Brucellosis: - Policy and Eradication Issues in Northern Ireland

Owen Denny
Senior Principal Veterinary Officer
So where is Northern Ireland?
A Clarification!

British Isles = everything on map

United Kingdom = England, Scotland, Wales and Northern Ireland.

Great Britain = England, Scotland and Wales.

Island of Ireland = Northern Ireland and Rep. Of Ireland.
We don’t have any of these!
Here is our Apex Predator

(Badger cub)
And we certainly don’t have any of these!
Legend has it that Saint Patrick removed the snakes from Ireland in the 5th century.

You might want to invite him to South Africa!
Northern Ireland

- Northern Ireland is principally a country of grass-based cattle farming.

- Forest cover is low (6.2% compared to European average of 36.9%)

- 75% of land usage is for agriculture.

- Beef and milk production are important agricultural constituents, comprising 51% of the agricultural output in 2005,

- Bovine brucellosis and bovine tuberculosis are the 2 most important diseases of cattle that we are eradicating.
The Brucellosis Eradication Scheme in Northern Ireland
History of brucellosis in NI

- 1930s - 60% of all herds affected.
- 1940s - vaccination of calves with Strain 19 vaccine
  - January 1949 - Notifiable disease in Northern Ireland.
- 1950 - pilot eradication scheme on farms selling raw milk.
- 1960s - voluntary scheme. 5-20% of herds infected
- 1963 compulsory eradication. Herd incidence was estimated at between 16% and 20% in dairy herds
- 1970s - scheme tightened-up. Herds depopulated. Herd incidence less than 3% by 1969 and to 0.6% by 1975
- 1988 - 2 yearly testing - <0.2% for 4 years.
- 1999-2012 Intensive eradication programme
- Feb 2012 – last confirmed case of brucellosis in Northern Ireland.
New Brucellosis Reactor Herds: Jan 1995 to Feb 2015
Brucellosis – Culture Confirmed 12-month Herd Incidence

BR annual herd incidence where infection confirmed by culture: December 2005 to February 2015
This is what we do in the Brucellosis Programme; -

• Test and slaughter programme. (Vaccination not permitted)
• Annual testing of eligible cattle
• Multiple blood tests used (mainly SAT, iElisa and CFT)
• All serological reactors are compulsorily slaughtered with compensation.
• Almost all herds with confirmed disease are depopulated
• Inner and outer ring testing around breakdowns (plus movement restrictions)
• Pre-movement testing
• Forward and Backward testing
• Monthly bulk milk testing
• Abattoir surveillance of adult females
• Reporting of Abortions compulsory in legislation
• Reactor cattle calves are slaughtered.
Issues and Lessons Learned in Northern Ireland

• Complete brucellosis eradication takes a long time
Complete brucellosis eradication takes a long time

Compulsory Eradication of Brucellosis Began in 1963

So it took us 49 years to eradicate!
Issues and Lessons Learned in Northern Ireland

• Complete brucellosis eradication takes a long time.

• Eradication is expensive
Eradication is expensive

Brucellosis Programme Costs

Admin. & VS Staff Costs
Compensation
VSD Lab Costs
Annual Total

Millions

= Approx 280M R
Issues and Lessons Learned in Northern Ireland

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• There are features in N. Ireland that hinder eradication
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- High cattle and herd density.
- High levels of cattle movement
- Multiple neighbours – 12-15 typical
- Farm fragmentation is extensive.
- Approximately 60% of herds use multiple premises. Therefore herds have multiple neighbours.
- A large proportion of herds utilise outdoor calving systems.
- Movement of livestock between fragments facilitates disease transmission. Infection at multiple premises in 17% of outbreaks.
- So - a potentially high rate of exposure to a disease that may remain undiagnosed for months or years.
Abortions
Abortions

- Abortions are notifiable in NI
- BR Control Order (NI) 2004: “Any bovine foetus or calf born dead or which dies within 24 hours of birth”
- Veterinary Surgeon and Farmer are required to report abortions
- 2010: >2,600 cattle blood sampled following reports.
- House animal in isolation, spray the area
- Efforts made to increase reporting
Abortions

• Substantial under-reporting of abortions occurs in the province.

