The Ideal Hospital

Hospital design and infection prevention and control

Dr. Massimo Giola

Infectious Diseases Physician

Tauranga Hospital, New Zealand

Hosted by Jane Barnett

jane@webbertraining.com

Disclaimer

- The contents of this presentation reflect my opinions only
- I have no conflict of interest.

The most frequent question I have been asked since moving to NZ

"Why have you left such a beautiful country as Italy to come to NZ?"

… now I've got the answer!

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“12 extra questions with Sir John Kirwan”

“What does New Zealand need more of?”

”I think we're in a good place, from a multi-cultural point of view. We probably need more Europeans. More Italians.”

John Kirwan. Photo / Dean Purcell

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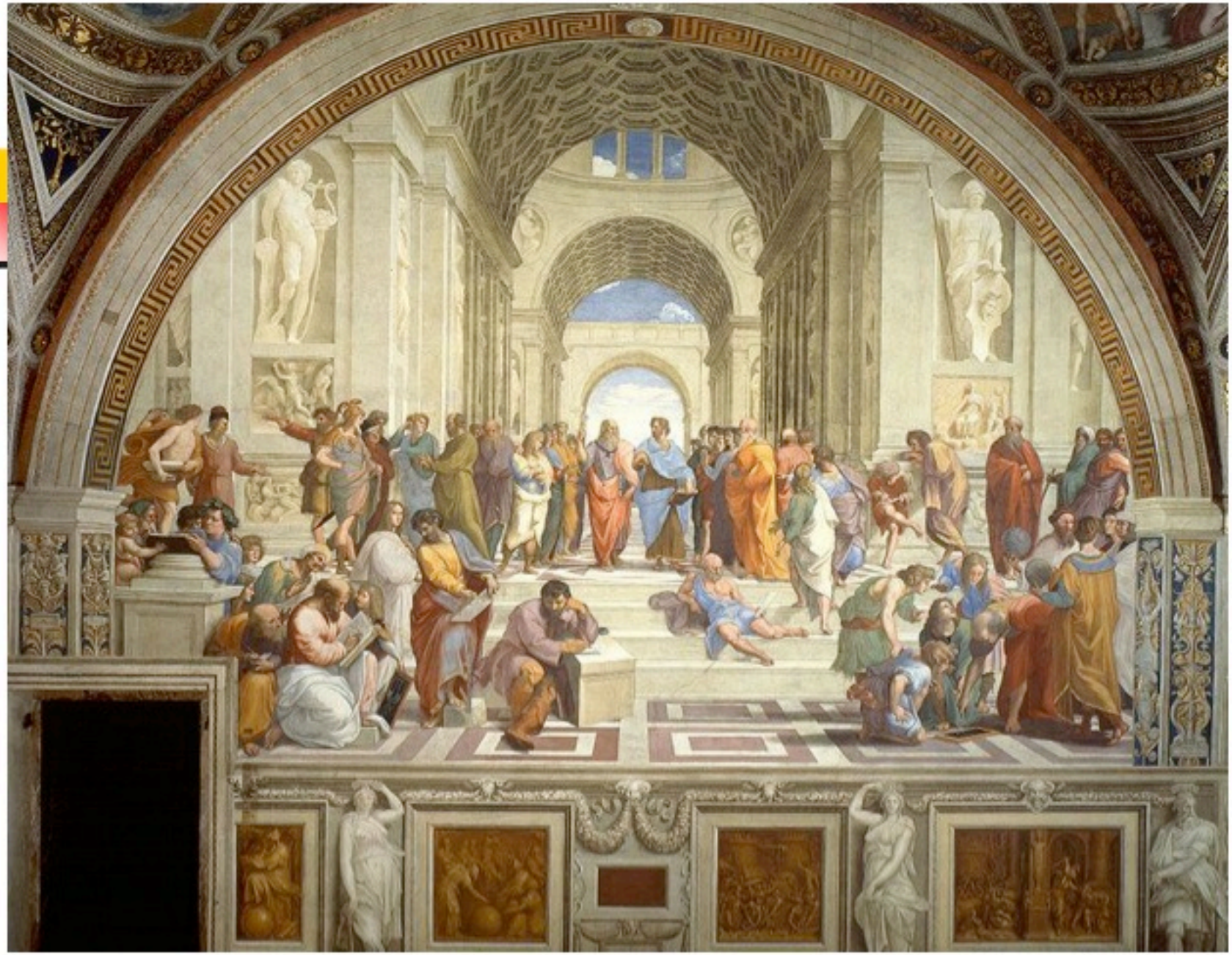
The most frequent question I have been asked since moving to NZ

"Why have you left such a beautiful country as Italy to come to NZ?"

