

Variation in indicators of antibiotic use among and within different settings: a systematic review

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All authors participated on behalf of the DRIVE-AB Consortium. DRIVE-AB is supported by IMI/EU and EFPIA.

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Background: Antibiotic use varies widely across and within settings. As part of the DRIVE-AB project, we performed a systematic review to assess the extent of variation of quantitative metrics and quality indicators of antibiotic use described in the literature.

Methods: Studies published in MEDLINE from 01/2004 to 01/2015 were identified using combinations of terms for the concepts “antibiotics”, “medication use” and “variation”. Only studies reporting variation in metrics or indicators of systemic antibiotic use after 2003 among a minimum predefined number of settings were included. Studies describing variation over time were excluded. All the steps of the systematic review were performed using the Distiller SR® software.

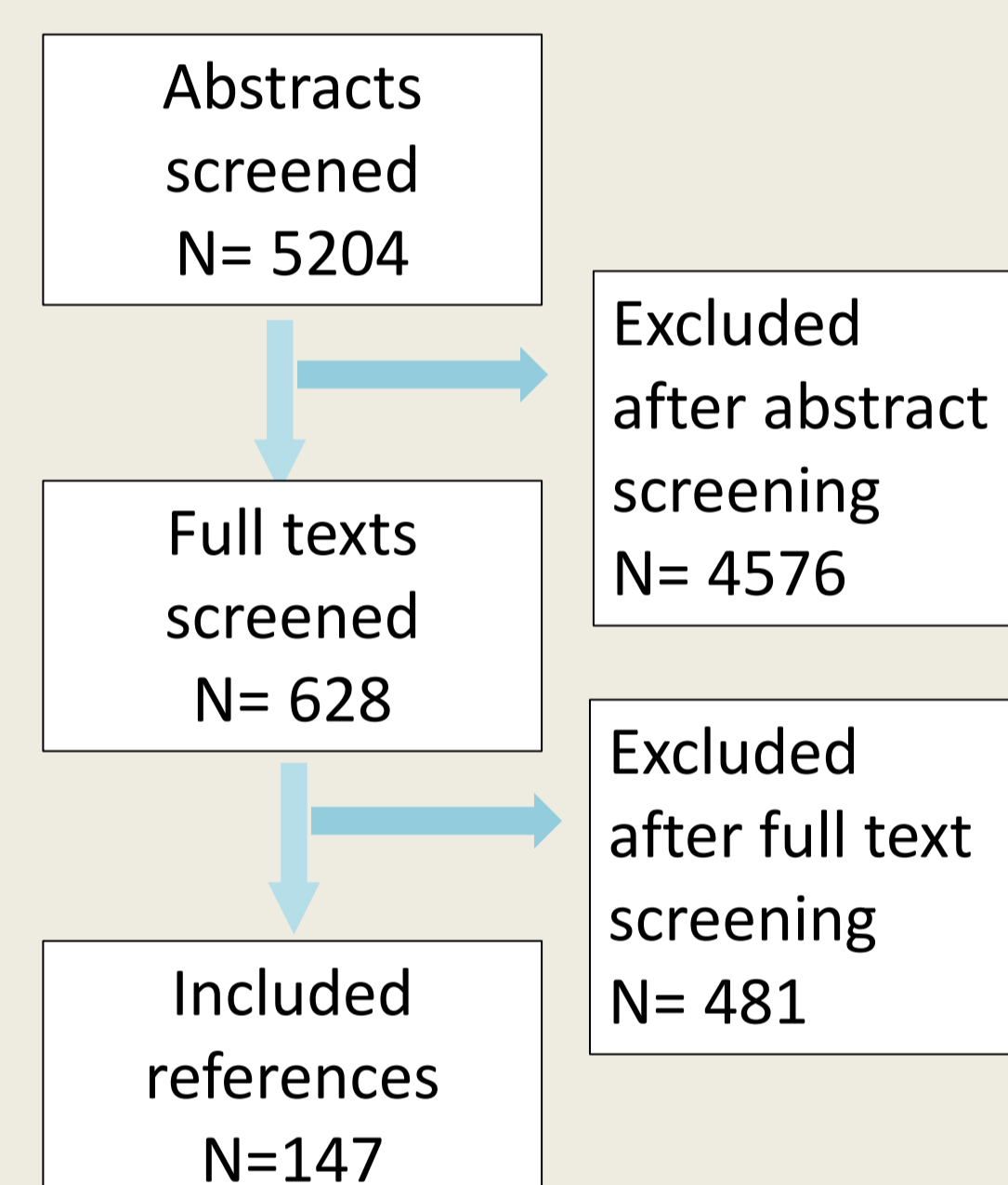
Levels of variation described:

