QUANTIFICATION OF CONTACTS ON DUTCH FARMS TO ASSESS THE
POTENTIAL RISK OF SPREAD OF FOOT-AND-MOUTH DISEASE IN
DENSELY AND SPARSELY POPULATED LIVESTOCK AREAS

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Certain areas in the Netherlands contain high density populations of livestock. These densely populated livestock areas (DPLAs) give rise 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 control strategies². Since foot-and-mouth disease (FMD) is so serious in its economic effects, it is a good starting point in considering the control options. The current control measures 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 disease⁴. 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.

Materials and methods
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).

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Figure 1. Two DPLAs and two SPLAs were involved in the survey¹. DPLA1 had 4176 animals/km², DPLA2 had 3347 animals/km², SPLA1 had 98 animals/km² and SPLA2 had 90 animals/km².

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Two regions were defined as DPLAs and two regions were defined as sparsely populated livestock areas (SPLAs). To classify as a DPLA for FMD, a region should have more than 450 susceptible 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. For the data collection a protocol of a previous study on farm contacts was used. In each region a veterinary clinic cooperated in the survey and informed farmers about this study. Each farmer agreeing to participate 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.

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. 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

<table>
<thead>
<tr>
<th>Risk</th>
<th>Type of contact</th>
</tr>
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<tbody>
<tr>
<td>Very high</td>
<td>Susceptible animal</td>
</tr>
<tr>
<td>High</td>
<td>Person or vehicle with animal contact</td>
</tr>
<tr>
<td>High</td>
<td>Animal products (milk, manure)</td>
</tr>
<tr>
<td>Medium</td>
<td>Other (non-animal) products (feed)</td>
</tr>
<tr>
<td>Low</td>
<td>Person or vehicle without animal contact</td>
</tr>
</tbody>
</table>

Results

In total 254 farms participated in this study (an 48% response rate). During the 14-day period 17079 contacts were recorded. The number of contacts per farm in each region are shown in Table 2. 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 2. Number of contacts per farm in each region in a 14-day period

<table>
<thead>
<tr>
<th>Region</th>
<th>Mean</th>
<th>St.dev.</th>
<th>Min.</th>
<th>Median</th>
<th>Max.</th>
<th>Median per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPLA1</td>
<td>62.6</td>
<td>32.33</td>
<td>5</td>
<td>57.0</td>
<td>144</td>
<td>4.07</td>
</tr>
<tr>
<td>DPLA2</td>
<td>57.5</td>
<td>28.46</td>
<td>7</td>
<td>57.0</td>
<td>143</td>
<td>4.07</td>
</tr>
<tr>
<td>SPLA1</td>
<td>104.3</td>
<td>83.75</td>
<td>34</td>
<td>82.5</td>
<td>439</td>
<td>5.89</td>
</tr>
<tr>
<td>SPLA2</td>
<td>62.9</td>
<td>29.72</td>
<td>5</td>
<td>62.0</td>
<td>141</td>
<td>4.43</td>
</tr>
</tbody>
</table>

The distance of the contacts is shown in Figure 2. SPLA1 and SPLA2 had a higher percentage of contacts in the long distance classes (> 10 km) and DPLA1 and DPLA2 had a higher percentage of contacts in the shorter distance classes (< 10 km). 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.
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. SPLA-farms in the survey had more contacts in a 14-day period than the DPLA-farms. 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.

References