Alternatives to Veterinary Antimicrobials (AVANT)

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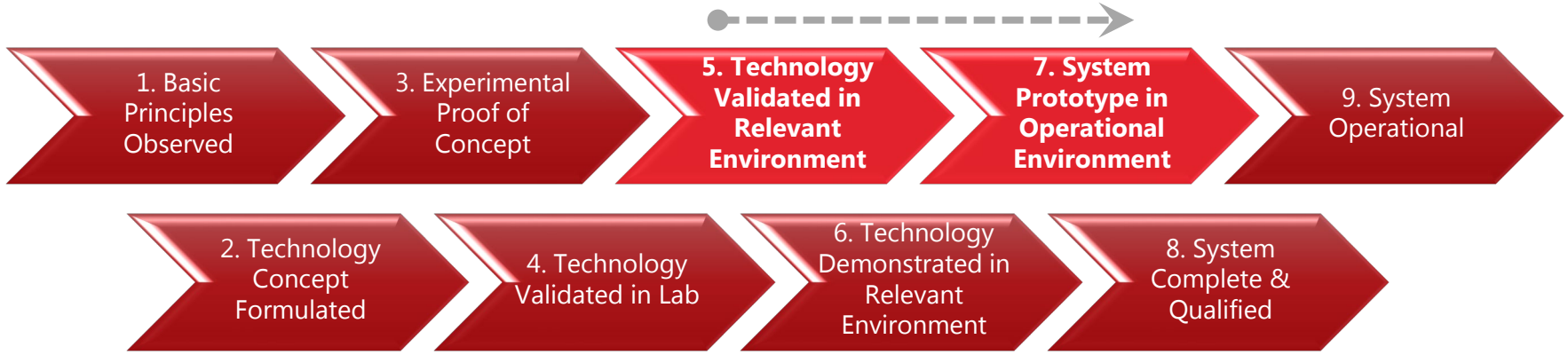
- **Funding program:** Sustainable Resources for Food Safety & Growth European Union's Horizon 2020 Research & Innovation
- **Call:** Anti-microbials and Animal Production
- **Type:** Innovation Action
- **Total budget:** € 6,537,033.75
- **Funded costs:** € 5,999,905.02
- **Starting date:** 1. January 2020
- **End date:** 31. June 2025
- **Duration:** 5.5 years
- **Number of partners:** 14 from 9 Nations

What is an Innovation Action?

- EU **Innovation Actions (IA)** support activities directly aiming at producing new or improved products
- Goal is to **develop alternative intervention measures** from **T**echnology **R**eadiness **L**evels **(TRL)** 5-6 to **TRL7**



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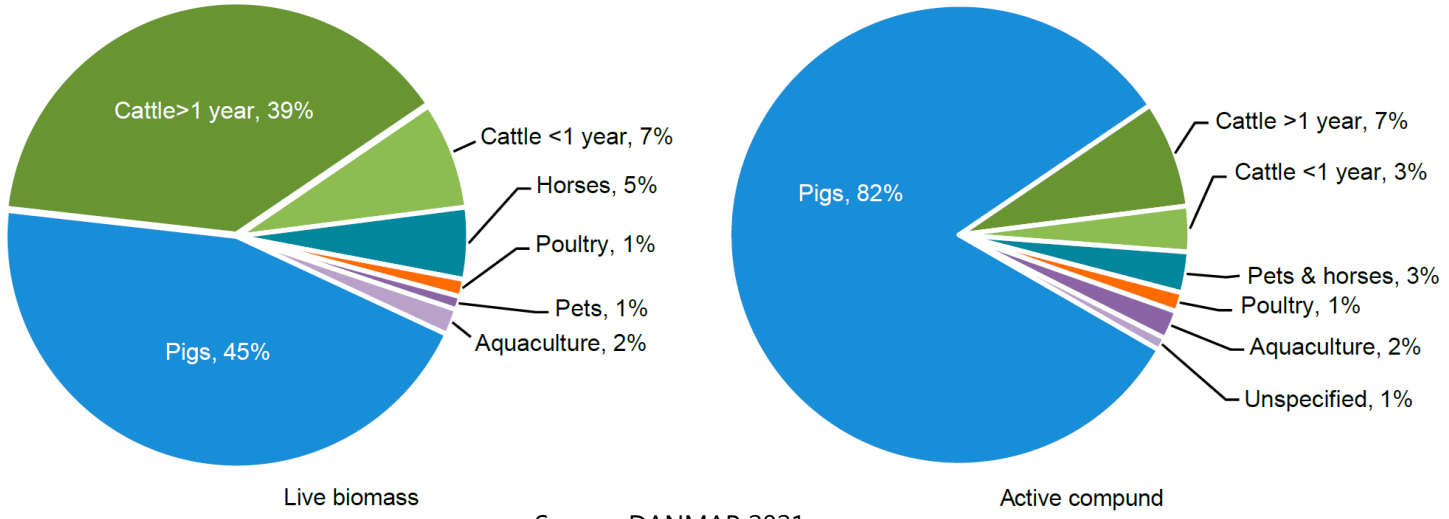
Focus on one animal species and one disease

