

## Practical approach by main clinical syndromes

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# Top-ten papers in Infection Control (2015-2017)

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### ABSTRACT

Healthcare-associated infections are a main Public Health challenge. In the era of antimicrobial resistance, more effective Infection Control Programs are needed. In this review we will discuss some publications related to hand hygiene (should the patients participate in the improvement programs?); some new strategies to enhance terminal room disinfection and important controversies on contact precautions policies (should we abandon them?). In the last year, there have been as well some reports that provide new insights in *Clostridium difficile* infection and in the impact of educational antimicrobial stewardship programs.

**Key words:** infection control,, cross infections, antimicrobial stewardship.

### Mejores publicaciones sobre control de infección

### RESUMEN

Las infecciones relacionadas con la asistencia sanitaria constituyen un gran desafío de salud pública. En la era de la resistencia a los antimicrobianos se necesitan programas de control de la infección más eficaces. En esta revisión, analizaremos algunas publicaciones relacionadas con la higiene de las manos (¿deberían los pacientes participar en los programas de mejora?); algunas nuevas estrategias para mejorar la desinfección terminal y controversias importantes sobre las políticas de precauciones de contacto (¿deberíamos abandonarlas?). En el último año, también ha habido algunas publicaciones relevantes que proporcionan nuevos

conocimientos sobre la epidemiología de la infección por *Clostridium difficile* y sobre el impacto de las intervenciones educativas enmarcadas en los PROA.

**Palabras clave:** control de la infección, infecciones cruzadas, administración de antimicrobianos

### HAND HYGIENE

Hand hygiene (HH) is the core element of infection prevention and control. In 2016, Stewardson et al. [1] published a study aimed to assess the effect of enhanced performance feedback and patient participation on HH compliance in the setting of a multimodal promotion. They did a single-centre, cluster randomised controlled trial (Geneve, Switzerland). After a 15-month baseline period, they randomised 67 hospitalization wards to one of three groups: control, enhanced performance feedback or enhanced performance plus patient participation. They made 1367 observations and evaluated 12579 opportunities of HH. Remarkably, basal compliance rates were around 60% in the three study arms. They found an overall increase in HH compliance of HCW from 65 to 74%. This increase between the baseline and intervention periods was significantly larger in wards exposed to both enhanced performance groups. However the improvement attributable to the patient participation did not reach statistical significance. This study highlights the challenges with randomised trials aimed to assess behaviour change. Authors recognize that there was a cross-contamination effect which could not be avoided.

The optimal HH technique remains poor defined. Pires et al. [2] performed a laboratory-based experimental study to evaluate the effect of hand-rubbing duration on the antimicrobial efficacy of HH. They demonstrated that performing hand rubbing for 15 seconds was not inferior to 30. Lack of time had been identified as one of the major factors which negatively influenced on HH compliance. Therefore reducing the time needed to perform an optimal HH gesture

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could lead to augmented HH compliance. Nevertheless, this study has been performed in a laboratory experimental setting which could influence in the applicability of results to real clinical practice.

## ENVIRONMENT & UNUSUAL OUTBREAKS

Environmental control and adequate disinfection could be involved in multidrug-resistant microorganisms cross-transmission and development of unusual outbreaks. We have selected four papers related to this aspect of infection control: one clinical trial report regarding the importance of room disinfection and three reports of unusual outbreaks due to environmental contamination.

Anderson et al. [3] published in 2017 the results of a pragmatic, cluster-randomized, crossover trial conducted at nine hospitals in the southern USA. They tried to assess the effects of four different strategies for terminal room disinfection on acquisition of multidrug-resistant microorganisms or *Clostridium difficile* strains. Rooms from which a patient with infection or colonisation with a target microorganism was discharged were terminally disinfected with one of four strategies: reference (quaternary ammonium disinfectant except for *C. difficile*, for which bleach was used); UV (quaternary ammonium disinfectant and disinfecting ultraviolet [UV-C] light except for *C. difficile*, for which bleach and UV-C were used); bleach; and bleach and UV-C. The next patient admitted to the targeted room was considered exposed. More than 31,200 patients were exposed; 21,395 met all inclusion criteria so more than 5,000 patients were included in every group. They found that patients admitted to rooms previously occupied by patients harbouring a multidrug-resistant microorganism or *C. difficile* were 10-30% less likely to acquire the same organism if the room was terminally disinfected using an enhanced strategy. The largest risk reduction occurred when a UV-C device was added to the standard disinfectant strategy. However, no significant decrease in outcomes was observed when they used bleach or bleach and UV. Hence, the incidence of *C. difficile* infection among exposed patients was not changed after adding UV to cleaning with bleach. This is the second clinical trial which has investigated the importance of an enhanced disinfection strategy in acquisition of multidrug-resistant microorganisms and the first one in using a UV device. Remarkably, authors assessed hand hygiene compliance, room cleaning compliance and colonisation pressure, which can play a role in the transmission risk. However, the study has some limitations: first, active surveillance cultures and molecular analysis to confirm crossed transmission were not conducted. Finally basal compliance rates for standard procedures were higher than usual which can impact on the applicability of results in other settings.

