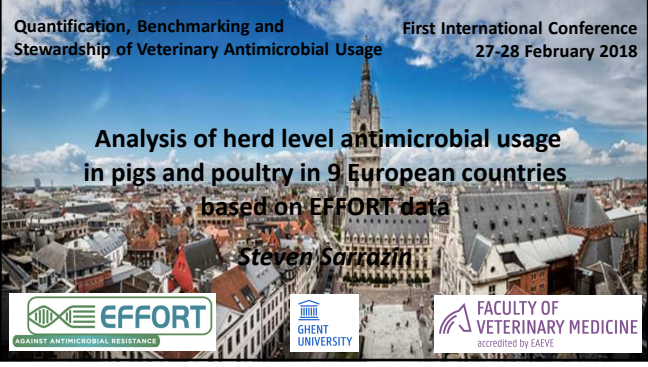**Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage**

First International Conference 27-28 February 2018

Analysis of herd level antimicrobial usage in pigs and poultry in 9 European countries based on EFFORT data

Steven Sarrazin

EFFORT
AGAINST ANTIMICROBIAL RESISTANCE

GHENT UNIVERSITY

FACULTY OF VETERINARY MEDICINE
accredited by EAEVE

Exchange of resistance genes and bacteria between different reservoirs
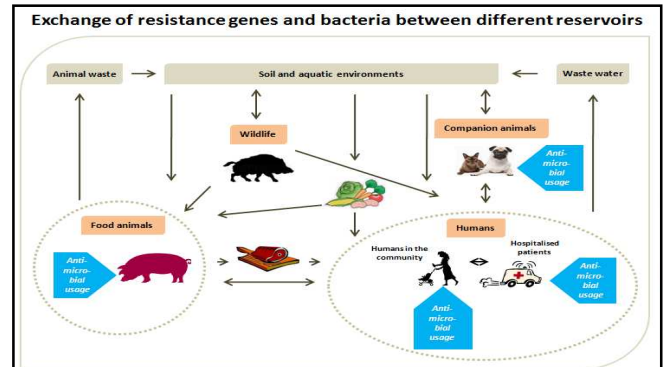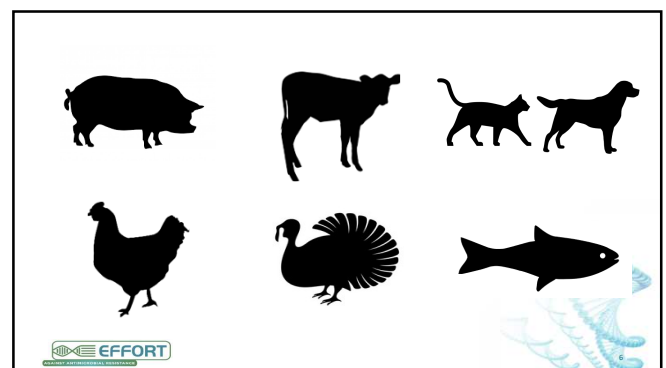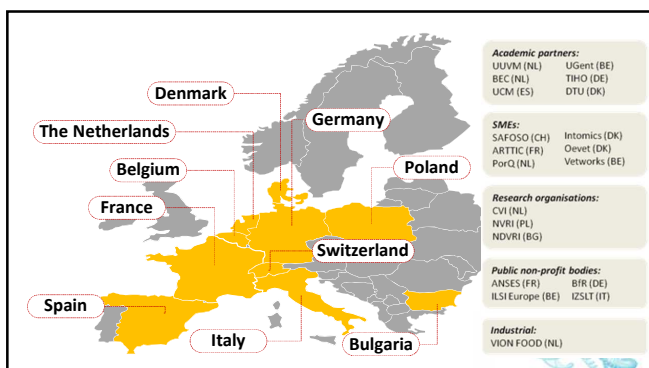

