



12 aprile 2025

Meyer Health Campus

Firenze



Proteggere i più piccoli:

**Strategie innovative per
la prevenzione delle
infezioni correlate all'assistenza
in ambito pediatrico**



Antimicrobial Stewardship nel bambino

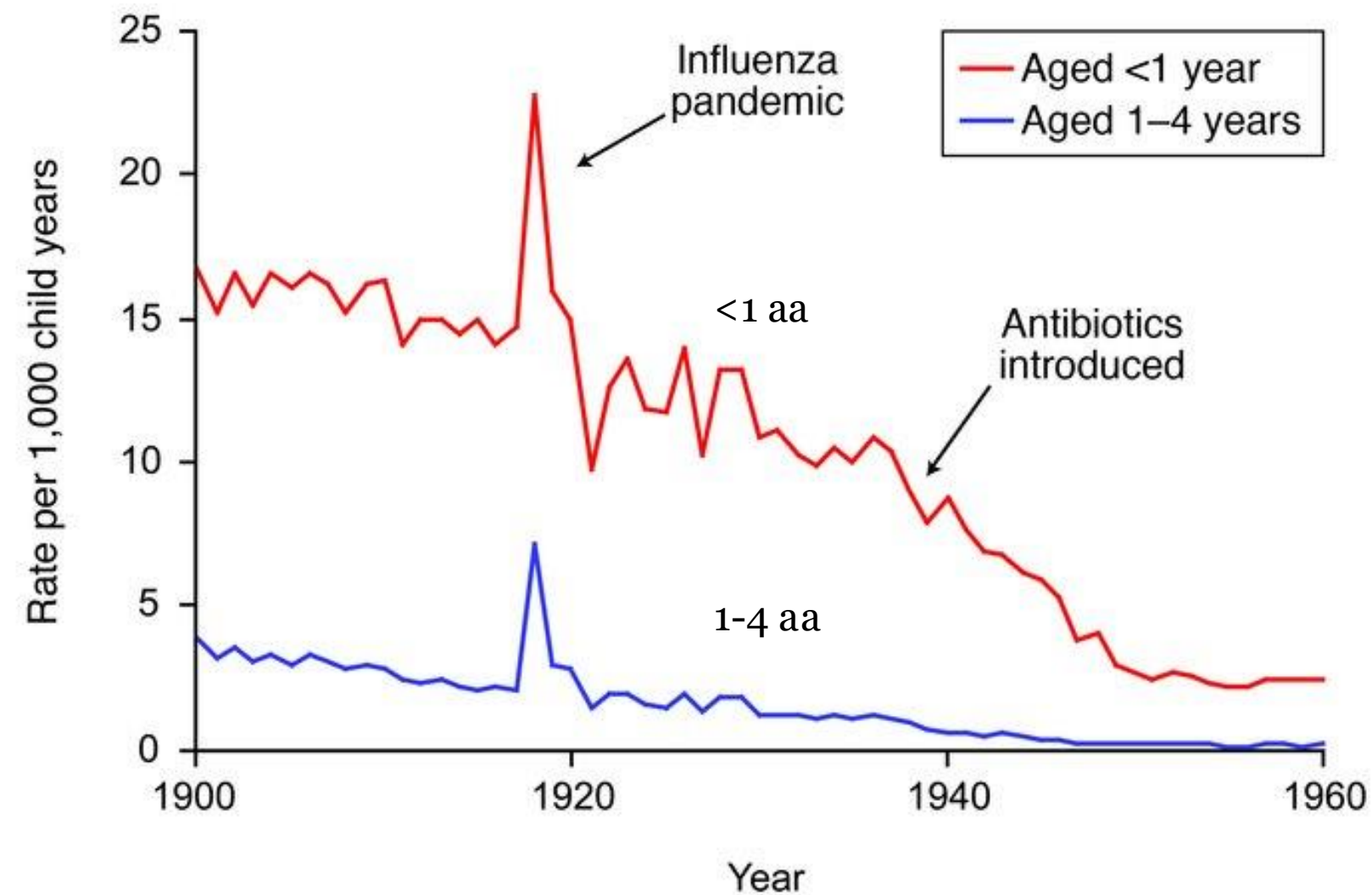
Carlotta Montagnani
SOC Malattie Infettive AOU Meyer IRCCS



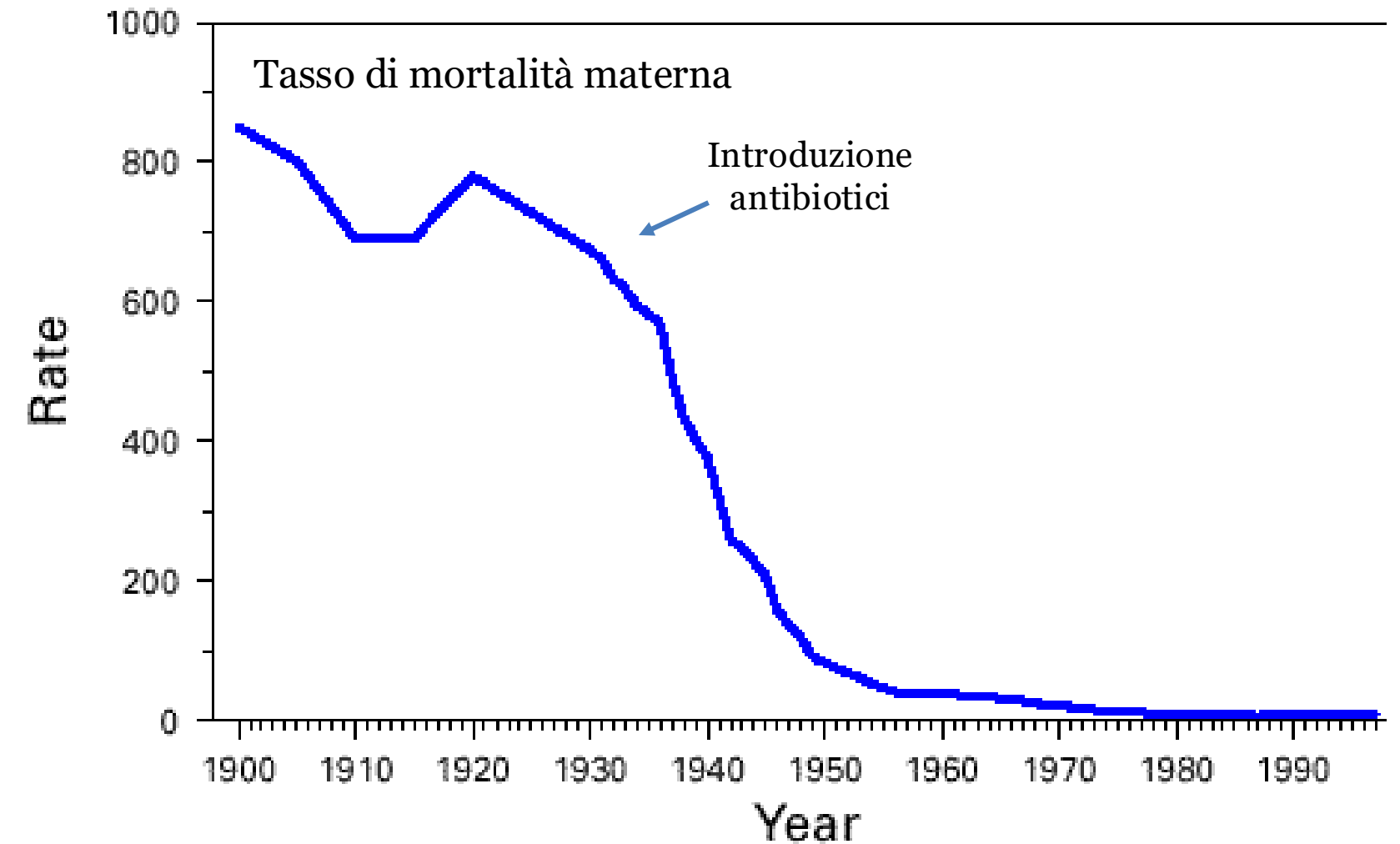
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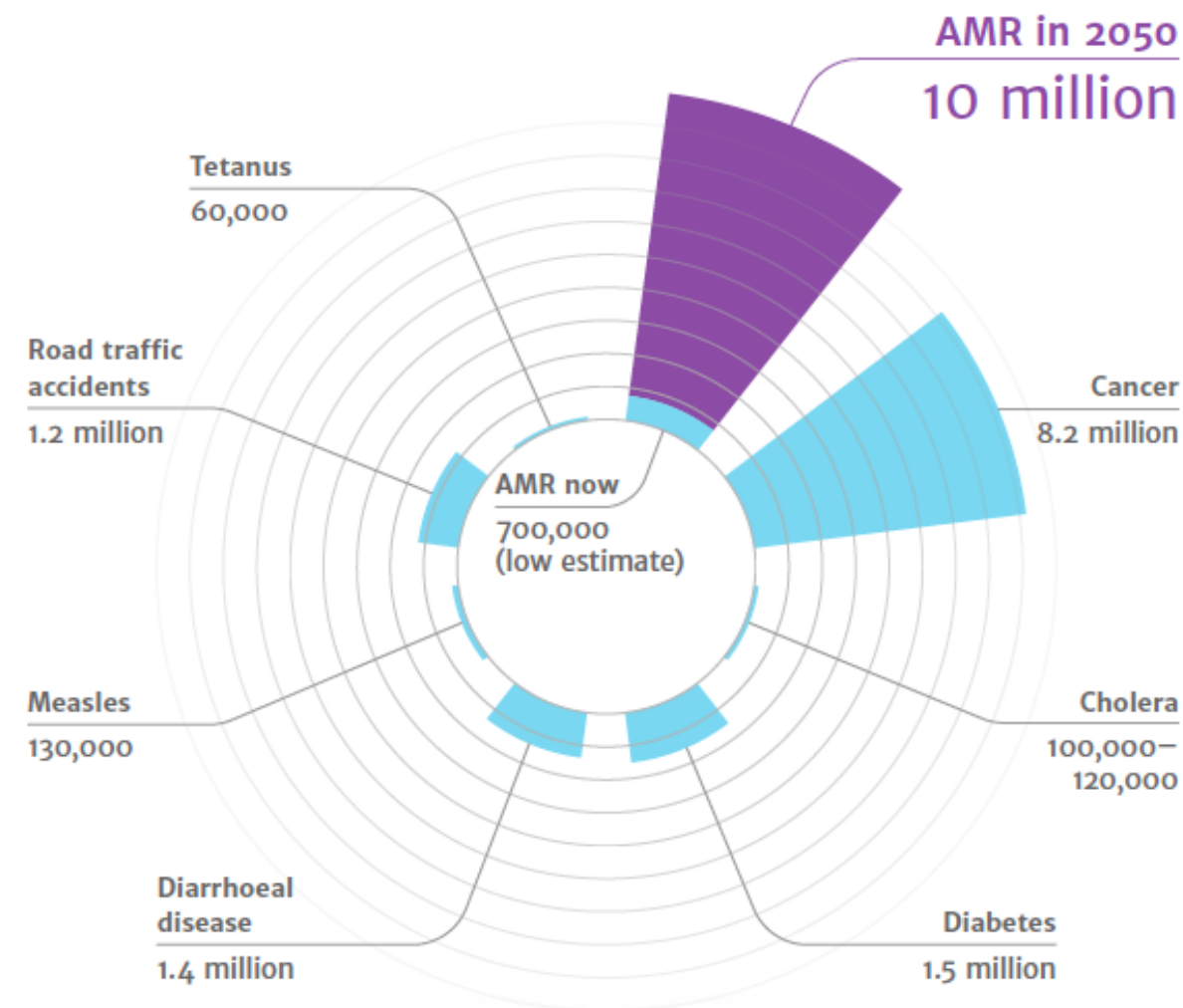
Importanza antibiotici in età pediatrica



