Prevention of Infection in Burns Units

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BRITISH BURN ASSOCIATION BBA

HEALTHCARE INFECTION SOCIETY

British Burn Association (BBA) and Healthcare Infection Society (HIS) Burns working party Members

BBA

- Val Edwards-Jones
- Becky Martin
- Naiem Moiemen
- Al Scott
- Sarah Smailes
- Clare Thomas
- Amber Young

HIS

- Peter Hoffman
- Pauline Jumaa (Chair)
- Louise Teare
- Mike Weinbren
- HIS administrative team

Guidelines

- Evidence-based guidelines to be developed to meet national burns care standards and to facilitate standardisation across units
- Staff should be aware of guidelines and trained in their use
- Guidelines do not replace clinical judgement
- For effective implementation guidelines should be developed with input from users.

Burn injuries

- Thermal
- Scalds
- Electricity
- Chemical
- Radiation
- Inhalational

- Major public health problem globally
- Estimated more than 300,000 deaths per year from fires alone (WHO)
- Mortality rates differ by as much as a factor of 10 across different regions of the world (WHO)
- More than 95% fatal fire-related burns occur in low or middle income countries (WHO)
- Burn-related disabilities and disfigurements, have secondary personal and economic effects on both the victim and their families. (WHO)

Burn injuries are preventable

Grenfell Tower 14 June 2017 London UK

- Approx 80 deaths, more than 70 injuries
- Criticism of fire safety building standards in UK including:
  - Use of flammable cladding
  - Lack of internal and external water sprinklers

Infection in burns patients

- Infection is the leading cause of mortality and morbidity in burns patients
- Up to 75% mortality in burns patients is from infection
- Infection of the burn injury may result in permanent scarring, disfigurement and disability
- These can have serious personal and financial implications for both the burn victim and their dependants.

Infection in burn patients

- Burn wound infection and burn pneumonia are the major infections in burns patients
- Pulmonary infection is the commonest infection in burns patients
- Infection may occur at multiple sites in burns patients
- The risk of burn wound infection relates directly to the extent of the burn

The burn patient and susceptibility to infection

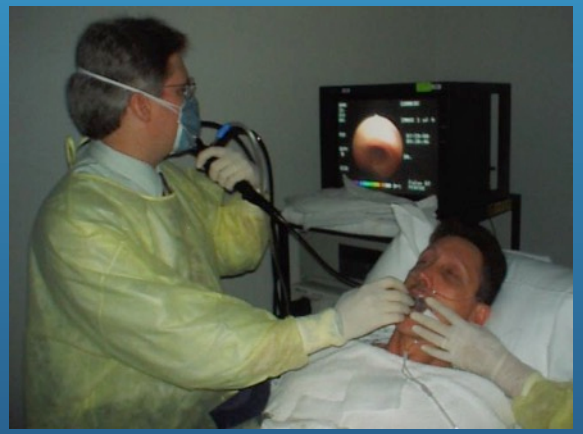
- Immunocompromised especially with burns of >30%
  - Changes in the innate and adaptive immunity lead to susceptibility to colonisation and infection
- Destruction of the skin or mucosal barrier leads to microbial access
- Necrotic tissue and exudate providing an environment which supports microbial growth
- Medical devices for monitoring provide portals for microbial entry
- Use of broad spectrum antimicrobials and risk of multiply-resistant organisms

The risk of of spread of organisms from burn patients to other patients

- Microbial colonisation of burn wounds cannot be prevented
- Burn patients have the potential to disperse organisms into the environment which may infect other patients.
  - Outbreaks reported where burn patients are the source of infection for other patients including non-burn patients
  - Multiply resistant organisms

Infection prevention and control in Burns

- Requires the same strict adherence to infection prevention and control procedures as in healthcare



Infection Prevention and Control in Burns

What is different about burns ?

- The pattern of microorganisms isolated from Burns patient are different of general Intensive Care Unit patients
- A high risk of colonisation/infection with multiply antibiotic resistant organisms.
- Protective and source isolation are both required for severe burns-Susceptibility and dispersal
- Treatment of burn injuries: ventilation, theatre, hydrotherapy

The diagnosis of infection in burn patients is not straightforward

- Based on clinical and laboratory findings but it is not straightforward in burns patients
- Fever often does not correlate well with infection in burn patients.
- Patients with extensive burn injury have physiological changes associated with hypermetabolism including hypo or hyperthermia, tachycardia, tachypnoea, glucose intolerance and mental status which can be mistaken for signs of infection.
- Blood cultures may be contaminated with skin flora from the burn injury.

American Burn Association (ABA) guidelines for diagnosing sepsis in burn patients.

J Burn Care Res. 2007 Nov-Dec;28(6):776-90.

American Burn Association consensus conference to define sepsis and infection in burns.

