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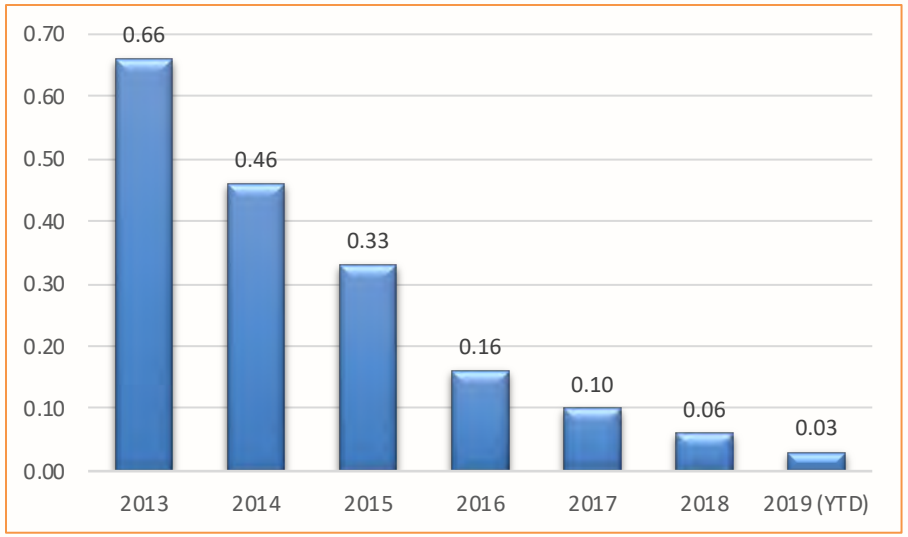
Factors affecting the spread of BVDV in Ireland

