

Temporal and Regional Differences in Antibiotic Use for Treatment of Invasive Methicillin-Resistant *Staphylococcus aureus* Infections in Swiss Hospitals, 2009 - 2019

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Background and Objectives

Antibiotics used for treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) are mainly daptomycin, glycopeptides (vancomycin and teicoplanin) and linezolid.

Objectives were

- to describe consumption of anti-MRSA antibiotics over time and to analyze differences in use between hospitals and regions
- and to identify factors associated with their consumption.

Methods

A retrospective observational multi-center study was conducted in 21 Swiss hospitals over a period of 11 years (2009 – 2019). Consumption data of glycopeptides, daptomycin and linezolid as well as incidence of invasive MRSA infections were yearly aggregated in defined daily doses (DDDs), cases, respectively, per 1000 bed-days. A linear regression model was developed to identify factors contributing to the use of anti-MRSA antibiotics.

A survey was sent to participating hospitals for investigating hospital internal usage guidelines of anti-MRSA Antibiotics in 2019. Survey answers were included in a second linear regression model describing anti-MRSA antibiotics consumption in 2019. All analyses were performed in R (version 3.6.1).

Results

- A significant ($P < 0.01$) increase was observed for all anti-MRSA antibiotics (glycopeptides 11.2 to 16.9 DDDs/1000 bed-days (+51 %), daptomycin 1.4 to 7.0 DDDs/1000 bed-days (+400 %), linezolid 0.51 to 0.67 DDDs/1000 bed-days (+31 %)).
- Consumption of all anti-MRSA antibiotics was significantly higher in university compared to non-university hospitals ($P < 0.01$), in ICU compared to non-ICU departments ($P < 0.01$) and in French/Italian-speaking compared to German-speaking parts ($P < 0.01$). In contrast to an overall increase in consumption, the use in university hospitals of the French speaking part remained stable (+ 3 %, Figure 1). Simultaneously, incidence of MRSA decreased significantly ($P < 0.01$) in university hospitals of French-speaking part only (-57 %).
- MRSA incidence was significantly ($P < 0.01$) associated with use of anti-MRSA antibiotics.
- Unlike the time period of 2009 to 2019, neither linguistic region nor MRSA incidence were associated with anti-MRSA antibiotics consumption in 2019.
- Antibiotic stewardship groups on-site and restrictions in prescriptions of daptomycin and glycopeptides, such as consultation of the chief physician, were both significantly ($P < 0.01$) associated with lower use of anti-MRSA antibiotics (Figure 2).

Regional Differences in Consumption of Anti-MRSA Antibiotics and MRSA Incidence from 2009 to 2019

