UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO
Dipartimento di Medicina Veterinaria

Antimicrobico-resistenza: la prospettiva *One health* come unica via di fuga

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VET MARE 2025
ONE HEALTH: SFIDE E OPPORTUNITÀ PER UN FUTURO SOSTENIBILE
Otranto, 1 luglio 2025

PREMESSA

- **Antibiotici: arma fondamentale per combattere le malattie infettive ad eziologia batterica**

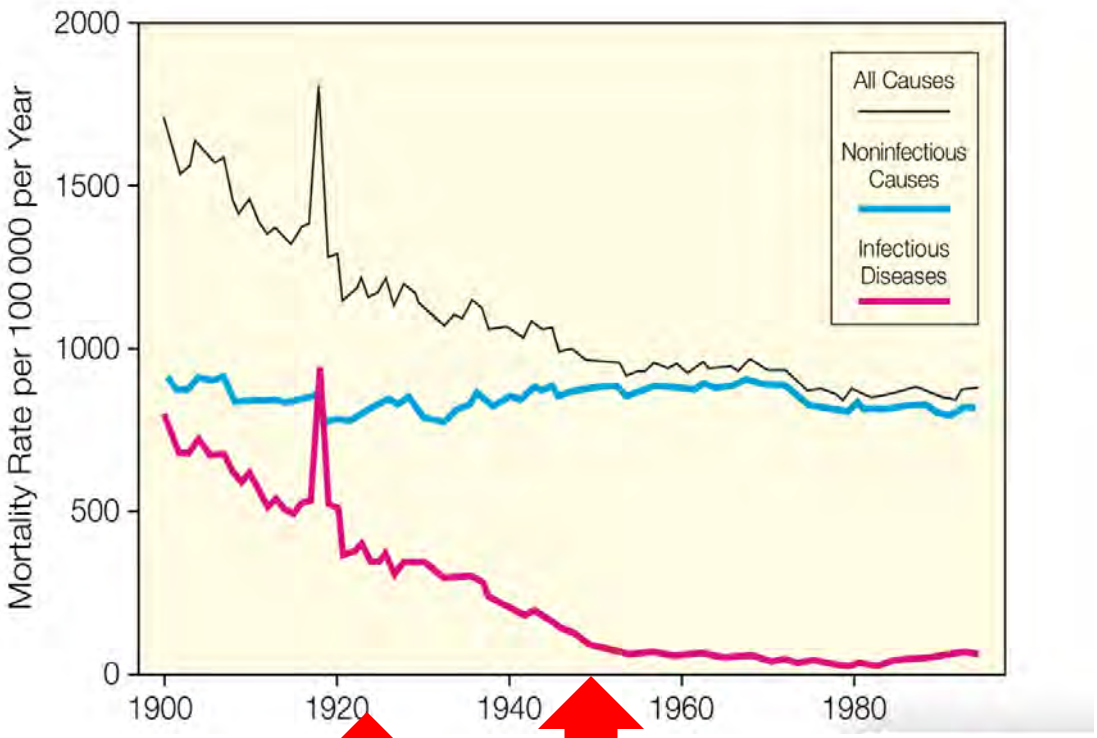
Decremento della mortalità

- **Batteri: nel corso del tempo hanno attivato svariati meccanismi di antibiotico-resistenza, sminuendo l'efficacia di diversi principi attivi**

Infezioni da superbugs*: possono essere mortali!

*** Es: *Methicillin resistant S. aureus*, Extended beta-lactamase producers, e altri**

DECREMENTO MORTALITÀ



Tasso di mortalità da malattie infettive negli Stati Uniti, paragonato ad altre malattie. In ascissa il tempo (indicato in anni). Fonte: Armstrong et al, 1999, mod.

Scoperta antibiotici

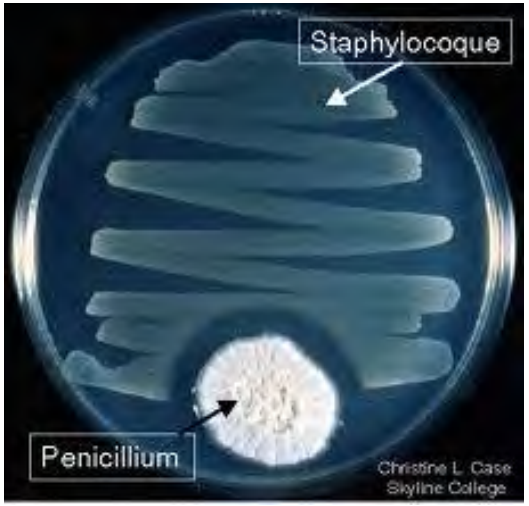
vaccinazioni, miglioramento condizioni igieniche e di nutrizione, ecc.

Antibiotici, chemioterapici, antimicrobici..??

Spesso nel linguaggio comune, scientifico e non, il termine ***antibiotico*** *viene utilizzato per indicare tutti i farmaci ad azione antibatterica. In base alla distinzione succitata, esso dovrebbe essere utilizzato solo per i prodotti di origine naturale, mentre quando si parla dei farmaci ad attività antibatterica in generale, dovrebbero essere definiti "****antimicrobici****". Di conseguenza, anche* ***l'antibiotico-resistenza*** *dovrebbe essere chiamata in altro modo. Nel linguaggio anglosassone, si parla di* ***drug resistance****, o* ***antimicrobial resistance****; in italiano si può ritrovare il termine* ***chemioresistenza****, che però può indurre a confusione (i chemioterapici sono farmaci antitumorali!). Quindi nel testo della lezione si preferisce usare il termine antibiotico nell'accezione più ampia, e conseguentemente il termine* ***antibiotico-resistenza.***

ANTIBIOTICO-RESISTENZA: di chi è la colpa?

FENOMENO NATURALE, CHE RIENTRA NEL CICLO BIOLOGICO DEI MICRORGANISMI (batteri, funghi)



LO SVILUPPO DELL'ANTIBIOTICO-RESISTENZA HA SUBITO UNA FORTE ACCELERAZIONE IN SEGUITO ALL'USO CLINICO (E NON SOLO!) DEGLI ANTIBIOTICI

MALATTIE INFETTIVE DELL'UOMO
AMBITO VETERINARIO
AGRICOLTURA

} **RICADUTA SU SALUTE DELL'UOMO E DEGLI ANIMALI**

<u>IMPATTO AMBIENTALE</u>

2014 WORLD HEALTH ORGANISATION

Antimicrobico-resistenza (AMR): un'emergenza globale

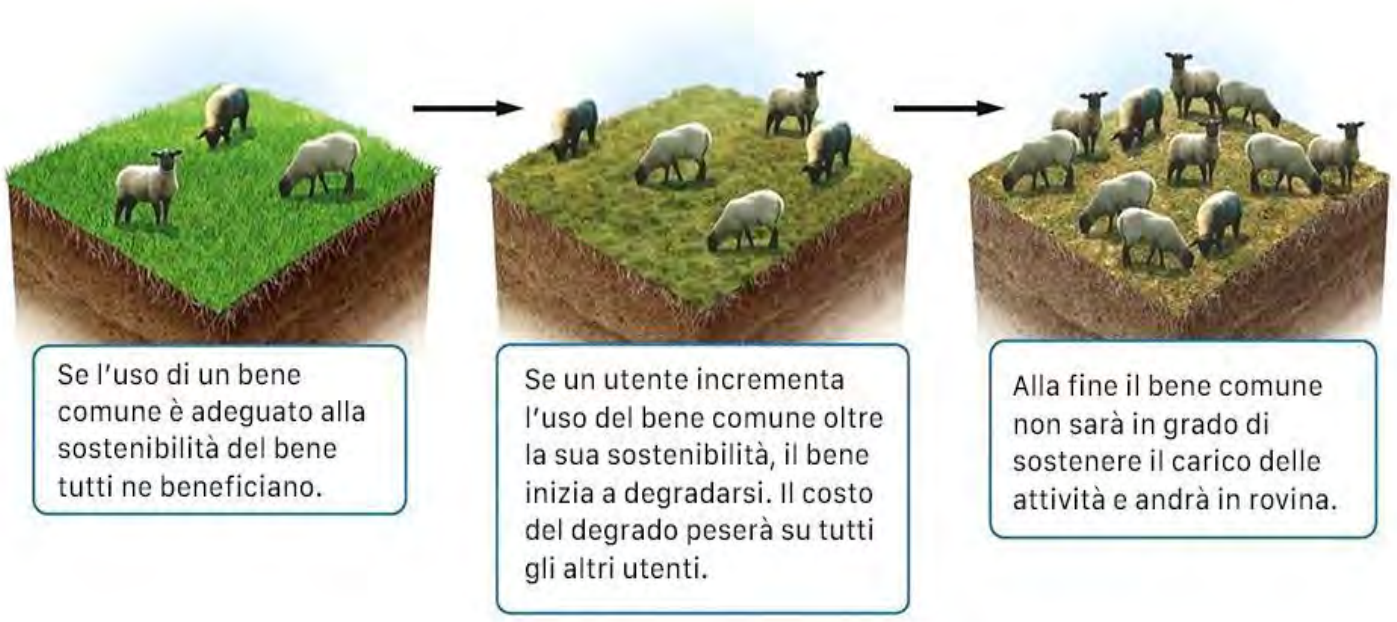
Mortalità: previsione di 10 milioni di decessi nel 2050

Perdite economiche pari a 100 trilioni di dollari

AMR: Problema ambientale

Approccio al problema nell'ottica della ONE HEALTH

AMR e *climate change: «tragedy of commons»*



Enviromental Science, © 2012 W.H. Freeman and Company

AMR e il cambiamento climatico, due fenomeni apparentemente molto distanti, sono legati al consumo di beni comuni (antibiotici e fonti di carbonio) e richiedono un approccio preventivo comune (valutazione dei costi, anche sociali, strategie a medio e lungo raggio, impatto sulle generazioni future). (Roope et al , *Science* 364, 41 -2019)

Antimicrobico-resistenza (AMR): APPROCCIO

ECONOMICO

ETICO

In che ordine? …

AMR: DALL' APPROCCIO ETICO….

The Ethical Significance of Antimicrobial Resistance
Littmann, et al PUBLIC HEALTH ETHICS 8 2015 209–224

British Medical Bulletin, 2022, **141**:4–14
https://doi.org/10.1093/bmb/ldab030
Advance Access Publication Date: 5 February 2022

OXFORD

Invited Review

Ethics and antibiotic resistance

Euzebiusz Jamrozik[1,2,3,*], and George S. Heriot[3]

[1]The Ethox Centre and Wellcome Centre for Ethics and Humanities, Nuffield Department of Population Health, University of Oxford. Old Road Campus, Oxford OX3 7LF, UK, [2]Monash Bioethics Centre, Monash

…A QUELLO ECONOMICO

Science Current Issue First release papers Archive About Submit manuscript

REVIEW

The challenge of antimicrobial resistance: What economics can contribute

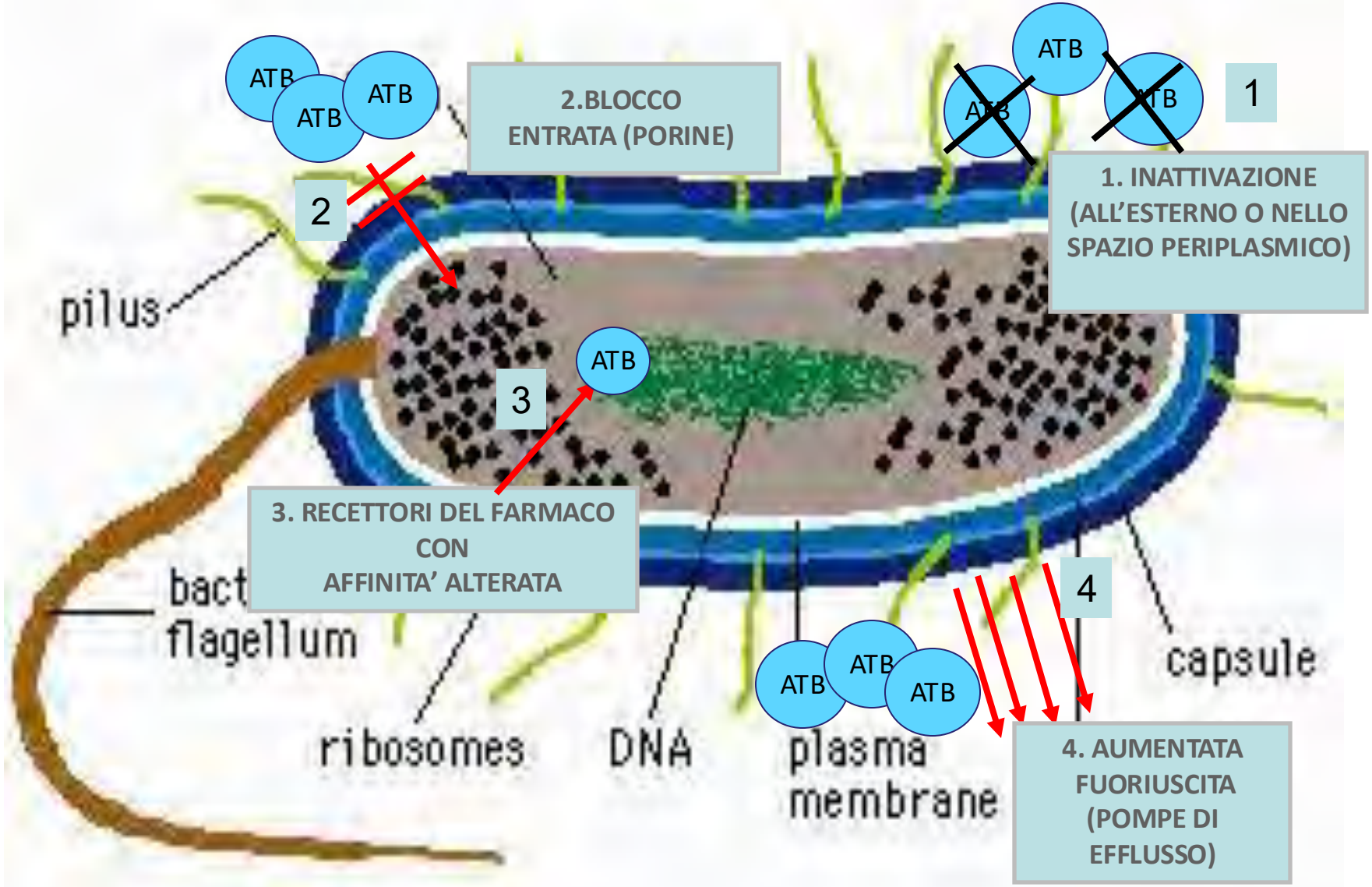
LAURENCE S. J. ROOPE, RICHARD D. SMITH, KOEN B. POUWELS, JAMES BUCHANAN, [...], AND SARAH WORDSWORTH +6 authors Authors Info & Affiliations

(..) Recent U.K. government–commissioned reports (6, 7) estimate that if no action is taken, by 2050, AMR will cause up to 10 million annual deaths globally, reduce gross domestic product (GDP) by 2 to 3.5%, and cost US$100 trillion.

(..) these projections exceed the current burden due to cancer, both in terms of mortality and cost (10). ***They also place the costs of AMR on par with the best current estimates of GDP loss associated with a 2°C rise above preindustrial levels in global average surface temperature.***

GDP: GROSS DOMESTIC PRODUCT

PRINCIPALI MECCANISMI DI RESISTENZA AGLI ANTIBIOTICI



ATB **MOLECOLA DI ANTIBIOTICO**

Meccanismi si possono sovrapporre!

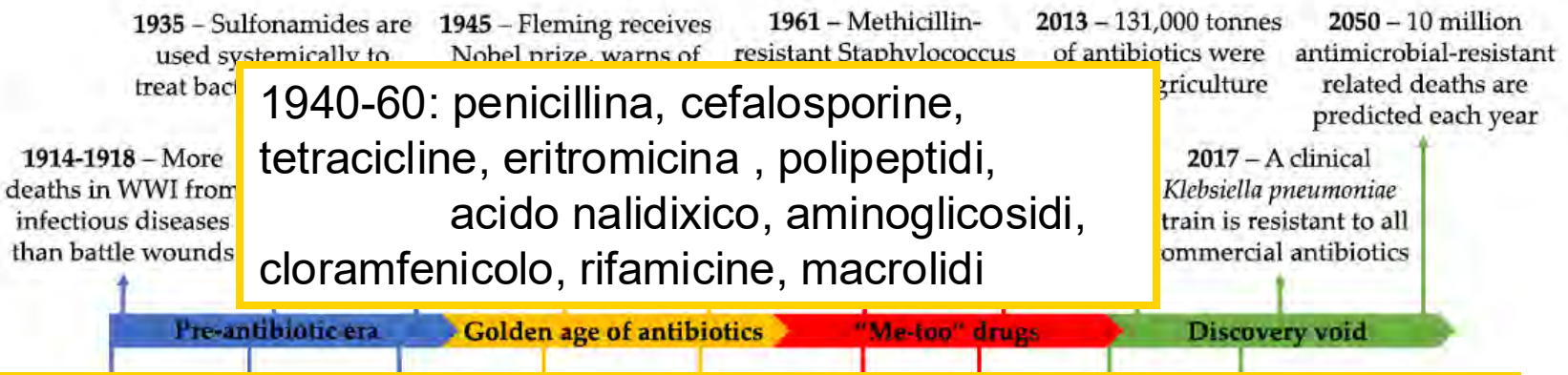
MECCANISMI D'AZIONE SPECIFICI ATB

Non sono molti

Già sfruttati per la scoperta/sintesi
Di molecole ad attività anti-microbica

Cronistoria della scoperta/invenzione di antibiotici

Periodo d'oro degli antibiotici



1940-60: penicillina, cefalosporine, tetracicline, eritromicina , polipeptidi, acido nalidixico, aminoglicosidi, cloramfenicolo, rifamicine, macrolidi

1945-cefalosporine (Giuseppe Brotzu, Università di Cagliari: *Micetina Brotzu)*
1947-50: tetracicline
1949: eritromicina (Abelardo Aguilar)
1959 : rifampicina (laboratori Lepetit Milano; Ermes Pagani)
1953: annunciata struttura del DNA

Browne et al. , International Journal of Molecular Sciences, 2020, 21, 7047

Vincenzo Tiberio, l'italiano che scoprì la penicillina prima di Fleming

Nel 1895 un italiano scoprì la penicillina. Ma nessuno lo prese sul serio e il suo studio finì in un archivio polveroso.

https://www.youtube.com/watch?v=jUu0xYUQGio

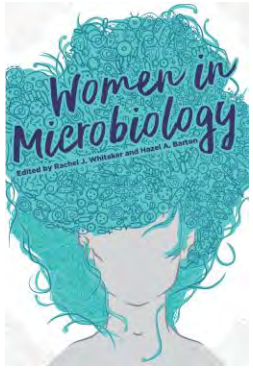
Luca Pani sulla scoperta degli antibiotici a Fuori TG (RAI 3)

AIFA - Agenzia Italiana del Farmaco • 1108 visualizzazioni

Il Direttore Generale dell'Agenzia Italiana del Farmaco (AIFA), Luca Pani, ricostruisce la storia della scoperta e della commercializzazione dei...