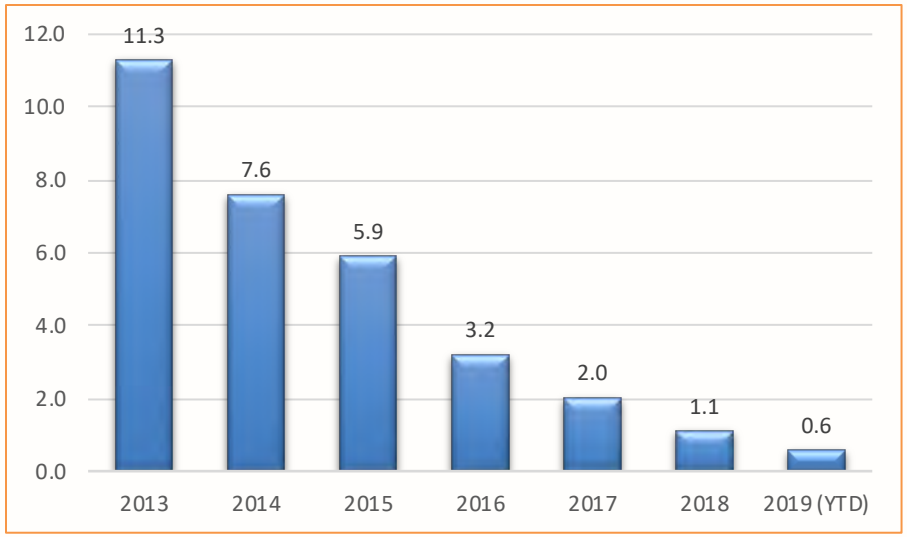
David Graham

BVDZero

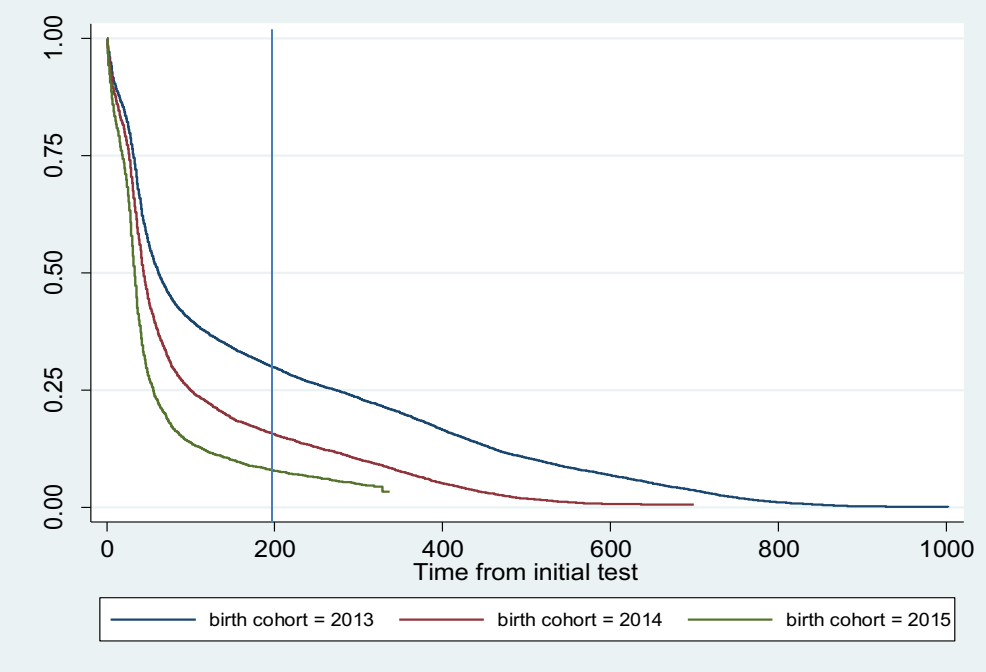
Cowbridge| 3rd July 2019

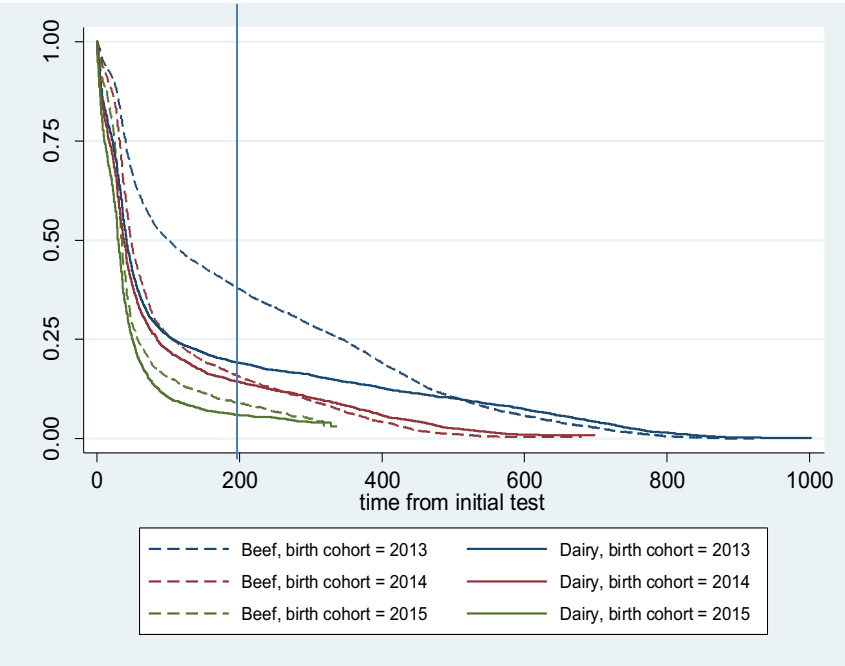
Progress-animal/herd level (%)





KEY CHALLENGE: RETENTION





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ELSEVIER

Temporal trends in the retention of BVD+ calves and associated animal and herd-level risk factors during the compulsory eradication programme in Ireland

T.A. Clegg[a,*], D.A. Graham[b], P. O'Sullivan[c], G. McGrath[a], S.J. More[a]

Impact of retention-within herd

Month of removal

Risk factor	Category	P[a]	P[b]	OR	95% CI Lower	Upper
Log herd size		<0.001	<0.001	1.95	1.71	2.23
Date (quarter/year) last BVD+ calf left the herd[c]	No known BVD+ in 2012	Referent	<0.001			
	January–March 2012	0.038		1.52	1.01	2.22
	April–June 2012	<0.001		1.88	1.37	2.56
	July–September 2012	<0.001		4.46	2.41	8.13
	October–December 2012	<0.001		4.61	2.95	7.10