Tasso di mortalità per polmonite



DEATHS ATTRIBUTABLE TO AMR EVERY YEAR



AMR: a major European and Global challenge

Extra healthcare costs and productivity losses due to multidrug-resistant bacteria in the EU:
EUR 1.5 billion each year



Selection of antibiotic-resistant pathogens in the community

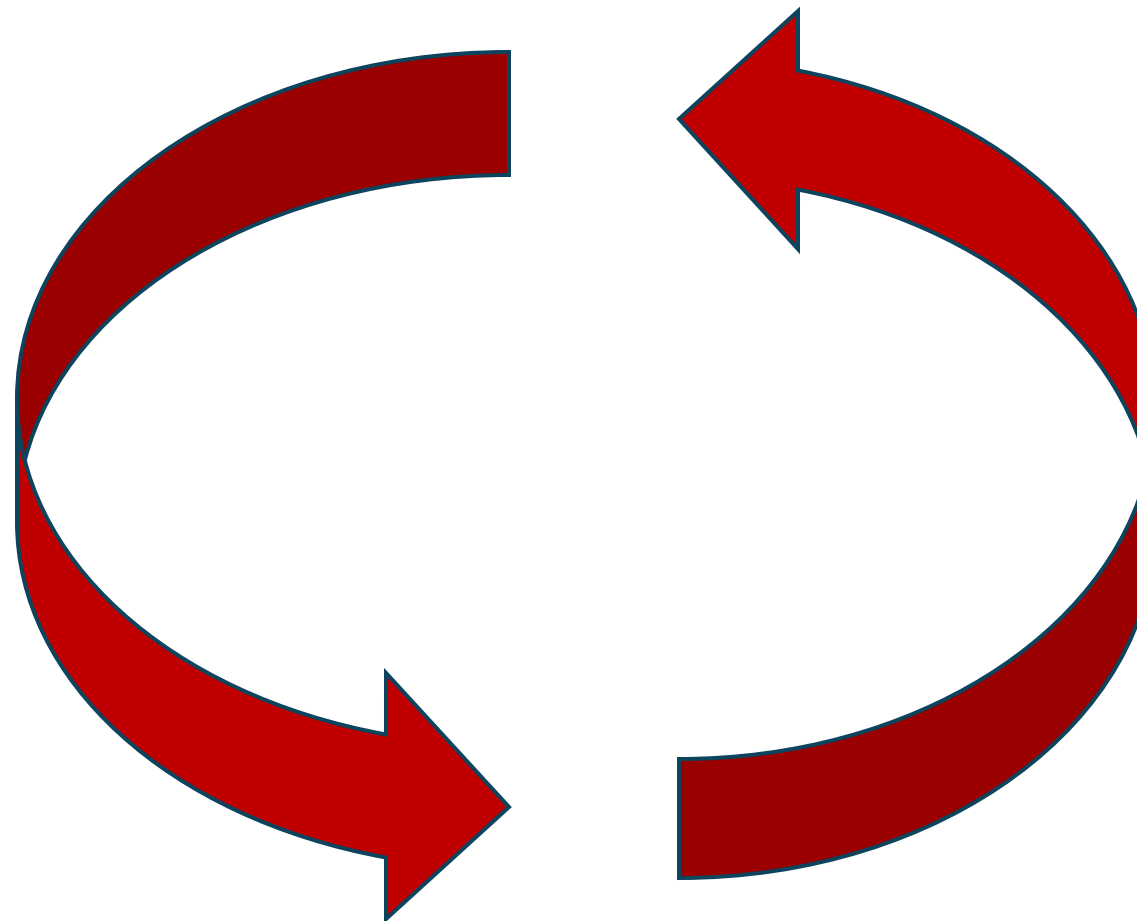
Yagupsky P, Pediatr Infect Dis J 2006;25:974-6

**Selection of
resistant
organisms**

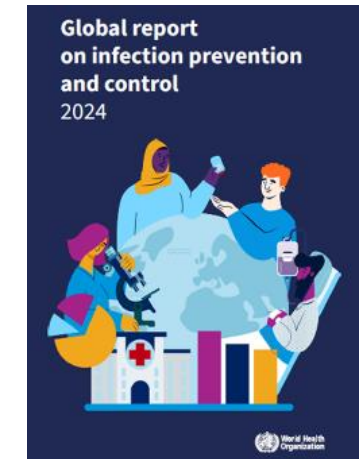
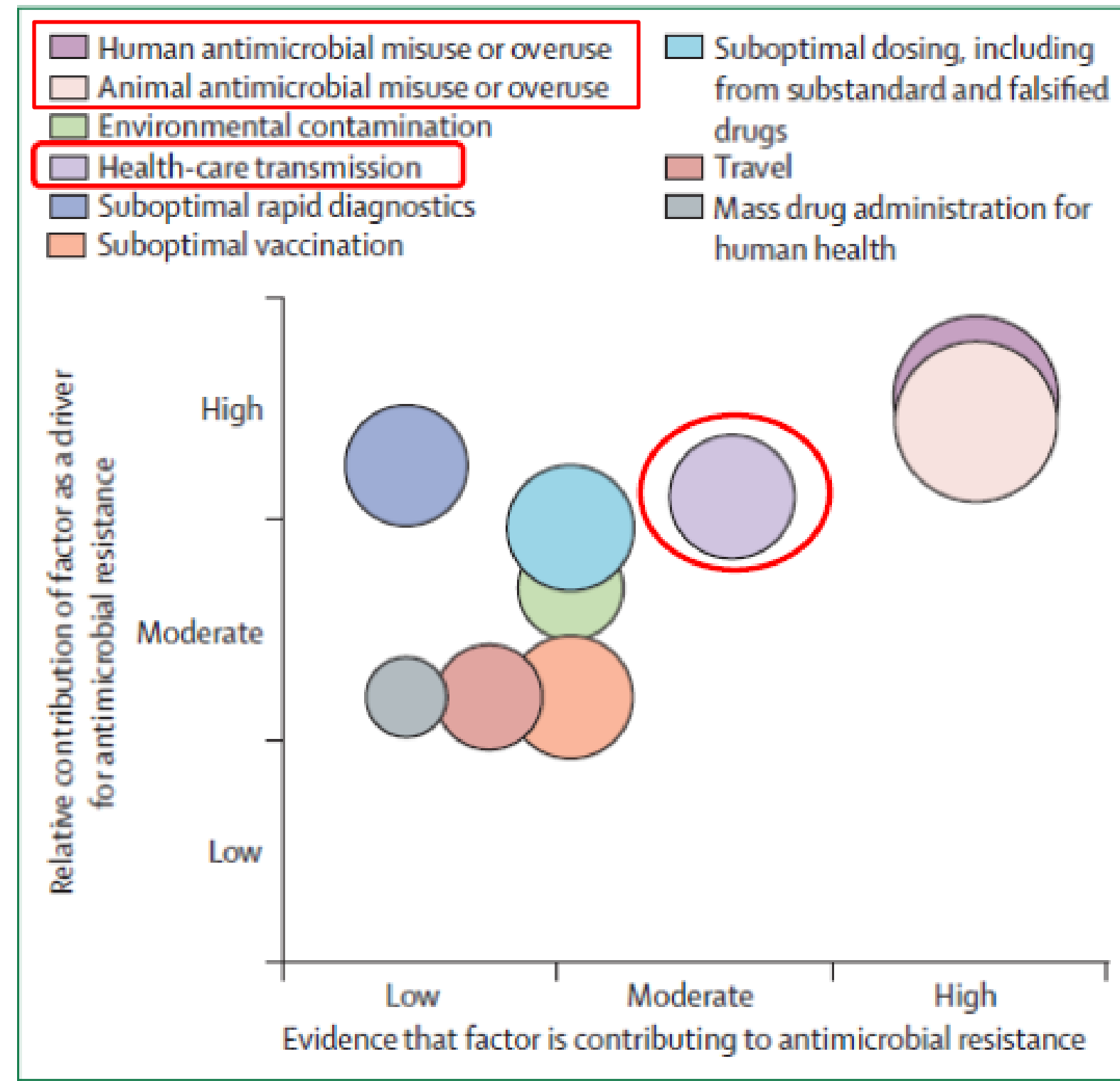
**Antibiotics
overuse**

**Additional
antibiotics
administration**

**Therapeutic
failure**



Fattori contribuenti l'AMR



Holmes HA, et al. Lancet 2016

Non solo un problema dell'età adulta...



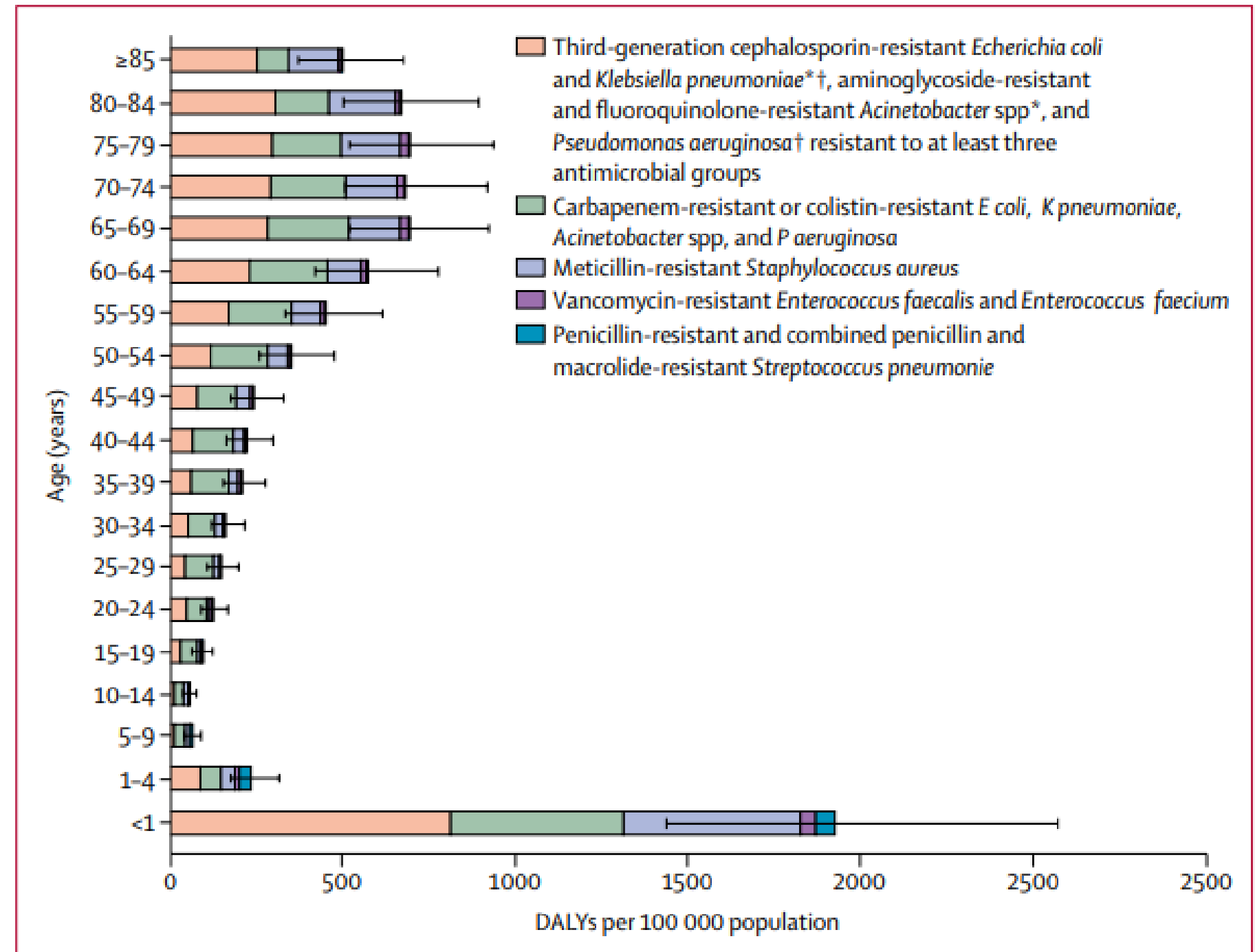
Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis



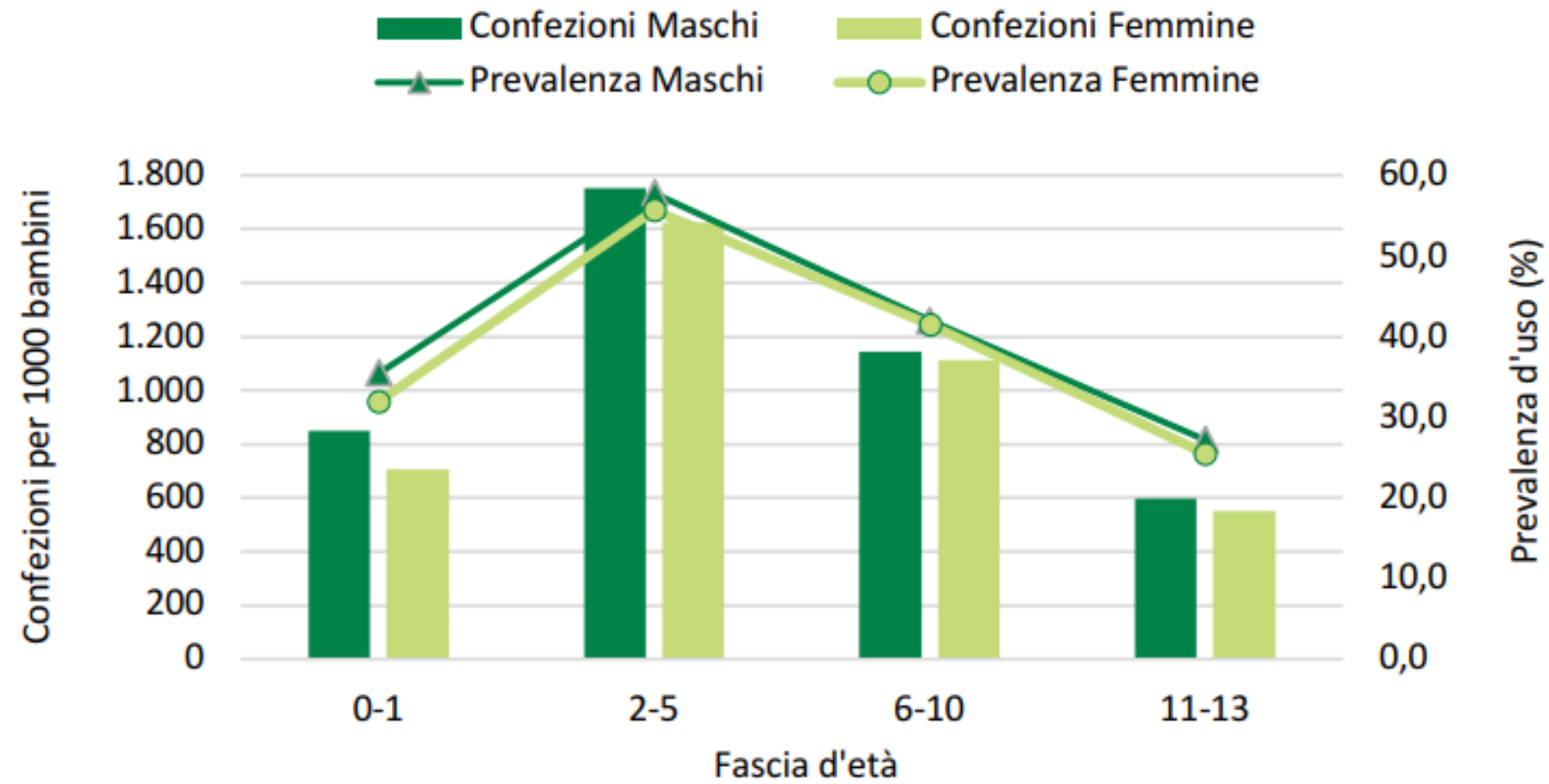
Alessandro Cassini, Liselotte Diaz Högberg, Diamantis Plachouras, Annalisa Quattrocchi, Ana Hoxha, Gunnar Skov Simonsen, Mélanie Colomb-Cotinat, Mirjam E Kretzschmar, Brecht Devleesschauwer, Michele Cecchini, Driss Ait Ouakrim, Tiago Cravo Oliveira, Marc J Struelens, Carl Suetens, Dominique L Monnet, and the Burden of AMR Collaborative Group*



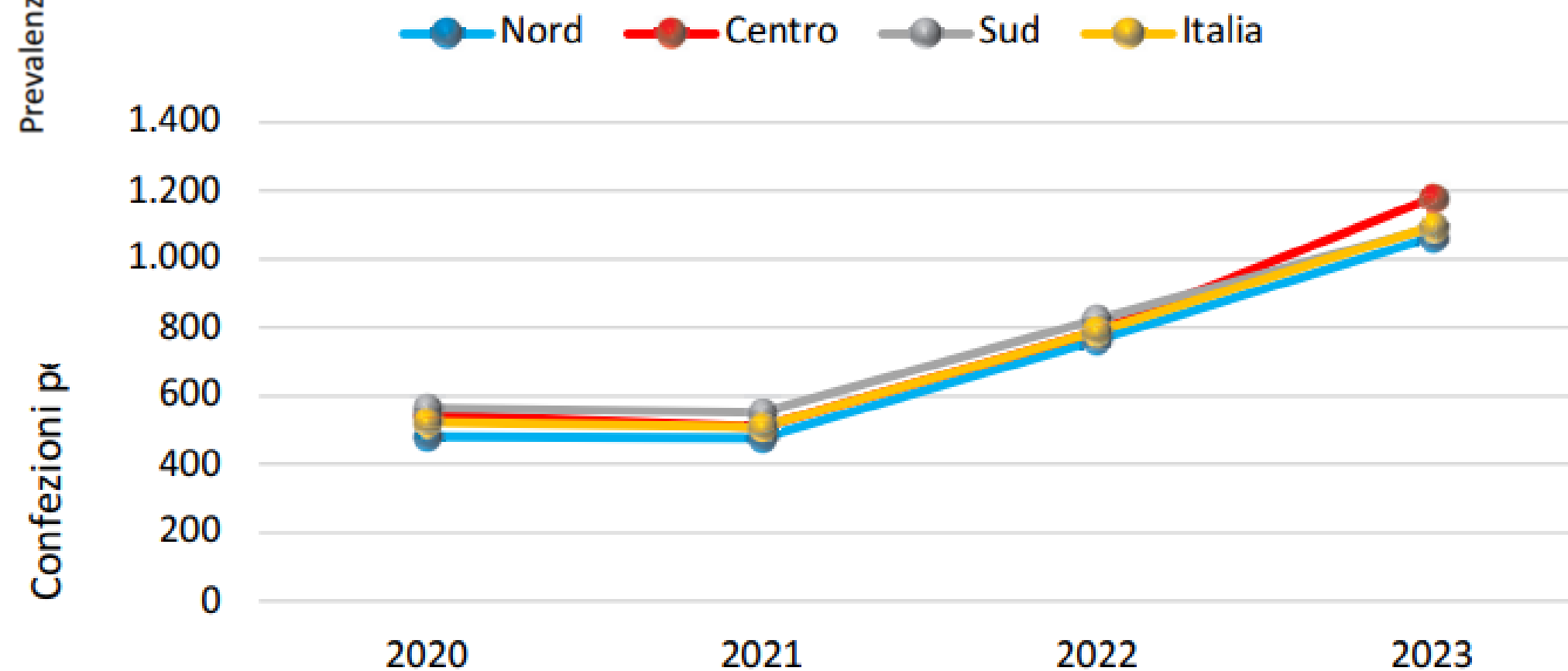
Cassini A, 2019



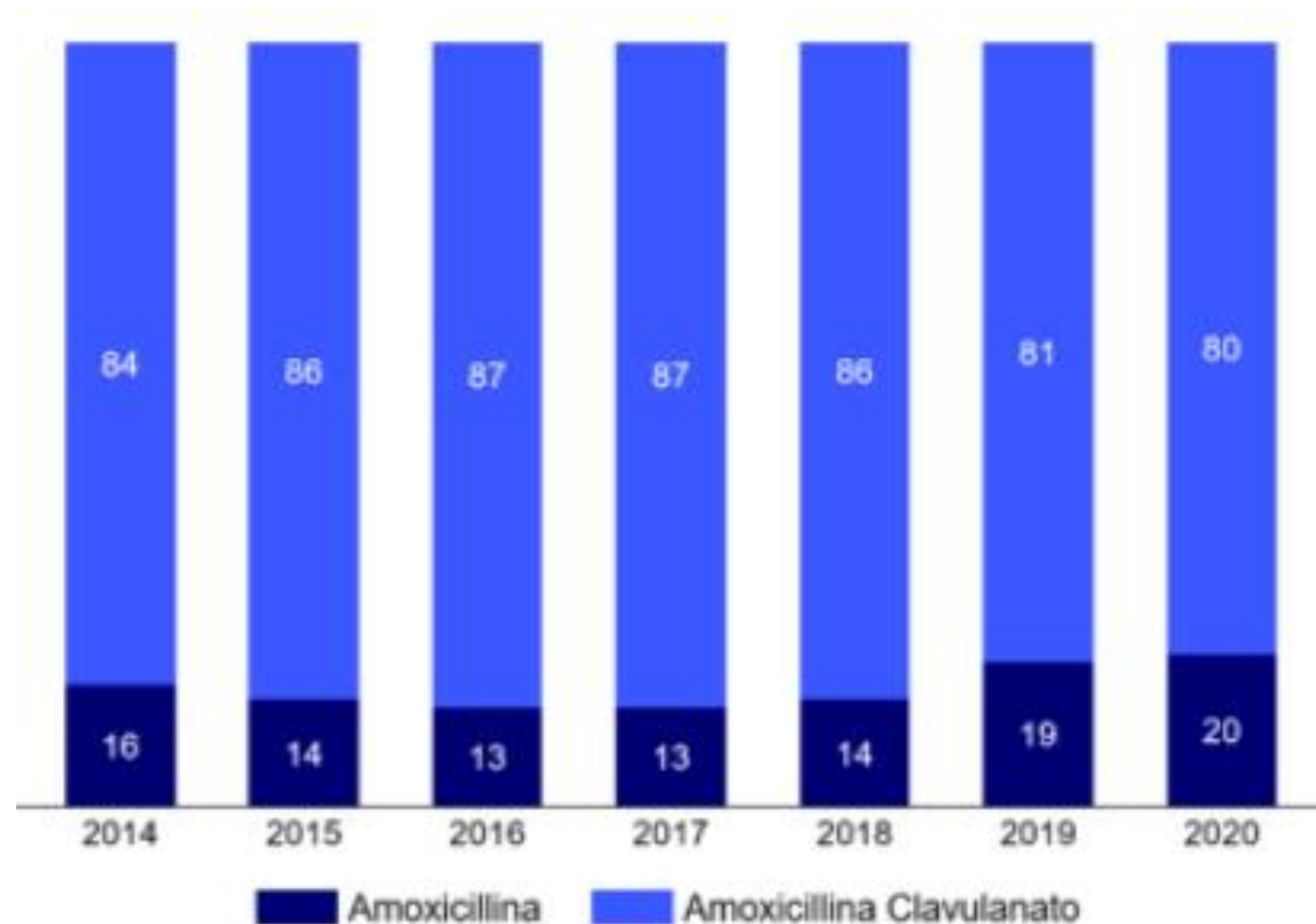
Strategie innovative per la prevenzione delle infezioni correlate all'assistenza in ambito pediatrico



