UK Health Security Agency

Final Report

Introduction of a *Campylobacter* proficiency testing scheme for food laboratories FS101219

August 2022

UK Health Security Agency – Food and Environmental Proficiency testing Unit

Table of Contents

Acknowledgements

FEPTU would like thanks all the participants that took part in this EQA programme, the data generated is invaluable.

In addition, thank you to the FEPTU team for delivering this EQA service to the laboratories.

Special thanks to The Food Standards Agency for appointing FEPTU to deliver this EQA programme.

Abbreviations

Abbreviations	**Definition**
CFU	Colony forming units
CPT	*Campylobacter* Proficiency Testing
EQA	External Quality Assessment
FEPTU	Food and Environmental Proficiency Testing Unit
FSA	Food Standards AgencySARS-2-Cov
UKAS	United Kingdom Accreditation Service
UKHSA	UK Health Security Agency
UN	United Nation

Executive Summary

In 2018, the Food Standards Agency (FSA) commissioned UK Health Security Agency (UKHSA; previously known as Public Health England) Food and Environmental Proficiency Testing Unit (FEPTU) to provide a bespoke external quality assessment (EQA) scheme for the detection and enumeration of *Campylobacter* spp. from a simulated matrix of uncooked chicken.

The EQA was sent to a maximum of 20 UK laboratories selected by the FSA that provided an accredited test for *Campylobacter* spp. testing in foods.

In summary, 13 dispatches of this EQA scheme were sent throughout the period March 2019 – November 2021. Three samples were sent with each delivery, representing a total of 39 simulated samples; 26 for enumerating the levels of *Campylobacter* spp. (if detected) and 13 for detection of the organism. Each simulated sample contained varying levels of *Campylobacter* strains (if included), and other microbiological flora found in raw chicken was also included as part of the sample design. The testing methods which laboratories used to enumerate and detect *Campylobacter* spp. in foods was also captured.

Due to the SARS-2-CoV pandemic this EQA exercise was suspended from March 2020 until January 2021, with agreement from the FSA.

Results reported were assessed using a unique UKHSA scoring system and categorised as 2, 1 and 0.

This method of UKHSA scoring system enabled laboratories to be provided with on-going performance assessment over a period of time.

Individualised reports were generated for each laboratory which included the results reported for each examination and the overall results submitted by all laboratories. After each distribution a confirmation e-mail was sent to the FSA with a list of activities and dates when the work was executed. A file containing the anonymised performance data of the laboratories and a blank summary scheme report was also provided.

Overall, laboratories returned an acceptable or questionable result for a minimum of 80% of samples examined for enumeration or detection of *Campylobacter* spp.. This shows that laboratories can undertake testing for *Campylobacter* spp. in foods to a using both enumeration and detection methods.

EQA provides laboratories with an independent external assessment of their performance. Regular participation in EQA schemes is an important part of laboratories quality procedures and helps to ensure that the results of their tests are accurate. Satisfactory performance with EQA can provide assurance to laboratories that they are compliant with testing standards, thereby meeting and maintaining accreditation requirements. It also provides an assurance step for their clients.

1. Introduction

In 2018, the Food Standards Agency (FSA) commissioned UK Health Security Agency's (UKHSA; previously known as Public Health England) Food and Environmental Proficiency Testing Unit (FEPTU) to provide a bespoke external quality assessment (EQA) scheme for the detection and enumeration of *Campylobacter* spp. from a simulated matrix representing uncooked chicken.

UKHSA exists to protect and improve the nation's health and wellbeing and reduce health inequalities. UKHSA is an executive agency, sponsored by the Department of Health and Social Care. FEPTU has over 32 years of experience in providing microbiology EQA schemes to food, water and environmental laboratories both in the UK and in over 70 countries internationally. The full comprehensive services offered by FEPTU can be found on this link: Proficiency testing for food, water and environmental microbiology.

This EQA scheme was available to food laboratories in the UK that provide an accredited test for *Campylobacter* spp. in foods. The selection of laboratories was done by the FSA.

