INFECTION CONTROL in PAEDIATRICS:

*a low-resource (African) perspective*

FIDSSA 2015

Angela Dramowski

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Department of Paediatrics and Child Health, Stellenbosch University
• I have nothing to disclose.
Red Cross War Memorial Children's Hospital
Cape Town, South Africa
http://www.jhsph.edu/sebin/x/m/hospital.jpg

Gertrude Children’s Hospital, Kenya
http://www.gerties.org/index.php

Children’s Cancer Hospital Egypt
www.57357.com

Abu El Reesh Children’s Hospital, Egypt
www.dailynewsegpyt.com
What’s different about IC in kids?

- Immature immunity (innate, acquired and vaccine-derived)
- Different behavioural profile
- Caregivers
- More handling and staff contact
- Infant feeding
- Respiratory and gastrointestinal viruses
What’s different about IC in Africa?

Figure 2. Risk factors contributing to healthcare-associated infection (HCAI) in sub-Saharan Africa (SSA). HIV, human immunodeficiency virus; PPE, personal protective equipment.
Core elements of a paediatric IC programme

- HAI surveillance & outbreaks
- Hand hygiene and PPE usage
- Staff health & education
- Safe preparation of feeds
- Behaviour change & institutional climate
- Catheter care
- Patient isolation and triage
- Environmental cleaning
Why bother to do surveillance?

Measure of the safety and quality of care
Determine intervention priorities and set targets
Benchmark against other units, institutions, countries
Negotiate for additional IC resources
In some countries a legal requirement
SA National Core Standards: require surveillance for HAI

Singh, 2014
Rates of HAI in European and American children

“neither present nor incubating at the time of admission”

PPS at 183 US hospitals using standard (NHSN) definitions
Adults (86%), paediatrics and neonates (14%)
Prevalence of paediatric HAI 0-17 years = 3.4%

Zingg, ECDC at 32nd ESPID conference 2014

Magill NEJM, 2014
Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis

Benedetta Allegranzi, Sepideh Bagheri Nejad, Christophe Combescure, Wilco Graafmans, Homa Attar, Liam Donaldson, Didier Pittet

Figure 2: Number of studies reporting health-care-associated infection in developing countries, 1995–2008
Size of dots indicates number of studies. Map created with ARCVIEW (version 9.3.1; ESRI, Redlands, CA, USA), using WHO criteria for official borders and disputed borders.

Overall HAI prevalence double; ICU HAI rates triple that of USAs

Allegranzi Lancet 2011
Why is paediatric HAI underreported?

Lack of:
- microbiological diagnostic capacity
- structured IPC programmes and expertise
- surveillance and reporting mechanisms
- legislation mandating HAI reporting
- patient safety focus and standards of care.

Applies even in relatively well-resourced African countries.

Nosocomial infections in Black South African Children.

COTTON, MARK F. FCP (PAED)(SA); BERKOWITZ, FRANK E. FCP (PAED)(SA); BERKOWITZ, ZAHAVA MSC; BECKER, PIET J. PHD; HENEN, CLAIRE FFPATH(SA)
## Paediatric HAI in SA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5 month cohort, any HAI</td>
<td>single day PPS, 4 HAI types</td>
<td>monthly PPS x 6, any HAI</td>
<td></td>
</tr>
<tr>
<td>HAI prevalence</td>
<td>14.3%</td>
<td>16.5%</td>
<td>21.2%</td>
</tr>
</tbody>
</table>

### Spectrum of paediatric HAI

<table>
<thead>
<tr>
<th>Category</th>
<th>Proportion of HAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloodstream infection</td>
<td>62</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>40</td>
</tr>
<tr>
<td>Respiratory tract infection</td>
<td>18</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>52</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>30</td>
</tr>
<tr>
<td>Skin &amp; soft tissue</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
</tr>
</tbody>
</table>

HAI prevalence:
- Cotton PIDJ 1989: 14.3%
- Duse unpublished 2005: 16.5%
- Dramowski unpublished 2014: 21.2%
Hospital-acquired bloodstream infections (BSI) in African children

Aiken (Kenya) 1.0 per 1000 patient days
Blomberg (Tanzania) 7.6 per 100 admissions
Dramowski (S. Africa) 1.6 per 1000 patient days (paeds)
Dramowski (S. Africa) 3.9 per 1000 patient days (neos)

