapse in 31 (7.71%) and death in en 30 (7.46%). Factors associated to "failure" were Charlson score ≥3 (OR 3.35; 95%CI 1.602-7.009); empirical and/or directed treatment not in keeping with the protocol (OR 5.68; 95%CI 2.898-11.217); and infection by ESBL and/or ciprofloxacin resistant *E. coli* (OR 4.43; 95%CI 1.492-13.184).

**Conclusions.** A high rate of AB prescriptions in admitted patients correspond to empirical infection treatment, being ceftriaxone and levofloxacin the most used AB. Inadequate empirical and/or directed treatment is associated to clinical or microbiological failure and death.

**Keywords: antibiotics, protocol, hospitalized patients, clinical failure, microbiological failure.**

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## Uso de antibióticos en un hospital clínico universitario: efecto del tratamiento antibiótico protocolizado en la evolución de pacientes hospitalizados con infección

## RESUMEN

**Objetivos**. Analizar los factores asociados a fracaso en los pacientes que están recibiendo tratamiento antibiótico en un hospital de tercer nivel.

**Pacientes y métodos.** Todos los pacientes que recibieron algún tratamiento antibiótico durante el mes de Abril de 2012 se siguieron de forma prospectiva y se analizaron los factores asociados a fracaso. El fracaso fue definido como clínico o microbiológico, recaída o muerte. La significación estadística fue establecida con una p<0,05.

**Resultados.** 602 de los 1.265 pacientes ingresados durante el mes de estudio llevaban al menos un antibiótico entre sus prescripciones médicas, correspondiendo en 178 de los casos a profilaxis antibiótica, 342 a tratamientos antibióticos empíricos y 82 a tratamientos dirigidos. Los antibióticos más utilizados fueron ceftriaxona y levofloxacino; la elección del tratamiento antibiótico tanto empírico como dirigido se hizo de acuerdo a los protocolos correspondientes en el 71% (242 de 342 casos) y el 67% (55 de 82 casos), respectivamente. De todos los pacientes que recibieron antibióticos como tratamiento (n=424), 402 tenían criterios de infección (en 22 casos el tratamiento se consideró innecesario dado que el paciente no presentaba proceso infeccioso alguno). De estos, 292 (72%) evolucionaron favorablemente, mientras los otros fueron considerados fallos terapéuticos, bien por persistencia microbiológica en 49 casos (12,8%), recaída en 31 casos (7,71%) y muerte en 30 (7,46%). Los factores asociados a "fracaso" fueron un índice de Charlson ≥3 (OR 3,35; 95%CI 1,602-7,009); el tratamiento antibiótico empírico o dirigido no ajustado a protocolo (OR 5,68; 95%CI 2,898-11,217); y la infección por *E. coli* BLEE y/o resistente a ciprofloxacino (OR 4,43; 95%CI 1,492-13,184).

**Conclusiones.** Un alto porcentaje de los antibióticos prescritos en pacientes hospitalizados corresponde a tratamientos empíricos, siendo ceftriaxona y levofloxacino los antibióticos

más usados. El tratamiento inadecuado, tanto empírico como dirigido, se asocia con fracaso clínico o microbiológico y con un mayor riesgo de muerte.

**Palabras clave: antibióticos, protocolos, pacientes hospitalizados, fallo clínico, fallo microbiológico.**

## INTRODUCTION

Antimicrobial agents represent a huge advance in clinical practice. Antibiotics are probably the paradigm in this group of drugs, although bacteria are becoming increasingly resistant to them, which is not only a threat for the patient as an individual but also for ill people as a whole, i.e. there are implications for public health[1-3]. Indiscriminate and inappropriate use of antibiotics is, moreover, increasingly linked to undesirable effects[4] (e.g. diarrhoea secondary to *Clostridium difficile* toxine[5,] candidemia fostered by prolonged use of antibiotic treatments)[6] and the emergence of infections caused by multi-resistant micro-organisms[7-9]. More generally, various studies have linked the inappropriate use of antibiotics to an increase in morbidity and mortality, lengthier hospital stays, lower life quality and increased economic costs[10,11]. Among other reasons, antibiotics are used incorrectly on account of: frequent wrong diagnoses of bacterial infectious diseases, limited knowledge of the epidemiology of the infections and the sensitivity patterns of the most frequently isolated micro-organisms, as well as a lack of knowledge about the pharmacological properties of antibiotics[12,13]. Hence, optimizing the use of antibacterial agents is today a priority in medicine[14], especially so given that 25-60% of hospital patients are administered systemic antibiotics[15] and that the use of these is inappropriate in almost 50% of cases according to some studies. Many restrictive and non restrictive measures and procedures have been put into practice in recent years to improve the use of antibiotics[16,17], but the response and acceptance by doctors is controversial and in most cases their positive effect has disappeared after the withdrawal of measures or active supervision by the infectious disease consultant, which is the principal correcting mechanism in a wide number of non restrictive studies[18,19].

