



Hospital antibiotic consumption in Switzerland: comparison of a multicultural country with Europe

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SUMMARY

The consumption of antibiotics in the inpatient setting of Switzerland was assessed to determine possible differences between linguistic regions, and to compare these results with European results. Data on antibiotic consumption were obtained from a sentinel network representing 54% of the national acute care hospitals, and from a private drug market monitoring company. Aggregated data were converted into defined daily doses (DDD). The total consumption density in Switzerland was close to the median consumption reported in European surveys. Between 2004 and 2008, the total consumption of systemic antibiotics rose from 46.1 to 54.0 DDD per 100 occupied bed-days in the entire hospitals, and from 101.6 to 114.3 DDD per 100 occupied bed-days in the intensive care units. Regional differences were observed for total consumption and among antibiotic classes. Hospitals in the Italian-speaking region showed a significantly higher consumption density, followed by the French- and German-speaking regions. Hospitals in the Italian-speaking region also had a higher consumption of fluoroquinolones, in line with the reported differences between Italy, Germany and France. Antibiotic consumption in acute care hospitals in Switzerland is close to the European median with a relatively low consumption in intensive care units. Some of the patterns of variation in consumption levels noticed among European countries are also observed among the cultural regions of Switzerland.

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Introduction

Epidemiological studies and mathematical models support a close correlation between the variation in antibiotic consumption and bacterial resistance.¹ Since there may be a time-lag between the consumption of antibiotics and the variation in resistance, continuous monitoring of consumption might be as important as the monitoring of resistance and can be helpful for several reasons: (i) to understand the main determinants of bacterial resistance; (ii) to predict the evolution of this resistance; (iii) to plan interventions

fostering appropriate consumption; and (iv) to assess the impact of such interventions.² In this context, hospitals represent 'hot spots' for selective pressure on micro-organisms, especially in intensive care units (ICUs).³ Therefore surveillance programmes have been developed at regional, national or international levels to monitor patterns of antibiotic consumption in hospitals.⁴

The first goal of our study was to describe the antibiotic consumption in the Swiss sentinel network. The second goal was to assess possible differences in hospital antibiotic consumption between the three major linguistic regions of Switzerland (German-, French- and Italian-speaking). In particular, we aimed at revealing whether the regional differences described in the ambulatory care setting were also observed in the hospital setting.^{5,6} Finally, our third goal was to compare the consumption of antibiotics in Swiss hospitals with those reported in European surveys.

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Methods

Design and sources of data on antibiotic consumption in Switzerland

This observational, multicentre study was based on two sources of data for the 2004–2008 antibiotic consumption in hospitals. (i) Data provided by a private drug market investigation company (IMS Health GmbH, Hergiswil, Switzerland) were purchased for 2004 and 2005. This exhaustive data set included the antibiotic quantities sold to all institutions with acute, intermediate and long term care. (ii) A sentinel network of acute care hospitals was set up in 2004. This network allows detailed analyses that would not be possible with the market data, e.g. adjustment to hospital activity with measurement of antibiotic consumption by linguistic region. We collected antibiotic consumption data from 42 acute care hospitals in 2004 and 57 in 2008, of which 37 were small size hospitals (<200 beds), 14 medium size (200–500 beds), and six large size (>500 beds, which includes the five Swiss university hospitals). Thirty-one were located in the German-, 22 in the French- and four in the Italian-speaking regions of Switzerland. The network represented 54% of the total number of acute somatic care hospitals (excluding psychiatric and rehabilitation centres) and 47% of all beds in this category in Switzerland (33% of all beds) and 49%, 73% and 100% in the German-, French- and Italian-speaking regions, respectively. Of the 42 hospitals that participated in the sentinel network in 2004, 39 (93%) provided data in 2008. Twenty-five hospitals (13 small, eight medium, and four large size) also provided data on adult ICUs. Their number increased to 37 (19, 14, and four, respectively) in 2008, representing 51% of the hospitals equipped with ICU beds in Switzerland.

