Campylobacter contamination in fresh whole chilled UK-produced chickens at retail: the final results from Year 3 (August 2016 to July 2017)

This report presents the final results of the third year of the UK Survey of Campylobacter contamination in fresh chicken at retail and reports the overall figures for August 2016 to July 2017 (year 3 of the survey). This includes previously unpublished data for April to July 2017 (based on a sample of 1,437 chickens) and consolidates all the data from the full 12 month period (based on 3,980 chickens in total).

The figures in this report, which are based on the revised protocol introduced in August 2016, are not directly comparable with those referring to previous years. The main changes to the protocol from 2016 onwards were:

- Samples must comprise 100% neck skin (under the new protocol samples are no longer topped up with breast skin as they were previously);

- Samples are smaller (5-10g depending on the amount of neck skin available) compared to the 25g used previously

More information on why a new protocol was needed, and on the issues with making comparisons with previous years, can be found in the Annex.

The results presented in this report are weighted to reflect retailer market share[1]. As the figures presented are estimates based on a sample survey, there is a degree of uncertainty associated with them. All tables and charts include 95% confidence intervals which reflect the uncertainty present in the results. They provide a range of values within which the true value will lie 95% of the time.

Key results

Comparisons with year 1 of the survey

- Comparing year 3 of the survey as a whole with year 1, between mid Feb 14 - mid Feb 15[2] and Aug 2016 - Jul 2017:

  - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 19.7% to 6.5%.

  - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 73.2% to 54.0%.

  - Looking at the percentage of chickens with all but the very lowest levels of contamination (chickens with at least 100 cfu/g), there was a significant decrease from 51.2% to 27.0%.

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[1] In all cases, the weighting is based on market share data provided by Kantar for the 52 weeks ending 1st February 2015.

[2] Year 1 of the survey represents a full 12 month period (mid February 2014 – mid February 2015). However, owing to the practicalities of collecting the samples required, the survey had to be extended slightly into the first week of March 2015.

- The latest results show that between Apr - Jul 2014 and Apr - Jul 2017:

    - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 colony forming units per gram (cfu/g)), from 20.1% to 5.9%.

    - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 74.5% to 56.9%.

    - Looking at the percentage of chickens with all but the very lowest levels of contamination (chickens with at least 100 cfu/g), there was a significant decrease from 53.4% to 27.5%.

Comparisons with year 2 of the survey

- Based on the series of months for which comparisons can be made between years 2 and 3 of the survey:

    - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 10.7% during Aug 2015 – Mar 2016 to 6.8% over the same period a year later (Aug 2016 - Mar 2017).

    - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 59.6% during Aug 2015 – Mar 2016 to 52.7% over the same period a year later (Aug 2016 - Mar 2017).

While these reductions in Campylobacter contamination are likely to be genuine, there are some issues around the comparability of the results between year 3 and the earlier years of the survey which should be borne in mind (see the Annex for further details).

Retailer comparisons

To compare the proportion of chickens with levels of Campylobacter above 1000 cfu/g between retailers, each retailer was compared to the overall average (weighted by market share) among all other retailers:

- The results for year 3 of the survey as a whole (Aug 2016 - Jul 2017) show that:

    - Morrisons (2.9%), Tesco (4.2%) and Waitrose (2.7%) were the only named retailers with a significantly lower prevalence than the average across the rest of the retail market.

    - The 'Others' grouping consisting of smaller retailers and butchers had a significantly higher prevalence (17.1%) than the average among the 9 named retailers (5.6%)

- The latest results (Apr - Jul 2017) show that:

    - Tesco (2.8%) and Waitrose (0.0%) were the only named retailers with a significantly lower prevalence than the average across the rest of the retail market.

    - The 'Others' grouping consisting of smaller retailers and butchers, had a significantly higher prevalence (14.1%) than the average among the 9 named retailers (4.7%).

Contents

Background to the survey

Foodborne Campylobacter has been estimated to make more than 280,000 people ill each year in the UK and is the biggest cause of food poisoning[3]. A European Food Safety Agency (EFSA) Opinion[4] stated that up to 80% of cases can be attributed to raw poultry meat and a tenfold decrease in the exposure levels from this source was likely to reduce the number of human Campylobacter cases by 50 to 90% across all Member States.

We report two summary measures of the extent of Campylobacter contamination in chickens at retail:

- The percentage of chicken skin samples positive for Campylobacter.
- The percentage of skin samples with a level of Campylobacter over 1000 colony forming units per gram (cfu/g).

All chickens, regardless of which retail outlet they are bought from, are at risk of being contaminated with Campylobacter, which is why it is important for consumers to handle and cook their chicken safely. Effective cooking will kill any Campylobacter on the chicken.

The Food Standards Agency (FSA) and industry have together focused on reducing Campylobacter levels greater than 1000 cfu/g, and a number of interventions along the food chain have been trialled, introduced and refined in recent years.

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[3] The Second Infectious Intestinal Disease Study (2014)
www.food.gov.uk/sites/default/files/IID2%20extension%20report%20%20FINAL%2025%20March%202020 14_0.pdf

[4] Scientific Opinion on *Campylobacter* in broiler meat production, control options and performance objectives and/or targets at different stages of the food chain:
www.efsa.europa.eu/en/efsajournal/doc/2105.pdf

Levels of contamination

The level of Campylobacter contamination on chicken skin is measured in terms of the number of colony forming units per gram of skin (cfu/g). Table 1 presents the levels of contamination found on chicken skin sampled during Apr - Jul 2017, showing the proportion of chickens in various bands of contamination. Only levels of 10cfu/g and over are detectable.

Detectable levels of Campylobacter are split into three bands: "10-99 cfu/g", "100-1000 cfu/g" and over 1000 cfu/g. 'Over 1000 cfu/g' is the highest band, and is the primary focus of attention.

Table 1 – Levels of Campylobacter on chicken skin: Apr - Jul 2014 and Apr - Jul 2017

Chicken skin	Level of Campylobacter contamination (cfu/g)			
	Less than 10	**10-99**	**100-1000**	**Over 1000**
Apr - Jun 2014				
Percentage of chickens	25.5 (22.9 - 28.2)	21.1 (18.7 - 23.6)	33.3 (30.4 - 36.2)	20.1 (17.6 - 22.6)
No. samples	334	277	426	251
Apr - Jun 2017				
Percentage of chickens	43.1 (40.0 - 46.1)	29.5 (26.7 - 32.2)	21.6 (19.1 - 24.1)	5.9 (4.5 - 7.3)
No. samples	334	277	419	251

95% confidence intervals reflect the uncertainty in the given estimate, providing a range of values within which the true percentage will lie 95% of the time. Like all other estimates in this report, the percentages are weighted according to the market share of each retailer.