ELSEVIER

Preventive Veterinary Medicine

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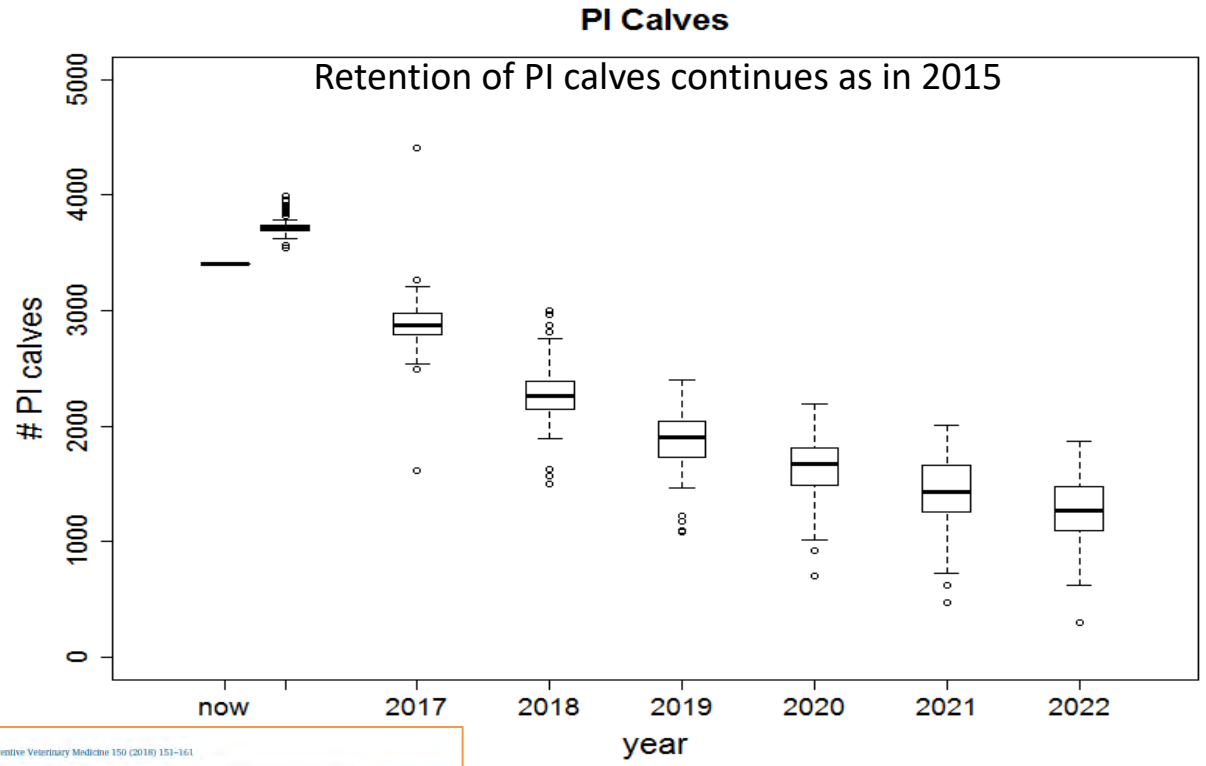
Influence of the retention of PI calves identified in 2012 during the voluntary phase of the Irish national bovine viral diarrhoea virus (BVDV) eradication programme on herd-level outcomes in 2013

D.A. Graham[a,*], T.A. Clegg[b], P. O'Sullivan[c], S.J. More[b]

IBM: IRISH BVD MODEL



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ELSEVIER

Eradicating BVD, reviewing Irish programme data and model predictions to support prospective decision making

H.-H. Thulke[a,*], M. Lange[a], J.A. Tratalos[b], T.A. Clegg[b], G. McGrath[b], L. O'Grady[b], P. O'Sullivan[c], M.L. Doherty[b], D.A. Graham[d], S.J. More[b]