In 2016 Cheng et al. [4] reported a hospital outbreak of pulmonary and cutaneous zygomycosis occurred over a period of 2 months in Hong Kong (China). Six immunosuppressed patients developed pulmonary and/or cutaneous infection

by *Rhizopus microsporus* through direct inhalation and skin contact of contaminated linen items supplied by a designated laundry for the Hospital. The fungal isolates from clinical and environmental samples were identified by morphology and gene sequencing. They sampled linen items supplied by both the designated laundry and by 9 other laundries in Hong Kong, as controls. 27% of the clothing from the designated laundry was positive for zygomycetes versus none of the linen items collected from the control laundries. 61% environmental samples and 100% air filters samples taken at the designated laundry were positive for zygomycetes. Three patients (50%) died.

This is the first major outbreak of pulmonary and cutaneous zygomycosis in immunosuppressed patients due to linen items. Until now, only 12 hospital outbreaks have been related to laundered linen items, and there is no public health consensus on the standard of hygienically clean linen items.

A study conducted by Potron et al. [5] between 2012 and 2014 described the first outbreak of OXA-204-producing Enterobacteriaceae in Europe. They investigated a total of 29 OXA-204  $\beta$ -lactamase-producing Enterobacteriaceae isolates. Of these 29 OXA-204 producers, 27 were isolated from 22 patients located in the same geographical area (Paris, France). These results led the investigators to do an epidemiological investigation. An endoscope was identified as the possible source of the outbreak: 17 patients had had direct contact with the endoscope while five were considered as secondary cases through patient-to-patient transmission on a clinical ward. Additionally, retrospective screening of all patients who had endoscopy with the suspected contaminated endoscope identified two colonised patients who underwent endoscopy as outpatients. Finally 14 patients were infected (four biliary infections, one hepatic abscess and nine urinary tract infections) and 12 patients were colonised. Endoscopy-associated transmission of carbapenemase-producing Enterobacteriaceae (CPE) might result in long-term carriage of the acquired CPE.

Finally, in 2017 van Ingen et al. [6] conducted a molecular epidemiological investigation by applying whole-genome sequencing on clinical and environmental *Mycobacterium chimaera* isolates after cardiac surgery from four European countries. They included 24 *M. chimaera* isolates from 21 cardiac surgery-related patients in Switzerland, Germany, the Netherlands and UK and 218 *M. chimaera* isolates from various types of heater-cooler units -HCUs- (that are used to control temperature within the extracorporeal circulation during cardiac surgery) from LivaNova and Maquet brand HCU production sites and unrelated environmental sources and patients. In summary, an extensive molecular epidemiological investigation including a large series of affected patients, the two market-leading brands of HCUs and their production sites suggests the possibility that the majority of cases of cardiothoracic surgery-related severe *M. chimaera* infections diagnosed in different countries resulted from a single common source of infection, LivaNova HCUs that were contaminated during production in Germany.

## CONTACT PRECAUTIONS AND DURATION OF COLONISATION IN LONG TERM ACUTE CARE HOSPITALS

In the last years, many studies analysing the impact of discontinuing contact precautions (CPs) for different multidrug-resistant microorganisms in the acute care setting have been published. We have selected a systematic literature review and meta-analysis through December 2016 [7]. Fourteen studies met inclusion criteria and were included in the final review. Six studies discontinued CPs for methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE) simultaneously, 3 for MRSA and 2 for VRE exclusively, 2 for extended-spectrum  $\beta$ -lactamase-producing *Escherichia coli* and 1 for *Clostridium difficile* infection. Most of the studies (10 studies) were conducted in the United States. Authors reported that discontinuing CPs for endemic MRSA and VRE has not resulted in a detectable increase in MRSA or VRE infection rates. This lack of effectiveness at preventing endemic MRSA and VRE infections could be due to low HCW compliance with CPs or low transmission of endemic infections. In addition, unintended consequences associated with CPs have been well documented. The importance of this meta-analysis recalls on the rethink exercise of recommendations which were suggested in 1970 when there was minimal surveillance for health-care associated infections and hand washing was the standard of care. Nowadays, many U.S hospitals are focusing resources on horizontal infection control strategies to prevent multidrug-resistant organisms. The current meta-analysis has important limitations: the inclusion of many studies that were before-after quasi-experimental studies is subjected to multiple biases and the follow-up time of the studies included was short (only one study had a long follow-up, 10 years).

