

Original article

# An antibiotic stewardship program in a French teaching hospital<sup>☆</sup>

## *Bilan d'un programme de bon usage des antibiotiques dans un CHU français*

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### Abstract

**Objectives.** – An antibiotic stewardship program was implemented in our teaching hospital in 1999, and strengthened in 2005. We report its organization and impact on antibiotic use.

**Methods.** – This observational study was conducted during a 10-year period (2002–2011).

**Results.** – Many interventions were implemented: Infectious Diseases Specialists (IDS) led systematic ward rounds in several departments (1999); nominative antibiotic order form (2005); documentation of IDS advice in the patient's electronic medical record (2007); IDS advice triggered by the pharmacist (formulary restriction, 2007) or because of positive blood cultures (2009); automated weekly extraction of advice given into a database (2011). Seven thousand two hundred and five pieces of advice were recorded between 2007 and 2011: 63% following physician request, 26% triggered by the pharmacist and 9% because of positive blood cultures. Advice was provided by IDS in 95% of cases (63% by phone). The number of antibiotic prescriptions remained stable since 2005 at around 400 defined daily doses (DDD)/1000 patient-days. Documenting, sharing, and choice of action were improved due to the database.

**Conclusions.** – Our antibiotic stewardship program is well accepted by physicians and allows controlling antibiotic use in our hospital.

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**Keywords:** Antibiotic stewardship; Antibiotic management team; DDD; Infectious diseases specialist

### Résumé

**Objectifs.** – Un programme de bon usage des antibiotiques est en place dans notre CHU depuis 1999, renforcé en 2005. Nous en décrivons ici les modalités et l'impact sur les prescriptions antibiotiques.

**Méthodes.** – Étude observationnelle sur dix ans (2002–2011).

**Résultats.** – De multiples actions ont été mises en place successivement, notamment : passages systématiques d'infectiologues dans de nombreux services (1999), ordonnance nominative (2005), formulaire traçant les avis donnés dans le dossier patient informatisé (2007), avis infectiologique déclenché par alerte pharmacien (antibiotiques à prescription restreinte, 2007) ou du fait d'hémocultures positives (2009), extraction automatisée des données du formulaire sous forme d'un tableau de bord (2011). Sept mille deux cent cinq avis ont ainsi été tracés de 2007 à 2011, demandés par le clinicien (63 %), déclenchés par l'alerte pharmacie (26 %) ou microbiologie (9 %) ; les avis étaient donnés par les infectiologues itinérants dans 95 % des cas (avis téléphonique dans 63 % des cas). Le niveau de prescriptions antibiotiques est resté stable depuis 2005, aux alentours de 400 DDJ/1000 journées d'hospitalisation. Le tableau de bord a permis de tracer, partager et cibler nos actions efficacement.

**Conclusions.** – Notre programme de bon usage des antibiotiques est bien accepté des cliniciens et permet une maîtrise des prescriptions antibiotiques.

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**Mots clés :** Bon usage des antibiotiques ; DDJ ; Infectiologue ; Référent

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## 1. Introduction

National guidelines for antibiotic stewardship in French healthcare institutions have been available since 1996 [1]. The lack of any specific funding made it sometimes difficult to implement any action in some institutions, and led to variable programs in institutions [2]. Sharing experience is one of the means allowing improvement of practice. Thus, the study recently published by a Nancy team on their antibiotic stewardship program was contributive [3]. We had for aim to describe our antibiotic stewardship program, implemented since 1999 and strengthened since 2005. The undertaken actions allowed mastering antibiotic prescriptions, and ranking our institution as one of those with the lowest antibiotic consumption among French tertiary-care teaching hospitals.

## 2. Methods

This descriptive retrospective study of data collected prospectively was conducted over a 10-year period at the Nice University Hospital (1600 beds, including 1035 for hospitalization in Medical Surgical, and Obstetrical units (MSO), in four sites). The aim of our study was to describe the antibiotic stewardship program in our hospital, and to assess its impact on antibiotic prescriptions. The prescriptions of antifungal and antiviral drugs were excluded from the study.

