Animal & Plant Health Agency

Asiantaeth Iechyd Anifeiliaid a Phlanhigion

Differences between bovine TB indicators in the IAA and the Comparison Area: First five years, 1st May 2010 to 30th April 2015

A report commissioned by the Welsh Government under Project OG0142

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Background

The Intensive Action Area (IAA) is an area located in north-eastern Pembrokeshire, covering 288 km² (Figure A). This area experienced some of the highest incidence rates of bTB in Wales between 2005 and 2010. Consequently, it was chosen as the location for a targeted programme of intensified cattle controls, heightened biosecurity measures and enhanced bTB testing regimes (see Appendix 3 for more information). Implementation of these measures began in May 2010 and a badger vaccination programme was introduced in May 2012. This report shows how trends in indicators of bTB within the IAA compare to other areas in Wales in the 5 years prior to the IAA being established and the subsequent 5 years. Specifically, we provide measures of bTB in the IAA, in a Comparison Area (CA) between 16 and 40 km from the edge of the IAA, and in Wales further than 40 km from the IAA. On 1st May 2010, when cattle controls began in the Intensive Action Area (IAA), the numbers of herds in the IAA and Comparison Area (CA) were 317 and 1410 respectively[1]. Measures of bTB are also assessed for a 2 km buffer around the IAA; these measures are not presented in the main body of the report but can be viewed for the figures within this report in Appendix Table A2 and for the tables in Appendix Tables A3a and A3b. The buffer is monitored because it was anticipated that herds within 2 km of the IAA may be secondarily affected by the control measures within the IAA, due to their close proximity and therefore likely contact with herds located there.

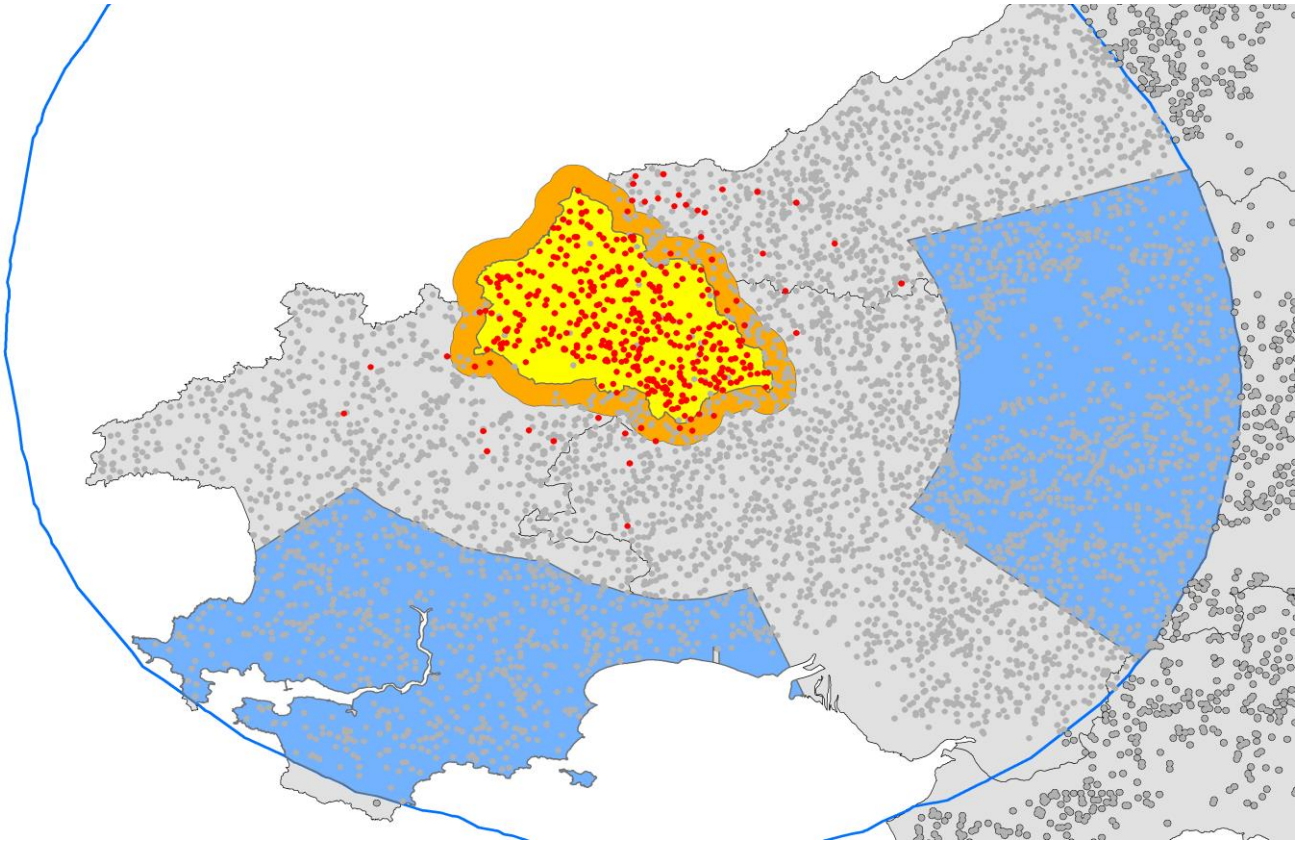


Figure A – Areas used for comparison: *the IAA Area (yellow), 2 km buffer area (orange), CA (blue, in two parts) and Wales more than 40 km from the edge of the IAA (north and east of the blue circle). Red dots indicate herds registered in the IAA during May 2014 to April 2015 and grey dots indicate other herds, according to their map reference in SAM release 6.*

[1] The Comparison Area (CA) contains more herds than the IAA to compensate for the lower apparent force of infection in the CA, evidenced by different proportions of herds with bTB incidents in the years leading up to the IAA.

Summary & Key messages:

A descriptive analysis has been undertaken to show bovine tuberculosis (bTB) testing effort and trends in measures of bTB incidence in cattle from 1st May 2005 to the end of April 2015, including the 60 months since the introduction of cattle controls in the IAA indicated within the figures of this report with a dashed box. We compare the trends observed in the IAA with those observed in the CA and the rest of Wales. In general, the observed differences in trends (except for testing intervals) are small in comparison with the historic variation between years.

The figures and associated descriptions below illustrate the key messages, which are described in more detail in the body of the report.

The average number of routine whole-herd-type tests (WHTT) per unrestricted IAA herd increased from 1.1 before the start of the IAA in 2009/10 to 2.1 in 2014/15 (Figure B, and Figure 2.1 in the full report), due to the increased frequency of routine surveillance testing in the IAA. By contrast, the comparable figures for the CA and for herds over 40km from the IAA remained relatively stable over the same period. In those areas routine testing has remained on an annual basis.

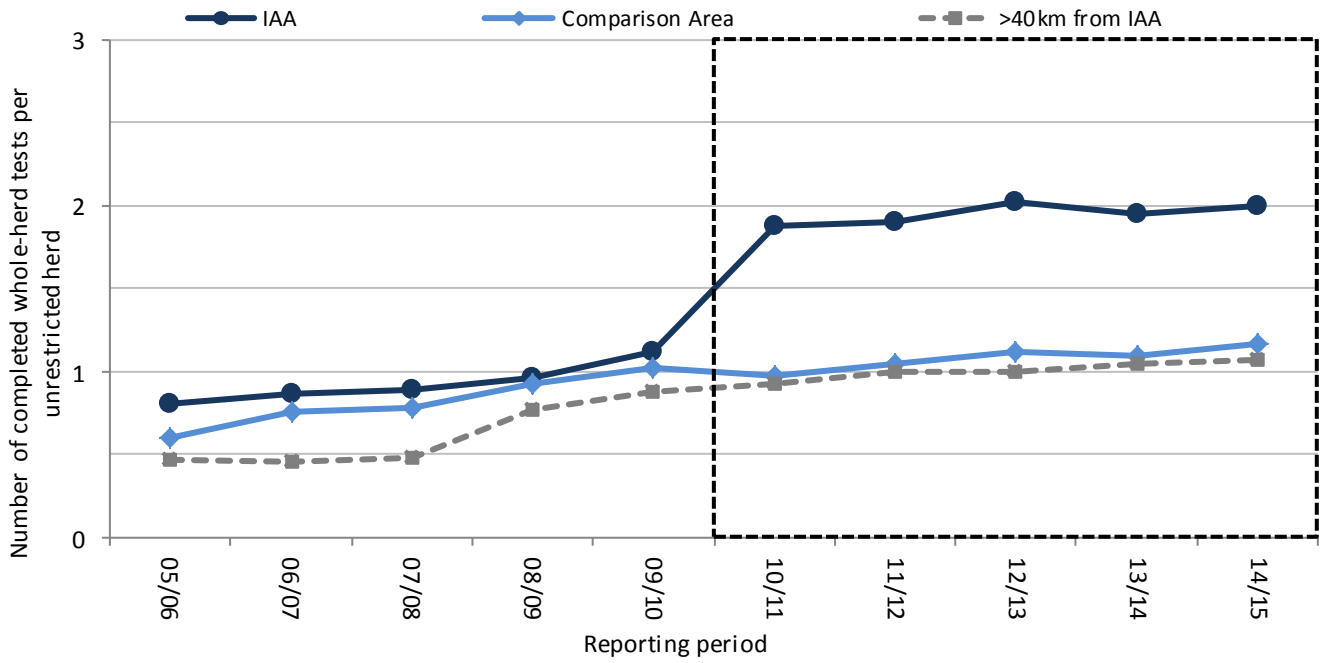


Figure B – Completed whole-herd-type tests (WHTT) per unrestricted herd

Between 2009/10 and 2010/11, the proportion of routine WHTT in unrestricted IAA herds that disclosed bTB incidents decreased whereas it remained stable in the CA (Figure C, and Figure 3.1 in the full report). This decrease was anticipated because the interval between herd tests in IAA herds was half that in the CA, with the implementation of 6 monthly testing in the IAA reducing the time which herds were exposed to infection while testing remained on an annual basis in the CA and the rest of Wales. In the rest of Wales there has been a gradual and small decline from 8% to 5% between 2009/10 and 2014/15.

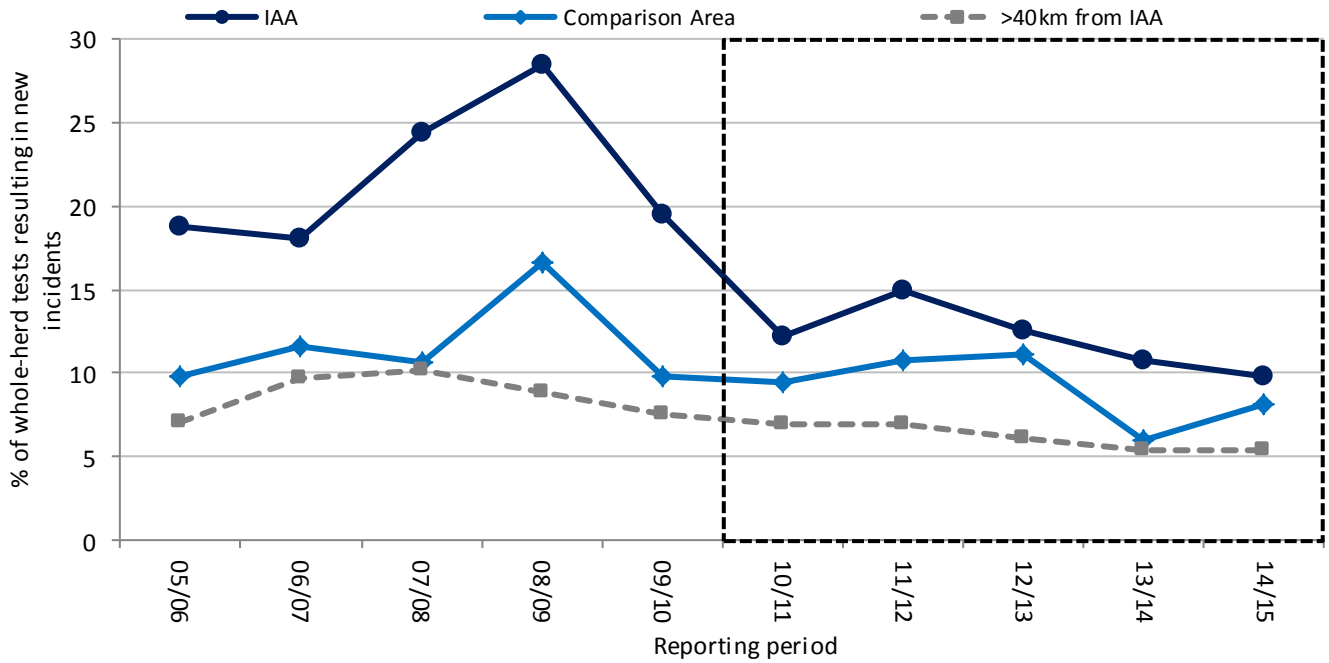


Figure C – WHTT on unrestricted herds resulting in a new bTB incident (OTF-W or OTF-S)

The proportion of IAA herds under restriction since May 2010 has remained roughly three times higher than in the CA (Figure D, and Figure 4.1) and reflects the high burden of infection within the IAA. The proportion of herds restricted in the IAA (prevalence) fluctuated between 22% and 30% in the first four years of the intervention but dropped to 19% in 2014/15. The overall trend observed in the CA was similar to that of the IAA; little change was observed in the CA between May 2010 and May 2013, with prevalence varying from 7% to 10% although a drop was observed in May 2014, to 6%.

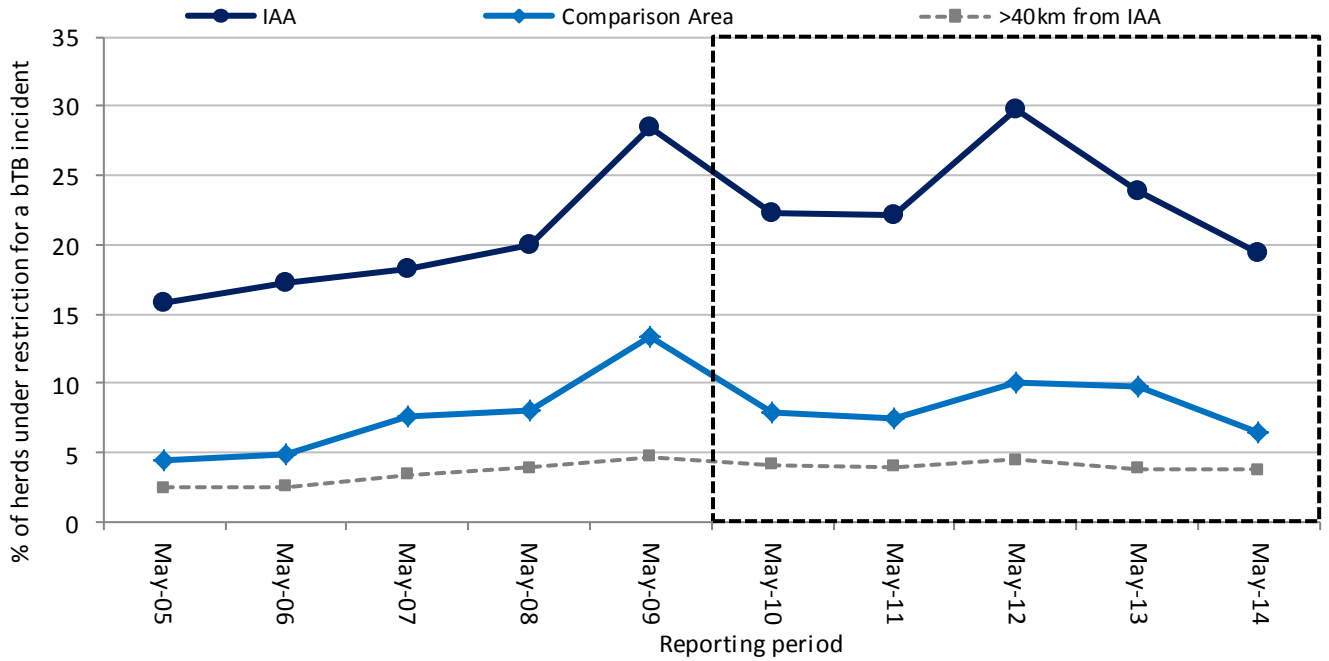


Figure D – Herds under restriction because of loss of OTF status

The number of surveillance tests, number of resulting incidents, number of incidents per 100 surveillance tests, number of reactors and prevalence for each area is presented, stratified by year, in Table A.

Table A – Summary of surveillance tests, incidents, number of reactors and prevalence

Time period		Number of surveillance tests[1]				Number of incidents			
		IAA	CA	>40 km	All of Wales	IAA	CA	>40 km	All of Wales
Pre-IAA	2005/06	36,200	99,700	334,900	653,100	54	89	353	667
	2006/07	40,200	126,600	390,600	787,700	56	128	464	871
	2007/08	39,600	119,900	424,500	804,800	79	120	490	991
	2008/09	39,200	126,400	623,200	1,024,300	85	202	636	1,308
	2009/10	39,100	130,700	700,100	1,121,600	59	125	595	1,040
IAA Controls	2010/11	54,500	139,200	778,00	1,223,300	57	114	571	996
	2011/12	49,700	136,300	778,000	1,242,400	69	138	600	1,113
	2012/13	44,800	132,600	751,000	1,205,800	59	147	524	1,030
	2013/14	48,800	136,200	781,000	1,234,600	50	77	476	827
	2014/15	58,200	155,200	795,200	1,326,800	46	108	474	881

Time period		Incidents per 100 OTF tests[2]				Number of reactors			
		IAA	CA	>40 km	All of Wales	IAA	CA	>40 km	All of Wales
Pre-IAA	2005/06	0.15	0.09	0.11	0.10	165	212	756	1,515
	2006/07	0.14	0.10	0.12	0.11	106	289	849	1,712
	2007/08	0.20	0.10	0.12	0.12	242	316	1,009	2,356
	2008/09	0.22	0.16	0.10	0.13	341	657	1,095	2,927
	2009/10	0.15	0.10	0.08	0.09	158	198	896	1,720
IAA Controls	2010/11	0.10	0.08	0.07	0.08	111	155	924	1,592
	2011/12	0.14	0.10	0.08	0.09	145	388	1,068	2,284
	2012/13	0.13	0.11	0.07	0.09	126	333	835	1,919
	2013/14	0.10	0.06	0.06	0.07	69	125	916	1,512
	2014/15	0.08	0.07	0.06	0.07	55	245	740	1,709

Time period		Prevalence			
		IAA	CA	>40 km	All of Wales
Pre-IAA	2005/06	0.16	0.04	0.02	0.04
	2006/07	0.17	0.05	0.03	0.04
	2007/08	0.18	0.08	0.03	0.05
	2008/09	0.20	0.08	0.04	0.06
	2009/10	0.29	0.13	0.05	0.08
IAA Controls	2010/11	0.22	0.08	0.04	0.06
	2011/12	0.22	0.07	0.04	0.06
	2012/13	0.30	0.10	0.04	0.07
	2013/14	0.24	0.10	0.04	0.06
	2014/15	0.19	0.06	0.04	0.05

[1]Number of surveillance tests rounded to nearest 100

[2]Number of incidents per 100 OTF tests calculated with raw data; may not reconcile exactly with number of surveillance tests due to rounding

Summary conclusion

Herds in the IAA are subject to more intensive field surveillance compared to herds in the CA, with IAA herds being tested on a 6-monthly basis (see Appendix 3 for more information). Additionally, herds in the IAA are subjected to modified movement restrictions and badgers have been vaccinated with BCG since 2012. None of these additional badger and cattle controls are in operation in the CA or in the rest of Wales. Consistent trends in indicators of bTB incidence have not yet been seen, although the reduction in the proportion of incidents that are OTF-W is encouraging. More time is required before any meaningful differences in trends between the herds in the IAA and CA can be identified.

Limitations of the report and study design

Although this report provides information on changes in bTB trends in the IAA and other areas in Wales, caution should be applied when making comparisons and drawing conclusions on this basis. There are a number of important reasons for this.

Selection of the IAA and the CA was not performed randomly, nor were either area replicated. There are known demographic differences between the IAA, the CA and the other areas which might influence bTB trends in those regions independently of policy interventions. For example, there is a higher proportion of large dairy herds in the IAA than in other areas, and such herds are more likely to see bTB incidents, regardless of location. Consequently, it is not appropriate to use conventional statistical tests when making comparisons because the areas are not directly comparable.

It is also important to consider that the major changes in testing regimes in the IAA are likely to have an impact on the statistics presented here. For example, increased testing is likely to result in an initial increase in the number of new incidents and also a greater number of herds under restriction. Later, we would expect the incidence *rate* (i.e. the number of incidents per 100 tests on OTF herds) to fall because, having identified many of the infected herds, we are likely to be doing more testing on OTF herds than previously. Other policies targeted exclusively towards the IAA include badgers vaccinated with BCG since 2012 and modified movement restrictions.

For these reasons it may not be possible to detect meaningful differences in disease trends between the IAA and the other areas until several years have elapsed. Differences observed in the short term may or may not be attributable to differences in surveillance and control strategies.

Despite these limitations useful information can still be obtained from long-term monitoring and evaluation of the policies in operation in the IAA.

