Costs of Healthcare Associated Infections in countries the Latina American and Caribbean Region: A systematic literature review

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Background

• Healthcare-associated infections (HAI) are among the most common preventable health adverse event
  - Threat to patient safety
  - Associated with significant health burden globally

• Economic evidence is relevant for the estimation of the costs and economic burden of HAI
  - Information to mobilize donors and partners, society and decision makers
  - Useful inputs for cost-effectiveness of interventions to prevent and reduce HAI and related morbidity and mortality

• HAIs in hospitals impose significant economic consequences on the nation’s healthcare system.
Background

• Limited data on costs of HAI in lower and middle income countries is available, being most evidence from developed countries as USA and Europe

• Given the low external validity of costing studies and taking into consideration differences in the healthcare system structure, one cannot use information generated in developed countries in LAC

• In 2000 PAHO published a standardized protocol for conducting studies on HAI costing, considering those with greater frequency and burden

• As a result, various costing studies have been published in LAC, in the past 10 years, using standardized methodology
Background

Relevant evidence

• Two recent studies in USA reported on
  o costs of HAI
  o its financial impact in the healthcare system
  o Benefits related to prevention of HAI, considering both disease and economic burden and impact of prevention interventions

• In both studies a systematic literature review of available evidence was performed

(ZIMLICHMAN et al., 2013; SCOTT II, 2009)
Background

CDC estimates, USA

• Scott et al, CDC study - uses results from the published medical and economic literature to provide a range of estimates for the annual direct hospital cost of treating HAI in the USA
• Overall annual direct medical costs of HAI to U.S. hospitals ranges from $28.4 to $33.8 billion in 2007
• Benefits of prevention range from a low of $5.7 to $6.8 billion (20 percent of infections preventable, CPI for all urban consumers) to a high of $25.0 to $31.5 billion (70 percent of infections preventable, CPI for inpatient hospital services).

SCOTT II, 2009
Background

Metanalysis and modelling, USA

• Zimlich et al. – systematic review to estimate attributable costs
• CDC data for HAI incidence, modelling to generate costs considering the US healthcare system perspective
• Costs and length of stay (LOS), by 5 major HAI, by site
• Total annual costs for 5 major infections = USD 9.8 billion
• Cost per case
  o Central line–associated bloodstream infections (CLA-BSI) = $45,814
  o Ventilator-associated pneumonia (VAP) = $40,144
  o Surgical site infections (SSI) = $20,785
  o Clostridium difficile infections (Clos) = $11,285
  o Catheter-associated urinary tract infections (CA-UTI) = $896
Rationale

• A systematic review of the literature will fully describe the available evidence on HAI costs in LAC, allowing better country, sub-regional and region cost estimates
  o Taking in to consideration variability within region and available studies
  o Through an assessment of the methods used, comparability of results will be allowed
  o Taking in to consideration rigorous criteria for quality assessment of the available evidence

• Such studies will generate evidence
  o Region specific estimates
  o To support estimation of the economic burden of ISS in the region, together with surveillance and epidemiologic data collected by countries
  o To support cost-effectiveness studies of selected interventions to prevent and control ISS in the Region
Health Economic Studies

1. What is the cost of a given disease/condition?

2. What is the cost of a given intervention?

3. How does benefits provided by this intervention relates to its costs?
Types of Economic Studies

- Economic Burden
  - Cost of illness analysis
- Program Cost analysis
- Full economic evaluation or Cost-consequence analysis
  - Cost-benefit
  - Cost-effectiveness
  - Cost-utility
Economic Burden Studies

• Estimates total costs of a disease or condition:
  o Direct cost: Medical and non-medical
  o Indirect cost: Productivity losses
• Generally reported as:
  o Annual total cost
  o Average patient lifetime cost
• Shows potential benefits of prevention
• Questions:
  o What are the costs of a BSI?
  o What are the costs of BSI to country X?
  o What is the additional cost of a patient with antibiotic resistant BSI when compared to a patient with susceptible BSI for a hospital/healthcare system/society?
Types of cost

• Direct
  o Medical
  o Non medical
• Indirect
• Intangible
• Average Cost
• Incremental Cost
Study Perspectives

• Societal
• Healthcare System
• Hospital
• Patient
• Industry
• Health Maintenance Organization (HMO)
The perspective will determine what costs will be considered in the analysis.