The project focuses on post-weaning diarrhoea in pigs because:

- **Pigs** is the animal species that accounts for most antimicrobials use
- **Post-weaning diarrhoea** as the main indication for antimicrobial use in pigs



Source: DANMAP 2021

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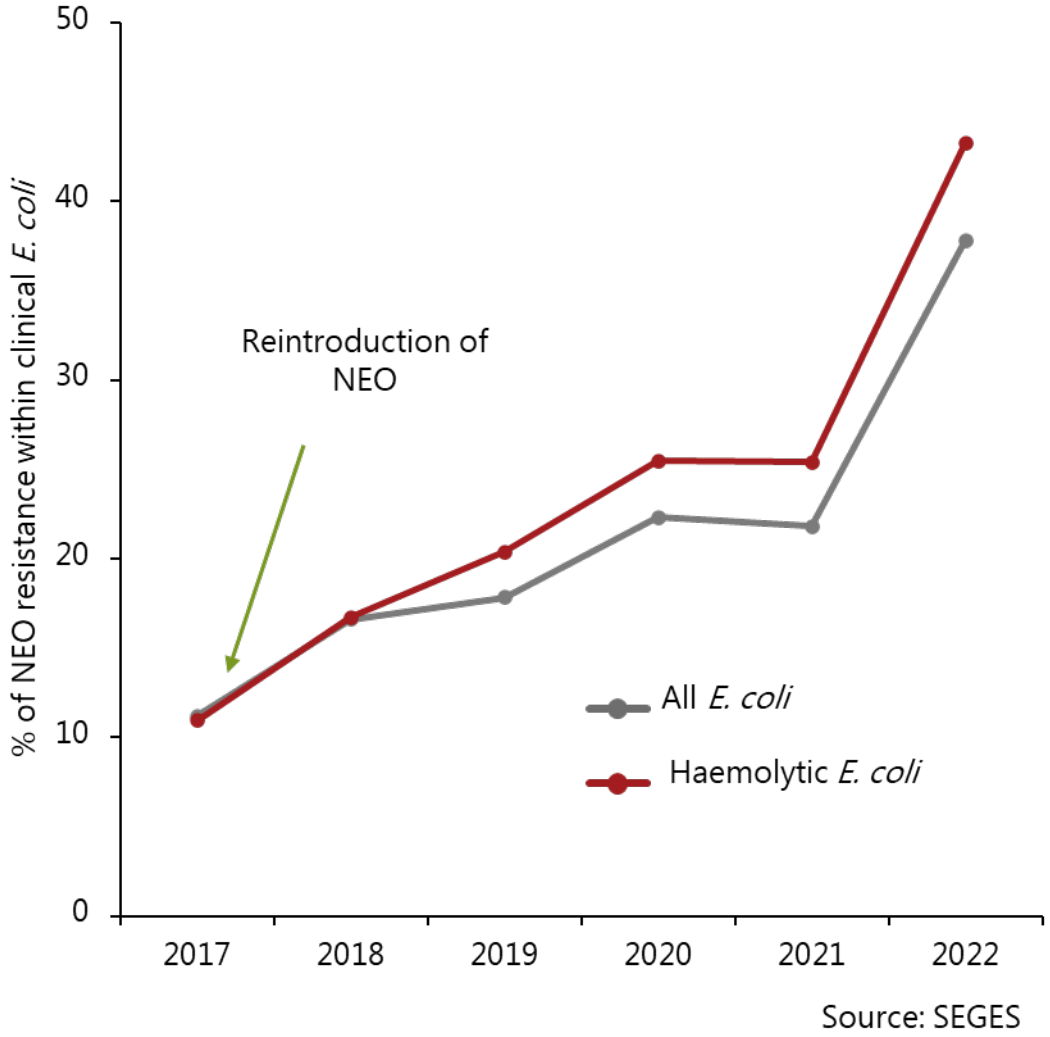
What is the challenge?

