ผลกระทบของการป้องกันการติดเชื้อที่เกี่ยวกับการบริการสุขภาพ
กับความปลอดภัยของผู้ป่วยและพยาบาล

(Impact of Infection Control on Patient & Nurse Safety)

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Principle of occupational health on infectious diseases

- Health care personnel (HCP) at risk of acquiring infection through occupational exposure
- HCP also transmit infections to patients and other HCP
- Occupational health program in place to prevent and manage infections in HCP

Practical guidelines for infection control in health care facilities, WHO 2004

HCPs & ID risk by contact

- Direct skin contact
  - Scabies, lice
  - *M. furfur*, dermatophyte
- Blood-borne pathogen
  - HIV, HBV, HCV
  - Ebola virus

HCPs & ID risk by droplets

- Respiratory; influenza, rhinovirus, diphtheria, pertussis
- Systemic; meningococcemia, rubella, CMV, parvovirus B19
- Misc: conjunctivitis, mumps, hand-foot-mouth disease (HFMD)

HCPs & ID risk by airborne

- Active tuberculosis in respiratory tract
- Varicella-zoster
- Measles

Infectious diseases harm among HCPs with pregnancy

- Increased maternal severity
  - Varicella
  - Hepatitis E
- Intrauterine fetal infection
  - Varicella
  - Rubella
  - Cytomegalovirus
  - Parvovirus B19

Infectious diseases harm among HCPs with pregnancy

- Initiate premature labor
  - Any IDs with associated febrile episode
- Teratogenic effect associated with antimicrobial agents
  - Ribavirin aerosolized in RSV
  - Pentamidine aerosolized in PCP

Category	Attack rate (%)
Influenza	45-60
RSV	42-56
Tuberculosis	20-50
Pertussis	43
Varicella	4.4-14.5
Rubella	13

Attack rate of various infectious disease outbreak among HCP

Schwartzman: Can Med Assoc J, 1999:161;1271-7

How contagious?

Type of EID, RID	Reproduction rate (1: no of infected pt)
Measles	12-18
Pertussis	12-17
Diphtheria	6-7
Polio	5-7
Mumps	4-7
HIV	1-4
Ebola	1-4

ผู้นำโสมใต้ยอมเลื่อนเยือนสหรัฐฯ คนผวา'เมอร์ส'ไม่เลิก-ตายอีก2ติดเชื้อเพิ่ม13

EID & transmission chracteristics

Type of Diseases & Categories	Avian influenza A(H7N9) virus	Middle East Respiratory Syndrome Coronavirus (MERS-CoV)	Avian influenza A(H5N1) virus	SARS-CoV
Human-to-human transmission	Some small clusters, No evidence of sustained spread	Several clusters (closed contact), but no evidence of widespread	Some small clusters, No evidence of sustained spread	Several hospital clusters and outbreaks, definite evidence of widespread
Hospital Outbreaks	No	Yes	No	Yes

WHO Global Alert & Response
Middle East respiratory syndrome coronavirus (MERS-CoV) – update 30 Aug 2013
Human infection with avian influenza A(H7N9) virus – update 11 Aug 2013
WHO/GIP, data in HQ as of 29 Aug 2013

EID & mortalities

Categories	Ebola	H7N9	MERS-CoV	H5N1	SARS-CoV
Latest inform	2 Jan 2015	2 October 2014	5 Feb 2015	6 Feb 2015	20 May 2003
Lab-confirmed cases	20,206	453	971	694	8,096 (probable)
Case Fatality Rate, no(%)	7,905 (39.1%)	175 (38.6%)	356 (36.6%)	402 (57.9%)	774 (9.6%)

Topics

- Infection control (IC) & patient safety
- Health-care associated infections (HAIs) & impacts on patient safety
- Impacts of IC on patient safety
- Conclusions

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The rationale of IC & patient safety

- Health-care-associated infections (HAIs) affect millions of patients worldwide
- At least 50% are preventable with IC
- Improvements in patient safety associated with a comprehensive IC
- The goal of IC is to eliminate HAIs
- Effective IC programs reduce HAI rates and are also cost-effective

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Health-care associated infections & impacts in different parts of the World

	Total population (millions)	HAIs (no/yr)	Mortality (no/yr)	Extra LOS (days)
EU	500	4,500,000	37,000	16,000,000 (pt-days)
USA	200	1,700,000	98,000	10.4-13.1
Thailand	65	380,000	37,000	10-12.5

