THE JOINT GOVERNMENT AND INDUSTRY TARGET

TO REDUCE *CAMPYLOBACTER* IN UK PRODUCED CHICKENS BY 2015

DECEMBER 2010

The purpose of this paper is to describe the target that has been agreed jointly between government and industry, to reduce *Campylobacter* in UK produced chicken.

INTRODUCTION

1. *Campylobacter* is the most common cause of bacterial food poisoning in the UK. It is found mainly in poultry but also in red meat, unpasteurised milk and untreated water. The FSA Strategy 2010-2015 includes the outcome that 'Food produced or sold in the UK is safe to eat'. A main priority for this is to reduce foodborne disease using a targeted approach – tackling *Campylobacter* in chicken as a priority. Reduction of *Campylobacter* in chicken is a priority because the handling, preparation and consumption of broiler meat may account for 20% to 30% of human cases of campylobacteriosis, while 50% to 80% may be attributed to the chicken reservoir as a whole[1]. The FSA food chain analysis project, which looked at risk from primary production to retail, concluded that the greatest risk of *Campylobacter* infection for people is from poultry meat, and hazards arise across the food chain that can result in the introduction of *Campylobacter* into food[2].

2. A survey[3] carried out by the Food Standards Agency (FSA) of *Campylobacter* in chicken on retail sale in the UK between May 2007 and September 2008, reported that *Campylobacter* was present in 65% of the fresh chicken samples tested. An EU baseline survey carried out in 2008 and published by EFSA[4] in March 2010 showed the UK estimated prevalence for *Campylobacter* in broiler batches (caecal contents) was 75% and on broiler carcasses (skin samples) 86%. These results were above the weighted EU mean prevalence's of 71% and 77% respectively. There was a wide range of *Campylobacter* prevalence across Members States varying from 4.9% to 100.0% on broiler carcasses and from 2.0% to 100.0% in broiler batches. The counts of *Campylobacter* on broiler carcasses varied widely between samples. In the UK 42% of samples contained less that 100 *Campylobacter* per gram (cfu/g) and 27% contained more than 1,000 *Campylobacter* per gram (cfu/g).

3. The findings from these surveys show that there are *Campylobacter* related challenges in our food-safety system. In order to achieve our strategic aim to reduce foodborne illness we have developed a *Campylobacter* Risk Management Programme (Annex 1). The programme encompasses a range of Government/industry partnership led projects coordinated through a Joint Action Plan on *Campylobacter* (Annex 2) and targeted at different points across the food chain.

4. To measure progress on the effectiveness of our *Campylobacter* Risk Management Programme we have agreed a new target for the reduction in levels of *Campylobacter* in UK produced raw chicken, to be achieved in a phased approach by April 2015. This paper describes the target.

5. The voluntary target described in this paper was recommended by the Sub-Group on a Target for *Campylobacter* Reduction, and agreed by the Joint Working Group on

[1] Scientific Opinion on Quantification of the risk posed by broiler meat to human campylobacteriosis in the EU (adopted 9 December 2009) http://www.efsa.europa.eu/en/scdocs/scdoc/1437.htm
[2] http://www.food.gov.uk/safereating/foodchain/summary/
[3] http://www.food.gov.uk/news/newsarchive/2009/oct/chicksurvey
[4] http://www.efsa.europa.eu/en/scdocs/scdoc/1503.htm

Campylobacter, whose membership includes the FSA, Defra, the British Poultry Council, the National Farmers Union and the British Retail Consortium. In agreeing the target, the Joint Working Group noted that the paucity and quality of the current data available to generate it has implications for the reliability of the figure as an indicator of a feasible and practical outcome.

TARGET TO REDUCE *CAMPYLOBACTER* IN UK PRODUCED CHICKENS

The Target

6. The target will be to reduce *Campylobacter* contamination on whole chickens in UK slaughterhouses and will be based on *Campylobacter* counts (enumeration) as this is considered more appropriate than a target based on prevalence. This reflects the fact that the count on birds is relevant to the risk to public health, with higher bacterial counts being the most risky[5]. Although as yet no level has been agreed as acceptable in terms of risk, a scientific paper published by EFSA in 2009 concluded that consumer risk appears to be particularly associated with exposure to high numbers of *Campylobacter*[6]. The aim of the target is to reduce the levels of the most highly contaminated chickens at the end of the slaughter process (post chill).

7. The target will be monitored using a banding approach, where samples are grouped into 3 bands according to whether the *Campylobacter* counts in chicken are above or below a set level (i.e. <100 cfu/g, 100-1,000 cfu/g, and >1,000 cfu/g). The target is limited to 3 bands for simplicity and to allow sensible interpretation when monitoring progress against the baseline. The target focuses on decreasing the proportion of birds in the most contaminated group i.e. >1,000 cfu/g. A number of factors affect the likelihood of exposure to *Campylobacter,* more detail is described in paragraph 29. Following exposure, the chance of illness is considered to be higher where higher numbers of organisms are ingested; hence the highest band is selected for the focus of the target

8. **The UK target for reduction of *Campylobacter* is a reduction in the percentage of chickens produced in UK poultry slaughterhouses that have the highest level of contamination, i.e. those with more than 1,000 cfu per gram, from a baseline of 27% in 2008 to 10% by 2015, measured post-chill**. It is expected that the least contaminated chickens i.e. less than 100 cfu per gram, will get no worse or will improve upon the baseline of 42% by 2015. The baseline was determined in 2008 by the EU survey of *Campylobacter* in broiler batches and on *Campylobacter* and *Salmonella* on broiler carcasses[7].

9. Progress towards the 2015 target will be reviewed in 2013 against an expected reduction in the most contaminated chickens in UK poultry slaughterhouses (i.e. those with more than 1,000 cfu per gram) from a baseline of 27% in 2008 to 19% by 2013[8]. The 2015 target will be reviewed in light of progress achieved by 2013 and available evidence to see what further reductions can be achieved, based on implementation of available interventions at commercial level.

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[5] Nauta *et al.* , 2009 International Journal of Food Microbiology ,129, 107-123

[6] EFSA 2009, Scientific Colloquium Summary Report 12, 4-5 December 2008, Rome, Italy

[7] EFSA 2010, Analysis of the baseline survey on the prevalence of *Campylobacter* in broiler batches and of *Campylobacter* and *Salmonella* on broiler carcasses in the EU, 2008 - Part A: *Campylobacter* and *Salmonella* prevalence estimates http://www.efsa.europa.eu/en/scdocs/scdoc/1503.htm

[8] This reduction from 27% in 2008 to 19% by 2013 (i.e. 8% reduction) is more challenging than what might be realistically expected by current interventions, particularly biosecurity, estimated to be closer to a 5% reduction. The more challenging reduction of 8% has been recommended as it will enable a statistical difference from the baseline to be measured using a reasonable sampling plan (less than 8% would require in excess of 2000 samples). However, taking account of both biosecurity interventions and improvements in slaughterhouse hygiene by 2013, this challenging reduction would not seem unreasonable

10. The target has been estimated using what is considered by international experts to be a robust model developed through the Joint FAO/WHO Food Standards Programme and the Codex Committee on Food Hygiene[9]. Interventions modelled have been those identified in the Joint Action Plan on *Campylobacter*, developed through the Joint Working Group on *Campylobacter*. However, the interventions modelled have not been tested in the field and it is currently unknown whether the practical outcomes will match the theoretical estimates of the model. The paucity of field data means that this initial target figure should be considered as a starting point and not as a robust indicator of a feasible outcome based on the current state of knowledge and experience. However, as new data becomes available and progress is measured, the target will be reviewed and, if necessary adjusted, to reflect what is achievable in the light of the new evidence.

11. Although the target is focussed on the reduction of levels of *Campylobacter* on UK produced chicken, our ultimate aim is to reduce levels of human infection. Meeting our ultimate aim of reducing campylobacteriosis is a challenge. Meeting the target to reduce *Campylobacter* on chicken meat will play a key role, but success will also depend on the impact of wider initiatives in the *Campylobacter* Risk Management Programme.

Evidence to Inform Target Setting

12. The target was informed by the reductions estimated from a mathematical model representing the chicken production process, following a similar method to that in a web-based tool currently being developed by Codex[10]. The effects of standard production processes (e.g. washing, evisceration, chilling) on the counts on an average bird, and the impact of applying a range of potential interventions, were sourced from a combination of available research, monitoring and surveys, and from the expert opinion of members of the group where information was less readily available. A number of assumptions were also made where necessary (see Annex 3 for an outline of the modelled process which is based on limited data as currently stands, and Annex 4 for data sources and assumptions). As there are uncertainties around the assumptions and data within the model, sensitivity analysis was undertaken in order to better understand the limitations and reliability of the model.