… now I've got the answer:

"I'm here to help!"

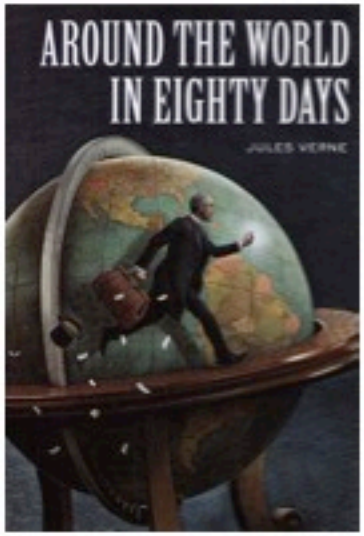
5

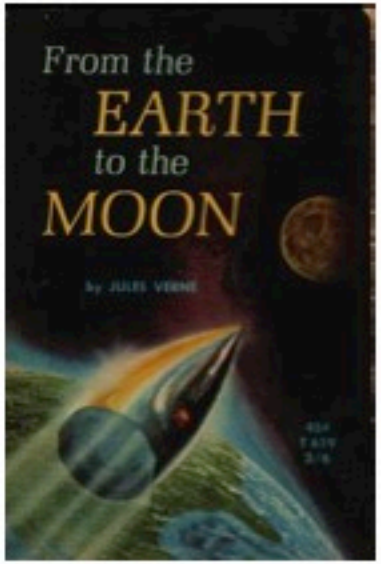


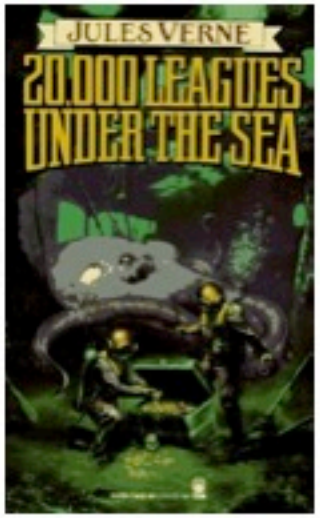
The School of Athens, Raphael, 1510-11 (Vatican Museums, Rome)

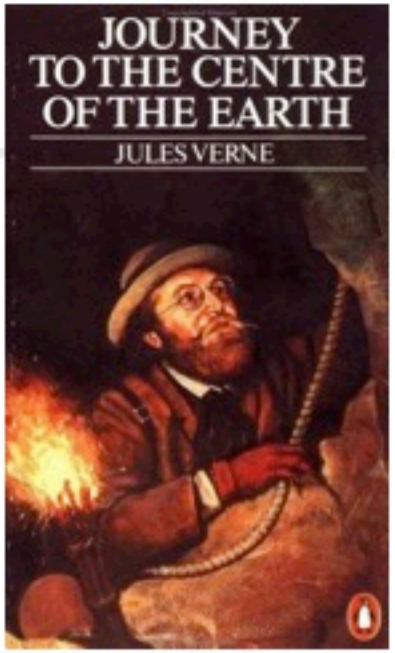
- In the centre of the fresco:
  - Plato on the left and Aristotle on the right
  - these two central figures gesture along different dimensions: Plato vertically, upward along the picture-plane, into the beautiful vault above; Aristotle on the horizontal plane at right-angles to the picture-plane.
- It is popularly thought that their gestures indicate central aspects of their philosophies:
  - for Plato, his Theory of Forms (=ideas)
  - for Aristotle, his empiricist views, with an emphasis on concrete details.