ATIONAL BVD ERADICATION PROGRAMME

BVDFree
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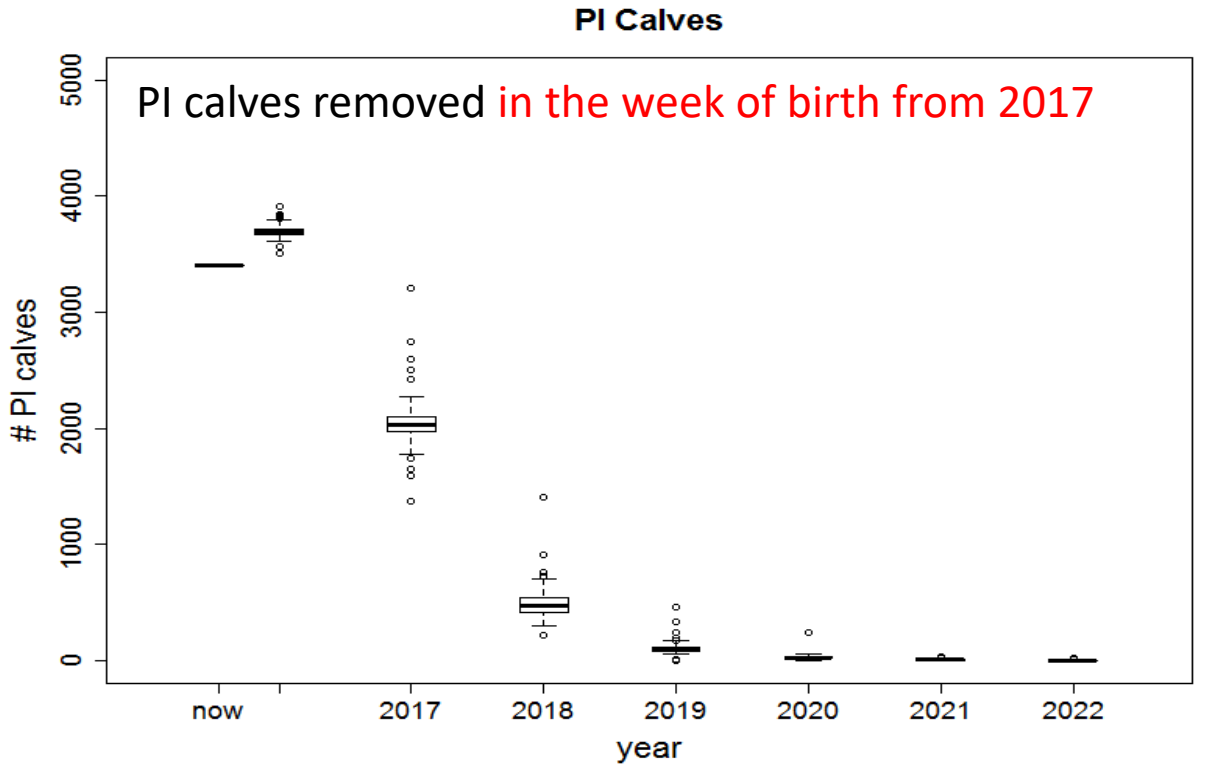
IBM: IRISH BVD MODEL

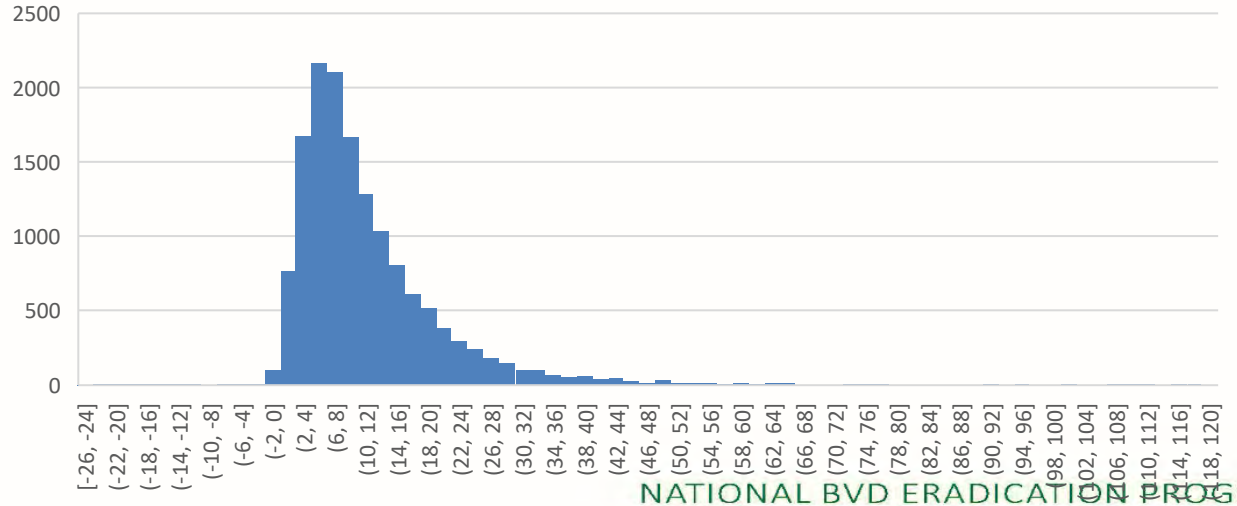


Prompt testing of all calves to identify minority of PIs
Prompt removal of identified PIs