There is an urgent need to find new solutions for **post-weaning diarrhoea in pigs** because:

- Development of effective vaccination programmes is difficult for various reasons
- Effective antimicrobials have either banned (zinc oxide) or restricted (colistin) to prevent AMR transmission to humans
- The causative bacteria (enterotoxigenic *Escherichia coli*, ETEC) are truly multidrug-resistant and effective antimicrobial options are lacking



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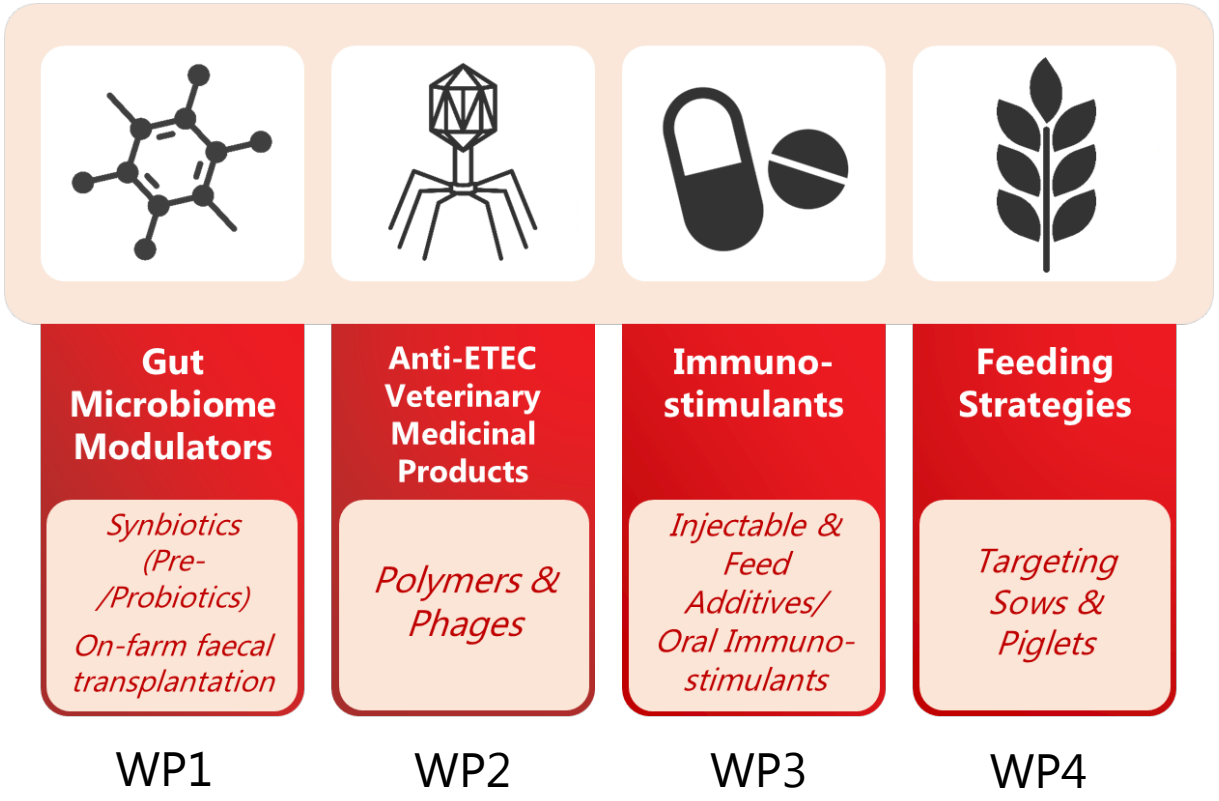
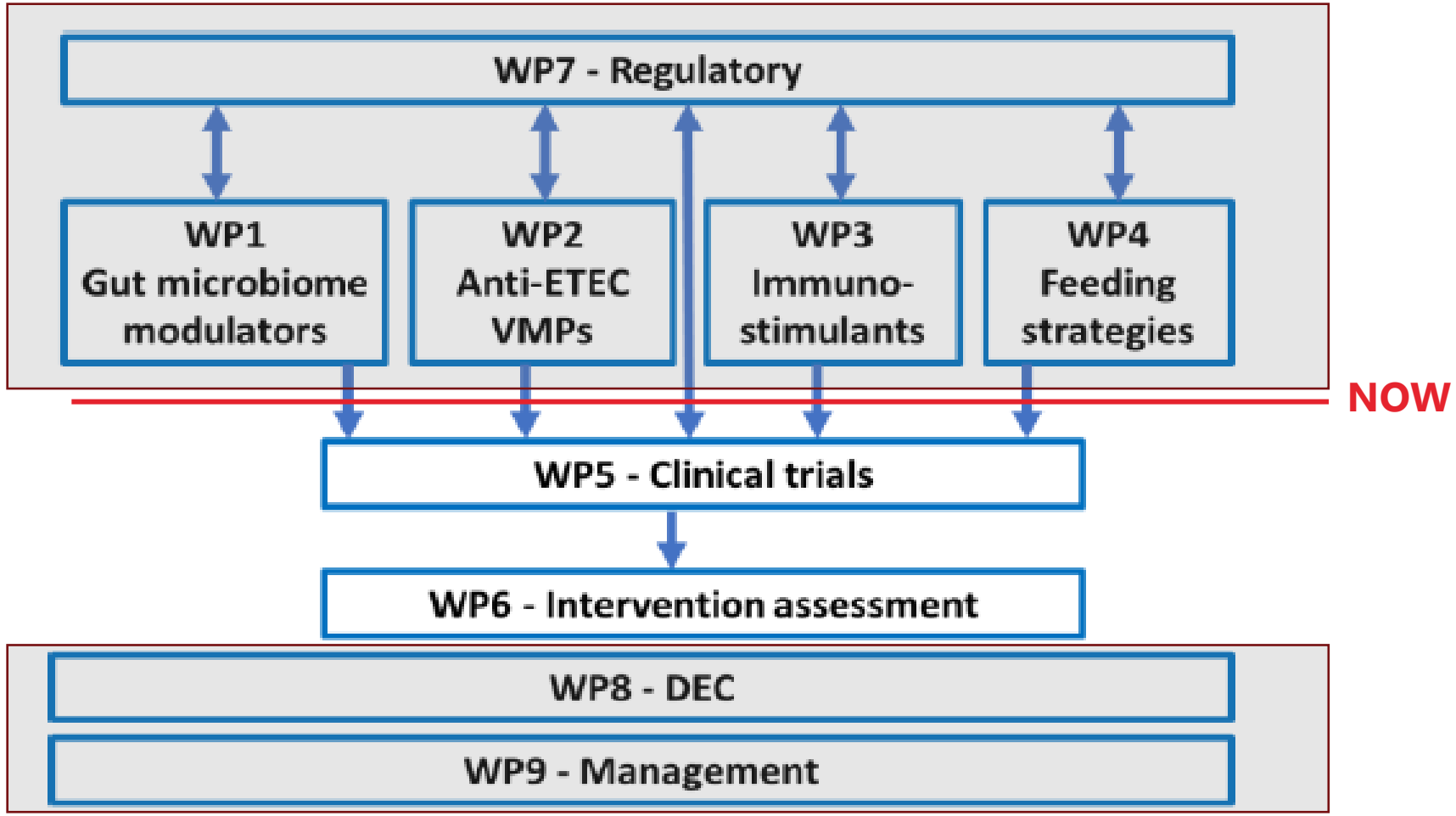
AVANT aim

