Inaugural infection control webinar series

The global burden of health care-associated infections

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First Global Patient Safety Challenge
Clean Care is Safer Care
WHO Patient Safety
Through the promotion of best practices in hand hygiene and infection control, the First Global Patient Safety Challenge aims to reduce health care-associated infection (HCAI) worldwide.
# Objectives of the Challenge

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Awareness</td>
<td>Burden of HCAI</td>
</tr>
<tr>
<td></td>
<td>Stakeholders’ engagement</td>
</tr>
<tr>
<td>2. Mobilising nations</td>
<td>Country pledges</td>
</tr>
<tr>
<td>3. Technical guidelines and tools</td>
<td>Implementation strategies</td>
</tr>
</tbody>
</table>
Estimates of the global burden of health care-associated infection are hampered by limited availability of reliable data.

First Challenge area of work on the burden of health care-associated infection.
Health care-associated infection is a major patient safety problem

Affects hundreds of millions of individuals worldwide each year

Multifaceted causation related to:
- systems and processes of care provision
- economic constraints on systems and countries
- human behaviour
Definition of health care-associated infection

“An infection occurring in a patient during the process of care in a hospital or other health-care facility which was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility”

## Burden of major infections worldwide

<table>
<thead>
<tr>
<th><strong>MALARIA</strong></th>
<th><strong>HIV</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• N° annual episodes: 300-500 mio</td>
<td>• N° affected: 39.5 mio</td>
</tr>
<tr>
<td>• N° annual deaths: 1.5-2.7 mio</td>
<td>• N° new infections/year: 4.3 mio</td>
</tr>
<tr>
<td>• 90 countries at risk worldwide</td>
<td>• N° deaths in 2006: 2.9 mio</td>
</tr>
<tr>
<td></td>
<td>• Most countries affected with different infection rates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TUBERCULOSIS</strong></th>
<th><strong>HEALTHCARE-ASSOCIATED INFECTIONS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• N° new infections/year: 8 mio</td>
<td>?</td>
</tr>
<tr>
<td>• N° deaths in 2005: 1.6 mio</td>
<td></td>
</tr>
<tr>
<td>• 1/3 of the world currently affected</td>
<td></td>
</tr>
</tbody>
</table>
Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data

Alan D Lopez, Colin D Mathers, Majid Ezzati, Dean T Jamison, Christopher J L Murray

Summary

Background Our aim was to calculate the global burden of disease and risk factors for 2001, to examine regional trends from 1990 to 2001, and to provide a starting point for the analysis of the Disease Control Priorities Project (DCPP).

Methods We calculated mortality, incidence, prevalence, and disability adjusted life years (DALYs) for 136 diseases and injuries, for seven income/geographic country groups. To assess trends, we re-estimated all-cause mortality for 1990 with the same methods as for 2001. We estimated mortality and disease burden attributable to 19 risk factors.

Findings About 56 million people died in 2001. Of these, 10.6 million were children, 99% of whom lived in low-and-middle-income countries. More than half of child deaths in 2001 were attributable to acute respiratory infections, measles, diarrhoea, malaria, and HIV/AIDS. The ten leading diseases for global disease burden were perinatal conditions, lower respiratory infections, ischaemic heart disease, cerebrovascular disease, HIV/AIDS, diarrhoeal diseases, unipolar major depression, malaria, chronic obstructive pulmonary disease, and tuberculosis. There was a 20% reduction in global disease burden per head due to communicable, maternal, perinatal, and nutritional conditions between 1990 and 2001. Almost half the disease burden in low-and-middle-income countries is now from non-communicable diseases (disease burden per head in Sub-Saharan Africa and the low-and-middle-income countries of Europe and Central Asia increased between 1990 and 2001). Undernutrition remains the leading risk factor for health loss. An estimated 45% of global mortality and 36% of global disease burden are attributable to the joint hazardous effects of the 19 risk factors studied. Uncertainty in all-cause mortality estimates ranged from around 1% in high-income countries to 15–20% in Sub-Saharan Africa. Uncertainty was larger for mortality from specific diseases, and for incidence and prevalence of non-fatal outcomes.
Section on HAI

European countries' national surveillance systems reporting to ECDC: Italy, Croatia, Norway, France, Portugal, Germany, UK, Austria, Finland, Hungary, Lithuania, Netherlands, Spain, Belgium, Luxemburg, Slovakia, Romania

New report only dedicated to HAI to be issued in 2010
CALCULATING ROUGH ESTIMATES OF THE HAI BURDEN…

HAI RATES IN MEMBER STATES

Average HAI rate: 10%
Average HAI attributable mortality: 5%
ALL countries affected worldwide