Time (days) from birth to test

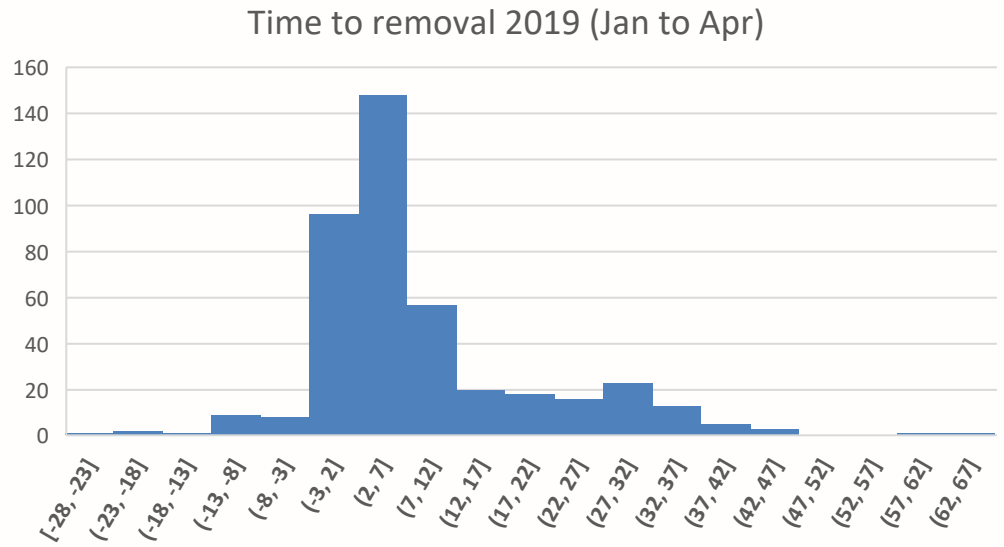
Comparing data from January until 30th April 2018 and 2019.

- **2018**: - Average days **16.8** (minimum -4, maximum 105)
- **2019**: - Average days **11.7** (minimum -26, maximum 119)



Time (days) from +test to removal

Comparing data for animals which had an initial test and were removed between 1st January and 30th April of 2018 and 2019.



	2018	2019
Median	12	6

Neighbour risk

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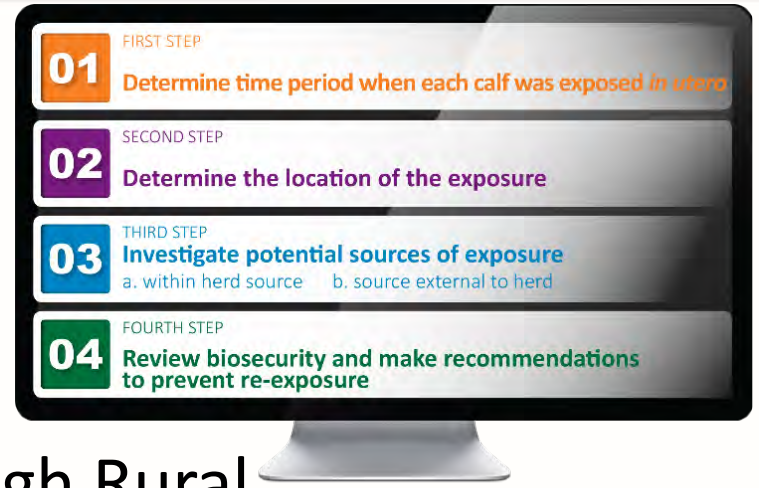
Quantifying the risk of spread of bovine viral diarrhoea virus (BVDV) between contiguous herds in Ireland

Graham D.A.[a,*], Clegg T.A.[b], Thulke H.-H.[c], O'Sullivan P.[d], McGrath G.[b], More S.J.[b]

- Aim: to estimate the risk of a herd having BVD-positive calves in January to June 2014 when **contiguous** to a herd that had at least one BVD positive calf born in 2013.
- Outcome:
  - Positive contiguous neighbour increased risk ~two-fold
  - (herd size, purchase, location, animals of unknown status)
  - **PATHWAY?**
  - Neighbour notification

HERD INVESTIGATIONS (TASAH)



- Trained vets
- Funded through Rural Development Plan
- Goals:
  - Identify plausible source(s)
  - Ensure herd is left BVD-free
  - Biosecurity recommendations

