

**Transmission Based Precautions Literature Review:
Patient Placement (Isolation/Cohorting)**

Version: 1.0
Owner/Author: Infection Control Team
Review Date: October 2015

DOCUMENT CONTROL SHEET

Key Information:

Title:	Transmission Based Precautions Literature Review: Patient Placement (Isolation/Cohorting)	
Date Published/Issued:	June 2014	
Date Effective From:	June 2014	
Version/Issue Number:	1.0	
Document Type:	Literature Review	
Document status:	Final	
Author:	Name:	Laura Macdonald
	Role:	Healthcare Scientist
	Division:	HPS
Owner:	Infection Control	
Approver:	Lisa Ritchie	
Approved by and Date:		
Contact	Name:	Infection Control Team
	Tel:	0141 300 1175
	Email:	nss.hpsinfectioncontrol@nhs.net
File Location:		

Version History:

This literature review will be updated in real time if any significant changes are found in the professional literature or from national guidance/policy.

Version	Date	Summary of changes	Changes marked
1.0	June 2014		

Distribution – this document has been distributed to:

Version	Date of Issue	Name	Job Title	Division

Approvals – this document requires the following approvals (in cases where signatures are required add an additional 'Signatures' column to this table)::

Version	Date Approved	Name	Job Title	Division
		Steering (Expert Advisory) Group for SICPs and TBPs		

Linked Documentation:

Document title	Document Filepath
National Infection Prevention and Control Manual	

HPS ICT Document Information Grid	
Title:	Transmission Based Precautions Literature Review: Patient Placement (Isolation/Cohorting)
Purpose:	To inform the Transmission Based Precautions chapter of the National Infection Prevention and Control Manual on the use of isolation/cohorting in order to facilitate prevention and control of HAIs in NHSScotland hospital settings.
Target audience:	All NHS Scotland staff involved in the prevention and control of infection in the hospital setting.
Circulation list:	Infection Control Managers, Infection Prevention and Control Teams, Public Health Teams
Description:	<p>This literature review examines the available professional literature on the use of isolation/cohorting in the hospital setting.</p> <p>For the purposes of this review the hospital setting is deemed to include: all services, clinics, or departments in the primary, secondary and tertiary hospital settings – for example, Specialised Centres, District General, Ambulatory Care, Day, Community, Children's.</p> <p>The review did not examine primary care settings, for example, Health Centres, GP surgeries, General Dental Practices, or patient's own homes.</p>
Update/review schedule:	HPS TBP's are updated in real time with changes made to recommendations as required.
Cross reference:	Standard Infection Control Precautions Literature Review: Patient Placement (Providing care in the most appropriate place in the hospital setting) http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=50112
Feedback/contact details:	nss.hpsinfectioncontrol@nhs.net
Update level:	Practice – <i>Initial review therefore currently not applicable</i> Research – <i>Initial review therefore currently not applicable</i>

Contents:

1. Objectives	5
2. Recommendations.....	6
3. Discussion.....	10
Implications for research.....	16
References	17

1. Objectives

The aim of this review is to examine the extant scientific literature regarding patient placement (isolation/cohorting) in the hospital environment to form evidence based recommendations for practice. The specific objectives of the review are to determine:

- What is an isolation suite/room?
- Are there any legislative requirements relating to the use of an isolation suite/room?
- What is a single room?
- What is a cohort area?
- How should patient placement decisions be made?
- Under what circumstances should a patient be placed in an isolation room?
- Under what circumstances should a patient be placed in an single room?
- Under what circumstances should a patient be placed in an cohort area?
- What is “cohort nursing”, and under what circumstances should it be implemented?

Note:

Transmission Based Precautions (TBPs) are measures that may be required in addition to Standard Infection Control Precautions (SICPs). It is assumed, for the purpose of this literature review, that all SICPs are adhered to, and therefore are not the focus of this literature review and the associated recommendations.

2. Recommendations

This review makes the following recommendations based on an assessment of the extant scientific literature on patient placement (isolation/cohorting):

What is isolation suite/room?

An isolation suite/room is defined as an “enhanced single room with en-suite facilities and ventilated lobby”.

(Mandatory requirement therefore no grade of recommendation can be made)

Are there any legislative requirements relating to the use of an isolation suite/room?

