



Framework of action plan against antimicrobial resistance in Taiwan

Shan-Chwen Chang, MD, PhD

College of Medicine

National Taiwan University

10 October 2019

WHO Global Action Plan on Antimicrobial Resistance

- At the 68th World Health Assembly in May 2015, the WHO endorsed a global action plan to tackle antimicrobial resistance.

Five strategic objectives:

- To improve awareness and understanding of antimicrobial resistance;
- To strengthen knowledge through surveillance and research;
- To reduce the incidence of infection;
- To optimize the use of antimicrobial agents; and
- Develop the economic cases for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.



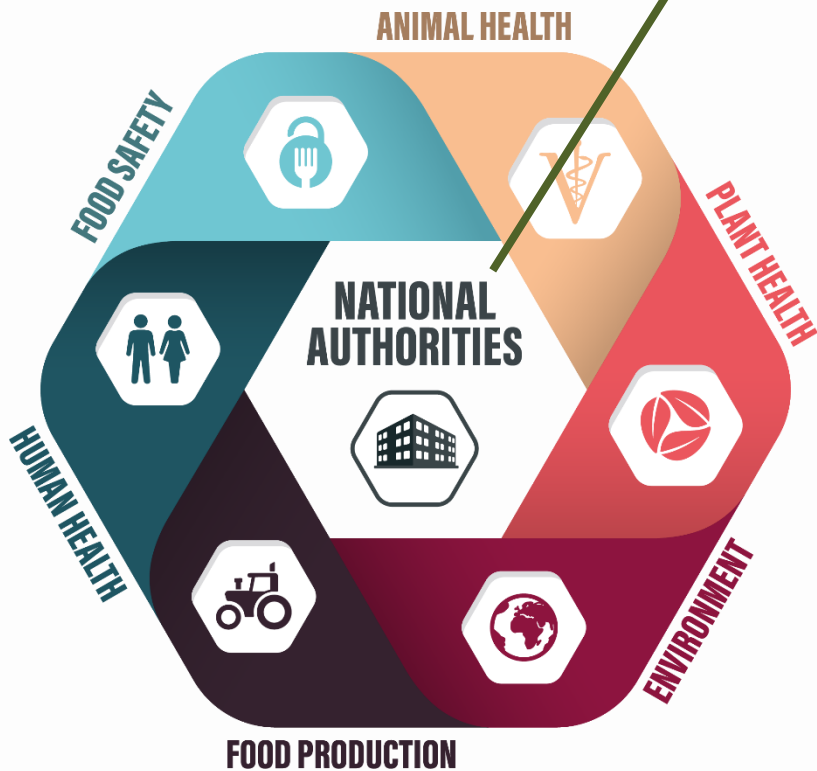
Global Action Initiatives - United Nations

- Global leaders met at the United Nations General Assembly in New York in September 2016 to commit to fighting AMR together.
- This is only the fourth time in UN history that a health topic is discussed at the General Assembly.



- World leaders pledged to...
 - ✓ **Strengthen regulations**
 - ✓ **Improve knowledge and awareness**
 - ✓ **Promote best practices**
 - ✓ **Foster innovative approaches**

Global Action Initiatives - FAO-OIE-WHO Collaboration



LEGISLATION:

Regulation is mandatory to promote appropriate use of antimicrobials: make sure legislation is implemented.



AWARENESS & EDUCATION:

Raise public awareness and educate all stakeholders



SURVEILLANCE & MONITORING:

Strengthen national AMR and antimicrobial use surveillance systems based on global standards.



RESEARCH:

Support and finance the development of methods for the prevention, diagnosis and treatment of disease, to reduce dependence on antimicrobials.

Framework to Combat AMR in Taiwan

Combating AMR with One Health

Council of Agriculture



Centers for Disease Control



Food and Drug Administration



National Health Insurance Administration



COA's Strategies to Combat AMR

Survey and monitor AMR in livestock

Survey and monitor veterinary medicines used in livestock

Review and minimize the number of antimicrobials for veterinary use

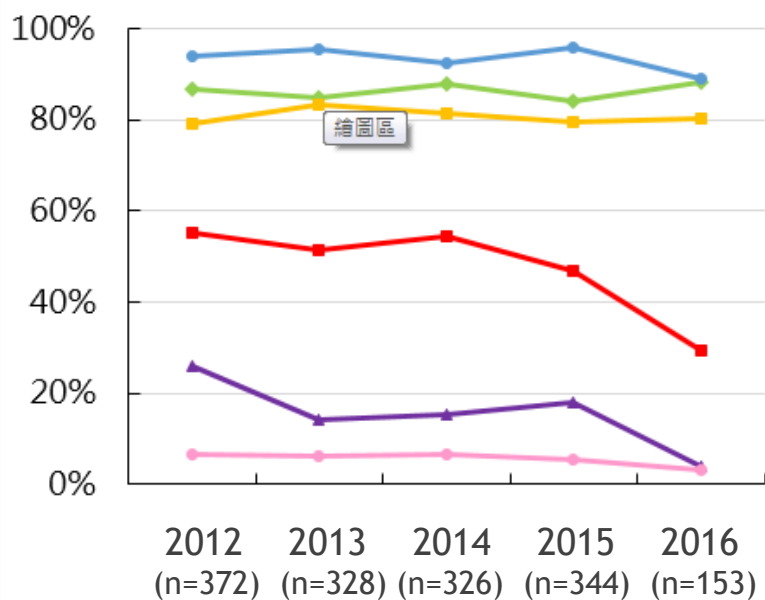
Govern veterinary medicine sales and promote appropriate use of antimicrobials in livestock

34 Banned Antimicrobials for Animal Feed

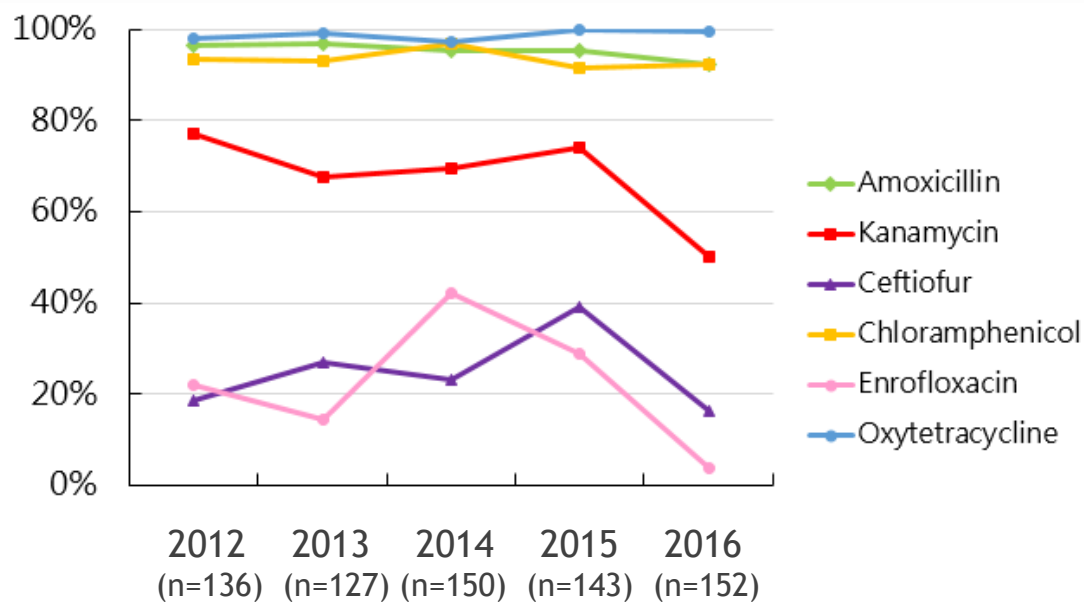
Antimicrobials		Antimicrobials	
1	Avoparcin	18	Ronidazole
2	Kanamycin	19	Thiopeptin
3	Kitasamycin	20	Destomycin A
4	Lasalocid	21	Hygromycin B
5	Salinomycin	22	Morantel citrate
6	Spiramycin	23	Nystatin
7	Streptomycin	24	Lincomycin
8	Sulfathiazole	25	Spectionmycin
9	Arprinocid	26	Virginiamycin
10	Buquinolate	27	Penicillin
11	Halofuginone	28	Bacitracin
12	Levamisole hydrochloride	29	Chlortetracycline
13	Robenidine	30	Colistin
14	Thyroprotein	31	Neomycin
15	Halquinol	32	Oxytetracycline
16	Nitrovin	33	Olaquinox
17	Roxarsone	34	Dimetridazole

Resistance in *E. coli* from Pigs and Chickens in Taiwan, 2012-2016

• Pigs

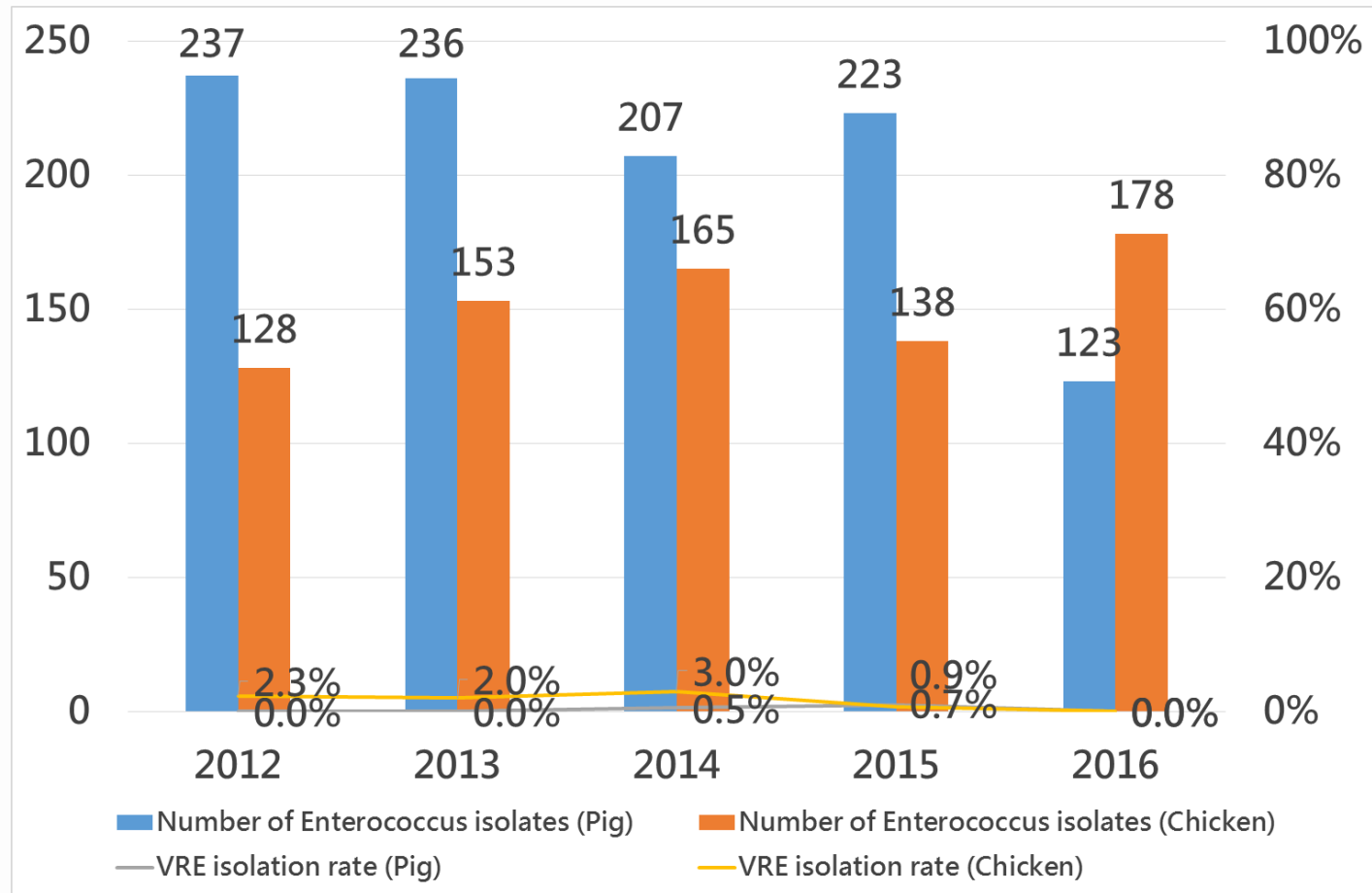


• Chickens



Isolation Rates of VRE among *Enterococcus* from Pigs and Chicken in Taiwan, 2012-2016

- VRE



FDA's Strategies to Combat AMR

- Establish the maximum antimicrobial residue limit for animal products
- Survey and inspect antimicrobial residue in animal products
- Strengthen the detection of illegal sales of antimicrobials
- Promote drug safety education for the general public

NHI's Strategies to Combat AMR

Establish the reimbursement regulations and restrictions for antimicrobials

Review and audit claims for reimbursement of antimicrobials

Survey and monitor indicators for antimicrobial use

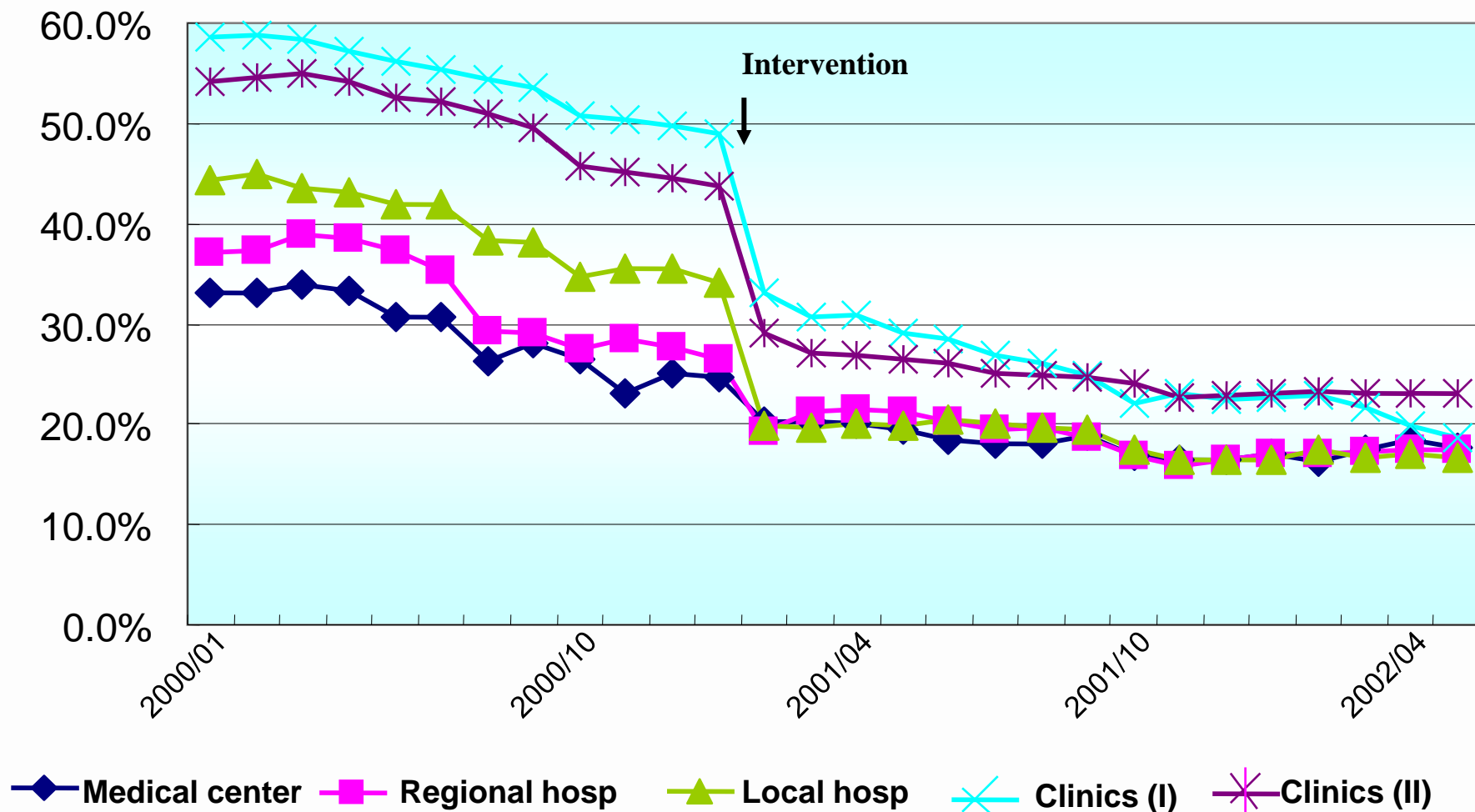
Establish incentives for hospitals with good ASP performance

Regulation of Antibiotic Usage for Patients with URI in NHI

- For patients with upper respiratory tract infections, antibiotics should not be used in patients with common cold or other viral respiratory tract infections. Antibiotics can be used only when there is evidence of bacteria infection, such as evidence of bacterial pharyngitis, bacterial bronchitis, bacterial sinusitis or bacterial otitis media.

(Effective since 2001-02-01)

Proportion of Patient-visits Prescribed with Antibiotics in Patients with Diagnosis of URI

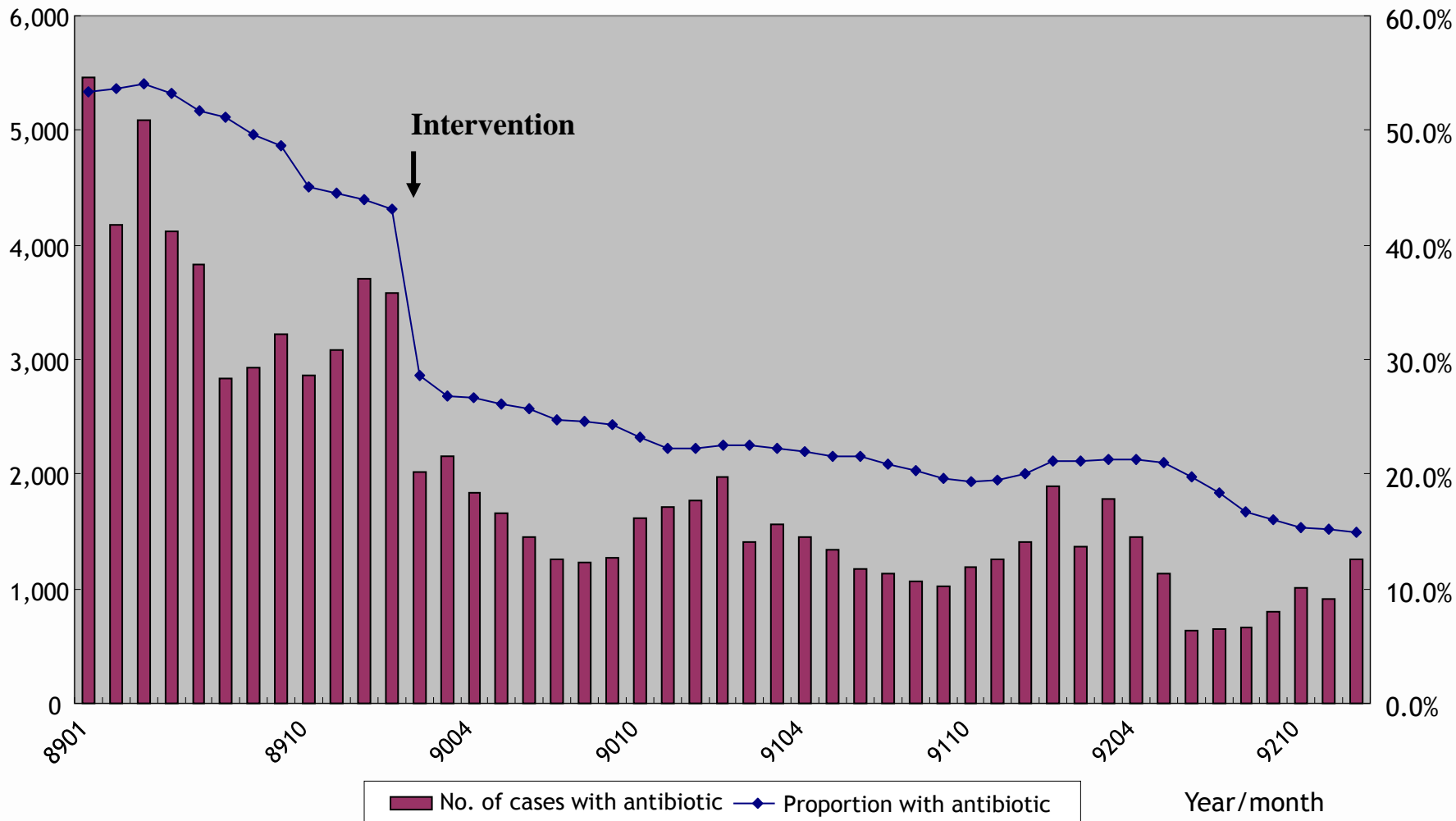


Proportion of URI Patients in OPD Prescribed with Antibiotics, Jan 2000 ~ Dec 2003

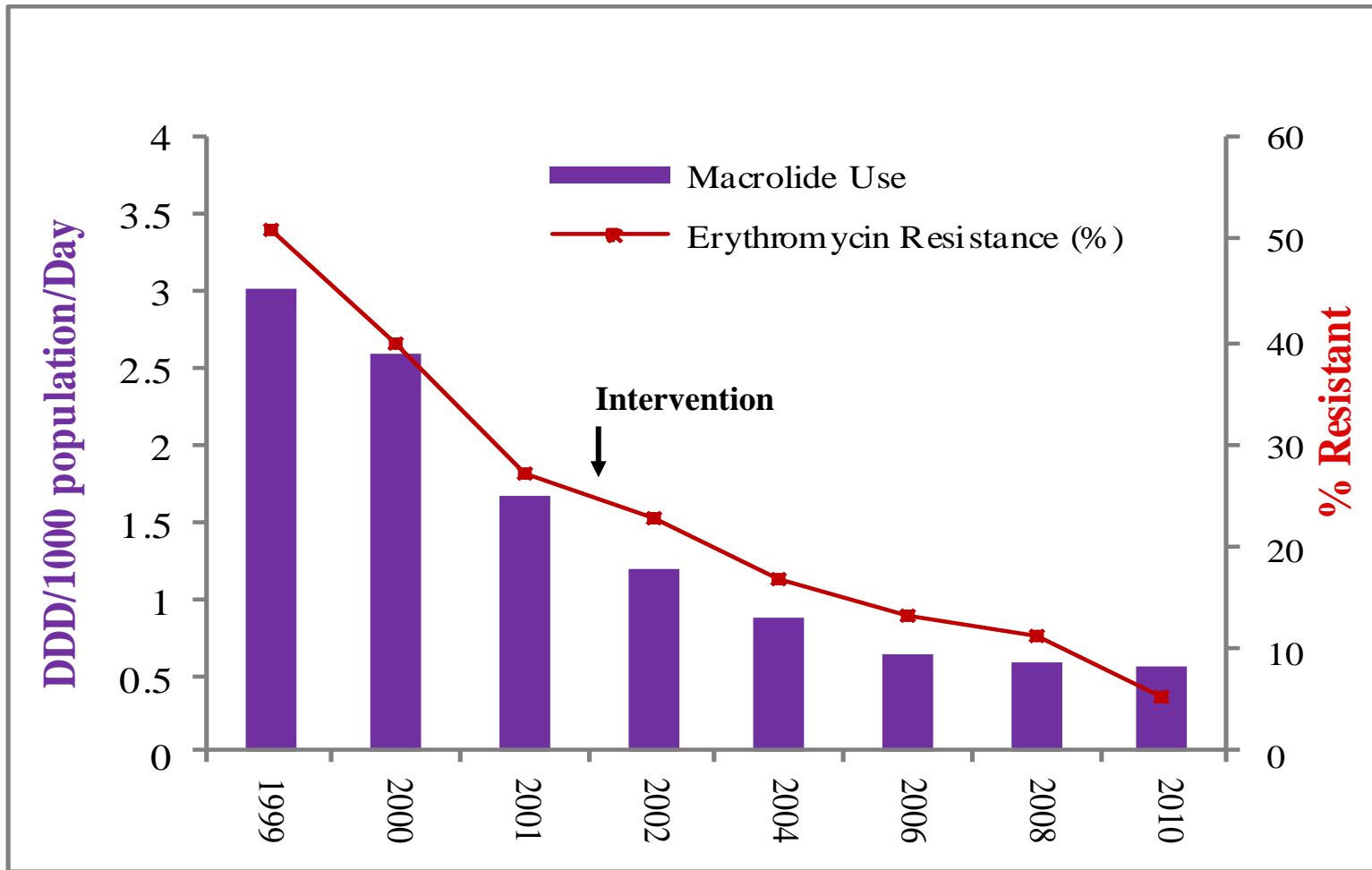
Monthly data of URI patients prescribed with antibiotics

No. of cases x1000

Proportion (%)