The objective of this exercise was to provide UK testing laboratories with EQA samples that simulated a matrix of uncooked chicken for *Campylobacter* spp. testing. EQA is a useful tool to help laboratories identify process gaps and highlight areas for quality improvements, this will provide the FSA with a better understanding of the performance of laboratories in isolating and enumerating *Campylobacter* spp. in real samples and to make sure that they were all operating at the same standards of detection.

1.1 Set up of the exercise

FEPTU is a UKAS accredited (Schedule of Accreditation 0006) EQA provider complying with ISO/IEC 17043:2010 (Conformity assessment - General requirements for proficiency testing).

1.2 Confidentiality

The procedures for the organisation of this EQA ensures that the identity of the laboratories and the association of their performance data is treated as confidential. The laboratories were provided with a unique laboratory identification, log-in and password details. After each distribution a confirmation e-mail was sent to the FSA with a list of activities and dates when the work was executed. A file containing the anonymised performance data of the laboratories and a blank summary scheme report was also provided.

1.3 Time frame

In January 2019 laboratories were contacted by the FSA by email to determine if they were interested in taking part in this funded EQA programme. 20 laboratories registered their interest for the first year (March 2019 – January 2020) of this tender which included six dispatches.

Renewal of tender participation for year 2 and 3 was done in December 2019 prior to the start of the next tender period the following year. Laboratories had the option to participate in selected distributions in year 2 and 3.

The 13 dispatches were sent on the following dates:

- 18 March, 7 May, 8 July, 9 September and 11 November 2019
- 13 January and 17 February 2020
- 25 January, 8 March, 10 May, 5 July, 6 September and 1 November 2021

Due to the SARS-2-CoV pandemic this EQA tender was suspended from March 2020 until January 2021 following discussion and agreement with the FSA. Additionally, the FSA also agreed to a temporary suspension of *Campylobacter* sampling (March-May 2020) by retailers for their own testing due to issues arising from Covid-19. All retailers re-commenced sampling by 1 June 2020.

1.4 Distribution

13 dispatches were sent from March 2019 – November 2021. Each dispatch contained three samples, two for reporting a *Campylobacter* spp. enumeration result and one a detection result. Each dispatch and each sample had unique numbers allocated.

Samples were sent as freeze-dried material which, when reconstituted, represented raw chicken. Each simulated sample design contained varying levels of *Campylobacter* strains (if included). Microbiological flora normally found in raw chicken was also included as part of the sample design (see Annex 1).

The simulated freeze-dried samples were dispatched at ambient temperature in approved United Nation (UN) containers. Samples were normally received by the participating laboratory within 72 hours of dispatch, and laboratories were informed to store samples at 4^{o}C until they were ready to process them.

Laboratories were given three weeks to report their results using a secure web-based reporting platform.

Three weeks after the distribution closed, the results were published, and reports were published within three weeks of the closing date.

1.5 Instructions to participants

Paperwork was included with the samples dispatched in the UN boxes, which included:

- specimen details (Annex 2; includes web links to safety instructions and how to report results via a secure web portal)
- instructions on storing and processing of samples (Annex 3)

Laboratories were informed to examine the samples using the methods they currently follow. Details of the method, media, incubation conditions and enrichment broth were provided by the laboratories to FEPTU when the EQA results were reported.

For the second EQA year only two distributions were dispatched by UKHSA. UKHSA is a category one responder to national incidents and therefore UKHSA staff were diverted to support the pandemic.

Following the SARS CoV-2 pandemic (March 2020), whereby administration staff were mandated to work from home, limited paperwork was included in the United Nations (UN) box when the EQA service was re-instated January 2021. Instead, emails were sent a week prior to the dispatch date and included all the paperwork required to process the samples. Laboratories were informed that if they did not receive the samples by the end of the week to contact FEPTU. No formal confirmation of receipt of samples was requested, and instead the confirmation of the laboratory receiving the samples was assumed when results were returned.

2. Test Materials

2.1 Preparation

The selection of the strains was chosen by the FEPTU team: different species of *Campylobacter* at varying colony forming units (CFU) per mL were included in the repertoire, and background organisms were included to simulate uncooked chicken.

