

CONSUMPTION SURVEILLANCE METHODS:

HOW TO COLLECT AND REPORT DATA

HOW TO AVOID COMMON PITFALLS

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DISCLOSURES

Conflicts of interest:

Nothing to disclose

Questions (please answer YES or NO):

- ① RDD/1000 patients per day is a globally accepted measure for antibiotic consumption
- ② There is not yet a well accepted measure for antibiotic consumption in pediatrics
- ③ Consumption data should be collected at least monthly



Is the “Low-Hanging Fruit” Worth Picking for Antimicrobial Stewardship Programs?

Debra A. Goff,¹ Karri A. Bauer,¹ Erica E. Reed,¹ Kurt B. Stevenson,^{2,3} Jeremy J. Taylor,¹ and Jessica E. West²

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Goff, DA. Clin Infect Dis 2012;55:587

WHY consumption data
should be monitored

Surveillance of Antibiotic Consumption

is recommended in evidence-based ABS guidelines:

- IDSA/SHEA DELLIT (USA 2007)
- DGI de With (D/A 2013)
- IDSA BARLAM (USA 2016)

”

Every Antibiotic Stewardship Program must measure antibiotic use ...

BARLAM et al. 2016

S3-Guideline

Strategies to enhance rational use of antibiotics in hospitals: a guideline by the German Society for Infectious Diseases

Requirements

- Team of ABS Experts
- Availability of surveillance data on



- pathogens
- resistance
- antimicrobial consumption

ABS core strategies

- local treatment guidelines
- antiinfective formulary
- approval requirements
- education
- proactive audits
- quality indicators

Supplemental ABS strategies

- Programs for treatment optimisation



- De-escalation
- duration of treatment
- parenteral-to-oral conversion
- dose optimisation
- Scheduled switch

- Rules for communication of microbiology results
- Rules for the management of patients with MR microorganisms and *C. difficile*
- IT-support

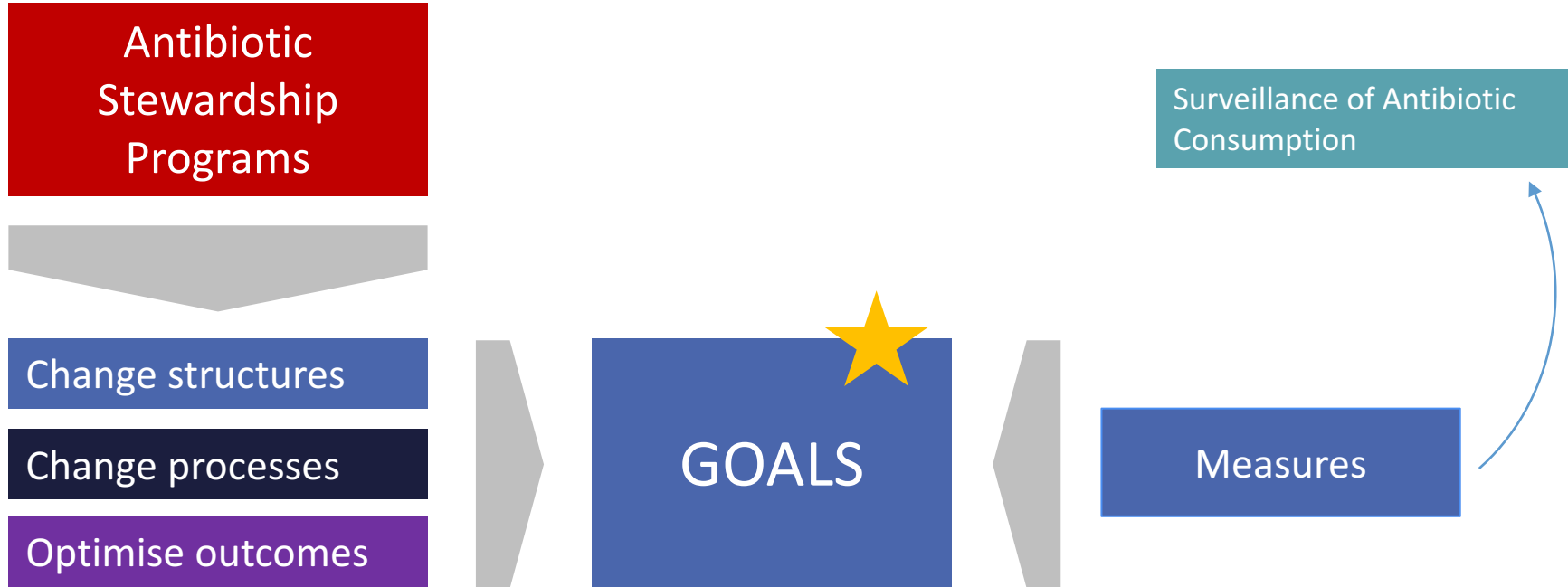
Table 3. Trends in consumption of antibiotics for systemic use in the hospital sector, EU/EEA countries, 2011–2015 (expressed as DDD per 1 000 inhabitants and per day)

Country	2011	2012	2013	2014	2015	Trends in antimicrobial consumption, 2011–2015	Average annual change 2011–2015	Statistically significant trend
Netherlands	0.97	0.96	0.95	0.95	0.98		<0.01	
Hungary	1.20	1.23	1.20	1.25	1.23		0.01	
Norway	1.47	1.44	1.39	1.41	1.40		-0.02	
Bulgaria	1.45	1.40	1.41	1.45	1.40		<0.01	
Poland (a)				1.43	1.43			N/A
Portugal (c)	1.45	1.46	1.64	1.55	1.57		0.03	
Belgium	2.02	1.71	1.67	1.60	1.66		-0.08	
Sweden	1.60	1.65	1.67	1.57	1.67		0.01	
Slovenia	1.66	1.56	1.55	1.61	1.68		0.01	
Luxembourg	2.02	2.02	2.00	1.81	1.78		-0.07	<
Estonia	1.86	2.11	1.91	1.94	1.82		-0.03	
Croatia	1.88	1.98	1.80	1.86	1.91		-0.01	
Ireland	1.79	1.76	1.79	1.66	1.91		0.01	
EU/EEA	1.96	1.98	2.05	2.01	2.05		0.02	
Greece	2.18	2.08	2.00	2.11	2.14		-0.01	
France	2.12	2.12	2.17	2.20	2.18		0.02	
Latvia	2.39	2.27	2.30	2.25	2.24		-0.03	
Denmark	1.74	1.78	2.02	2.13	2.34		0.16	>
Slovakia (a)		2.02	2.30	2.47	2.40			N/A
Italy	2.32	2.46	2.23	2.22	2.43		<0.01	
Finland (b)	3.09	2.79	2.77	2.64	2.50		-0.13	<
Lithuania (a)		2.39	2.38	2.35	2.54			N/A
United Kingdom (a)			2.45	2.59	2.55			N/A
Malta	1.67	1.44	1.75	2.18	2.86		0.31	>