Cattle demographics in the IAA and Comparison Area

Highlights

Trends in the number and type of herds and the number of cattle have remained consistent with previous years:

- The number of herds in the CA remained around 4 times higher than the IAA (Figure 1.1).
- The number of cattle in the CA was around 3 times higher than the IAA (Figure 1.2).
- Around 41% of cattle herds in the IAA were dairy, higher than all other regions (Figure 1.3).

Figures 1.1, 1.2 and 1.3 show the number and type of herds, and the number of cattle in the IAA, CA and in herds over 40 km from the IAA. The denominator for results in the category '>40km from IAA' was significantly greater than other areas, therefore for total numbers this group is divided by 10 in Figures 1.1 and 1.2 to be better compared to the IAA and CA.

Across Wales, the tendency in recent years has been for fewer, larger herds. The relative decrease in number of herds in the IAA between May 2010 and May 2015 (-16%) has been slightly larger than that observed in the CA (-10%) and in herds over 40 km from the IAA (-9%). Since the implementation of the IAA, there have been around 4 times as many herds in the CA as in the IAA.

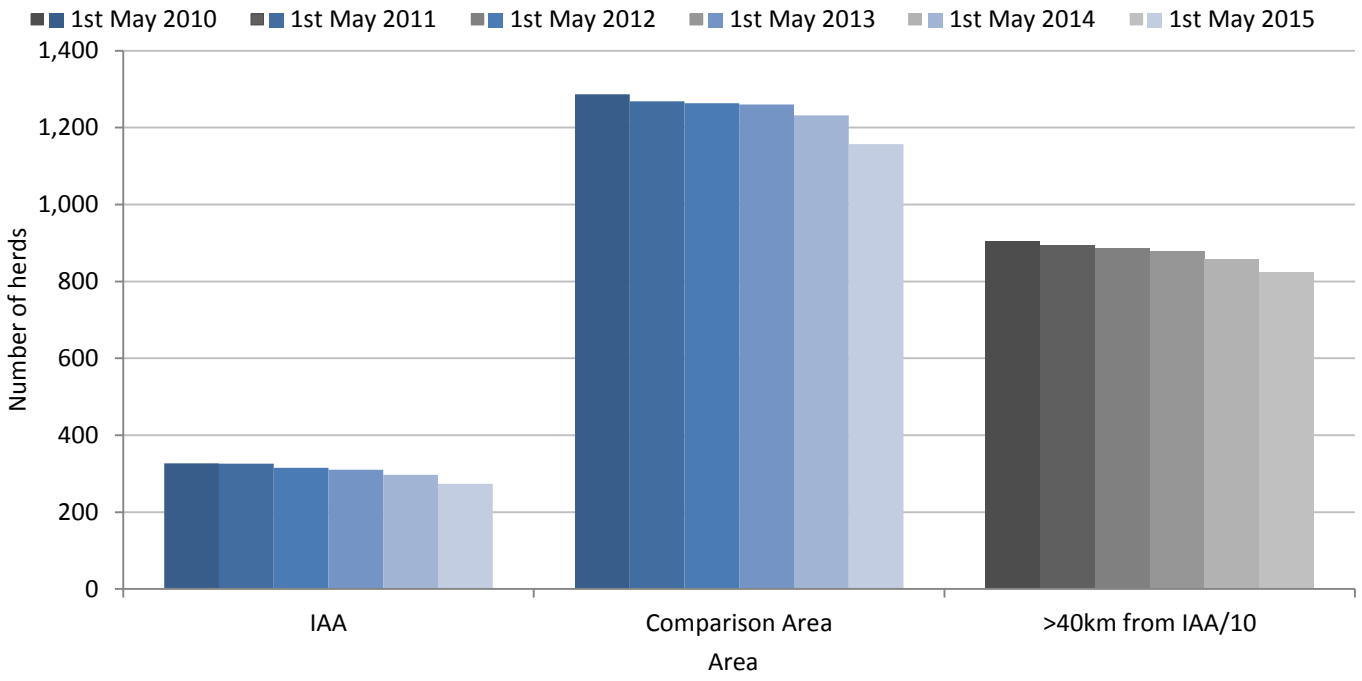


Figure 1.1 – Herds in Wales, May 2010 to May 2015; herds over 40 km from the IAA are highlighted in grey as the number of herds for this area has been divided by 10 to allow it to be presented alongside the IAA and CA

For numbers of cattle (Figure 1.2), the trend in the IAA in recent years has diverged with respect to trends in the rest of Wales. In 2010 the number of cattle in the CA was 2.5 times greater than the number of cattle in the IAA and 15 times greater in Welsh herds over 40 km from the IAA. On 1st May 2015, the difference was 3 times greater in the CA and 15 times greater in Welsh herds over 40 km from the IAA. The increased difference over the last five years is due to a decreasing trend in the number of cattle in the IAA and a gradually increasing trend in the CA and further afield.

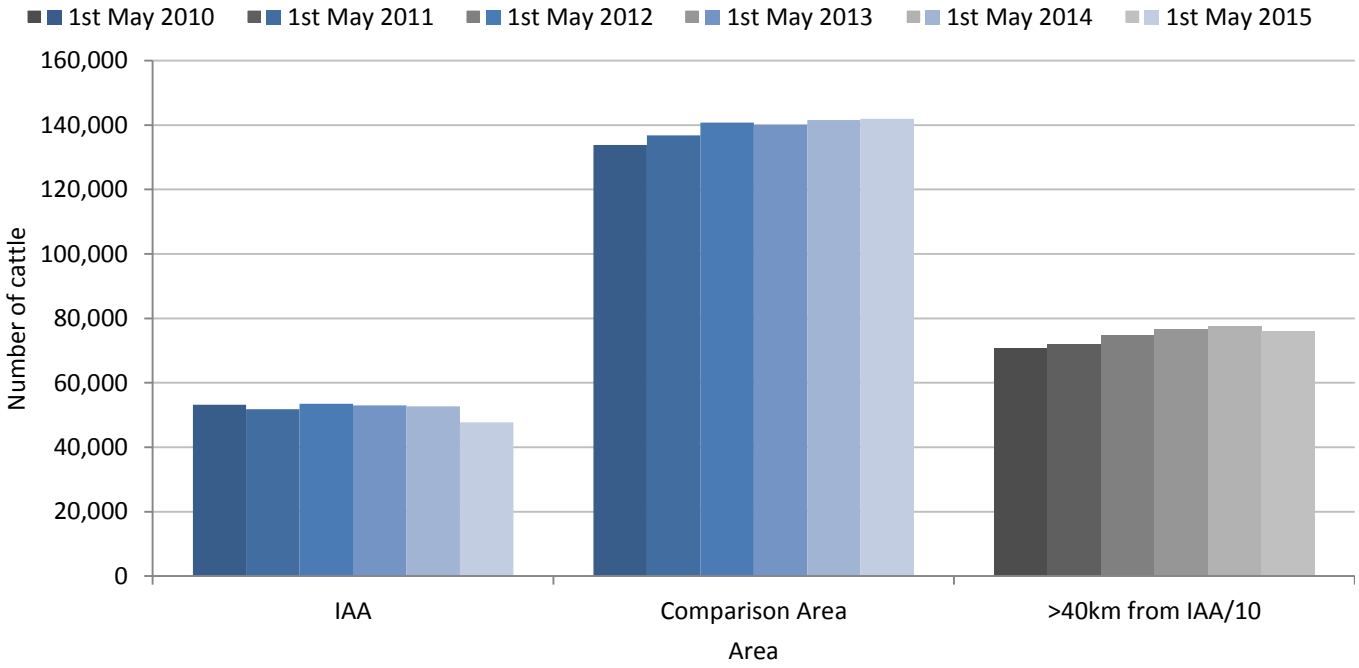


Figure 1.2 – Cattle in Wales, May 2010 to May 2015; herds over 40 km from the IAA are highlighted in grey as the number of herds for this area has been divided by 10 to allow it to be presented alongside the IAA and CA

In 2014/15, the proportion of dairy herds in the IAA was around 41% (Figure 1.3). This proportion was greater than in the CA (30%), which was similar to the 2 km buffer area (32%). The lowest proportion of dairy herds was observed in Welsh herds over 40 km from the IAA (15%). Across all of Wales, around 21% of cattle herds were dairy and 79% were beef or classified as "other". These proportions have remained stable over time.

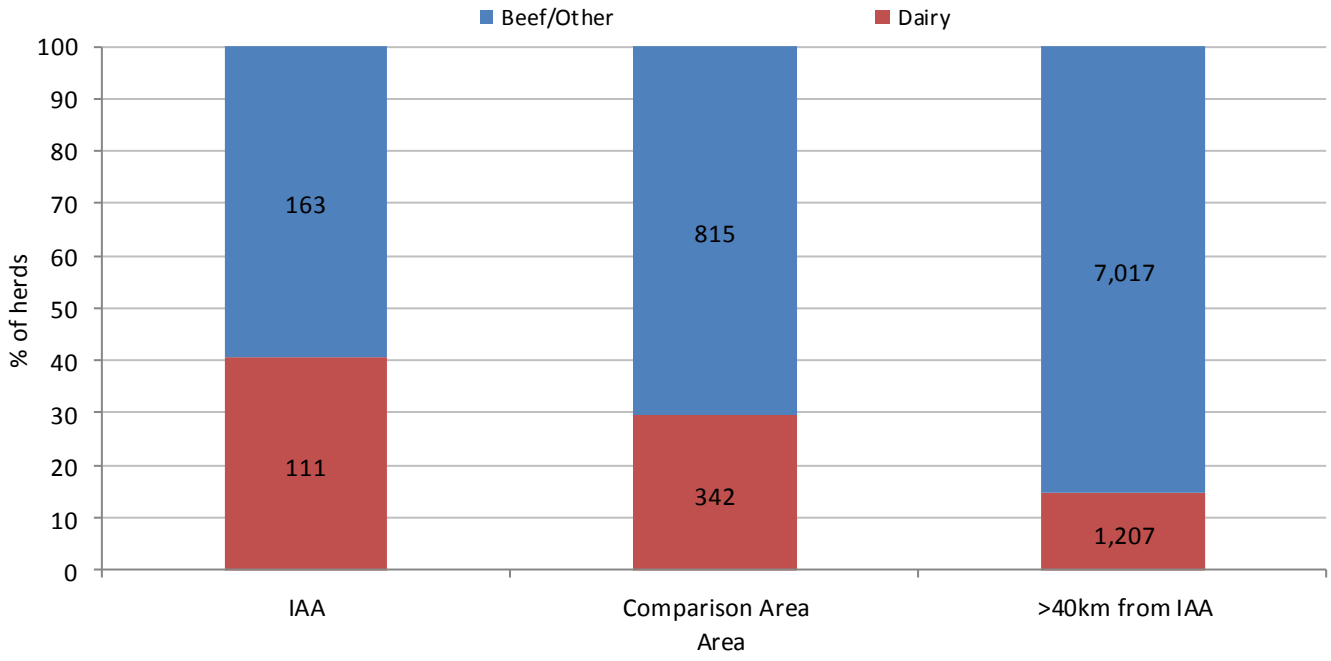


Figure 1.3 – Proportion of dairy and non-dairy herds, 2014/15

Testing effort

Highlights

Trends in the number of tests performed in all areas, in 2014/15, were variable compared to previous years:

- The average number of WHTT per unrestricted herd increased slightly to 2.1 in the IAA in 2014/15, from 2.0 the previous year (Figure 2.1).
- The average number of SICCT tests per animal in unrestricted herds in the IAA increased from 1.7 in 2013/14 to 1.9 in 2014/15, remaining around 1.5 times higher than in the CA (Figure 2.2).
- In 2014/15, twice as many interferon-gamma (IFN-g) tests were performed in the IAA compared to 2009/10; in the CA this was nearly three times as many (Figure 2.3).
- Between 2009/10 and 2014/15 in the IAA, a decline in the proportion of IFN-g tests that resulted in reactors was observed, from around 24% to around 9%. The average proportion of IFN-g tests reactors in the CA in 2014/15 was similar to that of the IAA, although following a more variable trend (Figure 2.4).

In October 2008 annual testing was introduced for all herds in Wales. Before then, a substantial proportion of unrestricted herds in the IAA were already tested annually, meaning that the average number of tests per herd was higher than in the CA. Since May 2010, herds in the IAA have been routinely tested on a six-monthly basis. In addition to routine testing, herds may be subjected to check tests (for example when contiguous herds have a bTB incident), meaning that the total number of tests in a year can exceed the frequency of routine testing applicable.

The average frequency of whole herd type tests (WHTT) per unrestricted IAA herd increased slightly in 2014/15 to 2.1 (Figure 2.1) although the trend has been relatively stable since the introduction of the IAA. A consistent trend has also been observed in the CA. There were 1.7 times as many WHTT per unrestricted herd in the IAA compared to the CA in 2014/15; this proportion has remained relatively stable since 2010/11 but was lower at around 1.1 prior to the IAA implementation. A similar pattern was observed in Welsh herds more than 40 km from the IAA.

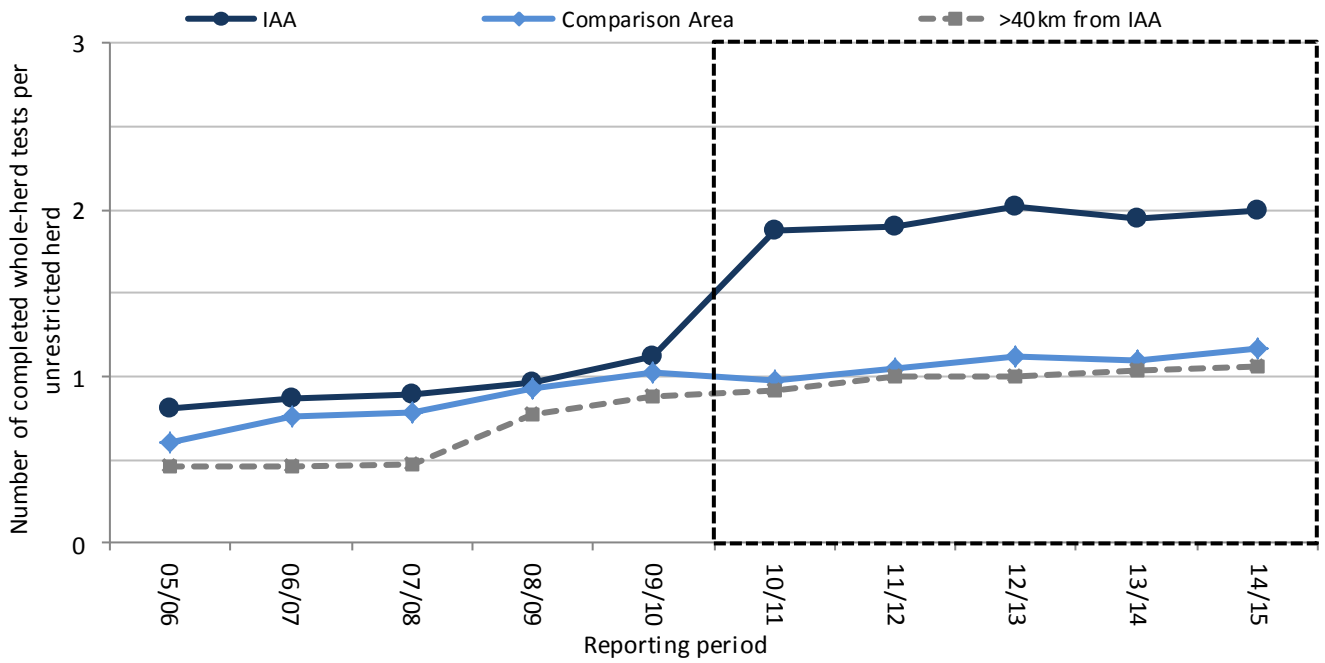


Figure 2.1 – Completed WHTT per unrestricted herd

Figure 2.2 shows the average number of Single Intradermal Comparative Cervical Tests (SICCT), known as the tuberculin skin test, per animal in unrestricted herds, per year. In the IAA this increased from 1.7 in 2013/14 to 1.9 in 2014/15, the highest level observed over the series. The average number of skin tests per animal in the CA in 2014/15 was 1.3 and in herds over 40 km from the IAA it was 1.2; these levels are consistent with previous years.

Since its implementation, the average frequency of skin tests per animal in the IAA in unrestricted herds has remained between 1.4 and 1.6 times higher than in the CA.

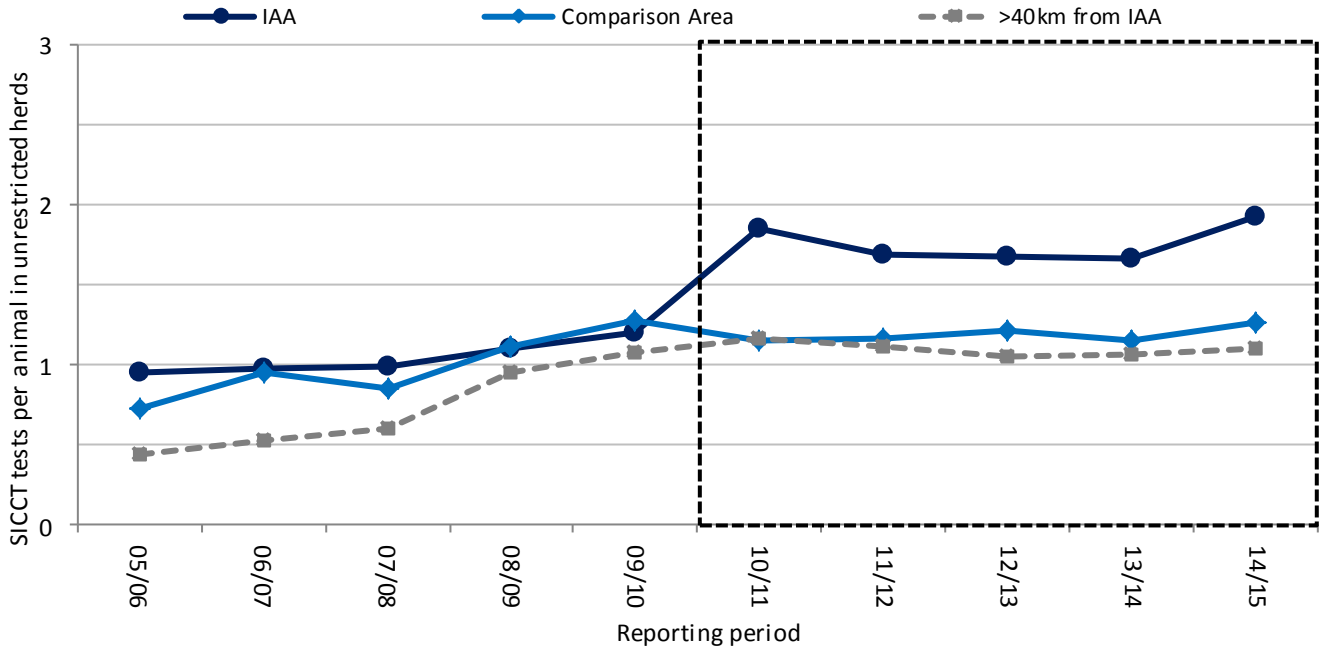


Figure 2.2 – SICCT tests per animal in unrestricted herds (all test types)

Table 2.1 shows the number of surveillance tests conducted in each area, the number of resulting reactors and the number of reactors per 1,000 surveillance tests. In the IAA, CA and in Welsh herds over 40 km from the IAA an overall decreasing trend in the number of reactors per 1,000 surveillance tests has been observed since 2008/09. In the IAA this declining trend continued in 2014/15 whereas in the CA there was an increase. The number of reactors per 1,000 tests in the IAA in 2014/15 decreased below that observed in the CA for the first time in 2014/15. The declining trend in the IAA is likely to be related to testing effort and does not necessarily reflect trends in incidence. This is because routine tests are carried out more frequently in the IAA; hence there is a shorter period between tests for cattle to become exposed to bTB, resulting in fewer reactors at subsequent tests. This is particularly relevant when comparing the difference between the number of reactors per 1,000 tests in the IAA and the CA pre- and post-implementation of additional control measures.