13. A range of interventions were evaluated to give indications of the size of reductions that may be possible, and are presented as examples of processes that could be implemented by industry as and when they are shown to be effective and are approved for use in the UK.

14. The results of the model (Annex 5) were used to frame discussions as to what might be an achievable, realistic and challenging target, based on known data. Final recommendations on the target levels were made by the working group based on the model's results, alongside consideration of the practicalities in implementing the interventions in an operational setting.

15. The costs of different interventions have **not** been taken into account when considering a target at this stage. Although an important consideration, both for industry and in terms of consumer acceptability, costs are not currently available in sufficient detail to make valid cost effectiveness comparisons. Once more robust data is available, the relative cost of effectiveness of interventions will be revisited.

[9] ftp://ftp.fao.org/codex/ccfh42/fh42_04e.pdf
[10] ftp://ftp.fao.org/codex/ccfh42/fh42_04e.pdf

Point in the Food Chain that the target will be set

16. The target will be set in the slaughterhouse at the end of the slaughter process, post chill. The advantages, and disadvantages, of a slaughterhouse target were compared to other options i.e. a target set at farm level, or at the point of sale to the consumer (in retail shops) or at the point where the chicken is packaged and "ready for retail" but is still within the slaughterhouse/cutting plant. Advantages and disadvantages associated with monitoring each option are outlined in Annex 6.

17. Setting the target at the end of slaughter was the preferred option as it would take account of the majority of slaughterhouse interventions and allow feedback to farms on flock-level interventions. It is also a point at which samples can be collected with relative ease and low cost. This option also has the key advantage of having a robust baseline against which to measure progress, the EU baseline survey of UK broiler carcasses (2008). Although setting the target at "ready for retail" instead would have the additional advantage of taking account of the potential benefit of packaging interventions, the lack of a baseline at this point in the food chain has weighed in favour of proposing the target is set at the end of slaughter before packing. One option is for baseline data at the point of "ready for retail" to be collected in future to enable an additional target to be set at that point later in the target period.

Interventions to deliver on the target

18. The target will be achieved through the implementation of interventions along the chicken production chain. These interventions have been described in the Joint Action Plan (see Annex 2 for a summary). A phased approach has been agreed, with initial interventions focusing on primary production whilst interventions at the slaughterhouse and retail points are further developed and trialled. The interface between the interventions and the target are described below.

Primary Production – Enhanced Biosecurity

19. The reductions will be achieved in the short term through industry commitment to enhanced biosecurity to keep *Campylobacter* out of UK poultry farms. The new on-farm standards will be implemented throughout the UK by the Red Tractor Farm Assurance Poultry Standards – Broiler and Poussin, in April 2011. The new standards will be implemented in Red Tractor assured chicken farms and other major retailer's independent assurance schemes that are part of the joint Working Group on *Campylobacter*. An estimate of the reduction in the risk of contamination (50% based on available data[11]) as a result of this intervention has been modelled. The model estimates that the percentage of *Campylobacter* counts in the most highly contaminated band i.e. > 1,000 cfu/g should decrease from the baseline of 27% to 19% in 2013. The expected date for this reduction is two years following the implementation of the intervention by the chicken industry (1 April 2011). As a result of this implementation it is expected that the percentage in the least contaminated band, <100cfu/g, will get no worse or improve upon the baseline of 42%.

[11] B15025: A critical review of interventions and strategies (both biosecurity and non-biosecurity) to reduce *Campylobacter* on the poultry farm http://www.foodbase.org.uk//admintools/reportdocuments/384-1-682_Final_report_version_10.pdf

20. The expected reductions will be monitored in bands of contamination levels as follows:

	Campylobacter enumeration		
	<100 cfu/g	100-1,000 cfu/g	>1,000 cfu/g
Baseline[12]	42%	31%	27%
Model estimates (2013)	58%	23%	19%
2013 Expected progress	Expected improvement	Expected improvement	19%

Slaughterhouse Interventions

21. Later in the 5 year target period, reductions are expected to be achieved through developments in slaughterhouse hygiene and specific interventions to reduce *Campylobacter* during processing. Some ongoing reduction is expected though use of the slaughterhouse self assessment tool which can help identify areas of a process where changes should assist in reducing levels of pathogens. This tool has been developed based on the currently available scientific evidence and members of the BPC who have online access to the tool are routinely undertaking assessments and where possible making changes together with monitoring *Campylobacter* levels on broiler carcasses. The reductions will be monitored against the EU baseline of UK broiler carcasses (2008) and the expected reductions will be monitored in bands of contamination levels as above.

22. The industry will implement specific, appropriate and proven slaughterhouse interventions to reduce *Campylobacter* as and when available, in combination with enhanced biosecurity and developments in hygiene standards. The range of interventions currently being trialled for efficacy, feasibility, practicality and cost benefit is detailed in the summary Joint Action Plan on *Campylobacter* attached in Annex 2. Some of the interventions, e.g. the use of lactic acid on poultry carcasses, are not currently permitted in the EU and work is underway to progress a change in the legislation, which may or may not be possible in the lifetime of this target. A programme of research to understand consumers' views and acceptability of interventions to reduce *Campylobacter* in chicken is also underway. The findings of the first wave of research, Citizens' Forums on *Campylobacter*, have been published[13].

23. As the majority of slaughterhouse interventions are unlikely to be implemented until after 2014, a target has been agreed based on modelling an estimated 0.5 $\log_{10}$ cfu/g reduction as a result of improved hygiene and pilot activity ahead of commercial implementation of interventions expected post 2014.

24. The model estimates that the percentage of *Campylobacter* counts in the most contaminated band, i.e. > 1,000 cfu/g, should result in a minimum reduction of 17% from the baseline of 27%, to 10% by 2015 as outlined below. As a result of this

[12] Percentage of *Campylobacter* counts present on UK broiler carcasses from a European Union-wide baseline survey on *Campylobacter* in broiler batches and on *Campylobacter* and *Salmonella* on broiler carcasses carried out in 2008
[13] http://www.food.gov.uk/science/socsci/ssres/foodsafetyss/citforumcampy

implementation it is expected that the percentage in the least contaminated band, <100 cfu/g, will get no worse or improve upon the baseline of 42%. Achieving this target will be highly dependent on the availability of interventions that are effective in reducing *Campylobacter*, and the scale and success of intervention trials over the next few years.

25. The expected reductions, monitored in bands of contamination set out below, are based on enhanced biosecurity plus the addition, beyond 2013, of the impact of slaughterhouse interventions and intervention trials:

	Campylobacter enumeration		
	<100 cfu/g	100-1,000 cfu/g	>1,000 cfu/g
Baseline	42%	31%	27%
2013 Expected progress	Expected improvement	Expected improvement	19%
Target reviewed 2013 2015 target reset as appropriate			
Model estimates (2015)	68%	22%	10%
Target 2015	Expected improvement	Expected improvement	**10% Target**

Retail Interventions

26. The target currently does not cover retail interventions due to the lack of a reliable baseline. However, the implementation of modified atmosphere packaging might potentially further reduce the level of *Campylobacter* before retail. If retail interventions are found to be effective (and new research will inform that position), as part of the review process consideration will be given to how to measure their impact on the levels of *Campylobacter* in retail chicken. This may involve setting an additional target and monitoring point, assuming a reliable baseline is available (see paragraph 17 above).

Monitoring of the target

27. The target will be monitored using a banding approach, where samples are grouped according to whether the counts are above or below a set level (e.g. 100 cfu/g). The target is focused on decreasing the proportion of birds in the higher groups. An alternative approach of basing the target on decreasing the value of an upper percentile was considered, where a target is set on the value of the count of the chosen percentile. It was, however, agreed that the target would be framed as bands as it is easier to communicate a target using this approach compared to using percentiles. The poultry industry can easily see where their individual company is placed in relation to the bands and how to monitor their progress within the bands. The target is limited to 3 bands for simplicity and to allow sensible interpretation when monitoring progress against the baseline.