Figure 1 – Percentage of chickens positive for Campylobacter broken down by level of contamination: Apr - Jul 2014 and Apr - Jul 2017
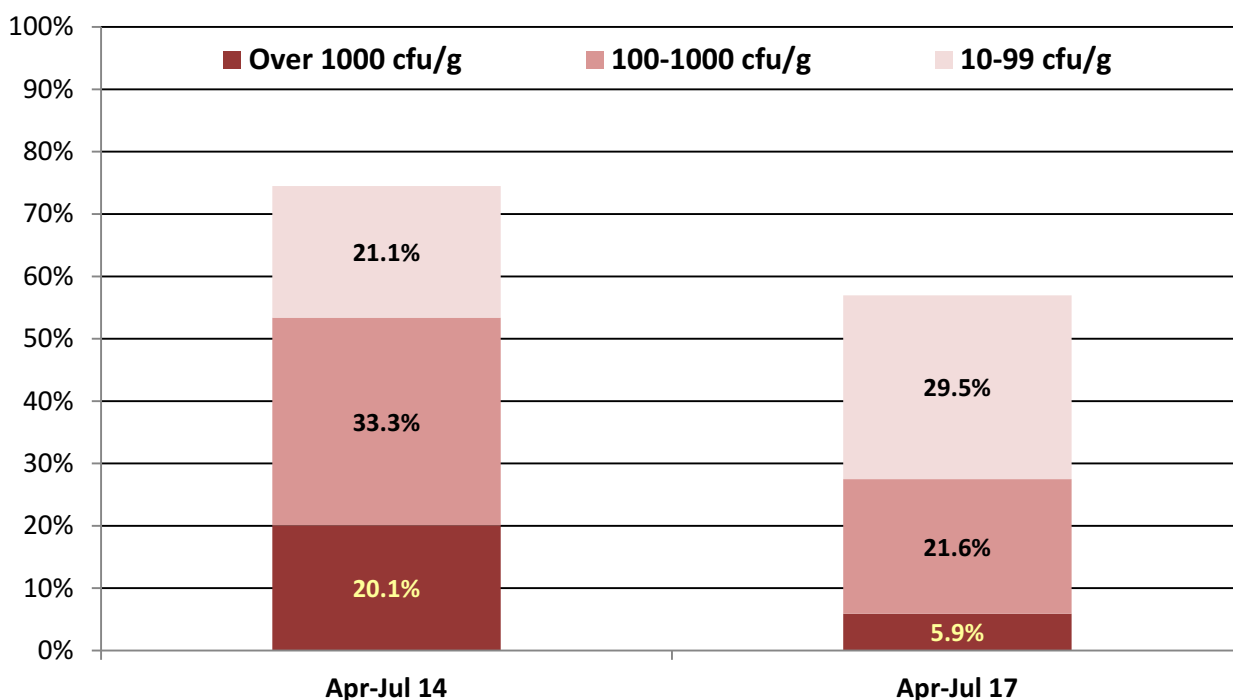
Results from the full year 3 of the survey (Aug 2016 - Jul 2017)

The results from Apr - Jul 2017 complete year 3 of the retail survey which began in Aug 2016. The results from year 3 of the survey as a whole show that:

- During Aug 2016 - Jul 2017, on average 6.5% of chickens at retail had high levels of Campylobacter contamination (over 1000 cfu/g) and 54.0% of chickens were positive for Campylobacter.

- The proportion of chickens with all but the very lowest levels of contamination (chickens with at least 100 cfu/g) was 27.0% during Aug 2016 – Jul 2017.

The comparability of results between years 2 and 3, as well as between years 1 and 3, is complicated by the change in the survey protocol, from Aug 2016 onwards (see the Annex for further details).

Comparisons with year 2 of the survey (Jul 2015 - Mar 2016)

Tables 2 - 3 and Figures 2 - 3 look at how the prevalence of Campylobacter contamination has varied throughout year 3 of the survey and show comparisons with year 2 of the survey.

The changes in the prevalence of Campylobacter contamination over the course of each year of the survey could be as a result of the following:

- Genuine improvement or deterioration in the performance of the industry
- Regular seasonal variation
- Irregular effects such as fluctuations in the weather

To attempt to disentangle the changes as result of these various effects would require an unbroken time series of data spanning several years as a minimum, which is not available.

For reasons mentioned in the Annex, year 2 of the survey did not span a full 12 months. Based on the months for which it is possible to attempt a like for like comparison between years 2 and 3 of the survey:

- There was a significant decrease in the percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 10.7% during Aug 2015 – Mar 2016 to 6.8% over the same period a year later (Aug 2016 – Mar 2017).