### 2.1. Description of the antibiotic stewardship program

Various actions have been implemented since 1999, and reinforced since 2005. These actions based on national and international recommendations for antibiotic stewardship are listed in Table 1 [4,5]. These actions rely on the antibiotic management team (AMT), which is the antimicrobial commission's operational team, and a multidisciplinary team including infectious diseases specialists, microbiologists, pharmacists, and infection control specialists. This team's missions were described in 2005 in a charter, validated by the Hospital's Medical Commission in 2006. The team meets every month to define and assess its actions. Three infectious diseases specialists ( $\approx 1$  equivalent to a full-time position) participate in this activity, allowing all units in our hospital to have a referent infectious diseases specialist. It was decided in 2007 for some drugs (costly and/or broad spectrum), that all their prescriptions would necessitate AMT approval within the first 48 hours of prescription (formulary restriction). The hospital pharmacy mails a recap of these prescriptions every day to infectious diseases specialists, who offer their advice and check with the prescriber the appropriateness of antibiotic prescriptions. It was also decided in 2009 that the bacteriological laboratory would mail a recap of positive blood cultures every day to infectious diseases specialists, to improve the management of bacteremia/fungemia. The infectious diseases specialist then offers the physician diagnostic and therapeutic advice. Finally, the bacteriological laboratory has been sending e-mails to the AMT since July 2012, if Enterobacteriaceae resistant to 3rd generation cephalosporins are suspected. All new interns have been given

a half-day training on antibiotic stewardship since 2008, focusing on the epidemiological context, the available tools in our hospital, and training them on case studies. Continuous medical training has also been offered to senior physicians since 2009.

### 2.2. Evaluation of antibiotic management team (AMT) activity

All advices given by the AMT have been recorded since 2007 in a file visible by all physicians in the patient's electronic medical record. This file may be updated (version 3 currently) and allows, besides given advice, collecting data allowing evaluating AMT activity, especially for the diagnoses, healthcare-associated infections, ESBL-producing Enterobacteriaceae, or restricted antibiotic prescriptions targeted by the advice. This file has allowed evaluating AMT activity (even if it underestimates the true activity, because of non-recorded advice, especially when given by telephone) since 2011. All file data are extracted automatically to a database. The given advice remains consultative; the final decision is the responsibility of the physician managing the patient [1].

### 2.3. Impact of the program on antibiotic prescriptions

The yearly expenses related to antibiotic prescriptions have been recorded by the pharmacy and available since 2002. Antibiotic prescriptions expressed in defined daily doses (DDD)/1000 patient-days (PD) have been recorded since 2005 (sorted by antibiotic class since 2007).

## 3. Results

### 3.1. Description of the antibiotic stewardship program

The ICATB score (antibiotic stewardship index) of our hospital has been 18/20 (class A institution) since 2006. The only missing points correspond to the absence of computerized prescriptions (planned for 2012). Various actions have been implemented since 1999 and strengthened since 2005 (Table 1) [6–20]. Every day, the referent infectious diseases specialists receive mails describing restricted antibiotic prescriptions and the list of bacteremia/fungemia, and contact the physicians managing the concerned patients to offer advice.

### 3.2. Evaluation of antibiotic management team activity since 2007 (file data)

Seven thousand two hundred and five pieces of advice have been recorded since 2007 for 3506 patients, with a regular yearly increase (228 in 2007, 550 in 2008, 1413 in 2009, 2245 in 2010, 2769 in 2011). Six departments accounted for 55% of all given advice: ICU (14%), hepato-gastro-enterology (11%), hematology (10%), digestive surgery (7%), geriatrics (7%), and nephrology (6%). The advice was asked by the physician in 63% of the cases, triggered by a pharmacy alert in 26% of the cases, and by the microbiology laboratory in 9% of the cases

Table 1

Description of the various interventions implemented.