	“Macro” level	“Micro” level
Inpatient	Data from ≥ 5 hospitals irrespective of their size OR Data from ≥ 5 identical units (eg ICUs) from ≥ 5 hospitals irrespective of their size	Data from ≥ 5 units/wards in the same hospital irrespective of their size OR ≥ 20 providers in the same hospital
Outpatient	≥ 2 countries or regions (same or different country) OR ≥ 5 clinics/primary health care facilities	≥ 50 providers in the same geographical area

Characteristics of included studies:

SETTING	INPATIENTS				OUTPATIENTS			MIXED	TOTAL
Level at which the variation is described (n of studies)	Units 27	Hospitals 48	Countries 7	Providers 9	Clinics 11	Smaller areas 8	Countries/ Regions 35	Countries 2	Total 147
High-income countries (n, %)	26 (96.3%)	43 (89.6%)	7 (100%)	7 (77.8%)	9 (81.8%)	8 (100%)	33 (94.3%)	1 (50%)	134 (91.2%)
Middle-low income countries (n, %)	1 (3.7%)	5 (10.4%)	0	2 (22.2%)	2 (18.2)	0	2 (5.7%)	1 (50%)	13 (8.8%)
Most frequent WHO region (n, %)	Europe 19 (70.4%)	Europe 27 (56.2%)	>1region 4 (57.1%)	Europe 6 (66.7%)	Europe 5 (45.4%)	Europe 5 (62.5%)	Europe 21 (60%)	Europe 2 (100%)	Europe 88 (59.9%)
Children included (n, %)	6 (22.2%)	8 (16.7%)	0	1 (11.1%)	3 (27.3%)	1 (12.5%)	3 (8.6%)	0	22 (15%)
Antibiotic prophylaxis included (n, %)	3 (11.1%)	3 (6.2%)	3 (42.8%)	0	0	0	0	0	9 (6.1%)
Single country (n, %)	25 (92.6%)	38 (79.2%)	0	9 (100%)	7 (63.6%)	8 (100%)	13 (37.1%)	0	100 (68%)
Number of hospitals/providers Median (IQR)	30 (IQR 9.5-44)	37 (IQR 18.8-127.3)	21 (IQR 19-31)	440 (IQR 140.5-4971)	14 (IQR 12-22.5)	15 (IQR 14-74.5)	15 (IQR 10-28)	N/A	N/A