Greenhalgh DG[1], Saffle JR, Holmes JH 4th, Gamelli RL, Palmieri TL, Horton JW, Tompkins RG, Traber DL, Mozingo DW, Deitch EA, Goodwin CW, Herndon DN, Gallagher JJ, Sanford AP, Jeng JC, Ahrenholz DH, Neely AN, O'Mara MS, Wolf SE, Purdue GF, Garner WL, Yowler CJ, Latenser BA; American Burn Association Consensus Conference on Burn Sepsis and Infection Group.

Expert review of the literature to develop and publish standardized definitions for sepsis and infection-related diagnoses in burn patients.

Standardized definitions are required to improve the capability of performing more meaningful multicenter trials among burn centers.

Correlation of American Burn Association sepsis criteria with the presence of bacteremia in burned patients admitted to the intensive care unit.

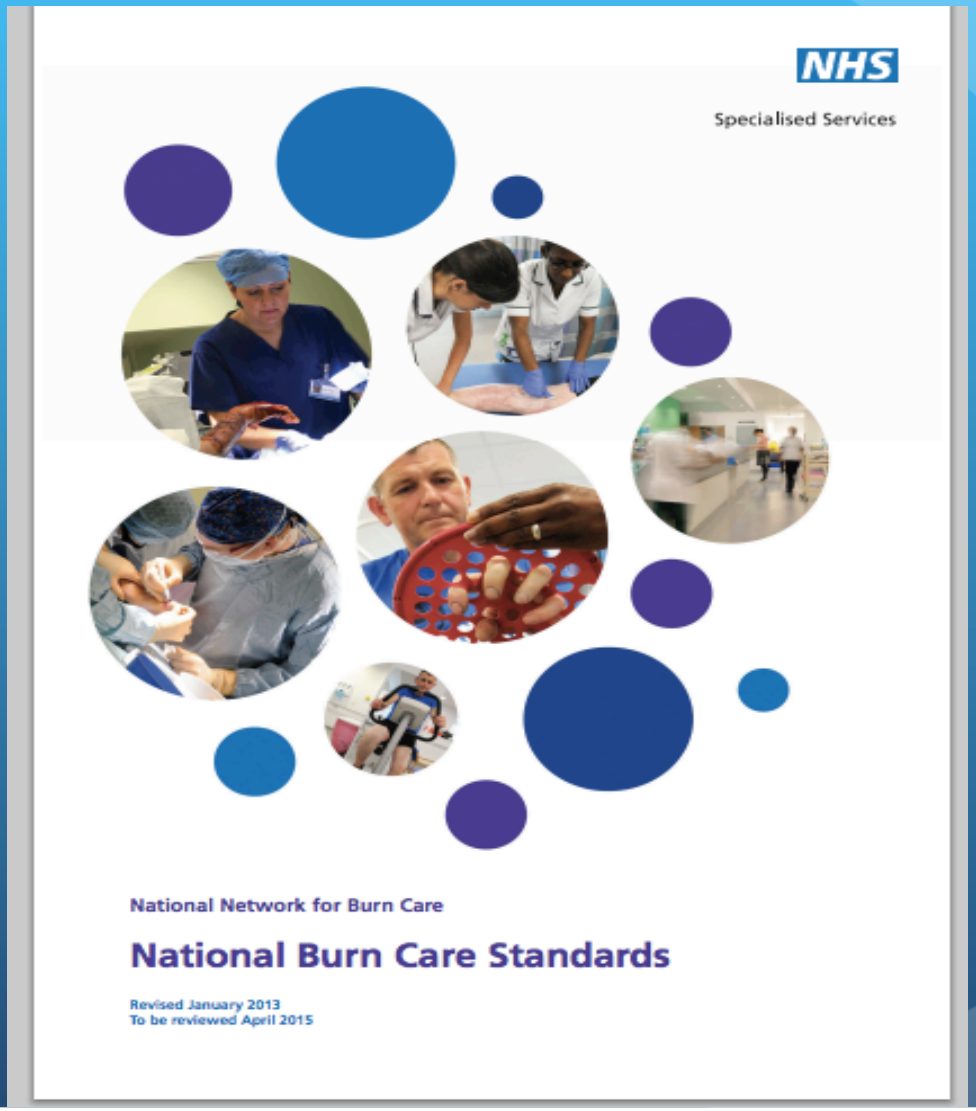
- Hogan BK et al.

J Burn Care Res. 2012; 33: 371-8.

