

Veterinary epidemiology – a key to sustainable pig production in Switzerland

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Abstract

Sustainable animal production requires a healthy production system including healthy animals producing wholesome products. Clinically infected but also clinically healthy food animals can be a risk for consumers. Epidemiology as a discipline is concerned with the occurrence of disease or disease indicators in populations as well as with factors influencing the occurrence. The knowledge of such risk factors forms the basis for preventive interventions and disease eradication programmes. By providing this information, epidemiology contributes significantly to the development and maintenance of healthy livestock. This is illustrated with the example of the enzootic pneumonia eradication programme of Switzerland.

An EP-free pig population does produce more efficiently and with a reduced use of antimicrobial drugs. This is desirable from both an economical and food safety point of view. Minimal-disease herds support sustainable production by reducing adverse impact on human and ecosystem health. The example of the EP eradication programme illustrates that applied epidemiological research supplements disease control programmes with critical information and is thus a key tool in developing sustainable animal production systems.

Introduction

Sustainable animal production requires a healthy production system including safe feed and feed production, healthy animals producing wholesome products and considerate treatment of waste water and slurry. The majority of diseases in pigs housed in intensive production systems are of infectious nature. Subclinically or clinically infected livestock are a risk for consumers either through direct transmission of zoonotic agents or indirectly if they are treated with antimicrobial substances that can create residue and/or resistance problems.

Epidemiology as a discipline is concerned with the occurrence of disease or disease indicators in populations as well as with factors influencing the occurrence. The knowledge of such risk factors forms the basis for preventive interventions and disease eradication programmes. By providing this information, epidemiology contributes significantly to the development and maintenance of healthy livestock.

The accumulation of epidemiological knowledge and the development of minimal-disease production systems are a continuing process where the output of research projects feeds into the implementation of disease control programmes. This process is illustrated in the following using the example of enzootic pneumonia.

Example: Eradication of enzootic pneumonia in Switzerland

Enzootic pneumonia (EP) is a disease of world-wide economical significance in swine production. The causative agent *Mycoplasma hyopneumoniae* was first isolated in the 1960ies. Soon, it became clear, that enzootic pneumonia is a multifactorial disease the consequences of which are greatly influenced by management factors (Kalich 1970a,b; Whittlestone 1976; Stärk 2000). Therefore, it is possible for a well-managed farm to be EP-infected without major disease symptoms (Keller 1976). However, whenever a problem in the management occurs, e.g. a problem in the ventilation system, symptoms occur. In such an outbreak situation, antibiotic treatment is typically applied. Medication against EP and secondary infections is also used in continuous productions systems to protect newly-added animals from clinical infection.

As a consequence of EP infection, a reduced production efficiency farms was observed in infected herds (Braude and Plonka, 1976; Christensen, 1995). This disadvantageous effect and the fact that antibiotic treatment cannot eliminate colonisation with *M. hyopneumoniae*, initiated the development of minimal disease herds that are EP-free. One such programme is the SPF programme as it is applied in many countries of the world (Twiehaus and Underdahl, 1975; Kuiper et al 1994). Such a system was developed in Switzerland in 1968 on a voluntary basis. Apart from EP, SPF farms are also free from a number of other infectious diseases (Keller 1980). Regular clinical inspection and monitoring using reliable diagnostic test systems were prerequisites for the development of this system.

From 1970 to 1990, the SPF programme was increasingly popular among Swiss farmers. However, a constant number of herds was re-infected with EP each year. In these herds, an expensive re-population strategy had to be applied to re-establish the SPF status. Later, a simpler technique was developed that only required a partial re-population (Zimmermann et al, 1989). But still, each re-infection was a set-back in the SPF programme and particularly for the affected farmers.

As the risk factors for re-infection were not known, epidemiological methods were applied to investigate possible reasons. A case-control study was conducted and provided evidence supporting the hypothesis of airborne transmission (Stärk et al., 1992). This hypothesis had earlier been postulated in the UK and in Denmark (Goodwin, 1985; Jorsal and Thomsen, 1988). In a situation with airborne transmission, the risk for re-infection is particularly high for farms in close neighbourhood of farms or in areas with a high pig density. This relationship was quantified with epidemiological analyses in Denmark (Thomsen et al., 1992).

The consequence of this observation was, that the only promising approach for high-risk areas would be an area-wide eradication of EP (Stärk et al., 1992). This was an ambitious idea and no expertise was available to indicate whether such a project would be feasible at all. Too much was at stake to experiment in the field. Alternatively, a spatial simulation model was developed to explore the feasibility of area-wide eradication (Laube et al., 1997). It was shown that it was sufficient to eradicate EP from the largest farms in an area to bring down the infection pressure sufficiently for the other farms. Many logistical questions could be explored with this model. Finally, sufficient evidence and logistical information was available to start the area-wide eradication project in the field. However, before the project could be started, the legal basis for compulsory eradication had to be provided. This was necessary because it was likely that not all producers would join an area-wide eradication on a voluntary basis. The legal basis was provided in the Ordonance on Animal Epizootics (TSV). Articles 246-247 state that compulsory eradication of EP and *Actinobacillus pleuropneumoniae* can be ordered by the cantonal veterinarian in specific areas.