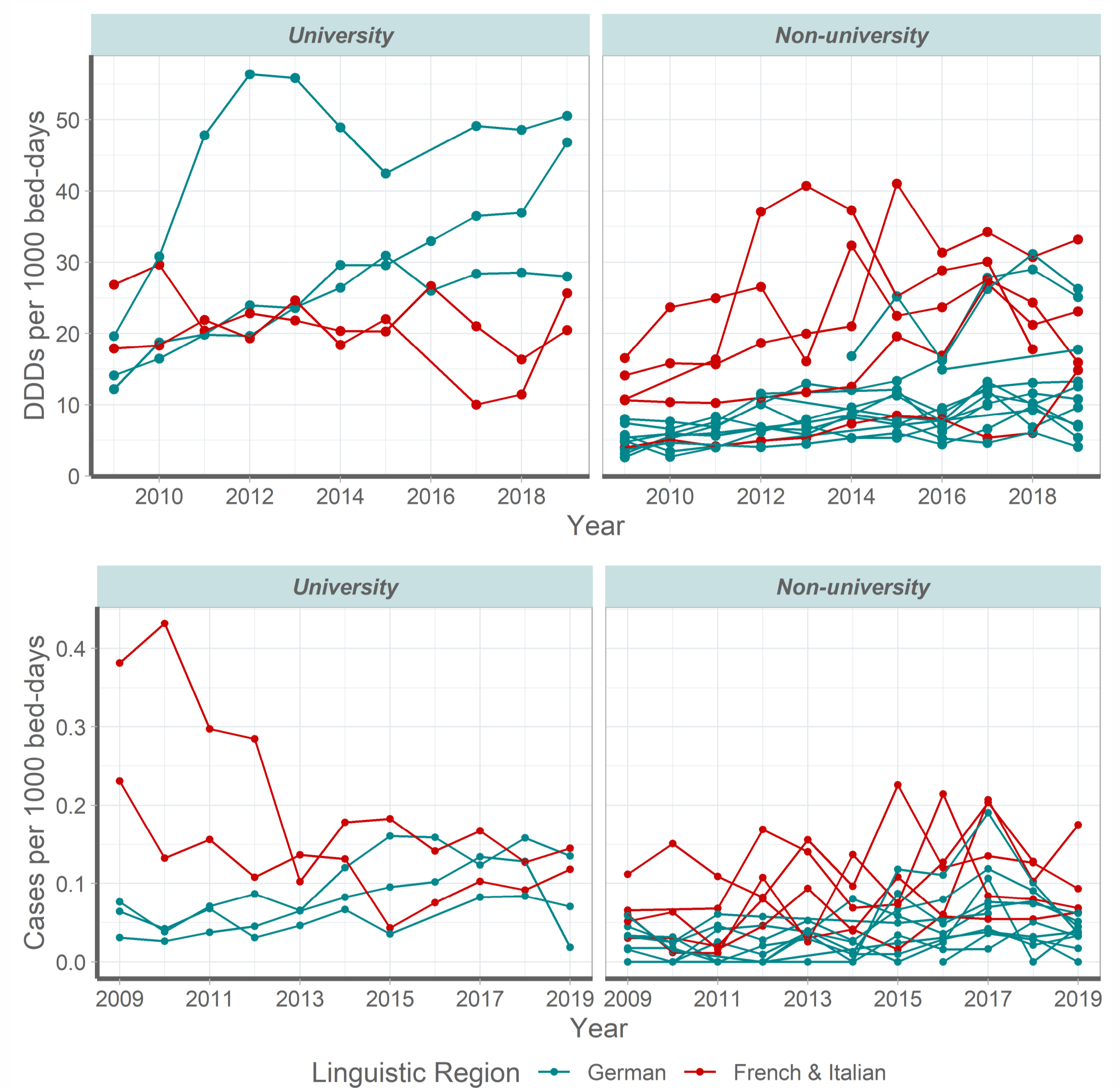


Figure 1: Temporal course of consumption of anti-MRSA antibiotics (defined daily doses (DDDs) per 1000 bed-days, upper panels) and MRSA incidence (invasive cases per 1000 bed-days, lower panels) in 21 Swiss hospitals yearly aggregated (dots) between 2009 and 2019 for university (left panels) and non-university hospitals (right panels) depicted per linguistic region.

Association between Antibiotic Stewardship and Use of Anti-MRSA Antibiotics in 2019

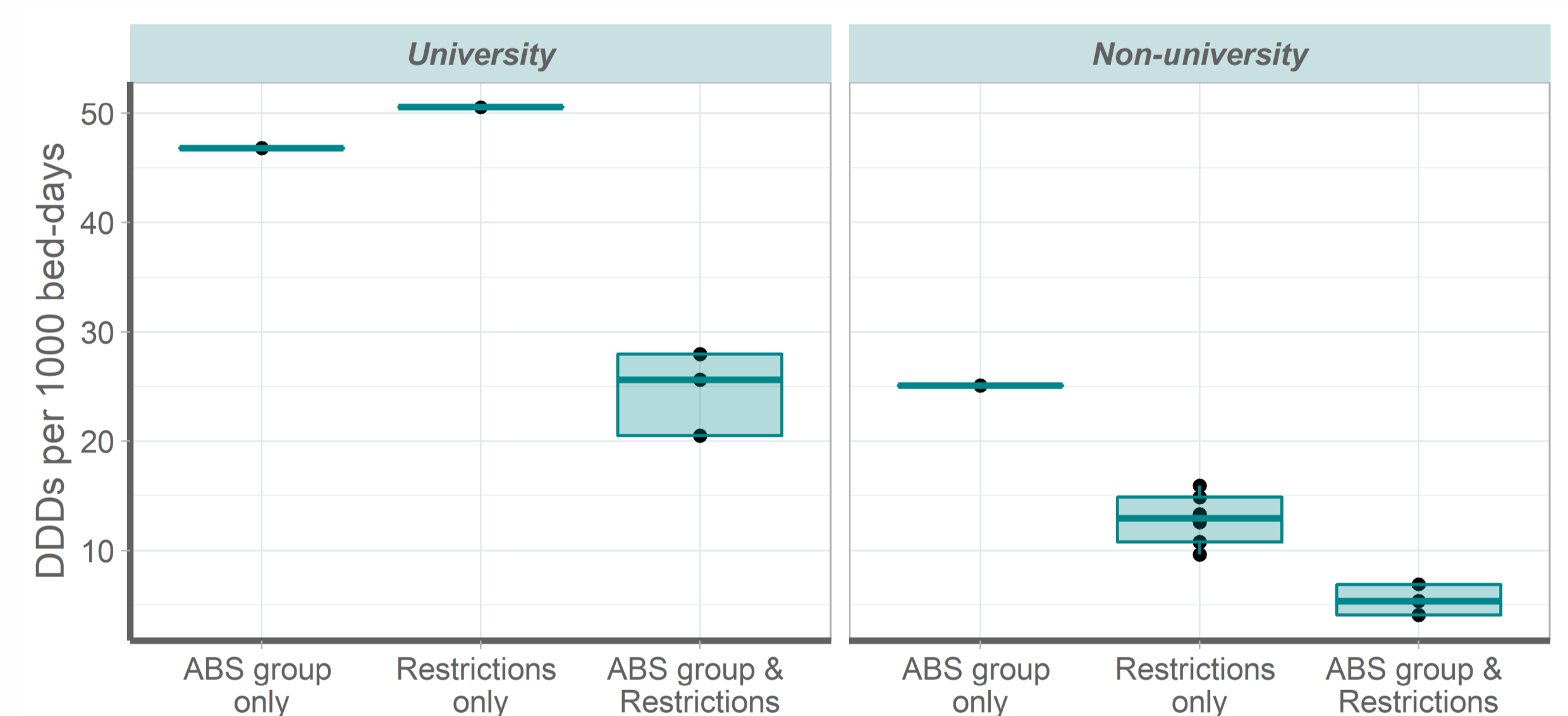


Figure 2: Association between antibiotic stewardship group on-site (ABS group), restrictions in prescription of daptomycin and glycopeptides and use of anti-MRSA antibiotics (defined daily doses (DDDs) per 1000 bed-days) in 21 Swiss hospitals (dots) for university hospitals (left panel) and non-university hospitals (right panel) in 2019.

Conclusion and Outlook

- Consumption of daptomycin, glycopeptides (vancomycin and teicoplanin) and linezolid increased between 2009 and 2019 despite a decreasing incidence of MRSA cases.
- There is large variation in consumption of anti-MRSA antibiotics between hospitals.
- Restrictions in prescription of glycopeptides and daptomycin in addition to regularly meeting antibiotic stewardship group on-site were associated with lower use of anti-MRSA antibiotics.