Table 2.1 – Tests for animals in herds not under restriction (surveillance tests) and resulting number of reactors

Time period		IAA			Comparison Area		
		Tests (thousands)	Reactors	Reactors per 1,000 tests	Tests (thousands)	Reactors	Reactors per 1,000 tests
Pre-IAA	2005/06	36.2	165	4.6	99.7	212	2.1
	2006/07	40.3	106	2.6	126.7	289	2.3
	2007/08	39.6	242	6.1	119.9	316	2.6
	2008/09	39.2	341	8.7	126.4	657	5.2
	2009/10	39.1	158	4.0	130.7	198	1.5
IAA Controls	2010/11	54.5	111	2.0	139.2	155	1.1
	2011/12	49.7	145	2.9	136.3	388	2.9
	2012/13	44.8	126	2.8	132.6	333	2.5
	2013/14	48.8	69	1.4	136.2	125	0.9
	2014/15	58.2	55	1.0	155.2	245	1.6

Time Period		Welsh herds over 40 km			All Wales		
		Tests (thousands)	Reactors	Reactors per 1,000 tests	Tests (thousands)	Reactors	Reactors per 1,000 tests
Pre-IAA	2005/06	334.9	756	2.3	653.1	1,515	2.3
	2006/07	390.6	849	2.2	784.7	1,712	2.2
	2007/08	424.5	1,009	2.4	804.8	2,356	2.9
	2008/09	623.2	1,095	1.8	1,024.4	2,927	2.9
	2009/10	700.1	896	1.3	1,121.6	1,720	1.5
IAA Controls	2010/11	778.0	924	1.1	1,223.3	1,592	1.3
	2011/12	717.5	1,068	1.4	1,181.8	2,284	1.9
	2012/13	751.0	835	1.1	1,205.8	1,919	1.6
	2013/14	781.0	916	1.2	1,234.6	1,512	1.2
	2014/15	795.2	740	0.9	1,326.8	1,709	1.3

Interferon-gamma (IFN-g) testing is a more sensitive test for bTB than the tuberculin skin test. It is being used more throughout Wales to help clear infection as well as being applied in herds experiencing recurrent incidents. Figure 2.3 illustrates the variability in use of IFN-g testing in the IAA and the CA over the past decade. The number of IFN-g tests conducted in all areas has been highly variable across the series. In the IAA the number of tests initially fell from a maximum in the series of 1200 tests in 2008/09 before doubling over the last five years, from around 500 in 2009/10 to just over 1,000 in 2014/15. This was similar to that observed in Welsh herds over 40 km from the IAA, where the total number of IFN-g tests increased by around 2.5 time between 2009/10 and 2014/15.

In the IAA there was a large increase in IFN-g testing over the last year, from around 700 to over 1,000. The level is now comparable with the levels seen whilst dealing with severely infected herds between 2007 and 2009. In the latest year there was a very sharp increase in gamma testing in the CA, from around 200 to over 1,200. However, Figure 2.3 shows that the series in the CA is volatile over time so short term changes should be considered in the context of longer term trends. In this case, it is difficult to discern a consistent trend, even over a period of many years, because large increases and decreases tend to be cancelled out the following year. In both the IAA and the CA the recent increases appear to be largely attributable to testing in herds with persistent infection. In the latest year such tests rose from 488 to 890 in the IAA and from 23 to 819 in the CA.

The use of IFN-g throughout Wales is carried out on a discretionary basis and the volatility in the absolute numbers of tests conducted will be as a result of this. For example, around 2007/08 and 2008/09 a small number of large herds in the IAA experienced breakdowns and the decision was made to use IFN-g to help clear infection which resulted in high numbers of tests being carried out in these years. These animals did not require re-testing in subsequent years which lead to the rapid decline in the number of IFN-g tests carried out. Rapid changes are therefore generally reflective of the flexibility in the application of this test and not reflective of overall IFN-g usage.

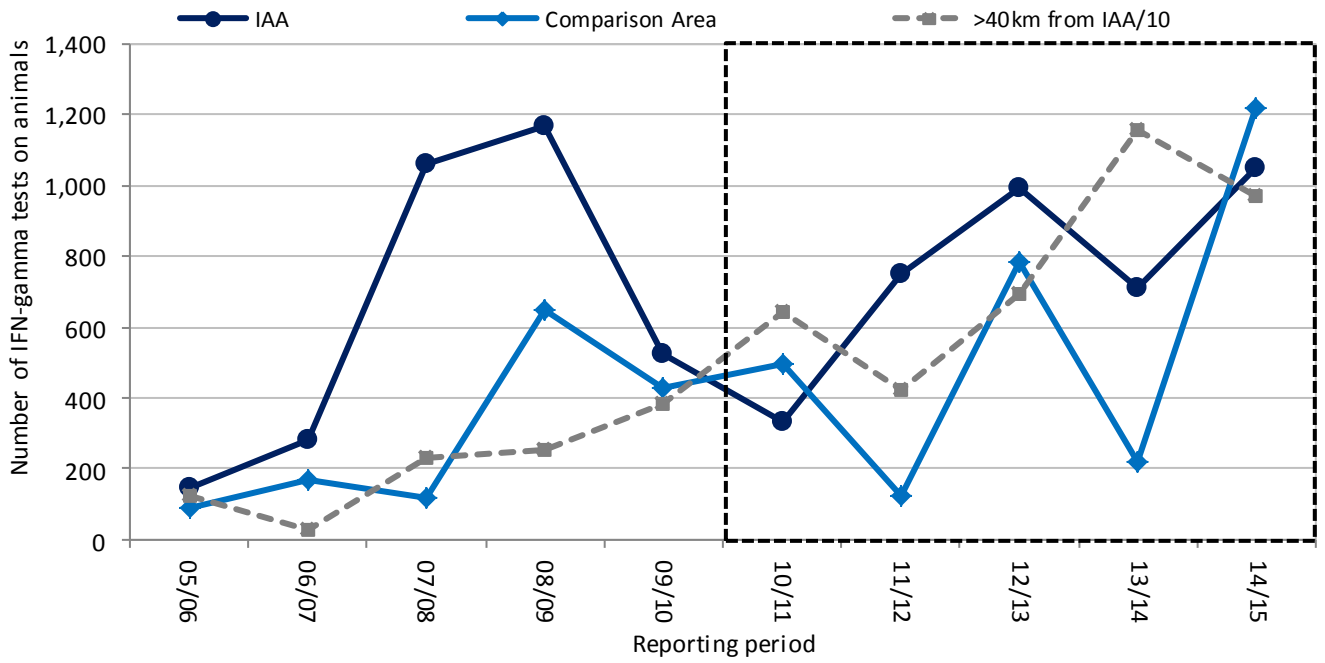


Figure 2.3 – Interferon-gamma tests

Figure 2.4 shows the proportion of IFN-g tests which resulted in reactors. There has been a stable decline in this proportion in the IAA 2007/08, with the level standing at 9% in 2014/15. This is similar to the trend observed in herds over 40 km from the IAA, where the level fell from around 16% at its height to 3% in 2014/15. The pattern in the CA is much more variable and no discernible trend has emerged over the last decade. In all areas, changes in the proportion of reactors to IFN-g testing can be related to changes in the number of tests conducted. For example, the drop in the proportion of reactors in the CA in the latest year was primarily due to a large increase in the denominator (number of IFN-g tests, up from 200 to 1,200), whilst the overall number of IFN-g test reactors increased by a relatively small amount (from 80 to 90). However, it is possible that using IFN-g more would be associated with a smaller number of reactors due to the higher specificity of the test, compared to SICCT.

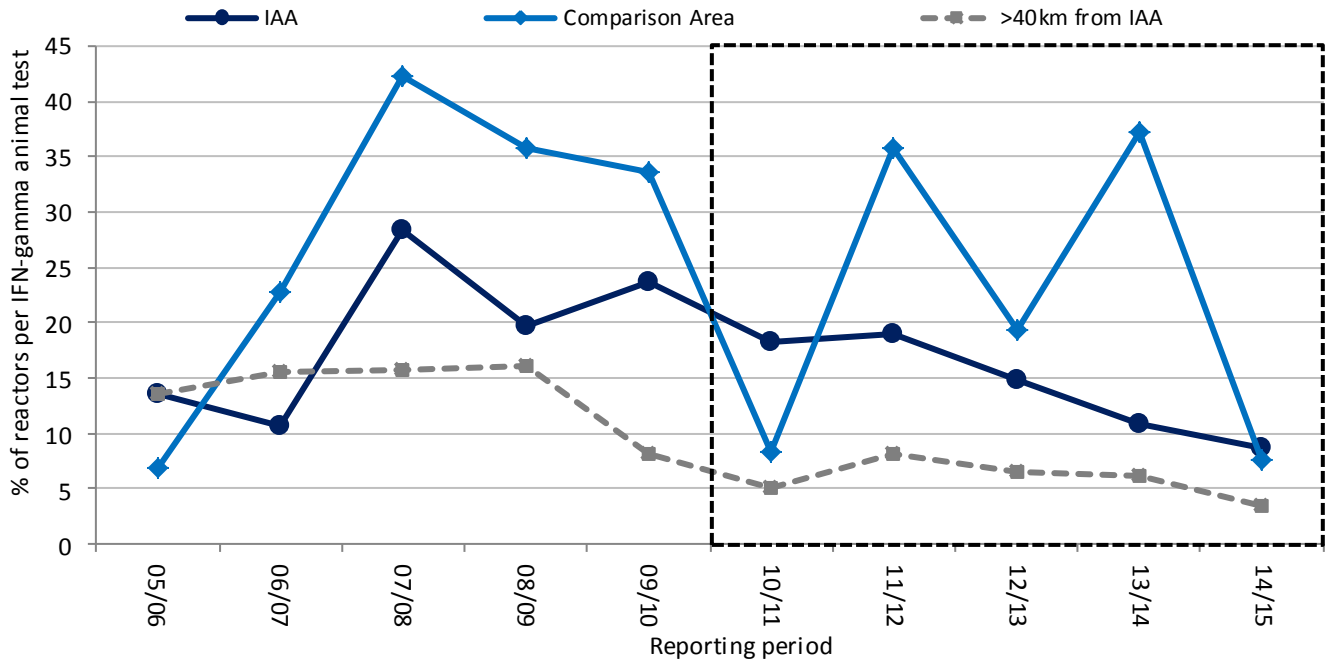


Figure 2.4 – Proportion of interferon-gamma animal tests that result in reactors

Incidents and reactors per test

Highlights

Overall, the decreasing trend in new incidents per whole herd type test (WHTT) and reactors per tuberculin skin test continued in 2014/15, whilst the proportion of OTF-W incidents remained high in all areas

- The number of incidents per WHTT in the IAA fell below 10% for the first time whereas the number in the CA rose slightly to around 8% (Figure 3.1).
- 94% of bTB incidents in the IAA were OTF-W, marginally higher than in the CA (90%) (Figure 3.2).
- The proportion of animals in the IAA which had an SICCT test and became reactors decreased by nearly 70% between 2009/10 and 2014/15 (Figure 3.3); the decrease in the CA in this period was lower at 54%. This is at least partly attributable to an increase in the number of animal tests in both areas (Table 3.1)
- The proportion of confirmed reactors in the IAA has been increasing since the implementation of cattle control (Figure 3.4).

The decreasing trend in the number of bTB incidents per completed whole herd type test (WHTT) in the IAA continued in 2014/15 when the proportion fell to below 10% for the first time (Figure 3.1).

In the CA, the proportion of bTB incidents per WHTT increased from 6% to 8% in the latest year, though over the long term there appears to be a slight downward trend. Further afield, the proportion in herds more than 40km away from the IAA fell slowly but consistently between 2007 and 2015.

In 2014/15 there were around 1.2 times as many bTB incidents per completed WHTT in the IAA compared with the CA and 1.8 times as many compared with herds more than 40 km away. Historically, there was a substantial difference between the areas represented by the IAA and the CA in the proportion of herd tests resulting in incidents. Since the IAA was established, however, the gap has narrowed. This is at least partly attributable to the larger increases in testing in the IAA compared with the CA.

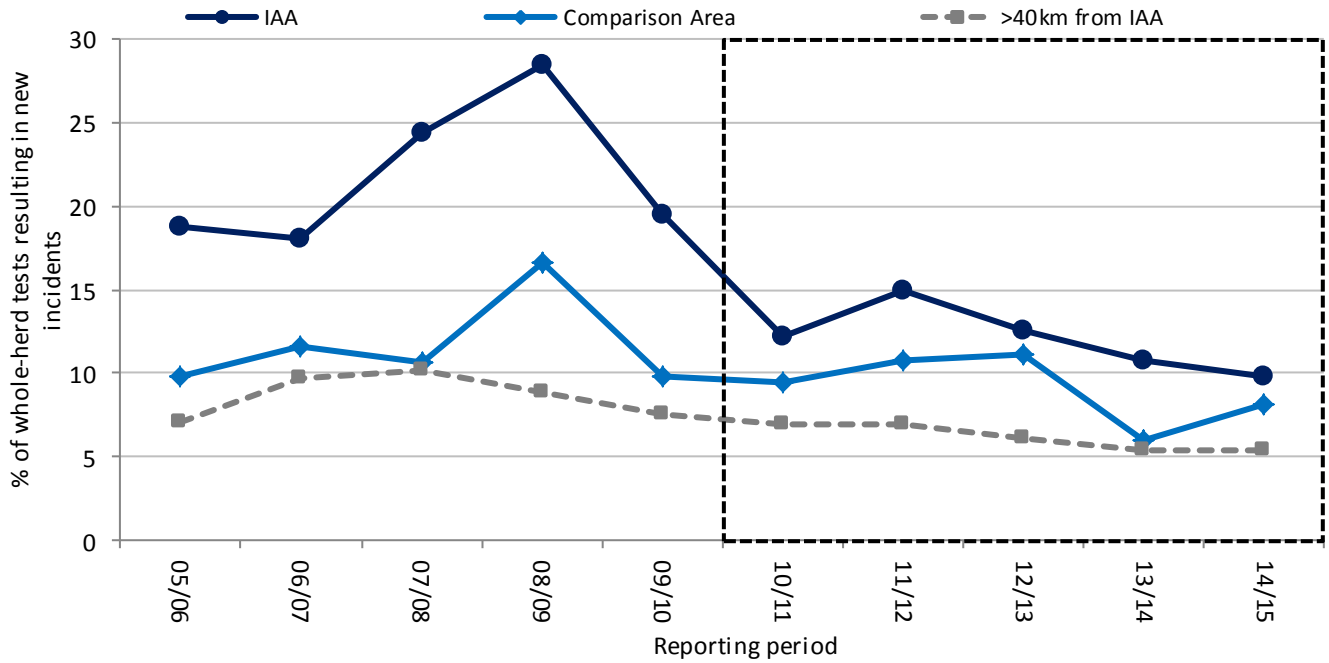


Figure 3.1 – Proportion of unrestricted herds losing their OTF status, per complete WHTT

Not all incidents result in OTF status being withdrawn (becoming OTF-W). In some cases – for example when post-mortem evidence of disease is not found and there is no perceived epidemiological risk – OTF status is suspended (OTF-S). The proportion of new bTB incidents in which OTF status is withdrawn has generally been higher in the IAA than in the CA and in herds over 40 km from the IAA (Figure 3.2). Higher rates of OTF-W are likely to reflect higher incidence rates. In 2014/15 around 94% of bTB incidents In the IAA were OTF-W. This has been broadly stable for the past 4 years. In the CA the proportion was 90%. This represents a small decrease in the IAA and CA in comparison from the previous year. In herds more than 40km away from the IAA, the proportion of incidents that were OTF-W has increased steadily and consistently over the past 6 years, currently standing at 78%.

Across Wales, there was a relatively sharp increase between 2010/11 and 2011/12. This is because before January 2011 only incidents in which post-mortem evidence had been identified were categorised as OTF-W, but subsequently an additional cohort of incidents were included, those with a perceived epidemiological risk. More information about this change is provided in Appendix 2.

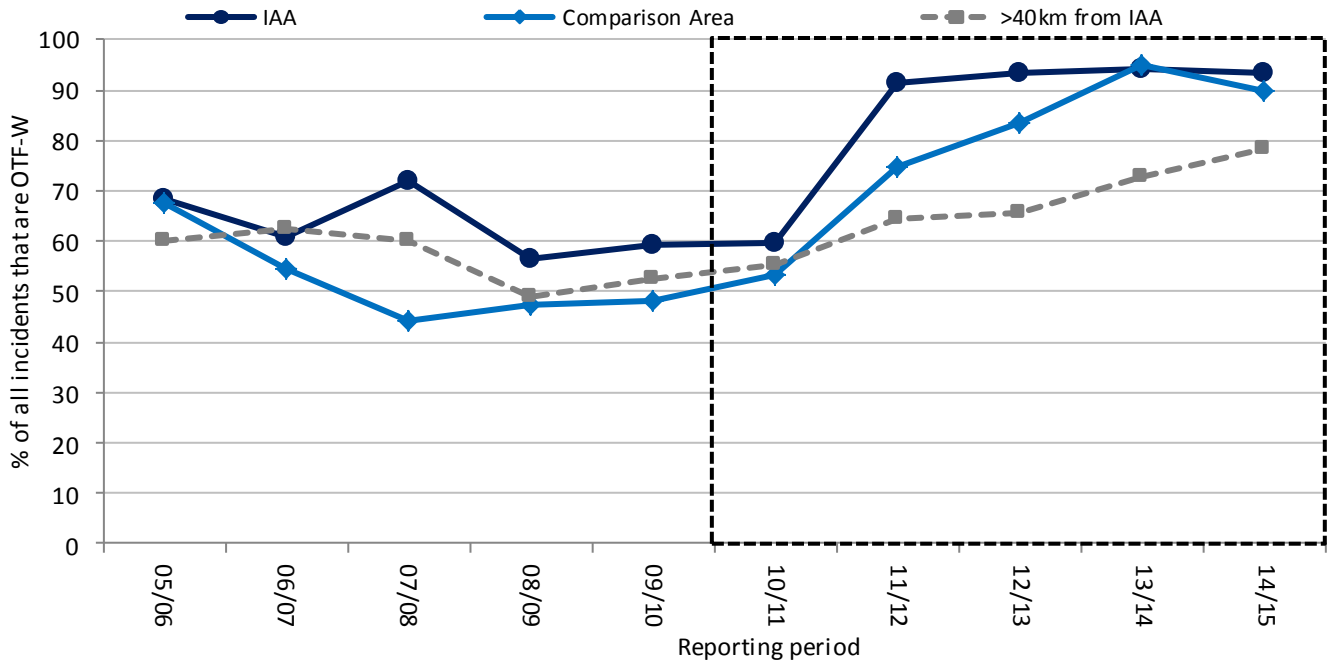


Figure 3.2 – Proportion of all incidents that are OTF-W

The number of surveillance tests, the number of resulting incidents and the number of incidents per 100 surveillance tests is shown in Table 3.1.

Table 3.1 – Tests for herds not under restriction (surveillance tests) and resulting number of incidents

Time period		IAA			Comparison Area		
		Tests (thousands)	Incidents	Incidents per 100 tests	Tests (thousands)	Incidents	Incidents per 100 tests
Pre-IAA	2005/06	36.2	54	0.15	99.7	89	0.09
	2006/07	40.3	56	0.14	126.7	128	0.10
	2007/08	39.6	79	0.20	119.9	120	0.10
	2008/09	39.2	85	0.22	126.4	202	0.16
	2009/10	39.1	59	0.15	130.7	125	0.10
IAA Controls	2010/11	54.5	57	0.10	139.2	114	0.08
	2011/12	49.7	69	0.14	136.3	138	0.10
	2012/13	44.8	59	0.13	132.6	147	0.11
	2013/14	48.8	50	0.10	136.2	77	0.06
	2014/15	58.2	46	0.08	155.2	108	0.07

Time period		Welsh herds over 40 km			All Wales		
		Tests (thousands)	Incidents	Incidents per 100 OTF tests	Tests (thousands)	Incidents	Incidents per 100 tests
Pre-IAA	2005/06	334.9	352	0.11	653.1	666	0.10
	2006/07	390.6	464	0.12	784.7	871	0.11
	2007/08	424.5	490	0.12	804.8	991	0.12
	2008/09	623.2	635	0.10	1,024.4	1307	0.13
	2009/10	700.1	595	0.08	1,121.6	1040	0.09
IAA Controls	2010/11	778.0	571	0.07	1,223.3	995	0.08
	2011/12	717.5	600	0.08	1,181.8	1113	0.09
	2012/13	751.0	524	0.07	1,205.8	1028	0.09
	2013/14	781.0	476	0.06	1,234.6	827	0.07
	2014/15	795.2	473	0.06	1,326.8	880	0.07

In recent years the proportion of animals in the IAA which had a skin test and became reactors has decreased substantially (Figure 3.3). In 2014/15 0.6% of animals which had a skin test became reactors, a relative fall of 69% over the period of the IAA.

The overall pattern observed in the CA has been consistently similar to that observed in the IAA. In 2014/15, 0.4% of animals which had a skin test became reactors. The relative decrease since before the IAA was 54%. The proportion of animals skin tested which became reactors has remained consistently higher in the IAA than in both the CA and in herds over 40 km from the IAA. Following its commencement, the proportion in the IAA has generally remained between two and three times that for the CA, but in the latest year the gap narrowed to its lowest (1.7 times the rate in the CA). The difference is potentially due to greater use of severe interpretation of the skin test in the IAA compared with the CA and other areas due to the known risk associated with the area.