BSI = only 3% of HAI in US

VAP ventilator-associated pneumonia
BSI bloodstream infection
CAUTI catheter UTI
CLABSI central line associated BSI
SSI surgical site infection
NV nosocomial viral infection

Courtesy: S. Coffin CHOP
High contamination rates, declining BSI rates

Figure 1 Trends in bloodstream infection, pathogen and contamination rates (2008–2013). BSI rates (blue) declined significantly (from 4.6 to 3.1 per 1000 patient days; Chi square for trend p = 0.02). Blood culture contamination rates (grey) were high (1123/17001 [6.6%]; 95% CI 6.4-6.8%) exceeding pathogen yield (orange) and increased over time (p = 0.003).
HAI surveillance assists antimicrobial stewardship

Antimicrobial resistance in selected BSI pathogens (%)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Community BSI</th>
<th>Hospital BSI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>15.3</td>
<td>65</td>
<td>0.0001</td>
</tr>
<tr>
<td>MDR A. baumannii</td>
<td>25</td>
<td>72.4</td>
<td>0.01</td>
</tr>
<tr>
<td>ESBL K. pneumoniae</td>
<td>75.7</td>
<td>78.3</td>
<td>0.82</td>
</tr>
<tr>
<td>ESBL E. coli</td>
<td>11.7</td>
<td>21.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Pooled resistance for 4 pathogens</td>
<td>25</td>
<td>65.8</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
You only find what you’re looking for...

- Pseudomonas
- MRSA
- Klebsiella
- Enterobacter
- Acinetobacter

**BSI rate per 1000 patient days**

**2012 NICU Serratia outbreak**

Dramowski Paeds Int Child Health 2015
Neonatal hospital-acquired BSI (Tygerberg)

BSI rate per 1000 patient days

- Serratia
- Pseudomonas
- MRSA
- Klebsiella
- Enterobacter
- Acinetobacter

Dramowski Paeds Int Child Health 2015
Core elements of a paediatric IC programme

- HAI surveillance & outbreaks
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- Safe preparation of feeds
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- Hand hygiene and PPE usage
- Behaviour change & institutional climate
Device-associated infections in PICU/NICU

Patrick Pediatrics 2014

Rosenthal ICHE 2013

**Table:**

<table>
<thead>
<tr>
<th>TCH NICU CLABSI</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>2012-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line days</td>
<td>1633</td>
<td>1554</td>
<td>1739</td>
<td>4926</td>
</tr>
<tr>
<td>CLABSI events</td>
<td>8</td>
<td>6</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>CLABSI rate</td>
<td>4.9</td>
<td>3.9</td>
<td>6.9</td>
<td><strong>5.3</strong></td>
</tr>
</tbody>
</table>

**Figure 1.** Evolution of central line–associated bloodstream infection rates in each neonatal intensive care unit (NICU).
CLABSI bundle elements: what’s changed?

- Hand hygiene
- Maximal barrier precautions
- Chlorhexidine skin antisepsis
- Catheter site selection
- Daily review of line necessity
- Sterile access
- Line securement
- Sterile dressings
CLABSI: the proverbial tip of the iceberg

• Multi-dose vials with limited use of claves
• Poor line care (central and peripheral)
• Very limited implementation of catheter bundles
• High rates of needlestick injury
Daily chlorhexidine gluconate (CHG) bathing

10 US PICU, RCT crossover with 4947 admissions
Reduced BSI rates in 10 US PICU (3.2 vs 4.9 / 1000 days)
Reduced CLABSI rates
Driven by reduction in gram positive BSI
Few CHG skin reactions 1/1000 days

RCT of Indian neonates (70 per arm)
0.25% CHG vs saline solution wipes daily
Blood cultures + skin swabs D1, D3, D7
BSI rate 3.5 vs 6.9% (NS)
Gram negative predominance

Milstone Lancet 2013

Gupta J Mat-Fet Neo Med 2015
Core elements of a paediatric IC programme

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- Staff health & education
- Safe preparation of feeds
- Behaviour change & institutional climate
- HAI surveillance & outbreaks
# Neonatal outbreaks at Tygerberg Hospital (2008-2014)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Year</th>
<th>Infections</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotavirus 1</td>
<td>2008</td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td>Rotavirus 2</td>
<td>2010</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Rotavirus 3</td>
<td>2015</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>H1N1 Influenza</td>
<td>2009</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Measles</td>
<td>2010</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Methicillin resistant <em>Staphylococcus aureus</em> (MRSA)</td>
<td>2012</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Methicillin resistant <em>Staphylococcus aureus</em> (MRSA)</td>
<td>2014</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Vancomycin-resistant enterococcus (VRE)</td>
<td>2013</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>2012</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>2014</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>2014</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Outbreak control measures: containment vs closure

