

Clinical outcomes following hospitalisation with *Clostridium difficile*

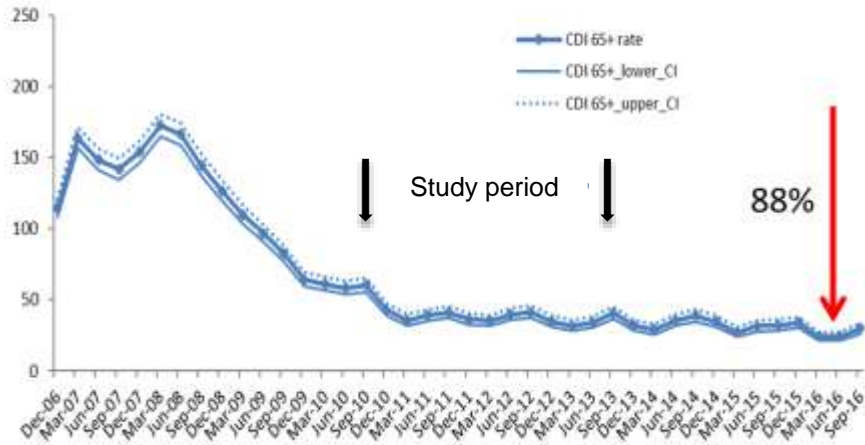
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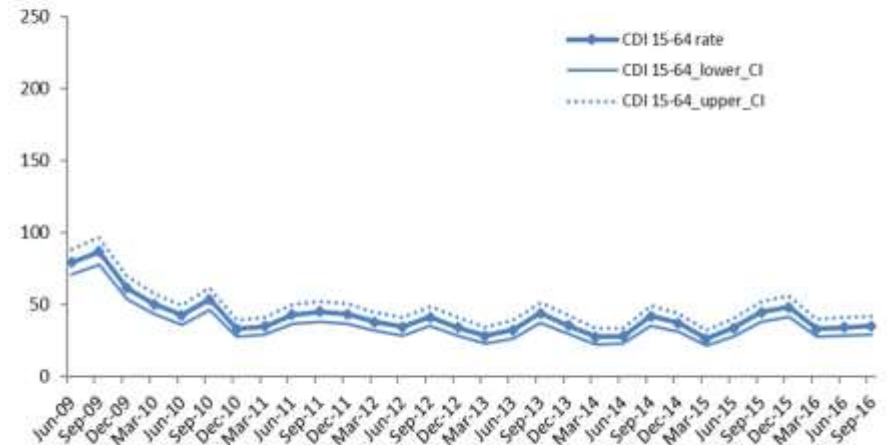


CDI in Scotland 2006–2016

Quarterly rates of Clostridium difficile in ages 65+ per 100 000 total bed days



Quarterly rates of Clostridium difficile in ages 15-64 per 100 000 acute bed days

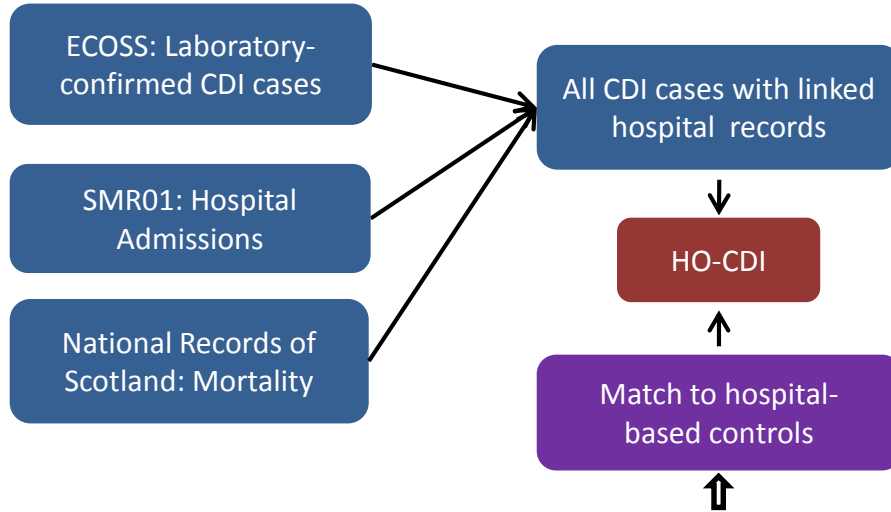


<http://www.hps.scot.nhs.uk/haic/sshaip/resourcedetail.aspx?id=3136>

Methods

- Four national patient level data sets were linked:
 - Laboratory-confirmed infections (ECOSS)
 - Prescriptions for antimicrobials in primary care (PIS)
 - All hospital admissions (SMR01)
 - National Records of Scotland: deaths
- All hospital cases of CDI in the period August 2010 to July 2013
- Matched with up to 6 hospital-based controls on age (to within 10 years), sex, admitting hospital and date of admission (to within 7 days)
- Each control used the diagnosis date of CDI for the matched case

