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Interim Measures to Prevent and Control Transmission of Carbapenemase-producing Enterobacteriaceae and other Multidrug-Resistant Gram-Negative Bacilli in Long-term Care Settings

COMITÉ SUR LES INFECTIONS NOSOCOMIALES DU QUÉBEC

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Summary

In 2010, the Comité sur les infections nosocomiales du Québec (CINQ) [Québec healthcare-associated infections committee] released its guidelines for preventing and controlling transmission of carbapenemase-producing Enterobacteriaceae, and then more recently, in 2015, its measures to prevent and control transmission of multidrug-resistant Gram-negative bacilli (MDR-GNB) in acute care settings.

The application of infection prevention and control (IPC) measures in long-term care settings (CHSLDs) must be adapted to the characteristics specific to these settings, as well as to the clientele residing in these settings. The purpose of this document is to provide IPC staff working in CHSLDs and the clinicians who practice there with up-to-date information that applies to these specific settings.

Persons who reside in long-term care facilities not only live there, but also receive healthcare services there. Even though this type of accommodation is increasingly restricted to persons with complex pathologies or major motor, sensory or cognitive dysfunctions, such accommodation must remain a pleasant and friendly place of residence. Therefore, the interventions differ from those usually carried out in care settings. The level of care provided usually differs from that provided in acute care settings and there is a lower proportion of at-risk persons. The long length of time the residents stay in such centres (often several years) limits, among other things, the long-term application of restrictive measures. It is also important to consider the impact that implementing additional precautions during care can have on a resident.

Regarding IPC measures to be taken at a CHSLD, the focus is to prevent the transmission of cases of carbapenemase-producing Enterobacteriaceae (CPE) within these settings so that they do not become a reservoir and increase the risk of transmission to short-term care facilities when the residents are transferred.

Québec

Since there is a limited amount of up-to-date epidemiological information documenting the potential for transmission of CPE in CHSLDs, the IPC measures recommended take into consideration the information in the literature on transmission of MDR-GNB.

These studies have clearly demonstrated that residents admitted to long-term care are potential reservoirs for MDR-GNB. Carriers can be the source of subsequent transmission when they are transferred to short-term care facilities if measures have not been taken. Some risk factors for developing infections among CHSLD clientele have also been identified, including invasive devices (urinary catheter, vascular catheter, gastrostomy, tracheostomy), wounds and a resident having recently taken, or still taking, antibiotics. The measures recommended take into consideration the intensity of the care provided to residents in the various types of long-term care centres. Besides accommodation, long-term care facilities may offer other types of services or care for certain beds or units, for example, transition beds or units, functional rehabilitation units (FRU) or short-term geriatric units (STGU), which is why it is so important to adapt the measures to meet the risk assessment (e.g. risk of environmental contamination or of developing an infection). Lastly, the measures recommended in this document may be adapted to reflect new epidemiological information.