Retrospective chart review

Among severe burn patients, the ABA trigger for sepsis did not correlate strongly with bacteremia

Burn care standards UK 2013



International Society for Burn Injury (ISBI) Practice Guidelines for Burn Care

August 2016 Volume 42, Issue 5, Pages 953–1021

Need for evidence based-guidance

Davies A, Spickett-Jones F, Brock P, Coy K, Young A

Variations in guideline use and practice relating to diagnosis and management of infection in paediatric burns services in England and Wales: A national survey

Burns 2017; 43: 215-222

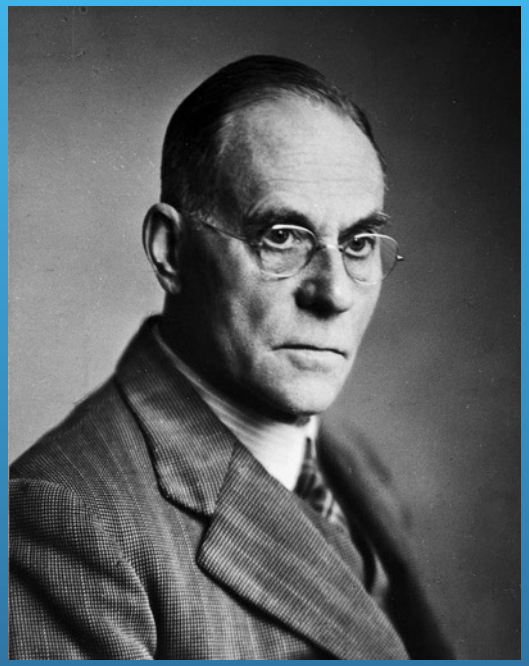
Staff from less than half the responding services reported that they had guidance for diagnosis and treatment of burns. There was variation both within services and between services about awareness of available guidance.

Challenges for setting evidence-based standards for infection control in burns patients

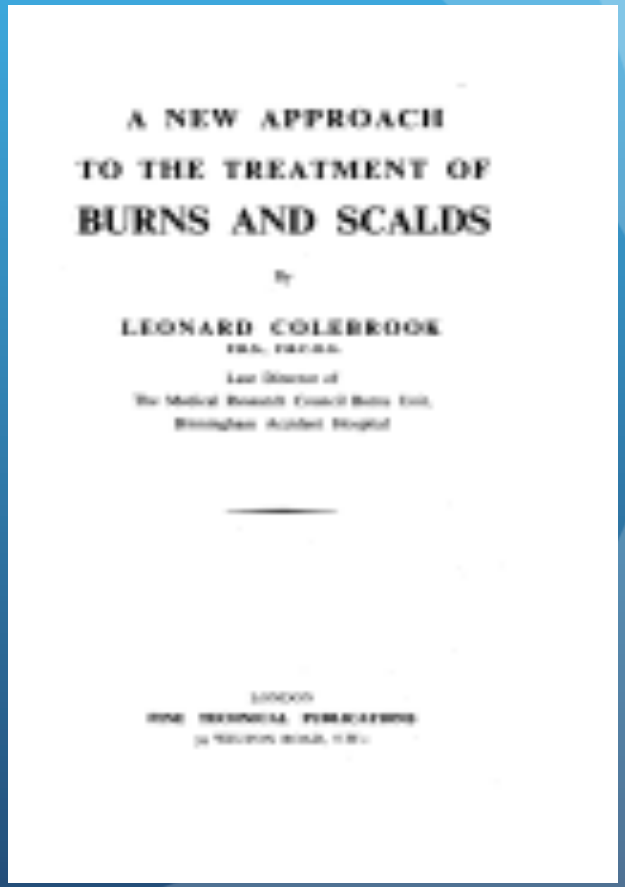
- Lack of high quality evidence
  - Methodological challenges in designing infection control trials
  - Challenges with standardised definitions of infection in burns patients (there are none)

No established standards for infection prevention and control in burns patients

Principles of prevention of infection in Burns Units



- Leonard Colebrook (1883-1967)


A NEW APPROACH
TO THE TREATMENT OF
BURNS AND SCALDS
By
LEONARD COLEBROOK

'What a nice fire'

'Yes, but where is your fireguard?'

Reducing the incidence of streptococcal infection-Colebrooke

- The incidence of streptococcal infection was reduced from 80-90% to 40-50% by aseptic dressing techniques.
- When penicillin cream and an air-conditioned dressing room were added to the procedure that the incidence of infection was reduced to 5.4%

Colebrooke L , Clark AM, Gibson T, Todd JP. Studies of burns and scalds, Part II. The control of infection in burns and scalds. *Spec. Rep. Ser. Med. Res. Coun.*(Lond.) (1944) No. 249

Bourdillon RB and Colebrook L. Air hygiene in dressing rooms for burns or major wounds. Lancet (1946) 1 561, 601

Colebrooke Let al. The control of infection in burns. Lancet (1948) 1 683

Prophylactic antibiotics?

Cochrane Database Syst Rev. 2013 Jun 6;(6):CD008738. doi: 10.1002/14651858.CD008738.pub2.

Antibiotic prophylaxis for preventing burn wound infection.