As part of local COSHH assessments a log book should be completed for each isolation suite. These log books should be located in the lobby. The following information should be recorded for each isolation suite:

- a schematic layout of the isolation suite and ventilation system serving it;
- information on the ventilation design parameters;
- a record of the actual ventilation performance at initial validation (“Acceptance testing”);
- records of the annual validations;
- records of the lobby pressure, taken by ward staff from gauges and monitoring devices provided;
- records of any routine service and maintenance activities;
- records of any repairs or modifications;
- a method statement for disinfecting the system.

(Mandatory requirement therefore no grade of recommendation can be made)

What is a single room?

See Standard Infection Control Precautions Literature Review: *Patient Placement (Providing care in the most appropriate place in the hospital setting)* for the definition of, and requirements for, a single room

<http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=50112>

What is a cohort area?

A cohort area is a bay/ward in which a group of patients (cohort) with the same infection are placed together. Cohorts are created based on clinical diagnosis, microbiological confirmation when available, epidemiology, and mode of transmission of the infectious agent.

(AGREE rating: Recommend)

How should patient placement decisions be made?

Patient placement decisions should be based on risk assessment which should consider the route of transmission alongside patient factors and symptoms that increase the risk of cross transmission (e.g. vomiting, diarrhoea, an unexplained rash, fever or respiratory symptoms).

(Good Practice Point)

Under what circumstances should a patient be placed in an isolation suite/room?

An isolation suite/room should be used, if available, to accommodate a patient known or suspected to be infected with a microorganism spread by the airborne (aerosol) route whilst the patient is considered infectious.

(AGREE rating: Recommend)

The door of an isolation suite/room must remain closed when not in use, and door opening should be kept to a minimum.

(Good Practice Point (GPP))

Under what circumstances should a patient be placed in a single room?

Patients who are known or suspected to be infected with a microorganism spread by the contact or droplet route should be cared for in single rooms when available.

(AGREE rating: Recommend)

Hospitals should have systems in place to be able to rapidly identify:

- patients who have been transferred from a hospital abroad;
- patients who have been hospitalised abroad within the last 12 months'
- patients who have previously been positive for CPE (carbapenemase producing enterobacteriaceae) at any body site.

These patients should be immediately isolated in a single room.

(Mandatory requirement therefore no grade of recommendation can be made)

Patients should remain isolated in a single room whilst they remain symptomatic and/or are considered infectious.

(Good Practice Point (GPP))

The decision to discontinue isolation should be based on clinical judgement.

(Good Practice Point (GPP))

The door of a single room must remain closed when not in use.

(Good Practice Point (GPP))

Under what circumstances should a patient be placed in a cohort area?

Patient cohorting may be appropriate when single rooms are not available and there is more than one patient with the same confirmed infection

(AGREE rating: Recommend)

Patient cohorting should be combined with other infection prevention and control measures e.g. hand hygiene, PPE and environmental decontamination.

(Grade D recommendation)

Patients should be separated by at least 3 feet (1m) from each other in a cohort area, and bed curtains can be drawn as an additional physical barrier.

(AGREE rating: Recommend)

What is “cohort nursing”, and under what circumstances should it be implemented?

Cohort nursing (staff cohorting) is defined as the use of a dedicated team of healthcare staff to care for patients infected with a single infectious agent.

Cohort nursing may be implemented to minimise the risk of contamination between groups of symptomatic and non-symptomatic patients if there is adequate staff resource available to do so.

(AGREE rating: Recommend)

3. Discussion

What is isolation suite/room?

An isolation suite is defined as an “enhanced single room with en-suite facilities and ventilated lobby (isolation suite)” within the Scottish Health Facilities Note (SHFN) 30³ and Scottish Health Planning Note (SHPN) 04 In-patient Accommodation: Options for Choice (Supplement 1 Isolation Facilities in Acute Care Settings).⁴ Inclusion of a ventilation system distinguishes an isolation suite/room from a single room.⁴ Where a patient presents an infection risk to others, a “negative pressure” isolation suite is used (source isolation).⁴ More recently isolation suites have included a positive pressure lobby which enables the room to be used for both source and protective isolation by preventing air entering the corridor or escaping from the room. The lobby also provides an area for healthcare workers to prepare before entering/exiting the room. The ventilation should be +10 Pascals in the lobby with respect to the corridor; patients’ room should have 10 air changes per hour and be neutral in pressure to that of the corridor; the en-suite having at least 10 air changes per hour and a negative pressure to that of the patient’s room.⁴ For more detailed information on the requirements for an isolation suite, see SHPN 04 SHPN 04 In-patient Accommodation: Options for Choice (Supplement 1 Isolation Facilities in Acute Care Settings).⁴

An isolation suite/room is defined as an “enhanced single room with en-suite facilities and ventilated lobby”.