In this study, we analyse all hospitalized patients who during the period of the study received antibiotic treatment. The aim was to describe the features of the antibiotics described, their degree of appropriateness and suitability and their effect on the patients' prognosis of the patients. A comparative study with 2 published historical cohorts from 1978 and 1982 was also made[20].

## PATIENTS AND METHODS

A retrospective review was made of the clinical records of all patients who in April 2012 had been given antibiotic treatment during their stay at our hospital, which is a third level, university centre with 863 beds, of which 629 are used by the general hospital. It provides specialized care for the population in area I (some 550,000 inhabitants) and it is a regional reference for types of surgery - cardiovascular, thoracic, maxillo-facial, plastic and burns, neurosurgery, medical and radiation, haemodynamic, nuclear medicine coordination and activity of solid organ transplants and haematopoietic.

All the antibiotic prescriptions were reviewed prospectively using the electronic prescription system in medical-surgical areas of the centre in the study. Patients in the paediatric, gynaecology and IC-reanimation wards were excluded as there was no electronic prescription program. After April, a retrospective review was made of all the clinical records of the patients identified in the first phase of the study. Patients who had received antiviral and antifungal treatments were excluded.

Data were collected following the pre-established study protocol. Information was recorded about the epidemiological characteristics of the patients, distribution by services, the antimicrobial agents they were administered, and they were classified by therapeutic groups and reason for prescription (prophylaxis *versus* empirical or guided treatment). Information was also collected on the patients' base illnesses, its prognosis (using the McCabe and Jackson criteria) and the clinical severity of the patient at the beginning of the infectious process (Winston *et al*)[21].

Each patient's type of infection and its focus was recorded according to the Atlanta (USA) CDC criteria. The place of acquisition was classified according to the 72-hour rule and it was considered a nosocomial infection if it appeared in the 72 hours following admission or if the patient had a record of admission in the previous month. Prior use of steroids was defined as the prior administration of a dose equal to or higher than the equivalent of 20 mg/day of prednisone for 2 weeks in the 2 months prior to the infection episode.

In the case of microbiological isolation of *Escherichia coli*, the existence of resistance to quinolones (ciprofloxacin) and the production of extended spectrum betalactamases (ESBL) were considered to be a unique variable, since both characteristics are associated in our sphere with inappropriate empirical treatment, as prescription of quinolones in patients with urinary infection continues to be habitual practice, even though it is not recommended in clinical guidelines.

The empirical treatment was as laid down at the start by the symptoms, and the directed treatment was introduced based on the microbiological information.

Use of antibacterial agents was defined as fitting the protocol once the antibiotics had been selected according to the recommendations for use, and as being clinically correct when the choice of antibiotic was not only appropriate but was also administered at the correct dose and intervals, for the correct duration and with appropriate sequencing (from parenteral to oral administration on the third day of deffervescence), in line with the relevant recommendations of the Infectious Diseases Society of America (IDSA) and the Spanish Society of Infectious Diseases and Clinical Microbiology (SEIMC).

In the directed treatments, the sensitivity of the isolated microorganism was taken into account when microbiological documentation existed. Prior infectious process was defined

as that which had occurred in the 6 weeks prior to the event under study.

The protocols for treatment and prophylaxis used as references to define the suitability of the empirical and directed treatments and the prophylaxis are the relevant clinical guidelines and those of our own hospital, which had been agreed on in earlier years with the various Services, although they were not made public until a year afterwards.

