

## Nationwide implementation of antibiotic management teams in Belgian hospitals: a self-reporting survey

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**Objectives:** Antibiotic management teams (AMTs) have been advocated to optimize the use of antimicrobials in hospitals. Since 2002, the Belgian Antibiotic Policy Coordination Committee (BAPCOC) has supported the development of AMTs in Belgian hospitals with policy guidance and federal funding for antibiotic managers. We performed a national, self-reporting survey to assess the level of AMT activities in 2007.

**Methods:** A structured questionnaire survey was performed on the composition, organization and service activities of the AMT in all acute care and larger chronic care hospitals in the country in 2007. Descriptive statistics were stratified by duration of AMT funding.

**Results:** Completed questionnaires were provided by 112 of 116 hospitals (response rate, 96.6%). Multidisciplinary AMTs varied in size (mean 10, range 2–28 members). Antibiotic stewardship tools used by AMTs included: hospital antibiotic formulary (96.3% of hospitals); practice guidelines for antibiotic therapy and surgical prophylaxis (91.6% and 96.3%, respectively); list of ‘restricted’ antimicrobial agents (75.9%); concurrent review of antibiotic therapies (64.2%); de-escalation of therapy after a few days (63.9%); sequential intravenous/oral therapy for antibiotics with equivalent bioavailability (78.7%); dedicated antimicrobial order forms (36.1%); automatic stop of delivery (43.5%); analysis of antibiotic consumption data (96.2%); and analysis of microbial resistance data (89.8%).

**Conclusions:** These data demonstrate a well-developed structure of AMTs in Belgian hospitals and the broad range of services provided. Technical and financial support by healthcare authorities was key to the extensive implementation of antimicrobial stewardship programmes across the national hospital care system.

**Keywords:** antimicrobials, antimicrobial stewardship, antibiotic resistance

### Introduction

Antibiotic management teams (AMTs) have been advocated as an excellent approach to optimize the use of antimicrobial drugs in hospitals. They strive to support clinical practitioners to avoid the inappropriate use of antibiotics and optimize their choice, dosing, route and duration of administration, with the aim of improving patient outcomes, promoting cost-effective therapy, avoiding adverse effects and reducing levels of resistance.<sup>1–4</sup> In 2007, the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America

(SHEA) issued guidelines that define key organizational aspects and interventions for developing such an antimicrobial stewardship programme.<sup>1</sup>

In 2002, the Belgian Antibiotic Policy Coordination Committee (BAPCOC) was able to secure federal funding, provide technical guidance and offer advanced specialist training for the formal establishment and follow-up of AMTs in 37 acute care pilot hospitals.<sup>5,6</sup> Building upon the favourable results of this pilot stage, another 24 acute care hospitals were recruited for the extended project in 2006. As of July 2007, all 112 acute care hospitals and the four chronic care hospitals with >150 beds in the country

receive financial support for hiring a trained manager for their AMT. To this end, an annual budget of €3.6 million is divided among hospitals according to their number of beds (range, €10 000–81 700 per hospital).

Furthermore, the minimum composition, mandate and tasks of hospital AMTs have been consolidated in legislation through publication of the Royal Decree of 12 February 2008 on the norms for AMTs as dedicated subgroups of the hospital Drugs and Therapeutic Committee. To guarantee a multidisciplinary approach, the AMT core membership must include an infectious diseases physician, a clinical microbiologist, an infection control physician and a hospital pharmacist.<sup>7</sup> Trained hospital antibiotic manager(s) are given the responsibility to carry out the antibiotic stewardship programmes and annual action plan as defined by the AMT. The main responsibilities of the AMT are the development of an antibiotic formulary and clinical practice guidelines on antibiotic therapy and prophylaxis, active initiatives to limit the inappropriate use of antibiotics, training of healthcare workers, audit of medical practice with feedback to prescribers and surveillance of local antibiotic consumption and microbial resistance. The AMTs must provide yearly activity reports by use of a standardized questionnaire, so that BAPCOC can monitor their organization, local objectives and delivery of services.

BAPCOC supports these AMTs by organizing an advanced training course on antibiotic policy and national study days on this topic. This was complemented in 2009 by the implementation of a comprehensive, web-based national surveillance system of hospital antibiotic consumption.

