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Behavioural factors affecting broiler farmers' decision making with regard to reduction of antibiotics use in the Netherlands

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Paper prepared for presentation for the 168th EAAE Seminar
Behavioural Perspectives in Agricultural Economics and Management

February 6-7, 2019
Swedish University of Agricultural Sciences
Uppsala, Sweden

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Carolien de Lauwere and Martien Bokma

Abstract

A telephone survey was carried out among 34 broiler farmers with low use of antibiotics and 27 broiler farmers with high use of antibiotics to find out which factors influence decision making of broiler farmers with regard to reduction of antibiotics. High users had lower odds for perceived control (OR=0.6; 95% CI=0.4-1.0; $p<0.05$) and relative risk perception (OR=0.5; 95% CI=0.3-0.9; $p<0.05$) and higher odds for perceived risk and uncertainty (OR=1.7; 95 % CI=1.0-2.9; $p<0.05$). Low and high users had comparable median scores for social norms and both perceived the veterinarian and the food supplier as most important information sources.

Keywords: antibiotics use, broiler farmers, decision making

1. Introduction

Farmers have to adapt their daily practice to increasing social concerns. Antibiotic resistance in humans is such a concern. In 2008, the Dutch government together with the Dutch Veterinary Association and livestock sectors took the initiative to decrease antibiotics use in the Dutch livestock sector. This decision was made due to the potential role between veterinary antibiotic use and antibiotics resistance in humans (Laxminarayan and Brown, 2001). The government steered the farmers in the livestock sector to decrease the use of antibiotics with 20% in 2011, 50% in 2013 and 70% in 2015 for livestock production, relative to the use in 2009 (Bondt et al., 2016). The use of antibiotics in livestock farming in the Netherlands has reduced since then (Speksnijder et al., 2015). However, some farmers are more successful in reducing antibiotics use than others. In 2017, a Dutch study was carried out by Wageningen University and Research in collaboration with the Dutch Animal Health Service to find out the critical success factors of low antibiotics use in (amongst others) broiler farming (Bokma et al., 2017). Both behavioural factors and technical factors were studied. In this paper emphasis is on behavioural factors. It is often assumed that farmers and other agents are rational self-interested economic agents. However, new insights have made increasingly clear that psychological and sociological elements should also be taken into account (Herzfeld and Jongeneel, 2012; Garforth, 2015). Because of this, policymakers, veterinarians and other farm advisers should understand why farmers make decisions as they do (Laanen et al., 2014). Understanding this can help them to better attune their interventions or incentives to what farmers really need to change their behaviour. The aim of this study is to understand decision making of broiler farmers with regard to antibiotics use. The Theory of Planned Behaviour (TPB) is used as basis. According to TPB, the intention of an individual to perform a certain behaviour – in this case reduction of antibiotics use – is influenced by his or her attitude towards the behaviour, the opinion of important others (social norm) about the behaviour and the individual's perception of the control he or she has over the behaviour (perceived behavioural control) (Ajzen, 1991). TPB has been applied in several agricultural domains, amongst others to understand which factors affect farmers' and veterinarians' attitudes towards the use of antibiotics in dairy farming and pig farming (Jones et

al., 2015; Visschers et al., 2016). The relative risk perception of farmers (the farmers perception of the antibiotics use on their farms and the health status of their farms in comparison with other farms) and their perceived risk and uncertainty also were included in the study because farmers who perceive less risks are probably less willing to adopt preventive measures (Ogurtsov et al., 2008). In addition, the broiler farmers' sensitivity towards a reward or a fine for respectively low or high antibiotics use was included in the study to find out whether the introduction of a reward or fine for low respectively high antibiotics use would be a useful intervention.

2. Material and method

2.1 Design and respondents

AVINED, a Dutch interest group for poultry farmers, asked 85 broiler farmers with structural low use of antibiotics (<8 Animal Defined Daily Doses (ADD) per animal year in 2014 and 2015) and 56 broiler farmers with structural high use of antibiotics (>18 ADD in 2014 and 2015) to participate in a telephone survey about technical and behavioural factors affecting broiler farmers' decision making with regard to (further) reduction of antibiotics. The broiler farmers were selected from an AVINED database with data about antibiotics use in the broiler sector in the Netherlands. Only broilers farmers with a conventional farming system in which broilers become ready for slaughter within six weeks were included in the selection for the telephone survey. In this paper, emphasis is on behavioural factors.

