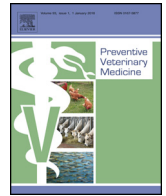




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## Preventive Veterinary Medicine

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# Effect of calf purchase and other herd-level risk factors on mortality, unwanted early slaughter, and use of antimicrobial group treatments in Swiss veal calf operations

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### ARTICLE INFO

#### Article history:

Received 1 October 2015  
Received in revised form 22 January 2016  
Accepted 25 January 2016

#### Keywords:

Metaphylaxis  
Veal  
Purchase  
Risk factors  
Herd size  
Antimicrobials

### ABSTRACT

The objective of this survey was to determine herd level risk factors for mortality, unwanted early slaughter, and metaphylactic application of antimicrobial group therapy in Swiss veal calves in 2013. A questionnaire regarding farm structure, farm management, mortality and antimicrobial use was sent to all farmers registered in a Swiss label program setting requirements for improved animal welfare and sustainability. Risk factors were determined by multivariable logistic regression. A total of 619 veal producers returned a useable questionnaire (response rate = 28.5%), of which 40.9% only fattened their own calves (group O), 56.9% their own calves and additional purchased calves (group O&P), and 2.3% only purchased calves for fattening (group P). A total number of 19,077 calves entered the fattening units in 2013, of which 21.7%, 66.7%, and 11.6% belonged to groups O, O&P, and P, respectively.

Mortality was 0% in 322 herds (52.0%), between 0% and 3% in 47 herds (7.6%), and  $\geq 3\%$  in 250 herds (40.4%). Significant risk factors for mortality were purchasing calves, herd size, higher incidence of BRD, and access to an outside pen. Metaphylaxis was used on 13.4% of the farms (7.9% only upon arrival, 4.4% only later in the fattening period, 1.1% upon arrival and later), in 3.2% of the herds of group O, 17.9% of those in group O&P, and 92.9% of those of group P. Application of metaphylaxis upon arrival was positively associated with purchase (OR = 8.9) and herd size (OR = 1.2 per 10 calves). Metaphylaxis later in the production cycle was positively associated with group size (OR = 2.9) and risk of respiratory disease (OR = 1.2 per 10% higher risk) and negatively with the use of individual antimicrobial treatment (OR = 0.3).

In many countries, purchase and a large herd size are inherently connected to veal production. The Swiss situation with large commercial but also smaller herds with little or no purchase of calves made it possible to investigate the effect of these factors on mortality and antimicrobial drug use. The results of this study show that a system where small farms raise the calves from their own herds has a substantial potential to improve animal health and reduce antimicrobial drug use.

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## 1. Introduction

Calf mortality is a key determinant of the economic result of veal or beef farms (Pardon et al., 2013). Mortality data are also used as primary indicators of animal welfare (Ortiz-Peleaz et al., 2008). In Europe, veal is defined as meat originating from calves slaughtered before the age of 8 months, and white and rosé veal are

distinguished based on meat color (EU Regulation EC 566/2008). In the mainstream European veal production system, large groups of calves are housed on slatted floors in compartmented stables and receive predominantly milk, either via a trough or an automated milk feeder (Sans and De Fontguyon, 2009; Pardon et al., 2014). However, in several countries, a more small-scale production, with fattening mainly of own excess male calves either with milk powder or own milk, represents an important source of income for the producers. In case excess milk is available on the farms, these producers buy extra calves to process this milk, which results in a higher financial return than selling the milk.

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Compared to dairy calves, mortality and the associated risk factors for the various veal production systems worldwide are an underexplored area. Although a substantially lower average mortality (3.0%) has been reported in Switzerland compared to countries in which veal is raised under mainstream conditions, e.g., Belgium (5.3%) (Bähler et al., 2012; Pardon et al., 2012a), further insights into risk factors for mortality are necessary. A low mortality risk is an important indicator of quality for production under veal quality labels that claim improved welfare. Compared to other European countries where only the mainstream veal production system is present, the Swiss situation offers a unique opportunity to explore the influence of purchase on mortality, given that many veal farms only fatten the calves born on the respective farm in Switzerland.

Another factor which has gained high importance in recent years is antimicrobial use in food animals, driven by the societal concern on the emergence of antimicrobial resistance in animal bacteria as a potential hazard for human health (Bosman et al., 2013). For label production, evidence of a low antimicrobial use has become increasingly important. Veal calves in European mainstream production have been shown to have a very high consumption of antimicrobials (MARAN-2009, 2011; Pardon et al., 2012b). Reducing antimicrobial use is thus a top priority for the veal industry, given the high prevalence of livestock-associated methicillin-resistant *Staphylococcus aureus* and extended-spectrum beta-lactamase harboring *Escherichia coli* (Graveland et al., 2010; Hordijk et al., 2013; Vandendriessche et al., 2013).