28. Industry have put in place an on-going voluntary harmonised monitoring programme and FSA will put in place an independent quality assessment of this monitoring alongside a minimal programme of independent monitoring. Both sets of data will be used by FSA to

assess ongoing progress towards meeting the target. The programme of independent monitoring is likely to be a randomised sampling scheme covering 85% of the industry based on throughput, and as such not all UK slaughter houses will be included in the monitoring programme. Annex 7 details the method currently used by industry in the harmonised voluntary monitoring programme, this is a working draft and will finalised spring 2011. The full details of the FSA independent monitoring programme, the quality assessment of the industry data and assessment of progress towards meeting the target using a combination of these data, will be available in spring 2011.

Impact on campylobacteriosis

29. It is difficult to directly estimate the impact of the target on human cases of *Campylobacter* food poisoning. A number of factors occurring between the point of chill and consumption will affect the likelihood of exposure to *Campylobacter*, such as buying behaviour, food hygiene practices and cross-contamination to ready-to-eat foods during preparation in both domestic and commercial settings. Following exposure, the chance of illness is considered to be higher where higher numbers of organisms are ingested. However, the available dose-response model[14] describing this relationship is based on limited information and is not considered to provide a reliable estimate of the magnitude of risk.

30. Further, there are a number of other causes and drivers of *Campylobacter* in humans, e.g. exposure to sources other than chicken, size of susceptible population, etc., and evidence on the relative contribution of these is limited. Recent research has suggested that between 35%[15] and 80%[16,17] of human campylobacteriosis cases may be attributable to chicken sources. On the assumption that all other factors remain constant, planned activity on farm and in the slaughterhouse could lead to between a 15% and 30% reduction in human cases.

31. However, it should be noted that reported campylobacteriosis cases have increased in recent years and it is difficult to separate out those that are from chicken sources. It is possible that the estimated reduction as a result of planned interventions to reduce *Campylobacter* in chicken is not observed as a result of increases in campylobacteriosis due to other factors.

Review of the target

32. Achievement of the target will be reviewed periodically, in addition to a formal review in 2013, to reflect the pace of implementation of interventions to reduce *Campylobacter*. In April 2011 new biosecurity standards will be implemented by the industry through Red Tractor Farm Assurance Poultry Standards – Broiler and Poussin, and a reduction in *Campylobacter* in chicken carcases as a result of this intervention is expected to be seen in 2012/13. Slaughterhouse interventions will, however, be implemented over a longer period and the expected reductions are unlikely to be seen until 2014/15. Some ongoing reduction is however expected though use of the slaughterhouse self assessment tool which can help identify areas of a process where changes should assist in reducing levels of pathogens. This tool has been developed based on currently available scientific evidence and members of the BPC who have online access to the tool are routinely

[14] Black, R.E., Levine, M.M., Clements, M.L., Hughes, T.P., Blaser, M., (1988) Experimental *Campylobacter jejuni* infection in humans. *J. Infect. Dis*. 157, 472-479
[15] The molecular epidemiology of Scottish *Campylobacter* isolates from human cases of infection using multilocus sequence typing (MLST) FSA http://www.foodbase.org.uk/results.php?f_report_id=339
[16] Wilson, D. J., E. Gabriel, A. J. H. Leatherbarrow, J. Cheesbrough, S. Gee, E. Bolton, A. Fox, P. Fearnhead, C. A. Hart and P. J. Diggle (2008) Tracing the Source of campylobacteriosis, *PLoS Genetics,* Volume 4, Issue 9
[17] Sheppard, S. K., Dallas, J. F., Strachan, N. J. C., MacRae, M., McCarthy, N. D., Wilson, D. J., Gormley, F. J., Falush, D., Ogden, I. D., Maiden, M. C. J. and K. J. Forbes (2009) *Clinical Infectious Diseases* **48**: 1072-1078

undertaking assessments, and where possible making changes, together with monitoring *Campylobacter* levels on broiler carcasses.

33. The model used to inform the target is based on a number of assumptions using the best available data at the current time. As more data becomes available through the research programme on *Campylobacter*, funded under the UK Research and Innovation Strategy for *Campylobacter* in the food chain (2010-2015)[18], the target will be reviewed and where appropriate revised. The research programme will also build on consumers' acceptability of interventions, including issues relating to cost, which will inform decisions on what is appropriate for the UK consumer and how best to communicate our *Campylobacter* control programme to the public.

34. The target should be seen as a tool to help reduce *Campylobacter* levels in chicken and improve food safety in the UK rather than a goal for its own sake. Therefore over the period of the target, as new data becomes available and progress is measured, the target will be reviewed. The target may be adjusted, to be either more challenging or less challenging than the current indicative reduction of the most contaminated chickens from a baseline of 27% in 2008 to 10% by 2015, to reflect what is achievable in the light of the new evidence.

[18] http://www.food.gov.uk/multimedia/pdfs/*Campylobacter*strategy.pdf

ANNEX 1

THE FOOD STANDARDS AGENCY'S
DRAFT *CAMPYLOBACTER* RISK MANAGEMENT PROGRAMME 2010-2015
(REVISED DECEMBER 2010)

ISSUE

The FSA Strategy 2010-2015 includes the outcome that 'Food produced or sold in the UK is safe to eat'. A main priority for this is to reduce foodborne disease using a targeted approach – tackling *Campylobacter* in chicken as a priority. This document outlines a draft strategy to achieve these aims by 2015.

VISION

Our vision for this work is to achieve a substantial reduction in the number of human cases of campylobacteriosis in UK by 2015, to be achieved through measures including a substantial reduction in the level of *Campylobacter* contamination in UK produced chicken by 2015.

BACKGROUND

1. The Foodborne Diseases Strategy was originally published in 2001 to coordinate the Agency's efforts to reduce foodborne disease, and in particular to meet a target of a 20% reduction in infectious foodborne disease by 2005. By 2005 a 19.2% reduction in laboratory confirmed cases of the Agency's 5 key foodborne pathogens was recorded. A renewed strategy for 2005-2010 was developed with the strategic aim of reducing foodborne disease further. A key target of this strategic plan was a 50% reduction in the prevalence of *Campylobacter* in chicken at retail sale by 2010.

2. The most recent Agency-commissioned survey on the prevalence of *Campylobacter* in chicken at retail sale published in October 2009 suggests that the above 50% target has not been met. Additionally cases of campylobacteriosis have gradually risen since 2004 and we expect to see a further increase in reported cases for 2009.

3. Our efforts since 2001 do not appear to have been effective in achieving a sustained reduction in human campylobacteriosis in the UK. The reduction of foodborne disease caused by *Campylobacter* is a key aim of the new FSA strategic plan 2010-15. This is focussed on the reduction of *Campylobacter* in chicken as 60-80% of cases of campylobacteriosis can be attributed to chicken. Our food chain analysis project, from primary production to retail, concluded that the greatest risk of *Campylobacter* infection for people is from poultry meat, and hazards arise across the food chain that can result in the introduction of *Campylobacter* into food.

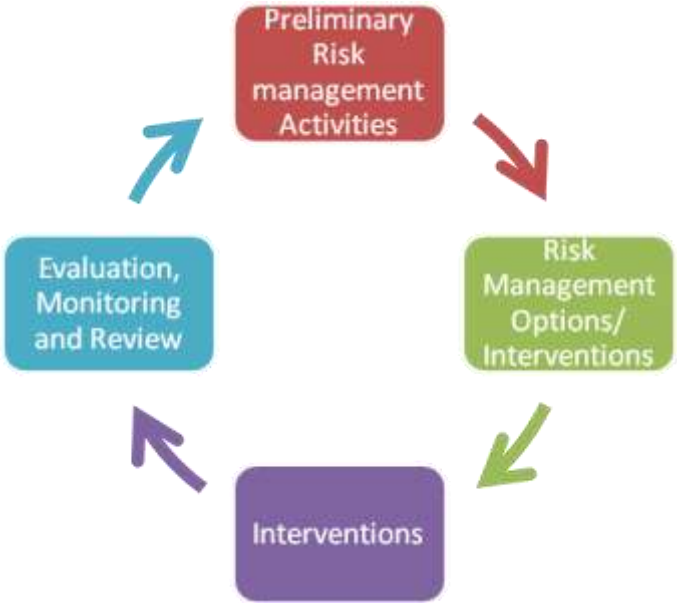
4. Our efforts to achieve our strategic aim will centre on development and implementation of a *Campylobacter* Risk Management Programme (see figure

below). The programme will encompass a range of projects targeted at different points across the food chain, from farm to fork.

5. To measure progress on the effectiveness of our work in this area a new target for the reduction in levels of *Campylobacter* in raw chicken will be set and published by December 2010, to be achieved by April 2015.