2.2 Measures

Farmers were asked to score propositions on a 7 point scale with 1 being the most negative answer and 7 being the most positive answer (for example very unlikely–very likely, absolutely not true–absolutely true, totally disagree–totally agree). The propositions concerned the extent to which low and high users of antibiotics were pro-active or awaiting to keep or get the use of antibiotics under the target value of 8 ADD (intention), the broiler farmers' attitude towards keeping or getting the use of antibiotics under the target value, their positive and negative behavioural beliefs about keeping or getting the use of antibiotics under the target value, descriptive and injunctive social norms (how do other broiler farmers act and what is expected of broiler farmers with regard to keeping or getting the use of antibiotics under the target value), perceived behavioural control and perceived risk and uncertainty with regard to keeping or getting the use of antibiotics under the target value, relative risk perception (the broiler farmers' assessment of the health status of their farms and their use of antibiotics in comparison with other broiler farmers) and the sensitivity towards a reward or fine. In addition, the broiler farmers got questions about the extent to which they perceived to have enough knowledge, time and money and the extent to which they perceived their housing system and the size of their farm sufficiently suitable to keep or get their use of antibiotics under 8 ADD. Finally questions were asked about the broiler farmers' preferred ways to gather knowledge (through individual advice, study groups, farmers' journals, internet, research reports, exhibitions, excursions to other farmers, courses/ training), and their motivation to comply to and their perceived importance of different persons or organisations for obtaining knowledge (veterinarian, feed supplier, other broiler farmers, customers, Dutch health service, interest organisation, government, partner, neighbour).

2.3 Statistics

A first step in the statistical analysis was to reduce the number of items (propositions) by combining them in theory-based constructs[1]. Subsequently, a reliability analysis was performed to check the consistency of the constructs. If Cronbach's alpha exceeded 0.60 a construct was considered as being consistent (Reynaldo and Santos; 1999)[2]. If Cronbach's alpha was lower than 0.60, separate items were included in the analyses.

In the next step, an univariate and multivariate logistic regression analysis was carried out to find differences between broilers farmers with structural low or high use of antibiotics according to the following model:

$$\ln\left(\frac{P(y_i = 1)}{P(y_i = 0)}\right) = \beta_0 + X_i\beta_1 + \varepsilon_i$$

where $P(y_i = 0)$ refers to the chance that farmer *i* is a structural low user of antibiotics and $P(y_i = 1)$ refers to the chance that farmer *i* is a structurally high user of antibiotics, β_0 is the intercept value for each level, X_i is a vector of explanatory variables related to low or high use of antibiotics, β_i the estimates of the explanatory variables, and ε_i represents the random error term vector.

The univariate logistic regression analysis was performed for each separate construct. Only constructs of which the scores seemed to differ between low and high users of antibiotics ($p<0.05$) were included in the multivariate model following a forward selection (meaning that the construct that had the highest association with low or high use of antibiotics was included first in the model, followed by the construct with the second highest association etc.). Correlations between constructs were calculated before including them in the model. If the correlation coefficient between two constructs was 0.50 or more, only one of the two constructs was included in the multivariate analysis (the one with the highest association with low or high use of antibiotics).

3. Results

3.1 Respondents

Thirty four (of 85) structural low users and 27 (of 56) structural high users of antibiotics responded to the survey (response 40% and 48% respectively). The main reasons for not responding mentioned by 49 non-responders were: tired of surveys (32.7%), no time (18.4%) and no interest (14.3%).

No significant differences between low and high users were found with regard to the number of stables, the number of broilers and the number of flocks of broilers (average of 2014 and 2015).

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[1] A construct is an explanatory variable which is not directly observable. It consists of a set of related concrete, observable variables or items.

[2] According to Reynaldo and Santos (1999), 0.7 is an acceptable reliability coefficient but lower thresholds are sometimes used in the literature (Colémont and Van den Broucke, 2008).

However, structural low users had less flocks of broilers per stable and smaller flocks per stable per round than structural high users (table 1)[3].