To develop and test innovative alternatives to antimicrobials for reducing AMU in pigs



Project structure and status



Selection of interventions

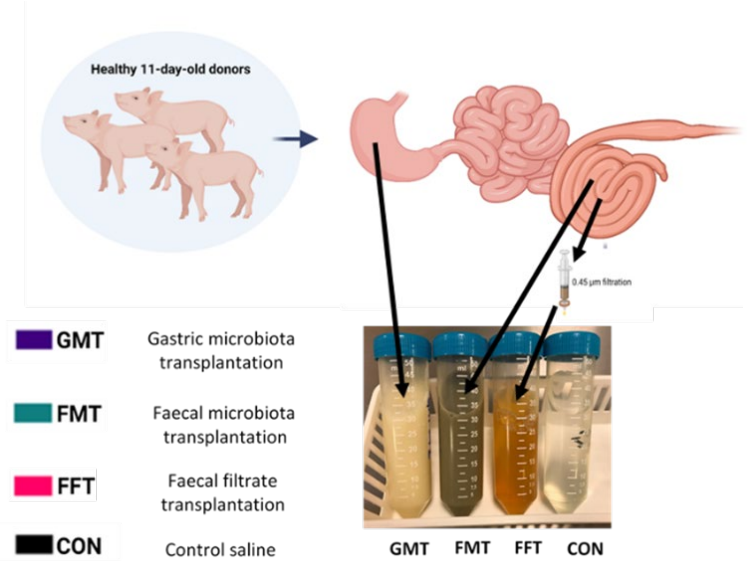
Two interventions were selected for farm trials based on the outcomes of the 4 pre-clinical WPs:

1. **Faecal microbiota transplantation (FMT)** developed by UCPH (DK) in WP1
2. **Fibre-rich diet** developed by Schothorst Feed Research (NL) in WP4

→ Farm trials will be conducted in single farms in Denmark, France and the Netherlands to assess the efficacy, costs and effects on antimicrobial use of these interventions (WP5 and WP6)

