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# Implementing a tele-expertise system to optimise the antibiotic use and stewardship: The case of the Montpellier University Hospital (France)

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**Abstract.** This paper has two aims: 1) to describe the tele-expertise system implemented in the Montpellier University Hospital (France) in order to optimize antimicrobial use 2) to analyze the prescribers' adherence to this system. For the second purpose, an observational prospective study was conducted for 12 months. Data were collected from counselling advices, which were notified in the electronic medical records. 1386 tele-expertise actions were performed. Among them, 87% were made without clinical evaluation at the bedside. The prescribers' adherence rate to a diagnosis was 79%. For the therapeutic requests, 87% of answers were fully followed. The results outline how the tele-expertise system enables both infectious disease specialists and prescribers to make better decisions in particular cases.

**Keywords.** Infectious diseases, Information Systems, Clinical Decision Support Systems, Hospital, Electronic Medical Records.

## Introduction

Antimicrobial resistance is a global public health concern. Inappropriate antimicrobial use has been described as the most important preventable cause of drug resistance [1]. Infections with resistant pathogens are associated with increased morbidity, mortality, and health care costs. Consequently, antimicrobial stewardship programs (ASP) have focused on drug expertise, antibiotic prescription and monitoring resistance patterns, regular reporting information on antibiotic use to clinical staff [2]. Electronic health records (EHR) and clinical decision support systems (CDSS) are supposed to enhance ASPs application [3].

Nevertheless, adherence to practice guidelines is influenced by many factors, such as the involvement of local actors in their development and distribution [4]. A higher physicians' adherence to guidelines was associated with the implementation of restriction systems based on computer physician order entry (CPOE) or of automatic alerts [5]. However, alerts could be excessive, non practical and non-actionable [3].

Furthermore, the use of general recommendations and guidelines is not always appropriate in particular cases and do not match the prescribers' specific needs.

The French national care pathway alert for antibiotics (2011-2016) promotes counselling networks in which the role of experts in antibiotics use is emphasized. Various studies have shown that the infectious diseases advices lead to the reduction of inappropriate antibiotic therapy and a decrease in antibiotics use [6] while decreasing mortality rate [4]. Nevertheless, the counselling activity of the Infectious Disease specialist requires a considerable expenditure of time by the Infectious Disease Department because of the complexity of the clinical cases and the disparity among the necessary information sources.

## 1. Tele-expertise system design

In this context, the French teaching hospital of Montpellier (2500 bed) has implemented an innovative tele-expertise system, which is based on the collaborative use of the Electronic Medical Records (EMR). The aims of this system are to facilitate the intra-hospital tele-expertise by the Infectious Disease specialist (IDS), the traceability and readability of the counselling for the prescribers at the point of care, the reassessment of the clinical cases and the monitoring of the IDS department activity. The global process is described in figure 1.

Each advice is notified within a specific form, indexed by the patient's history, the clinical and the pathogen infection classification, and identified by predefined items (i.e. viral infections, central nervous system, immunocompromised patients). IDS decided not to prescribe antimicrobial drugs directly in order to empower physicians who ask for counselling.

Regular automatic queries provide real time anonymous data from IDS activity, as the number of phone calls, the regimental number, the prescriber's department, the infection class, the time passed since the first evaluation, the antimicrobial suggestion.

In this context, a prospective observational survey was conducted in order to provide a better understanding of the prescribers' needs and adherence to the teleexpertise system.

#### 2. Research setting and results

An observational prospective study was conducted between the 1st of February 2013 and the 30th of January 2014, more than six months after the implementation of the system.

## 2.1. Research setting and data collection

Collected data from EMR included clinical and biological data at baseline and follow up during hospitalization after 3 and 5 days. Moreover, the follow up of the inpatient after discharge was also checked. Notifications from the IDS record were all reviewed. Adherence was assessed for a particular clinical situation and not for each notification.



Figure 1. Schematic of tele-expertise process

# 2.2. Results

1386 tele-expertise actions were performed for 870 inpatients. Among them, 63% of requests were related to an initial assessment, 25% of a second assessment and 12% of a second consultation meeting assessment. 87% of the answers were made without physician face-to-face discussion and clinical evaluation at the inpatient bedside.

An average of 116 counselling actions were reported per month, which is much lower than the total number of calls, knowing that folders' creation by prescribers was voluntary. Only 12% of counselling was requested for diagnostic purposes while 86% for therapeutic advises. Antibiotic treatment was already underway in 71% of cases. 65% of cases were focused on modifying the ongoing strategy. Concerning the topic, expertise was related to osteoarticular infections (27%) and surgical infections (12%).

The number of calls and of counselling requests per month increased over the 12 months of study, although the latter has started six months after the implementation of this system. The information counselling was noticed in the inpatient discharge letter in 43% of cases. One request out of four was discussed in the IDS team consultation meeting.