- There was a significant decrease in percentage of chickens positive for Campylobacter, from 59.6% during Aug 2015 – Mar 2016 to 52.7% over the same period a year later (Aug 2016 – Mar 2017).
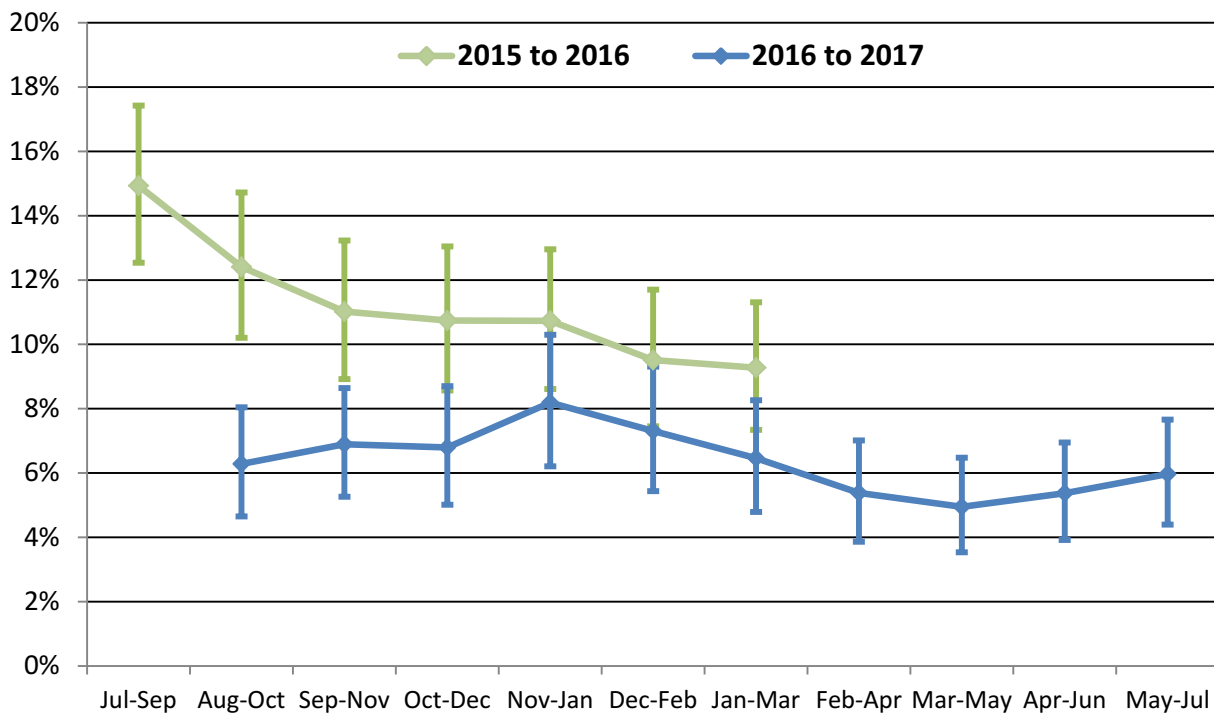
Table 2 – Year on year changes in the percentage of chickens with high levels of Campylobacter (over 1000 cfu/g) between years 2 and 3 of the survey, based on a 3 month rolling period

Time Period	Percentage of skin samples over 1000 cfu/g Campylobacter		Change (percentage points)
	2015 to 2016	**2016 to 2017**	
Jul - Sep	14.9 (12.5 - 17.4)		
Aug - Oct	12.4 (10.2 - 14.7)	6.3 (4.6 - 8.0)	-6.1 (-9.0 to -3.3)
Sep - Nov	11.0 (8.9 - 13.2)	6.9 (5.3 - 8.6)	-4.1 (-6.9 to -1.4)
Oct - Dec	10.7 (8.6 - 13.0)	6.8 (5.0 - 8.7)	-3.9 (-6.9 to -1.0)
Nov - Jan	10.7 (8.6 - 13.0)	8.2 (6.2 - 10.3)	-2.5 (-5.5 to 0.4)
Dec - Feb	9.5 (7.4 - 11.7)	7.3 (5.4 - 9.3)	-2.2 (-5.1 to 0.7)
Jan - Mar	9.3 (7.3 - 11.3)	6.5 (4.8 - 8.3)	-2.8 (-5.5 to -0.2)
Feb - Apr		5.4 (3.9 - 7.0)	
Mar - May		4.9 (3.5 - 6.5)	
Apr - Jun		5.4 (3.9 - 6.9)	
May - Jul		6.0 (4.4 - 7.7)	
Aug - Mar	**10.7 (9.4 - 12.1)**	**6.8 (5.7 - 7.9)**	**-3.9 (-5.7 to -2.2)**

Indicates a statistically significant year on year decrease
Indicates a statistically significant year on year increase

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Figure 2 – The percentage of chickens at retail with high levels of Campylobacter (over 1000 cfu/g): during years 2 and 3 of the survey, based on a 3 month rolling period

95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate and provide a range of value within which the true prevalence will lie 95% of the time.

Table 3 – Year on year changes in the percentage of chickens positive for Campylobacter between years 2 and 3 of the survey, based on a 3 month rolling period

Time Period	Percentage of skin samples positive for Campylobacter		Change (percentage points)
	2015 to 2016	**2016 to 2017**	
Jul - Sep	76.3 (73.3 - 79.2)		
Aug - Oct	71.7 (68.6 - 74.7)	59.1 (55.5 - 62.6)	-12.6 (-17.3 to -7.9)
Sep - Nov	65.2 (61.9 - 68.4)	57.9 (54.4 - 61.3)	-7.3 (-12.1 to -2.6)
Oct - Dec	58.9 (55.4 - 62.5)	54.5 (51.0 - 58.1)	-4.4 (-9.5 to 0.7)
Nov - Jan	53.1 (49.5 - 56.7)	51.3 (47.6 - 54.9)	-1.9 (-7.0 to 3.2)
Dec - Feb	49.2 (45.5 - 53.0)	51.4 (47.7 - 55.0)	2.1 (-3.1 to 7.4)
Jan - Mar	50.0 (46.5 - 53.5)	48.8 (45.3 - 52.4)	-1.2 (-6.1 to 3.8)
Feb - Apr		47.3 (43.7 - 51.0)	
Mar - May		48.7 (45.0 - 52.5)	
Apr - Jun		56.1 (52.4 - 59.8)	
May - Jul		58.5 (55.1 - 61.8)	
Aug - Mar	**59.6 (57.5 - 61.7)**	**52.7 (50.5 - 54.9)**	**-6.9 (-9.9 to -3.9)**

Indicates a statistically significant year on year decrease
Indicates a statistically significant year on year increase