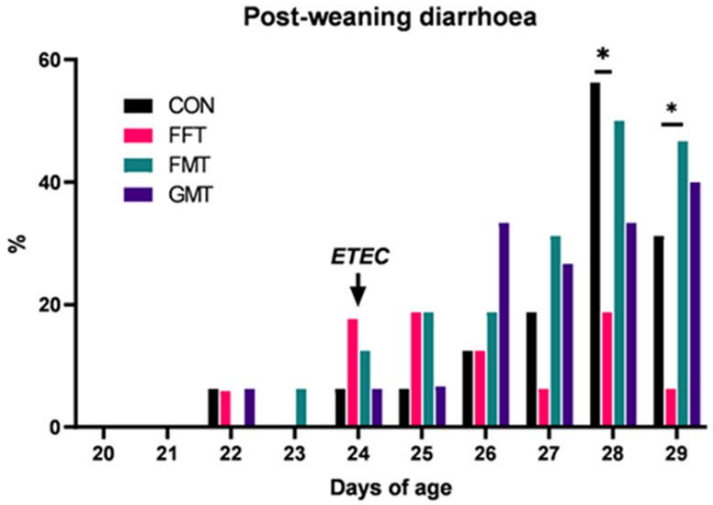
Pre-clinical data on FMT

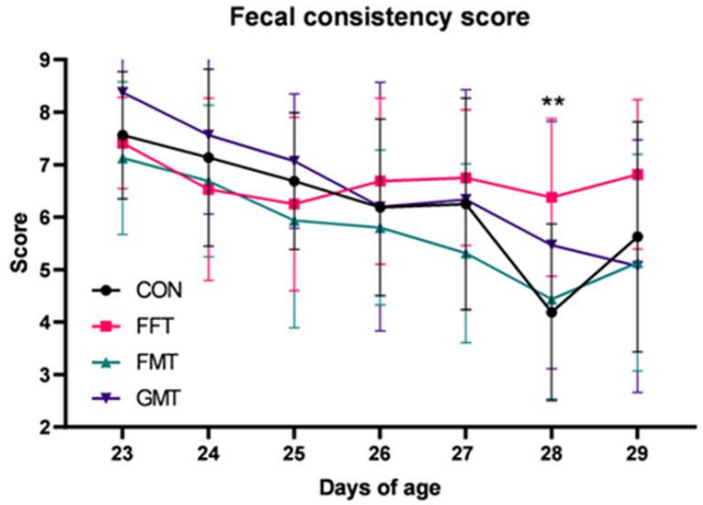
Preliminary results in animal facilities



3 types of faecal transplant

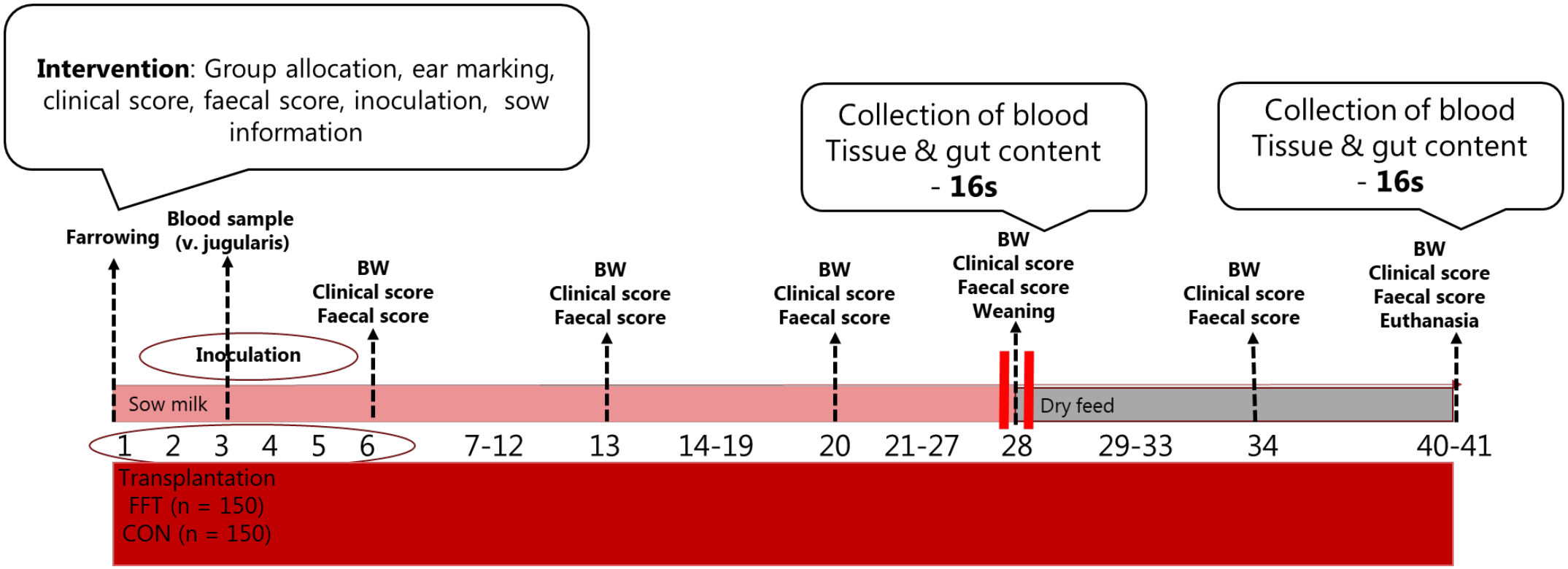
FFT significantly reduced the percentage of diarrhoeic piglets at the end of the weaning period and was selected for further studies