(Mandatory requirement therefore no grade of recommendation can be made)

Are there any legislative requirements relating to the use of an isolation suite/room?

As part of local COSHH assessments a log book should be completed for each isolation suite. These log books should be located in the lobby. The following information should be recorded for each isolation suite:

- a schematic layout of the isolation suite and ventilation system serving it;
- information on the ventilation design parameters;
- a record of the actual ventilation performance at initial validation (“Acceptance testing”);
- records of the annual validations;

- records of the lobby pressure, taken by ward staff from gauges and monitoring devices provided;
- records of any routine service and maintenance activities;
- records of any repairs or modifications;
- a method statement for disinfecting the system.

(Mandatory requirement therefore no grade of recommendation can be made)

What is a single room?

See *Standard Infection Control Precautions Literature Review: Patient Placement (Providing care in the most appropriate place in the hospital setting)* for the definition of, and requirements for, a single room <http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=50112>

What is a cohort area?

A cohort area is a bay/ward in which a group of patients (cohort) with the same infection are placed together.^{1;2} Cohorts are created based on clinical diagnosis, microbiological confirmation when available, epidemiology, and mode of transmission of the infectious agent.²

(AGREE rating: Recommend)

How should patient placement decisions be made?

There is a hierarchy of patient placement decisions, informed by risk assessment, that should be undertaken for patients requiring care using Transmission Based Precautions. This should include assessment of the route of transmission and potential spread of the infection alongside risk factors such as exposure to blood and body fluids.² Patient factors and symptoms that may contribute to cross transmission should also be considered (e.g. vomiting, diarrhoea, an unexplained rash, fever or respiratory symptoms).

As single rooms are often in short supply the use of an isolation priority tool is suggested in the literature.⁵⁻⁷

Patient placement decisions should be based on risk assessment which should consider the route of transmission alongside patient factors and symptoms that increase the risk

of cross transmission (e.g. vomiting, diarrhoea, an unexplained rash, fever or respiratory symptoms).

(AGREE rating: Recommend)

Under what circumstances should a patient be placed in an isolation suite/room?

There is consensus on the role of suitable ventilation in the prevention of infectious agents disseminated by the airborne (aerosol) route. One systematic review in which 40 original studies were evaluated by a team of experts in the field of engineering and microbiology, demonstrated strong evidence of an association between the spread of airborne infectious diseases such as chickenpox and measles and the direction of airflow and supported the use of negative pressure isolation rooms for the control of specific infectious agents.⁸ For the purposes of infection prevention and control, an isolation suite/room is the preferred choice for patients known or suspected to have infections spread by the airborne (aerosol) route.²

An isolation suite/room should be used, if available, to accommodate a patient known or suspected to be infected with a microorganism spread by the airborne (aerosol) route whilst the patient is considered infectious.

(AGREE rating: Recommend)

Where the single room is a negative pressure room (i.e. to prevent escape of airborne microorganisms from the room), or a positive pressure room (i.e. protective isolation to prevent airborne microorganisms from entering the room), then the door should remain closed to help maintain the correct pressure differential.⁹ There is evidence that door opening can disrupt the containment effectiveness of negative pressure rooms, allowing the dispersal of airborne particles into adjacent areas.^{10;11} Therefore, it is recommended that door-opening is kept to a minimum, and doors should remain closed when not in use.

The door of an isolation suite/room must remain closed when not in use, and door opening should be kept to a minimum.

(Good Practice Point (GPP))

Under what circumstances should a patient be placed in a single room?

There is consistent evidence that isolation in a single room is effective in reducing transmission of infections spread by the contact or droplet routes, when combined with other infection prevention and control measures such as hand hygiene and PPE.^{2;6;12-21} In addition single room isolation has been shown to be effective for control of infections which can cause extensive environmental contamination (e.g. patients with *C. difficile* infection)^{2;22-28} and infections with microorganisms which are resistant to antibiotics.²⁹⁻³¹

Patients who are known or suspected to be infected with a microorganism spread by the contact or droplet route should be cared for in single rooms when available.