EFFORT
AGAINST ANTIMICROBIAL RESISTANCE

Ecology from Farm to Fork
Of microbial drug Resistance and Transmission

www.effort-against-amr.eu
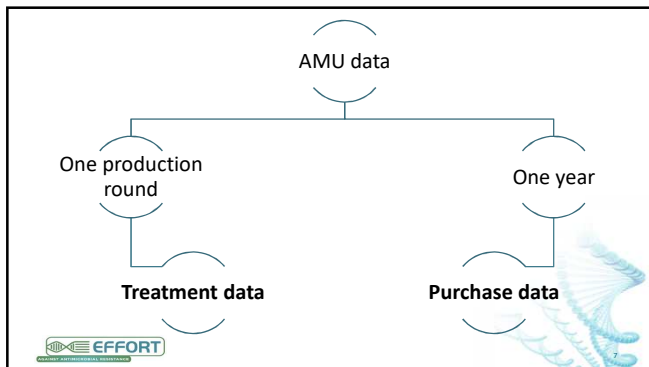

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Slide 7

AMU data

- One production round → Treatment data
- One year → Purchase data
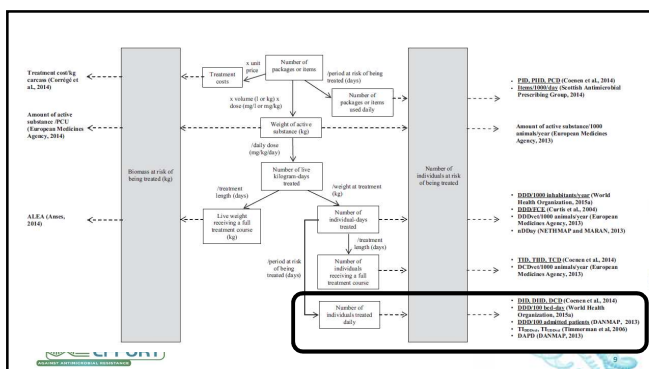
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7

Slide 8

REVIEW ARTICLE

Guidance on the Selection of Appropriate Indicators for Quantification of Antimicrobial Usage in Humans and Animals

L. Collineau[1,2], C. Belloc[2], K. D. C. Stärk[1], A. Hémonic[3], M. Postma[4], J. Dewulf[4] and C. Chauvin[5]

[1] SAFOSO AG, Bern Liebefeld, Switzerland
[2] BIOEPAR, INRA, Oniris, Nantes, France
[3] IFIP – French Pork and Pig Institute, Le Rheu, France
[4] Department of Reproduction, Obstetrics and Herd Health, Veterinary Epidemiology Unit, Faculty of Veterinary Medicine, Ghent University, Ghent, Belgium
[5] Anses – French Agency for Food, Environmental and Occupational Health and Safety, Ploufragan, France

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Slide 9

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9

Slide 10

Treatment incidence (TI)

Per 100 animals at risk
to be treated with antimicrobials

% of animals that receives
a daily dose of antimicrobials

during which % of time an animal
is treated with antimicrobials

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(Timmerman et al., 2006)
10

Slide 11

Treatment incidence (TI)

$$\frac{\text{Total amount of antimicrobial drug used or purchased}}{\text{Dose} \times \text{Number of days at risk} \times \text{Kg animal at risk}}$$

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(Timmerman et al., 2006)
11

Slide 12

Total amount of antimicrobial drug used or purchased

Dose × Number of days at risk × Kg animal at risk

used dose of the product × concentration of active substance × treatment duration × number of animals treated

| 10ml | 50mg/100ml | 5 days | 10,000 animals |

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→ **25,000 mg active substance**
12

Total amount of antimicrobial drug used or purchased
Dose × Number of days at risk × Kg animal at risk

Defined Daily Dose → DDDvet

Defined Course Dose → DCDvet

ESVAC

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13

Total amount of antimicrobial drug used or purchased
Dose × Number of days at risk × Kg animal at risk