Pre-clinical data on FMT

Study design in experimental farm

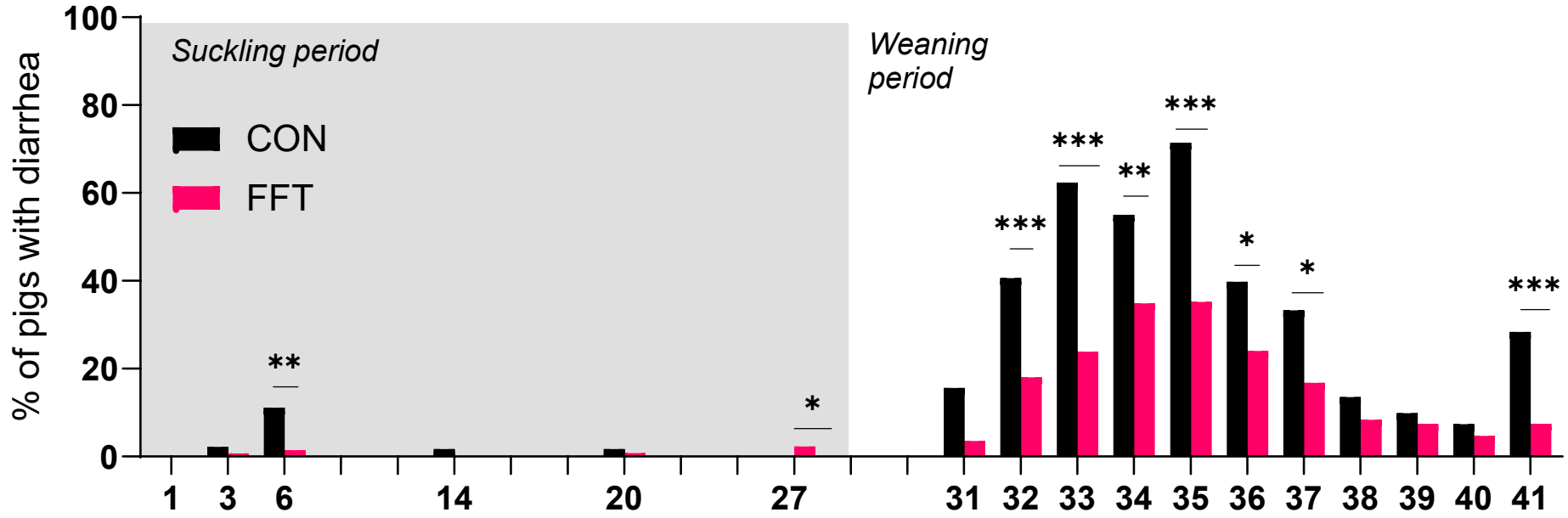


BW = body weight
FFT = faecal filtrate transplantation, CON = control group

Pre-clinical data on FMT

Results (occurrence of diarrhoea)

Daily occurrence (%) of piglets displaying symptoms of diarrhoea in the treatment (FMT) and control (CON) groups. Significant differences between groups are indicate as *p < 0.05; **, p < 0.01; ***, p < 0.001.