Overarching benchmarks

SAC data show trends in higher level (national, european, global) statistics

ECDC 2016





SAC is the
„speedometer“
for antimicrobial use

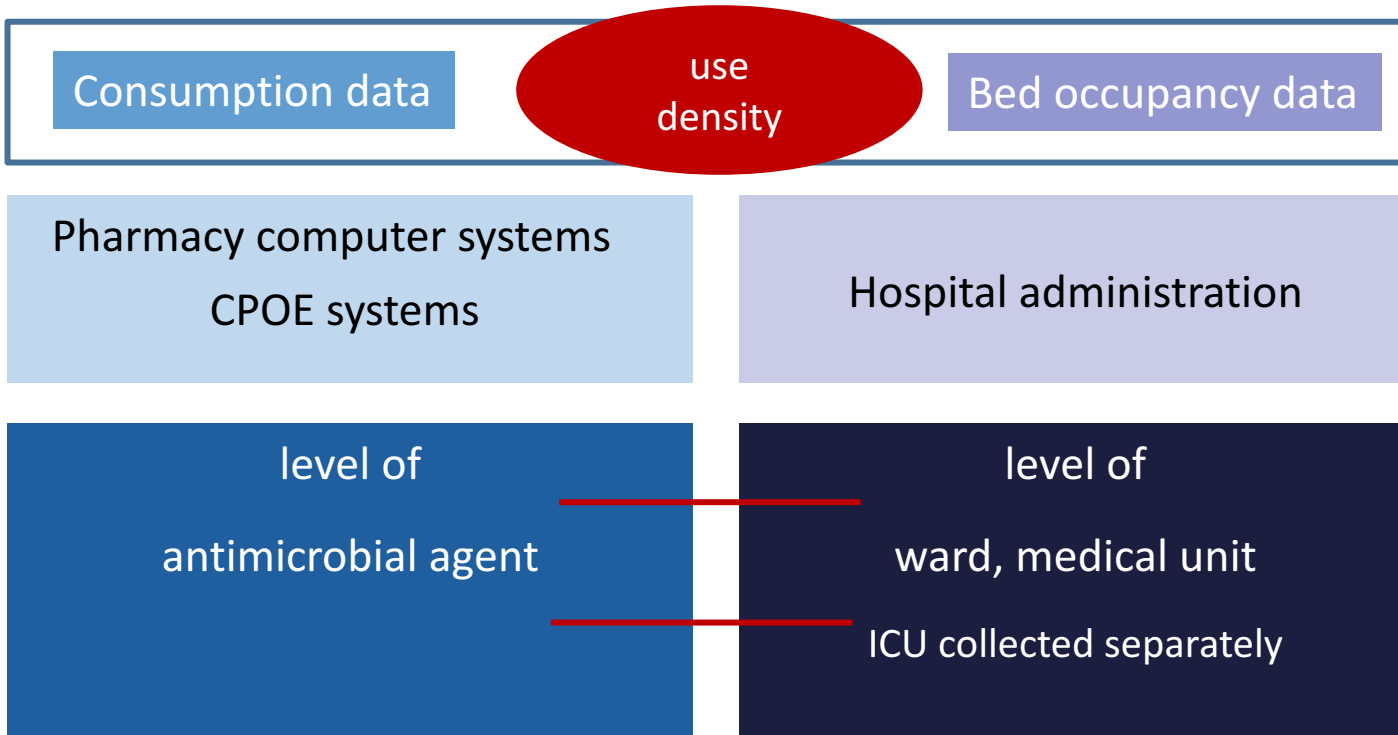
HOW consumption data should be collected



What are we looking for?

”

*How many
of what
in which area
in a certain time period?*



Data are calculated as a rate, expressing the „density“ of antimicrobial use:

from ATC/DDD index (WHO)

(numerator) $\frac{\text{drug units (mg, g) / DDD}}{1000 \text{ patients per day}}$

(denominator) (also: 100 pts per day)

=

use density

$\frac{n \text{ Defined Daily Doses (DDD)}}{1000 \text{ patients per day}}$

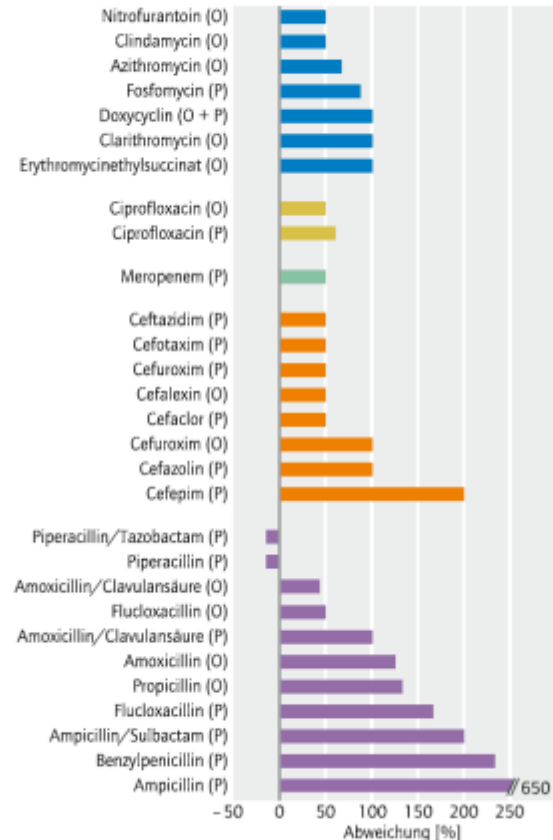
(also: 100 pts per day)

The diagram illustrates the calculation of use density. On the left, a fraction is shown with 'drug units (mg, g) / DDD' as the numerator and '1000 patients per day' as the denominator. A blue box above the numerator contains the text 'from ATC/DDD index (WHO)' with a blue arrow pointing to the numerator. To the right of this fraction is an equals sign. To the right of the equals sign is a box containing a fraction with 'n Defined Daily Doses (DDD)' as the numerator and '1000 patients per day' as the denominator. A red box above the numerator of this second fraction contains the text 'use density'.

Defined Daily Doses (DDD) or Recommended Daily Doses (RDD)?

DDD are less than doses administered in some antiinfectives

- overestimation of consumption
- definition of recommended daily doses (RDD) on a national level
- RDD are not globally accepted

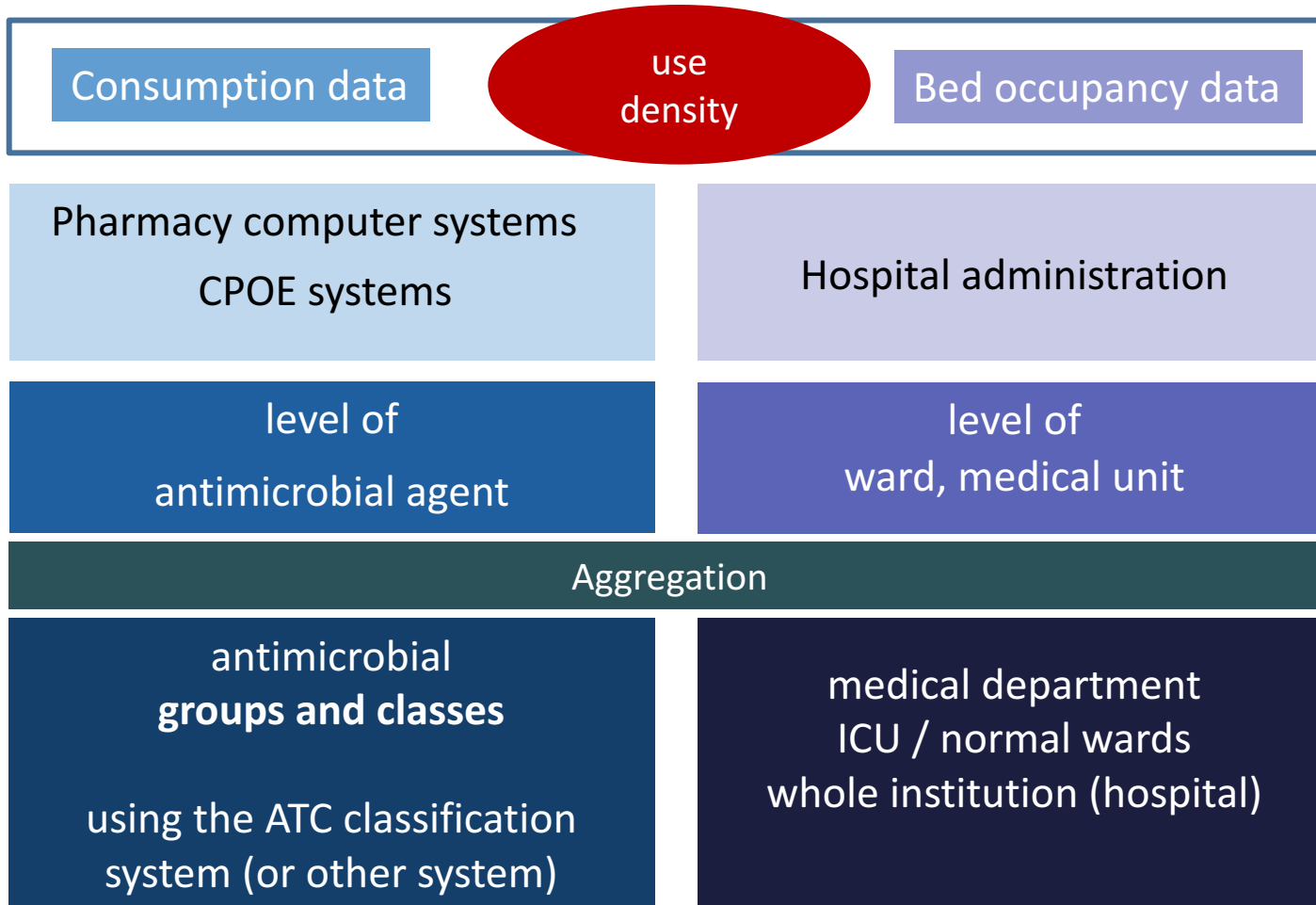


Probst W et al. Krankenhauspharmazie 2017;38:6-22

Metrics in pediatrics?