Use of ward closure to control outbreaks among hospitalized patients in acute care settings: a systematic review

H. Wong¹,², K. Eso¹,², A. Ip¹,², J. Jones¹,², Y. Kwon², S. Powelson², J. de Grood¹,², R. Geransar¹,², M. Santana¹,², AM. Joffe³,⁴, G. Taylor³,⁴, B. Missaghi²,³, C. Pearce³, W. Ghali¹,²,³, J. Conly¹,²,³*

cohort sick babies
use incubators for isolation
restrict staff movement
designated staffing
stop movement of babies
education parents & staff
sick staff to stay at home
Syndromic isolation: proactive vs reactive

Empiric use of transmission-based precautions on first signs/symptoms of infection
e.g. rash for HSV, loose stools for rotavirus, RDS for RSV

Take appropriate specimens and de-isolate if negative

Assumes a sufficient number of isolation beds and staffing
Outbreak control measures: staff screening

May be helpful for MRSA, CRE outbreaks

Especially is suspected ‘super-shedders’

Very unpopular, expensive and labour intensive!

For MRSA Need to screen all clinical staff with 1 x nasal swab

Decolonisation regimen for MRSA:

mupirocin ointment intra-nasally bd +

daily chlorhexidine gluconate hair and body washes x 7 days

Repeat screening (at least 2 sites) post decolonisation

Treating Parents to Reduce NICU Transmission of Staphylococcus aureus (TREAT PARENTS) trial: protocol of a multisite randomised, double-blind, placebo-controlled trial
Outbreak control measures: environmental sampling

Not always required
Can be expensive, misleading
Difficult to standardise
Low yield

Suggestions:
Culture only after line list & observation steps
Culture things only if likely to be a route of transmission
Think about bacterial growth preferences
Discuss with the laboratory before screening
Reprocessing of single use medical devices

Common practice to recycle single use items
Lack of training in decontamination & sterilization

Potential for outbreaks
e.g. *Serratia marcescens* in NICU
source = reprocessed (disposable) ventilator tubing

Intervention:
disposable single use vent. circuits
washer disinfector machine condemned
Staff in CSSD were retrained
Pathogens

Query: "Neonatal"
Grouped by: SP
Result:
347 articles altogether (100%)
75 rows in following table

<table>
<thead>
<tr>
<th>SP</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td>65</td>
<td>18.73</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>51</td>
<td>14.70</td>
</tr>
<tr>
<td>Serratia marcescens</td>
<td>39</td>
<td>11.24</td>
</tr>
<tr>
<td>&lt;No value contained in article&gt;</td>
<td>22</td>
<td>6.34</td>
</tr>
<tr>
<td>Enterobacter cloacae</td>
<td>20</td>
<td>5.76</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>19</td>
<td>5.48</td>
</tr>
<tr>
<td>Acinetobacter baumannii</td>
<td>13</td>
<td>3.75</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>10</td>
<td>2.88</td>
</tr>
<tr>
<td>Candida parapsilosis</td>
<td>7</td>
<td>2.02</td>
</tr>
<tr>
<td>Enterovirus B</td>
<td>7</td>
<td>2.02</td>
</tr>
<tr>
<td>Influenza A</td>
<td>7</td>
<td>2.02</td>
</tr>
</tbody>
</table>

Source

Querystring: "Neonatal"
Grouped by: SC
Result:
347 articles altogether (100%)
8 rows in following table

<table>
<thead>
<tr>
<th>SC</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>191</td>
<td>55.04</td>
</tr>
<tr>
<td>Patient</td>
<td>69</td>
<td>19.88</td>
</tr>
<tr>
<td>Personnel</td>
<td>34</td>
<td>9.80</td>
</tr>
<tr>
<td>Environment</td>
<td>25</td>
<td>7.20</td>
</tr>
<tr>
<td>Medical equipment/device</td>
<td>19</td>
<td>5.48</td>
</tr>
<tr>
<td>Care equipment</td>
<td>13</td>
<td>3.75</td>
</tr>
<tr>
<td>Drug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Control measures