(AGREE rating: Recommend)

Recently carbapenemase producing enterobacteriaceae (CPE) have become a major public health issue and guidance has been issued for NHSScotland which recommends patients identified as high risk must be isolated in a single room.²⁹ High risk patients are defined as those who: have been transferred from a hospital abroad; have been hospitalised abroad within the last 12 months; have previously tested positive for CPE at any body site.²⁹ A CMO letter to reinforce this requirement has also been circulated.³²

Hospitals should have systems in place to be able to rapidly identify:

- patients who have been transferred from a hospital abroad;
- patients who have been hospitalised abroad within the last 12 months;
- patients who have previously been positive for CPE at any body site.

These patients should be immediately isolated in single rooms.

(Mandatory requirement therefore no grade of recommendation can be made)

The duration that a patient should remain isolated in a single room is determined by clinical judgement and depends on factors such as whether the patient is immunocompromised as this may result in prolonged shedding of microorganisms.^{2;25}

Patients should remain isolated in a single room whilst they remain symptomatic and/or are considered infectious.

(Good Practice Point (GPP))

The decision to discontinue isolation should be based on clinical judgement.

(Good Practice Point (GPP))

Very limited evidence was identified relating to the dispersal of airborne microorganisms associated with door opening in non-pressurised rooms. One observational study found that keeping patient doors closed was associated with lower rates of hospital-acquired diarrhoea in paediatric wards.³³ However, it is considered good practice to keep the doors to such rooms closed, as this provides physical separation patients in isolation from other patients.¹ Therefore, the door to the isolation room should remain closed, and should only be opened when entering/leaving, however, Department of Health guidance recognises that in some cases this may not be possible.^{1;2}

The door of the single room must remain closed when not in use.

(Good Practice Point (GPP))

Under what circumstances should a patient be placed in a cohort area?

Cohorting forms part of a hierarchy of patient placement decisions for patients requiring care using Transmission Based Precautions. This approach is particularly relevant when there are increased numbers of cases e.g. MRSA and/or if single rooms are in short supply.^{1-3;28} Although it is difficult to elucidate the evidence to support the effectiveness of cohorting as it is mainly used during outbreaks, the findings suggest that it is effective when combined with other infection prevention and control measures such as hand hygiene, appropriate PPE and environmental decontamination.^{2;13;16;21;26;28;34-36} However, it is important to ensure that there is adequate separation of at least 3 feet (approximately 1 metre) between patients. The use of curtains may also be used as a further means of separation.^{2;37}

Patient cohorting may be required when single rooms are not available and there is more than one patient with the same infection.

(AGREE rating: Recommend)

Patient cohorting should be combined with other infection prevention and control measures e.g. hand hygiene, PPE and environmental decontamination.

(Grade D recommendation)

Patients should be separated by at least 3 feet (approximately 1 m) from each other in a cohort area, and bed curtains can be drawn as an additional physical barrier.

(AGREE rating: Recommend)

What is “cohort nursing”, and under what circumstances should it be implemented?

Cohort nursing (staff cohorting) is defined as the use of a dedicated team of healthcare staff to care for patients infected with a single infectious agent.^{1;2} Evidence suggests that this approach may be beneficial when control methods have been unsuccessful and/or an outbreak is continuing.³⁸⁻⁴⁰ There is some evidence to suggest that cohort nursing is an effective intervention to further minimise the risk of cross contamination and should be implemented if there are adequate resources to do so.^{1;28;34-36}

Cohort nursing (staff cohorting) may be implemented to minimise the risk of contamination between groups of symptomatic and non-symptomatic patients if there is adequate staff resource available to do so.

(AGREE rating: Recommend)

Implications for research

Further research into the use and effectiveness of both patient and staff cohorting would be beneficial to inform guidance.

There is a need to further study the potential negative psychological effects of isolation on patients, and how these can be minimised.