*Description des différentes actions mises en place.*

Action	Year of the instauration
Antimicrobials commission (3 meetings/year)	Before 2005
Systematic weekly round of the referent infectious diseases specialist in some units (especially in those with high antibiotic use)	
Advice of the infectious diseases specialist available 24 h/24 h 7 d/7 d via the unit's on-call physician	
Results of bacteremia/fungemia given to the physician by telephone in real-time by the microbiologist	
Monitoring expenses related to antibiotic prescriptions	
Local guidelines (curative antibiotic therapy and antibiotic prophylaxis) printed out	
Audits and feedback, made every year, on various topics [6,8,10–16,18,19]	
Patient's electronic medical record, including hospitalization medical reports, imaging, and biological test reports	
AMT, multidisciplinary, grouping infectious diseases specialists, pharmacists, infection control specialists, microbiologists. Monthly meetings. Drafting of a mode of functioning (charter)	2005
Infectious diseases specialists ( $\approx 1$ full-time position) and pharmacists ( $\approx 1$ full-time position), with time specifically dedicated to antibiotic stewardship	
Nominative antibiotic order form	
Surveillance of antibiotic prescriptions at the university hospital and in units, in DDD/1000 patient-days	
Optimization of doses by the pharmacists, with consultation of microbiological data on the patient's electronic medical record. Advice of referent infectious diseases specialist if needed	
Delivery of antibiotics for 3 days on one of the hospital sites in case of empirical antibiotic therapy, of restricted prescription antibiotic or of parenteral antibiotic therapy (delivery for 7 days in other cases)	
Issuing local guidelines (curative antibiotic therapy [Antibiogarde <sup>®</sup> ] and antibiotic prophylaxis) on the Intranet	
Standardization of antibiotic prophylaxis protocols and easier availability for physicians with kits [19]	
Courses/staff meetings in some units on antibiotic stewardship	
Drafting specific diagnostic and therapeutic protocols for some units	2006
Presentation and validation of AMT activity by the institution's medical commission	
Specific form filled out by AMT members, visible by all physicians on the patient's electronic medical record	2007
List of restricted prescription antibiotics (costly and/or broad spectrum), requiring advice of an infectious diseases specialist to maintain the treatment	
Systematic antibiotic stewardship training for new interns	2008
Systematic advice from the infectious diseases specialist in case of bacteremia/fungemia	2009
Monthly pluridisciplinary meetings for bone and joint infections	
Yearly antibiotic stewardship continuous medical training sessions offered to senior physicians of the university hospital	
Biyearly journal, sent by mail, on various themes of infectious diseases	
Creation of the referent infectious diseases unit	2010
Computerized database, with weekly update, created automatically from data entered in the patient's electronic medical record file filled in by the AMT. This computerized database is accessible to all members of the AMT via the Intranet	2011
Advice of the infectious diseases specialist triggered by the microbiology laboratory when Enterobacteriaceae resistant to 3rd generation cephalosporins are identified	2012
Electronic prescription of drugs (tested in some units)	

AMT: antibiotic management team.

(other origin in 2% of the cases). The advice was given by the referent infectious diseases specialist in 95% of the cases and by the pharmacist in 5% of the cases. It was telephone advice in 63% of the cases, and face-to-face advice in the unit in 37% of the cases. The therapeutic advice was: to modify the ongoing antibiotic therapy (36%), to maintain the ongoing antibiotic therapy (27%), to initiate an antibiotic therapy (24%), to stop the ongoing antibiotic therapy (7%), or to refrain from initiating any antibiotic therapy (6%).

### 3.3. Impact of the program on antibiotic prescriptions

We observed a decrease of pharmaceutical expenses related to antibiotic prescriptions between 2002 and 2011 (Fig. 1), related to a decreased cost from 2005 to 2011, while prescriptions (in DDD/1000 PD) had remained stable since 2005 (Fig. 2). Various audits of practice have also been performed concerning: carbapenem or linezolid prescriptions, reevaluation of antibiotic therapy, or impact of infectious diseases specialist's advice

on bacteremia management [6,8,10–16,18,19]. The last mentioned audit (unpublished data) allowed demonstrating that the systematic advice of the infectious diseases specialist for bacteremia led to modifying the antibiotic prescriptions in 65% of

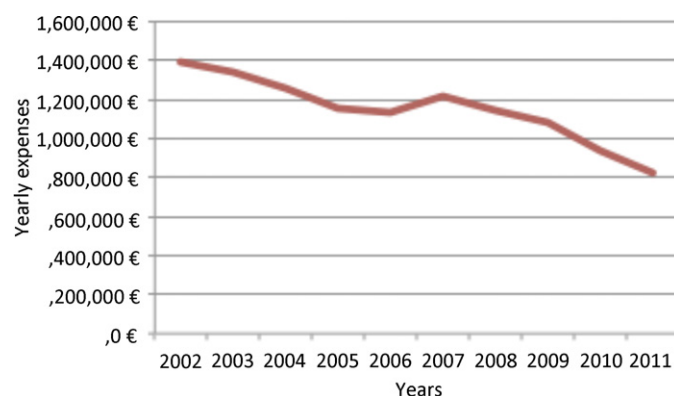


Fig. 1. Antibiotic prescription induced cost between 2002 and 2011. *Dépenses liées aux prescriptions antibiotiques de 2002 à 2011.*

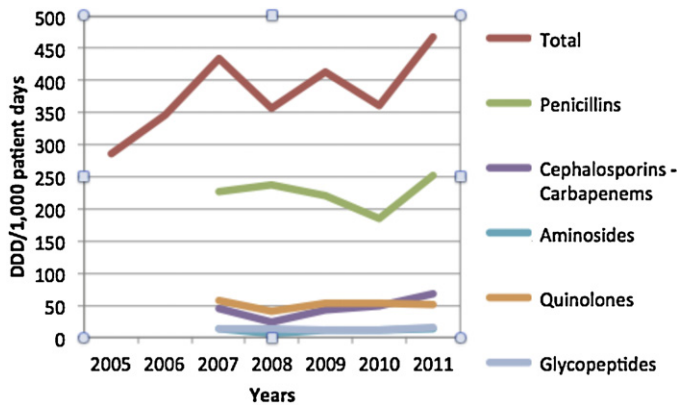


Fig. 2. Yearly antibiotic use since 2005, in defined daily doses (DDD)/1000 patient-days (PD).