2018- plausible sources identified

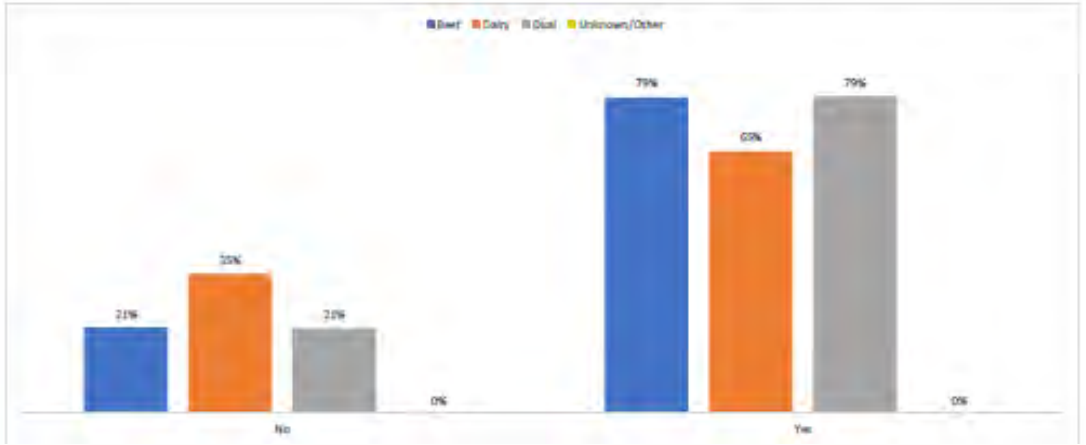
REVIEW BIOSECURITY, IDENTIFY SOURCE AND MAKE RECOMMENDATIONS TO PREVENT RE-EXPOSURE

Section 10
Result of herd investigation

Q55. Based on the herd investigation and biosecurity review, have you identified a plausible source or sources of BVDV virus responsible for the PIs in this herd?

Response	Beef	Dairy	Dual	Unknown/Other	Grand Total
No	80	109	15	0	204
Yes	294	204	56	0	554
Total	374	313	71	0	[illegible]

Response	Beef	Dairy	Dual	Unknown/Other	Grand Total
No	21%	35%	21%	0%	27%
Yes	79%	65%	79%	0%	73%
Total	100%	100%	100%	0%	100%



Potential sources per herd

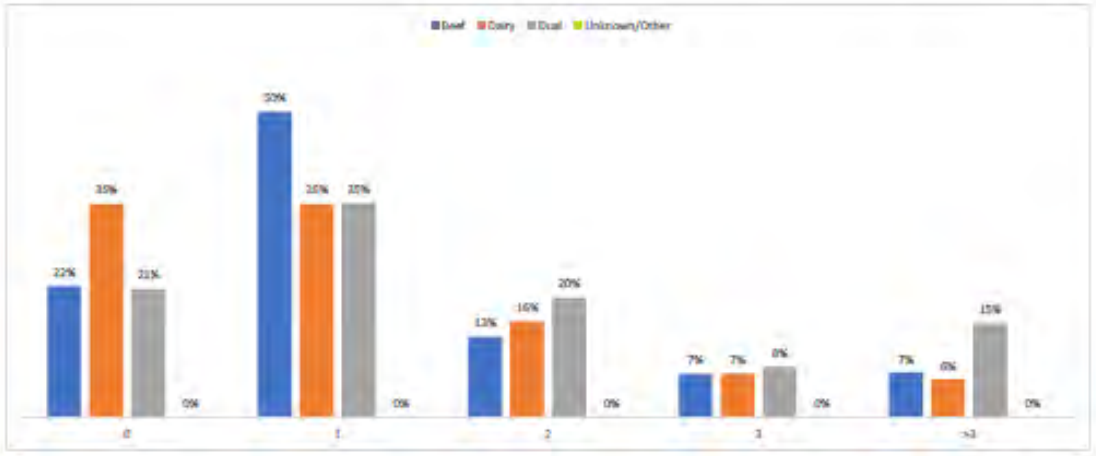
Section 10

Result of herd investigation

Number of sources identified per herd, by herd type

Response	Beef	Dairy	Dual	Unknown/Other	Grand Total
0	81	110	15	0	206
1	188	110	25	0	323
2	50	50	14	0	114
3	27	23	6	0	56
>3	28	20	11	0	59
Total	374	313	71	0	758

Response	Beef	Dairy	Dual	Unknown/Other	Grand Total
0	22%	35%	21%	0%	27%
1	50%	35%	35%	0%	43%
2	13%	16%	20%	0%	15%
3	7%	7%	8%	0%	7%
>3	7%	6%	15%	0%	8%
Total	100%	100%	100%	0%	100%



Frequency of sources of exposure

Q56. Summary of Sources Identified

Source Identified - Within Herd	Beef	Dairy	Dual	Unknown/Other	Total
Previously identified PI: known PI retained in herd	52	28	6	0	86
Unidentified PI: Animal whose status was not previously known that was found to be PI during the investigation	7	8	0	0	15
Unidentified PI: Animal present during WOS whose status was unknown and which left the herd without being tested	6	9	3	0	18
Introduced TI animal	81	60	21	0	162
Trojan birth	70	18	13	0	101
False negative: animal with a NEGATIVE status that was found to be PI during investigation	12	4	1	0	17
Other species - Sheep	12	2	6	0	20
Other species - Goats	1	0	3	0	4
Other species - Alpaca	1	0	0	0	1
Other species - Llama	0	0	0	0	0
Other species - Deer	4	3	0	0	7
Total	246	132	53	0	431