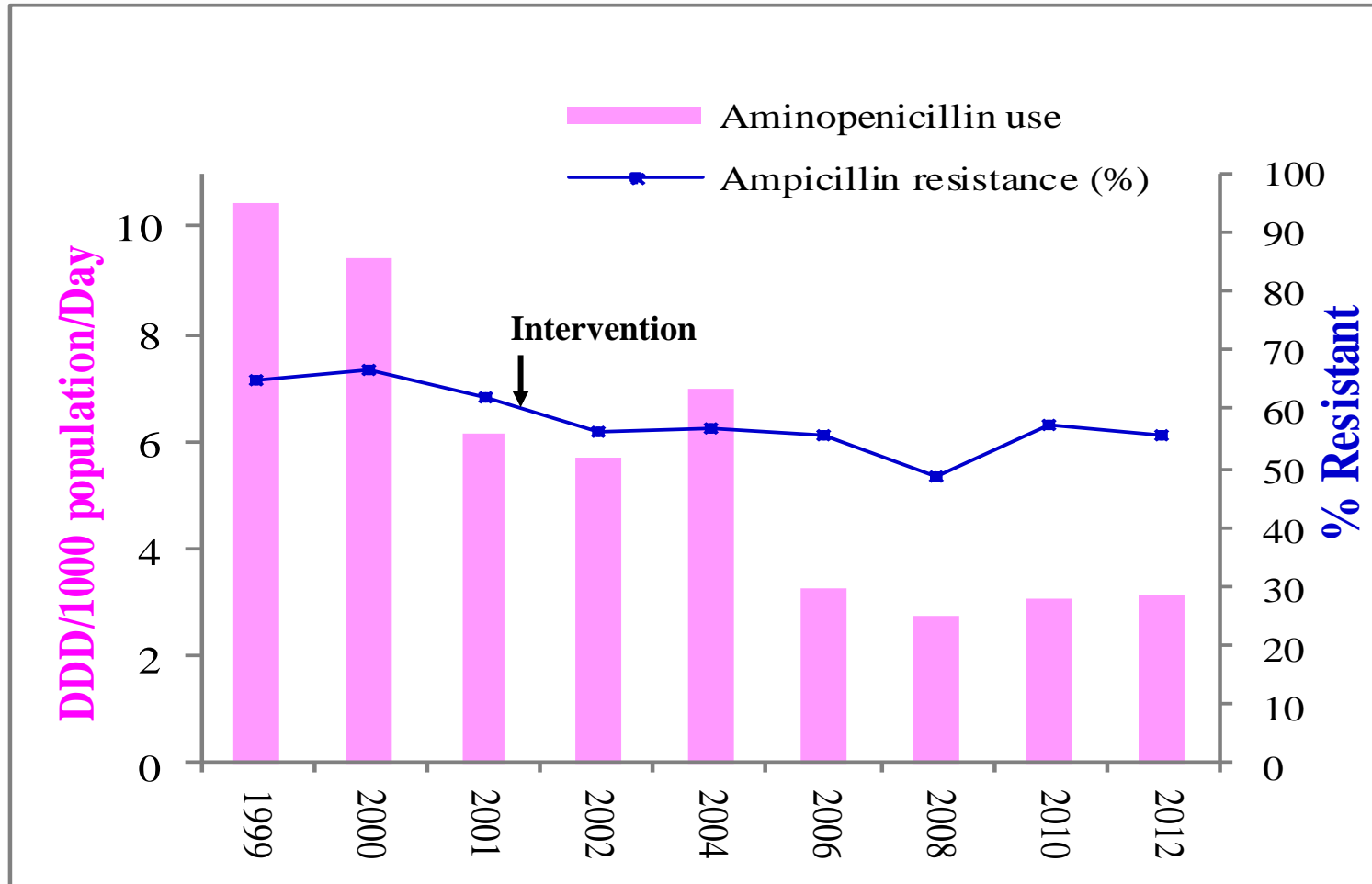
Erythromycin Resistance in Group A *Streptococcus*



Data source:

- Macrolide consumption: NHIRD sampling database (2006-2010 data provided by Institute of Population Health Sciences/NHRI)
- Erythromycin resistance: 1999-2002, TSAR hospitals annual summary; 2004-2010, TSAR

Ampicillin Resistance in *Haemophilus influenzae*



Data source:

- Aminopenicillin consumption: NHIRD sampling database (2004-2012 data provided by Institute of Population Health Sciences/NHRI)
- Ampicillin resistance: 1999-2002, TSAR hospitals annual summary; 2004-2010, TSAR

CDC's Framework to Combat AMR

National Level (CDC)

- Formulate AMR policies and strategies
- Establish a national advisory committee
- Promote cross-sectoral cooperation
- Designate qualified and dedicated staffs
- Provide appropriate funds

Local Level (Health Departments)

- Promote AMR related programs and policies
- Evaluate ASP performance of healthcare facilities within their respective jurisdiction

Community Level

- Professional associations and societies: Join task force in promoting AMR strategies
- Healthcare facilities: Comply with related laws and AMR prevention and control regulations
- General public: Raise awareness through education

CDC's Strategies to Combat AMR



Establish multi-channel surveillance mechanisms on drug-resistant organisms



Ensure the appropriate use of antibiotics through AMR-related hospital audits and national ASP

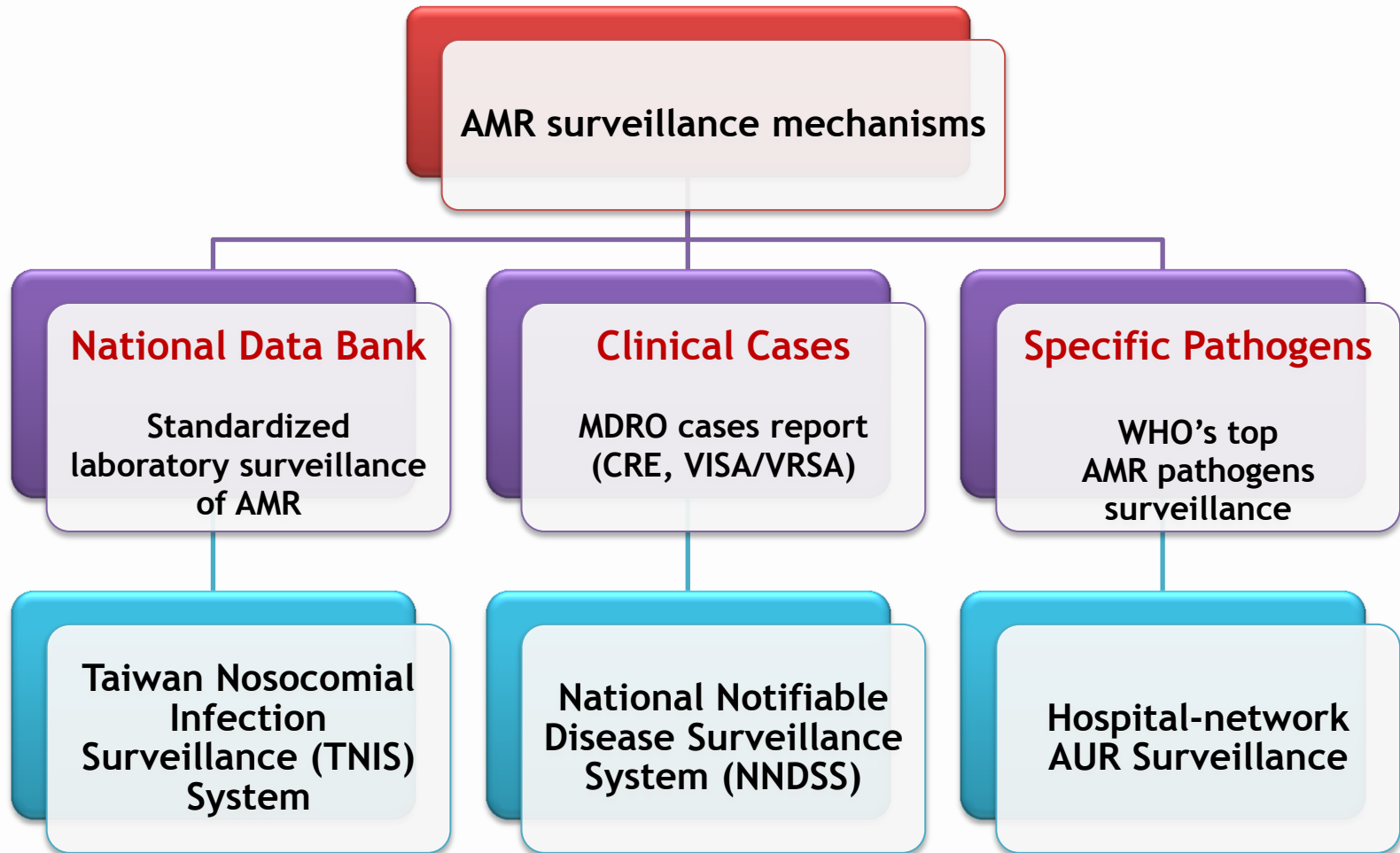


Improve awareness and knowledge of AMR through effective communication, education and training



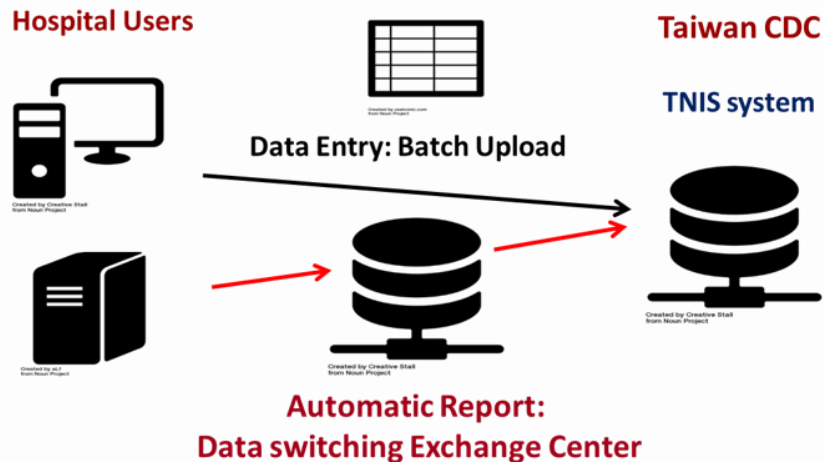
Promote cross-sectoral cooperation on containing AMR

Multi-channel Surveillance Mechanisms



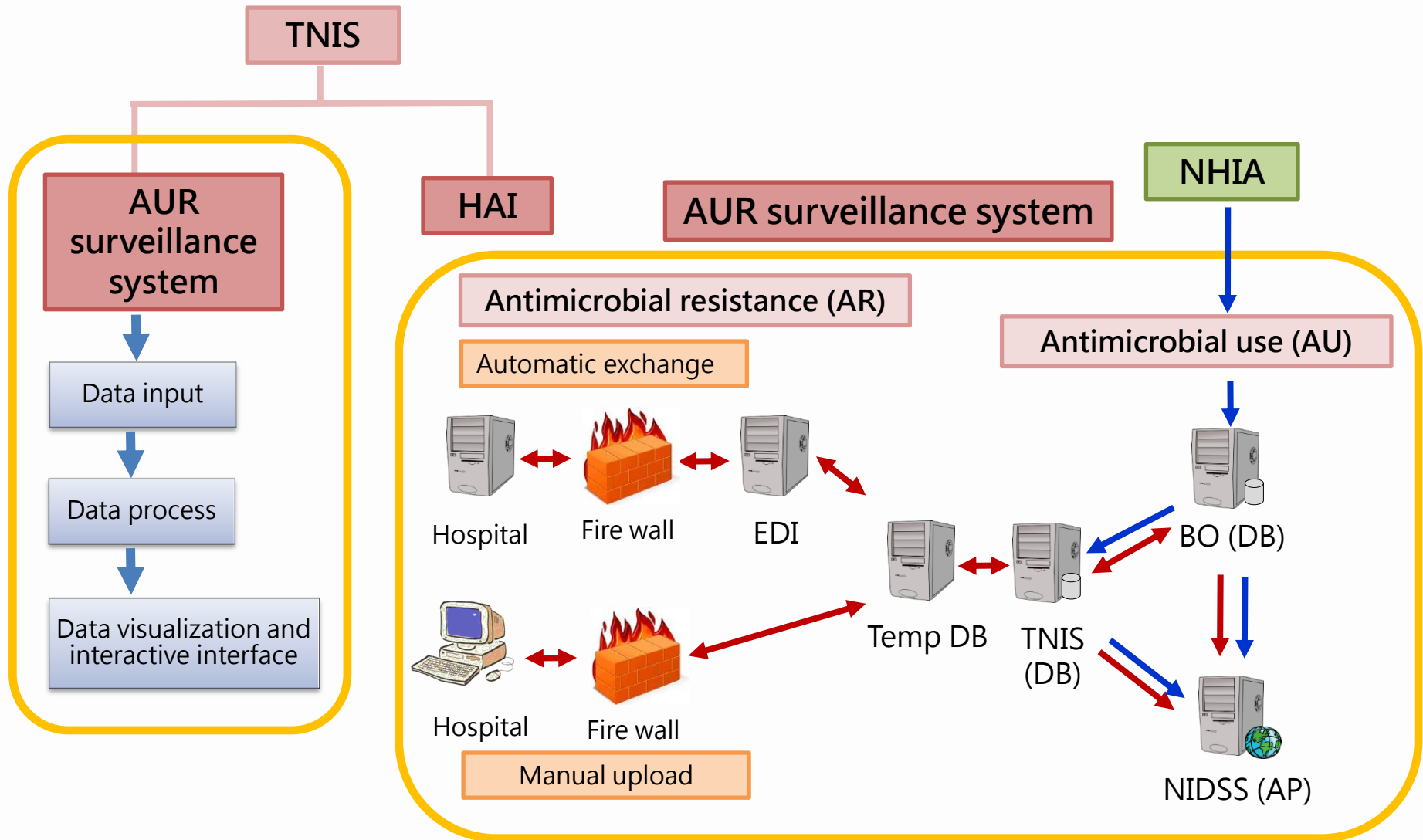
AMR Surveillance through TNIS

- Hospitals report individual lab test data of clinical isolates to Antimicrobial Usage and Resistance (AUR) Module within the TNIS system.

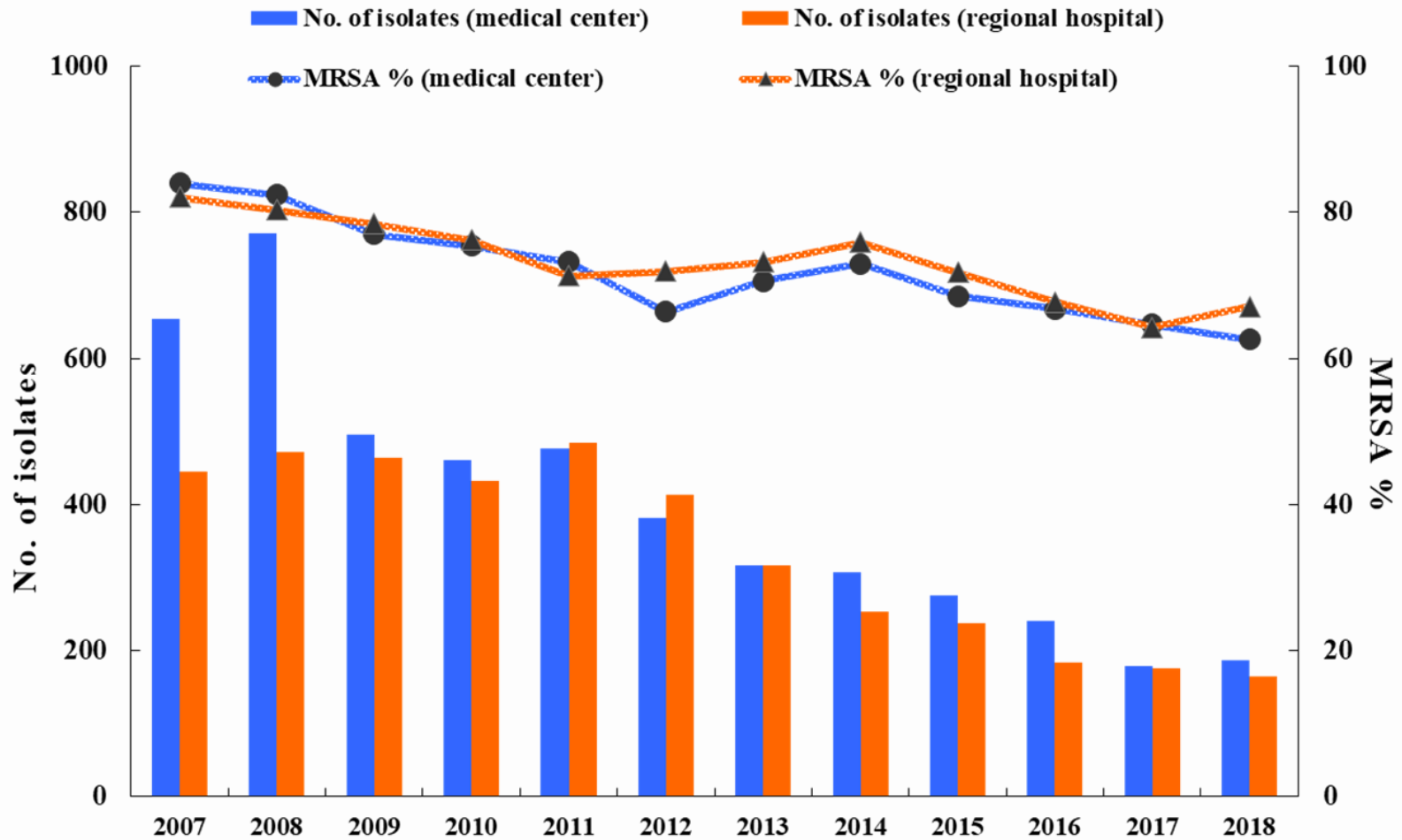


Surveillance pathogens	
<i>Escherichia</i> spp.	<i>Enterococcus</i> spp.
<i>Klebsiella</i> spp.	<i>Acinetobacter baumannii</i>
<i>Enterobacter</i> spp.	<i>Acinetobacter calcoaceticus</i>
<i>Proteus</i> spp.	<i>Acinetobacter calcoaceticus-Acinetobacter baumannii</i> complex
<i>Salmonella</i> spp.	<i>Pseudomonas aeruginosa</i>
<i>Shigella</i> spp.	<i>Staphylococcus aureus</i>
<i>Citrobacter</i> spp.	<i>Streptococcus pneumoniae</i>
<i>Morganella</i> spp.	<i>Neisseria gonorrhoeae</i>
<i>Providencia</i> spp.	<i>Clostridium difficile</i>
<i>Serratia</i> spp.	<i>Helicobacter pylori</i>
<i>Yersinia</i> spp.	

Antimicrobial Use and Resistance (AUR) Surveillance System in Taiwan



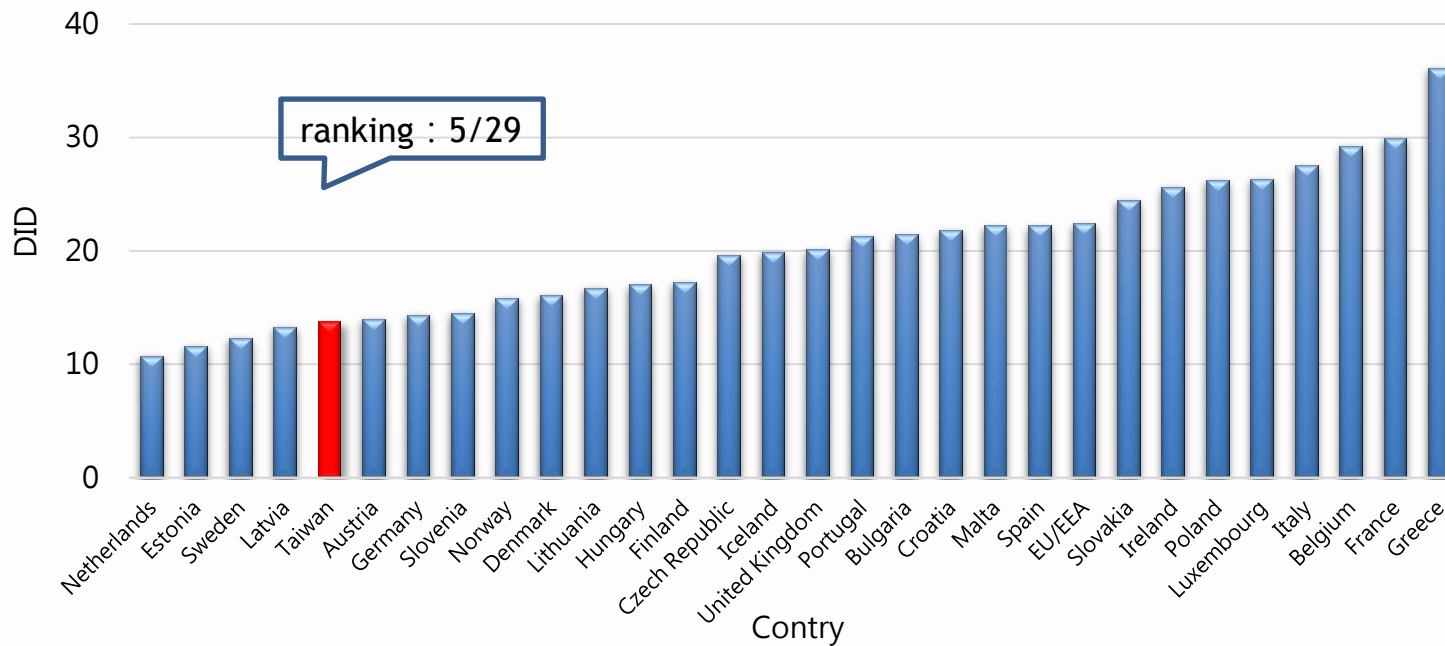
National AMR Reports



The percentage of MRSA in healthcare-associated *S. aureus* infections ICUs

International Comparison of Antimicrobial Consumption

Outpatient DDD per 1000 inhabitants and per day, 2015

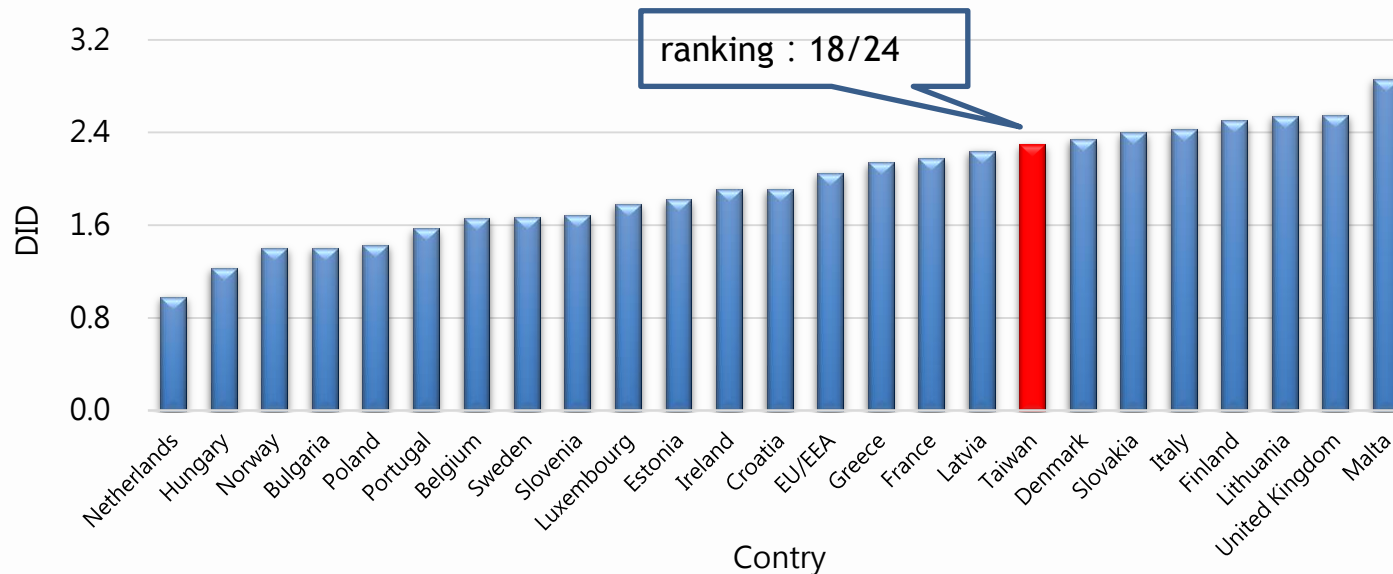


Country	2015-門診
Netherlands	10.7
Estonia	11.6
Sweden	12.3
Latvia	13.3
Taiwan	13.8
Austria	14
Germany	14.3
Slovenia	14.5
Norway	15.8
Denmark	16.1
Lithuania	16.7
Hungary	17
Finland	17.2
Czech Republic	19.6
Iceland	19.9
United Kingdom	20.1
Portugal	21.3
Bulgaria	21.4
Croatia	21.8
Malta	22.2
Spain	22.2
EU/EEA	22.4
Slovakia	24.5
Ireland	25.6
Poland	26.2
Luxembourg	26.3
Italy	27.5
Belgium	29.2
France	29.9
Greece	36.1

Source: European Centre for Disease Prevention and Control. Antimicrobial consumption 2015. In: ECDC. Annual epidemiological report for 2015