References

- (1) Isolating patients with healthcare associated infection - A summary of best practice. Department of Health 2010 [cited 2011 May 18]; Available from: URL: http://hcai.dh.gov.uk/files/2011/03/Document_Isolation_Best_Practice_FINAL_100917.pdf
- (2) Siegel JD, Rhinehart E, Jackson M, Chiarello L. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007. Centres for Disease Control and Prevention 2007 [cited 2011 Sep 19]; Available from: URL: <http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html>
- (3) SHFN 30: Infection Control in the Built Environment: Design and Planning. Version 3. Health Facilities Scotland 2007 January [cited 2011 Oct 4]; Available from: URL: <http://www.hfs.scot.nhs.uk/publications/shfn-30-v3.pdf>
- (4) Scottish Health Planning Note 04 - In-patient Accommodation: Options for Choice (Supplement 1: Isolation Facilities in Acute Settings). Health Facilities Scotland 2008 September [cited 2011 Oct 18]; Available from: URL: <http://www.hfs.scot.nhs.uk/publications/SHPN%204%20Supplement%201.pdf>
- (5) Breathnach AS, Zinna SS, Riley PA, Planche TD. Guidelines for prioritisation of single-room use: a pragmatic approach. *Journal of Hospital Infection* 2010 Jan;74(1):89-91.
- (6) Humphreys H, Grundmann H, Skov R, Lucet JC, Cauda R. Prevention and control of methicillin-resistant *Staphylococcus aureus*. *Clinical Microbiology & Infection* 2009 Feb;15(2):120-4.
- (7) Jeanes A, Macrae B, Ashby J. Isolation prioritization tool: revision, adaptation and application. *British Journal of Nursing* 2011 May 9;20(9):540-4.
- (8) Li Y, Leung GM, Tang JW, Yang X, Chao CY, Lin JZ, et al. Role of ventilation in airborne transmission of infectious agents in the built environment - a multidisciplinary systematic review. *Indoor Air* 2007 Feb;17(1):2-18.
- (9) Sehulster L, Chinn RY. Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR Recommendations and Reports* 2003 Jun 6;52(RR-10):1-42.
- (10) Adams NJ, Johnson DL, Lynch RA. The effect of pressure differential and care provider movement on airborne infectious isolation room containment effectiveness. *Am J Infect Control* 2011 Mar;39(2):91-7.
- (11) Tang JW, Eames I, Li Y, Taha YA, Wilson P, Bellingan G, et al. Door-opening motion can potentially lead to a transient breakdown in negative-pressure isolation conditions: the importance of vorticity and buoyancy airflows. *Journal of Hospital Infection* 2005 Dec;61(4):283-6.
- (12) Bartley J, Streifel AJ. Design of the environment of care for safety of patients and personnel: does form follow function or vice versa in the intensive care unit?. *Critical Care Medicine* 2010 Aug;38(8:Suppl):S388-98.
- (13) Cole M, Lai L. Reviewing the efficacy of infection control isolation. *British Journal of Nursing* 2009 Apr;18(7):403-4.

- (14) Davies A, Thomson G, Walker J, Bennett A. A review of the risks and disease transmission associated with aerosol generating medical procedures. *Journal of Infection Prevention* 2009 Jul;10(4):122-6.
- (15) Gould D. Isolation precautions to prevent the spread of contagious diseases. *NURS STAND* 2009;23(22):47-55.
- (16) Hignett S, Lu J. Space to care and treat safely in acute hospitals: recommendations from 1866 to 2008. *Applied Ergonomics* 2010 Sep;41(5):666-73.
- (17) Jefferson T, Del MC, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: a Cochrane review. *Health Technology Assessment (Winchester, England)* 2010 Jul;14(34):347-476.
- (18) Larson EL, Cohen B, Ross B, Behta M. Isolation Precautions for Methicillin-Resistant *Staphylococcus aureus*: Electronic Surveillance to Monitor Adherence. *American Journal of Critical Care* 2010;19(1):16-26.
- (19) Mears A, White A, Cookson B, Devine M, Sedgwick J, Phillips E, et al. Healthcare-associated infection in acute hospitals: which interventions are effective? *Journal of Hospital Infection* 2009;71(4):307-13.
- (20) Morris-Downes M, Smyth EG, Moore J, Thomas T, Fitzpatrick F, Walsh J, et al. Surveillance and endemic vancomycin-resistant enterococci: some success in control is possible. *Journal of Hospital Infection* 2010 Jul;75(3):228-33.
- (21) Rodriguez-Bano J, Garcia L, Ramirez E, Martinez-Martinez L, Muniain MA, Fernandez-Cuenca F, et al. Long-term control of hospital-wide, endemic multidrug-resistant *Acinetobacter baumannii* through a comprehensive "bundle" approach. *Am J Infect Control* 2009 Nov;37(9):715-22.
- (22) Beggs CB, Kerr KG, Noakes CJ, Hathway EA, Sleigh PA. The ventilation of multiple-bed hospital wards: review and analysis. *Am J Infect Control* 2008 May;36(4):250-9.
- (23) Best EL, Fawley WN, Parnell P, Wilcox MH. The potential for airborne dispersal of *Clostridium difficile* from symptomatic patients. *Clinical Infectious Diseases* 2010 Jun 1;50(11):1450-7.
- (24) Bobo LD, Dubberke ER. Recognition and prevention of hospital-associated enteric infections in the intensive care unit. *Critical Care Medicine* 2010 Aug;38(8:Suppl):S324-34.
- (25) Cheng FWT, Lee V, Shing MMK, Li CK. Prolonged shedding of respiratory syncytial virus in immunocompromised children: implication for hospital infection control. *Journal of Hospital Infection* 2008;70(4):383-5.
- (26) Gasink LB, Brennan PJ. Isolation precautions for antibiotic-resistant bacteria in healthcare settings. *Current Opinion in Infectious Diseases* 2009 Aug;22(4):339-44.
- (27) Salgado CD, Mauldin PD, Fogle PJ, Bosso JA. Analysis of an outbreak of *Clostridium difficile* infection controlled with enhanced infection control measures. *Am J Infect Control* 2009 Aug;37(6):458-64.
- (28) Vonberg RP, Kuijper EJ, Wilcox MH, Barbut F, Tull P, Gastmeier P, et al. Infection control measures to limit the spread of *Clostridium difficile*. *Clinical Microbiology & Infection* 2008 May;14(Suppl 5):2-20.

