



THE UNIVERSITY of EDINBURGH
Global Academy of
Agriculture and Food Systems

DDI Data-Driven
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Part of the Edinburgh & South East Scotland City Region Deal

Antimicrobials & food systems

Image by Aleksandar Littlewolf on Freepik

Carys Redman-White MA MRes VetMB MRCVS

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What are antimicrobials?

- Antimicrobials are drugs to treat **infections caused by microbes**
 - Bacteria
 - Fungi
 - Viruses
 - Microscopic parasites (e.g. protozoa)
- Different kinds of antimicrobial treat different infections
- Today's focus: **antibiotics** (used for **bacterial infections**) in farmed animals

Graphic: US Center for Disease Control



AN ANTIBIOTIC IS THE WRONG TOOL TO TREAT A VIRUS.

Make sure you use the right tool for the job.

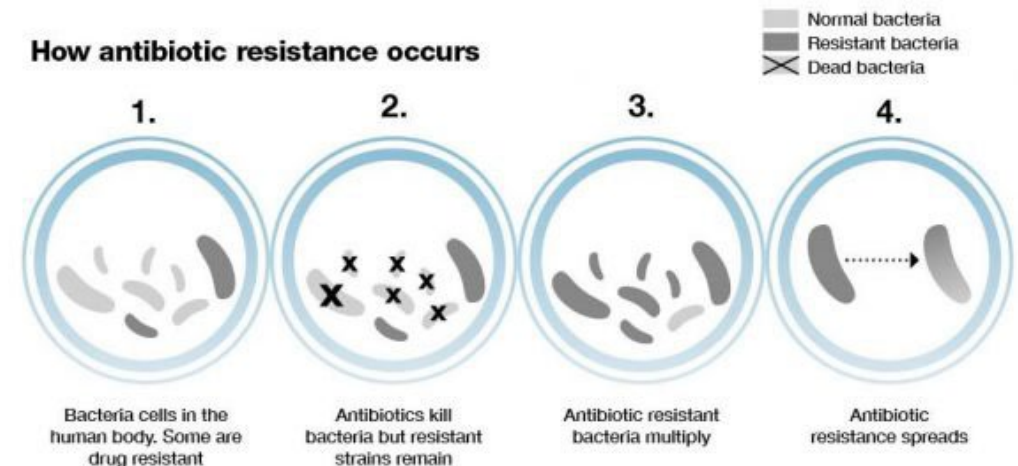
Antibiotics save lives by treating certain infections caused by bacteria, not viruses like colds or flu. When they're not needed, antibiotics won't help you, and the side effects could still hurt you. Ask your doctor when an antibiotic is the right tool for your illness and when it's not.

To learn more about antibiotic prescribing and use, visit www.cdc.gov/antibiotic-use.



Antimicrobial resistance (AMR)

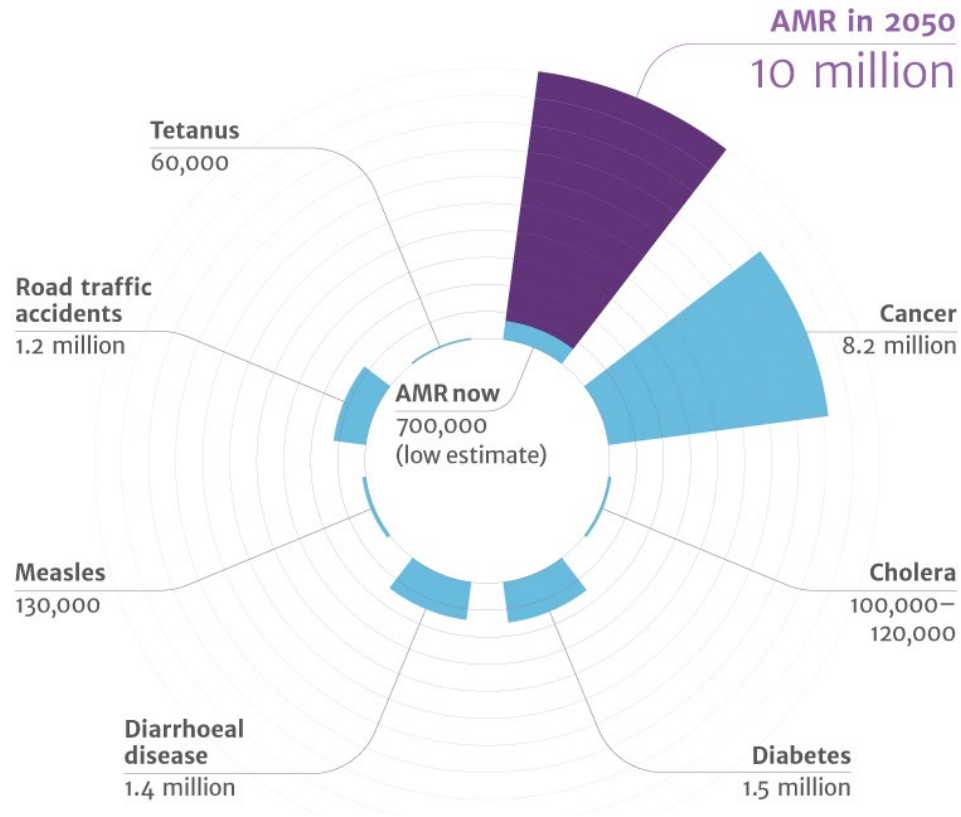
- In a population of microbes, some will be more resistant than others
 - Mutations, or sharing genetic material
- When an antimicrobial is used, the susceptible ones will be killed
- Any left over will be the resistant ones
 - These then grow and multiply, making up more of the population
- Infections caused by these resistant microbes will be much harder to treat