Jules Verne (1828-1905): a 19th Century sci-fi pioneer









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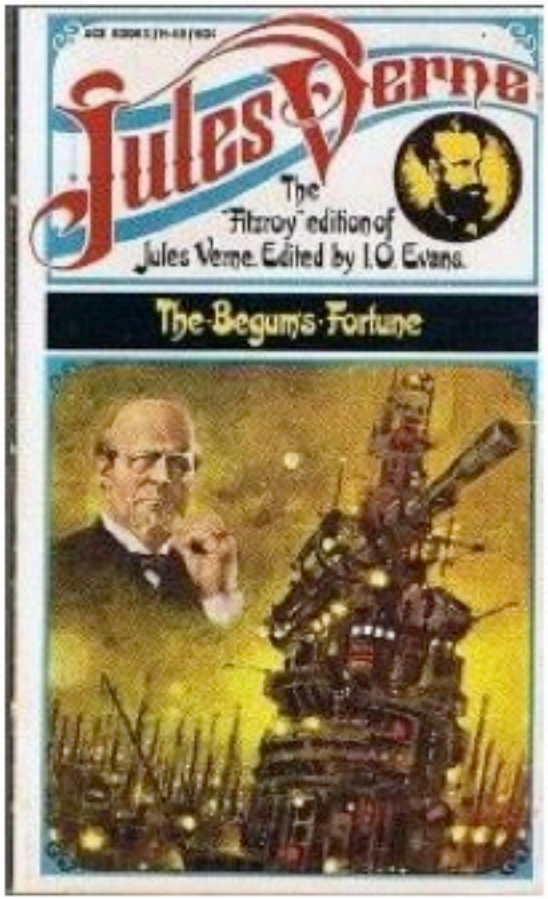
… but also (maybe) less widely known works…



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… where he actually describes the ideal hospital:

- "Hospital in the home" is the rule in France-ville, the "hospital" the exception
- 20-30 beds per "ward"
- Single-room, ensuite only
- Totally disposable (pinewood cabins to be incinerated at the very least every year - or more often if required)
- No carpet, wallpaper, etc. (not even in the houses)

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Paris, Hotel Dieu, circa 1500: sewing the body bags…

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Italy's Renaissance Hospitals

Florence, Spedale degli Innocenti

Pistoia, Ospedale del Ceppo

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What has been the paradigm shift in IPC over the last decade?

- “It’s the bugs, stupid!”
- Once upon a time, MRSA was king
- Traditional contact isolation and hand-washing sufficed (maybe)

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The new kids on the block

- We live now in the era of the new bugs:
  - viruses (Noro, etc.)
  - fungi (*Aspergillus*, etc.)
  - waterborne diseases (*Legionella*, etc.)
  - spore-forming organisms (*Clostridia*, etc.)
  - VRE
  - multi-drug resistant (Gram neg.) organisms
    - *Pseudomonas*
    - *Acinetobacter*
    - carbapenem-R *Enterobacteriaceae*

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New strategies and weapons are needed

- The pendulum swings back to enhanced cleaning and environmental control
- “One bum, one toilet” should be the mantra we repeat morning and evening
- IPC professionals are back to the table where the big decisions are made and the big money is spent

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The ideal hospital of the 21st Century

- The beds/toilets ratio should be 1
- New hospitals should be built with 100% single rooms with ensuite
  - St. Olav's Hospital (Trondheim, Norway)
  - Erasmus Medical Centre (Rotterdam, Belgium)
  - Fiona Stanley Hospital (Perth, Oz)
  - Royal Adelaide Hosp. (Adelaide, Oz)
- Even in the most conservative settings new hospitals have 50% single, 50% double rooms (all with ensuite)

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Advantages of the single room

- Strongly linked to:
  - reduced hospital-acquired infections
  - improved patient sleep
  - improved patient privacy
  - improved communication with the care team
  - increased overall patient satisfaction

Am J Infect Contr 2010; 38: S1-12

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Advantages of the single room

- Less strongly (but still) linked to:
  - reduced medical errors
  - reduced patient stress
  - improved social support
  - decreased staff stress
  - increased staff effectiveness
  - increased staff satisfaction

Am J Infect Contr 2010; 38: S1-12

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IPC Building Guidelines in Ireland, 2008

Category	Issues and findings	Single occupancy room*	Multiple occupancy room*
Cost	Operating costs	Decreased	Inconclusive
	Initial capital costs	Increased	Decreased
	Occupancy rates	Increased	Decreased
	Length of stay	Decreased	Increased
	Medication errors and costs	Decreased	Increased
Infection prevention and control	Rate of nosocomial infection	Decreased	N/A**
	Patient transfers	Decreased	Increased
	Patient length of stay	Decreased	Increased
	Infections in burns patients	Decreased	N/A
	HCV*** transmission between patients	Decreased	N/A
	Hospital-acquired diarrhoea	Decreased	Increased
Falls and accidents	Falls in patients requiring supervision	Increased	Decreased
	Falls in elderly when provisions are taken	Decreased	Decreased
	Access to bathrooms	N/A	Decreased
Hospital design and therapeutic impacts	Privacy	Increased	Decreased
	Pain medication	Inconclusive	Inconclusive
	Patient consultation with physician	Inconclusive	Inconclusive
	Patient preference for room design	Inconclusive	Inconclusive
	Noise level	Decreased	Increased
	Sleep disturbance	Decreased	Increased
	Patient satisfaction	Increased	Decreased
	Patient control	Increased	Decreased
	Crowding	Decreased	Increased
	Stress reduction through music	Increased	Decreased

