

# The applicability of guidelines on antimicrobials provided by the Danish Health Authority

Nina Ank, Mona Kjærsgaard & Rita Andersen Leth

## SUMMARY

**INTRODUCTION:** Our objective was to investigate the knowledge of "Guidelines on prescribing antibiotics for physicians and others in Denmark" published by the Danish Health Authority in 2012, and the usefulness of these guidelines for Danish hospital doctors.

**METHODS:** We collected information on the perceived awareness and usefulness of the guidelines using a questionnaire distributed at two regional hospitals. Furthermore, to evaluate the use of the guidelines we collected data about 310 patients treated with antimicrobials at the two hospitals.

**RESULTS:** Less than 50% of the respondents knew that the guidelines existed and among those who did know of the existence of the guidelines, less than 50% found that the guidelines were applicable to their daily clinical work. Regarding sampling of microbiological tests, we found that in 188 of the 310 cases both urine and blood had been sampled. A discontinuation date was registered in the medication module at the time of the prescription in 27% of the prescriptions. In terms of reassessment, we evaluated 282 cases and found that a reassessment had taken place in 62% of these cases.

**CONCLUSIONS:** The results of the survey indicate that knowledge and use of the guidelines are sparse, and our data from the audits underline these data.

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**TRIAL REGISTRATION:** not relevant. The Danish Data Protection Agency (R. no.: 1-16-02-84-15) and the Central Denmark Region approved the project.

In 2012, the Danish Health Authority published "Guidelines on prescribing antibiotics for physicians and others in Denmark". The guidelines were published owing to a need for a more prudent use of antimicrobials [1, 2].

Before the introduction of these guidelines, the prescription of antimicrobials was based mainly on guidelines found on the website [medicin.dk](http://medicin.dk), in publications by scientific societies, and in local guidelines [2]. The

guidelines provided by the Danish Health Authority outline the standards required of physicians when prescribing antimicrobials [1].

The main aim of the guidelines was to promote a more rational antimicrobial prescription pattern, thereby reducing unnecessary use and ensuring that critically important antimicrobials are used only when there are no alternatives. Specifically, the guidelines target the use of carbapenems, fluoroquinolones and cephalosporins [1].

In Denmark, the consumption of antimicrobial agents is monitored as part of The Danish Integrated Antimicrobial Resistance Monitoring and Research Programme [3]. In primary care, the total consumption of antimicrobials has increased since 1997, stagnating as from 2011. In somatic hospitals, the highest consumption of antimicrobials was registered in 2014, which was followed by a slight decline. The three groups of critically important antimicrobials – carbapenems, fluoroquinolones, and cephalosporins – accounted for 22% of the antimicrobials used in 2016 [4]. We wanted to examine the knowledge of the existence of the guidelines from 2012 and the perceived usefulness of these guidelines among Danish hospital doctors. In addition, we audited medical records to investigate the frequency of stated discontinuation of antimicrobial treatment, reassessment of antimicrobial treatment, as well as sampling of urine specimens and blood cultures before initiation of antimicrobial treatment.

## METHODS

### Survey instrument

A questionnaire was developed in cooperation with a group of experts on questionnaire design. In order to check the comprehension and clarity of the questions, the questionnaire was pilot tested. Two rounds of interviews were conducted; in total we interviewed ten doctors. The questionnaire collected information on the awareness and the perceived usefulness of "Guidelines on prescribing antibiotics for physicians and others in Denmark". Data were also collected about the respondents' current speciality and employment. Data were

## ORIGINAL ARTICLE

Department of  
Clinical Microbiology,  
Aarhus University  
Hospital, Denmark

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**TABLE 1**

Representativeness of the sample with regard to hospital and seniority.

	Population, n (%)	Sample, %
<i>Hospital</i>		
A	219 (53)	50
B	193 (47)	50
<i>Seniority</i>		
Junior doctors	210 (52)	49
Senior doctors	191 (48)	51

**TABLE 2**

Percentages of the doctors with awareness of the "Guidelines on prescribing antibiotics for physicians and others in Denmark" from 2012 by the Danish Health Authority [1].

Respondents	n (%)	N
All doctors	141 (47)	298
Senior doctors	78 (50)	155
Junior doctors	63 (44)	143

analysed for representativeness with regard to hospital, hospital unit and seniority.

The questionnaire used a seven-point Likert scale where the respondents specified their level of agreement or disagreement [5]. A score of seven equals "fits precisely", and a score one equals "does not fit at all".

