Integration of Epidemiological Evidence in a Decision Support Model for the Control of Campylobacter in Poultry Production

The control of human Campylobacteriosis is a priority in public health agendas all over the world. Poultry is considered a significant risk factor for human infections with Campylobacter and risk assessment models indicate that the successful implementation of Campylobacter control strategies in poultry will translate on a reduction of human Campylobacteriosis cases. Efficient control strategies implemented during primary production will reduce the risk of Campylobacter introduction in chicken houses and/or decrease Campylobacter concentration in infected chickens and their products. Consequently, poultry producers need to make difficult decisions under conditions of uncertainty regarding the implementation of Campylobacter control strategies. This manuscript presents the development of probabilistic graphical models to support decision making in order to control Campylobacter in poultry. The decision support systems are constructed as probabilistic graphical models (PGMs) which integrate knowledge and use Bayesian methods to deal with uncertainty. This paper presents a specific model designed to integrate epidemiological knowledge from the United Kingdom (UK model) in order to assist poultry managers in specific decisions related to vaccination of commercial broilers for the control of Campylobacter. Epidemiological considerations and other crucial aspects including challenges associated with the quantitative part of the models are discussed in this manuscript. The outcome of the PGMs will depend on the qualitative and quantitative data included in the models. Results from the UK model and sensitivity analyses indicated that the financial variables (cost/reward functions) and the effectiveness of the control strategies considered in the UK model were driving the results. In fact, there were no or only small financial gains when using a hypothetical vaccine B (able to decrease Campylobacter numbers from two to six logs in 20% of the chickens with a cost of 0.025 £/chicken) and reward system 1 (based on similar gross profits in relation to Campylobacter levels) under the specific assumptions considered in the UK model. In contrast, significant reductions in expected Campylobacter numbers and substantial associated anticipated financial gains were obtained from this model when considering the reward system 2 (based on quite different gross profits in relation to Campylobacter levels) and the use of a hypothetical cost-effective vaccine C (able to reduce the level of Campylobacter from two to six logs in 90% of the chickens with a cost of 0.03 £/chicken). The flexibility of probabilistic graphical models allows for the inclusion of more than one Campylobacter vaccination strategy and more than one reward system and consequently, diverse potential solutions for the control of Campylobacter may be considered. Cost-effective Campylobacter control strategies that can significantly reduce the probability of Campylobacter introduction into a flock and/or the numbers of Campylobacter in already infected chickens, and translate to an attractive cost-reward balance will be preferred by poultry producers.

General information
Publication status: Published
Organisations: National Food Institute, Division of Epidemiology and Microbial Genomics, National Veterinary Institute, Aalborg University
Contributors: Garcia Clavero, A. B., Madsen, A. L., Vigre, H.
Pages: 516-535
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Agriculture
Volume: 3
Issue number: 3
ISSN (Print): 2077-0472
Ratings:
ISI indexed (2013): ISI indexed no
Original language: English
Electronic versions:
agriculture_03_00516.pdf
DOIs: 10.3390/agriculture3030516
URLs: http://www.mdpi.com/2077-0472/3/3/516
Source: dtu
Source-ID: n:oai:DTIC-ART:doaj/391674457::36202
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review