6. Although our target will be focussed on the reduction of levels of *Campylobacter* on chicken in the UK, our ultimate aim is to reduce levels of human infection. Therefore our *Campylobacter* Risk Management Programme will be complemented by other work to improve public awareness and effective use of messages about good food hygiene practice at home and in catering establishments.

Development of FDS Risk management Programmes
Working in partnership with Stakeholders



STAKEHOLDER ENGAGEMENT & PARTNERSHIP WORKING

7. We will deliver *Campylobacter* reduction through stakeholder engagement and partnership working. To both set and achieve a target for the reduction of *Campylobacter* in chicken we will need to engage and work with a range of groups external to the Agency. We recognise that we can best protect UK consumers and achieve a significant reduction in UK *Campylobacter* levels through good working partnerships and stakeholder engagement.

8. A greater understanding of the microbiology of *Campylobacter* needs to be built, which will entail a considerable basic research effort, much of which is outside the Agency's direct remit. To this end we have engaged with Defra and the

BBSRC to develop a coordinated programme of *Campylobacter* research. This coordinated approach to research funding will ensure that future *Campylobacter* research will feed into practical outcomes in the control of *Campylobacter* infection. An initial workshop was held 12-14th October 2009 to explore and develop research priorities, with researchers, industry and officials. A follow-up meeting to discuss outcomes of the workshop further and agree respective priorities was held on 15th December 2009. A joint *Campylobacter* research strategy was published in July2010, with the first research calls in the co-ordinated programme taking place in July 2010.

9. We need to engage and build partnerships with industry from the farm level to the point of delivery to the consumer. There are existing links at farm, processing and retail level that we can develop further to build a partnership approach with each sector to allow delivery of the reduction in *Campylobacter* levels in chicken.

10. We also need to ensure that we engage the consumer, taking into account their views. Interventions in the food chain to control *Campylobacter* must be acceptable to consumers, both from the point of view of economic impact (i.e. the effect on the price of chicken) and sensitivities around the wholesomeness of the food.

APPROACH

11. In 2010 we have concentrated on developing and agreeing a realistic and evidence based target for the reduction of *Campylobacter* in chicken, developing and implementing a stakeholder engagement strategy to facilitate this and taking forward a coordinated programme of research with other funders to understand the complexities of infection with this organism.

12. In 2011-2015 we will utilise our engagement with stakeholders and outputs from research to implement interventions designed to reduce *Campylobacter* levels to our target figure. We will also continue to work to improve public awareness and use of messages about good food hygiene practice at home and in catering establishments to reduce levels of campylobacteriosis in the human population.

SETTING A TARGET

13. We aim to set an evidence based target for the reduction of *Campylobacter* in chicken by the end of 2010. To achieve this aim we will:

    a. Take into account the results of the EFSA baseline survey of the prevalence of *Campylobacter* in broilers and carcasses (available at: www.efsa.europa.eu/en/scdocs/scdoc/1503.htm), the Scientific Opinion on “Quantification of the risk posed by broiler meat to human campylobacteriosis in the EU”, adopted in December 2009 (available at http://www.efsa.europa.eu/en/scdocs/scdoc/1437.htm), and any EU targets that may be set regarding *Campylobacter* in chicken.

b. Ensure we have robust evidence of the level of *Campylobacter* in chicken at the point in the food chain where the target will be set. We will take into account previous FSA surveys and data from other sources to set an appropriate baseline against which we will then monitor.

c. Develop an understanding of the points in the food chain where interventions to reduce *Campylobacter* levels are best targeted, and the level of reductions that such interventions could achieve. To underpin this we will undertake an analysis of the chicken production chain from farm to fork to identify effective interventions, any barriers or impediments to their successful uptake and the cost/benefit of such interventions.

d. Use modelling techniques, encompassing data from (a), (b) and (c) to generate a rational, evidence-based and realistic target. We will discuss and agree this target with industry.

ACHIEVING THE TARGET

14. To achieve the target, we will need to engage and work with a range of stakeholders throughout the food chain to effect change. We will need to gain their agreement for the need for action, provide a sound evidence-base for the actions or options available, including how effective they can be expected to be, and the magnitude of reduction that we can be expected to achieve together. We will:

    a. Work with industry to trial and evaluate interventions, particularly at slaughterhouse level, and coordinate this work through the development and implementation of a Joint Action Plan on *Campylobacter*

    b. Work with Industry (at all levels, including retail) to promote and achieve uptake of successful interventions

    c. Monitor the level of *Campylobacter* in chicken at the agreed point in the food chain to set the target, and at other points in the food chain, on a regular basis to determine if interventions are successful

15. We will continue to work to effect better awareness of *Campylobacter* and food hygiene behaviour among consumers and caterers throughout the lifespan of the strategic plan.

16. We will work at four levels of the food production chain – primary production, processing, retail and consumers, as outlined below, to achieve the target.

Primary Production

17. Considerable work has already been undertaken by the FSA and Defra in partnership to understand *Campylobacter* at farm level and to develop interventions to try and reduce flock prevalence. The focus has been the promotion of biosecurity to minimise infection entry and spread in poultry sheds.

18. Work has already been undertaken by the Veterinary Laboratories Agency on behalf of the FSA and Defra (in response to the EFSA 2008 baseline survey) to determine flock and carcass prevalence and risk factors for acquisition of *Campylobacter* infection in poultry at farm level.

19. There has also been extensive engagement with Industry at farm level, with biosecurity firmly on the agenda for this group. We have worked in partnership with the British Poultry Council (BPC) and Assured Chicken Production (ACP) to deliver the key biosecurity messages, and have worked with individual companies in the poultry growing and catching industries to train their staff on best practice biosecurity. New on-farm standards will be implemented throughout the UK by the Red Tractor Farm Assurance Poultry Standards in April 2011 on Red Tractor assured chicken farms.

20. To continue to build on our work with primary producers we intend to:

    a. Monitor flock and carcass prevalence as appropriate throughout the lifespan of the strategic plan
    b. Regularly engage with this sector to ensure promotion of biosecurity measures, through trade associations and relevant events (e.g. Pig and Poultry Fair)
    c. Undertake research to evaluate the success of biosecurity interventions on farm in reducing flock prevalence and to determine how to effect behaviour changes among farm workers and managers that will ensure key biosecurity activities are complied with consistently.

Slaughterhouse/Processing

21. International research has shown that interventions can be particularly fruitful at the processor level (i.e. slaughterhouse) through adoption of best practice.

22. A number of antimicrobial treatments for reduction of *Campylobacter* are in use, e.g. in the USA and New Zealand. These are not currently permitted by the EU although this could be subject to change in the future. However, there are still a range of other alternative interventions available such as treatment with steam that may be used within the EU.

23. Also, there may be scope for overall improvements in Good Hygienic Practice in slaughterhouses that could lead to reduced levels of *Campylobacter* on carcasses. The FSA-developed slaughterhouse hygiene tool is currently being piloted by the majority of large poultry processors and will enable us to measure the effectiveness of existing systems, suggest where hygiene improvements may be possible and help us to evaluate the effectiveness of these.

24. We will take this work forward by:

a. Engaging industry to identify feasible slaughterhouse interventions, through the joint Government/BPC/BRC Working Group on *Campylobacter*, convened in August 2009.

b. Taking forward a Joint Action Plan, informed by the International *Campylobacter* meeting held in March 2010 to discuss strategies to reduce *Campylobacter* and identify interventions that have been effective in reducing *Campylobacter* in chicken in other countries. The key aim was to learn from the experiences of other countries, to discuss in detail the approaches taken, and to have a better understanding of any barriers to implementation of such interventions in the UK context. We heard evidence from those working in the poultry industry as well as the regulators.

c. Conducting an evaluation of the effectiveness of the FSA slaughterhouse hygiene tool in poultry slaughterhouses. We need to know whether use of the tool to generate an improved hygiene score results in reduced *Campylobacter* levels on carcasses. If this proves to be successful we would expect to continue to support the tool and look to ensure it is rolled out as widely as possible.

d. Reviewing the current state of knowledge and available data on interventions already trialled or used by the UK poultry processing industry.

e. Trialling interventions that are currently allowed in the EU and monitoring their effectiveness and acceptability in partnership with industry. We would then work closely with industry to achieve wider take up of successful interventions once we have data that demonstrates their efficacy.

f. Working at the EU level in relation to the EU position regarding the use of antimicrobial treatments in the slaughterhouse.