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Figure 3 – The percentage of chickens at retail positive for Campylobacter during years 2 and 3 of the survey, based on a 3 month rolling period
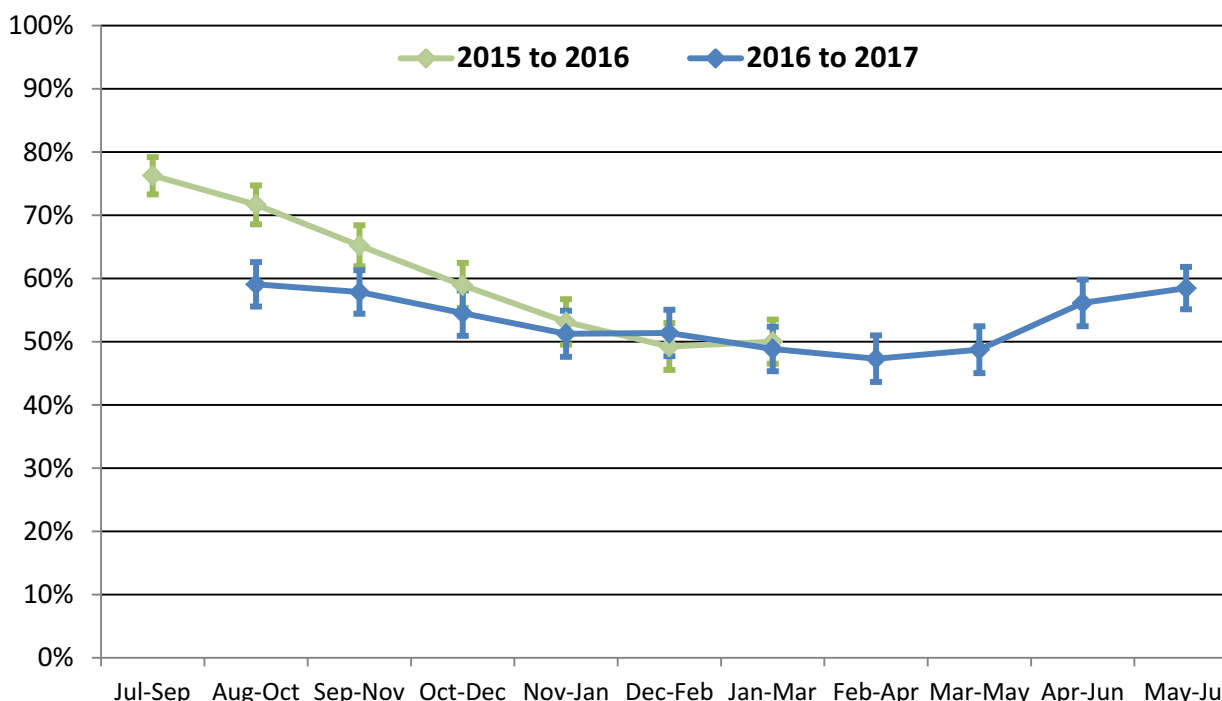
95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate and provide a range of value within which the true prevalence will lie 95% of the time.

Comparisons with year 1 of the survey (mid Feb 2014 - mid Feb 2015)

Tables 4 - 5 and Figures 4 - 5 compare the prevalence of Campylobacter contamination between years 1 and 3 of the survey.

As years 1 and 3 of the survey both cover a full 12 month period, the average prevalence across each of these 12 months periods can be compared:

- Between mid Feb 2014 - mid Feb 2015[5] and Aug 2016 - Jul 2017

    - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 19.7% to 6.5%.

    - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 73.2% to 54.0%.

    - Looking at the percentage of chickens with all but the very lowest levels of contamination (chickens with at least 100 cfu/g), there was a significant decrease from 51.2% to 27.0%.

As survey years 1 and 3 are not well aligned, with year 1 commencing from mid-February and year 3 commencing from the start of August, comparisons between them can be made both two years apart and three years apart:

- Over the 2 years between Aug 2014 - Jan 2015 and Aug 2016 - Jan 2017

    - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 20.2% to 7.2%.

    - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 76.9% to 55.2%.

- Over the 3 years between Mar - Jul 2014 and Mar - Jul 2017

    - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 19.7% to 5.9%.

    - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 74.5% to 56.9%.

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[5] Year 1 of the survey represents a full 12 month period (mid February 2014 – mid February 2015). However, owing to the practicalities of collecting the samples required, the survey had to be extended slightly into the first week of March 2015.

Table 4 – Changes in the percentage of chickens positive for Campylobacter between years 1 and 3, based on a 3 month rolling period

Time Period	Percentage of skin samples over 1000 cfu/g Campylobacter		Change (percentage points)
	Year 1	Year 3	
3 year difference			
	Apr - Jul 14	**Apr - Jul 17**	
Mar-May	17.7 (14.8 - 20.6)	4.9 (3.5 - 6.5)	-12.7 (-16.0 to -9.5)
Apr-Jun	19.6 (16.7 - 22.6)	5.4 (3.9 - 6.9)	-14.3 (-17.6 to -10.9)
May-Jul	22.6 (19.7 - 25.6)	6.0 (4.4 - 7.7)	-16.6 (-20.0 to -13.3)
Mar-Jul	**19.7 (17.5 - 22.0)**	**5.9 (4.5 - 7.3)**	**-14.0 (-16.6 to -11.5)**
2 year difference			
	Aug 14 - Jan 15	**Aug 16 - Jan 17**	
Aug-Oct	20.3 (17.7 - 22.9)	6.3 (4.6 - 8.0)	-14.0 (-17.1 to -10.9)
Sep-Nov	18.9 (16.2 - 21.7)	6.9 (5.3 - 8.6)	-12.0 (-15.2 to -8.8)
Oct-Dec	18.9 (16.1 - 21.7)	6.8 (5.0 - 8.7)	-12.1 (-15.4 to -8.7)
Nov-Jan	20.2 (17.2 - 23.2)	8.2 (6.2 - 10.3)	-12.0 (-15.6 to -8.3)
Aug-Jan	**20.2 (18.2 - 22.2)**	**7.2 (5.9 - 8.6)**	**-13.0 (-15.4 to -10.6)**
Difference between the whole survey years 1 and 3			
	Mid Feb 14 - Mid Feb 15	**Aug 16 - Jul 17**	
Whole year	**19.7 (18.3 - 21.1)**	**6.5 (5.6 - 7.3)**	**-13.2 (-14.9 to -11.5)**

Indicates a statistically significant year on year decrease
Indicates a statistically significant year on year increase