• Studies elsewhere have reported abortion rates, from all causes, of 6.2% in Great Britain (Leech, 1962), 5% in New Zealand and 5.9% in Israeli dairy cows (Markusfeld, 1997).

• Even an abortion rate of 3% in Northern Ireland would mean a reporting rate of less than 10%, with significantly lower levels during periods of reduced brucellosis incidence.
Issues and Lessons Learned in Northern Ireland

• Complete brucellosis eradication takes a long time.
• Eradication is expensive.
• There are features in N. Ireland that hinder eradication
• Local spread is very important in the epidemiology of brucellosis
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Approx:-

50% at contiguous herd testing
15% at routine testing
15% post abortion
5% Bulk Milk
<1% Pre-movement
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- Brucellosis can spread very rapidly in a susceptible population
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We have a good example where one primary outbreak spread to at least 38 other herds.

Some of the herds only revealed infection after several herd tests.
New BR Reactor Herds: January 1995 to November 2011

IT happened here!
Issues and Lessons Learned in Northern Ireland

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• **Good biosecurity is an essential part of the eradication scheme**
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Breakdowns have been caused by:

- Straying or mixing of cattle with neighbouring herds.
- Using common grazing in a brucellosis risk area.
- Allowing casual visitors on to the farm without cleansing and disinfection.
- Using a shared bull.
- Taking land for grazing in a brucellosis risk area.
- Sharing equipment and feed e.g. crushes, fertility equipment, and silage.
- Spreading slurry from other farms on land.
Good biosecurity is an essential part of the eradication scheme.

• Also
  – Animal identification
  – Traceability
  – IT support
  – Legal powers

Biosecurity and these other aspects are important throughout a control programme. And they become even more important as eradication is in sight. The foundations should be laid at the start of the programme.
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- Compensation levels should be appropriate.
Valuation and compensation

• We value cattle on farm before slaughter
• Reactors paid to limit of 75% of average market value
• Contact cattle – 100% value with no limit.
• Salvage value goes to Competent Authority
• Hard to eradicate a disease if it is financially attractive to have it!
Survey to Estimate Fraudulent Infection of Herds

• Confidential questionnaire. Guaranteed anonymity.

• A sample size of 405 seropositive herds: 1 Jan 1999 - 31 Aug 2005.

• Suspicion of fraud existed in almost 13% of outbreaks during the period. A further 9% were thought to have occurred indirectly as the result of fraud in another contact herd.

In 2010

Foetus used in Armagh cattle herd infection bid

An apparent attempt to infect a cattle herd with brucellosis has been described as appalling by Agriculture Minister Michelle Gildernew.

A foetus infected with the disease was found dumped in a field at Lislea, County Armagh.

It was found near feeding buckets where cows, calves and a bull were grazing, but did not come from the herd.

The foetus had been opened from its neck to its belly, with meal placed over it and inside it.

Mrs Gildernew said DNA tests would be used to help track down those responsible.

"DNA samples taken from the foetus and the bacterium itself will be analysed, so that future genetic identification of the source of the infected foetus and the strain of the bacteria is possible.

"As I previously reported, my veterinary officers now have new processes that allow them to explore in detail the disease links between herds, going back over the past number of years," the minister said.
What caused the stories in the news?

“he miraculously found the foetus lying behind bushes on a rented farm, half a mile away from home. The foetus was split open, filled with meal and placed in a position not meant to be found.

I cannot understand how people can stoop so low to infect another man’s herd with brucellosis. It’s obviously potentially financially motivated for them …” (Farm Week, Jan 22, 2010.)
“Value for Money”

• Typically 85-95% of confirmed herds are depopulated each year.

• Remind the Industry that there is not an automatic depopulation policy.

• “Value for Money” is simply a convenient publicity and communication label, not a new policy.

• A positive side effect of this approach is that it discourages fraud and deliberate infection.

• Compensation changed in 2012 – 11 years after it was first identified as an issue
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• No diagnostic tool correctly identifies all infected or non-infected animals;
Value in Multiple tests

Analysis (2007): All test data – 300k samples, 4300 herds

150 culture-positive cattle
82 culture-positive herds
(first disclosure test)

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• **Effective co-ordination of HQ and Field is important**
Queries in relation to individual breakdowns should go to Judith Graham in the first instance.
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- Effective co-ordination of HQ and Field is important.