### Survey administration

The questionnaire was distributed in October 2015 at two regional hospitals in the Central Denmark Region. Doctors were invited to complete the questionnaire at their daily meeting. Those who were not present received both an e-mail and a letter with the questionnaire. Questionnaires not returned within two weeks triggered an e-mail reminder. A tracking number was used for each participant to ensure confidentiality.

### Data collection

Data were collected from the electronic health records from the free-text module and the medication module in the period from 1 September 2015 to 11 November 2015 at one hospital and from 1 June to 24 August 2016 at the other hospital. All patients receiving antimicrobial treatment administered at the hospitals in the study period were eligible for inclusion and exported from the Business Intelligence Portal. Patients hospitalised at the department of paediatrics and patients treated with antimicrobial prophylaxis for less than 24 hours were excluded. In total, 310 randomly selected cases were included. The workflow has pre-

viously been described in detail [6]. For data on discontinuation, only data from the medication module were used. Data were stored in the software solution Research Electronic Data Capture (REDCap) [7].

### Statistical analysis

This was an observational study, and the results are presented as proportions shown as percentages. For analysis of representativeness, the chi-square test was used. The Danish Data Protection Agency (R. no.: 1-16-02-84-15) and the Central Denmark Region approved the project.

*Trial registration:* not relevant.

## RESULTS

### Awareness about and applicability of the guidelines

We examined the awareness and the applicability of "Guidelines on prescribing antibiotics for physicians and others in Denmark" using a survey. The response rate was 73%, and analyses show that the sample only had a minor undercoverage with regard to one hospital and junior doctors (Table 1). With regard to hospital units, the sample was representative.

As shown in Table 2, we found that less than 50% of the doctors were aware of the guidelines' existence. Furthermore, we found that senior doctors (consultant and staff specialist 1) tended to be aware of the guidelines to a greater extent than junior doctors (house officer/senior house officer/specialist registrar).

With the questionnaire we investigated if the principles in the guidelines were followed and if the guidelines were found to be practical in their daily work. 47% of the doctors stated that they followed the guidelines (ratings 6 and 7). Figure 1 shows the perceived usefulness of the guidelines. Of the senior doctors, 53% stated that they followed the guidelines (ratings 6 and 7); for the junior doctors the corresponding share was 41%.

We also addressed the question of the usefulness of the guidelines in the daily work. 45% of the doctors stated that they found the guidelines applicable to their daily clinical work. Of the senior doctors, 46% (ratings 6 and 7) stated that the guidelines were practicable in their daily work. For junior doctors, the corresponding share was 43%. We also addressed the question of the applicability of the local guidelines. 61% of senior doctors and 68% of junior doctors stated that they prescribed antibiotics in accordance with local guidelines. With regard to practicability, the percentages were 58 and 59, respectively.

### Discontinuation

The guidelines recommend that the duration of the antimicrobial treatment is stated in the patient's med-

ical record. We analysed 493 unique antimicrobial prescriptions. For 27% of the prescriptions, a discontinuation date was registered in the medication module at the time of prescription.

**Culture sampling before initiation of antimicrobial treatment**

The guidelines require sampling of microbiological specimens before initiating antimicrobial treatment. We examined the sampling of urine specimens and blood cultures before initiation of treatment in 310 cases. We found that in 132 of those cases blood cultures had been collected. In the 178 cases where blood cultures had not been collected, we examined if a plausible reason could be found in the patients' health records (experts assessment [6]). We found that in 94 of the 178 cases, a reason for not collecting blood cultures could be found in the patients' health records. The main reasons were infections where bacteraemia could not be expected (n = 55) (e.g. mild lung infections, cystitis), prolonged prophylactic treatment after surgery (n = 28), or reasons related to childbirth (n = 9). Finally, one patient was hospitalised with diarrhoea and one initiated antimicrobial treatment upon suggestion from a clinical microbiologist. Furthermore, we addressed the number of cases where, if relevant according to expert assessments, both urine specimens and blood cultures had been sampled before initiation of antimicrobial treatment and found that in 188 of the 310 cases both samples had been collected when needed (expert assessment [6]).

**Reassessment**

The guidelines also outline that a reassessment with regard to the indication, choice of medicine, dose and duration of treatment must take place within 48 hours after initiation of antimicrobial treatment. We evaluated 282 cases and found that a reassessment had taken place in 62% (n = 282) of the cases (expert assessment [6]).

