

Characterization of neomycin resistance in *E. coli* from pigs

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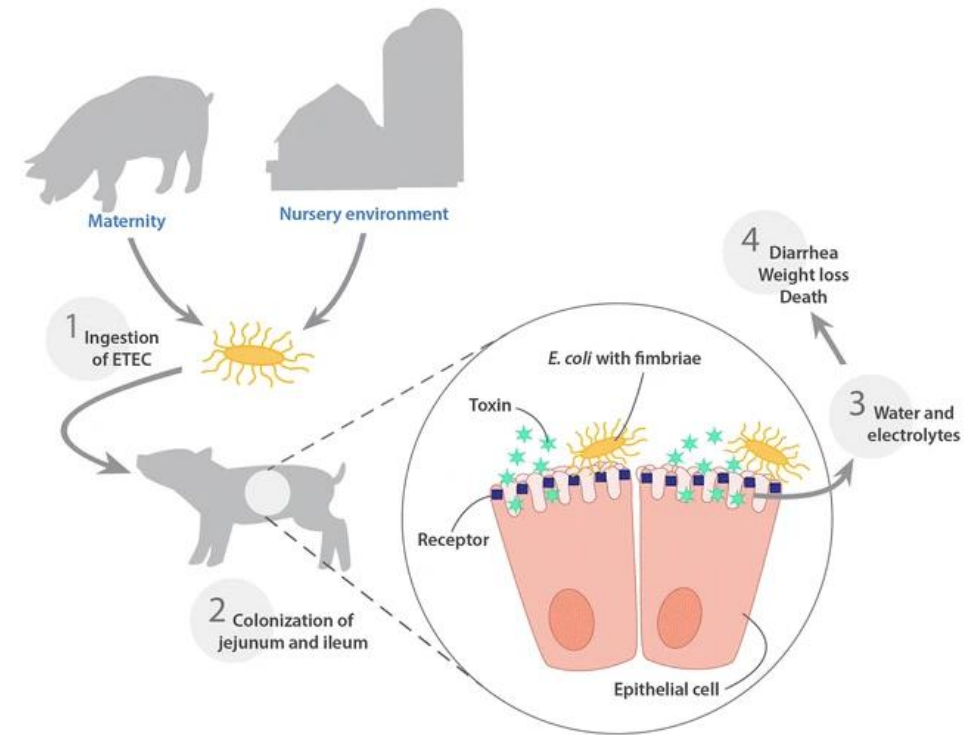


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E. coli and neomycin usage in pig farming

- Pathogenic *E. coli* strains, mainly enterotoxigenic *E. coli* (ETEC), are a leading cause of porcine enteritis, including neonatal diarrhea and post-weaning diarrhea
- ETEC infection results in reduced feed intake and weight loss, and increases the risk of mortality, particularly in young piglets
- Neomycin (NEO) is commonly used in pig farming to prevent porcine enteritis, after the restrictions on the use of colistin and zinc oxide



Source: Rhouma *et al.*, 2017 - *Acta Vet Scand*

E. coli and neomycin usage in pig farming

- NEO resistance has increased in clinical *E. coli* isolated from Danish pig farms
- We have recently demonstrated an association between NEO resistance and NEO use at the farm level in Denmark

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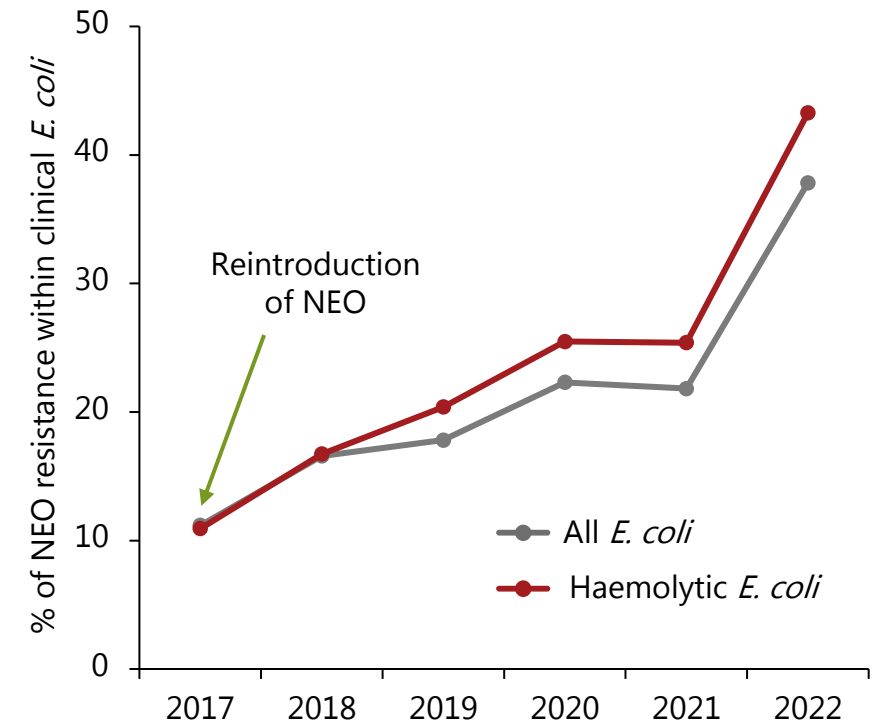
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Neomycin resistance in clinical *Escherichia coli* from Danish weaner pigs is associated with recent neomycin use and presence of F4 or F18 fimbriae