Global hospital admissions per year: ?
Affected patients/year: ?
N° deaths/year: ?
Reasons why estimating the burden of HAI is difficult

- Other health priorities prevailing
- Lack of denominator(s)
- Difficulties in conducting surveillance:
  - Need for expertise, time, funds
  - Use of standardized definitions
  - Distinction between infection/colonization/contamination
  - Establishing the association with health care
  - Evaluation of clinical evidence (e.g. surgical wound, catheter insertion site, etc)
  - Need for information from the patient records
  - Performance of microbiologic tests and other investigations

- Interpretation and use of data
Lessons learned from Semmelweis (1861)

Recognize → Explain → Act

![Graph showing percentage of interventions from 1841 to 1850. The graph indicates a substantial decrease in percentage after May 15, 1847, following an intervention. The graph includes data points for the years 1841 to 1849, with a trend line showing a decrease in the percentage of interventions from 1847 onwards.]

- First
- Second

World Health Organization
Patient Safety
A World Alliance for Safer Health Care
SAVE LIVES
Clean Your Hands
Effectiveness of surveillance to reduce HAI

*(Gastmeier et al, JHI 2006)*

### Relative Risk (1st year vs 3rd year):

- **VAP**: 0.71 (95% CI: 0.66-0.76)
- **CR-BSI**: 0.80 (95% CI: 0.72-0.90)
- **SSI**: 0.72 (95% CI: 0.64-0.80)

### Table I

<table>
<thead>
<tr>
<th>Year</th>
<th>ICUs participating</th>
<th>Ventilator-days</th>
<th>VAP</th>
<th>VAP rate (per 1000 ventilator-days)</th>
<th>Catheter-days</th>
<th>CR-BSI rate (per 1000 catheter-days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>24</td>
<td>32,054</td>
<td>483</td>
<td>15.4</td>
<td>55,851</td>
<td>118</td>
</tr>
<tr>
<td>1998</td>
<td>69</td>
<td>84,684</td>
<td>902</td>
<td>10.7</td>
<td>141,939</td>
<td>241</td>
</tr>
<tr>
<td>1999</td>
<td>113</td>
<td>121,648</td>
<td>1139</td>
<td>9.4</td>
<td>203,182</td>
<td>409</td>
</tr>
<tr>
<td>2000</td>
<td>171</td>
<td>183,829</td>
<td>1602</td>
<td>8.7</td>
<td>306,689</td>
<td>527</td>
</tr>
<tr>
<td>2001</td>
<td>214</td>
<td>225,133</td>
<td>1776</td>
<td>7.9</td>
<td>383,176</td>
<td>695</td>
</tr>
<tr>
<td>2002</td>
<td>246</td>
<td>255,819</td>
<td>1809</td>
<td>7.1</td>
<td>437,585</td>
<td>748</td>
</tr>
<tr>
<td>2003</td>
<td>248</td>
<td>273,970</td>
<td>1750</td>
<td>6.4</td>
<td>465,119</td>
<td>920</td>
</tr>
<tr>
<td>Total</td>
<td>309</td>
<td>1,177,137</td>
<td>9461</td>
<td>8.0</td>
<td>1,993,541</td>
<td>3658</td>
</tr>
</tbody>
</table>

**ICU component:**

- **Departments participating**
- **Operative procedures**
- **Inpatient SSI**
- **Inpatient SSI rate (%)**

**SSI**, surgical site infection; **VAP**, ventilator-associated pneumonia; **CR-BSI**, central-venous-catheter-related primary bloodstream infection.
Prevalence of HAI in developed countries

** Incidence

Average in Europe: 7.1%

ECDC, Comm Dis Report 2008
HAI burden in USA

- Incidence: 5–6%; 1.7 million affected patients
  - Urinary Tract Infection: 36%; 561,667 episodes, 13,088 deaths
  - Surgical Site Infection: 20%; 274,098 episodes (1.98%)
  - Catheter Related Bloodstream Infections: 11%; 250,000 episodes, 28,000 deaths
  - Ventilator Associated Pneumonia: 11%; 5.4/1000 ventilator-days

- Attributable mortality: 3.6%, approximately 99,000 deaths
- Annual economic impact: about US$ 4.5 billion

HAI burden in Europe

- Prevalence: 3.5–14.8% (average: 7.1%)
- 4 131 000 affected patients
- 4 544 100 episodes of HAI every year
- 16 million extra days of hospital stay
- 37 000 attributable deaths (and contribution to an additional 110 000)
- Annual economic impact: about EUR 7 billion per year (including direct costs only)