Beneficial outcomes are underlined

***N/A: not addressed*

****Hepatitis C virus*

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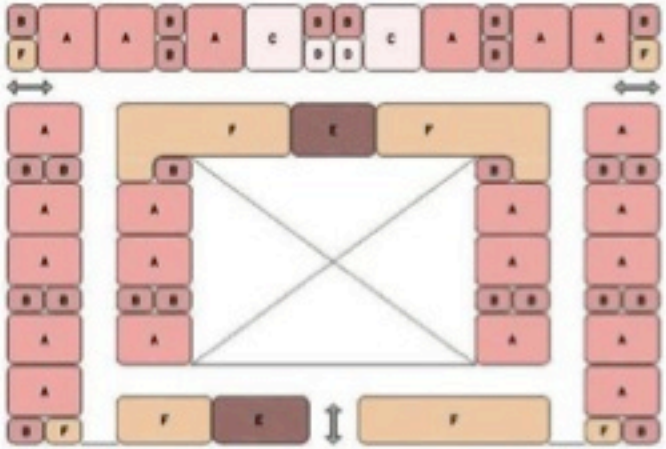
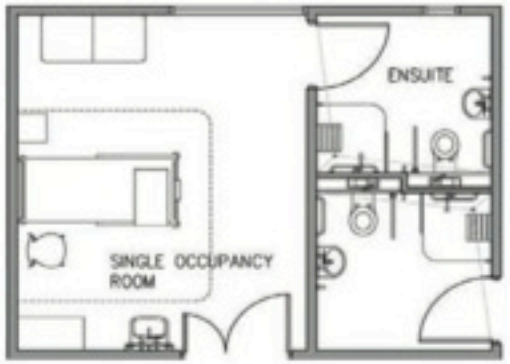
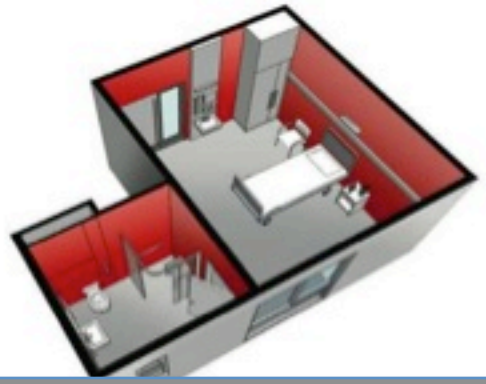
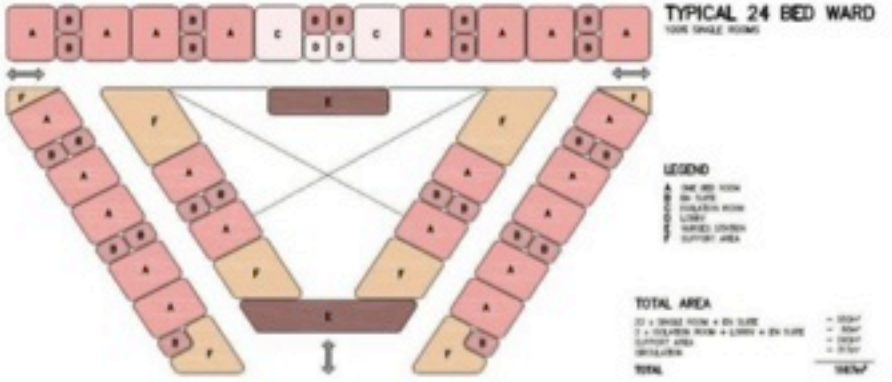
IPC Building Guidelines in Ireland, 2008









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The ideal room

Erasmus Med. Centre (Rotterdam)

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The ideal room

La chambre d'hopital du futur, Lille expo, 2012

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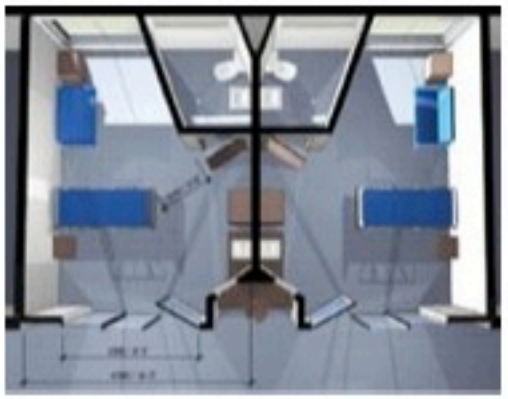
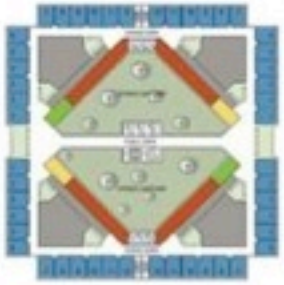
The ideal room