*Évolution annuelle des prescriptions antibiotiques depuis 2005, en doses définies journalières (DDJ)/1000 journées d'hospitalisation.*

the cases, and improved searching for the portal of entry and secondary localizations.

#### 4. Discussion

We described our antibiotic stewardship program, which allowed mastering antibiotic prescriptions. A survey made in 2008 showed that restricted prescription of some antibiotics and availability of an infectious diseases specialist's advice were perceived positively by junior and senior physicians in our University Hospital [7].

Our hospital has one of the lowest antibiotic consumption in France among tertiary-care teaching hospitals: the results of a 2007 study were that the average consumption for 27 French University Hospitals was 592 DDD/1000 PD, whereas our prescription level was 435 DDD/1000 PD at the same period [21]. The Nancy University Hospital reported a consumption of 635 DDD/1000 PD (2.56 millions euros) in 2008, for an institution similar to ours (1700 beds, including 1454 beds for MSO hospitalization), despite a program for antibiotic stewardship implemented for several years [3].

Our antibiotic stewardship program allowed for a relatively stable antibiotic consumption (in DDD) since 2005. The program had been initiated in 1999 and there might have been a decrease of consumption between 1999 and 2005, but DDD data is not available for that period. Antibiotic prescriptions would probably have increased since 2005 (as it did on a national level) if an antibiotic stewardship program had not been implemented in our University Hospital: the Afssaps 2011 report on antibiotic consumption mentioned a constant increase since 2006 (in DDD/1000 PD) in French hospitals [22].

A special feature in our hospital is the multidisciplinary organization relying on referent infectious diseases specialists, the microbiology laboratory, and the pharmacy providing data allowing these infectious diseases specialists to offer their help to the physician managing the patient. The documentation of the referent's advice in the patient's electronic medical record is very helpful, and the resulting database allows documenting the main diagnoses for which advice was given, the medical

units concerned, healthcare-acquired infections, the antibiotics agents used, etc. The possibility for the CLIN (French acronym for Local Committee for the prevention and management of healthcare-acquired infections) to identify in real-time (weekly extraction of data) healthcare-acquired infections, which is usually difficult to obtain spontaneously from physicians, is for us a true improvement to better understand these infections and to offer improvement measures. Finally, besides the offered advice, we try to promote antibiotic stewardship training for interns and seniors by offering targeted training sessions and editing a biannual journal with the latest developments in infectious diseases. This multidisciplinary collaboration is also a great tool to try to control the current spread of ESBL-producing Enterobacteriaceae.

Our study nevertheless had some limitations. We did not follow qualitative indicators during long periods, because their measure was complex and time consuming; the audits nevertheless revealed the positive impact of our antibiotic stewardship program [6,8,10–16,18,19], and our organization allows the systematic reevaluation of restricted antibiotics, as required by the HAS (French National Authority for Health). The qualitative positive impact of an infectious diseases specialist's advice has been widely demonstrated in the literature [6,23–27]. The observational design of our study did not allow proving that mastering antibiotic prescriptions was due to our antibiotic stewardship program, even if no other change (except for team rotations) occurred. The institution's infection control policy and the changing epidemiology of multiresistant bacteria certainly also had an impact on the evolution of antibiotic prescriptions.

What are the current barriers to improve our antibiotic stewardship program? The opposition of prescribers is very limited (two units only), because the sometimes-intrusive aspect of calls/advice is compensated by the availability of infectious diseases specialists, pharmacists, and microbiologists. The institution's support is clearly identified. The fact that our University Hospital is located on four geographic sites sometimes make it difficult to organize actions, with a lot of advice given by telephone, but the hospital should come back to two geographic sites in the short-term. The two major problems currently met are:

- the absence of dedicated funding for the AMT (the pharmacist dedicated to antibiotics – equivalent to a 0.6 full-time position – is nevertheless supported financially by savings made on antibiotic expenses), despite the availability of  $\approx 1$  full-time infectious diseases specialist position for this activity. The tools created allow for an accurate evaluation of our activity by unit, and could serve as a basis for reflecting on valorization of our actions;
- we do not have computerized prescription of antibiotics for the moment in our hospital, or any automatized measure of indicators. This would allow implementing audits with real-time feedback, for example to reevaluate antibiotic prescriptions around day 3.

Our antibiotic stewardship program is well accepted by physicians and allows mastering antibiotic prescriptions. A dedicated

financing of the referent infectious diseases specialists and electronic tools are now necessary to make it even more effective.

### Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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