The adverse and perverse effects of healthcare-associated infections: An infection control expert’s perspective

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[Hospitals had] “become the gates which lead to death”

Thomas Lightfoot (1850): London Medical Times
1996

Van Nierop, et al.
J Clin Micro 1998; 36(10): 3085-7
XbaI restriction digest of *E. cloacae* isolates from an outbreak in a Gauteng hospital run on PFGE

Lanes: MW: molecular weight marker VI; 1-18: isolates/strains 1-18
Gauteng’s hospitals of neglect

"Why was my sister left to rot to death?"

Dirty fingers led to death of six babies

Fury over ‘hospital from hell’

DIRTY HANDS LED TO BABY DEATHS

DIRTY HAND KILLED BLOEM BABIES

CONSIDERING OUR STAFF LIMITATIONS WE FIND THIS MORE TIME AND COST EFFECTIVE

WARD 13

FURY OVER "HOSPITAL FROM HELL"
The Issues...

- Outbreak responses REACTIVE rather than PROACTIVE
- Surveillance systems WEAK – delay in outbreak detection -> increased cases, increased loss of lives. Costs (direct + indirect) inestimable
- Education, staffing, infrastructure and “political support” historically POOR
- INFECTION CONTROL NOT PRIORITISED
- Whose responsibility is it? And accountability?
Gauteng Hospital Situational Analysis:

- Questionnaires sent to 18 HCFs in Gauteng
- 61%: **NO** established ICCs
- Hospitals with ICNs: 50% nil; 22% 1 ICN; 28% 2-3 ICNs
- 32% ICNs not trained; 21% 3-day training course; 36% 6-month training course; 11% “other”
- Surveillance: 11% nil; 30% lab-based; 24% comprehensive; 16% targeted; 19% “other”; 22% spent > 50% of time on surveillance
- % Time spent on Staff Education/week: 72% spent < 10% of time on Staff Education
- % Time spent on IC Ward Rounds/week: only 12% spent > 50% of their time in IC W/R; 35% spent < 10% of the time in IC WR
- Other commitments: OH&S (~ 11% respondents spending > 50% of time on OH&S); Waste disposal (ranged from 0-90%!, with ~ 17% of respondents spending > 50% of time on waste)
EDUCATION: Training and capacity building at ALL levels health-care associated activities. Materials required. Responsibilities of universities, nursing colleges, Policies and procedures: NB buy-in from all relevant players. Identification of key research activities.

SURVEILLANCE: Establishment of a central data processing unit for surveillance. Pilot study for NNIPS using selection of Gauteng HCFs. Later, NNIPS (provincial, and then country-wide). Will provide EVIDENCE of the problem and assist in TARGETING activities.

ESTABLISHMENT OF IC WORKING GROUP WITHIN DoH: needs to define criteria for numbers of ICNs, organograms, roles, job descriptions, prioritized activities, link to outbreak response teams and CDCs, career ladders, etc. Look at concept of “link nurses” (? Incentives). Links into existing programs.

WORKSHOP FOR IC FOR SENIOR MANAGERS: Budget for additional staffing requirements; ? Part of scarce skills negotiations; operational issues; line functions, etc.

HARMONIZATION OF OHS, IC & OTHER FUNCTIONS: Closely interlinked. Require independent, but closely collaborating practitioners. Coordination essential.

POLITICAL SUPPORT AT ALL LEVELS VITAL TO SUCCESS OF THIS PROGRAM
Adverse events:

- **AE:** injury/harm resulting from medical intervention

- Preventable AEs: errors that result in injury or do harm

- There can either be:
  - NO ERRORS
  - ERROR, NO HARM
  - ERROR, HARM
  - ERROR, DEATH
Adverse effects of healthcare-associated infections:

- Serious illness (morbidity) and death (mortality) – related to a variety of patient-care procedures; also consider AEs following antimicrobial therapy & potentially avoidable interventions to treat infective complications...
- Costs (direct and indirect): individual, community, heath-care systems; economy
- Impact of additional antibiotic therapy: to patient but also to microbial ecology, pharmaceutical industry, future of antibiotics
- Patient source of infection, both in the health-care facility and the community
- Occupational health-related adverse effects

[Infection Rates: Useful indicator of the quality of delivery of health care!]
Killer bugs strike hospitals

One in seven patients at risk of picking up life-threatening infection

THE SUPERBUG MENACE

Superbugs are bacteria that are resistant to one or more types of antibiotic

The World Health Organisation this week reported the emergence and spread of the following superbugs in hospitals. They lead to major hospital-acquired infections such as urinary tract infections, pneumonia, wound infections, sepsis and foreign body infections (for example, of a pacemaker).

THE number of patients struck down by hospital-acquired infections should be recorded, says one of the country’s top critical care specialists, Professor Guy Richards.

Richards said a register of infections, in particular wound sepsis, would be the best way to control them.

Septic wounds are a good indicator of the efficiency of hospital infection control.