Dr Amalia Voureka Koutsouri, lady Fleming (1909-1971)

.. Dalla resistenza all'antibioticoresistenza

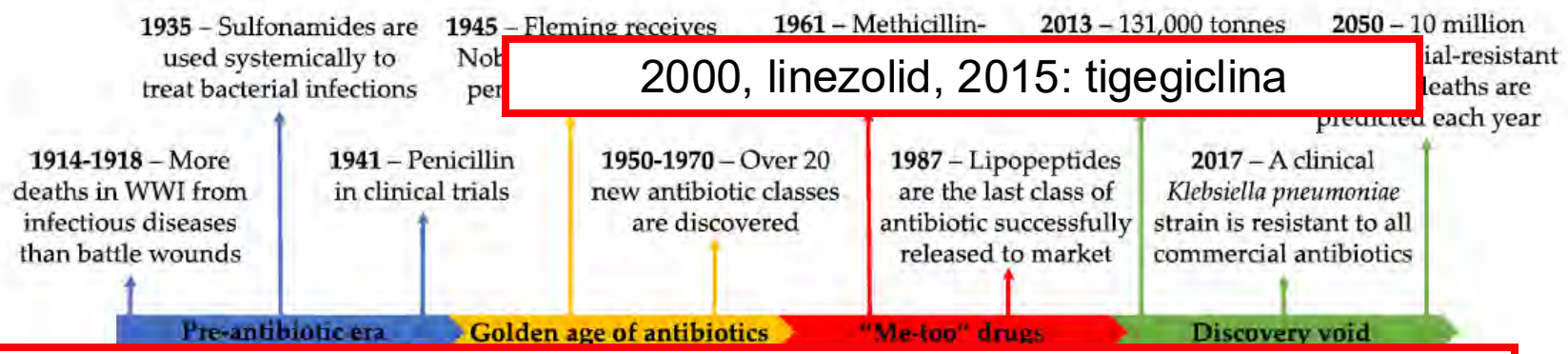


Studi scientifici:
Sostanze ad attività antimicrobica
Motilità *Proteus* spp.
Resistenza a penicillina

https://www.fnovi.it/sites/default/files/Amalia%20Fleming%20DEF.pdf

Cronistoria della scoperta/invenzione di antibiotici

Periodo del ***me too drugs***



XXI secolo: "*Me too drugs*" No nuovi antibiotici, ma potenziamento di molecole già esistenti (metodo per aggirare problema dei brevetti)
Ampliamento spettro d'azione

Tecnologia farmaceutica si sposta dalla ricerca al marketing!

ATB-RESISTENZA: Può essere:

NATURALE

ACQUISITA

1 ATB-RESISTENZA NATURALE

BATTERI che

NON HANNO le STRUTTURE BERSAGLIO degli antibiotici

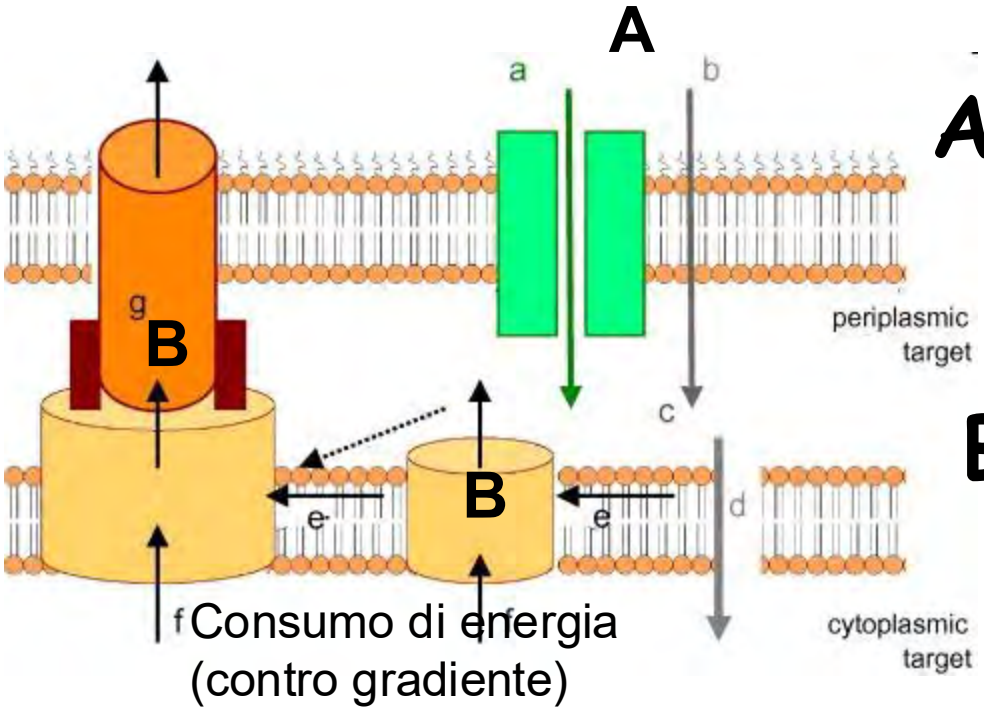
- **MICOPLASMI:** sono privi di parete cellulare
- **FORME L*:** forme prive di p.cellulare si formano *in vivo*

ATB-RESISTENZA
Naturale: esempi/3

Pseudomonas spp.:

A) Ostacolati meccanismi di entrata farmaco

B) aumentata fuoriuscita



A) porine dal diametro molto ristretto

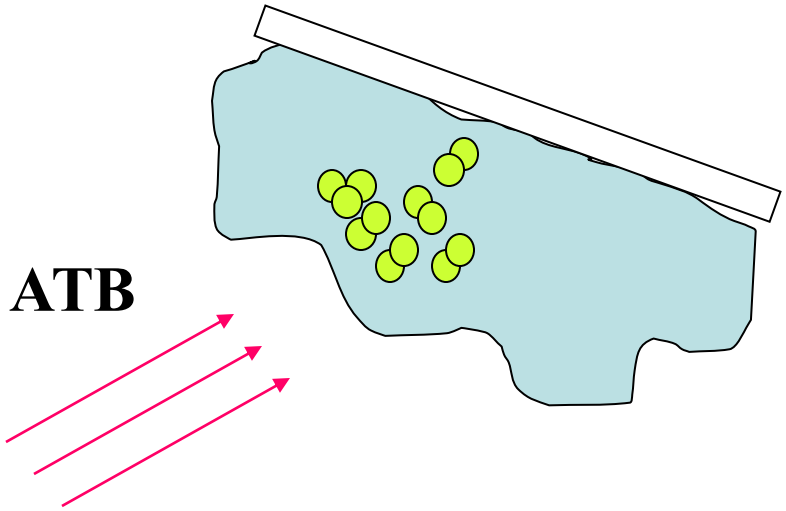
B) pompe di efflusso molto attive

BIOFILM

ATB-RESISTENZA
Naturale /4

PELLICOLA
EXTRACELLULARE
POLISACCARIDICA

RALLENTA /BLOCCA
PENETRAZIONE
DELL'ATB



ATB-RESISTENZA Naturale

CARATTERISTICA COSTITUTIVA DI UNA SPECIE/GENERE ECC.

NON CAMBIA NEL TEMPO

SI COMBATTE USANDO IL FARMACO *AD HOC* (DIAGNOSI EZIOLOGICA)

ATB-RESISTENZA ACQUISITA

BASE GENETICA

EVOLVE NEL TEMPO (anche giorni, sett)

IMPOSSIBILE PREVEDERLA!

MUTAZIONI

TRASFERIMENTO GENETICO

SCOPERTA/ PRODUZIONE DI UN ANTIBIOTICO E SVILUPPO DI ATB-RESISTENZA

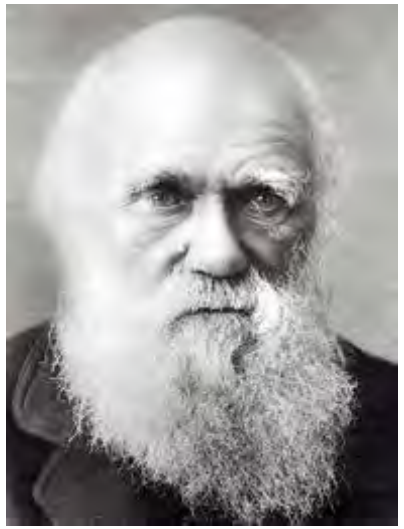
Farmaco	Scoperta	Impiego per la terapia	Insorgenza atb-resistenza
Penicillina	1928	1943	1940
Tetracicline	1948	1952	1956
Eritromicina	1952	1955	1956
Vancomicina	1956	1972	1987
Acido nalidixico	1960	1962	1966
Gentamicina	1963	1967	1970
Fluorochinoloni	1978	1982	1985

ATB-RESISTENZA ACQUISITA

Concetto darwiniano di evoluzione

Survival of the fittest

clone batterico con mutazione
ha più *chances* di
sopravvivenza, rispetto a
popolazione
atb-sensibile, in ambiente
in cui ci sono gli antibiotici

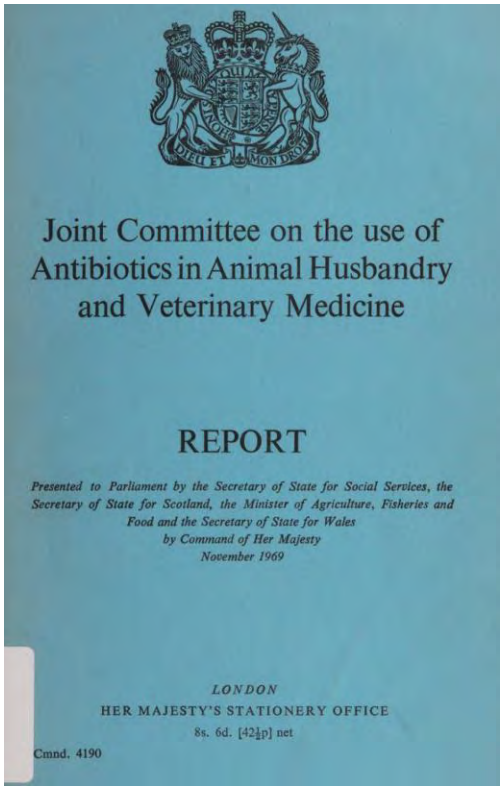


Di chi sono le responsabilità?

Medici , medici veterinari, case farmaceutiche??

"Le popolazioni batteriche devono essere considerate un *unicum* nella natura: uomini, animali e ambiente condividono e diffondono gli stessi geni di resistenza"*

Unico Approccio risolutivo: ottica della ONE HEALTH


Joint Committee on the use of Antibiotics in Animal Husbandry and Veterinary Medicine

REPORT

Presented to Parliament by the Secretary of State for Social Services, the Secretary of State for Scotland, the Minister of Agriculture, Fisheries and Food and the Secretary of State for Wales by Command of Her Majesty November 1969

LONDON
HER MAJESTY'S STATIONERY OFFICE
8s. 6d. [42½p] net
Cmnd. 4190

"Report di Swann, 1969!

ATB-RESISTENZA ACQUISITA

USO ATB IN AMBITO UMANO

ATB-RESISTENZA ACQUISITA

USO ATB IN AMBITO VETERINARIO

April 11, 2012 | US News | Isaac

FDA Seeks to Limit Antibiotic Use in Livestock

I guess it was after I started abusing antibiotics that I noticed my four extra teats...

IPOTESI

USO IRRESPONSABILE DI ANTIBIOTICI NEGLI ANIMALI HA CAUSATO IL DIFFONDERSI DELL'ANTIBIOTICO-RESISTENZA IN AMBITO UMANO

VERO O FALSO?

USO DEGLI ANTIBIOTICI IN MEDICINA VETERINARIA

TERAPIA → **ANIMALI DA COMPAGNIA DA REDDITO**

PROFILASSI (prevenzione) → **ANIMALI DA REDDITO (animali da compagnia)**

AUXINICI: in passato (ANTIBIOTIC GROWTH PROMOTERS, AGP) → **ANIMALI DA REDDITO**

VIETATI DAL 2006 IN EU, 2017 USA

ANIMALI
DA REDDITO

2.TEMPI DI SOSPENSIONE

Intervallo di tempo che intercorre tra impiego dell'antibiotico e utilizzo dell'alimento (latte, carne, miele,ecc)

3.MAXIMUM RESIDUE LEVELS (MRL)

Quantità max tollerata negli alimenti di residuo antibiotico

4. RICERCA SOSTANZE INIBENTI: Controlli a campione su alimenti

CONDIZIONATO DA VINCOLI LEGISLATIVI

1.NECESSITA' DI RICETTA MEDICA, PEER TUTTI GLI ANIMALI

SISTEMA INFORMATICO DI RICETTA ELETTRONICA
Rilasciata SOLO dal veterinario!!

IN PASSATO. PER ANIMALI DA REDDITO RICETTA IN TRIPLICE COPIA (VETERINARIO, FARMACISTA, ALLEVATORE)

REGISTRO DELLE REAZIONI AVVERSE

5.FARMACOVIGILANZA

ANIMALI
DA REDDITO,
DA COMPAGNIA

Veterinari che controllano altri veterinari, evitando conflitto di interessi

Controlli sull'uso degli antibiotici, ad esempio:

-detenzione antibiotici (farmaci ad uso umano?);

- **Evitare uso off label (farmaci registrati per altre specie animali rispetto a quella a cui è destinata)**

Punti critici nell'uso degli atb

- Categorie di animali allevati /pets : aumentate
- Animali non convenzionali
  (selvatici)

Farmaci usati in deroga

Pochi principî attivi (no studi di farmacocinetica/dinamica)

USO DEGLI ANTIBIOTICI IN MEDICINA VETERINARIA

PUNTI CRITICI/1

- **In alcune realtà zootecniche, la**
- **somministrazione di antibiotici è di massa, cioè effettuata *per os* ACQUA, ALIMENTI (mangimi medicati)**

ricetta veterinaria

- **Soprattutto per piccole specie (volatili, conigli,ecc)**
- **Non si ha la certezza che il singolo animale assuma la dose terapeutica**
- **Animale malato mangia/beve di meno**
- **Sollecitazione della flora microbica intestinale**

USO DEGLI ANTIBIOTICI IN MEDICINA VETERINARIA

PUNTI CRITICI/2

ANIMALI DA REDDITO

- **METAFILASSI**

Trattamento di animali sani in un focolaio di malattia (infettiva batterica) per contenere diffusione del contagio

- **CHEMIOPROFILASSI**

Trattamento di animali sani durante fasi critiche dell'allevamento (svezzamento, trasporto, fine lattazione ecc)

Perché punto critico? trattamento animali sani

METAFILASSI: ECCEZIONE E NON REGOLA!

DECRETO LEGISLATIVO 7 dicembre 2023, n. 218

Adeguamento della normativa nazionale alle disposizioni del regolamento (UE) 2019/6 del Parlamento europeo e del Consiglio dell'11 dicembre 2018 relativo ai medicinali veterinari e che abroga la direttiva 2001/82/CE, ai sensi dell'articolo 17 della legge 4 agosto 2022, n. 127. (23G00225) (GU Serie Generale n.2 del 03-01-2024)

note: Entrata in vigore del provvedimento: 18/01/2024

- RISCHIO GRAVE DI CONTAGIO
- NO USO EMPIRICO
- ✓ **DIAGNOSI EZIOLOGICA,**
- ✓ **TEST DI SENSIBILITA' IN VITRO**

METAPHYLAXIS, FROM **28th JANUARY 2022** ONWARDS

- **Article 107** (Use of antimicrobial medicinal products)
- 3. Antimicrobial medicinal products **shall not be used for prophylaxis other than in exceptional cases, for the administration to an individual animal** or a restricted number of animals when the risk of an infection or of an infectious disease is very high and the consequences are likely to be severe.
- 4. Antimicrobial medicinal products shall be used for metaphylaxis **only when the risk of spread of an infection or of an infectious disease in the group of animals is high and where no other appropriate alternatives are available.** Member States may provide guidance regarding such other appropriate alternatives and shall actively support the development and application of guidelines which promote the understanding of risk factors associated with metaphylaxis and include criteria for its initiation.

Regulation 2019/6 European Parliament

USO DEGLI ANTIBIOTICI IN MEDICINA VETERINARIA

PUNTO CRITICO/3 (appartenente al passato)

IL PECCATO ORIGINALE DEI VETERINARI ESEMPIO DEI GROWH PROMOTERS (GP)

Somministrazione di atb a bassi dosaggi (subterapeutici) ad animali da reddito per migliorare le *performances* produttive

No ricetta veterinaria

PRINCIPIO:

- **Modulazione/riduzione flora intestinale**

- **Migliori incrementi ponderali**

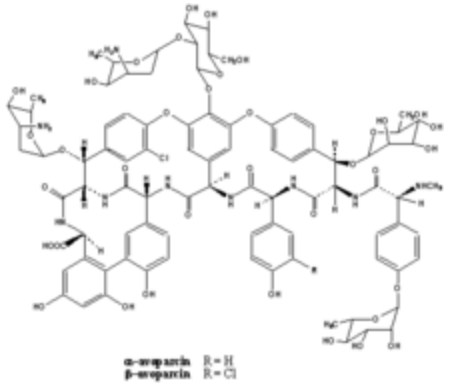
GROWTH PROMOTERS: PROBLEMA DELLE RESISTENZE CROCIATE

AFFAIRE AVOPARCINA

Usato come GP in polli e suini
Resistenza crociata con vancomicina (VRE, enterococchi vancomicina resistenti)

I DIVIETO (1999): vietati alcuni antibiotici promotori della crescita nelle produzioni animali. PRINCIPIO ISPIRATORE del divieto: vietare prodotti che contenessero o antimicrobici appartenenti a classi di farmaci utilizzati anche nel trattamento di infezioni umane.

L'Unione europea ha vietato l'utilizzo dei restanti antimicrobici utilizzati come GP a partire dal 1 gennaio 2006 (reg. 1831/2003).

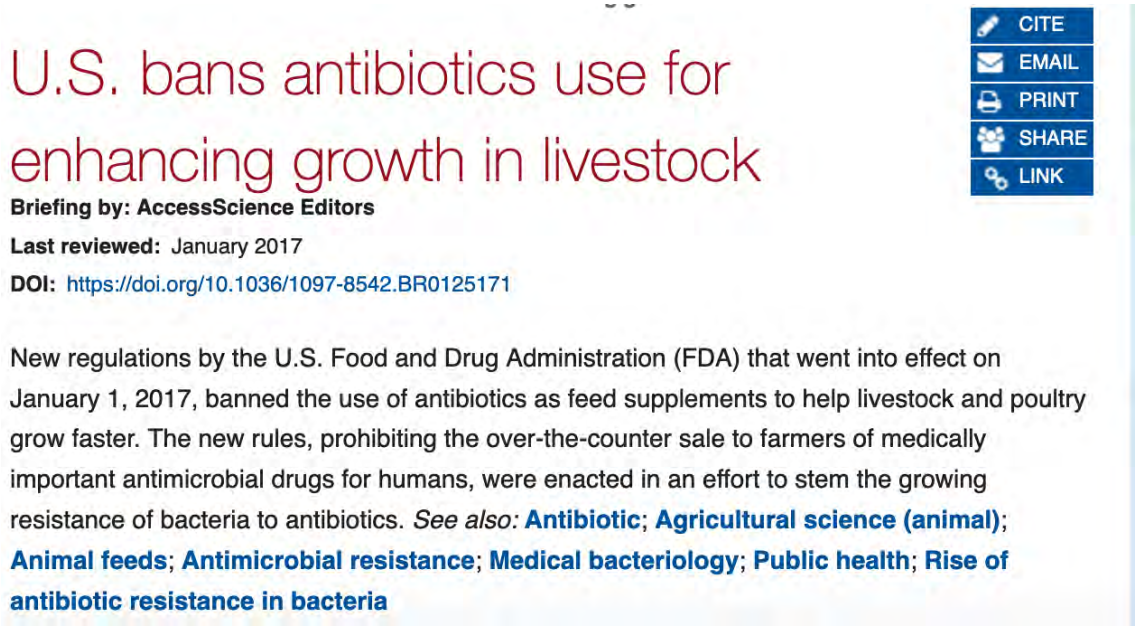


Altro esempio TILOSINA : res crociata con ERITROMICINA

Non- therapeutic use of Antibiotics in FOOD PRODUCING ANIMALS

IMPROVEMENT

EUROPEAN UNION: AGP have been banned (2006)



U.S. bans antibiotics use for enhancing growth in livestock

CITE
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LINK

Briefing by: AccessScience Editors

Last reviewed: January 2017

DOI: https://doi.org/10.1036/1097-8542.BR0125171

New regulations by the U.S. Food and Drug Administration (FDA) that went into effect on January 1, 2017, banned the use of antibiotics as feed supplements to help livestock and poultry grow faster. The new rules, prohibiting the over-the-counter sale to farmers of medically important antimicrobial drugs for humans, were enacted in an effort to stem the growing resistance of bacteria to antibiotics. *See also:* **Antibiotic**; **Agricultural science (animal)**; **Animal feeds**; **Antimicrobial resistance**; **Medical bacteriology**; **Public health**; **Rise of antibiotic resistance in bacteria**

INTERNET: you can buy everything!!

