

System for early warning and national surveillance of antimicrobial resistance!

Gunnar Kahlmeter

Clinical microbiology

Växjö, Sweden

“Early warning for antimicrobial resistance”

- **Local level** (laboratory uptake area)
 - easy to achieve with good laboratory software systems.
- **National level**
 - many different computer systems; more difficult to achieve technically
 - agreements on ownership more problematic than techniques to collect data
 - “Early warning” requires realtime connection between “host” (central computer) and guests (local laboratory systems).
- **Global level**
 - national and international networks of “CDC”s

Early warning against...

- **Especially unwanted phenotypes**
 - local level, national level, global
 - defined locally and nationally
- **Predefined threshold levels of resistance**
- **Outbreaks (local)**
- **Trends (software to pick up trends)**
 - local and national
- **Laboratory errors (QC of database)**
 - individual laboratories

Especially unwanted phenotypes... examples from history

- MRSA (late 60ies/70ies)
- *N. meningitidis* with Sul-resistance (70ies: from 0.01 % - 70 %)
- *N. gonorrhoeae* with betalactamase production (mid 70ies)
- *H. influenzae* with betalactamase production (mid 70ies)
- *S. pyogenes* with erythromycin resistance (ERGAS)
- *S. pneumoniae* with penicillin resistance (80ies)
- MRSA (early 90ies)
- ESBL producers (90ies)
- VRE (90ies)
- MDRTB (90ies)
- Exceptional MDR (multidrug resistance) (90ies)
 - *Acinetobacter*, *Pseudomonas*
- MBL, KPC, NDM (2000ies)

Especially unwanted phenotypes...

Current candidates are dependant on prevalens

- MRSA – single incidents / outbreak detection?
 - Some countries (NL, SE, DK, N, SF), individual hospitals, individual wards, still have very low MRSA levels.
- ESBLs – outbreak detection?
 - Individual wards, neonatal dpts, ICU
- VRE – outbreak detection?
- KPC – single incidents / outbreak detection.
- MBL/NDM – single incidents / outbreak detection
- MDRTB – single incidents / outbreak detection
- Exceptional multiresistance – single incidents

Svebar

Swedish antimicrobial resistance early warning and surveillance system

Gunnar Kahlmeter, SMI and Växjö

Tomas Söderblom, SMI

Johan Struwe, SMI

Karin Tegmark-Wisell, SMI

Katarina Skärlund, SMI

[Startsida]

Information

Översikt
Medverkande

Externa länkar

Svebars externa
projektinformation

Sammanställningar och
presentationer

Smittskyddsinstitutet

Smittskyddsinstitutet
resistensövervakning

ResNet

Swedres

Nordicast

ECDC- Antimicrobial
Resistance and Healthcare-
associated Infections
Programme

Eucast

Svebar - Swedish surveillance of antimicrobial resistance



Svebar – two components

1. Early warning (EW)
2. Antimicrobial resistance surveillance
 - Automatic (but avoid pre-mapping)
 - Deal early with proprietary issues – who owns data, how to publish, ...
 - Offer benefits to participating laboratories

Svebar - Swedish surveillance of antimicrobial resistance

Svebar

- Sweden 9 miljon inhabitants
- SMI (Smittskyddsinstitutet)
- ≈ 25 laboratories (clinical microbiology)
- ≈ 5-6 different IT systems
- For each IT system a programme which exports all bacteriological culture-data in a structured XML-file, organised
 - DATA-ID (laboratory ID; not patient ID)
 - DATE of SAMPLE ADMISSION
 - TYPE OF ANALYSIS (Blood culture, Urin culture etc)
 - SPECIES (or if no species: NEGATIVE)
 - ANTIBIOTIC (disk)
 - AST RESULT: SIR (ZONE and/or MIC)

Svebar - Swedish surveillance of antimicrobial resistance

Smi

SMITTSKYDDSinSTITUTET
Swedish Institute for Communicable Disease Control

Export, import, export and import

- 25 labs export the last 14 days of culture results at 00.30
- The 25 files are imported by Svebar (between 2 – 6 in the morning).
- Each file goes through the CENTRAL and the LOCAL early warning "exceptional phenotype trapping" system.
- Data is deposited in the "surveillance database" – but only data belonging to the 14th day.
- CENTRAL and LOCAL reports are built and exported and then imported by each of the 25 laboratories.





















