Teaming up for animal health, in the interest of animals, their owners and society at large
Control of *Salmonella* spp. in Dutch dairy herds

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### Human salmonellosis cases (per 17,000,000 humans)

<table>
<thead>
<tr>
<th>Category</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>General population</td>
<td>28,000</td>
<td>27,500</td>
<td>27,200</td>
</tr>
<tr>
<td>General practitioner</td>
<td>4,200</td>
<td>4,100</td>
<td>4,380</td>
</tr>
<tr>
<td>Hospitalised</td>
<td>1,100</td>
<td>1,080</td>
<td>1,068</td>
</tr>
<tr>
<td>Death</td>
<td>27</td>
<td>27</td>
<td>25</td>
</tr>
</tbody>
</table>
Geschatte bijdrage aan de humane, laboratoriumbevestigde salmonellose (linker y-as) door reizen (of onbekend), landbouwhuisdieren of hun producten. Omvangrijke explosies die niet representatief zijn voor de Salmonella-status van de Nederlandse vee- en pluimveestapel, zijn in groen aangegeven. (Bron: Laboratoriumsurveillance RIVM)
A prolonged outbreak of *Salmonella* Typhimurium infection related to an uncommon vehicle: hard cheese made from raw milk

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AND J. VAN STEENBERGEN\(^1\), on behalf of the Outbreak Investigation Team\(^\dagger\)

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Teaming up for animal health

Export value
€ 6.6 bn

Dairy’s contribution to the Dutch trade balance
9%

1.6 mn cows
Dairy product export

35% for Dutch use

Outside of the EU
20%

Within the EU
45%
Control in Dutch dairy herds

- Certification-and-surveillance programme (2000 – present)
  - enable low risk trade of cattle between herds
  - alert farmers to an infection in their herd
  - reduce human exposure

- Control programme dairy processors (2008 – present)
  - stimulate farmers to control infection in their herd
  - reduce prevalence of infection
Scheme of dairy processors

- Bulk milk ELISA @ 4 month intervals
Scheme of dairy processors

- Bulk milk ELISA @ 4 month intervals

Level 1
Continuously test negative

Level 2
2 consecutive positive bulk milk ELISA’s

Level 3
Persistently test-positive

• Participate in workshop at local vet practice

• Draw action plan with vet
• Eliminate active carriers from lactating herd
Test round (1 to 11)
OR = 0.91

Season: Sept - Dec
OR = 2.1

Soil type:
- Sand: reference
- Clay: OR = 1.8
- Sandy loam: OR = 1.4

Surface water area
- ≤ 2%: reference
- >2%: OR = 1.3

Dairy herds within 500 m:
- No herds: reference
- Test-negative herd(s): OR = 0.8
- Test-positive herd(s): OR = 2.0

Province (1 to 12)
Distance to pigs:
- >2 km: reference
- 0 km: OR = 1.9

Herd size
- Average: reference
- < 36: OR = 0.7
- 36-75: OR = 0.9
- 73-137: OR = 1.1
- >137: OR = 1.6

Increase of herd size (1 yr)
- Average: reference
- >12.5% increase: OR = 0.9

Net profit
- Average: reference
- 10% highest: OR = 0.5

Cattle introduced from other herds
- None: reference
- Test-negative herd(s): OR = 1.2
- Test-positive herd(s): OR = 1.4
Concept of control

- Preventive measures
  - reduce rate of introduction of infection
  - increase probability of extinction of infection
Clinical trial (2005-2008)

• 50 herds, > 1 year infected

• intervention: identification of salmonella carriers & advice to eliminate them

• aim: evaluate efficacy of intervention, adjusted for differences in herd management
Clinical trial

- Fitted time until ‘salmonella-unsuspected’

The graph shows the proportion of certified herds over time for both intervention and control groups. The solid line represents good herd management, while the dotted line indicates poor herd management. The time scale is in years, with the proportion of certified herds ranging from 0 to 1.
Clinical trial

- Probability of achieving ‘salmonella-unsuspected’ status within 1 year:

<table>
<thead>
<tr>
<th>Culling salmonella carriers:</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive herd management:</td>
<td>57%</td>
</tr>
<tr>
<td>Combined approach:</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>
Scheme of dairy processors

- Bulk milk ELISA @ 4 month intervals
Field study (2012-2014)

- 100 dairy herds, level 3 after test round 2012-2:

<table>
<thead>
<tr>
<th>Herds</th>
<th>2012-3</th>
<th>2012-3</th>
<th>Number of herds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>N</td>
<td>N</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>N</td>
<td>20</td>
</tr>
<tr>
<td>Case</td>
<td>P</td>
<td>P</td>
<td>50</td>
</tr>
</tbody>
</table>
Calving shed
Individual: reference
Group: OR = 14
None: NS

Calves 1st week water
Yes: reference
No: OR = 4.2

Concentrates 14 days ante partum
Yes: reference
No: OR = 4.0

Soil:
Sandy loam, low moor bog, clay >> sand

Harvesting silage between fertilisation with slurry and summer barn feeding
Yes or N/A: reference
No: OR = 6.1

Cats: OR = 7.2
Field study (2012-2014)

Further analyses confirm effects of

- Infection pressure
- Hygiëne and separation of groups
- Resistance to infection
- Soil type
Field study (2012-2014)

Action plans

- Important preventive measures frequently not identified
- Poor compliance
- Often only part of herd tested to identify active carriers
- Identified active carriers not always eliminated

Results

- 1/3 of Level 3 herds achieved Level 1 during 16 months study period
Post mortem (dairy herds)

Number of isolates

Year

- Not typed
- E
- D
- C
- B

Teaming up for animal health
Active carriers, 2008-2012 ($n = 286$)
Discussion

- Control in infected herds is feasible, provided the farmer is prepared to take vigorous action

- Progress on national level less than anticipated
Discussion

Challenges for the future:

• Influence contact structure between herds
• Stimulate farmers to take action, right now
• Study dynamics of various serotypes and adapt, if needed, control measures
Conclusion

Salmonellosis in dairy cattle: endemic, yet dynamic