Data linkage for CDI



All the cases and controls will be linked to :

- SMR01 – comorbidity markers
- PIS: Prescriptions while in community
 - Antimicrobials
 - Proton pump inhibitors/H2 antagonists
 - Drug counts
- Death records

All cases of CDI were diagnosed while the individual was in hospital, **HO-CDI (hospital-onset CDI)**:

including **CA-HO**, those tested **within 48 hours of hospital admission (presumed Community Acquired)**, and

HA-HO, those tested **over 48 hours from hospital admission (presumed Hospital Acquired)**

Up to **6** controls are matched on the basis of **age, gender and hospital and date of admission**

Demographic results

Variable	Cases (3304), N	%	Controls (9516), N	%
Gender				
Male	1385	41.9	3907	41.06
Female	1919	58.0	5609	58.94
CDI type				
CA	1297	39.3	*	*
HA	2007	60.7	*	*
Admitted from a Care Home				
No	3132	94.8	9125	95.9
Yes	172	5.2	391	4.1
	Median	IQR	Median	IQR
Antimicrobial prescriptions previous year	1	0,3	1	0,3
Number of admissions previous year	2	1,3	1	0,3
Total prescriptions previous year	58	30,9	48	22,8
Different prescriptions previous year	13	8,2	11	6,2
Length of stay (days) before the date of CDI	5	1,2	4	1,2

Mortality and discharge status

	Cases			Controls		
	Total	N	%	Total	N	%
Mortality at 2 months	3304	953	28.8	9516	1362	14.3
Died in hospital within 2 months	3304	731	22.1	9516	855	9.0
Discharged within 2 months	3304	2022	61.2	9516	7542	79.3
Still in hospital at 2 months	3304	551	16.7	9516	1119	11.8

**After adjustment for comorbidities and demographic features
the hazard ratio (HR) of death for Cases relative to Controls is **2.12 (95% CI 1.93, 2.33)****

Comorbidities associated with the current admission were also positively associated with mortality

Length of stay*

- The additional length of stay for a CDI case is **2.16** (1.57, 2.99) times greater than the length of stay for the control patients without CDI
- Median length of stay post CDI for Cases: **17.0** days
- Median length of stay 'post CDI' for Controls: **7.3** days
- Additional length of stay associated with CDI: **9.7** days

Log normal survival regression model

*Adjusting for comorbidities associated with admissions to hospital in the previous 5 years , prescriptions and antibiotic prescriptions, reason for admission, deprivation, age, sex and length of stay in hospital prior to CDI

Recurrence and age

Age	Hazard Ratio for recurrence
Under 65	1
65–74	1.5 (95% CI: 1.1–2.1)
75–84	2.0 (95% CI: 1.4–2.7)
85+	2.1 (95% CI: 1.5–3.0)

Recurrence and readmission

	Total	N	%
Recurrence within 90 days among those who survived first CDI EPISODE	2740	373	13.6
Subsequent recurrence within 90 days among those who survived the first RECURRENCE	371	85	22.9
Subsequent recurrence within 1 year among those who survived the first RECURRENCE	371	108	29.1
Discharged within 30 days of first CDI episode; readmitted within 6 months	1712	1015	59.3
Discharged at least 30 days after first CDI episode; readmitted within 6 months	626	334	53.4