On this legal ground, a pilot area was selected which was well separated from the surrounding area by natural boundaries (mountains, forest) that were known to hinder airborne transmission. A procedure to co-ordinate the partial-depopulation of swine herds

in the area was developed. One key element was the control of trade to prevent re-infection through purchase of infected animals. This project was scientifically accompanied to collect further epidemiological knowledge and to identify critical factors before implementing the programme in other areas (Masserey-Wullschleger and Maurer, 1998).

After successful eradication of EP in this pilot area, producers and authorities were highly motivated to continue with more areas. The eradication regions were broadened. As more and larger areas were included, the logistics of the project became more challenging. Therefore, a strategy for the entire country was developed with the goal to terminate the eradication by the year 2004 (Anonymous, 1999; Figure 1).

Although the project is in full swing at the moment, it is not without problems. Again, re-infections in the EP-free regions are occurring, sometimes with obvious reasons, but sometimes without clear explanation. These re-infections are jeopardising the success of the entire project as undetected re-infected farms in the incubation period and infected farms before the re-eradication are a risk for their neighbours. To identify risk factors for this new type of re-infections, again an epidemiological study is planned. This project will provide practical guidelines on how to prevent re-infections and – if they occur – on how to best handle them.

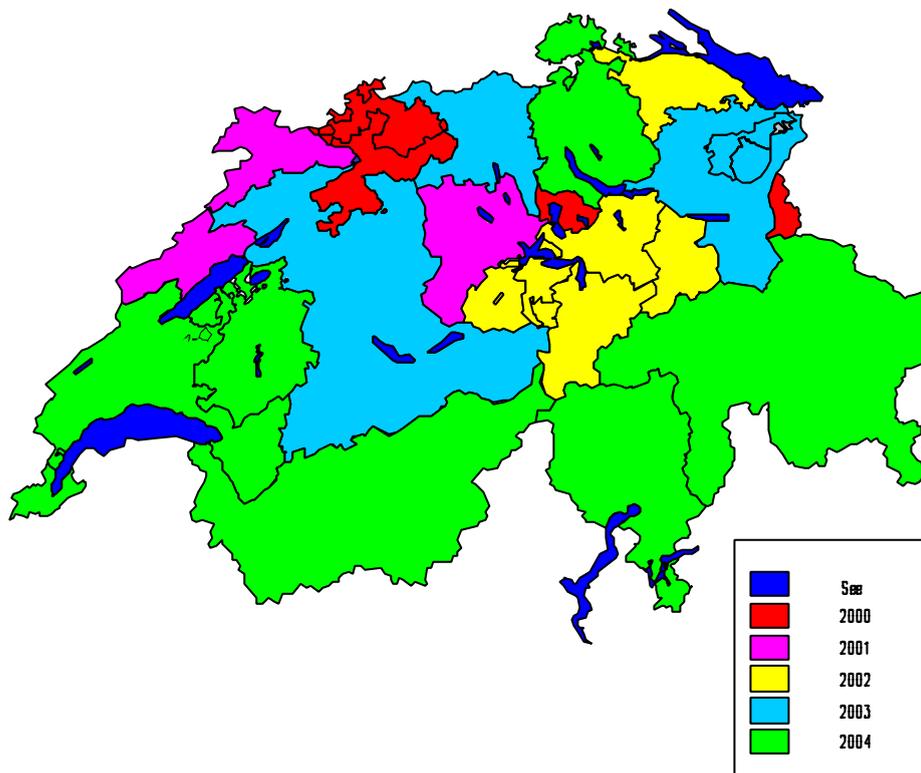


Figure 1. Time schedule for EP eradication in Switzerland

Conclusion

As summarised in Table 1, a series of epidemiological research projects provided (and continue to provide) input to the stepwise development of an EP-free production system in Switzerland.

Table 1. Input provided by research projects to develop EP eradication programme

Epidemiological project aim	Implementation in the field
Identification of risk factors for EP re-infection of breeding farms	Risk indicator to estimate re-infection risk, decision support for farmers who wish to eradicate EP
Feasibility study for area-wide EP eradication (simulation model)	Decision to declare EP as a disease to be eradicated from certain areas (legal basis)
EP eradication in a pilot area	Development of a guide to plan and coordinate eradication in an area
Identify risk factors for EP re-infection in eradicated areas	Development of preventive measures and guidelines

An EP-free pig population will produce more efficiently and with a reduced use of antimicrobial drugs. This is desirable from both an economical and food safety point of view. Minimal-disease herds support sustainable production by reducing adverse impact on human and ecosystem health. The example of EP eradication illustrates that applied epidemiological research supplements disease control programmes with critical information and is thus a key tool in developing sustainable animal production.

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