Source Identified - Outside Herd	Beef	Dairy	Dual	Unknown/Other	Total
Direct contact - Boundary contact	95	92	19	0	206
Direct contact - Shared grazing	4	2	0	0	6
Direct contact - Returning cattle (TI)	20	18	4	0	42
Indirect contact - Herdowner	57	43	22	0	122
Indirect contact - Other personnel	42	58	11	0	111
Indirect contact - Small equipment	17	5	1	0	23
Indirect contact - Large equipment	23	16	11	0	50
Indirect contact - Shared facilities	8	6	2	0	16
Total	266	240	70	0	576

Grand Total	512	372	123	0	1007

NHS Risk factor study

- ~72,000 herds with NHS at end of 2017
- 546 herds lost NHS during 2017, due to the birth of one or more PI calves.

- Given prior NHS
    - Introduction of infection from outside herd
    - Unidentified source of infection within the herd / establishment

- **Case herds** – NHS on Jan 1st 2017, but lost that status in 2017, due to the disclosure of a BVD virus positive animal.

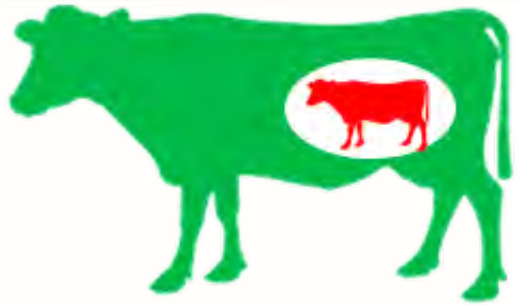
- **Control herds**- had NHS on Jan 1st 2017, and retained that status in 2017. A total of 2192 control herds were randomly selected (a ratio of 4 controls to cases).
- (Dr. Damien Barrett, DAFM)

Outcomes:

- **Previous history of BVD***
  - Most significant in the year preceding the awarding of NHS (OR 23)
    - Residual infection within herd or management practices?
- **Mortality levels***
  - Increased calf mortality in 2017 (OR 3)
- **Herd size***
  - Odds of NHS loss in herds > 131 almost 4 times that of a herd < 20 cattle
- **Herd expansion***
  - Herds that increased by ≥9 cows between 2013 and 2017 – OR 1.75 times that of herd where there was no increase in numbers
- **Purchase***
  - Purchase of pregnant female increased odds by 2.2 for each animal purchased
  - BUT overall purchase did not emerge as a significant issue
- **PI Density***
  - Increased density of PIs within 10 km of the herd in the previous year
- **Co-grazing with sheep** (NS)

Trojan dams

- 29,422 BVD+ birth events 2013-2015
- % trojan:
  - 0verall- **8.6%**; 2013- **7.1%;** 2014- **9.2%;** 2015- **10.6%**
  - Herds (one or more trojan births)
  - 2013- **9.9%;** 2014- **11.8%;** 2015- **13.3%**



- Risk factors for trojan birth:
- Herd type: Dairy < beef (7.0% to 9.5%)
- herd size
- Dam parity
  - 1- 14.7%
  - 2 - 5.5%
  - 3 - 4.8%
  - 4+- 4.0
- Risk factor for selling trojan dam
  - Selling two or more pregnant females
  - >2 BVD+ animals in the herd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Quantifying the role of Trojan dams in the between-herd spread of bovine viral diarrhoea virus (BVDv) in Ireland

Fiona Reardon[a,*], David A. Graham[b], Tracy A. Clegg[a], Jamie A. Tratalos[a], Padraig O'Sullivan[c], Simon J. More[a]

Trojan dams- impact of control measures

- **Effectiveness** of movement restrictions for varying periods following the removal of PI animals from infected herds in preventing Trojan births in other herds.

