Burden of *Clostridium difficile* infections (CDIs) in France in 2014

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Je déclare le lien d'intérêt suivant: Salarié Da Volterra
Background

- *Clostridium difficile* infections (CDIs) are a growing medical concern worldwide:
  - The burden each year in the USA is high\(^1\):
    - 453,000 infections
    - 29,000 deaths
    - $4.8 billion in excess costs
  - In the EU: €3 billion/year that will double in 40 years\(^2\)
  - In France, a recent study\(^3\) extrapolated from local data the costs to 163.1M€ at the national level

- **Our objectives:**
  - Describe the hospitalized patients affected by CDI in France from national data
  - Measure the costs caused by CDI in the hospitals in France from the public health insurance perspective

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\(^1\) Lessa et al., 2015  
\(^2\) Kuijper et al., 2006  
\(^3\) Le Monnier et al., 2015
Methods

Data Source

- **PMSI: Programme de Médicalisation des Systèmes d'Information**
  - an exhaustive medico-administrative hospital discharges database
  - covering all public and private hospitals in France

- PMSI includes data on each hospital stay including:
  - socio-demographic data (gender, age, residence code)
  - medical information on the primary diagnosis and comorbidities (secondary associated diagnoses), coded using ICD-10 classification
  - examinations and treatments received
  - the Diagnosis Related Group (DRG) attributed to the stay
Methods

Data Collection on *Clostridium difficile* infections

All hospital stays with a primary, related and associated CDI specific code were selected from the 2014 PMSI database using the ICD-10 codes A047 (“Enterocolitis due to *Clostridium difficile*”)

Hospital stays with a primary diagnosis of CDI (A047)

Analysis of patients’ gender, age, length of stay (LOS) and costs.

Hospital stays with a diagnosis of CDI in **comorbidity** (A047)

A retrospective case–control (1:1) analysis was performed.

Cases: hospitalizations **with CDI** in comorbidity

Controls: hospitalizations **without CDI** in primary diagnosis or in comorbidity.

Matching method was based on:
- Age, sex and DRG
- Same year of hospitalization (2014)

Controls were randomly chosen among possibilities.

LOS and costs were compared by non-parametric tests (Wilcoxon).
Methods
Economic Burden of CDI Hospitalizations

- Public health insurance perspective.
- Hospital costs were calculated using official DRG payments (DRG payments to hospitals shall cover all incurred expenses: medical procedures, nursing care, treatments [except expensive drugs], food and accommodation, ...).
- Additional costs per day of hospitalization in emergency or intensive care units were added to DRG payments, when appropriate.
- For private hospitals, physicians’ fees were also added to the DRG payments (ENCC).
Results

Hospital Stays Characteristics

<table>
<thead>
<tr>
<th>Overall number of hospitalizations for CDI</th>
<th>13,516 patients</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>16,099 stays</td>
</tr>
</tbody>
</table>

- CDI as primary diagnosis
  - 4,968 patients
  - 5,834 stays

- CDI as comorbidity
  - 9,156 patients
  - 10,265 stays
Results

Patient Characteristics

Distribution of CDI Patients (n=13,516) per Age Group

- CDI as Primary Diagnosis
- CDI as Comorbidity

>65 → 65%
Results

CDI as the Primary Diagnosis

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Controls were randomly chosen among possibilities.

LOS and costs were compared by non-parametric tests (Wilcoxon).
Results: CDI as the Primary Diagnosis
Costs & Length Of Stay (LOS)

CDI as Primary Diagnosis - Mean LOS and Mean Individual Cost per Age Group

- Costs
- LOS

Individual Cost (Euros)
Length of Stay (days)

Age Group (year)

0  5  10  15  20  25  30
0 € 2,000 € 4,000 € 6,000 € 8,000 € 10,000 € 12,000 €
Results: CDI as the Primary Diagnosis
Costs & Length Of Stay (LOS)
Results: CDI as the Primary Diagnosis

Total Costs

Total Economic Burden: 30 728 975 €
Results

CDI as Comorbidity (Case-Control Study)

All hospital stays with a primary, related and associated CDI specific code were selected from the 2014 PMSI database using the ICD-10 codes A047 ("Enterocolitis due to Clostridium difficile")

A retrospective case–control (1:1) analysis was performed.

Cases: hospitalizations with CDI in comorbidity
Controls: hospitalizations without CDI in primary diagnosis or in comorbidity.

Matching method was based on:
- Age, sex and DRG
- Same year of hospitalization (2014)

Controls were randomly chosen among possibilities.

LOS and costs were compared by non-parametric tests (Wilcoxon).
Results: CDI as Comorbidity

**Costs**

**Individual Costs for Patients with CDI (Case) and without CDI (Control) per Age Group**

*** p < 0.001
* P < 0.05
Results: CDI as Comorbidity

Costs

Individual Costs for Patients with CDI (Case) and without CDI (Control) per Age Group

Additional CDI Attributable Costs
Mean  +8 295 € ± 17 163 €

Cases (With CDI)
Controls (Without CDI)

*** p < 0.001
* P < 0.05

**
**
**
Results: CDI as Comorbidity

Length of Stay

LOS for Patients with CDI (case) and without CDI (control) per Age Group

Cases (With CDI)

Controls (Without CDI)

Results: CDI as Comorbidity

Length of Stay

*** p < 0.001

* P < 0.05

*** p < 0.001

* P < 0.05
Results: CDI as Comorbidity

Length of Stay

LOS for Patients with CDI (case) and without CDI (control) per Age Group

- **Cases (With CDI)**
- **Controls (Without CDI)**

Additional CDI Attributable LOS
- Mean: +17 days ± 30 days

**Results:**
- **CDI as Comorbidity**
- **Length of Stay**
  - *** p < 0.001
  - * P < 0.05

**Mean**
- Additional CDI Attributable LOS
  - Mean: +17 days ± 30 days

**Age Group (year)**
- 0-10
- 11-20
- 21-30
- 31-40
- 41-45
- 46-50
- 51-55
- 56-60
- 61-65
- 66-70
- 71-75
- 76-80
- 81-85
- 86-90
- 91-95
- 96-100
- 101-105

*** p < 0.001
* P < 0.05
Results: CDI as Comorbidity

Total Costs

Total Costs of CDI as Comorbidity

Total Economic Burden: 84,975,278 €
Results

Key Teachings

Total Economic Burden: 30 728 975 €

Total Economic Burden: 84 975 278 €

Overall Economic Burden: 115.7 M€

### CDI as

<table>
<thead>
<tr>
<th></th>
<th>Primary diagnosis</th>
<th>Comorbidity</th>
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<tbody>
<tr>
<td>Costs</td>
<td>5,267 ± 3,645€</td>
<td>+8,295 ± 17,163€</td>
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<tr>
<td>LOS</td>
<td>12 ± 11 days</td>
<td>+17 ± 30 days</td>
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Discussion & Conclusions

- **Discussions:**
  - Possible misclassification of CDI cases in the PMSI
  - Unknown if CDI diagnoses were confirmed with lab tests
  - Multiple CDI episodes during the same hospital stay were not captured
  - UCD were not included: under-estimation of costs
  - Overall economic burden of 115.7M€ for French public health insurance differs from Le Monnier al., 2015: 163.1M€ because of methods

- **Conclusions:**
  - CDIs have a very **high clinical and economic burden** in the hospital.
  - When present as comorbidity, **CDI significantly increases the LOS and the economic burden**.
  - **Preventive approaches** should be implemented to avoid CDIs.
Thank you for your attention