(ECDC, Comm Dis Report 2008)

<table>
<thead>
<tr>
<th>Country</th>
<th>N° of cases/year</th>
<th>N° of deaths/year</th>
<th>Costs/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>100,000</td>
<td>5,000</td>
<td>UK£ 1 billion</td>
</tr>
<tr>
<td>Scotland</td>
<td>/</td>
<td>/</td>
<td>UK£ 183 mio</td>
</tr>
<tr>
<td>Switzerland</td>
<td>70,000</td>
<td>/</td>
<td>CHF 230-300 mio</td>
</tr>
</tbody>
</table>
HAI rates in adult high-risk patients in Developed Countries*

*Systematic review of the literature conducted by WHO
Device-associated HAI in Developed Countries*

* Systematic review of the literature conducted by WHO
The impact of HCAI

HCAI can cause:
- more serious illness
- prolongation of stay in a health-care facility
- long-term disability
- excess deaths
- high additional financial burden
- high personal costs on patients and their families
Impact of nosocomial infections

Attributable mortality
0% to 40%

Prolongation of length of stay
5 to 25 days

Increase of costs
5,000 to 40,000 euros
Facts about health-care associated infection in developing countries

- The risk of infection is 2-20 times higher than in developed countries, and the proportion of patients infected can exceed 25% (Allegranzi B & Pittet D, ICHE 2007)

- **Unsafe blood transfusion** causes every year:
  - 16 million hepatitis B infections,
  - 5 million hepatitis C infections, and
  - 160 000 cases of HIV

- **Reuse of contaminated syringes** caused in 2000:
  - 21 million hepatitis B infections (33% of new infections)
  - 2 million hepatitis C infections (40% of new infections)
  - 260 000 HIV infections (5% of new infections)

- **Unsafe waste disposal**: in 22 developing countries, the proportion of facilities using inappropriate waste disposal methods ranges from 18% to 64%
Conditions leading to higher HAI burden in developing countries

- Inadequate hygiene conditions
- Poor infrastructure
- Inadequate / insufficient equipment
- Lack of microbiological information
- Understaffing
- Overcrowding
- Lack of knowledge and low staff preparedness
- Inappropriate use of antibiotics
- More diseased population
- Unfavorable social background
- Lack of national policies and programs
- Costs falling on individual patients
IC constraints to IC in Africa at national level

Constraints
- Absence of policies
- Absence of guidelines for IC
- Insufficient funds
- Inappropriate organizational structures & coordination
- Lack of data collection
- Inadequate human resources
- Lack of monitoring & evaluation
- Insufficient commitment of partners
- Inadequate infrastructure
- Insufficient sensitization of HCWs to policies

First GPSC African workshop, Rwanda, December 2007
Systematic literature review on HAI rates in developing countries 1995-2008
Study distribution per region

Type of Infection per WHO Region

Number of Studies

International
West Pacific
South-East Asia
Europe
Eastern Mediterranean
Americas
Africa

Systematic review of the literature conducted by WHO
Studies on general HAI rates from developing countries (1995-2008): 89*

- Europe: 26
- Eastern Mediterranean: 12
- Americas: 28
- Africa: 3
- South East Asia: 14
- Western Pacific: 3

*including 2 international studies

Systematic review of the literature conducted by WHO
Studies on specific site infection rates in adult patients from developing countries (1995-2008): 91

- Studies on SSI: 54
- Studies on HAP/VAP: 24
- Studies on BSI: 8
- Studies on UTI: 5
Studies on neonatal/pediatric HAI rates from developing countries (1995-2008): 29

- Africa: 1
- Eastern Mediterranean: 3
- Americas: 17
- South East Asia: 4
- Europe: 2
- Western Pacific: 2

Systematic review of the literature conducted by WHO
Scope of the studies

Systematic review of the literature conducted by WHO
Systematic review of the literature conducted by WHO
Prevalence of HAI in developing countries

Systematic review of the literature conducted by WHO

- Latvia: 5.7%
- Lithuania: 9.2%
- Albania: 19.1%
- Turkey: 13.4%
- Lebanon: 6.8%
- Morocco: 17.8%
- Tunisia: 17.8%
- Mali: 18.7%
- Thailand: 7.3%
- Brazil: 14.0%
- Malaysia: 13.9%
- Tanzania: 14.8%
HAI rates in adult ICU/high risk patients

Range: 4.1-90.1 inf./1000 pts-days
USA: 13.04 inf./1000 pts-days

Systematic review of the literature conducted by WHO
# Device-associated infection rates in ICUs in developing countries compared to NHSN rates

