


Infection Prevention in High and Middle Income Countries

Bruce Gamage, Dr. Pierre Parneix, Prof. Li Han

Broadcast live from the German Society for Hospital Hygiene

DEUTSCHE GESELLSCHAFT FÜR KRANKENHAUSHYGIENE

12. KONGRESS FÜR KRANKENHAUSHYGIENE



Berlin – Russisches Haus
30. März bis 2. April 2014

Broadcast live from ...
Congress of the German Society for Hospital Hygiene

Infection Prevention in High and Middle Income Countries
Chair - Prof. Walter Popp

- 1... **Infection Prevention in Canada**
Bruce Gamage (Vancouver)
- 2... **Hospital Hygiene in France**
Dr. Pierre Parneix (Bordeaux)
- 3... **Infection Prevention in China**
Prof. Dr. Li. Han (Beijing)

www.webbertraining.com March 31, 2014


Infection Prevention and Control in Canada: *From VRE to CRE*

Bruce Gamage, RN BSN CIC
President, IPAC Canada
2013/2014

My thanks to Dr Linda Hoang
and Dr Michael Gardam

Outline

- IPAC in Canada
- Recent Trends in Antibiotic Resistant Organisms in Canada
- Changing Approaches
- Emerging Organisms



Germany
80 Million

Canada
34 Million

VANCOUVER 2010

IPAC in Canada

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IPAC – Canada

- ▶ IPAC Canada is a national, multidisciplinary association committed to the wellness and safety of Canadians by promoting best practice in infection prevention and control through education, standards, advocacy and consumer awareness.



IPAC Canada's Roles

- ▶ initiating and coordinating effective communication and cooperation among all disciplines united by infection control activities
- ▶ supporting and/or developing effective and rational infection control practices
- ▶ standardizing infection control practices
- ▶ promoting research in areas related to infection control
- ▶ promoting and facilitating infection control education for both infection control practitioners and other personnel working in hospitals, nursing homes and related institutions.

Public Health Agency of Canada

- ▶ National Surveillance (CNISP)
 - Surveillance data submitted from 52 large hospitals from across Canada
- ▶ Centre for Communicable Disease and Infection Control –
 - National IPAC Guidelines

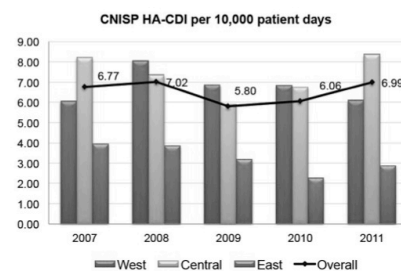
Provincial Bodies

- ▶ Public Health Ontario (PIDAC/RICN)
- ▶ Manitoba Department of Health
- ▶ Alberta Health Services
- ▶ BC Provincial Infection Control Network
- ▶ Infection Control Nova Scotia
- ▶ Infection Control Newfoundland and Labrador

- ▶ Each Province produces their own guidance documents!

Recent Trends in ARO in Canada

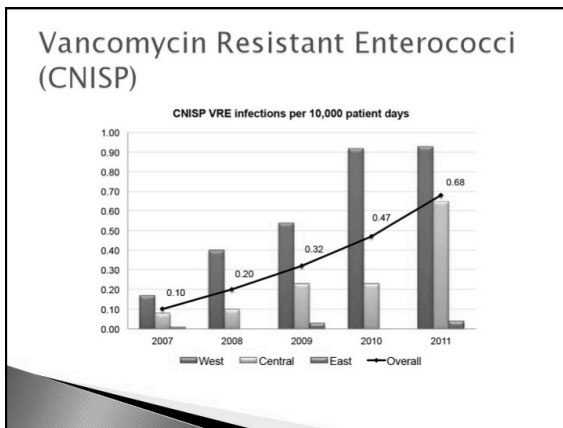
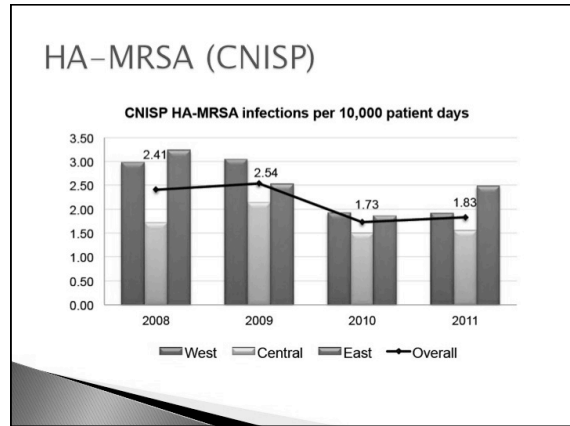
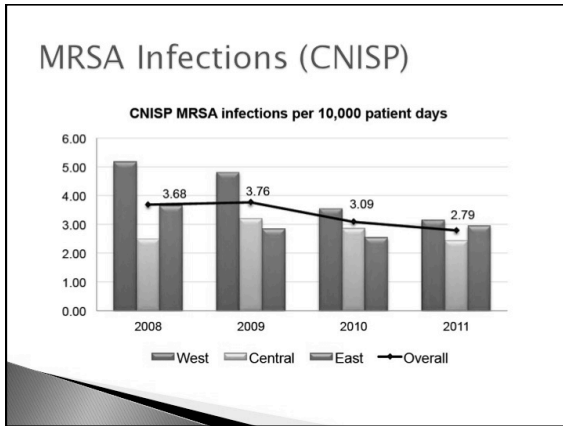
C. difficile Infections (CNISP)



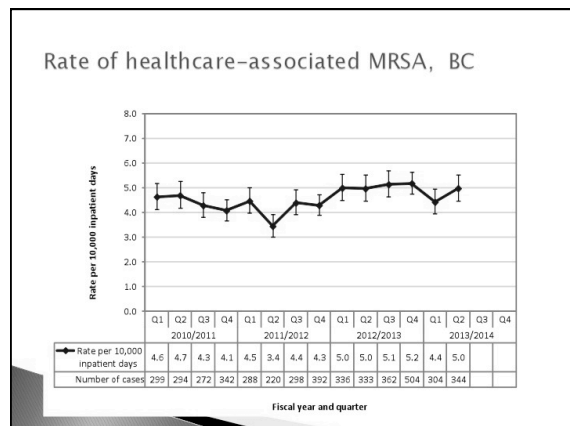
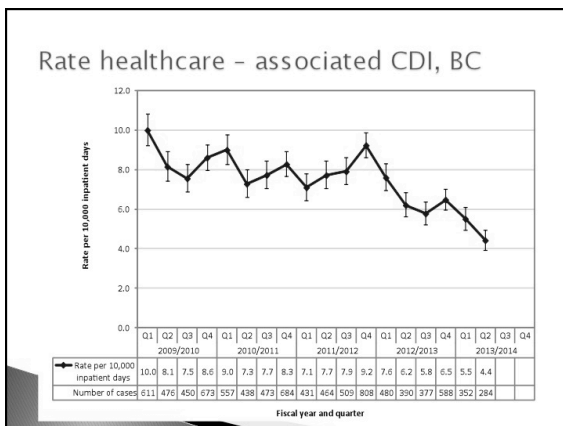
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- #### Provincial Surveillance Programs
- ▶ Variations in laws around reportable organisms
 - ▶ Some provinces require reporting of HAI (e.g. Ontario and Quebec)
 - ▶ In BC CDI, MRSA and Hand Hygiene Compliance are collected provincially
 - ▶ Reports are available at www.picnet.ca

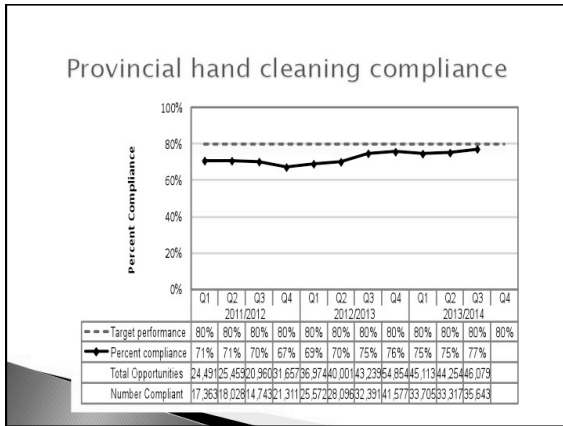


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New Approaches

- ▶ Changes to approach to VRE in Ontario and BC
- ▶ Evaluation of changes

Early concerns about VRE

- ▶ Emerging organism
- ▶ Highly drug resistant
- ▶ Poor therapeutic options
- ▶ Resistance gene transfer to more pathogenic organisms i.e. MRSA

VRE

- ▶ Enterococci in general are intrinsically drug resistant
- ▶ Do not produce toxins
- ▶ Frequently found with other organisms
- ▶ Infections typically occur in patients with considerable pre-existing morbidity
- ▶ High mortality rate but contribution of vancomycin resistance is not clear

Typical VRE infections in adults

- ▶ Urinary tract
 - infection vs. colonization
 - Often catheter-associated
- ▶ Bacteremia >> endocarditis
 - Often catheter associated
 - Frequently polymicrobial (GI source etc.)
- ▶ Deep tissue infections and wounds
 - Usually polymicrobial

Very rarely caused by VRE

- ▶ Respiratory tract infections
- ▶ Meningitis
- ▶ Skin, soft tissue infections

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Specific versus non-specific control measures

- ▶ Specific control measures
 - Admission screening
 - Contact isolation, periodic screening
- ▶ Non-specific control measures
 - Hand hygiene
 - Environmental cleaning
 - Practice bundles
 - Antimicrobial stewardship

Does VRE increase length of stay?

- ▶ Yes, but why?
 - Marker for severe morbidity
 - Small percentage of patients develop significant infections
 - Infection control measures themselves
 - increase LOS
 - Isolation
 - Slowing of patient transfers

Decision

- ▶ Stop specific VRE control measures
- ▶ 2010 Vancouver Island Health screening only patients admitted to designated units.
 - Patients in other patient care areas are not placed on additional precautions unless they have diarrhea
- ▶ 2012 4 Hospitals in Ontario stopped screening for VRE, isolating cases or reporting outbreaks
- ▶ 2013 2 other health authorities adopted similar policies
- ▶ Prospectively collect data to inform future practice.