A quality improvement program in long-term acute care hospitals (LTACHs) has been recently reported by Haverkate et al. in 2016 [8]. They determined the duration of colonisation with carbapenemase-producing *Klebsiella pneumoniae* (KPC) during admission and between discharge and re-admission in a cohort of patients from 4 LTACHs in Chicago. During the study period, a bundled intervention was implemented. This infection control bundle involved daily bathing of all LTACH patients with 2% chlorhexidine gluconate (CHG) education of the medical staff on KPC and infection prevention, adherence monitoring (focusing on hand hygiene), patient and staff cohorting, and surveillance screening. Surveillance screening for KPC comprised rectal swab culture screening on admission and every other week for all LTACH patients. During a median 1-month LTACH stay, 83% of patients are still colonised with KPC after a 4-weeks period. Even more, 50% of patients who are readmitted after 9 months are still colonised. According to this, patients who are found to be KPC carriers remain colonised throughout their hospitalization and it seems justified to isolate KPC-positive patients for the duration of their hospital stay. Taking account the limitations of the study, they didn't perform molecular studies, so there is no way to

know if a patient carried the same strain of KPC or if it was a recolonisation.

## NEW INSIGHTS IN *CLOSTRIDIUM DIFFICILE* EPIDEMIOLOGY

*Clostridium difficile* infection (CDI) is the most common cause of diarrhoea in hospital. CDI occurs when there is a susceptible host and sufficient exposure to the organism. Many factors may increase host susceptibility to CDI, but the most crucial host-related risk factor is exposure to antibiotics. We have selected a recent project conducted by Freedberg et al. [9], published in 2016, which remarks the colonisation pressure importance. The aim of the study was to assess whether receipt of antibiotics by prior bed occupant was associated with increased risk for CDI in subsequent patients who occupied the same bed. This was a retrospective study in four affiliated but geographically distinct hospitals in New York City metropolitan area; 100,615 pairs of patients were analyzed. Receipt of antibiotics by prior bed occupants was associated with increased risk for CDI in subsequent patients even after adjusting for potential confounders. The median time from bed admission to CDI when a subsequent patient developed the infection was 6.4 days (IQR 4.0-9.5). The results of this study support the previous findings regarding colonisation pressure (number of patients nearby who already have the infection) by demonstrating that the CDI risk profile of the prior bed occupant is likely to be a part of this *C. difficile* colonisation pressure. The weaknesses of this study fall on the biases of an observational study and biases of selected housing. There are also other limitations: it has been conducted in a single centre, which makes the results non generalizable to other institutions and in a non-outbreak setting, so the relationship between antibiotics and CDI may differ during an outbreak.

## ANTIMICROBIAL STEWARDSHIP PROGRAMS

The global increase in antimicrobial resistance has brought along the implementation of intervention programs to promote the appropriate use of antimicrobials. In 2017, Molina et al. [10] published the impact of an educational antimicrobial stewardship program on antibiotic consumption, incidence density of hospital-acquired *Candida* spp. and multidrug-resistant (MDR) bloodstream infections (BSI) and crude mortality rate per 1,000 occupied bed days (OBDs). They conducted a quasi-experimental intervention study over a 5-year period. A multidisciplinary team conducted a multifaceted educational intervention in a tertiary-care hospital. The main activity consisted in peer-to-peer educational interviews between counsellors and prescribers from all departments to reinforce the principles of the proper use of antibiotics without performing any antibiotic changes. A total of 3,176 educational interventions (EIs) were performed with prescribers from all clinical units; more than 1,200 EIs were held in the first year, followed by an average of 500 EIs per year. The average time required for each

interview was 10 minutes. The median consumption dropped from 1,008 (interquartile range [IQR], 980–1,078) to 774 (750–787) DDDs per 1,000 OBDs from the first to the last year. The incidence density of hospital-acquired candidemia and MDR BSI diminished parallel to the antibiotic pressure. Conversely, the incidence density of hospital-acquired BSIs produced by non-MDR strains of the same microorganisms under study did not change during the intervention. All-cause 14-day crude death rate for hospital-acquired candidemia and MDR BSIs was reduced parallel to its incidence. This study proves that an educational intervention can improve antibiotic consumption, infection incidence by MDR and *Candida* spp. and mortality.

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