> Animals (Basel). 2020 Mar 17;10(3):503. doi: 10.3390/ani10030503.

The Online Sale of Antibiotics for Veterinary Use

Juan F Garcia [1], M Jose Diez [2], Ana M Sahagun [2], Raquel Diez [2], Matilde Sierra [2], Juan J Garcia [2], M Nelida Fernandez [2]

Dopo il divieto di uso dell'avoparcina come GP, la prevalenza di infezioni da VRE nell'uomo è calata?

The ongoing challenge of vancomycin-resistant *Enterococcus faecium* and *Enterococcus faecalis* in Europe: an epidemiological analysis of bloodstream infections

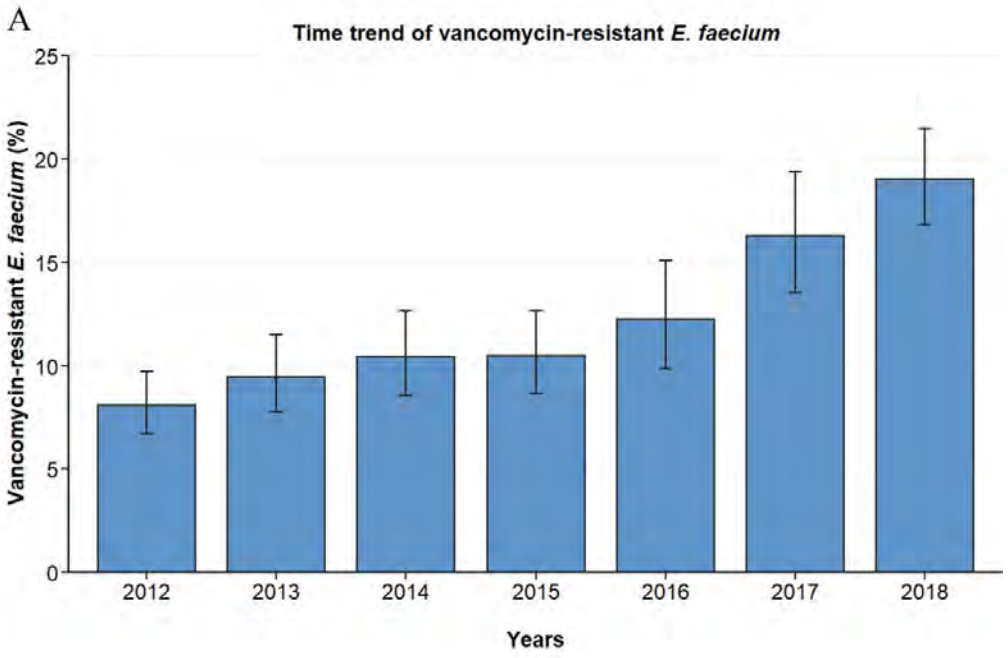
Olaniyi Ayobami, Niklas Willrich, Annicka Reuss, Tim Eckmanns, and Robby Markwart

Unit 37: Nosocomial Infections, Surveillance of Antimicrobial Resistance and Consumption, Robert Koch Institute, Berlin, Germany

ABSTRACT

Vancomycin-resistant enterococci infections are of great public health significance due to limited therapeutic options. We investigated epidemiological trends and risk factors of vancomycin resistance in enterococci isolates from patients with bloodstream infections in the EU/EEA from 2012 to 2018. Routine vancomycin susceptibility data of clinical *E. faecium* (n = 67,022) and *E. faecalis* (n = 103,112) blood isolates from the European Antimicrobial Resistance Surveillance Network were analysed using descriptive statistics and multivariable regression analyses. In Europe, proportions of vancomycin-resistant *E. faecium* (VREFm) increased from 8.1% (95%CI 6.7–9.7%) in 2012 to 19.0% (95%CI 16.8–21.5%) in 2018. Rising VREFm proportions were observed across all European regions, both genders and all age groups except children and adolescents (1–19 years). Adults (20–59 years) and elderly (≥60 years) had an increased likelihood of VREFm compared to children and adolescents (1–19 years) (OR: 1.99 [95%CI 1.42–2.79, $p<0.001$] and OR: 1.56 [95%CI 1.09–2.23, $p = 0.014$], respectively). Inpatients hospital units, including internal medicine and ICUs, were associated with an increased likelihood of VREFm (OR: 2.29 (95%CI 1.58–3.32, $p < 0.001$) compared to the emergency department which reflects patients with community origin of *E. faecium* infections. The mean proportion of vancomycin-resistant *E. faecalis* in Europe was found to be low (1.1% [95%CI 0.9–1.4%]). Local and regional authorities should intensify efforts directed at diagnostic and antimicrobial stewardship for vancomycin and all last resort drugs for the management of VREFm, particularly for hospitalized elderly patients.

VRE EUROPA



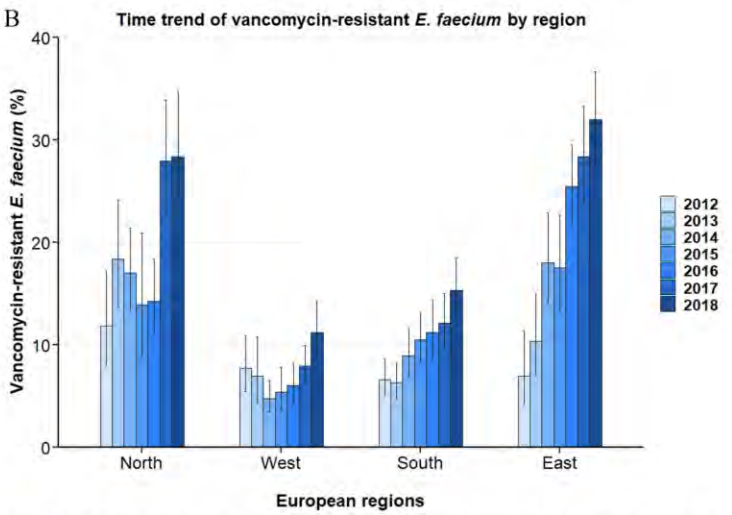


Figure 1. Time trend of vancomycin-resistant *E. faecium* from blood isolates *in the* EU/EEA. Time trend of vancomycin-resistant *Enterococcus faecium* in (A) 30 countries of the European Union, European Economic Area and the United Kingdom, and in (B) major regions within Europe. Vancomycin resistance proportions are expressed as population-weighted mean proportions (%) among all *Enterococcus faecium* blood isolates, with corresponding 95% confidence intervals.

…(Contrary to the trend in Europe, a large multicentre study showed that VREF (faecalis) proportions in blood isolates reduced from 80.7% in 2010 to 66% in 2016 in the United States)

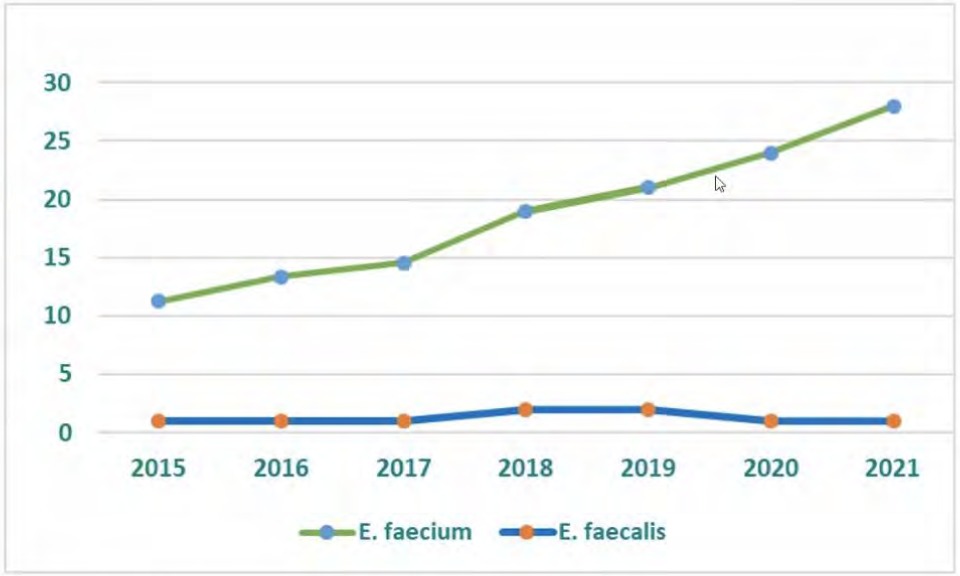
In Italia

Enterococchi

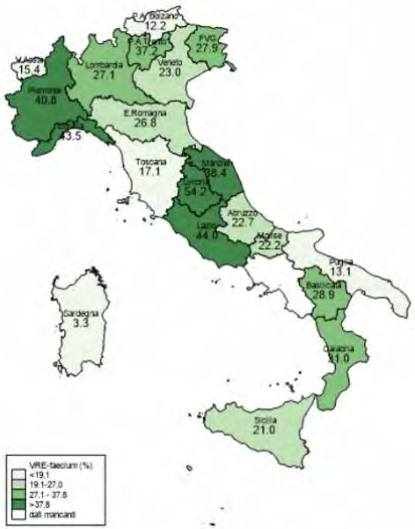
Resistenza alla vancomicina (VRE)

% Res

Trend 2015-2021



Prevalenza Regionale 2021



VRE

ESISTONO I BATTERI MDR* IN MEDICINA VETERINARIA?

* MULTIDRUGRESISTANT

Esempio 2: beta-lattamasi a spettro esteso (ESBL) nei Gram -

Resistenza a betalattamici (penicilline, cefalosporine), monobattamici, carbapenemici)

frontiers in Veterinary Science

ORIGINAL RESEARCH
published: 27 March 2018
doi: 10.3389/fvets.2018.00062

High Prevalence of Extended-Spectrum β-Lactamase Producing Enterobacteriaceae Among Clinical Isolates From Cats and Dogs Admitted to a Veterinary Hospital in Switzerland

*Anna Lena Zogg[1], Sabrina Simmen[1], Katrin Zurfluh[1], Roger Stephan[1], Sarah N. Schmitt[2] and Magdalena Nüesch-Inderbinen[1]**

[1] National Centre for Enteropathogenic Bacteria and Listeria, Vetsuisse Faculty, Institute for Food Safety and Hygiene, University of Zürich, Zürich, Switzerland, [2] Vetsuisse Faculty, Institute of Veterinary Bacteriology, University of Zürich, Zürich, Switzerland

OPEN ACCESS

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Citation:
Zogg AL, Simmen S, Zurfluh K, Stephan R, Schmitt SN and Nüesch-Inderbinen M (2018) High Prevalence of Extended-Spectrum

Objectives: This study aimed to identify and characterize extended-spectrum β-lactamase (ESBL) producing Enterobacteriaceae among clinical samples of companion animals.

Methods: A total of 346 non-duplicate Enterobacteriaceae isolates were collected between 2012 and 2016 from diseased cats ($n = 115$) and dogs ($n = 231$). The presence of bla_{ESBL}, PMQR genes, and the azithromycin resistance gene *mph(A)* was confirmed by PCR and sequencing of *bla* genes. Isolates were further characterized by antimicrobial resistance profiling, multilocus sequence typing, phylogenetic grouping, identification of mutations in the QRDR of *gyrA* and *parC*, and screening for virulence-associated genes.

Results: Among the 346 isolates, 72 (20.8%) were confirmed ESBL producers [58 *Escherichia coli (E. coli)*, 11 *Klebsiella pneumoniae (K. pneumoniae)*, and 3 *Enterobacter cloacae*]. The strains were cultured from urine ($n = 45$), skin and skin wounds ($n = 8$), abscesses ($n = 6$), surgical sites ($n = 6$), bile ($n = 4$), and other sites ($n = 3$). ESBL genes included $bla_{CTX\text{-}M\text{-}1, 14, 15, 27, 55}$, and $bla_{SHV\text{-}12}$, predominantly $bla_{CTX\text{-}M\text{-}15}$ (54.8%, 40/73), and $bla_{CTX\text{-}M\text{-}1}$ (24.7%, 18/73). Further genes included *qnrB* (4.2%, 3/72), *qnrS* (9.7%, 7/72), *aac(6')-Ib-cr* (47.2%, 34/72), and *mph(A)* (38.9%, 28/72). Seventeen (23.6%) isolates belonged to the major lineages of human pathogenic *K. pneumoniae* ST11, ST15, and ST147 and *E. coli* ST131. The most prevalent ST was *E. coli* ST410 belonging to phylogenetic group C.

Rischi microbiologici associati alla dieta BARF (nutrire pets con alimenti a basee di carne cruda)

MATERIALI E METODI

FOCOLAIO A
All. varie razze,
In Campania

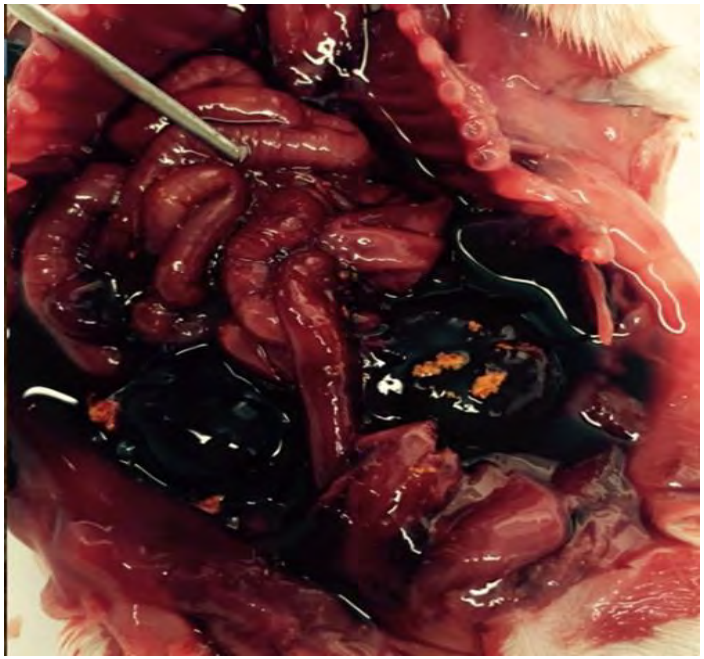
Allevamenti di cani
Mortalità del 100%
nelle cucciolate colpite
Primi 3 gg di vita

FOCOLAIO B
All. labrador
In prov. di Bari

Gennaio/febbraio 2017

5 cucciolate (Razza Spitz)
Alimentazione fattrici integrata con carcasse di pollo crude

-3 carcasse di cuccioli
-tamponi rettali di 9 madri
-campioni di acqua



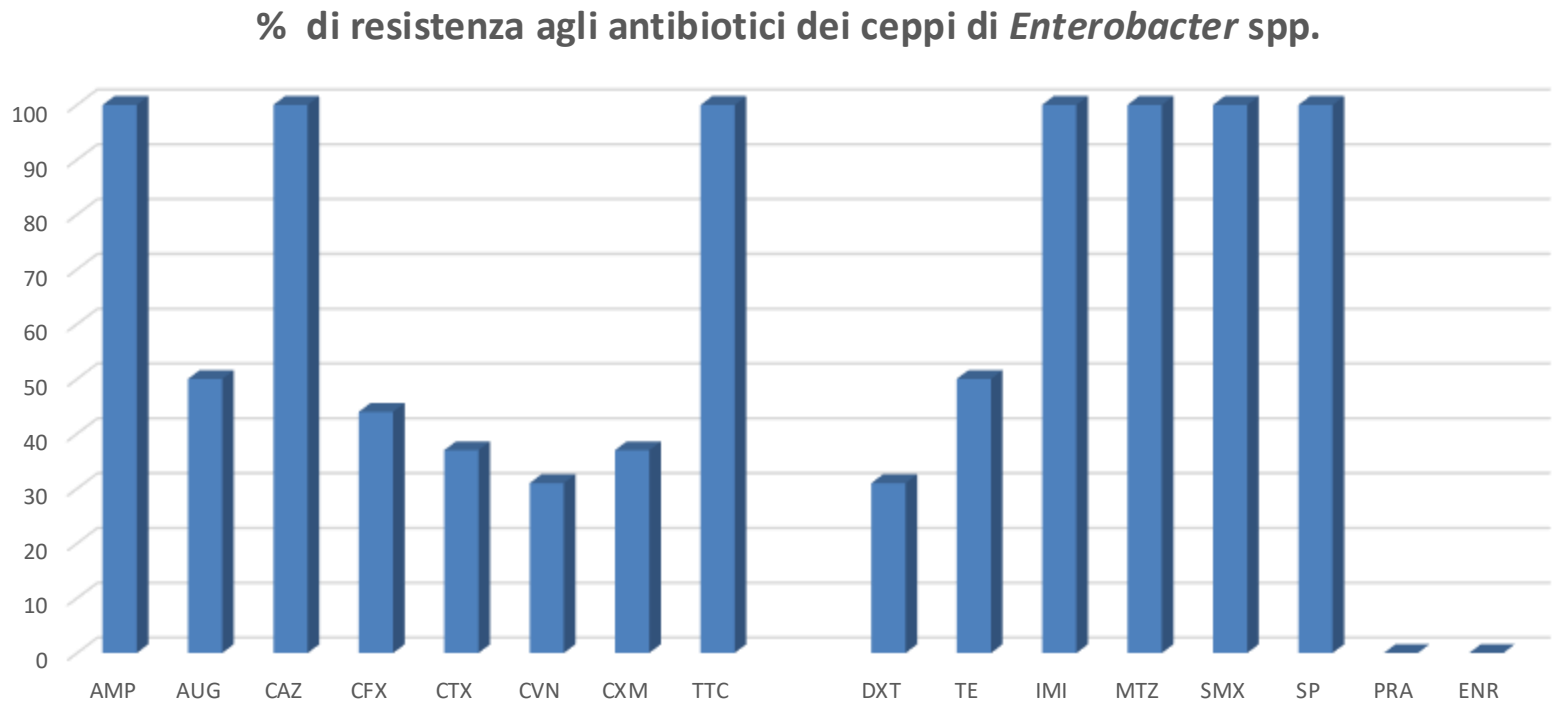
Lesioni indicative di setticemia

Marzo 2017

cucciolata di 8 soggetti

-Carcassa di 1 cucciolo

% di Resistenze assolute calcolate sui 14 ceppi di *Enterobacter spp*. isolati dai 2 focolai



- % di Resistenze elevate verso **beta lattamici**, **imipenem, metronidazolo**, **sulfamidici**, **spiramicina**

Enterobacter spp.: prototipo di batterio ubiquitario, opportunista, antibiotico-resistente

Reservoirs of MRSA and clonal spreading

Healthcare associated (HA) 1990

- Individuals hospitalized in the 6-12 months prior to infection
- Associated with invasive procedures or devices
- Resistance to antibiotics
- ST5, ST239, ST22, ST30, ST45

1990

Community associated (CA) 2000

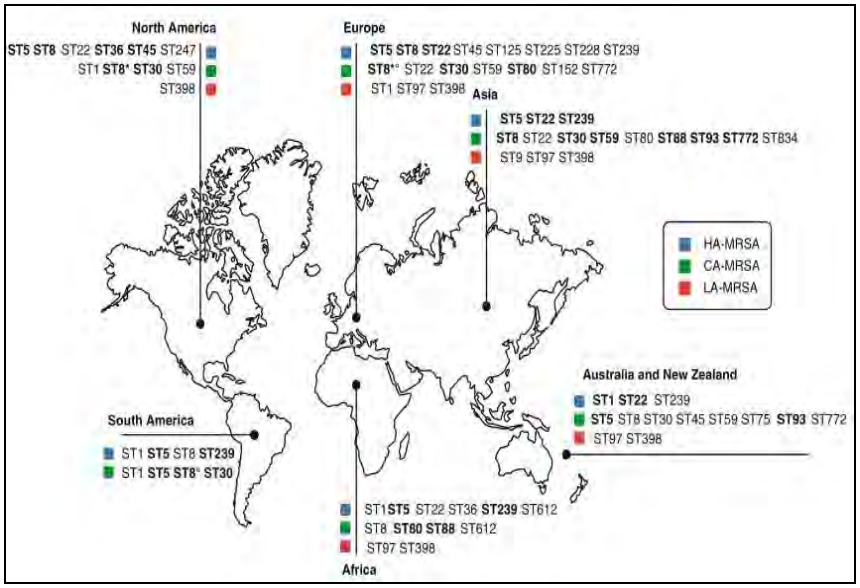
- Not hospitalized individuals
- Low-level of susceptibility to non β-lactam antibiotics
- Presence of virulence factors (PVL)
- Associated with SSTI
- ST1, ST8, ST30, ST59, ST80