- (29) Health Protection Scotland. Interim Guidance: Non-prescribing control measures to prevent cross transmission of Carbapenemase-Producing Enterobacteriaceae in acute settings. HPS 2013 [cited 2013 Jul 1]; Available from: URL: <http://www.documents.hps.scot.nhs.uk/hai/amr/cpe-guidance.pdf>
- (30) Gould D. Effective strategies for prevention and control of Gram-negative infections. NURS STAND 2009 Aug 5;23(48):42-6.
- (31) Siegel JD, Rhinehart E, Jackson M, Chiarello L. Management of multidrug-resistant organisms in health care settings, 2006. Am J Infect Control 2007 Dec;35(10 Suppl 2):S165-S193.
- (32) Scottish Government Directorate of Chief Medical Officer and Public Health. CMO/SGHD(2013)14: Antimicrobial Resistance. SGHD 2013 [cited 2013 Aug 27]; Available from: URL: [http://www.sehd.scot.nhs.uk/cmo/CMO\(2013\)14.pdf](http://www.sehd.scot.nhs.uk/cmo/CMO(2013)14.pdf)
- (33) Jusot JF, Vanhems P, Benzait F, Berthelot P, Patural H, Teyssier G, et al. Reported measures of hygiene and incidence rates for hospital-acquired diarrhea in 31 French pediatric wards: is there any relationship? Infection Control & Hospital Epidemiology 2003 Jul;24(7):520-5.
- (34) Ergaz Z, Arad I, Bar-Oz B, Peleg O, Benenson S, Minster N, et al. Elimination of vancomycin-resistant enterococci from a neonatal intensive care unit following an outbreak. Journal of Hospital Infection 2010 Apr;74(4):370-6.
- (35) Gilroy SA, Miller SB, Noonan C, Susman R, Johnson L, Kullman M, et al. Reduction of hospital-acquired methicillin-resistant Staphylococcus aureus infection by cohorting patients in a dedicated unit. Infection Control & Hospital Epidemiology 2009 Feb;30(2):203-5.
- (36) Groothuis J, Bauman J, Malinoski F, Eggleston M. Strategies for prevention of RSV nosocomial infection. Journal of Perinatology 2008 May;28(5):319-23.
- (37) Ching W-H, Leung MKH, Leung DYC, Li Y, Yuen PL. Reducing risk of airborne transmitted infection in hospitals by use of hospital curtains. Indoor and Built Environment 2008;17(3):252-9.
- (38) Carmeli Y, Akova M, Cornaglia G, Daikos GL, Garau J, Harbarth S, et al. Controlling the spread of carbapenemase-producing Gram-negatives: therapeutic approach and infection control. Clinical Microbiology & Infection 2010 Feb;16(2):102-11.
- (39) Langer AJ, Lafaro P, Genese CA, McDonough P, Nahass R, Robertson C. Using active microbiologic surveillance and enhanced infection control measures to control an outbreak of health care-associated extended-spectrum beta-lactamase-producing Klebsiella pneumoniae infections-New Jersey, 2007. Am J Infect Control 2009;37(1):73-5.
- (40) Maragakis LL, Winkler A, Tucker MG, Cosgrove SE, Ross T, Lawson E, et al. Outbreak of multidrug-resistant Serratia marcescens infection in a neonatal intensive care unit. Infection Control & Hospital Epidemiology 2008 May;29(5):418-23.