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Figure 4 – The percentage of chickens at retail positive for Campylobacter during year 3 of the survey compared to year 1, based on a three month rolling period
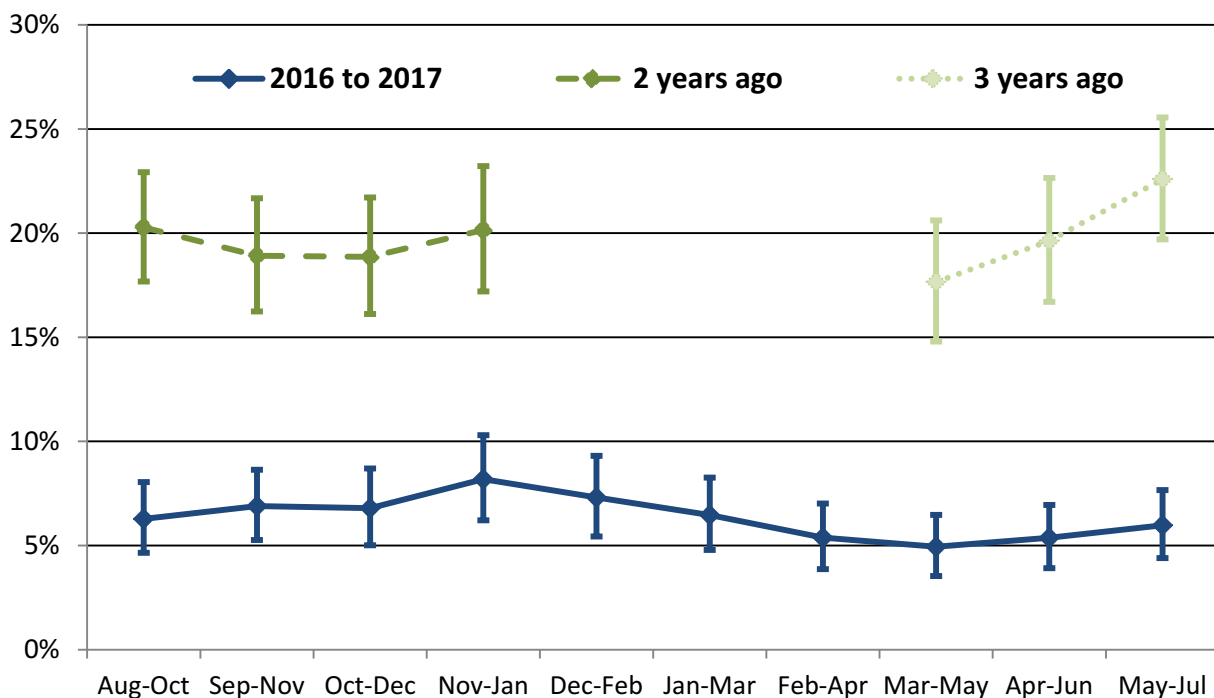
Table 5 – Changes in the percentage of chickens positive for Campylobacter between years 1 and 3, based on a 3 month rolling period

Time Period	Percentage of skin samples over 1000 cfu/g Campylobacter		Change (percentage points)
	Year 1	Year 3	
3 year difference			
	Mar - Jul 14	**Mar - Jul 17**	
Mar-May	62.6 (59.1 - 66.1)	48.7 (45.0 - 52.5)	-13.9 (-19.0 to -8.8)
Apr-Jun	70.3 (67.0 - 73.6)	56.1 (52.4 - 59.8)	-14.2 (-19.1 to -9.2)
May-Jul	78.3 (75.6 - 80.9)	58.5 (55.1 - 61.8)	-19.8 (-24.1 to -15.5)
Mar-Jul	**74.5 (71.8 - 77.1)**	**56.9 (53.9 - 59.9)**	**-17.5 (-21.5 to -13.5)**
2 year difference			
	Aug 14 - Jan 15	**Aug 16 - Jan 17**	
Aug-Oct	80.5 (78.0 - 82.9)	59.1 (55.5 - 62.6)	-21.4 (-25.7 to -17.1)
Sep-Nov	77.6 (74.8 - 80.3)	57.9 (54.4 - 61.3)	-19.7 (-24.1 to -15.3)
Oct-Dec	74.3 (71.3 - 77.2)	54.5 (51.0 - 58.1)	-19.8 (-24.4 to -15.1)
Nov-Jan	73.3 (70.1 - 76.4)	51.3 (47.6 - 54.9)	-22.1 (-26.8 to -17.2)
Aug-Jan	**76.9 (74.9 - 78.9)**	**55.2 (52.6 - 57.7)**	**-21.7 (-25.0 to -18.5)**
Difference between the whole survey years 1 and 3			
	Mid Feb 14 - Mid Feb 15	**Aug 16 - Jul 17**	
Whole year	**73.2 (71.7 - 74.6)**	**54.0 (52.3 - 55.8)**	**-19.1 (-21.4 to -16.8)**

       Indicates a statistically significant year on year decrease
       Indicates a statistically significant year on year increase

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Figure 5 – The percentage of chickens at retail positive for Campylobacter: during year 3 of the survey, compared to year 1, based on a three month rolling period
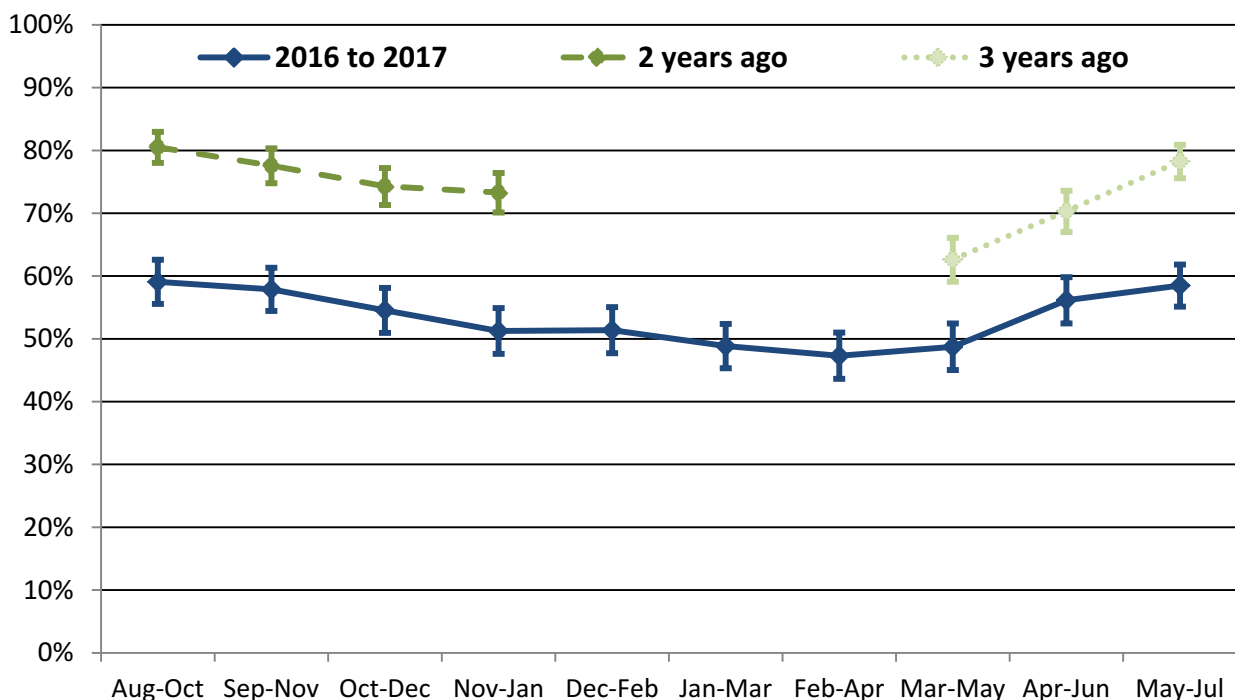
Results by retailer

Table 6 shows the latest results for the two summary measures of Campylobacter contamination in chickens at retail, by retailer. Figure 6 illustrates the percentage of skin samples with high levels of Campylobacter contamination (over 1000 cfu/g), by retailer. Both Table 6 and Figure 6 include 95% confidence intervals for each of the prevalence estimates (in Figure 6 these are represented as vertical bars). Where these overlap, this indicates that there may be insufficient data to draw firm conclusions about which may have the lower prevalence for the given summary measure.