## Methods

As of July 2007, 116 hospitals were entitled to financial support for their AMT. BAPCOC received reports from 112 of them (response rate, 96.6%): 37/37 hospitals who piloted the project in 2002 (group A); 24/24 hospitals who joined the project in 2006 (group B); and 51/55 hospitals who joined the project in 2007 (group C). As shown in Table 1, larger hospitals (university and non-university hospitals) are overrepresented in group A.

An English version of the questionnaire is available as Supplementary data at JAC Online (<http://jac.oxfordjournals.org/>). The questionnaire included questions on the following topics: members of the AMT and their professional qualification; copy of minutes of the AMT meetings; strategic plan; communication methods and mode of interaction with healthcare workers and other hospital bodies; and implementation of antibiotic stewardship initiatives such as the antibiotic formulary and clinical practice guidelines, prescription guidance and support tools, and the analysis of antibiotic consumption and microbial resistance.

## Results

The mean number of members of the AMTs was 10 (range, 2–28). This number increases with the number of beds in the

**Table 1.** Distribution of hospitals according to the number of beds and the time at which they first received financial support for their AMT

	Group A (2002)	Group B (2006)	Group C (2007)	Total
≤400 beds	5	12	39	56
401–800 beds	19	11	12	42
>800 beds	13	1	0	14
Total	37	24	51	112

hospital (9, 9.9 and 13.4 members in hospitals with up to 400 beds, 401–800 beds and >800 beds, respectively). Likewise, the AMTs were larger in hospitals selected in 2002 for the pilot stage than in hospitals who joined the project later (8.6, 10.5 and 11.4 members in hospitals from groups C, B and A, respectively). Besides the core members mentioned in the Introduction, the following specialists were most frequently involved in the AMT: critical care physicians (1.1 per AMT); pulmonologists (0.6); paediatricians (0.5); and geriatricians (0.3).

The majority of AMTs evaluated their initiatives and outcomes (71.4%) and defined their activities and goals for the upcoming year (83.0%) as well as for a longer period (58.9%).

As expected, interactions between the AMT and the infection control and pharmacy committees were extensive, with 92% and 79%, respectively, of the hospitals reporting participation of a member of the two committees in the AMT. Senior hospital management is less often directly involved in the AMT, with rates of participation of 63%, 41% and 23% for the chief physician, the hospital manager and the head of the nursing department, respectively.

The AMTs used several means of communication with the healthcare workers, especially consultation by telephone, e-mail, intranet and face-to-face interaction in the form of outreach visits by the infectious diseases physician or clinical microbiologist and staff meetings at ward level.

The degree of implementation of antibiotic stewardship initiatives in the acute care hospitals is presented in Table 2. Almost all the acute care hospitals had developed an antibiotic formulary (96.3%) and clinical practice guidelines for empirical and aetiological antibiotic therapy and surgical prophylaxis (91.6% and 96.3%, respectively). Annual update of the formulary was frequently achieved (59.6% of the hospitals with a formulary), and the same was true for therapeutic guidelines (42.9% of the hospitals with guidelines) and prophylactic guidelines (25.0% of the hospitals with guidelines).

Three-quarters (75.9%) of the acute care hospitals had defined a list of 'restricted' antimicrobial agents that required justification for their use and either prior approval or *post hoc* review by a member of the AMT for delivery by the hospital pharmacy. The antimicrobials most frequently restricted were carbapenems (57 hospitals), linezolid (43), third- and fourth-generation cephalosporins (38), glycopeptides (37), moxifloxacin (32), piperacillin/tazobactam (30) and tigecycline (26).

Furthermore, two-thirds (64.2%) of the acute care hospitals used a concurrent review system whereby antibiotic therapies for certain indications (e.g. sepsis) or for patients on certain units [e.g. intensive care unit (ICU)] were checked daily by a member of the AMT, with immediate feedback to the prescriber in the case of inappropriate therapy.

Likewise, two-thirds (63.9%) of AMTs in the acute care hospitals actively promoted de-escalation of therapy after a few days for certain indications or for patients on certain units, once the clinical evolution of the patient could be evaluated and microbiological results were available.

Sequential therapy for antibiotics with equivalent bioavailability, i.e. conversion of parenteral to oral therapy as early as possible, was a tool used in the majority (78.7%) of acute care hospitals, whereas fewer acute care hospitals made use of dedicated antimicrobial order forms (36.1%) and automatic stop of delivery (43.5%) of the antibiotic after a defined number of days.

