Critical fail and success factors for reduced use of antibiotics in veal calves

EAAP 2019 Workshop 37: Strategies reducing antimicrobial need

Martien Bokma [JW van Riel, CC de Lauwere, AFG Antonis, M Kluivers]

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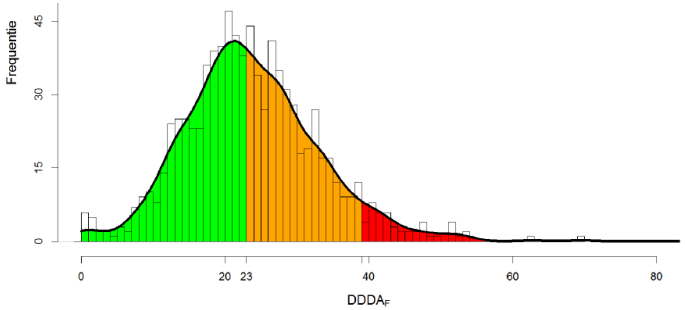
Background



- Dutch veal calf sector: various activities since 2007 to reduce use of antibiotics (AB) → 47% reduction until 2016; since then stagnating
- Veterinary Medicine Authority (SDa) 2016: analyse characteristics low-use farms compared to high-use farms → derive success factors
- Study ordered by Dutch Ministry of Agriculture and veal industry (SBK/SKV): conducted in 2016-17; covering data years 2013-2015

Research objectives

- besides giving insight in transitions of farms in AB use between years, between groups within farms et cetera, and other sub-objectives,

- ... to identify factors that are associated with AB use on white-veal farms, by statistical analysis of characteristics at farm and group level based on data owned by the veal calf sector

Materials and methods: focus on statistical analysis

- **InfoKalf database**: owned by veal sector, containing data on AB use and farm and group-level characteristics (farm AI-AO)

Factors of the database included in the analysis [2013-2015]
Group-level dataset
Region (2 digit postal code)
Veterinarian code and veal farm code
Number of calves (total number, # gender (heifers/bulls), # colour code (b&w; non-b&w)
Number of nationalities in the group (incl. nationality of largest subgroup)
Date of first and last delivered calf at onset
Duration of vacancy period between rounds
Average starting weight and sum (treatment weights)
DDDA, split according to 1st, 2nd and 3rd choice

Materials and methods (2): statistical analysis

- Data nested structure → mixed model, total variance in 3 variance groups: veterinarian, veal farm (between-farm variance), group (within-farm variance)
- 1) explanatory factors tested singly (univariate) on AB use effect
- 2) forward selection of explanatory factors (multivariate); attr. R2
- 3) examining possible interaction between terms in the model
- significant factors ($p < 0.05$)

Materials and methods (3): statistical analysis

- Effects of factors ‘gender’, ‘nationality’ and ‘colour code’ have been corrected for body weight
- Index factor = the multiplication factor to show the relative effect (average is 1; 0.85 means 15% less AB use)

year	White veal DDDA (N farms total)	White veal DDDA (709 farms; N groups)
2013	23.2 (780)	29.1 (1059)
2014	19.8 (780)	26.7 (1026)
2015	22.4 (780)	28.8 (1047)

Results: effect of country of origin and number of origins

Factor in multivariate model	Subclasses	Index	95%CI	N
Country of origin (for 1 country of origin and colour code >80% b&w)	The Netherlands	reference		1766
	Germany	0.93	0.86 – 1.00	762
	Other	0.90	0.79 – 1.01	604
Interaction between the number of countries of origin and the main country of origin	>1; The Netherlands	reference		696
	>1; Germany	1.00	0.94 – 1.07	529
	>1; Other	1.13	1.02 – 1.25	541

- Groups with 100% Dutch calves → higher AB use (up to 10%) than comparable homogeneous flocks from other nationalities
- Groups 'other' 2 or more nationalities → exception to this, comparable to 100% Dutch calves