Consumo di antibiotici in Italia



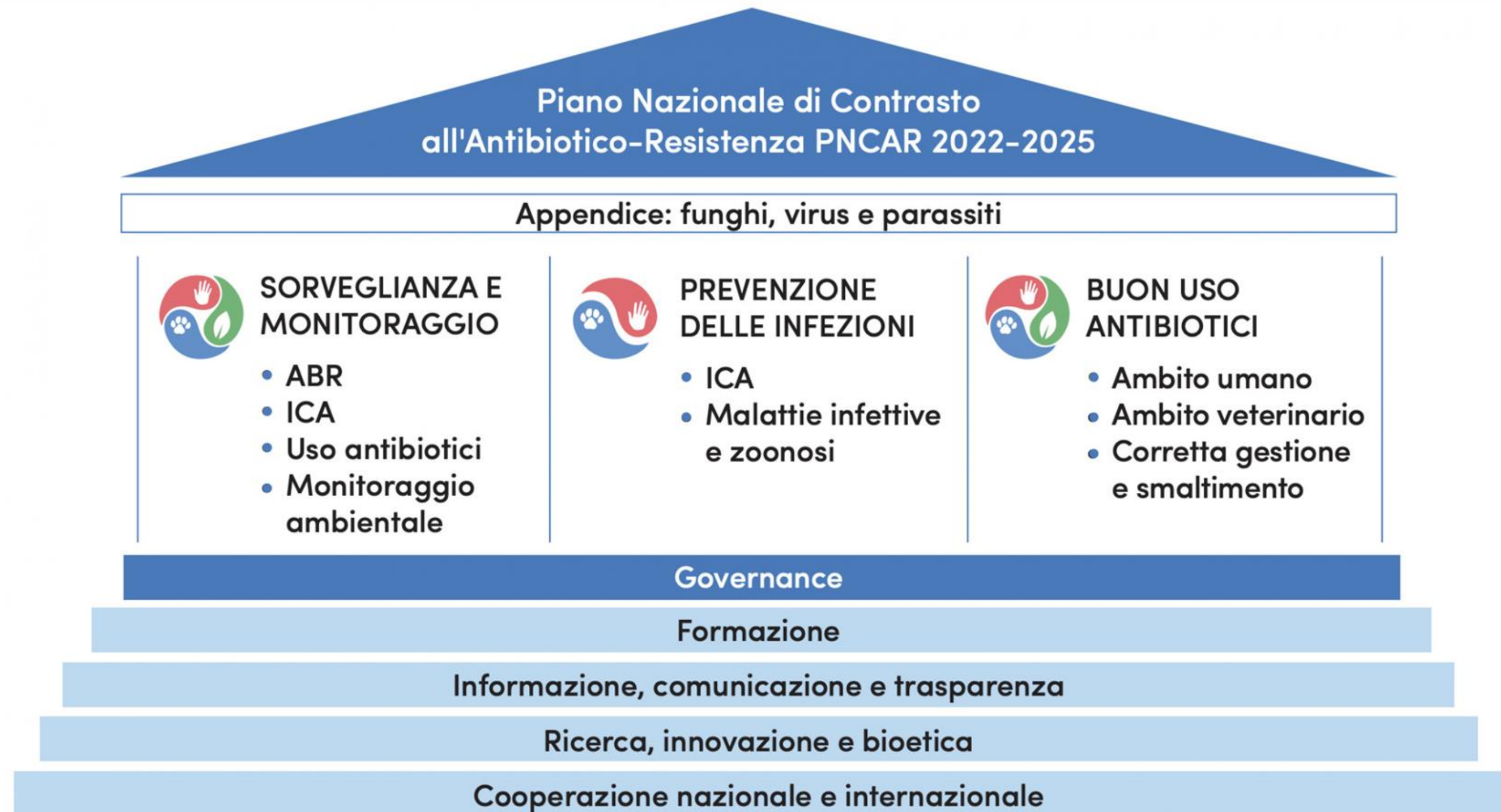
Amoxicillina vs Amoxi/clav



L'utilizzo improprio di amoxicillina/acido clavulanico determina un ampliamento dello spettro di azione non necessario nella gran parte delle patologie infettive per le quali viene prescritta causando un aumento del rischio di fenomeni di antibiotico resistenza e reazione avverse attribuibili alla componente del clavulanato.

	Amoxicillina	Amoxicillina - clavulanato
AV Centro	28	72
AV Nord-Ovest	9	91
AV Sud-Est	20	80

Strategie innovative per la prevenzione delle infezioni correlate all'assistenza in ambito pediatrico



Effects of national antibiotic stewardship and infection control strategies on hospital-associated and community-associated meticillin-resistant *Staphylococcus aureus* infections across a region of Scotland: a non-linear time-series study

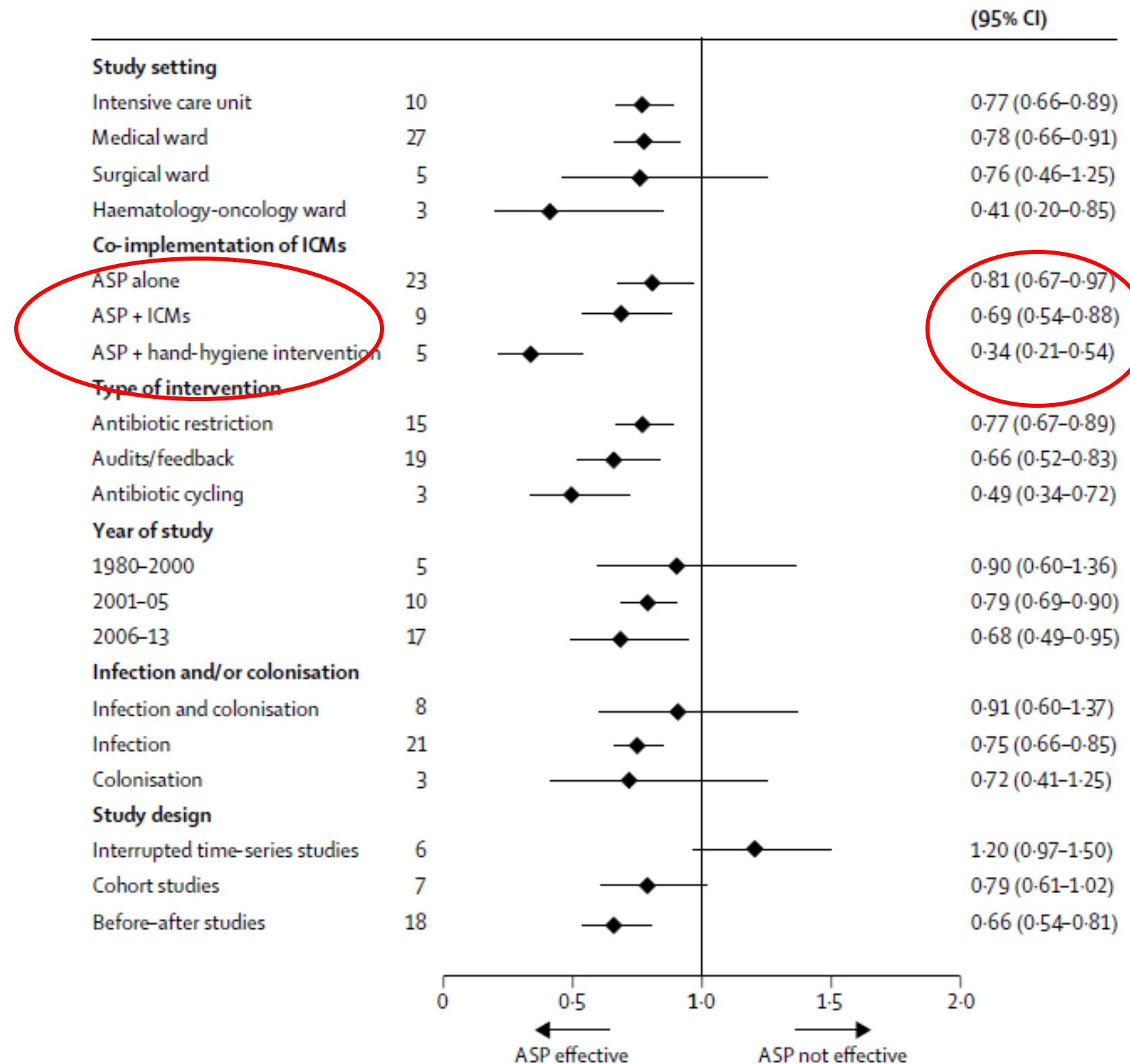
	Without intervention	With intervention	Marginal difference in MRSA prevalence density associated with successive interventions			MRSA cases prevented per year (95% CI)
			Absolute reduction (95% CI)	p value	Relative reduction† (95% CI)	
Hospitals						
Hand hygiene campaign (January, 2007)	1.890	1.500	0.390 (−0.527 to 1.307)	0.448	21% (−27 to 69)	246 (−316 to 822)
Universal screening (August, 2008)	1.417	1.129	0.288 (−0.725 to 1.53)	0.495	20% (−51 to 92)	180 (−444 to 796)
Hospital antibiotic stewardship (May, 2009)	1.091	0.499	0.592 (0.001 to 1.180)	0.049	54% (1 to 100)	355 (1 to 714)
Combined	1.890	0.947	0.943 (0.267 to 1.619)	0.006	50% (14 to 86)	592 (168 to 1017)
Community						
Indirect effects (hospital interventions)*	0.071	0.045	0.026 (0.008 to 0.038)	0.001	32% (11 to 54)	390 (128 to 652)
Primary care antibiotic stewardship (May, 2009)	0.045	0.028	0.017 (0.004 to 0.029)	0.012	37% (9 to 64)	281 (71 to 491)
Combined	0.071	0.038	0.033 (0.018 to 0.048)	<0.0001	47% (25 to 68)	567 (311 to 822)

Lawes T et al, 2015

Effect of antibiotic stewardship on the incidence of infection and colonisation with antibiotic-resistant bacteria and *Clostridium difficile* infection: a systematic review and meta-analysis

THE LANCET
Infectious Diseases

Baur D, et al. Lancet Infect Dis 2017



Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Dellit TH, et al. Clin Infect Dis 2007; 44:159-177*

Stewardship antimicrobica :

Attività che ottimizza il trattamento anti-microbico e contempla scelta del farmaco, dose, via di somministrazione e durata della terapia

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Dellit TH, et al. Clin Infect Dis 2007; 44:159-177*

Stewardship antimicrobica : obiettivo primario

Ottimizzare *l'outcome* clinico riducendo al minimo le possibili conseguenze :

- Tossicità
- Selezione di organismi patogeni (*C. difficile*)
- Insorgenza di resistenze

Infectious Diseases Society of America and the Society for Healthcare
Epidemiology of America guidelines for developing an institutional program to
enhance antimicrobial stewardship. *Dellit TH, et al. Clin Infect Dis 2007; 44:159-177*

Stewardship antimicrobica : obiettivo secondario

Ridurre i costi sanitari senza
inficiare la qualità della cura

Dove è possibile agire?





Educazione...
Non solo gli operatori

Viruses or bacteria
What caused your infection?

