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LESS IS MORE IN INTENSIVE CARE

Less contact isolation is more in the ICU: con

Gabriel Birgand[1], Jeroen Schouten[2] and Etienne Ruppé[3*]

Nearly half of all hospital-acquired infections (HAI) occur in intensive care units (ICU) [1]. Among HAIs, those caused by multidrug-resistant organisms (MDRO) are associated with poor patient outcomes. The ICU setting involves multiple facilitators for the development of antimicrobial resistance: loss of physiological barriers, high transmission risk, and high ecological antibiotic pressure (an average of 70% of patients in ICU are prescribed antibiotics [2]). MDRO may be transmitted from patient-to-patient via staff hands, from the environment or event directly from person to person. Furthermore, ICU represents a hub in the hospital network and MDRO can spread from the ICU to other wards, other hospitals, or long-term care facilities, where patients are discharged [3].

The epidemiology of MDRO has been changing dramatically during the last decade, especially due to the rise in the community settings of carbapenemase-producing Enterobacterales (CPE) species (namely, those producing NDM and OXA-48-like carbapenemases) in addition to the common MDRO already well settled in the ICU (methicillin-resistant *Staphylococcus aureus* [MRSA], vancomycin-resistant enterococci [VRE], extended-spectrum beta-lactamases-producing Enterobacterales [ESBLE], other CPE, *Pseudomonas aeruginosa,* and *Acinetobacter baumannii*).

To circumvent the circulation of MDRO, the basics of infection control are pivotal. Standard precautions primarily represent the horizontal approach based on hand hygiene compliance and thorough environmental cleaning. As a consequence, compliance of staff with these standard precautions is critical for the control of MDRO dissemination [4]. Nonetheless, compliance with the World Health Organization's "Five Moments for Hand Hygiene" remains poor in ICU with an estimated rate of 59.6% in a recent review [5]. To overcome this issue, a vertical approach, including active surveillance culture and contact precautions (CPs) for colonized patients was introduced. CPs include wearing gowns and gloves when in direct contact with the patient and are usually associated with isolation of the patient in a single-bed room. These measures contribute to a better knowledge and awareness by healthcare workers making tangible the risk of transmission. Studies performed in ICU describe a substantial (15–21%) increase in hand hygiene compliance for patients under CPs [6, 7]. However, large clinical trials have failed to clarify that CPs could have a beneficial effect for preventing the transmission of MDRO. Indeed, assessing the effectiveness of CPs as a single measure is challenging. One of the reasons for that is that most of studies published in the field have been performed in various epidemiological settings with different prevalences of MDRO and have assessed the efficacy of multiple measures executed at the same time rather than CPs alone [8, 9]. Moreover, data have not been adjusted for many confounding factors including MDRO colonization pressure or compliance with standard precautions. Hence, CPs in ICU remain controversial depending on which angle is chosen. Indeed, the efficacy of CPs depends on the type of MDRO and the setting (Fig. 1), but also on the baseline level of compliance with standard precautions, i.e., the expected efficacy of CPs may be lower when the level of standard precautions is already high.

ESBLE that spreads both in the hospital and in community settings exemplify why CPs need to be customized according to the type of MDRO. The ever-growing influx of ESBL-producing *Escherichia coli* carriers from the community to healthcare structures orientates the strategy toward a horizontal approach in hospitals rather than vertical approaches. However, non-*E.coli* Enterobacterales such as *Klebsiella* spp. and *Enterobacter* spp. are estimated to be 3.7-fold more transmissible than *E.*

*Correspondence: etienne.ruppe@gmail.com
[3] Université de Paris, IAME, INSERM, 75018 Paris, France
Full author information is available at the end of the article