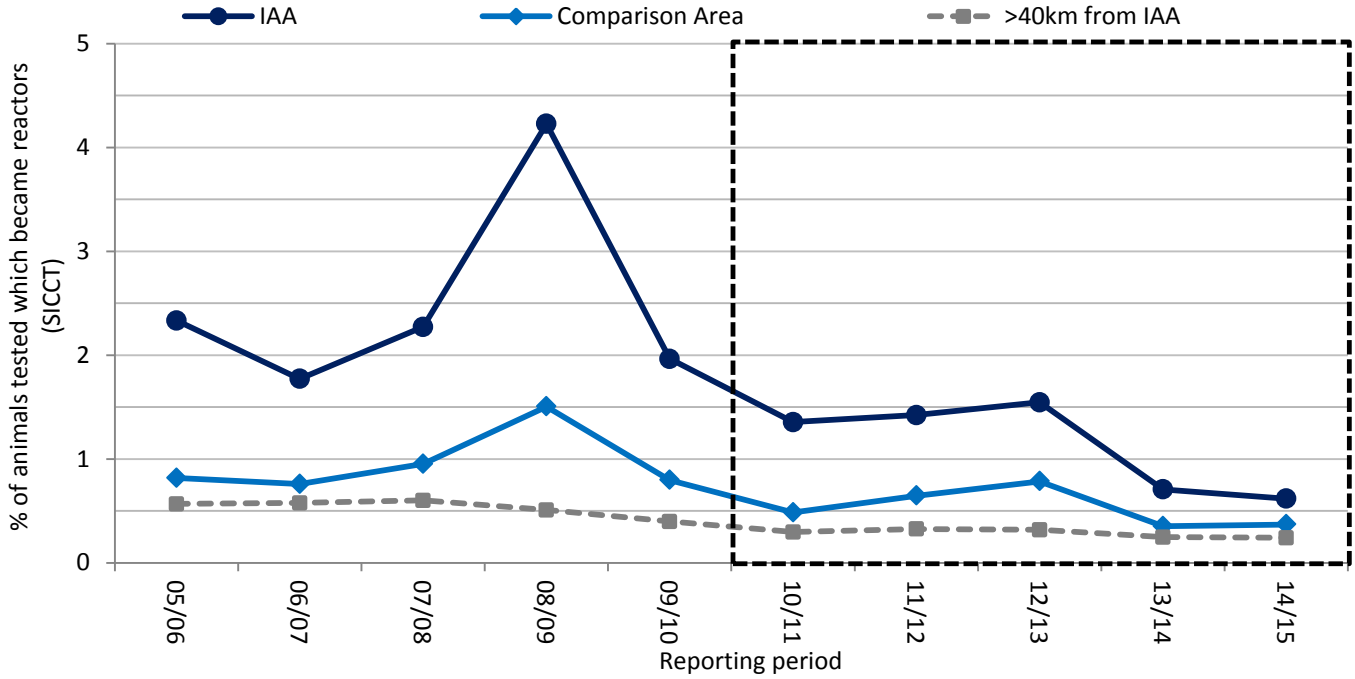


Figure 3.3 –Proportion of animals which had an SICCT test and became reactors

The proportion of skin test reactors with post-mortem evidence of bTB (visibly-lesioned reactors or *M. bovis* culture positive animals) is shown in Figure 3.4. The proportion of confirmed reactors fell between 2008/09 and 2010/11 to the lowest level in the series (46% and 18%). However, following the implementation of the IAA this has steadily risen to the highest level observed with the series in 2014/15 (59%). This pattern has been reflected to a lesser degree in the CA. This implies that more truly infected reactors are being detected in the IAA than elsewhere. Although a greater use of severe interpretation in the IAA would mean that a higher level of non-lesioned animals would be expected to be removed, the persistently higher incidence rate in the IAA compared with other areas might be the reason why this is not being observed.

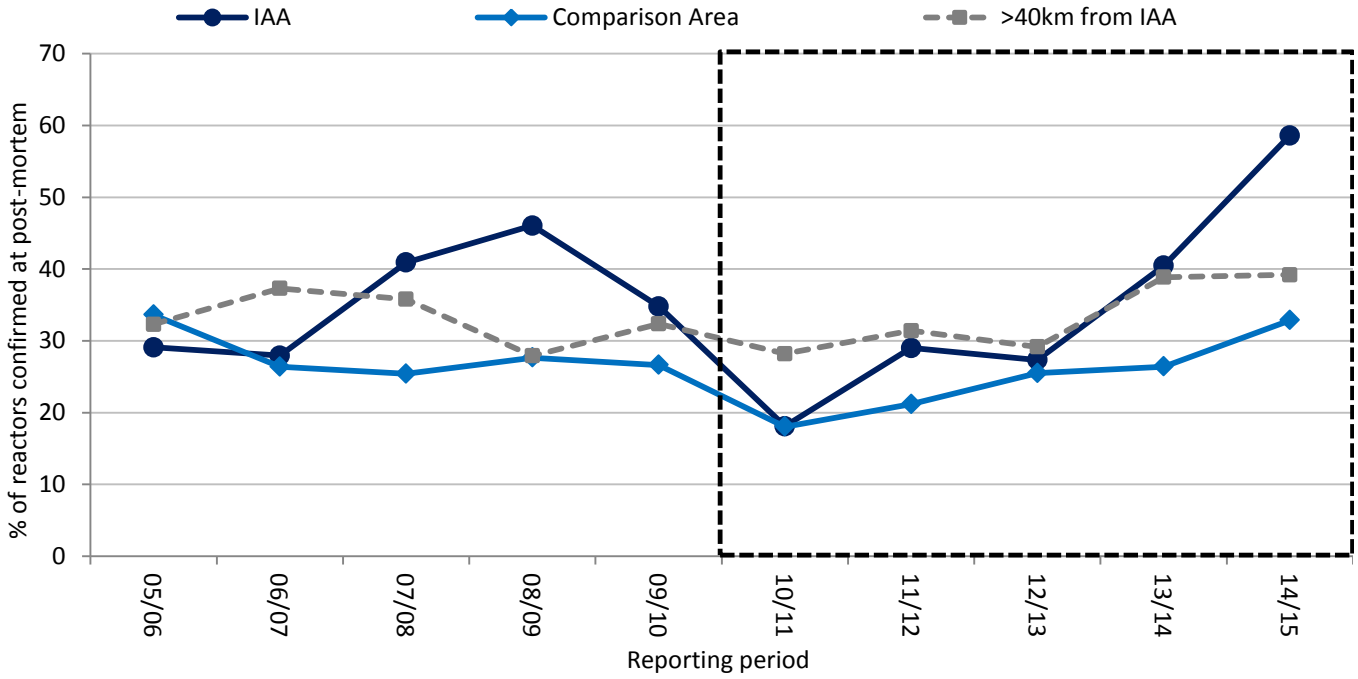


Figure 3.4 – Proportion of SICCT test reactors with bTB confirmed at post-mortem

Proportion of herds under restriction

Highlights

- The proportion of herds under restriction has remained around 3 times higher in the IAA than in the CA (Figure 4.1).

The prevalence of TB is measured using the proportion of herds in which restrictions are in place because of the loss of OTF status. Figure 4.1, showing the proportion of herds under restriction for loss of OTF status, shows that the patterns observed in the IAA and the CA are very similar. For both areas there was a sharp increase in prevalence into 2009, the year before the IAA was established. Thereafter, the pattern fluctuated, with no discernible long-term trend having emerged. In May 2014 19% of herds in the IAA were under restrictions, compared with 6% in the CA, both representing a substantial fall from the previous year.

The proportion of herds under restriction at the start of the reporting period (1st May) in the IAA has typically been around three times higher than in the CA since May 2005/06 and around 5 times higher than in Welsh herds over 40 km from the IAA. This ratio has not decreased overall since the start of the IAA controls. This is potentially due to the extra testing performed at the end of OTF-S incidents in the IAA, which increases the time that herds are under restrictions for such incidents. However, it is also likely that higher prevalence rates are related to higher incidence rates.

The proportion of herds under restriction for an OTF-W incident in all areas follows a very similar pattern to the proportion of herds under restriction for any bTB incident (Figure 4.2). This similarity between trends is reflective of the high proportion of OTF-W incidents in Wales.

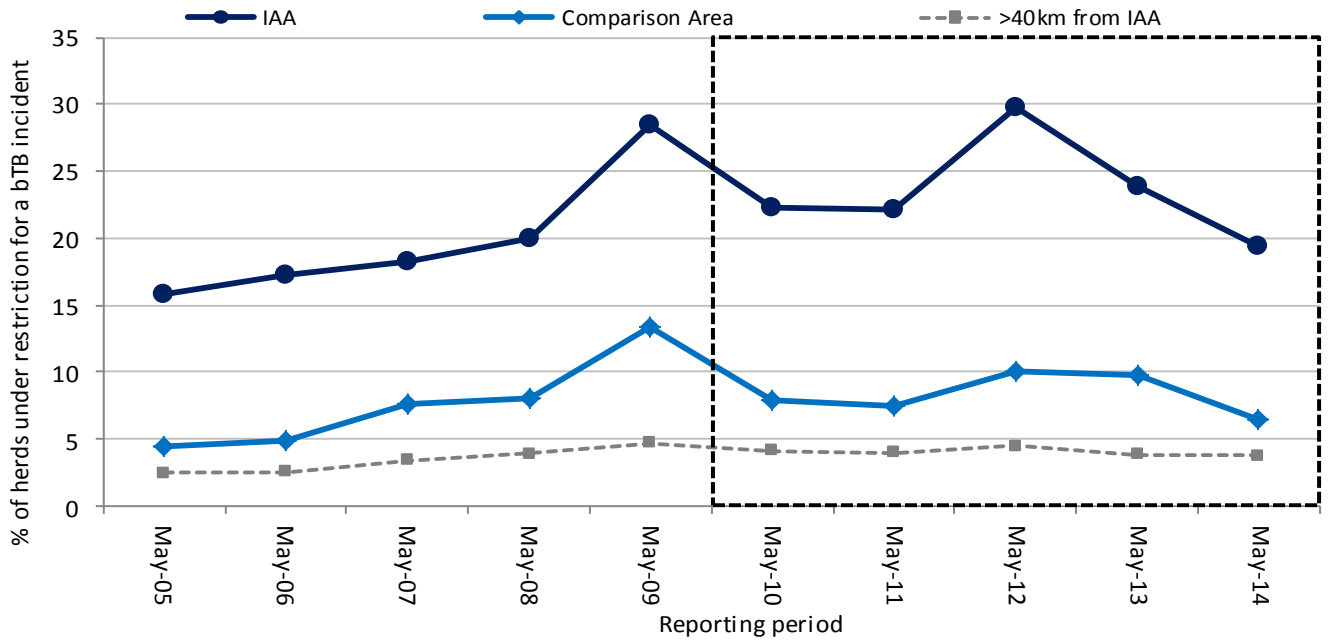


Figure 4.1 – Proportion of herds under restriction, at the start of the reporting period, due to loss of OTF status

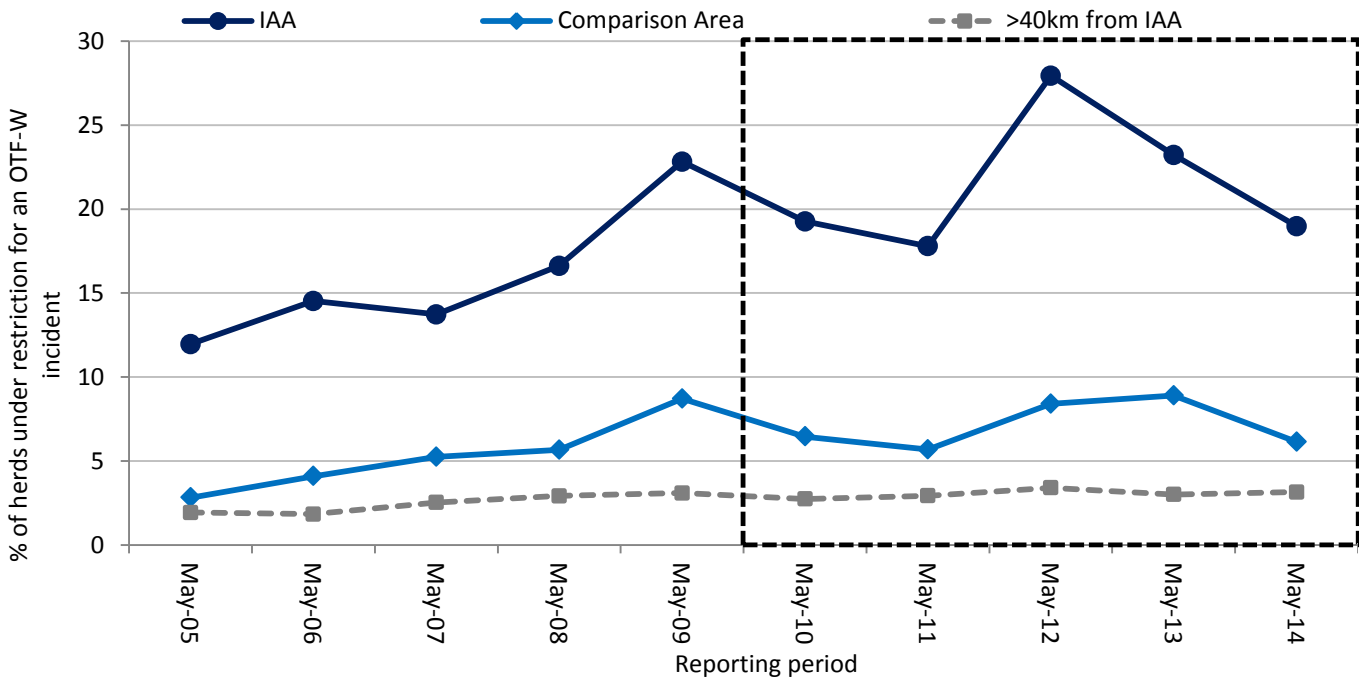


Figure 4.2 – Proportion of herds under restriction due to withdrawal of OTF status (OTF-W)

Incidents per 100 herds and reactors per 1,000 animals

Highlights

The number of incidents per 100 herds and reactors per 1,000 animals continues to be higher in the IAA than in the CA:

- There were roughly twice as many new bTB incidents per 100 unrestricted herds in the IAA compared to the CA (Figure 5.1).
- Twice as many cattle were slaughtered for bTB control per 1,000 cattle in the IAA compared with the CA (Figure 5.3).
- Between 2009/10 and 2014/15 both the IAA and CA saw overall declines in the number of skin test reactors per 1,000 cattle of around 48% (Figure 5.4).
- In 2014/15, the proportion of skin test reactors with post-mortem evidence of bTB in both the IAA and CA increased (Figure 5.5).
- The number of animals becoming slaughterhouse cases remained variable although the CA continued to see more slaughterhouse cases than the IAA (Figure 5.6). This is expected due to the increased frequency in routine testing in the IAA resulting in cattle being slaughtered earlier for bTB control.

After an initial increase in incidence following the introduction of interventions in the IAA, average incidence has decreased for the third year running, to 18 per 100 unrestricted herds in 2014/15 (Figure 5.1). A more variable pattern in incidence was observed in the CA, with an increase in 2014/15 to 10 per 100 unrestricted herds. Despite this, the long-term trends in the IAA and the CA are similar. Consistently more new bTB incidents per 100 unrestricted herds are observed in the IAA compared to the CA. In 2013/14, there were three times as many new incidents in the IAA, reducing to approximately twice as many incidents in 2014/15, a proportion more in line with previous years.

Comparatively, a more stable trend was observed in herds over 40 km from the IAA with incidence remaining between 5 and 7 bTB incidents per 100 unrestricted herds between 2009/10 and 2014/15. In this time around 3 times as many more new bTB incidents per 100 unrestricted herds were observed in the IAA compared with herds more than 40 km from the IAA.

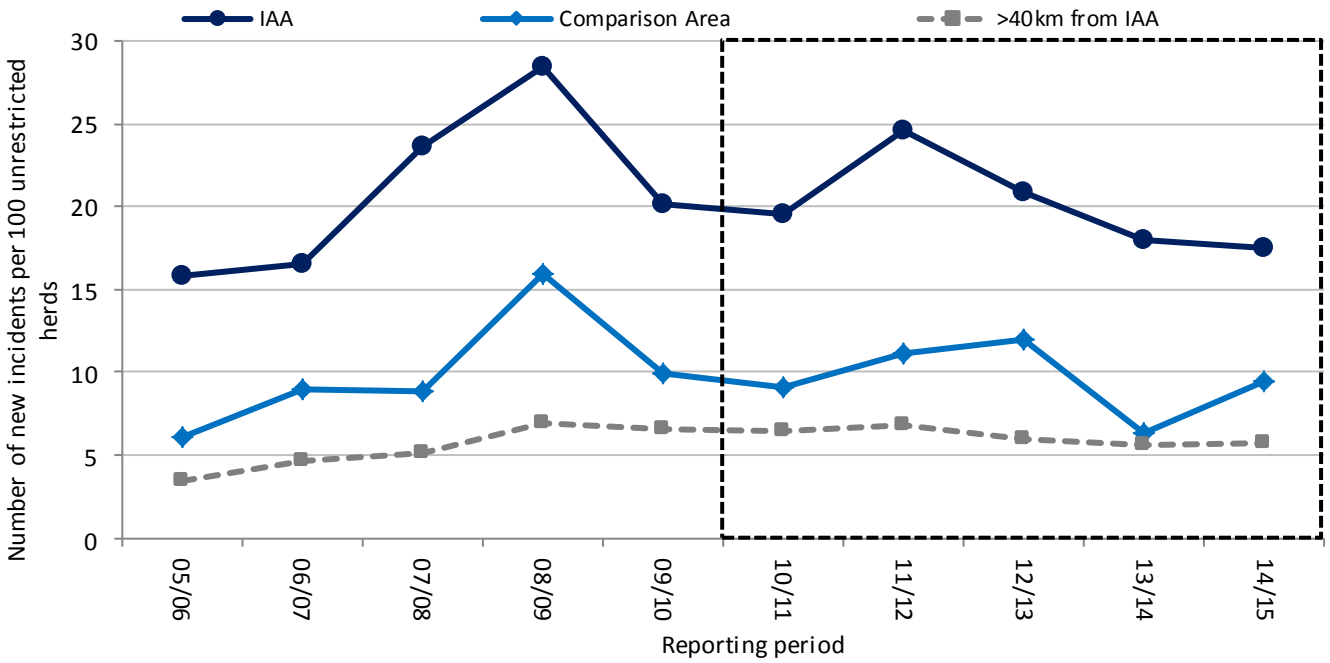


Figure 5.1 – New incidents per 100 unrestricted herds (herd incidence rate)

The rate for OTF-W incidents only follows a very similar pattern to that described for all incidents (Figure 5.2). The exception to this is the increase in the IAA into 2011/12, which is sharper for OTF-W incidents than for all incidents combined. This is attributable to the January 2011 change in how some incidents are classified, meaning that some incidents that would previously have been classified as OTF-S were subsequently classified as OTF-W based on epidemiological reasoning (OTF-W-2). For herds more than 40km away from the IAA, there is a sustained, albeit subtle, increase in the OTF-W incidence rate over the past decade, which contrasts somewhat to the rate for all incidents combined, which has fallen slightly since 2009.

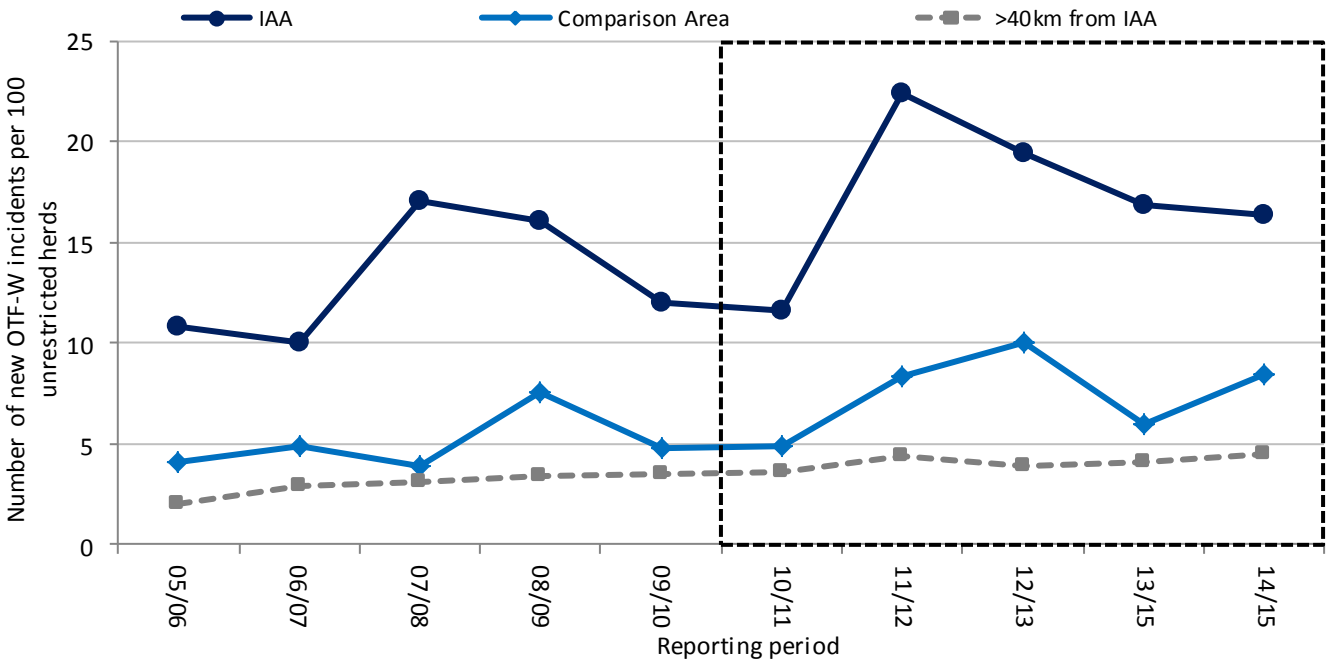


Figure 5.2 – New OTF-W incidents per 100 unrestricted herds

In the IAA, between 2009/10 and 2014/15, the number of cattle slaughtered for bTB control (per 1,000 cattle) declined overall from 21 to 11 (Figure 5.3). However, nearly all of this decrease was seen in 2013/14, and there was actually a small increase in the latest year. The trend in the CA is similar, although with lower numbers of cattle slaughtered. Comparatively, a stable trend was observed in herds over 40 km from the IAA with the average number of cattle slaughtered for bTB control in these areas remaining between 4 and 5, per 1,000 cattle, the same period.

