CONTACT PATTERNS ON DUTCH FARMS IN DENSELY AND SPARSELY POPULATED LIVESTOCK AREAS

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Abstract: A survey was conducted on contacts off and onto livestock farms in four regions in the Netherlands. The main goal was to assess the potential risk of spread of foot-and-mouth (FMD) through normal contact patterns of farms in areas with different livestock densities. Farm contacts were classified in terms of risk of FMD transmission. Number and distances of classified farm contacts were compared between densely and sparsely populated livestock areas. The data can be used to show if there are differences in how the disease might spread prior to diagnosis between areas with high and low densities.

Keywords: farm contact patterns, livestock density, foot-and-mouth disease, risk

1. INTRODUCTION

Certain areas in the European Union contain high density populations of livestock. In the Netherlands these densely populated livestock areas (DPLAs) are mainly situated in the southern and eastern part. De Vos et al. (2000) defined DPLAs as areas that have an extremely high concentration of cattle, pigs, sheep and goats in comparison with other areas in the EU. DPLAs have developed because they have considerable economic advantages. Their development give rise, however, to an increased risk of animal disease epidemics. Eradication of disease in DPLAs within the framework of the present EU Directives is possible, but there is a need to refine effective control strategies taking into account the characteristics of the DPLAs (Dijkhuizen and Davies, 1995). For this reason the EU has financed a project to develop prevention and control strategies for outbreaks of infectious animal diseases in DPLAs (Dijkhuizen and Jalvingh, 1997). Since foot-and-mouth disease (FMD) is so serious in its economic effects and is the most infectious of all animal diseases, it is a good model to take as an starting point in considering the options for the control of epidemic livestock diseases in DPLAs. Council Directive 85/511/EEC lays down the measures appropriate for the control of FMD (Anonymous, 1985). EU regulations are based on a strategy of non-vaccination and stamping out. An outbreak of FMD would lead to an imposition of zones for protection (minimal radius of 3 km) and for surveillance (minimal radius of 10 km) around infected farms. The most important issue in defining the boundaries of these zones relates to the number and destination of contacts that have occurred off and onto any infected farm prior to diagnosis, as these represent potential opportunities to spread the disease (Sanson et al., 1993)
In order to estimate the likely number of contacts off and onto farms for the event of an FMD outbreak a survey was conducted in four regions in the Netherlands. The main goal was to assess the potential risk of spread of foot-and-mouth (FMD) through normal contact patterns of farms in areas with different livestock densities.

2. MATERIALS AND METHODS

1.1 Selection of regions

Four different regions, centered around municipalities, were selected for this study as representative of the various mixes of livestock farms in the Netherlands (Figure 1). Two of these regions were defined as DPLAs and the other two regions were defined as sparsely populated livestock areas (SPLAs). The minimum density criterion for a DPLA has been based on animal numbers per km^2, taking into account total land area (De Vos et al., 2000). To classify as a DPLA for FMD, a region should have more than 450 animals per km^2 or more than 300 pigs per km^2. For defining a SPLA for FMD a maximum density criterion of 150 animals per km^2 was used.
DPLA1 was centered around Bernheze with a density of 4176 animals/km^2, DPLA2 was centered around Wehl with a density of 3347 animals/km^2, SPLA1 was centered around Zeewolde with a density of 98 animals/km^2 and SPLA2 was centered around Veendam with a density of 90 animals/km^2 (CBS, 1998).

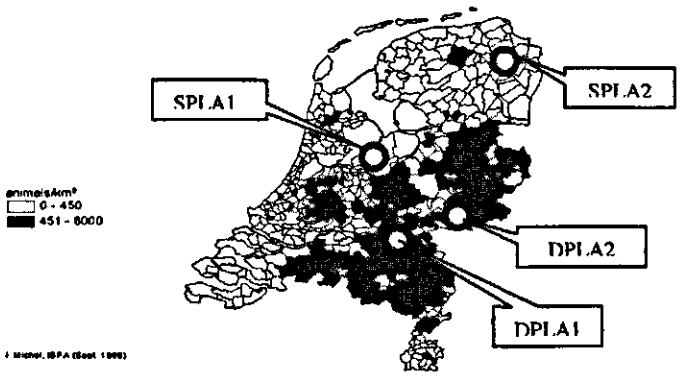

Figure 1. Two DPLAs and two SPLAs were involved in the survey.

1.2 Data collection

For the data collection a protocol of a previous study on farm contacts by Nielen et al. (1996) was used. In each region a veterinary clinic cooperated in the survey. These clinics informed their farmers about this study. Each farmer agreeing to participate in the study was visited. During the visit a questionnaire on general farm information was completed. Farmers were then asked to record all movements off and onto their farm for a period of 14 days in October or November 1999. Special forms had been developed for recording every movement of animals, animal products and people off or onto the farm, together with the origin or destination involved.

1.3 Data analysis

The collected data were used to obtain an indication of the contact patterns of farms in the different DPLAs and SPLAs. Contact patterns were described by the number of contacts, distance of contacts and classification of contacts in terms of risk of FMD transmission.
All the data was entered into the statistical package SPSS for Windows (version 8.0.2, SPSS Inc., Chicago, USA). The distance between origin and destination of a contact was calculated with a route-planning program (CD-foongids 1999, version 4.0.1, KPN Telecom) . Each contact was classified in terms of risk of FMD transmission, as shown in Table 1.