Evaluation

- ▶ Results Pending...
- ▶ Negative clinical impact has been negligible
 - Substantial decrease in isolation costs
 - Increased ability to focus on other organisms

Emerging Organisms

CPO

What are Carbapenemase Producing Organisms (CPO)?

- ▶ Carbapenemases are a class of enzymes that inactivate carbapenem antibiotics by hydrolysing them.
- ▶ Carbapenem antibiotics, often referred to as "last resort antibiotics":
 - Imipenem
 - Meropenem
 - Ertapenem
- ▶ Carbapenemases most commonly in *E. coli* and *Klebsiella spp.*, (Enterobacteriaceae) but have also been found in other Gram-negative species.

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Beta-lactamase Family

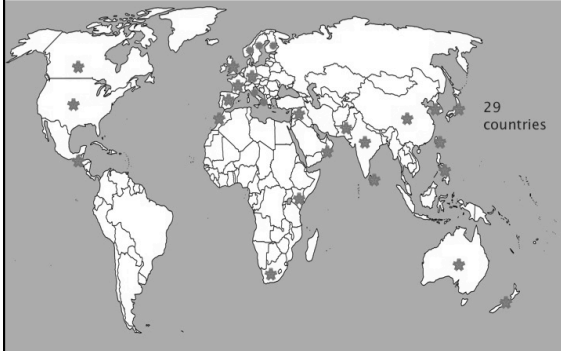
Molecular Class	Types
A	TEM, SHV, CTX-M KPC, GES, SMC, IMI, PER, NMC-A, SFO, SFC, BIC, IBC
B	NDM-1, IMP, VIM, GIM, SPM, SIM, DIM, AIM, KHM
C	CMY, ACT, FOX, MOX
D	OXA, PSE OXA-48

New Delhi Metallo-beta-lactamase (NDM-1)

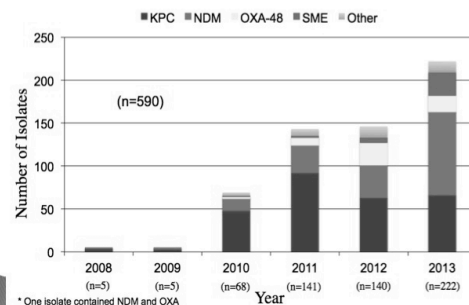
- ▶ Reports in 2008 of Swedish and UK travelers to Indian subcontinent
- ▶ Since then, reports of high endemicity in Indian, Pakistan and Bangladesh hospitals
- ▶ NDM-1 genes in sewage and water reservoirs in some Indian cities
 - 51/171 (30%) waste water seepage
 - 2/50 (4%) communal drinking water samples

Walsh et al. The Lancet Infectious Diseases, 2011, 11: 355-62

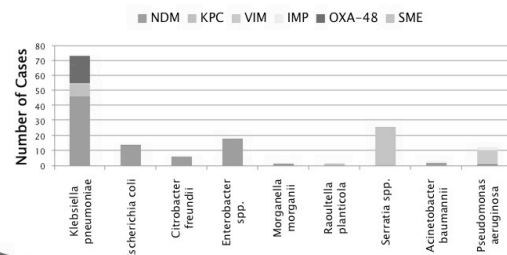
Global Distribution NDM-1



Carbapenem Producing Organisms in Canada



Carbapenemase Producing Organisms by Species, 2008-Current*

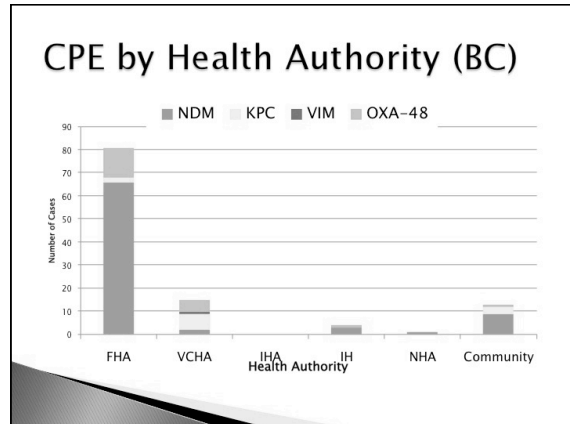
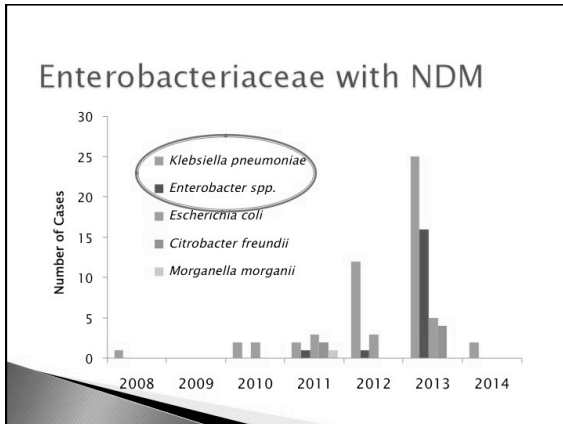


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- #### How are these organisms transmitted?
1. Patient-to-patient
 2. Shared Health Care equipment
 3. Environmental Contact (environmental reservoirs)
 4. Health care workers (Primarily hands)

- #### Risk factors for Colonization and Infection with CPO
- ▶ Risk factors for acquisition of CPO
 - prolonged hospitalization
 - Poor functional status
 - ICU stay
 - invasive devices
 - Immunosuppression
 - multiple antibiotic agents
 - ▶ Risk factors for infection once colonized with CPO
 - Previous invasive procedure
 - Diabetes mellitus
 - Solid organ tumor
 - Tracheostomy
 - Urinary catheter
 - Prior exposure to antipseudomonal penicillin
- If colonized with CPE, 9-47% of patients may develop infection

- #### CPO Measures Implemented
- ▶ Screening/Active surveillance
 - On admission to Unit
 - Weekly point prevalence
 - All contacts of suspect or confirmed cases, at 0, 7 and 21 days
 - ▶ Precautions
 - Private room and staff cohorting and dedicated equipment
 - ▶ Cohorting of patients and staff
 - "CPO" nursing assignments & dedicated ward
 - Hand hygiene & PPE (goal: 100%)
 - Weekly audits
 - ▶ Antimicrobial stewardship

- #### CPO Measures Implemented
- ▶ Avoid discarding any bodily fluids in sinks
 - ▶ Cleaning
 - Enhanced cleaning including daily 2nd clean of high touch surfaces in affected rooms/units
 - Use hydrogen peroxide
 - Terminal clean on discharge of colonized patients:
 - Discard all supplies, terminal clean, audit of clean
 - ▶ Daily CHG baths for all colonized patients.

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Infection Control Processes

- ▶ Screening for all admitted patients
 - Question: "Have you been hospitalized or had renal dialysis outside of Canada anytime in the previous 6 months?"
 - If yes: patient will have rectal screen for CPO

Next Steps and Challenges

- ▶ Better and faster testing
 - Develop Real-time PCR method for screening specimens directly
- ▶ Maintain aggressive infection control state & CPO alerts between facilities
- ▶ Continued Provincial level surveillance with infection control data
 - Collaboration with PICNet
- ▶ Further explore genomic characteristics of BC strains and transmission behaviour
 - Whole Genome Sequencing

Summary

- ▶ CPO are an emerging pathogen with global spread, now in Canada
- ▶ CPE can spread within institutions
- ▶ The most vulnerable patients are the most at risk to become colonized and infected
- ▶ Treatment of infections is complex
- ▶ Control of spread requires full compliance with precautions and antibiotic stewardship



11. Kongress für Krankenhaushygiene

Berlin, 30 March-2 April 2014

EUNETIPS European network of university hospitals for patient safety

Infection prevention in high and middle income countries


Hospital Hygiene in France

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www.sf2h.net

Hospital hygiene in France www.sf2h.net

Conflict of interest




SF2H Risque infectieux et soin

bulletin épidémiologique hebdomadaire www.sf2h.net

BEH NUMÉRO SPECIAL

JUILLET 1993

Conseil Supérieur d'Hygiène Publique de France
 Section "Prophylaxie des maladies"
 Groupe de travail "Infections nosocomiales"

Surgical wound infection prevention

11 recommendations (11%) :

- Skin preparation = 3
- Surgical attire = 2
- Antibiotic prophylaxis = 2
- Environment quality = 2
- Patients' risk factors = 2

100 recommandations
 pour la surveillance
 et la prévention
 des infections nosocomiales

100 recommandations
 for nosocomial infections' surveillance
 and prevention - July 1993

70 pages - Arial 13

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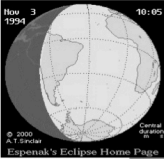

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National strategy

3 Novembre 1994

SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in-english-as-well.html

Hospital hygiene in France www.sf2h.net

National strategy

3 Novembre 1994



First national nosocomial infections' prevention programme

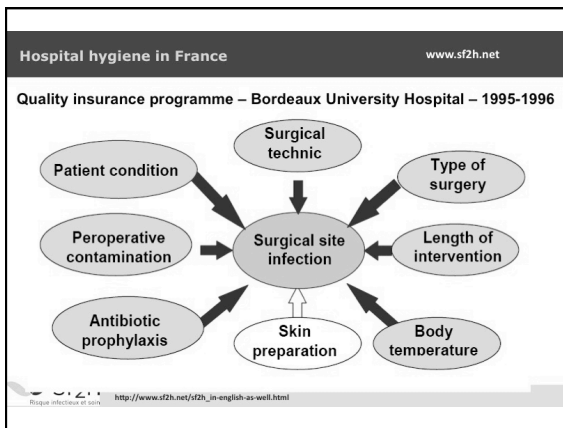
Objectives 1995-2000

- 30% decrease of NI
- Practices improvement et guidelines elaboration
- Launching of QIP



