The ADKAR® change management model for farmer profiling with regard to antimicrobial stewardship in livestock production

Het ADKAR®-verandermodel voor typering van veehouders met betrekking tot verantwoord antibioticagebruik bij landbouwhuisdieren

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ABSTRACT

Antimicrobial stewardship in veterinary practice and animal production is important from a One Health perspective. The ADKAR® change management model is a well-known strategy to implement behavioral change in people and small businesses. The objective of this study was to adapt the existing ADKAR® change management model to enable herd veterinarians to profile farmers with regard to antimicrobial stewardship. Therefore, an antimicrobial stewardship related scoring scale was defined. Subsequently, ADKAR® profiles of 26 poultry and 28 pig farmers from Belgium and the Netherlands were determined. For 57% of the farmers, perception and/or motivation were expected to limit successful change. For 70% of the farmers, knowledge and for 52% of the farmers, a lack of ability were the limiting factor. The ADKAR® model proved useful for identifying the key elements that prevent successful behavioral change in farmers to reduce the use of antibiotics in farm animals.

SAMENVATTING

Het "One Health"-principe indachtig is het belangrijk om zo min mogelijk antibiotica te gebruiken bij landbouwhuisdieren. Het ADKAR®-verandermodel is een bekende methode om gedragsverandering bij mensen als ook in het bedrijfsleven te implementeren. Het doel van deze studie was het bestaande ADKAR®-verandermodel toepasbaar te maken voor bedrijfsdierenartsen in de veehouderij, zodat zij veehouders kunnen typeren met betrekking tot het verantwoord gebruik van antibiotica bij hun dieren. Nadat er op basis van de ADKAR®-systematiek een vijfpuntscoresysteem was gedefinieerd, werden het ADKAR®-profiel bepaald van 26 pluimvee- en 28 varkenshouders uit België en Nederland. Zevenenvijftig procent van de veehouders bleek onvoldoende bewust van de risico's en/of onvoldoende gemotiveerd om het antibioticumgebruik te verminderen. Bij 70% van de veehouders bleek kennis en bij 52% het gebrek aan mogelijkheden om te veranderen de beperkende factor. Het ADKAR®-model bleek nuttig om in te schatten welke factoren veehouders verhinderen om het gebruik van antibiotica bij landbouwhuisdieren te verminderen.

INTRODUCTION

Antimicrobial stewardship in livestock production is pre-eminently the domain of the herd veterinarian. Prudent use of antibiotics prevents residues in animal products and limits the selection of antimicrobial resistance (AMR) in micro-organisms (Dorado-Garcia et al., 2016; Dyar et al., 2017). In livestock production, veterinary advice aims at improving animal health and production and reducing risk factors for disease (Jansen et al., 2010). Subsequently, the farmer is responsible for implementing this advice in farm management and working procedures. In some cases, farmers do not comply with the given advice (Rojo-Gimeno et al., 2016; Postma et al., 2017). Reasons for non-compliance with advice may be versatile, but sociological factors, like perception of the problem or motivation for change can be the underlying cause (Jansen et al., 2010; Kristensen et al., 2011). Therefore, to improve the uptake of veterinary advice in general and regarding prudent use of antibiotics specific, the veterinarian needs to understand and address these sociological factors in his or her professional relationship with the farmer. To help herd veterinarians assessing perception and motivation as a starting point for a change process towards the reduction of antibiotic use (ABU) and AMR, practical tools are needed. To support veterinarians in understanding sociological factors of change management in farm processes and in providing advice in a more effective manner, utilization of established change management models for individuals and organizations could be useful. ADKAR® is an acronym for Awareness, Desire, Knowledge, Ability and Reinforcement, identifying the five elements of behavioral change. The ADKAR® change model has already been successfully enrolled in corporate business as well as in human medicine (Hiatt, 2006; Shepherd et al., 2014; Wong et al., 2019). The objective of this study was to adapt the ADKAR® change model to antimicrobial stewardship in livestock farming by presenting scoring criteria per ADKAR® element. Secondly, a pilot project was run with the model to profile pig and poultry farmers with a higher than average ABU in Belgium and the Netherlands.