Zingg W, et al. Lancet Infect Dis 2015;15:212–24
Magill SS, et al. N Engl J Med 2014;370:1198-208
Kleven M, et al. Public Health Reports 2007;122:160-6
Danchaivijitr S, J Med Assoc Thai 2005; 88 (Suppl 10): S1-9

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IC Factors associated with NI reduction

Haley AW, et al. Am J Epid 1985:121(2);182-205

- US general hospitals in 1970-76
- Infection surveillance and control strongly associated with 32% reductions in rates of UTI, RTI, SSI & BSI
- Essential components included
  - Organized surveillance system
  - Infection control activities
  - a trained, infection control physician or an infection control nurse per 250 beds
  - SSI Feedback system to practicing surgeons

Key EU IC components 2015

- Organisation at the hospital level
- Bed occupancy, workload & staffing
- Access to materials, equipment and optimum ergonomics
- Appropriate use of guidelines
- Education and training

Zingg W, et al. Lancet Infect Dis 2015;15:212–24

Key EU IC components 2015

- Auditing
- Surveillance and feedback
- Multimodal and multidisciplinary prevention programmes that include behavioural change
- engagement of champions
- Positive organisational culture

Zingg W, et al. Lancet Infect Dis 2015;15:212–24

IC Strategy Guidelines 2014

American Journal of Infection Control 42 (2014) 820-8

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Practice recommendation

A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals: 2014 Updates

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IC Strategy Guidelines 2014

Sponsored by

- The Society for Healthcare Epidemiology of America (SHEA)
- The Infectious Diseases Society of America (IDSA)
- The American Hospital Association (AHA)
- The Association for Professionals in Infection Control and Epidemiology (APIC)
- The Joint Commission International (JCI)

IC Strategy Guidelines 2014

- Hand hygiene
- Central line-associated blood stream infection (CLABSI)
- Ventilator-associated pneumonia (VAP)
- Surgical site infection (SSI)
- Catheter-associated urinary tract infection (CAUTI)

Strategies to prevent HAIs through hand hygiene

1. Basic practices for hand hygiene: recommended for all acute care hospitals
   1. Select appropriate products (quality of evidence: II).
2. Provide convenient access to hand hygiene equipment and products by placing them strategically and assuring that they are refilled routinely as often as required (quality of evidence: III).
3. Involve HCP in choosing products (quality of evidence: III).
4. Perform hand hygiene with an alcohol-based hand rub or, alternatively, an antimicrobial or nonantimicrobial soap for the following indications (quality of evidence: II).
5. Perform hand hygiene with antimicrobial or non-antimicrobial soap when hands are visibly soiled (quality of evidence: II).
6. Assess unit- or institution-specific barriers to hand hygiene with frontline HCP for the purpose of identifying interventions that will be locally relevant (quality of evidence: III).

Strategies to prevent HAIs through hand hygiene

7. Implement a multimodal strategy (or "bundle") for improving hand hygiene adherence to directly address the organization's most significant barriers (quality of evidence: II).
8. Educate, motivate, and ensure competency of HCP (anyone caring for the patient on the institution's behalf) about proper hand hygiene (quality of evidence: III).
9. Measure hand hygiene adherence via direct observation (human observers), product volume measurement, or automated monitoring (quality of evidence: II).
10. Provide feedback to HCP on hand hygiene performance (quality of evidence: III).

Health-care associated infections & impacts of specific IC interventions

Category	Type of intervention & outcome	Pre-intervention	Post-intervention	Units
Hand hygiene	Alcohol HR & NI rate	16.9	9.9	%
Isolation & precaution	Gown/gloves & VRE	19.6	9.1	per 1,000 ICU-days
Surveillance	VRE culture & acquisition	2-27	1-10	%

Pittet D, et al. Lancet 2000:356;1307
Puzniak LA, Clin Infect Dis 2002:35;18
Huang SS, J Infect Dis 2007;195:339

How many ICNs needed in a hospital?