Evolution of patients takes in situations of cure and failure, understood as the microbiological persistence in cases where this was recorded, clinical failure, relapse and *exitus vitae*, following the criteria in the literature. Monitoring of patients was performed until hospital dispatch.

A comparative study was also made with the cohorts in similar studies[20] made by our group in 1978 and 1982. In 1978, there was no defined antibiotic policy at our centre. This came into effect in 1980 and its effect is evaluated in 1982. It consisted, among other things, in developing the first protocols of empirical treatment in the main infectious processes. As of 1995, agreed protocols came in which were much broader and there have been periodic updates by the Committee for Antimicrobial Agents and Control of Nosocomial infection, of which the most recent was in 2012.

The data were analyzed using the SPSS 19.0 statistics program. The relation or association between qualitative variables was done by analysis of contingency tables with the Pearson $\chi^2$ test supported by a residue analysis to determine the dependence direction and the Fisher exact test. For quantitative variables means were compared using the Student t test. The level of statistical significance was set at $p<0.05$. A bivariate analysis was performed to detect prognosis pro factors associated with non-cure, and these were submitted to a multivariate analysis using the logistic regression method.

## RESULTS

**Descriptive Study.** Of the 1,265 patients admitted to the HCUVA general residence in April 2012, 602 (49.5%) received systemic antibiotic treatment. Of these, 424 (70.4%) did so under a therapy regimen (342 empirical treatments, 57%; and 82 directed treatments, 14%) and 178 (29.6%) were prophylactic. Samples for cultures were collected in 284/602 (47.2%): 272 (64.2%) in the therapeutic group and 12 (6.7%) in the prophylactic cohort. Some of the samples taken for culture were positive in 109 patients and 141 microorganisms were found (some patients had several microbiological isolations): 42 in urine cultures (29.8%), 27 in wound cultures (19.2%), 20 (14.2 %) in blood cultures, 19 (13.4%) in sputum, 19 (13.4%) in drainage cultures, 6 (4.3%) in stool cultures and 8 (5.7%) in other foci cultures. *E. coli, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae* and *Enterobacter cloacae* were the most frequently isolated microorganisms (table 1).

The most used antibiotics were: ceftriaxone and levofloxacin as treatment and amoxicillin-clavulanic and cefuroxime as prophylaxis.

Choice of empirical and directed treatments were in line with protocols in 70.8% (242 of 342 cases) and 67% (55 of 82), respectively. Both, empirical and directed treatment (when the latter represented a modification of the former based on the microbiological data), were appropriate and in keeping with protocols in 292/424 (68.9%). In the case of prophylaxis, treatment was according to protocol in 168 of the178 cases. Of all treatments (prophylaxis not included), monotherapy was used in 308 patients (72%) and combinations in the rest.

As for clinical use of antibiotics, this was deemed suitable in 343/602 (57%), in 227/424 (53.3%) of the treatment cases and in 116/178 (65.1%) of the prophylaxis cases.

Of all the patients receiving antibiotics for therapy (n=424), 402 had infection criteria (in 22 cases antibiotic treatment was deemed unnecessary since the patient showed no infectious process). Of these, 292 (72%) showed a good evolution, while the others were considered as failed therapies, either because of microbiological persistence in 49 (12.8%), relapse in 31 (7.71%) and death in en 30 (7.46%).

The bivariate analysis revealed an association with a bad prognosis in case of rapidly fatal base illness (McCabe I), urinary focus, previous invasive procedures, previous infection, prior use of corticoids, nosocomial acquisition, positive urine culture for resistant *E. coli* (ESBL and/or resistant to ciprofloxacin), empirical treatment not in line with protocol, and clinical use of incorrect empirical or directed antibiotic ($p<0.05$). The data on the bivariate study are given in detail in table 2.