- DDD/RDD are **not defined for pediatric patients**
- Pediatric patients should be excluded from SAC
- A system for pediatrics is „under construction“ (days of therapy?)



ATC classification system

Level	ATC code				
1	J	ANTIINFECTIVES FOR SYSTEMIC USE			
2	J01	ANTIBACTERIALS FOR SYSTEMIC USE			
3	J01C	BETA-LACTAM ANTIBACTERIALS, PENICILLINS			
4	J01CA	Penicillins with extended spectrum			
		Name	DDD	Unit	Route
5	J01CA01	ampicillin	2	g	iv
5	J01CA04	amoxicillin	1	g	po
5	J01CR21	ampicillin/sulbactam	6	g	iv

It's not all about **collecting** data...

- Do we have to change empiric treatment?
- Are there changes or trends over time ?
- Are there hot spots of inadequate use?
- Do resistance data correlate with consumption data?
- How do we compare in the benchmark?

...we have to answer questions

Document
Analyze
Interpret
Define ABS interventions
Communicate



german infection prevention act

HOW consumption data should be reported



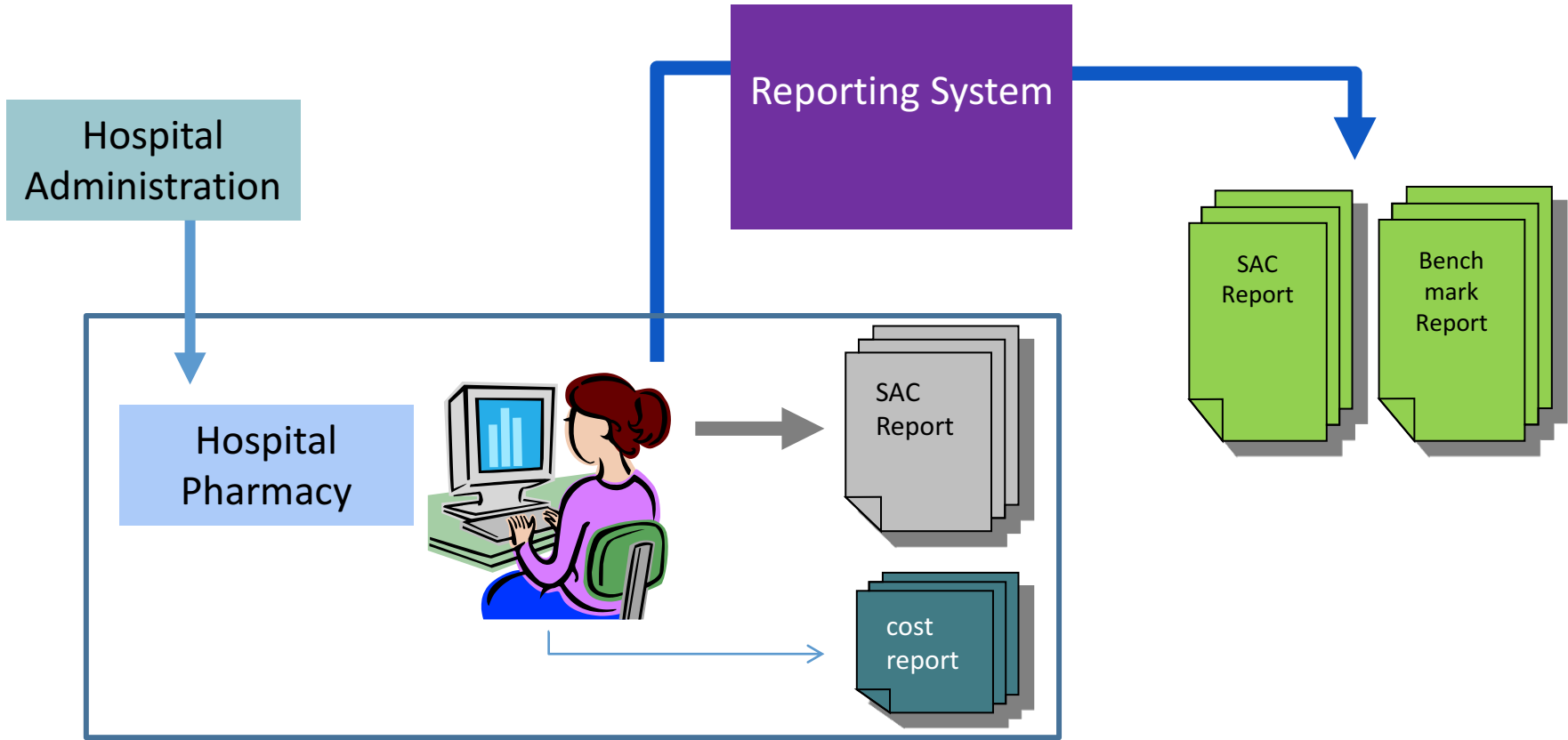
Glasgow ■ Edinburgh
Belfast ■ Newcastle
Birmingham ■ Norwich
Cardiff ■ London
Plymouth ■ Portsmouth

TUESDAY 15:00

Do it yourself **OR** reporting system?

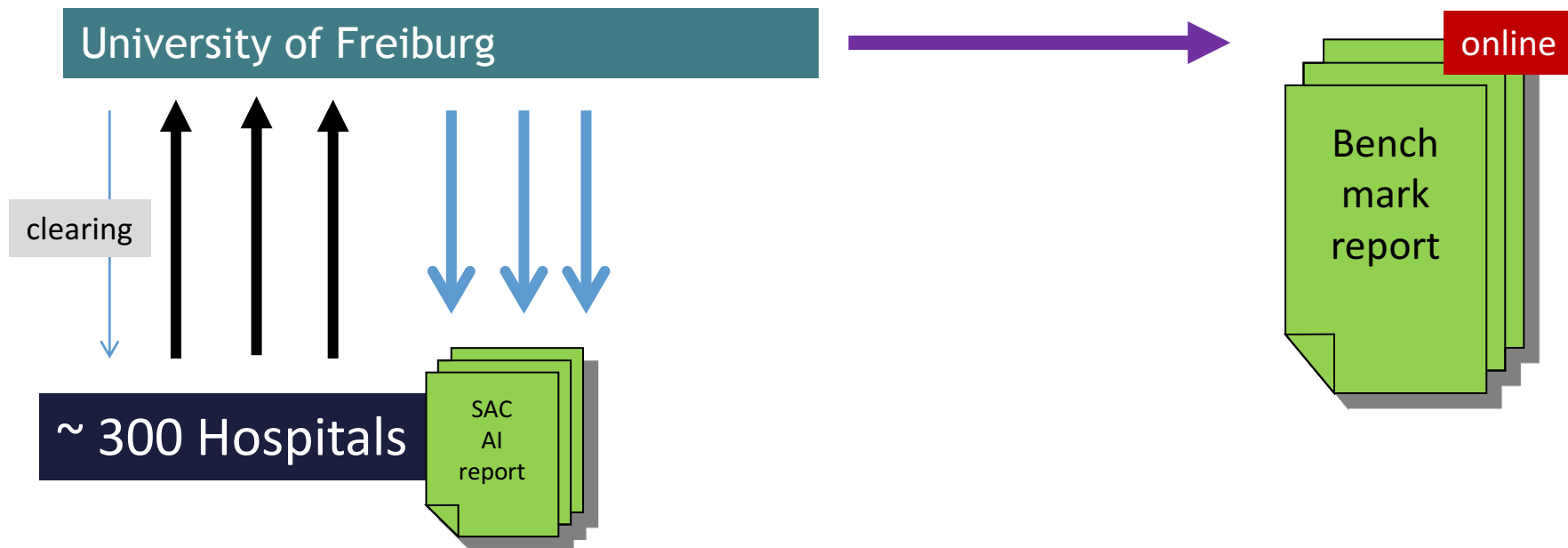
THE ONLY WAY
— TO DO —
GREAT WORK
— IS —
TO LOVE
— WHAT YOU DO —