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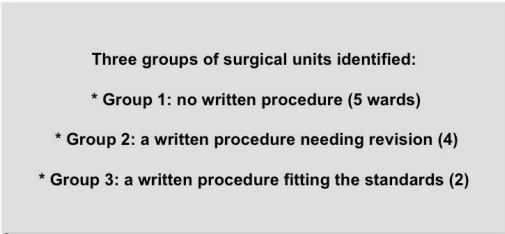


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Quality insurance programme – Bordeaux University Hospital – 1995-1996

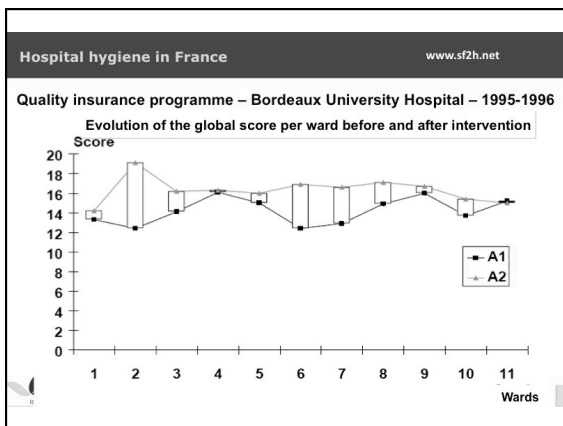
Three groups of surgical units identified:

- * Group 1: no written procedure (5 wards)
- * Group 2: a written procedure needing revision (4)
- * Group 3: a written procedure fitting the standards (2)



SF2H
Risque infectieux et soins


http://www.sf2h.net/sf2h_in-english-as-well.html



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The biggest ICPs' fights of the XXth century!

Get rid of iodine tincture!!!



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Risque infectieux et soins

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www.sf2h.net

Surgical wound infection prevention

4 recommendations (4%) :


- Skin preparation = 1
- Surgical attire = 1
- Antibiotic prophylaxis = 1
- Environment quality = 1
- Patients' risk factors = 0

100 recommandations pour la surveillance et la prévention des infections nosocomiales

117 pages - Arial 10

Hospital hygiene in France www.sf2h.net

Raiders of the lost 2000-2004 programme!



SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in_english-as-well.html

SF2H Société Française d'Hygiène Hospitalière

CONFERENCE DE CONSENSUS
GESTION PRE-OPERATOIRE DU RISQUE INFECTIEUX
5 mars 2004 - Institut Pasteur - Paris

Questions posées

1. EN PRÉ-OPÉRATOIRE, QUELS DÉPISTAGES SYSTÉMATIQUES ET QUELLES STRATÉGIES PRÉVENTIVES APPLIQUER ?
2. EN PRÉ-OPÉRATOIRE ET DE DÉCONTAMINATION, QUELLES SONT LES RECOMMANDATIONS ?
3. EN PRÉ-OPÉRATOIRE, COMMENT METTRE EN ŒUVRE LES RECOMMANDATIONS ?

It is strongly recommended to perform a cleansing with antiseptic soap solution followed by wide disinfection of the surgical site (A-1)

SF2H – Consensus statement 2004

<http://www.sfh.net>

Conférence de Consensus "Gestion préopératoire du risque infectieux" Paris- 5 mars 2004

Hospital hygiene in France www.sf2h.net

National strategy
18 Novembre 2004



SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in_english-as-well.html

<http://www.filmstarts.de/>

Hospital hygiene in France www.sf2h.net

National strategy
18 Novembre 2004



Second national nosocomial infections' prevention programme

Objectives 2005-2008

- 100% of hospital performing surgery are surveying targeted procedures in each specialty
- At least 75% of hospitals are performing yearly evaluation of practices

SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in_english-as-well.html

<http://www.filmstarts.de/>

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The biggest ICPs' fights of the XXth century!

Enjoy your clipping!



SF2H 1992

http://www.sf2h.net/sf2h_in_english-as-well.html

2007

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The biggest ICPs' fights of the XXth century!

STEPHEN CLARKE
Installing author of *A Year in the Bush*

talk to the SNAIL
Ten Commandments for Understanding the French




SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in-english-as-well.html

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Facing the real life – 2003-2007

Preoperative skin preparation evaluation through observational audit
Southwestern France HAI control centre (Cclin So)



Practices	2003 (2,255 observations)	2007 (6,683 observations)
Hair removal	85.1%	94.8%


SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in-english-as-well.html

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The biggest ICPs' fights of the XXth century!

Enjoy your cleansing!



Disinfection of the surgical site

The four-step preparation of the surgical site is effective in reducing the risk of SSI: cleansing with an antiseptic soap, rinsing, drying, and disinfecting with a disinfectant of proven efficacy, which is left to dry in air.




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Risque infectieux et soins

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Facing the real life – 2003-2007

Preoperative skin preparation evaluation through observational audit
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Practices	2003 (2,255 observations)	2007 (6,683 observations)
Cleansing	53.9%	71.6%
Disinfection	99.0%	96.9%

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The scientific approach

RECOMMANDANDA

Mise à jour de la conférence de consensus
Gestion préopératoire du risque infectieux

October 2013

No recommendation can be issued for cleansing before performing disinfection on clean skin. (B2)

SF2H – Consensus statement Update 2013

SF2H
Risque infectieux et soins

http://www.sf2h.net/publications-SF2H/SF2H_recommandations_gestion-preopératoire-du-risque-infectieux_2013.pdf

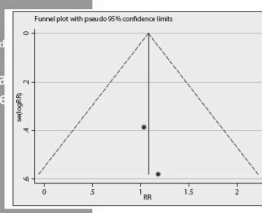
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The scientific approach

RECOMMANDANDA

Mise à jour de la conférence de consensus
Gestion préopératoire du risque infectieux

October 2013



can be issued as performing an skin. (B2)

s statement 113

SF2H
Risque infectieux et soins

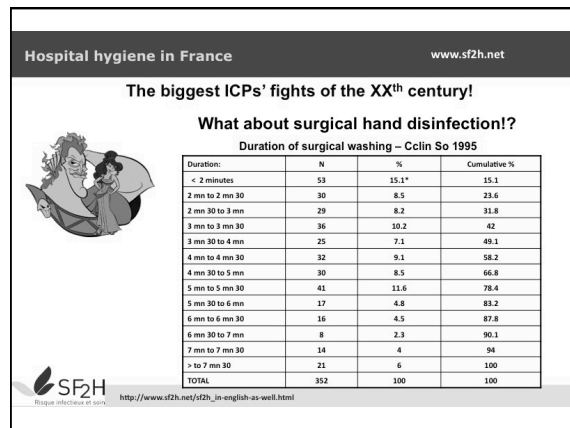
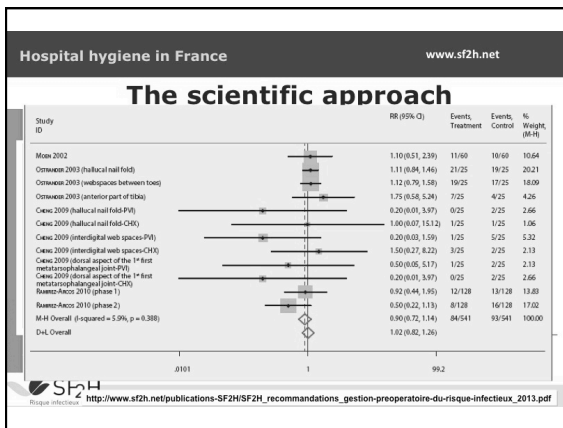
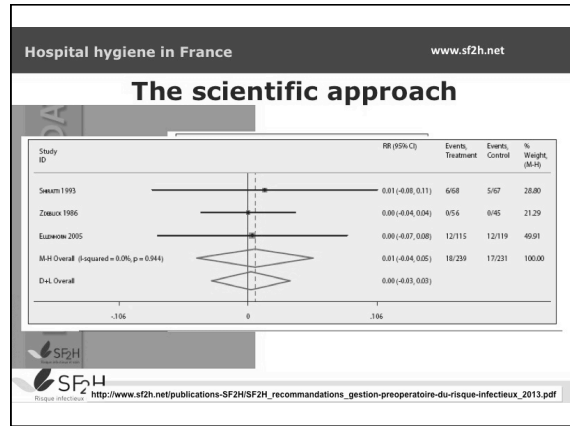
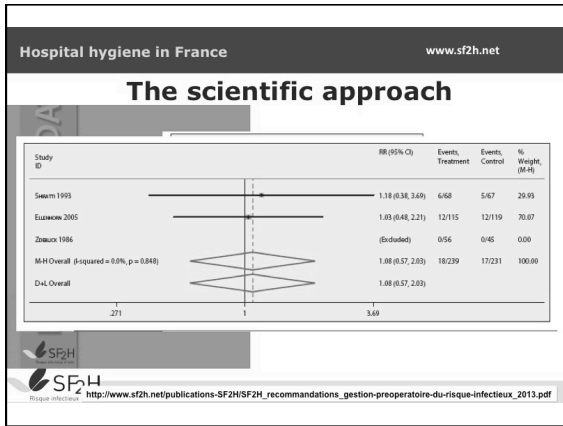
http://www.sf2h.net/publications-SF2H/SF2H_recommandations_gestion-preopératoire-du-risque-infectieux_2013.pdf

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The biggest ICPs' fights of the XXth century!

What about surgical hand disinfection?!