**DISCUSSION**

We report an overall poor knowledge among Danish physicians of the existence of the guidelines on prescribing antimicrobials published by the Danish Health Authority in 2012. In addition, we report that among the physicians with awareness of the guidelines, less than 50% found that the guidelines were useful. In order to address the applicability of the guidelines in the daily work, we examined 310 random patients treated with antimicrobials and found that the recommendations in the guidelines on discontinuation, sampling of microbiological tests, and reassessment of antimicrobial treatment were only followed to a limited degree.

One can speculate on many different barriers and

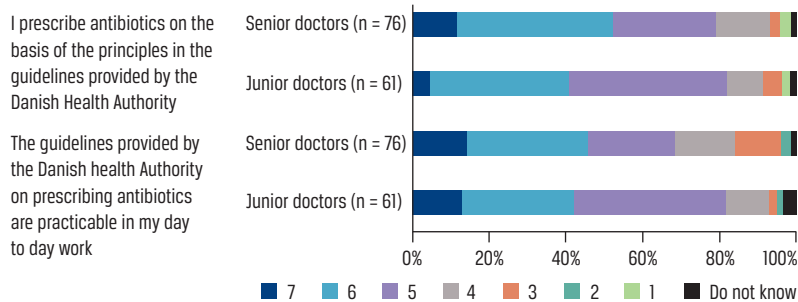
enablers for doctors to follow guidelines. Fischer et al thoroughly reviewed the barriers and strategies to guideline implementation in 2016 [8], stressing that the main barriers are related to the physicians' lack of awareness of the guidelines and familiarity with the guidelines. The authors also underlined the needs for the guidelines to be accessible and applicable. It is beyond the scope of our study to establish whether or not the Danish Health Authorities have considered implementation strategies when publishing the guidelines. Nonetheless, awareness of the guidelines and familiarity with the guidelines are limited. In a Danish-Norwegian study among general practitioners, a need for short and practical clinical guidelines was expressed, and in addition the format, accessibility, and implementation strategies influenced the use of the guidelines [9]. Although our study was conducted at two hospitals, it is reasonable to speculate that the attitude in a hospital setting is similar to the attitude in primary care. This runs contrary to a Dutch study where the dominating barrier against following national guidelines among general practitioners was patient-related factors [10]. In a Spanish study among physicians, a positive attitude towards clinical guidelines as a tool to standardise clinical practice was seen [11]. When considering the Dutch [10] and the Spanish studies [11], one must bear in mind that there might be cultural differences which should be taken into account. Indeed, cultural differences might be the reason for diverse findings in these two studies compared with the Danish-Norwegian study.

Our study has several strengths. We distributed our survey to a large cohort at two different hospitals, thus increasing the robustness of our data. Furthermore, we had a high response rate and limited undercoverage, which heightens the generalisability of our findings. In addition, we conducted 310 audits of antimicrobial treatment examining the daily clinical practice. Our

**FIGURE 1**

The usefulness of the guidelines "Guidelines on prescribing antibiotics for physicians and others in Denmark" provided by the Danish Health Authority, 2012 [1].

Rating 1-7: seldom-always.



data from the audits underline our observations from the survey.

However, our study also has some limitations. The questionnaire used in our study has not been used before. It was, though, validated by an expert in questionnaire design. We examined the perceived attitude to the national guidelines on prescribing antibiotics. Alternatively, we could have designed the questionnaire aiming to explore the physicians' knowledge of the contents of the guidelines as done by Ng et al [12]. However, by our design we achieved insight into doctors' knowledge of the existence of guidelines on antimicrobial prescription, and by conducting audits of antimicrobial treatment, we gained knowledge of the actual performance in the daily clinical work. We had two experts evaluate the data on discontinuation, sampling of microbiological tests and reassessment. We have evaluated the need for more experts in the study by Kragelund et al and found that adding an extra expert did not change the outcome of the audit [6].

## CONCLUSIONS

We found only limited knowledge of the existence of the guidelines on antimicrobial prescription from the Danish Health Authority. The doctors who did know of the guidelines found them to be of limited value. Furthermore, our data from the medical records showed that the guidelines were used infrequently. We suggest that publication of national guidelines is followed with implementation strategies and that these strategies involve a communication plan.

**CORRESPONDENCE:** *Nina Ank*. E-mail: [ninaank3@rm.dk](mailto:ninaank3@rm.dk)

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