<table>
<thead>
<tr>
<th>Surveillance network, study period, country</th>
<th>Setting</th>
<th>No. of patients</th>
<th>CLA-BSI*</th>
<th>VAP*</th>
<th>CR-UTI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHSN, 2006–2007, USA¹</td>
<td>PICU</td>
<td>/</td>
<td>2.9</td>
<td>2.1</td>
<td>5.0</td>
</tr>
<tr>
<td>INICC, 2002–2007, 18 developing countries²</td>
<td>PICU</td>
<td>1,808</td>
<td>6.9</td>
<td>7.8</td>
<td>4.0</td>
</tr>
<tr>
<td>NHSN, 2006–2007, USA¹</td>
<td>Adult ICU#</td>
<td>/</td>
<td>1.5</td>
<td>2.3</td>
<td>3.1</td>
</tr>
<tr>
<td>INICC, 2002–2007, 18 developing countries²</td>
<td>Adult ICU#</td>
<td>26,155</td>
<td>8.9</td>
<td>20.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Argentina (various studies)</td>
<td>Adult ICU (any type)</td>
<td>/</td>
<td>25.8</td>
<td>49.5</td>
<td>18.5</td>
</tr>
<tr>
<td>Brazil (various studies)</td>
<td>Adult ICU (any type)</td>
<td>/</td>
<td>/</td>
<td>22.7</td>
<td>/</td>
</tr>
<tr>
<td>India (various studies)</td>
<td>Adult ICU (any type)</td>
<td>/</td>
<td>5.6</td>
<td>20.9</td>
<td>6.3</td>
</tr>
<tr>
<td>Turkey (various studies)</td>
<td>Adult ICU (any type)</td>
<td>/</td>
<td>13.6</td>
<td>21.2</td>
<td>11.0</td>
</tr>
</tbody>
</table>

* Overall (pooled mean) infection rates/1000 device-days
INICC = International Nosocomial Infection Control Consortium; NHSN = National Healthcare Safety Network; PICU = paediatric intensive care unit; CR-BSI = catheter-related bloodstream infection; VAP = ventilator-associated pneumonia; CR-UTI = catheter-related urinary tract infection.

¹ NHSN report. *Am J Infect Control* 2008
† Argentina, Brazil, Colombia, Costa Rica, Cuba, El Salvador, India, Kosova, Lebanon, Macedonia, Mexico, Morocco, Nigeria, Peru, Philippines, Turkey, Uruguay
# Medical/surgical ICUs
Surgical Site Infection Rates in Developing Countries

Range: 2.6-30.9%

Systematic review of the literature conducted by WHO
Infections in neonatal patients

- Neonatal infection rates in developing countries are 3-20 times higher than in industrialized countries.

- Among hospital-born babies these infections are responsible for 4% to 56% of all causes of death in the neonatal period, (3/4 in South East Asia and sub-Saharan Africa) (Zaidi et al, Lancet Infect Dis 2005)

- **Brazil (various papers):**
  - Overall infection rates in NICUs: 38.6%
  - HAI incidence density: 37.3±16.4 infections per 1000 patient-days (pooled weighted means) (6.9 infections per 1000 patient-days in the USA, Klevenś et al, Public Health Reports 2007)

Systematic review of the literature conducted by WHO
## Risk factors for HAI in multivariate analysis