Results (2): effect of group size and interaction with nationalities

Factor in multivariate model	Subclasses	Index	95%CI	N
Number of calves in the group (for 1 country of origin)	<400	reference		639
	400 – 800	1.15	1.08 – 1.22	1190
	800 – 1200	1.21	1.13 – 1.29	868
	>1200	1.26	1.15 – 1.36	435
Interaction between number of nationalities and group size	>1; <400	reference		230
	>1; 400 - 800	1.06	1.00 – 1.13	668
	>1; 800 - 1200	1.06	1.00 – 1.12	548
	>1; >1200	1.12	1.01 – 1.23	320

- More AB use in larger than smaller groups (up to 26%)
- More nationalities in the group, differences in AB use btw. small (< 400) and large groups (> 1200) are also pronounced

Results (3): effect of % female calves and Irish calves

Factor in multivariate model	Subclasses	Index	95%CI	N
% heifer calves in the group	0 – 50%	reference		1538
	50 – 80%	0.95	0.92 - 0.98	1313
	> 80 %	0.86	0.81 - 0.92	1281
% Irish calves in the group (with country of origin is 'Other')	0 – 50%	reference		3035
	50 – 80%	0.82	0.75 – 0.90	52
	> 80%	0.70	0.63 – 0.78	45

- Higher % of female calves → up to 14% lower AB use
- 100% Irish calves in the group: associated with 30% lower AB

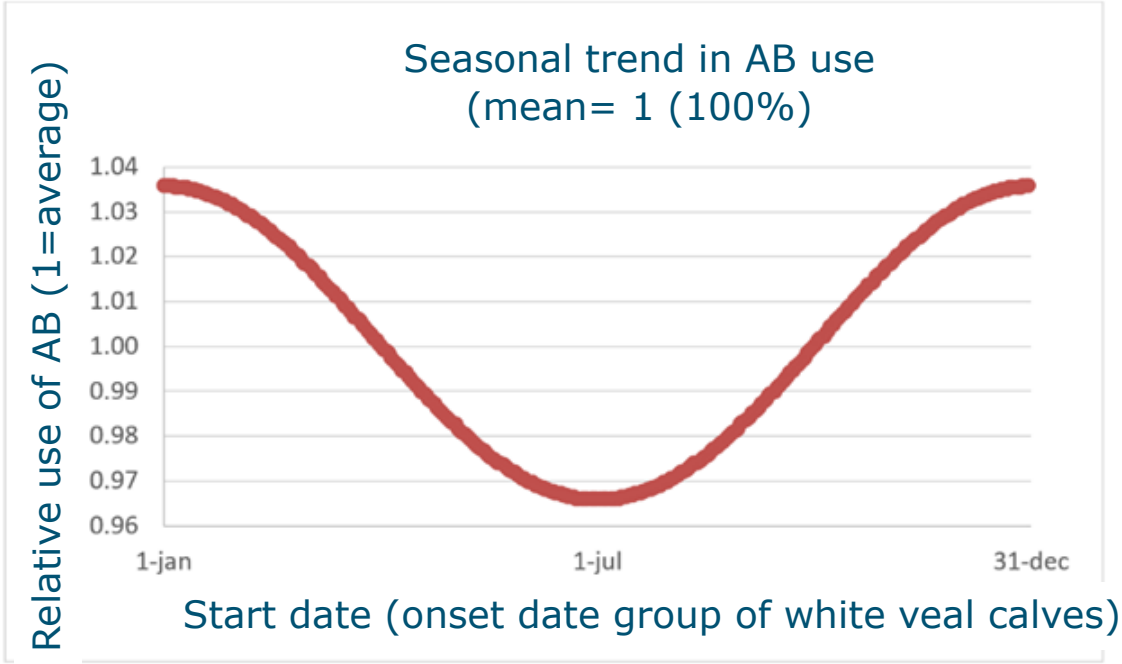
Results (4): effect of body weight at start