Hand-Rubbing With an Aqueous Alcoholic Solution vs Traditional Surgical Hand-Scrubbing and 30-Day Surgical Site Infection Rates

A Randomized Equivalence Study

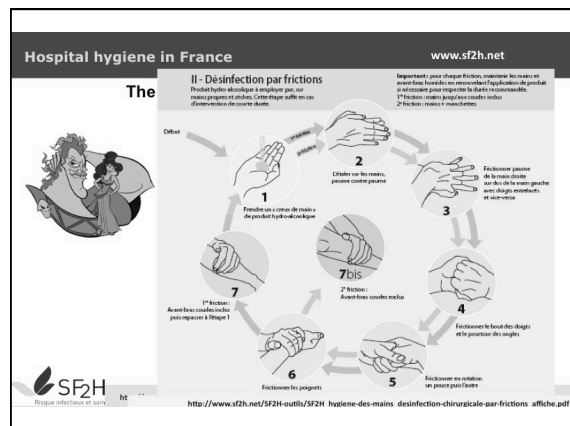
Jean Jacques Parienti, MD, DTM&H
 Pascal Thibon, MD
 Remy Heller, PharmD, PhD
 Yannick Le Roux, MD, DCH
 Peter von Theobald, MD, DCH
 Hervé Benardou, MD, DCH
 Alain Bourret, MD
 François Lemarchand, MD, DCH
 Xavier Le Gouvenor, MD

JAMA, August 14, 2002—Vol 288, No. 6

for Members of the Antiseptic Chirurgicale des Mains Study Group

Site %
1.1
1.6
1.8
2
1.1
1.2
1.8
1.4
1.2
1.8
1.1
4
30
30

http://www.sf2h.net/publications-SF2H/SF2H_hygiene-des-mains-desinfection-chirurgicale-par-frictionsaffiche.pdf

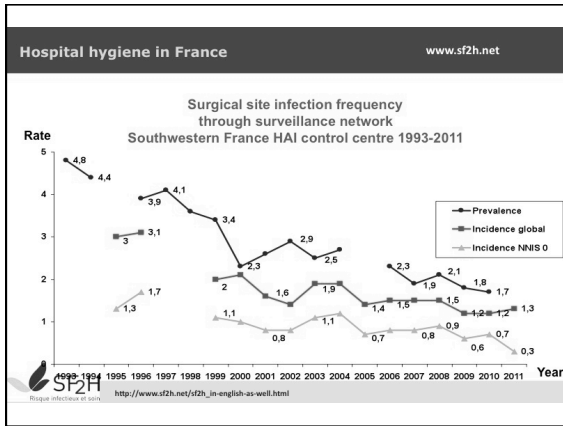


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Surveillance and Prevention of healthcare-associated infections
September 2010

Surgical site infection prevention

8 recommendations (5%) :

- Skin preparation = 2
- Surgical attire = 2
- Surveillance/notification = 2
- Antibiotic prophylaxis = 1
- Environment quality = 1
- Patients' risk factors = 0

175 pages - Arial 8

http://www.uk-essen.de/ueunetips/pdf/spi.france_surveillance_and_prevention_of_healthcare-associated_infections.pdf

Hospital hygiene in France www.sf2h.net

A cultural revolution!

An APIC Guide
2010

Guide to the Elimination of Orthopedic Surgical Site Infections

http://www.apic.org/downloads/ortho_guide.pdf

http://www.sf2h.net/sf2h_in-english-as-well.html

Webzine HAS

ACTUEL | INFOS INS | VOTRE PRATIQUE | DOSSIERS SPÉCIAUX | I&IPC | CERTIFICATION DES ÉTABLISSEMENTS

Vous êtes ici : Accueil > Sécurité du patient > Focus

SÉCURITÉ DU PATIENT

En bref
Focus
Bibliographie
Retour d'expérience

Medical Team Training pour réduire les risques associés aux soins

Aller vers des équipes de soins plus sûres : le Medical Team Training (MTT) améliore la sécurité des soins au bénéfice des patients et du climat social.

Une [indéfinissable] liée à l'équipe : tenait protectrice ou tenait défaillante, l'équipe est au cœur de l'alphee et l'omnie c sécurité des soins. La nature humaine est ainsi faite que dans la réalisation d'une activité complexe une personne commet 3 à 5 erreurs par heure. Il serait vain de vouloir les combattre, car c'est la contrepartie de l'intelligence humaine qui repose sur une sé de compromis, de simplifications de l'environnement et de prise de risques.

Fort heureusement, 80 % de ces erreurs sont récupérées par celles qui les a commises. Mais qu'en est-il des 20 % restantes ? Certaines d'entre elles sont récupérées par l'ergonomie du système et surtout par les autres membres de l'équipe. À contrario, les défaillances de fonctionnement des équipes de soins (communication, coopération, etc.) sont les causes les pl fréquemment observées dans l'analyse approfondie des événements indésirables dans la santé.

C'est par exemple la "ra cause profonde retrouvée dans les 9 000 événements porteurs de risques enregistrés en 2011 (40 000 depuis le début) dans la base de l'accréditation des médecins.

ips Infection Prevention Society

Royal College of Nursing

Infection prevention and control commissioning toolkit

Strategic vision: zero tolerance of HCAs

<http://www.ips.uk.net/uploads/Board/IPSRCtoolkit.pdf>

http://www.sf2h.net/sf2h_in-english-as-well.html

Hospital hygiene in France www.sf2h.net

National strategy
26 August 2009

http://www.sf2h.net/sf2h_in-english-as-well.html

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Infection Prevention in High and Middle Income Countries

Bruce Gamage, Dr. Pierre Parneix, Prof. Li Han

Broadcast live from the German Society for Hospital Hygiene

Hospital hygiene in France www.sf2h.net

National strategy

26 August 2009

Third national HAI and nosocomial infections' prevention programme

Objectives 2009-2013

In 2012, 100% of hospitals should use tools to improve the quality of practices (like check list for example)

SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in-english-as-well.html

Hospital hygiene in France www.sf2h.net

The WHO checklist

« SÉCURITÉ DU PATIENT AU BLOC OPÉRATOIRE »

WORLD HEALTH ORGANIZATION

Mandatory since January 2010 in France

http://www.has-sante.fr/portail/jcms/c_821671/la-check-list-securite-du-patient-au-bloc-operatoire

Hospital hygiene in France www.sf2h.net

The biggest ICPs' fights of the XXth century!

A near miss!

4 La préparation cutanée de l'opéré est documentée dans la fiche de liaison service / bloc opératoire (ou autre procédure en œuvre dans l'établissement)

Oui Non* N/A

4 Preoperative skin preparation is traced in the ward/operating room link form

http://www.has-sante.fr/portail/jcms/c_821671/la-check-list-securite-du-patient-au-bloc-operatoire

http://www.sf2h.net/sf2h_in-english-as-well.html

Hospital hygiene in France www.sf2h.net

The new era of root cause analysis!

- contralateral pain in the foreground,
- no information cross-checking before anesthesia induction (check list not done),
- no skin marking of the correct side by the surgeon during the preoperative visit,
- extension of the depilation zone to both legs for "aesthetic reasons"

SF2H
Risque infectieux et soins

<http://www.sf2h.net/sf> <http://www.ccecqa.asso.fr/page/prage>

Hospital hygiene in France www.sf2h.net

Cancer(Radiotherapie) 16 (2012) 201-208

Disponible en ligne sur **SciVerse ScienceDirect** www.sciencedirect.com

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Article original

Méthode Orion® : analyse systémique simple et efficace des événements cliniques et des précurseurs survenant en pratique médicale hospitalière

ORION®: A simple and effective method for systemic analysis of clinical events and precursors occurring in hospital practice

F. Debouck^b, É. Rieger^a, H. Petit^b, G. Noël^a, L. Ravinet^{b,*}

* Département de radiothérapie, centre régional de lutte contre le cancer Paul-Strauss, 2, rue de la Perle-de-1193rd, BP 65, 67085 Stasbourg cedex, France
* AFM42 Consulting, 21, allée de la Montagne, 78240 Chambourcy, France

SF2H
Risque infectieux et soins

http://www.sf2h.net/sf2h_in-english-as-well.html

HEALTHCARE INFECTION SOCIETY **HIS 2014**

Welcome **SciVerse ScienceDirect** www.sciencedirect.com

Elsevier Masson **Frank Debouck** <http://www.afm42.fr/>

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Infection Prevention in High and Middle Income Countries

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Hospital hygiene in France www.sf2h.net

The RCA approach

5 key points to control Pacc associated-risks

- ① Do not introduce new medical device without a transverse anticipative approach
- ② Develop a procedure, including the need of specific device, and spread it to the partner organizations susceptible to receive your patients
- ③ Think risk/benefit and do not forget to include Pacc-associated care burden in your balance
- ④ Analyze the vulnerabilities of your information system in terms of monitoring intravenous devices and integration of targeted transmissions
- ⑤ Check in every organization that supervision of care and recourse to expertise are in place

SF₂H
Risque infectieux et soins
<http://www.invs.sante.fr/Dossiers-thematiques/Maladies-infectieuses/Infections-associees-aux-soins/Signalement-et-alertes/>

Hospital hygiene in France www.sf2h.net

Be open to consumers and patients!


http://m.youtube.com/watch?v=7XD0l_OCHFY

SF₂H
Risque infectieux et soins
<http://www.sf2h.net/sf2h> <https://www.youtube.com/user/gcclin/videos>

Hospital hygiene in France www.sf2h.net

National strategy

New programme in preparation...



Fourth national HAI and nosocomial infections' prevention programme


14-18 → 15-19

SF₂H
Risque infectieux et soins
http://www.sf2h.net/sf2h_in-english-as-well.html

Hospital hygiene in France www.sf2h.net

Conclusion


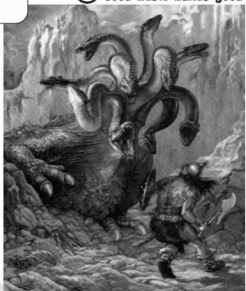
⑤ Think patient safety:

- High quality skin preparation is now a basis to build more safety around,
- Develop new strategies to tackle remaining problems:
 - Focus on organizational and human factors, 
- A need to fit with the shortage of resources,
- But stay strong for ongoing and future challenges!