**Table 2.** Implementation of antibiotic stewardship initiatives in the acute care hospitals according to the time at which they first received financial support for their AMT and the number of beds, by percentage

Antibiotic stewardship initiative	Group A (2002)	Group B (2006)	Group C (2007)	≤400 beds	401-800 beds	>800 beds	Total
Antibiotic formulary	100	95.6	93.7	92.4	100	100	96.3
Guidelines for empirical and aetiological antibiotic therapy	100	91.3	85.1	90.4	90.2	100	91.6
Guidelines for antibiotic prophylaxis	100	95.6	93.7	92.4	100	100	96.3
Antimicrobial order forms	51.4	39.1	22.9	30.2	36.6	57.1	36.1
Requirement of justification and/or authorization for specific antibiotics	86.5	95.6	58.3	64.1	82.9	100	75.9
Prospective audit with intervention and feedback	86.1	73.9	42.5	51.9	73.2	84.6	64.2
Automatic stop order	64.9	47.8	25	37.7	46.3	57.1	43.5
Streamlining or de-escalation of therapy	75.7	73.9	50	54.7	68.3	85.7	63.9
Parenteral to oral conversion	86.5	91.3	66.7	81.1	73.2	85.7	78.7
Analysis of antibiotic consumption	100	100	91.3	94	97.6	100	96.2
Analysis of microbial resistance	97.3	95.6	81.2	84.9	95.1	92.9	89.8

Nearly all (96.2%) acute care hospitals analysed antibiotic consumption data in their institution, be it once a year (62.4% of the hospitals that analysed consumption data), twice a year (20.8%), quarterly (10.9%) or even more frequently (5.0%). Importantly, 88.1% of the hospitals that analysed consumption data provided feedback to the prescribers. A minority of AMTs analysed these data separately for each unit (19.8% of the hospitals that analysed consumption data) or for some specific units (36.6%), most frequently the ICU, geriatric ward and haematology-oncology ward. Likewise, most AMTs performed comprehensive analyses by antibiotic class (34.7% of the hospitals that analysed consumption data) or for some specific classes (49.5%), most frequently carbapenems (56 hospitals), piperacillin/tazobactam (55), fluoroquinolones (54), glycopeptides (51), third-generation cephalosporins (47), fourth-generation cephalosporins (45), aminoglycosides (45) and aminopenicillins (41).

Finally, AMTs in 89.8% of the acute care hospitals also analysed resistance data. We noticed that resistance data were analysed less frequently than consumption data, with 75.2%, 14.4%, 6.2% and 2.1% of these hospitals analysing resistance data once a year, twice a year, quarterly or more frequently, respectively. Again, several AMTs analysed the data separately for all units (11.3% of the hospitals that analysed resistance data) or some specific units (50.2%), most frequently the ICU, haematology-oncology ward, geriatric ward and pneumology ward.

The situation in the four chronic care hospitals was as follows: antibiotic formulary ( $n=4$ ); guidelines for antibiotic therapy ( $n=4$ ); antimicrobial order form ( $n=0$ ); requirement of justification and/or authorization for specific antimicrobials ( $n=3$ ); prospective audit with intervention and feedback ( $n=0$ ); automatic stop order ( $n=2$ ); streamlining of therapy ( $n=2$ ); sequential therapy ( $n=2$ ); analysis of antibiotic consumption ( $n=3$ ); and analysis of microbial resistance ( $n=1$ ).

## Discussion

This report indicates a well-developed structure and broad range of services provided by AMTs in Belgian acute care and chronic care hospitals in 2007. Clearly, the financial support and the

legislative framework provided by the Belgian government and the coordination by BAPCOC have enabled the almost universal establishment of AMTs in Belgian acute care hospitals within a short time frame. These findings are in contrast to surveys from other countries such as the large survey conducted on the implementation of the IDSA-SHEA guidelines in US hospitals in 2008, where only 48% of the respondents ( $n=357$ ; response rate, 10%) stated that their hospital had an AMT at that time.<sup>8</sup> Likewise, a survey among all acute care hospitals in Quebec in 2006, with a response rate of 84% (68 of 81 hospitals), showed that a multidisciplinary AMT was in place in 36% of responding hospitals and 22% of responding hospitals had an active quantitative antimicrobial surveillance programme.<sup>9</sup> As part of the European Commission Concerted Action Antibiotic Resistance Prevention and Control (ARPAC) Project, data on antibiotic stewardship and antibiotic consumption data for the year 2001 were obtained from 170 hospitals and 139 hospitals, respectively, from no less than 30 European countries.<sup>10</sup> Half of the surveyed hospitals reported having an antibiotic committee (89/170; 52%) with significant variation across Europe (74% of northern European hospitals versus 31% of south-eastern European hospitals). Total annual antibiotic consumption was only marginally lower in hospitals with an antibiotic committee compared with those without a committee [54.7 versus 55.3 defined daily doses (DDDs)/100 bed-days].