Characteristics of carbapenemase-producing Enterobacteriaceae

Infectious agent	Enterobacteriaceae (*Klebsiella* spp., *Escherichia coli*, *Proteus* spp., *Citrobacter* spp., *Serratia* spp., *Enterobacter* spp., etc.)
Reservoir	Enterobacteriaceae are part of the normal gut flora. They are frequently found in clinical samples from other colonization or infection sites (e.g. urine, wounds, sputum).
Epidemiology	▪ High and sustained potential of transmission, spreading rapidly worldwide. ▪ The source of numerous outbreaks in short-term care settings and inter-facility spread, including facilities providing long-term care. ▪ Since they were first described in 2001 in the United States, carbapenemase-producing Klebsiella pneumoniae (KPC) have spread globally. In the Unites States, long-term care facilities have been involved in the regional spread of KPC, and KPC outbreaks have occurred in these settings. Several studies have been published describing how these facilities have contributed to introducing KPC into short-term care facilities. ▪ In 2004, Viau (2012) reported 12 cases of colonization by KPC in a long-term care facility with adult and pediatric residents with neurological impairment in Ohio. Perez (2010) reported that 75% of new cases of KPC in Northeastern Ohio were patients transferred from long-term care; 60% of these patients returned to the long-term care facility once discharged. ▪ Among the patients admitted to 13 hospitals in Southeastern Michigan in 2008-2009, 32% of cases of KPC detected within the initial 72 hours had been recently hospitalized in a long-term acute care facility (Marchaim, 2012). ▪ In Los Angeles County, 34% of the 675 cases of healthcare-acquired KPC infections reported by laboratories (mandatory reporting) were from long-term acute care hospitals (LTACH) and 8% from skilled nursing facilities (Marquez, 2013). ▪ Studies carried out during investigations of KPC outbreaks in numerous hospitals and LTACHs in Indiana, Illinois and Virginia have shown that a high proportion of cases (90% and 84%, respectively) had recently stayed at a long-term care centre and that all the isolates were genetically linked, suggesting inter-facility spread (CDC, 2011; Won, 2011). ▪ A point prevalence study involving severe long-term acute care facilities (LTACFs) in Chicago in 2011 showed that 30% (119/391) of patients were colonized by KPC compared with 3% (30/910) of patients hospitalized in short-term intensive care units (prevalence ratio, 9.2 [6.3-13.5]). All the LTACFs had patients who were KPC carriers (prevalence of 10% to 54%), compared with 15 of the 24 short-term care hospitals (prevalence 0% to 29%). Apart from colonization, the risk factors found were: staying in a long-term acute care facility, mechanical ventilation and the length of the stay (Lin CID, 2013).

Infectious agent	Enterobacteriaceae (*Klebsiella* spp., *Escherichia coli*, *Proteus* spp., *Citrobacter* spp., *Serratia* spp., *Enterobacter* spp., etc.)
Epidemiology (continued)	▪ 15 of the 24 short-term care hospitals (prevalence of 0% to 29%). Apart from colonization, the risk factors found were: staying in a long-term acute care facility, mechanical ventilation and length of stay (Lin CID, 2013). ▪ In Chicago, during the same year, in a case-control study, Prabaker *et al*. (2012) assessed colonization by KPC in 180 patients transferred from long-term care facilities in an acute care hospital. Fifteen (8.3%) of them were colonized. The highest proportion of colonized patients was among patients from a long-term acute care centre (4 of 12, i.e. 33%), followed by centres where patients on ventilators were residing (9 out of 33, i.e. 27.3%), then long-term care centres with no patients on ventilators (2 out of 135, i.e. 1.5%). None of the 180 control patients admitted from the community were carriers. ▪ According to data from Israel, where KPC infections are endemic in hospitals, a study of prevalence of rectal colonization carried out in over 40% of patients from 13 post-acute care hospital facilities (PACHs) in 2008-2009 identified 2% of new carriers (Ben-David *et al*., 2011). ▪ The main risk factor for colonization identified was sharing a room with a known case (RR 3.09 [IC 1.52-6.23]). A policy of screening on admission was a protective factor (RR 0.41 [IC 018-0.93]). ▪ Among the 140 patients already known to be carriers, 47% were still colonized and the risk factors identified for long-term colonization were having recently taken antibiotics (< 3 months) and having tested positive for infection fewer than 90 days previously. ▪ Seventy percent were no longer carriers 90 days following their last positive result, but several were still carriers after more than 10 months. ▪ Feldman *et al*. (2013) studied colonization in a cohort of 125 carriers up to five months after they had left an acute care facility. Thirty percent (30%) of them still tested positive when they were tested three months after they were discharged. Among the 30 patients monitored up to five months, 70% (n=21) were still positive, but the study did not assess whether this was a persistence of carrier status or a reinfection. ▪ Schechner *et al*. (2009) assessed an increased susceptibility of 15% when the sample was tested using PCR. That is why in Israel, the criteria for discontinuing additional precautions are to show that three rectal samples (two cultures and one PCR test) are negative 90 days after a positive result; however, an alert remains in the medical record, since the patient may become positive again (Schwaber, 2014). ▪ The implementation in 2008 of a program to prevent and control infections resulted in a significant reduction in the spread of KPC in Israel. However, it was not until prevention and control measures had been implemented in long-term care facilities that it was possible to further reduce the spread of healthcare-associated infections in acute care settings. Contrary to the measures implemented in short-term care facilities, some measures such as cohorting with dedicated staff for the cohorted residents and restricting patients to their rooms were not considered appropriate for long-term care, as they could compromise rehabilitation and socialization (Schwaber and Carmeli, 2014). ▪ To sum up, even though most studies pertain to long-term care centres providing acute care where the level of intensity of care and the use of invasive devices are high, the patients admitted from long-term care play a significant role in introducing CPE into acute care settings in endemic regions. Furthermore, most studies pertain to KPC, which is quite different from CPE, most often the culprit in outbreaks. ▪ The risk of colonization in facilities where care is less intensive and the risk of infection in colonized patients is unknown. ▪ Several studies report that the implementation of measures to prevent and control infections results in a reduction in transmission and the end of outbreaks (Schwaber, 2014; Munoz-Price, 2010; CDC, 2011; Chitnis, 2012)