According to the multivariate analysis, there was a statistically significant association with "failure" (relapse, no microbiological cure or *exitus vitae*) in case of baseline clinical severity (OR 3.35; 95%CI 1.602-7.009); empirical and/or directed

**Table 1** Microbiological Data.

| MICRORGANISM | N= 141<br>n (%) |
|---|---|
| *Streptococcus pneumoniae* | 5 (3.5) |
| *Staphylococcus aureus* | 11 (7.8) |
| *Pseudomonas aeruginosa* | 11 (7.8) |
| *Escherichia coli* | 34 (24.1) |
| *Klebsiella* spp. | 11 (7.8) |
| *Enterococcus* spp. | 12 (8.5) |
| *Enterobacter* spp. | 5 (3.59 |
| *Proteus* spp. | 7 (4.9) |
| *Staphylococcus epidermidis* | 4 (2.9) |
| *Citrobacter* spp | 4 (2.9) |
| *Morganella* spp | 4 (2.9) |
| *Bacteroides* spp | 4 (2.9) |
| Other | 29 (20.5) |

**Table 2** **Prognosis factors for therapy failure. Bivariate analysis.**

| VARIABLE | CURE N=292 n (%) | FAILURE N=110 n (%) | p |
|---|---|---|---|
| SEX | | | |
| Male | 155 (53) | 61 (55) | ns |
| Female | 137 (47) | 49 (45) | |
| PRIOR MANIPULATION | 23 (8) | 18 (16) | <0.017 |
| PREVIOUS STEROIDS | 50 (17) | 33 (30) | < 0.0005 |
| PREVIOUS CYTOSTATICS | 19 (6,5) | 17 (15,4) | < 0.0005 |
| PREVIOUS SURGERY | 24 (8) | 12 (11) | ns |
| PREVIOUS INFECTION (6 weeks prior) | 56 (19) | 37 (34) | < 0.0005 |
| PREVIOUS ANTIBIOTIC TREATMENT | 65 (22) | 42 (38) | ns |
| BASELINE SEVERITY | | | |
| Critical | 2 (0,7) | 5 (4,5) | < 0.0005 |
| Bad | 25 (8,6) | 25 (22,8) | |
| Regular | 254 (87) | 75 (68,2) | |
| Stable | 11 (3,7) | 5 (4,5) | |
| BASE ILLNESS | | | |
| McCabe I | 14 (4,8) | 20 (18,2) | < 0.0005 |
| McCabe II | 163 (55,8) | 58 (52,7) | ns |
| McCabe III | 53 (18,2) | 20 (18,2) | ns |
| No base illness | 62 (21,2) | 12 (10,9) | < 0.0005 |
| SEPSIS | 25 (8,6) | 9 (8,2) | ns |
| FOCUS OF INFECTION | | | |
| Urinal | 47 (16,1) | 28 (25,5) | < 0.0005 |
| Abdominal | 40 (13,7) | 11 (10) | ns |
| Wound | 6 (2,1) | 10 (9,1) | ns |
| Respiratory | 147 (50,4) | 40 (36,4) | < 0.0005 |
| Skin/soft parts | 22 (7,5) | 5 (4,5) | ns |
| Oral | 8 (2,7) | 0 (0) | ns |
| Others | 4 (1,3) | 3 (2,7) | ns |
| Not affiliated | 18 (6,2) | 13 (11,8) | ns |
| ADQUISITION | | | |
| Community | 259 (89) | 79 (72) | < 0.0005 |
| Nosocomial | 33 (11) | 31 (28) | |
| ISOLATED MICROORGANISM | | | |
| *S. pneumoniae* | 5 (1,7) | 0 (0) | ns |
| *S. aureus* | 7 (2,4) | 3 (2.7) | ns |
| *P. aeruginosa* | 1 (0,3) | 4 (3.6) | ns |
| *E. coli* ESBL or resistant to quinolone | 12 (4,2) | 16 (14.5) | < 0.0005 |
| *Klebsiella* spp. | 4 (1,3) | 5 (4.5) | ns |
| *Enterococcus* spp. | 3 (1,1) | 6 (5.5) | ns |
| *Enterobacter* spp. | 2 (0,7) | 2 (1.8) | ns |
| *Proteus* spp. | 6 (2,1) | 1 (0.9) | ns |
| *S. epidermidis* | 1 (0,3) | 2 (1.8) | ns |
| *Citrobacter* spp. | 1 (0,3) | 2 (1.8) | ns |
| *Morganella* spp. | 1 (0,3) | 2 (1.8) | ns |
| Others | 17 (5,8) | 4 (3.6) | ns |
| Negative | 124 (42,5) | 35 (31.9) | ns |
| No cultures | 108 (37) | 28 (25.6) | ns |
| DOCUMENTED BACTERIEMIA | 11 (3,8) | 6 (5.5) | ns |
| ADJUSTED TO PROTOCOL (EMPIRICAL AND DEFINITIVE) | 233 (80) | 61 (55) | <0.0005 |
| CORRECT CLINICAL USE (EMPIRICAL AND DEFINITIVE) | 199 (68) | 29 (26) | <0.0005 |