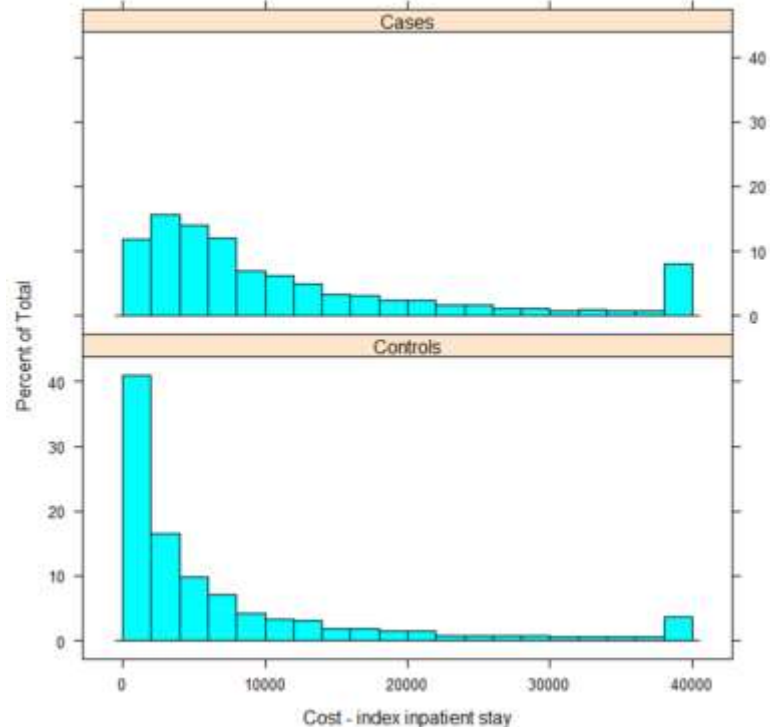
Costs associated with continuous inpatient stay of first episode

Median cost for Cases: £7500

Median cost for Controls: £2800

Costs were based upon the daily costs for different types of beds – general, ICU/HDU etc.

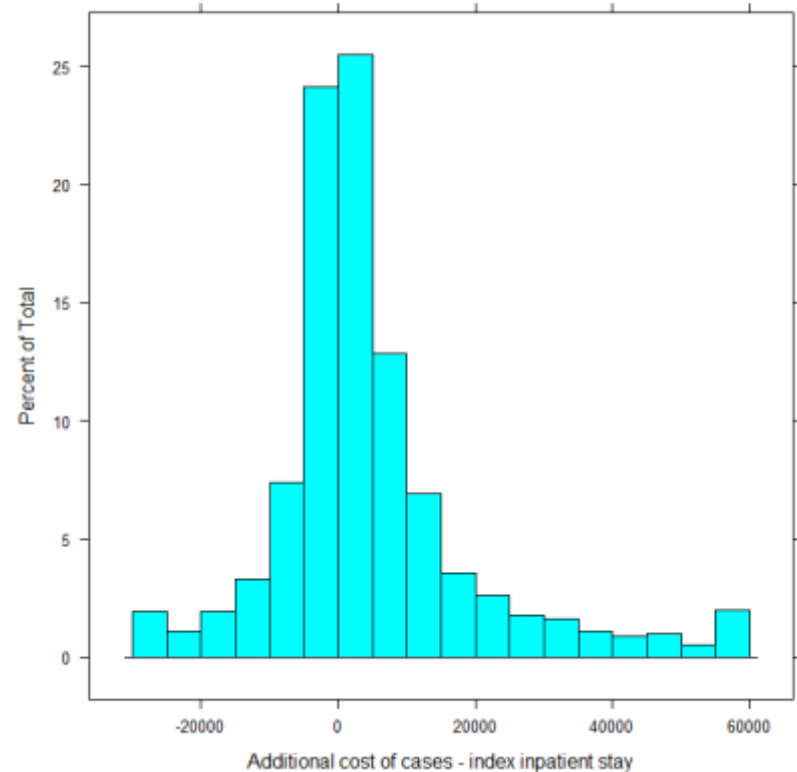
Patients who die contribute no costs following death



Additional costs associated with continuous inpatient stay of first episode

Median additional cost for Cases: £1700

Calculated as the difference in the costs for the continuous inpatient stay associated with the CDI episode for the Case, compared with the average of the costs for the matched Controls