Infectious agent	Enterobacteriaceae (*Klebsiella* spp. *Escherichia coli*, *Proteus* spp., *Citrobacter* spp., *Serratia* spp., *Enterobacter* spp., etc.).
Antibiotic resistance	Production of antibiotic-resistance enzymes called carbapenemases, often in association with other antibiotic resistance mechanisms. These carbapenemases will allow the bacteria to resist antibiotics in the carbapenem antibiotic family (ertapenem, meropenem, imipenem) often used as “last resort” antibiotics to treat infections. Various antibiotic resistance enzymes have been described, including the KPC enzyme, identified in a strain of carbapenemaseproducing Klebsiella pneumoniae, metalloenzymes β-lactamase (New Delhi metalloβ-lactamase (NDM-1), Verona Integron metalloβ-lactamase (VIM) or metalloβ-lactamase active on imipenem (IMP). The antibiotic-resistance genes are generally located on the plasmids (mobile genetic elements), enabling the transmission of these genes between various species of bacteria. Therefore, transmission of CPEs is based on the gene (e.g. KPC, NDM-1, VIM, IMP), not only on the same species of bacteria, as in other multidrug-resistant pathogens (e.g. vancomycin-resistant enterococci (VRE) or methicillin-resistant Staphylococcus aureus (MRSA).
Infections	Urinary tract, intraabdominal, pneumonia, bacteremias.
Laboratory detection	Phenotype detection: ▪ Antimicrobial susceptibility testing (resistance to ertapenem, meropenem or imipenem). ▪ Grows on a selective culture medium (chromogenic agar or carbapenem agar or discs). ▪ Phenotype tests: carbapenem inhibition test, disc method combined with inhibitors, Modified Hodge Test. Genotype detection (confirmation): ▪ Detection of antibiotic-resistance genes (KPC, OXA-48, SME, IMI/NMC, NDM-1, VIM, IMP, etc.) using a nucleic acid amplification test, performed at the Laboratoire de santé publique du Québec (LSPQ) [Québec’s public health laboratory].
Route of transmission	▪ Direct and indirect contact with the patient or their contaminated environment, including any contaminated healthcare material and medical devices. ▪ Risk of transmission mainly by the hands of healthcare staff. ▪ Increased risk of transmission in cases involving diarrhea, incontinence, invasive devices, or a wound with discharge.
Duration of colonization	The duration of colonization mentioned in the literature varies. According to the studies consulted (Feldman, 2013 and Schwaber, 2014) the percentage of patients who continue to be carriers decreases over time (30-35% of carriers after three to six months). The risk of transmission continues for as long as the resident remains a carrier.

* For further details on other major MDR-GNB or the various resistance mechanisms, see the document prepared for acute care settings, CINQ 2015. https://www.inspq.qc.ca/sites/default/files/publications/2131_measures_control_prevent_transmission_gram.pdf.