Table 1. Some features of interviewed broiler farmers with low and high use of antibiotics *(N=61)*

Factor	**High users (N=27)**		**Low users (N=34)**	
	Mean	Median	Mean	Median
No. of stables (avg. 2014 and 2015)	2.8	2	3.8	3
No. of animals (avg. 2014 and 2015)	670079	506015	611081	385745
No. of flocks (avg. 2014 and 2015)	20.1	15.0	24.4	19.8
No. of flocks per stable (avg. 2014 and 2015)	7.2	7.0	6.4	6.5
Size of flocks per stable per round (avg. 2014 and 2015)	33888	33453	23040	21987

3.2 Constructs

Thirty five separate items about behavioural factors influencing broiler farmers' decision making could be reduced to 10 valid constructs (Cronbach's alpha >0.60; table 2). No valid construct could be made of 5 items related to the broilers farmers' intention to keep or get the use of antibiotics under the target value of 8 ADD, and of 5 items related to the broiler farmers' control belief strength (including propositions about the extent to which broiler farmers perceived to have enough money, time and knowledge to keep or get the use of antibiotics under the target value of 8 ADD, and the extent to which they perceived their housing system and farm size suitable to achieve this).

3.3 Differences between broiler farmers with low- and high use of antibiotics

The multivariate logistic regression showed that broiler farmers with high use of antibiotics for their broilers had lower odds for perceived control (OR=0.60; $p<0.05$)[4] and relative risk perception (OR=0.48; $p<0.05$) and higher odds for perceived risk and uncertainty (OR=1.73; $p<0.05$). Pseudo R^2 (a proxy of the variance explained) was 44.3% ($p<0.05$). The analysis was based on 52 farmers (30 low and 22 high users) (table 3). Lower odds for high users for perceived control mean that it is 40% less likely that they perceive more control over their choice to keep or get their antibiotics use under 8 ADD than low users. Lower odds for high users for relative risk perception mean that it is 52% less likely that they estimate the health status of their farm higher and their use of antibiotics lower when they compare themselves with other broiler farms than low users. Analogue to this, higher odds for perceived risk and uncertainty for high users mean that it is 73% more likely that they perceive reduction of antibiotics more risky than low users and are more uncertain about it. In this model the broiler farmers' attitude was not included because the construct was highly correlated with perceived control (r=0.53) and relative risk perception (r=0.70).

[3] These variables were not incorporated in the model due to the low number of participants in the survey; see Bokma-Bakker et al. (2017) for more detail about technical factors.
[4] Perceived behavioural control – controllability; see table 2

Univariate logistic regression analysis showed that it was more likely that low users were more positive about antibiotics reduction (attitude) (OR=0.42; $p<0.01$), had higher scores for positive behavioural beliefs (OR=0.57; $p<0.05$) and lower scores for negative behavioural beliefs (OR=2.19; $p<0.01$) about antibiotics reduction, perceived more control about it (OR=0.19; $p<0.001$, for perceived capability and OR=0.47; $p<0.001$ for perceived controllability), perceived less risk and uncertainty (OR=2.37; $p<0.001$), had higher scores for relative risk perception (OR=0.34; $p<0.001$) and were more sensitive for a reward or a fine for low or high antibiotics use than high users (OR=0.76; $p<0.05$) (table 2). Separate items of the constructs mentioned above show that it is more likely that broiler farmers with low antibiotics use:

- perceive keeping or getting the use of antibiotics under 8 ADD as more advantageous, good, feasible and useful than high users (attitude). They scored at the positive side of the scale whereas high users scored neutral or only slightly positive on these items.
- are more convinced than high users that keeping or getting the use of antibiotics under 8 ADD will generate more income on the long term, is positive for human health and prevents resistance against antibiotics in humans (positive behavioural beliefs). On the other hand, it is more likely that broiler farmers with high use of antibiotics are more convinced than low users that keeping or getting the use of antibiotics under 8 ADD will lead to stress for the animals and more outbreaks of diseases, and will cost a lot of effort, time and money (negative behavioural beliefs).
- perceive themselves as more capable to keep or get the use of antibiotics under 8 ADD than high users, especially because of their knowledge about keeping or getting the use of antibiotics under 8 ADD, and their perceived possibilities and motivation to realize this (perceived behavioural control – capability). In addition, it is more likely that they perceive more control over their choice to keep or get their antibiotics use under 8 ADD (perceived behavioural control - controllability).
- Perceive getting or keeping the use of antibiotics under 8 ADD as less risky than high users and are less uncertain about it. They score at the negative side of the scale on these items, while high users score around neutral (perceived risk and uncertainty).
- Estimate the health status of their farm higher and their use of antibiotics lower compared with other broiler farms than high users (relative risk perception)
- Are more willing to prevent the use of antibiotics for their animals if they would receive €0.01/kg for antibiotics-free groups of broilers.