- The Programme must be managed strategically and reviewed regularly.
Strategic Response to increased disease - Historic

Brucellosis: new reactor herds.
Jan 1997 - June 2005

<table>
<thead>
<tr>
<th>A</th>
<th>Bulk Milk Elisa testing</th>
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<tbody>
<tr>
<td>B</td>
<td>Br Publicity Campaign</td>
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<td>C</td>
<td>Staff training and PVP meetings</td>
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<tr>
<td>D</td>
<td>OTMS Abattoir testing</td>
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<tr>
<td>E</td>
<td>Annual testing in 3 high risk DVOs</td>
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<td>F</td>
<td>Clls for Br breakdowns</td>
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<td>G</td>
<td>Reactor progeny purchase</td>
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<tr>
<td>H</td>
<td>BT50 segregation notice</td>
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<tr>
<td>I</td>
<td>Enhanced restrictions on contiguous herds</td>
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<td>J</td>
<td>6 month destocking after breakdown</td>
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<tr>
<td>K</td>
<td>HQ resource expanded to 3 DVOs</td>
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<tr>
<td>L</td>
<td>Updated staff instructions</td>
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<tr>
<td>M</td>
<td>BCI</td>
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<tr>
<td>N</td>
<td>Br database</td>
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<tr>
<td>O</td>
<td>Annual testing in all DVOs (Br Review)</td>
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<tr>
<td>P</td>
<td>Removal of low CFT animals</td>
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<tr>
<td>Q</td>
<td>Modifications to valuation procedure (Br Review)</td>
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<tr>
<td>R</td>
<td>Premovement testing (Br Review)</td>
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<tr>
<td>S</td>
<td>Slurry treatment with lime (Br Review)</td>
</tr>
</tbody>
</table>

Historic
Holistic Approach:

Factors affecting the level of Brucellosis

1. Improved Disease Detection.
   - A. More frequent testing
   - B. Reduction in overdue testing
   - C. More severe test interpretation
   - D. Use of alternative serological tests
   - E. Abattoir surveillance
   - F. Reduction in testing errors
   - G. Bulk Milk Elisa

2. Resource Issues
   - A. Sufficient Vet. Officers
   - B. Sufficient AWHIs
   - C. Programme Management Team Resource

3. At risk testing and tracing
   - A. Complete risk testing
   - B. Rapid testing
   - C. Removal of high risk traces

4. Financial considerations
   - A. Over-Compensation reduced
   - B. Accurate and efficient valuation procedures

5. Cattle demographics
   - A. Decrease in cattle population
   - B. Reduction in cattle movements
   - C. Reduction in average age
   - D. Decrease in herd size
   - E. Reduced farm fragmentation

6. Farm Management
   - A. Improvement in biosecurity, including: Boundary Fencing Visitors Cleaning and disinfection
   - B. Improved detection & reporting of abortions

7. Training/Education
   - Improved knowledge base for:
     - A. VOs
     - B. AWHIs
     - C. PVPs
     - D. HKs
     - E. Reduction in apathy

8. Brucellosis Scheme Management
   - A. Improved isolation of reactors and inconclusives
   - B. More rapid removal of reactors to slaughter
   - C. Improved staff instructions/guidance
   - D. Improved checking/Audit of delivery
   - E. Focus on high incidence offices,
     - F. Cattle segregation (BT50)

9. Compliance/Fraud issues
   - A. Enhanced Enforcement
   - B. Reduction in Fraud (Val + SI tests)
   - Photographs
   - C. Disease Clls

10. Computer support for the Scheme
    - A. Enhancement of APHIS
    - B. Effective Br Database
New Brucellosis Programme Initiatives – Oct 2008

- 72 Initiatives based on the 10 categories below

1. Improved Disease Detection
2. Resource Issues
3. At risk testing and tracing
4. Financial considerations
5. Cattle demographics
6. Farm Management
7. Training\Education
8. Brucellosis Scheme Management
9. Compliance\Fraud issues
10. Computer support for the Scheme
Rank Order of Impediments to Brucellosis Eradication