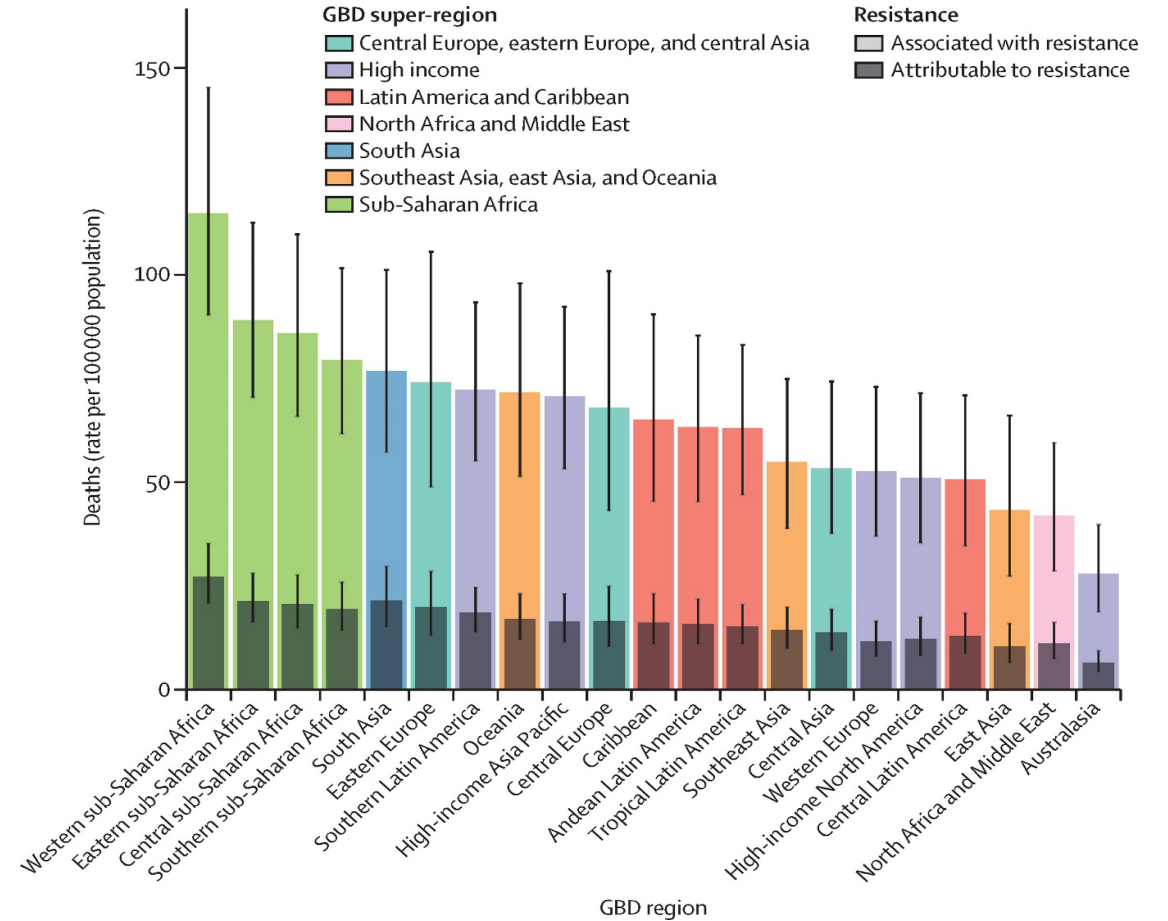
Graphic: UK Government Veterinary Service <https://vets.blog.gov.uk/>