2000 circa

Livestock associated (LA) 2005-present

- Firstly isolated from a pig farm (Netherlands, 2005)
- Some isolates *mecC* positive (homologous of *mecA*)
- Frequently associated with TE or SXT resistance
- Non-typeable by PFGE
- ST398, ST9, ST97, ST22, ST5, ST1, ST130

Dal 2005



Monaco et al., 2016

Livestock associated MRSA: scarsa (o nulla) trasmissione inter-umana

MRSP infections and clonal spreading

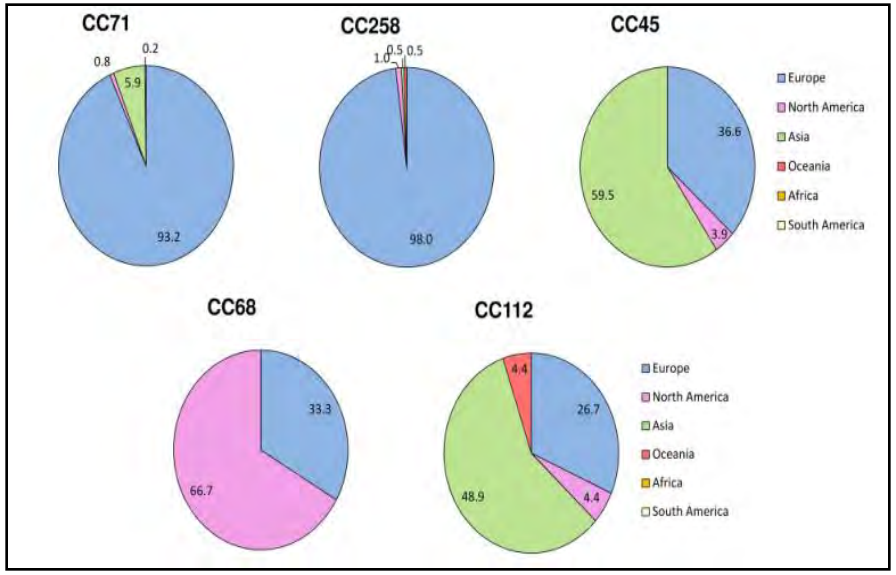
Dogs and Cats (Griffeth et al., 2008)

Horses and Donkeys (Ruscher et al., 2009)

Humans (Steggman et al., 2010)

ZOONOTIC POTENTIAL

Geographical distribution of MRSP lineages



Dos Santos et a., 2016

ST71 and ST258 are the dominant clones in Italy

Veterinary Microbiology 211 (2017) 103–106

Contents lists available at ScienceDirect

Veterinary Microbiology

journal homepage: www.elsevier.com/locate/vetmic

Short Communication

Frequency, antimicrobial susceptibility and clonal distribution of methicillin-resistant *Staphylococcus pseudintermedius* in canine clinical samples submitted to a veterinary diagnostic laboratory in Italy: A 3-year retrospective investigation

G. Ventrella[a], A. Moodley[b], E. Grandolfo[a,*], A. Parisi[c], M. Corrente[a], D. Buonavoglia[a], L. Guardabassi[d]

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI MEDICINA VETERINARIA

SEA TURTLE CLINIC DiMeV

AMR come problema ambientale: LOGGERHEAD SEA TURTLES AS BIO-INDICATORS

For bio-monitoring the state of marine health is important to identify and monitor sentinel species, assuming that their health reflects the health of the ecosystem where they reside

- No history of therapeutic antibiotic exposure
- Long life-span
- Long period to reach sex-maturity
- Near-costal feeding

Wild marine species can harbour resistant microbial species involved into AMR genes recombination and spreading

(Aguirre et al., 2002; Aguirre and Lutz, 2004; Parsons et al., 2008; Pace et al., 2019).

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SEA TURTLE CLINIC DiMeV

Marine Pollution Bulletin 164 (2021) 112015

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Detection of multi-drug resistance and AmpC β-lactamase/ extended-spectrum β-lactamase genes in bacterial isolates of loggerhead sea turtles (*Caretta caretta*) from the Mediterranean Sea

Adriana Trotta [a,*], Margie Cirilli [a], Mariarosaria Marinaro [b], Sunčica Bosak [c], Georgia Diakoudi [a], Stefano Ciccarelli [a], Serena Paci [a], Domenico Buonavoglia [a], Marialaura Corrente [a]

[a] Department of Veterinary Medicine, University of Bari "Aldo Moro", Str. Prov
[b] Department of Infectious Diseases, Istituto Superiore di Sanità, Viale Regina El
[c] Department of Biology, Faculty of Science, University of Zagreb, Rooseveltov n

animals

MDPI

Article

Antimicrobial Resistance in Loggerhead Sea Turtles (*Caretta caretta*): A Comparison between Clinical and Commensal Bacterial Isolates

Adriana Trotta [1,*], Mariarosaria Marinaro [2], Alessio Sposato [1], Michela Galgano [1], Stefano Ciccarelli [1], Serena Paci [1] and Marialaura Corrente [1]

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* Correspondence: adriana.trotta@uniba.it or trotta.adri@gmail.com

MATERIALS & METHODS

- **Apulia, South Italy**
- **52 injured loggerhead sea turtles *C. caretta***

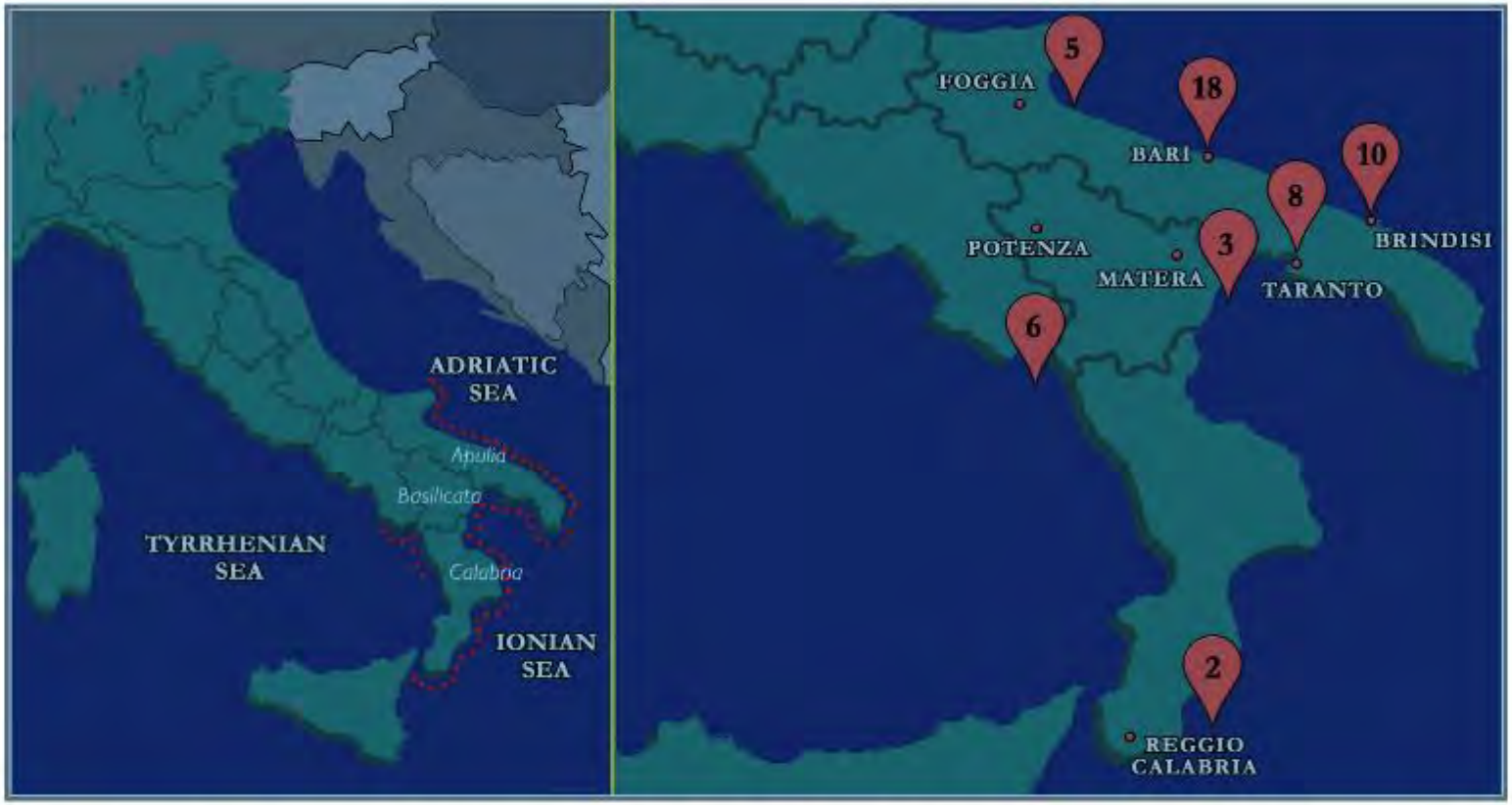

Fig. 1. Map of the Southern-Adriatic/Ionian coastlines where turtles (*Caretta caretta*) were found stranded or captured by local fishermen; the number of subjects found/captured in each coastal area are indicated. Image source: www.freepik.com.

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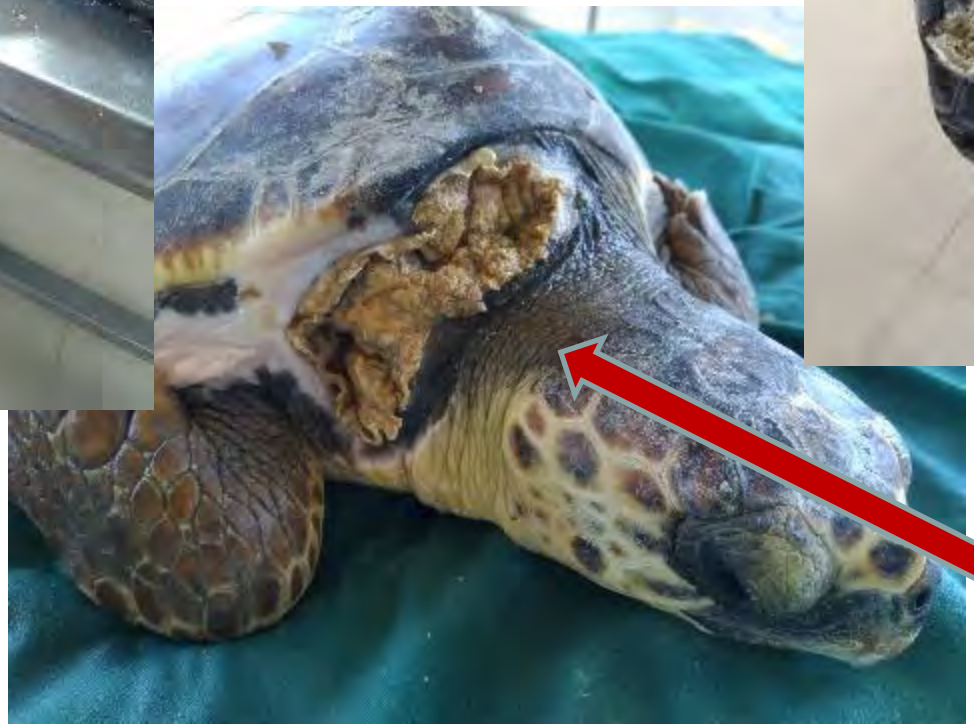
DEPARTMENT OF VETERINARY MEDICINE

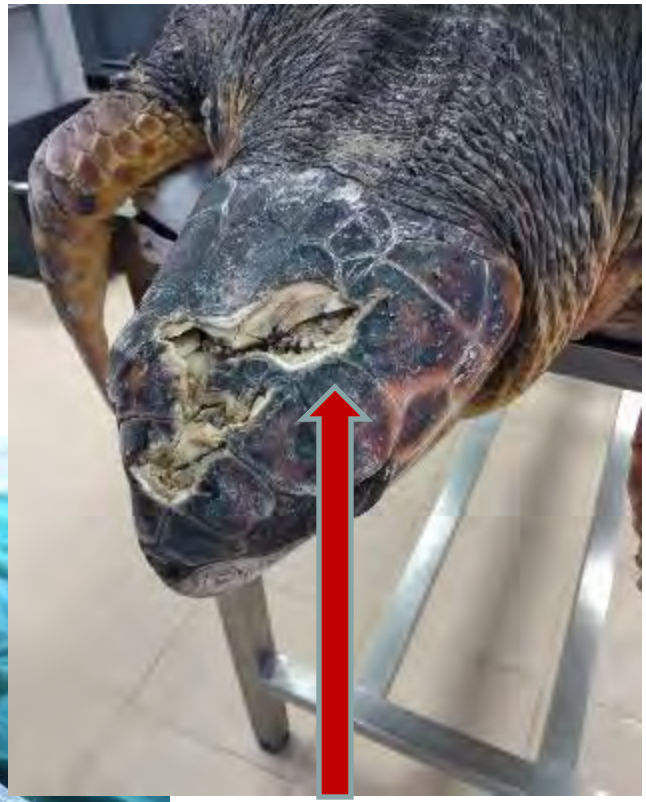
SEA TURTLE CLINIC DiMeV

HRZZ Croatian Science Foundation

TurtleBIOME

- Recent wounds
- Old wounds

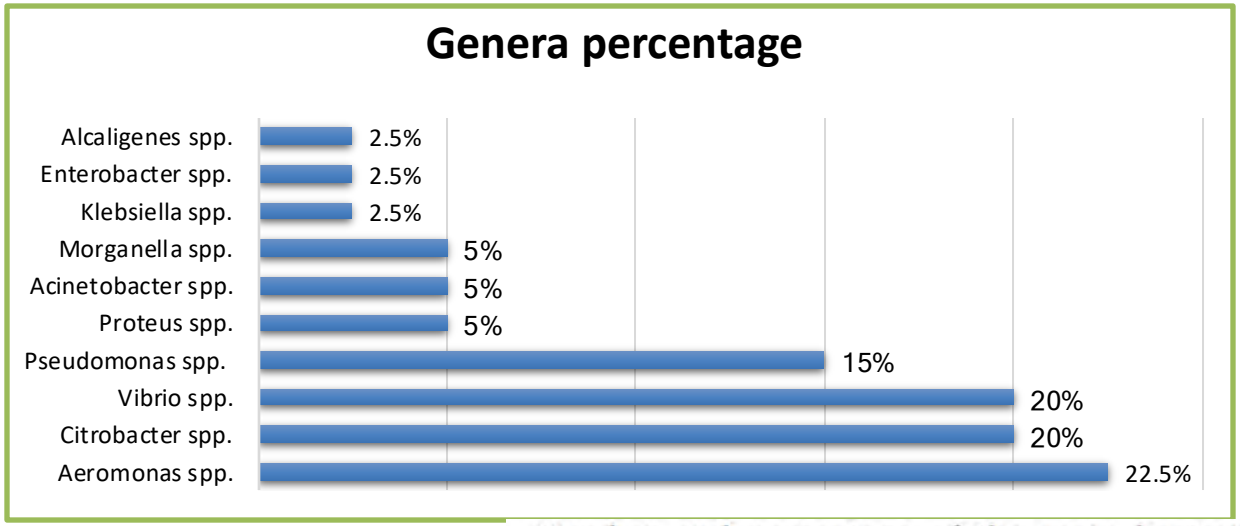




Bone fracture

Granulation tissue

RESULTS



Identification at species level by 16sRNA sequencing

Number and percentage of the main bacterial genera identified in clinical samples and distribution of different bacterial species.

Genera	Number (percentage)	Species (n°)
Aeromonas spp.	9 (22.5%)	*A. hydrophila* (8)
Vibrio spp.	8 (20%)	*V. vulnificus* (3)
		V. alginolyticus (3)
		V. metschnikovii (1)
		V. fluvialis (1)
Citrobacter spp.	8 (20%)	*C. freundii* (8)
Pseudomonas spp.	6 (15%)	*P. aeruginosa* (2)
		P. putida (2)
		P. putrefaciens (2)
Acinetobacter spp.	2 (5%)	*A. calcoaceticus* (2)
Morganella spp.	2 (5%)	*M. morganii* (2)
Proteus spp.	2 (5%)	*P. vulgaris* (2)
Enterobacter spp.	1 (2.5%)	*E. cloacae* (1)
Alcaligenes spp.	1 (2.5%)	*A. faecalis* (1)
Klebsiella spp.	1 (2.5%)	*K. oxythoca* (1)

RESULTS

- 9/40 (22%) STRAINS WERE RESISTANT **TO ALL THE TESTED MOLECULES**
- 30/40 (75%) OF ISOLATES EXHIBITED a **MDR PHENOTYPE**

Protocollo Number: 691/17			
Data lettura: 13/07/2017			
Medico Veterinario curante/referente: Sea Turtles Clinic (DiMeV)			
Specie: *Caretta caretta* (Dafne)			
Samples: BAL		**BACTERIA**	
ANTIBIOTICO	**Sigla**	*Citrobacter spp.*	*Aeromonas spp.*
Ampicillin	**AMP**	R	R
Amoxicillin + cl. Acid	**AUG**	R	R
Cephalexin	**CFX**	R	R
Ceftazidim	**CAZ**	R	R
Cefuroxim	**CXM**	R	R
Ciprofloxacin	**CIP**	R	R
Danofloxacin	**DFX**	R	R
Doxycyclin	**DXT**	R	R
Enrofloxacin	**ENR**	R	R
Imipenem	**IMI**	R	R
Moxifloxacin	**MOX**	R	R
Predofloxacin	**PRA**	R	R
Tetracycline	**TE**	R	R

R = RESISTANT

RESULTS

Resistance/susceptibility number and percentage found in bacterial isolates from sea turtles tested by disk diffusion test.

Antibiotics	Phenotypic profile			
	R	R (%)	S	S (%)
AMP	39[a]	97.5%[b]	1[a]	0.5%[b]
AMC	36	90%	4	10%
CFX	36	90%	4	10%
CTX	31	77.5%	9	22.5%
CAZ	28	70%	12	30%
CXM	29	72.5%	11	27.5%
AZT	24	60%	16	40%
SXT	20	50%	20	50%
CIP	27	67.5%	13	32.5%
DFX	31	77.5%	9	22.5%
ENR	24	60%	16	40%
MOX	27	67.5%	13	32.5%
PRA	33	82.5%	7	17.5%
TET	23	57.5%	17	42.5%
DXT	19	47.5%	21	52.5%

"R": resistant number; "R(%)": resistant percentage; "S": susceptible number; "S (%)": susceptible percentage.

AMP: Ampicillin, AMC: Amoxicillin+Clavulanic acid; CFX: Cephalexin; CTX: Cefotaxime; CAZ: Ceftazidime; CXM: Cefuroxime; AZT: Aztreonam; SXT: Trimethoprim-sulphamethoxazole; CIP: Ciprofloxacin; DFX: Danofloxacin; ENR: Enrofloxacin; MOX: Moxifloxacin; PRA: Pradofloxacin; TET: Tetracycline; DXT: Doxycycline.

[a] Number of isolates showing that phenotype.

[b] Percentage of isolates showing that phenotype.

HIGH % of resistance against β-Lactams

RESULTS

Genera and number of bacterial isolates resistant to cephalosporins as determined by the disk diffusion test and confirmed by DDST and molecular methods (PCR/sequencing).