Infection	Most people get better by	Common cause			Are antibiotics recommended?
		Virus	Virus or bacteria	Bacteria	
COVID-19	1-3 weeks	✓			NO
Common cold	1-2 weeks	✓			NO
Flu	2-3 weeks	✓			NO
Laryngitis	1 week	✓			NO
Tonsillitis / Pharyngitis	1 week	✓			NO
Acute bronchitis	3 weeks	✓			NO
Sinusitis	2 weeks		✓		SOMETIMES
Sore throat	1 week		✓		SOMETIMES
Ear infection	1 week		✓		SOMETIMES
Exacerbation of COPD	1-2 weeks		✓		SOMETIMES
Pneumonia	1-2 weeks			✓	YES
Urinary tract infection	2-3 days			✓	YES

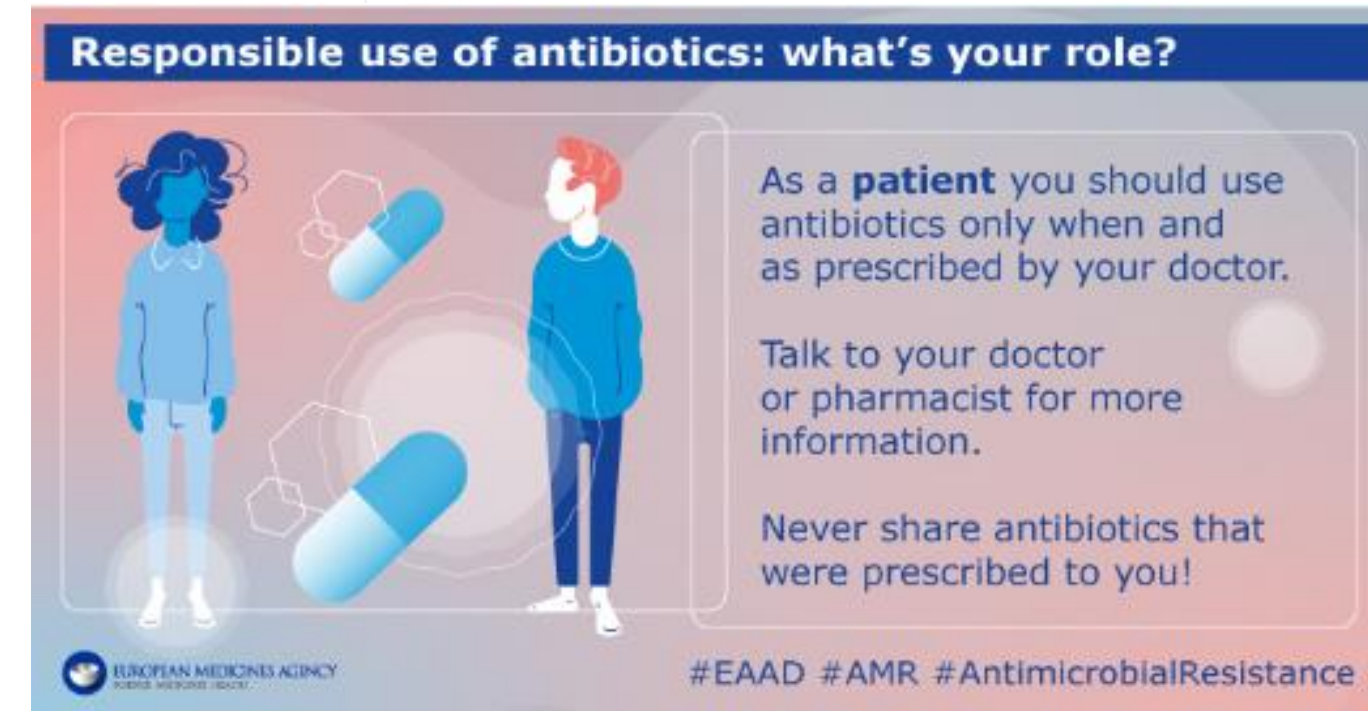
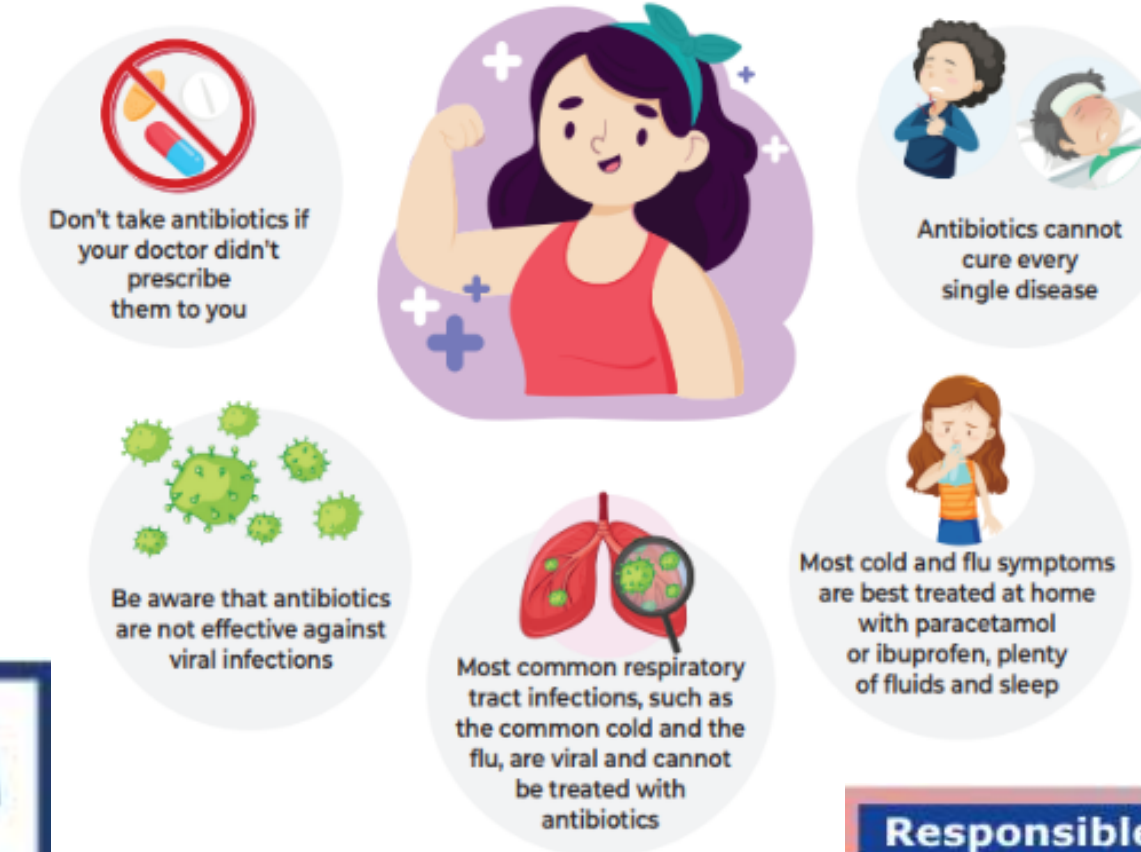
Antibiotics are only needed to treat certain infections caused by bacteria. Viral infections should not be treated with antibiotics. Use of antibiotics can lead to antimicrobial resistance. This means that antibiotics become ineffective and infections become increasingly difficult to treat.

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Strategie innovative per la prevenzione delle infezioni correlate all'assistenza in ambito pediatrico

HAPPY  **PATIENT**

HOW CAN YOU FIGHT IT?



Interventi sulla terapia antibiotica

Regola delle «5 D»

- Right diagnosis
- Right drug
- Right dose (route of administration)
- Right duration
- (De-escalation)

Interventi sulla terapia antibiotica

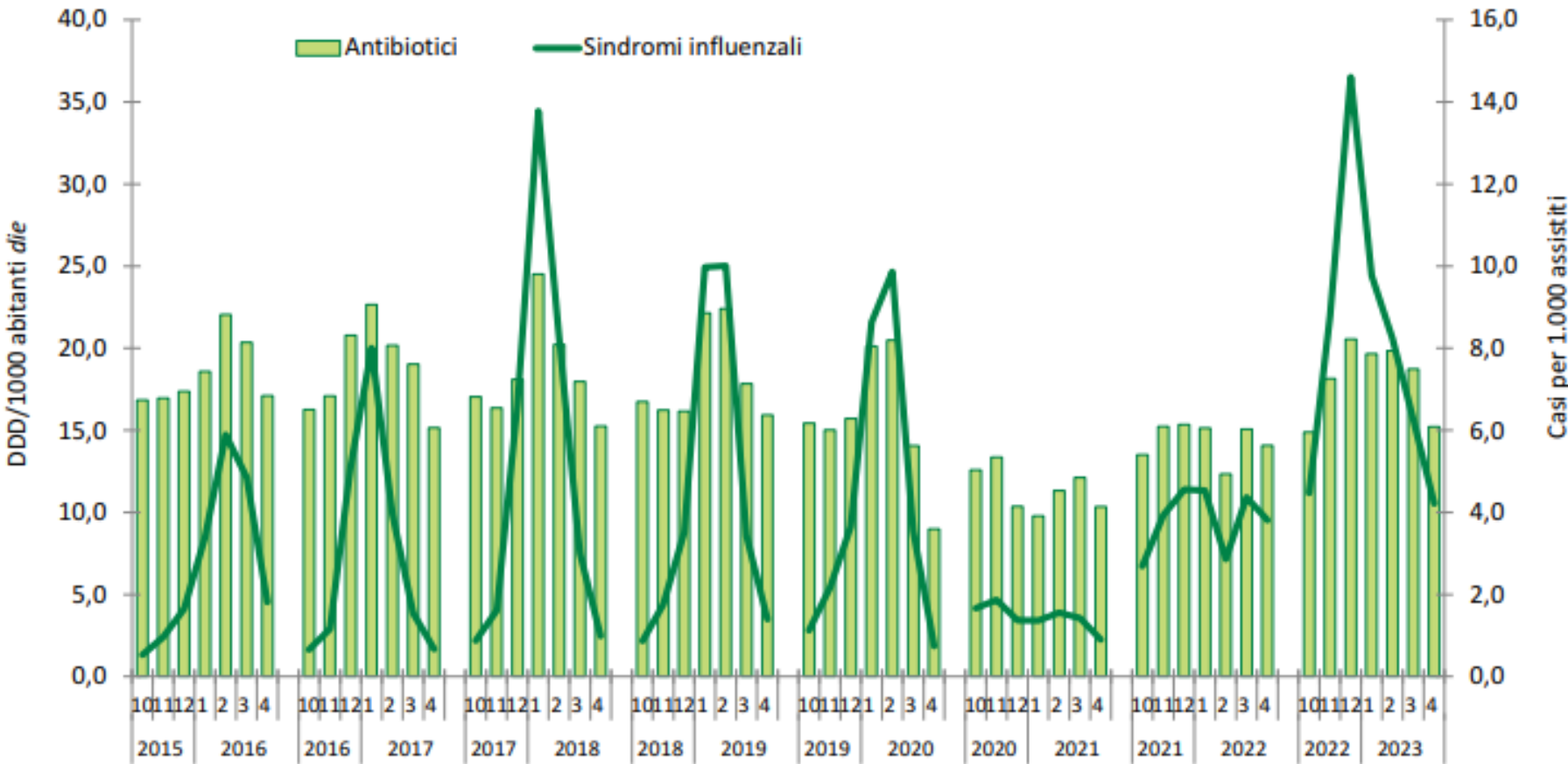
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Trattare solo le vere
infezioni batteriche

Interventi sulla terapia antibiotica

Disease	Cases (n)	Antibiotic prescriptions (n)	Prescriptions (%)	Fever (%)
Rhinitis	219	7	3.2	27.9
Sinusitis	21	5	23.8	23.8
Non-group A streptococcal pharyngitis	78	20	25.6	70.5
Group A streptococcal pharyngitis	32	32	100	65.6
Otitis media	102	74	72.5	46.1
Laryngitis	41	6	14.6	39
Bronchitis	167	93	55.7	67.3
Bronchiolitis	10	1	10	40
Pneumonia	8	8	100	37.5
Total	678	246	36.3	41.3



Picca M, 2023

Pediatric Infectious Diseases and Medical Microbiology



1. Don't routinely use antibiotics other than amoxicillin in the treatment of children with presumed community-acquired pneumonia (in the outpatient setting).
2. **Don't use a bag** for collection of **urine cultures** to diagnose urinary tract infections
3. **Don't routinely collect** or process specimens for **Clostridium difficile** testing in **infants less than one year** of age with diarrhea.
4. Don't routinely treat uncomplicated acute hematogenous osteomyelitis with prolonged intravenous therapy.