AMR: a “silent pandemic”



Global AMR-related deaths in 2016, and projected figure for 2050. O’Neill report <https://amr-review.org/>

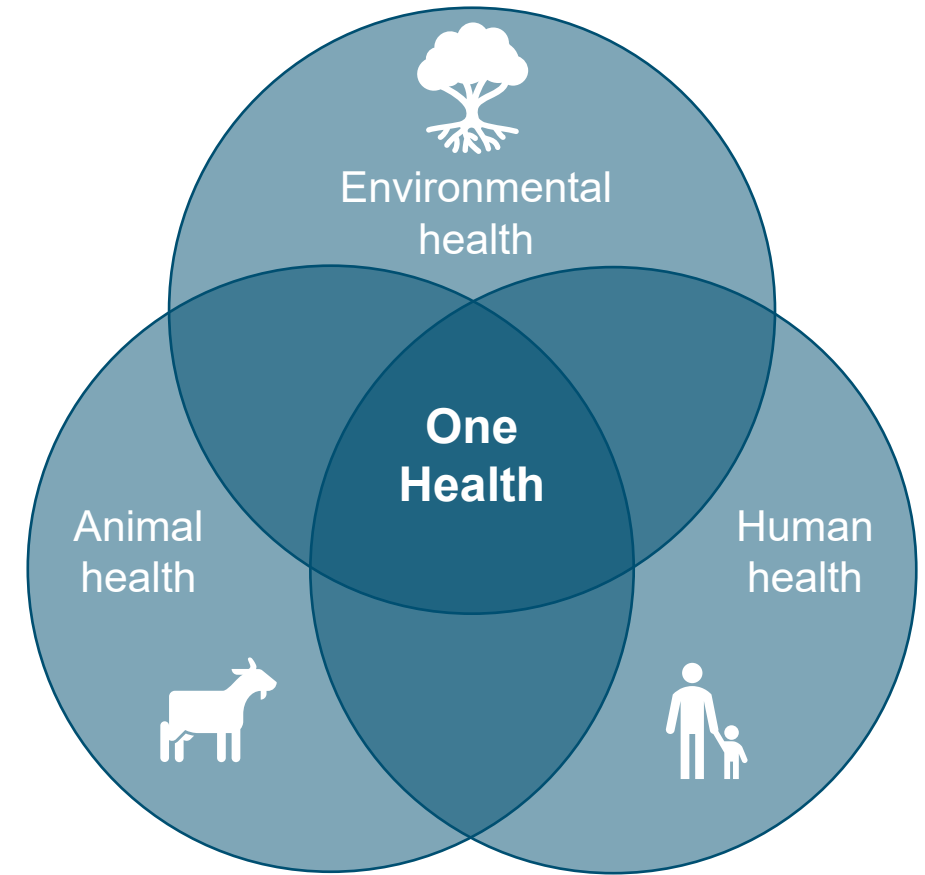


Deaths associated with or attributable to AMR in 2019 by study region. Murray *et al.*, 2022



AMR: a One Health challenge

- Human, animal, and environmental health are interlinked
- For example, infections spreading between humans and animals
 - Sometimes via the environment
- But healthy farm animals also mean:
 - Food sources and livelihoods for humans
 - Less land use and other environmental impacts of farming