Defined Daily Dose → DDDvet

Defined Course Dose → DCDvet

Used Daily Dose → **UDDvet**

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14

Total amount of antimicrobial drug used or purchased
Dose × **Number of days at risk** × Kg animal at risk

Broilers	Sucklers	Weaners	Fatteners	Sows
42 days	**28 days**	**45 days**	**117 days**	**365 days**
[35; 49]	**[20; 35]**	**[21; 102]**	**[60; 230]**	

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15

Total amount of antimicrobial drug used or purchased
Dose × Number of days at risk × **Kg animal at risk**
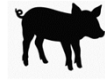
number of animals at risk x standard weight

1 kg	**4 kg**	**12 kg**	**50 kg**	**220 kg**

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16

Treatment incidence (TI)

On farm level

Treatment 1 → TI = x_1
Treatment 2 → TI = x_2
Treatment 3 → TI = x_3
...
Treatment n → TI = x_n

$$\sum$$

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17

Treatment incidence (TI)

Long-acting factor (LA)

a value to represent the duration of activity of a long-acting product

(Postma et al., 2015)

Active substance	LA factor
Amoxicillin	1.8
Ampicillin	2.5
Cefquinome	2
Ceftiofur	5
Enrofloxacin	1.5
Florfenicol	2
Marbofloxacin	2
Oxytetracycline	2.7
Tildipirosin	9.3
Tulathromycin	7
Tylosin	2

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Treatment incidence (TI)

TI200

standardised lifespan of 200 days

(Sjölund et al. , 2016)
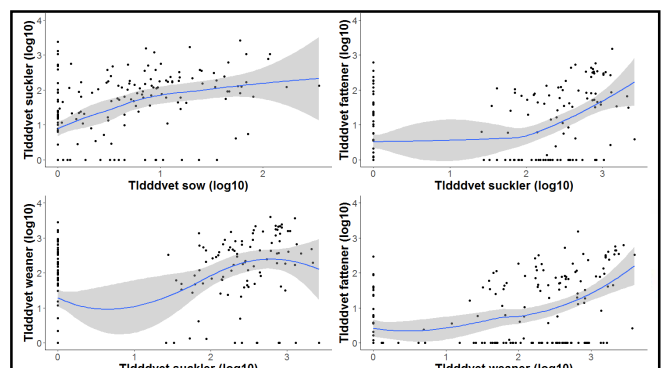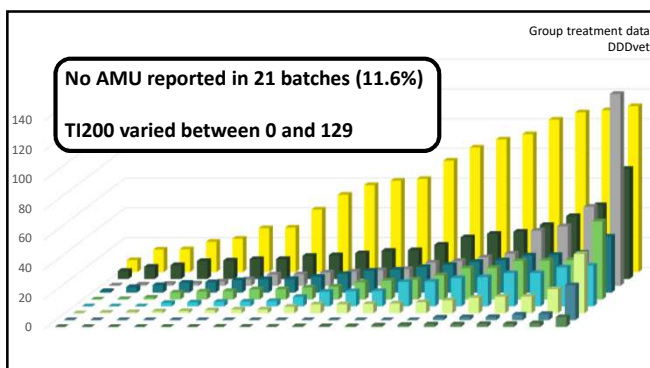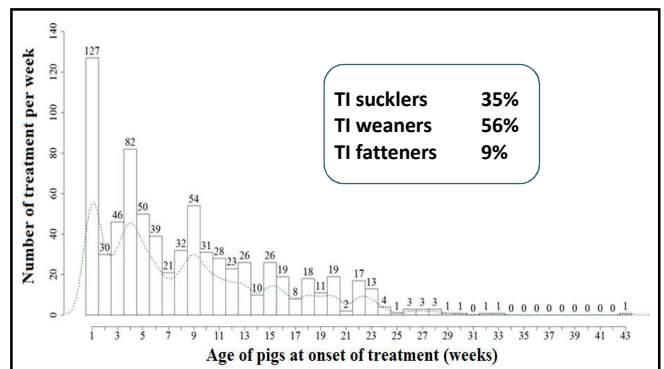
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19