Table 1. Risk of a contact to spread FMD during the period that a farm is infected , but before clinical signs have occurred (Sanson, 1993, Nielen, 1996)

Risk	*Type of contact*
Very high	Susceptible animal
High	Person or vehicle with animal contact
High	Animal products (milk, manure)
Medium	Other (non-animal) products (feed)
Low	Person or vehicle without animal contact

3. RESULTS

In total 254 farms participated in this study (an 48% response rate). Table 2 shows the number of farms per farm type for each region.

Table 2. Number of farms per farm type for each region

	DPLA1		*DPLA2*		*SPLA1*		*SPLA2*	
Farm type	#	%	#	%	#	%	#	%
Dairy	29	39.2	20	23.5	32	84.2	22	38.6
Sows	5	6.8	14	16.5	0	0	10	17.5
Fattening pigs	6	8.1	15	17.7	1	2.6	7	12.3
Farrow-to-finish	10	13.5	11	12.9	0	0	4	7.0
Mixed	24	32.4	25	29.4	5	13.2	14	24.6
Total	74	100	85	100	38	100	57	100

1.1 Number of contacts

During the 14-day period 17079 contacts were recorded. The number of contacts per farm in each region are shown in Table 3. The distribution of numbers of contacts was positively skewed for SPLA1 (Skewness = 2.85). There was a significant difference in the numbers of contacts per farm between each of the four regions (ANOVA, P = 0.00). SPLA1 had a significantly higher number of contacts than the other regions.

Table 3. Number of contacts per farm in each region in a 14-day period

Region	*Mean*	*St.dev.*	*Min.*	*Median*	*Max.*	*Median per day*
DPLA1	62.6	32.33	5	57.0	144	4.07
DPLA2	57.5	28.46	7	57.0	143	4.07
SPLA1	104.3	83.75	34	82.5	439	5.89
SPLA2	62.9	29.72	5	62.0	141	4.43

1.2 Distance of contacts

The distance of the contacts is shown in Figure 2. The regions SPLA1 and SPLA2 had a higher percentage of contacts in the long distance classes (> 10 km) and the regions DPLA1 and DPLA2 had a higher percentage of contacts in the shorter distance classes (< 10 km).

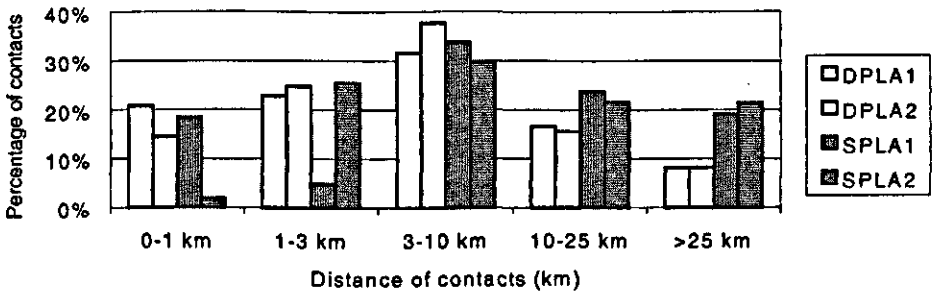

Figure 2. Percentage of contacts per distance class for each region.

1.3 Classification of contacts in terms of risk of FMD-transmission

Figure 3 shows the number of contacts occurring over various risk levels per farm in each region. SPLA1-farms had more contacts in the high and low risk level than the farms in the other regions.

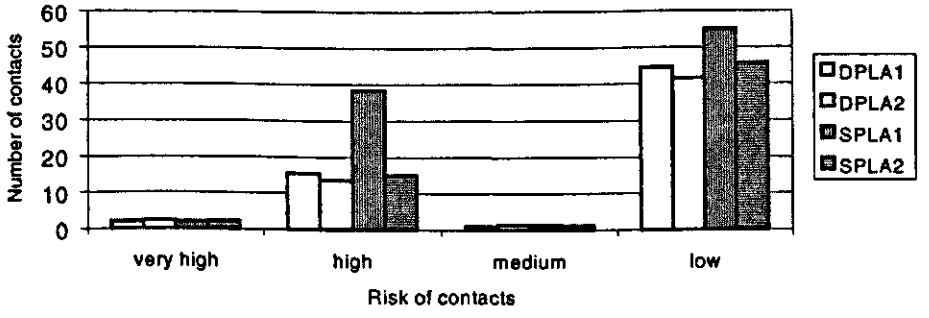

Figure 3. Number of contacts per farm in each region in a 14-day period, stratified by risk level.

4. DISCUSSION

This paper reports the preliminary results of a survey aimed at giving insights into contact patterns of farms in areas with different livestock densities. This study demonstrated that the SPLA-farms in the survey had more contacts in a 14-day period than the DPLA-farms in the survey. The SPLA-farms also had more contacts that occurred over larger distances.

An outbreak of FMD would lead to an imposition of protection and surveillance zones around infected farms. For the farms involved in this study, the minimal radius of 3 km for the protection zone would cover 41.4% of all contacts off and onto DPLA-farms and 25.4% of all contacts off and onto SPLA-farms. The minimal radius of 10 km for the surveillance zone would cover 76.5% of all contacts off and onto DPLA-farms and 57.5% of all contacts off and onto SPLA-farms.

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