<table>
<thead>
<tr>
<th>ME</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient screening/surveillance</td>
<td>327</td>
<td>60.89</td>
</tr>
<tr>
<td>Personnel screening/surveillance</td>
<td>250</td>
<td>46.55</td>
</tr>
<tr>
<td>Hand washing/hand disinfection</td>
<td>248</td>
<td>46.18</td>
</tr>
<tr>
<td>Isolation/cohorting</td>
<td>239</td>
<td>44.51</td>
</tr>
<tr>
<td>(Change) antibiotic therapy</td>
<td>236</td>
<td>43.95</td>
</tr>
<tr>
<td>Modification of care/equipment</td>
<td>183</td>
<td>34.08</td>
</tr>
<tr>
<td>Disinfection/Sterilization</td>
<td>173</td>
<td>32.22</td>
</tr>
<tr>
<td>Protective clothing</td>
<td>137</td>
<td>25.51</td>
</tr>
<tr>
<td>Personnel training</td>
<td>111</td>
<td>20.67</td>
</tr>
<tr>
<td>Closure of affected location</td>
<td>79</td>
<td>14.71</td>
</tr>
<tr>
<td>Environmental screening</td>
<td>49</td>
<td>9.12</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>44</td>
<td>8.19</td>
</tr>
<tr>
<td>Restriction of workload</td>
<td>49</td>
<td>7.45</td>
</tr>
</tbody>
</table>

May 2015: 3241 outbreaks, among them 537 neonatal outbreaks
Core elements of a paediatric IC programme

- HAI surveillance & outbreaks
- Catheter care
- Patient isolation and triage
- Environmental cleaning
- Staff health & education
- Safe preparation of feeds
- Hand hygiene and PPE usage
- Behaviour change & institutional climate

Image of a baby in a hospital setting.
Infant feeds as a risk factor for HAI

- Lack of standardized protocols & training
- Ageing and poorly maintained equipment
- Regular EBM exposures: non-maternal HIV
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- Behaviour change & institutional climate
# Environmental cleaning

## Table 1: Persistence of clinically relevant bacteria on dry inanimate surfaces.

<table>
<thead>
<tr>
<th>Type of bacterium</th>
<th>Duration of persistence (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp.</td>
<td>3 days to 5 months</td>
</tr>
<tr>
<td><em>Bordetella pertussis</em></td>
<td>3 – 5 days</td>
</tr>
<tr>
<td><em>Campylobacter jejuni</em></td>
<td>up to 6 days</td>
</tr>
<tr>
<td><em>Clostridium difficile</em> (spores)</td>
<td>5 months</td>
</tr>
<tr>
<td><em>Chlamydia pneumoniae, C. trachomatis</em></td>
<td>≤ 30 hours</td>
</tr>
<tr>
<td><em>Chlamydia psittaci</em></td>
<td>15 days</td>
</tr>
<tr>
<td><em>Corynebacterium diphtheriae</em></td>
<td>7 days – 6 months</td>
</tr>
<tr>
<td><em>Corynebacterium pseudotuberculosis</em></td>
<td>1 – 8 days</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>1.5 hours – 16 months</td>
</tr>
<tr>
<td><em>Enterococcus spp. including VRE and VSE</em></td>
<td>5 days – 4 months</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em></td>
<td>12 days</td>
</tr>
<tr>
<td><em>Helicobacter pylori</em></td>
<td>≤ 90 minutes</td>
</tr>
<tr>
<td><em>Klebsiella spp.</em></td>
<td>2 hours to &gt; 30 months</td>
</tr>
<tr>
<td><em>Listeria spp.</em></td>
<td>1 day – months</td>
</tr>
<tr>
<td><em>Mycobacterium bovis</em></td>
<td>&gt; 2 months</td>
</tr>
<tr>
<td><em>Mycobacterium tuberculosis</em></td>
<td>1 day – 4 months</td>
</tr>
<tr>
<td><em>Neisseria gonorrhoeae</em></td>
<td>1 – 3 days</td>
</tr>
<tr>
<td><em>Proteus vulgaris</em></td>
<td>1 – 2 days</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>6 hours – 16 months; on dry floor: 5 weeks</td>
</tr>
<tr>
<td><em>Salmonella typhi</em></td>
<td>6 hours – 4 weeks</td>
</tr>
<tr>
<td><em>Salmonella typhimurium</em></td>
<td>10 days – 4.2 years</td>
</tr>
<tr>
<td><em>Salmonella spp.</em></td>
<td>1 day</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>3 days – 2 months; on dry floor: 5 weeks</td>
</tr>
<tr>
<td><em>Shigella spp.</em></td>
<td>2 days – 5 months</td>
</tr>
<tr>
<td><em>Staphylococcus aureus, including MRSA</em></td>
<td>7 days – 7 months</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em></td>
<td>1 – 20 days</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em></td>
<td>3 days – 6.5 months</td>
</tr>
<tr>
<td><em>Vibrio cholerae</em></td>
<td>1 – 7 days</td>
</tr>
</tbody>
</table>
Evaluation study of environmental cleaning