Costs associated with all stays in hospital in 6 months following CDI

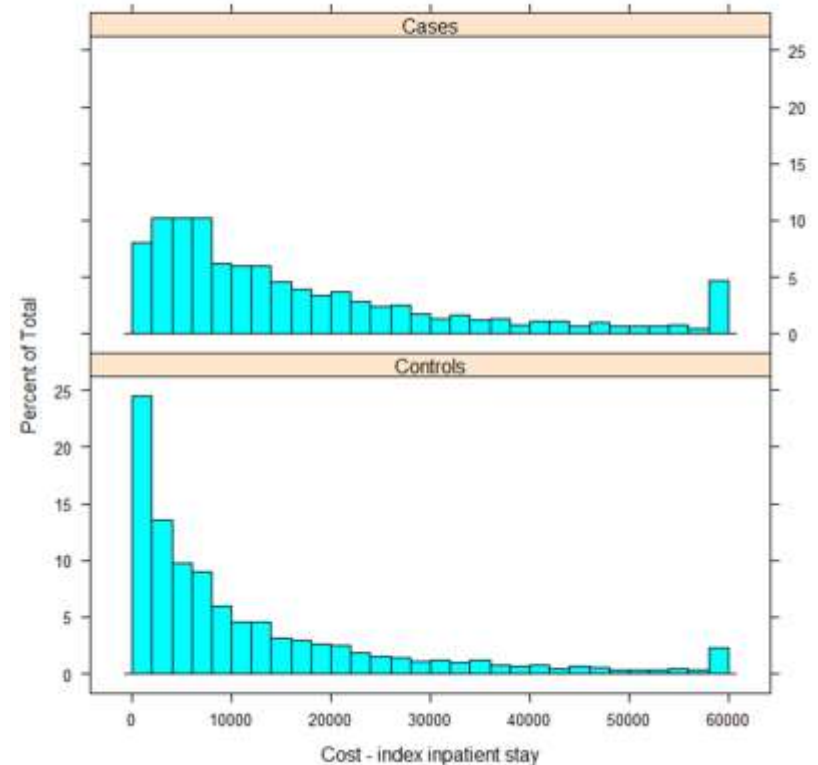
Median cost for Cases: £11,600

Median cost for Controls: £6,500

Even though there is greater mortality among CDI patients, all hospital costs in the 6-month period following CDI are nearly 2 times greater among Cases than Controls

Costs were based upon the daily costs for different types of beds – general, ICU/HDU etc.

Patients who die contribute no costs following death



Conclusions

- This study demonstrates the additional impact on the health service in Scotland of CDI infections
 - 1,100 CDI hospital cases a year
 - 10,670 bed days over a year
 - Equivalent to a 30-bed ward fully occupied
- The median cost per case is £7,500 with a median additional cost of £1,700
- Mortality is doubled among patients who have a CDI compared with controls
- Length of stay is doubled compared to controls
- A sixth of patients cured of the initial CDI recur within 3 months
- One third of those who recur have a second recurrence within a year
- Although 60% of discharged CDI patients are readmitted, CDI is not the reason for the readmission

Acknowledgements

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Reasons for initial admission and readmission

	Admission (N=3304), %	Readmission (N=726), %
1 Myocardial infarction	5.6	6.1
2 Congestive heart failure, cardiomyopathy etc.	7.5	6.1
3 Atherosclerosis, aortic aneurysm, vascular disease	5.6	6.7
4 Stroke etc.	6.4	9.5
5 Dementia	5.8	5.4
6 Bronchitis, pneumoconiosis etc.	13.2	10.2
7 Gout, lupus, rheumatoid arthritis etc.	1.9	1.8
8 Gastrointestinal or ulcers	2.2	2.9
9 Liver problems	4.6	3.9
10 Diabetes	11.6	11.7
11 Diabetes with complications	1.3	2.8
12 Hemiplegia, paraplegia etc.	0.2	0.7
13 Renal problems	13.0	11.8
14 Cancer	17.5	9.9
15 Alcohol-related liver failure, varices etc.	2.5	2.1
16 Metastatic cancer	5.5	1.2
17 HIV related	0.2	0.7

Little difference in reasons for admissions

Cancer less frequent for readmission

All readmissions, not just those within 1 year

Multiple reasons for admission are possible

Costs associated with having CDI compared with the controls

Pounds sterling (£)		1st Quartile	Median	3rd Quartile
Continuous inpatient stay associated with episode of CDI	Cases	3,728	7,456	16,060
	Controls	932	2,796	8,388
Additional hospital costs associated with being a case (calculated from the difference in costs of the cases and the average of the matched controls)		-1,864	1,713	8,396
Total hospital costs in 6 months following CDI date	Cases	5,126	11,650	23,750
	Controls	2,324	6,524	16,170