Genera	Number of bacterial isolates	Number of Cephalosporins-resistant strains by using the disk diffusion test	Number of cAmpC/ESBL-producing strains	
			Confirmed by DDST[a]	Confirmed by PCR and sequencing for at least 1 gene
Aeromonas spp.	9	6	5	2
Vibrio spp.	8	6	4	2
Citrobacter spp.	8	8	5	4
Pseudomonas spp.	6	5	2	2
Acinetobacter spp.	2	2	1	1
Morganella spp.	2	1	1	1
Proteus spp.	2	2	0	0
Enterobacter spp.	1	1	1	1
Alcaligenes spp.	1	1	0	0
Klebsiella spp.	1	1	1	0
Total	40	33 (82.5%)	20 (50%)	13 (32.5%)

[a] DDST: double-disk synergy test.

RESULTS

13/40 strains (45%) positive:

- 13/40 pos for bla_{AmpC} gene (45%)
- 5/40 pos for $bla_{CTX\text{-}M}$ gene (17,5%)
- 2/40 pos for bla_{TEM} gene (12, 5%)
- 1/40 pos for bla_{SHV} gene (2,5%)

Isolated bacterial species with relative cAmpC/ESBLs detected genes.

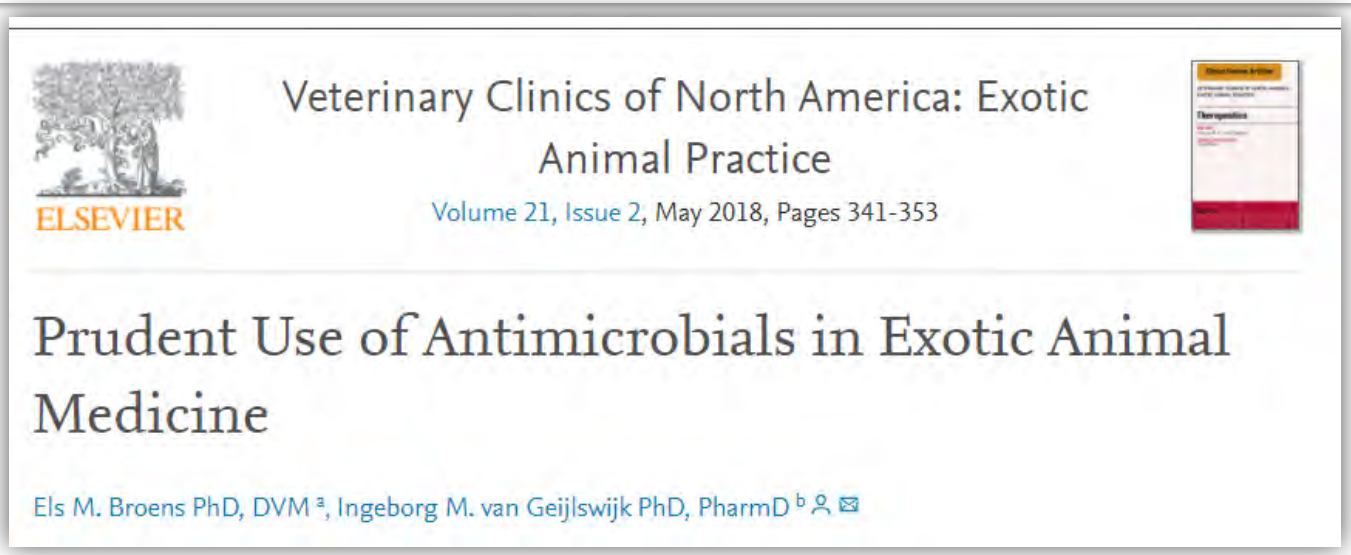
	cAmpC/ESBLs genes				
Species	cAmpC	$bla_{CTX\text{-}M}$	bla_{TEM}	bla_{SHV}	Total genes
A. hydrophila	$bla_{ACT\text{-}2}$	$bla_{CTX\text{-}M\text{-}3}$	/	/	2
A. hydrophila	$bla_{ACT\text{-}2}$	/	/	/	1
V. vulnificus	$bla_{ACT\text{-}24}$	$bla_{CTX\text{-}M\text{-}3}$	/	/	2
V. alginolyticus	$bla_{ACT\text{-}24}$	$bla_{CTX\text{-}M\text{-}3}$	/	/	2
C. freundii	$bla_{ACT\text{-}2}$	/	$bla_{TEM\text{-}236}$	$bla_{SHV\text{-}12}$	3
C. freundii	$bla_{ACT\text{-}2}$	/	/	/	1
C. freundii	$bla_{DHA\text{-}1}$	/	/	/	1
C. freundii	$bla_{ACT\text{-}17}$	/	/	/	1
P. putrefaciens	$bla_{ACT\text{-}24}$	$bla_{CTX\text{-}M\text{-}3}$	/	/	2
P. fluorescens	$bla_{ACT\text{-}24}$	/	/	/	1
A. calcoaceticus	$bla_{ACT\text{-}24}$	$bla_{CTX\text{-}M\text{-}3}$	$bla_{TEM\text{-}236}$	/	3
M. morganii	$bla_{ACT\text{-}17}$	/	/	/	1
E. cloacae	$bla_{CMY\text{-}37}$	/	/	/	1
Total types	13	5	2	1	/

13/40 strains (45%) positive:

- 2/40 pos for 3 genes (12.5%)
- 4/40 pos for *2* genes (10 %)

No association between genera and *ESBLs* detection

Antibiotic treatment in sea turtles



ELSEVIER

Veterinary Clinics of North America: Exotic Animal Practice

Volume 21, Issue 2, May 2018, Pages 341-353

Prudent Use of Antimicrobials in Exotic Animal Medicine

Els M. Broens PhD, DVM [a], Ingeborg M. van Geijlswijk PhD, PharmD [b]

- Pharmacokinetics and pharmacodynamics in reptiles highly dependent on various factors (external temperature, anatomical district, etc.)
- Only experimental data on few species
- Limited terapeutic options (ceftazidime/ enrofloxacin)

- Off label use
- Treatment based most on empiric evidence and pragmatic arguments

MOLECULAR CHARACTERISATION OF ESBL GENES

- MOST OF THOSE GENES ARE CHARACTERISTIC OF HUMAN ISOLATES
- FOUND IN OPPORTUNISTIC BACTERIA
- LARGE GENOME= BIG BIOLOGIC PLASTICITY
- GRAM NEGATIVE= CONJUGATION

- SWITCH OF ACTIVITY OF GENES, WITH OTHER FUNCTIONS ?

- THOSE BACTERIA CAN CAUSE OUTBREAKS (NOSOCOMIAL INFECTIONS)

- ATB IN WATER WASTE? COASTAL POLLUTION= WILDLIFE

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DIPARTIMENTO DI
MEDICINA VETERINARIA

Antimicrobial resistance and sea turtles: to treat or not to treat? That's the question!

Marialaura Corrente, DVM
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Department of Veterinary Medicine,
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43RD INTERNATIONAL SEA TURTLE SOCIETY SYMPOSIUM
UNITY AND COLLABORATION
ACCRA, GHANA - 2025

COME LIMITARE/PREVENIRE L'AMR IN AMBITO VETERINARIO

Veterinari (prescrittori di atb)
Cittadini (consumatori di atb)
Opinion makers

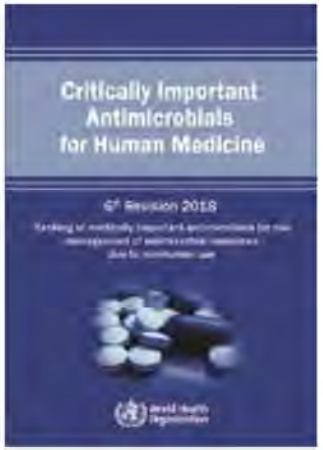
Conoscenze
Buone prassi

formazione
Informazione
aggiornamento

List WHO Critically important antimicrobials for human medicine , 6th rev 2018

- ***Top four atb critically important:***

- **Cefalosporine di III e di IV,**
- **fluorochinoloni,**
- **macrolidi ,**
- **glicopeptidi**



Download (772.2 kB)

Overview

The WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR) reviews and updates the WHO list of critically important antimicrobials for human medicine in every two years. The current revision took place at the fifth meeting of the AGISAR held in Bogota, Colombia in 2013.

Other available languages

- French
- Spanish

Infographics

Nuovi principî attivi: automaticamente nella lista 1

Colistina: da farmaco veterinario a last resort drug

one world • one health

World Health Organization

Home / Newsroom / Article / Public discussion on the WHO Medically Important Antimicrobial List, 7th Revision

Public discussion on the WHO Medically Important Antimicrobial List, 7th Revision

(Previously known as the WHO Critically Important Antimicrobial List)

6 February 2023 | Call for consultation

The WHO Medically Important Antimicrobial List, 7th Revision

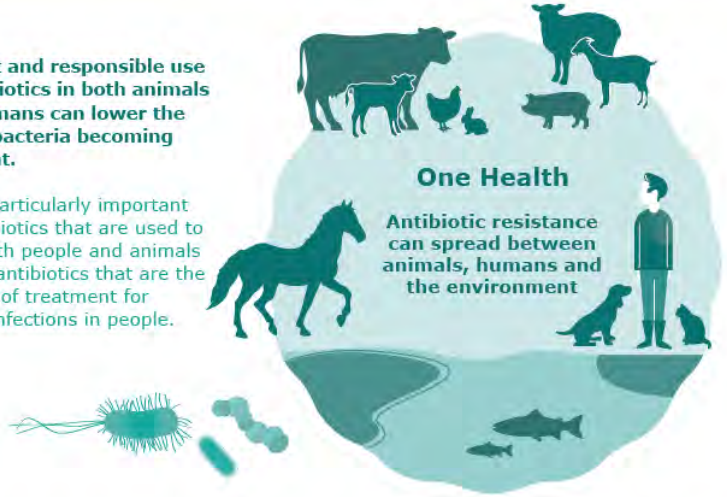
https://www.who.int/news-room/articles-detail/public-discussion-on-the-who-medically-important-antimicrobial-list--7th-revision

EMA

Categorisation of antibiotics for use in animals
for prudent and responsible use

Prudent and responsible use of antibiotics in both animals and humans can lower the risk of bacteria becoming resistant.

This is particularly important for antibiotics that are used to treat both people and animals and for antibiotics that are the last line of treatment for critical infections in people.



The Antimicrobial Advice Ad Hoc Expert Group (AMEG) has categorised antibiotics based on the potential consequences to public health of increased antimicrobial resistance when used in animals and the need for their use in veterinary medicine.

The categorisation is intended as a tool to support decision-making by veterinarians on which antibiotic to use.

Veterinarians are encouraged to check the AMEG categorisation before prescribing any antibiotic for animals in their care. The AMEG categorisation does not replace treatment guidelines, which also need to take account of other factors such as supporting information in the Summary of Product Characteristics for available medicines, constraints around use in food-producing species, regional variations in diseases and antibiotic resistance, and national prescribing policies.

Category A
Avoid

- antibiotics in this category are not authorised as veterinary medicines in the EU
- should not be used in food-producing animals
- may be given to companion animals under exceptional circumstances

Category B
Restrict

- antibiotics in this category are critically important in human medicine and use in animals should be restricted to mitigate the risk to public health
- should be considered only when there are no antibiotics in Categories C or D that could be clinically effective
- use should be based on antimicrobial susceptibility testing, wherever possible

Category C
Caution

- for antibiotics in this category there are alternatives in human medicine
- for some veterinary indications, there are no alternatives belonging to Category D
- should be considered only when there are no antibiotics in Category D that could be clinically effective

Category D
Prudence

- should be used as first line treatments, whenever possible
- as always, should be used prudently, only when medically needed

Category A
Avoid

- antibiotics in this category are not authorised as veterinary medicines in the EU
- should not be used in food-producing animals
- may be given to companion animals under exceptional circumstances

Category B
Restrict

- antibiotics in this category are critically important in human medicine and use in animals should be restricted to mitigate the risk to public health
- should be considered only when there are no antibiotics in Categories C or D that could be clinically effective
- use should be based on antimicrobial susceptibility testing, wherever possible

Categorisation of antibiotic classes for veterinary use
(with examples of substances authorised for human or veterinary use in the EU)

A — AVOID

Amdinopenicillins
mecillinam
pivmecillinam

Ketolides
telithromycin

Monobactams
aztreonam

Rifamycins (except rifaximin)
rifampicin

Carboxypenicillin and ureidopenicillin, including combinations with beta lactamase inhibitors
piperacillin-tazobactam

Carbapenems
meropenem
doripenem

Lipopeptides
daptomycin

Oxazolidinones
linezolid

Riminofenazines
clofazimine

Sulfones
dapsone

Streptogramins
pristinamycin
virginiamycin

Drugs used solely to treat tuberculosis or other mycobacterial diseases
isoniazid
ethambutol
pyrazinamide
ethionamide

Other cephalosporins and penems (ATC code J01DI), including combinations of 3rd-generation cephalosporins with beta lactamase inhibitors
ceftobiprole
ceftaroline
ceftolozane-tazobactam
faropenem

Glycopeptides
vancomycin

Glycylcyclines
tigecycline

Phosphonic acid derivates
fosfomycin

Pseudomonic acids
mupirocin

Substances newly authorised in human medicine following publication of the AMEG categorisation
to be determined

B — RESTRICT

Cephalosporins, 3rd- and 4th-generation, with the exception of combinations with β-lactamase inhibitors
cefoperazone
cefovecin
cefquinome
ceftiofur

Polymyxins
colistin
polymyxin B

Quinolones: fluoroquinolones and other quinolones
cinoxacin
danofloxacin
difloxacin
enrofloxacin
flumequine
ibafloxacin
marbofloxacin
norfloxacin
orbifloxacin
oxolinic acid
pradofloxacin

Category C
Caution

- for antibiotics in this category there are alternatives in human medicine
- for some veterinary indications, there are no alternatives belonging to Category D
- should be considered only when there are no antibiotics in Category D that could be clinically effective

Category D
Prudence

- should be used as first line treatments, whenever possible
- as always, should be used prudently, only when medically needed

C — CAUTION

Aminoglycosides (except spectinomycin)

amikacin
apramycin
dihydrostreptomycin
framycetin
gentamicin
kanamycin
neomycin
paromomycin
streptomycin
tobramycin

Aminopenicillins, in combination with beta lactamase inhibitors

amoxicillin + clavulanic acid
ampicillin + sulbactam

Cephalosporins, 1st- and 2nd-generation, and cephamycins

cefacetrile
cefadroxil
cefalexin
cefalonium
cefalotin
cefapirin
cefazolin

Amphenicols

chloramphenicol
florfenicol
thiamphenicol

Lincosamides

clindamycin
lincomycin
pirlimycin

Pleuromutilins

tiamulin
valnemulin

Macrolides

erythromycin
gamithromycin
oleandomycin
spiramycin
tildipirosin
tilmicosin
tulathromycin
tylosin
tylvalosin

Rifamycins: rifaximin only

rifaximin

D — PRUDENCE

Aminopenicillins, without beta-lactamase inhibitors

amoxicillin
ampicillin
metampicillin

Tetracyclines

chlortetracycline
doxycycline
oxytetracycline
tetracycline

Aminoglycosides: spectinomycin only

spectinomycin

Anti-staphylococcal penicillins (beta-lactamase-resistant penicillins)

cloxacillin
dicloxacillin
nafcillin
oxacillin

Sulfonamides, dihydrofolate reductase inhibitors and combinations

formosulfathiazole
phthalylsulfathiazole
sulfacetamide
sulfachlorpyridazine
sulfaclozine
sulfadiazine
sulfadimethoxine
sulfadimidine
sulfadoxine
sulfafurazole
sulfaguanidine
sulfalene
sulfamerazine
sulfamethizole
sulfamethoxazole
sulfamethoxypyridazine
sulfamonomethoxine
sulfanilamide
sulfapyridine
sulfaquinoxaline
sulfathiazole
trimethoprim

Natural, narrow-spectrum penicillins (beta lactamase-sensitive penicillins)

benzathine benzylpenicillin
benzathine phenoxymethylpenicillin
benzylpenicillin
penethamate hydriodide
pheneticillin
phenoxymethylpenicillin
procaine benzylpenicillin

Cyclic polypeptides

bacitracin

Steroid antibacterials

fusidic acid

Nitroimidazoles

metronidazole

Nitrofuran derivatives

furaltadone
furazolidone

DIVIETO DI USO DI ANTIBIOTICI
(in vigore dal 9 febbraio 2023
Regolamento Europeo 2022/1955)

ALLEGATO

Antimicrobici o gruppi di antimicrobici riservati al trattamento di determinate infezioni nell'uomo

1) Antibiotici
   a) Carbossipenicilline
   b) Ureidopenicilline
   c) Ceftobiprolo
   d) Ceftarolina
   e) Combinazione di cefalosporine e inibitori di beta-lattamasi
   f) Cefalosporine siderofore
   g) Carbapenemi
   h) Penemi
   i) Monobattami
   j) Derivati dell'acido fosfonico
   k) Glicopeptidi
   l) Lipopeptidi
   m) Ossazolidinoni
   n) Fidaxomicina
   o) Plazomicin
   p) Glicilcicline
   q) Eravaciclina
   r) Omadaciclina

COME LIMITARE/PREVENIRE L' ATB-RESISTENZA

1. **USO PRUDENTE (o responsabile) DEGLI ANTIBIOTICI: ridurre uso degli atb , secondo categorie EMA**

2. USO RAZIONALE DEGLI ANTIBIOTICI: somministrazione razionale di atb a livello di individuo, con lo scopo di ottimizzare efficacia clinica e minimizzare insorgenza di atb- resistenza

Concetti diversi, ma con obiettivo comune:

Linee guida per responsabilizzare all'uso degli antibiotici

USO PRUDENTE/RAZIONALE

DIAGNOSI EZIOLOGICA:
NON ABBANDONARE MOLECOLE "VECCHIE"

1. RISOLVE PROBLEMA DI ATB-RES. NATURALE

Spesso salvando la vita degli individui!!
ES RICKETTSIOSI

<u>Tetracicline (no brevetto)</u>,
e non cefalosporine di IV (brevetto)

2. MINIMIZZA ATB-RES. ACQUISITA

Si usano meno principî att a largo spettro e/o "nuovi"

USO PRUDENTE/RAZIONALE

PROTOCOLLO TERAPEUTICO RISPETTATO

Modalità di somministrazione, tempi, ecc

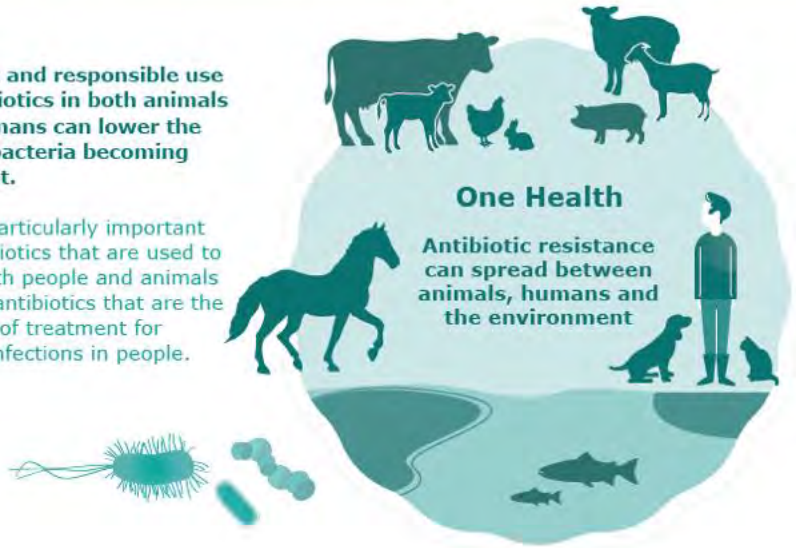
spesso il protocollo prevede somministrazione anche dopo la scomparsa dei sintomi

In ogni caso, linee guida che si devono integrare con la professionalità del medico VETERINARIO (*che agisce secondo scienza e coscienza!)*

EMA Categorisation of antibiotics for use in animals
for prudent and responsible use

Prudent and responsible use of antibiotics in both animals and humans can lower the risk of bacteria becoming resistant.