MATERIALS AND METHODS

The ADKAR® change model

ADKAR® is an acronym for Awareness, Desire, Knowledge, Ability and Reinforcement. To achieve behavioral change, all five elements of the ADKAR® model must be addressed sufficiently and in the right sequence (Hiatt, 2006). The authors transformed the five-point scale -modified from Hiatt - of each element of the ADKAR® model to be used in assessing the farmer's attitude towards prudent use of antibiotics in livestock. On this scale, a score of 1 represented the lowest score and 5 represented the highest score. A farmer's ADKAR® profile was determined by the individual scores for each element. According to Hiatt (2006), each element with score 3 or less blocks change.

ADKAR® profiling of farmers

In 2017, the i-4-1-Health cross-border project was established in the Dutch-Belgian border region, focused on infection control in human and veterinary health care settings and AMR reduction. In this project, pig and poultry farmers in the Dutch-Belgian border region were recruited for an eighteen-month coaching program focused on infection prevention and ABU reduction. The inclusion criteria for farmers in the study were having either a sow herd with weaned pigs or a broiler farm, both with ABU higher than the national benchmark presented by 'Antimicrobial Consumption and Resistance in Animals' (AMCRA) in Belgium and the 'Autoriteit Diergeneesmiddelen' in the Netherlands. Farmers were invited to participate voluntary in the project via newsletters of farmers organizations. To establish a starting point for coaching of the farmer, the ADKAR® profiles were determined of the 54 participating farmers, 15 poultry farmers and 14 pig farmers in Belgium and 11 poultry farmers and 14 pig farmers in the Netherlands. After a herd visit, during which the use of antibiotics in the farm was discussed and a biosecurity audit was performed, the veterinary coach (one per country) scored each farmer on the first four elements (A-D-K-A) according to the criteria in Table 1. The 'Reinforcement' component was not scored at this moment as no reduction measures had been proposed or implemented previously at that time. The profiling skills of the veterinary coaches were first trained by a professional training institute in a one-day training on change management.

Data analyses

The results of A-D-K-A scores were compared between species (pig and poultry farms) and country (Belgium and the Netherlands) by means of a linear mixed model (SPSS 27.0 IBM).

RESULTS

The criteria for the ADKAR® profile were set, discussed and finalized after discussions in a stakeholder-workshop with a group of 26 herd veterinarians of the swine and poultry farms enrolled in the i-4-1-Health project (Table 1). In the livestock -antimicrobial stewardship- adapted farmer's ADKAR® profile, Awareness represented the understanding of the farmer that prudent use and ABU reduction in livestock production is important, as ABU in livestock is a risk for the selection and transmission of antibiotic

Table 1. Definition of the scoring elements of the livestock antimicrobial stewardship adapted model, with a five-point scale according to Hiatt's ADKAR® change management model.

ADKAR	Description building block (element)	Score	Explanation score
A (wareness)	Represents the awareness that AMU in livestock production should be reduced while this is a risk for introduction of antimicrobial resistant bacteria in animals and men.	1	Farmer missed all information regarding AMU and AMR. Is not aware there are reduction goals, nor is aware AMU is a risk for AMR.
		2	Farmer is aware of the recommendation to reduce AMR, but is completely denying the problems related to AMR.
		3	Farmer is aware that AMR should be reduced, but contests the role AMU in livestock. Mentions the role of AMU in human medicine and/or the role of AMU in dogs and cats.
		4	Farmer is aware that AMU should be reduced, and accepts the reduction goals.
		5	Farmer is fully aware that AMU should be reduced, as he accepts the risks and opportunities for livestock production. He takes responsibility for the AMU in the farm and embraces the reduction goals for the farm.
D (esire)	Represents the personification of the awareness. "Does the farmer himself want to reduce AMU in his farm?"	1	Farmer states: "This is not my problem. It does not concern me".
		2	Farmer will reduce, but is not the first adaptor. Farmer states: "my "neighbour" should also reduce".
		3	Farmer wants to reduce, but slowly. The goal is not to reach the lowest use possible, just enough is also OK.
		4	Farmers goal is to reach the lowest AMU possible, with equal costs.
		5	Farmers goal is to reach the lowest AMU possible, even if there are considerable costs related to the reduction.
K (nowledge)	Represents the knowledge and skills of the farmer to implement measures to improve health and to reduce the need for antimicrobial treatment.	1	It is not clear what is causing the health problems in the farm. It is not possible to draw up an action plan. The farmer and his network really do not know where to start.
		2	Low or inaccurate knowledge, experience or skills which are needed for the execution of the action plan are available for the farmer. Or, the underlying cause of the problem is not yet identified.
		3	Information on health problem(s) is available for the farmer, action plan can be drawn up.
		4	Information is available, but some discussion about the implementation. Support for the farm and farmer is needed to implement change.
		5	Information is available, Action plan is accepted and knowledge and skills are sufficiently available at level of farmer, veterinarian and personnel of the farm.
A (bility)	Represents the implementation phase of the change. Will or is the farmer implementing changes in management or working methods. (Topics for change are: feed, management, climate, working methods etcetera).	1	Farmers sees only obstacles for every proposed change and therefore does not implement any.
		2	Farmer implements a limited number of changes which are easy to achieve. The selection is not made upon expected effect, but on requested input.
		3	Some changes are accepted and implemented in the farm. Or implementation is saved for the rebuilding or new building.
		4	Farmer is implementing systematically. But money or time are hampering some changes.
		5	Farmer is investing time, money and/or effort to implement changes.
R (einforcement)	Represents the sustainability of change. To sustain change an active positive reinforcement is necessary	1	Farmer has negative experiences with reducing AMU.
		2	Farmer received or receives negative feedback from the personal environment with regard to reducing AMU.
		3	AMU reduction is not perceived to have a positive or negative effect
		4	Successful reduction has led to more job satisfaction and better herd performance
		5	Successful reduction has led to better economic performance or a higher personal status.