The Montreal Children's Hospital

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Ideal hospitals… in Australia

Fiona Stanley Hospital, Perth

Layout of the wards, new Royal Adelaide Hospital

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…and all around the world:

- France: historically, very high percentage of single-bed rooms (approaching 100%)
- USA: almost universal switch to 100% single rooms
- Germany: prevailing model the double room with ensuite

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…and all around the world:

- Finland: new hospitals built with 50% single, 50% double rooms with ensuite
- Netherlands: in the last 10 years trend towards 50% single, 50% double
- Norway: ranging from 100% single to 50% single, 50% double

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…and all around the world:

- Ireland: projects currently planning for 50% single room accommodation
- Switzerland: from the 90s onwards, new hospitals are built with 50% single, 50% double rooms
- UK: progressively trending towards higher percentages of single rooms

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…and all around the world:

- Ireland: projects currently planning for 50% single room accommodation
- Switzerland: from the 90s onwards, new hospitals are built with 50% single, 50% double rooms
- UK: progressively trending towards higher percentages of single rooms

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…maybe even in NZ?

- Unfortunately we are building right now brand new hospitals (e.g. Whakatane) still with a large proportion of multi-bedded rooms (59.5%):
  - 79 beds in total
  - 11 x 4 bedded rooms
  - 2 x 3 bedded rooms
  - 3 doubles
  - 21 singles

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Other “intelligent” features of the ideal hospital…

- … that no architect would consider unless you talk them through!
  - hand washing basins in the corridors
  - layout of the bigger wards that allows effective separation in separate cohorting wings (duplicate services, sliding glass doors midway down the corridor)

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The ideal hospital has five (not four) categories of isolation precautions

- The four traditional ones:
  - Airborne
  - Droplet
  - Contact
  - Protective
- Plus a fifth one…

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"Contact +" isolation

- Should be used instead of contact isolation for highly contagious diarrhoea
- Norovirus, *C. difficile*
- Contact precautions PLUS:
  - shut the door
  - wear full protective equipment (gown, gloves) for direct contact
  - wash hands with soap & water rather than alcohol-based gel

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In the ideal hospital the cleaners are the real VIPs

- The importance of hospital cleaners steadily degraded over the past 15-20 years
- Insufficient cleaning is especially associated with:
  - *C. diff.* and other spore-forming pathogens
  - VRE
  - Gram. neg. MDROs
  - MRSA

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Back to the future? when hospitals used to smell of bleach…

- Bleach-based cleaning
  - useful for VRE, spores, Norovirus…
- Non-touch methods (and enough time…) for terminal cleaning
  - hydrogen peroxide vapours
  - UV light

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BMC Infectious Diseases

BioMed Central

Research article

Open Access

Reduction of *Clostridium Difficile* and vancomycin-resistant *Enterococcus* contamination of environmental surfaces after an intervention to improve cleaning methods

Brittany C Eckstein[1], Daniel A Adams[1], Elizabeth C Eckstein[2], Agam Rao[3], Ajay K Sethi[4], Gopala K Yadavalli[1] and Curtis J Donskey*[1]

Address: [1]Research Service, Louis Stokes Cleveland Veterans Affairs Medical Center, 10701 East Blvd., Cleveland, Ohio, USA, [2]Infection Control Department, Louis Stokes Cleveland Veterans Affairs Medical Center, 10701 East Blvd., Cleveland, Ohio, USA, [3]Department of Medicine, University Hospitals of Cleveland, 10000 Euclid Avenue, Cleveland, Ohio, USA and [4]Department of Epidemiology and Biostatistics, Case Western Reserve University School of Medicine, 10900 Euclid Avenue, Cleveland, Ohio, USA

Email: Brittany C Eckstein - britteck@aol.com; Daniel A Adams - daa2124@columbia.edu; Elizabeth C Eckstein - Elizabeth.Eckstein@va.gov; Agam Rao - agam.rao@case.edu; Ajay K Sethi - aks26@case.edu; Gopala K Yadavalli - gopal.yadavalli@med.va.gov; Curtis J Donskey* - curtisd123@yahoo.com