<table>
<thead>
<tr>
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<th>Perspective</th>
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<tr>
<td></td>
<td>Individual</td>
</tr>
<tr>
<td>Physician</td>
<td>- or +</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>- or +</td>
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<tr>
<td>Transport to hospital</td>
<td>+</td>
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<tr>
<td>Workloss due to illness or time spent caring for sick</td>
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Systematic Literature Review

Study Team

- **Dra Cristiana Toscano**
  - Professor, Epidemiologist, Health economist
  - Federal University of Goiás, Brazil

- **Prof Martha Martinez**
  - Professor, Librarian
  - Gonçalo Muniz Institute, Oswaldo Cruz Foundation, Bahia, Brazil

- **Prof Ana Laura Zara**
  - Colaborator, Epidemiologist
  - Federal University of Goiás, Brazil

- **Dra Valeska Stempliuk**
  - Pan-American Health Organization – PAHO
Objectives

• Assess the cost and additional length of stay (LOS) of healthcare care associated infections in countries in the Latin American and Caribbean Region, considering the following priority infection sites

  o surgical site infections (SSI)
  o catheter associated urinary tract infections (CA-UTI)
  o ventilator associated pneumonia (VAP)
  o central line associated bloodstream infection (CVC-BSI)
Methods

- Sysmatic Literature Review
- PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) ([www.prisma-statement.org](http://www.prisma-statement.org))
- Study protocol registered in PROSPERO (International prospective register of systematic reviews)
Methods – Study Design

• Databases Searched
  o PUBMED, LILACS, EMBASE

• Study Period
  o No restriction of date

• Language
  o No restriction

• Infection Sites
  o Central line–associated bloodstream infections (CLA-BSI)
  o Ventilator-associated pneumonia (VAP)
  o Surgical site infections (SSI)
  o Catheter-associated urinary tract infections (CA-UTI)
Methods
Inclusion criteria

• Study population
  o Pacientes hospitalizados

• Comparator
  o Hospitalized patients without HAI

• Outcomes of interest
  o Main: Incremental costs related to HAI
  o Secondary: Incremental length of stay (LOS), antimicrobial use (in DDD) and mortality associated with HAI

• Location
  o Countries in the LAC Region

• Study Designs
  o Observational cohort, case control and cross-sectional
  o Longitudinal before-after and quasi-experimental
  o Systematic Review and Metanalysis
Methods
Exclusion criteria

• Studies design to assess risk factors for HAI and therefore only consider information prior to HAI diagnosis (regarding LOS and ATB use)
• Population: Infections acquired in the community
• Study design: Case series
• Comparator: Lack of comparison among patients with and without HAI (and therefore unable to estimate incremental outcomes)
Search Strategy and Terms

LAC countries and Region

Search Strategy and Terms
LAC countries and Region

2. “Caribbean Region”[MeSH Terms] OR Caribbe* OR "west indies"[All Fields] OR "montserrat"[All Fields] OR "Latin America"[Mesh] OR ("latin"[All Fields] AND "america"[All Fields]) OR Antilles OR “Antillas” OR “Netherlands Antilles”[MeSH Terms] OR “Southern Cone” OR “South America”[All Fields] OR “South American”[All Fields] OR “Central America”[All Fields] OR Centroamerica* OR “America Central” OR “America del Sur” OR Sulamerica OR Sudamerica = 78913

LAC REGION = #1 OR #2
CATHETER ASSOCIATED URINARY TRACT INFECTIONS


COST AND ADDITIONAL LENGTH OF STAY


OR


#1 AND (#2 OR #3) AND (LAC REGION) = 78 (CAUTI)
Search Strategy and Terms
Central line–associated bloodstream infections (CLA-BSI)

CENTRAL LINE ASSOCIATED BLOODSTREAM INFECTION
1. “Catheterization, Central Venous/adverse effects”[MESH] OR “Central Venous Catheters/adverse effects”[MESH] OR (Central Line*[TIAB] AND (Bloodstream infecti* OR BSI)) OR CABS I OR (“central venous” AND catheter*) = 21413

COST AND ADDITIONAL LENGTH OF STAY
OR

#1 AND (#2 OR #3) AND (LAC REGION) = 77 – DUPLICADOS = 51
Search Strategy and Terms

Ventilator-associated pneumonia (VAP)

VENTILATOR-ASSOCIATED PNEUMONIA


COST AND ADDITIONAL LENGTH OF STAY


OR


#1 AND (#2 OR #3) AND (LAC REGION) = 472 – DUPLICADOS = 443
Search Strategy and Terms
Surgical site infections (SSI)