Raccomandazioni pediatriche



- 1. Non prescrivere** antibiotici nelle **patologie acute delle vie respiratorie** presumibilmente virali in età pediatrica (otiti, sinusiti, faringiti, bronchiti)
- 2. Non somministrare** terapia antibiotica ai bambini con **faringotonsillite** acuta **in assenza di conferma microbiologica** di infezione da Streptococcus pyogenes a seguito di test rapido o esame colturale.
- 3. Non fare diagnosi di Infezione delle Vie Urinarie** in base al solo **esame colturale** delle urine.
- 4. Non eseguire la profilassi antibiotica** peri-operatoria quando questa non sia **necessaria**.
- 5. Non superare le 24 ore di profilassi antibiotica** dopo la chirurgia, la durata della profilassi dovrebbe essere la più breve possibile.

Interventi sulla terapia antibiotica

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Principali infezioni in età pediatrica



Management of Acute Pharyngitis in Children: Summary of the Italian National Institute of Health Guidelines

Amoxicillina



Updated Guidelines for the Management of Acute Otitis Media in Children by the Italian Society of Pediatrics

NON COMPLICATE

Amoxicillina

Marchisio P, Galli L, Chiappini E Pediatr Infect Dis J. 2019

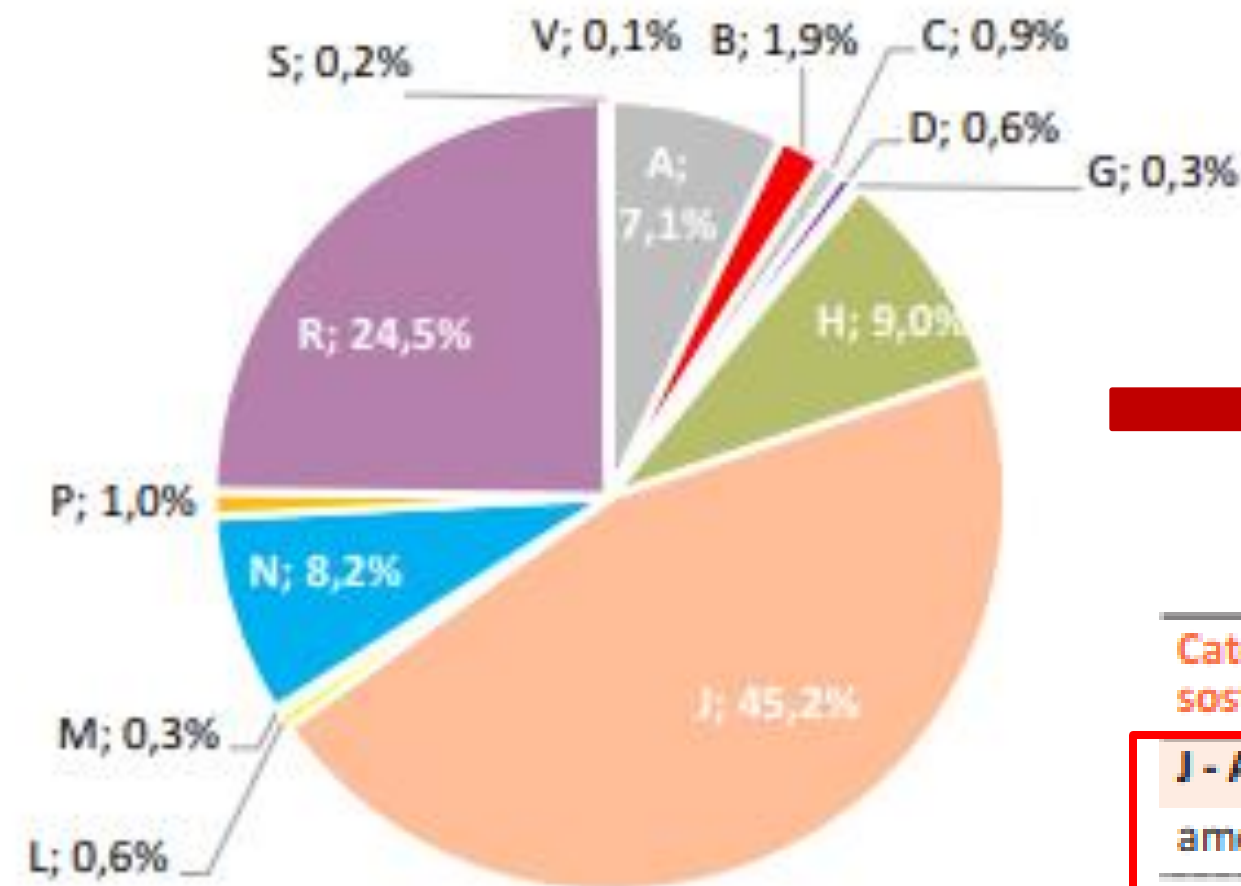


British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011

Amoxicillina

The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America 

Utilizzo dei farmaci in età pediatrica



Categoria terapeutica/ sostanza	Confezioni (per 1000 bambini)	Δ % 23-22	Δ % 22-21	Prevalenza (per 1000 bambini)	Rapp M/F
J - Antinfettivi per uso sistemico	977,3	29,9	53,3	482,0	1,1
amoxicillina/acido clavulanico	409,7	45,4	57,3	210,4	1,1
amoxicillina	149,8	27,7	67,6	72,5	1,1
cefixima	123,3	36,1	69,7	79,3	1,1
azitromicina	100,2	8,7	28,9	66,2	1,1

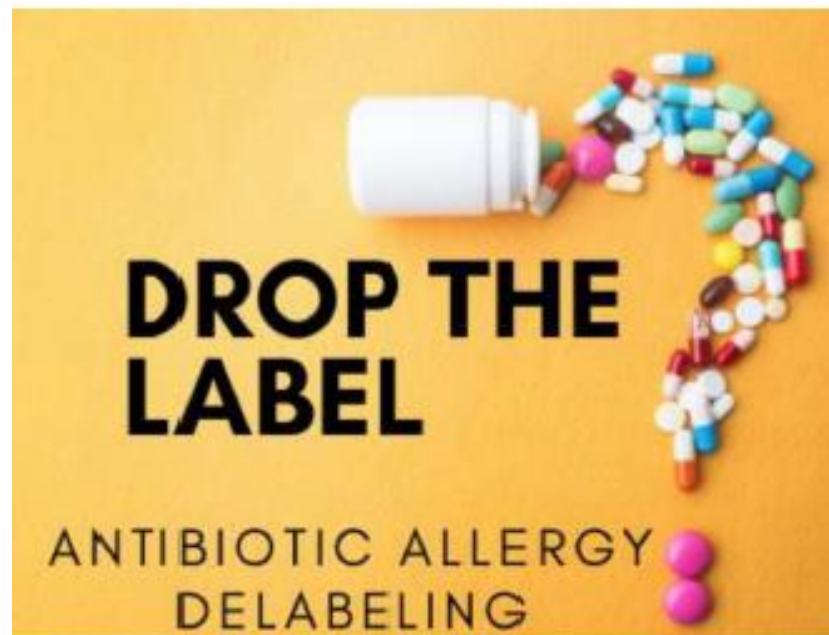
The Impact of Clinical Pathways on Antibiotic Prescribing for Acute Otitis Media and Pharyngitis in the Emergency Department

	ACUTE OTITIS MEDIA (AOM)					GAS PHARYNGITIS				
	Pre-intervention period		Post-intervention period		p value	Pre-intervention period		Post-intervention period		p value
	n	%	n	%		n	%	n	%	
Patients included	295		278			298		366		
TREATMENT										
“Wait and see” for AOM or no antibiotic treatment for GAS pharyngitis	64	21.7	92	33.1	p<0.01	147	49.3	200	54.6	p=0.17
Antibiotic therapy	231	78.3	186	66.9	p<0.01	151	50.7	166	45.4	p=0.17
TYPE OF ANTIBIOTICS										
Amoxicillin	74	32.0	96	51.6	p<0.001	81	53.6	155	93.4	p<0.001
Broad spectrum (amoxi-clavulanate +cephalosporins+ macrolides)	157	68.0	90	48.4	p<0.001	70	46.4	11	6.6	p<0.001
Amoxicillin-clavulanate	106	45.9	70	37.6	p=0.09	60	39.7	5	3.0	p<0.001
Cephalosporins	47	20.3	16	8.6	p<0.001	10	6.6	6	3.6	p=0.28
Macrolides	4	1.7	4	2.2	p=0.76	-	-	-	-	-

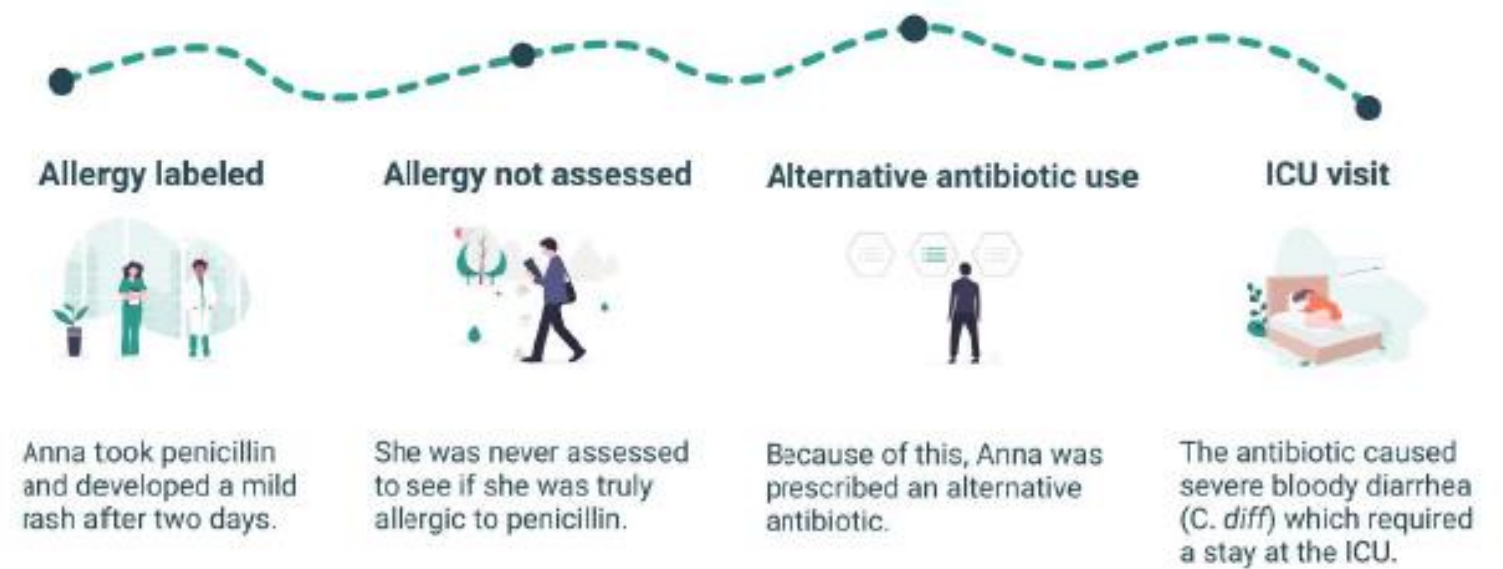
Donà D, et al. 2018

Il de-labeling dell'allergia ai beta-lattamici

Because most **antibiotic allergy labels** acquired in **childhood** are carried into adulthood, the overlabeling of antibiotic allergy is a liability that leads to unnecessary long-term **health care risks, costs, and antibiotic resistance.**



Harms of false penicillin allergy labels: *Meet Anna*



Anna was never allergic to penicillin, her ICU visit could have been prevented.