International Comparison of Antimicrobial Consumption

Inpatient DDD per 1000 inhabitants and per day, 2015

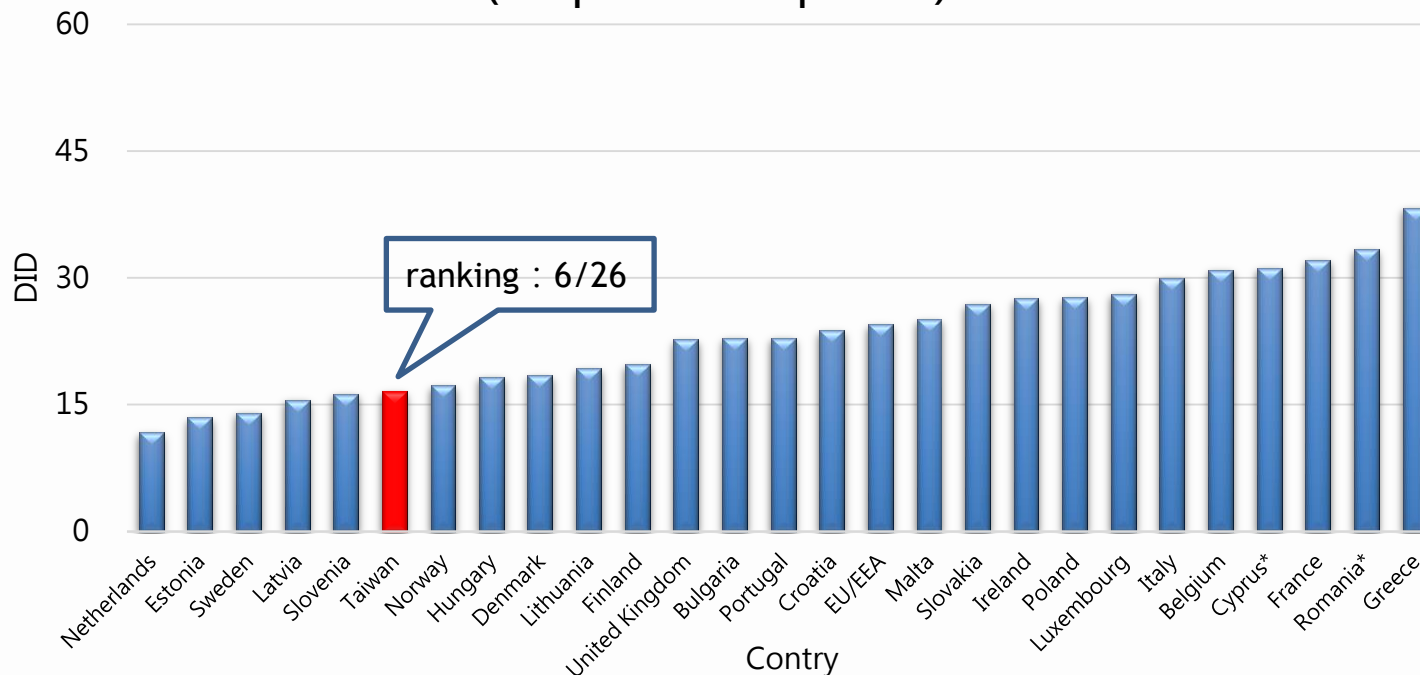


Country	2015-住院
Netherlands	0.98
Hungary	1.23
Norway	1.40
Bulgaria	1.40
Poland	1.43
Portugal	1.57
Belgium	1.66
Sweden	1.67
Slovenia	1.68
Luxembourg	1.78
Estonia	1.82
Ireland	1.91
Croatia	1.91
EU/EEA	2.05
Greece	2.14
France	2.18
Latvia	2.24
Taiwan	2.29
Denmark	2.34
Slovakia	2.40
Italy	2.43
Finland	2.50
Lithuania	2.54
United Kingdom	2.55
Malta	2.86

Source: European Centre for Disease Prevention and Control. Antimicrobial consumption 2015. In: ECDC. Annual epidemiological report for 2015

International Comparison of Antimicrobial Consumption

Nationwide DDD per 1000 inhabitants and per day, 2015
(Outpatient + Inpatient)



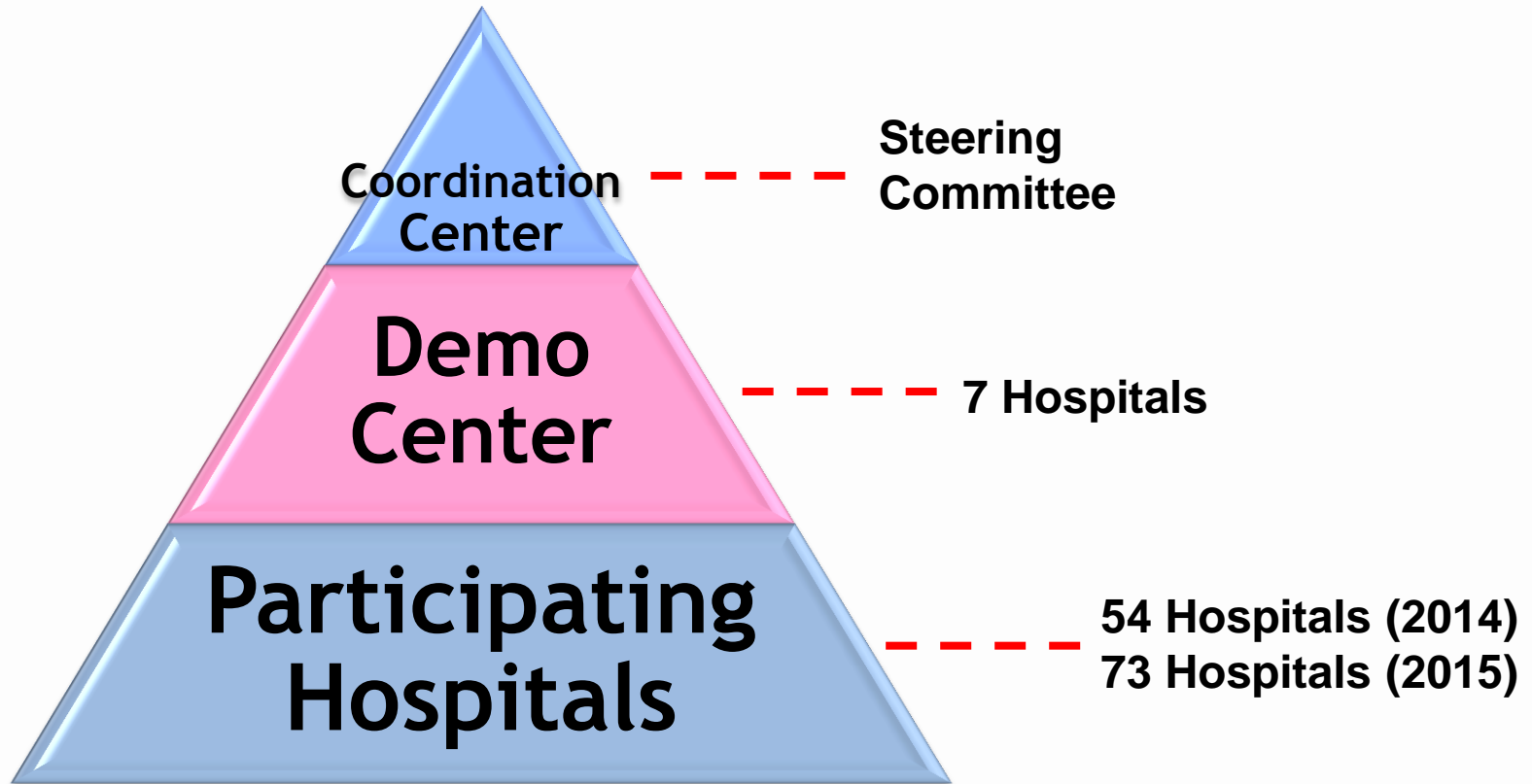
Country	2015-全國
Netherlands	11.7
Estonia	13.4
Sweden	14.0
Latvia	15.5
Slovenia	16.2
Taiwan	16.5
Norway	17.2
Hungary	18.2
Denmark	18.4
Lithuania	19.2
Finland	19.7
United Kingdom	22.7
Bulgaria	22.8
Portugal	22.9
Croatia	23.7
EU/EEA	24.5
Malta	25.1
Slovakia	26.9
Ireland	27.5
Poland	27.6
Luxembourg	28.1
Italy	29.9
Belgium	30.9
Cyprus*	31.1
France	32.1
Romania*	33.3
Greece	38.2

Source: European Centre for Disease Prevention and Control. Antimicrobial consumption 2015. In: ECDC. Annual epidemiological report for 2015

Special Project Supported by Taiwan CDC for ASP in Hospitals

- Initiated in 2013
- Set up a coordination center
- Set up a steering committee with members including ID specialists, pharmacists, microbiologists, infection control professionals, hospital administrators, leaders from different specialty societies
- Set up components of ASP which can be applied in Taiwan hospitals
- Recruit hospitals as Demonstration Centers

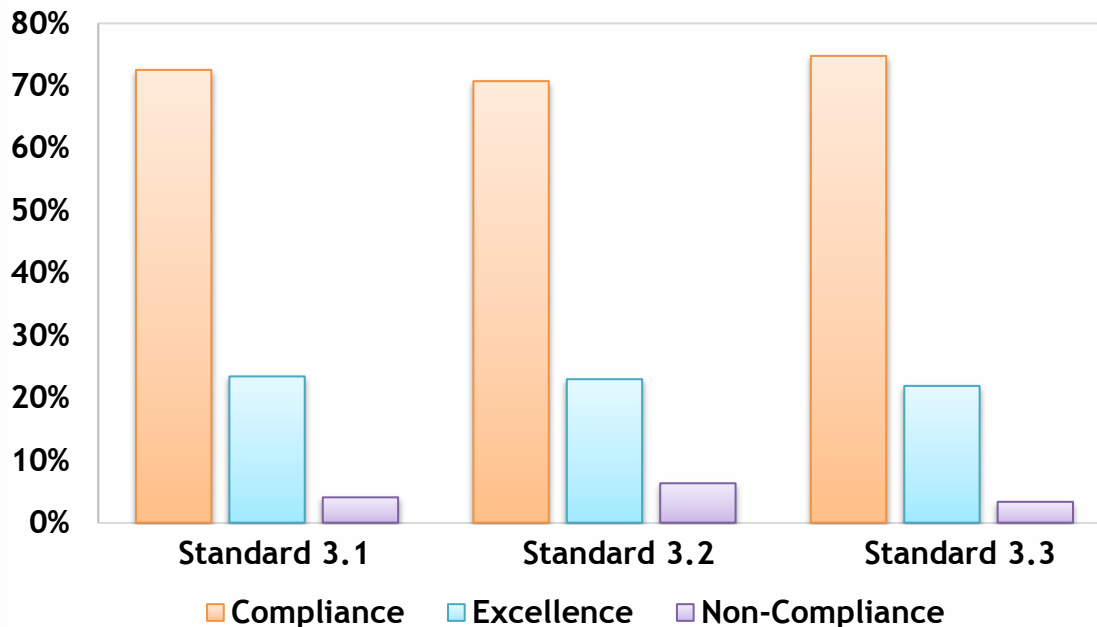
Structure for ASP in Taiwan



AMR-related Hospital Audits

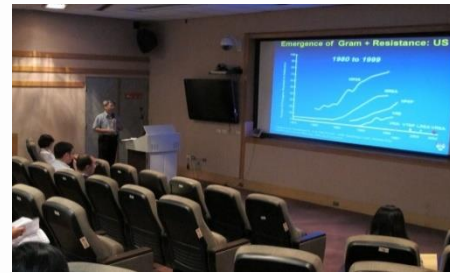
Assessment Standards

- 3.1 Leadership and responsibilities in Antimicrobial Stewardship program
- 3.2 Mechanism for surveillance and management of antibiotic use
- 3.3 Measures for surveillance, diagnosis, and isolation of resistant microbes



A total of 224 hospitals were evaluated in 2017.


Education for Healthcare Workers



Posters for Hospital Use (Goals and Strategies of ASP)

抗生素管理計畫

5大目標、4大策略



Antibiotic Stewardship Program 抗生素管理計畫
ASP

有關抗生素管理計畫「五大目標」如下：

5 目標


- 1 確保病人安全與提升醫療品質
- 2 確保抗生素合理的使用
- 3 減少細菌抗藥性發生及散播
- 4 珍惜現有抗生素資源
- 5 降低醫療照護相關感染

4 策略

- 1 監測抗藥性及抗微生物製劑使用
 - 抗藥性監測
 - 抗微生物製劑使用情形監測
- 2 抗微生物製劑合理使用
 - 正確診斷 (Diagnosis) ■ 正確用藥 (Drug)
 - 正確劑量 (Dosage) ■ 適時降階 (De-escalation)
 - 正確期程 (Duration)
- 3 感染管制 推行組合式照護 (care bundle)、落實洗手、隔離及消毒措施、避免傳播、落實有效的無菌技術。
- 4 文化建立 建立謹慎合理抗生素使用文化

衛生福利部疾病管制署 財團法人醫院評鑑暨醫療品質策進會

5D in 抗藥菌 out



Antibiotic Stewardship Program 抗生素管理計畫
ASP

- 1 **Diagnosis**
正確採樣
快速檢驗得診斷
- 2 **Drug**
藥品品項絕對對
- 3 **Dosage**
正確劑量剛剛好
- 4 **Duration**
開方設限不可少
- 5 **De-escalation**
降階治療一定要

衛生福利部疾病管制署 財團法人醫院評鑑暨醫療品質策進會

e-Learning Materials for Healthcare Workers

1. 常見出疹性發燒之鑑別診斷、治療與醫院感染管制措施

2. 百日咳鑑別診斷、預防、治療與醫院感染管制

3. 醫院管理與領導者推動抗生素管理經驗分享

4. 建置抗生素管理資訊系統經驗分享

5. 國家型抗生素管理計畫

6. WHONET教育訓練

7. 抗生素使用與抗藥性細菌

8. 抗
11. 多重抗藥性細菌 (CRISDR) 病人感染管理

9. 抗

10. 抗
12. 醫療照護相關感染微生物

13. 退伍軍人症之鑑別診斷

14. 發燒簡介

15. 艱難梭狀桿菌感染症

16. 護理師在抗生素管理

17. 護理師在抗生素管理中所扮演的角色

18. 藥師在抗生素管理中所扮演的角色

19. 藥師於抗生素管理之職責

20. 感受性測試的原則與方法：紙錠法、最低抑菌濃度法

21. 臨床微生物培養流程改善經驗分享：血液

22. 採檢注意事項(送驗原則、檢體選擇、收

23. 抗生素簡介(上)

24. 抗生素簡介(下)

25. 抗生素管理計畫內部稽核與注意事項

26. 肺部感染的治療(上)

27. 肺部感染的治療(下)

28. 醫療機構執行供水系統退伍軍人菌消毒之相

29. 抗生素合理使用與病人安全

30. H7N9流感診斷、治療與醫院感染管制

31. MRSA的診斷、治療與醫院感染管制

32. CRE診斷、治療與醫院感染管制

33. 細菌藥物敏感性試驗規範---聚焦在主要抗藥性菌種

34. 麻疹之群突發調查和感染管制措施

35. KPC的診斷、治療與醫院感染管制

36. NDM-1的診斷、治療與醫院感染管制

37. VRE的診斷、治療與醫院感染管制

38. 多重抗藥性細菌之抗藥機轉

39. 抗生素管理計畫之輔導規劃

40. 抗藥性鮑氏不動桿菌的疾病防治

41. 非典型感染介紹(鑑別診斷與處置)(上)-恙蟲病與斑疹傷寒

42. 非典型感染介紹(鑑別診斷與處置)(中)-Q熱與鉤端螺旋體病

43. 非典型感染介紹(鑑別診斷與處置)(下)-類鼻疽與漢他病毒

44. 清淨手術之抗生素的合理使用

45. 上呼吸道感染之鑑別診斷與處置

46. 腹腔內感染之鑑別診斷與處置

47. 泌尿道感染之鑑別診斷與處置



AMR Awareness and Education

For Healthcare Workers

Guidebooks on CDC website

The screenshot shows a webpage with a navigation menu at the top: 最新活動訊息 | 傳染病介紹 | 衛教與教材 | 通報與檢驗 | 國際旅遊與健康 | 預防接種 | 統計資料 | 防疫夥伴 | 出版品類 | 學術研究. Below the menu is a breadcrumb trail: 首頁 > 傳染病介紹 > 感染管制及生物安全 > 抗生素抗藥性管理 > 抗微生物製劑相關管制措施. A table lists various guidebooks:

傳染病介紹	抗微生物製劑相關管制措施
傳染病介紹	
第一類法定傳染病	CRE(Carbapenem-Resistant Enterobacteriaceae)防治指引 490 2017-12-29
第二類法定傳染病	Candida auris 感染管制建議 739 2017-11-02
第三類法定傳染病	社區型MRSA問與答
第四類法定傳染病	萬古黴素抗藥性腸球菌
第五類法定傳染病	抗生藥管理手冊
其他傳染病	CRAB(Carbapenem-Resistant Acinetobacter baumannii)
人畜共通傳染病	MRSA(Methicillin-Resistant Staphylococcus aureus)
感染管制及生物安全	預防和控制多重抗藥性
	抗微生物製劑使用指引
	清淨手術預防性抗生素

Below the table is the cover of the 'ASP Antibiotic Management Handbook' (ASP 抗生藥管理手冊). The cover features the ASP logo, the title 'National Action Plan Antimicrobial Stewardship Program', and the publisher '衛生福利部疾病管制署'.

E-learning courses on CDC website

Identification, treatment & infection control of common infections

Rational use of antibiotics

Healthcare workers' respective roles and responsibilities in ASP

Infection control of MDROs

Laboratory diagnosis of infections

Education for Patients and Community



AMR Awareness and Education

For General Public



Taiwan CDC has initiated “World Antibiotic Awareness Week” and encouraged general public to respond by signing the pledge online.

抗生素抗藥性誓言---我宣誓合理使用抗生素

濫用抗生素已導致具抗藥性的「超級細菌」產生，這將會使你或是你的家人，在下次需要使用抗生素可能已經失效。世界衛生組織已將抗生素抗藥性視為嚴重公共衛生的威脅，而你可以透過承諾「合理使用抗生素」來改變現狀！

我宣誓， * **I declare,**

- 1. 只服用醫生處方之抗生素，並按療程完成服藥。
Only use antibiotics when prescribed by a certified health professional and follow medical advice to complete the medication.
- 2. 養成良好手部衛生習慣以避免病菌傳播。

Prevent the spread of pathogens by regularly washing hands.

- 3. 鼓勵我的家人及朋友合理使用抗生素。

Encourage my family and friends to use antibiotics appropriately.

宣誓日期 * **Date**

MM DD YYYY

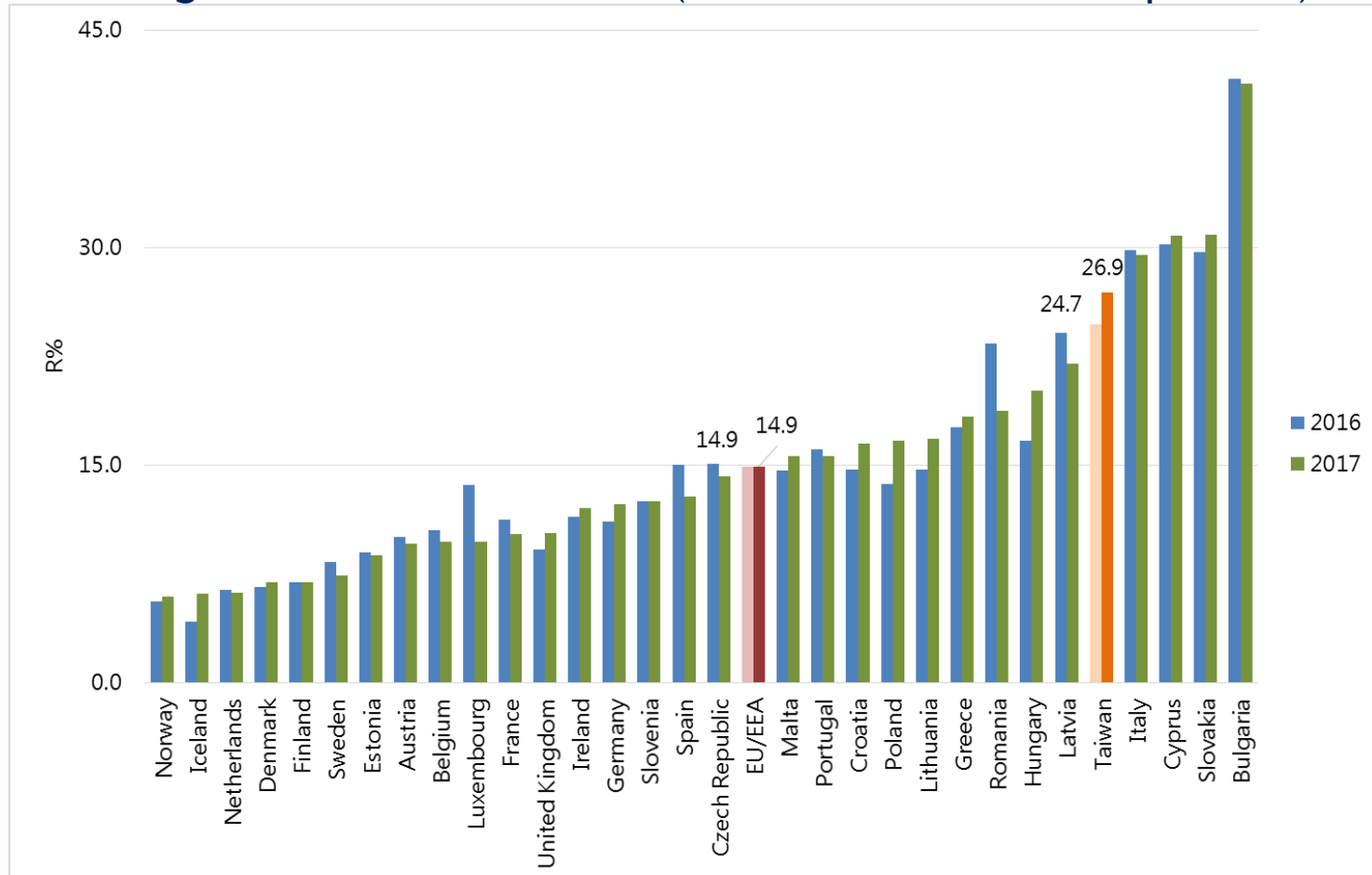
__ / __ / 2018 **Date**

姓名 * **Name**

您的回答

AMR International Comparison(1)

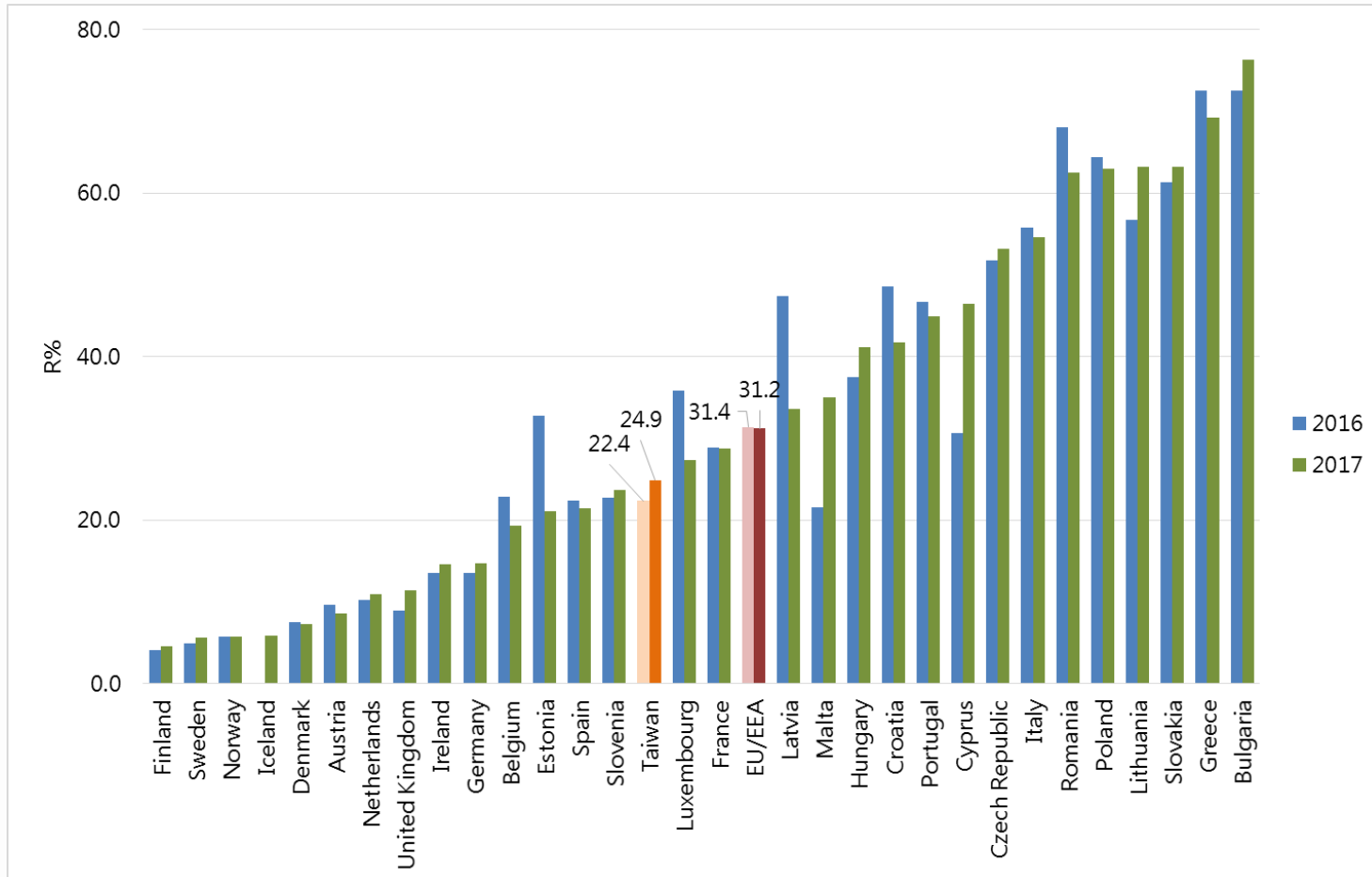
- Third generation cephalosporins-resistant *Escherichia coli* among blood and CSF isolates (clinical isolates / deduplicate)