resistant bacteria in animals and humans. The willingness to reduce ABU was determined in the element Desire. Therefore, Desire reflected the internalization of Awareness and thus represented the intrinsic motivation of the farmer to change. Knowledge represented the cognitive knowledge of tools and farm management procedures to improve animal health and to reduce risks for disease, e.g. biosecurity and infection prevention measures, and thus to reduce the need for ABU. Ability represented the availability of

resources to implement change, such as time, manpower to do the work, money to invest and specific skills and competences of the stockmen in the herd. Reinforcement represented the sustainability of the established change. Important factors for reinforcement were negative and positive feedback of change on productivity, profitability and impact of change on the farmer. In short, in the farmer profiles Awareness and Desire reflected the perception and motivation part of ABU reduction, whereas Knowledge and Ability reflected the possibilities and opportunity to accomplish ABU reduction. Reinforcement represented the expected sustainability or persistence of the change (Table 1). The average farmers' ADKAR® antimicrobial stewardship profile scores, scored in a five-point scoring scale (1 represents the lowest score and 5 represents the highest score) for the combined elements Awareness (A), Desire (D), Knowledge (K) and Ability (A), were 3.0 for the Belgian farmers and 3.8 for the Dutch farmers. Average scores for pig farmers were 3.3 versus 3.4 for poultry farmers. None of the average scores for the separate elements Awareness, Desire, Knowledge or Ability differed significantly between the type of animals (pigs or poultry). Scores for Awareness ($p<0.001$), Desire ($p<0.05$) and Ability ($p<0.001$) were significantly higher in the