Barajas-Nava LA[1], López-Alcalde J, Roqué i Figuls M, Solà I, Bonfill Cosp X.

Author information

1 Iberoamerican Cochrane Centre, Institute of Biomedical Research (IIB Sant Pau), Barcelona, Spain. leticia.barajas@cochrane.es.

Abstract

BACKGROUND: Infection of burn wounds is a serious problem because it can delay healing, increase scarring and invasive infection may result in the death of the patient. Antibiotic prophylaxis is one of several interventions that may prevent burn wound infection and protect the burned patient from invasive infections.

OBJECTIVES: To assess the effects of antibiotic prophylaxis on rates of burn wound infection.

AUTHORS' CONCLUSIONS: The conclusions we are able to draw regarding the effects of prophylactic antibiotics in people with burns are limited by the volume and quality of the existing research (largely small numbers of small studies at unclear or high risk of bias for each comparison). The largest volume of evidence suggests that topical silver sulfadiazine is associated with a significant increase in rates of burn wound infection and increased length of hospital stay compared with dressings or skin substitutes; this evidence is at unclear or high risk of bias. Currently the effects of other forms of antibiotic prophylaxis on burn wound infection are unclear. One small study reported a reduction in incidence of pneumonia associated with a specific systematic antibiotic regimen.

No firm conclusions

Digestive decontamination

Rubio-Regidor M, Martín-Pellicer A, Silvestri L, van Saene HKF, Lorente JA, de la Cal MA.

Burns. 2017

Digestive decontamination in burn patients: A systematic review of randomized clinical trials and observational studies.

To assess the effect of selective digestive decontamination (SDD) or non-absorbable enteral antibiotics (EA) on mortality, the incidence of infection and its adverse effects in burn patients.

None of the studies reported an increase in antibiotic resistance.
In one RCT SDD was associated to an increase in MRSA infections, which was controlled with enteral vancomycin.

Conclusions: SDD and EA have shown a beneficial effect in burn patients. Both practices are safe. Higher quality RCTs required.

No firm conclusions

Which antiseptics?

Cochrane Database Syst Rev. 2017 Jul 12;7:CD011821. doi: 10.1002/14651858.CD011821.pub2.

Antiseptics for burns.

Norman G[1], Christie J, Liu Z, Westby MJ, Jefferies JM, Hudson T, Edwards J, Mohapatra DP, Hassan IA, Dumville JC.