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Source: SEGES

Aims of our study

To identify the NEO resistance determinants and assess their genetic location and mobility in pig pathogenic *E. coli*



A collection of 128 NEO-resistant clinical *E. coli* isolates collected from Danish pig farms from 2018 to 2020 was analyzed by WGS

Our *E. coli* strain collection

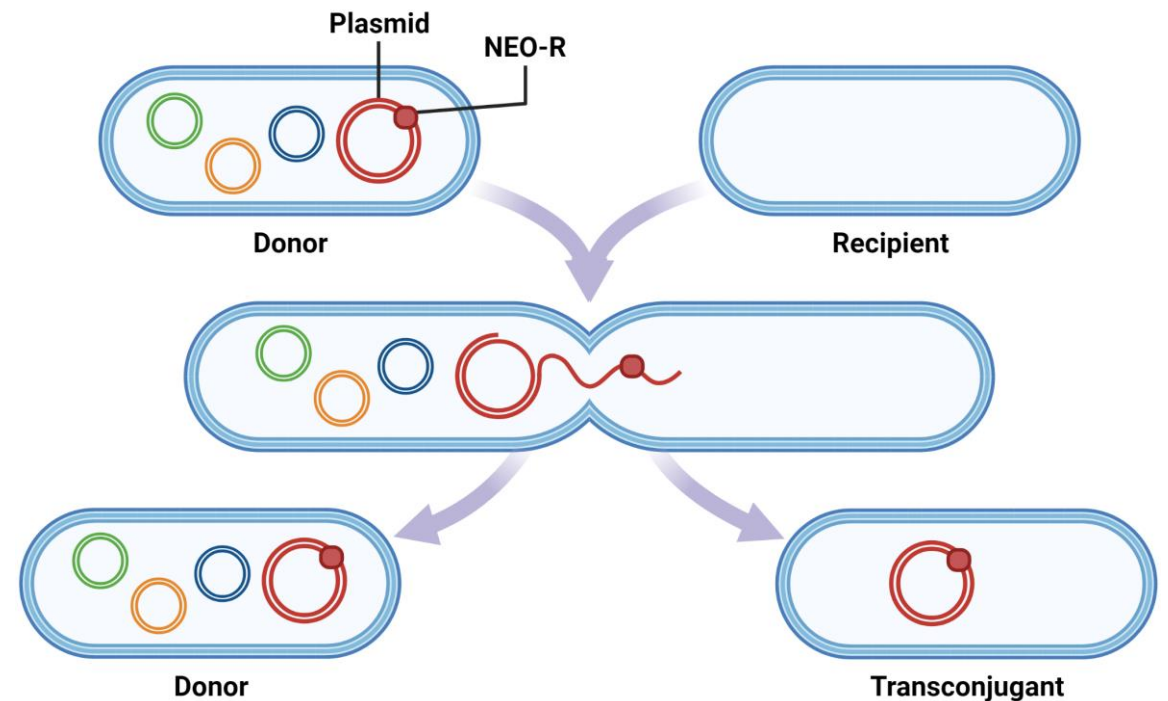
- ✓ Almost 70% of strains were ETEC
- ✓ Around 40% and 30% of strains carried fimbrial type F4 or F18, respectively
- ✓ A high number of lineages were identified, of which ST100-F4 was the most prevalent
- ✓ 95% of isolates were resistant to three or more antimicrobials tested in addition to NEO, especially to sulfamethoxazole and tetracycline

Distribution of NEO MICs and resistance genes

- NEO MICs ranged from 64 to ≥ 4096 mg/L (ECOFF ≥ 16 mg/L)
- More than 80% of isolates displayed MICs between 128-512 mg/L
- Two aminoglycoside-modifying enzymes (*aph*) conferring resistance to NEO were identified in our collection:
 1. *aph(3')-Ia* (119 isolates, 93%)
 2. *aph(3')-Ib* (9 isolates, 7%)

In vitro conjugative transfer of NEO resistance

- NEO resistance was transferrable to laboratory *E. coli* strain from 25 out of the 32 strains (78%) selected for the conjugation experiments
- NEO resistance in recipient strains was equal to that of the corresponding donor
- Based on plasmid typing, the same replicon type was detected in recipients and their respective donors



Characterization of conjugative plasmids

- *aph(3')-Ia* was found on different large conjugative plasmids, which also presented other resistance genes
- *aph(3')-Ib* was associated with a small conjugative plasmid that has not been reported in *E. coli*



Take home message...

We present evidence that recent spread of NEO resistance within clinical *E. coli* in Danish pig farms is:

1. Associated with the recent usage of NEO (Subramani *et al.*, 2023)
2. Not related with a specific *E. coli* lineage
3. Mediated by *aph(3')-Ia*, and to a lesser extent by *aph(3')-Ib*, which are carried on transferable plasmids
4. Probably linked to the use of antimicrobials other than NEO



Thank you



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