SF₂H
Risque infectieux et soins
http://www.sf2h.net/sf2h_in-english-as-well.html

Good fights make good ICPs

pure.fm
Good music makes good people

SF₂H
Risque infectieux et soins
http://www.sf2h.net/sf2h_in-english-as-well.html



Brief review on the prevention and control of Healthcare-Associated Infections and Multidrug-Resistant Organisms in China

Li Han, Yong Chen, Jingya Zhao, Xuelin Han, Shuguang Tian, Fangyan Chen, Jia Zhao, Xiangzhao Meng

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A Webber Training Teleclass
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Infection Prevention in High and Middle Income Countries

Bruce Gamage, Dr. Pierre Parneix, Prof. Li Han

Broadcast live from the German Society for Hospital Hygiene

Outlines

- Literature introduction on epidemiology of major healthcare-associated infections and multidrug-resistant organisms responsible for these infections in China
- Introduction of ongoing efforts to control healthcare-associated infections in China: guidelines and surveillance
- Introduction of our work.

Cross sectional survey-2008 by China Healthcare-associated infection surveillance system

Nr. Hospitals: 269;
 Nr.Total patients: 169,888
 Nr. Healthcare-associated infections:7196
 Nr. Community-associated infections: 38221
 Prevalence rate of HAI: 4.29%;
 Prevalence rate of CAI: 22.79%

Ren N, et al. Cross-sectional investigation on nosocomial infection in China in 2008. ZhongGuo GanRan KongZhi ZaZhi [chinese]

Cross sectional survey-2008 by China Healthcare-associated infection surveillance system

The prevalence of nosocomial infection in different hospitals

Hospital type (no. of beds)	No. of hospitals	No. of patients included	Prevalence rate(%)	The percentile				
				P10	P25	P50	P75	P90
<300	79	11562	2.28	0.00	0.77	1.86	3.16	5.26
300-599	76	27655	3.08	0.64	1.91	2.61	4.49	5.79
600-899	42	30795	4.36	2.64	3.00	4.07	5.12	6.71
>900	72	97728	4.44	2.27	3.00	4.22	5.60	6.97

Ren N, et al. Cross-sectional investigation on nosocomial infection in China in 2008. ZhongGuo GanRan KongZhi ZaZhi [chinese]

Pathogens in healthcare-associated infection and community-associated infection (% , No. of isolate), 2010

Pathogen	Healthcare-associated infection	Community-associated infection	χ^2	P
Gram positive bacteria	20,691 (441)	28,681 (3,918)	182.96	0.00
<i>Staphylococcus aureus</i>	8,820 (415)	5,311 (723)	82.21	0.00
<i>Staphylococcus epidermidis</i>	2,431 (102)	2,311 (313)	0.19	0.66
Other <i>Staphylococcus</i>	2,141 (49)	2,322 (313)	2.86	0.09
<i>Streptococcus pneumoniae</i>	0,880 (4)	2,322 (313)	3.59	0.06
Other <i>Streptococcus</i>	1,391 (7)	6,288 (858)	249.84	0.00
<i>Enterococcus faecalis</i>	1,671 (18)	1,430 (19)	1.75	0.19
<i>Enterococcus faecium</i>	1,471 (10)	0,801 (17)	16.20	0.00
Other <i>Enterococcus</i>	0,371 (2)	0,521 (7)	2.12	0.15
<i>Mycobacterium spp.</i>	0,311 (1)	3,380 (463)	220.73	0.00
Other gram-positive cocci	1,521 (8)	3,451 (47)	81.51	0.00
Gram negative bacteria	66,031 (599)	46,991 (403)	678.35	0.00
<i>Escherichia coli</i>	12,531 (11)	12,110 (10)	2.91	0.09
<i>Klebsiella pneumoniae</i>	10,721 (7)	8,491 (13)	97.45	0.00
Other <i>Klebsiella bacteria</i>	1,091 (7)	0,971 (13)	0.63	0.43
<i>Pseudomonas</i>	3,391 (24)	3,281 (4)	0.00	0.97
<i>Pseudomonas</i> spp.	1,281 (9)	1,431 (10)	1.29	0.26
<i>Citrobacter spp.</i>	0,271 (1)	0,141 (1)	0.60	0.44
<i>Serratia spp.</i>	0,031 (1)	0,081 (1)	1.33	0.25
<i>Haemophilus spp.</i>	0,071 (1)	0,041 (1)	0.64	0.42
Gram-negative bacilli	87,371 (186)	7,161 (63)	626.53	0.00
Other <i>Pseudomonas</i>	0,851 (5)	0,801 (1)	0.68	0.78
Other <i>Pseudomonas</i>	11,011 (7)	1,401 (2)	306.63	0.00
Other <i>Acinetobacter</i>	1,381 (1)	1,001 (1)	4.60	0.03
Other <i>Acinetobacter</i>	0,171 (1)	0,251 (1)	1.22	0.27
<i>Stenotrophomonas maltophilia</i>	2,101 (4)	0,431 (1)	50.83	0.00
<i>Bacteroides spp.</i>	0,261 (1)	0,431 (1)	12.68	0.00

Wen, et al. Distribution of pathogens and antimicrobial resistance: An analysis of China healthcare-associated infection cross-sectional survey in 2010. Chin J Infect Control, 2012,11: 1-5

China Healthcare-associated infection surveillance system

Pathogens in healthcare-associated infection and community-associated infection (% , No. of isolate)

Pathogen	Healthcare-associated infection	Community-associated infection	χ^2	P
<i>Serratia spp.</i>	0,691 (4)	0,571 (4)	1.98	0.30
<i>Salmonella spp.</i>	0,071 (1)	0,181 (2)	4.44	0.04
Other gram-negative bacteria	2,011 (10)	3,681 (5)	42.47	0.00
Anaerobe	0,181 (1)	0,371 (1)	7.18	0.01
Fungi	18,621 (8)	18,411 (4)	8.23	0.03
<i>Candida albicans</i>	4,821 (3)	5,141 (2)	0.97	0.32
<i>Candida tropicalis</i>	0,251 (2)	0,481 (1)	3.61	0.02
Other <i>Candida</i>	0,391 (7)	0,801 (10)	1.46	0.23
Other Fungi	4,091 (2)	3,391 (4)	0.18	0.71
Virus	1,411 (8)	5,331 (28)	184.77	0.00
<i>Mycoplasma</i>	0,271 (1)	4,451 (4)	272.83	0.00
<i>Chlamydia</i>	0,081 (0)	0,391 (5)	43.76	0.00
<i>Spiracheta</i>	0,091 (0)	0,421 (8)	47.90	0.00
Other pathogens	0,821 (7)	2,481 (47)	183.45	0.00
Total	100,001 (6,943)	100,001 (1,653)	-	-

Wen, et al. Distribution of pathogens and antimicrobial resistance: An analysis of China healthcare-associated infection cross-sectional survey in 2010. Chin J Infect Control, 2012,11: 1-5

SSI(1)

Epidemiology and outcomes of surgical site infections following orthopedic surgery

Guang-qing Li MSc¹, Hong-Feng Guo MSc¹, Yong Guo MSc¹, Guang-wei Dong MSc¹, Wen-Zhen Mo MSc¹

¹Department of Infection Control, Shanghai University of Medicine and Health Sciences, Shanghai, China

Table 2 Patients related and surgery-related risk factors for SSIs by univariate analysis

Variable	SSIs (n=45)	No. SSIs (n=2,070)	OR (95% CI)	P
Sex (F/M)	20/25	1,001/1,015	1.23 (0.68-2.23)	.489
Age (yr)	49.20 (10.36)	51.03 (10.61)	1.01 (0.98-1.03)	<.001
Weight (kg)	66.45 (15.16)	68.62 (11.29)	1.02 (0.98-1.05)	.382
Smoking (yes)	10 (22.2)	224 (11.1)	2.29 (1.12-4.69)	.02
Abuse alcohol (yes)	3 (6.7)	127 (6.3)	1.06 (0.33-3.48)	1.0
Diabetes mellitus (yes)	7 (15.6)	90 (4.5)	3.94 (1.71-9.07)	.002
Orthopedic implant (yes)	35 (77.8)	1,425 (70.7)	1.45 (0.71-2.95)	.300
Previous surgery (yes)	14 (31.1)	328 (16.2)	1.97 (1.03-3.75)	.03
Prophylactic antibiotics (no)	4 (8.9)	310 (15.2)	1.97 (1.03-3.75)	.03
Postoperative drain (yes)	23 (51.1)	478 (23.3)	1.45 (0.71-2.95)	.300
Surgery time (>3 h)	14 (31.1)	582 (28.3)	1.45 (0.71-2.95)	.300
ASA score (≥3)	2	1	1.03	0.95
Diabetes mellitus	1	851	7.59 (3.015-18.832)	<.001
Smoking	1	2,378 (1,115-5,073)	2.378 (1.115-5.073)	.025
Previous surgery	2	2,190 (1,114-4,308)	2.190 (1.114-4.308)	.023
No prophylactic antibiotics	2	6,562 (2,652-16,989)	6.562 (2,652-16,989)	.002

*P values of 2-tailed independent t tests, χ^2 tests, P nonparametric tests.
 Mean (standard deviation).
 NOTE: Final model: Overall model test 44.077 (df = 5), P value <.001; the Hosmer-Lemeshow goodness-of-fit test was 1.299, df = 3, P = .729; The classification correctness was 97.8%.