* Corresponding author

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BMC Infectious Diseases 2007, 7:61 doi:10.1186/1471-2334-7-61

Received: 6 December 2006

Accepted: 21 June 2007

BRIEF REPORTS

HYPOCHLORITE KILLING OF COMMUNITY-ASSOCIATED METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS*

Randall G. Fisher, MD, Rebecca L. Chain, BS, Pamela S. Hair, MS, and Kenji M. Cunnion, MD, MPH

Abstract: We tested in vitro hypochlorite (bleach) killing of community-associated methicillin-resistant *Staphylococcus aureus* isolates to determine optimal concentration and duration. For all isolates maximal killing, >3-log decrease in colony forming units (CFU), was found after 5 minutes in 2.5 μL/mL bleach. We estimate that 2.5 μL/mL bleach is approximately one-half cup of bleach in one-quarter tub of water.

Key Words: *Staphylococcus aureus*, MRSA, hypochlorite, bleach bath

Accepted for publication March 20, 2008.

From the Department of Pediatrics, Eastern Virginia Medical School, Children's Specialty Group, The Children's Hospital of The King's Daughters, Norfolk, VA.

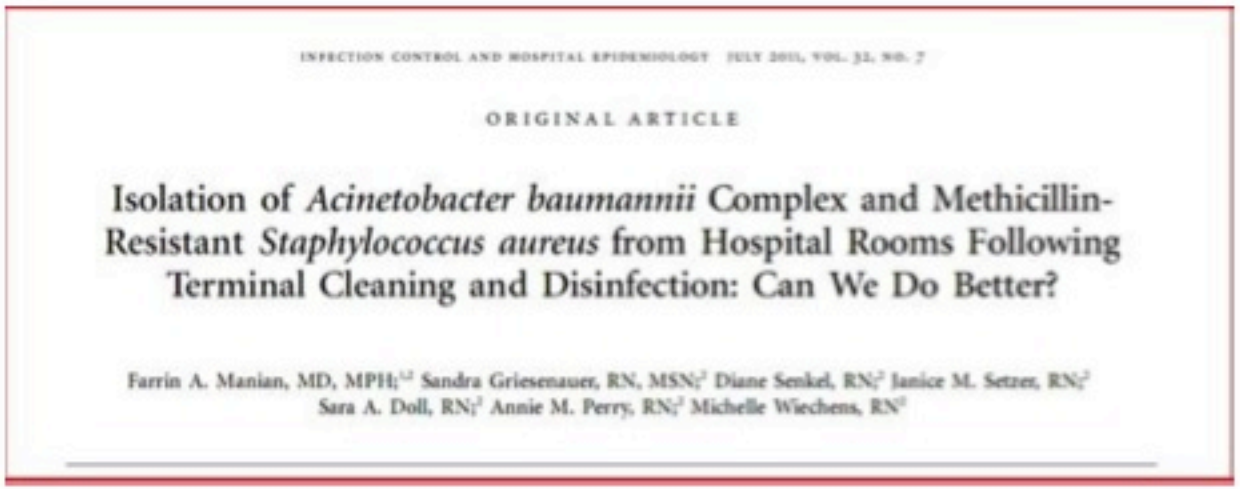
Address for correspondence: Kenji M. Cunnion, MD, MPH, Division of Infectious Diseases, 601 Children's Lane, Norfolk, VA. E-mail: kenji.cunnion@chkd.org.

DOI: 10.1097/INF.0b013e318175dd71

accordance with Eastern Virginia Medical School IRB protocol #06-04-WC-0040. Five isolates were from children with invasive MRSA infections and 5 isolates were from children with MRSA colonization. Invasive isolates were recovered from blood, bone, or joint cultures. Colonizing isolates were recovered by nasopharyngeal swab as part of routine colonization screening. Bacteria were grown on 2% NaCl Columbia agar plates (Becton Dickinson, Franklin Lakes, NJ) overnight at 37°C. The investigators felt that growth on agar would more closely simulate growth on a solid surface (ie, skin) than growth in liquid media. Bacterial colonies were scraped from agar plates and suspended in sterile phosphate-buffered saline (PBS). The concentration of bacteria was standardized by optical densitometry to 10^8 colony forming units (CFU)/mL. Light microscopy confirmed that a uniform suspension of bacteria was achieved with minimal clumping.