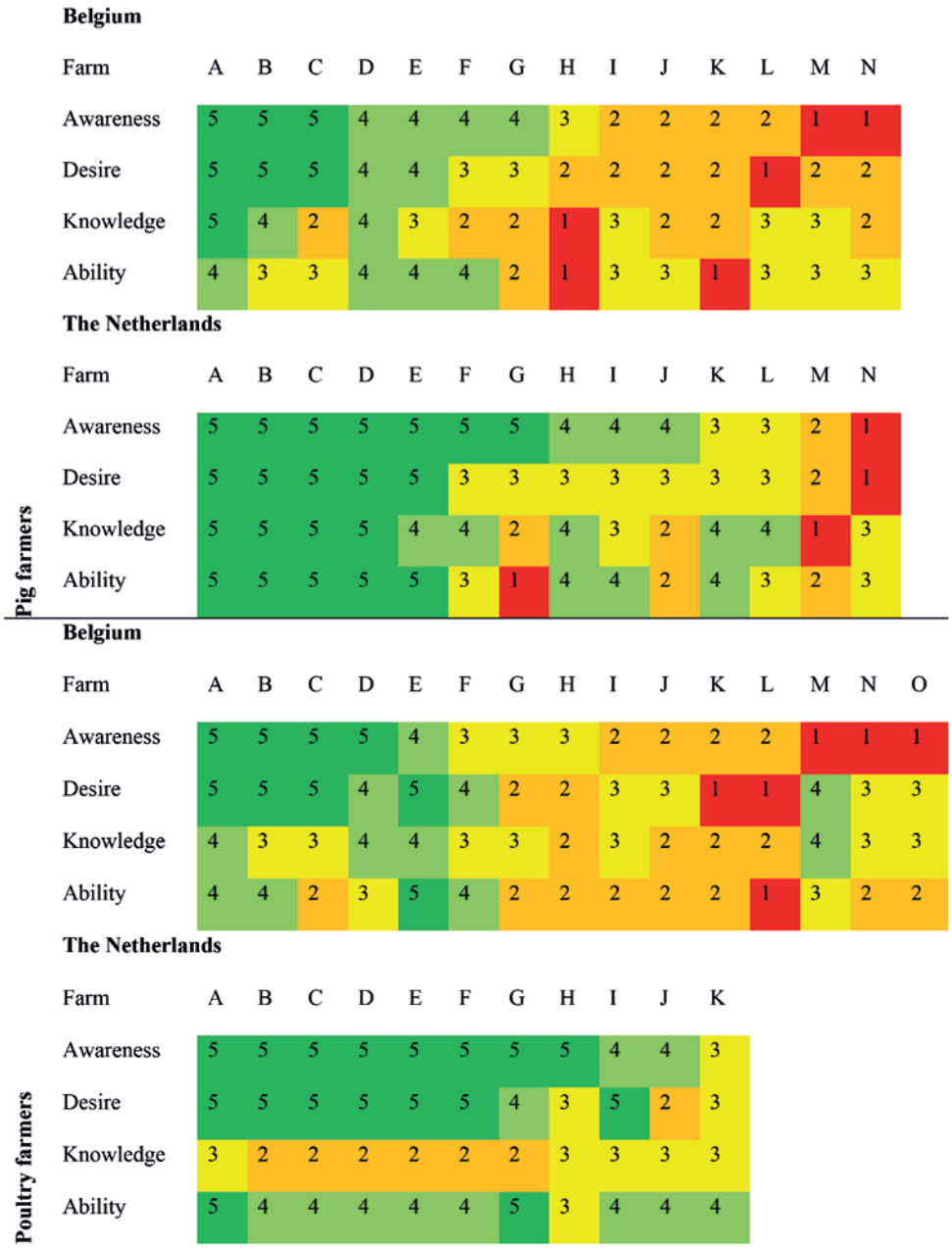

Figure 1. Individual ADKAR® profiles of pig and poultry farmers for the elements Awareness, Desire, Knowledge and Ability, stratified per species and country (n=54). A score of 1 represented the lowest score and 5 represented the highest score. As described by Hiatt (2006), if an element scored 1, 2 or 3, this element had to be considered to block the change of farm processes by the farmer towards AMU reduction.

Netherlands than in Belgium. Overall, 31% (17/54) of the farmers scored 3 or less on all first four ADKAR® elements, which means these farmers lack Awareness, Desire, Knowledge and Ability (Figure 1). For Awareness, 40% (22/54) of the farmers scored 3 or less, for Desire 54% (29/54) of the farmers scored 3 or less. Thirty-one of 54 (57%) farmers scored 3 or less for Awareness and/or Desire. Of these 31 farmers, twenty farmers scored 3 or less on Awareness as well as on Desire. For Knowledge, 70% (38/54) of the farmers scored 3 or less and for Ability 52% (28/54) of the farmers scored 3 or less. The 38 farmers with a low score on Knowledge were eleven Dutch poultry farmers (100%, 11/11), eleven Belgian poultry farmers (73%, 11/15), five Dutch pig farmers (38%, 5/14) and eleven Belgian pig farmers (79%, 11/14). Forty-five out of 54 farmers (83%) scored 3 or less for at least one of the four elements. Nine farmers scored 4 or 5 on each of the four criteria, being two Belgian pig farmers (14%, 2/14), five Dutch pig farmers (36%, 5/14) and two Belgian poultry farmers (13%, 2/15). Four Dutch pig farmers scored 5 for all four elements.