Retail

25. Engaging with and influencing retailers will be a critical factor if we are to succeed with any new *Campylobacter* reduction strategy. There is evidence that retailers are able to positively influence food standards and quality through their purchasing and marketing strategies. The FSA Chief Executive wrote to the Chief Executives of the major food retailers in the UK in December 2009 and again in 2010 to highlight the issue of *Campylobacter* in chicken and to request their help in tackling this problem. Responses have been positive and have indicated their willingness to work with the Agency on this issue.

26. Interventions at producer and processor level must be acceptable to retailers. We need to identify whether any of the interventions we intend to suggest to processors and producers may not be acceptable to retailers, or whether retailers think they would not be acceptable to their customers.

27. We will also explore the role that specific interventions at retail may play in reducing *Campylobacter* prevalence on chickens and reducing risk to consumers e.g. modified atmosphere packaging or leak-proof packaging.

28. We will explore options for in-store campaign work with retailers and the foodservice sector to increase awareness of *Campylobacter* and the importance of safe storage, handling and cooking in preventing foodborne illness.

Consumers

29. Although the priority for action within this programme is expected to be at the farm, processing and retail stages of the food chain, it will be important to continue to work with consumers and caterers to achieve improvements in food hygiene practices that will contribute to reducing foodborne illness caused by *Campylobacter*.

30. We need to incentivise consumers to take food safety more seriously and improve hygiene behaviours. To do this we will explore whether raising consumer awareness of *Campylobacter* as a specific pathogen or risk would be a useful strategy and undertake research to understand the drivers for consumer behaviour in relation to food safety and how to effect positive behaviour change. We will use the outcomes of this research to develop new and novel messaging that would do this.

31. We need to undertake research to understand which interventions at the producer/processor level to reduce *Campylobacter* levels would be acceptable to the consumer. We also need to understand what would need to be done to reassure consumers of the safety of interventions that are not currently considered acceptable, building on the findings of the Citizen Forums held summer 2010.

CONCLUSION

32. A co-ordinated and actively managed *Campylobacter* Risk Management Programme is currently being developed to contribute to the delivery of our strategic aim of reducing foodborne illness, with campylobacteriosis as a priority. As chicken is a major source of *Campylobacter* infection in humans, contamination of chicken meat is being tackled as a priority. A range of activities at all stages of the food chain are proposed to allow us to set an evidence based target for the reduction of *Campylobacter* in chicken by December 2010 and deliver this by 2015.

May 2010 (Revised December 2010)

ANNEX 2

JOINT ACTION PLAN ON *CAMPYLOBACTER*[19] – SUMMARY (DECEMBER 2010)

On farm trials/interventions

1. On-farm implementation of the revised poultry standards (April 2011)
2. Investigate:
    - various physical hygiene barriers
    - C&D of water reservoir and drinkers and modify ACP standards accordingly if appropriate
    - electrolysed water in farm C&D (and modify ACP standards accordingly if appropriate)
    - feasibility of a Farm Hygiene Tool and trial against farms' *Campylobacter* status
    - measures (direct or proxy) of farmer adherence to biosecurity measures
    - rapid on-farm *Campylobacter* test kit
    - motivational drivers of biosecurity compliance. Develop effective education programme if appropriate
    - pilot fly screens on chicken houses
    - pilot pens for turkeys during thinning

Transport trials/interventions

3. Investigate:
    - logistics of naturally drying crates and modules (in summer months) and trial crate drying if feasible
    - re-installing FSA prototype crate washer
    - extent of any *Campylobacter* introduction via washed crates
    - novel crate and module disinfection methods
4. Review and update existing best practice guidance for C&D of crates, modules and lorry decks

Processing trials/interventions

5. Investigate:
    - lactic acid wash in turkey and chicken processing
    - electrolysed water sprays washes in slaughterhouse
    - modified steam treatment
6. Assemble papers on all lactic acid trials and advice on additional work required for technical dossier to support case to Commission

[19] The Joint Action Plan on *Campylobacter* will be continually updated to reflect progress throughout the life of the programme

Retail trials/interventions/consumer behaviour

7. Review use of leak proof packaging for chicken products
8. Review on-pack best practice instructions on storage, handling, preparation and cooking for consumers on chicken products
9. Investigate:
    - impact of different modified atmosphere packaging techniques (MAP) on *Campylobacter*
    - novel packaging systems
10. Consumer education to raise awareness of risks if *Campylobacter* food poisoning and provide public with risk mitigation strategies, and consider:
    - deliberative research to understand consumers attitudes to potential interventions
    - social science research to understand consumer behaviours to bring about behaviour change

Catering sector

11. Investigate:
    - issue of undercooked liver pate/parfait
    - develop best practice compliance toolkit and refresher education programme via Safer Food Better Business programe

Surveillance and monitoring

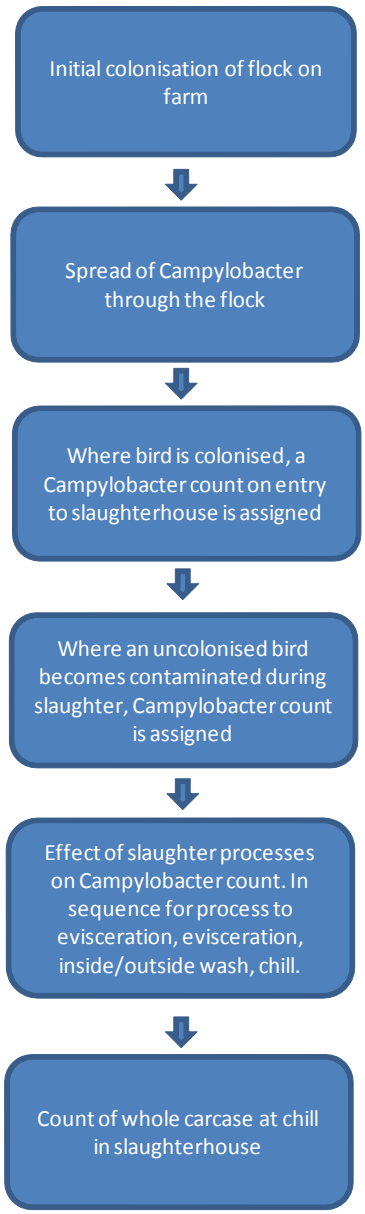
12. Consider:
    - industry harmonised monitoring to enumerate *Campylobacter* on sample carcasses in slaughterhouse using FSA supplied enumeration method
    - independent monitoring for the target (FSA)
    - periodic surveys of *Campylobacter* contamination of raw chicken and chicken products at retail level, wherever possible ensuring comparability between surveys