Svebar - Swedish surveillance of antimicrobial resistance

Svebar

- Early warning
 - exceptional antimicrobial resistance (spectacular phenotypes)
 - Committee defines and reviews definitions of exceptional phenotypes for early warning.
 - Communication between central and local on "hits"
- Antimicrobial resistance surveillance
 - national comprehensive database of all culture data
 - Laboratory, sample ID (number), date.
 - Patient: age, gender, geographical area (county, hospital code)
 - Type of sample/analysis (blood/culture, urine/culture etc)
 - Species
 - Antimicrobial (zone, MIC and interpretations SIR)

Svebar - Swedish surveillance of antimicrobial resistance

Svebar – Early Warning

	▼ Labkod ▲	▼ Art ▲	▼ Antibiotika ▲	Aktivt	Antal R	%R	%(I + R)	Period	C/L
 	Alla	STAPHYLOCOCCUS AUREUS	VANKOMYCIN OR TEICOPLANIN OR DAPTOMYCIN OR LINEZOLID	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	ENTEROCOCCUS FAECIUM	VANKOMYCIN OR TEICOPLANIN	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	STREPTOCOCCUS PNEUMONIAE	AMOXICILLIN OR AMPICILLIN OR CEFOTAXIM OR CEFTRIAXON OR MEROPENEM OR PENICILLIN V	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	ESCHERICHIA COLI	ERTAPENEM OR IMIPENEM OR MEROPENEM OR DORIPENEM	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	KLEBSIELLA PNEUMONIAE	ERTAPENEM OR DORIPENEM OR IMIPENEM OR MEROPENEM	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	ESCHERICHIA COLI	AMPICILLIN	ja	0	30	Ej valt	3 månader	Centralt
 	Alla	ESCHERICHIA COLI	CIPROFLOXACIN	ja	0	Ej valt	10	3 månader	Centralt
 	Alla	STREPTOCOCCUS PNEUMONIAE	PENICILLIN V	ja	0	5	Ej valt	2 veckor	Centralt
 	Alla	PSEUDOMONAS AERUGINOSA	CEFTAZIDIM AND DORIPENEM OR ERTAPENEM OR MEROPENEM OR IMIPENEM	ja	1	Ej valt	Ej valt	2 veckor	Centralt
 	Alla	STREPTOCOCCUS PNEUMONIAE	ERYTHROMYCIN OR KLINDAMYCIN AND TETRACYKLIN AND TRIMETOPRIMSULFA	ja	1	Ej valt	Ej valt	2 veckor	Centralt
	Alla	STREPTOCOCCUS PYOGENES	PENICILLIN G	ja	1	Ej valt	Ej valt	2 veckor	Centralt

Svebar - Swedish surveillance of antimicrobial resistance

Svebar

- Daily Central Report (to SMI):
 - Summarise all "exceptional phenotypes"
 - Allows communication between Central and Local
- Daily Local Report
 - Lists the local contribution to the "exceptional phenotypes" report
 - Lists locally defined phenotypes of local interest (each lab can define their own EW traps)

Svebar - Swedish surveillance of antimicrobial resistance

----- SUMMARY -----

Total number of registrations: 373221

Number of negative registrations: 233354 (62%)

Numbers of registrations last 24 hours:

SE100 : 0

SE110 : 227

SE120 : 2573

SE230 : 127

SE240 : 181

SE250 : 202

SE300 : 0

SE310 : 0

SE320 : 0

SE450 : 0

SE540 : 59

SMI001 : 0

TOTAL : 3369

ALERT: There are items in correction list

ALERT: There are one or more warnings

----- Filter Analysis -----

Central filter ID: 195

Lab : All

Species : STAPHYLOCOCCUS AUREUS

Antib. : VANKOMYCIN OR TEICOPLANIN OR DAPTOMYCIN OR LINEZOLID

NOO : 1

%R : N/A

%(R+I) : N/A

Period : 14 days

Triggers: none

Central filter ID: 199

Lab : All

Species : ENTEROCOCCUS FAECIUM

Antib. : VANKOMYCIN OR TEICOPLANIN

NOO : 1

%R : N/A

%(R+I) : N/A

Period : 14 days

Triggers: 2

Date :20111123

Lab :SE240

Sample date :20111111

Ident :See report-file.

Date :20111123

Lab :SE240

Sample date :20111111

Ident :See report-file.

Central filter ID: 206

Lab : All

Species : ESCHERICHIA COLI

Antib. : ERTAPENEM OR IMIPENEM OR MEROPENEM OR DORIPENEM

NOO : 1

%R : N/A

%(R+I) : N/A

Period : 14 days

Triggers: None

ESCMID Online Lecture Library
© by author

Central filter ID: 207

Lab : All

Species : KLEBSIELLA PNEUMONIAE

Antib. : ERTAPENEM OR DORIPENEM OR IMIPENEM OR MEROPENEM

NOO : 1

%R : N/A

%(R+I) : N/A

Period : 14 days

Triggers: 2

Date :20111124

Lab :SE230

Sample date :20111109

Ident :See report-file.

Date :20111124

Lab :SE230

Sample date :20111109

Ident :See report-file.

Svebar

- Early warning
 - exceptional antimicrobial resistance (spectacular phenotypes)
 - Committee defines EW phenotypes
 - Communication between central and local on "hits"
- Antimicrobial resistance surveillance
 - national comprehensive database of all culture data
 - Laboratory, sample ID (number), date.
 - Patient: age, gender, geographical area (county, hospital code)
 - Type of sample/analysis (blood/culture, urine/culture etc)
 - Species
 - Antimicrobial (zone, MIC and interpretations SIR)

Svebar - Swedish surveillance of antimicrobial resistance

Svebar – AMR database

Google

Sida S kerhet

Filter	ESCHERICHIA COLI	V�lj...	20110924 20111109	V�lj...	2001 2011	V�lj... V�lj...
Calc	Art ▲	Labkod ▲	Provdatum ▲	Typ av analys ▲	Remiss�r ▲	F�delsedatum
ESCHERICHIA COLI	SE540	20111108	URINODLING	2011	195305 (58)	
ESCHERICHIA COLI	SE230	20110927	URINODLING	2011	195008 (61)	
ESCHERICHIA COLI	SE110	20111025	URINODLING	2011	192805 (83)	
ESCHERICHIA COLI	SE250	20110925	URINODLING	2011	196605 (45)	
ESCHERICHIA COLI	SE110	20111027	URINODLING	2011	191909 (92)	
ESCHERICHIA COLI	SE110	20111021	URINODLING	2011	191808 (93)	
ESCHERICHIA COLI	SE230	20111101	BLODODLING AEROB ANAEROB	2011	193802 (73)	
ESCHERICHIA COLI	SE250	20110926	URINODLING	2011	192203 (89)	
ESCHERICHIA COLI	SE110	20111026	URINODLING	2011	192505 (86)	
ESCHERICHIA COLI	SE250	20110926	URINODLING	2011	195508 (56)	
ESCHERICHIA COLI	SE240	20111027	URINODLING	2011	192812 (83)	
ESCHERICHIA COLI	SE230	20110927	URINODLING	2011	193702 (74)	
ESCHERICHIA COLI	SE230	20111031	ALLM�N ODLING	2011	194608 (65)	
ESCHERICHIA COLI	SE230	20111019	URINODLING	2011	194402 (67)	
ESCHERICHIA COLI	SE110	20111026	URINODLING	2011	200809 (3)	
ESCHERICHIA COLI	SE230	20111020	URINODLING	2011	198203 (29)	
ESCHERICHIA COLI	SE110	20111026	URINODLING	2011	192208 (89)	
ESCHERICHIA COLI	SE250	20110925	URINODLING	2011	192701 (84)	
ESCHERICHIA COLI	SE240	20111102	URINODLING	2011	198203 (29)	
ESCHERICHIA COLI	SE230	20111020	URINODLING	2011	194204 (69)	
ESCHERICHIA COLI	SE230	20111031	URINODLING	2011	194009 (71)	
ESCHERICHIA COLI	SE250	20110926	URINODLING	2011	194108 (70)	
ESCHERICHIA COLI	SE110	20111028	URINODLING	2011	192711 (84)	
ESCHERICHIA COLI	SE250	20110927	URINODLING	2011	196408 (47)	
ESCHERICHIA COLI	SE230	20111102	URINODLING	2011	194206 (69)	