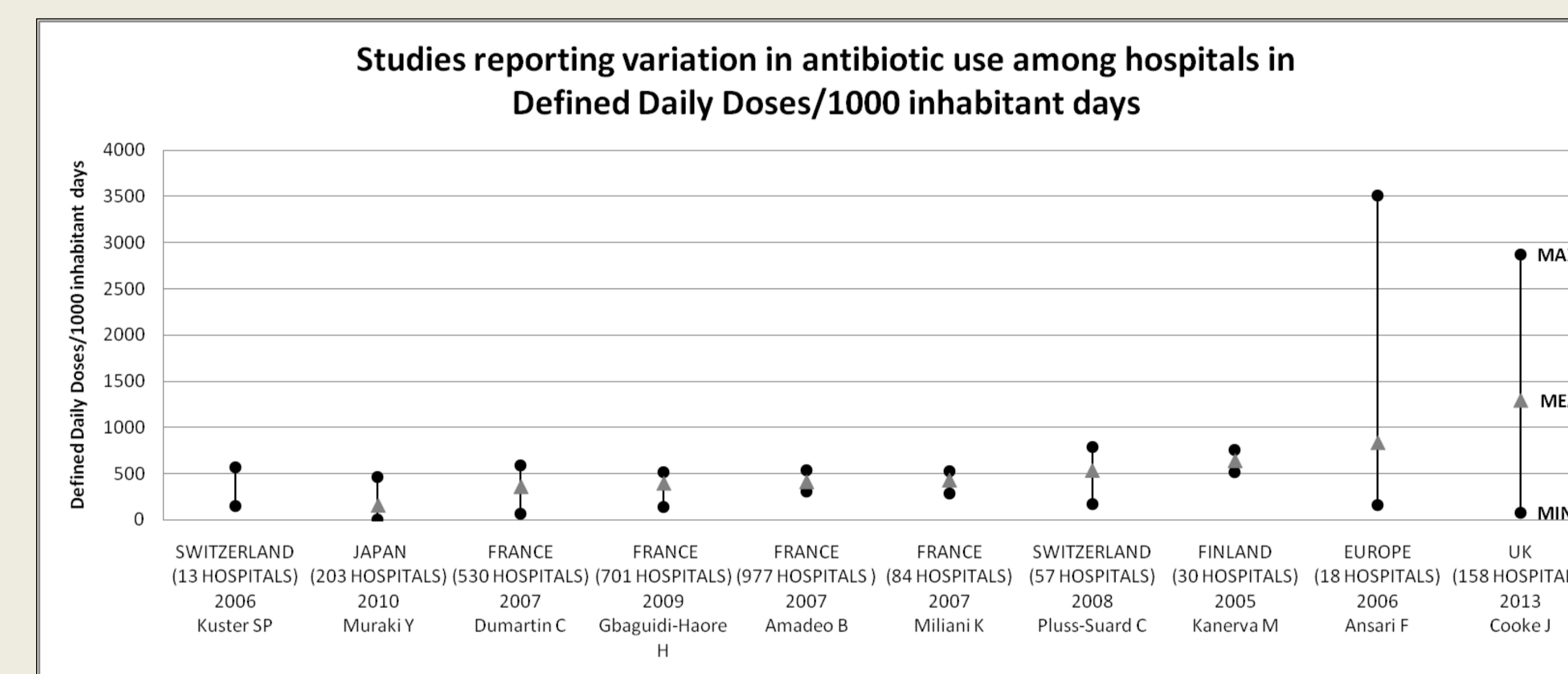
Flow chart



Results:

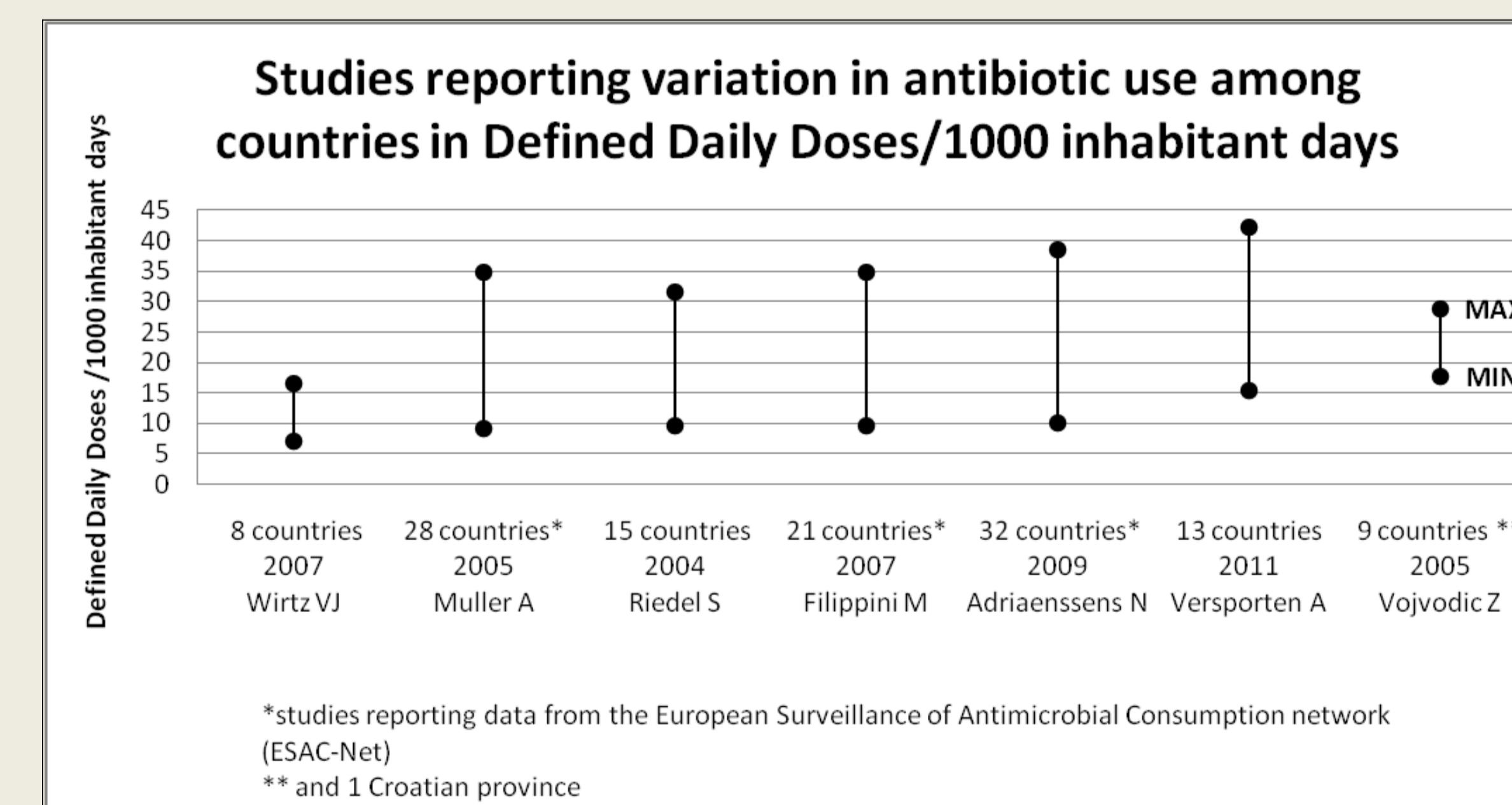
- 147 studies met inclusion criteria
- 55.8% (n=82) described variation exclusively in the **inpatient setting**, mainly among different hospitals (n of studies=48)
- In the **outpatient setting** variation was mainly described among countries or regions (n=35, 55.5%)
- Overall the two **most frequently reported metrics** were % of patients treated with antibiotics, often for specific populations or indications (n=67, 45.6%) and defined daily doses with different denominators (n=54, 36.7%).
- Figures below show the most frequently reported quantity metrics