The number of cattle slaughtered for bTB control per 1,000 cattle in the IAA has consistently been higher than in the CA. In 2014/15, this was around twice as many in the IAA compared with the CA, a difference that has been observed since 2012/13. This has reduced from around 3 times as many in 2011/12.

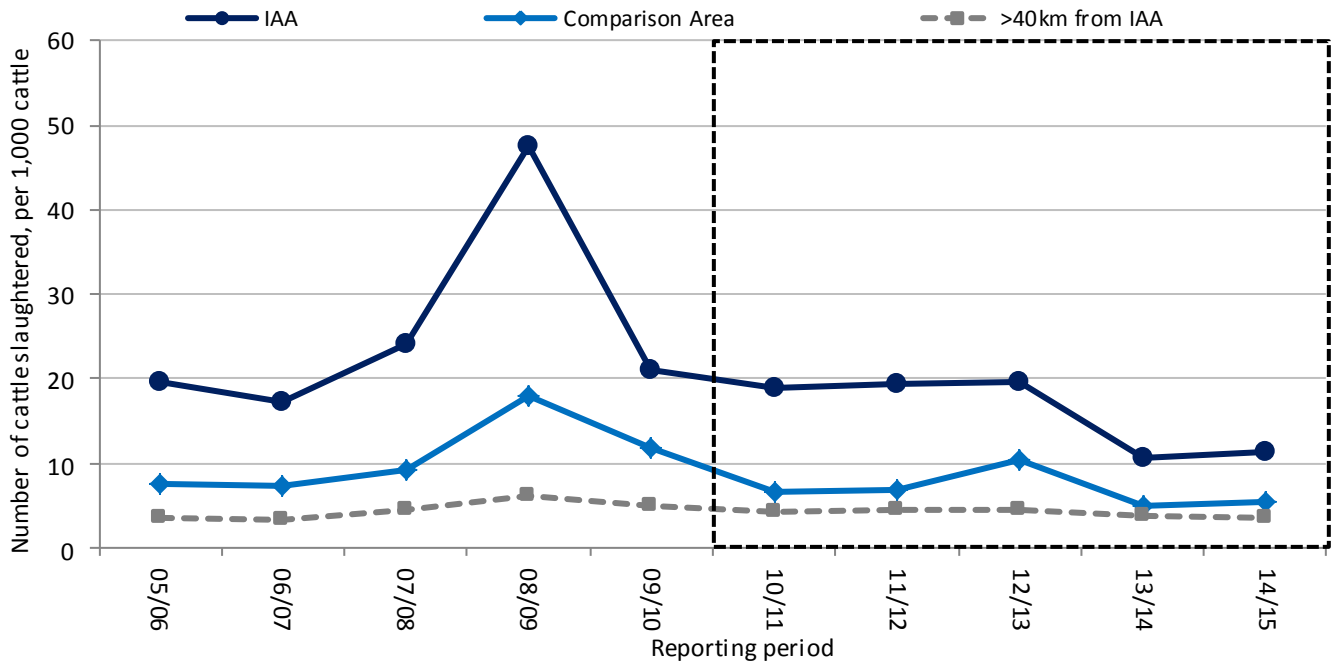


Figure 5.3 – Cattle slaughtered for bTB control (excluding slaughterhouse cases), per 1,000 cattle

The pattern in the number of tuberculin skin test reactors (Figure 5.4) is very similar to the pattern in the number of cattle removed for bTB control (Figure 5.3) and the number of skin test reactors per 1,000 tests (Figure 3.3), as would be expected.

As with the number of cattle slaughtered for bTB control per 1,000 cattle, in 2014/15, the IAA saw around twice as many skin test reactors per 1,000 cattle when compared with the CA. However, unlike the number of cattle slaughtered, the proportion of skin test reactors in the IAA compared to the CA has generally remained consistent since prior to the implementation of the IAA.

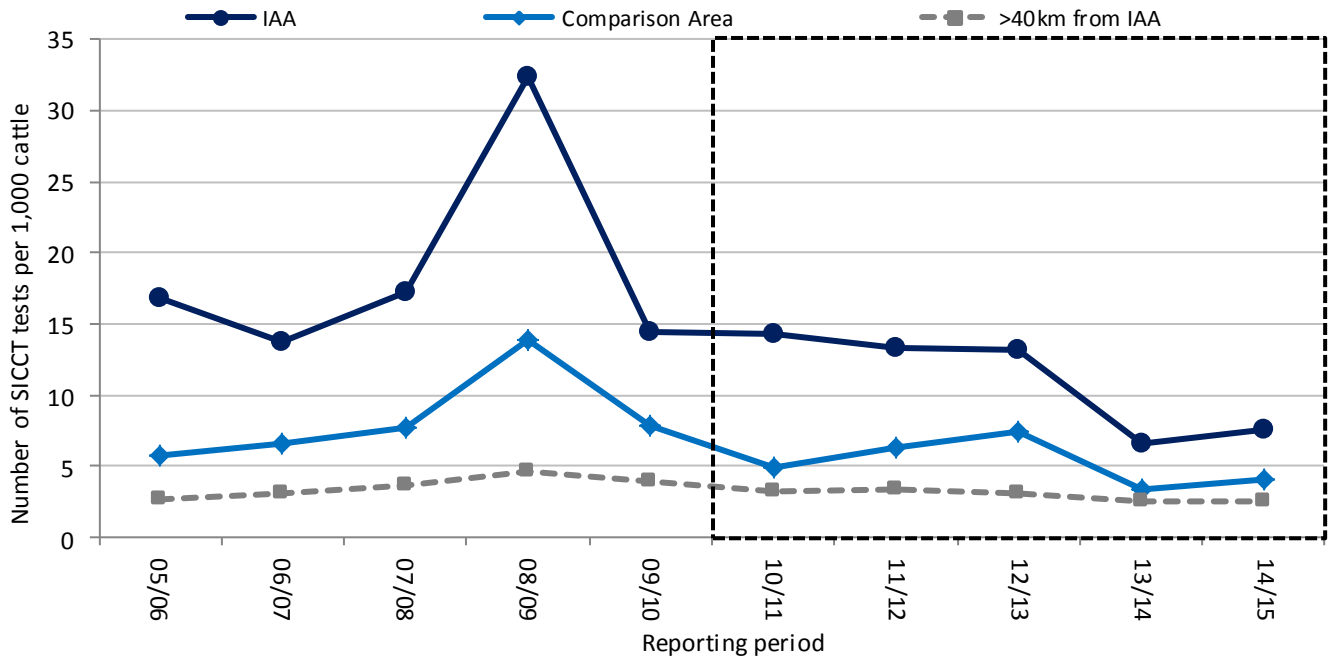


Figure 5.4 – SICCT reactors per 1,000 cattle

The number of skin test reactors with post-mortem evidence of bTB (visibly-lesioned reactors or *M. bovis* culture positive animals) per 1,000 cattle followed a similar pattern to the number of skin test reactors (Figures 3.3 and 3.4) although on a lower scale, as would be expected (Figure 5.5). In the IAA the number of reactors with post-mortem evidence was relatively stable, between 3 and 4 per 1,000 cattle, until the latest year, which saw an increase to 5 per 1,000 cattle.

As with the IAA, the CA has seen stable numbers of skin test reactors with post-mortem evidence since 2010/11. However, the increase in the CA into 2014/15 was less pronounced in the CA. The proportion in the CA has consistently been close to the proportion in herds more than 40km from the IAA, currently around 1 per 1,000 cattle.

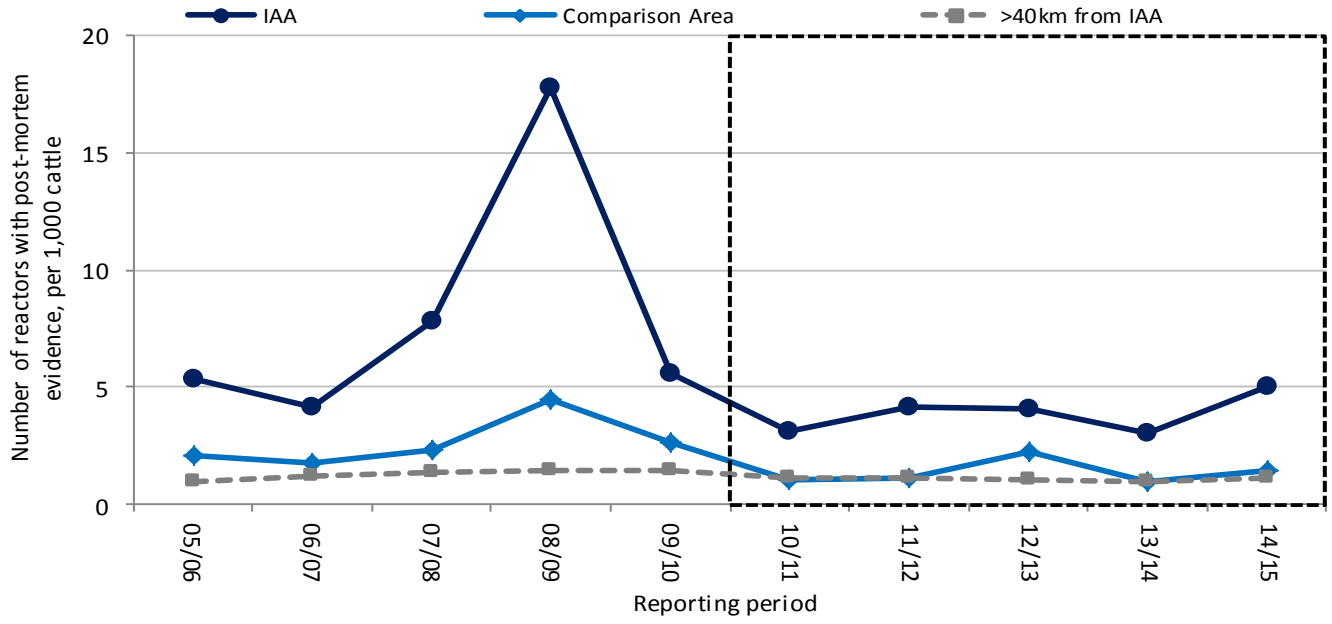


Figure 5.5 – Reactors found with post-mortem evidence of M. bovis, per 1,000 cattle

Some animals are identified as positive bTB cases during routine inspection at slaughter. These are known as slaughterhouse cases and the numbers are persistently low (less than 1 animal per 10,000 cattle in Wales). Because these cases are rare, apparent trends over the short term are sensitive to relatively small changes, meaning that the series is inevitably quite unstable. Because the IAA and the CA are themselves relatively small areas, the numbers of these cases are very small and no obvious long-term trend emerges from the data (Figure 5.6).

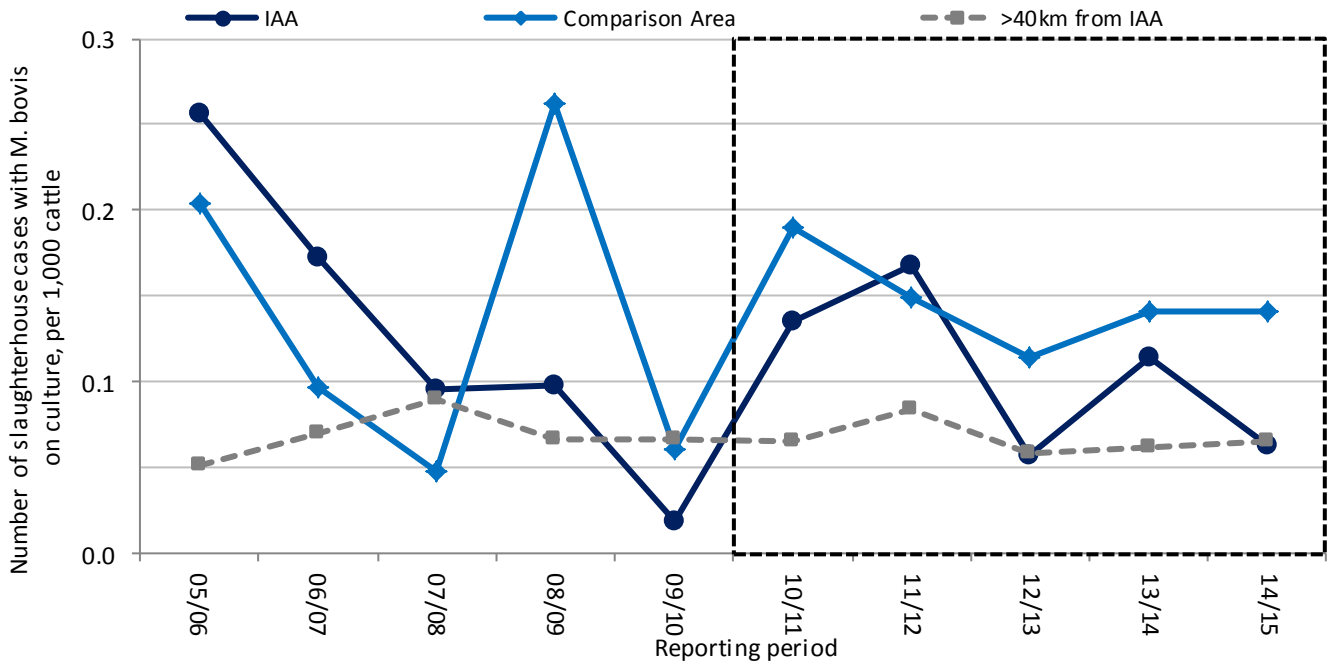


Figure 5.6 – Slaughterhouse cases found to have M. bovis on culture, per 1,000 cattle in the population

Duration and lifting of restrictions

Highlights

- The proportion of IAA herds having restrictions lifted, and the median duration of OTF-W incidents, remained steady in 2014/15
- There was a relative decrease in median duration of incidents in the IAA of around 31% between 2009/10 and 2014/15, compared to 26% in the CA (Figure 6.1).

The median duration of incidents has been variable across all areas over the past decade, although a more consistent trend emerges for OTF-W incidents (Figure 6.1) compared with OTF-S incidents (Figure 6.2), probably because of the greater number of OTF-W incidents. The median duration of OTF-W incidents in the IAA fell in 2014/15, a trend also seen in the the CA. There was a slight downward trend in the median duration of OTF-W incidents in the IAA over the long term, although there were some intermittent increases. Since the IAA was established there has been a decrease of 31%, from around 13 months to around 9 months.

In the CA, it is difficult to discern a long-term trend, although there has been a decrease of 26% since 2009/10, from around 14 months to around 9 months. The median duration of OTF-W incidents in Welsh herds over 40 km from the IAA boundary has consistently remained around 7 months since 2005/06.

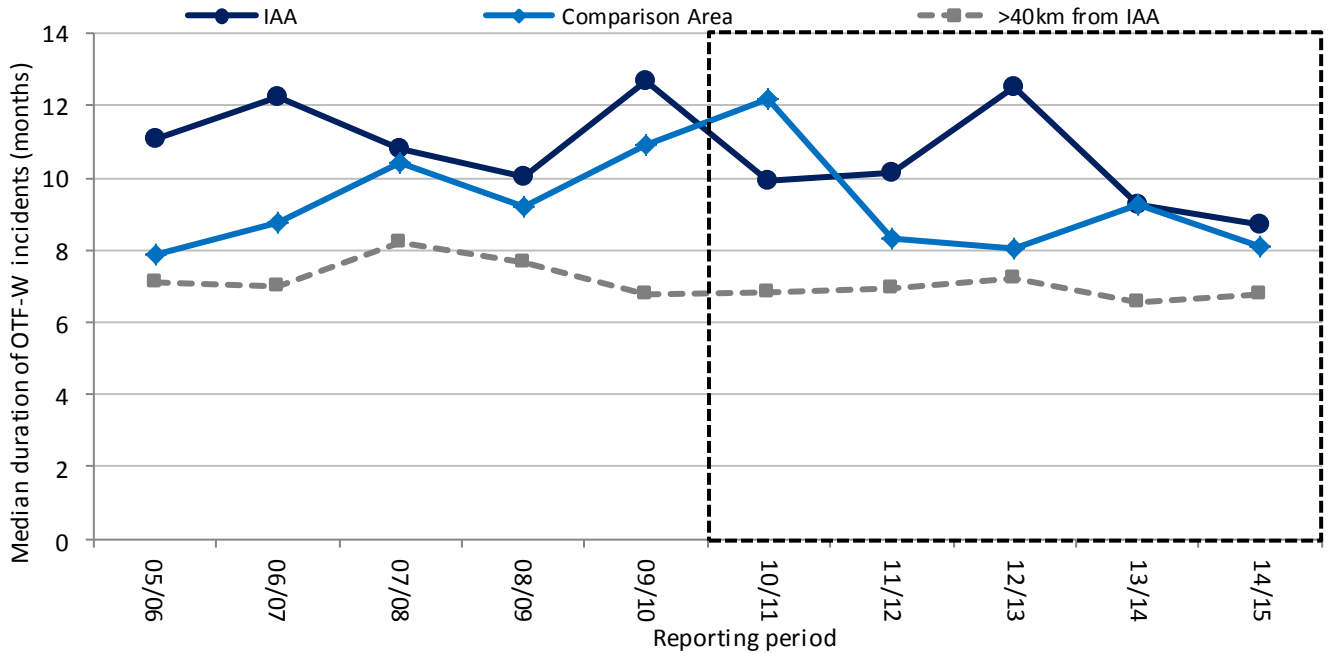


Figure 6.1 – Median duration of OTF-W incidents ending in each reporting period (months)

As identified in previous reports, the median duration of OTF-S incidents tends to be volatile because there are few of them, particularly in small areas such as the IAA and the CA (Figure 6.2). There was only one OTF-S incident in the IAA ending in 2014/15, compared to four in 2013/14 and eight in 2012/13.. The median duration of OTF-S incidents in herds over 40 km from the IAA boundary has been relatively stable, between 3 and 4 months over the past decade.

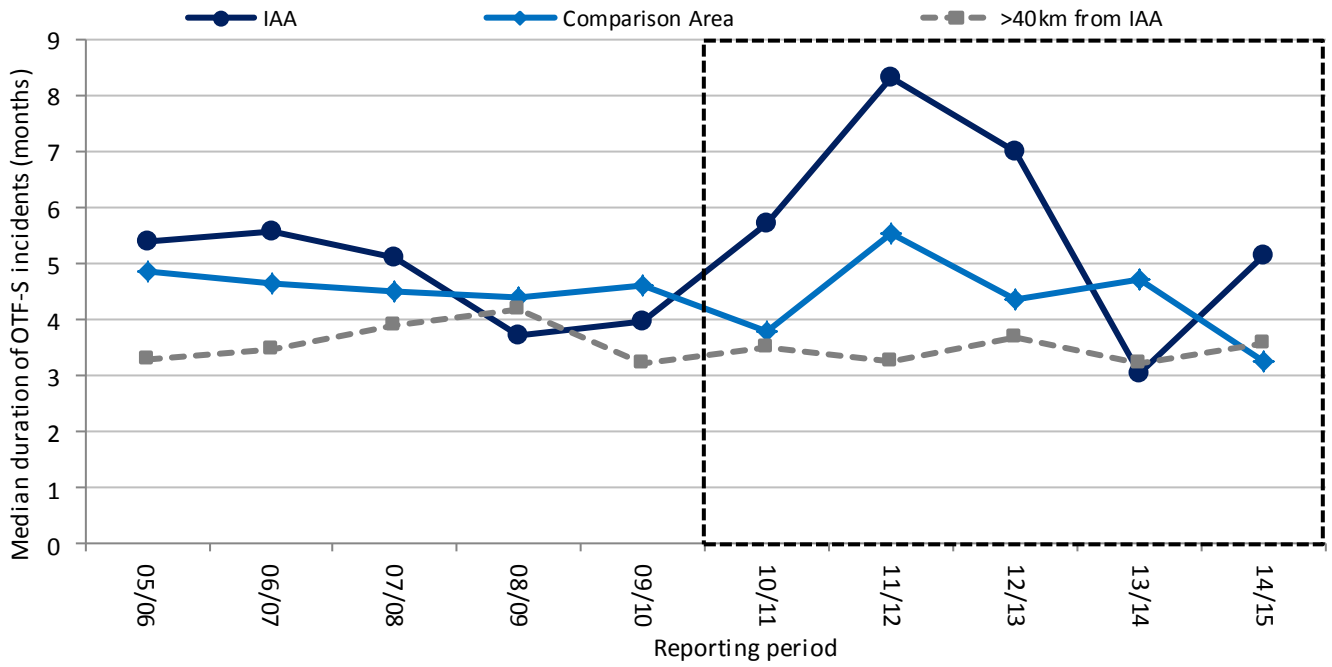


Figure 6.2 – Median duration of OTF-S incidents ending in each reporting period (months)

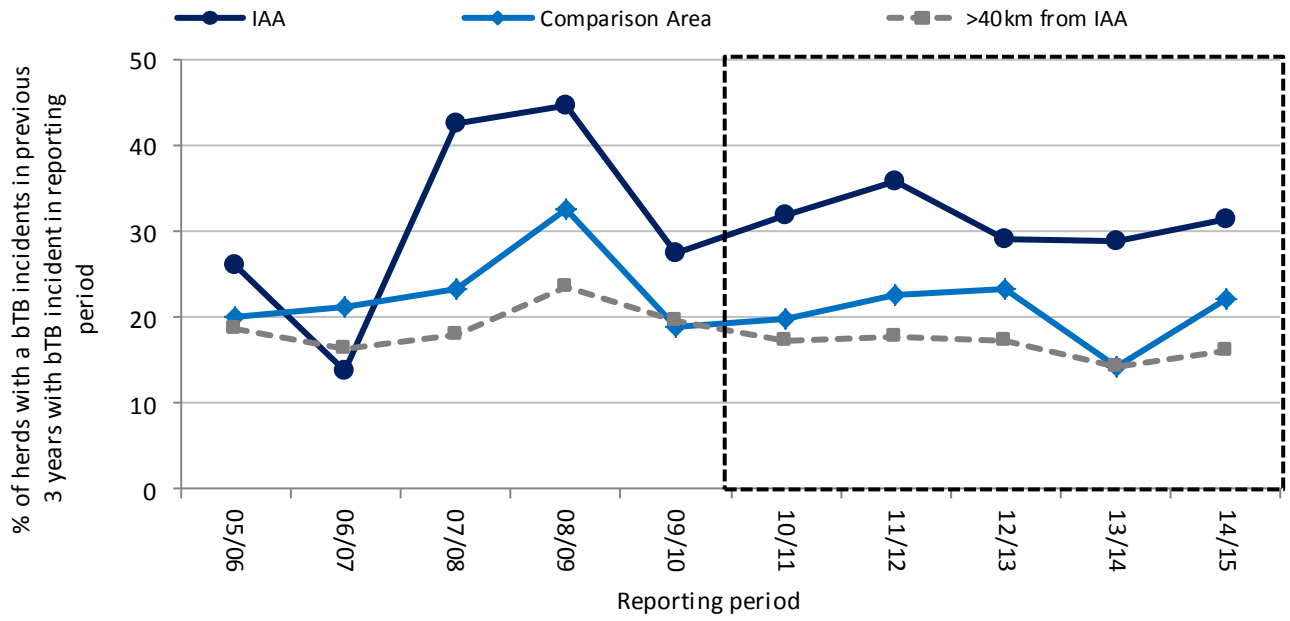
Recurrence of bovine TB

Highlights

- There were 419 recurrent incidents in Wales between 1st May 2014 and 31st April 2015 (Table 7.1).
- 32% of herds in the IAA had a recurrent bTB incident compared to 22% of herds in the CA in 2014/15 (Figure 7.1).