The corresponding numbers are mentioned in appendix I.

It appeared not to be possible to make a consistent construct of the intention to keep or get the use of antibiotics under the target value of 8 ADD. Univariate regression analysis of separate items showed that it is more likely that broiler farmers with low use of antibiotics have higher scores for the items ‘I am planning to keep or get the use of antibiotics for my broilers under the 8 ADD in the coming three years’ (OR=0.31; $p<0.05$) and ‘In three years, the antibiotics use for my broilers is lower than 8 ADD’ (OR=0.62; $p<0.05$), and lower scores for the item ‘If the use of antibiotics will be prohibited I will wait as long as possible before I quit using antibiotics (OR=1.35; $p<0.05$) (appendix I).

Table 2. Behavioural factors influencing the decision making of broiler farmers with relatively low and high use of antibiotics – median and mean scores and results of the univariate logistic regression analysis and reliability analysis to check the consistency of the constructs. (OR = Odds Ratio, CI = Confidence Interval) (median and mean scores on a 7 point scale, 1 being the most negative score and 7 being the most positive score).

			High users				Low users						
Construct	Cron-bach's Alpha	No. of items	Med	Mean	N	Std.	Med	Mean	N	Std	OR	95% CI	Z
Attitude	0.83	4	4.4	4.4	26	1.7	6.3	6.0	31	1.0	0.42	0.25-0.69	-3.40**
Positive behavioural beliefs	0.85	6	4.8	4.8	25	1.6	6.2	5.9	27	1.2	0.57	0.37-0.90	-2.40*
Negative behavioural beliefs	0.85	6	3.9	3.8	26	1.3	1.8	2.4	29	1.4	2.19	1.36-3.54	3.21**
Social norm – injunctive	0.64	3	6.3	6.4	25	0.5	6.8	6.4	30	0.9	0.99	0.49-2.01	-0.02
Social norm – descriptive	0.82	3	6.0	5.6	17	1.5	6.0	6.1	18	0.7	0.67	0.34-1.32	-1.16
Perceived behavioural control – capability	0.63	5	5.2	5.2	25	0.8	6.1	6.2	32	0.7	0.19	0.08-0.47	-3.59***
Perceived behavioural control – controllability	0.84	2	2.0	2.5	26	1.5	5.3	4.9	32	1.8	0.47	0.32-0.69	-3.91***
Perceived risk and uncertainty	0.70	2	4.0	4.0	26	1.4	1.5	2.1	33	1.4	2.37	1.51-3.74	3.72***
Relative risk perception	0.78	2	4.5	4.5	23	1.3	6.5	6.2	33	1.1	0.34	0.20-0.59	-3.86***
Sensitivity to a reward or fine	0.82	2	4.0	3.6	25	2.0	5.0	4.9	31	2.3	0.76	0.59-0.98	-2.10*

*p<0.05; **p<0.01; ***p<0.001

Table 3. Behavioural factors influencing the decision making of broiler farmers with relatively low and high use of antibiotics – results of the multivariate logistic regression analysis; OR = Odds Ratio, CI = Confidence Interval).

Factor	OR	95% CI	Z
Perceived behavioural control	0.60	0.38-0.95	-2.2*
Relative risk perception	0.48	0.25-0.92	-2.2*
Perceived risk and uncertainty	1.73	1.04-2.88	2.1*