<https://www.dropthelabel.ca>

Norton AE, et al. Pediatrics 2018

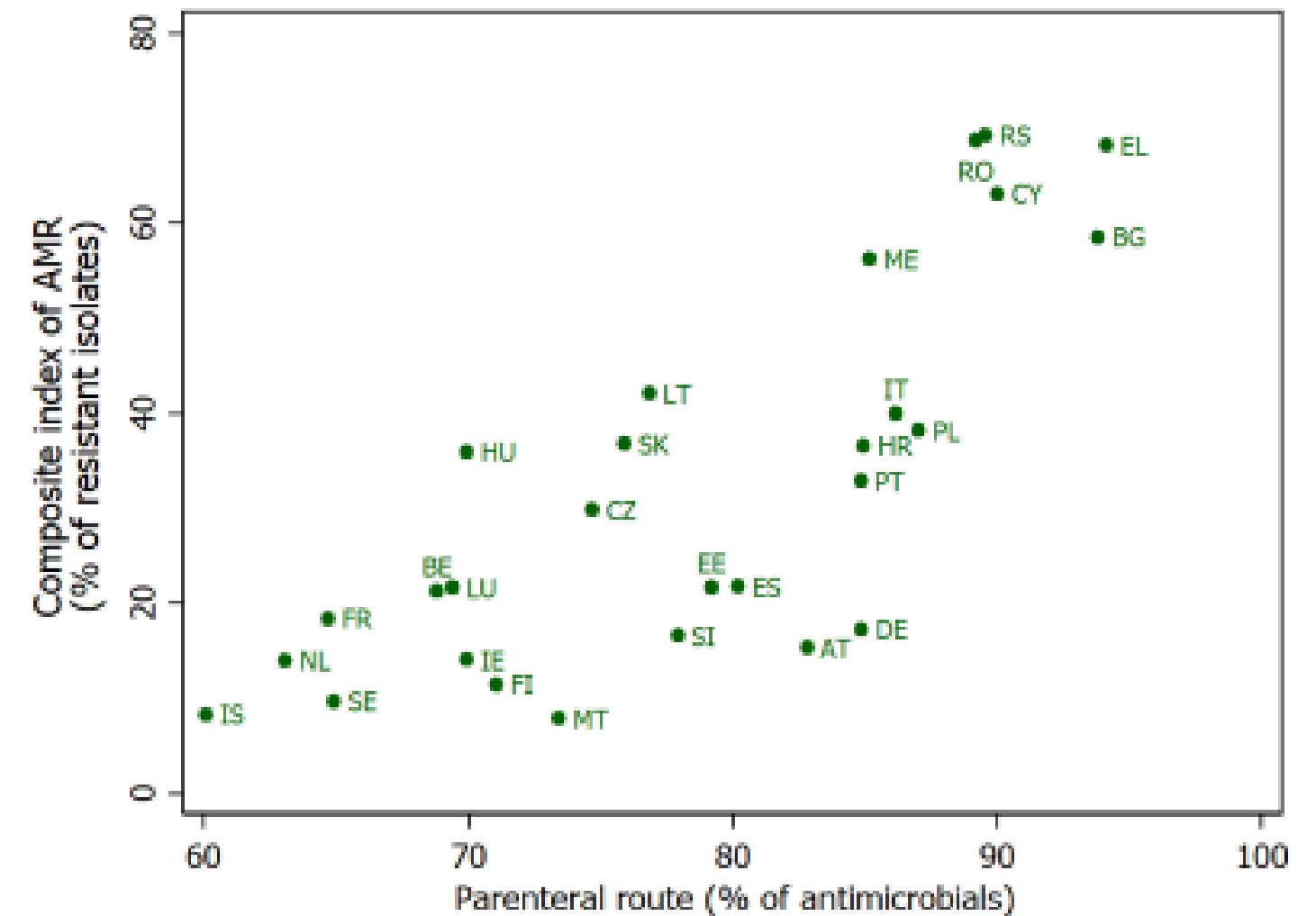
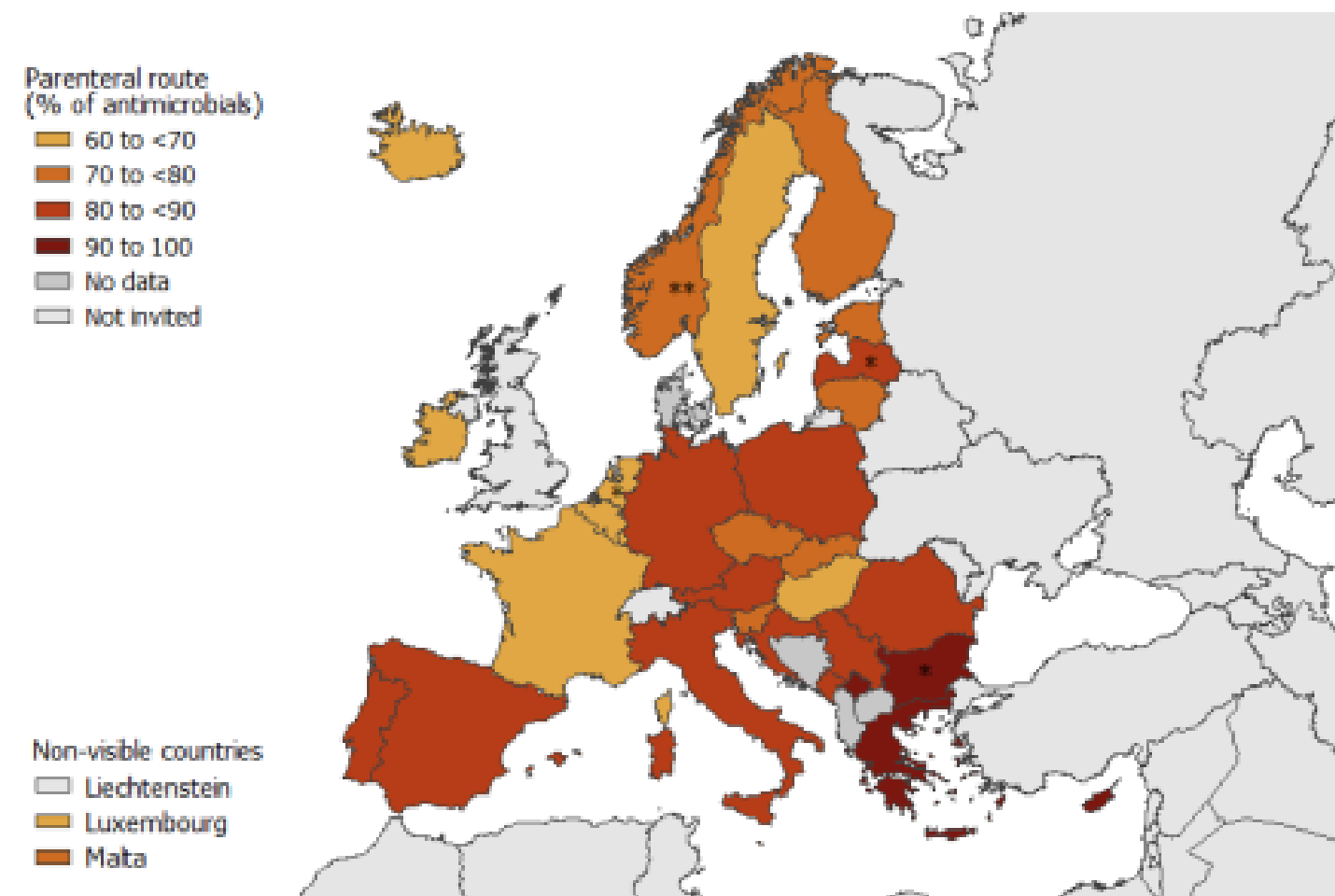
Interventi sulla terapia antibiotica

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- Right duration
- (De-escalation)

La % di antibiotici prescritti per via parenterale correla fortemente con il composite index of AMR ($p > 0.001$)

Figure 61. Percentage of antimicrobials for which the route of administration was parenteral, ECDC PPS 2022–2023



ECDC, 2023

Strategie innovative per la prevenzione delle infezioni correlate all'assistenza in ambito pediatrico

**Antibiotici adatti allo switch per os
(biodisponibilità > 90%)**

Amoxi-clav, Cefalexina, Clindamicina, TMP-SMX, metronidazolo, fluconazolo



Rivalutare dopo 48 ore dall'inizio della terapia antibiotica

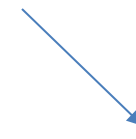
- Clinicamente stabile (apiretico, indici di flogosi in calo, parametri vitali stabili)
- Capace di assumere farmaci per os

Si



**Passaggio a
terapia orale**

No



**Rivaluta ogni
24 ore**

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Effectiveness and safety of modified fully oral 9-month
treatment regimens for rifampicin-resistant tuberculosis
a prospective cohort study



Lancet Infect Dis 2024;
24: 1151-61

JAMA Pediatrics | [Original Investigation](#)

Short-Course Therapy for Urinary Tract Infections in Children The SCOUT Randomized Clinical Trial

JAMA Pediatr. 2023;177(8):782-789.

Theoklis Zaoutis, MD; Nader Shaikh, MD; Brian T. Fisher, DO; Susan E. Coffin, MD; Sonika Bhatnagar, MD;
Kevin J. Downes, MD; Jeffrey S. Gerber, MD; Timothy R. Shope, MD; Judith M. Martin, MD; Gysella B. Muniz, MD;
Michael Green, MD; Jennifer P. Nagg, RN; Sage R. Myers, MD; Rakesh D. Mistry, MD; Shawn O'Connor, BS;
Walter Faig, PhD; Stephen Black, MS; Elizabeth Rowley, PhD; Kellie Liston, BA; Alejandro Hoberman, MD

JAMA Pediatrics | [Original Investigation](#)

Short-Course vs Long-Course Antibiotic Therapy for Children With Nonsevere Community-Acquired Pneumonia A Systematic Review and Meta-analysis

JAMA Pediatr. 2022;176(12):1199-120

Short Oral Antibiotic Therapy for Pediatric Febrile Urinary Tract Infections: A Randomized Trial

Giovanni Montini, MD,^{a,b} Antimo Tessitore, MD,^c Karen Console, MD,^c Luca Ronfani, MD,^d Egidio Barbi, MD,^{e,f}
Marco Pennesi, MD,^g on behalf of the STOP Trial Group

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

MARCH 10, 2022

VOL. 386 NO. 10

Shorter Treatment for Nonsevere Tuberculosis in African and Indian Children

A. Turkova, G.H. Wills, E. Wobudeya, C. Chabala, M. Palmer, A. Kinikar, S. Hissar, L. Choo, P. Musoke, V. Mulenga,
V. Mave, B. Joseph, K. LeBeau, M.J. Thomason, R.B. Mboizi, M. Kapasa, M.M. van der Zalm, P. Raichur,
P.K. Bhavani, H. McIlleron, A.-M. Demers, R. Aarnoutse, J. Love-Koh, J.A. Seddon, S.B. Welch, S.M. Graham,
A.C. Hesselning, D.M. Gibb, and A.M. Crook, for the SHINE Trial Team*