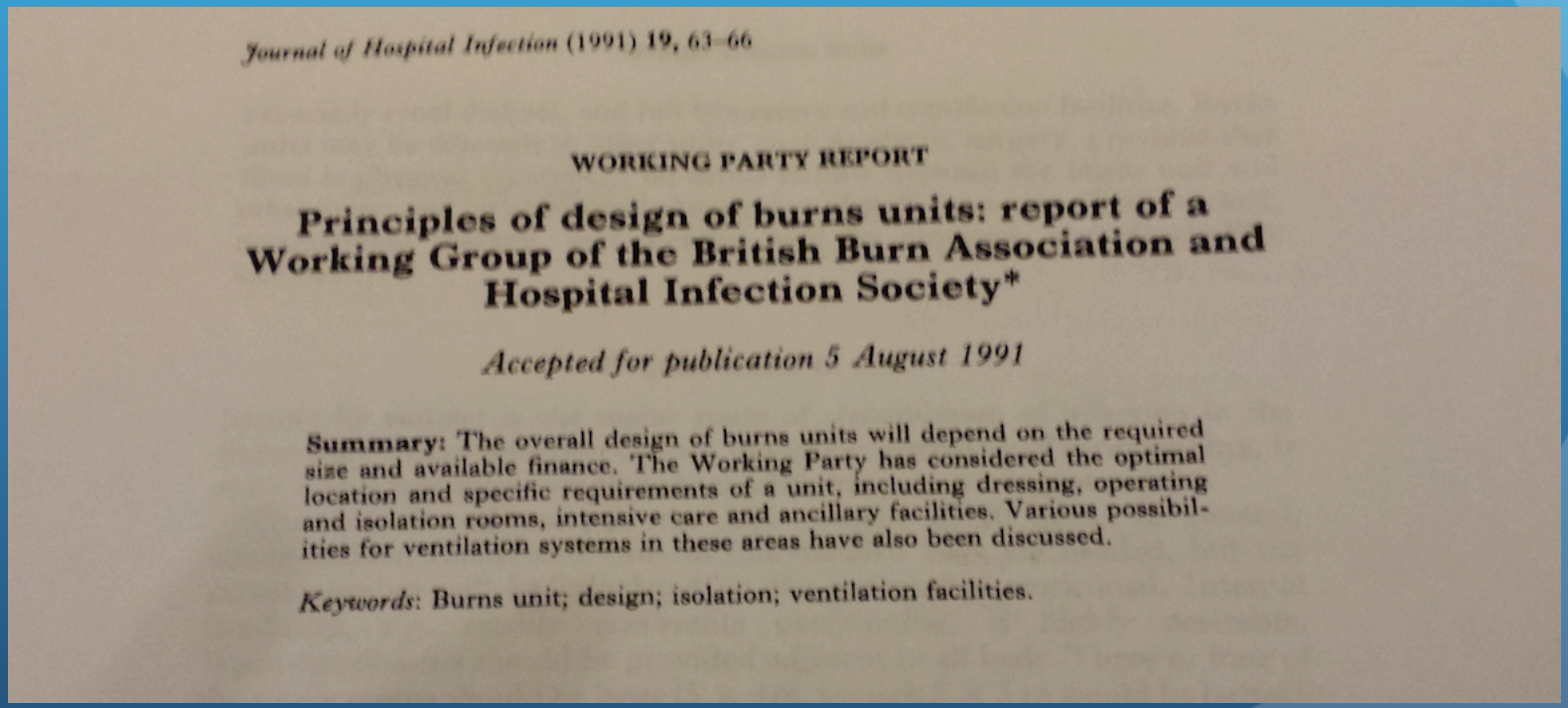
⊕ Author information

AUTHORS' CONCLUSIONS: It was often uncertain whether antiseptics were associated with any difference in healing, infections, or other outcomes. Where there is moderate or high certainty evidence, decision makers need to consider the applicability of the evidence from the comparison to their patients. Reporting was poor, to the extent that we are not confident that most trials are free from risk of bias.

No firm conclusions

THE JOURNAL OF HOSPITAL INFECTION
The Official Journal of the Healthcare Infection Society

Principles of design of burns units: report of a Working Group of the British Burn Association and Hospital Infection Society.



Journal of Hospital Infection (1991) **19**, 63–66

WORKING PARTY REPORT

Principles of design of burns units: report of a Working Group of the British Burn Association and Hospital Infection Society*

Accepted for publication 5 August 1991

Summary: The overall design of burns units will depend on the required size and available finance. The Working Party has considered the optimal location and specific requirements of a unit, including dressing, operating and isolation rooms, intensive care and ancillary facilities. Various possibilities for ventilation systems in these areas have also been discussed.

Keywords: Burns unit; design; isolation; ventilation facilities.

Layout and design

- Dedicated facilities and equipment
- Physical separation of patients
- Proximity of theatres and intensive care beds ‘50m’
- Dedicated burns theatre
- Ideally dedicated Intensive Care Unit (ICU) beds separate from other ICU patients and segregation of staff

Probably not practical for most existing units but should be possible for new builds

Cleaning and disinfection

- The challenge of decontaminating the environment between patients to prevent transmission of infection
- Failure to adequately decontaminate the environment can result in onward transmission of organisms

Experience with burns patient infected with multiply resistant organisms and cleaning the environment

Environmental decontamination following occupancy of a burns patient with multiple carbapenemase-resistant organisms

Garvey MI, Bradley CW, Jumaa P

J Hosp Infect 2016 136-140

Patient History

- Burn patient transferred to UK for humanitarian reasons following 50% SBA burn injury (upper body, arms and face) sustained 10 days previously
- Went to theatre for debridement burned and necrotic skin
- Died of sepsis 18hours after admission
- Patient known to be infected with carbapenem-resistant organisms

Cleaning regimen

Routine clean for infected patient

- Cleaning and disinfection with hypochlorite solution and detergent (Chlorclean Guest Medical, UK)
- 6% Hydrogen peroxide H_2O_2 misting (Oxypharm UK)

Assessment of room immediately following cleaning

Satisfactory

- Visually clean- ‘Macroscopically clean’
- Cleaning procedure completed in line with local guidance

Was it microscopically clean?

- Sampling of multiple clean touch points in vicinity of patient and communal area surfaces
- 15 surfaces tested
- Vicinity of patient
- Communal areas

Results

Vicinity of patient

CPO's from: Ventilator, drip stands, extract vent, ventilator monitor; floor

No CPO's Bed frame

Communal areas

CPO's from: Sink tap handles, Sink, window sill

No CPO's: Notes trolley; Shower trolley; Door handle of room Handwash sink Door handle of ante room

Second clean before room occupied

- Detergent disinfection/Chlor clean
- Steam cleaning
- Double strength hypochlorite
- Hydrogen peroxide 12%

Resampling

- No CPO’s isolated

Learning

- Contaminated ICU room after occupation burn room for approximately 14 hours with an infected patient and who was in theatre for 4 hours (Theatre had been cleaned with the same procedures but no sampling was performed)
- Effective cleaning is key to prevent transmission
- More resources needed to include routine assessment of cleaning and education of cleaning staff

Near miss?

Unrealistic expectations of cleaning staff ?