• Control measure 1 (CM_1): Herds are restricted and **eligible animals (female >12 months)** are unable to move while any BVD+ animal is in the herd.
• CM_2: 4 months (120 days)
• CM_3: 9 months (270 days)
• CM_4: 12 months (365 days)

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Potential infection-control benefit of measures to mitigate the risk posed by Trojan dams in the Irish BVD eradication programme

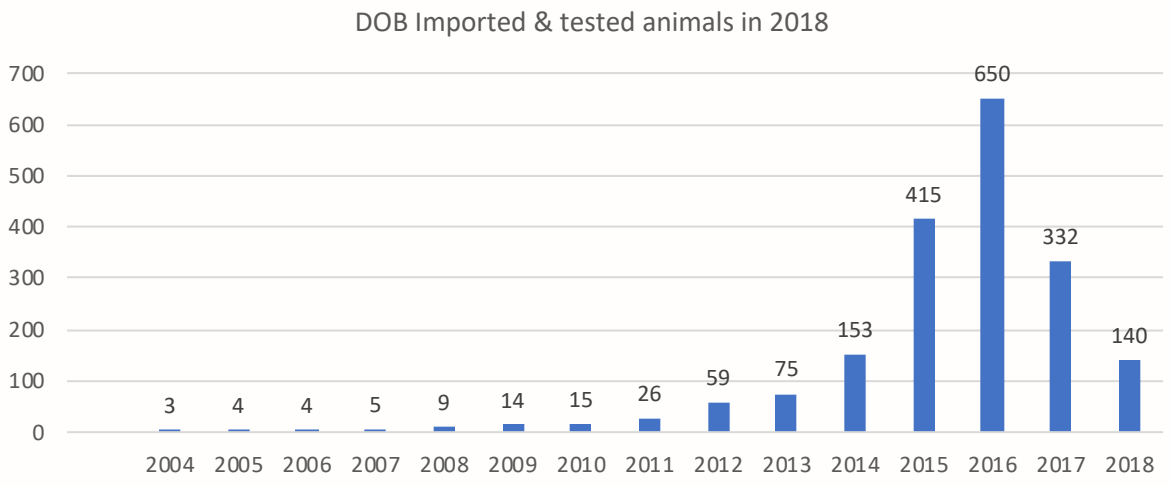
Fiona Reardon[a,*], David Graham[b], Tracy A. Clegg[a], Jamie Tratalos[a], Padraig O'Sullivan[c], Simon J. More[a]

Effectiveness

Control measures[a]	Herd type[b]			All herds
	Dairy	Beef	Dual	
Number of movements of Trojan dams that would have been prevented				
CM_1	78	66	6	147
Number (and %) of Trojan dams (n = 747) that would have been prevented from moving from the first source herd containing one or more BVD + animals during pregnancy[c]				
CM_1	65 (23.9)	66 (17.4)	6 (6.3)	137 (18.3)
CM_2	96 (35.3)	104 (27.4)	25 (26.3)	225 (30.1)
CM_3	111 (40.8)	135 (35.5)	27 (28.4)	273 (36.5)
CM_4	114 (41.9)	135 (35.5)	27 (28.4)	279 (37.3)
number (%) that calved within 9 months of movement				
CM_1	2,282 (13.2)	1060 (11.9)	666 (17.2)	3979 (13.3)
CM_2	4,665 (14.7)	2394 (12.2)	1215 (16.8)	8206 (14.1)
CM_3	7,049 (16.3)	4318 (13.2)	2024 (18.2)	13,240 (15.4)
CM_4	8,274 (16.0)	5384 (13.0)	2331 (18.2)	15,763 (15.1)
Number (%) of herds with at least one Trojan birth in 2015 (n = 535) where all Trojan births would have been prevented[d]				
CM_1	23 (16.7)	51 (15.5)	3 (4.5)	77 (14.4)
Number (%) of herds with at least one BVD + birth in 2015 (n = 4251) where all BVD + births would have been prevented[e,f]				
CM_1	15 (1.0)	46 (2.0)	2 (0.5)	63 (1.5)
CM_2	29 (1.9)	67 (2.9)	11 (3.0)	107 (2.5)
CM_3	35 (2.3)	91 (3.9)	13 (3.5)	139 (3.3)
CM_4	36 (2.3)	91 (3.9)	14 (3.8)	141 (3.3)

Imports (2018)

Country	Total	Positive
AT	7	0
BE	5	0
DE	106	0
DK	475	0
FR	103	0
IT	23	0
NL	146	1
RO	8	0
UK9 (NI)	447	1
UK5 (Scot)	108	0
UK non 9/5	474	1
	1904	3 (0.16%)



Conclusions

- Prompt identification and removal of PIs critical to maximizing progress
  - Facilitate within and between herd spread
  - Range of measures have contributed to ongoing improvements in both
- Prohibition on movement of un-tested, suspect and positive animals addresses previous greatest risk (biosecurity)
- Previously less important pathways become proportionately more important
- Attention to these other direct and indirect pathways critical
- Benefits beyond BVD

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