ANNEX 3
DECEMBER 2010

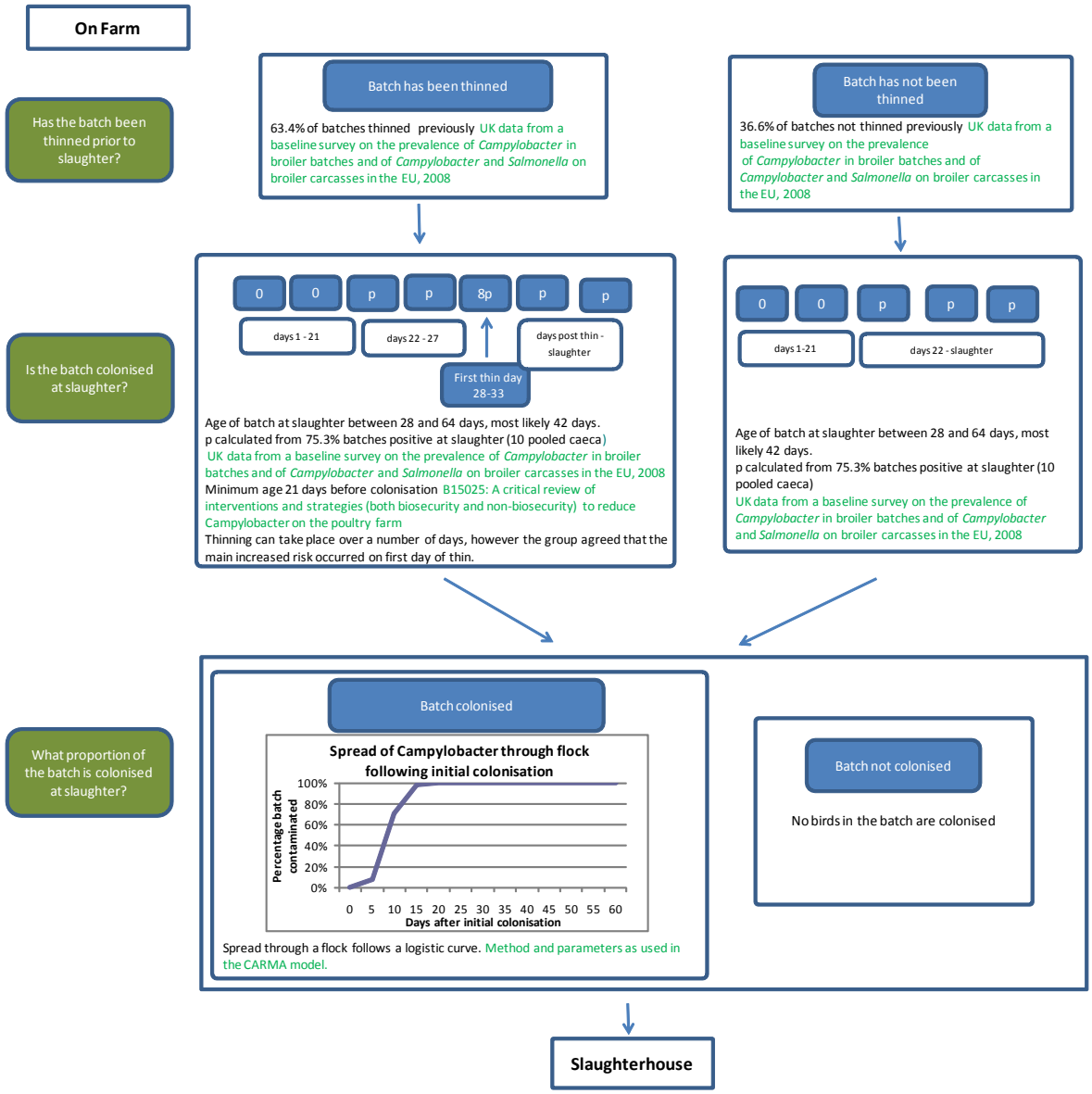
Model Process

A model of the chicken production process was constructed to simulate the effects of the process on an average bird from growing on farm and through the slaughterhouse process. The model was developed in consultation with members of the Sub-Group on a Target for *Campylobacter* Reduction and assumptions within the model informed by members of the group.

The following diagrams illustrate the general process.

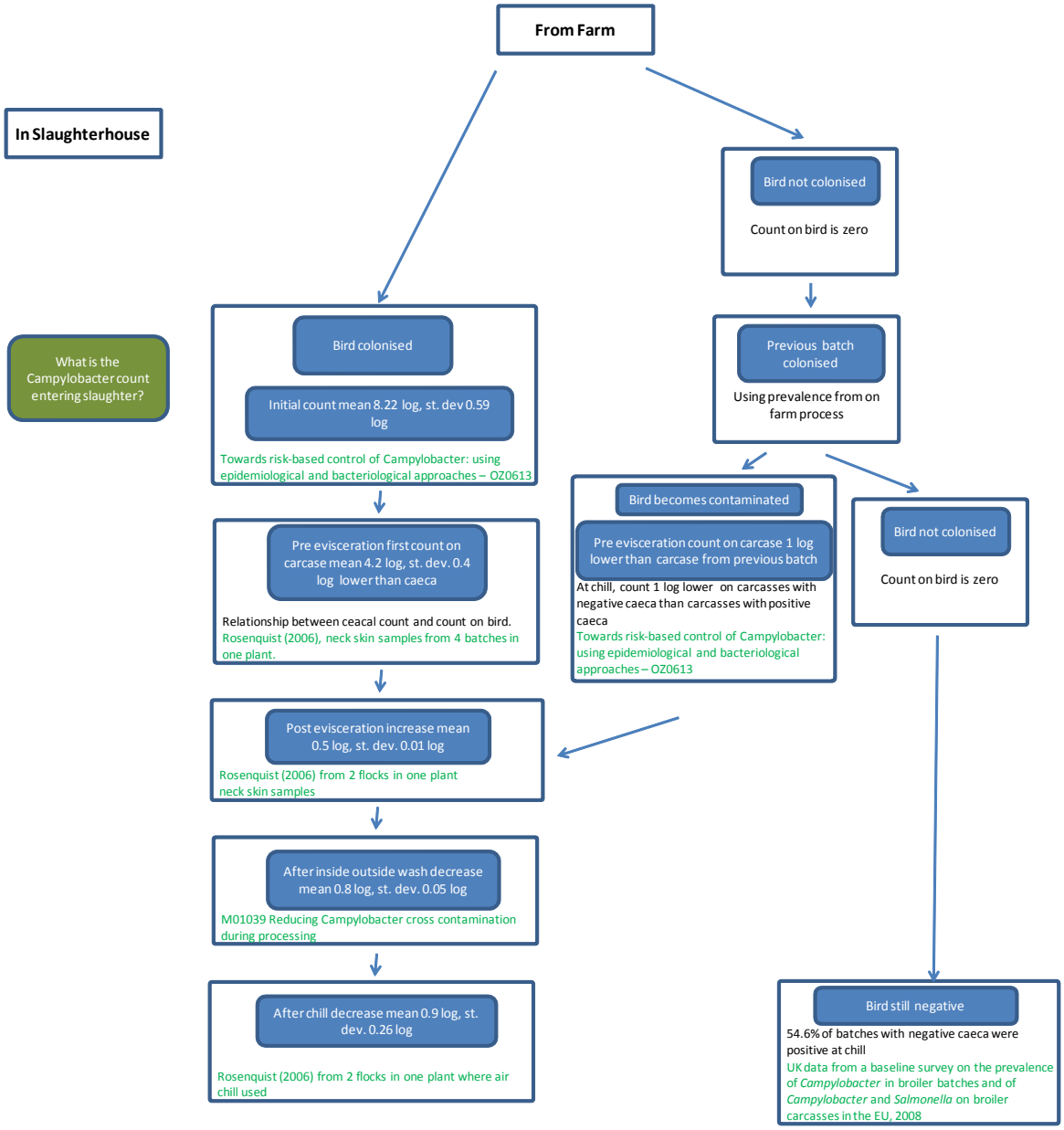


The on farm section calculates the probability of a batch being contaminated at slaughter (the between flock prevalence) and the prevalence within the flock. The method to calculate prevalence within flock followed the method applied by the CARMA model, a risk assessment model developed in The Netherlands[20]



[20] http://www.rivm.nl/carma/resultaten/Euroforum%2020020925/index.htm

In the slaughterhouse, the count of Campylobacter is also considered, and effects of standard production processes (e.g. washing, evisceration, chilling) on the counts on the bird are tracked through the slaughterhouse. The modelling process in the slaughterhouse follows a similar method to that described in a web-based tool currently under development by CODEX[21].



Following validation of the model output against the UK results of the EU baseline survey, a range of interventions were added at the relevant part of the process to estimate their effect on the count on a bird at point of chill

[21] http://www.who.int/foodsafety/micro/jemra/assessment/campy/en/index.html

Data Sources and Assumptions – Annex 4

The tables below summarise the sources of data used in the model. For values of parameters see the process flow chart.

On Farm *Dec 2010*

Source	Parameters within the model	Notes
UK data from a baseline survey on the prevalence of *Campylobacter* in broiler batches and of *Campylobacter* and *Salmonella* on broiler carcasses in the EU, 2008	Proportion of batches thinned prior to slaughter	A randomised survey covering 85% of UK poultry production. For each batch sampled, information on the thinning status and age of the batch was collected.
	Prevalence at slaughter of batches both from flocks that have been thinned and un-thinned previously.	A randomised survey covering 85% of UK poultry production. For each batch sampled, information on the thinning status and age of the batch was collected
	Range of ages of batches at slaughter (both from flocks that have been thinned and un-thinned previously)	The highest age at slaughter was amended downwards from 74 to 64 days as the baseline survey included organic and extensively reared birds, which are slaughtered later.
B15025: A critical review of interventions and strategies (both biosecurity and non-biosecurity) to reduce Campylobacter on the poultry farm, FSA report	Risk of Campylobacter being introduced into a house is higher on day of thin than on each of the other days.	Thinning was found to be a risk factor.
M.J. Nauta, W.F. Jacobs-Reitsma, E.G. Evers,W. van Pelt, A.H. Havelaar Riskassessment of Campylobacter in the Netherlands via broiler meat and other routes	Detected spread of Campylobacter within a flock following initial colonisation is according to a logistic curve.	This adopts the method and parameters used in the CARMA model which was parameterised using a study where 4 birds in a flock were seeded with Campylobacter and the flock tested at intervals to determine the speed of spread through the flock.
Expert opinion of the target setting group	A batch is not colonised with Campylobacter before 21 days old.	Consensus opinion of the group as Campylobacter positive flocks have rarely been detected before 3 weeks old
	Increased risk from thinning applies on the first day of thin.	Consensus opinion of the group.
	Risk of Campylobacter being introduced into the house is equal on all days except for thin	Agreed within the group.