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SSI(2)

Table 1
Category of healthcare-associated infection (HCAI) and antibiotic use according to hospital departments (10 hospitals 2007 and 13 hospitals 2008) in Hubei Province, China

Variables	2007					2008					Overall N = 20,250
	IM	SU	PE	KU	Others	IM	SU	PE	KU	Others	
Patients with HCAI no. (%)	145 (4.96)	139 (4.02)	19 (2.88)	15 (3.49)	11 (1.29)	220 (4.65)	171 (3.01)	28 (3.62)	26 (3.81)	16 (1.39)	790 (3.88)
95% CI	[4.9-5.7]	[3.7-4.8]	[1.8-4.16]	[2.09-4.81]	[0.53-2.85]	[4.05-5.24]	[2.55-3.42]	[2.3-4.94]	[2.74-5.67]	[0.71-2.06]	[3.62-4.15]
No. of HCAIs	148 (5.85)	146 (4.23)	19 (2.88)	21 (4.73)	11 (1.29)	231 (4.88)	183 (3.22)	30 (3.88)	28 (4.79)	16 (1.39)	833 (4.08)
95% CI	[4.25-5.84]	[3.35-4.98]	[1.69-4.16]	[3.37-6.48]	[0.53-1.29]	[4.26-5.69]	[2.76-3.88]	[2.52-5.24]	[2.99-5.80]	[0.71-2.06]	[3.62-4.37]
AP	97 (3.11)	27 (2.29)	16 (2.61)	16 (3.82)	7 (1.82)	186 (3.31)	91 (1.69)	22 (2.88)	25 (2.73)	11 (0.92)	588 (2.98)
SSP	1 (0.03)	32 (0.93)	0	1 (2.27)	1 (0.12)	3 (0.06)	36 (0.69)	4 (0.13)	0	2 (0.17)	80 (0.39)
UTI	24 (0.82)	7 (0.26)	0	4 (3.65)	0	25 (0.53)	10 (0.18)	0	2 (2.56)	0	37 (0.35)
CTI	9 (0.31)	12 (0.35)	3 (0.46)	0	2 (0.24)	12 (0.25)	19 (0.35)	6 (0.76)	0	1 (0.09)	60 (0.31)
BSI	3 (0.10)	4 (0.12)	0	1 (2.27)	0	6 (0.13)	2 (0.04)	0	1 (1.49)	0	17 (0.08)
STI	7 (0.24)	4 (0.12)	0	1 (2.27)	0	9 (0.19)	5 (0.09)	1 (0.13)	0	0	27 (0.13)
Other infections	7 (0.24)	10 (0.29)	0	0	1 (0.12)	10 (0.21)	17 (0.30)	0	0	2 (0.17)	47 (0.23)
Antibiotic use (g of patients)	38.19	54.88	70.00	60.51	57.77	39.48	54.94	79.37	80.55	54.51	59.93
Purpose of antibiotic use (% of patients)											
Treatment	30.07	20.03	63.55	50.00	26.24	29.71	17.36	70.12	35.82	23.35	27.94
Prophylaxis	4.87	27.41	8.64	22.27	17.08	7.69	31.23	5.69	42.39	24.51	18.44
Treatment + prophylaxis	3.44	7.44	4.40	13.64	14.47	2.74	6.35	2.46	16.45	4.88	5.35

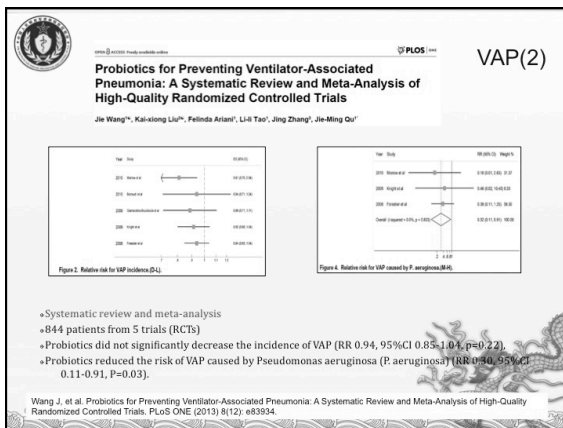
IM, internal medicine; SU, surgery; PE, paediatrics; KU, intensive care unit; Others, consulting departments of Chinese traditional medicine, dentistry, ENT (ear, nose and throat), ophthalmology and dermatology; HCAI, healthcare-associated infection; SSI, surgical site infection; UTI, urinary tract infection; CTI, gastrointestinal tract infection; BSI, bloodstream infection; STI, skin and soft tissue infection; Other infection, including peritonitis, cholecystitis, severe system infection, deep organ infection, and HCAI not included in all listed cases; CI, confidence interval.
* 95% number of SSIs per 100 operations in the surgical departments.

Xie DS, et al. Journal of Hospital Infection 76 (2010) 150

VAP(1)

- Retrospective analysis
- Patients: 401 neonates, neonatal intensive care unit, mechanical ventilation \geq 48 hours
- Time: from January 2008 to February 2012
- VAP: 85/401 (21.2%)
- Pathogen: Gram-negative bacteria (97%), including *Klebsiella pneumoniae* (51%), *Acinetobacter baumannii* (17%) and *Escherichia coli* (12%) as the three most frequent ones.
- Resistance: amoxicillin, amoxicillin/clavulanic acid, piperacillin, ceftazidime, ceftazolin, and cefotaxime, with a susceptibility rate of below 15%, and demonstrated decreased sensitivity to imipenem and meropenem, with a susceptibility rate of below 75%.
- Five independent risk factors for VAP: birth weight (OR=1.399, P<0.05), duration of mechanical ventilation (OR=1.966, P<0.01), length of hospital stay (OR=1.812, P<0.01), times of tracheal intubation (OR=2.056, P<0.01), 1 min Apgar score (OR=2.146, P<0.01).

Zhang, et al. Pathogens and risk factors for ventilator-associated pneumonia in neonates. Zhongguo Dang Dai Er Ke Za Zhi. 2013, 15: 14-8 (Chinese)



HAP(1)

Study design: prospective multicenter study
13 Chinese urban tertiary hospitals.

Settings: respiratory general ward and respiratory intensive care unit (RICU)
Time: from August 2008 to December 2010.

HAP: 42 877 hospitalized patients, 610 cases of HAP (1.4%);
0.9% (362/41 261) in respiratory general ward;
15.4% (248/1616) in RICU.
93.9% (573 cases) of patients had at least one underlying disease, and
91.0% (555 cases) had exposure to at least one antimicrobial agent within
90 days prior to HAP diagnosis.

Pathogens: *Acinetobacter baumannii* 30.0%,
Pseudomonas aeruginosa (22.0%),
Staphylococcus aureus (13.4%),
Klebsiella pneumoniae (9.7%).

Liu YN, et al. Adult hospital acquired pneumonia: a multicenter study on microbiology and clinical characteristics of patients from 9 Chinese cities. Zhonghua Jie He He Hu Xi Za Zhi. 2012, 35:739-46 (Chinese)

HAP(1)

Resistance:

A. baumannii, more than 70% resistance rates to carbapenems, and the susceptibility to ceftazidime/sulbactam, polymyxin B and tigecycline were 40.8%, 99.3% and 95.8%, respectively.

S. aureus, 87.8% MRSA

Mortality rate of HAP cases: 34.5%;

Hospital stay of patients with HAP was 23.8±20.5 days; Average for inpatients 13.2±13.6 days (P < 0.01).

Mean costs of HAP: 108 950±116 608 yuan; average hospital costs of respiratory inpatients (17 999±33 364 yuan (P < 0.01)).

Liu YN, et al. Adult hospital acquired pneumonia: a multicenter study on microbiology and clinical characteristics of patients from 9 Chinese cities. Zhonghua Jie He He Hu Xi Za Zhi. 2012, 35:739-46 (Chinese)

UTI(1)

HAPNES
Hospital Acquired Pneumonia and Nosocomial Infection Study

Survey on hospital-acquired urinary tract infection in neurological intensive care unit

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Table 1. Rate of hospital urinary tract infection

Age (years)	66.5 ± 12.6
Gender (M/F)	545/371
Primary disease	
Cerebral hemorrhage	503
Stroke	278
Other	135
Number of cases of urinary tract infection (n, %)	291, 31.8
Community-acquired urinary tract infection (n, %)	45, 4.9
Nosocomial urinary tract infection (n, %)	246, 26.9

Table 3. Pathogenic strain distribution and composition ratio

Bacterial strain	Number of strains	Composition ratio (%)
<i>Escherichia coli</i>	39	64.1
<i>Enterococcus faecalis</i>	15	16.3
<i>Klebsiella pneumoniae</i>	4	4.3
<i>Pseudomonas aeruginosa</i>	3	3.3
<i>Citrobacter freundii</i>	2	2.2
<i>Staphylococcus epidermidis</i>	1	1.1
<i>Enterobacter cloacae</i>	1	1.1
<i>Haemophilus</i>	1	1.1
<i>Staphylococcus aureus</i>	1	1.1

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UTI (2)

TABLE 2 Prevalence of VFs among UPEC causing BUIs that persist and result from re-infection*

Variance factor	No. of persistence isolates (%) (n=39)	No. of re-infection isolates (%) (n=86)	P value
Adhesins	4 (10)	11 (13)	0.9108
αfa	33 (84)	75 (86)	0.8988
fae	19 (49)	20 (23)	0.4823
papA	1 (3)	8 (9)	0.4116
papG	3 (8)	2 (2)	0.3066
papH/papI	20 (51)	23 (26)	0.6006
papK/papL	0 (0)	9 (10)	0.0481
αfa	6 (15)	3 (4)	0.1568

TABLE 3 Numbers of E. coli isolates which belong to different phylogenetic groups and are resistant to various antibiotics

Item	No. of isolates (%) (n=20)	No. of resistant isolates (%) (n=20)	P value*
Item			
Phylogenetic group			
A1	9 (45.0%)	20 (100.0%)	0.0001
A2	10 (50.0%)	14 (70.0%)	0.0002
B	1 (5.0%)	0 (0.0%)	0.9999

BSI(1)

Extended-spectrum beta-lactamase-producing *Escherichia coli* and *Klebsiella pneumoniae* bloodstream infection: risk factors and clinical outcome

Bin Du, Yan Liang, Hongsheng Liu, Dechang Chen, Jiaxin Liu, Yuxian Xu, Xuhai Xu

Table 2 Treatment and clinical outcome of patients with E. coli or K. pneumoniae bacteremia

Variable	ESBL-positive (n=23)	ESBL-negative (n=62)	Total (%) (n=85)	P value
Antibiotic treatment				
β-Lactam	7	33	40 (47%)	0.061
Imipenem	13	6	19 (22%)	0.000
β-Lactam/β-lactamase inhibitor	0	13	13 (15%)	0.016
Antimycotics	5	7	12 (14%)	0.293
Fluoroquinolones	2	6	8 (9%)	1.000
Combination therapy	4	5	9 (11%)	0.245

Table 3 Predictors for hospital mortality in patients with bacteremia due to E. coli or K. pneumoniae: results of multivariate analysis (OR odds ratio, CI confidence interval, APACHE acute physiology and chronic health evaluation)

