Social impact of epizootics

- Analysis of broadening considering as example foot-and-mouth disease (FMD)

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Introduction

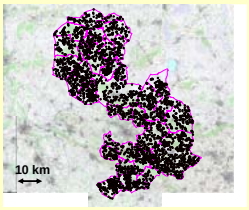

Fig. 1: 3839 farms with cloven-hoofed animals in Osnabrueck

Foot-and-mouth disease is the most relevant infectious disease of agricultural livestock husbandry with respect to its economical consequences[1,2]. International live-stock trafficking and the ever increasing exposure of people travelling to FMD-affected countries result in the disease becoming a permanent threat.

In the present study the consequences of an epizootic break-out were investigated by means of an exemplary case. The aim is to identify typical consequences of the disease by showing a concrete, isolated case in germany. Not only the number of potentially affected animals or agricultural farms was established, but also the economical and social consequences.

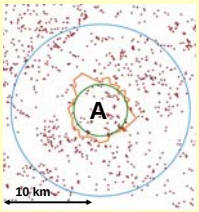

Fig. 2: Quarantined area & Observation area

Method

Epidemiolgical investigation on "farm A"

Analysed outbreak of FMD on "farm A" is based on a virtual primary outbreak at a strictly pig-producing farm in an area with high livestock density in Osnabrueck County, Germany. In order to describe a case that is founded on real-life vectors, an epidemiologic evaluation at "farm A" was conducted (Fig.3). Within our study 13 potential vectors of virus transmission were identified. A total number of 79 contacts of various durations were found within a 12-week study period. Occurrence of direct vector to animal contact and the number of cloven-footed animal producing farms that were subsequently visited by the vector was also recorded. Furthermore, the sum of all subsequently visited farms for each vector and the type of farm (pig-producing, cattle farm etc.) was determined.

Expert survey

As an important component of the epidemiologic analysis, risk factors supporting the spread of FMD-virus had to be determined and quantified within the study area. A structured expert survey was chosen as a method for risk assessment. Eight recognized experts in the field were contacted to rank vectors individually in terms of potential of spreading the virus (Fig.4).

Radial dissemination

Based on the previous data a computer model was established in collaboration with the Friedrich-Loeffler-Institute / Wusterhausen, Germany that simulates a primary radial dissemination of FMD-virus from "farm A". This model solely predicts primary FMD-virus outbreaks at subsequent farms that had direct contact with "farm A" (Fig.5). In contrast to other models results were not limited to the number of affected farms and animals, but also included a detailed evaluation of social impact.

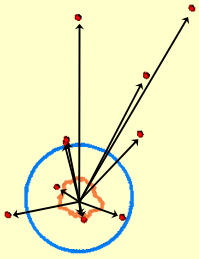

Fig. 5: Radial dissemination

epidemiologic relevant vector	visits: number	visits: duration / minutes	form of contact: entered stall	form of contact: animal contact
cull truck	25	54	no	no
animal feed delivery	11	112	no	no
pregnancy examination	5	110	yes	yes
pickup piglets (GVG)	3	110	no	yes
pig shipment (GVG)	2	40	no	yes
cattle dealer	6	75	no	yes
plumbing	1	30	yes	yes
veterinarian	7	390	yes	yes
piglets sold to another farmer	5	255	no	yes
ventilation technician	1	60	yes	yes
Raiffeisen (trading co.)	11	420	no	no
county official (measures stalls)	1	240	no	no
daughter shows piglets to neighbour kid	1	15	yes	yes
sperm delivery	3	5	no	no

Fig. 3: Three month epidemiological contacts on "farm A " in Osnabrueck County

contact / vector	expert A	B	C	D	E	F	G	H	min	max
Animal movement										
selling							4			
selling piglets from "farm A" to another farmer	3	3	4	4	4	4	4	4	3,00	4,00
buying			4				4		4,00	4,00
"farm A" is buying pigs (GVG)	3-4	3	4	4	3	3	4	4	3,00	4,00
moving around flocks of sheep	2	2	4	3		1-2	3	2	1,00	4,00
Passenger traffic related to "farm A"										
visiting a zoo etc.	3	1	1-2	1	1	1-4	1	2	1,00	4,00
visiting a pet shop	1	1	1-2	1	1	1	1	2	1,00	2,00
trip abroad	1	1	1-2	1	1	1	2	1	1,00	2,00

Fig. 4: Expert survey for evaluating the hazard of FMD-impact

Results

76 scenarios (Fig.6) were calculated and the results were summarized in four categories:

- Costs for killing animals, disinfection, and mobile control centre (Fig.7)
- Business economy losses (Fig.7)
- Political economy losses (Fig.7)
- Required resources and effects on public (e.g. Fig.8)

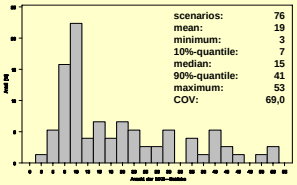

Fig. 6: # of infected farms

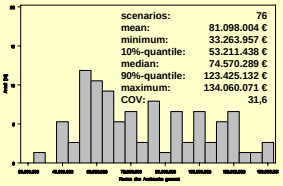

Fig. 7: Total costs in €

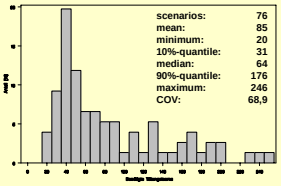

Fig. 8: # culling teams needed

Discussion & Conclusion

Results shown represent in multiple terms only 'the lower end' of expected consequences since this study was only focused on FMD-virus outbreaks that were directly linked to "farm A". The consequences were only estimated for Osnabrueck County. Multiple superior/higher ranking consequences were not taken into account due of data protection. Overall it is estimated that up to 2 billion € have to be calculated, if FMD-outbreak will take place in the federal state of Lower Saxony.

References:
(1) James AD, Rushton J. The economics of foot and mouth disease. Rev Sci Tech. 2002 Dec;21(3):637-44.
(2) Woolhouse M, Donaldson A. Managing foot-and-mouth. Nature. 2001 Mar 29;410(6828):515-6.