This is particularly important for antibiotics that are used to treat both people and animals and for antibiotics that are the last line of treatment for critical infections in people.



The Antimicrobial Advice Ad Hoc Expert Group (AMEG) has categorised antibiotics based on the potential consequences to public health of increased antimicrobial resistance when used in animals and the need for their use in veterinary medicine.

The categorisation is intended as a tool to support decision-making by veterinarians on which antibiotic to use.

Other factors to consider

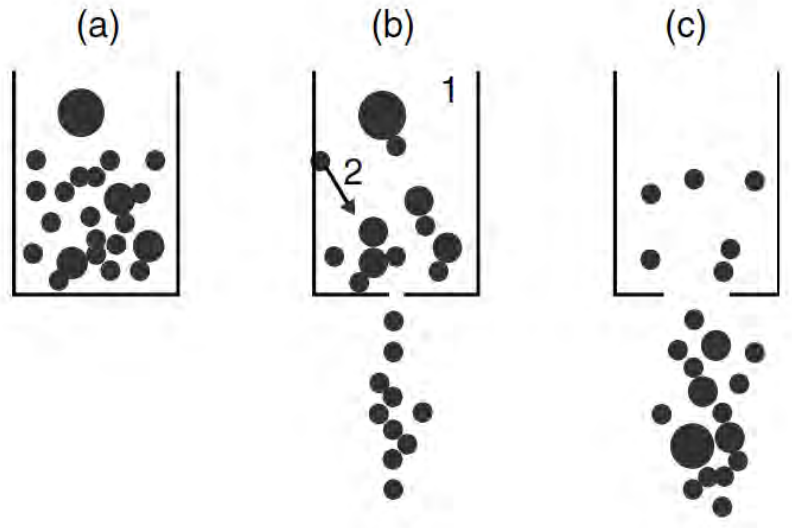
The **route of administration** should be taken into account alongside the categorisation when prescribing antibiotics. The list below suggests routes of administration and types of formulation ranked from the lowest to the highest estimated impact on antibiotic resistance.

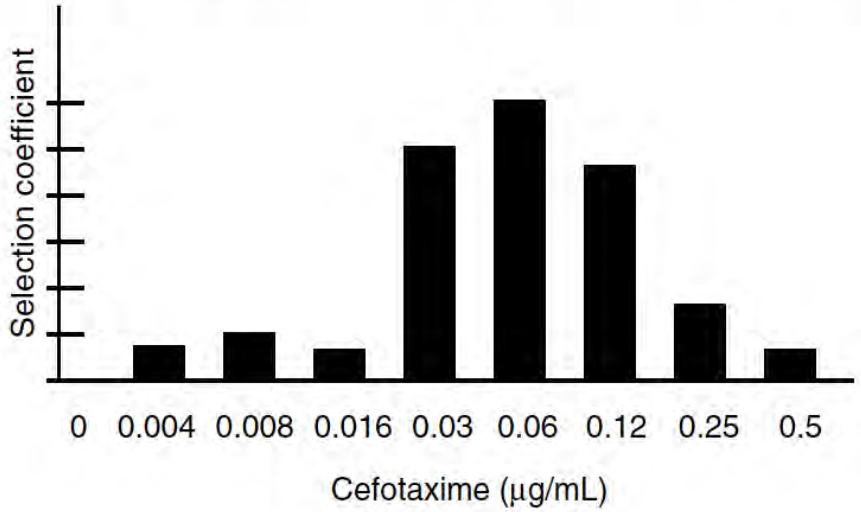
Local individual treatment (e.g. udder injector, eye or ear drops)
Parenteral individual treatment (intravenously, intramuscularly, subcutaneously)
Oral individual treatment (i.e. tablets, oral bolus)
Injectable group medication (metaphylaxis), only if appropriately justified
Oral group medication via drinking water/milk replacer (metaphylaxis), only if appropriately justified
Oral group medication via feed or premixes (metaphylaxis), only if appropriately justified

Trattare o non trattare? Questo è il problema!

Ceppi mutanti -subpopolazione in a)

Popolazione sensibile





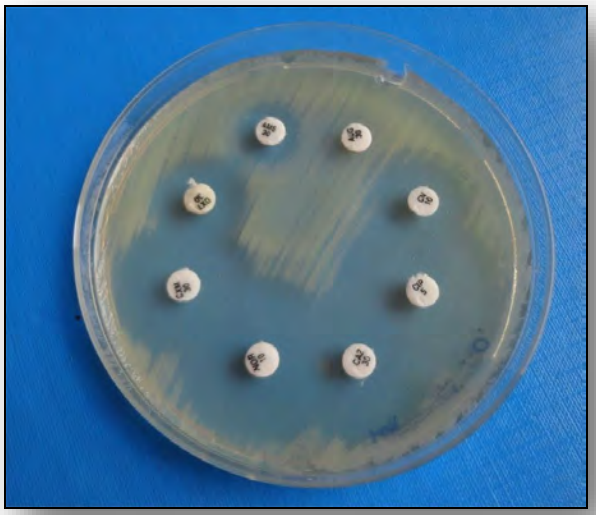
Guide to Antimicrobial use in animals, 2008- Blackwell publishing

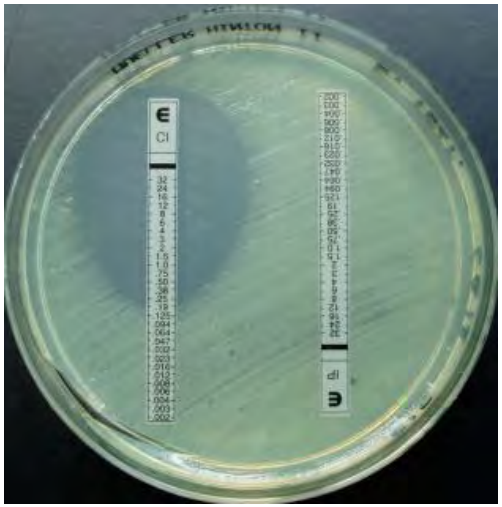
TEST DI LABORATORIO

ANTIBIOGRAMMA
MIC

ATB AD USO VETERINARIO

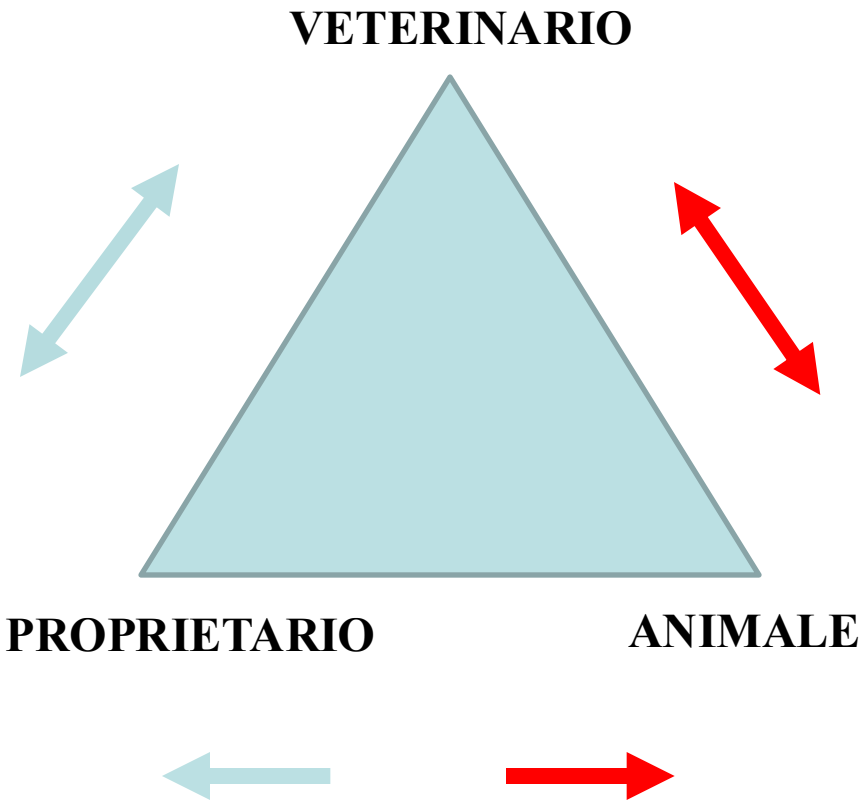
BREAKPOINTS VETERINARI





STRUTTURA VETERINARIA (allevamento, ecc) :

INTERAZIONE, PIU' O MENO SENZIENTE, TRA :



OGGETTO DELLE CURE E' IL MENO CONSAPEVOLE!!

Concetto centrale: la ***compliance*** del proprietario

Riduzione dell'uso degli antibiotici spesso richiede la collaborazione dei pet-owners

Canine pyoderma = one of the major indications for antimicrobial prescribing in small animal practice

- 54,600 dogs in the UK (2010)-electronic records
- 683 (1.3%) dogs with **pyoderma**

Summers *et al. BMC Veterinary Research* 2014, **10**:240
http://www.biomedcentral.com/1746-6148/10/240

BMC Veterinary Research

RESEARCH ARTICLE Open Access

Prescribing practices of primary-care veterinary practitioners in dogs diagnosed with bacterial pyoderma

Jennifer F Summers[1*], Anke Hendricks[2] and David C Brodbelt[1]

- 97% received antimicrobials, **92% systemic therapy**
- Co-amoxiclav, cefalexin, clindamycin, cefovecin

Treatment of superficial pyoderma

Older textbooks: 3 weeks systemic therapy (to include 1 week beyond clinical resolution) +/- topical therapy

Veterinary Dermatology

Vet Dermatol 2014; **25**: 163–e43 DOI: 10.1111/vde.12118

Guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis (Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases)

Andrew Hillier*, David H. Lloyd†, J. Scott Weese‡, Joseph M. Blondeau§, Dawn Boothe¶, Edward Breitschwerdt**, Luca Guardabassi††, Mark G. Papich**, Shelley Rankin‡‡, John D. Turnidge§§ and Jane E. Sykes¶¶

The emergence of highly drug-resistant MRS (mainly MRSP) with few or no options for systemic AMD therapy has provided a **new stimulus for the topical** approach…"

MRSP: Methicillin resistant *Staphylococcus pseudintermedius*

A proposito di ***compliance….***

Ad es: Shampoo 2-3 volte a sett, 10 min contatto
Piuttosto che la pillola magica…

Trattamento topico vs sistemico: decisione del vet !

Come si comportano i veterinari nella pratica quotidiana?

Formazione

FARMACOVIGILANZA

Indagine *on line* sull'uso degli antibiotici nella clinica degli animali da compagnia

Valeriana Colao, Maria Fiorella Greco, Gianpiero Ventrella, Antonio Di Bello, Marialaura Corrente
Dipartimento di Medicina Veterinaria, Università degli studi di Bari "Aldo Moro", Valenzano (BA)

N¡ 7 Settembre 2013 SUMMA ANIMALI DA COMPAGNIA, pag. 1-10

N=8000 unità statistiche

6. Richiede ed attende l'esito dell'antibiogramma prima di prescrivere una terapia antibiotica?

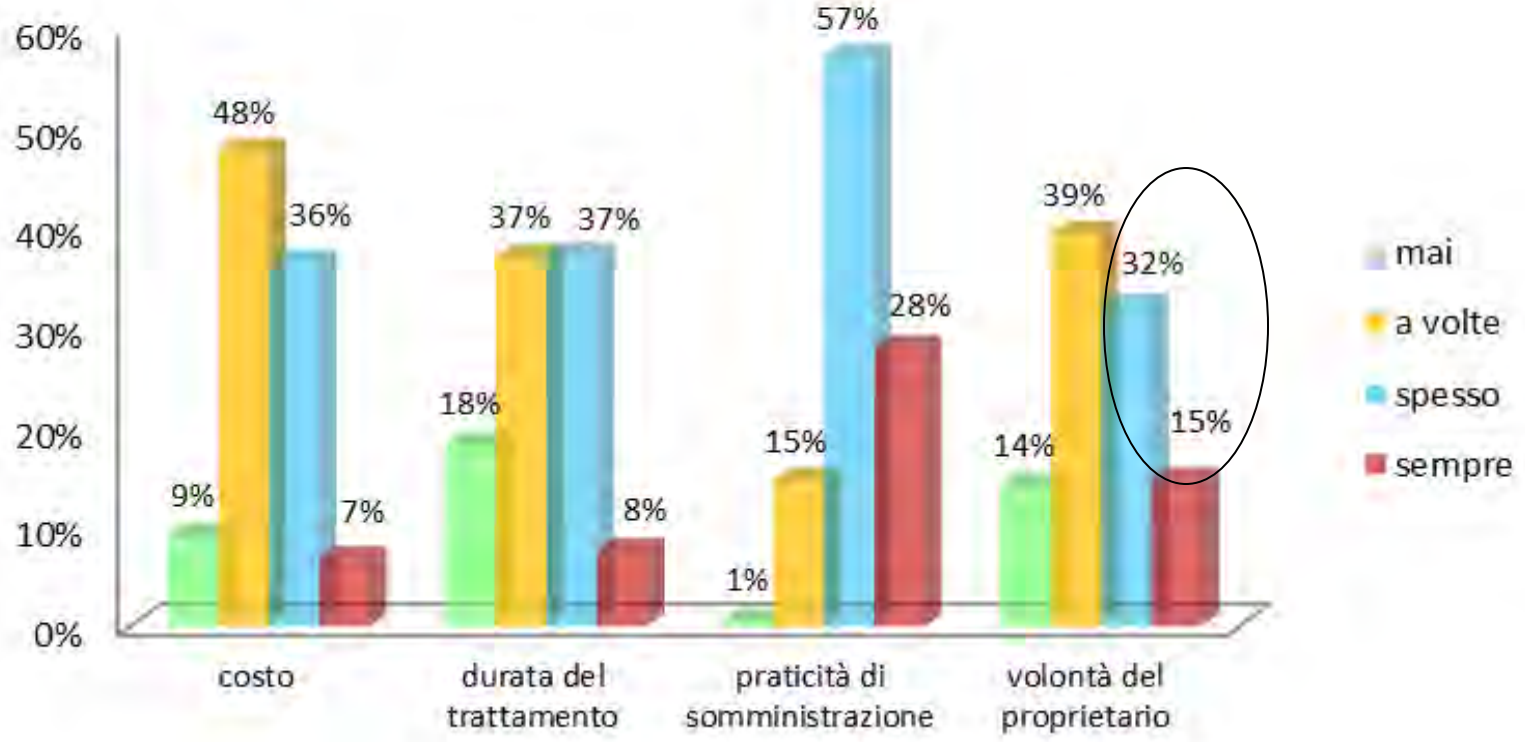
no

Uso razionale:
sì o no ?

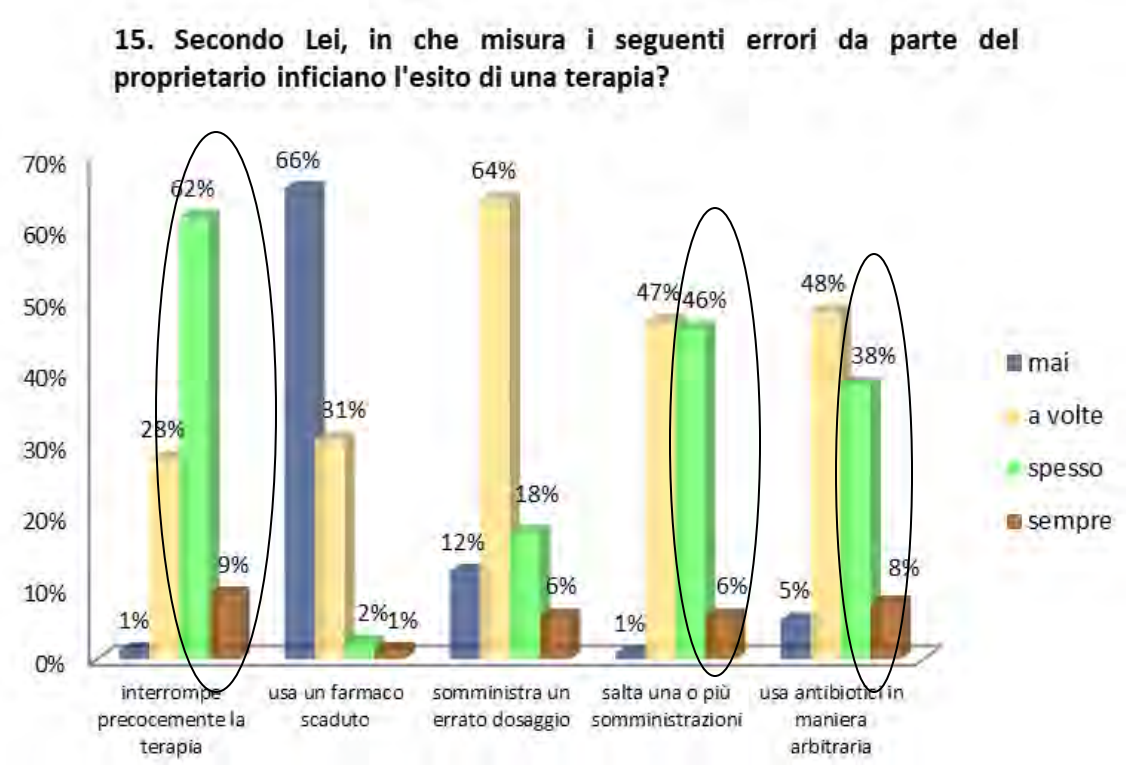
8. Secondo Lei, le disponibilità economiche del proprietario condizionano la richiesta dell'antibiogramma?

no

11. Indipendentemente da valutazioni di carattere scientifico (spettro d'azione, farmacocinetica, ecc..) in che misura i seguenti fattori La influenzano nella scelta dell'antibiotico?



ERRORI CONDOTTI DAL PROPRIETARIO



1 (71%)

2 (52%)

3 (46%)

animals

MDPI

Article

Dog Owners' Attitude toward Veterinary Antibiotic Use and Antibiotic Resistance with a Focus on Canine Diarrhea Management

Alessia Candellone [1,2,*,†], Paola Badino [1,†], Flavia Girolami [1], Ugo Ala [1], Floriana Mina [3] and Rosangela Odore [1]

[1] Department of Veterinary Sciences, University of Turin, 10095 Grugliasco, Italy
[2] Nutrito Vet srl, Rosta, 10090 Turin, Italy
[3] Duregger srl, 12038 Savigliano, Italy
* Correspondence: nutritovet@gmail.com
† These authors contributed equally to this work.

INDAGINI SU PET-OWNERS

Simple Summary: Antimicrobial resistance (AMR) is one of the main health concerns worldwide and addressing the problem through the One Health approach is essential to manage the burden of AMR emergence and transmission. Prudent use of antibiotics and compliance to the prescribed therapy are key actions to prevent the impact of AMR in animals and humans. As regards companion animals, the effective use of antibiotics depends on the collaboration of pet-owners with prescribing vets. To improve compliance, it is important to improve pet-owner understanding of AMR-associated risks. We conducted an online survey to investigate AMR knowledge amongst dog owners with a focus on canine acute diarrhea (AD) management. AD is a good example to consider. The disease is stressful for owners that seek veterinary help for their dog's condition. Some cases of canine AD are still treated with antibiotic courses as first-line medication despite antimicrobial administration often being unnecessary. Rather, it has been observed that dietary management and administration of nutraceuticals can positively impact on the resolution of symptoms. Respondents to our survey were reasonably aware of AMR existence and AMR-associated risks. Almost all of them agreed that treating canine AD with nutraceuticals would represent a valuable alternative to antibiotics.