A recurrent incident is defined as the first bTB incident disclosed during the *current period* (i.e. 2014/15) where the herd had been under restriction for bTB at any time during the *history period.* The *history period* refers to the 36 months preceding the start date of the recurrent incident, or where there is no recurrent incident in the herd, is the 36 months prior to the mid-point of the *current period*[2]. The figures presented here show the proportion of historical incidents that recurred – for example a recurrence rate of 20% would mean that, of the herds which had an incident in the previous 36 months, 20% went on to have an incident in the reporting period.

Following an initial increase in recurrence after the start of the IAA to 36% in 2011/12, recurrence fell to the pre-IAA level and subsequently increased slightly. In 2014/15 it stood at 32% (Figure 7.1). An increase in recurrence was also observed in the CA, from a low of 14% in 2013/14 to 22% in 2014/15. This increasing trend was also seen to some extent in herds over 40 km from the IAA. Recurrence levels in the IAA are persistently higher than in the CA and other parts of Wales, and there is no clear evidence to suggest a change in this pattern.



[2] Since herds must be free from restriction in the current period long enough for a six-month check test to be performed, herds under restriction for the first four months (due to a prior incident) were excluded from the analyses

Figure 7.1 – Proportion of herds that had a bTB incident in the previous 3 years that had an incident in each reporting period

Table 7.1 describes recurrence in Welsh herds. There were 419 recurrent incidents in all of Wales during the period 1st May 2014 to 30th April 2015, and the time elapsed between incidents ranged from 1 to 36 months with a median of 16 months. Generally the number and type of recurrent bTB incidents, across all areas in 2014/15, is similar to that seen in 2013/14.

Overall, the median unrestricted time between incidents was shorter in the IAA compared with the CA irrespective of the current and previous incident type. This is consistent with the pattern described above – recurrence is a bigger issue in the IAA, with incident herds less likely to stay free from bTB than in the CA and other parts of Wales.

Overall in Wales the median unrestricted time between the last incident in the history period and the first incident in 2014/15 was shorter when the previous incident was OTF-W than when the previous incident was OTF-S. However, for each previous incident type, the median time between incidents tended to be shorter when the 2014/15 incident was OTF-S rather than OTF-W.

Table 7.1: Time elapsed between the end of movement restrictions in the most recent TB incident in the previous 3 years and the start date of the first incident in the current period

Area	Previous incident type[1]	New incident type[2]	Time elapsed (months)[3]					
			Mean	Median	SD	Minimum	Maximum	Count
IAA	OTF-W	OTF-W	15	13	9	3	29	31
	OTF-W	OTF-S	5	5	n/a	5	5	1
	OTF-W	Any	15	12	9	3	29	32
	OTF-S	OTF-W	18	16	13	6	35	4
	OTF-S	OTF-S	n/a	n/a	n/a	n/a	n/a	n/a
	OTF-S	Any	18	16	13	6	35	4
	Any	OTF-W	15	13	9	3	35	35
	Any	OTF-S	5	5	n/a	5	5	1
	Any	Any	15	13	9	3	35	36

Area	Previous incident type[1]	New incident type[2]	Time elapsed (months)[3]					
			Mean	Median	SD	Minimum	Maximum	Count
Comparison Area	OTF-W	OTF-W	17	17	8	1	36	54
	OTF-W	OTF-S	17	20	5	11	21	3
	OTF-W	Any	17	17	8	1	36	57
	OTF-S	OTF-W	23	25	8	11	31	4
	OTF-S	OTF-S	18	18	17	6	30	2
	OTF-S	Any	21	25	10	6	31	6
	Any	OTF-W	18	17	8	1	36	58
	Any	OTF-S	18	20	9	6	30	5
	Any	Any	18	18	8	1	36	63

Area	Previous incident type[1]	New incident type[2]	Time elapsed (months)[3]					
			Mean	Median	SD	Minimum	Maximum	Count
Over 40 km	OTF-W	OTF-W	16	15	9	4	34	141
	OTF-W	OTF-S	4	4	n/a	4	4	1
	OTF-W	Any	16	15	9	4	34	142
	OTF-S	OTF-W	21	21	8	6	34	26
	OTF-S	OTF-S	17	18	10	5	35	21
	OTF-S	Any	20	19	9	5	35	47
	Any	OTF-W	17	17	9	4	34	167
	Any	OTF-S	17	18	10	4	35	22
	Any	Any	17	17	9	4	35	189

Area	Previous incident type[1]	New incident type[2]	Time elapsed (months)[3]					
			Mean	Median	SD	Minimum	Maximum	Count
All Welsh Herds	OTF-W	OTF-W	16	15	9	1	36	345
	OTF-W	OTF-S	12	11	7	4	21	7
	OTF-W	Any	16	15	9	1	36	352
	OTF-S	OTF-W	22	21	8	6	35	43
	OTF-S	OTF-S	18	19	10	5	35	24
	OTF-S	Any	20	20	9	5	35	67
	Any	OTF-W	16	16	9	1	36	388
	Any	OTF-S	17	17	10	4	35	31
	Any	Any	16	16	9	1	36	419

[1] Any: The most recent incident in the history period regardless of whether OTF-S or OTF-W incident; OTF-W: the last incident where the last incident was OTF-W; OTF-S: the last incident where the last incident was OTF-S

[2] Any: OTF-S or OTF-W incident(s) between 1st May 2014 and 30th April 2015 (the current period); OTF-W: OTF-W incident(s) occurred at any time in current period (not necessarily the first); OTF-S: only OTF-S incident(s) occurred in current period

[3] Includes only recurrent incidents where the preceding incident ended in the period 36-months prior to this incident. Time elapsed was calculated as the number of days between the end of the last incident and the start of the first new incident in the current period. If the first incident in the current period was OTF-S but the herd subsequently had an OTF-W incident, the new incident type is shown as OTF-W but the date of the first incident (OTF-S) is used to calculate the time elapsed.

Number of reactors per incident

Highlights

- Overall reductions in the number of reactors per incident of 40% and 36% were observed in the IAA and CA, respectively, between 2009/10 and 2014/15 (Figure 8.1).
- Although the long-term trend for the number of reactors with post-mortem evidence of disease is down, there was an increase in the latest year in the IAA and the CA of around 65% (Figure 8.2).

The average number of reactors per incident in the IAA has decreased from 13 in 2009/10 to 8 in 2014/15, a relative reduction of 40% (Figure 8.1). Similarly, in the CA it has decreased from 8 to 5, a reduction of 36%. The trend in the IAA is less stable than in the CA and this is likely to be because the IAA is smaller. Further afield in Wales, the average number of reactors in herds more than 40 km from the IAA has remained between 4 and 5 over the past decade.

Despite a relatively small increase in the IAA in the most recent period, overall the average number of reactors per incident appears to be approaching similar levels to those observed in the CA and in herds 40 km from the IAA. The overall reduction is similar between the IAA and CA (40% vs. 36%). It is considered likely that the high reductions in the IAA in recent years, compared to the CA, may reflect the fact that increases in testing frequency result in incidents being identified sooner, meaning that the disease has less time to spread and the number of infected cattle will be smaller.

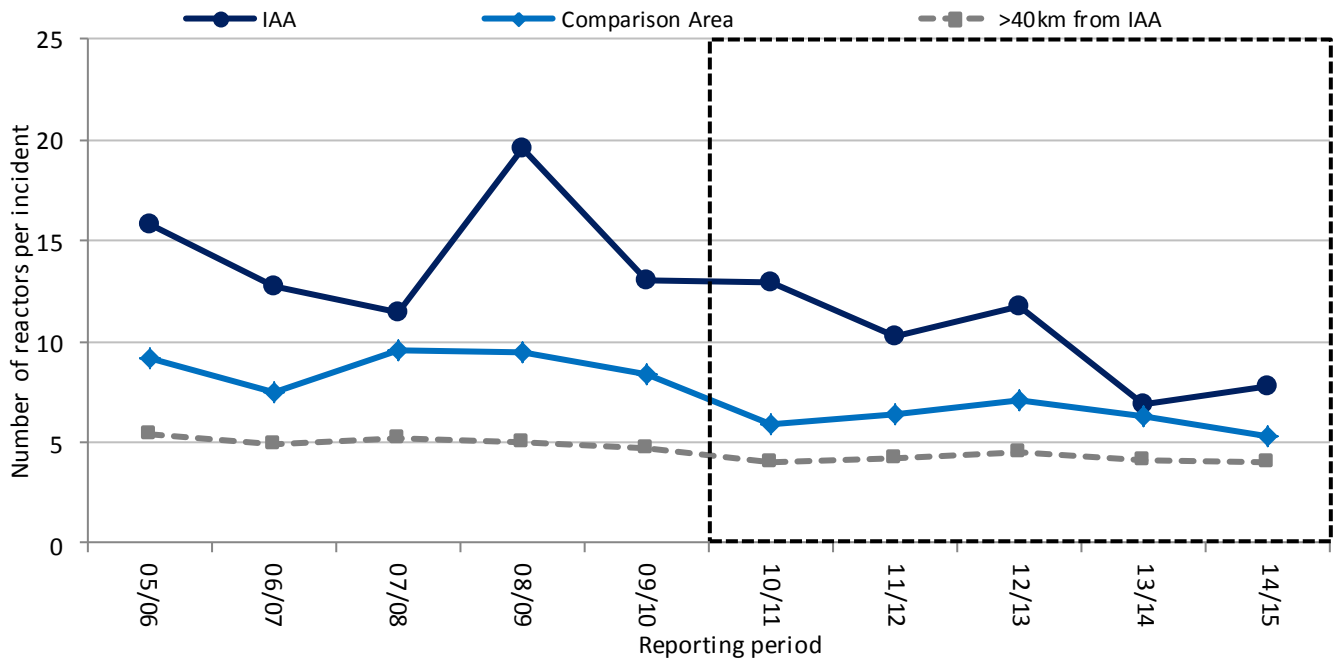


Figure 8.1 – Reactors per incident

Figure 8.2 shows the average number of evidently infected animals (visibly lesioned reactors or *M. bovis* culture positive animals) per OTF-W incident. Following a sharp decrease in the two years to 2010/11, the numbers have varied between 2 and 4 animals per incident in the IAA. Broadly, the pattern in the CA is similar. In both areas there was an increase in the latest year of 65%. Despite these increases, overall decreases in the number of reactors with post-mortem evidence of 41% and 22% were seen in the IAA and CA respectively between 2009/10 and 2014/15.The average number of evidently infected animals in herds more than 40 km from the IAA has remained between 2 and 4 since prior to the implementation of the IAA.

Much of the decrease in the IAA since it was established is likely to be attributable to increases in testing frequency, since this increases the likelihood of identifying the disease in its early stages, when physical evidence is less likely to be present at post-mortem inspection.

In addition, across Wales the classification of incidents as OTF-W-2 will contribute to a decrease in the number of reactors with post-mortem evidence of bTB infection as this results in unconfirmed animals being included in the OTF-W cohort.

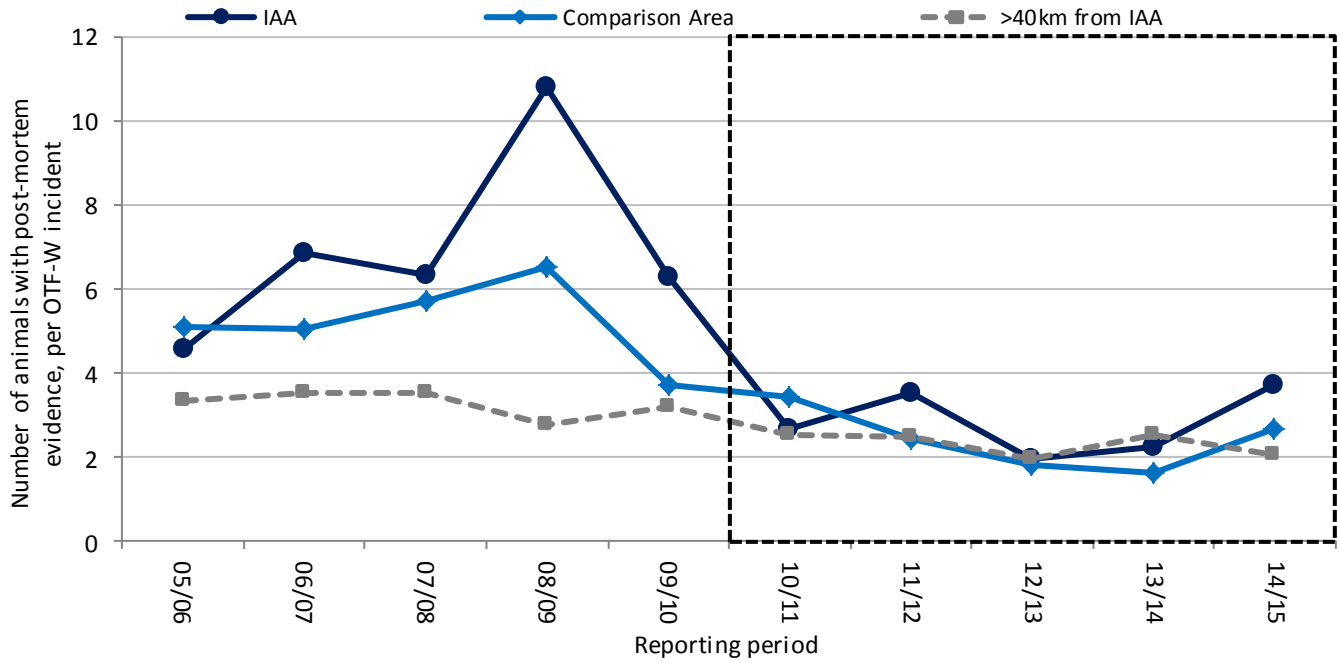


Figure 8.2 – Animals with post-mortem evidence of M. bovis, per OTF-W incident

Appendix 1: Source data quality statement

Herd denominator data from 2009 to the present have been obtained from the APHA's SAM database. Data prior to this has been obtained from a combination of SAM and its predecessor VetNet, due to activity periods of herds commencing only from 2008 in SAM when it was launched. There have been some on-going issues with the TB testing data compiled in the SAM system since its inception. These data issues have been improving and there is now more confidence in the dataset.

In 2013/14, it was noted that there were some minor differences in the herd denominator data presented in that report, compared to earlier reports. There are two reasons for this:

1. Prior to 2013/14, the denominator for herds in each period was calculated as herds that were active for at least six months of the reporting period. From 2013/14, the denominator has been herds in existence at the end of each reporting period (mid-April). This is to provide consistency between the annual bTB surveillance report for Wales and the GB National Statistics. As such, the denominator data for all historic reporting periods was revised.

2. Herds are identified as being located in the IAA based upon lists provided by field staff (as described in the Methods section of this report). The population of herds in the IAA is constantly changing and so the number of herds on these lists fluctuates from month to month. Any herds that have been active in the IAA at any time, according to the field lists, are labelled in this report as IAA herds. However, on some occasions the dates between which herds are marked as active in SAM don't quite match with the dates that herds appear on the lists maintained by the field staff. As such, the number of herds active in the IAA at a single point in time (i.e. the end of the reporting period) as listed in SAM, may be slightly different to the number on the field lists. This has led to some changes to the IAA herd denominator in previous years following the revision of the data for all historic reporting periods as described above.

Despite these minor discrepancies, SAM is the most accurate source of cattle TB data available and is used for all analyses of cattle bTB in GB conducted by APHA. It is important to ensure that the same methodology is used to produce the data for each reporting period so that any trends can be accurately interpreted. For this reason, and to ensure that there is consistency between other bTB publications, the revised data used for the 2014 report will continue to be used in future reports. Therefore herd denominator data differences may be observable between reports subsequent to 2013/14 and those relating to 2012/13 or earlier.

A TB10 form is issued at the end of a bTB incident to lift the restrictions imposed on cattle movements onto and off the holding. Inaccurate or missing TB10 information has been a serious issue within SAM and effort has been made to reduce their frequency since the 2012 annual surveillance report for Wales. The situation is now much improved although there are still a number of incidents with obviously incorrect TB10 dates which we endeavour to adjust to a more realistic date based on testing history. It should be noted that management of the closure of incidents involves the receipt of a BT5 form which provides evidence of cleansing and disinfection on the incident premises. This is required before a TB10 can be issued to formally close the incident. Delays to the BT5 receipt or non-receipt at all will artificially prolong the duration of incidents, which in effect should last until the final clearing skin test.

The delay in the issuing of TB10s can lead to non-control tests occurring when the herd appears to be under restrictions. Conversely, control tests such as short interval tests may also appear in unrestricted herds. This is often explained by herds being connected to herds which have suffered a bTB incident.

Appendix 2: OTF-W-2

Until January 2011 the only bTB incidents in which officially TB free status was withdrawn (OTF-W) in Wales were those in which post-mortem evidence of *Mycobacterium bovis* infection was identified in at least one slaughtered animal (see Appendix table A1 for more detail).

In January 2011 changes were implemented which meant that an additional cohort of incidents would also be categorised and managed as OTF-W from then on. These were a subset of previously OTF-S incidents that met defined epidemiological criteria. These criteria included herds with a pre-existing history of infection with bTB, consideration of the local disease situation and where an additional epidemiological risk is identified by the APHA. This cohort has become known as OTF-W-2. In common with other herds where OTF status is withdrawn (OTF-W), two consecutive clear herd tests are required to restore their OTF status rather than the single clear test required by herds with only a suspended OTF status (OTF-S), and their first short interval test read at severe interpretation.

The OTF-W-2 cohort is a subset of OTF-W. Efforts have been made to identify this group and include them within the OTF-W cohort in this report. Incidents classified in SAM as OTF-W-2 that occurred from the start of 2013 have been validated by cross-checking SAM data against the raw data collected by regional offices. This validation has not been possible for OTF-W-2 incidents that occurred in the calendar years of 2011 and 2012. For these incidents, unvalidated classification in SAM has been used. This may result in some incidents in these two years (and subsequently the time periods 2010/11, 2011/12 and 2012/13) being wrongly classified, but it should give a better indication of the proportion of incidents that are OTF-W than has previously been presented.

As a result of the inclusion of OTF-W-2 incidents within the OTF-W cohort, the proportion of incidents which are classified as OTF-W since 2011 is higher in this report compared to previous versions of the report.