Data source: Surveillance of antimicrobial resistance in Europe, 2017

AMR International Comparison(2)

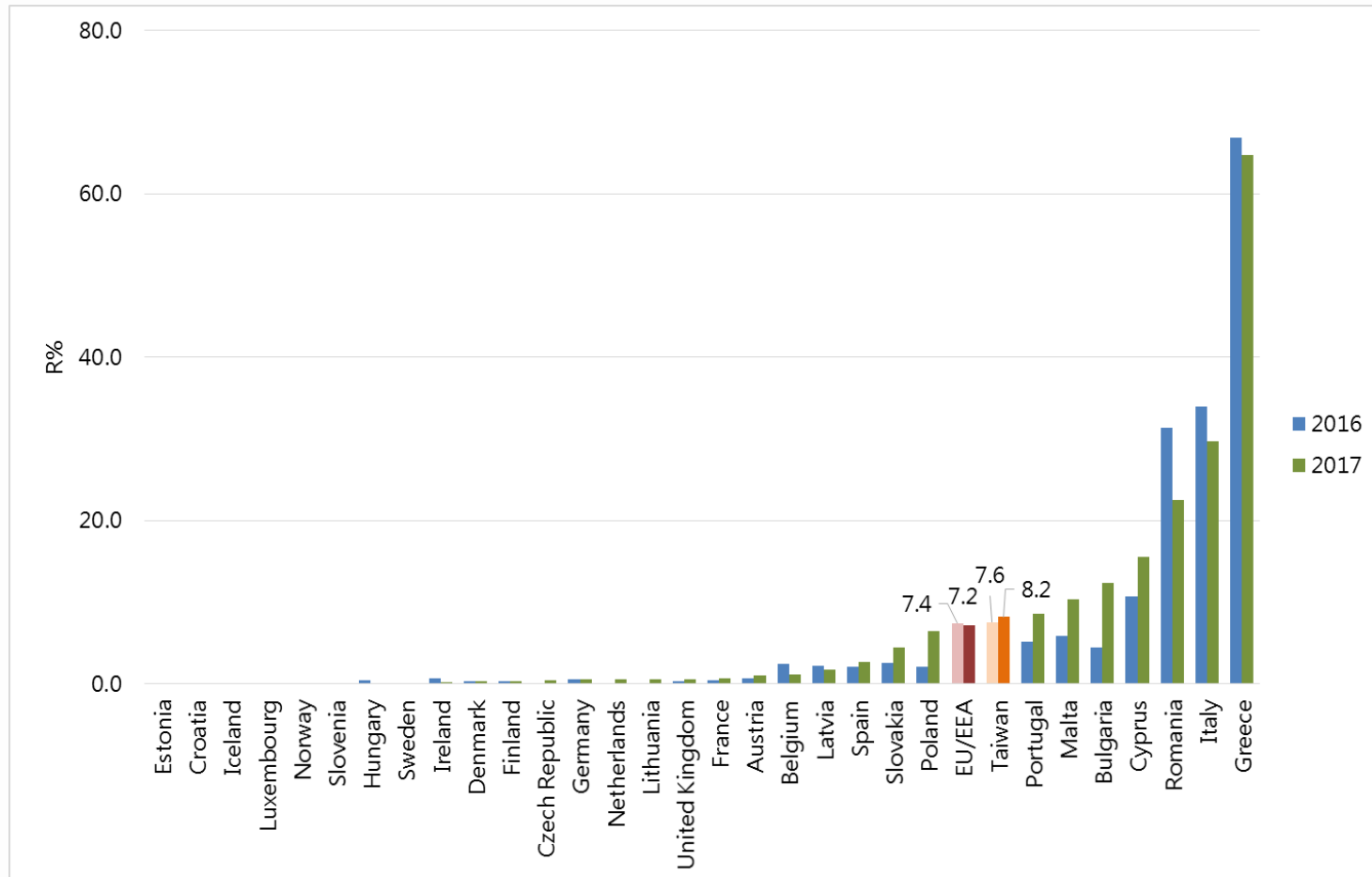
- Third generation cephalosporins-resistant *Klebsiella pneumoniae* among blood and CSF isolates (clinical isolates / deduplicate)



Data source: Surveillance of antimicrobial resistance in Europe, 2017

AMR International Comparison(3)

- Carbapenems-resistant *Klebsiella pneumoniae* among blood and CSF isolates (clinical isolates / deduplicate)



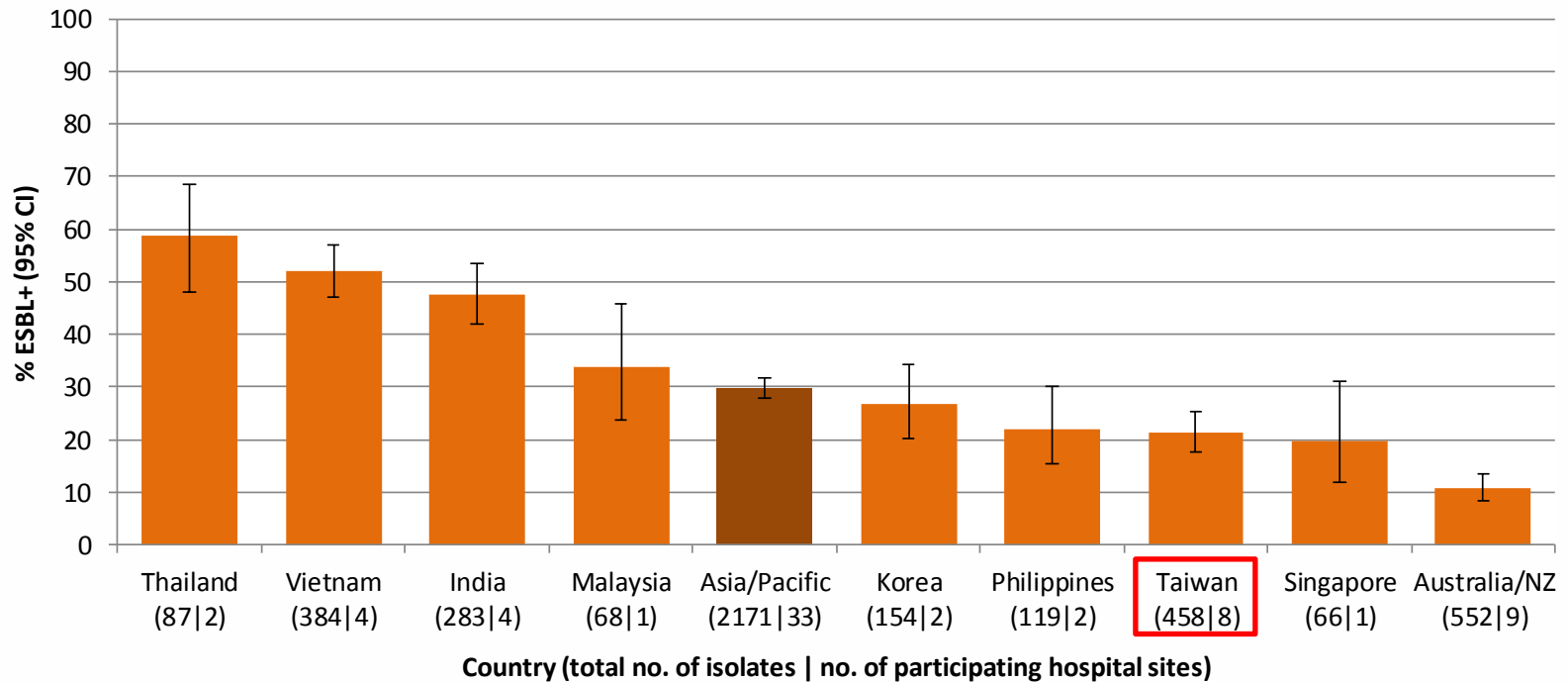
Data source: Surveillance of antimicrobial resistance in Europe, 2017

AMR International Comparison(4)

Rate of ESBL production amongst isolates of *E. coli* causing urinary tract infections (UTIs) and Intra-abdominal infection (IAI)

Year 2016

Asia/Pacific, 2016 (IAI+UTI)



**ESBL: Extended-spectrum β -lactamases

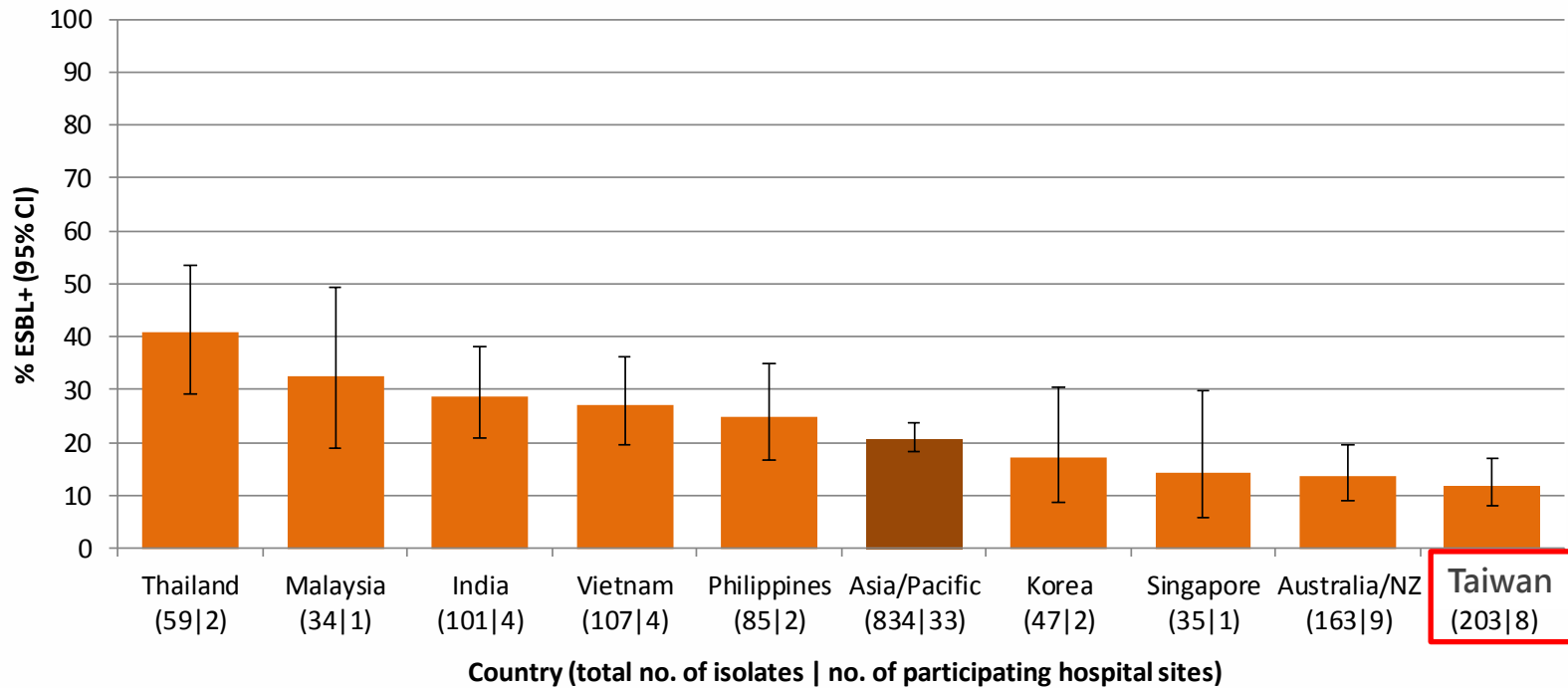
Data from Study for Monitoring Antimicrobial Resistance Trends (SMART)

AMR International Comparison(5)

Rate of ESBL production amongst isolates of *K. pneumoniae* causing urinary tract infections (UTIs) and Intra-abdominal infection (IAI)

Year 2016

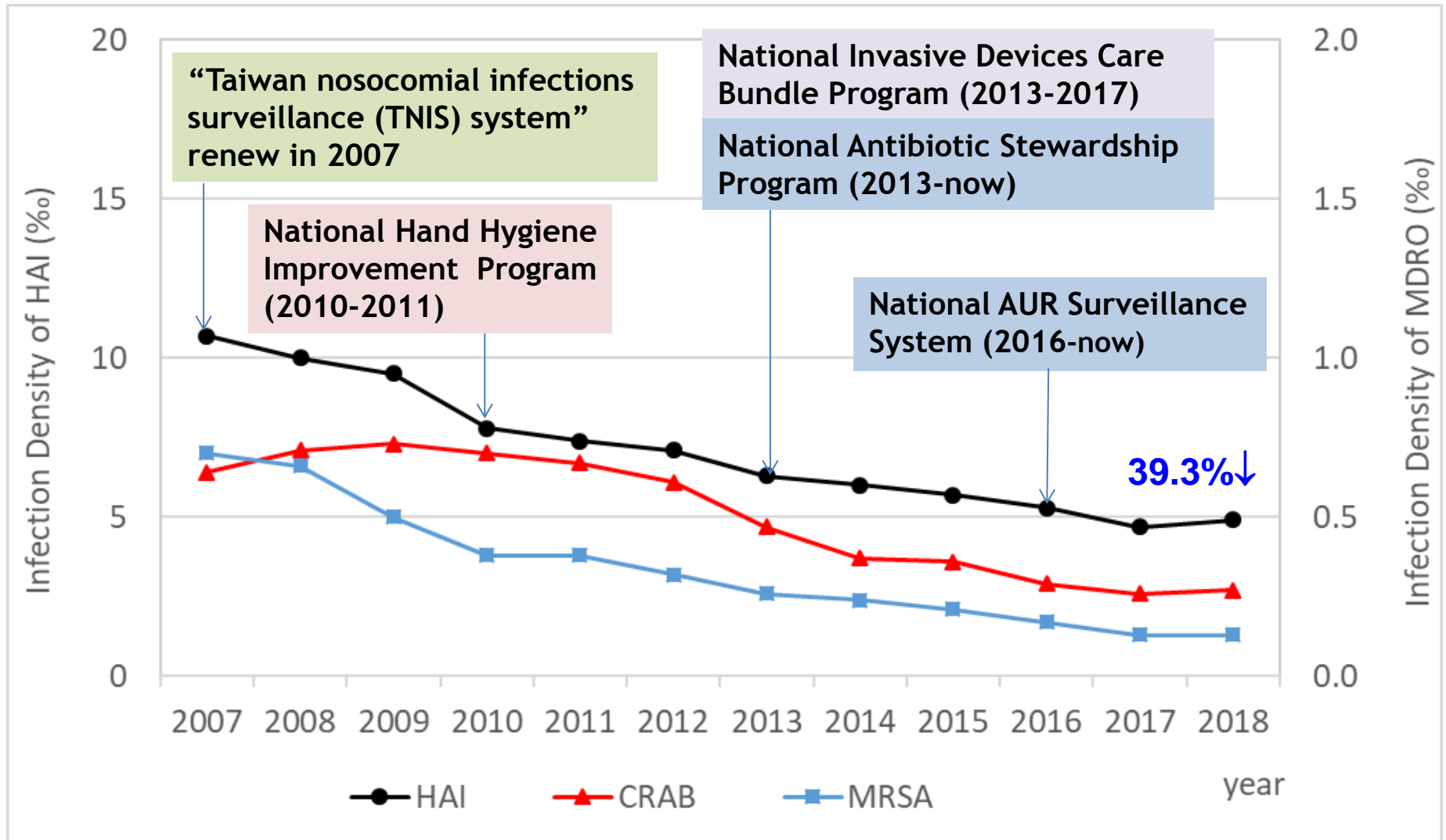
Asia/Pacific, 2016 (IAI+UTI)



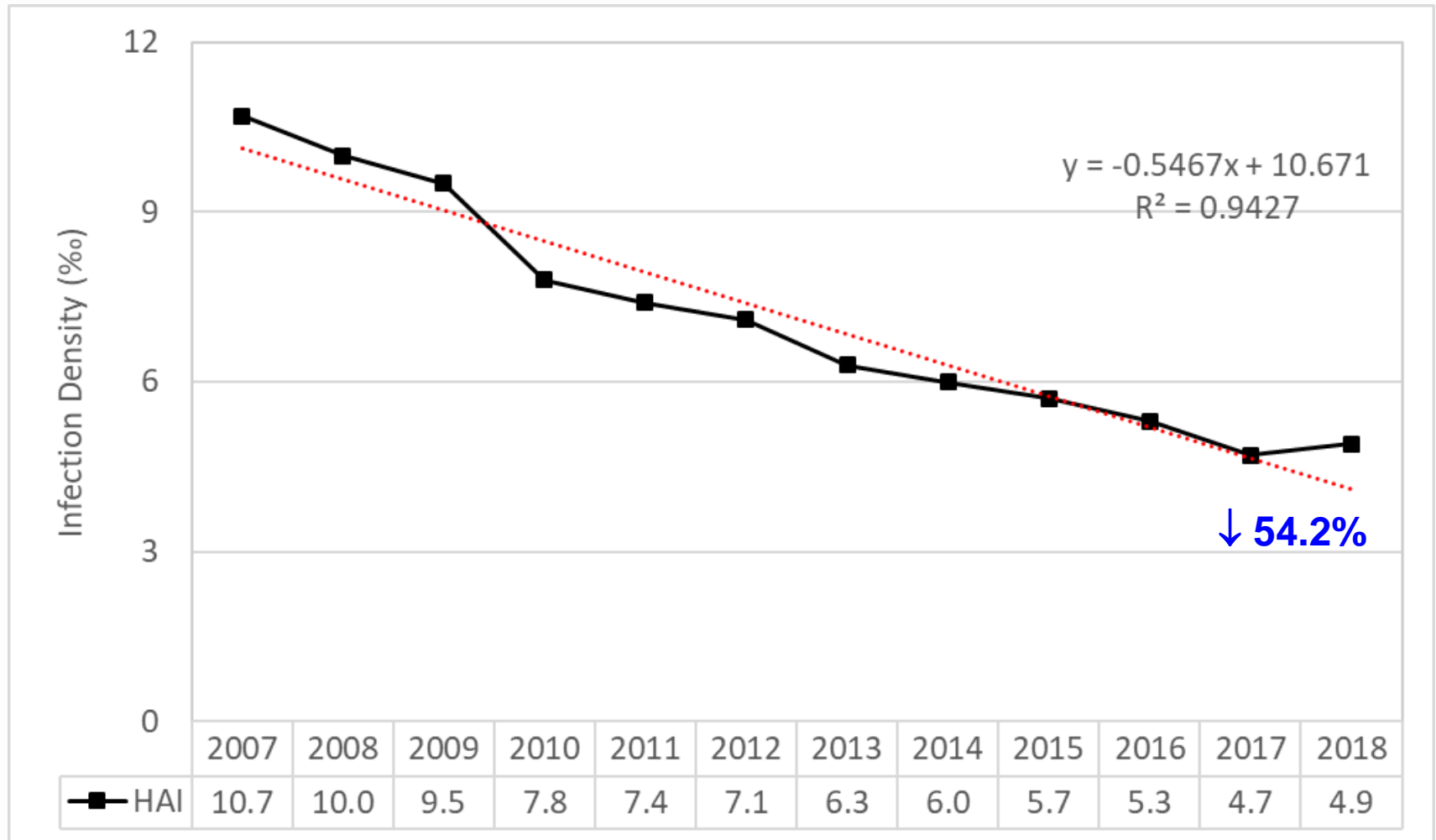
**ESBL: Extended-spectrum β -lactamases

Data from Study for Monitoring Antimicrobial Resistance Trends (SMART)

Outcome of Infection Prevention and Control (Healthcare-associated Infections)

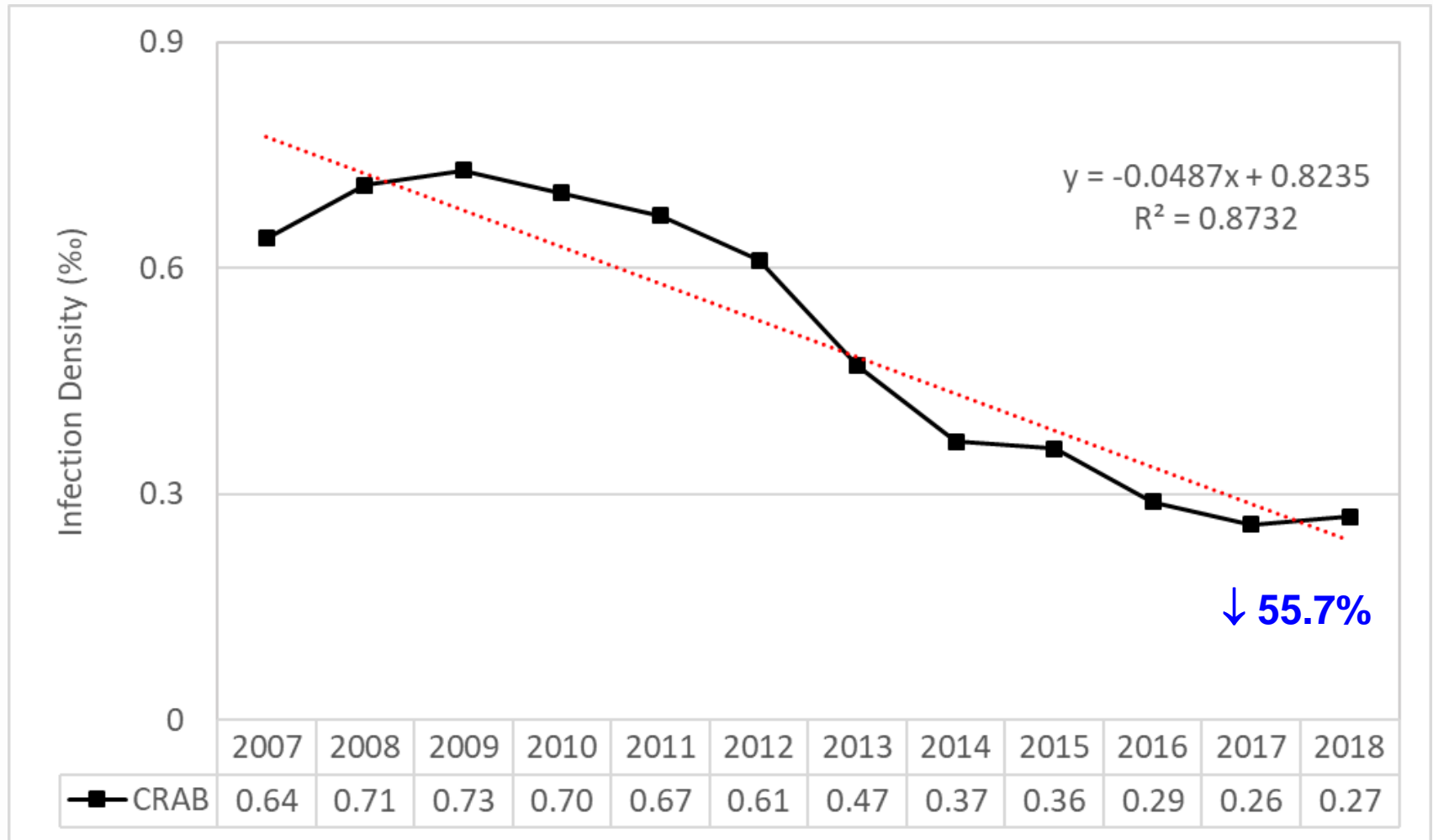


Infection Density of HAI in ICU (2007-2018)