Come i proprietari si procurano gli antibiotici

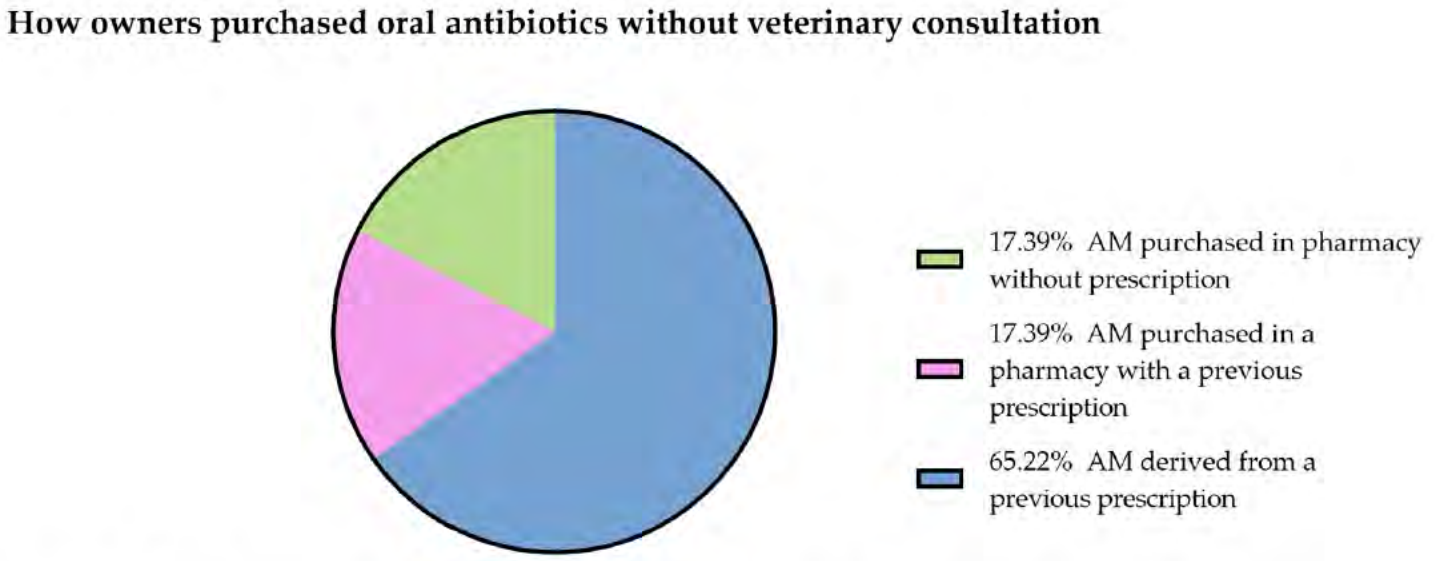


Figure 1. How owners purchased oral antibiotics without veterinary consultation.

Perché interrompono terapia antibiotica?

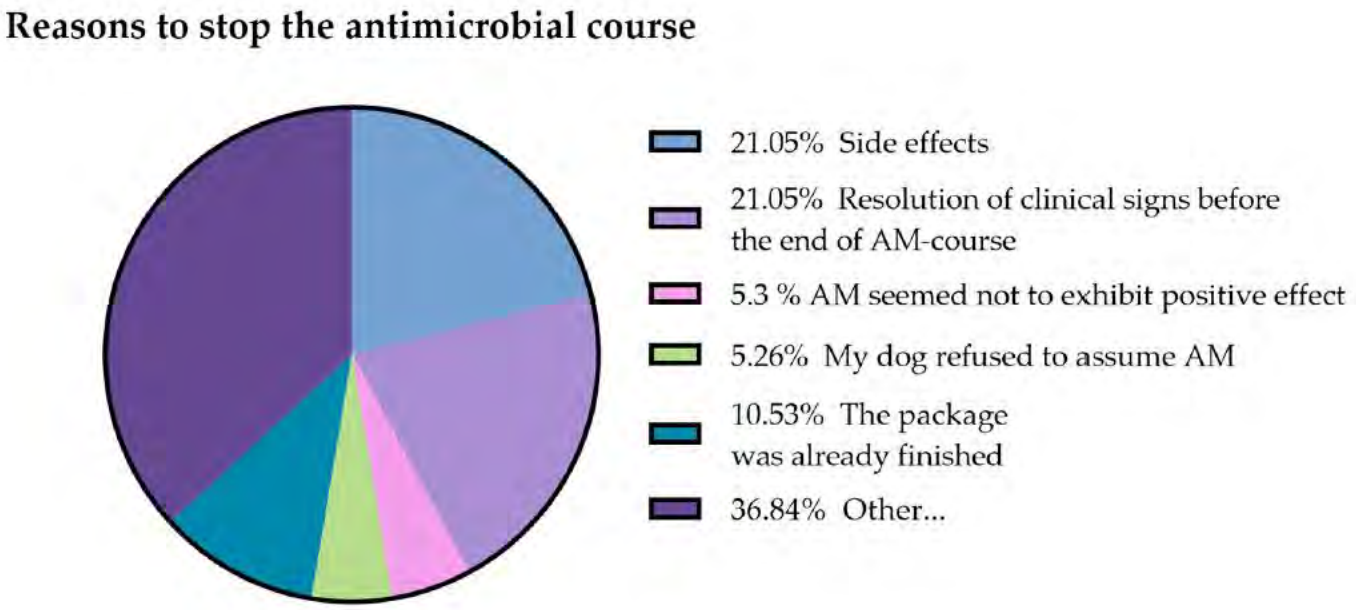


Figure 2. Reasons for stopping antibiotic administration before the end of treatment.

Figure 1. How owners purchased oral antibiotics without veterinary consultation.

10% rispondenti: cambiano vet se non ricevono terapia atb !

A proposito di informazione e fake news:

"Quella dei batteri resistenti agli antibiotici potrebbe essere la causa delle nuove pandemie, ben più tremende.."

"(…) gli antibiotici con cui sono nutriti i nostri pesci.."

GROWTH PROMOTERS: VIETATI!!

BENESSERE ANIMALE

BURIONI: "ANTIBIOTICI NEGLI ALLEVAMENTI PER INCREMENTARE IL PESO". NON È VERO

Roberto La Pira 20 Aprile 2023

ANTIBIOTICI E ALLEVAMENTI

Cartabianca, ANMVI replica all'infettivologo Bassetti

16 Novembre 2022

Dopo le dichiarazioni a carta bianca-rai 3, ANMVI replica all'infettivologo Bassetti. Su allevamenti e antibiotici ha fatto disinformazione

L'infettivologo **Matteo Bassetti**, ospite ieri sera del programma "Carta Bianca" si è avventurato in dichiarazioni sugli allevamenti italiani che- a suo dire- "*producono batteri resistenti e infezioni*". Incautamente ha rincarato: "*Producono inquinamento da batteri resistenti che uccidono le persone*". Bassetti ha infine concluso che in medicina umana si stanno facendo "*dei grossi sforzi per usare bene gli antibiotici negli esseri umani, ma nella veterinaria siamo ancora lontani, quindi bisogna cambiare le regole*".

GROWTH PROMOTERS: VIETATI!!

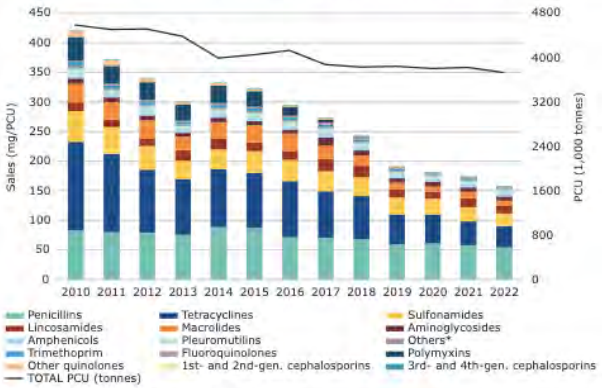
ANMVI: ASSOCIAZIONE NAZIONALE MEDICI VETERINARI ITALIANI

Italia: vendite di antibiotici animali da reddito 2010-2022

ITALY

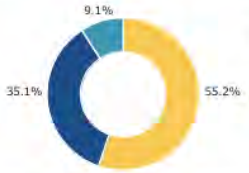
Sales trends (mg/PCU) of antibiotic VMPs for food-producing animals

Sales trends by antibiotic class (mg/PCU) from 2010 to 2022[1]



[1] Sales data sorted from highest to lowest in 2022.
* The class 'Others' includes sales of the following sub-classes: imidazole derivatives (metronidazole), nitrofuran derivatives (furazolidone) and other antibacterials (bacitracin, furaltadone, rifaximin, spectinomycin). Of note is that some of the sales could be for non-food-producing animals.

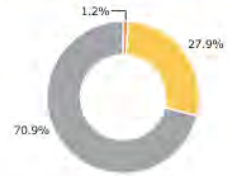
Proportion of sales (mg/PCU) by product form in 2022[1]



Sales of oral powders, oral solutions and premixes accounted for 90.5% of total sales in 2022.

[1] The sales of oral powders and other forms (intramammary, intrauterine, bolus and oral paste products) are not represented in this figure and represent 0.2% and 0.4% of total sales, respectively.

Proportion of sales (mg/PCU) by AMEG categories in 2022



The majority of antibiotic VMP sales in 2022 belonged to the AMEG category D (Prudence), accounting for 70.9% of total sales.

Since 2011:

- 57.5% overall annual sales (from 371.0 mg/PCU to 157.5 mg/PCU in 2022)
- 76.2% 3rd- and 4th-generation cephalosporin sales (from 0.36 mg/PCU to 0.09 mg/PCU in 2022)
- 59.0% fluoroquinolone sales (from 2.2 mg/PCU to 0.90 mg/PCU in 2022)
- 95.9% other quinolone sales (from 9.1 mg/PCU to 0.38 mg/PCU in 2022)
- 98.1% polymyxin sales (from 30.7 mg/PCU to 0.58 mg/PCU in 2022)
- PCU decreased by 17.4% between 2011 and 2022

2022 sales data

In 2022, overall sales decreased by 9.2% in comparison to 2021 (from 173.6 mg/PCU to 157.5 mg/PCU). The three highest selling antibiotic classes were penicillins, tetracyclines and sulfonamides, which accounted for 34.6%, 22.6% and 13.8% of total sales, respectively.

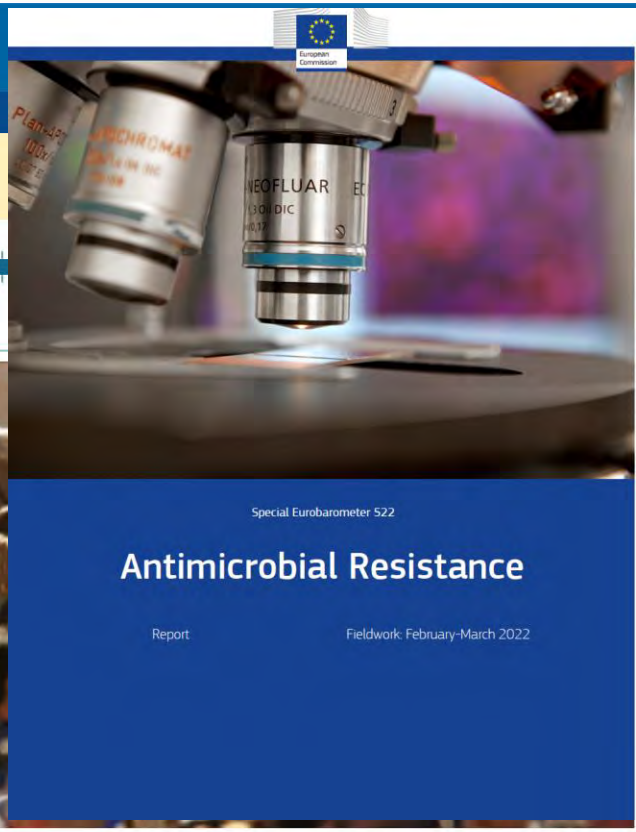
Diminuite del 57% (media europea: -53%)

https://www.anmvioggi.it/in-evidenza/75194-esvac.html

On the use of antimicrobial agents as growth promoters, a total of 112 responding countries (112 out of 160; 70%) did not use any antimicrobial agents for growth promotion in animals in their countries as of 2019, regardless of the presence or absence of legislation or regulations. Forty-two countries (42 out of 160; 26%) reported use of antimicrobials for growth promotion; of these, 20 countries (20 out of 42; 48%) had a regulatory framework that either provided a list of antimicrobials that could be used as growth promoters or provided a list of those that should not be used as growth promoters.

an overall decrease of 34% in the mg/kg was observed at the global level; a decrease was noted across all Woah Countriesw

Indagini Eurobarometer



Condotte 6 indagini (2009-2023) sull'uso degli antibiotici e conoscenze degli stessi da parte dei cittadini europei

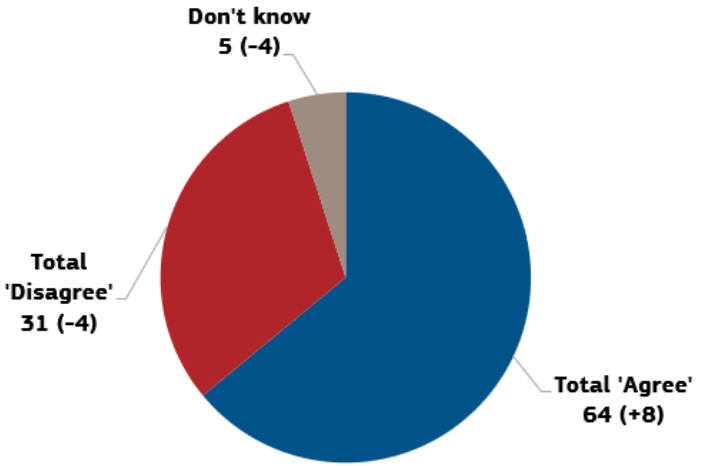
(Numero di intervistati: ca 30.000 (face-to face)

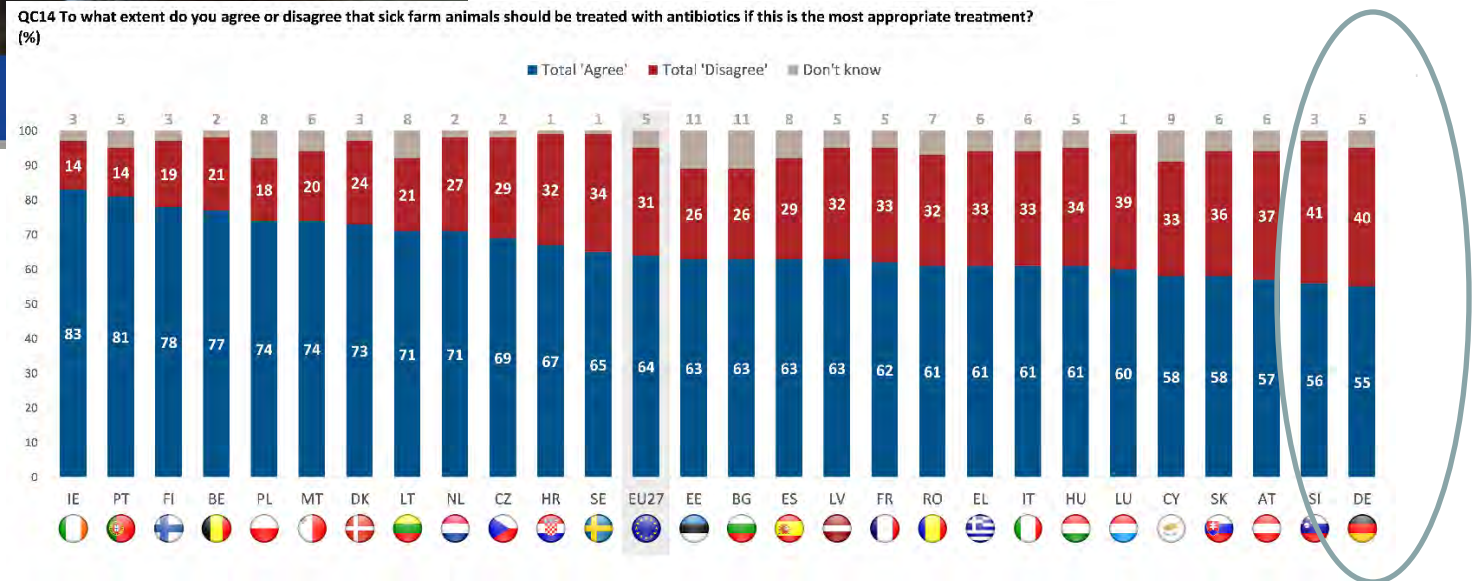
V. USE OF ANTIBIOTICS IN AGRICULTURE AND THE ENVIRONMENT

The treatment of sick animals with antibiotics

(Da Pagina 77 del documento)

QC14. To what extent do you agree or disagree that sick farm animals should be treated with antibiotics if this is the most appropriate treatment?
(% - EU)

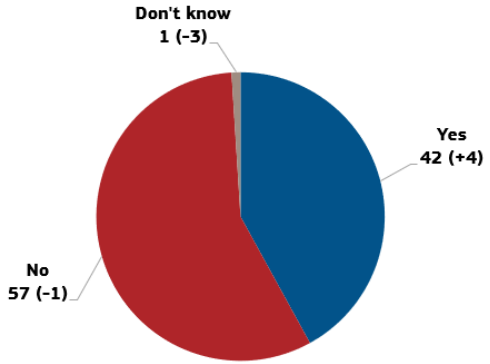




Ban on the use of antibiotics within the EU to stimulate growth in farm animals

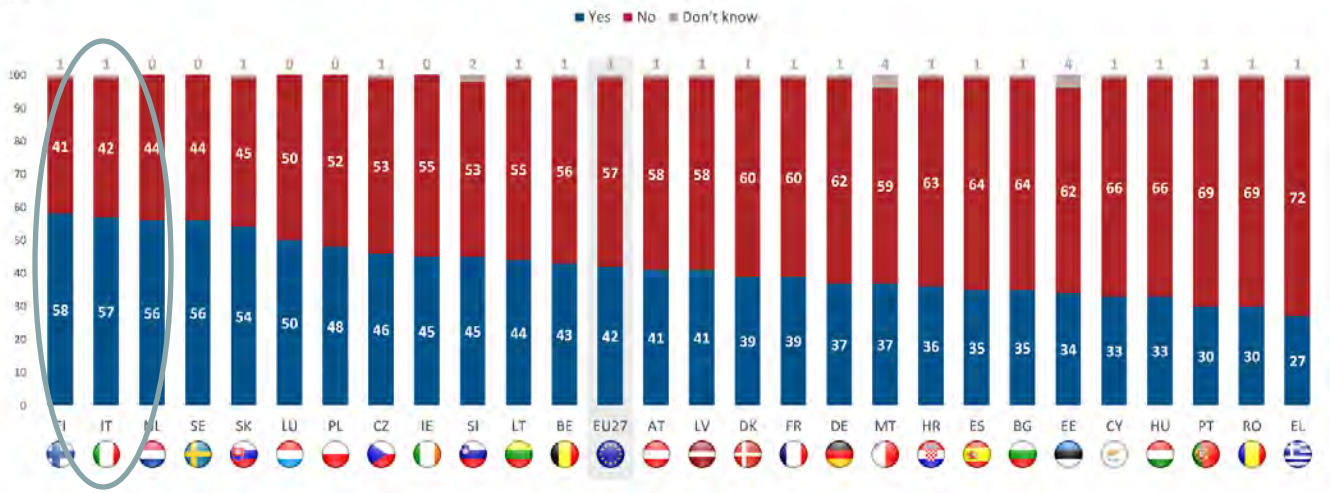
Close to three /five Europeans are not aware of the EU ban on the use of antibiotics to stimulate growth in farm animals !!