Source	Parameters within the model	Notes
Towards risk-based control of Campylobacter: using epidemiological and bacteriological approaches – OZ0613	Count in caeca as initial contamination a bird from a positive batch	Caecal samples taken from 10 broilers.
	Count on the carcase of a bird from a batch that was negative entering slaughter is 1 log lower than from a batch that was positive entering slaughter	
Rosenquist H, Somner HM, Nielsen NL, Christensen BB (2006) The effect of slaughter operations on the contamination of chicken carcasses with thermotolerant Campylobacter *International Journal of Food Microbiology* 108 P226–232	The relationship between count in caeca and count on carcase before point of evisceration	900 samples collected from 6 broiler flocks slaughtered in two Danish commercial slaughter plants. For each point in slaughter tested, 30 neck skin samples were taken from each of 6 flocks, immediately after the operation. In addition, 30 samples of intestinal content were taken at evisceration for each broiler flock. A regression on the count in caeca and count on carcase was used to describe the count on a carcase prior to evisceration.
	Effect on count from evisceration process.	
	Effect on count on carcase from air chill process.	
M01039: Reducing campylobacter cross-contamination during poultry processing,	Effect on count from inside/outside wash	Results from the control situation in a study investigating the decontamination effect of various chemicals. Naturally contaminated carcasses were taken from a production line immediately before chill. Neck skin samples were taken.
UK data from European Union-wide baseline survey on *Campylobacter* in broiler batches and on *Campylobacter* and *Salmonella* on broiler carcasses carried out in 2008	Distribution of counts on whole carcases after chill	Neck skin from a carcase sample taken from each batch at the point of chill was enumerated. These results were used as a validation point for the output of the model at chill.

Interventions *Nov 2010*

Intervention	Data source	Parameters within the model	Notes
On-farm interventions	B15025: A critical review of interventions and strategies (both biosecurity and non-biosecurity) to reduce Campylobacter on the poultry farm.	Modelled scenarios of 50%, and a lower 25%, reduction in risk of contamination per day on farm.	The report reviewed published intervention studies which suggested that strict hygiene controls could reduce Campylobacter positive flocks by up to 50%. However, the studies were limited so there is some uncertainty over whether such a reduction is possible.
Lactic acid spray	Cudjoe KS, Kapperud G, 1991 The effect of lactic acid sprays on Campylobacter jejuni inoculated onto poultry carcasses, *Acta Vet scand.* 32(4):491-8	Smallest: 0.3 log Most likely: 1.3 log Largest: 2 log	Modelled as an additional process, applied after inside outside wash and before chill. Parameters used in the CARMA model to reflect the results of a number of studies in the practical environment.
Electrolysed water	Gellynck X, Messens W, Halet D, Grijspeerdt K, Hartnett E, Viaene J (2008) Economics of reducing Campylobacter at different levels within the Belgian Poultry Meat Chain *Journal Food Protection* Vol. 71, No. 3 P479-485	Smallest: 1.1 log Most likely: 2.3 log Largest: 3 log	Modelled as a substitution for standard inside outside wash. Dressed broilers were taken from a commercial processing plant and inoculated 5 birds in each batch with Campylobacter. Immersed in a chiller tank with 15 birds not inoculated. Sampled carcase rinse. Compared the levels on the treatment to the control immersed in tap water. Two replicate trials.

Intervention	Data source	Parameters within the model	Notes
Steam treatment	James C, James S J, Hannay N, Purnell G, Barbedo-PintoC, Yaman H, Araujo M, Gonzalez M L, Calvo J, Howell M, Corry J E (2007) Decontamination of poultry carcasses using steam or hot water in combination with rapid cooling or freezing of carcass surfaces. *International Journal of Food Microbiology 114* p195-203	Applying steam for 10 had 1.8 (st. dev. 0.91) log reduction effect.	Modelled as a substitution for standard inside outside wash. Carcasses obtained immediately after chilling and stored frozen, then inoculated and treated with steam for 10, 12 or 20 seconds. Sampled breast skin. Three trials carried out for each treatment and the levels before and after treatment compared.
Hot water	M01019: Physical methods readily adapted to existing commercial lines for reducing pathogens, particularly campylobacters, on raw poultry.	Smallest: 0 log Most likely: 0.75 log Largest: 3 log	Modelled as a substitution for standard inside outside wash Immersion in hot water at 70 deg. C for 40 s.
Modified atmosphere packing	Gellynck X, Messens W, Halet D, Grijspeerdt K, Hartnett E, Viaene J (2008) Economics of reducing Campylobacter at different levels within the Belgian Poultry Meat Chain *Journal Food Protection* Vol. 71, No. 3 P479-485	Between 2.0 and 2.6 log reduction.	Intervention implemented after chill. Results for inoculated chicken fillets stored chilled in an oxygen based gas mixture for 8 days.
Representative intervention post wash	Expert group opinion	Normal(0.5,0.5)	Recommended by the group as a conservative estimate to reflect the fact that modelled interventions were applied in research conditions and may have a lesser effect when applied in an industrial setting.

ANNEX 5
DECEMBER 2010
Model Results

This table summarises the output from the model on the expected reductions following implementation of the listed interventions.

	<100	100-1,000	>1,000
UK EU baseline survey results	42%	31%	27%

Post Chill

	Intervention	<100	100 - 1,000	>1,000
One intervention	**Model Baseline**	**39%**	**33%**	**28%**
	On farm - risk of contamination reduced by 50% per day	56%	24%	20%
	On farm - risk of contamination reduced by 25% per day	45%	30%	25%
	Slaughterhouse - electrolysed water	81%	16%	3%
	Slaughterhouse - lactic acid	78%	18%	4%
	Slaughterhouse - hot water	67%	23%	10%
	Slaughterhouse - Steam	71%	19%	10%
Two interventions	On farm + electrolysed water	86%	12%	2%
	On farm + lactic acid	84%	13%	3%
	On farm + hot water	66%	27%	7%
	On farm + steam	79%	14%	7%

The effect of interventions in the slaughterhouse used results from research under experimental conditions. However, it was suggested that in an industrial setting the reductions practically achievable may be less pronounced, with a 0.5 to 1 log more likely to be achievable. An additional representative intervention was therefore modelled, based on a conservative estimate of mean 0.5 (standard deviation 0.5) log reduction, and the target set from this output. This assumes that an intervention would need to be shown to make such an impact if it is to be implemented.

Intervention	<100	100-1,000	>1,000
Model Baseline	**39%**	**33%**	**28%**
Representative slaughterhouse intervention	55%	30%	15%
On farm risk reduced by 50% plus slaughterhouse intervention	68%	22%	10%

Change from baseline	<100	100-1,000	>1,000
Representative slaughterhouse intervention	16%	-3%	-13%
on farm risk reduced by 50% plus slaughterhouse intervention	29%	-11%	-18%

ANNEX 6
DECEMBER 2010

Comparison of Points in the Food Chain to Set the Target

Point	Advantage	Disadvantage
On farm	Direct measure of the impact of interventions to reduce prevalence on farms.	Likely to be less cost effective to monitor than other points, as many farms to be sampled and requires agreement for access.
		Would not measure the impact of interventions applied during slaughter and packing for retail. Will need agreement to publish results
Slaughterhouse (at point of chill)	Likely to be more cost effective to monitor than at retail, as fewer premises to be sampled (see later) and some slaughterhouses already monitoring at this point and their data can with audit contribute to monitoring the target	Would not measure the impact of interventions applied after slaughter and dressing.
	More direct measure of the impact of interventions in the slaughter process and on the farm as tracing back to the farm/flock is possible.	Monitoring requires agreement with slaughter houses for access to carry out repeated sampling and to share data.
	Potentially covers all of the market of chicken produced in the UK, whether directed to retail or through catering or further processing.	Will need agreement from slaughterhouses to publish results.
	Reliable throughput data enables more representative sampling than in retail.	
	Most robust information available, UK data from EU baseline survey provides a baseline at chill in slaughterhouse.	
Product 'ready for retail' (Product in retail packaging but still within the slaughterhouse/ cutting plant)	Likely to be more cost effective to monitor than at retail, as fewer premises to sample (see later).	May have additional costs as some slaughterhouses currently test earlier in the process.
	Would measure the impact of interventions applied up to the point of retail.	Monitoring requires agreement with slaughter houses for access to carry out repeated sampling.
	Would be able to trace back to farm and slaughterhouse interventions.	May need agreement from slaughterhouses to publish results.
	Better market share data may allow for more representative sampling than in retail.	No current baseline data to measure progress against.
	Variables such as packaging and storage can be collected and any associations between these and *Campylobacter* investigated.	