Among hospitals



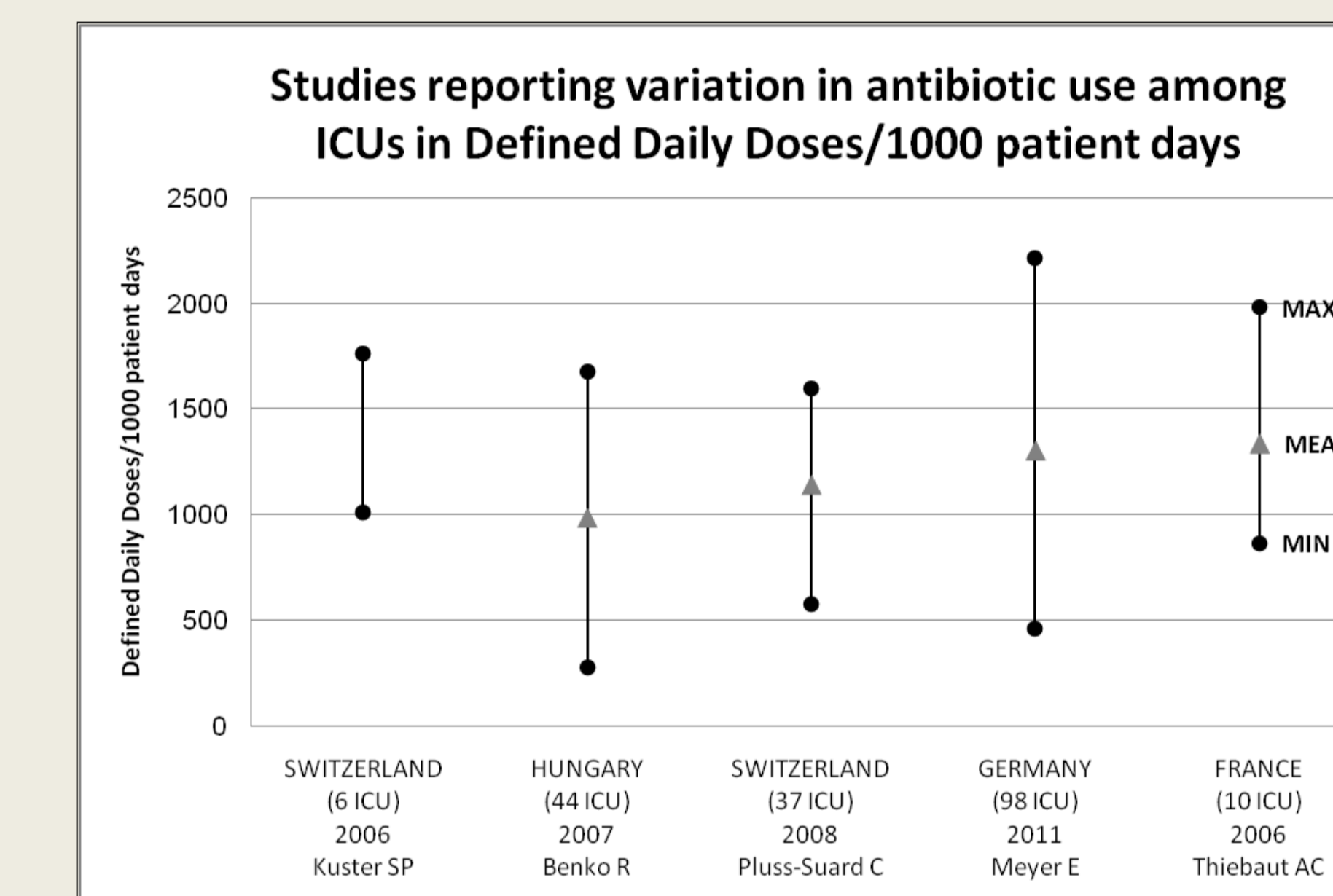
Reported variation in antibiotic use in DDD/1000 inhabitants-day