Known risk of pathogen transmission from prior room occupant

Paediatric isolation rooms for terminal cleaning

3 modes of evaluation (pre and post-cleaning):

- Quantitative microbiological surface cultures
- Ultraviolet gel surface markers
- ATP bioluminescence measurements
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Hand hygiene: it’s no joke!

“Sounds like an obsessive-compulsive disorder. Normal people don’t spend that much time washing their hands.”
Personal protective equipment

Contact Precautions

VISITORS/ VISITING STAFF

STOP!

REPORT TO NURSE IN CHARGE BEFORE ENTERING THIS ROOM

HAND Use alcohol rub or wash hands before leaving the room

Aprons/Gloves Wear an apron when entering the room. Wear gloves for direct or indirect contact with the patient or excretions and secretions

Door Keep door closed at all times if patient in isolation

Before leaving Decontaminate equipment when it leaves the room. Discard gloves and apron and carry out hand hygiene before leaving the room

Airborne Precautions

VISITORS/ VISITING STAFF

STOP!

REPORT TO NURSE IN CHARGE BEFORE ENTERING THIS ROOM

HAND Use alcohol rub or wash hands before leaving the room

Respirator Wear N95 respirator (FFP3) for MDR XDR-TB patients Aerosol generating procedures

Aprons/Gloves Wear an apron when entering the room. Wear gloves for direct or indirect contact with the patient or excretions and secretions

Door Keep door closed at all times

Before leaving Decontaminate equipment when it leaves the room. Discard gloves, apron and mask. Carry out hand hygiene before leaving the room

Droplet Precautions

VISITORS/ VISITING STAFF

STOP!

REPORT TO NURSE IN CHARGE BEFORE ENTERING THIS ROOM

HAND Use alcohol rub or wash hands before leaving the room

Mask Wear water resistant mask when working within 1 metre of the patient

Aprons/Gloves Wear an apron when entering the room. Wear gloves for direct or indirect contact with the patient or excretions and secretions

Door Keep door closed at all times if patient in isolation

Before leaving Decontaminate equipment when it leaves the room. Discard gloves, apron and mask. Carry out hand hygiene before leaving the room

- Alcohol handrub available: 89%
- PPE available: 74%
- Correct precaution type: 71%
- Hand hygiene performed: 65%
- Precautions adhered to: 58%

Observations = 1223  Observations = 358

Dramowski ARIC 2015
Personal protective equipment

Mandatory use of gloves during RSV season 2002-2010
25% reduction all HAI
RR of BSI, CLABSI, HAP = 0.63 0.61 0.20

Benefits of Universal Gloving on Hospital-Acquired Infections in Acute Care Pediatric Units
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- Behaviour change & institutional climate
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- Hand hygiene and PPE usage
Patient isolation and triage
Utilization of paediatric isolation facilities in a TB-endemic setting

Angela Dramowski¹*, Mark F. Cotton¹ and Andrew Whitelaw²

Table 1 Paediatric isolation room utilization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Percentage</th>
<th>Interquartile range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete patient isolation episodes</td>
<td>335</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Median patient age (months)</td>
<td>17</td>
<td>-</td>
<td>6–50</td>
</tr>
<tr>
<td>Median stay in isolation room (days)</td>
<td>4</td>
<td>-</td>
<td>2–8</td>
</tr>
<tr>
<td>Indication for isolation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- infection control (IPC) purposes</td>
<td>260</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>- nursing care</td>
<td>46</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>- palliation/privacy</td>
<td>13</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>- other⁹</td>
<td>16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Transmission-based precautions⁸ applied</td>
<td>260</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>- airborne precautions</td>
<td>136</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>- droplet precautions</td>
<td>57</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>- contact precautions</td>
<td>67</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