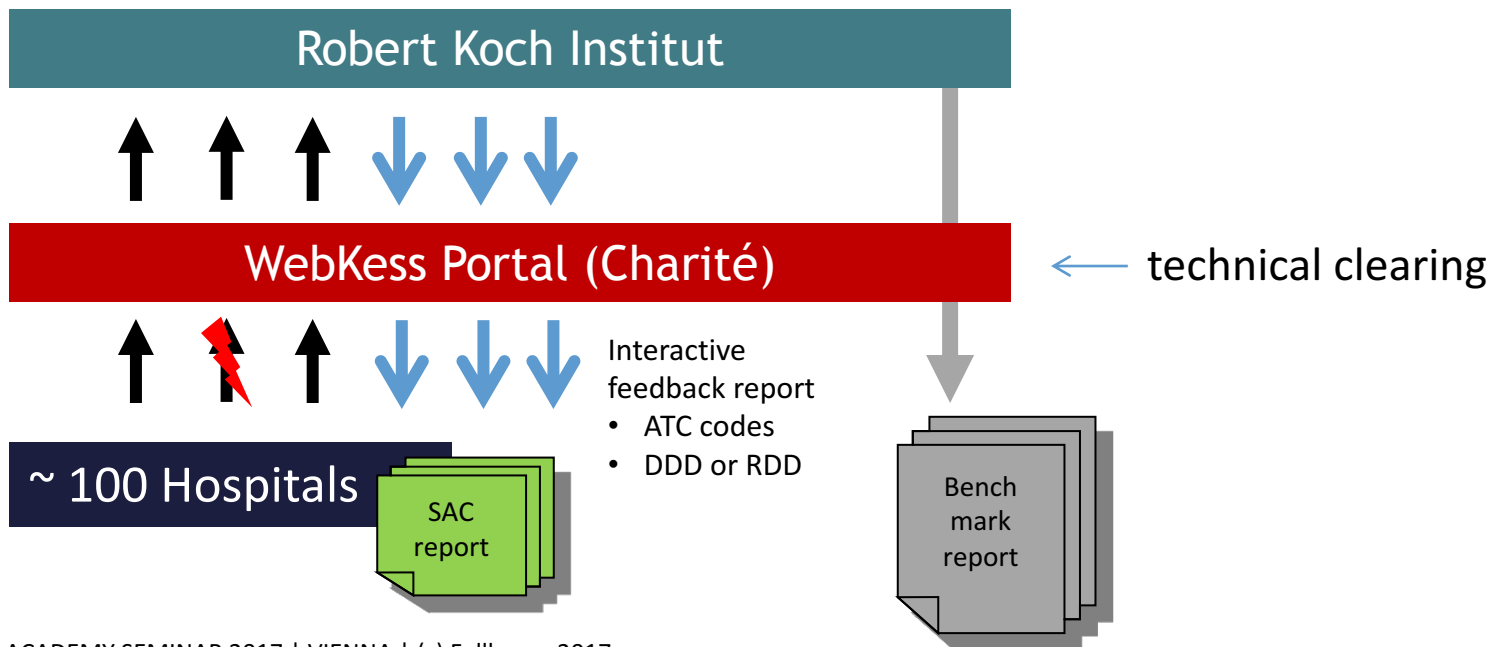
Surveillance Systems at the national level (Germany)

ADKA-if-DGI Projekt (based at Freiburg University)



Surveillance Systems at the national level (Germany)

Antibiotika Verbrauchssurveillance (AVS) based at Robert Koch Institut



Surveillance Systems at the european level: ESAC-Net

The screenshot shows the website for the European Centre for Disease Prevention and Control (ECDC), an agency of the European Union. The page is titled "European Surveillance of Antimicrobial Consumption Network (ESAC-Net)". The header includes the ECDC logo and navigation links for "Infectious diseases & public health", "News & events", and "Publications & data". The breadcrumb trail reads: Home > About us > Partnerships and networks > Disease and laboratory networks > European Surveillance of Antimicrobial Consumption Network (ESAC-Net). A left sidebar lists various disease and laboratory networks, with "Disease and laboratory networks" selected. The main content area features the title "European Surveillance of Antimicrobial Consumption Network (ESAC-Net)" and sub-navigation for "about us" and "networks and partnerships". Social media icons for Twitter, Facebook, LinkedIn, and Email are present. Two columns of text describe the network: "About the network" states it is a Europe-wide network of national surveillance systems providing reference data on antimicrobial consumption; "Data collection and analysis" states the network continues collecting reference data on antimicrobial consumption for systemic use in the community and hospital sector in EU and EEA/EFTA. A footer note recommends allowing cookies for the best experience.

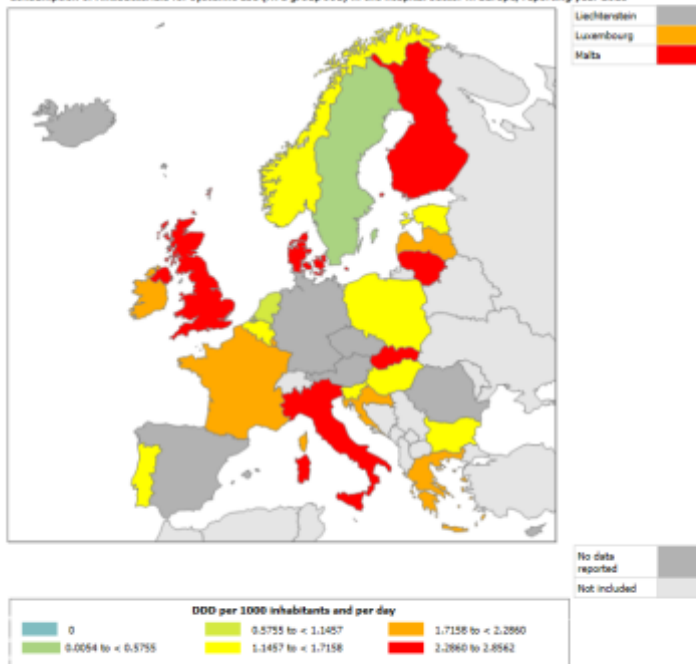
” To improve the reporting of hospital AMC, ESAC-Net is developing a hospital-based surveillance of AMC.

Surveillance Systems at the european level



Geographical distribution of the consumption of Antibacterials for systemic use (ATC group J01) in the hospital sector in Europe, reporting year 2015 - 2015

Consumption of Antibacterials for systemic use (ATC group J01) in the hospital sector in Europe, reporting year 2015



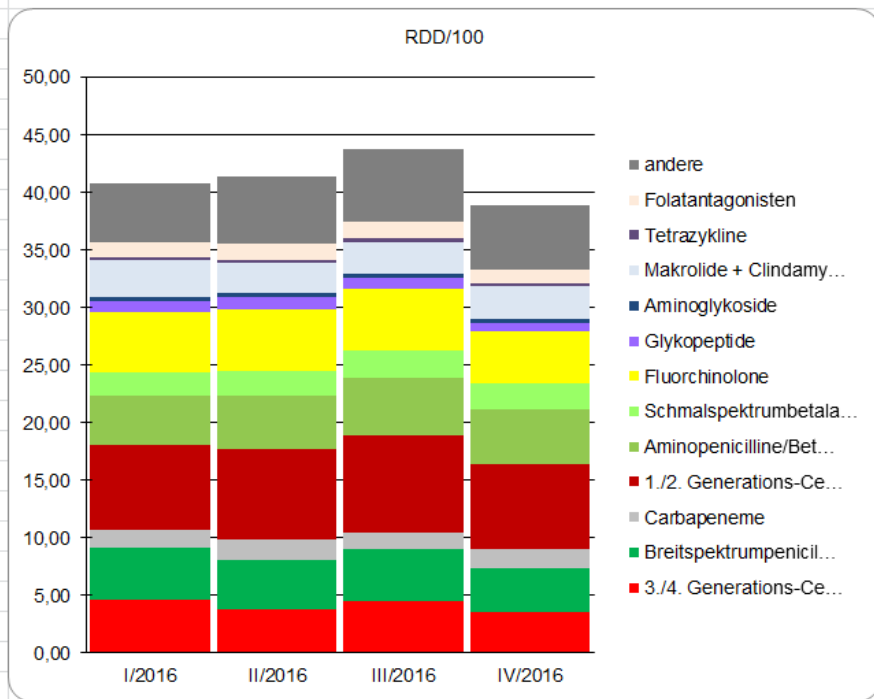
Beware of methodological differences ...

- ambulant/hospital?
- non prescription ABX?