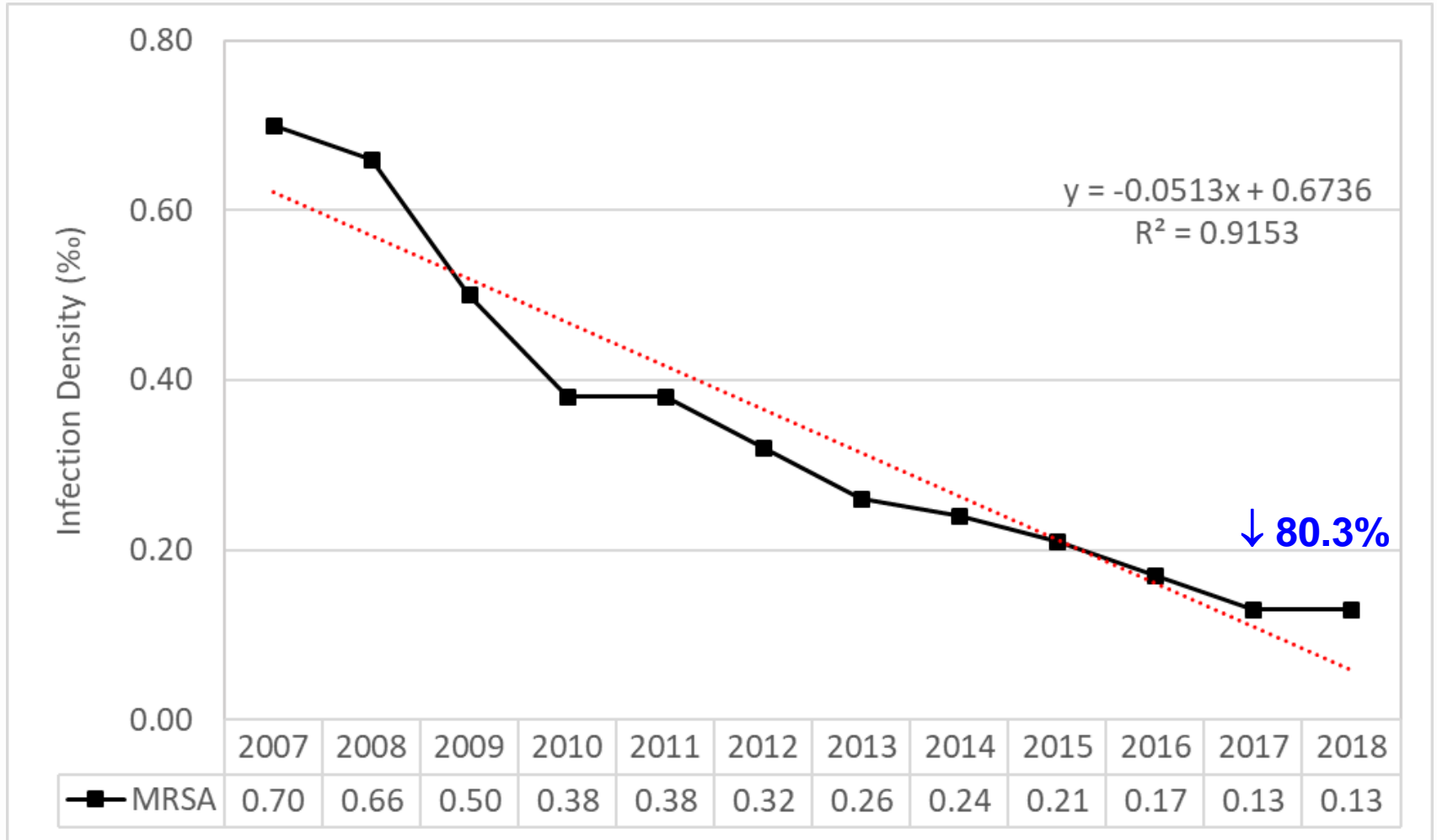
HAI: Healthcare-associated infection

Infection Density of HA-CRAB in ICU (2007-2018)



CRAB: Carbapenem-resistant *Acinetobacter baumannii*

Infection Density of HA-MRSA in ICU (2007-2018)

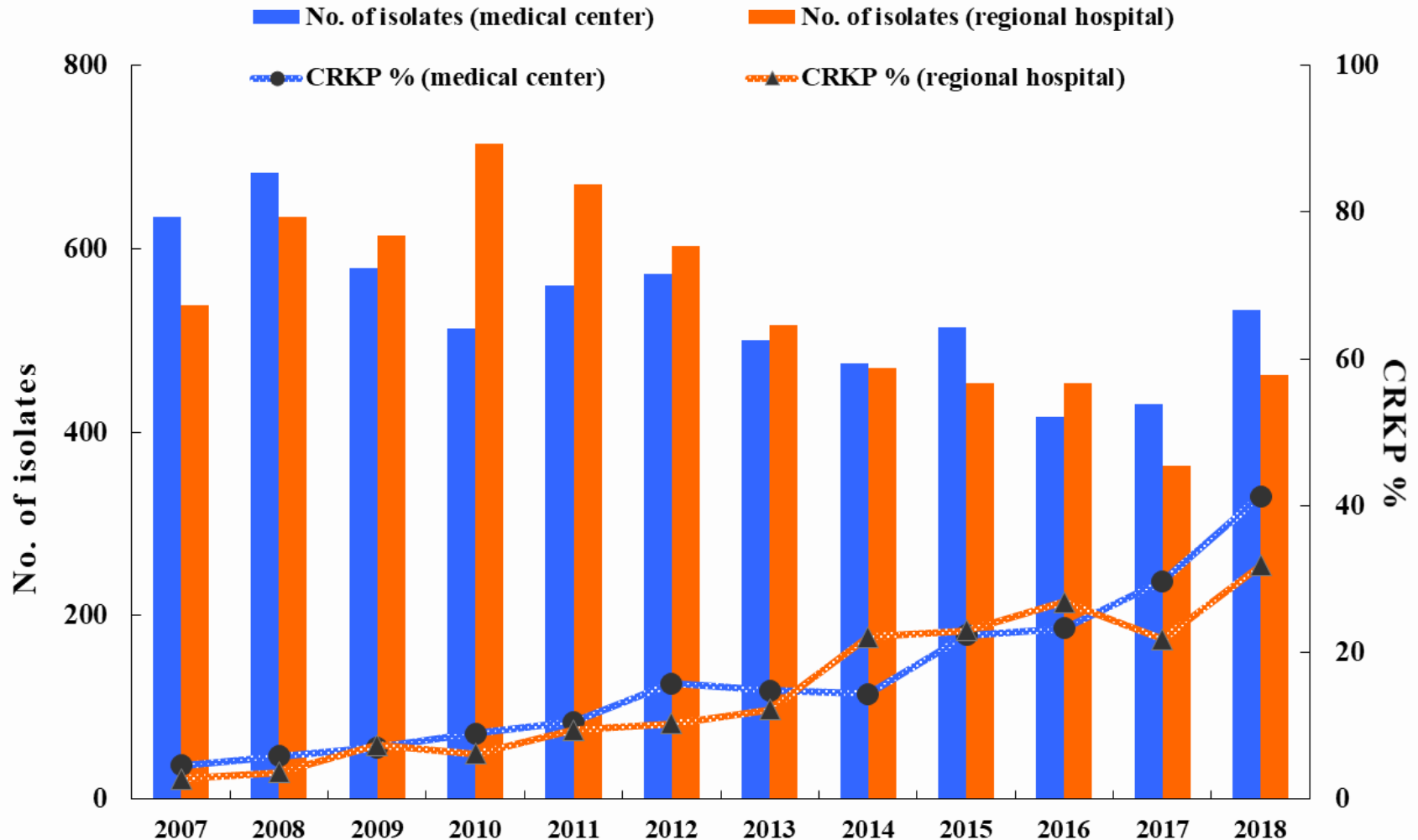


MRSA: Methicillin-resistant *Staphylococcus aureus*

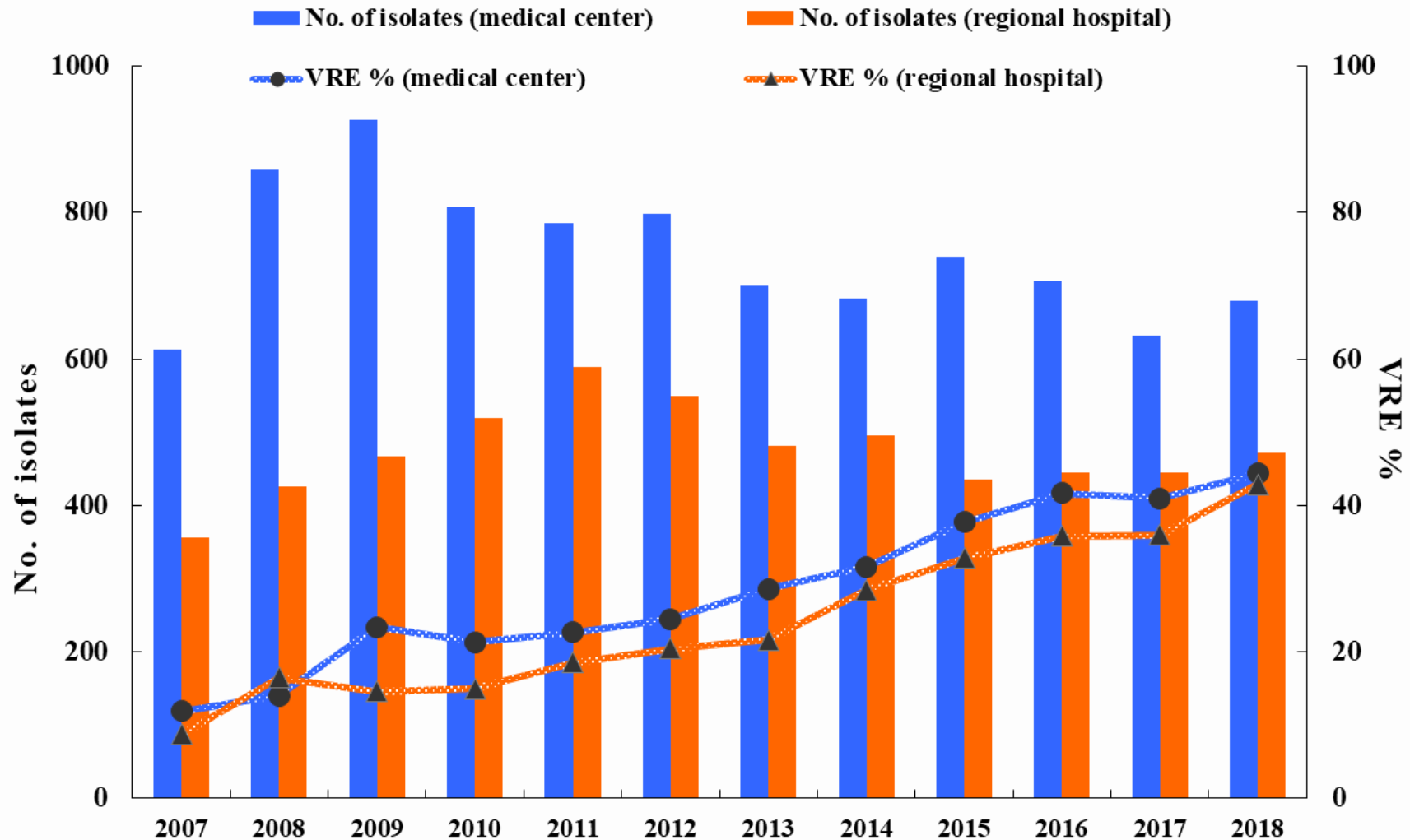
Research of AMR in Taiwan

- AMR surveillance
- Epidemiological study (molecular epi)
- Resistant mechanism
- Treatment of resistant bacteria infection
- Infection control of MDRO bacteria
- Relationship of AMR in human and animal

Carbapenem resistance of healthcare-associated *K. pneumoniae* infections in the ICUs of medical centers and regional hospitals, 2007~2018



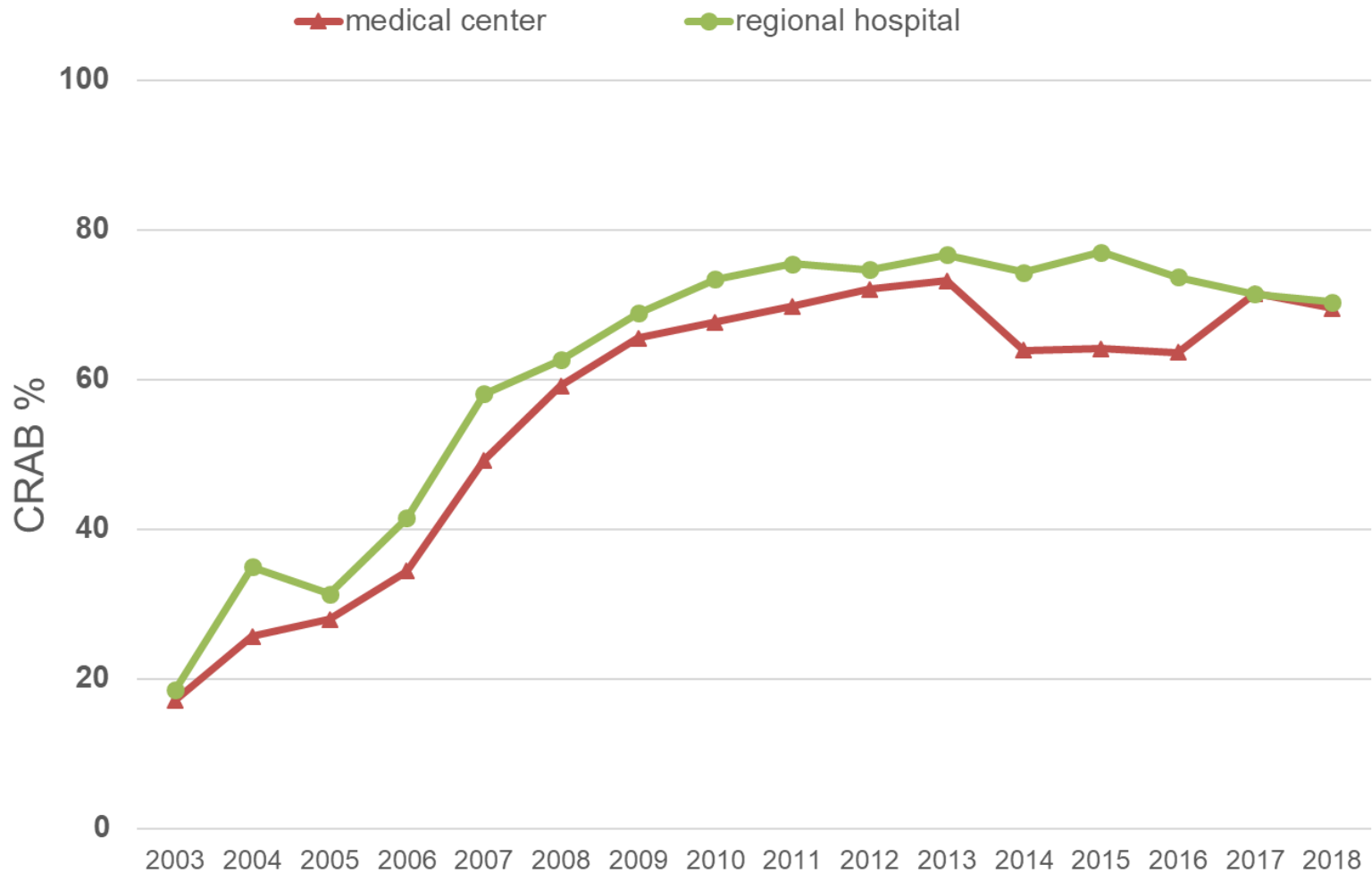
Vancomycin resistance of healthcare-associated *Enterococcus* infections in the ICUs of medical centers and regional hospitals, 2007~2018



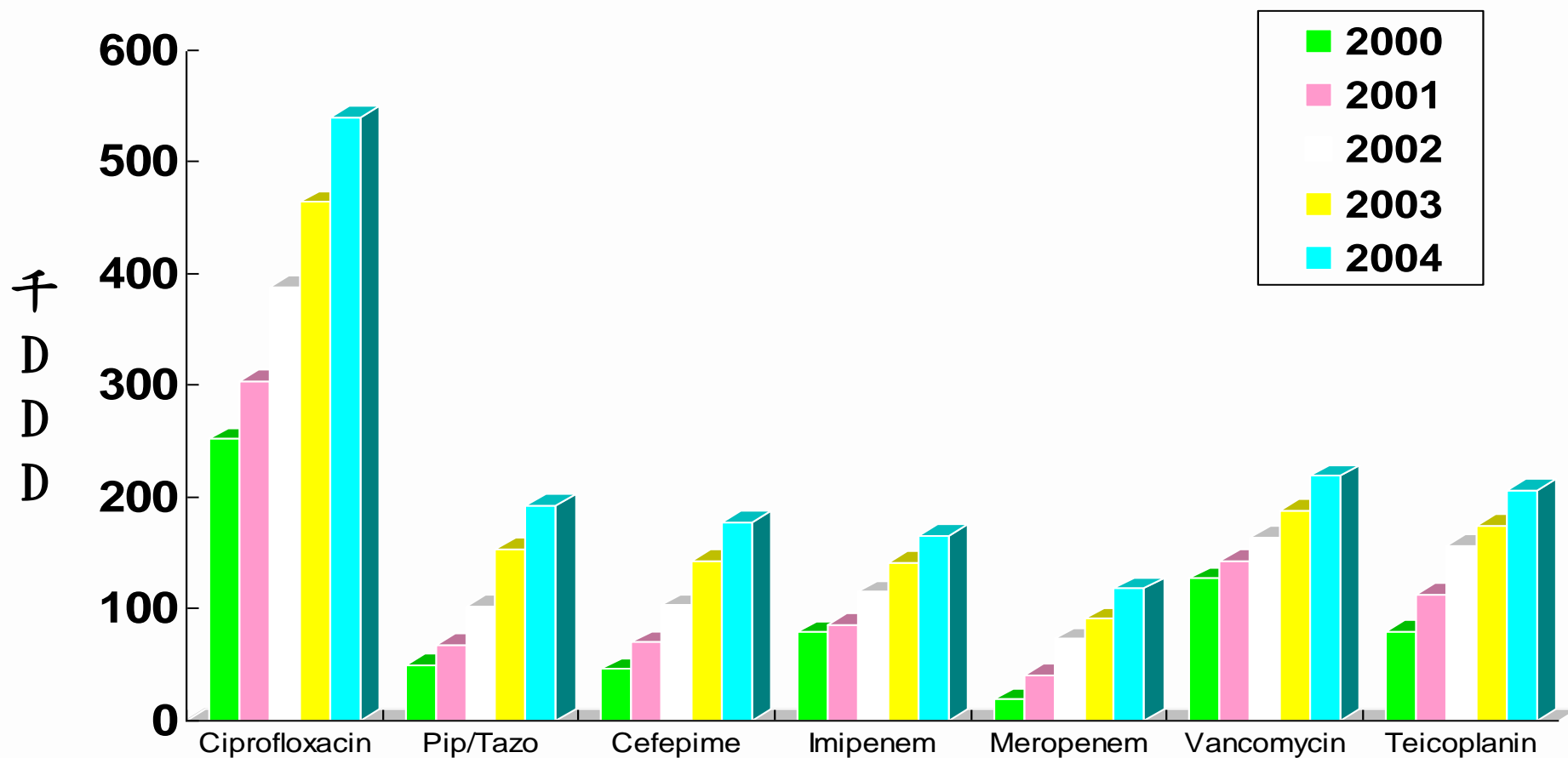
Thank you for your attention!



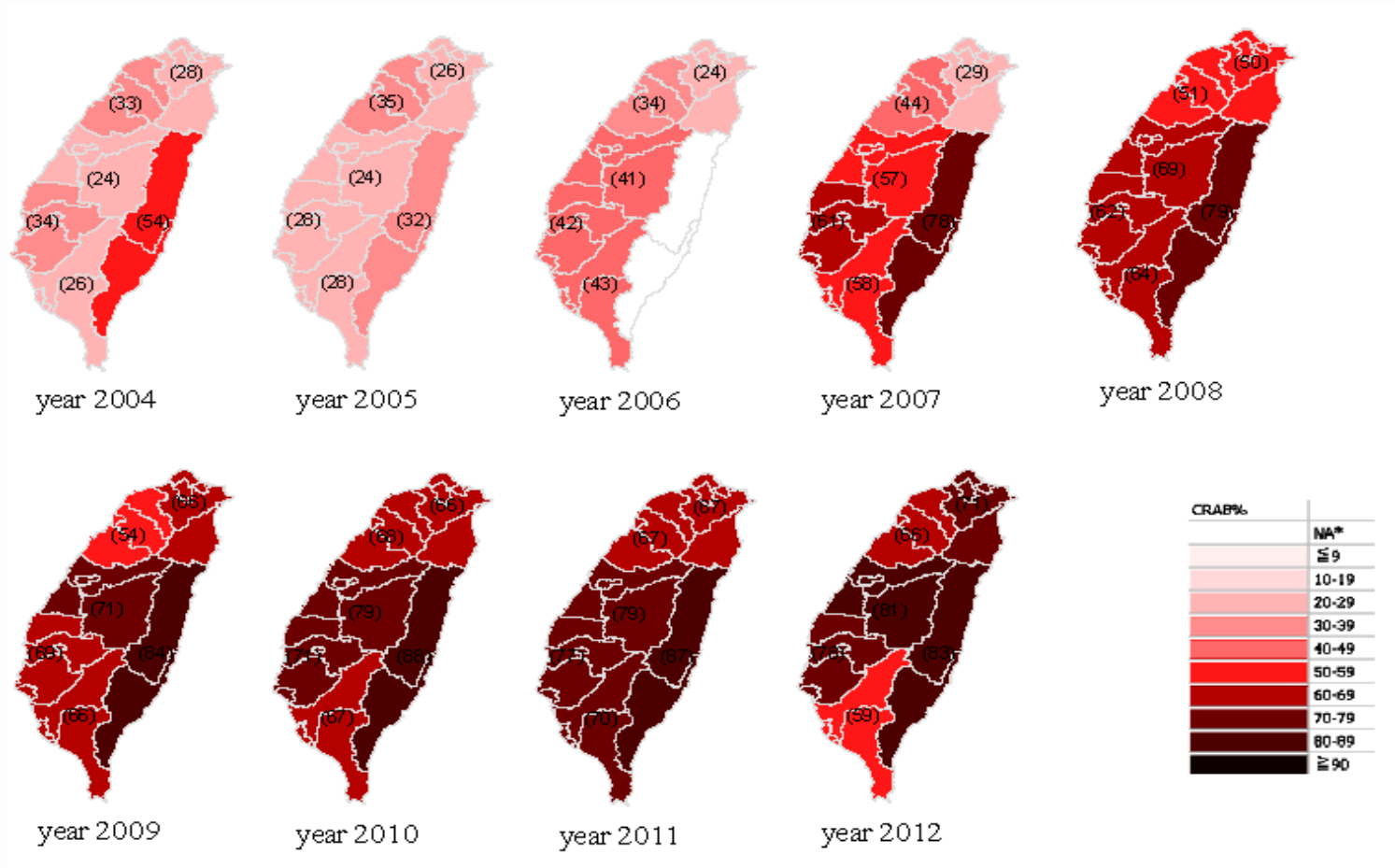
CRAB % among healthcare-associated *A. baumannii* infections in ICUs of medical centers and regional hospitals, 2003~2018



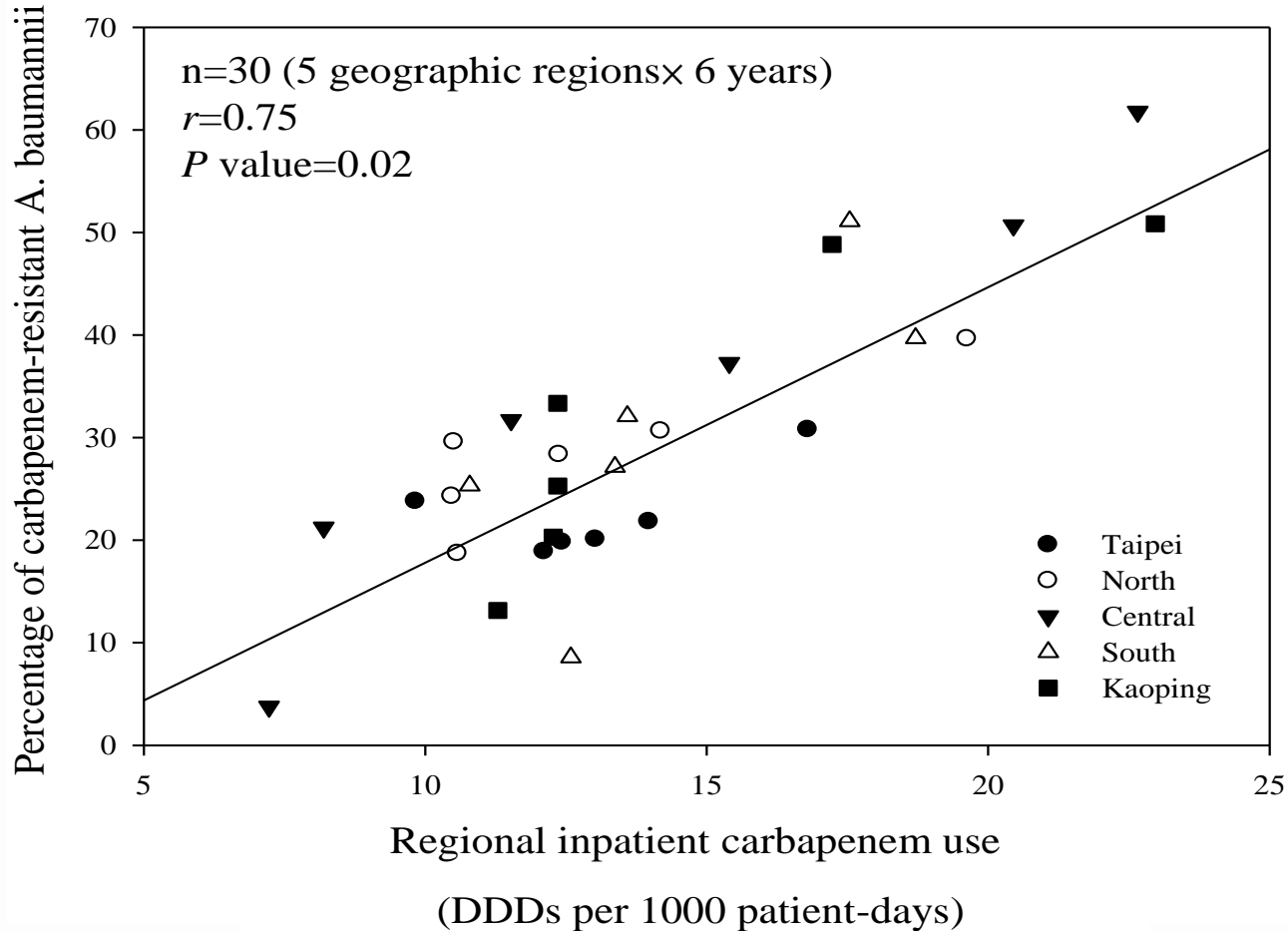
Annual consumption of broad spectrum antibiotics in Taiwan (DDDs)