With their multidisciplinary composition and an average of 10 members, the AMTs were clearly well equipped to perform their tasks. The infectious diseases physician, clinical microbiologist, infection control physician and hospital pharmacist are obviously key players, but the commitment of other specialties will no doubt have a positive influence on the successful implementation of the antibiotic policy.

Furthermore, we can conclude that key tools such as antibiotic formularies, clinical practice guidelines for antibiotic therapy and prophylaxis, pro-active sequential therapy, restriction of specific antimicrobials, prospective audit with intervention and feedback, and streamlining of therapy were used by at least two-thirds of Belgian AMTs. This compares favourably with the results of the survey in US hospitals with reported rates of

80%, 69%, 46%, 38%, 66% and 42% for use of closed formularies, guidelines and clinical pathways, intravenous to oral conversion protocols, preauthorization, prospective monitoring of prescribing and appropriateness, and proactive streamlining, respectively.<sup>8</sup>

Obviously, the time of creation of the AMT and the number of beds in the hospital influenced the level of implementation of the different antibiotic stewardship initiatives, with the highest levels in the hospitals who piloted the project in 2002 and those with >800 beds. While formularies, guidelines and the analysis of consumption and resistance data were also adopted in >80% of the hospitals who joined in 2007 or with up to 400 beds, interventions that require more interaction with the prescribers and are therefore more time and resource consuming—such as authorization, prospective audit and streamlining—were clearly much less used in these hospitals with presumably more limited resources.

According to the IDSA–SHEA guidelines (i) prospective audit with intervention and feedback and (ii) formulary restriction and preauthorization are the core strategies of such a programme.<sup>1</sup> Several studies have demonstrated that prospective audit by an infectious diseases physician or clinical pharmacist with feedback to the prescriber can reduce inappropriate use of antimicrobials and costs, without adversely affecting clinical response.<sup>10–14</sup> Formulary restriction and preauthorization for selected antibiotics have been shown to reduce the use and costs of the targeted agents.<sup>15,16</sup> However, use may shift to alternative antimicrobials and the impact on microbial resistance is variable.<sup>17–19</sup>

Multidisciplinary development of evidence-based practice guidelines incorporating local microbiology and resistance patterns,<sup>20–22</sup> de-escalation of empirical therapy on the basis of microbiological results and clinical evolution,<sup>23–25</sup> and systematic switch from parenteral to oral antibiotics as soon as allowed by the patient's condition,<sup>26–29</sup> have proved their positive impact on antibiotic use, costs and/or length of hospital stay. As such, they can be useful supplements to the core strategies.<sup>1</sup>

Finally, according to this survey, almost all Belgian AMTs complied with the IDSA–SHEA recommendation to analyse antibiotic consumption data (96.2%) as a process measure and microbial resistance data (89.8%) as an outcome measure to determine the impact of their stewardship programme.<sup>1</sup>

As of 2009, BAPCOC and the Scientific Institute of Public Health (WIV-IPH) implemented a web-based national surveillance programme for hospital antibiotic consumption. This programme serves as a standardized tool for the hospitals themselves to monitor the evolution of their antibiotic use and compare it with the national mean (cross-institutional benchmarking). Comparisons over the years and between hospitals are possible thanks to the uniform methodology with a list of antibiotics to be reported and inclusion of all wards except for psychiatric wards, differentiated into non-paediatric and paediatric wards. Nominator (number of tariffication unit codes for each antibiotic) and denominator (number of bed-days and admissions) data are collected by a web-based data upload module that calculates the use of each antibiotic in DDDs per 1000 bed-days and DDDs per 1000 admissions. Then hospitals can immediately perform several analyses online themselves. The surveillance programme will also allow BAPCOC to evaluate the overall impact of the AMTs over the years. Process quality

indicators for analysis of compliance with best practice guidelines will be piloted as well.

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## Supplementary data

An English version of the questionnaire is available as Supplementary data at JAC Online (<http://jac.oxfordjournals.org/>).

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