KH gesamt*	I/2016		II/2016		III/2016		IV/2016		I/2016		II/2016		III/2016		IV/2016		
Pflegelage (PT) und Fallzahlen (FZ)	76.334	13.775	76.783	13.853	74.522	13.648	74.686	13.629	76.334	13.775	76.783	13.853	74.522	13.648	74.686	13.629	
	Menge in "Recommended Daily Doses[RDD]" absolut und pro 100 PT								Menge in "Defined Daily Doses[DDD]" absolut und pro 100 PT								
	RDD	/100	RDD	/100	RDD	/100	RDD	/100	DDD	/100	DDD	/100	DDD	/100	DDD	/100	
Antinfektiva GESAMT	33.183	43,47	33.578	43,73	35.212	47,25	31.096	41,64	44.072	57,74	44.900	58,48	47.074	63,17	42.087	56,35	
Antimykotika systemisch GESAMT	1.095	1,44	845	1,10	1.201	1,61	1.039	1,39	1.835	2,40	1.346	1,75	1.884	2,53	1.706	2,28	
Virustatika GESAMT	440	0,58	621	0,81	692	0,93	503	0,67	358	0,47	530	0,69	542	0,73	406	0,54	
Tuberkulostatika GESAMT	552	0,72	337	0,44	701	0,94	531	0,71	723	0,95	522	0,68	922	1,24	803	1,07	
Antiparasitäre Med. GESAMT	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	
Antibiotika GESAMT	31.095	40,74	31.775	41,38	32.617	43,77	29.023	38,86	41.156	53,92	42.502	55,35	43.726	58,68	39.172	52,45	
Betalaktame	18.602	24,37	18.824	24,52	19.558	26,24	17.522	23,46	26.037	34,11	27.130	35,33	27.881	37,41	25.109	33,62	
Breitspektrumbetalaktame	8.183	10,72	7.528	9,80	7.786	10,45	6.767	9,06	8.395	11,00	7.738	10,08	7.936	10,65	7.042	9,43	
3./4. Generations-Cephalosporine	3.530	4,62	2.926	3,81	3.361	4,51	2.658	3,56	3.621	4,74	2.977	3,88	3.457	4,64	2.701	3,62	
Breitspektrumpenicilline	3.407	4,46	3.318	4,32	3.348	4,49	2.835	3,80	2.920	3,83	2.844	3,70	2.870	3,85	2.430	3,25	
Carbapeneme	1.246	1,63	1.284	1,67	1.077	1,44	1.274	1,71	1.855	2,43	1.917	2,50	1.610	2,16	1.912	2,56	
Intermediärspektrumbetalaktame	8.854	11,60	9.676	12,60	10.010	13,43	9.017	12,07	12.712	16,65	13.912	18,12	14.429	19,36	12.702	17,01	
1./2. Generations-Cephalosporine	5.639	7,39	6.110	7,96	6.313	8,47	5.454	7,30	9.497	12,44	10.346	13,47	10.733	14,40	9.139	12,24	
Aminopenicilline/Betalaktamaseinhibitor	3.215	4,21	3.566	4,64	3.697	4,96	3.563	4,77	3.215	4,21	3.566	4,64	3.697	4,96	3.563	4,77	
Schmalspektrumbetalaktame	1.565	2,05	1.621	2,11	1.762	2,36	1.737	2,33	4.930	6,46	5.481	7,14	5.515	7,40	5.365	7,18	
Fluorchinolone	4.012	5,26	4.078	5,31	4.001	5,37	3.357	4,49	4.863	6,37	5.062	6,59	5.222	7,01	4.423	5,92	
Glykopeptide	758	0,99	809	1,05	722	0,97	522	0,70	758	0,99	809	1,05	745	1,00	524	0,70	
Aminoglykoside	221	0,29	285	0,37	277	0,37	249	0,33	295	0,39	380	0,50	369	0,50	332	0,44	
Sonstige Antibiotika	7.502	9,83	7.779	10,13	8.060	10,82	7.374	9,87	9.204	12,06	9.121	11,88	9.510	12,76	8.785	11,76	
Makrolide + Clindamycin	2.494	3,27	1.983	2,58	1.997	2,68	2.133	2,86	4.015	5,26	3.079	4,01	2.995	4,02	3.255	4,36	
Tetrazykline	131	0,17	246	0,32	279	0,37	234	0,31	223	0,29	407	0,53	520	0,70	452	0,61	
Folatantagonisten	1.029	1,35	1.097	1,43	1.124	1,51	851	1,14	1.029	1,35	1.097	1,43	1.124	1,51	851	1,14	
Cotrimoxazol	1.029	1,35	1.097	1,43	1.124	1,51	851	1,14	1.029	1,35	1.097	1,43	1.124	1,51	851	1,14	
andere	3.849	5,04	4.454	5,80	4.660	6,25	4.156	5,56	3.936	5,16	4.538	5,91	4.872	6,54	4.226	5,66	
Linezolid	297	0,39	396	0,52	520	0,70	283	0,38	297	0,39	396	0,52	520	0,70	283	0,38	
Metronidazol	3.208	4,20	3.739	4,87	3.563	4,78	3.516	4,71	3.208	4,20	3.739	4,87	3.563	4,78	3.516	4,71	
Top 15 Antiinfektiva	Menge in RDD absolut, absteigend sortiert, jüngstes Quartal																
		I/2013	II/2013	III/2013	IV/2013	I/2014	II/2014	III/2014	IV/2014	I/2015	II/2015	III/2015	IV/2015	I/2016	II/2016	III/2016	IV/2016
Cefuroxim	iv	0	0	0	0	0	0	0	0	0	0	0	0	3.473	3.690	3.690	3.476
Sultamicillin	po	0	0	0	0	0	0	0	0	0	0	0	0	2.474	2.915	2.978	2.902
Piperacillin + Tazobactam	iv	0	0	0	0	0	0	0	0	0	0	0	0	3.373	3.313	3.350	2.833
Ceftriaxon	iv	0	0	0	0	0	0	0	0	0	0	0	0	3.350	2.825	3.176	2.574
Metronidazol	po	0	0	0	0	0	0	0	0	0	0	0	0	1.788	2.120	1.739	2.040

KH gesamt*	I/2016		II/2016	
Pflege tage (PT) und Fallzahlen (FZ)	76.934	13.775	76.783	13.853
	Menge in "Recommended Daily Do			
	RDD	/100	RDD	/100
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1./2. Generations-Cephalosporine	5.639	7,39	6.110	7,96
Aminopenicilline/Betalaktamaseinhibitor	3.215	4,21	3.566	4,64
Schmalspektrumbetalaktame	1.565	2,05	1.621	2,11

Data from the **hospital level**:

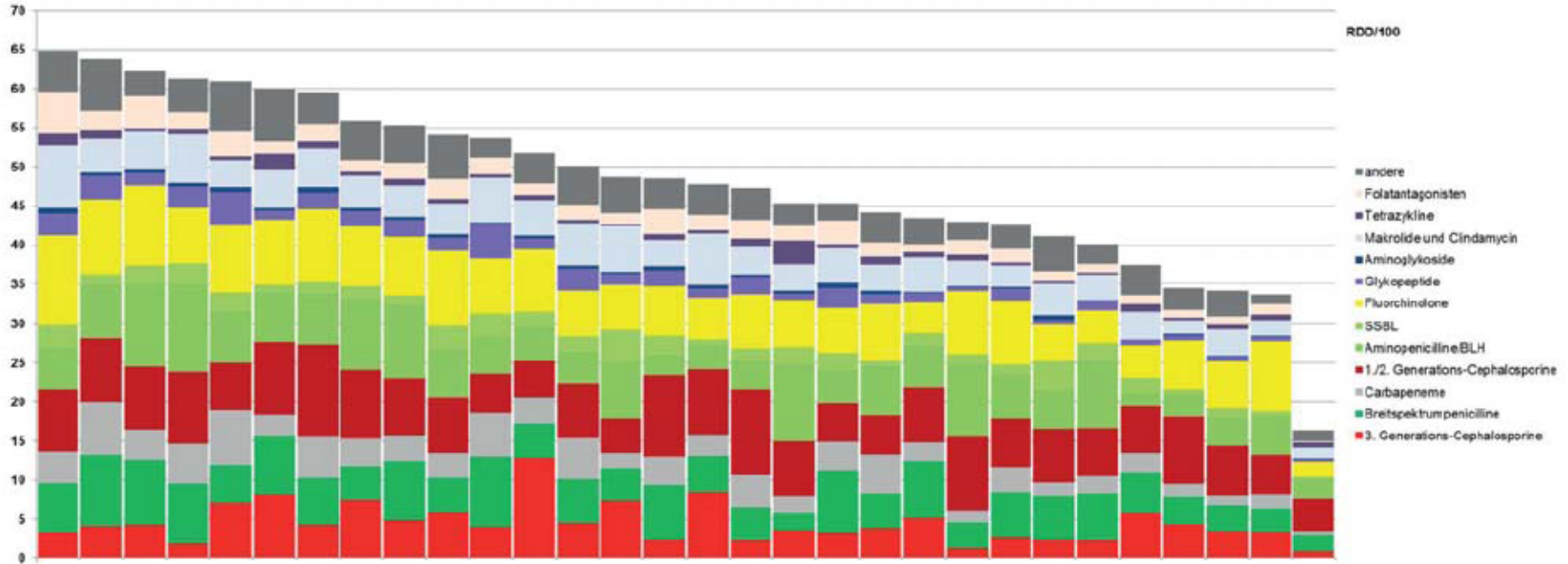


	I/2016	II/2016	III/2016	IV/2016
3./4. Generations-Ce...	4,62	3,81	4,51	3,56
Breitspektrumpenicil...	4,46	4,32	4,49	3,80
Carbapeneme	1,63	1,67	1,44	1,71
1./2. Generations-Ce...	7,39	7,96	8,47	7,30
Aminopenicilline/Bet...	4,21	4,64	4,96	4,77
Schmalspektrumbetala...	2,05	2,11	2,36	2,33
Fluorchinolone	5,26	5,31	5,37	4,49
Glykopeptide	0,99	1,05	0,97	0,70
Aminoglykoside	0,29	0,37	0,37	0,33
Makrolide + Clindamy...	3,27	2,58	2,68	2,86
Tetracykline	0,17	0,32	0,37	0,31
Folatantagonisten	1,35	1,43	1,51	1,14
andere	5,04	5,80	6,25	5,56

” *How many of what has been used in which area, in a certain time period?*

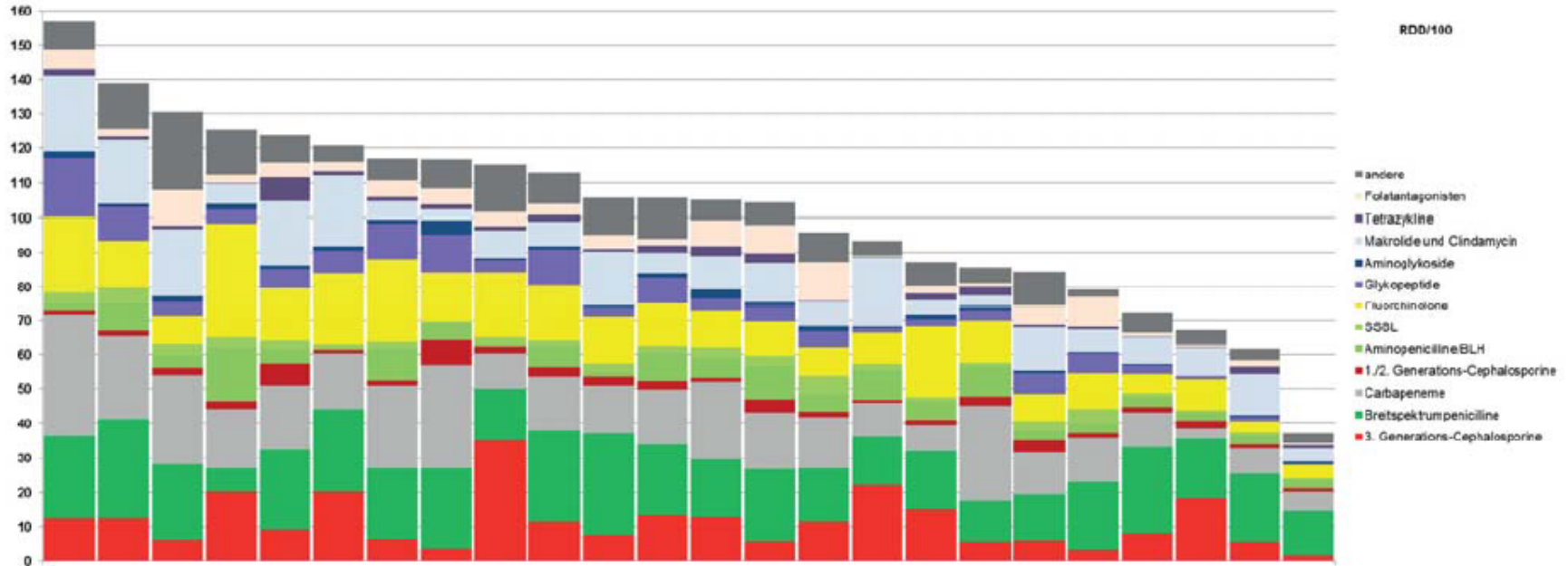
Benchmark report

Whole hospitals > 800 beds



Benchmark report

Internal medicine / ICU / hospitals > 800 beds



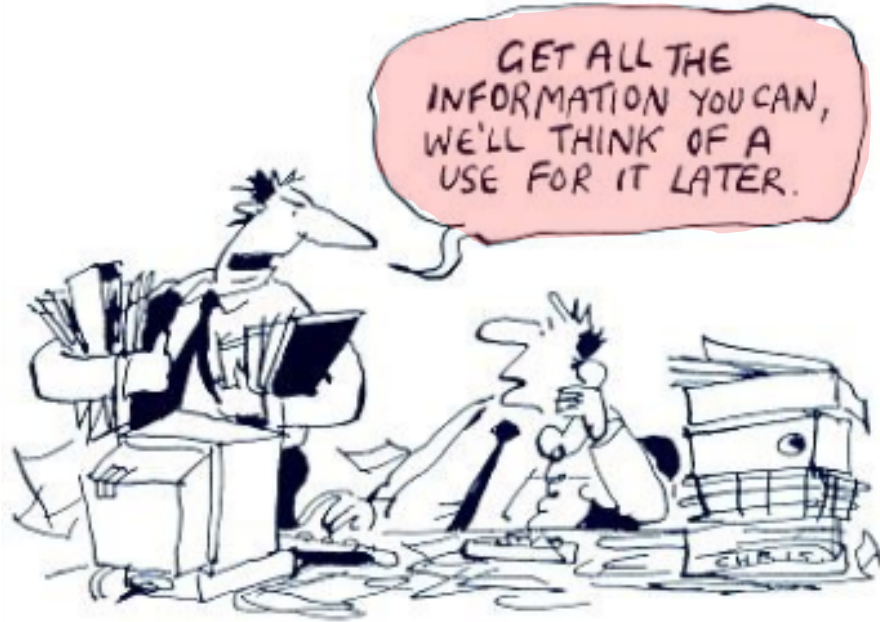
Internistische Intensivmedizin:

Mittlerer Antibiotikaverbrauch in Tagesdosen pro 100 Pflegetage (RDD/100).

	<400 Betten		400-800 Betten		> 800 Betten	
	Median	Interquartilbereich	Median	Interquartilbereich	Median	Interquartilbereich
3./4. Generations-Cephalosporine	7,0	4,0 - 11,6	6,5	4,5 - 10,5	11,2	5,8 - 15,0
Breitspektrum-Penicilline	14,6	8,5 - 22,2	13,2	10,3 - 18,7	20,4	15,8 - 23,7
Carbapeneme	7,9	3,9 - 14,9	8,2	6,4 - 10,2	16,0	10,5 - 23,6
1./2. Generations-Cephalosporine	3,6	2,0 - 5,9	1,4	0,9 - 2,7	1,8	1,3 - 2,9
Aminopenicillin/BLI-Kombinationen*	5,2	2,6 - 8,7	6,5	3,1 - 10,0	4,9	2,7 - 8,4
Schmalspektrum-Penicilline [#]	1,4	0,5 - 2,2	1,7	1,4 - 3,1	2,2	1,1 - 3,2
Fluorchinolone	10,7	6,6 - 14,7	10,8	5,7 - 14,0	13,2	9,3 - 19,0
Glykopeptide incl. Daptomycin	1,9	0,7 - 2,4	2,3	1,0 - 3,0	4,7	2,3 - 7,1
Aminoglykoside	0,3	0,1 - 0,6	0,5	0,3 - 0,7	1,2	0,6 - 1,5
Makrolide und Clindamycin	9,4	5,8 - 12,7	7,2	5,5 - 9,5	8,2	6,0 - 18,3
Tetrazykline	0,5	0,1 - 1,1	0,5	0,4 - 1,1	1,1	0,9 - 2,0
Folatantagonisten/Sulfonamide	1,3	0,7 - 2,2	1,8	0,8 - 3,9	3,7	1,9 - 5,9
andere	6,2	3,5 - 8,0	5,2	1,7 - 7,3	8,0	4,7 - 10,7
darunter Metronidazol	3,7	2,6 - 5,1	2,7	1,3 - 4,8	2,7	1,9 - 4,4