Svebar - Swedish surveillance of antimicrobial resistance

20110928	NASOFARYNXODLING	2011	201109 (0)	Kvinna	i	i													
20110928	NASOFARYNXODLING	2011	200508 (6)	Man	i	i													
20111027	NASOFARYNXODLING	2011	195207 (59)	Kvinna	i	i													
20111019	BLODODLING AEROB ANAEROB	2011	194510 (66)	Kvinna	i	i													
20111027	NASOFARYNXODLING	2011	201107 (0)	Man	i														
20111019	BLODODLING AEROB ANAEROB	2011	194510 (66)	Kvinna															
20111013	ALLMÄN ODLING	2011	201005 (1)	Man	i														
20111020	BLODODLING AEROB ANAEROB	2011	197312 (38)	Man	i														
20111016	ALLMÄN ODLING	2011	193706 (74)	Man	i														
20111008	NASOFARYNXODLING	2011	200209 (9)	Man	i														
20111011	ALLMÄN ODLING	2011	193512 (76)	Man															
20111004	NASOFARYNXODLING	2011	198306 (28)	Kvinna	i														
20111013	NASOFARYNXODLING	2011	200905 (2)	Kvinna															
20111020	BLODODLING AEROB ANAEROB	2011	197312 (38)	Man															
20111006	ALLMÄN ODLING	2011	201108 (0)	Kvinna	i														
20111024	NASOFARYNXODLING	2011	197705 (34)	Man	i														
20111030	NASOFARYNXODLING	2011	195510 (56)	Man	i														
20111014	ALLMÄN ODLING	2011	201103 (0)	Man	i														
20111004	NASOFARYNXODLING	2011	194707 (64)	Kvinna	i	i													
20111004	ALLMÄN ODLING	2011	194111 (70)	Okänd	i	i													
20111005	NASOFARYNXODLING	2011	197709 (34)	Kvinna	i	i													
20111010	NASOFARYNXODLING	2011	196006 (51)	Kvinna	i	i													
20111016	ALLMÄN ODLING	2011	193706 (74)	Man	i	i													
20111005	NEDRE LUFTVÄGAR	2011	194504 (66)	Man	i	i													
20111017	ALLMÄN ODLING	2011	199306 (18)	Kvinna	i	i													
20111005	ALLMÄN ODLING	2011	200604 (5)	Man	i	i													
20111015	NASOFARYNXODLING	2011	194210 (69)	Kvinna	i	i													
20111006	BLODODLING AEROB ANAEROB	2011	194307 (68)	Man	i	i													
20111017	NASOFARYNXODLING	2011	196010 (51)	Kvinna	i	i													
20111006	BLODODLING AEROB ANAEROB	2011	194307 (68)	Man	i	i													
20111019	ALLMÄN ODLING	2011	196005 (51)	Man	i	i													