**Table 3** **Patterns of change.**

| | COHORT 1978 N (%) | COHORT 1982 N (%) | COHORT 2012 N (%) |
|---|---|---|---|
| PRESCRIPTION OF ANTIBIOTICS | 491 (45)* | 393 (33) | 602 (48)* |
| APPROPRIATE USE | 244 (49)* | 270 (69) | 460 (76)* |
| SERVICES | | | |
| Medical | 183 (37)* | 184 (47) | 356 (59)* |
| Surgical | 308 (63) | 209 (53) | 246 (41) |
| MONOTHERAPY | 334 (68) | 255 (65) | 477 (79)* |

*** See text for statistical significance**

treatment not in keeping with the protocol (OR 5.68; 95%CI 2.8981-11.217); and infection by ESBL and/or ciprofloxacin resistant *E. coli* (OR 4.43; 95%CI 1.492-13.184).

For the comparative study with earlier cohorts (table 3), the use of antibiotics was significantly higher in 1978 (46.4%) and 2012 (49%) than in 1982 (33%). Suitability was similar in the first two years of the study (49%, 53% and 68.7% respectively), and significantly greater in 2012 (69%) compared to 1978. Prescriptions by the Medical Services increased significantly in 2012 (59%) in relation to 1978 (37%) and 1982 (47%). Monotherapy was significantly more frequent in 2012 (79%) than in 1978 (68%) and 1982 (65%).

## DISCUSSION

The study of this cohort highlights that global use of antibiotics (49.5%) in hospital patients at our centre is higher than that detected in primary hospitals in Europe in 2012 (36%)[22] and slightly higher than that found in the EPINE of 2011(42.5%)[23] and in tertiary hospitals of the EPINE of 2012 (45.6%)[22]. These difference may be related first to the fact that the participation in the EPINE of 2011 consisted of a greater number of hospitals with under 500 beds with a lower rate of serious infections, and secondly to the greater complexity of the patients in our hospital. Indeed, our hospital has an advanced transplant program (solid organ and haematopoietic) as well as being a centre of reference for biological treatments and for high risk surgery in patients with severe neoplasm. The percentage of patients receiving antibiotic (non prophylactic) treatment is on a par with that of other centres (33%).

As for the type of antibiotic most frequently used, our results are similar to those reported in the EPINE 2012[22], in which a greater use of amoxicillin-clavulanic, levofloxacin, ceftriaxone, ciprofloxacin and cefazolin was detected. In our cohort, the most used antibiotics were amoxicillin-clavulanic and cefuroxime in the antibiotic prophylaxis (in accordance with the protocols in use in our centre), and ceftriaxone and levofloxacin in therapeutic prescriptions, which, in a month like April with less respiratory infection prevalence may seem questionable.

Requests for microbiological studies appear as basic procedures in the diagnosis evaluation of the infectious pathology and its more exact therapeutic evaluation. However, as in a multicentre European study (ESAC)[24], whose rate of culture requests was under 50%, in our analysis cultures were collected from 47% of patients, although this figure rose to 64% for the subgroup of patients receiving antibiotics for non prophylactic but for therapeutic aims, which is a more correct evaluation, since the indication of collection of samples for culture is exceptional in the cases of bacterial prophylaxis. Even so, this low percentage of requests for cultures is associated to limited education in the area of infectious pathology and antimicrobial therapeutics, as is borne out in many classical and more recent studies in the literature[25-27]. This low prevalence in the requests for samples for culture means that a high percentage of treatments prescribed in our study are empirical (57%). If to this we add that many patients in our hospitals are elderly or have some degree of immunecompromised, and this often means that they present little or no hyperthermia, and therefore samples for culture are not taken and empirical treatments are undertaken which cannot easily be directed according to the microbiological data, then it is easy to understand the importance of correct protocols at each centre that would enable clinicians to make the correct choice for the initial antibiotic treatment[28].