Study	Year	1 ICN: beds	1 ICP: admission	1 Micro: beds
Haley RW	1985	250	NA	NA
O'Boyle	2002	100-125	NA	NA
Morrison J	2004	167	NA	NA
Van de Broek	2007	178	5,000	806
Weiss	2009	100 (150-250 LTCF)	NA	NA

Haley AW, et al. Am J Epid 1985:121(2);182-205
Morrisson J, et al. Am J Infect Control 2004:32(1);2-6
Weiss K, et al. Infect Control Hosp Epidemiol 2009; 30: 156–62
O' Boyle C, et al. Am J Infect Control 2002;30(6):321-33.
Van de Broek, et al. J Hosp Infect 2007, 65(2):108-11

"CLABSI bundles"

- Multifaceted CLABSI interventions
- Effective to decrease CLABSI rates
- Most likely to be successful in established patient safety culture
- Success rates depends on adherence

Berenholtz SM, Pronovost PJ, Lipsett PA, et al. Crit Care Med 2004;32:2014-20
Gastmeier P, Geffers C. J Hosp Infect 2006;64:326-35
Marshall J, et al. Infect Control Hosp Epid 2014:35;753-71

CLABSI "CLABSI"

- Chlorhexidine skin preparation
- Learning: Training for HCP
- Assessment daily of indication
- Barrier: maximum & sterile
- Scrub the hub, aseptic technic
- Inspection of cath site: q shift

VAP "WHAP"

- Weaning protocol
- Head of bed elevation
- Antiseptic oral care
- Personel education/hand hygiene

Arroliga AC, et al. Resp Care 2012;57:688-96
Heck S, A, et al. Am J Infect Control 2012;in press
Morris AC, et al. Crit Care Med 2011;39:2218-24
Bird D, et al. Arch Surg 2010;165:465-70

CAUTI "CAUTI"

- Closed drainage system
- Aseptic technique
- Uroflow maintenance
- Training & hand hygiene
- Indication assessment OD

Health-care associated infections & impacts of IC bundle interventions

Category	Outcome measurement	Pre-intervention	Post-intervention	Units
VAP	VAP rate	16.9	9.9	per 1,000 vent-days
CLABSI	CLABSI rate	14.0	1.4	per 1,000 cath-days
CAUTI	CAUTI rate	13.3	4.0	per 1,000 cath-days

Pittet D, et al. Lancet 2000:356;1307
Apisarnthanarak A, et al. Am J Infect Control 2010;38:449-55
Titsworth WL - J Neurosurg - 01-APR-2012; 116(4): 911-20

Zero HAIs as a result of IC bundle interventions

Category	Outcome measurement	Pre-intervention	Post-intervention	Units
VAP	VAP rate	10.5	0	per 1,000 vent-days
CLABSI	CLABSI rate	3.3	0	per 1,000 cath-days
CABG	SSI rate	1.5	0	per 100 procedure

Heck S, A, et al. Am J Infect Control 2012;40:877-9
Longmate AG, et al. BMJ Qual Saf 2011;20:174-80

"CLABSI Bundles": Pros & Cons

Pros	Cons
Effective, some settings reducing and maintaining their infection rates at zero	Zero CLABSI rates uncommon across bundle studies with poor to fair quality of evidence
Relatively inexpensive	Significant time and resources at the outset of the intervention
In Australian ICU study, bundle cost-effective if implementation costs over 18 mo below $24,880 per ICU	Nontrivial costs of monitoring and the education activities required to implement a bundle

Halton KA, et al. PLoS One 2010; 5(9): e12815. doi:10.1371/journal.pone.0012815
Simpson D, et al. Paediatr Child Health 2014;19(4):e20-e3

"Antimicrobial catheters": Pros & Cons

Pro	Cons
Reduced CRBSI, (ARR 2%, 95% CI 3-1, RR 0.61, 95% CI 0.51-0.73, NNTB 50)	No different rates of clinical sepsis (RR 1.0 (95% CI 0.88 to 1.13)) & all-cause mortality (RR 0.88 (95% CI 0.75 to 1.05)
Reduced CL colonization (ARR 10%, 95% CI 13-7%), RR 0.66, 95% CI 0.58-0.75, NNTB 10)	Risk of potential side-effects including anaphylaxis, etc.
No significant different rates of adverse effects, based on systematic review	Relatively expensive

Lai NM, et al. Coch Datab Syst Rev 2013, 6.:CD007878. DOI:10.1002/14651858.CD007878.pub2

A decade of investment in infection prevention: A cost-effectiveness analysis)

Category	Gain per ICU (CLABSI)	Gain per ICU (VAP)
Life-years (LYs)	15.55	9.61
Quality-adjusted LYs (QALYs)	10.84	6.55
Reductions in index admission ICU costs	$174,713.09	$163,090.54
Incremental cost-effectiveness ratios (ICERs)	$14,250.74 per LY	$23,277.86 per QALY

Dick AW, et al . American Journal of Infection Control 43 (2015) 4-9

Conclusions

- Significant HAIs impacts on patient safety
- Significant proportions of HAIs preventable
- Significant effects & cost effectiveness of IC esp., multimodal approach, bundles on HAIs