Antib	Disk	Prim	Zon	SIR	Mic
CEROTAXIM	30	1	39	S	
ERYTHROMYCIN	15	1	24	S	
ISOXAZOLYL PENICILLIN	1	1	30	S	
KLINDAMYCIN	15	1	21	S	
MEROPENEM	10	1	44		
NORFLOXACIN	30	1	16	S	
PENICILLIN G	10	1	34		0.016
PENICILLIN V	10	1		S	
RIFAMPICIN	2	1	25	S	
TETRACYKLIN		1	25	S	
TRIMETOPRIMSULFA	25	1	22	S	
VANKOMYCIN	5	1	18	S	

Svebar - Swedish surveillance of antimicrobial resistance

Antibiotikum	Total	S %	I %	R %
AMIKACIN	11	90,9	9,1	0
AMOXICILLIN	562	3,6	63,7	32,7
AMOXICILLINCLAVULANSYRA	5	60	0	40
AMPICILLIN	16 926	26,3	45,7	28
AZTREONAM	364	18,1	6	75,8
CEFADROXIL	36 723	56,5	40,2	3,3
CEFALEXIN	4	25	0	75
CEFEPIM	360	31,4	5,3	63,3
CEFOTAXIM	12 951	91	0,5	8,5
CEFOXITIN	160	34,4	0	65,6
CEFPODOXIM	239	7,5	0	92,5
CEFTAZIDIM	15 018	92,2	1,6	6,2
CEFTIBUTEN	22 573	98,6	0,1	1,4
CEFUROXIM	305	80	0,7	19,3
CIPROFLOXACIN	34 185	89,5	0,3	10,2
COLISTIN	13	100	0	0
DOXYCYKLIN	4	0	0	100
ERTAPENEM	156	98,7	0	1,3
FOSFOMYCIN	746	63,9	0	36,1
FUSIDINSYRA	1	0	0	100
GENTAMICIN	2 999	89,5	0,5	10
IMIPENEM	721	99,9	0	0,1