Measures to prevent and control transmission of CPEs

Routine Practices	
INDICATIONS **For all residents, including confirmed carriers (colonization or infection) WITHOUT risk factors for environmental contamination, (such as no incontinence, no behavioural problems or wandering)**	Proper and consistent implementation of routine practices during the delivery of healthcare: ▪ Hand hygiene with alcohol-based hand rub (ABHR) or soap and water (antiseptic or plain) during the 4 moments for hand hygiene. ▪ Wear gloves when contact with blood or other body fluids is likely. ▪ Wear a long-sleeved gown during the delivery of healthcare or when interacting with residents where splashing or spattering of blood or other body fluids is likely (e.g. while changing dressings, handling human waste). Perform audits to monitor proper hand hygiene and proper use of protective gear.
Additional Precautions	
INDICATIONS **If the resident who is a carrier is likely to contaminate their environment** ▪ Incontinence with diarrhea ▪ Behavioural problems (e.g. wandering with risk of contaminating the environment of other residents) **Or** if a roommate has one of the following risk factors **for acquiring an infection:** ▪ Urinary catheter ▪ Endotracheal tube or tracheostomy ▪ Gastrostomy ▪ Recent surgical wound ▪ Bedsore or other chronic wound with discharge.	**Implementation of additional precautions to protect against transmission by contact, without restricting patients to their rooms:** ▪ Wearing a long-sleeved gown and gloves during delivery of direct care for residents.* ▪ If the patient has a tracheostomy, wear a mask during open ventilation or aspiration in compliance with routine practices. ▪ Additional precautions are not recommended to protect against contact transmission (bed contact) while waiting for the resident's screening results, but may be considered locally if deemed necessary by the IPC team based on local epidemiology.
Healthcare materials and medical devices	▪ Use disposable medical devices, or dedicate devices to a single resident. ▪ Limit the amount of healthcare materials that enter the room. ▪ Reusable multiple-patient medical devices that could not be disinfected prior to their being used for another resident.

* Direct care: hands-on care (e.g. bathing, washing or turning, changing clothes, incontinence care, dressing changes, open wound and lesion care, performing personal hygiene).

Additional Precautions	
Duration of additional precautions	▪ Implement the additional precautions for a minimum of six months after the last positive result. ▪ The first follow-up screening may be performed more than three months after the last positive screening. The additional precautions may be discontinued after the initial three-month period, when a minimum of three screenings (rectal swab* and the other sites that have previously tested positive, e.g. urine, wound, ostomy) performed a least one month apart are negative. ▪ When the additional precautions have been discontinued, it is advisable to continue screening the resident every three months or any other time period specified by the IPC team for the duration of their stay.
Accommodation of the resident	**Preferred accommodation is a single room with a dedicated toilet** ▪ For a resident who has been confirmed as colonized or infected by CPE with factors likely to result in environmental contamination, such as fecal incontinence for which the resident does not wear incontinence briefs, a wound with discharge that cannot be contained in dressing, etc., a single room is the preferred accommodation. They should also have access to a dedicated toilet. If this is not possible, make sure they have a dedicated commode or bedpan and use hygienic bags. **Room sharing** ▪ A resident who has been confirmed as colonized or infected by CPE may share the room and the toilet of a non-colonized resident **with no factors likely to result in environmental contamination** (fecal incontinence with resident not wearing incontinence briefs, wound with discharge, etc.) **and** when their roommate has no risk factors for acquisition (wound, urinary catheter, ostomy, etc.). ▪ Two residents who are CPE carriers with the same type of carbapenemase (the same gene, for example, a *Klebsiella* spp. carrier with KPC may share their room with a resident who is an *E. coli* carrier with KPC). ▪ Don't put a resident who is a CPE carrier with a resident who is a confirmed carrier of multidrug-resistant bacteria (e.g. MRSA, VRE).
Residents' personal care	▪ Ensure proper personal hygiene (bath/shower or sponge bath) in compliance with the facility's established procedures. ▪ Ensure that the sheets, the bedding and the resident's clothes are changed regularly, in compliance with the facility's established procedures. ▪ Reserve all personal hygiene products and any barrier creams used for bedsores for the resident's exclusive use. ▪ Ensure the resident's hands are cleaned using alcohol-based hand rub (ABHR) or soap and water, especially after they use the toilet, before meals and before leaving their room.

* Rectal swab: the swab must be inserted into the rectum to a depth of a few millimeters so that it comes in contact with stool.