Appendix 3: Enhanced biosecurity and bTB testing regime changes in the IAA

The additional cattle controls in the IAA comprised enhanced biosecurity and changes to bTB testing regimes. They include:

(1) restricting cattle movements within the IAA and between the inside and outside of the IAA, involving revocation of Sole Occupancy Authorities (SOAs) with stricter control on reallocation, withdrawal of BCMS linkages between herds, etc.;

(2) use of source & spread tracing in OTF-S (in addition to the mandatory tracing in OTF-W herds), and

(3) A programme of badger vaccination commenced in May 2012. Reports for years one, two and three can be found at: http://new.wales.gov.uk/topics/environmentcountryside/ahw/disease/bovinetuberculosis/intensive-action-area/badger-vaccination-iaa/?lang=en

Enhanced testing has increased the number of tests applied to animals in herds, with a potential impact on surveillance statistics:

(1) the frequency of periodic surveillance testing of whole herds has been increased from 12-monthly to six-monthly;

(2) use of the interferon-gamma (IFN-g) blood test has been encouraged in the IAA and is currently being applied to aide in clearing infection in herds that have suffered repeat incidents[3]. The IFN-g test has been used to improve the sensitivity of testing animals in such herds in the IAA, but has not been used to disclose new bTB incidents.

[3] http://gov.wales/topics/environmentcountryside/ahw/disease/bovinetuberculosis/intensive-action-area/cattle-controls-iaa/?lang=en

Appendix 4: Methods

This report shows the trends in indicators of bTB in herds registered as using land in the IAA, in a 2-km buffer around the IAA, in a Comparison Area (CA) between 16 and 40 km from the edge of the IAA, and in Wales further than 40 km from the IAA.

Reporting periods

Reporting periods begin on 1st May and end on 30th April the following year.

In previous reports, the denominator for herds in period was calculated as herds that were active for at least six months of the reporting period. From 2013/14 report onwards, the denominator is herds in existence at the end of the reporting period (end of April). This is to provide consistency between the annual bTB surveillance report for Wales, and the GB National Statistics.

Definition, selection and location of IAA and Comparison Areas

The identity of all herds registered in the IAA was provided by the Welsh APHA field services team at the start of the compilation of this report. In several cases the map reference attributed to an IAA herd in SAM 6 was outside the IAA geographical area, but this was not considered an error because many herds in the IAA do not use land in the IAA continuously. Herds with bTB located in the 2 km wide buffer around the IAA are assessed because of the proximity of the herds to the IAA. However non-IAA herds with bTB and map references between 2 and 16 km from the edge of the IAA are excluded from the report because the degree to which they have contact with IAA herds is uncertain.

The selection of the Comparison Area had to achieve a compromise between matching for bTB incidence rate and matching for environmental, cultural and technical influences. The nearest set of herds with a bTB incidence rate almost equal to that in the IAA herds was over 100 km away. In order to ensure similar influences on bTB in the IAA and CA herds, CA herds that were close to the IAA were preferred. It was necessary to select herds having map references at least 16 km from the edge of the IAA to reduce the likelihood that herds in the CA would use land in the IAA. A CA was selected that was as near to the IAA as this limit permitted but in order to ensure an adequate number of bTB incidents in the CA it necessarily had a larger number of herds and cattle than in the IAA. In the CA the absolute number of bTB incidents was actually slightly larger than in the IAA, which should in theory supports statistical comparisons. The CA extends to 40 km from the edge of the IAA and includes a large section of Carmarthenshire. The CA occupies a band 16-40 km from the IAA, but two parts of the band where bTB herd incidence is low have been excluded.

For non-IAA herds, a list of all herds active at any point between 1st May 2005 and 30th April 2015 was created, and herds allocated to areas based on their map references. This is consistent with previous reports. Any herds that were classified as IAA herds by the field services team, but were identified as being outside the IAA based on their map references, retained their area allocation of IAA. Any herds that were identified as being in the IAA based on their map reference, but were not on the list provided by the field services team, were investigated. Reasons for discrepancies includes herds which were archived prior to 2010 (commencement of the IAA) which were given a final area allocation of IAA, and herds which had no or very few animals, and so were given a final area allocation of Excluded.

The lines on the plots for the 2-km buffer of the IAA are often irregular in direction and sometimes exceptionally low or high. This is a result of the small number of denominator herds

(129 in 2010, 115 in 2014). Because of the small denominator, minor changes in the statistics caused by the change in the calculation of denominator data described above will be more apparent for this area when compared to previous reports.

Appendix Table A1: Glossary of definitions and descriptions

Short name	Full name	Definition or description
/ year	Annualised	Calculation of ratios and proportions from annual totals or averages. For example, the annualised OTF-W incidence is the *total* number of new OTF-W incidents in a year divided by the *average* number of OTF herds that are active in that year
bTB	Bovine tuberculosis	Infection with *Mycobacterium bovis*, including suspected infection not confirmed by slaughterhouse infection
DC	Dangerous contact	An animal in a herd from which OTF status has been withdrawn and is not a reactor or clinical case, but is slaughtered for bTB control because veterinary judgment considers that the risk of having and spreading infection is high.
Herd size	Herd size	For a bTB incident (OTF-S or OTF-W), herd size is the largest number entered in SAM at any time during the incident. For officially bTB free herds, herd size is the size recorded at the most recent testing occasion.
Herd types	Herd types	'***Beef'*** *includes* Beef, Beef Fattener, Beef Suckler and Stores herds '***Dairy***' includes Dairy, Dairy Dealer, Dairy (Other), Dairy Producer-Retailer, House Cow and Producer herds; '***Other'*** (where shown) includes Calf Rearers, Heifer Rearers, Heifer, Mixed, City Farm, Dealer Herds, and herds described in SAM as 'Other herds'.
Incidence	[Herd] incidence, incidence rate	Herd incidence rate is the ratio between the number of detected bTB incidents of a given type and a denominator for the population, which is the number of unrestricted active herds, regardless of whether they have been tuberculin tested.
Incident	Incident	A bTB *incident* refers to one herd not previously under movement *restrictions* in which at least one test reactor or a culture-positive slaughterhouse case has been found, and also a retested inconclusive reactor (2xIR) in Wales since 2009. The *restriction*, and thus the incident, commences on the date of the disclosing test, and ends on the date that *Form TB10* is issued. A herd may commence more than one TB incident in the same year.
IAA	Intensive Action Area	An area with high bTB prevalence in North Pembrokeshire, adjacent to Ceredigion, in which enhanced cattle control measures (including twice-yearly routine testing and enhanced testing for OTF-S incidents) have been applied since May 2010.
IR	Inconclusive Reactor	An animal showing a particular pattern of reactions to a SICCT test. *If an animal has an inconclusive reactor (IR) test result and is slaughtered as a result, it can be reclassified as a reactor.*
2 km buffer	IAA buffer (2 km)	All land between the boundary of the IAA and 2km outside the boundary.
CA	Comparison Area or comparison herds	A selected area between 16 and 40 km from the boundary of the IAA in which the incidence of bTB had been relatively high between 1st May 2005 and 30th April 2010. Herds with map references in the Comparison Area are termed Comparison Herds.
Active IAA herd or live IAA CPHH	Live herd or Active herd registered in the IAA	A bovine herd identified using the County/Parish/Holding/Herd notation. Live IAA herds are defined by SAM data as being *active* at the end of each 12-month period. A herd is *active* for the period between its first registration ("Live" date) and it's reported closing date ("Archive" date). *IAA herds are designated as being in the IAA by the APHA field surveillance team.*

Short name	Full name	Definition or description
Active non-IAA herd or live non-IAA CPHH	Live herd or Active herd (not registered in the IAA)	A bovine herd identified using the County/Parish/Holding/Herd notation. Live non-IAA herds are defined by SAM data as being *active* at the end of each 12-month period. A herd is *active* for the period between its first registration ("Live" date) and it's reported closing date ("Archive" date). The number of non-IAA herds depends on the accuracy of active and inactive dates given in SAM, and differs from the number given in Agricultural Censuses (which involves sampling and extrapolation) or CTS (unsuitable because of aggregation at the CPH level). *The geographical area (Comparison Area, 2-km Buffer etc.) in which a non-IAA herd is located depends solely on the Easting and Northing coordinates recorded in SAM.*
M. bovis	*Mycobacterium bovis*	The causative organism of bovine tuberculosis
Movement restrictions	Movement restrictions	Prohibitions on the free movement of animals into and out of a herd because of the presence or suspicion of *M. bovis* infection (these can also be imposed because statutory tests are overdue). The number of herds under restriction is calculated at given time points. Herds under restriction during a 12-month period are here calculated as the average number at the beginning and end of the period. *Herd restrictions due to overdue tests are excluded from analyses in this report because precise data is unavailable and to avoid overestimating disease.*
New incident	New bTB incident	A newly disclosed *incident* in a herd that was previously OTF.
OTF	Officially Bovine Tuberculosis Free	The state of a herd ***not*** being under restriction because of withdrawal or suspension of Officially TB Free status. A full definition of *Officially TB Free status* appears in Appendix 3 of European Union (1998), Council Directive 98/46/EC. *The terms OTF, OTF suspended and OTF withdrawn were introduced on 1st January 2011, and have been used retrospectively to describe the status of all herds.*
OTF-S	Officially Bovine Tuberculosis Free status Suspended	For the purposes of this report, OTF-S is the status of a herd *restricted* because of a bTB incident where there is suspicion of infection being present but the criteria for OTF withdrawal have not been reached. *OTF suspension due to overdue testing is not reported here*
OTF-W	Officially Bovine Tuberculosis Free status Withdrawn	For the purpose of this report, OTF-W refers to a herd *restricted* because of a bTB incident in which appropriate evidence of *M. bovis* infection has been obtained in at least one slaughtered animal, i.e. *M. bovis* has been identified in a cultured tissue sample and/or lesions are detected in the carcass of a SICCT or IFN-γ test reactor. Slaughterhouse cases with visible lesions typical of bTB result in suspension of OTF status, which is changed to *withdrawal of OTF status* if *M. bovis* has been identified in cultured tissues. It also includes herds restricted because of a bTB incident that has been classified as OTF-W-2 based on epidemiological reasoning.
PME	*Post mortem* examination	Examination (to various extents) of the carcass and organs of slaughtered cattle for suspected lesions of bovine TB. Such post mortem examinations include those at an APHA Regional Laboratory, those at the slaughterhouse of animals suspected of being infected (e.g. reactors, IRs and DCs), and those constituting routine meat inspection
Reactor	Reactor	An animal showing a particular pattern of reactions to a SICCT test or to a gamma interferon (IFN-g) assay that uses bovine and avian tuberculin reagents, not including an animal first suspected to have bTB at the slaughterhouse. *If an animal has an inconclusive reactor (IR) test result and is slaughtered as a result, it can be reclassified as a reactor.*

Short name	Full name	Definition or description
SICCT	Single Intradermal Comparative Cervical Test	Also commonly referred to as the 'skin test' or 'tuberculin skin test', the testing procedure involves the injection of small amounts of *M. bovis* and *M. avium* tuberculins (PPD) into two sites of the skin of the animal's neck, followed by a comparative measurement of any delayed-type hypersensitivity reaction (hard swelling or oedema) which develops at the injection sites after 72 hours. Each tuberculin is a mixture of antigens in the form of purified protein derivative (PPD) of the cell wall of a standard strain of *M. bovis* or *M. avium*
Total cattle	Total cattle	The total of the herd sizes given for herds in SAM. These sizes have been recorded by the veterinarian who performed a most recent skin test, generally the most recent test before the 31st July following the 12-month period being reported. Where no herd size has been retrievable from the testing history, the estimate of herd size in SAM has been used.
VE-SlHo	(Confirmed) slaughterhouse case	The finding of visible lesions from which *M. bovis* can be cultured in a bovine animal that had not been under suspicion for bTB at the time of slaughter. The finding of a slaughterhouse case in a herd not under OTF-W movement restrictions leads to the withdrawal of OTF status; the finding of a slaughterhouse case in a herd already under OTF-W restrictions is recorded in SAM but does not disclose a new incident.
TB10	Form TB10	The name of the form issued at the end of a bTB incident to lift the restrictions imposed on cattle movements onto and off the holding.
Unrestricted herds	Unrestricted herds, OTF herds	*Unrestricted herds* include all herds that are not in an on-going incident, which includes herds undergoing a disclosing test, which is allowed up to 14 days for completion. *Herds that are restricted because tests are overdue are not counted as unrestricted herds in this report because precise data is unavailable.*
SAM 6	SAM Release 6 database, TB in Cattle database	SAM 6 is the version of APHA's bTB control and surveillance system from which this report has been compiled. It records (amongst other things) details of herds, bTB tests, bTB incidents, slaughtered cattle (reactors, slaughterhouse cases and direct contacts), and inconclusive reactor cattle.
WHTT	Whole Herd Type Test	A test in which *at least* as many animals are tested as in a periodic surveillance test. The test types include RHT; WHT; WHT2; 12M; 6M; 90D; CON; CON6 ; CON12; CT; CT(EM); CT(I-I); CT-HS1 & 2; CT-NH1, 2 & 3; CT-RH1, 2 & 3; CT-RTA; CTW 1 & 2; IA6 & 12, (and SI or IASI in herds under restriction). When several part tests are need to complete the herd test, the test date for a multi-day whole herd type test in this report is that purported to be for the final test, identified by the letter "C" (indicating a completed test) at the beginning of the PartCode field.

Appendix Table A2: Data for Figs 1.1 to 8.2 shown in the body of the report

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
Figure 1.1 - Number of herds from 1st May 2010 to 2015	May-10	327	1,287	115	9,035	13,065
	May-11	326	1,268	112	8,930	12,917
	May-12	315	1,263	111	8,849	12,795
	May-13	310	1,260	114	8,788	12,723
	May-14	297	1,232	111	8,578	12,425
	May-15	274	1,157	115	8,224	11,892
Figure 1.2 - Number of cattle from 1st May 2010 to 2015	May-10	53,166	133,802	10,652	706,045	1,167,340
	May-11	51,809	136,787	21,458	720,269	1,192,106
	May-12	53,525	140,775	9,633	745,734	1,217,564
	May-13	52,990	140,082	9,773	765,423	1,239,962
	May-14	52,704	141,553	9,755	775,376	1,255,500
	May-15	47,691	141,976	13,074	759,163	1,239,261
Figure 1.3 - Relative proportion of dairy and non-dairy herds on 1st May 2015 (beef/other)	May-15	59.5%	70.4%	67.8%	85.3%	79.3%
Figure 1.3 - Relative proportion of dairy and non-dairy herds on 1st May 2015 (dairy)	May-15	40.5%	29.6%	32.2%	14.7%	20.7%
Figure 2.1 (B) - Number of completed WHTT per unrestricted herd, 2005/06 to 2014/15	05/06	0.8	0.6	0.7	0.5	0.5
	06/07	0.9	0.8	0.8	0.5	0.5
	07/08	0.9	0.8	0.8	0.5	0.6
	08/09	1.0	0.9	1.0	0.8	0.8
	09/10	1.1	1.0	1.0	0.9	0.9
	10/11	1.9	1.0	0.9	0.9	1.0
	11/12	1.9	1.0	1.1	1.0	1.0
	12/13	2.0	1.1	1.1	1.0	1.0
	13/14	2.0	1.1	1.0	1.0	1.1
	14/15	2.1	1.2	1.2	1.1	1.1
Figure 2.2 - Number of SICCT tests per animal in unrestricted herds, 2005/06 – 2014/15, including all test types	05/06	0.9	0.7	0.9	0.4	0.5
	06/07	1.0	0.9	1.0	0.5	0.6
	07/08	1.0	0.8	0.9	0.6	0.7
	08/09	1.1	1.1	1.0	1.0	1.0
	09/10	1.2	1.3	0.9	1.1	1.1
	10/11	1.8	1.2	0.4	1.2	1.2
	11/12	1.7	1.2	1.2	1.1	1.2
	12/13	1.7	1.2	1.4	1.1	1.1
	13/14	1.7	1.2	1.2	1.1	1.1
	14/15	1.9	1.3	1.2	1.1	1.2

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
Figure 2.3 - Total number of interferon-gamma tests on animals	05/06	148	87	323	123	1,799
	06/07	284	167	9	27	1,739
	07/08	1,062	116	9	229	4,339
	08/09	1,168	648	15	255	5,188
	09/10	522	426	7	384	5,481
	10/11	330	498	3	645	7,810
	11/12	751	123	6	421	7,186
	12/13	991	782	61	693	10,716
	13/14	711	220	21	1,157	15,039
	14/15	1,050	1,218	182	9,728	17,587
Figure 2.4 - Proportion of reactors per IFN-gamma animal test		%	%	%	%	%
	05/06	13.5	6.9	5.6	13.6	11.8
	06/07	10.6	22.8	77.8	15.5	10.6
	07/08	28.3	42.2	55.6	15.8	22.5
	08/09	19.6	35.8	53.3	16.1	22.6
	09/10	23.6	33.6	0.0	8.1	14.5
	10/11	18.2	8.2	0.0	5.0	6.9
	11/12	18.9	35.8	66.7	8.1	12.0
	12/13	14.8	19.3	6.6	6.4	11.0
	13/14	10.8	37.3	71.4	6.2	7.9
	14/15	8.7	7.6	6.0	3.4	5.1
Figure 3.1 (C) - Proportion of WHTT on unrestricted herds, resulting in new OTF-W or OTF-S incidents in a 12-month period, 2005/06 to 2014/15		%	%	%	%	%
	05/06	18.8	9.7	12.0	7.1	8.4
	06/07	18.0	11.6	18.5	9.7	10.5
	07/08	24.5	10.7	17.2	10.1	11.9
	08/09	28.4	16.6	15.5	8.8	11.9
	09/10	19.5	9.8	11.0	7.5	8.8
	10/11	12.2	9.4	8.7	7.0	8.2
	11/12	15.0	10.7	11.6	6.9	8.6
	12/13	12.6	11.1	12.6	6.1	8.0
	13/14	10.8	5.9	9.2	5.4	6.4
	14/15	9.8	8.1	9.8	5.4	6.7

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
		%	%	%	%	%
Figure 3.2- Proportion of all incidents (OTF-W and OTF-S) that are OTF-W	05/06	68.5	67.4	72.7	60.1	60.3
	06/07	60.7	54.7	77.3	62.3	56.8
	07/08	72.2	44.2	76.5	60.2	54.9
	08/09	56.5	47.5	47.1	49.1	46.7
	09/10	59.3	48.0	50.0	52.6	49.9
	10/11	59.6	53.5	55.6	55.3	53.7
	11/12	91.3	74.6	78.6	64.6	69.8
	12/13	93.2	83.7	80.0	65.6	74.6
	13/14	94.0	94.8	100.0	72.7	80.5
	14/15	93.5	89.8	100.0	78.3	84.0
		%	%	%	%	%
Figure 3.3 - Proportion of animals with SICCT test which became reactors	05/06	2.3	0.8	1.9	0.6	0.9
	06/07	1.8	0.8	1.3	0.6	0.7
	07/08	2.3	1.0	3.0	0.6	1.1
	08/09	4.2	1.5	2.4	0.5	1.3
	09/10	2.0	0.8	0.5	0.4	0.8
	10/11	1.4	0.5	0.4	0.3	0.8
	11/12	1.4	0.6	0.5	0.3	0.9
	12/13	1.5	0.8	0.4	0.3	0.8
	13/14	0.7	0.4	0.8	0.2	0.5
	14/15	0.6	0.4	0.6	0.2	0.5
		%	%	%	%	%
Figure 3.4 - Proportion of SICCT test reactors with bTB confirmed at post-mortem (visible lesions or *M. bovis* on culture	05/06	33.1	36.9	13.5	36.0	30.7
	06/07	29.6	29.9	38.2	38.8	30.8
	07/08	46.6	27.2	28.0	38.5	34.5
	08/09	54.5	32.3	15.8	30.4	32.6
	09/10	37.9	31.4	22.2	35.3	31.1
	10/11	20.0	19.8	21.1	32.8	27.0
	11/12	33.0	22.1	33.9	34.5	28.4
	12/13	29.8	27.5	38.6	32.1	27.8
	13/14	46.2	28.3	41.4	43.0	35.7
	14/15	66.1	37.4	59.3	43.0	41.9