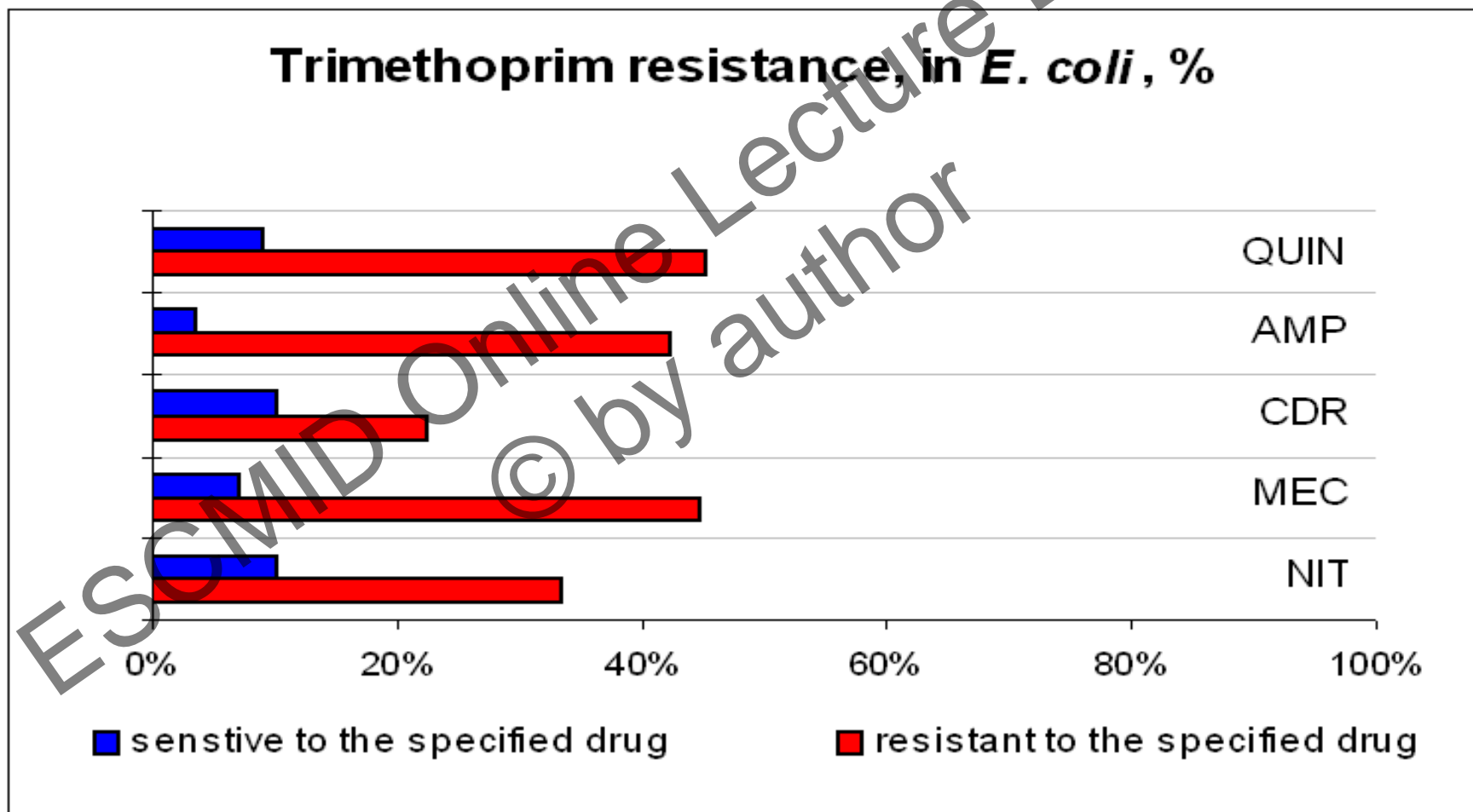
Algorithms for susceptibility testing are common in clinical microbiology

- E.coli in urine sample – routine AST:
 - Amoxicillinclavulanate
 - Trimethoprim or Trimethoprimsulfa
 - Quinolone
 - Nitrofurantoin
 - Pivmecillinam (in some countries)
- If ≥ 3 "R"s extend next day with:
 - Aminoglycoside
 - 3rd gen cephalosporine
 - Carbapenem

.....or something similar

Associated resistance

E. coli



Antibiotikum	Total	S %	I %	R %
AMIKACIN	11	90,9	9,1	0
AMOXICILLIN	562	3,6	63,7	32,7
AMOXICILLINCLAVULANSYRA	5	60	0	40
AMPICILLIN	16 926	26,3	45,7	28
AZTREONAM	364	18,1	6	75,8
CEFADROXIL	36 723	56,5	40,2	3,3
CEFALEXIN	4	25	0	75
CEFEPIM	360	31,4	5,3	63,3
CEFOTAXIM	12 951	91	0,5	8,5
CEFOXITIN	160	34,4	0	65,6
CEFPODOXIM	239	7,5	0	92,5
CEFTAZIDIM	15 018	92,2	1,6	6,2
CEFTIBUTEN	22 573	98,6	0,1	1,4
CEFUROXIM	305	80	0,7	19,3
CIPROFLOXACIN	34 185	89,5	0,3	10,2
COLISTIN	13	100	0	0
DOXYCYKLIN	4	0	0	100
ERTAPENEM	156	98,7	0	1,3
FOSFOMYCIN	746	63,9	0	36,1
FUSIDINSYRA	1	0	0	100
GENTAMICIN	2 999	89,5	0,5	10
IMIPENEM	721	99,9	0	0,1

ESCMID Online Lecture Library © by author



When?

- 8 laboratories online since up to 2 years
- + 10 more during 2012-13
- All labs 2014
- Cost per lab: 5 000 – 10 000 €

Thank you

ESCMID Online Lecture Library
© by author