Hypochlorite Killing Assays. One milliliter of bacterial suspensions (10^8 CFU) were sedimented by centrifugation and resuspended in municipal tap water or municipal tap water with hypochlorite. Clorox bleach (The Clorox Co., Oakland, CA), a 6% hypochlorite solution, was diluted in municipal tap water to 2.5 μL/mL (vol/vol), unless otherwise described. Bacterial suspensions were then incu-

A 10^5



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2011, VOL. 32, NO. 7

ORIGINAL ARTICLE

Isolation of *Acinetobacter baumannii* Complex and Methicillin-Resistant *Staphylococcus aureus* from Hospital Rooms Following Terminal Cleaning and Disinfection: Can We Do Better?

Farrin A. Manian, MD, MPH;[1,2] Sandra Griesenauer, RN, MSN;[2] Diane Senkel, RN;[2] Janice M. Setzer, RN;[2] Sara A. Doll, RN;[2] Annie M. Perry, RN;[2] Michelle Wiechens, RN[2]

The ideal hospital makes the cleaners' life easy

- One system, one finishing style
- No carpet anywhere, no soft fabric furniture
  - the "totally washable" hospital
  - no nooks and crannies
  - no cluttered corridors
  - a place for everything and everything in its place!

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The Haematology & Bone Marrow Transplant Unit, Zurich

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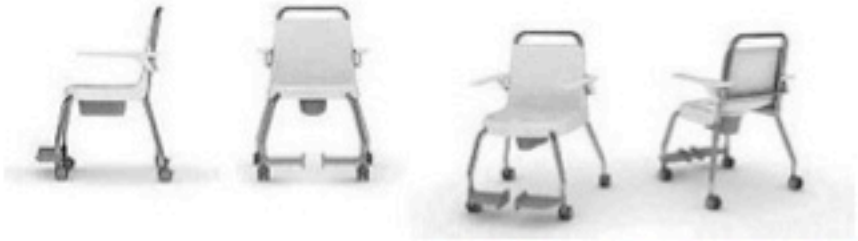
The “Design Bugs Out” Project



http://mediacentre.dh.gov.uk/2011/11/18/new-designs-help-to-combat-bugs-in-hospitals/

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Nursing and Physician attire as possible source of nosocomial infections

- Potentially pathogenic bacteria:
  - *Acinetobacter*
  - *Pseudomonas*
  - *Staph. aureus*
  - *Enterobacteriaceae*
- 63% of sampled uniforms
- Antibiotic-R bacteria from 14% of uniforms (nurses) and 6% (physicians)

Am J Infect Contr 2011; 39: 555-9

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Does it matter what we are wearing?

- Probably no, as long as we change our clothes daily
- No one else in the world except UK & Friends wears street clothes in the hospital
- Colour-coded scrubs are the most practical option

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Dressed to impress?

Fig 1. Description of attires and their corresponding photographs for male and female doctors.

Clin Med 2009; 6: 519-24

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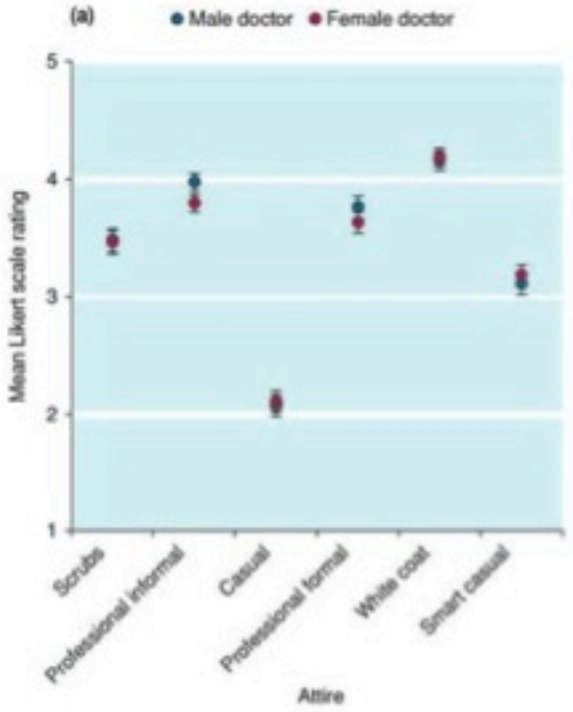
Dressed to impress?