<table>
<thead>
<tr>
<th>RISK FACTOR</th>
<th>N° of STUDIES</th>
<th>COUNTRIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HAI GENERAL</strong></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>- Length of stay</td>
<td>4</td>
<td>Tanzania, Mexico, Lebanon, Morocco</td>
</tr>
<tr>
<td>- Surgery</td>
<td>3</td>
<td>Mexico, Cuba, Morocco</td>
</tr>
<tr>
<td>- Intravascular catheter</td>
<td>3</td>
<td>Cuba, Tunisia, Morocco</td>
</tr>
<tr>
<td>- Urinary catheter</td>
<td>3</td>
<td>Cuba, Lebanon, Morocco</td>
</tr>
<tr>
<td>- CVC</td>
<td>1</td>
<td>Lebanon</td>
</tr>
<tr>
<td>- Age</td>
<td>1</td>
<td>Mexico</td>
</tr>
<tr>
<td>- Immunodeficiency</td>
<td>1</td>
<td>Cuba</td>
</tr>
<tr>
<td>- Pediatrics</td>
<td>1</td>
<td>Mexico</td>
</tr>
<tr>
<td><strong>HAI IN ICU</strong></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>- Length of stay in ICU</td>
<td>4</td>
<td>India, Mexico, Turkey, Egypt</td>
</tr>
<tr>
<td>- Surgery</td>
<td>3</td>
<td>Mexico, Brazil, Turkey</td>
</tr>
<tr>
<td>- Sedative medication</td>
<td>2</td>
<td>Mexico, Turkey</td>
</tr>
<tr>
<td>- Parenteral nutrition</td>
<td>1</td>
<td>India</td>
</tr>
<tr>
<td>- Neurological failure at admission</td>
<td>1</td>
<td>Mexico</td>
</tr>
<tr>
<td>- Hyperosmolar solution</td>
<td>1</td>
<td>Mexico</td>
</tr>
<tr>
<td>- Nasogastric tube</td>
<td>1</td>
<td>Brazil</td>
</tr>
<tr>
<td>- Age</td>
<td>1</td>
<td>Brazil</td>
</tr>
<tr>
<td>- Pulmonary diagnosis at admission</td>
<td>1</td>
<td>Turkey</td>
</tr>
<tr>
<td>- Tracheostomy</td>
<td>1</td>
<td>Turkey</td>
</tr>
<tr>
<td>- CVC</td>
<td>1</td>
<td>Turkey</td>
</tr>
<tr>
<td>- Community onset infection at admission</td>
<td>1</td>
<td>India</td>
</tr>
</tbody>
</table>
# Impact of HAI in some developing countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>SETTING</th>
<th>INFECTION RATE</th>
<th>MORTALITY</th>
<th>EXTRA LOS (days)</th>
<th>EXTRA COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>ICUs</td>
<td>/</td>
<td>/</td>
<td>VAP: 9</td>
<td>VAP: US$ 2,255/case</td>
</tr>
<tr>
<td>Brazil</td>
<td>Burn unit- single Hs</td>
<td>53.2% (I)</td>
<td>Crude Mortality: BSI: 21% (20 times higher)</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Brazil</td>
<td>H-W- 11 Hs in one city</td>
<td>14% (P)</td>
<td>/</td>
<td>/</td>
<td>US$ 18 Mio/year</td>
</tr>
<tr>
<td>India</td>
<td>12 ICUs- 6 Hs</td>
<td>4.4% (I)</td>
<td>Extra Mortality: VAP: 19% CVC-BSI: 4% CA-UTI: 11.6%</td>
<td>VAP: 11 CVC-BSI: 5 CA-UTI: 8</td>
<td>/</td>
</tr>
<tr>
<td>Malaysia</td>
<td>H-W- single H</td>
<td>13.9% (P)</td>
<td>/</td>
<td>/</td>
<td>Cost x antibiotics x NI: US$ 521,000/year</td>
</tr>
<tr>
<td>Mexico</td>
<td>ICUs</td>
<td>/</td>
<td>/</td>
<td>CVC-BSI: 6</td>
<td>CVC-BSI: US$ 11,591/case</td>
</tr>
<tr>
<td>Turkey</td>
<td>H-W- single H</td>
<td>/</td>
<td>/</td>
<td>HAI gen: 23</td>
<td>HAI gen: US$ 2026/case</td>
</tr>
</tbody>
</table>

Systematic review of the literature conducted by WHO
Conclusions (1)

- The burden of HAI worldwide is likely to be very high and causes prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, significant additional financial burden, high costs for patients and their family, and excess deaths.
- The lack of a reliable denominator and the use of different definitions and methodologies makes it currently impossible to obtain accurate global estimates.
- Some developed countries and facilities succeeded at establishing good surveillance systems, others not yet.
- Existent regional networks and national surveillance systems should be strengthened and new ones established.
Conclusions (2) – situation in developing countries

- Scattered picture; many countries not represented
- Intra- and inter-continental unbalance (Europe>Americas>South East Asia)
- Most frequent types of studies: hospital-wide prevalence and SSI studies
- Low number of high quality papers (48.2%)
- Lack of information on sample size, proportion of infection diagnosed with microbiological criteria
- Limited information on etiology
- Very limited information about risk factor and impact
- SSI is the most frequent infection site hospital-wide and SSI rates are 3-20 fold higher than in developed countries
- Hospital-wide HAI rates do not seem to be particularly higher (2-3 fold) than in developed countries
- HAI rates in ICU, particularly device-associated infections, are 3-30 times higher than in the USA
Aiming at... **10 000 registered health-care facilities** by May 2010

The countdown has started!

Register your facility at [http://www.who.int/gpsc/5may](http://www.who.int/gpsc/5may)
Inaugural infection control webinar series

The modern approach to infection control
16 February 2010, 3 pm (CET*)

D. Pittet, Geneva, Switzerland
Lead
First Global Patient Safety Challenge
Clean Care is Safer Care
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