CRAB Surveillance in ICUs of Medical Centers and Regional Hospitals- by region



Relationship of Carbapenem Consumption and CRAB%



Antimicrobial Resistance in Iceland

One health program and actions

Icelandic settlement

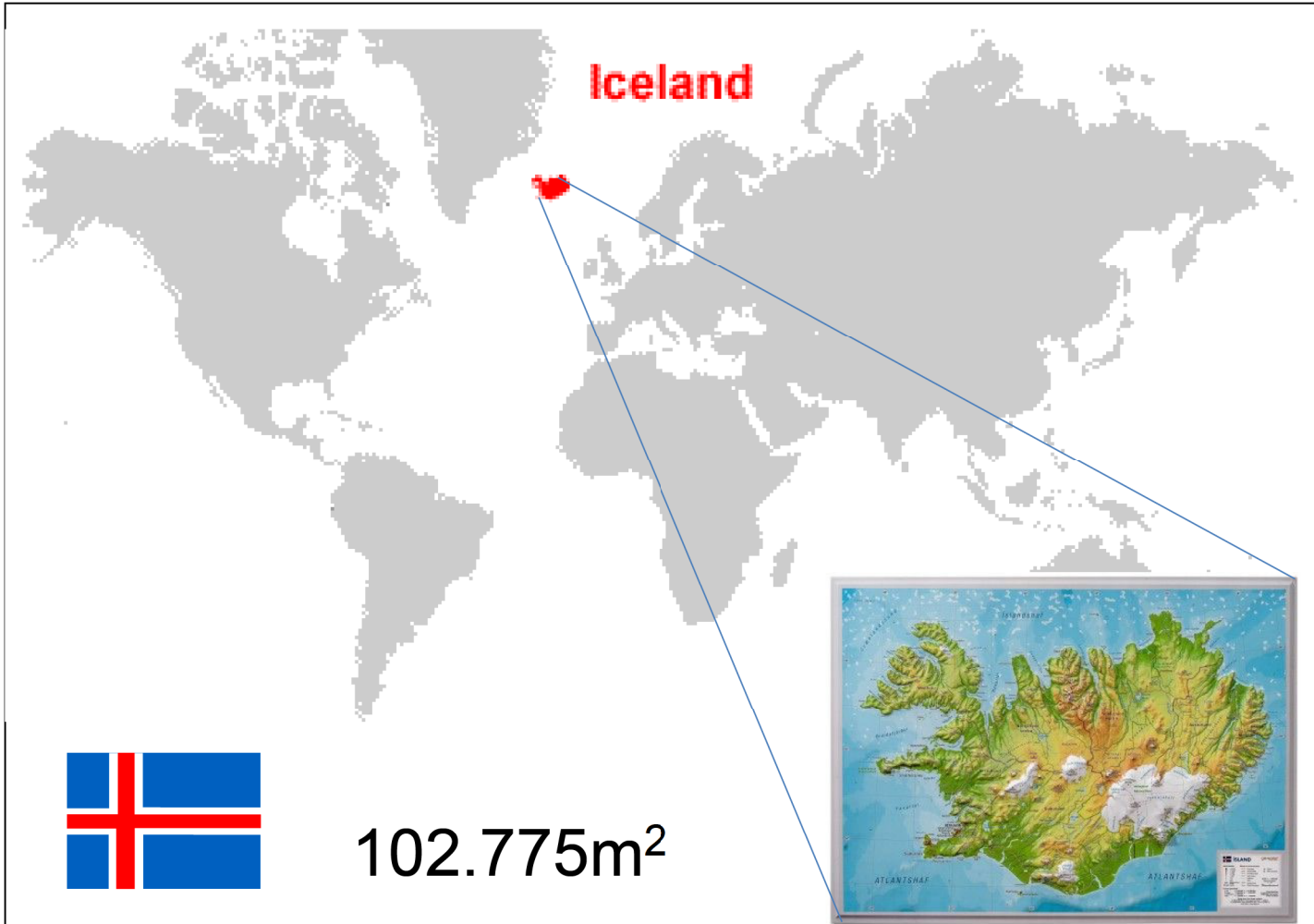
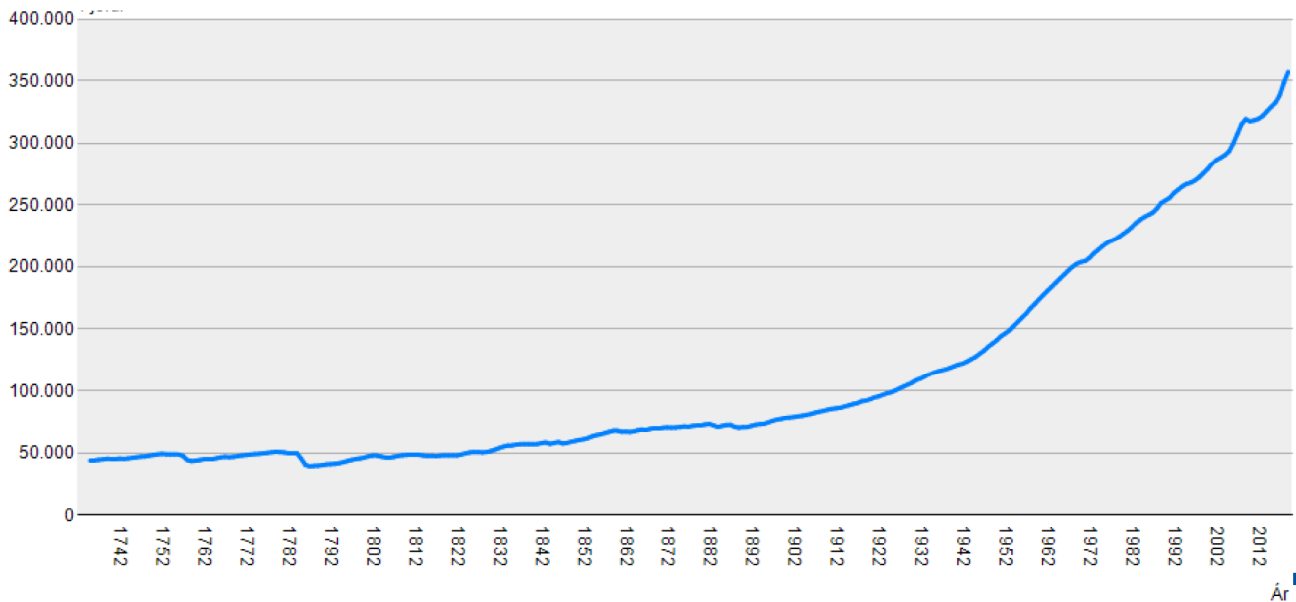
- Age of settlement considered 874-930
 - Settled by the Vikings
 - Norwegian, Irish and Scottish origin



Icelandic population today

■ Humans 360.390

- Sheep 480.500
- Horses 77.000
- Cattle 78.500
- Pigs 3.550
- Poultry 288.000



102.775m²



The Icelandic health care system

- Hospitals owned and run by the state
 - No payment by patients
- Primary care delivered from health care centers, run by the state
 - Minimal payments by patients
- Specialists outside hospitals are private practitioners paid by the patients and the state
 - Referral not necessary



Antimicrobial Use

- Human use
 - All antimicrobial prescriptions from all pharmacies in the country electronically linked to a central database at the Directorate of Health
 - The Icelandic Medicines Agency collects information from wholesalers on the sales of all antimicrobials in the country
- Animal use
 - All sales collected by the Icelandic Medicines Agency
 - Electronic registration of antimicrobial use according to animal species has recently been introduced

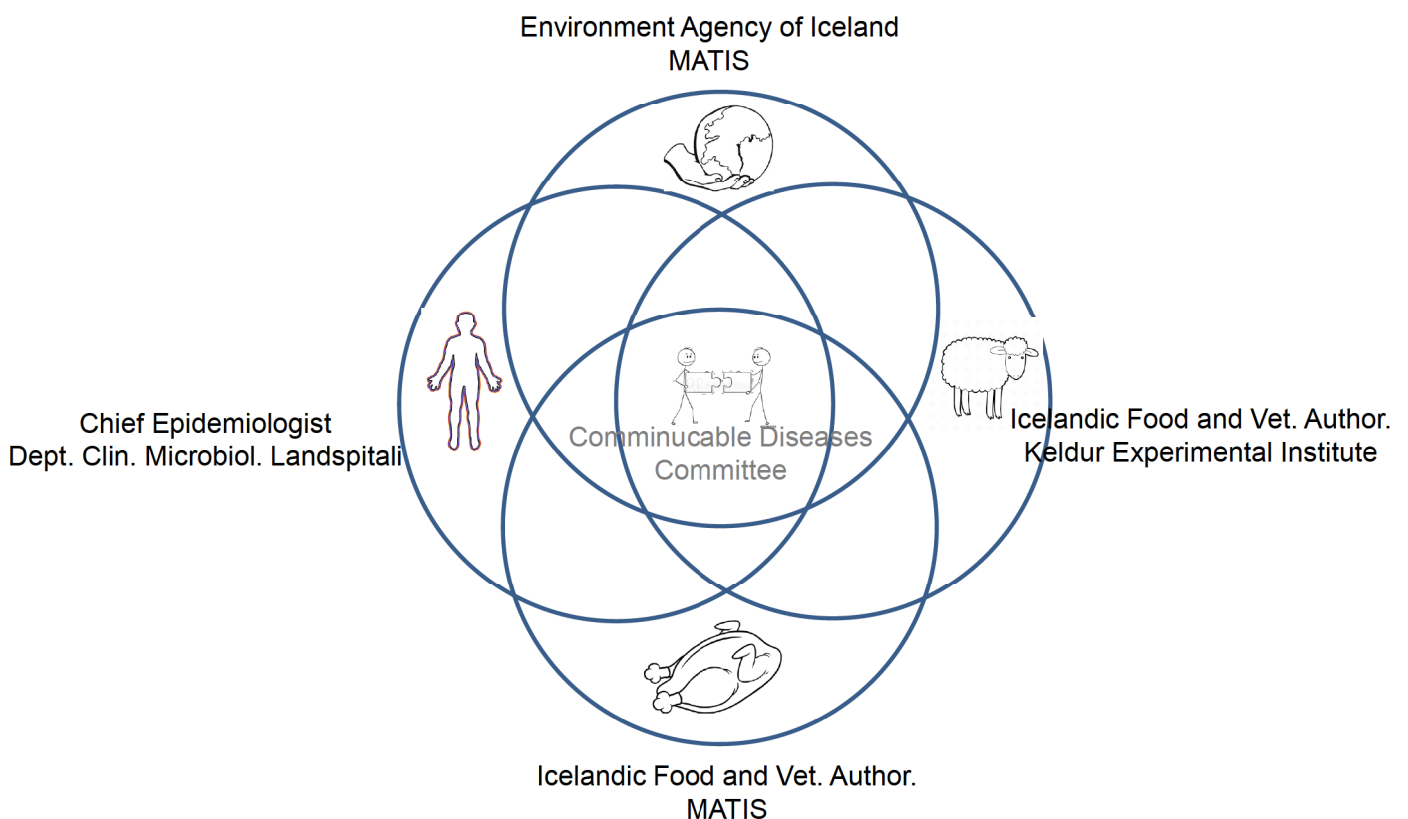
AMR surveillance - Human

- Responsibility: Chief Epidemiologist at the Directorate of Health
- Main laboratories: Department of Clinical Microbiology at Landspítali University Hospital and at Akureyri Hospital
 - Invasive infections 100% coverage (EARS-Net)
 - Other infections >90% coverage
- Web page: <https://www.landspitali.is/fagfolk/reglur-leidbeiningar-og-handbaekur/naemisprof-syklalyfjanaemi/>

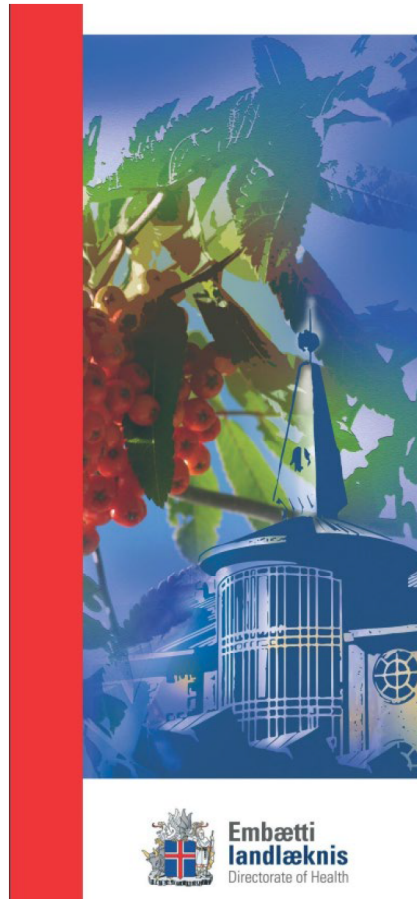
AMR surveillance – Animals and food

- Responsibility: Icelandic Food and Veterinary Authority
 - Web page: www.mast.is
- Laboratories: Experimental Institute at Keldur and MATÍS
 - Web pages: www.keldur.is and www.matis.is

One Health in Iceland



Publication of antimicrobial use and antimicrobial resistance in humans, animals and food



Sýklalyfjanotkun
og
sýklalyfjanæmi
baktería
í mönnum og
dýrum á Íslandi
2017

September 2018



<https://www.landlaeknir.is/smit-og-sottvarnir/syklalyfjaonaemi-syklalyfjanotkun/>

Funding

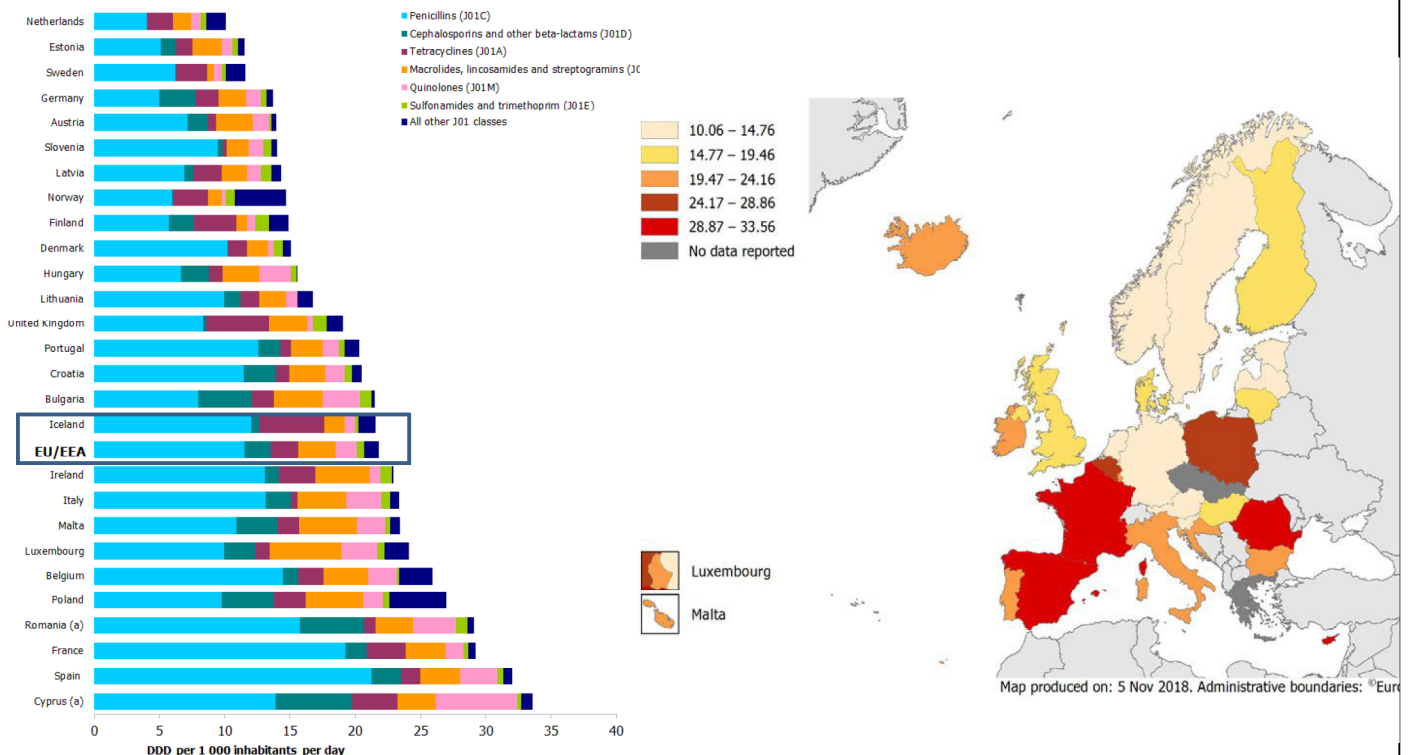
- The Directorate of Health (including the Office of the Chief Epidemiologist) and the Icelandic Medicines Agency are funded by the Government
- The Icelandic Food and Veterinary Authority, the Experimental Institute at Keldur, MATÍS and the hospital laboratories are mainly funded by the Government but partly by charging for services
- All surveillance activities of antimicrobial use and antimicrobial resistance are funded by the Government

Iceland and the European Union

- Iceland is a member of the European Economic Area (EEA), and as such full participant in the European Centre for Disease Prevention and Control (ECDC), European Food Safety Authority (EFSA) and European Medicines Agency (EMA)
 - Monitoring of antimicrobial use and resistance
 - Humans: ESAC-Net and EARS-Net
 - Animals and food: ESVAC and EFSA
 - Joint inter-agency antimicrobial consumption and resistance analysis (JIACRA) reports
- https://www.ema.europa.eu/en/documents/report/ecdc/efsa/ema-second-joint-report-integrated-analysis-consumption-antimicrobial-agents-occurrence_en.pdf



Outpatient use of antimicrobials - 2017



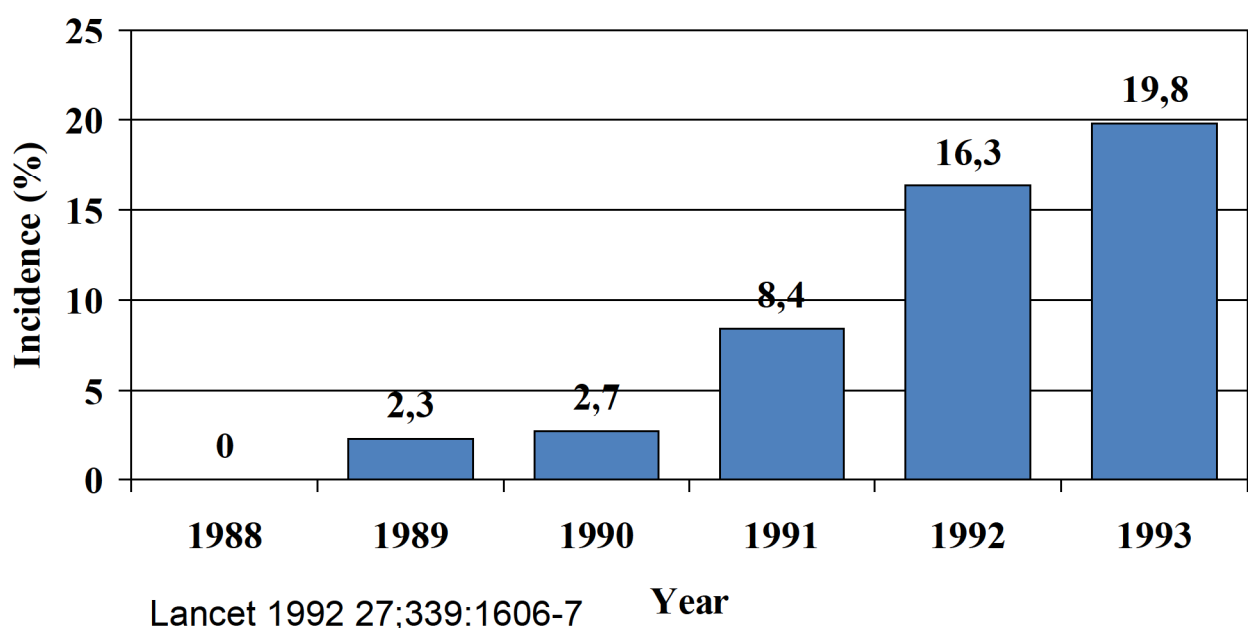
<https://ecdc.europa.eu/sites/portal/files/documents/ESAC-NET-reportAER-2017-updated.pdf>

High antimicrobial use in children

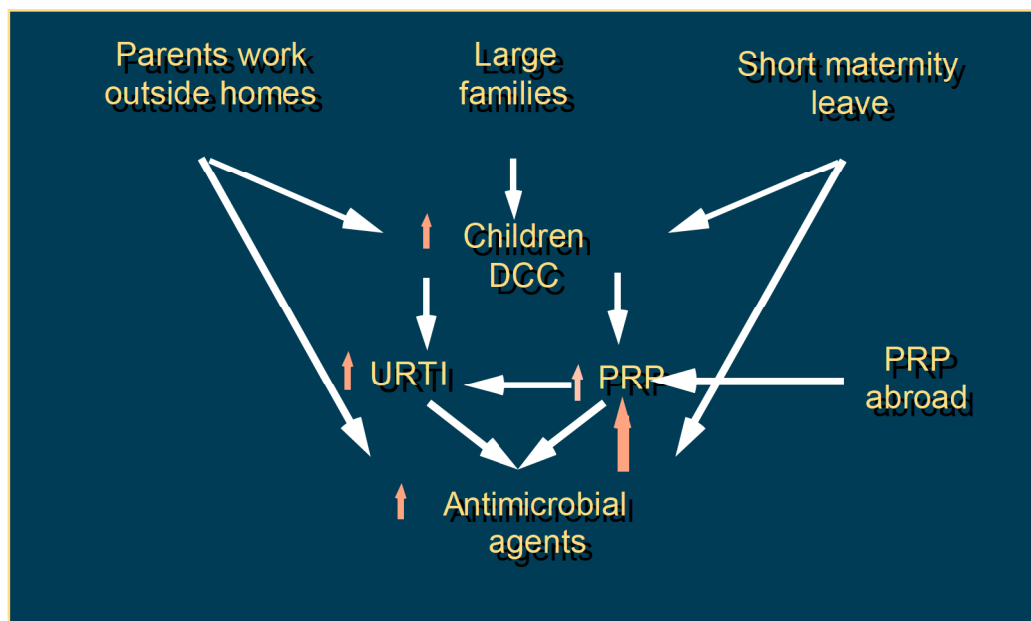
- About 90-95% of children in the capital area attend day care centers from 1-2 years of age
- Frequent respiratory tract infections
- Close contacts facilitates spread of respiratory tract pathogens
- Pneumococci colonise about 2/3 of children in day care centers
- Pneumococci are exclusive human pathogens and most common cause of acute otitis media, pneumonia and meningitis



Iceland Penicillin non-susceptible pneumococci

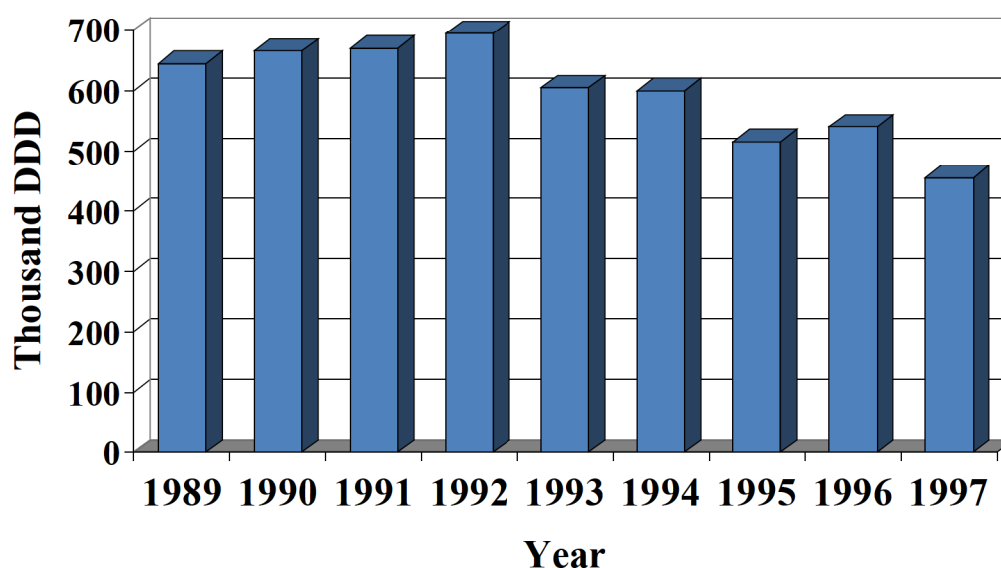


Vicious circle in Day Care Centres



Kristinsson KG, Microb Drug Resist 1995;1:121-5

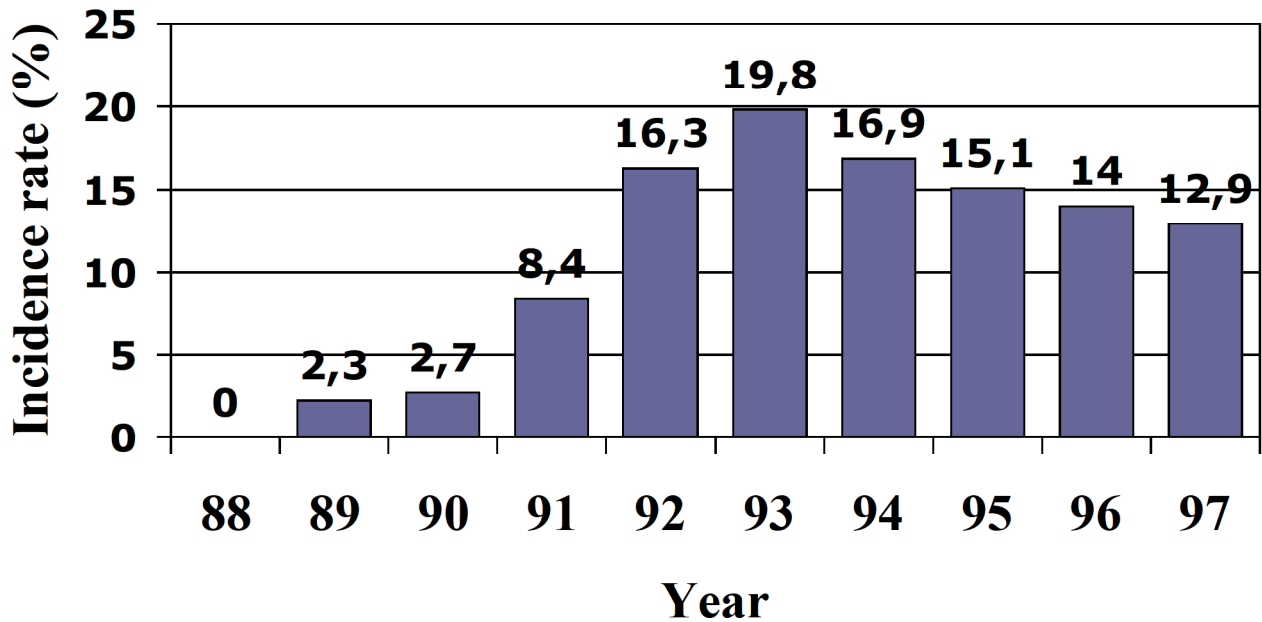
Antibacterial use - liquid form



35% reduction from 1992 to 1997.