Larsen et al., work in progress

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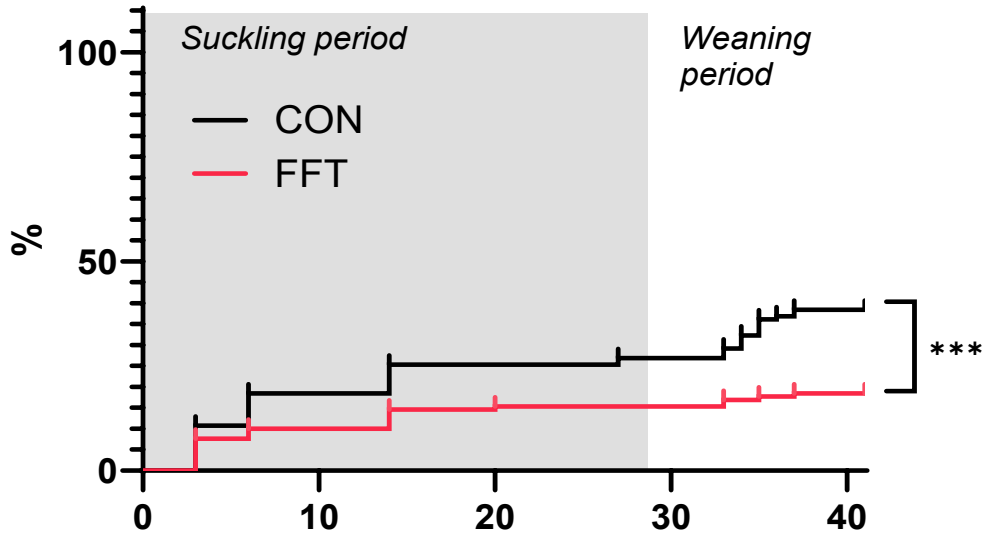
Pre-clinical data on FMT
Results (mortality rate)

Mortality rate (%) in the treatment (FMT) and control (CON) groups.

Significant differences between groups are indicate as *p < 0.05; **, p < 0.01; ***, p < 0.001.



N.B. Mortality rates include piglets that were euthanized for displaying severe illness. No antibiotics were administered during the study.

DANMARKS FRIE FORSKNINGSFOND

SEGES INNOVATION

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Obstacles for the use of faecal transplantation (FMT) in pigs

Regulatory constrains

- The EU legislation does not allow feeding of pigs with faeces
- FMT does not qualify as neither feed additive (EFSA) or medicinal product (EMA) according to the current EU legislation
- In Denmark and France, the national competent authorities have denied authorization to perform the clinical trials using FMT

Technical challenges

- Quick on-farm tests should be developed for donor screening
- Faecal filtrates may be equally efficient, but would require on-farm equipment (centrifuge, filters) for practical implementation
- Handling of individual pigs for inoculation is laborious

The AVANT survey among end-users

- **Objective:** to assess acceptance of different alternatives to antibiotics among pig farmers, veterinarians and consumers
- **Methods:** a telephone survey was conducted in 2021 by a professional company in 5 countries (Denmark, France, Germany, Poland and Spain)
- **Key results:**
  1. Traditional solutions such as vaccines and biosecurity measures are more favorably accepted than innovative solutions such as FMT and phage therapy
  2. Ca. 70% consumers state that they would pay 10% or more to buy food products from animals that are not treated with antibiotics

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Take home messages & points for discussion

1. Alternatives to antibiotics may help to reduce occurrence or duration of disease but are unlikely to be effective as antibiotics in curing diseased animals
2. There are regulatory gaps to be filled if we want to replace use of antibiotics with innovative alternatives in livestock production
3. Eliminating AMU in livestock production without impacting animal health and welfare requires a holistic approach that involves political decisions and public acceptance

Acknowledgments

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