Risks from other equipment

Risk of toys

Rev Paul Pediatr. 2014;32(3):151–156.

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ORIGINAL ARTICLE

Sensitivity profile of *Staphylococcus spp.* and *Streptococcus spp.* isolated from toys used in a teaching hospital playroom☆

Vanessa Stolf Boretti*, Renata Nunes Corrêa, Silvana Soléo Ferreira dos Santos, Mariella Vieira Pereira Leão, Célia Regina Gonçalves e Silva

Universidade de Taubaté (UNITAU), Taubaté, SP, Brazil

Received 12 December 2013; accepted 18 March 2014

Rev Paul Pediatr. 2014;32(3):149–150.

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EDITORIAL

Toys from hospital playrooms as a source of pathogens in nosocomial infections

Brinquedos em brinquedotecas como uma fonte de microrganismos patogênicos para as infecções hospitalares

Sonia Regina Testa da Silva Ramos*

Universidade de São Paulo, São Paulo (USP), SP, Brazil

"...it is play that is universal, and that belongs to health: playing facilitates growth and therefore health."
Winnicott

Playing is part of the child's life, and it is through play that the child often expresses nonverbal feelings. This form of expression is of great importance when subjected to injuries, such as hospitalization. To deprive the child of her language is to worsen the injury. Thus, an appropriate space for playing within the hospital environment is highly recommended. In Brazil, since 2005, bers and, therefore, greater contact with potentially contaminated hands and utensils. Moreover, infectious causes very often predominate in pediatric hospitalizations.[5]

Although the increased vulnerability of children and pathogen exposure are well known, the role of contamination of surfaces and particularly of toys has received little attention from hospital infection control and research teams and it is considered a priority.[6,7]

Boretti *et al*,[8] in an article published in the present issue of this journal, showed that microorganisms of the *Staphylococcus* genus, both coagulase-negative and posi-

Water-assisted dressing changes ‘Hydrotherapy’

- The practice of burn wound cleaning and hydrotherapy varies considerably.
- Opinion is divided on risk versus benefits

The purpose of hydrotherapy is to :

- Reduce the microbial load
- Facilitate separation of the eschar
- Wash of exudate and topical creams
- Loosen adherent dressings
- Facilitate physiotherapy and improve patient comfort

Risks of hydrotherapy-Water quality

- Survey UK 2012 Kunsdishora et al.
- 5/21 services used sterile bottled water/saline
- Tap water 13/21

Risks of hydrotherapy- Equipment

- Outbreaks traced to contaminated hydrotherapy equipment
  - Hand held shower spray
  - Stretcher