Mean Minimum Maximum
Isolation room occupancy rate⁹

2172/3294 225/540 487/558

(66 %)  (42 %)  (87 %)
Proportional utilization of isolation bed-days

- Respiratory viruses 48 (35%)
- Drug-resistant bacteria 43 (32%)
- Gastroenteritis viruses 28 (21%)
- M. tuberculosis 16 (12%)

Missed pathogens warranting isolation

- Occupied: 2172
- Missed: 2054
- Delayed: 51
- Inappropriate bed-days: 171
Demand for isolation facilities (May – Oct. 2014)

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>projected occupancy</td>
<td>144%</td>
<td>152%</td>
<td>208%</td>
<td>73%</td>
<td>69%</td>
<td>89%</td>
</tr>
</tbody>
</table>

- occupied bed-days
- missed bed-days
- monthly isolation bed-days available
Projected occupancy if syndromic isolation is implemented

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>projected occupancy</td>
<td>180%</td>
<td>187%</td>
<td>245%</td>
<td>114%</td>
<td>97%</td>
<td>123%</td>
</tr>
</tbody>
</table>

- **Occupied bed-days**
- **Missed bed-days**
- **Syndromic bed-days**
Recommendations for paediatric isolation

- minimum of **40% of total beds**
- provision for **airborne precautions** on new wards/renovations
- proportion with mechanical ventilation depends on TB burden
- **syndromic isolation**, clinical case definitions
- need **staff education, written policy**, and **active management** of paediatric isolation
Core elements of a paediatric IC programme

- Hand hygiene and PPE usage
- HAI surveillance & outbreaks
- Catheter care
- Patient isolation and triage
- Environmental cleaning
- Safe preparation of feeds
- Staff health & education
- Behaviour change & institutional climate
Risk factors for HAI: health systems

- Weak or non-existent IC programs
- Severe shortage of IC practitioners
- Lack of patient safety culture / awareness of HAI
- No requirement for surveillance & reporting of HAI
Paediatric staff as a potential source of infection

- Minimal training in IC (undergraduate & in-service)
- Limited knowledge of HAI and IPC principles
- Understaffing, high turnover, use of agency staff
- Additional functions eg portering, cleaning
- Presenteeism
- Minimal uptake of available vaccinations
- Lack of accountability and IC champions
### Table 4. Regression models for factors influencing paediatric healthcare provider KAP

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>Regression coefficient (K, A)</th>
<th>Odds ratio (P)</th>
<th>95% confidence interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong></td>
<td>Job category (medical)</td>
<td>-1.066</td>
<td>-</td>
<td>-1.56 - -0.571</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Attitudes</strong></td>
<td>Student status</td>
<td>0.679</td>
<td>-</td>
<td>0.285 – 1.073</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Job category (nursing)</td>
<td>0.329</td>
<td>-</td>
<td>0.006 – 0.653</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Influenza vaccination</strong></td>
<td>Age (older)</td>
<td>-</td>
<td>0.94</td>
<td>0.88 – 0.99</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Presenteeism</strong></td>
<td>Job category (medical)</td>
<td>-</td>
<td>19.18</td>
<td>6.41 – 57.36</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Respirator fit-testing</strong></td>
<td>Job category (nursing)</td>
<td>-</td>
<td>0.43</td>
<td>0.21 – 0.88</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Hand hygiene compliance</strong></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Adherence to TBP signs</strong></td>
<td>Job category (nursing)</td>
<td>-</td>
<td>3.62</td>
<td>1.53 – 8.56</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>PPE usage</strong></td>
<td>Job category (nursing)</td>
<td>-</td>
<td>19.22</td>
<td>6.33 – 58.36</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
INSANITY

Doing the same thing over and over again expecting different results.
Paediatric HAI prevention in South Africa