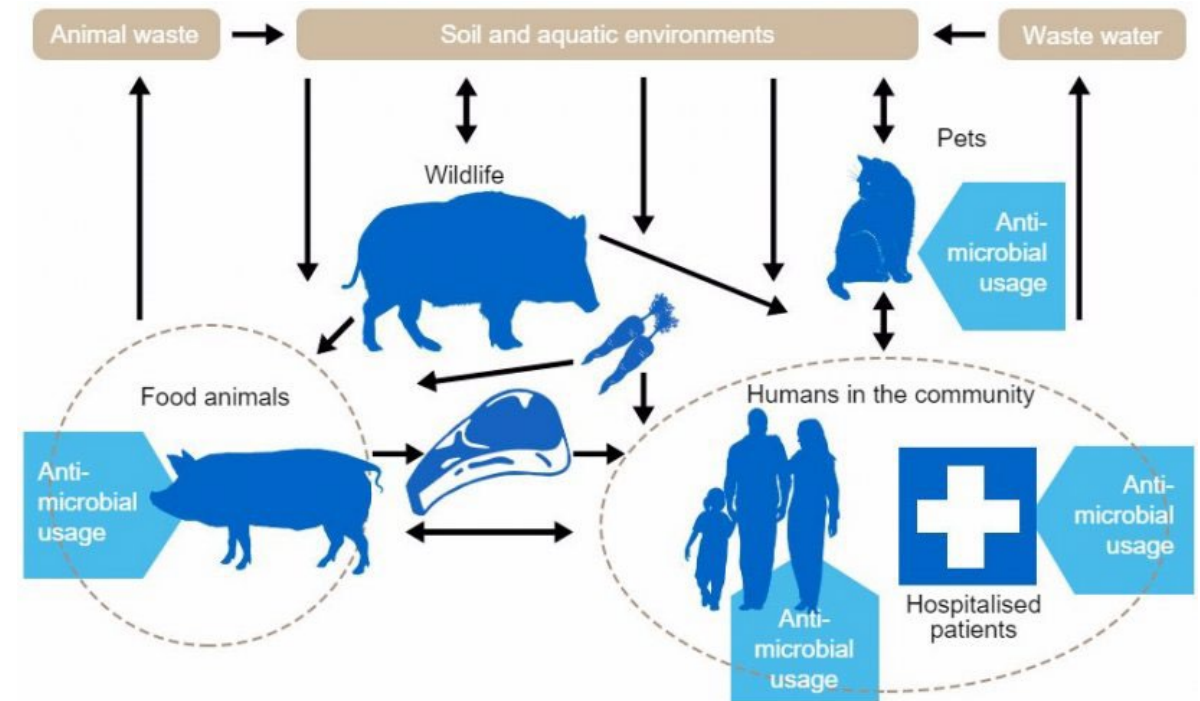


The “One Health” paradigm



Antimicrobial use in farmed animals

- Used for a range of purposes
 - Treating disease
 - Preventing disease
 - Growth promotion
- Total amount used in farming likely higher than that in humans
- Selection for AMR
 - Effective vet medicines needed
 - Many of the antimicrobials are the same ones used in human medicine
 - Transfer to humans