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
		%	%	%	%	%
Figure 4.1 (D) - Proportion of herds under restriction on 1st May each year because of loss of OTF status	May-05	15.8	4.5	5.1	2.5	3.7
	May-06	17.3	4.9	8.6	2.5	3.5
	May-07	18.2	7.7	15.5	3.4	5.0
	May-08	20.1	8.0	17.6	3.9	5.8
	May-09	28.5	13.4	15.4	4.7	7.8
	May-10	22.3	7.9	7.0	4.1	6.0
	May-11	22.1	7.5	5.4	4.0	5.6
	May-12	29.8	10.1	10.8	4.5	6.9
	May-13	23.9	9.8	11.4	3.8	6.2
	May-14	19.3	6.4	7.0	3.8	5.3
Figure 5.1 - Proportion of unrestricted herds experiencing new OTF-W or OTF-S incidents in each 12-month period (herd incidence rate) per 100 unrestricted herds	05/06	15.8	6.1	8.7	3.4	4.5
	06/07	16.6	9.0	17.3	4.7	6.1
	07/08	23.7	8.9	14.8	5.2	7.2
	08/09	28.4	15.9	15.5	6.9	9.9
	09/10	20.2	10.0	10.6	6.6	8.1
	10/11	19.5	9.1	8.2	6.4	7.8
	11/12	24.6	11.2	12.8	6.8	8.8
	12/13	20.9	12.0	13.3	6.0	8.2
	13/14	18.0	6.3	9.1	5.6	6.7
	14/15	17.6	9.5	11.3	5.8	7.5
Figure 5.2 - Proportion of unrestricted herds experiencing new OTF-W incidents in each 12-month period per 100 unrestricted herds	05/06	10.9	4.1	6.3	2.1	2.7
	06/07	10.1	4.9	13.4	2.9	3.5
	07/08	17.1	3.9	11.3	3.1	4.0
	08/09	16.1	7.6	7.3	3.4	4.6
	09/10	12.0	4.8	5.3	3.5	4.0
	10/11	11.6	4.9	4.5	3.6	4.2
	11/12	22.4	8.3	10.1	4.4	6.2
	12/13	19.5	10.0	10.6	3.9	6.1
	13/14	16.9	6.0	9.1	4.0	5.4
	14/15	16.4	8.5	11.3	4.5	6.3
Figure 5.3 - Number of cattle slaughtered for bTB control (excluding slaughterhouse cases), per 1,000 cattle in the population	05/06	19.8	7.5	21.4	3.5	5.7
	06/07	17.2	7.3	15.6	3.3	5.1
	07/08	24.0	9.3	22.9	4.6	7.4
	08/09	47.7	18.1	29.1	6.0	11.6
	09/10	21.1	11.7	7.2	5.0	7.8
	10/11	19.0	6.6	2.4	4.3	6.3
	11/12	19.5	6.9	6.6	4.5	6.9
	12/13	19.7	10.5	6.9	4.6	7.5
	13/14	10.7	4.9	9.1	3.7	4.9
	14/15	11.4	5.5	8.5	3.5	5.2

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
Figure 5.4 - Number of SICCT test reactors per 1,000 cattle in the population	05/06	16.8	5.8	15.3	2.7	4.5
	06/07	13.7	6.6	12.7	3.2	4.7
	07/08	17.2	7.8	23.4	3.7	6.1
	08/09	32.4	13.9	20.5	4.6	8.6
	09/10	14.5	7.8	4.2	4.0	5.7
	10/11	14.3	4.9	1.8	3.2	4.7
	11/12	13.3	6.3	5.8	3.4	5.4
	12/13	13.1	7.4	4.5	3.1	5.2
	13/14	6.6	3.4	7.2	2.5	3.2
	14/15	7.5	4.0	6.2	2.5	3.6
Figure 5.5 - Number of cattle found with visible lesions or M. bovis, per 1,000 cattle in the population	05/06	5.4	2.1	2.4	1.0	1.4
	06/07	4.1	1.8	4.6	1.2	1.4
	07/08	7.8	2.3	5.9	1.4	2.0
	08/09	17.8	4.4	4.3	1.4	2.9
	09/10	5.5	2.6	0.9	1.4	1.8
	10/11	3.1	1.1	0.4	1.1	1.4
	11/12	4.2	1.1	2.0	1.1	1.4
	12/13	4.1	2.2	1.7	1.1	1.5
	13/14	3.0	1.0	3.0	1.0	1.1
	14/15	5.0	1.5	3.7	1.1	1.5
Figure 5.6 - Number of slaughterhouse cases found to have M. bovis on culture, per 1,000 cattle in the population	05/06	0.26	0.20	0.10	0.05	0.08
	06/07	0.17	0.10	0.10	0.07	0.07
	07/08	0.10	0.05	0.40	0.09	0.08
	08/09	0.10	0.26	0.21	0.07	0.09
	09/10	0.02	0.06	0.00	0.07	0.06
	10/11	0.14	0.19	0.00	0.07	0.08
	11/12	0.17	0.15	0.10	0.08	0.09
	12/13	0.06	0.11	0.00	0.06	0.06
	13/14	0.11	0.14	0.21	0.06	0.07
	14/15	0.06	0.14	0.15	0.06	0.08
Figure 6.1 - Median duration of OTF-W incidents ending in each 12-month period (months)	05/06	11.1	7.9	12.8	7.1	7.8
	06/07	12.3	8.7	6.7	7.0	7.9
	07/08	10.8	10.4	10.7	8.2	8.9
	08/09	10.0	9.2	12.3	7.7	8.3
	09/10	12.7	10.9	13.9	6.8	8.6
	10/11	9.9	12.2	23.5	6.8	8.0
	11/12	10.2	8.3	9.0	6.9	7.3
	12/13	12.5	8.1	8.3	7.2	8.0
	13/14	9.2	9.2	8.5	6.6	8.0
	14/15	8.7	8.1	8.6	6.8	7.2

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
Figure 6.2 - Median duration of OTF-S incidents ending in each 12-month period (months)	05/06	5.4	4.9	3.2	3.3	4.6
	06/07	5.6	4.7	7.8	3.5	3.9
	07/08	5.1	4.5	3.7	3.9	4.4
	08/09	3.7	4.4	5.2	4.2	4.4
	09/10	4.0	4.6	3.3	3.2	3.7
	10/11	5.7	3.8	5.7	3.5	3.7
	11/12	8.3	5.6	6.4	3.2	3.9
	12/13	7.0	4.4	7.8	3.7	4.1
	13/14	3.1	4.7	6.7	3.2	3.5
	14/15	5.2	3.3	0	3.6	3.7
Figure 6.3 - Proportion of herds that had restrictions lifted during a 12 month period, per 100 restricted herds: OTF-W and OTF-S		%	%	%	%	%
	05/06	84.5	125.4	100.0	135.3	124.8
	06/07	85.7	126.4	127.3	147.9	129.4
	07/08	113.8	108.2	70.0	134.6	125.7
	08/09	82.9	124.5	95.5	153.2	131.4
	09/10	87.4	113.1	122.2	152.2	125.9
	10/11	79.5	118.6	137.5	158.3	134.9
	11/12	66.7	114.7	133.3	158.6	133.0
	12/13	81.9	114.2	116.7	146.0	125.4
	13/14	94.6	105.6	123.1	149.1	126.0
	14/15	90.6	123.0	125.0	147.6	130.2
Figure 6.4 - Proportion of OTF-W herds that had restrictions lifted during a 12 month period, per 100 restricted herds		%	%	%	%	%
	05/06	63.6	100.0	100.0	111.1	99.5
	06/07	71.7	93.3	112.5	120.6	100.0
	07/08	98.0	65.3	43.8	105.6	91.4
	08/09	48.3	76.9	68.2	108.6	87.5
	09/10	65.8	79.8	113.3	123.8	96.0
	10/11	61.9	86.7	75.0	122.3	98.6
	11/12	58.6	98.6	116.7	133.3	111.1
	12/13	78.4	107.5	120.0	125.2	110.5
	13/14	91.7	104.5	130.0	135.6	117.3
	14/15	90.4	115.5	125.0	134.4	120.4
Figure 7.1 - Proportion of herds that had a bTB incident in the previous 3 years, that had an OTF-W or OTF-S incident in the current 12 month period		%	%	%	%	%
	05/06	26.2	20.0	14.7	18.6	19.2
	06/07	13.9	21.2	36.1	16.4	19.1
	07/08	42.6	23.3	31.8	18.1	23.1
	08/09	44.6	32.7	27.3	23.5	28.8
	09/10	27.5	18.8	22.2	19.7	20.8
	10/11	32.1	19.8	15.0	17.4	19.4
	11/12	36.0	22.6	16.7	17.8	21.0
	12/13	29.1	23.4	31.0	17.3	21.3
	13/14	28.8	14.3	10.3	14.2	15.9
	14/15	31.6	22.3	15.2	16.1	19.1

Figure description	Date(s)	All IAA herds	Comparison Herds	2 km buffer of IAA	Wales herds >40 km from IAA	ALL OF WALES
Figure 8.1 - Number of SICCT reactors per OTF-W or OTF-S incident starting in the 12-month period	05/06	15.8	9.2	14.2	5.4	7.9
	06/07	12.8	7.5	6.0	4.9	6.5
	07/08	11.4	9.5	13.9	5.2	7.2
	08/09	19.6	9.5	11.5	5.0	7.6
	09/10	13.1	8.4	3.8	4.7	6.4
	10/11	13.0	5.9	4.2	4.1	5.6
	11/12	10.3	6.4	4.0	4.2	5.9
	12/13	11.8	7.1	2.9	4.6	6.2
	13/14	6.9	6.2	7.0	4.1	4.9
	14/15	7.8	5.3	6.2	4.1	5.4
Figure 8.2 - Number of animals with visible lesions or M. bovis culture, per OTF-W incident starting in the 12-month period	05/06	4.6	5.1	5.3	3.3	3.9
	06/07	6.9	5.1	4.5	3.5	4.3
	07/08	6.3	5.7	2.6	3.5	4.4
	08/09	10.8	6.5	2.8	2.8	4.5
	09/10	6.3	3.7	2.0	3.2	3.7
	10/11	2.6	3.4	1.0	2.5	2.6
	11/12	3.5	2.4	1.7	2.5	2.3
	12/13	1.9	1.8	1.5	1.9	1.7
	13/14	2.3	1.6	2.9	2.5	2.1
	14/15	3.7	2.7	3.8	2.0	2.3

Appendix Table A3a: Summary of number of surveillance tests, incidents, reactors and prevalence in the 2 km IAA buffer (Table A, Table 2.1 and Table 3.1)

	Time period	Number of surveillance tests	Number of incidents	Incidents per 100 OTF tests	Number of reactors	Reactors per 1,000 tests	Prevalence
Pre-IAA	2005/06	8,000	11	0.14	22	2.75	0.05
	2006/07	10,000	22	0.22	80	8.04	0.09
	2007/08	8,000	17	0.21	35	4.42	0.16
	2008/09	8,000	17	0.21	33	4.10	0.18
	2009/10	8,800	12	0.14	9	0.57	0.15
IAA Controls	2010/11	9,400	9	0.10	14	1.48	0.07
	2011/12	10,200	14	0.14	17	1.66	0.05
	2012/13	11,300	15	0.13	27	2.39	0.11
	2013/14	8,400	10	0.12	26	3.11	0.11
	2014/15	12,900	13	0.10	44	3.41	0.07

Appendix Table A3b: Time elapsed between the end of movement restrictions in the most recent TB incident in the previous 3 years and the start date of the first incident in the 2 km IAA buffer (Table 7.1)

Previous incident type[1]	New incident type[2]	Time elapsed (months)[3]					
		Mean	Median	SD	Minimum	Maximum	Count
OTF-W	OTF-W	17	16	8	8	29	5
OTF-W	OTF-S	n/a	n/a	n/a	n/a	n/a	n/a
OTF-W	Any	17	16	8	8	29	5
OTF-S	OTF-W	n/a	n/a	n/a	n/a	n/a	n/a
OTF-S	OTF-S	n/a	n/a	n/a	n/a	n/a	n/a
OTF-S	Any	n/a	n/a	n/a	n/a	n/a	n/a
Any	OTF-W	17	16	8	8	29	5
Any	OTF-S	n/a	n/a	n/a	n/a	n/a	n/a
Any	Any	17	16	8	8	29	5

Appendix Table A4: Number of surveillance tests (herds not under restriction), reactors and resulting incidents and the number of disease control tests taken in herds under restriction in 2014/15 (for Table 2.1)

IAA

Test and test type	Surveillance tests			Disease Control	Total Tests
	Total Tests	Reactors	Incidents	Total Tests	
Area Risk	**19,540**	**23**	**12**	**0**	**19,540**
VE-CON	19,424	23	12	0	19,424
VE-CON6	116	0	0	0	116
Control	**1,814**	**0**	**0**	**65,258**	**67,072**
VE-CT(EM)	939	0	0	0	939
VE-CT(I-I)	677	0	0	5,210	5,887
VE-IFN_NSR	0	0	0	1	1
VE-IFN_PERSI	0	0	0	890	890
VE-IFN_SLHERD	0	0	0	55	55
VE-SI	198	0	0	59,102	59,300
Herd Risk	**13,636**	**12**	**10**	**0**	**13,636**
VE-6M	12,954	12	10	0	12,954
VE-12M	682	0	0	0	682
Inconclusive reactors	**105**	**12**	**0**	**147**	**252**
VE-IFN_2X_IR	0	0	0	104	104
VE-IR	105	12	0	43	148
Movement Risk	**597**	**0**	**0**	**363**	**960**
VE-TR	313	0	0	119	432
VE-PII	284	0	0	244	528
Private, pre and post movement	**2,263**	**4**	**4**	**104**	**2,367**
VE-PRMT	2,263	4	4	104	2,367
New Herds	**24**	**0**	**0**	**0**	**24**
VE-CT-NH1	24	0	0	0	24
Other	**0**	**0**	**0**	**470**	**470**
VE-ASG	0	0	0	470	470
Routine	**20,306**	**16**	**19**	**155**	**20,461**
VE-IA12	8,298	8	6	0	8,298
VE-IA6	11,867	8	13	127	11,994
VE-WHT	141	0	0	28	169
Slaughterhouse	**0**	**0**	**1**	**0**	**0**
VE-SLH	-	0	1	0	**0**

Comparison Area

Test and test type	Surveillance tests			Disease Control	Total Tests
	Total Tests	Reactors	Incidents	Total Tests	
Area Risk	**73,170**	**160**	**48**	**326**	**73,496**
VE-CON	55,504	150	39	0	55,504
VE-CON12	17,666	10	9	326	17,992
Control	**2,110**	**2**	**1**	**95,627**	**97,737**
VE-CT(EM)	83	0	0	0	83
VE-CT(I-I)	443	0	0	8,805	9,248
VE-IFN_PERSI	0	0	0	819	819
VE-IFN_SLHERD	0	0	0	183	183
VE-SI	1,321	2	1	84,457	85,778
VE-TBU	263	0	0	1,363	1,626
Herd Risk	**33,399**	**40**	**18**	**0**	**33,399**
VE-6M	22,038	21	9	0	22,038
VE-12M	11,361	19	9	0	11,361
Inconclusive reactors	**357**	**46**	**0**	**258**	**615**
VE-IFN_2X_IR	0	0	0	216	216
VE-IR	357	46	0	42	399
Movement Risk	**2,094**	**10**	**4**	**77**	**2,171**
VE-PII	786	0	0	25	811
VE-TR	1,308	10	4	52	1,360
Private, pre and post movement	**16,551**	**9**	**4**	**805**	**17,356**
VE-PRI	474	1	1	4	478
VE-PRMT	16,077	8	3	801	16,878
New Herds	**680**	**0**	**0**	**0**	**680**
VE-CT-NH1	516	0	0	0	516
VE-CT-NH2	164	0	0	0	164
Other	**0**	**0**	**0**	**197**	**197**
VE-ASG	0	0	0	197	197
Routine	**27,215**	**24**	**15**	**0**	**27,215**
VE-WHT	27,215	24	15	0	27,215
Slaughterhouse	**0**	**0**	**18**	**0**	**0**
VE-SLH	0	0	18	0	0

IAA 2 km Buffer

Test and test type	Surveillance tests			Disease Control	Total Tests
	Total Tests	Reactors	Incidents	Total Tests	
Area Risk	**6,139**	**17**	**5**	**217**	**6,356**
VE-CON	4,320	17	5	217	4,537
VE-CON12	1,819	0	0	0	1,819
Control	**457**	**0**	**0**	**7,885**	**8,342**
VE-CT(I-I)	0	0	0	293	293
VE-IFN_SLHERD	0	0	0	165	165
VE-SI	457	0	0	7,427	7,884
Herd Risk	**3,319**	**2**	**2**	**0**	**3,319**
VE-6M	2,410	0	0	0	2,410
VE-12M	909	2	2	0	909
Inconclusive reactors	**13**	**3**	**0**	**17**	**30**
VE-IFN_2X_IR	0	0	0	17	17
VE-IR	13	3	0	0	13
Movement Risk	**93**	**0**	**0**	**37**	**130**
VE-TR	64	0	0	36	100
VE-PII	29	0	0	1	30
Private, pre and post movement	**1,295**	**0**	**0**	**0**	**1,295**
VE-PRMT	1,295	0	0	0	1,295
New Herds	**5**	**0**	**0**	**0**	**5**
VE-CT-NH1	5	0	0	0	5
Routine	**1,589**	**25**	**4**	**0**	**1,589**
VE-IA6	425	3	1	0	425
VE-WHT	1,164	22	3	0	1,164
Slaughterhouse	**0**	**0**	**2**	**0**	**0**
VE-SLH	0	0	2	0	0

Welsh Herds >40 km from IAA

Test and test type	Surveillance tests			Disease Control	Total Tests
	Total Tests	Reactors	Incidents	Total Tests	
Area Risk	**173,667**	**290**	**151**	**1,329**	**174,996**
VE-CON	119,290	211	108	1,246	120,536
VE-CON12	53,776	79	43	83	53,859
VE-CON6	601	0	0	0	601
Control	**11,304**	**6**	**6**	**230,026**	**241,330**
VE-CT(EM)	1,520	2	1	575	2,095
VE-CT(I-I)	5,321	1	2	23,987	29,308
VE-IFN_LOW_IN	0	0	0	5,743	5,743
VE-IFN_NSR	0	0	0	2	2
VE-IFN_PERSI	0	0	0	3,581	3,581
VE-IFN_SLHERD	0	0	0	167	167
VE-SI	4,114	2	2	195,847	199,961
VE-TBU	349	1	1	124	473
Herd Risk	**109,046**	**189**	**95**	**405**	**109,451**
VE-6M	72,456	138	63	0	72,456
VE-12M	36,590	51	32	405	36,995
Inconclusive reactors	**801**	**87**	**0**	**361**	**1,162**
VE-IFN_2X_IR	0	0	0	235	235
VE-IR	801	87	0	126	927
Movement Risk	**8,799**	**11**	**11**	**509**	**9,308**
VE-AI	70	0	0	0	70
VE-EX	75	0	0	0	75
VE-PIO	88	0	0	0	88
VE-TR	6,014	10	9	473	6,487
VE-PII	2,552	1	2	36	2,588
Private, pre and post movement	**119,881**	**72**	**44**	**433**	**120,314**
VE-POSTMT	17	0	0	0	17
VE-PRI	347	0	0	1	348
VE-PRMT	119,517	72	44	432	119,949
New Herds	**3,364**	**1**	**1**	**0**	**3,364**
VE-CT-NH1	3,059	1	1	0	3,059
VE-CT-NH2	305	0	0	0	305
Other	**0**	**0**	**0**	**194**	**194**
VE-ASG	0	0	0	194	194
Routine	**369,179**	**171**	**120**	**586**	**369,765**
VE-WHT	369,150	171	120	586	369,736
VE-WHT2	29	0	0	0	29
Slaughterhouse	**0**	**0**	**45**	**0**	**0**
VE-SLH	0	0	45	0	0

All Welsh herds

Test and test type	Surveillance tests			Disease Control	Total Tests
	Total Tests	Reactors	Incidents	Total Tests	
Area Risk	**427,439**	**823**	**324**	**1,892**	**429,331**
VE-CON	324,161	709	256	1,483	325,644
VE-CON12	102,561	114	68	409	102,970
VE-CON6	717	0	0	0	717
Control	**20,292**	**28**	**9**	**590,870**	**611,162**
VE-CT(EM)	2,952	2	1	575	3,527
VE-CT(I-I)	8,994	21	4	44,179	53,173
VE-IFN_LOW_IN	0	0	0	6,041	6,041
VE-IFN_ANOM	0	0	0	13	13
VE-IFN_PERSI	0	0	0	9,707	9,707
VE-IFN_SLHERD	0	0	0	746	746
VE-IFN_NSR	0	0	0	3	3
VE-SI	7,569	4	3	527,775	535,344
VE-TBU	777	1	1	1,831	2,608
Herd Risk	**235,195**	**435**	**188**	**557**	**235,752**
VE-6M	167,597	301	128	152	167,749
VE-12M	67,598	134	60	405	68,003
Inconclusive reactors	**2,045**	**183**	**0**	**1,408**	**3,453**
VE-IFN_2X_IR	0	0	0	1,077	1,077
VE-IR	2,045	183	0	331	2,376
Movement Risk	**15,438**	**27**	**22**	**1,249**	**16,687**
VE-AI	72	0	0	0	72
VE-EX	80	0	0	0	80
VE-PIO	102	0	0	12	114
VE-TR	10,126	26	18	847	10,973
VE-PII	5,058	1	4	390	5,448
Private, pre and post movement	**165,830**	**112**	**67**	**1,691**	**167,521**
VE-POSTMT	19	0	0	0	19
VE-PRI	837	1	1	7	844
VE-PRMT	164,974	111	66	1,684	166,658
New Herds	**4,848**	**5**	**3**	**0**	**4,848**
VE-CT-NH1	4,355	5	3	0	4,355
VE-CT-NH2	493	0	0	0	493
Other	**17**	**0**	**0**	**1,175**	**1,192**
VE-ASG	17	0	0	1,175	1,192
Routine	**457,755**	**279**	**185**	**741**	**458,496**
VE-CTW1	8	0	0	0	8
VE-WHT	436,999	260	165	614	437,613
VE-WHT2	29	0	0	0	29
VE-IA12	8,375	8	6	0	8,375
VE-IA6	12,344	11	14	127	12,471
Slaughterhouse	**0**	**0**	**82**	**0**	**0**
VE-SLH	-	0	82	0	0