SURGICAL SITE INFECTIONS
1. "Surgical Wound Infection"[Mesh] OR surgical site infection*[TIAB] OR
   ("Postoperative"[TIAB] OR post-operative OR postsurgical[TIAB] OR post-
   surgical[TIAB]) AND infection*[TIAB]) OR wound infection*[TIAB] OR SSI[TIAB]
   = 79106

COST AND ADDITIONAL LENGTH OF STAY
   “Hospital Cost”[TIAB] OR “Drug cost” OR “Cost Analyses”[TIAB] = 915903
   OR

#1 AND (#2 OR #3) AND (LAC REGION) = 215 – DUPL. = 195
Search Strategy and Terms

Cross Infections

CROSS INFECTION

COST AND ADDITIONAL LENGTH OF STAY

OR


#1 AND (#2 OR #3) AND (LAC) = 411 – DUPL. = 206
Methods
Data retrieval and analysis

• Two independent investigators performed the review of titles and abstracts to identify studies to be included in the review
• Two independent investigators performed the Reading of the full articles, data extraction and assessment of study methodology and quality
• A third reviewer was consulted if consensus was not reached
• Descriptive analysis of main outcome results and study methods was performed
Methods

Variables extracted and considered

• 1) Study characterization: author, country, contact details, year of publication, study design, hospital characterization and site where study was conducted (number of bed, type of ward); study location and period; sample size;

• 2) Epidemiologic characterization: patient characterization (type of infection, underlying illness/cause of hospitalization, average age, sex); number of cases and controls; all reported outcomes; outcome definition, secondary outcomes; diagnostic criteria and comorbidities; definition used for AIHs; reported AIH prevalence or incidence;

• 3) Economic characterization: study perspective; guidelines used for costing; costing methods used; cost components/categories (direct hospital costs, indirect costs) and cost items considered; cost data sources; currency and exchange rate; discount rate; adjustment for inflation; year of reported costs; sensitivity analysis
Methods
Data quality assessment

• Data extraction considered all relevant economic data as recommended by current guidelines

• The following standardized criteria for economic evaluation studies were considered for the evaluation of studies regarding their methodological quality
Results

• A total of **1.794 citations were identified**:
  o 399 duplicates were excluded
  o 1.395 title and abstract revisión performed in
  o 142 papers obtained for full reading

• **Full Reading of 142**
  • resulted in inclusión of 122 studies

• **Reported results on**
  o XX BSI
  o YY SSI
  o ZZ UTI
  o WW VAP
Duplicates (n = 399)

Total no duplicates (n = 1,395)

Selected for full article review (n = 142)

Excluded by title and abstract review (n = 1,245)

Excluded after full text reading (n = 20)

Included in Review (n = 122)
Results

Table studies by country
Results

Table studies by site
Results

Table studies by outcome presented
Results

Table studies by design
Results
Surgical site infections (SSI)

- $ and LOS
Results
Catheter associated urinary tract infections (CA-UTI)

- $ and LOS
Results
Ventilator associated pneumonia (VAP)

- $ and LOS
Results

Central line associated bloodstream infection (CVC-BSI)

- $ and LOS
Discussion
Lack of consistency in Cost Estimates

- Cost estimates will depend
  - assessment is at the individual or multiple institutions
  - figures are based on comparison of a resistant versus susceptible patient/infection or they are total costs of care (resistant versus nothing)
  - figures include hospital costs only, look at patient costs, or incorporate productivity costs (i.e. consider the health care or the ‘societal’ perspective),
  - methods used to estimate costs
  - focused on one or multiple disease areas
  - preventative control measures are included
- Lack of consistency generates problems in assessing the true scale of the problem
Healthcare related infections

Priority research questions

• Impact HAI on healthcare expenditure → interventions are urgently needed
• Studies of the cost-effectiveness of these new interventions
  o Economic benefits of novel interventions need to be quantified.
  o Reliable and detailed information on the economic burden and costs of HAI in LAC is needed
Economic Research and HAI

■ What is needed?
  ■ Economic burden
  ■ Cost of program/interventions
  ■ Cost-effectiveness of interventions

■ How results will be used?

■ What methods should be used?
  ■ Considering suitability for each need

■ Standardize methodology for consistency and comparability

■ Research networks for collaboration
Conclusions

- **First** Systematic Literature Review of HAI costs in LAC.
- Several studies available, using adequate methods and allowing for comparison among countries and within sub-regions
- Importance of locally generated HAI cost data
- In combination with surveillance and epidemiology data on HAI from countries → burden of HAI, economic burden of HAI can be generated
  - Important for movilización of resources, decisión makers and society
  - Important as baseline for the future assessment of the impact of interventions to reduce HAI