Treatment incidence (TI)

$$\frac{\text{Total amount of antimicrobial drug used}}{\text{Dose} \times \text{Number of days at risk} \times \text{Kg animal at risk}}$$
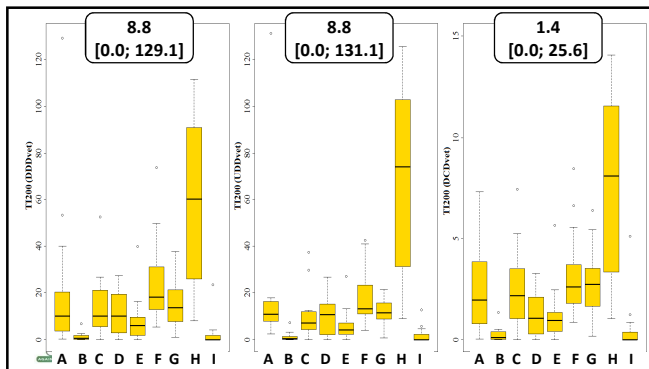
$$\text{TI}_{\text{UDDvet}} =$$

$$\frac{\text{UDDvet (mg/kg/day)} \times \text{Treatment duration} \times \text{Kg of animals treated}}{\text{UDDvet (mg/kg/day)} \times \text{Number of days at risk} \times \text{Kg animal at risk}}$$

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20

Van Gompel et al., in prep.

TI sucklers	**35%**
TI weaners	**56%**
TI fatteners	**9%**

Age of pigs at onset of treatment (weeks)

No AMU reported in 21 batches (11.6%)

TI200 varied between 0 and 129

Group treatment data
DDDvet

Boxplots with values: 8.8 [0.0; 129.1], 8.8 [0.0; 131.1], 1.4 [0.0; 25.6] — TI200 (DDDvet), TI200 (UDDvet), TI200 (DCDvet) for groups A B C D E F G H I

High correlations between indicators for dosage

	DDDvet – UDDvet	DDDvet – DCDvet	UDDvet – DCDvet
TI suckler	0.96	0.99	0.94
TI weaner	0.95	0.99	0.94
TI fatteners	0.98	0.99	0.97
TI200	0.94	0.98	0.90

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26

Purchase data

Purchase data
DDDvet

12 farms (6.7%) reported no purchased products
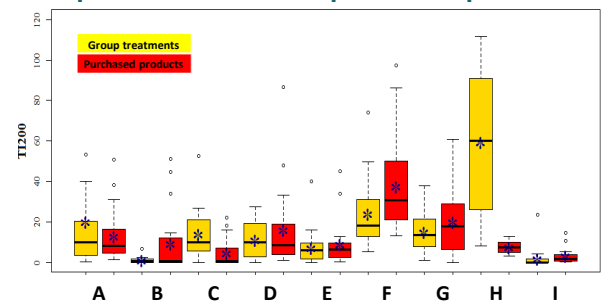
43 farms (25.6%) period of reporting < 6 months

Median TI200 = 7.3   [0.0; 97.3]   *(TI200$_{group}$ = 8.8)*

Median TI sow = 1.3   [0.0; 35.4]
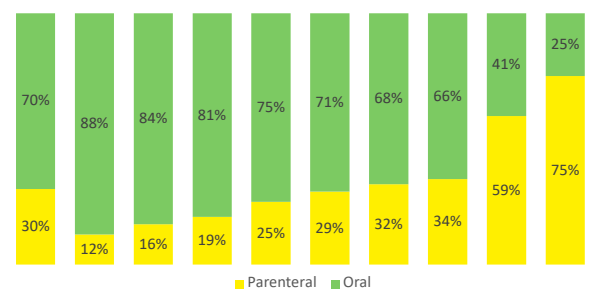
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27