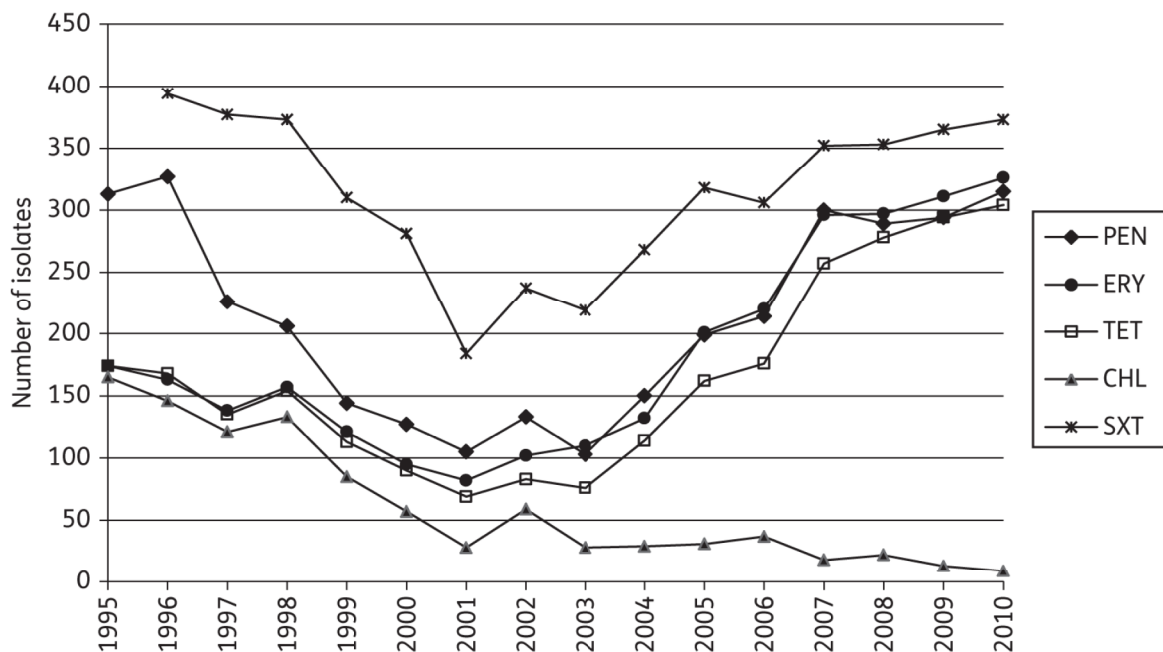
Effect of interventions

Penicillin non-susceptible pneumococci



LANDSPÍTALI

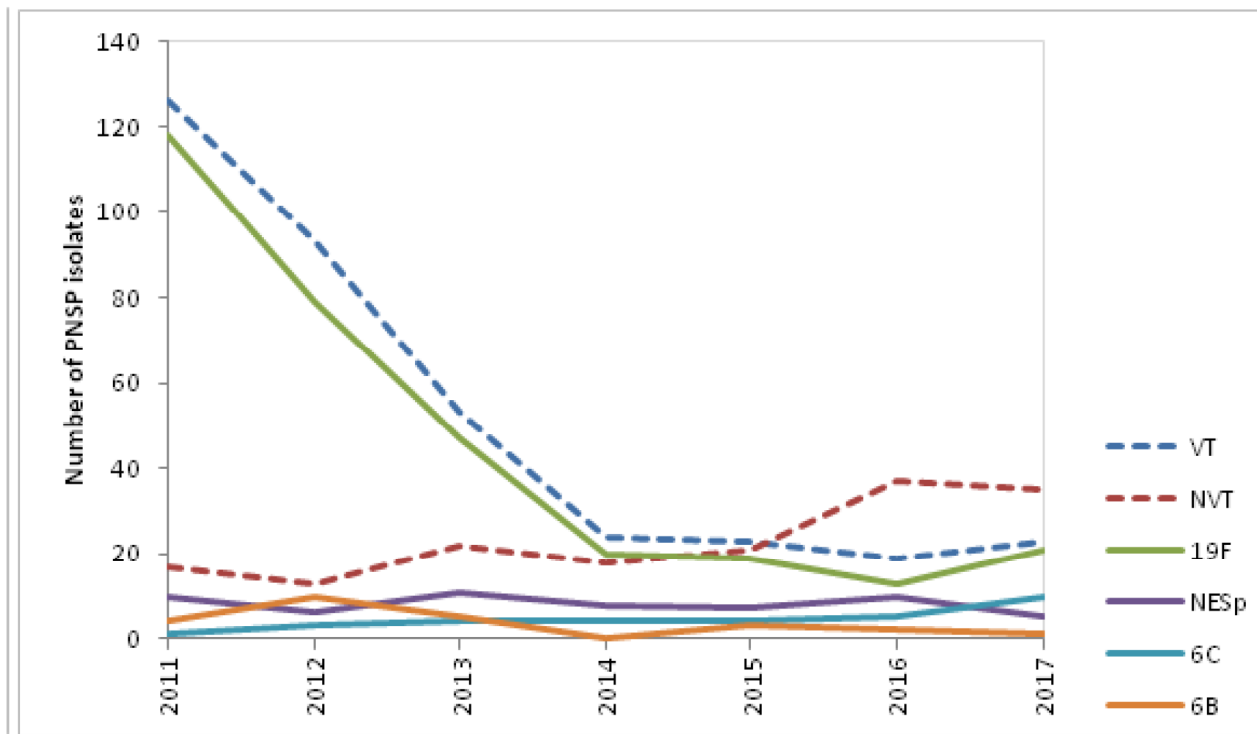
Resistant pneumococci



Hjalmarsdottir MA and Kristinsson KG, J Antimicrob Chemoth 2014

Pneumococcal vaccination for children introduced in January 2011

Effect of vaccination



Reykjavik Health Centers

- Swedish guidelines (STRAMA) were adapted and introduced in 2017
STRAMA: <https://strama.se/?lang=en>
- All physicians get regular information about their antibiotic prescriptions and how much they prescribe in comparison to other physicians and also comparisons between health centers
- Last year AM prescriptions were reduced by 3% and azithromycin prescriptions by 9%
- All Icelanders have a unique personal id number
Possible to query several databases- research



HEILSUGÆSLAN

Þú ert sérstakur og staðfær. Þú ert með heil.

Embætti landlæknis Íslandsmann

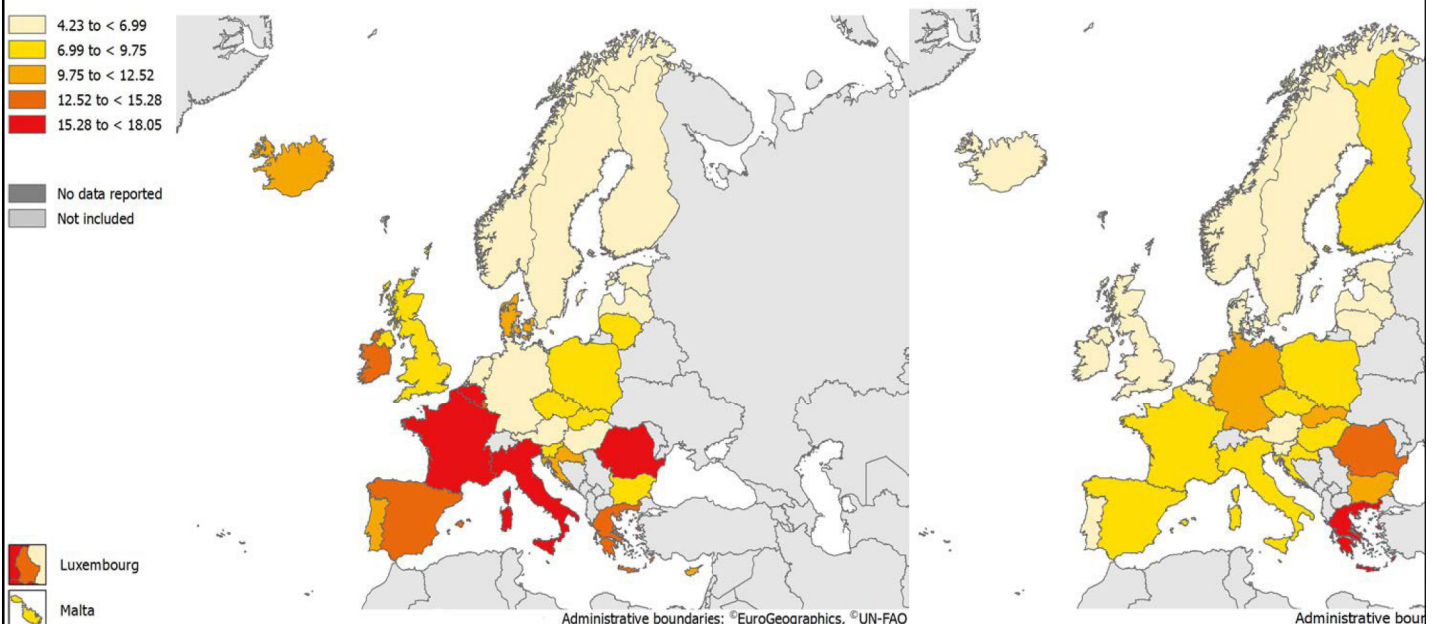
Strama



E. coli and *Klebsiella*

- Opportunistic pathogens that colonize the gastrointestinal tract of humans and animals
- Prevalent in the environment, especially where there is faecal contamination
- Certain food products may be contaminated, e.g. meat and vegetables
- Important causes of human infections, e.g. urinary tract infections and sepsis

Use of penicillins and other beta lactam antibiotics for humans in 2014



E. coli og *K. pneumoniae* resistant to 3rd generation cephalosporins Invasive isolates EARS-Net 2017

Figure 3.3. *Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, by country, EU/EEA countries, 2017

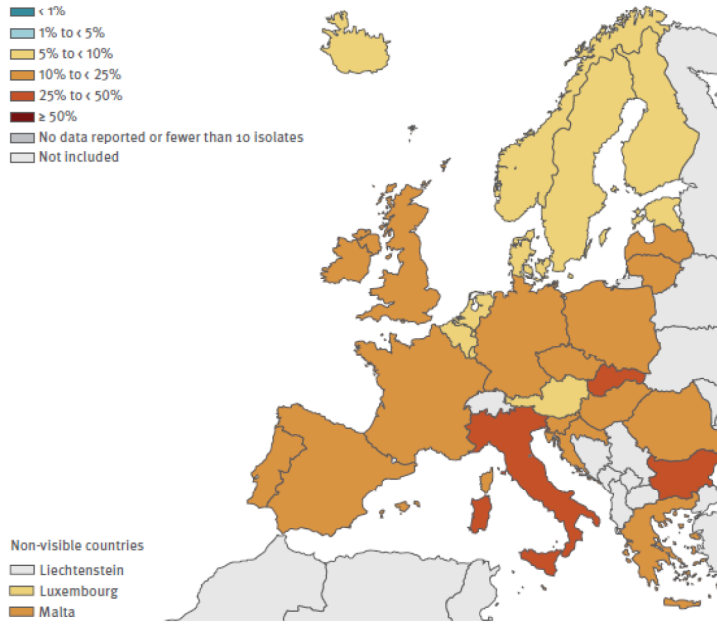
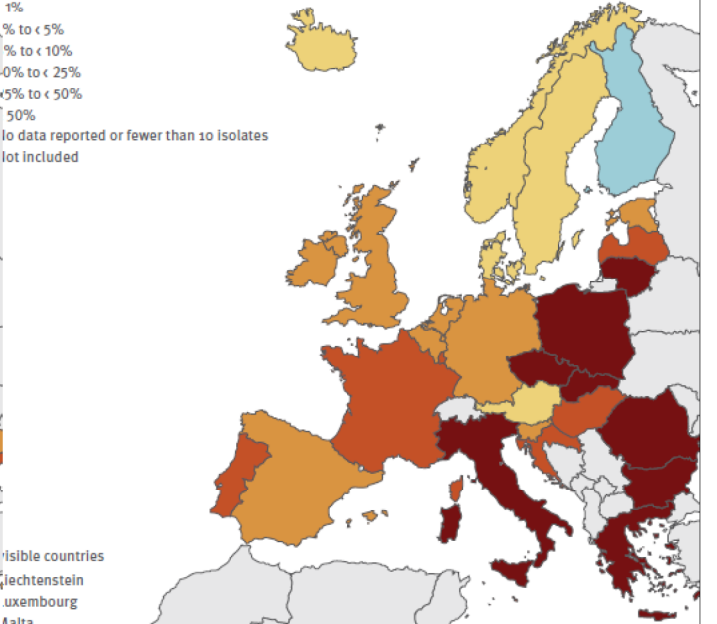
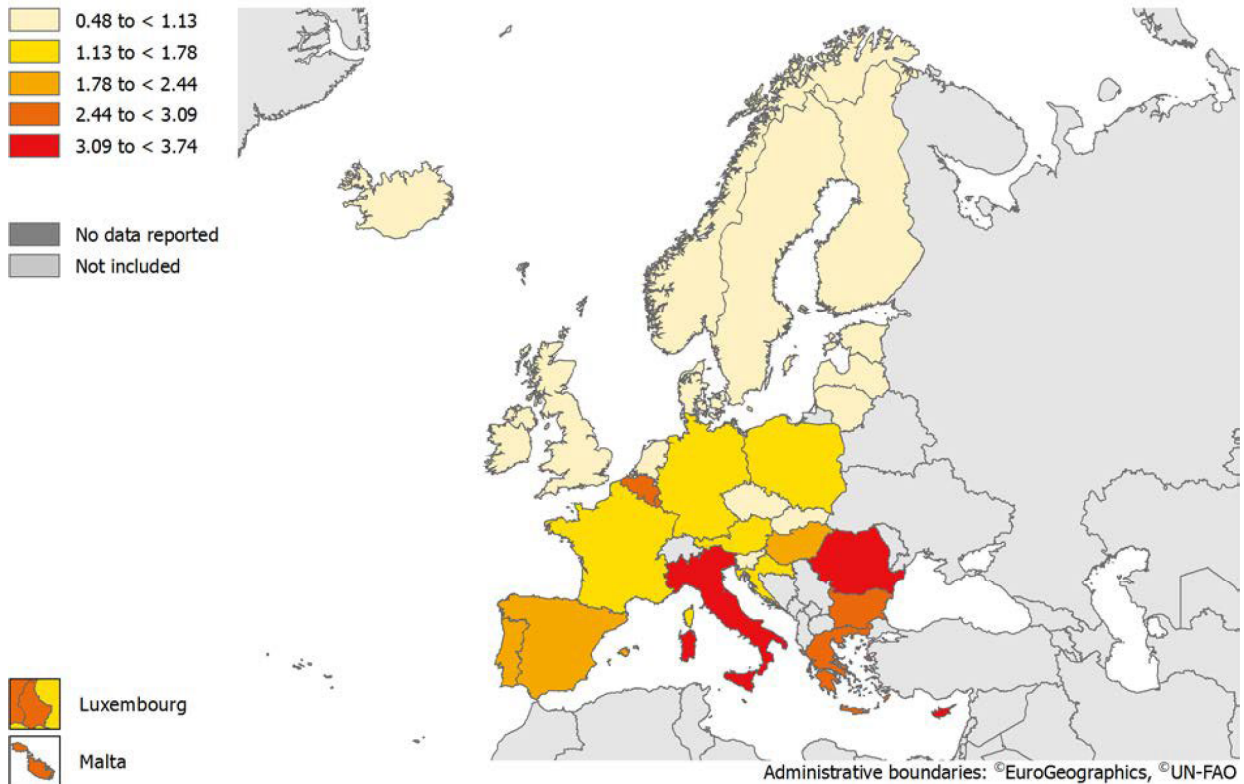
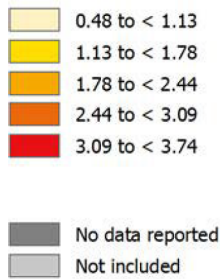


Figure 3.9. *Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, by country, EU/EEA countries, 2017



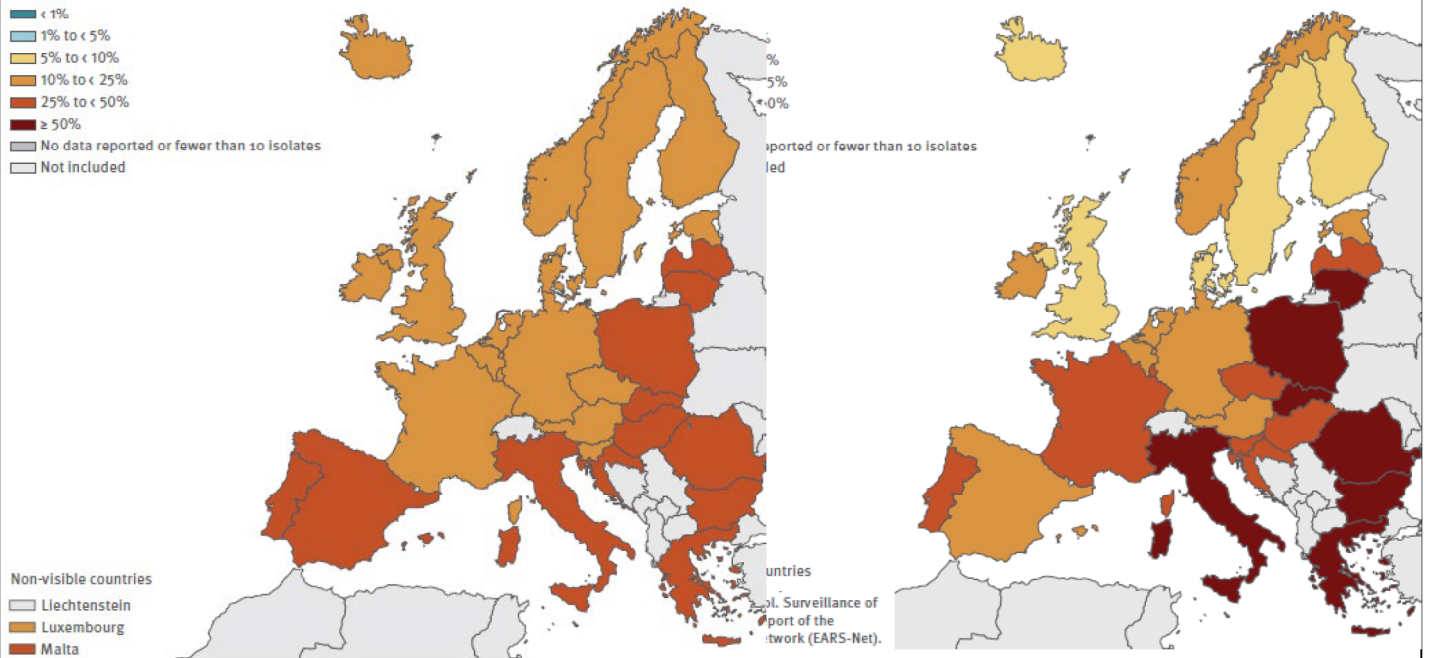
Use of fluoroquinolones in 2014



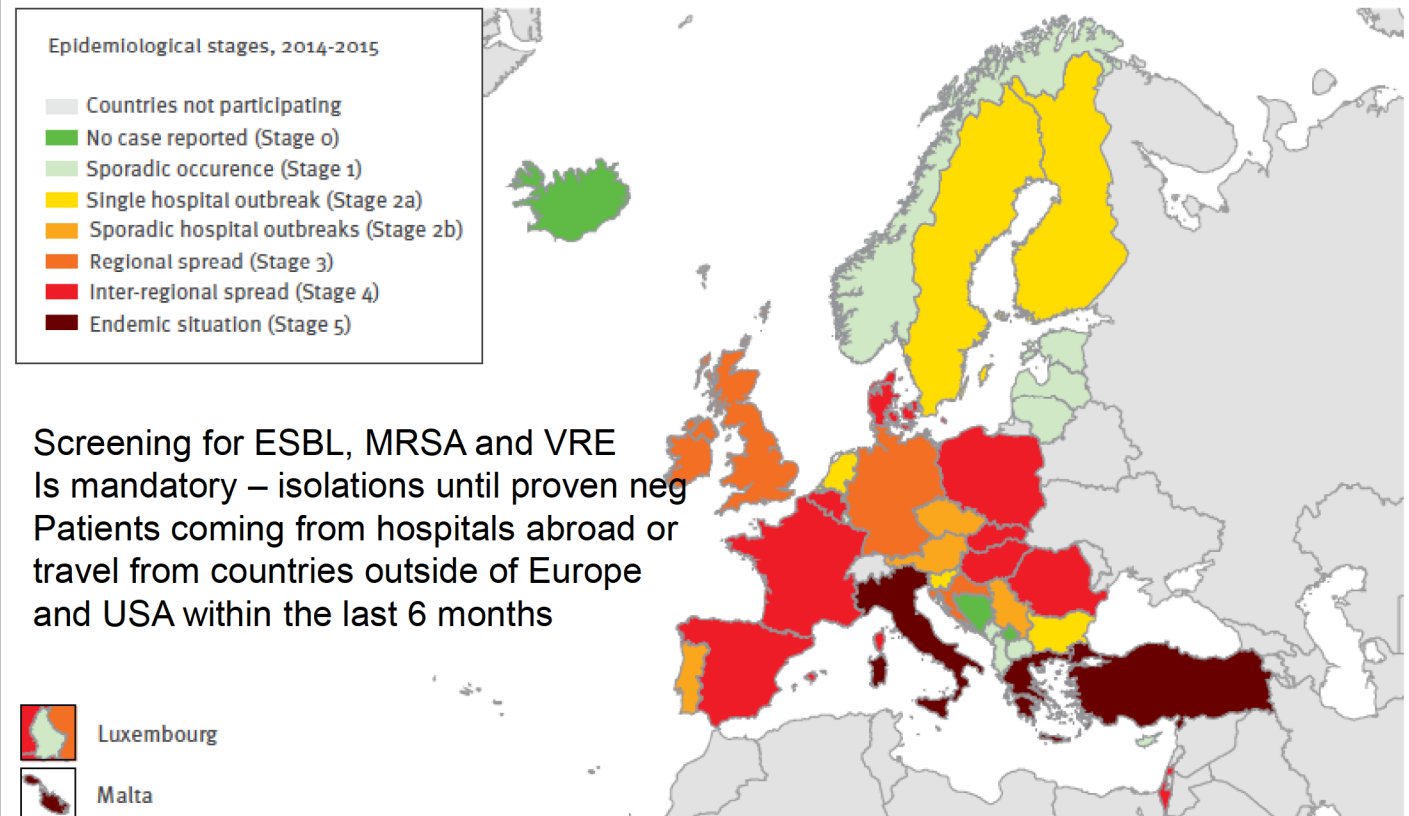
Administrative boundaries: ©EuroGeographics, ©UN-FAO

E. coli og *K. pneumoniae* resistant to quinolones Invasive isolates EARS-Net 2017

Figure 3.2. *Escherichia coli*. Percentage (%) of invasive isolates with resistance to fluoroquinolones in EU/EEA countries, 2017. *Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to fluoroquinolones in EU/EEA countries, 2017.