Adherence was assessed for 927 clinical situations, taking into account that several tele-expertise actions may occur for the same inpatient counselling. For the diagnosis (n=111), 79% counselling suggestions (95% CI 76.4-81.6%) were fully followed, 11% not followed, 6 % partially followed and 4% not evaluable. For strictly therapeutic requests (n=797), 87% of answers (95% CI 84.8-89.2%) were followed, 5% partially followed and 3% non-assessable. The suggestions from the IDS consultation meeting were followed in 82% and partially followed in 7% of cases. Medical managers of the most advice demanding departments consider the proposal was totally relevant and convenient in most cases, even if bedside evaluation occurred in less than 6% of the evaluations.

## 2.3. Discussion and limitations

The rate of situations leading to a request is consistent with the results of other studies [7], which is probably linked to the French recommendations for good practice that highly suggest referring to IDS for the osteoarticular infection cases [8].

Our study outlines that prescribers' adherence to the IDS counselling is high even if counselling is assisted by telephone and EMR use. This result is in contrast with other studies leading to the conclusion that telephone counselling may be less effective than formal consultation and IDS consultation [9, 10]. This gap may be explained by the original way to link telephone and EMR use in a clinical tele-expertise decision system. The data traceability and the phone communication between the IDS and the prescriber may be sufficient to support the trust relationship between them.

IDS activity is monitored in order to identify recurrent medical situations requiring IDS counselling, especially situations concerning the difficulty of establishing diagnosis or making a therapeutic decision. These situations have led to the creation of work groups focused on developing new clinical processes and standards. Moreover, the traceability of counselling into the EMR system makes available all the IDS suggestions and prescribers' decisions to the clinical staff (including pharmacists, microbiologists and hygienist), thereby improving the coordination and continuity of care (e.g. inpatient transfer). This is a positive effect of using the system of teleexpertise, which is however difficult to assess according to cost-benefits analysis or inpatient mortality rate.

The main limitation of this study is constituted by its observational nature that does not establish causal links and does not assess the prescribers' adherence compared to a control group. However, if the adherence to the tele-expertise system leads to more targeted and tailored requirements, we cannot consider a randomized controlled study with a control group that did not benefit from this system.

## 3. Conclusion

While CDSS provides automated assistance to the clinicians' decision, the teleexpertise system implemented in the Montpellier University Hospital enables both IDS and prescribers to make better decisions in diagnosis and choice of antimicrobial therapeutics in order to optimize the antibiotic use and stewardship. The system is focused on the judgment of the IDS advising prescribers in particular situations whereas real-time integrated electronic medical records provide all relevant data. The continuous analysis of the medical decisions and of the use of the specific IDS medical record drives qualitative improvements in the inpatient care and in IDS competencies.

Measuring the impact of inappropriate antimicrobial treatments is difficult and the concept of fair antimicrobial use is subjective. Thus, the challenge is to change the administrators' and providers' focus from the "antibiotic police" to a "quality of care initiative" taking into account prescribers' adherence and their awareness to make meaningful decisions in specific cases.

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## References

- Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. BMJ. 2010;340:c2096.
- [2] Lee CR, Cho IH, Jeong BC, Lee SH. Strategies to minimize antibiotic resistance. Int J Environ Res Public Health. 2013;10(9):4274-305.
- [3] Forrest GN, Van Schooneveld TC, Kullar R, Schulz LT, Duong P, Postelnick M. Use of electronic health records and clinical decision support systems for antimicrobial stewardship. Clin Infect Dis. 2014;59 Suppl 3:S122-33.
- [4] Westphal JF, Jehl F, Javelot H, Nonnenmacher C. Enhanced physician adherence to antibiotic use guidelines through increased availability of guidelines at the time of drug ordering in hospital setting. Pharmacoepidemiol Drug Saf. 2011;20(2):162-8.
- [5] Agwu AL, Lee CK, Jain SK, Murray KL, Topolski J, Miller RE, et al. A World Wide Web-based antimicrobial stewardship program improves efficiency, communication, and user satisfaction and reduces cost in a tertiary care pediatric medical center. Clin Infect Dis. 2008;47(6):747-53.
- [6] Cisneros JM, Neth O, Gil-Navarro MV, Lepe JA, Jimenez-Parrilla F, Cordero E, et al. Global impact of an educational antimicrobial stewardship programme on prescribing practice in a tertiary hospital centre. Clin Microbiol Infect. 2014;20(1):82-8.
- [7] Gennai S, Francois P, Sellier E, Vittoz JP, Hincky-Vitrat V, Pavese P. Prospective study of telephone calls to a hotline for infectious disease consultation: analysis of 7,863 solicited consultations over a 1year period. Eur J Clin Microbiol Infect Dis. 2011;30(4):509-14.
- [8] Société de Pathologie Infectieuse de Langue Francaise. Recommandations de pratique clinique -Infections ostéo-articulaires sur matériel (prothèse, implant, ostéosynthèse). SPILF. 2008.
- [9] Yinnon AM. Whither infectious diseases consultations? Analysis of 14,005 consultations from a 5-year period. Clin Infect Dis. 2001;33(10):1661-7.
- [10] Sellier E, Labarere J, Gennai S, Bal G, Francois P, Pavese P. Compliance with recommendations and clinical outcomes for formal and informal infectious disease specialist consultations. Eur J Clin Microbiol Infect Dis. 2011;30(7):887-94.