This recommendation follows a Sunday Times expose on how the rise in antibiotic-resistant superbugs is turning South African hospitals into danger zones.

[at about 8% in developed countries] then there is a problem. In South Africa, doctors and nurses do not have the time or facilities for adequate record-keeping.

This month, SA’s first probe into hospital-acquired infections will be launched in Gauteng.

Top infection control expert Professor Adriano Duse of Wits University will run the investigation until May with the Gauteng Health Department.

The study will take place at two major academic hospitals, two provincial hospitals and two private hospitals.

It will give a snapshot into the scale of the problem.

What is already clear is that the
Bug sleuths come across a litany of horrors

CLAIRE KEETON

SEWAGE overflowing into a hospital ward, food reheated in an incinerator and three infants crammed into unsafe containers;

- The door missing on an incinerator for burning hospital waste;
- The same incinerator being used for industrial paint.

Said Duse: “The biggest crisis is that staff often get out of the ivory tower and realise that fairly simple things can be done to prevent things like this.”

About three hospitals in each of the major provinces twice a year.

CRISIS BY NUMBERS

±2-million
Number of people it serves, from the areas of Katlehong, Thokoza, Germiston, Vosloorus, Standerton, Heidelberg and Edenvale.

R7.5-million
Budget for salaries each month.

R4.1-million
How much is actually spent on staff salaries each month.

R550 000
How much is budgeted each month on overtime.

±R342 000
How much is actually spent on overtime.

1 838
How many staff it should have.

1 269
How many staff it does have.

569
The total number of vacancies.

±300
The number of vacancies for doctors, nurses and medical staff.

2
Hospitals from which it takes patients - Germiston and Heidelberg.

9
Clinics from which it takes referrals and which it supplies with drugs.

PAINFUL ORDEAL: Josephine Sekhoto was infected with an antibiotic-resistant bacteria three years ago, after she underwent surgery on her knee. With her is her son, Sipho.
Perception of what constitutes a SAE: Infection with a “superbug”

- But what is a “superbug”?
- MDR pathogen? … problems with this concept
- Novel pathogen?
- Emerging and re-emerging pathogens?
- Formidable infectious agent?
Spread Of Resistant Clones Of GRE

- Garden City 7-11
- Milpark 12-13,19
- JHB Gen 14
- Morningside 15
- Arwyp 16-17
- Mulbarton 18

Lane 1-6 *E. faecium* isolates from hospital S1, Lane 7-11 *E. faecium* isolates from hospital P1, Lane 12-13 *E. faecium* isolates from hospital P2, Lane 14-19 *E. faecium* VanA isolated from S1 in 1997 and four private hospitals in 1998, Lane 20 *E. faecium* VanA ATCC 51559, Lane 21-22 *E. faecalis* Van A isolates from S1 and S2, Lane 23 *E. faecalis* Van A ATCC51299
**Gram Positive South African bacterial foes:**

**Staphylococci:**

MRSA: 25% of 2815 patient’s blood cultures (1 Jan – 31 Dec 2000, NASF); 34% of 2171 patient’s blood cultures (Jan Dec 2001, NASF) – vs. SENTRY study (AAC 2002 46(3);879-881): 40.4% of 94 patient’s blood cultures) in 1998-9

Mupirocin R: SENTRY (Tunridge J, et al. Poster C2-1123, 42nd ICAAC, 2002, California) : 64% of 130 blood culture isolates

hGISA: JH 2.9% of 175 isolates – first isolate described in 1998: SAMJ 2000; 90(11):1113: CHB 1.7% of 175 isolates; HJ 50% of 10 isolates

**CoNS: JH Jan 1999 – July 2001:**

1225 isolates collected; 6% clinically significant – of these, 91.9% from blood cultures and 8.1% from CVC tips: 79% *S epidermidis* & 10.8% *S haemolyticus*: rest were other CoNS

Teicoplanin R: 1.4% (MIC 32 µg/ml)
Teicoplanin IR:29.7% (MIC 16 µg/ml)

Vancomycin R: 0%
Vancomycin IR:4.1% (MIC 8-16 µg/ml)
Aims of this project:

- To determine, hopefully more realistic, prevalence rates of uniformly defined NIs in South African health-care facilities.

- From the above, where microbiology data is available, distinguish between colonization, pseudo-infection and infection.