- Likert confidence scale:
  - 1 = less confident
  - 5 = most confident
  - 3 = neutral

Clin Med 2009; 6: 519-24

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Judging a book by its cover

Some sartorial options (see bmj.com for the rest)

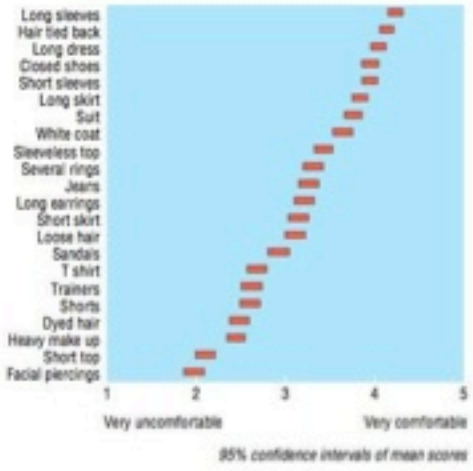

Fig 2 Patients' 95% CIs of scores for female doctors' items

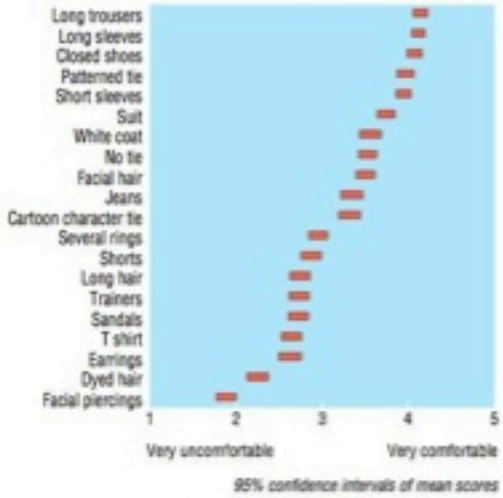

Fig 3 Patients' 95% CIs of scores for male doctors' items

BMJ 2005; 331: 1524-7

Judging a book by its cover

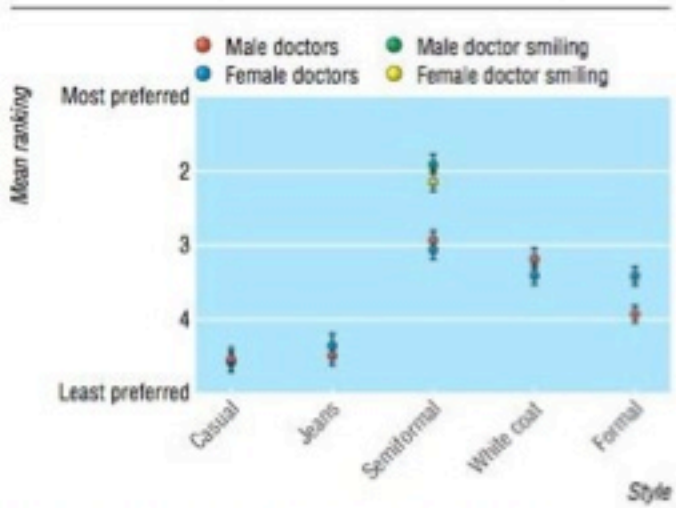

Fig 1 Patients' mean rankings (95% CIs) for doctors' dress

A smile (at least in Aotearoa - New Zealand) goes a long way!

BMJ 2005; 331: 1524-7

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Let's just avoid going to the extreme

DOI: 10.1308/147363509X452876

BARE BELOW THE . . .
WHAT DO PATIENTS WANT THEIR DOCTOR TO WEAR?

J Henderson SpR, Department of Plastic and Reconstructive Surgery
H Budd ST2, Department of Trauma and Orthopaedic Surgery
J Wimhurst Consultant Trauma and Orthopaedic Surgeon, Department of Trauma and Orthopaedic Surgery
Norfolk and Norwich University Hospital NHS Trust

Ann R Coll Surg Engl (Suppl) 2009; 91: 246-8

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Thank you very much for your attention!

Ospedale dell'Angelo, Mestre, Italy

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28 February THE CLINICAL AND BUSINESS CASE FOR INVESTING IN IMPROVED ENVIRONMENTAL HYGIENE

Speaker: Mark Heller, Unisource Worldwide

06 March *(WHO Teleclass)* PATIENT PARTICIPATION IN HAND HYGIENE PROMOTION AND IMPROVEMENT

Speaker: Prof. Yves Longtin, University of Laval, Canada

07 March RATIONALE AND CONCEPTS IN DENTAL INFECTION CONTROL

Speaker: Prof. Raghu Puttaiah, Managed Care Concepts

14 March UPDATE ON "NO TOUCH' ROOM DISINFECTION SYSTEMS: UV LIGHTS, HYDROGEN PEROXIDE AND OZONE

Speaker: Dr Dick Zoutman, Queen's University, Kingston

21 March TUBERCULOSIS INFECTION CONTROL IN HIGH HIV BURDENED COUNTRIES

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