*BLI=Betalaktamase-Inhibitor

[#] Penicillin, Ampicillin, Amoxicillin, Flucloxacillin



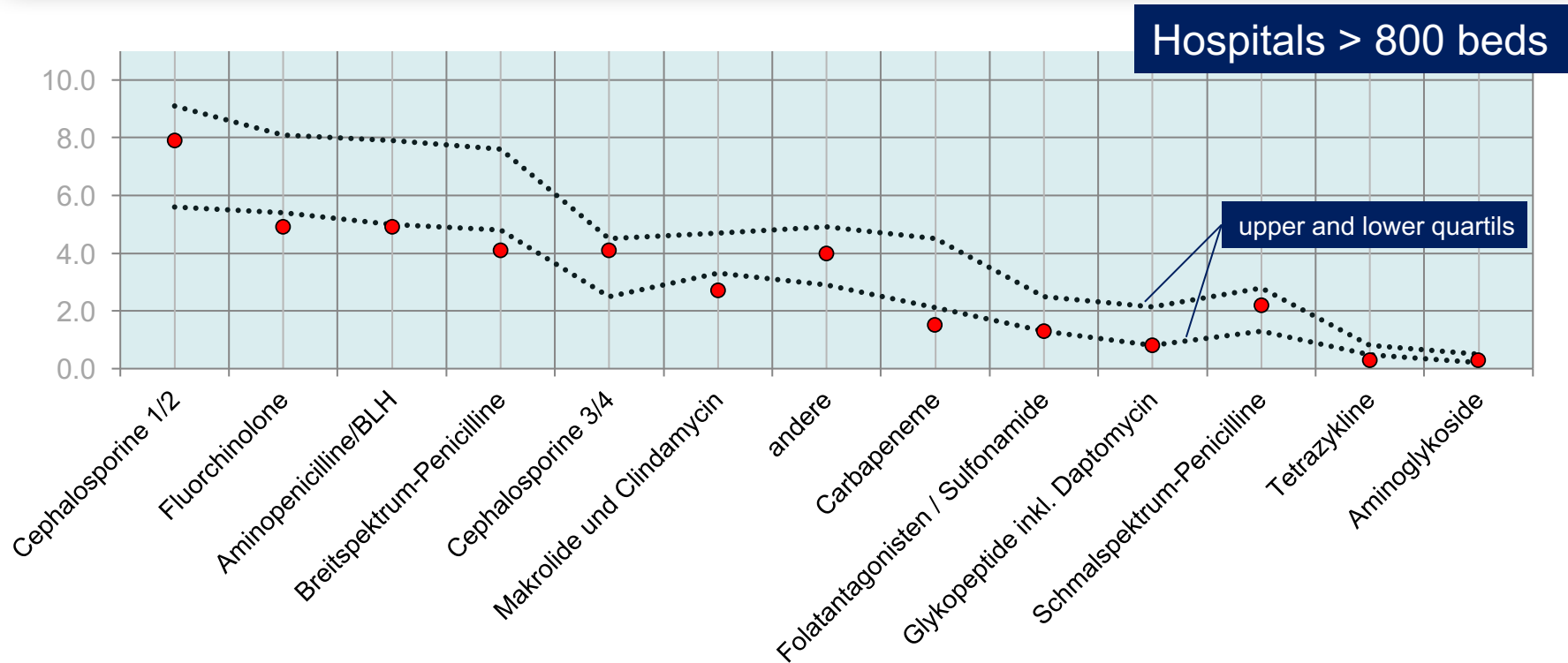
**... at least annually,
preferably quarterly.**

German S3-Guideline

... continuously.

How to **visualize** consumption data

(Data in RDD/100 pts per day from Krankenhaus-Vergleichsreport 2015/2016, ADKA-if-DGI Projekt)



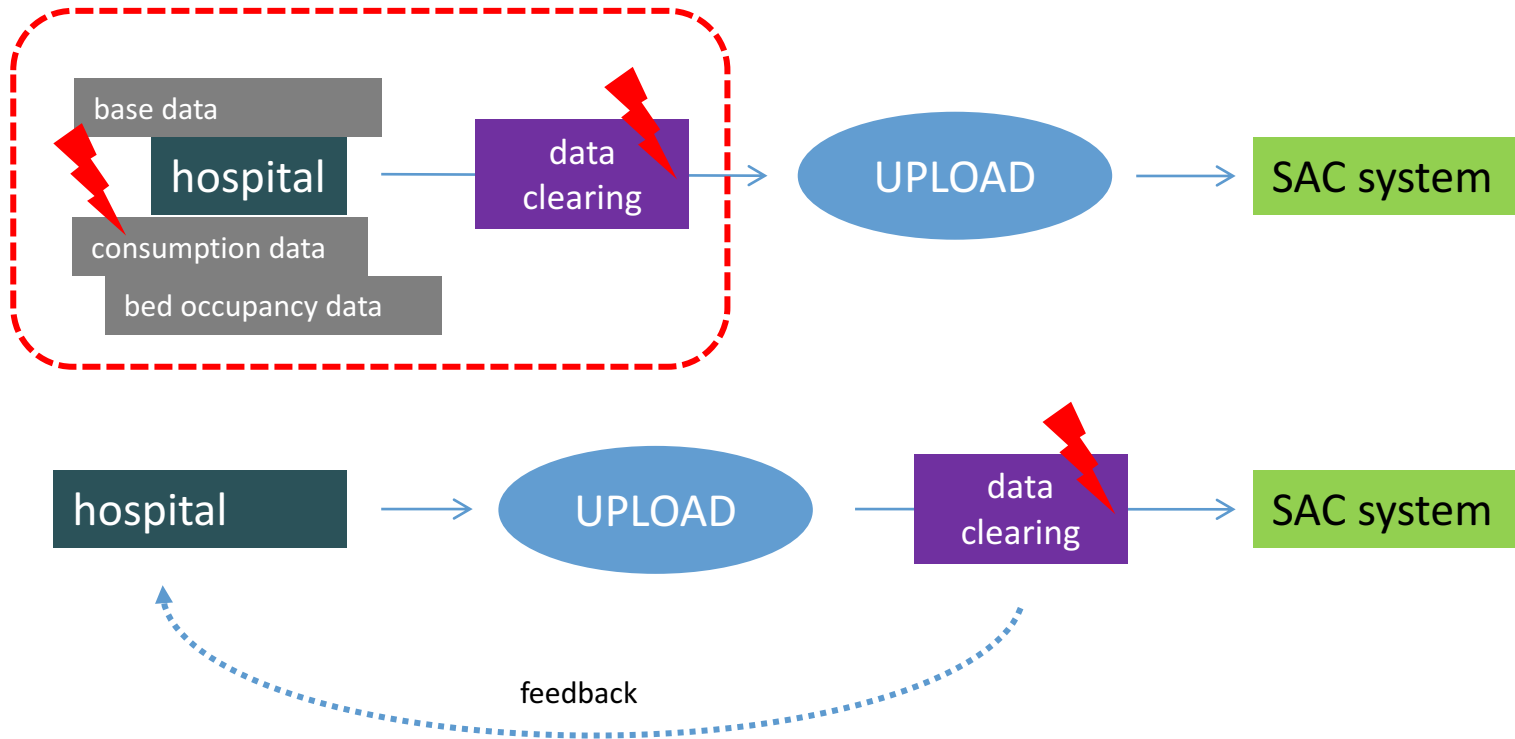
CONSUMPTION SURVEILLANCE METHODS:

HOW TO COLLECT AND REPORT DATA

HOW TO AVOID COMMON PITFALLS



... data quality is critical!



... data quality is critical!

Systemic vs. local antimicrobials:

- Vancomycin?
- Colistin, Tobramycin inhalation?