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Future prospects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of data on paediatric HAI</td>
<td>Laboratory, Micro, ID support</td>
</tr>
<tr>
<td>Lack of IPC training &amp; practitioners</td>
<td>Growing pool of IPC-trained HCW</td>
</tr>
<tr>
<td>Understaffing / Overcrowding</td>
<td>Political and managerial will</td>
</tr>
<tr>
<td>Lack of isolation facilities</td>
<td>National Core Standards</td>
</tr>
<tr>
<td>Aging infrastructure/equipment</td>
<td>Quality improvement campaigns</td>
</tr>
<tr>
<td>Heavy ID burden: HIV/TB</td>
<td>Motivated paediatric staff</td>
</tr>
<tr>
<td>Lack of HCW accountability</td>
<td>Antimicrobial stewardship/IPC alliance</td>
</tr>
</tbody>
</table>
Thank you!
Infection Prevention and Control

A guide for healthcare workers in low-resource settings

Learn together
IPC programmes, risk management and surveillance

Dr Angela Dramowski

6th Infection Control Africa Network conference
23-28 September 2016
# Routes of pathogen transmission

<table>
<thead>
<tr>
<th>Direct: hands</th>
<th>Airborne</th>
<th>Feeds</th>
<th>Multi-dose vials</th>
<th>In utero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect: equipment, devices, surfaces</td>
<td>Droplet</td>
<td>Fomites</td>
<td>Vaccinations</td>
<td>Rubella, Varicella, HIV</td>
</tr>
<tr>
<td><em>S. aureus</em>, <em>K. pneumoniae</em>, <em>S. marcescens</em>, <em>E. coli</em></td>
<td><em>M. tuberculosis</em>, Measles, VZV, RSV, Influenza, Adenovirus, Pneumocystis</td>
<td>Various bacteria, Rota, norovirus, HIV (EBM)</td>
<td>HIV, Hep B, Hep C</td>
<td></td>
</tr>
</tbody>
</table>
Which factors contribute to HAI development in the paediatric wards?

<table>
<thead>
<tr>
<th>Poor IC practices</th>
<th>System challenges</th>
<th>Lack of education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low HH / PPE compliance</td>
<td>Overcrowded wards</td>
<td>Lack of IC education, training for staff and caregivers</td>
</tr>
<tr>
<td>Insufficient IPC provisions</td>
<td>Understaffing</td>
<td></td>
</tr>
<tr>
<td>Sharing of equipment</td>
<td>Lack of isolation facilities</td>
<td>Lack of an institutional culture of a patient safety</td>
</tr>
<tr>
<td>Poor aseptic technique</td>
<td>Poor use of triage &amp; patient cohorting</td>
<td></td>
</tr>
<tr>
<td>Unnecessary devices</td>
<td>Inadequate ventilation</td>
<td></td>
</tr>
<tr>
<td>Overuse of antibiotics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What can be done to reduce paediatric HAI rates at our institution?

<table>
<thead>
<tr>
<th>Resources</th>
<th>Practices</th>
<th>Education/feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional human resources (especially nurses)</td>
<td>Rapid patient triage and cohorting</td>
<td>IC training (for providers, patients and caregivers)</td>
</tr>
<tr>
<td>Provision of alcohol hand rub at every bedside</td>
<td>Early discontinuation and reduced antibiotic use</td>
<td>share HAI surveillance data with feedback to wards</td>
</tr>
<tr>
<td>More isolation beds</td>
<td>Prompt removal of unnecessary invasive devices</td>
<td>Stricter enforcement of IC protocols</td>
</tr>
<tr>
<td></td>
<td>Improved disinfection of shared equipment</td>
<td>Empowerment to reprimand transgressors; “Naming and shaming” punitive measures</td>
</tr>
<tr>
<td></td>
<td>Improved cleaning of the patient environment</td>
<td>Stronger leadership and IC champions</td>
</tr>
</tbody>
</table>
Paediatric medical providers:
  higher knowledge scores but
  lower desired attitude/practice scores than nurses

Improved IC education:
  in-service and improved undergraduate training
  emphasis on hand hygiene, routes of transmission

Behaviour change:
  influenza immunization and not working when sick

Paediatric providers support:
  reporting of HAI events
  stricter enforcement of IC recommendations.
Outline

• Challenges of infection control (IC) in children
• IC implementation in Africa
• Core elements of IC for paediatric facilities
  
  Surveillance
  Outbreak management
  Safe feed preparation
  Environmental cleaning
  Patient isolation
  Hand hygiene, protective equipment
  Staff health and behaviour change
Core elements of a paediatric IC programme

- Hand hygiene and PPE usage
- HAI surveillance & outbreaks
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