Group treatments versus purchased products

DDDvet

Group treatments (yellow), Purchased products (red). TI200 for groups A B C D E F G H I

Moderate correlations between treatment and purchased data

	DDDvet	DCDvet
TI suckler	0.40	0.38
TI weaner	0.47	0.43
TI fatteners	0.50	0.49
TI200	0.45	0.41

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29

Variation between countries

Stacked bar chart. Oral (green) / Parenteral (yellow):
70%/30%, 88%/12%, 84%/16%, 81%/19%, 75%/25%, 71%/29%, 68%/32%, 66%/34%, 41%/59%, 25%/75%

Parenteral ▮ Oral ▮

5

Variation in treatment duration

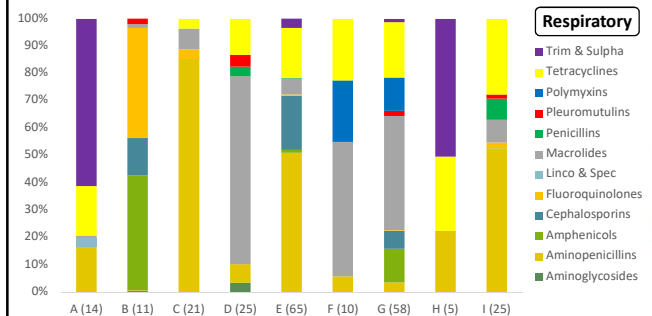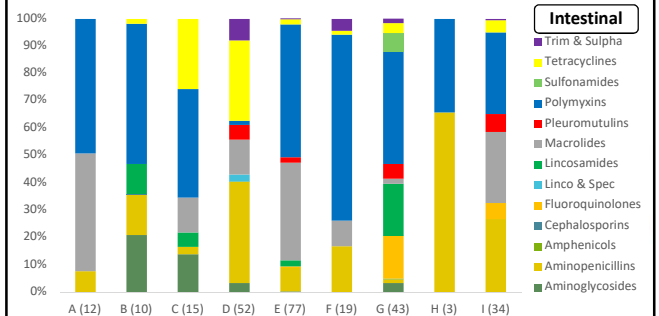|	Average	Median	Minimum	Maximum
Oral	10.6	7	1	80
LA	5.2	5	1.8	28
Non-LA	2.6	1	3	7
Topical	2.2	1	1	5
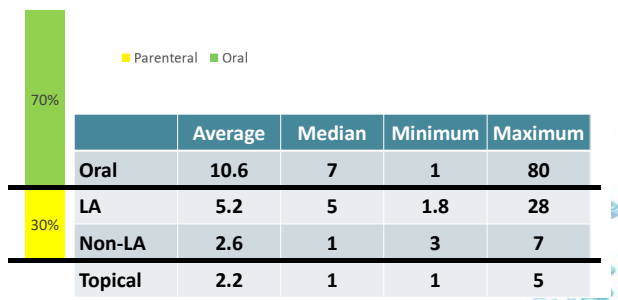
Indications for treatment
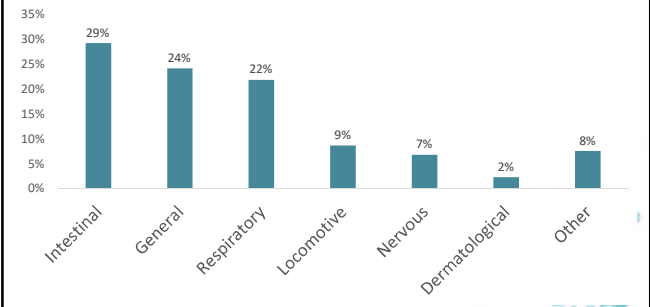
Choice of antimicrobial class
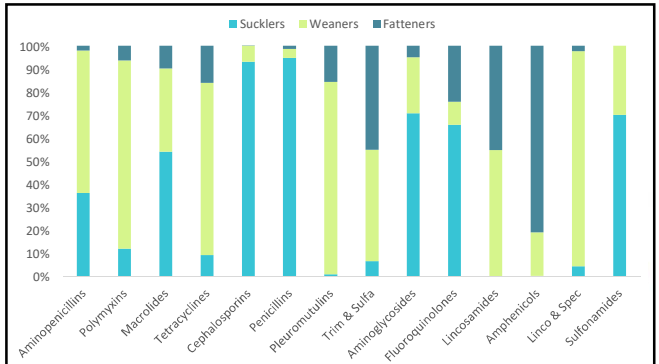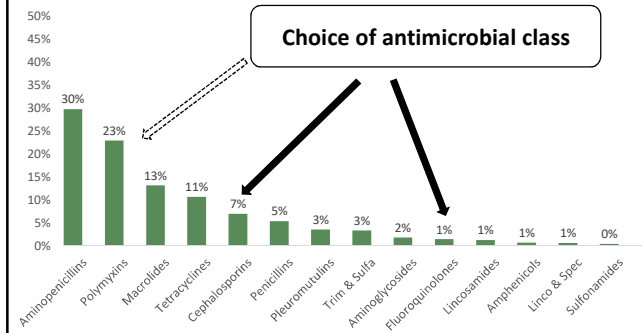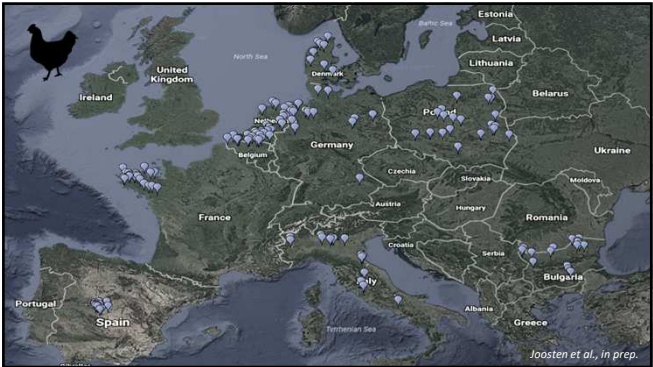