Pediatric Infectious Diseases and Medical Microbiology



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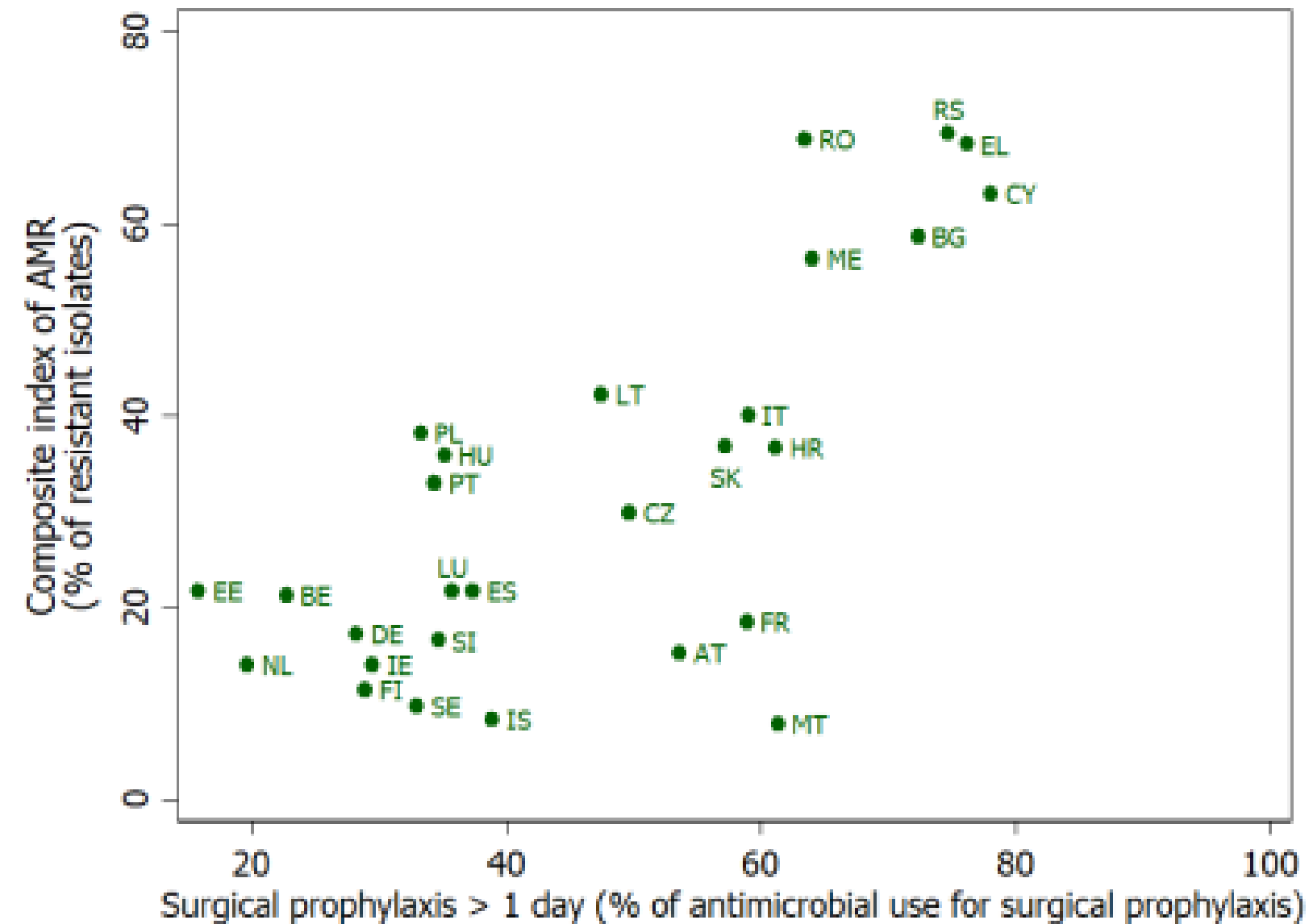
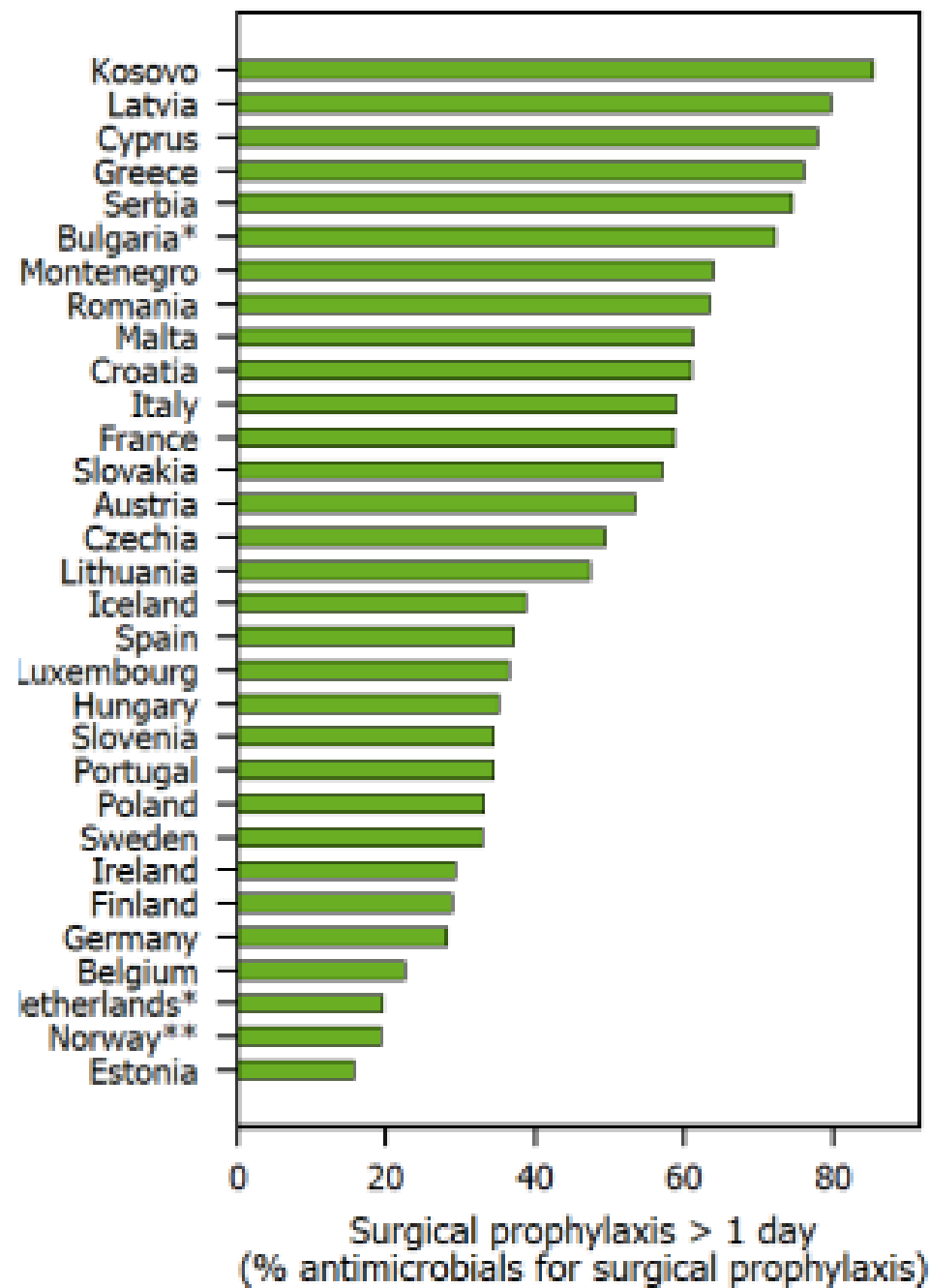


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La % di profilassi perioperatoria > 1 giorno correla fortemente con il composite index of AMR ($p > 0.001$)

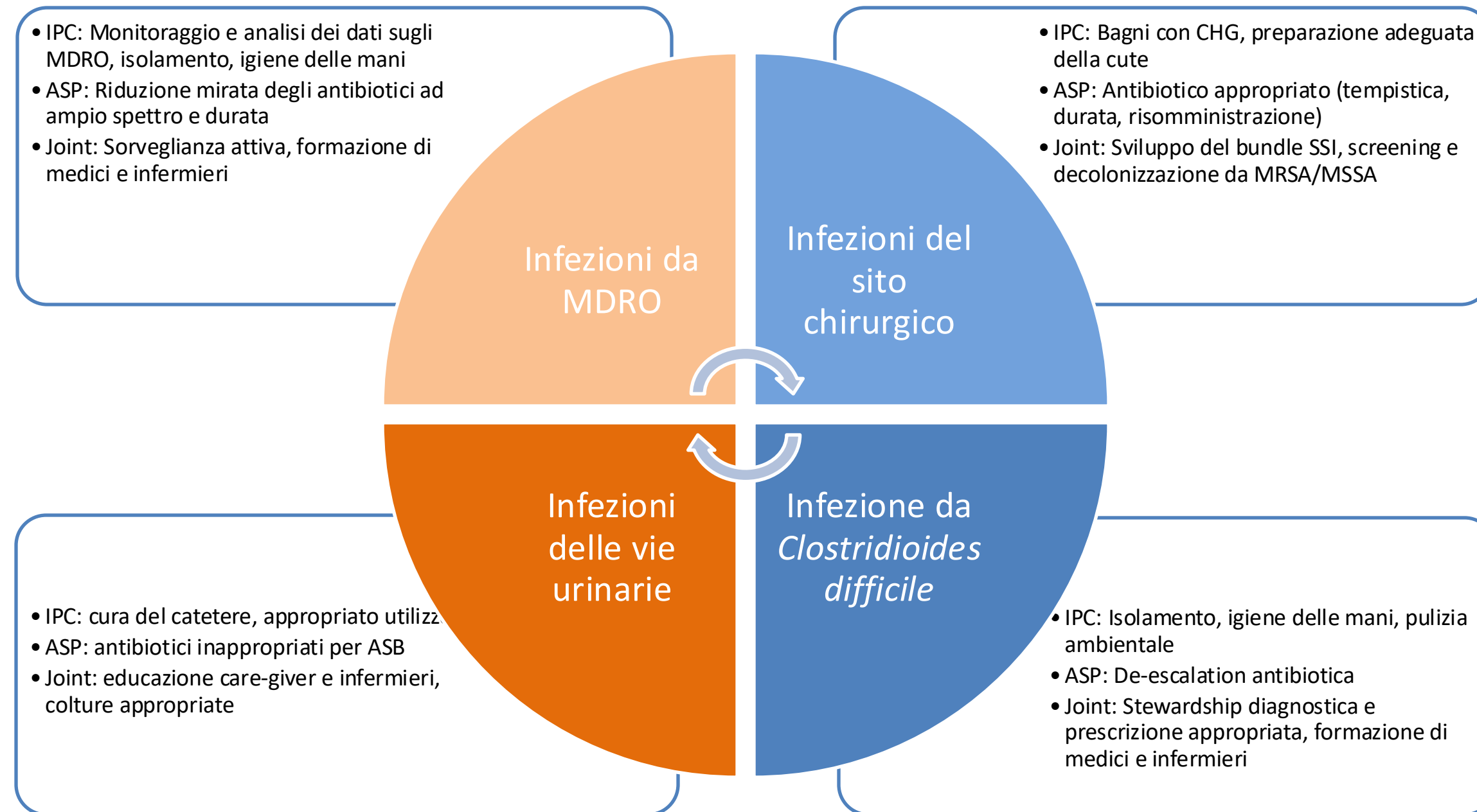


ECDC, 2023

Cosa facciamo noi?

- Monitoraggio consumo di antibiotici in termini di DDD e DOT
- Monitoraggio dei microrganismi multiresistenti
- Monitoraggio del Clostridioides difficile
- Sistema di pre-autorizzazione (carbapenemi, teicoplanina e tutti i farmaci Reserve)
- Rivalutazione delle prescrizioni antibiotiche (appropriatezza, dose, interazioni, passaggio dalla terapia endovenosa a orale e durata)
- Redazione, diffusione e monitoraggio protocolli sulla terapia antibiotica (sepsi, IVU, Osteomieliti/Artriti, polmoniti, faringiti, profilassi perioperatoria)
- Formazione degli operatori
- Educazione di pazienti e famiglie

Dove agire assieme all'IPC?



Strategie innovative per la prevenzione delle infezioni correlate all'assistenza in ambito pediatrico



12 aprile 2025 Meyer Health Campus Firenze