Dose reduction is not considered

Drug shortages: Update your base data!

Reorganisation of wards: Update your base data!

... mixed specialty (combined) wards

- How many - is it a relevant part of the hospital?
- Is a „fixed split“ of antibiotic consumption possible?
- CDC-NHSN-80%-rule?

You have to make some decisions ...

hospital

what time period?

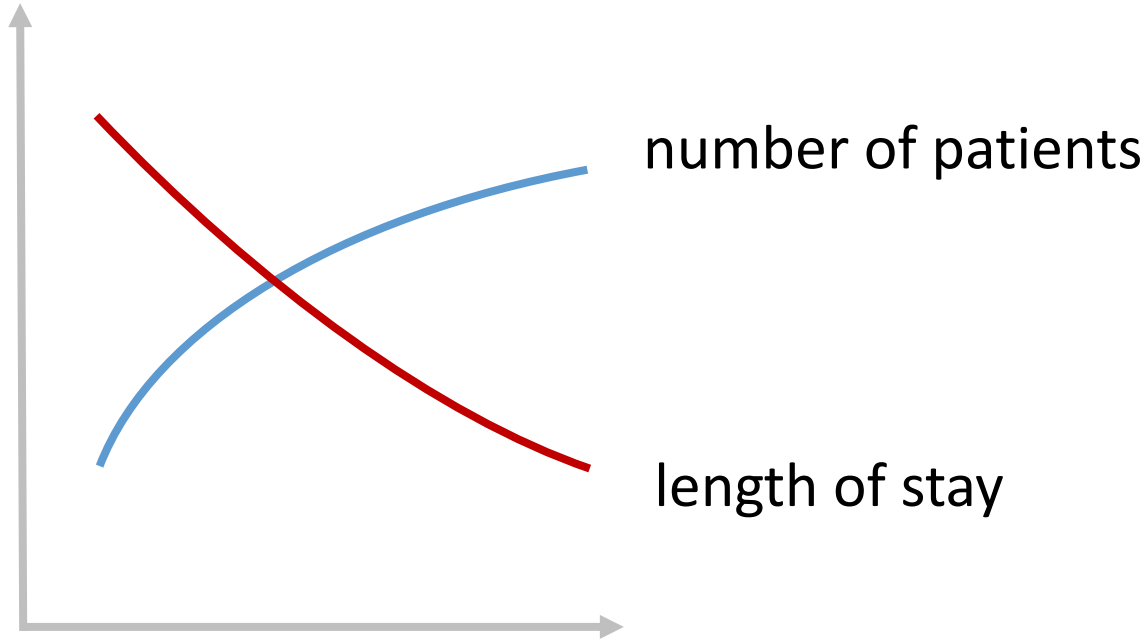
DDD or RDD?

DIY or SAC system?



SAC system

commercial or non commercial?



100 pts
get 1 DDD
over 10 days
=
100 DDD/1000 pt per day

200 pts
get 1 DDD
over 5 days
=
200 DDD/1000 pt per day

SAC is just a tool: Use it in the right way...!

Local trend vs. **benchmark**

methodology?
representative?

Quantity is not **Quality of therapy**

Consumption is not **Resistance**

Digging deeper: With Point Prevalence Studies!

We should know

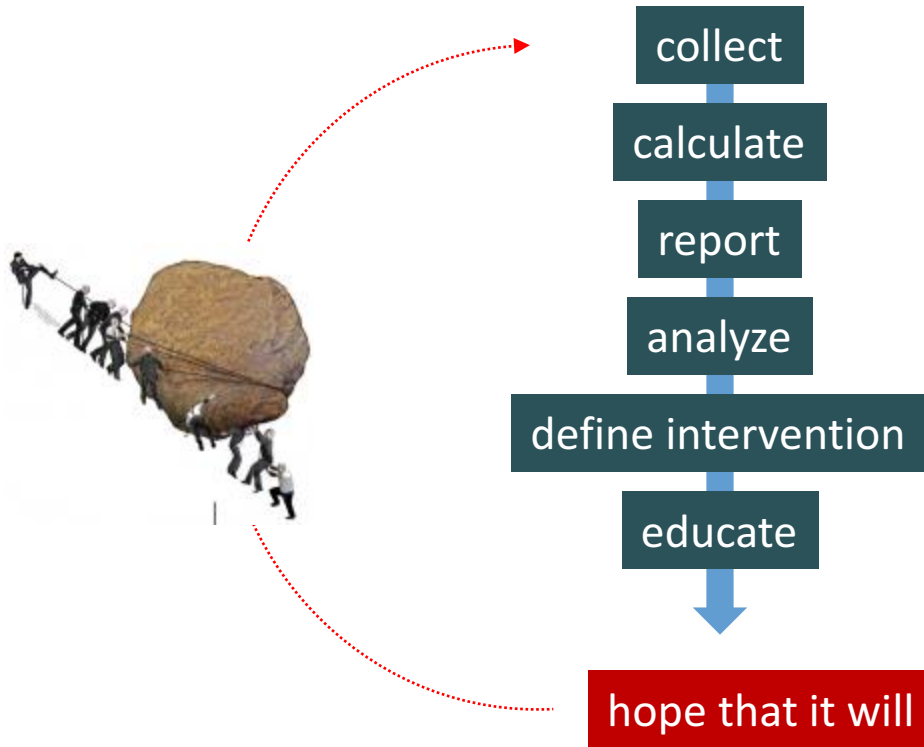
what we can learn from SAC data

what we can **NOT** learn ...



It's not more
than a
speedometer ...

It's not all about consumption data ...



SUMMARY



Six key steps

to Surveillance of Antibiotic Consumption

- 1 Look at your data
- 2 Standardisation is key
- 3 Join a national, non commercial surveillance system
- 4 Keep your base data up to date
- 5 Look at your local trends first
- 6 Don't overestimate the benchmarks

SUMMARY (handout)

Surveillance of Antimicrobial Consumption in Hospitals: Summary

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WHY consumption should be monitored

- Surveillance of Antimicrobial Consumption (SAC) is the „speedometer“ for antimicrobial use
- SAC is a requirement for antimicrobial stewardship programs
- SAC is recommended in evidence based guidelines for antimicrobial stewardship (DELLIT, BARLAM, deWITh)
- SAC shows trends in antimicrobial use at the local, national and global level
- SAC may trigger changes of empiric treatment
- SAC may demonstrate trends over time
- SAC may detect hot spots of inadequate use of antimicrobials

HOW data should be COLLECTED

- **Consumption data** is collected at the product level from pharmacy computer systems or electronic prescribing systems
- **Bed occupancy data** are provided by the hospital administration
- Data should be collected at the level of wards or medical units
- Intensive Care Units should be considered separately
- SAC data should be calculated in Defined Daily Doses (DDD) or Recommended Daily Doses (RDD) as the numerator and 1000 patients per day or 100 patients per day as the denominator
- Results are a measure for density of antimicrobial use
- There is no well accepted measure for pediatrics so far

HOW data should be REPORTED

- Use data should be reported on a regular basis (at least once a year, preferably quarterly).
- Use data should be reported and aggregated to the level of the hospital and medical department, but also be available to the level of the ward
- Use data should be reported and aggregated according to ATC codes (or other systems, if established on a national level)
- DIY is an option, but well established surveillance systems on the national level are strongly recommended
- Benchmarking data may provide additional information, but should be interpreted with caution
- The cost of antimicrobial therapy should also be reported (local level only)

Pitfalls

- Metrics are not standardized on an international level
- Using DDD is much accepted, but results in an overestimation of consumption for some anti-infectives
- Mixed specialty wards may be responsible for relevant inaccuracy of results
- Master data must be kept up to date
- Dose reduction in renal failure may cause inaccuracy
- Pediatric departments should be excluded
- Local trends are more important than benchmarks
- International benchmarks should be handled with caution for methodological differences
- Data quality is critical, clearing is recommended

6 key steps to SAC in hospitals

- 1 Look at your data
- 2 Standardisation is key
- 3 Join a national, non commercial surveillance system
- 4 Keep your base data up to date
- 5 Look at your local trends first
- 6 Don't overestimate the benchmarks

Questions and Answers:

①

RDD/1000 patients per day is a globally accepted measure for antibiotic consumption:

NO

②

There is not yet a well accepted measure for antibiotic consumption in pediatrics:

YES

③

Consumption data should be collected at least monthly:

NO

THANK YOU 😊