Correlation of antimicrobial consumption with *Clostridioides difficile* incidence across the departments of an academic medical center

Nasstasja Wassilew[1*] , Alexandra Zehnder[2*] , Andrew Atkinson[1,3], Andreas Kronenberg[2#] , Jonas Marschall [1,3#]

[1] Department of Infectious Diseases and Hospital Epidemiology, Inselspital Berne, Bern University Hospital and University of Bern, Bern, Switzerland
[2] Institute for Infectious Diseases, University of Bern, Bern, Switzerland
[3] Division of Infectious Diseases, Washington University School of Medicine, St. Louis, MO, US
[*] denotes shared first authors, [#] denotes shared last authors

AIM

The aim of the study was to correlate Clostridioides difficile infection (CDI) incidence with total antibiotic consumption and use of specific antibiotics or antibiotic groups across 17 clinical departments of an academic hospital.

METHODS

Retrospective correlation study in a single Swiss tertiary hospital centre with data on CDI and antibiotic prescriptions from 1.1.2008 to 31.12.2021. CDI episodes were defined using CDC criteria. Antibiotic consumption was reported per WHO in defined daily doses (DDD). A mixed effects logistic regression model was fitted with each department as random effect to determine CDI incidence as a function of year and adjusted for antibiotic consumption.

RESULTS

- We identified 2'492 *Clostridioides difficile* positive samples classified into 1'827 CDI episodes, further analysed in this study
- Overall incidence of CDI varied between 5.0 (2021) and 9.8 (2009) episodes/10'000 patient-days
- A decreasing trend could be observed from 2008 to 2021, in line with a slight decrease in antibiotic consumption (Fig 1)

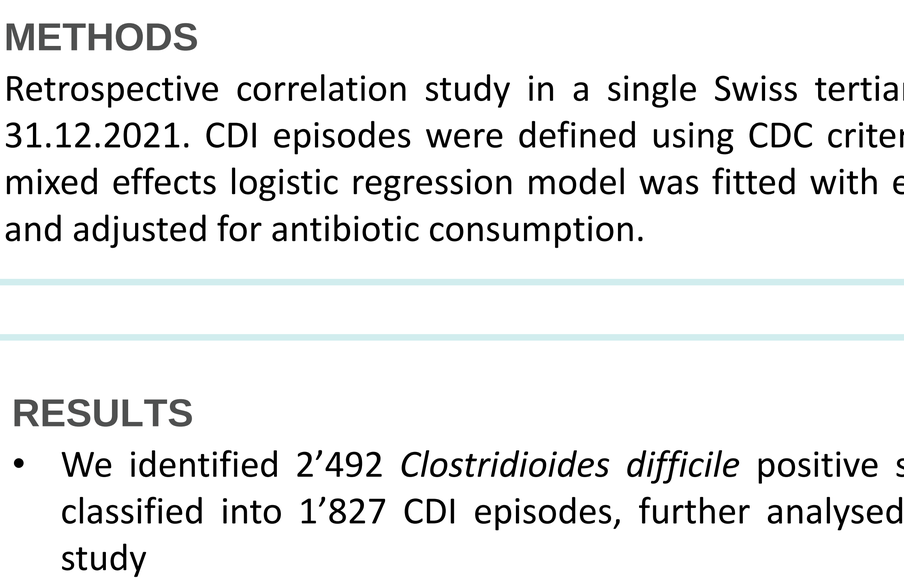


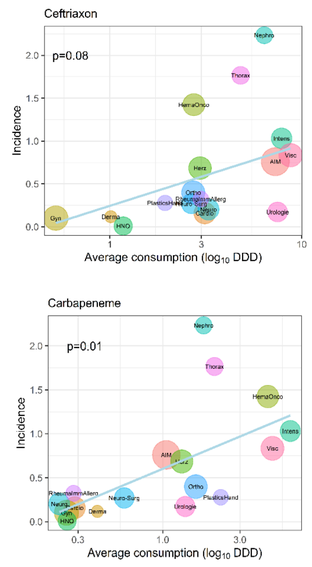
Figure 1: CDI incidence trajectory per 10'000 person days 2008-21 (left hand axis), and sum of total antibiotic consumption of individual departments in DDD/100 person days (right hand axis, blue bars);

- Correlation between overall antibiotic consumption and CDI incidence was significant in both univariable (IRR 1.16 (95% CI 1.09, 1.23; p<0.001) and multivariable analysis (IRR 1.16 (95% CI 1.08, 1.23; p<0.001)
- Analysis of CDI incidence and average antibiotic consumption by department revealed no significant trends, but high variability between individual departments (Fig 2)

Fig 2: Overall CDI incidence plotted against weighted median yearly antibiotic consumption per 100 patient-days. Size of bubble is proportional to the number of patient-days; weighted line of best fit in light blue, dashed.

- Analysis of individual antibiotic groups revealed marginal trends (p-values for slope), suggesting correlation with CDI incidence for carbapenems (p=0.01), ceftriaxone (p=0.08), cefepime (p=0.01), macrolides (p=0.01), and piperacillin/tazobactam (p=0.07, Fig 3)

Fig 3: CDI incidence (per 1000 person days) and average consumption 2008-21 (DDD/100 person days) for ceftriaxon and carbapenems (examples); size of the bubble is proportional to the number of person-days; line of best fit (light-blue, solid) with p-value for the slope top left.



Conclusions

Our findings serve as a reminder that the larger the volume of antibiotics consumption is in a given hospital, the greater the risk of *C. difficile* infections and that certain antibiotics may be more strongly associated with CDI incidence than others. Implementing surveillance programs to highlight this correlation could prepare the ground for interventions aimed at reducing antibiotic consumption and, subsequently, CDI incidence.