Among countries



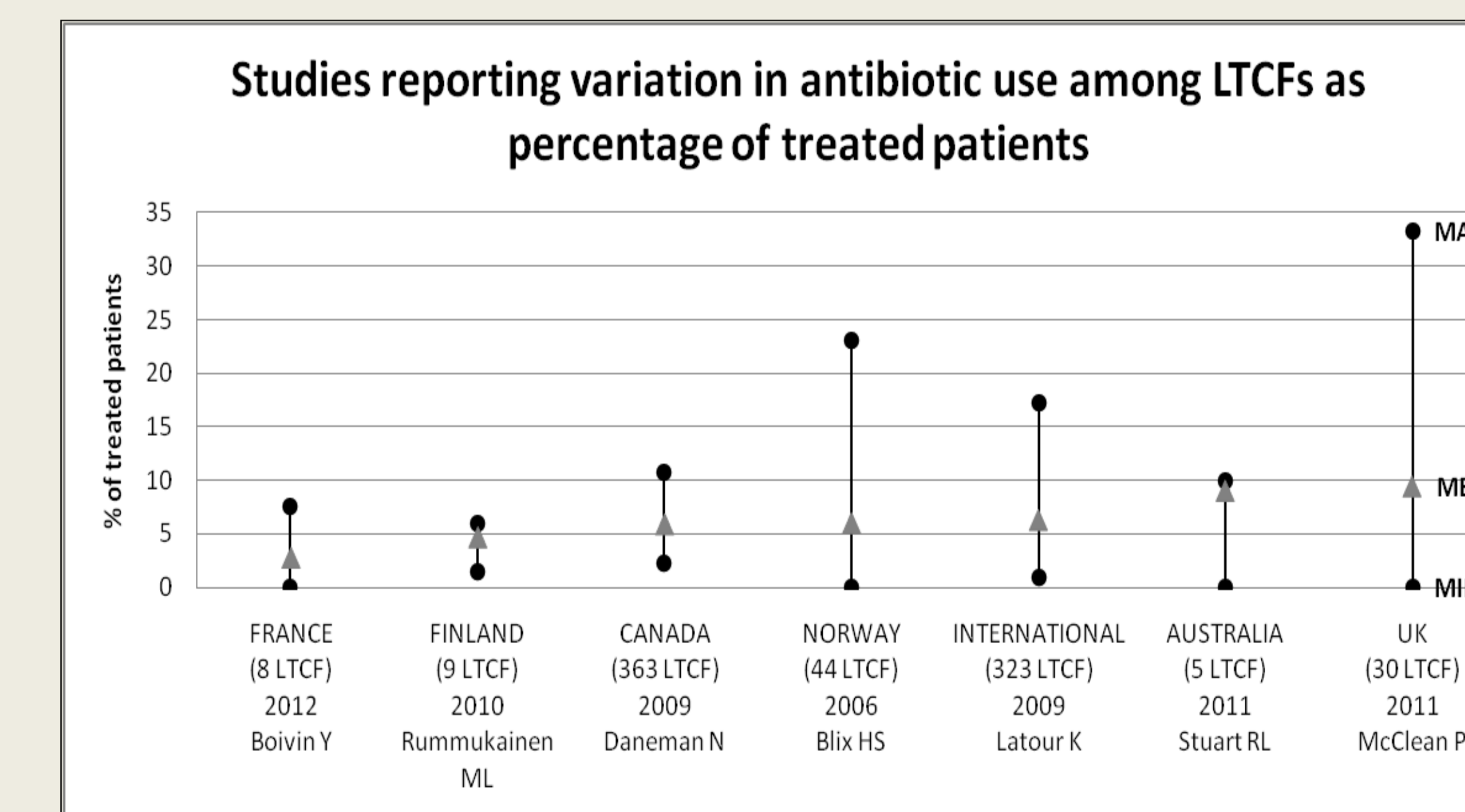
*studies reporting data from the European Surveillance of Antimicrobial Consumption network (ESAC-Net)
** and 1 Croatian province

Among ICUs



Reported variation in % of treated patients

Among LTCFs



Conclusions:

- There is a large variation in metrics of antibiotic use even across similar settings
- Most data are based on retrospective observational studies from high-income countries, with a predominance of European studies
- More data from low and middle-income studies are urgently needed
- Given the close link between antibiotic use density and antimicrobial resistance development, understanding the reasons behind the observed variation seems crucial to design effective antibiotic stewardship interventions