Most Important

1. Failure to report abortions
2. Movement of cattle
3. 100% Compensation
4. Fragmentation of holdings
5. Farmer attitude and knowledge
6. Poor biosecurity - other
7. Cattle mixing with other herds
8. Misleading/inaccurate info from hos
9. Calving practices
10. Limitations of the tests
11. Failure to depopulate herds & traces
12. Failure to test on time (h/o)
13. Inadequate resource
14. Restocking of herds too soon
15. Fencing inadequate to prevent straying
16. Personnel contacts
17. Progeny of reactors incorrectly identified
18. Inadequate C&D after an outbreak
19. Sharing of bulls
20. Use of contractors
21. Perceived VS failings
22. Inadequate testing facilities

Least Important
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- No diagnostic tool correctly identifies all infected or non-infected animals;
- Effective co-ordination of HQ and Field is important
- The Programme must be managed strategically and be regularly reviewed

- Quality control and performance checks are essential to ensure important actions are not missed.
In a nutshell – what gets checked, gets done!
Computer System

Animal and Public Health Information System (APHIS) animal identification, movement and test management database:

- Approx 8,000 users (herd owners, meat plants, Private Veterinary Practitioners (PVPs), auctioneers, dairies, laboratory and VS staff)
- Records all, herds, individual animal identification, all movements
- Records full details of all TB and brucellosis tests, from 1988
- Also holds outfarm information, contiguous herds and PVP details

Invaluable for brucellosis eradication
Quality Control in the Brucellosis Programme

1. **Key Performance Indicators**
   - Monthly summary charts

2. **Brucellosis Surveillance, Risk Activities and Breakdowns**
   - Local and HQ scrutiny

3. **HQ Breakdown checklist**
   - Comprehensive checklist in discussion with breakdown VO. Currently covered by Judith Graham

4. **Buddy Veterinary Officer Visit**
   - Elaine Dickson - supportive checking and discussion with breakdown VO

5. **Epidemiological Scrutiny**
   - All confirmed breakdowns scrutinised by Darrell. Area investigations for clusters

6. **Brucellosis Manager’s Toolkit**
   - Comprehensive set of reports to allow checking of all aspects of Programme delivery. Local management and periodic remote audit by David Brown.

7. **Work Programme Evaluation and Feedback**
   - Meeting with SAHWIs 3 times per year to assess delivery quantity and quality - Sharon Verner

8. **Breakdown Scrutiny by BPMT**
   - All confirmed breakdowns are monitored and discussed at fortnightly meetings

9. **Laboratory Checks**
   - Additional testing at valuation and slaughter. DNA matching, including pedigree.

10. **Local supervision by DVO**
    - DVO quality assures local breakdown management

11. **DVO Audits**
    - Visit by 2 BPMT members and 50+ items assessed.

12. **APHIS Performance and Enhancements**
    - Sharon Verner and Barbara Geddis

13. **Operations Management Unit**
    - Monthly summary of delivery of Programme against plans
Some additional checks

• Positives are re-sampled at valuation and slaughter. Titres are compared.

• Pregnancy status of all reactors checked at slaughter

• Recently - DNA pedigree checks for all confirmed herds

• Females with no calves in last 2 years are highlighted in risk and routine herds
Brucellosis Manager’s toolkit

- Identify key stages in test ‘cycle’
- Set targets for each stage
- Measure performance against targets using detailed reports
Management of Brucellosis - range of detailed reports available under the following categories:-