Randomness in choice of active substance

Randomness in choice of active substance
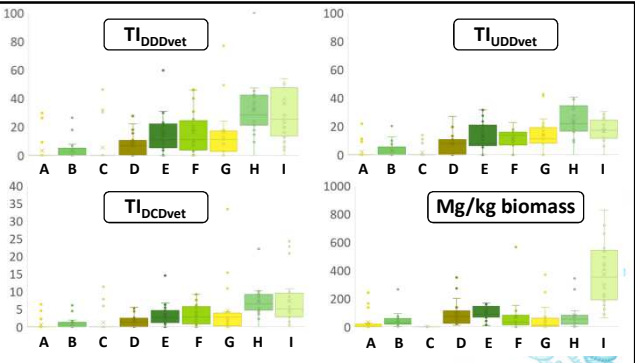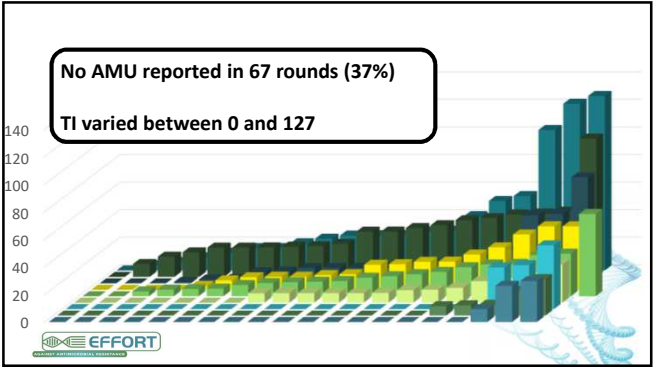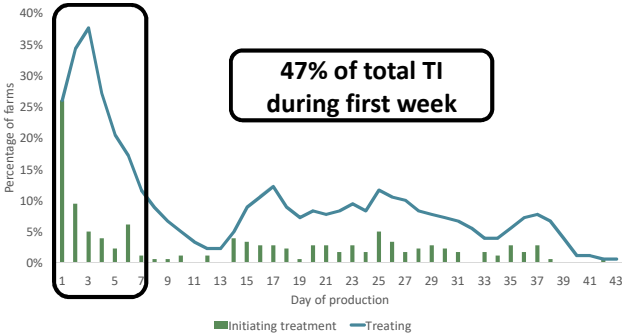
Key messages