Table 6 – The prevalence of Campylobacter on chickens at retail, by retailer: Aug 2016 - Jul 2017

Retailer	No. of samples	% skin samples over 1000 cfu/g Campylobacter	% skin samples positive for Campylobacter
Aldi	409	6.0 (3.7 - 8.4)	56.7 (51.9 - 61.6)
Asda	387	7.6 (5.1 - 10.3)	57.1 (52.1 - 62.0)
Co-op	406	4.4 (2.5 - 6.6)	53.0 (48.1 - 57.9)
Lidl	408	7.1 (4.7 - 9.6)	55.7 (50.9 - 60.5)
M&S	407	6.4 (4.2 - 8.9)	62.7 (58.1 - 67.3)
Morrisons	392	2.9 (1.4 - 4.6)	51.1 (46.2 - 56.1)
Sainsbury's	395	5.5 (3.4 - 7.8)	52.8 (47.9 - 57.7)
Tesco	404	4.2 (2.4 - 6.2)	46.7 (41.9 - 51.5)
Waitrose	409	2.7 (1.1 - 4.4)	38.6 (33.9 - 43.3)
Others	363	17.1 (13.1 - 21.3)	71.6 (66.9 - 76.2)
All	**3,980**	**6.5 (5.6 - 7.3)**	**54.0 (52.3 - 55.8)**

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

- To compare the percentage of chickens with levels of Campylobacter above 1000 cfu/g between retailers, each retailer was compared to the overall average (weighted according to market share) among all other retailers. During Aug 2016 - Jul 2017:

  - Morrisons (2.9%), Tesco (4.2%) and Waitrose (2.7%) were the only named retailers with a significantly lower prevalence than the average across the rest of the retail market.

  - The 'Others' grouping consisting of smaller retailers and butchers had a significantly higher prevalence (17.1%) than the average among the 9 named retailers (5.6%)

Figure 6 – The percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), by retailer: Aug 2016 - Jul 2017
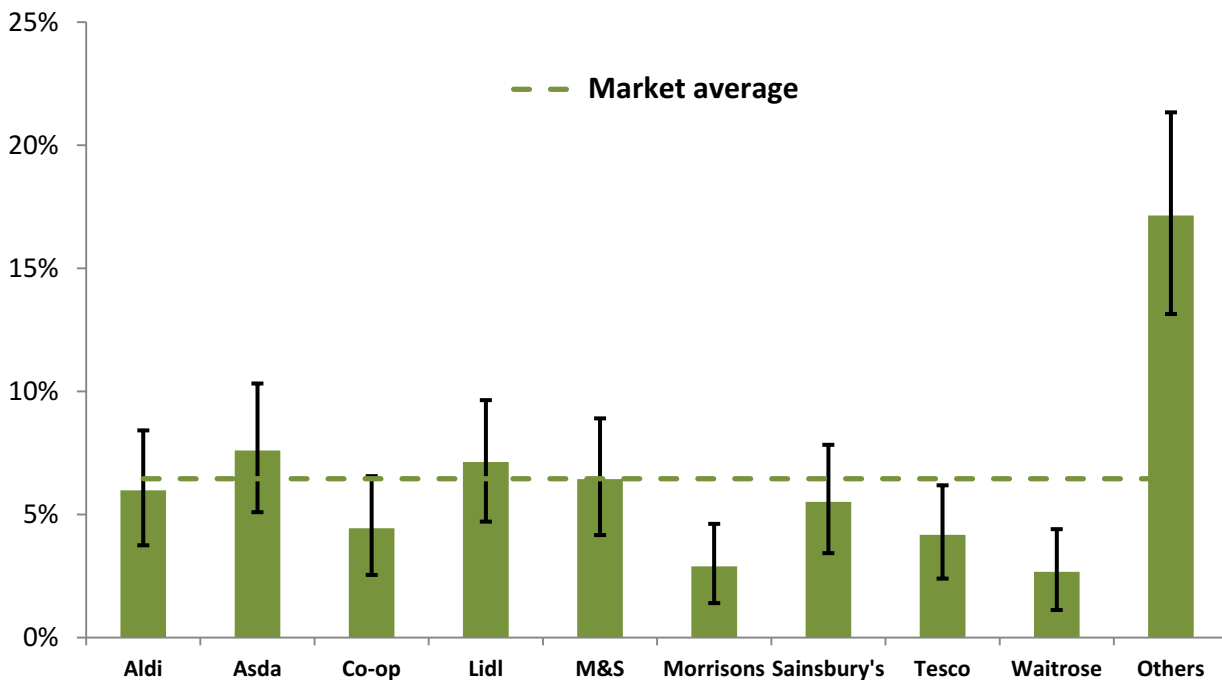
95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Results from the final months of year 3 of the survey (Apr - Jul 2017)

The results from the final months of the survey show that:

- During Apr - Jul 2017, 5.9% of chickens at retail had high levels of Campylobacter contamination (over 1000 cfu/g) and 56.9% of chickens were positive for Campylobacter.

Change over time

Owing to seasonal variation (some parts of the year naturally seeing higher levels of contamination than others) these results are not comparable with earlier results from year 3 of the survey. It is also not possible to compare these results with the same period the previous year (Apr - Jul 2016), as this time period was not covered by year 2 of the survey. However these latest results may be compared with year 1 of the survey.

- Between Apr - Jul 2014 and Apr - Jul 2017 (see Figure 1):

  - There was a significant decrease in percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), from 20.1% to 5.9%.

  - There was a significant decrease in the percentage of chickens positive for Campylobacter, from 74.5% to 56.9%.

  - Looking at the percentage of chickens with all but the very lowest levels of contamination (chickens with at least 100 cfu/g), there was a significant decrease from 53.4% to 27.5%.