Occurrence of carbapenemase-producing *Enterobacteriaceae* based on self-assessment by national experts, 38 European countries, May 2015

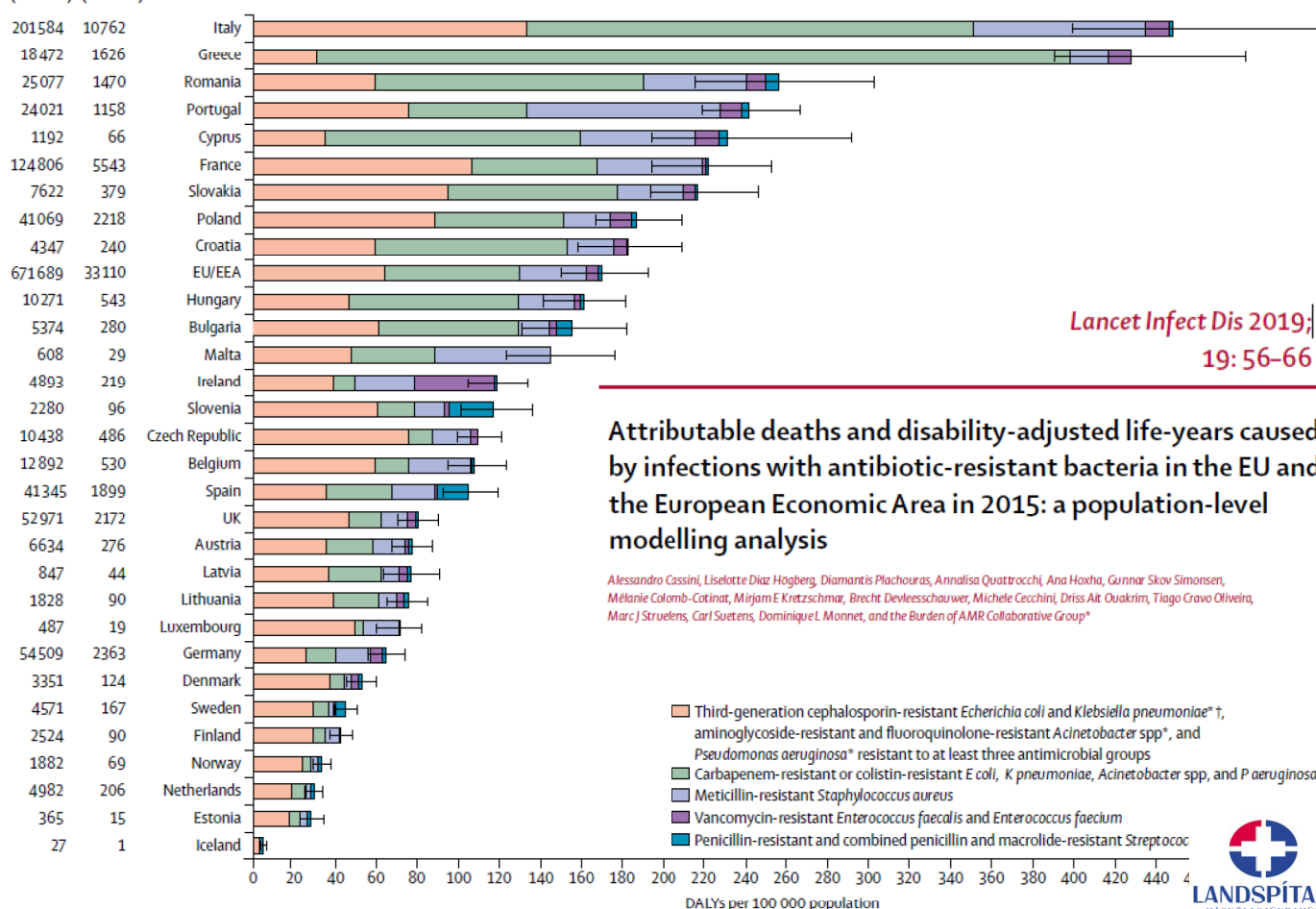


Carbapenemase Producing Enterobacteriaceae

Nr	Sex	Age	Date	Bacteria	Enzyme	Sample type	Hospitalised abroad	Specimen number
1	M	12	Oct 2015	<i>E.coli</i>	NDM	Rectal swab	Philippines	S1510120225
2	M	78	Dec 2015	<i>K.pneumoniae</i> <i>E.coli</i>	OXA-48 OXA-48	Rectal swab	Tenerife, Canary Islands	S1512030245
3	M	25	Feb 2016	<i>E.coli</i> <i>E.aerogenes</i>	NDM NDM	Rectal swab	India	S1602190274
4	M	41	Oct 2016	<i>K.pneumoniae</i>	OXA-48	Rectal swab	Morocco	S1610030180
5	M	64	Sep 2017	<i>E.coli</i>	NDM	Rectal swab	Thailand	S1709110008
6	M	39	Dec 2017	<i>K.pneumoniae</i> <i>K.oxytoca</i> <i>C.freundii</i>	VIM VIM VIM	Rectal swabs and bronchial aspirate	Spain (Madrid)	S1712060097 S1712060180
7	M	60	Jan 2018	<i>E.coli</i>	NDM	Rectal swab	India	S1801240126
8	F	65	Oct 2018	<i>K.pneumoniae</i>	KPC	Rectal swab and urine	Italy	S1810010221 S1810010145
9	M	54	Feb 2019	<i>K.pneumoniae</i> <i>E.coli</i>	NDM NDM	Rectal swab	Philippines	S1902160080
10	F	89	May 2019	<i>K.pneumoniae</i>	OXA-48	Rectal swab	Tenerife, Canary Islands	S1905110070
11	F	33	May 2019	<i>E.coli</i>	OXA-48	Rectal swab	Egypt – No hospital contact	S1905100170
12	F	31	May 2019	<i>E.coli</i>	NDM	Urine	Thailand	S1905160168

Cases
(median)

Deaths
(median)



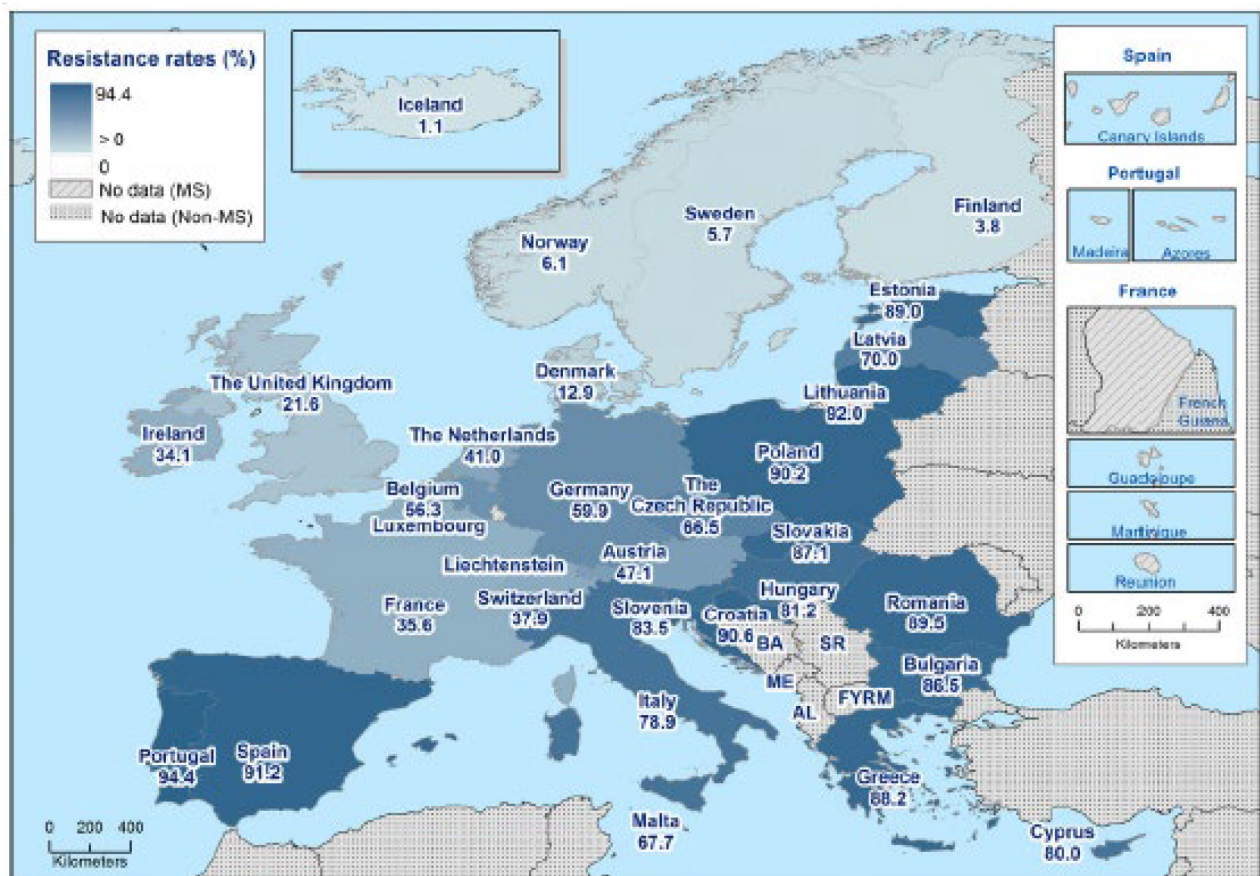
APPROVED: 31 January 2019

doi: 10.2903/j.efsa.2019.5598

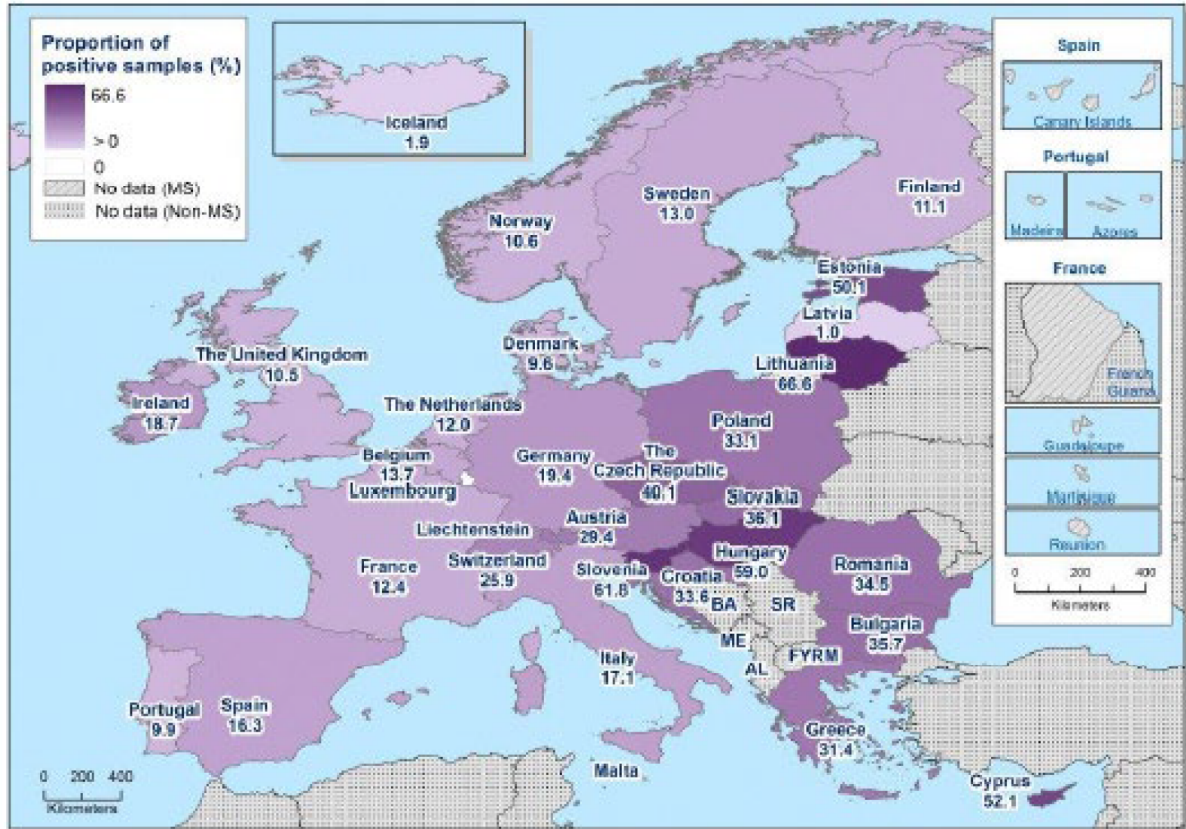
The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2017

European Food Safety Authority and
European Centre for Disease Prevention and Control

Ciprofloxacin resistance in *E.coli* from poultry



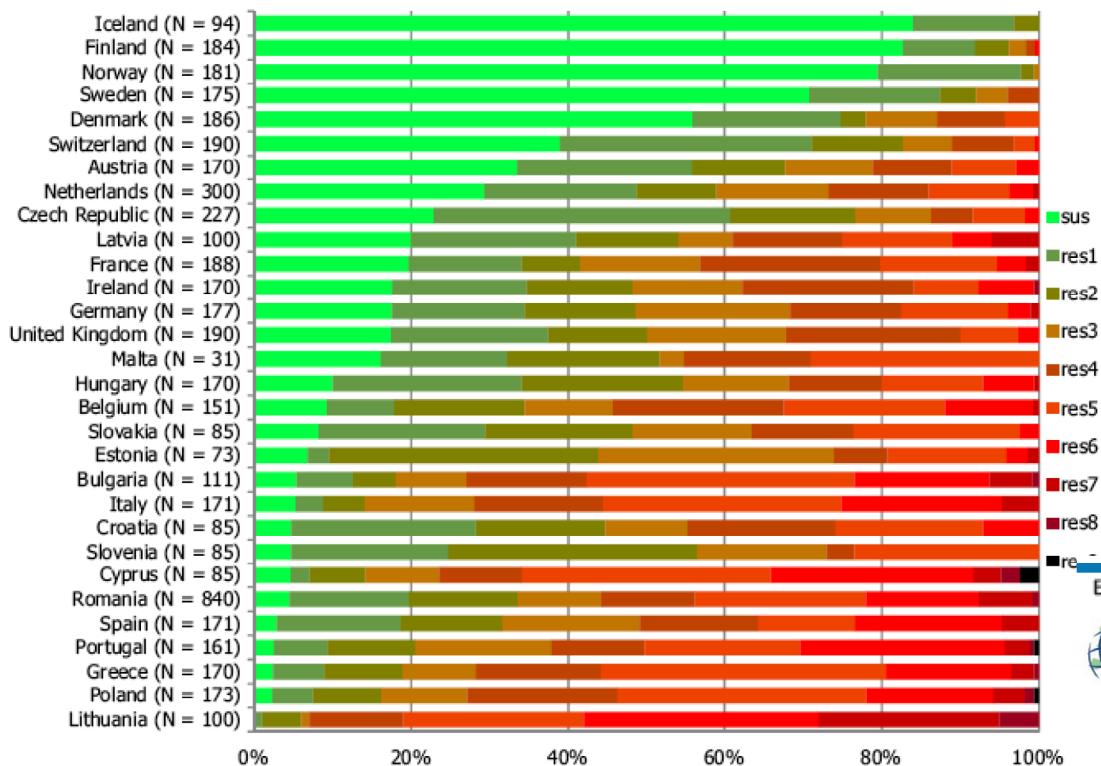
ESBL (presumptive) in *E. coli* from poultry



33

LANDSPÍTALI

AMR in *E. coli* from poultry - 2016



EFSA Journal 2018;16(2):5182



34

LANDSPÍTALI

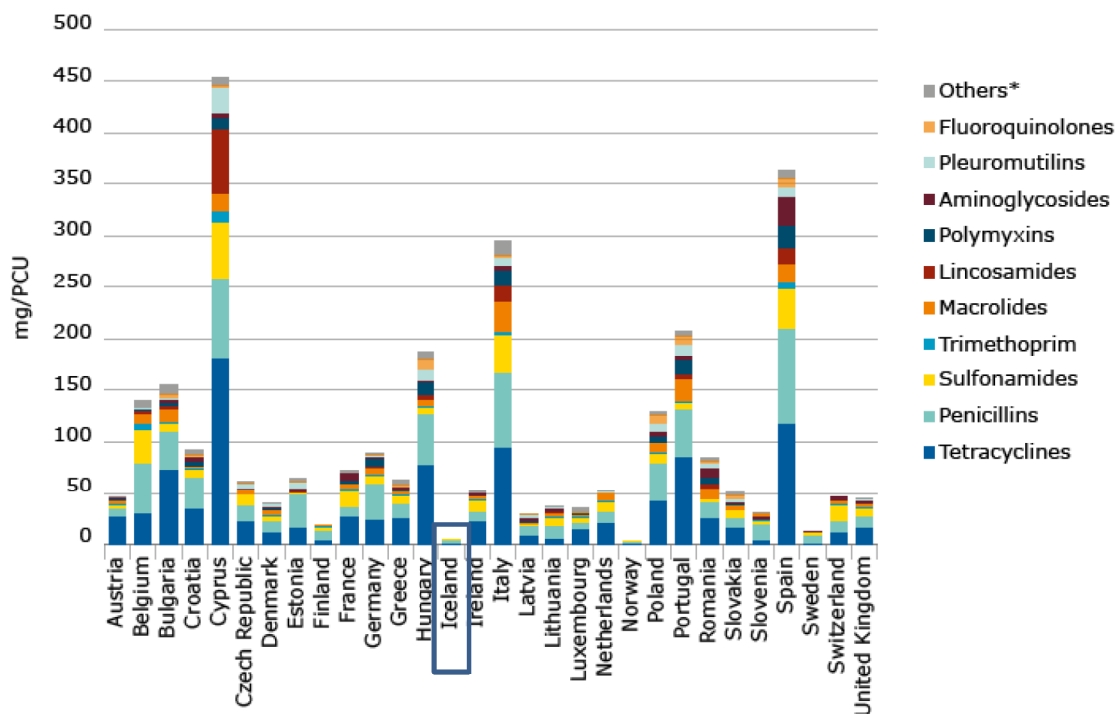
Sales of veterinary antimicrobials mg/PCU

Sales of veterinary antimicrobial agents in 30 European countries in 2016

Trends from 2010

Eighth ESVAC report

15 October 2018
EMA/275982/2018
Veterinary Medicines Division



35

Endemic infectious diseases Livestock

Number of infectious agents

Livestock	Iceland	Abroad
Horses	64 (20%)	317
Cattle	42 (19%)	223
Sheep	66 (27%)	248

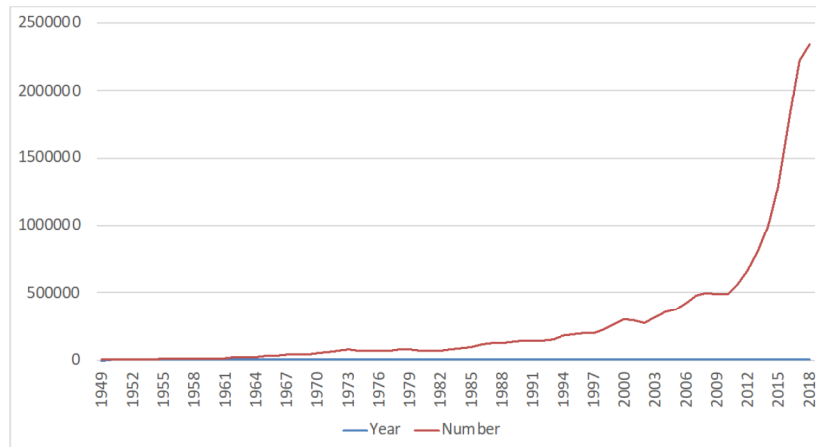
Information from Dr. V. Svansson, Keldur Experimental Institute

36

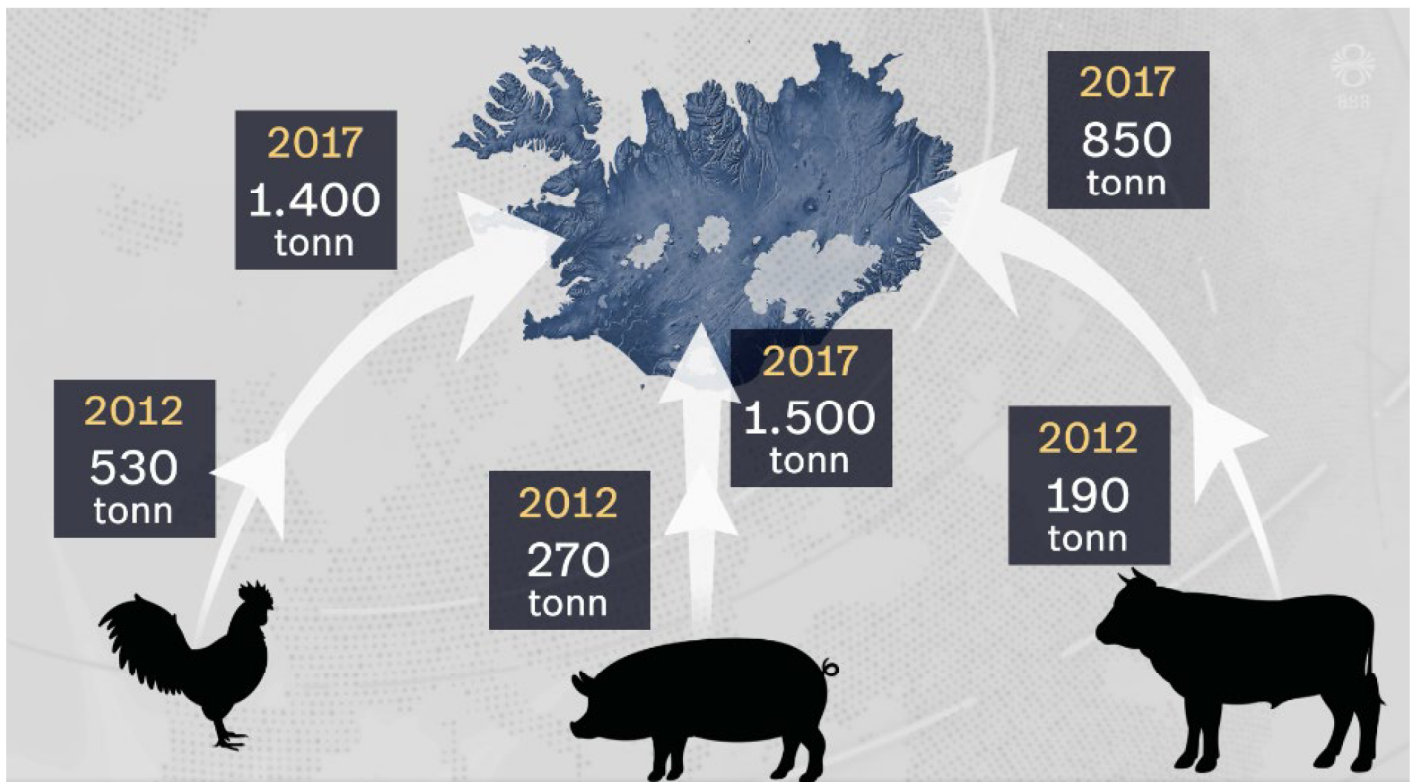
LANDSPÍTALI

Excellent situation under threat

- Increased importation of meat and vegetables
- Rapidly increasing tourism, especially after 2010



- Increased number of the elderly Icelandic population is living in Spain or Portugal for several months each year



Recent developments

- In 2018 the Government had not officially adopted an action plan against AMR
- AMR threat highlighted at meetings, articles and in interviews with the press AND the importance of keeping AMR rates low in Iceland
 - Important to inform the public and politicians
- The Farmers Union and the Progressive Party at the Parliament – common interest

Importation of fresh meat

- Restrictive importation laws and regulations
 - Importation of fresh meat not allowed
 - Temporary exemption from the EEA rules
- Food wholesalers took the matter to the EFTA court and won
- The Supreme Court in Iceland ruled that the Government has to change the laws on 12th October 2018
- Government has changed the law – take effect on 1st January 2020
- Government plans 17 countermeasures to mitigate the effect of this change with allocated budget

Government Action Plan



- Iceland should be at the forefront in actions to reduce the spread of AMR
 - Introduce policies for the prudent use of antibiotics for humans and animals
 - Enhance surveillance for AMR in animals, food production and food, i.e. to exceed those recommended by EU
 - Review the use of antiparasitic drugs for animals
 - Study the prevalence of AMR in the environment
 - Increase AMR surveillance in hospitals and other health institutes
 - Introduce measures to reduce the likelihood of AMR spread from tourists

Summary

- Successful action plan against AMR requires knowledge and commitment from the public and politicians
- Different risk factors apply for different pathogens - therefore multiple approaches are needed
- Sharing the environment with animals requires a One Health approach
- International travel and food trade highlights the importance of a global approach
 - We need a rapid, simple and cheap method to detect important resistance genes