High variation between farms

High AMU at young age

Similar results with different indicators for dosage

Positive associations between age categories

Randomness in choice of active substance

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Joosten et al., in prep.

47% of total TI during first week

No AMU reported in 67 rounds (37%)

TI varied between 0 and 127

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TI_{DDDvet} TI_{UDDvet} TI_{DCDvet} Mg/kg biomass

	TI_{DDDvet}	TI_{DCDvet}	TI_{UDDvet}	Mg/kg biomass	TI_{DDDvet}	TI_{DCDvet}
TI_{DCDvet}	0.99					
TI_{UDDvet}	0.93	0.92			Treatment data	Purchase data
Mg/kg biomass	0.44	0.43	0.42			
TI_{DDDvet}	0.54	0.54	0.49	0.91		
TI_{DCDvet}	0.55	0.54	0.49	0.91	0.99	
ESVAC 2015	0.64	0.64	0.57	0.64	0.55	0.55

7

Indications for treatment

Intestinal	45%
Colibacillosis	16%
Omphalitis	12%
Respiratory	10%
Locomotive	6%
Non-specific	5%
General	4%
Mortality	2%

Choice of antimicrobial class

Polymyxins	27%
Aminopenicillins	25%
Fluoroquinolones	19%
Tetracyclines	11%
Trim & Sulfa	8%
Linco & Spec	5%
Macrolides	3%
Aminoglycosides	2%
Penicillins	1%
Lincosamides	1%
Other quinolones	0%
Amphenicols	0%

Randomness in choice of active substance

Intestinal

Legend: Trim & Sulfa, Tetracyclines, Polymyxins, Penicillins, Macrolides, Lincosamides, Fluoroquinolones, Amphenicols, Aminopenicillins

Key messages

High variation between farms

High AMU at young age

Similar results with different indicators for dosage

Considerable use of critically important AM

Randomness in choice of active substance

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A joint EFFORT…

Project coordination
Jaap Wagenaar & Haitske Graveland

Data collection
All researchers in all countries

Data processing
Liese Van Gompel, Roosmarijn Luiken & Dick Heederik

Data analysis
Philip Joosten & Jeroen Dewulf

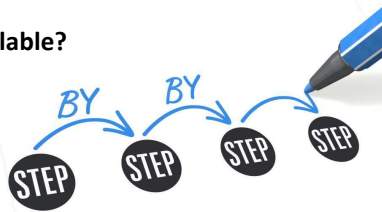EFFORT

Challenges in data collection

No reported use
≠
no use

TOP SECRET

Anonymization of countries

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Challenges in data collection

Data available?

49

Challenges in data processing
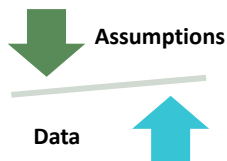
**Product
vs.
Active substance**

**Mg
vs.
Ml**

Per kg bodyweight *vs.* Per kg feed *vs.* Per liter water

50

Challenges in data analysis

**Which age
category?**

Assumptions

Data

Actual weight?

51

Antimicrobial Resistance in the Food Chain – From Science to Policy
26-28 November 2018, Utrecht, NL
International Conference of
European EFFORT Project (FP7)

The EFFORT International Conference will take place in the heart of the Netherlands in Utrecht: http://tivolivredenburgzakelijk.nl/en/

52

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