Factor	Subclasses (kg)	Index	N
Effect of average starting body weight	<41.5	Reference	412
	41.5 - 43	0.95	349
	43 - 44.5	0.95	648
	44.5 - 49	0.89	635
	49 - 52	0.89	597
	>52	0.87	489

Factor in multivariate model	Subclasses	Index	95%CI	N
Effect of average starting weight compared to the overall average starting weight (linear effect)	X: Body weight -/- average (body weight)	0.991	0.986 – 0.996	3132

- Also linear checked: increase in average starting body weight of 1 kg coincides with appr. 1% lower AB use → max. 10% in study range

Results (5): effect of season at start (onset of calves)



- Lower AB use when started in spring or summer
- Appr. 7% lower AB use with start date 1th July compared to 1th January

Wrap up main effects ....

Factor in multivariate model	Association → AB use is reduced when: …
Group size (1 origin)	.. group sizes are smaller (strong effect)
Country of origin (b&w calves; 1)	.. other nationality than NL
Number of origins	.. only 1 nationality compared to more nationalities in the group
Body weight at start	.. when average starting weight is higher (1 kg higher .. 1% less AB)
Proportion of heifers	.. higher proportion of heifers in the group (> 50%)
Irish calves	.. higher percentage of Irish calves in the group (strong effect)
Season	.. start of the rearing in spring or summer

Explained variance

Variance component	Explained variance by multivariate model	Source of unexplained variance in final model (sum=100%)	N (2013-2015)
Veterinarian	49,4 %	3,6 %	54 veterinarians
Farm	38,5 %	14,2 %	709 farms
Group	5,6 %	82,2 %	3132 groups
Total	*14.7%*		

- farm size most important explanatory factor, then N natiol., weigth..
- other factors than available in dataset also relevant!

→ farmers/vet attitude, stockmanship, quality of housing, of calves,..?

Follow up

- Several determinants of AB use (statistical associations) → what are underlying reasons?
- and: several large white-veal farms, despite meeting all 'failure' factors of model, have structural low AB use → how do they do it? …
- 2018-2019: in-depth qualitative research on **large** white-veal farms: 5 low users; 5 matching high users: → both **technical** and **social** factors

NL veal sector already achieved strong reduction in AB use → the search for additional reducing strategies is going on!

Thank you for your attention!

Results (4) effects of colour code b&w/non-b&w (breed)

Factor	Subclasses	Index	95%CI	N
Percentage colour code b&w in the group (with main country of origin NL)	80-100%	refer.		1169
	50-80%	1.07	1.02 – 1.13	1043
	<50%	0.95	0.88 – 1.02	920
Interaction colour code b&w and main country of origin	50-80%; The Netherlands	refer.		633
	50-80%; Germany	1.00	0.90 – 1.10	190
	50-80%; Overig	0.93	0.84 – 1.03	220
	<50%; The Netherlands	refer.		816
	<50%; Germany	1.15	1.02 – 1.28	65
	<50%; Overig	0.88	0.74 – 1.03	39

- Groups with mainly German calves:

> 50% b&w have ca. 15% lower AB use than predominantly non b&w calves

Summarizing main effects ....

Factor in multivariate model	Association → AB use is reduced when: ...	Explananation?
Group size (1 origin)	.. group sizes are smaller (strong effect)	Lower infection pressure, infection persistence, ..?
Country of origin (b&w calves; 1)	.. other nationality than NL	(Pre)selection before transport, other breeds ..?
Number of origins	.. only 1 nationality compared to more nationalities in the group	Differences in health and immune status, ..?
Body weight at start	.. when average starting weight is higher (1 kg higher .. 1% less AB)	Heavier calves more robust and/or prev. less problems ..?
Proportion of heifers	.. higher proportion of heifers in the group (> 50%)	Heifers more robust, bull calves grow (too) fast ..?
Irish calves	.. higher percentage of Irish calves in the group (strong effect)	?? Unknown
Season	.. start of the rearing in spring or summer	Less respiratory problems at higher T and lower RH, ..?