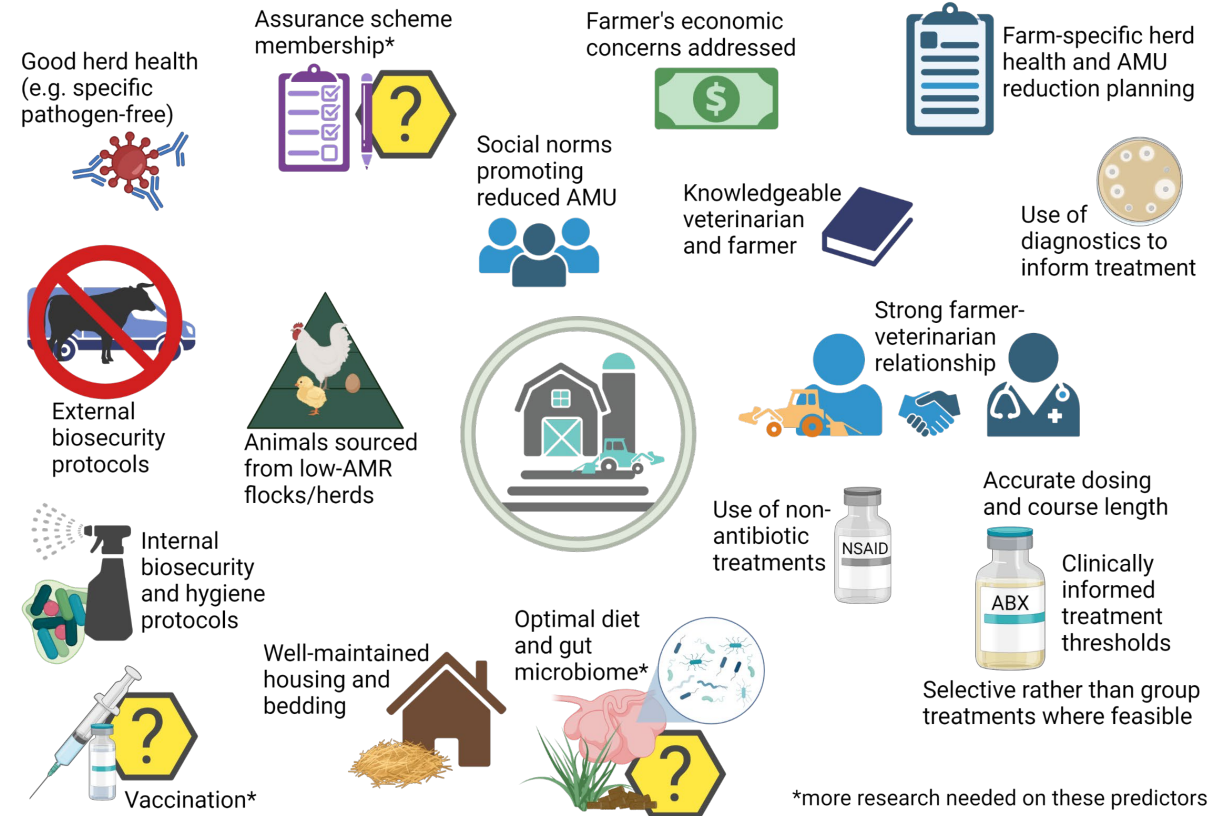


Antimicrobial resistance gene movement pathways in a One Health context Figure:
<http://www.effort-against-amr.eu/>



Avoiding AMR on farms: farm level

- Antimicrobial stewardship
 - “As little as possible, as much as necessary”
 - Using the right antimicrobial for the infection
 - Treating according to vet advice
- Preventing disease
 - Husbandry
 - Biosecurity and hygiene
 - Preventative treatments



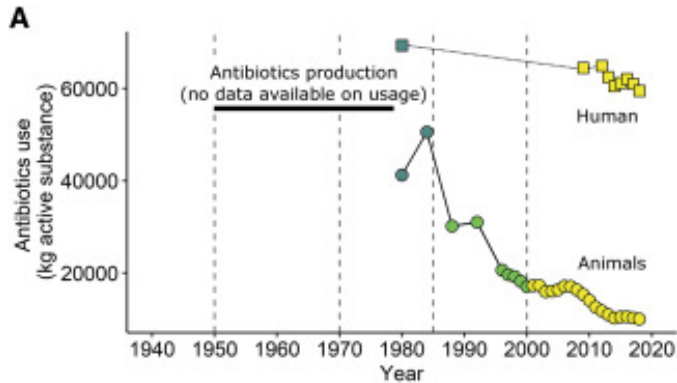
Predictors of low antimicrobial use and resistance on European farms. Redman-White *et al.*, 2023
Graphic created using BioRender.

Avoiding AMR on farms: national level

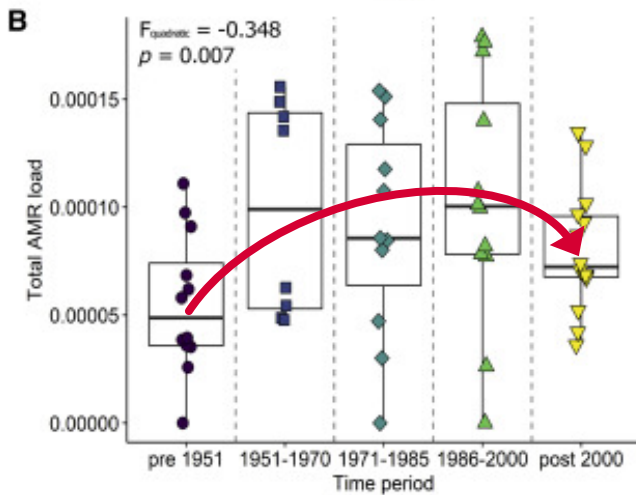
- Regulations
 - Controlling **which antimicrobials** can be used in food animals
 - Controlling **how antimicrobials are used** – e.g., growth promoters and preventative use
 - Drug **withdrawal periods** for meat, milk, and eggs
 - Antimicrobial use and resistance **surveillance**
- Social norms and public perceptions
- Optional **accreditation schemes**, e.g. organic farming
 - Requirements may vary significantly!