Risk factor	Survivors (n=64)	Nonsurvivors (n=21)	OR (95%CI)	P value
APACHE II score	14.6±5.3	19.6±5.5		0.004
Malignancy	28	15	3.214 (1.105, 9.350)	0.028
Septic focus	1	9	47.290 (5.470, 408.175)	0.000
Creatinine > 5 mg/dl	2	5	9.488 (1.718, 54.015)	0.009
Previous beta-lactams	26	14	7.975 (3.673, 17.312)	0.008
LOS more than 2 weeks before bacteremia	22	16	6.109 (1.976, 18.991)	0.001
Inappropriate antibiotic treatment	7	7	2.701 (1.227, 5.914)	0.016
Treatment with β-Lactam	26	14	2.923 (1.028, 8.232)	0.038
Treatment with imipenem	14	1	14.240 (0.616, 324.624)	0.023
Treatment failure	8	15	17.500 (5.260, 58.236)	0.000

Fatality and secular trend of bloodstream infections during hospitalization in China: A systematic review and meta-analysis

BSI(2)

YANG Zhen-qun¹, ZHANG Si-wei², WANG Bo¹, XU Xiaohua¹, SHI Zheng¹, HE Yingqian¹, GU Xing¹, YANG Hai-wei¹, LI Department of Epidemiology and Health Statistics, Peking University School of Public Health, Beijing 100191, 2. Antimicrobial Chemist, Global Epidemiology, AstraZeneca Pharmaceuticals, USA

Table 1 BSI fatality rates of patients with different underlying conditions

Patients	No. of BSI cases	No. of deaths	Type of BSI	Median and range (IQR)	Weighted fatality rate (%)	Heterogeneity P	I ² (%)
General population	7	1380	HA + CA	30.36 (9.41-21.2)	20 (1.1)	<0.001	90.0
Immunocompromised	13	1300	HA + CA	49.71 (32.7-66.7)	49 (3.7)	<0.001	99.8
Hematology and/or cancer	4	130	HA	36.80 (20.0-39.1)	37 (28.2)	<0.001	20.4
ICU	6	628	HA + CA	29.90 (15.1-45.8)	30 (4.8)	<0.001	22.2
Hospital-acquired	3	372	HA + CA	14.3 (1.2-26.8)	13 (3.6)	<0.001	90.7
Neonatal wards	18	2417	HA + CA	9.2 (0.0-18.8)	11 (0.4)	<0.001	75.1
Healthcare workers	3	113	HA + CA	9.7 (4.2-12.1)	10 (8.8)	<0.001	91.0
Other*	18	1231	HA + CA	13.4 (3.7-26.3)	34 (2.8)	<0.001	84.1
Total	72	7262	HA + CA	25 (6.0-36.2)	78 (1.1)	<0.001	91.0

Figure 3 Secular trend of BSI fatality rates: results from meta-analysis

Epidemiological and Genetic Diversity of *Staphylococcus aureus* Causing Bloodstream Infection in Shanghai, 2009-2011

BSI(3)

Xu Chen¹, Wen-Kui Wang², Li-Zhong Han¹, Ying Liu¹, Hong Zhang¹, Jin Yang¹, Qing-Zhong Liu¹, Yu-Chan Huang¹, Yu-Xing Ni¹

Time: 2009 to 2011.

Settings: 4 hospitals, Shanghai

Pathogen: S. aureus in BSI
major (88.7%) is HA-MRSA, only two clones (ST239-MRSA-III and ST5-MRSA-II) also MSSA (distinct diversity); CA-MRSA

Resistance: linezolid, teicoplanin and vancomycin were still efficacious for treating S. aureus including MRSA

DAI

Device-associated infection rates, device use, length of stay, and mortality in intensive care units of 4 Chinese hospitals: International Nosocomial Control Consortium findings

Bijie Hu MD¹, Lili Tao MD¹, Victor D. Rosenthal MD, MSc, CIC², Kun Liu MD¹, Yong Wang MD¹, Yan Han MD¹, Xiangdong Cao MD¹, Shengbin Li MD¹, Chuanxin Lu MD¹, Hongmei Wang MD¹, Chenzhou Han MD¹, Wei Pan MD¹, Catherine L. Saunders PhD, MBBS

Settings: 7 ICUs in 4 hospitals

Time: Between August 2008 and July 2010;

Admissions: 2,631 admissions

VAP: 10.46/1,000 mechanical ventilator (MV)-days;

CLABSI: 7.66/1,000 central line (CL)-days;

CAUTI: 1.29/1,000 urinary catheter (UC)-days. Pooled DU ratios were 0.43 for MV, 0.71 for CL, and 0.76 for UC.

Crude extra LOS: 15 days for CLABSI, 20.5 days for VAP, and 27 days for CAUTI.

Crude extra mortality: 14% for CLABSI; 22% for VAP; 43% for CAUTI.

Conclusions: VAP and CLABSI rates were higher than CDC/NHSN's reported data, and LOS and mortality were increased. Compared with the CDC/NHSN and INICC data, the pooled DU ratio for MV was similar, and DU ratios for CL and UC use ratios were slightly higher.

The prevalence of ESBL-producers amongst E. coli and Klebsiella in China

Table 1 Rates of extended-spectrum β-lactamase (ESBL)-producing *Escherichia coli* and *Klebsiella* in China.

Location	Enter (n)	E. coli	Klebsiella	Study date	Reference
Hospitals in six Chinese cities	640	31.0		2009	[61]
14 hospitals across China (CHINET 2009)	565	41.4		2009	[62]
Shanghai hospitals, China	589	49.6		2009	[196]
A children's hospital in Beijing, China	770	76.09		2003-2008	[181]
12 hospitals across China (CHINET 2007)	550	45.0		2007	[77]
A hospital ICU in Wuhan, China	792	24.8		2007	[189]
Shanghai hospitals, China	550	53.9		2007	[100]
Shanghai hospitals, China	530	51.1		2006	[120]
8 hospitals across China (CHINET 2005)	389	38.1		2005	[91]
A hospital ICU in Shanghai, China	476	60.6		2005	[121]
A hospital in Hangzhou, China	558	43.5*		2005	[122]
A hospital in Chengdeqing, China	175	31.4*		2004-2005	[123]
4 hospitals in Shanghai, China	365	45.0		2004	[124]
A hospital respiratory ICU in Guangzhou, China	-	47.8*		2004	[125]
A hospital ICU in Changsha, China	340	30.7*		2003-2004	[53]
A hospital surgical ICU in Guangzhou, China	662	58.5		2003-2004	[94]
Guangzhou hospitals, China	392	44.7		2003	[126]
Shanghai hospitals, China	336	44.2		2003	[127]
ICUs from 19 hospitals in seven Chinese central cities	457	34.9*		2002	[90]
4 hospitals in Kunming, China	379	36.3		2002	[128]
15 tertiary hospitals in Hubei, China	313	34.7		2002	[129]
ICUs from 19 hospitals in seven Chinese central cities	286	25.7*		2001	[97]

ICU, Intensive Care Unit.
* *Klebsiella pneumoniae*.

Yezi Li & Han. IJAA, 2012

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Rates of methicillin resistance amongst *S. aureus* and CoNS in China

Table 4
Rates of methicillin resistance amongst *Staphylococcus aureus* and coagulase-negative staphylococci (CoNS) in China.

Location	Rate (%)		Study date	Reference
	<i>S. aureus</i>	CoNS		
14 hospitals across China (CHINET 2009)	52.7	71.7	2009	[62]
Shanghai hospitals, China	62.3	77.0	2008	[196]
12 hospitals across China (CHINET 2008)	55.9	75.9	2008	[70]
A children's hospital in Beijing, China	10.6	86.2	2003–2008	[18]
A hospital ICU in Wuhan, China	84.0	90.0	2007	[199]
12 hospitals across China (CHINET 2007)	54.0	77.0	2007	[71]
Shanghai hospitals, China	61.1	75.9	2007	[100]
Shanghai hospitals, China	64.6	82.2	2006	[120]
A hospital in Shanghai, China	93.2	94.9	2005	[121]
8 hospitals across China (CHINET 2005)	69.0	82.0	2005	[98]
A hospital in Hangzhou, China	68.6	86.8	2005	[122]
17 hospitals in 15 Chinese cities	62.9	-	2004–2005	[73]
14 hospitals in Shanghai, China	63.9	82.0	2004	[124]
A hospital surgical ICU in Guangzhou, China	94.7	88.2	2001–2004	[49]
Guangzhou hospitals, China	70.8	82.4	2003	[126]
Shanghai hospitals, China	59.8	80.3	2003	[127]
A hospital in Guangzhou, China	65.3	70.7	2002–2003	[131]
4 hospitals in Kunming, China	36.3	-	2002	[128]
15 tertiary hospitals in Hubei, China	38.6	72.6	2002	[129]
13 hospitals across China	89.2	-	2000–2001	[62]
11 hospitals in Shanghai, China	84.0	77.0	1999	[90]
13 hospitals across China	81.8	-	1998–1999	[91]
Shanghai hospitals, China	54.9	70.7	1998	[138]

ICU: Intensive Care Unit.