Sink design

Photo: Courtesy M Weinbren, P Hoffman 2017

Shower head showing contamination

Photo courtesy of
M Weinbren, P Hoffman 2017

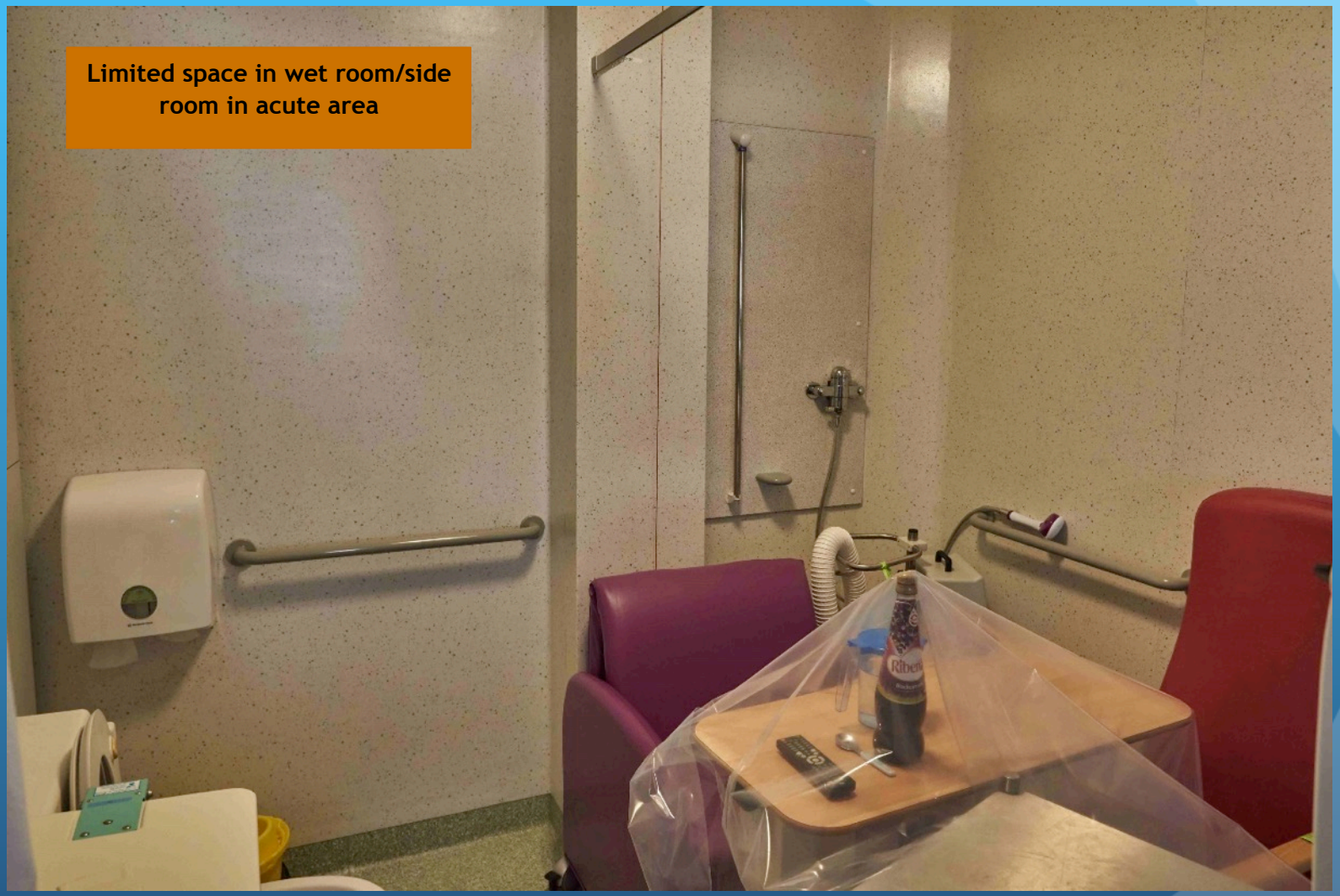


Photo courtesy of M Weinbren 2017

Water-risk of contamination of equipment

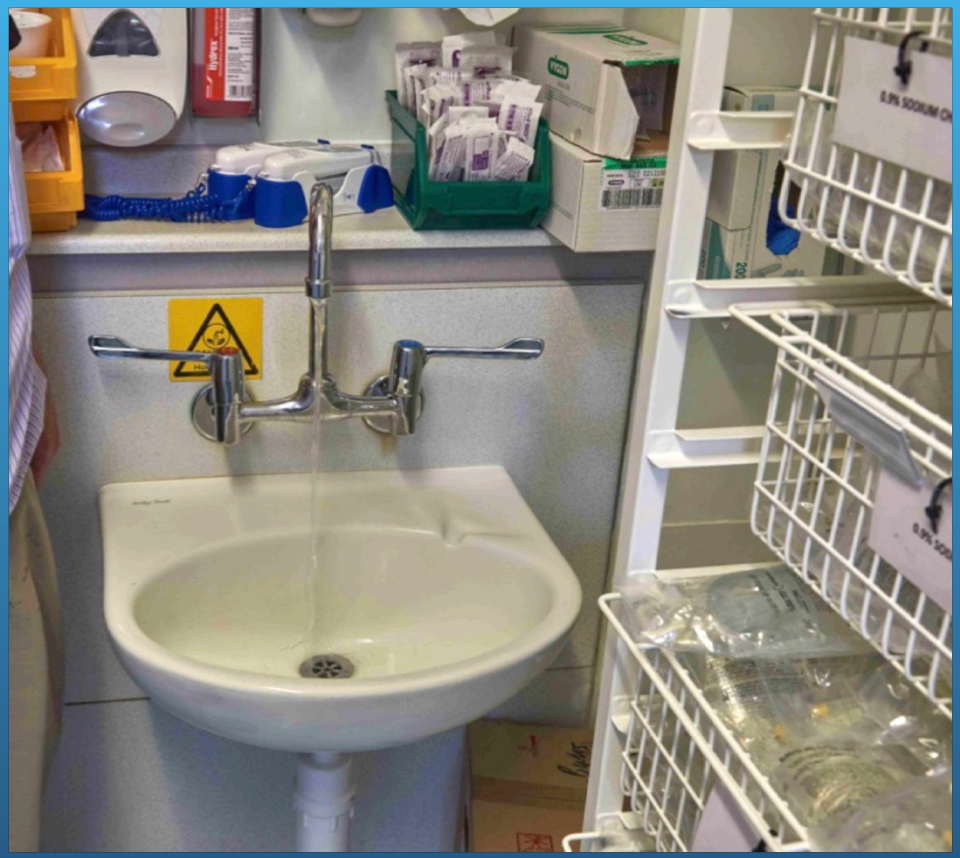
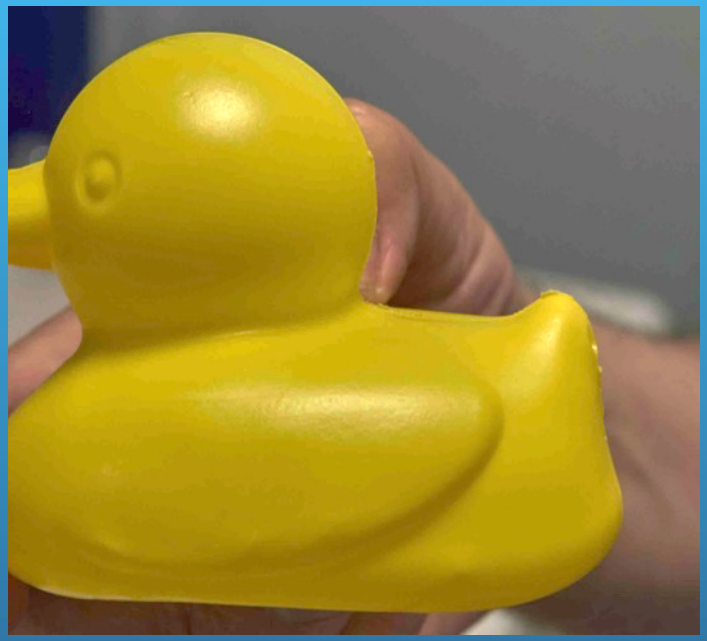