Sources of data on antibiotic consumption in Europe

From the literature 15 studies or reports were selected from European countries assessing the consumption of antibiotics;

results were compared with the Swiss data for all hospitals and their ICUs.^{7–16}

Data collection

Data were collected on antibiotic agents for systemic consumption group J01 of the Anatomical Therapeutic Chemical (ATC) classification.¹⁷ Antibiotic consumption (in grams or millions of International Units) was converted into defined daily doses (DDD) using the 2009 release of the DDD by the World Health Organization Collaborative Centre for Drug Statistics Methodology.¹⁷

For the sentinel network, data were collected from the entire hospitals, and separately from the adult ICUs when possible. Regarding drug market data, IMS Health GmbH used the classification of the European Pharmaceutical Marketing Research Association (EphMRA). By contrast with the ATC classification, EphMRA does not include metronidazole, sulfadiazine, and fosfomycin in its definition of the J01 group.

Data on hospital occupied bed-days and admissions within the sentinel network were collected, enabling expression of the consumption density as DDD per 100 occupied bed-days (DDD per 100 BD) and as DDD per 100 admissions (DDD per 100 A). To compare the Swiss consumption with the studies using the DDD per 1000 inhabitants per day, we used IMS data and demographic features of the Swiss population.

Data analysis

A one-level mixed model for repeated measurements was used to compare antibiotic consumption across linguistic regions over the years. In the model, the independent variables 'time' and 'linguistic region' were treated as fixed repeated-measures factors, and hospital was treated as a random effect. Two dummy variables were created for the categorical variable 'linguistic region' and were compared to the reference, which corresponded to the German-speaking area in our case. Two-sided $P < 0.05$ was considered statistically significant.

Table 1

Use of systemic antibiotics (ATC J01 code, expressed in defined daily doses per 100 bed-days) in 2004 and 2008 in all Swiss sentinel hospitals, and by linguistic region (German-, French- and Italian-speaking)

	All participating hospitals				German-speaking hospitals		French-speaking hospitals				Italian-speaking hospitals			
	2004	2008	Trend 2004–2008		2004	2008	2004	2008	Comparison with German-speaking hospitals		2004	2008	Comparison with German-speaking hospitals	
			Coef. ^a	P-value					Coef. ^a	P-value			Coef. ^a	P-value
Total antibiotic use	46.2	53.4	0.4	0.208	46.7	52.9	41.6	54.3	1.3	0.659	68.5	63.9	13.2	0.023
Penicillins (J01C)	19.0	23.7	0.2	0.323	22.1	26.7	18.4	24.9	–2.9	0.070	21.5	23.7	–2.6	0.397
Combinations of penicillins and β-lactamase inhibitors (J01CR)	16.1	19.8	0.0	0.824	16.9	21.2	14.6	17.8	–3.2	0.047	16.2	16.8	–4.2	0.193
Cephalosporins (3rd and 4th generation ^b)	5.2	5.6	–0.2	0.011	4.3	4.7	5.3	6.8	2.3	<0.001	13.3	8.2	5.6	<0.001
Carbapenems ^c	1.6	2.8	0.2	<0.001	1.3	1.5	1.9	3.2	0.6	0.066	1.5	3.1	1.0	0.156
Fluoroquinolones (J01MA)	6.3	8.2	0.0	0.666	6.0	8.0	5.6	8.2	0.3	0.685	12.6	10.5	4.3	0.002
Macrolides (J01FA)	2.6	3.3	–0.1	0.296	2.1	2.8	3.1	4.1	0.9	0.086	5.0	4.2	1.8	0.089
Vancomycin (J01XA01)	0.4	0.8	0.0	<0.001	0.4	0.6	0.6	1.1	0.3	0.003	0.7	1.2	0.5	0.003

^a A one-level mixed model for repeated measurements used 'time' and 'linguistic region' as fixed effect and 'the hospitals' as random effect. The German-speaking area was used as the reference. The coefficients correspond to the effect of time or linguistic region on the antibiotic use. $P < 0.05$ was considered statistically significant.

^b Fourth generation cephalosporins were only represented by cefepime in Switzerland.

^c Only meropenem and imipenem were used in Switzerland.

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