- Are tests allocated correctly?
- Are herdkeepers notified of due risk tests?
- Are tests arranged on time?
- Are restrictions applied for overdue tests correctly?
- Are enforcement procedures in place for o/d tests?
- Are samples processed within target time?
- Are tests being checked in lab on time?
- Are queries at VSD getting sorted out on time?
- Are VOs interpreting/following up tests on time?
- Correct interpretation.
- Are restrictions applied correctly
- Are admin staff progressing tests?
- Are valuations being completed on time?
- Are valuations processed by admin within target time?
- Are valued reactors/NICs slaughtered within target times?
- Br breakdown follow up tasks:
<table>
<thead>
<tr>
<th>Measure</th>
<th>All DVOs</th>
<th>01</th>
<th>02</th>
<th>03</th>
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<tbody>
<tr>
<td><strong>Testing</strong> % of RHTs sampled last month within 30 days of due date</td>
<td>G8</td>
<td>A1i</td>
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<td>A1i</td>
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<td>R1</td>
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<td>G3</td>
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<td>G4</td>
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<td>G3</td>
<td>G9</td>
<td>G9</td>
<td>G9</td>
<td>G+</td>
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<td><strong>Testing</strong> % of individual animal level tests sampled last month within 30 days of due date</td>
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<td>G1</td>
<td>G3</td>
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<tr>
<td><strong>Testing</strong> % of CTC tests sampled last month within 30 days of due date</td>
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<td>A1h</td>
<td>G4</td>
<td>R1</td>
<td>A1i</td>
<td>G+</td>
<td>G1</td>
<td>G6</td>
<td>R1</td>
<td>G1</td>
<td>R3</td>
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<td><strong>Test Cycle Progress</strong> % of tests with test date last month confirmed within 3 working days of test date</td>
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<td><strong>Test Cycle Progress</strong> % of Br tests with positive results interpreted within 1 working day of result submission</td>
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- Compensation levels should be appropriate.
- No diagnostic tool correctly identifies all infected or non-infected animals;
- Effective co-ordination of HQ and Field is important.
- Quality control and performance checks are essential to minimise mistakes.

- Publicity and communications are important.
Publicity & Communications

• Press articles
• Stakeholder meetings
• Radio interviews
• Press advertising
• Press releases
• Practical items with brucellosis messages
  – Magnetic calendars, pens, ice scrapers, fridge magnets, coasters, etc.
• Van – “Report all Abortions”
Regular Communications
Working Together to Beat Brucellosis

- Farmers
- The Minister
- Private Vets
- Veterinary Sciences Division AFBI
- Field Offices
- VPHU
Veterinary and political commitment

Keady Market
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• Effective co-ordination of HQ and Field is important
• Quality control and performance checks are essential to minimise mistakes.
• The Programme should constantly adapt and improve.
• Publicity and communications are important.

• Sometimes extreme measures may be necessary
Disease Clusters in 2010

Keady Cluster

Lislea Cluster
Northern Ireland: Herd Density

Kernel Smoothing: Bandwidth = 10 km

Density (Herds per square km):
- 0 - 1.3
- 1.3 - 2.7
- 2.7 - 4
- 4 - 5.3
- 5.3 - 6.6
New BR Reactor Herds: January 1995 to November 2011

- Month - Year
- No. of Reactor Herds
- 12 month moving average

Armagh
Additional Area Measures

• Increased frequency of lateral risk testing from 3-4 months to 2.

• Increase in the number of risk tests required before derestricntion of inner and outer ring herds (inner ring – 3 tests; outer ring – 2 tests)

• Inner and outer ring herds (approx 70 herds) all movements by licence.

• Forward Tracing of cattle from Inner Ring Herds

• Targeted Abattoir Sampling – flag to meat inspector (40 herds)

• Bulk milk testing every 2 weeks

• Testing dropped to 6 months in risk herds, and zero risk policy with tests.
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• Last lesson – who caused the brucellosis problem?
Possible brucellosis in a 2.4 to 2.8 million year old hominid 
(Australopithecus africanus,) from Sterkfontein, South Africa

The macroscopic, microscopic and radiological appearance of the lytic lesions of the lumbar vertebrae is consistent with brucellosis.

10 Divisional Veterinary Office Areas
Animal traceability - live

• **Births** registered from herdkeeper notification (MC1 form, phone, electronic)
  • Colour, breed, sex, DOB, Dam identity, (sire identity)

• All **moves** recorded from herdkeeper notifications and from Market/Abattoir input
  • Holding numbers & dates of movement

• **Deaths** recorded from herdkeeper notifications and Abattoir/Rendering plant input
  • Date of death & means of disposal
Bovine Herds - information

- Herd keeper details – name, address, map reference
- List of animals
- Testing review and preview
- Movements to & from herd
- Tags issued and not yet used
- Movement notification documents issued and not yet used
- Associated herds (epidemiological links)
- Out farms
- Contiguous herds