DISCUSSION

In this paper, the ADKAR® change management model as a starting point for veterinary coaching towards antimicrobial stewardship is described. Using farmer specific ADKAR® profiles, 54 pig and poultry farmers from Belgium and the Netherlands were scored. In 45 of these 54 farmers, elements which may hamper reduction were identified. In the other nine farmers, blockages were not found and the coaching could immediately focus on providing veterinary technical advice to improve health and to reduce ABU. Besides the lack of knowledge and ability, the authors also found that in 57% (31/54) of the farmers, perception and/or motivation (Awareness and Desire) needed to be properly addressed and improved by the coaches before focusing on technical veterinary advice on farm management could be successful. The lack of perception and motivation found in this study could be a possible explanation why farmers do not implement advice given towards a more health-orientated strategy of herd management, although previous studies have shown that these health-orientated strategies can be successful (Rojo-Gimeno et al., 2016; Collineau et al., 2017; Postma et al., 2017). This result is very relevant for the herd veterinarian in his or her everyday veterinary practice; especially in these cases where the veterinarian wants to implement a major change in farm management or when a farmer is not implementing given advice. In this study, the importance of addressing awareness and desire is emphasized as the lack of one or both of them may hamper the adoption of the provided veterinary advice, especially in topics not directly related to improvement of production or reduction of costs. Therefore, support is needed to help (pig and poultry) veterinarians assess and address lack of perception and motivation of farmers in general and related to antimicrobial stewardship specifically.

Experiences in human health care show that changes for better health care and antimicrobial stewardship are more effectively implemented when tailor-made and multifaceted: addressing patient, professional, organization of care, in a cultural and socio-economic context (Wensing et al., 1998; Grol and Grimshaw, 2003; Hulscher et al., 2010). In dairy farming, a multifaceted approach to implement change has already been successfully applied using the RESET model. RESET summarizes different models from the literature in five important incentives for change: Regulation, Education, Social pressure, Economics and Tools (Lam et al., 2017). In contrast to RESET, which focusses on interventions to increase perception and/or motivation, ADKAR® helps the veterinarian to identify limitations of farmers in the change process towards reduction of ABU, among which perception and motivation.

In the present study, the factor Knowledge also proved to be an important limiting factor for successful ABU reduction. Remarkable is the lack of Knowledge scored in all participating Dutch poultry farmers with higher than average ABU, of which eight of the eleven farmers scored 4 or 5 for the other A-D-K-A elements, suggesting Knowledge was the only limiting factor. The main reason for the low scores for Knowledge in this group proved the inadequate knowledge regarding raising poor quality newly hatched broiler chicks. All participating Dutch farmers struggled with poor quality of these hatchlings at the time of the assessment. Although in general, Knowledge seems a relatively easy-to-correct element for the veterinarian, this specific health issue seems to form a knowledge gap for poultry farmers towards low and prudent ABU.

The observed difference in the scores of the Dutch and Belgium farmers in this study should be interpreted with care because of the unknown interobserver agreement and different starting dates of the national ABU reduction program in livestock (2011 in the Netherlands versus 2016 in Belgium). With regard to external validity, the authors want to stress that due to the recruitment strategy, inclusion criteria and the small number of participating farmers, the results of the profiles cannot be simply extrapolated to the Belgian nor the Dutch pig and poultry farmer in general. Nonetheless, the significant higher scores for three out of the four A-D-K-A elements in the Netherlands might suggest that farmers in the Netherlands are already better informed and convinced about the need and possibility to reduce the use of antimicrobials, something, which is also translated in the European antimicrobial usage data in animals (ESVAC 2018) where the antimicrobial use in the Netherlands is shown to be substantially lower than in Belgium.

Further studies on a larger scale should be conducted to confirm this observation and demonstrate the link between ADKAR® profiling scores and the true antimicrobial use at farm or country level, and to study the effectiveness of intervention strategies like the RESET methodology to identify which of the RESET interventions (Regulation, Education, Social pressure, Economics and Tools) is successful in which farmer profile.

CONCLUSIONS

The ADKAR® model proved useful for identifying farmer specific key elements that prevented successful behavioral change in the farmers to reduce the use of antibiotics in their farms. The insight in the ADKAR® farmer profile and thus the limiting factor for change should help the veterinarian to design a tailored intervention and/or improvement plan for each specific farmer.

ACKNOWLEDGMENTS

The authors want to thank all farmers who participated voluntary in the i-4-1-Health cross border project, and all participants of the i-4-1-Health workshop, where ADKAR scores were fine-tuned. The authors want to thank Prosci Inc. for granting permission to use the trademark ADKAR®.

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