Additional Practices	
Human waste management	▪ If a dedicated toilet is recommended and the resident cannot get around, ensure that they have a dedicated commode or bedpan, and use hygienic bags. ▪ Dispose of human waste as close as possible to the point of care to avoid contaminating the environment. ▪ Cleaning the bedpans with a hand shower must be prohibited. ▪ When the resident uses a shared toilet, disinfect the high-touch surfaces after each use in accordance with routine practices.
Environment, Laundry, Waste Management	
Disinfection of the environment	▪ Use the recommended personal protective equipment (PPE) when disinfecting the room. ▪ Disinfect the room in compliance with the facility's established procedures. The high-touch surfaces and the bathroom must be cleaned at least daily as recommended in the hygiene and cleanliness guidelines (MSSS, 2006). It is not necessary to use bleach. ▪ When additional precautions to prevent contact transmission are discontinued, or when the resident is discharged, perform terminal disinfection of the room in compliance with the facility's established procedures. ▪ Dispose of or clean the disinfection materials to avoid contaminating the environment.
Dishes	▪ Follow the facility's established procedures for washing dishes and utensils.
Laundry	▪ Follow the facility's established procedures for washing linens and bedding. ▪ Follow the facility's established procedures for washing residents' clothes on the unit/floor or when they are washed by their family.
Waste management	▪ Follow the facility's established procedures.
Resident and Visitor Movements	
Movement outside their room	▪ The resident may move freely outside their room and go to the dining room, and participate in social and community activities. ▪ Assist residents who are carriers with hand hygiene using an alcohol-based hand rub (ABHR) or soap and water before they leave their room, before meals or before they participate in any social or community activities.
Visitors	▪ Perform hand hygiene with an alcohol-based hand rub (ABHR) or soap and water before and after visiting. ▪ A visitor who provides care* must perform hand hygiene and wear a long-sleeved gown and gloves when they are in close physical contact (body-to-body) with the resident.
Consultation, appointments or transfer to another setting	▪ Inform the receiving facility when a resident known to be a CPE carrier is being transferred to another institution, facility or care unit in compliance with the facility's established procedures. ▪ Indicate the date of the last positive screening, if this information is available.

* Direct care: bathing, washing or turning, changing clothes, incontinence care, dressing changes, open wound and lesion care, performing personal hygiene.

Screening	
Indications for screening	▪ **Screening on admission** (day 0 and day 7), only for residents who have been transferred from another facility or who are returning from a stay at another facility where there is an outbreak reported on the list *Avis sur les BMR- Rapport cumulatif des signalements d'éclosions* [Advisory on multidrug-resistant bacteria – cumulative report on outbreak reporting] prepared by the MSSS [Québec's ministry of health and social services]. ▪ Additional precautions are not recommended to protect against contact transmission (bed contact) while waiting for the resident's admission screening results*, but may be considered locally, if deemed necessary by the IPC team based on local epidemiology. ▪ **Screening of residents known to be carriers**: on admission and every three months during their stay. ▪ If the results are negative ≥ 3 months after the last positive screening, perform monthly screening until a minimum of three negative consecutive screenings has been obtained. It is advisable to continue screening the resident every three months, for the duration of their stay or for a period of time specified by the IPC team (one year, for example). **When a positive clinical sample is discovered in an unknown case:** ▪ **Screen at least all close contacts** (residents sharing the same room or the same toilet) on day 0, day 7 and day 14. ▪ Implementing additional precautions may be considered to prevent contact transmission (bed contact) with close contacts** while waiting for screening results (decision made locally by the IPC team). ▪ Depending on the functional organization of the care unit, the local IPC team **may decide to screen more distant contacts** (residents who have shared the same healthcare staff or the same professionals (e.g. physiotherapist, occupational therapist, respiratory therapist) or who have shared a common physical location (e.g. physiotherapy room)) on day 0, day 7 and day 14. ▪ Following assessment by the local IPC team, considering staff sharing (number of workers assigned to the care of the known carrier) and the frequency of interventions, **screening all residents who are staying in the same unit may be considered.** ▪ Some care facilities may decide locally to **periodically screen** (e.g. once a month) all residents in a unit where a confirmed CPE-carrier is staying for several months to assess transmission on the unit. The local IPC team will make this decision based on the local epidemiology. This screening strategy must be periodically reassessed to adjust to the development of the local epidemiological situation and the local risk factors for transmission within the facility.
Infection	▪ Collect a sample from potentially infected sites (i.e. where there are signs and symptoms in keeping with an infection), regardless of whether the resident has a carrier status, before starting them on antibiotics.
Collection sites to be used for screening	▪ Stools or rectal swab*** and all other colonization or infection sites that previously tested positive (e.g. endotracheal secretions in the case of a tracheostomy, ostomies, drain and catheter sites, urine if the patient has a urinary catheter).
Carrier status alert in the medical record	▪ Place a CPE-carrier status alert in the resident's medical record. ▪ It is up to the IPC department to remove the alert from the resident's medical record. However, since excretion can be intermittent and as we do not know the average duration of colonization, it is difficult to specify when the alert can be removed.