Retail	Gives a measure of contamination of chicken at the point of purchase by the consumer, following the combination of all interventions up to this point.	Some imports may be difficult to detect and exclude from sampling. *Believe this is only an issue for smaller butchers. Origin and identification labelling would allow this for larger retailers.*
	Smaller risk of validation processes not being sufficient to ensure independence of sampling.	Up to 20% of the UK available supply of chicken is estimated to be supplied to catering establishments and not included in throughput from producers who also supply retail. Benefits from a target may not feed through to this portion of the chicken supply.
	Avoids legal issues with arranging access with slaughterhouses for sampling and publishing results.	Tracing back to the flock would be more difficult.
	Variables such as packaging and storage can be collected and any associations between these and *Campylobacter* investigated.	Will have additional costs as slaughterhouses test earlier in the process

Considerations When Setting the Target

Coverage of a Target at Retail/Ready for Retail

As not all chicken production is directed to the retail market, a target set at retail or 'ready for retail' could exclude the chicken directed towards the catering sector. Comparison of the volume of the retail market[22] against the total volume of chicken produced[23] suggests that 50% of UK produced chicken would be covered if the target was set at either of these points. However, as a number of producers supply both sectors, the majority of measures they take to reduce Campylobacter will apply to retail chicken and chicken supplied to caterers. This would increase the effective coverage of a retail survey to include the part of the catering sector that is supplied by these producers. By mapping the proportion of a producers' throughput that goes to retailers, we can estimate the proportion of catering supply that they also cover and use this to calculate the size of catering market not covered by a target.

Package information from products in the 2008 FSA retail survey gave an indication of the larger producers supplying chicken to the retail sector. Collectively, these producers accounted for 78% of total UK slaughter throughput. As the analysis concentrated on larger producers and is based on survey samples, this suggests that the effective coverage including all suppliers of the retail sector is likely to be at least 78% of UK production.

Products for a target at Retail/Ready for Retail It was considered that if the target was set at retail or at the point of 'ready for retail' in the slaughterhouse, it should only apply to chilled whole chickens. This would aid simplicity of comparison of Campylobacter counts across the samples, eliminating issues with comparing the count on a portion with the count on a whole bird. It is also easier to exclude chicken which has been grown or slaughtered outside of the UK in whole birds than portions, as portions originating from outside the UK may have a UK identification mark if they were processed in the UK. A target on whole birds would not cover the 49%[24] of chilled chicken sold as portions. However this is not believed to be a major

[22] BPC, UK retail chicken sales 52 weeks to August 2008
[23] Defra , 2008 Poultry and Poultry meat supply, carcase weight
[24] BPC, UK retail chicken sales 52 weeks to August 2008

issue as counts on portions have been lower than on whole birds and the primary source, and production process, for portions is the same as for whole birds so similar reductions would be expected to be seen across portions.

The target would also not include frozen chicken. Around 12% of sales of unprocessed chicken are frozen, and only 1% of all retail sales are frozen whole birds. Again, this is not believed to be a major issue as Campylobacter load is significantly reduced by freezing. The FSA retail survey found only 14% of frozen samples were Campylobacter positive, and where they were enumerated the counts were below 150 cfu/g, suggesting that the public health risk from frozen chicken is much lower than from chilled.

Imports

Imported chicken is outside the scope of this target, which concentrates on UK produced chicken. An estimated 30% of chicken in the UK is from non-UK production, consisting of 21% from other EU countries and 10% from non-EU countries. Chicken from non-EU countries is mainly further processed, so may pose a smaller risk than UK produced chicken. Supplies from EU countries are more likely to be chilled so may pose a risk from campylobacter and should be measured.

Non-housed Production

Based on 2006 market share data, 92% of chilled whole chickens sold at retail is housed chicken, while 7% is free range and 1% is organic. Free range and organic chicken may have higher prevalence than housed.

Assuming that free range and organic chicken will be included in monitoring of a target, there is a risk that improvements in the housed sector would be masked by increases in market share of the free-range and organic sectors. Monitoring could be set up to measure load and prevalence in the non-housed sectors separately to the housed sector, and investigation of changes in market share included as analysis of progress towards a target. This would increase the sample sizes necessary in order to conclude that differences are statistically significant.

Survey Sample Size

Consideration was made of the relative size and costs of official monitoring of the target when deciding the point to set the target. The target was further informed by reflecting on the survey sample sizes required to determine a change is statistically significant under the banding approach.

ANNEX 7
DECEMBER 2010

Industry harmonised monitoring to measure *Campylobacter* levels on a slaughter line and for provision of data to FSA to contribute toward measuring progress against the target.

Draft protocol – to be finalised spring 2011

Background

BPC member companies have agreed to undertake voluntary monitoring of broiler carcasses post chill. Samples of neck skin that are taken for testing against the microbiological criteria (regulation EC 2073/2005) for *Salmonella* can be additionally tested for *Campylobacter* levels. This is a practical approach at low additional sampling cost for the industry that will provide data on *Campylobacter* levels that can produce a trend for each individual slaughter line and when assessed collectively can be compared against the baseline to assess progress against the target. How to compare the data from combined neck skin samples and any changes to the sample type and frequency will be considered by the Joint Working Group on *Campylobacter* following evidence produced by the FSA.

Sampling method, frequency, laboratory sample preparation (including details for both *Salmonella* and *Campylobacter* for clarity) **and laboratory sample examination** (*Campylobacter* only)

Sampling method

From a slaughter batch which is defined as a delivery of birds to a slaughterhouse that are slaughtered consecutively and have been raised together (sharing the same air space in their house) take a piece of neck skin of approximately 10g from each of 3 carcasses selected at random from the slaughter batch. Place the three neck skins together in one sample bag and send chilled (+2 - 8^0C) to the laboratory for *Salmonella* and *Campylobacter* examination. Examination should start ideally within 24hr and not more than 72 hours after the sample has been taken.

Sampling frequency

Sample 5 slaughter batches on one day in a week chosen at random alternating the day of the week. This will result in 5 separate samples from one sampling session, each sample composed of 3 neck skins. Sampling sessions should be at least the same frequency as for *Salmonella* (once a week for large slaughterhouses, reducing to once a month for smaller slaughterhouses) full details of sampling frequency and throughput is described at www.ukmeat.org.

Laboratory sample preparation

In the laboratory weigh a 26g test portion of neck skin from each sample and add to 9 volumes (234ml) of Buffered Peptone Water at room temperature.
Treat the sample for 1 minute using a stomacher or pulsifier (avoid foaming by removing air from the treatment bag).
Remove 10mls suspension for *Campylobacter* enumeration and use the remaining suspension for *Salmonella* detection if required.

Laboratory examination method for *Campylobacter*

Undertake *Campylobacter* enumeration following ISO/TS 10272-2 2006 using the 10ml of suspension (which contains 1g of neck skin for calculation purposes). The enumeration method has to be capable of detecting a range of 10 cfu/g to 10^6cfu/g.
Undertake confirmation of *Campylobacter* colonies (at least one per slaughter batch) using phenotypic methods as described in ISO 10272-1 2006(E) a published PCR method, or other accepted methods provided by the FSA.

Laboratory quality control

It is recommended that the laboratories undertaking the *Campylobacter* examinations are accredited or are working towards accreditation to ISO 17025 and the scope of the accreditation includes ISO 10272-1 and ISO10272-2 for chicken samples. The FSA will additionally establish an independent quality assessment of participating laboratories.

Results

Calculate the count of *Campylobacter* per gram of neck skin for each sample (of three neck skins) and record 5 results per sampling session. Record the date and time the sample was taken and details of the slaughter batch including age and flock production type (cockerels, pullets, mixed, standard housed, freedom food housed, free range, organic).