Results by retailer

**Table 7 – The prevalence of Campylobacter on chickens at retail,
by retailer: Apr - Jul 2017**

Retailer	No. of samples	% skin samples over 1000 cfu/g Campylobacter	% skin samples positive for Campylobacter
Aldi	149	5.4 (2.3 - 10.3)	57.0 (48.7 - 65.1)
Asda	128	10.2 (5.5 - 16.7)	61.7 (52.7 - 70.2)
Co-op	164	3.0 (1.0 - 7.0)	50.6 (42.7 - 58.5)
Lidl	140	5.7 (2.5 - 10.9)	52.9 (44.2 - 61.3)
M&S	140	6.4 (3.0 - 11.9)	57.9 (49.2 - 66.1)
Morrisons	131	3.1 (0.8 - 7.6)	58.0 (49.1 - 66.6)
Sainsbury's	137	7.3 (3.6 - 13.0)	60.6 (51.9 - 68.8)
Tesco	141	2.8 (0.8 - 7.1)	51.1 (42.5 - 59.6)
Waitrose	164	0.0 (0.0 - 2.2)	43.9 (36.2 - 51.9)
Others	143	14.1 (8.4 - 20.6)	69.1 (61.2 - 76.7)
All	**1,437**	**5.9 (4.5 - 7.3)**	**56.9 (53.9 - 59.9)**

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Table 7 shows the latest results for the two summary measures of Campylobacter contamination in chickens at retail, by retailer. Figure 7 illustrates the percentage of skin samples with high levels of Campylobacter contamination (over 1000 cfu/g), by retailer. Both Table 7 and Figure 7 include 95% confidence intervals for each of the prevalence estimates (in Figure 7 these are represented as vertical bars). Where these overlap, this indicates that there may be insufficient data to draw firm conclusions about which may have the lower prevalence for the given summary measure.

- To compare the percentage of chickens with levels of Campylobacter above 1000 cfu/g between retailers, each retailer was compared to the overall average (weighted according to market share) among all other retailers. During Apr - Jul 2017:

  - Tesco (2.8%) and Waitrose (0.0%) were the only named retailers with a significantly lower prevalence than the average across the rest of the retail market.

  - The 'Others' grouping consisting of smaller retailers and butchers had a significantly higher prevalence (14.1%) than the average among the 9 named retailers (4.7%)

Figure 7 – The percentage of chickens with high levels of Campylobacter (over 1000 cfu/g), by retailer: Apr - Jul 2017
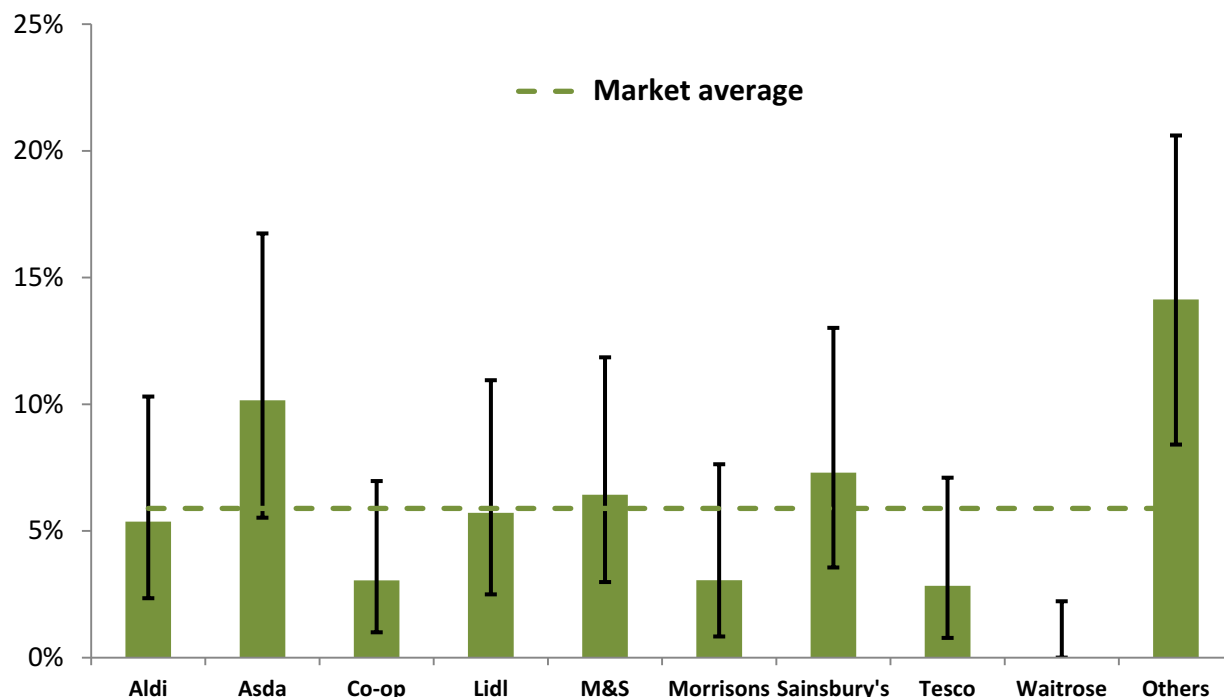
95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate and provide a range of values within which the true prevalence will lie 95% of the time.

Additional notes

All chickens, regardless of which retail outlet they are bought from, are at risk of being contaminated with Campylobacter, which is why it is important for consumers to handle and cook their chicken safely. Effective cooking will kill any Campylobacter on the chicken.

There are other survey variables by which results could be disaggregated, e.g. the possible differences associated with how close the chicken is to the use-by date or the weight of the chicken, among others. These associations are best looked at as part of a considered analysis that takes account all the variables involved. Such an analysis will be included as part of a more in-depth report by Public Health England, and the raw data from the survey will be published in this report.

The final report and raw data for year 1 of the survey (mid Feb 2014 to mid Feb 2015) can be found at:
www.food.gov.uk/science/research/foodborneillness/b15programme/b15projects/fs241044A.

The final report and the raw data for year 2 of the survey (Jul 2015 to Mar 2016) can be found at:
www.food.gov.uk/science/microbiology/Campylobacterevidenceprogramme/retail-survey-year-2.

Annex

Eligibility criteria

Chickens eligible for inclusion in this survey are:

- Whole, chilled, raw, UK-produced standard, free range or organic chickens;
- Where contained in a package, it was unopened and undamaged;
- NOT frozen;
- NOT basted, herbed, stuffed, marinated or otherwise modified.