*p<0.05

3.2 Similarities between broiler farmers with low- and high use of antibiotics

Similarities between low and high users of antibiotics are that both groups think that they have enough money, time and knowledge to keep or get the use of antibiotics under 8 ADD and that they perceive their housing system and farm size as suitable to achieve this (control belief strength; see appendix I for corresponding numbers). In addition, both low and high users think that it is expected from that that they keep or get their antibiotics use under 8 ADD (injunctive social norm) and that farmers like themselves of farmers who are important to them undertake actions to keep or get their antibiotics use under 8 ADD (descriptive social norm) (table 2). In both groups the veterinarian appeared to have the most influence on the broiler farmers' decision to keep or get the use of antibiotics under 8 ADD (mean scores 5.3 and 6.1 for low and high users respectively; median scores both 6) (motivation to comply). The veterinarian followed by the feed suppliers appeared to be the most important knowledge sources for low and high users with regard to keeping or getting the use of antibiotics under 8 ADD (mean score 6.5 and median score 7.0 for both groups for the veterinarian and mean scores for the feed supplier 5.8 and 5.5 respectively for low- and high users and median scores for the feed supplier 6.0 for both groups). For both high and low users individual advice appeared to be the most preferred way to gain knowledge about keeping or getting the use of antibiotics under 8 ADD (mean scores 6.4 and 6.0 respectively for low- and high users and median scores 7.0 and 6.0 respectively for low and high users).

4. Discussion and conclusion

The results show that it is more likely that broiler farmers who use a low amount of antibiotics for their broilers perceive more control and less risk and uncertainty with regard to the reduction of antibiotics use than high users. Uncertainty as driver for antibiotics use is mentioned as well in dairy farming with regard to the prevention (Scherpenzeel et al., 2017) and treatment of mastitis (Swinkels et al., 2015). Trujillo-Barrera et al. (2016) found that perceived risk appeared to be a barrier to the adoption of sustainable practices, while risk tolerance appeared to be a positive moderator of the relationship between economic rewards and adoption.

Compared to high users, it appeared to be more likely that low users perceived the use of antibiotics for their broilers as low compared to other farms and the health status of their farms as high compared to other farms (relative risk perception). High users perceived the use of antibiotics for their broilers as neutral compared to other farms, which may be an indication that they were not aware of their relative high use of antibiotics. If this is the case, education is helpful. Probably veterinarians and feed suppliers can play a role in this because both high and

low users mentioned them as their most important information sources. In addition, peer groups can play a role because high and low users also appeared to be sensitive for social norms. The importance of social norms and the veterinarian with regard to the use of antibiotics is also mentioned by Jones et al. (2015). According to Garforth et al., 2013, the main factors that influence livestock farmers' decision on whether or not to implement a specific disease risk measure are: attitudes to, and perceptions of, disease risk; attitudes towards the specific measure and its efficacy; previous experience of a disease or of the measure; and the credibility of information and advice. These authors place great importance on access to authoritative information with most seeing vets as the prime source to interpret generic advice from national bodies in the local context. However, because of this importance of veterinarians for further reduction of antibiotics and their interaction with farmers herein, Speksnijder et al. (2015) emphasize the importance of attitudes of veterinarians towards antibiotic use and reduction opportunities. They found that especially experienced veterinarians could be educated about possible risks related to veterinary overuse of antibiotics, while younger veterinarians might require additional support to act independently from farmers' and significant others.

Garforth et al. (2013) also mention characteristics of the enterprise as an important factor that influence livestock farmers' decision on whether or not to implement a specific risk measure. Farmers may perceive a measure impractical due to certain farm characteristics. In our study broiler farmers with low or high use of antibiotics did not perceive their housing system or farm size unsuitable for keeping or getting the use of antibiotics under 8 ADD (appendix I). However, the study on technical factors showed that structural low users had significantly less flocks of broilers per stable and smaller flocks per stable per round than structural high users[5].

In addition to the results of the multivariate logistic regression analysis, univariate logistic regression analyses showed that it was more likely that broiler farmers with a low use of antibiotics for their animals have a more positive attitude towards the reduction of antibiotics use, had lower scores for negative and higher scores for positive behavioural beliefs and perceived themselves more capable of keeping or getting the use of antibiotics under 8 ADD. Attitude, beliefs and self-efficacy are more often mentioned as drivers to take animal health related measures, for example by Jansen et al. (2010) with regard to Mastitis control, Sok et al. (2015, 2016) with regard to a voluntary vaccination programme against Blue Tongue, Marier et al. (2016) with regard to Salmonella control and Ritter et al. (2017) with regard to animal disease control programmes. Furthermore, high users appeared to be less sensitive for a reward for low use of antibiotics than low users. Introduction of a system of rewards or fines to influence antibiotics use thus may not be sufficient to stimulate high users to reduce their use of antibiotics. Valeeva et al. (2007) also found that not all farmers are comparably sensitive to financial rewards or fines for good or bad mastitis management. The authors state that at least for some farmers the traditional approach of communicating only common economic logic for better mastitis control remains the most appropriate. This is also found by Trujillo-Barrera et al. (2016) with regard to the adoption of sustainable practices by Dutch hog farmers.