Success stories: Sweden



- Swedish policy reduces antibiotic use in farming

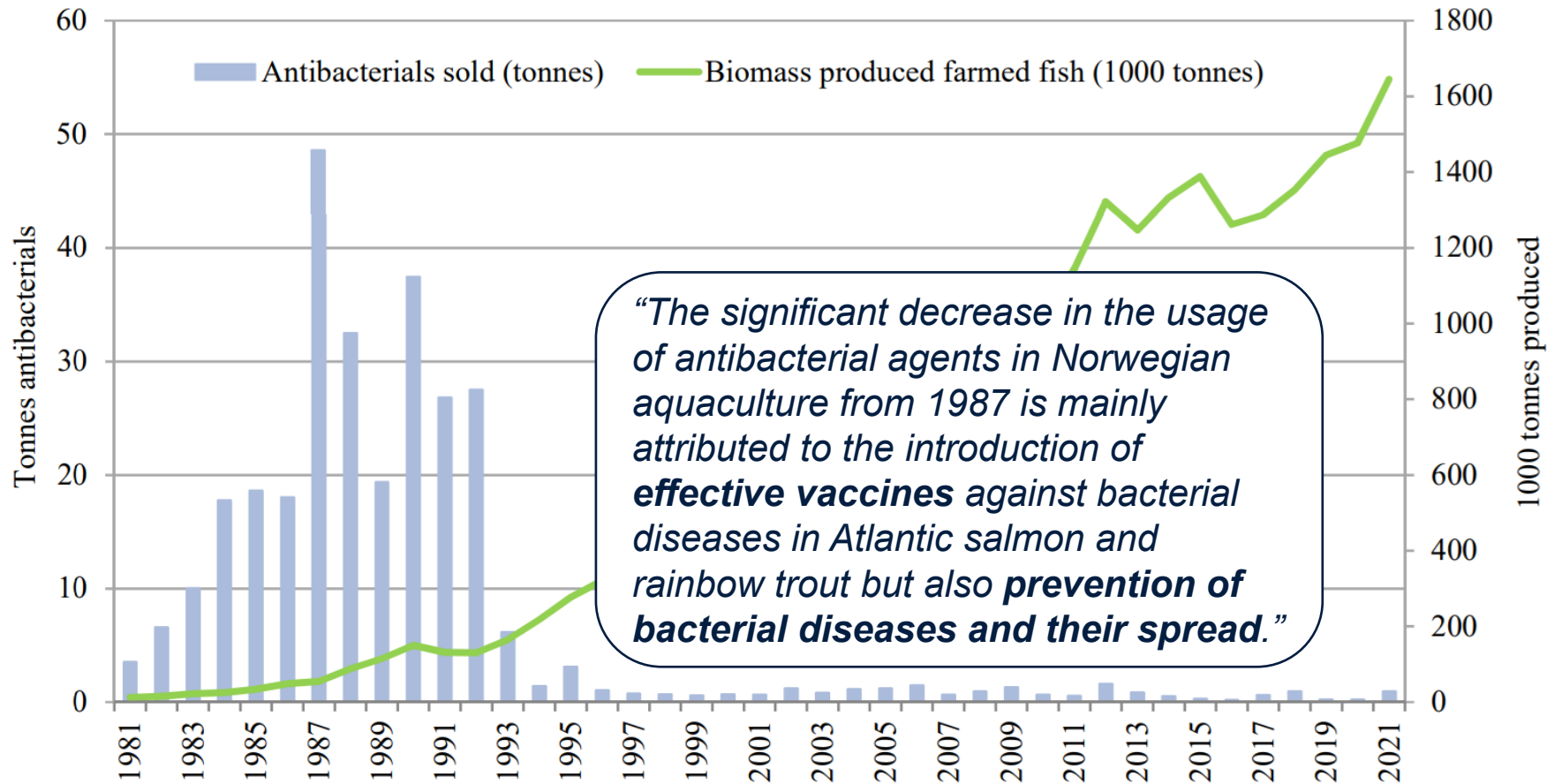


- This is reflected in AMR reductions in wildlife

Antibiotic use in Sweden (A) reflected in total AMR load in brown bear dental calculus (B)
Figure: Brealey *et al.*, 2021



Success stories: Norway



- Norwegian aquaculture
 - Antibiotic use ↓
 - Productivity ↑

Antibacterial use in the Norwegian aquaculture industry 1981-2021
 Figure and quote: NIPH and The Norwegian Veterinary Institute, NORM-VET, 2022



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Thank you

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