- Link antimicrobial resistance (AMR) profiles to colonizing versus infecting organisms to get a true perspective of the clinical relevance (patient outcome) of AMR data.
Determining rates of HAIs in South Africa:

- **Nosocomial infection prevalence study**
  - Initial pilot study to involve 2 academic, 2 non-academic provincial, and 2 private hospitals (Jan 2005)
    - Johannesburg Hospital (# beds = 900)
    - Pretoria Academic (# beds = 924)
    - Leratong Region (# beds = 704)
    - Tembisa District (# beds = 932)
    - Afrox – Pretoria (# beds = 500)
    - Netcare – Johannesburg (# beds = 500)
  - Once potential problems identified and resolved, proceed with a strategy for a National Nosocomial Infection Prevalence Survey

- Study will look at major nosocomial infection categories to include: urinary tract, lower respiratory tract, bloodstream, & surgical site infections. NNIS/CDC HAI criteria used.
Data Collection Form 1- General Parameters:

- Patient demographics
- Medical risk factors
- Surgical risk factors & other invasive procedures
- Device-related risk factors
- Antibiotic and non-antibiotic therapy during admission
### Surveillance of Healthcare-Associated Infection

**Surveillance Manual (Version 1.1)**  
February, 2003

Developed by Infection Control Team  
The Royal Hospitals  
Belfast

### Hospital Infection Survey 2001

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Q12</th>
<th>Q13</th>
<th>Q14</th>
<th>Q15</th>
<th>Q16</th>
<th>Q17</th>
<th>Q18</th>
<th>Q19</th>
<th>Q20</th>
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<tbody>
<tr>
<td>Survey date</td>
<td>Directorate</td>
<td>Ward number</td>
<td>Admission date to hospital</td>
<td>Hospital number</td>
<td>Gender</td>
<td>Date of birth</td>
<td>Admission type</td>
<td>Was patient transferred?</td>
<td>Admission diagnosis</td>
<td>Admission diagnosis</td>
<td>More than 1 diagnosis</td>
<td>Medical Risk Factors</td>
<td>Urinary catheter</td>
<td>Invasive lines</td>
<td>Intravascular device</td>
<td>Duration of peripheral line</td>
<td>Duration of central line</td>
<td>Duration of other vascular device</td>
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<tr>
<td>D</td>
<td>D</td>
<td>M</td>
<td>M</td>
<td>Y</td>
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</tbody>
</table>

- Select all that apply
  - Major trauma
  - COAD
  - Stroke/paraplegia
  - Diabetes
  - Malnourished

- Select all that apply
  - Urinary catheter
  - Suprasphincteric urethral closed

- Type of break
  - Vascular ulcer
  - Pressure sore
  - Vascular & pressure
  - Diabetic ulcer
  - Other

- Other invasive procedures
  - ERCP
  - Percutaneous drainage procedure
  - Other endoscopy (e.g. surgery)
  - Other invasive procedure
  - Other invasive procedure

Survey: SU  
Series: 2  
Page: 1  
Infection Control, The Royal Hospitals, Belfast BT12 6BA
Data Collection Forms 2 & 3:

- HAI–specific information (including outcome)
- Isolate information including AMR
### Surgical Site Infection

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<thead>
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<th>Q1</th>
<th>Q2</th>
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<tr>
<td>Serial number from Survey 112</td>
<td>Type of SSI</td>
<td>Date of operation</td>
<td>Endoscopic approach</td>
<td>General anaesthetic</td>
<td>Date of surgical site infection</td>
<td>SSI operation class</td>
<td>Surgical site</td>
<td>SSI culture result</td>
<td>Antibiotic Mx for Infection</td>
<td>Pathogens</td>
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<tr>
<td>D</td>
<td>M</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
<td>Y</td>
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<td>Y</td>
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<td>Superficial</td>
<td>Deep</td>
<td>Organ space</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Clean</td>
<td>Head / Neck</td>
<td>Positive</td>
<td>Yes</td>
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<td>Amphotericin B</td>
<td>Vancomycin</td>
<td>Methicillin Resistant Staphylococcus aureus</td>
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**Note:** Enter isolate information on Survey 20 form.
Why automated data entry (ADE) using manual questionnaires & optical scanning?

- System accessible to all HCFs – once questionnaires completed, sent to centralized data processing unit -> cost effective; rapid feedback
- Patient-based, not isolate-based
- ICN at cold interface; not in office / laboratory
- Improved speed & accuracy of data entry; substantial cost savings [Infect Control Hosp Epidemiol. 1997 Jul; 18(7):486-491]
  - 22-fold productivity increase cf. manual data entry (MDE) with validation
  - Saving of $ 0.63 [~ R 4.12] per questionnaire in clerical time
  - After validation, error rate of < 0.2 errors / 1000 responses (ADE) vs. 12.4 errors / 1000 responses (MDE)
Do accredited facilities TRULY have significantly lower HAI rates?

- No certainty, despite fact that many claim to have unusually low HAI rates

- No standardized systems of data collections

- Laboratory result rather than patient orientated
IC is a good indicator of quality of health care delivery and is an important requirement for accreditation. A good surveillance system is essential.

Vertical audits, through analysis of main areas of competency, will highlight flaws (both at patient care and organizational management levels) in current system.

Identification and rectification of problems is evidence of a quality improvement philosophy.

Principles of this process can be extended to other critical areas of health care delivery.

The above can be adapted to or done within the framework and requirements of a chosen international accreditation body.
Conclusion: NIs are [S]AEs but appropriate indicators need to be defined!
“It is only too frequently forgotten that the true art of medicine is not to cure disease but to prevent it”

Victor Robinson