The study shows that taking into account farmers' attitudes, perceptions and preferences can be helpful to get a better understanding of farmers' decision making and is useful for the design of tailor-made interventions.

[5] This was not elaborated further in this paper; see Bokma-Bakker et al. (2017) for more details.

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Appendix I. Behavioural factors influencing the decision making of broiler farmers with relatively low and high use of antibiotics – median and mean scores of separate items and results of an univariate logistic regression analysis (OR = Odds Ratio, CI = Confidence Interval) (median and mean scores on a 7 point scale, 1 being the most negative score and 7 being the most positive score).

	High users				Low users						
Item	Med	Mean	N	Std	Med	Mean	N	Std.	OR	95% CI	Z
Intention (no consistent construct; Cronbach's Alpha < 0.60)											
Within the coming three years, I am going to try to keep or get the use of antibiotics for my broilers under 8 ADD	7.0	6.6	27	0.7	7.0	6.8	33	0.9	0.68	0.32-1.41	1.0
I will try to keep or get the use of antibiotics for my broilers under 8 ADD only, if it gets obliged	1.0	1.9	27	1.5	1.0	1.5	33	1.2	1.22	0.82-1.84	1.0
I am planning to keep or get the use of antibiotics for my broilers under the 8 ADD within the coming three years	7.0	6.6	25	.7	7.0	6.9	34	0.4	0.31	0.10-0.96	-2.0*
In three years, the antibiotics use for my broilers is lower than 8 ADD	6.0	5.4	22	1.3	7.0	6.1	33	1.2	0.62	0.39-0.98	-2.0*
If the use of antibiotics will be prohibited I will wait as long as possible before I quit using antibiotics	5.0	4.5	24	2.1	1.0	2.9	31	2.5	1.35	1.06-1.71	2.4*
Attitude – for my farm keeping or getting the use of antibiotics for my broilers under 8 ADD is ...											
Very disadvantageous – very advantageous	4.0	4.2	26	2.1	7.0	5.9	33	1.6	0.61	0.45-0.84	-3.1**
Very bad – very good	4.0	4.2	26	2.2	7.0	6.1	32	1.3	0.56	0.40-0.79	-3.3**
Totally unfeasible – totally feasible	4.0	4.1	27	2.0	7.0	6.0	34	1.7	0.58	0.41-0.81	-3.2**
Very unuseful – very useful	5.0	4.9	26	1.9	7.0	6.1	33	1.6	0.67	0.48-0.93	-2.4*
Positive behavioural beliefs – Keeping or getting the use of antibiotics for my broilers under 8 ADD ...											
Provides more income in the long-term	5.0	4.4	27	2.1	7.0	5.6	32	2.0	0.77	0.59-1.00	-2.0*
increases work pleasure	6.0	5.0	27	2.1	7.0	5.9	33	1.9	0.79	0.60-1.04	-1.7