In veal calves, the vast majority (>95%) of the antimicrobials used is given as oral group treatments in the milk (Pardon et al., 2012b). Prophylactic antimicrobial use is nowadays forbidden in several European countries, however the treatment of apparently healthy animals kept together with sick animals is common practice (Pardon et al., 2012b) under the appellation “metaphylaxis”, i.e., the simultaneous antimicrobial treatment of clinically healthy animals and animals that show clinical symptoms of disease in a shared compartment (Aarestrup, 2005). It is clear that reducing metaphylactic group treatments is the key factor to substantially reduce antimicrobial use in the veal industry. However, there is minimal knowledge on herd-level factors which drive the application of antimicrobial metaphylaxis in the different forms of veal production.

Therefore, the objectives of the present study were to determine herd level risk factors for mortality, unwanted early slaughter, and application of metaphylactic antimicrobial therapy either upon arrival or later in the fattening period in Swiss veal farms.

## 2. Materials and methods

### 2.1. Study design, farm selection and questionnaire

A questionnaire study was designed with the objective to determine risk factors for mortality, unwanted early slaughter, and application of metaphylaxis in Swiss veal herds. The target population consisted of the 2169 Swiss veal herds which produced under the IP-SUISSE label in 2013 (16.4% of the Swiss veal production). In addition to housing the calves on straw with access to roughage and water in compliance with the Swiss animal protection law (Tierschutzverordnung, 2008), specific label conditions include a minimal straw-bedded area of 1.8 m<sup>2</sup> or 2 m<sup>2</sup> per calf for calves weighting less or more than 200 kg, respectively, (IP-SUISSE, 2013), and from 2015 on a permanent access to an outside pen and a total minimal surface of 3.5 m<sup>2</sup> or 4.5 m<sup>2</sup> per calf for calves with an age of less or more than 120 days, respectively (IP-SUISSE, 2015). A list of all farms producing veal under IP-SUISSE conditions was

provided by the label organization. Inclusion criteria for farms to be included in the analysis were the availability of information at least on mortality, animal purchase and herd size. Herds with less than 5 veal calves slaughtered per year were excluded.

A questionnaire consisting of 18 questions distributed in 4 parts was sent to the 2169 veal farmers between March and May 2014, either electronically or by surface mail depending on the availability of an e-mail address. The first part of the questionnaire was designed to record data on the number of animals fattened and slaughtered in 2013, and the numbers of deaths or unwanted early slaughters. The second part focused on general farm management, including questions on animal purchase, availability of an outside pen, and the number of calves per pen. In part three, the principles of antimicrobial use were explored (individual/group; product(s) used; oral/parenteral application; estimates of disease distribution among the calves treated with antimicrobial drugs [bovine respiratory disease (BRD), diarrhoea, otitis and others]). Group treatments, further mentioned as “metaphylaxis” in this study report, were defined in the questionnaire as the “routine treatment of all animals with antimicrobials” upon arrival or later during the fattening period. In the final part of the questionnaire, producers were asked how they perceived the health status of their calves and whether they would be interested in further collaboration in a project to improve veal calf health management in Switzerland. The questionnaire was pretested by 9 veal producers and 6 veterinarians working at the Vetsuisse-Faculty, University of Berne. One reminder was sent to all non-responders two weeks before the deadline for participation.

### 2.2. Data management and statistical analyses

All data were entered into a relational database (Access, Microsoft Inc., Redmont Washington, USA) and imported into a statistical program for descriptive and statistical analysis (NCSS 9, Kaysville, Utah, USA). Herd size was defined as the total number of calves fattened in 2013, group size as the number of calves per pen, and maximal occupancy as the maximum number of calves present at the same time at the farm in 2013. Mortality (% per year) was calculated as the number of calves which died or were euthanized in 2013 over the number of calves which entered the veal herd in the same year, times 100. The annual incidence of unwanted early slaughter was calculated by dividing the number of calves which were slaughtered before the targeted slaughter weight was reached, divided by the number of calves which entered the veal herd in the same year, times 100. Estimates of disease distribution among treated calves were provided by the farmers. The proportion of calves suffering from a specific disease among those receiving antimicrobial treatment was defined as disease risk, e.g., BRD risk. Application of metaphylaxis upon arrival was distinguished from its use later in the fattening period.

For statistical analyses, the unit of analysis was the herd. Both mortality risk and unwanted early slaughter risk showed a right-skewed distribution and were heavily zero-inflated. Therefore, mortality risk and unwanted early slaughter risk were transformed into a binary outcome. For mortality, the average mortality risk in Swiss veal calves of 3.0% (Bähler et al., 2012) was used as a cut-off to distinguish herds with high mortality and low mortality risk. For unwanted early slaughter, herds with an incidence >0% were compared with herds which did not have any cases.

In total, 5 logistic regression models were constructed, with 3% mortality as cut-off (<3% vs. ≥3%), unwanted early slaughter (yes/no), metaphylaxis (yes/no), metaphylaxis upon arrival (yes/no), and metaphylaxis later in the fattening period (yes/no) as outcome variables. For mortality and unwanted early slaughter, the effect of the 15 parameters listed in Table 1 was evaluated. For the metaphylaxis models, 11 parameters were tested (Table 2).

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