According to our analysis none adjusted to protocol empirical and/or directed treatment (OR 5.68; 95%CI 2.898-11.217), critical baseline severity (OR 3.35; 95%CI% 1.602-7.009) and infection by ESBL- *E. coli* and/or resistant to ciprofloxacin (OR 4.43; 95%CI % 1.492-13.184), were significantly associated with relapse, non-microbiological cure or *exitus vitae*. As regards proper use of antibiotics and its effect on the evolution of patients with serious infections, various studies show that inappropriate treatment in cases of sepsis is associated with worse evolution and higher mortality[29-31]. However, this aspect has always been a bone of contention and many studies do not identify it as such, with more weight being given to determining in the prognosis the greater or lesser baseline clinical severity or worse prognosis of the base illness. In our cohort, both factors were of influence, although the weight of the former would seem to be greater. In our opinion, the fact that a treatment that is not adjusted to the protocols is associated with a bad evolution conditions the need for centres to have protocols that adjust to their idiosyncrasy.

Noteworthy in our series is the high degree of adjustment of the prophylactic treatments, which is in agreement with an earlier project by our working group in which the process of prescription and dispensing of these medicines was improved. Like on other centres, the problem of these guidelines lay in the duration (prolonged prophylaxis instead of solely at the time of surgery)[32].

Degree of suitability in empirical treatments is acceptable, although not excellent in our centre (70%) and, interestingly, somewhat lower for directed treatments (67%). These results probably give a good indication of protocol compliance. Nowadays, optimization of antibiotic prescriptions is sought and there are several groups and projects focusing on this[33]. In our experience, and in line with other authors, continuous education is very important in this sense[34-36], as is active participation by the infections consultant, which in earlier studies gave greater matching of antibiotic treatment than mere isolated information[37], as has been corroborated by other researchers[38]. Unfortunately, in a recent study in Spain only 40% of hospitals had activities aimed at optimizing use of antibiotics, with large differences found according to geographical areas and types of hospital[39].

When we analyze the percentages of appropriate clinical uses, the degree of suitability falls to 53% of the medicines prescribed for therapeutic ends and to 65% of the prophylaxes. That is, over 35% of antibiotic use was inappropriate in some of the pharmacological parameters and in the duration of the treatment, highlighting the real need to structure programs to implement the use of antibiotics with the active participation of clinics with experience in infectious pathology[40-43], not to mention the indispensable logistic support of Hospital Pharmacy. Several studies have already valued the huge potential of electronic prescription programs in this sense[33].

Worthy of mention is the fact that the results of adjustment or compliance with protocols at our centre, which has no active consultancy procedures or clinical suggestions, are similar to those reported by other authors[38] in studies in which experts in infectious pathology make written recommendations in patients' clinical records.

Noteworthy too, is that in our cohort the presence of infection by *E. coli* producer of ESBL or resistant to ciprofloxacin is significantly related to a bad evolution (OR 4.43; 95%CI 1.492-13.184). This means that in many of these cases the initial empirical treatment may be inappropriate and that the protocol needs to be adapted to this growing profile of resistances in hospitales[8,10].

It is also seen that the sustained work of many years has led in our centre to a greater compliance with protocols in 2012 than in 1978 and 1982, although there is still a long journey towards excellence. Hence, it is important to continue to maintain efforts[43].

In conclusion, compliance with protocols for antibiotic treatment in a tertiary hospital is associated with a better prognosis, and although the pattern of resistance and the initial severity are factors, which we can affect, we can develop policies and programs aimed at improving antibiotic prescription in our hospitals.

## ACKNOWLEDGEMENTS

To Dr. Erill for his help and support.

## FUNDING

None

## TRANSPARENCY DECLARATIONS

None to declare

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