Is good for my broilers health	4.5	4.6	26	1.9	6.0	5.3	31	1.9	0.82	0.62-1.08	-1.4
Is good for my broilers animal welfare	5.0	4.3	26	2.3	5.5	5.0	32	2.0	0.85	0.67-1.08	-1.3
Is good for human health	6.0	5.0	25	2.3	6.0	6.6	34	1.1	0.57	0.38-0.85	-2.7**
Prevents resistance against antibiotics in humans and animals	6.0	5.1	25	2.1	6.0	6.5	32	1.1	0.56	0.36-0.87	-2.6**
Negative behavioural beliefs –. Keeping or getting the use of antibiotics for my broilers under 8 ADD..											
Is negative for the farm results	4.0	3.9	27	1.8	1.5	2.9	32	2.3	1.26	0.97-1.62	1.8
Leads to stress for the annimals	3.0	3.5	27	2.0	1.0	2.2	32	1.9	1.42	1.07-1.87	2.4*
Leads to more disease outbreaks in my broilers	3.0	3.7	26	2.0	1.0	2.2	33	1.7	1.55	1.14-2.13	2.8**
Costs me a lot of effort	4.5	4.4	26	1.9	2.0	2.5	34	1.9	1.1	1.21-2.15	3.3**
Costs me a lot of time	4.0	3.8	26	1.8	2.0	2.9	34	2.2	1.25	0.97-1.62	1.7
Costs me a lot of money	4.0	3.8	26	1.8	1.5	2.4	34	1.8	1.54	1.13-2.10	2.8**
Perceived behavioural control - capability											
I have sufficient knowledge to keep or get the use of antibiotics for my broilers under 8 ADD	6.0	5.4	26	1.6	6.0	6.18	34	1.1	0.63	0.40-0.99	-2.0*
It is possible for me to keep or get the use of antibiotics for my broilers under 8 ADD	5.0	4.2	25	1.9	6.0	6.1	34	1.2	0.47	0.31-0.72	-3.5**
I can keep or get the use of antibiotics for my broilers under 8 ADD if I want to	3.5	3.4	26	1.9	6.0	5.5	33	1.5	0.49	0.34-0.72	-3.6***
I can keep or get the use of antibiotics for my broilers under 8 ADD only if I have a new stable	1.0	1.5	26	0.9	1.0	1.3	33	0.8	1.21	0.65-2.26	0.6
I can keep or get the use of antibiotics for my broilers under 8 ADD if my current stable is adapted	1.0	1.9	26	1.6	1.0	1.8	32	1.5	1.03	0.73-1.46	0.9

Perceived behavioural control - controllability											
Keeping or getting the use of antibiotics for my broilers under 8 ADD is in my own hands	2.0	2.2	26	1.3	5.0	4.8	33	2.1	0.48	0.33-0.69	-3.8***
It is especially up to me to keep or get the use of antibiotics for my broilers under 8 ADD	2.0	2.9	26	2.0	5.0	4.9	33	1.8	0.59	0.44-0.80	-3.4**
Control belief strength (no consistent construct; Cronbach's Alpha < 0.60)											
I expect that I cannot spend much money to keep or get the use of antibiotics for my broilers under 8 ADD	3.0	3.3	23	1.5	3.0	3.1	31	2.1	1.06	0.79-1.42	0.4
I expect that I cannot spend much time on keeping or getting the use of antibiotics for my broilers under 8 ADD	2.0	2.7	23	1.5	1.5	2.1	30	1.5	1.38	0.93-2.03	1.6
I expect to have enough knowledge and experience to keep or get the use of antibiotics for my broilers under 8 ADD	6.0	5.72	25	1.23	6.0	6.2	33	0.9	0.63	0.38-1.07	-1.7
I expect that my housing system is sufficiently suitable for keeping or getting the use of antibiotics for my broilers under 8 ADD	7.0	6.2	26	1.3	7.0	6.4	33	1.1	0.87	0.56-1.36	-0.6
My farm is too big to keep or get the use of antibiotics for my broilers under 8 ADD	1.0	1.4	26	0.8	1.0	1.4	33	1.1	1.00	0.58-1.71	-0.0
Perceived risk and uncertainty											
I feel uncertain about keeping or getting the use of antibiotics for my broilers under 8 ADD	5.0	3.4	26	1.9	1.0	1.9	33	1.5	1.64	1.17-2.29	2.9**
I have the feeling that it is very risky to keep or get the use of antibiotics for my broilers under 8 ADD	5.0	4.5	26	1.8	2.0	2.2	33	1.6	2.03	1.42-2.89	3.9***

Relative risk perception											
How do you estimate the health status of your broilers compared to that at other farms? (much worse – much better)	5.0	5.0	23	1.1	6.0	6.0	33	1.4	0.55	0.35-0.87	-2.6**
How much antibiotics do you use for your broilers compared to other farms? (much more – much less)	4.0	4.0	27	1.6	7.0	6.4	34	0.9	0.24	0.13-0.57	4.3***
Sensitivity towards a reward or fine											
I would try to avoid the use of antibiotics for my broilers as much as possible if I would receive €0.01/kg extra for antibiotics-free flocks of broilers.	4.0	3.8	25	2.2	7.0	5.6	31	2.4	0.72	0.57-0.92	-2.6**
I would try to avoid the use of antibiotics for my broilers as much as possible if I would receive €0.01/kg less for flocks of boilers which are not free of antibiotics	4.0	3.4	25	1.9	5.0	4.2	31	2.6	0.87	0.69-1.09	-1.2

*p<0.05; **p<0.01; ***p<0.001