Photo courtesy of M Wei

Hollow plastic bath toys



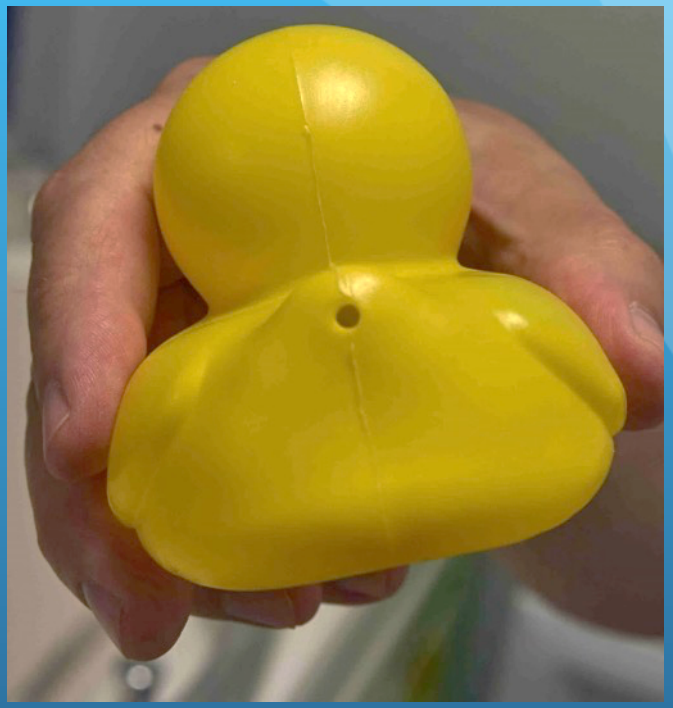


Photo courtesy of M Weinbren, P Hoffman 2017

Theatres and ventilation for burns

- Conventionally ventilated theatres have positive pressure ventilation
  - The dilution of contaminated skin scales from staff in the theatre and prep room to reduce contamination of the wound and on exposed instruments
  - To prevent contaminated air from areas surrounding the theatre

Are these factors applicable to burn patients?

- The normal skin flora of staff is not a significant risk to burns patients
- If the patients are in negative pressure rooms in the adjacent ward, the air will not have significant contamination

Main infection risks in Burns theatres

- Containment of airborne contamination during procedures to stop contamination of communal areas and patient rooms
- Contamination of sequential patients in theatre

Proposal for the design of new burns theatres

Negative pressure achieves both of these

Isolation rooms

Isolation facilities required

Burns wards mainly single rooms but there will be some common areas

Isolation rooms-3 choices

- Positive pressure
  - Risk of transmission of airborne organisms into the communal areas
- Positive pressure ventilated lobby
  - High air movement and risk of cooling by evaporation
- Negative pressure
  - Contains dispersion of airborne organisms from the room

Prevention of Infection in Burn patients

Clinical management of the burn injury

- Extent of burn surface area and depth-minor versus severe
- Nature of the burn
- Antimicrobials and dressings

Design and management of the burns unit

- Segregation and containment
- Strict adherence to routine infection prevention control procedures
  - Layout and design
  - Cleaning and environment
  - Water in burns services
  - Theatres and Ventilation
  - Isolation rooms

Conclusions

- Prevention of infection is key to improve the outcome of burn injuries
- Burns infection prevention control standards are needed
- Because of the lack of high quality evidence, these will be pragmatic based on current experience and what is considered best practice
- The recommendations for the design of burns units are likely to be more applicable to new build burns services rather than existing premises

Thank you