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# Carbapenemase-producing Enterobacteriaceae: use of a dynamic registry of cases and contacts for outbreak management

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SUMMARY

***Background:*** The emergence and spread of carbapenemase-producing Enterobacteriaceae (CPE) have become a major public health problem. Control and prevention of CPE infections hinge on isolation precautions for carriers and active screening and follow-up of contacts.

***Aim:*** To implement an open registry of cases and contacts for acute outbreak management, long-term data collection and epidemiological investigation.

***Methods:*** All cases, defined as patients (infected or colonized) with a CPE-positive culture during their hospitalization, and contacts (e.g. patients cared for by the same healthcare team as a case) were registered in an ongoing database. Hospital stays were cross-referenced for every new entry and epidemiological links (e.g. shared contacts) investigated. All cases and contacts not cleared by complete screening were registered on an active list.

***Findings:*** Between October 2012 and November 2014, we registered 30 cases and 1268 contacts, among which 24 were linked to two or three separate cases. Only 6.5% of contacts fulfilled complete screening with three rectal swabs, and 1145 contacts are still registered on the active surveillance list. Two outbreaks (12 and nine cases) occurred nine months apart. Cross-referencing of hospital stays using the registry revealed epidemiological links between seemingly unrelated cases of CPE-positive patients and suggested an environmental source of transmission, which was demonstrated thereafter.

***Conclusion:*** We implemented a simple and multi-purpose tool to manage CPE episodes and investigate epidemiological links. Efforts are necessary to improve screening of contact patients who may be occult sources of transmission. A regional registry could be helpful.



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## Introduction

Carbapenems are antimicrobials of last resort used to treat severe infections caused by multidrug-resistant organisms (MDROs). During the last decade, carbapenemase-producing Enterobacteriaceae (CPE) have emerged and spread worldwide, becoming a public health problem. Acquisition of these bacteria is mostly nosocomial but community-acquired CPE have also been described.[1–6] In Europe, endemicity of CPE infections has been reported for three countries (Greece, Italy, and Malta) and in France the number of CPE episodes notified to the French Institute for Public Health Surveillance (InVS) has increased from 10 in 2009 to 405 in 2013.[7,8] Containing the spread of these bacteria is therefore a priority, and guidelines for infection control and prevention measures have been published in many countries.[9] All of them recommend active screening of high-risk patients (such as travellers having received medical attention abroad) and putting suspected or confirmed CPE carriers under contact precautions. The French guidelines additionally recommend assigning dedicated healthcare teams to cases and contacts.[10] The latter are defined as all patients cared for by the same healthcare professionals as a case, albeit part time. All contacts must be traced and screened, by three weekly stool or rectal swabs, before being cleared and allowed to transfer. In case of discharge home before full screening, an alert must be kept on the patient, who shall require contact precautions and screening completion whenever (and wherever) next hospitalized. This involves rigorous follow-up and information to caregivers for all uncleared contacts.

Practical implementation of these guidelines can prove difficult. Indeed, different databases are needed for different phases of case or outbreak management: one to identify and screen contacts at the time of the alert and one for long-term follow-up of cases and contacts when patients return to hospital. Moreover, considering patients' frequent transfers between different healthcare facilities, there is a need to centralize information.

The aim of this study was to design and implement an open registry of cases and contacts, which could be used as a tool for long-term data collection and patient follow-up, acute outbreak management (contact tracing), and investigation of transmission links.

## Methods

### Settings

The University Hospital of Montpellier, France, is a 2600-bed tertiary care teaching hospital organized in five distinct sites, providing medical, surgical, obstetrical, psychiatric and long-term care, as well as seven intensive care units (ICUs). In 2013, there were 222,491 hospitalizations. The infection control team comprises 1.6 full-time doctors and seven nurses. The Nimes University Hospital reference laboratory for CPE identification performs prospective genotyping of all strains isolated in the region.

### MDRO surveillance and control policy

A systematic screening for MDRO [nasal and rectal swabs for detection of meticillin-resistant *Staphylococcus aureus* (MRSA) and cephalosporin-resistant Enterobacteriaceae respectively] is performed for all patients admitted to ICU for more than 48 h and once weekly thereafter. In other units, screening is warranted in patients presenting risk factors (history of previous MDRO carriage, transfer from a long-term care facility, chronic wounds and/or indwelling medical device). A daily automatic report from the microbiology laboratory informs the infection control team of MDRO-positive clinical or screening samples. MDRO-positive patients are put under contact precautions for the duration of their hospitalization.

MDRO presenting a resistance profile suggestive of CPE are submitted to microbiological investigations as described.[11] Patients transferred from a foreign hospital or with a previous hospitalization abroad in the last 12 months are screened for MDRO, including CPE upon admission. In this study, CPE strains of the same species and displaying the same resistotype were compared by repetitive sequence-based polymerase chain reaction (rep-PCR) using the DiversiLab® system (bioMérieux, Marcy l'Etoile, France).[12] Isolates that clustered >95% were considered related.

### Study definitions

The cases were defined as patients with a CPE-positive culture from any infected or colonized site during their hospitalization. An outbreak was defined as at least two CPE cases linked by an epidemiological chain of transmission: an index case followed by one or more secondary case(s). When cross-transmission was suspected, microbiological confirmation was required. A sporadic case was defined as an index case (with or without secondary cases) that could not be linked to an epidemiological source; hence all sporadic cases were deemed imported, even if diagnosed more than 48 h after admission.

The contacts were the patients cared for by the same healthcare team as a case. Microbiological screening of contact patients (repeat weekly rectal or stool swabbing) was undertaken until three negative results were obtained, and contact precautions maintained for these contact patients until clearance. In case of unavoidable transfer to another healthcare facility, information was passed to continue screening and contact precautions. In case of discharge home of an uncleared contact, screening and contact precautions were resumed upon re-hospitalization.

### Registry design

The registry was adapted from the InVS tool used for surveillance of an episode of CPE. It is an Excel® ongoing database (see Supplementary material online) composed of four sheet tabs:

- The 'cases' sheet contains information on CPE cases (personal and demographic data, hospitalization abroad, bacteriological data, etc.).