* Depending on the sensitivity of the screening tests performed in the microbiology laboratory and on the local epidemiology, the contact precautions applied while waiting for the screening results may be discontinued after the first negative result.

** Depending on the sensitivity of the screening tests performed in the microbiology laboratory or the local epidemiology, the contact precautions applied while waiting for the screening results may be discontinued if the result on day 7 is negative.

*** Rectal swab: the swab must be inserted into the rectum to a depth of a few millimeters so that it comes in contact with stool.

Special measures in case of outbreak

The following measures are to be implemented during a CPE outbreak in association with the measures described previously, as well as the prevention and control measures required during any outbreak such as: greater insistence on hand hygiene and additional precautions, enhanced disinfection of the environment, healthcare materials and medical devices, staff training, etc.

Definition of outbreak	▪ Occurrence of 2 new healthcare-associated cases (admitted more than 72 hours previously), colonized or infected, epidemiologically linked.
Contact screening (stools or rectal swab)	▪ Screening on day 0, day 7 and day 14 of close contacts (residents who stayed more than 24 hours in the same room as a confirmed, non-isolated case). ▪ Screening on day 0, day 7 and day 14 of more distant contacts (residents who stayed on the same unit as a confirmed, non-isolated case). ▪ Screening on day 0, day 7 and day 14 of contacts who received care from the same staff, if a transmission via staff is suspected. ▪ Weekly screening of the affected ward up to a minimum of three weeks with no new cases discovered. ▪ Staff screening is not recommended. ▪ Some care facilities may locally decide to perform screening on discharge from a ward experiencing an outbreak.
Additional precautions	▪ Implement the additional precautions** to prevent contact transmission without restricting the resident identified as a close contact to their room (bed contact), while waiting for the results of screening tests performed on day 0, day 7 and day 14.
Alert	▪ Advise the receiving centre when a resident who is a carrier or a contact is transferred to another centre. ▪ Report the outbreak to the Direction de santé publique (DSPu) [regional public health authority].
End of outbreak	▪ When no new case has been discovered for a minimum of three consecutive weeks, following the identification of the last confirmed case. ▪ Advise the DSPu of the end of the outbreak.

* Rectal swab: the swab must be inserted into the rectum to a depth of a few millimeters so that it comes in contact with stool.

** Depending on the sensitivity of the screening tests performed in the microbiology laboratory or the local epidemiology, the contact precautions implemented while waiting for the screening results may be discontinued if the result on day 7 is negative.

Measures to prevent and control transmission of other MDR-GNB

Bacteria	IPC measures
Group 1 Bacteria (CINQ 2015) ▪ *Acinetobacter* resistant to ≥ 5 classes of antibiotics ▪ Enterobacteria resistant to ≥ 5 classes of antibiotics without carbapenemase production ▪ Other Gram-negative bacillus resistant to ≥ 5 classes of antibiotics, other than *Pseudomonas aeruginosa* or *Stenotrophomonas maltophilia*	Some care facilities may locally decide to implement additional precautions to prevent contact transmission, without restricting residents to their rooms (see previous table for details). It is up to the IPC department to discontinue additional precautions. No close or more distant contact screening is recommended.
Group 2 Bacteria (CINQ 2015) ▪ *Acinetobacter* resistant to ≥ 3 classes of antibiotics ▪ Enterobacteria resistant to ≥ 3 classes of antibiotics ▪ Enterobacteria resistant to carbapenems via a mechanism other than carbapenemase production ▪ Other Gram-negative bacillus resistant to ≥ 3 classes of antibiotics ▪ *Pseudomonas aeruginosa* resistant to ≥ 5 classes of antibiotics ▪ Stenotrophomonas maltophilia resistant to TMP-SMX	No special measures in a CHSLD.

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