Samples are collected from retail premises (including both retailer own-brand and branded chickens) in the UK, and the information gathered includes temperature on receipt, the approved premises code of the poultry plant and use-by dates.

The comparability of results between the revised and old protocols

The methodological issue that caused the need for a revised protocol is explained in the January-March 2016 report:
www.food.gov.uk/sites/default/files/campy-survey-report-jan-mar-2016.pdf.

With the aim of restoring the robustness of the survey, alternative measures of contamination were considered before the new protocol was decided upon and the details are reported here:
www.gov.uk/government/statistics/announcements/uk-survey-of-Campylobacter-contamination-in-fresh-retail-chicken-and-its-packaging-4th-quarterly-release-of-results.

The revised protocol from August 2016 means that subsequent results are not directly comparable to those reported in previous years. The two main changes to the protocol, from August 2016 onwards, are:

- Samples must comprise 100% neck skin (topping up with breast skin is no longer permitted as it was previously);
- Samples are smaller (5-10g depending on the amount of available neck skin) compared to the 25g used previously

The first change was instituted to tighten up the protocol, because strong evidence had emerged that topping up with breast skin reduces the measured level of Campylobacter in the skin samples[6] and breast skin was increasingly being used due to trimming of neck skin. Thus, the anticipated effect of this change (using breast skin alone) is to increase the measured levels of Campylobacter contamination.

The second change was necessitated by the first change: in many cases it is only possible to secure a sample that is 100% neck skin by accepting a smaller sample size. So under the amended protocol reported results are based on 5-10g skin samples. An attempt was made to indirectly estimate the effect of moving from 25g samples to samples of less than 10g, on the

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[6] FSA's Campylobacter Retail Survey Report January to March 2016:
www.food.gov.uk/sites/default/files/campy-survey-report-jan-mar-2016.pdf

measured levels of contamination. While this provided no significant evidence of such an effect, there was a large degree of uncertainty around this estimate.

Based on the available evidence, it seems reasonable to conclude that where we observe a reduction in Campylobacter prevalence, when comparing results under the revised protocol with those under the previous protocol, it is likely to represent a genuine reduction. Indeed it is possible that the reduction is being underestimated (owing to the move to 100% neck skin samples). However, we do not have sufficiently robust evidence to entirely rule out the possibility that the revised protocol may be less stringent than the old one. Hence, some caution is required when interpreting the measured changes over time as they may have been impacted by the change in protocol.

Statistical features

This report includes prevalence estimates for the 9 retailers which have a market share greater than 4% - the 'named' retailers. All butchers and other smaller retailers are grouped together into an 'Others' category.

During the first survey (mid-Feb 2014 – mid-Feb 2015), chickens were sampled from retailers to reflect their market share, with a planned 4,000 samples altogether and designed to estimate the overall mean prevalence of Campylobacter in fresh retail chickens in the UK over a 12-month period.

In the second year (Jul 2015 - Mar 2016), this was altered to give more robust prevalence estimates for the named retailers as well as to estimate the mean prevalence. An equal number of chickens were sampled from each of the named retailers (100 per quarter) and for butchers (50 per quarter) and smaller retailers (50 per quarter). Adopting this design has a negligible effect on the precision of estimate for the overall mean prevalence, while resulting in better comparability between retailers. As with the first survey, for each of the named retailers the split in terms of the types of chickens sampled (standard/ free-range/ organic) was based on the market share data. The current survey follows the same sampling design as the second survey (Jul 2015 - Mar 2016).

To remove any bias from not sampling chickens according to market share, the survey data are weighted using the market share data. So the overall prevalence figures are a weighted average of the prevalence figures for each of the 9 named retailers, butchers and 'other small retailers'. The prevalence figure given for the 'others' category is a weighted average of the prevalence figures of butchers and the figures calculated for 'other smaller retailers'.

The market share data used were supplied by Kantar for the 52 weeks ending 1st February 2015. As these data are a snapshot of a fixed period of time, they may not reflect the dynamic nature of the market. These data fulfil several criteria:
- They are derived from a large UK-wide consumer panel.
- They are able to provide information specifically referring to chickens at retail which meet eligibility criteria for inclusion in the survey.
- They provide breakdowns by type of chicken (standard, free-range, organic).

Confidence intervals, for the estimated prevalence of individual retailers for Apr-Jul 2017 are exact confidence intervals. The average prevalence estimates for individual retailers across the whole of year 3 of the survey are weighted averages of the 4 quarters of the year and so bootstrap confidence intervals are used for these estimates. Likewise, since the estimates of the overall prevalence, and the estimates of prevalence for the 'Others' category are weighted averages, bootstrap confidence intervals are also used for these estimates.

Laboratory testing

The testing laboratories were the three Public Health England (PHE) Food, Water and Environmental Microbiology Laboratories, as well as the Agri-Food Biosciences Institute (AFBI) Laboratory in Northern Ireland. Once samples reached the laboratory, testing was indicated within 24 hours, and certainly before 48 hours after sampling. Chickens were tested before or on their use-by dates. Sampling and laboratory personnel prevented cross contamination between samples and from the surrounding environment at all stages, e.g. by wearing gloves and changing them between handling each chicken, and the cleaning of equipment and work surfaces after each sample.

One sample consisting of 10g of neck-skin was analysed for each chicken. If 10 grams of neck-skin was not available, a range of 2g to 10g could be used and the weight was accurately recorded. Chickens with less than 5g of neck-skin available for testing were be re-sampled and tested. Chickens with neck-skin weights between 2g and 5g were analysed according to protocol in order to gain further insight about how the weight of the neck skin may affect the contamination levels, but these results were not used in deriving the published figures.

The chicken samples tested were examined utilising the enumeration method based on that described in EN/ISO/TS 10272-2:2006 'Microbiology of food and animal feeding stuffs – Horizontal method for detection and enumeration of *Campylobacter* spp – Part 2: Colony-count technique'. Enumeration using direct plating with a detection limit of 10 colony forming units (cfu) per gram (g) of neck-skin was used.

Any isolates of Campylobacter species were sent to the PHE laboratory in Colindale for further speciation.

Further information

Additional information on the survey design and testing can be found in the revised survey protocol (1st August 2016) at:
www.food.gov.uk/sites/default/files/retail_survey_protocol_year3.pdf.

We aim to meet the needs of our users. If you have any feedback on this publication please send it to chickensurvey@foodstandards.gsi.gov.uk.