Yezi & Han, IJAA, 2012

Laws, Regulations and Guidelines

Law

- ◆ Infectious Disease Control & prevention in people's republic of china (2004)

Regulations

- ◆ Regulation on Hospital Infection Management (2006)
- ◆ Regulation on Management of Medical Waste (2003)
- ◆ Regulation on Disinfection Management (2002)

Laws, Regulations and Guidelines

Technical guidelines

- ◆ Guideline for Prevention and Control of Surgical Site Infection (GJB 7480—2012)
- ◆ Guideline for Diagnosis of Nosocomial Infection (trial) (2001)
- ◆ Guidelines for Clinical Application of Antimicrobial drugs (2004)
- ◆ Guideline for Endoscope Cleaning and Disinfection (2012)
- ◆ Guideline for Dental Equipment Disinfection in Healthcare Settings (2005)
- ◆ Specification of Nosocomial Outbreak Reporting and Disposal Management (2009)
- ◆ Standard for construction of Hospital Clean Operation Department (2002)

Laws, Regulations and Guidelines

Technical guidelines

- ◆ Central Sterile Supply Department (CSSD): WS 310—2009
 - ◆ Part I : management standard
 - ◆ Part II :standard for operating procedure of cleaning , disinfection and sterilization
 - ◆ Part III: surveillance standard for cleaning ,disinfection and sterilization
- ◆ Guideline for isolation in hospitals (WS/T 311—2009)
- ◆ Guideline for nosocomial infection surveillance (WS/T 312—2009)
- ◆ Guideline for hand hygiene of healthcare workers in healthcare settings (WS/T 313—2009)
- ◆ Guideline of Hospital Air Purification management (WS/T368—2012)

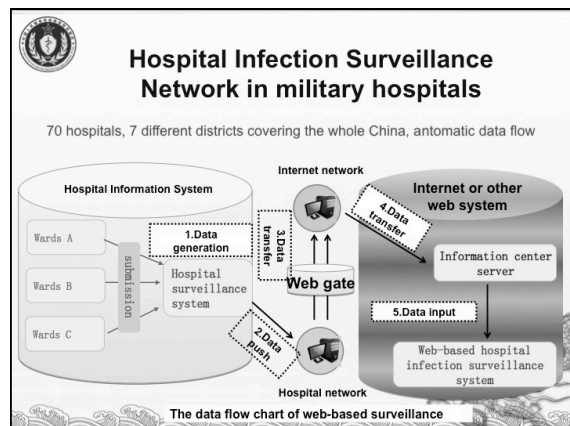
Academy of Military Medical Sciences (Chinese PLA Center for Disease Control & Prevention)

Chinese PLA Institute for Disease Control & Prevention

Division of Hospital Infection Control

Working through . . .

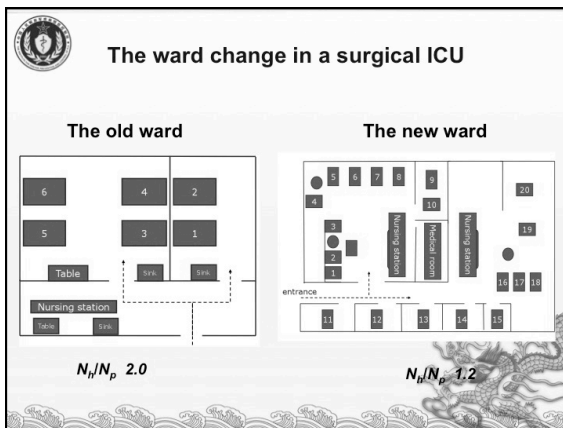
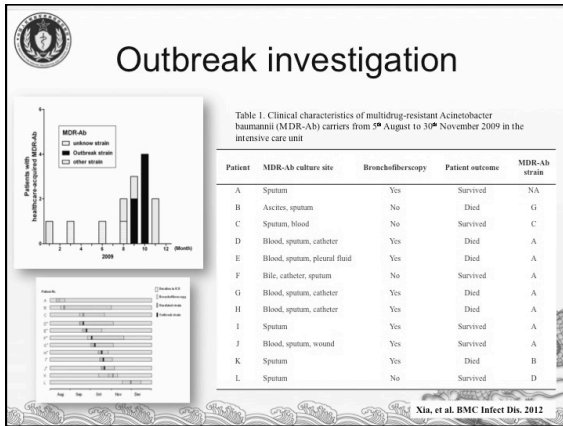
- Surveillance
- Outbreak Investigations
- Recommendation and Standard
- Intervention Implementation
- Research: MDRO (Acinetobacter and Fungus); infection mechanism



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Detection of MRSA in patients, HCWs and environment

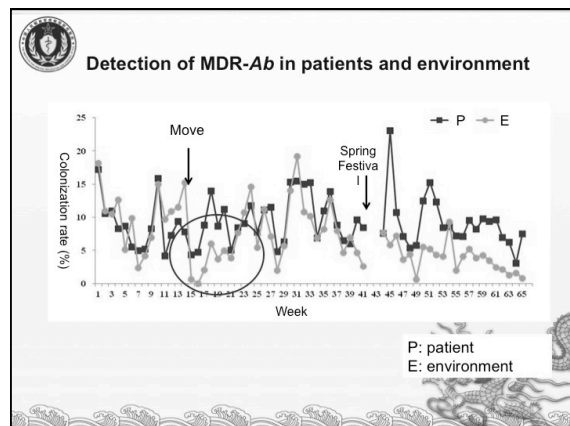
Sites	Old ward		New ward		P value
	Samples taken n	MRSA positive n(%)	Samples taken n	MRSA positive n(%)	
Patients					
Anterior nares	273	47(17.2)	2555	85(3.3)	<0.001
Total four sites	1,098	115(10.5)	10,261	195(1.9)	<0.001
Sampling density	1.96 (1098/560)		1.82 (10261/5636)		0.17
Health care workers					
Hand	284	23(8.1)	379	9(2.4)	<0.001
Anterior nares	86	1(1.2)	139	1(0.7)	0.999
Total	370	24(6.6)	518	10(1.9)	<0.001
Environment					
Bed sheet	249	13(5.2)	1290	23(1.8)	0.001
Dispensing station	163	4(2.5)	756	4(0.5)	0.037
Water tap	132	2(1.5)	983	1(0.1)	0.039
Air	273	14(5.1)	1332	7(0.5)	<0.001
Total	2053	83(4.0)	10811	98(0.9)	<0.001

MRSA prevalence, acquisition and transmission in ICUs

Variables	Old ward (n=64)	New ward (n=454)	P value
Positive on admission, no. (%)	9(14.1)	8(1.8)	<0.001
ICU acquisition, no. (%)	13(23.6)	33(7.4)	<0.001
Patient-days at-risk	318	3782	-
ICU acquisition per 1,000 patient-days at-risk	40.9	8.7	<0.001
Number of new cases per imported case	1.4	4.1	-

Hand hygiene compliance	31.3%	18.2%
Nursing cohorting level	0.62	0.47

Chen Y, et al. American Journal of Infection Control. 2014



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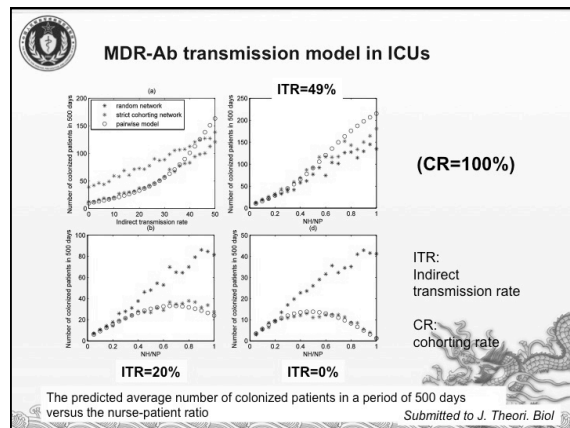
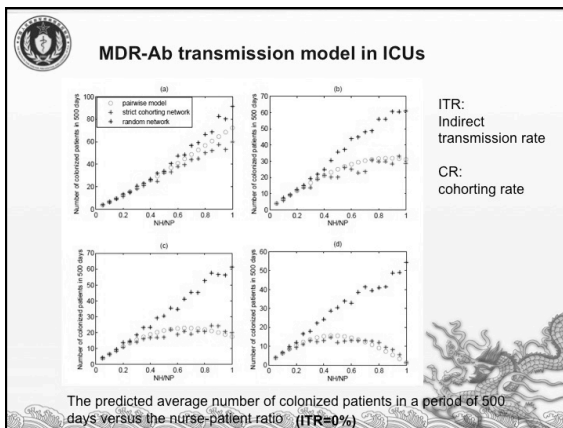
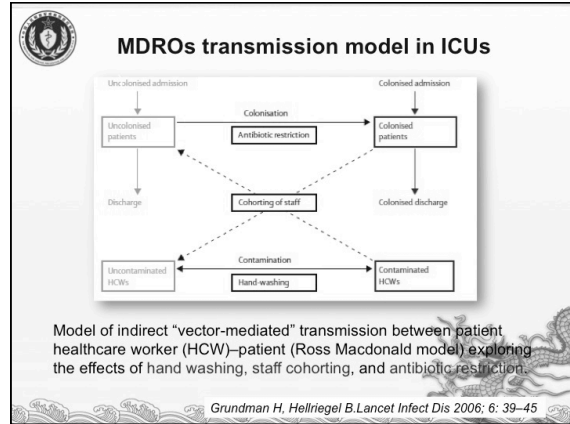
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MDR-Ab prevalence, acquisition and transmission in ICUs

Variables	Old ward (n=64)	New ward (n=454)	P value
Positive on admission, no. (%)	19(29.7)	49(10.8)	<0.001
ICU acquisition, no. (%)	17(37.8)	84(20.7)	0.009
ICU acquisition per 1,000 patient-days at-risk	70.0	34.9	0.015
Number of new cases per imported case	0.9	1.7	-

The nurse cohorting level and hand hygiene compliance are strong predictors of MDROs transmission in ICUs



Dissemination and Characterization of NDM-1-Producing *Acinetobacter pittii*

- ♦ NDM-1, new metallo-β-lactamase highly resistant to carbapenem, frequently found in *Enterobacteriaceae*, world-wide spread.
- ♦ Predominantly in *Acinetobacter baumannii*, no transmission in ICU was reported.

Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study
Lancet Infect Dis 2010

Dissemination of NDM-1 positive bacteria in the New Delhi environment and its implications for human health: an environmental point prevalence study
Lancet Infect Dis 2011

All NDM-1 positive strains were *Acinetobacter pittii*

Source	Total isolates N	NDM-1 Positive N(%)
Patients		
Swab sample	1425	5(0.4)
Clinical sample	230	0(0.0)
Health care workers		
Environmental sampling	104	0(0.0)
Environmental sampling	1354	22(1.6)
Total	3114	27(0.9)

Infection Prevention in High and Middle Income Countries

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Thanks for your attention!



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