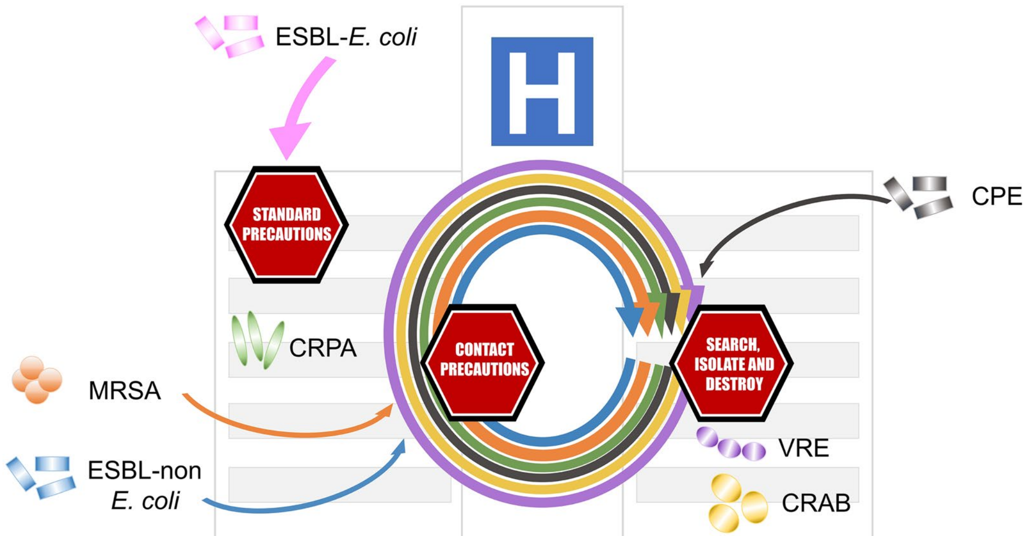

Fig. 1 Schematic representation of the different strategies to prevent the transmission of multidrug-resistant organisms (MDRO). The arrows outside the hospital depicts the influx of MDRO from the community. The arrows within the hospital depicts the intra-hospital transmissions. The signs depict the proper strategy according to the type of MDRO. *CPE* carbapenemase-producing Enterobacterales, *CRAB* carbapenemase-resistant *Acinetobacter baumannii*, *CRPA* carbapenemase-producing *Pseudomonas aeruginosa*, *ESBL* extended-spectrum beta-lactamase, *MSRA* methicillin-resistant *Staphylococcus aureus*, *VRE* vancomycin-resistant enterococci

coli in European ICU, which supports applying CPs for such organisms but not for ESBL-producing *E. coli* [10].

Beyond ESBLE, CPE are on a worldwide rise and on the priority list of the WHO and the CDC. The scarcity of active antibiotic treatments for such strains call for the highest level of precautions, even for *E. coli* strains. Along with CPs, a very strict strategy with strong commitment to extensive screening and isolation of colonized and contact patients carried out by dedicated staff was proven efficient in controlling CPE outbreaks [11]. As for *A. baumannii* and carbapenemase-producing *P. aeruginosa*, a strict search and isolation strategy added to antimicrobial stewardship has proven its efficiency to limit their spread [12]. Indeed, refraining from using the antibiotics that impair the gut microbiota the most and favor the acquisition of MDRO is a potential leverage against cross transmission, but actionable evidence supporting such concept is currently lacking [13].

In situations with a low prevalence of MDRO, preemptive CPs and surveillance screening applied for high-risk patients (recently returning from an endemic region, including repatriated patients) have shown to prevent the spread of such organisms due to the prompt implementation of control measures on admission, thereby decreasing the risk of cross-transmission [14].

Besides multidrug-resistant Gram-negative bacilli, MRSA and VRE are still here. CPs for MRSA and VRE patients remain highly controversial. The main effective measures to decrease MRSA burden in an endemic setting are to improve hand hygiene compliance [15]. A recent study on MRSA, pragmatically suggests to restrict CPs to high-risk activities (i.e., touching the endotracheal tube or the bedding or bathing the patient) and specific healthcare personnel (i.e., occupational therapists, physical therapists, and respiratory therapists) [16].

National policies for the control of VRE are heterogeneous, mainly due to the unclear morbi-mortality impact. Applying CPs alone failed to control the spread of VRE patients [17]. The environmental dimension of enterococci which are particularly resilient and can survive for prolonged periods on inanimate surfaces may explain these difficulties. However—as for CPE—some countries have made the choice to impose strict control measures on these organisms (i.e., France), and have succeeded in keeping a low prevalence of invasive infection [14].

In conclusion, the benefit of CPs depends on the patient, organism, epidemiological, and organizational factors. An obvious benefit of CPs was shown for CPE, *A. baumannii* and *P. aeruginosa* in low prevalent ICU. Given the ongoing rise of CPE together with the scarcity of available antibiotics active on these bacteria, we believe that CPs in the ICU should remain part of the preventive measures aiming at controlling the spread of MRDOs, even if we acknowledge that CPs may not be effective for all of them.

Author details
[1] NIHR Health Protection Research Unit, Antimicrobial Resistance and Healthcare Associated Infection, Imperial College London, London, UK. [2] Department of Intensive Care and Centre for Infectious Diseases, Radboudumc, Nijmegen, The Netherlands. [3] Université de Paris, IAME, INSERM, 75018 Paris, France.

Compliance with ethical standards

Conflicts of interest
The authors declare that they do not have any conflict of interest.

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