QC15. Did you know that using antibiotics to stimulate growth in farm animals is banned within the EU?
(% - EU)



(Feb/Mar 2022 - Sept 2018)

QC15 Did you know that using antibiotics to stimulate growth in farm animals is banned within the EU?
(%)



Esempio di buona informazione

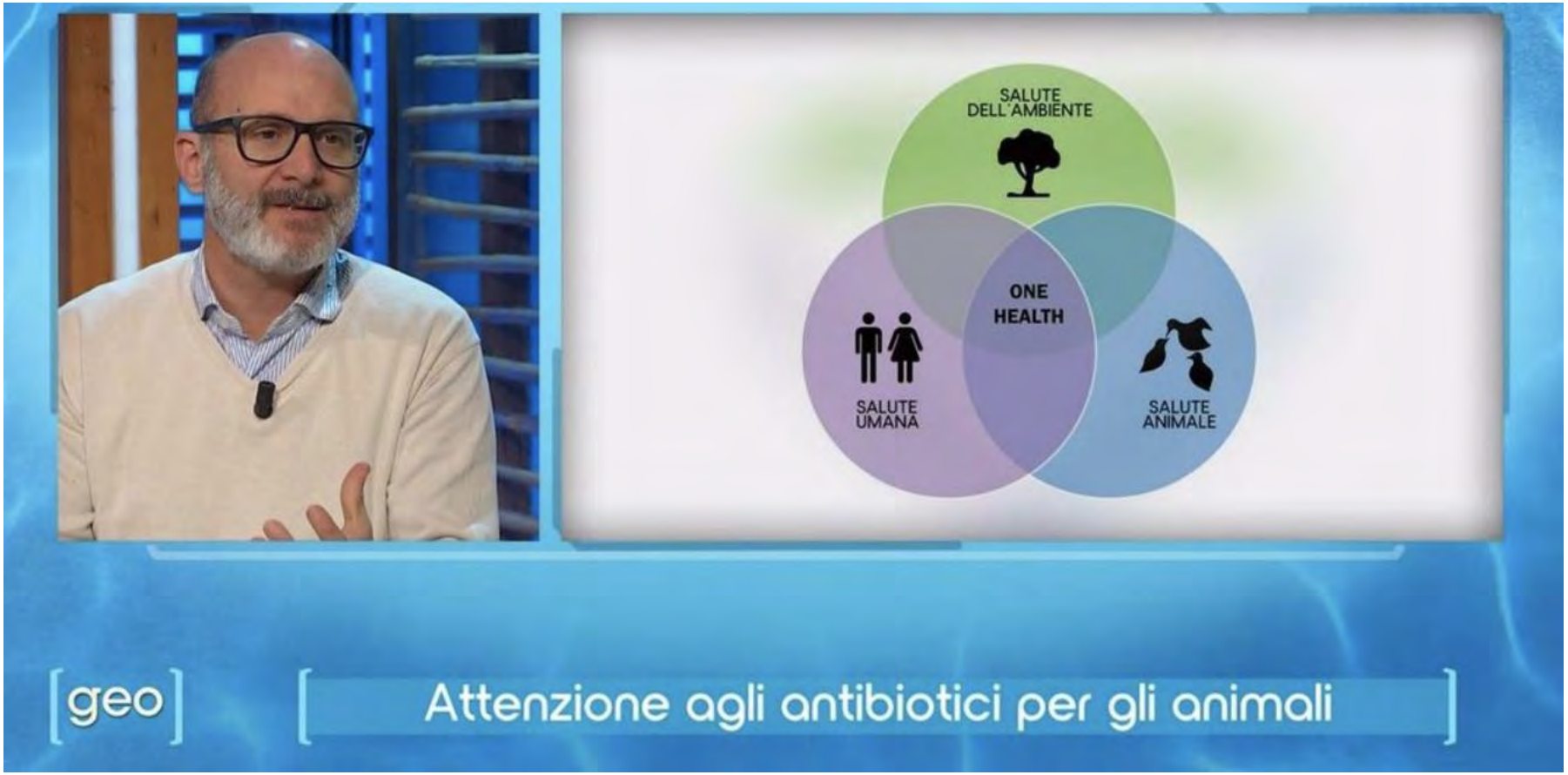
ANMVI Associazione Nazionale Medici Veterinari Italiani

.

“In Italia i veterinari prescrivono i medicinali tramite la ricetta elettronica e in questo modo ogni farmaco viene registrato e tracciato”.
“Nel peggiorare della situazione mondiale, l’Italia risulta invece una nazione in cui l’impiego degli antibiotici si è ridotto drasticamente, per questo riceverà dall’Unione Europea dei premi economici da investire nella salute”.
Cosa possiamo fare tutti noi?

- Non usare farmaci senza la prescrizione medica
- Usare i medicinali come ci indica il medico
- Avere un rapporto con la medicina sempre più di fiducia

Il Dottor Paolo Selleri - veterinario vicepresidente di Anmvi, è stato ospite di Geo per parlare di medicinali e di antibiotico resistenza.
Per vedere la puntata: http://tinyurl.com/2n22frjb



PROSPETTIVE FUTURE: NUOVI ANTIBIOTICI IN MED VET ? NO GRAZIE

Numerose sperimentazioni *in vitro* :

- Sostanze naturali (olii essenziali,peptidi,
- Ozono,ecc)

Manca step seguente, sperimentazione *in vivo*

Eventuali nuovi antibiotici: ad uso esclusivo nell'uomo

Crisi del settore: drug repurposing

Uso dei batteriofagi

Università degli Studi di Ferrara

Agenda17 Plus

Webmagazine del Laboratorio Design of Science

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SALUTE E BENESSERE

Cerca ...

DOSSIER ANTIBIOTICO RESISTENZA: IL RITORNO DEI FAGI Efficaci anche in agricoltura, zootecnia e veterinaria, contribuiscono a risolvere i problemi degli allevamenti intensivi

Aprile 25, 2025

di Diletta Chirici

[English below] Nella lotta alla farmaco resistenza, la terapia fagica sta guadagnando attenzione come potenziale alternativa agli antibiotici per la loro caratteristica selettività nella loro azione contro i batteri, la capacità di autoregolazione in risposta ai batteri bersaglio e, in generale, la sempre più evidente efficacia: se questo è vero in medicina, oggi questa possibilità si apre anche alla cura degli animali.

Extra dossie

Il morbillo torn
all'Europa. È ca
anche in Italia
di Alice Ghilardi
Maggio 20, 2025

https://www.agenda17.it/2025/04/25/dossier-antibiotico-resistenza-il-ritorno-dei-fagi-efficaci-anche-in-agricoltura-zootecnia-e-veterinaria-contribuiscono-a-risolvere-i-problemi-degli-allevamenti-intensivi/

DOCUMENTO FARMINDUSTRIA

»Sviluppare un nuovo antibiotico richiede tempo (sono necessari circa 10-15 anni per far progredire un candidato farmaco dalla fase preclinica a quella clinica) e denaro (fino a un miliardo di euro), senza la garanzia di un ritorno economico che copra almeno le spese di ricerca e sviluppo. Per gli antibiotici nelle classi esistenti, in media, solo una molecola su 15 in fase di sviluppo preclinico raggiungerà i pazienti. Per le nuove classi di antibiotici solo un candidato su 30 avrà successo»

Richiesti incentivi «Push and pull»

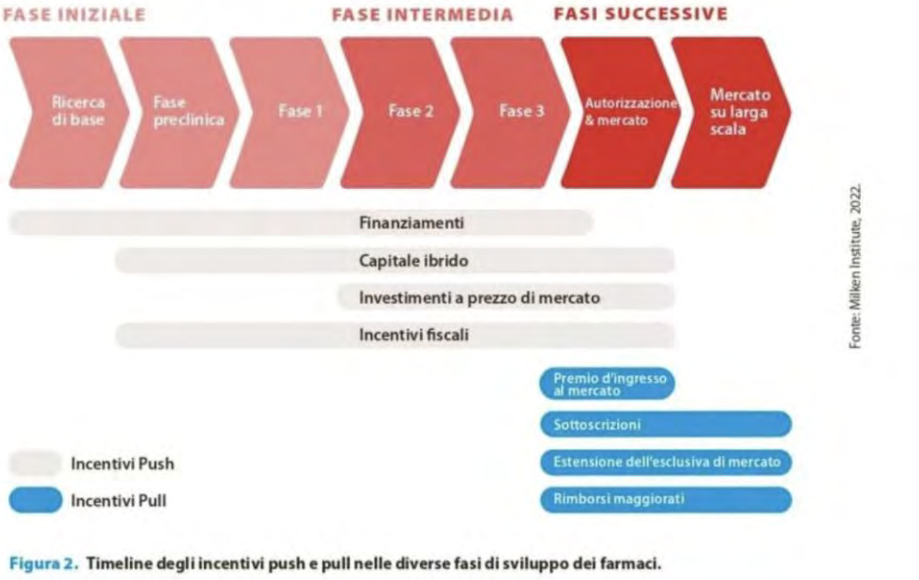


Figura 2. **Timeline degli incentivi push e pull nelle diverse fasi di sviluppo dei farmaci.**

https://www.farmindustria.it/documenticategory/documenti-e-position-paper/

Riduzione dell’uso degli antibiotici

Sorveglianza
Uso prudente
Divulgazione
Ricerca
cooperazione

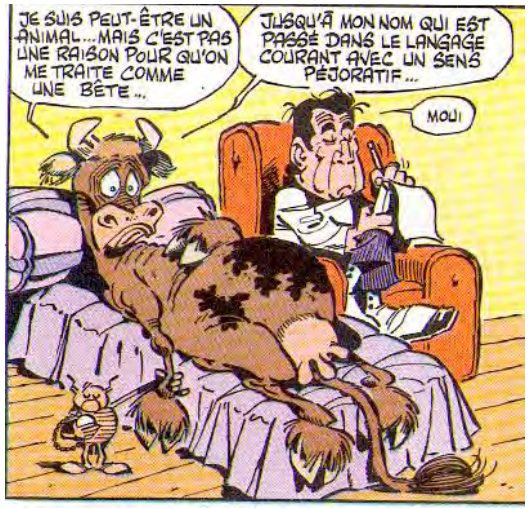
RIDUZIONE DELL'USO DEGLI ANTIBIOTICI

NORME DI BIOSICUREZZA ESTERNA E INTERNA

PROGRAMMI DI VACCINAZIONE

RINFORZARE IMMUNITÀ NATURALE

SELEZIONE LINEE GENETICHE RESISTENTI?



- Accorgimenti: da semplici a quelli di più lungo raggio

ALLEVAMENTI *ANTIBIOTIC FREE*

- Possibilità di escludere completamente gli antibiotici dalla filiera produttiva

  OBIETTIVO REALIZZABILE?

- Scelta di uso responsabile si intreccia con esigenze commerciali

- Allevamenti a ciclo chiuso, breve periodo
- Bovine da latte?

Riduzione dell'uso di antibiotici passa attraverso corrette pratiche di management (igiene) e di biosicurezza. USO DI VACCINI

BIOSICUREZZA, BENESSERE ANIMALE E RIDUZIONE USO ANTIMICROBICI

CLASSY FARM: sistema informativo del Ministero della Salute, integrato nel portale nazionale della veterinaria (www.vetinfo.it), che definisce la categorizzazione degli allevamenti in base al rischio

Aree oggetto di valutazione

- Biosicurezza
- Benessere animale
- Parametri sanitari e produttivi
- Alimentazione animale
- Consumo di farmaci antimicrobici
- Lesioni rilevate al macello

PREMIALITA'

Spendere di più per mangiare meglio

BERNARD ROLLIN

ETHICS, SCIENCE, AND ANTIMICROBIAL RESISTANCE

deliberations run along the following lines:

Well-established, current biological theory, as well as "circumstantial evidence," as well as much informed scientific opinion suggest that use of antibiotics in animal feeds presents a major potential threat to human health if we continue to use them subtherapeutically as we have been doing. What benefits do we lose by truncating such use? The main loss, I am told, will be in the cheapness of food. It will cost more to produce animal products. According to the NRC report, the "average annual per capita cost to consumers of a ban on subtherapeutic drug use is $4.84 to $9.72."[9] So the question to citizens is, in essence, would you be willing to pay $10.00 per year for insurance against the risk of creating antibiotic resistant pathogens? Most consumers, I daresay, would not think twice about saying, "Of course!" (Many of my scientist colleagues in this area, while *professionally* skeptical of our knowledge, also say "yes" when they think of the potential harm to their children, i.e., when they think in their "citizen," common sense, non-scientist mode.) We, as a society, have grown extremely risk-averse about human health.

Journal of Agricultural and Environmental Ethics **14:** 29–37, 2001.

Antibiotico-resistenza: Trump licenzia i veterinari e accontenta le lobby degli allevatori

Di **Riccardo Quintili** - 2 Maggio 2025

HOME ▸ AVMA NEWS ▸ VETERINARIANS AMONG THOSE CUT IN EXTENSIVE LAYOFFS AT HHS

AVMA | News

Veterinarians among those cut in extensive layoffs at HHS

The layoffs are part of a dramatic restructuring as part of President Donald Trump's executive order, "Implementing the President's 'Department of Government Efficiency' Workforce Optimization Initiative."

Health Secretary Robert F. Kennedy Jr. has pledged to fire 10,000 people across the agencies under HHS. When combined with HHS' other efforts, including early retirement and voluntary buyouts, 82,000 full-time employees will be reduced to 62,000, according to a March 27 HHS press release. The department claims it will save taxpayers $1.8 billion per year.

The cuts began the first week of April, with many employees learning they were being placed on administrative leave or offered reassignment, while thousands of other employees were terminated, including senior leadership.

Among those let go were more than 140 leaders and staff members at the FDA's Center for Veterinary Medicine (CVM), many of whom are veterinarians, according to news reports and the AVMA.

Additional veterinarians feeling the impacts work across a variety of areas within the FDA—including the Human Foods Program, the Office of Inspections and Investigations, the Center for Drug Evaluation and Research, the Center for Devices and Radiological Health, and the Center for Biologics Evaluation and Research—as were those working across the CDC and NIH.

Uso responsabile degli antibiotici

- **Restituire centralità alla figura del medico veterinario**

Damien Hirst,
Armadietto di farmaci
(Napoli, Gallerie Zevallos)

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI MEDICINA VETERINARIA

Antibiotici: usarli meno e meglio

Giornata europea sull'uso consapevole degli antibiotici

18 Novembre 2021

Aula Magna del Campus di Medicina Veterinar

Programma

Moderatrice: Marialaura Corrente, Docente di Microbiologia del Dipartiment

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI MEDICINA VETERINARIA

Uso dei farmaci negli animali

Cosa c'è di nuovo?

09 giugno 2021

ore 11.30 - 16.00

I sessione

ore 11.30-12.30

Saluti: Dott. Giovanni Albergo, Presidente dell' Ordine dei Medici Veterinari Bari-BAT

Moderatrice: Prof.ssa Marialaura Corrente, Docente del DiMeV

Relatrice: Dott.ssa Raffaella Barbero, Dirigente Veterinario ASL Torino 4, Coordinatrice Gdl Farmaco FNOVI

"Impiego di farmaci registrati per l'uomo in ambito veterinario: opportunità o forzatura?"

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI MEDICINA VETERINARIA

World Antimicrobial awareness week

Uso prudente degli antibiotici: il contributo dei medici veterinari

23/11/2023 Dalle ore 14:15

Aula Magna - Campus di Medicina Veterinaria

Moderatrice: Marialaura Corrente, Direttrice della Scuola di Specializzazione in Malattie Infettive, Profilassi e Polizia Veterinaria

14.15: Registrazione partecipanti

14.30 Saluti
Nicola Decaro (Direttore del Dipartimento di Medicina Veterinaria)
Maria Tempesta (Coordinatrice del Dottorato in Sanità animale e Zoonosi)

14.40-15.00 - Grazia Greco (Docente del DiMeV), Daniela Mrenoshki (PhD student)
Scelta consapevole della terapia antimicrobica in medicina veterinaria: metodi ed esperienze

15.10-15.30 - Nicola Pugliese (Docente del DiMeV)
Da Falco naumanni a Caretta caretta: resistenze ai fluorochinoloni in ambiente terrestre e marino

15.40-16.00 - Michela Maria Dimuccio, (PhD student)
ClassyFarm. Benessere Animale e Biosicurezza per un uso sostenibile degli antimicrobici

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI MEDICINA VETERINARIA

La World antimicrobial resistance awareness week

nello spirito della One Health

h. 9.00-13.00 13 novembre 2024

Con una settimana d'anticipo rispetto alla WAAW (che ricorre quest'anno dal 18 al 24 novembre) cogliamo la preziosa opportunità di avere con noi Luca Guardabassi, Professore della One Health Antimicrobial Resistance, presso il Department of Veterinary and Animal Sciences, Faculty of Health and Medical Sciences, University of Copenhagen (UCPH), per un seminario sull'AMR in ambito veterinario e umano, con un approccio One Health.

Saluti
Nicola Decaro Direttore del DiMeV
Maria Tempesta, Coordinatrice del Corso di Dottorato in Sanità animale e Zoonosi

Moderano:
Marialaura Corrente, Presidente della Scuola di Specializzazione in Malattie Infettive, Profilassi e Polizia Veterinaria
Andrea Zatelli, Coordinatore del Corso di Dottorato in Scienze Cliniche, Internistiche, Chirurgiche, Ostetriche Veterinarie.

Programma:
- Il contributo del settore veterinario ai problemi di AMR nell'uomo
- La trasmissione della resistenza antimicrobica tra esseri umani e animali da compagnia
- La manipolazione del microbioma per prevenire la diarrea post-svezzamento nei suini

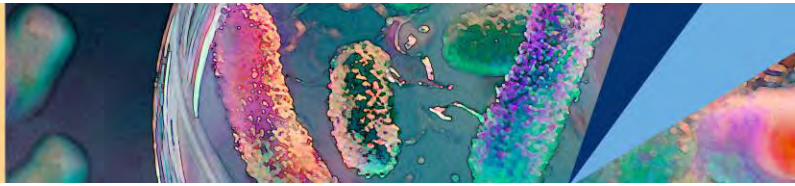
Sessione Q&A

Aula Terio - Campus di Medicina Veterinaria

Strada Prov.le per Casamassima, Km. 3 - Valenzano (BA)

Antimicrobico-Resistenza
e One Health:
Sfide Globali e Soluzioni Locali

3 luglio 2025
Padiglione 152
Centro Congressi Regione Puglia,
Nuova Fiera del Levante - Bari



UNIVERSITÀ
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ALDO MORO

DIPARTIMENTO DI
MEDICINA VETERINARIA

EFFETTI DEGLI ANTIBIOTICI SUGLI ANIMALI E USO PRUDENTE

Marialaura Corrente, DVM
Professoressa Associata
Dipartimento di Medicina Veterinaria
Università degli studi di Bari Aldo Moro
marialaura.corrente@uniba.it

agriculture

MDPI

Review

Animal Welfare, Health and the Fight against Climate Change: One Solution for Global Objectives

Giancarlo Bozzo [1], Marialaura Corrente [1], Giovanni Testa [2], Gaia Casalino [1], Michela Maria Dimuccio [1], Elena Circella [1], Nazario Brescia [3], Roberta Barrasso [1] and Francesco Emanuele Celentano [3,*]

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[2] Postgraduate School in Inspection of Food of Animal Origin, Veterinary Medicine, University of Bari, Strada Provinciale per Casamassima km 3, 70010 Valenzano, Italy; giovanni.testa@outlook.com
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Abstract: Climate change is internationally recognized as a source of concern by governments, scientists and public opinion. In this context, the need to find concrete solutions becomes increasingly urgent. Numerous economic sectors contribute to alteration of climate, especially livestock and, more generally, food production-related activities. For this reason, animal welfare policies, the complex of norms and regulations adopted by single Member States and the European Union in the field of meat production, could be a useful instrument in the climate transition invoked by policy makers and scientists. The aim of this paper was to analyze the current system of animal welfare from a legal and veterinary perspective, and to demonstrate how important and useful, it could be in the fight against climate change; at least if correctly implemented and applied.

Keywords: animal welfare; health; antibiotics; climate change

check for updates

Citation: Bozzo, G.; Corrente, M.; Testa, G.; Casalino, G.; Dimuccio, M.M.; Circella, E.; Brescia, N.; Barrasso, R.; Celentano, F.E. Animal Welfare, Health and the Fight against Climate Change: One Solution for Global Objectives. *Agriculture* **2021**.

4. Antibiotics, Antimicrobial Resistance, and Animal Welfare

Most of the literature on the consequences of the emergence an

FREURAW

SUMMER SCHOOL

BENESSERE ANIMALE E ONE HEALTH:

REGOLAMENTAZIONE, PRODUZIONE E SICUREZZA ALIMENTARE

20 – 30 ottobre 2025, online

francesco.celentano@uniba.it