Strains of *Campylobacter* spp. and background organisms were taken from a bank of organisms held in the FEPTU laboratory as fully characterised isolates; these strains were fully characterised in-house using conventional methods and an analytical profile index system (if available). Strains of *Campylobacter* spp. were obtained from an UKHSA *Campylobacter* reference laboratory.

Samples were prepared as freeze-dried material at least five weeks before the dispatch date. This method of preparing samples has been extensively validated and proven to preserve organisms over long period of time and is a method used for other well established accredited schemes provided by UKHSA. The freeze-drying matrix used was inositol serum broth.

Samples in freeze dried format were stored at 4^{o}C.

The simulated samples that contained strains of *Campylobacter* spp. had varied CFU values, from $1.0x10^{2}$ – $1.0x10^{5}$.

3. Homogeneity and stability

After sample preparation, post-preservation testing was done to confirm if the sample content matched the expected sample design.

If these results were acceptable, then samples were processed further quantitatively to determine homogeneity for the *Campylobacter* spp. in the sample only. Replicate testing of the *Campylobacter* spp. from 10 randomised samples was tested. Homogeneity results were analysed using robust in-house statistical analyses and used to assess batch acceptance according to in-house procedures. If results were accepted, then they were included in a distribution and then tested for stability prior to an assigned dispatch date.

Stability testing was done on three samples two weeks prior to dispatch date. A further three samples were tested a week after the dispatch date on samples that had been through the postal system, and results were analysed using in-house statistical analyses and would confirm if transit conditions had any impacted on the stability of the *Campylobacter* spp. in the sample.

Samples were tested in the FEPTU laboratory according to international methods to replicate the methodology that laboratories would use on real samples:

- ISO 10272-1:2017 Microbiology of the food chain — Horizontal method for detection and enumeration of *Campylobacter* spp. – Part 1 Detection method.
- ISO 10272-2:2017 Microbiology of the food chain — Horizontal method for detection and enumeration of *Campylobacter* spp. – Part 2: Colony-count technique.

This is in accordance with food laboratories being accredited to ISO/IEC 17025:2010 (General requirements for the competence of testing and calibration laboratories).

4. Assigned values, standard uncertainties and scoring

Results for enumerations and samples were analysed according to ISO 13528:2015 (Statistical methods for use in proficiency testing by interlaboratory comparison).

4.1 Assigned values

Assigned values for enumerations (quantitative) were determined using robust statistics; the participants' median value was designated as the assigned value.

Assigned values for detection (qualitative) results was determined by confirmation of microbiological contents within the sample.

Performance assessment forms an integral component for a laboratory to confirm their performance with EQA samples. The data can show a trend in performance either with a specific parameter or as an overall examination in a scheme. Laboratories will receive a report comparing their performance to other participating laboratories. Laboratories can then determine whether their own performance on this PT scheme was acceptable and take appropriate action. UKHSA scoring system is designed to allow for this analysis of performance overtime.

4.2 Scoring and evaluation criteria

Scores were applied to reported results as an easy management tool.

Results reported were assessed using a unique UKHSA scoring system and is categorised as 2, 1 and 0. Scores of 2 and 0 are used for qualitative results and translate as 2 being satisfactory and 0 as unsatisfactory. The z-score formula is not used for allocating z-scores for qualitative tests. Participants who report a correct result are allocated a z-score of 0.

4.3. Enumeration results (quantitative)

Percentiles are used to identify results outside the expected range by ranking all participants' counts from lowest to highest and calculating the 5^{th}, 10^{th}, 90^{th} and 95^{th} percentiles. The 0.5 $\log_{10}$ rule, which is based on microbiological criteria and has been adapted from a publication by Basil Jarvis (Sampling for Microbiological Analysis in 'The Microbiological Safety and Quality of Food' Volume II, 1999, edited by Lund,

Baird-Parker and Gould), is then applied before scores are allocated so counts within 0.5 $\log_{10}$ units of the consensus median are re-classified as satisfactory and allocated the maximum score. The value of the maximum score is scheme dependent. As a general rule, questionable and unsatisfactory results should be investigated.

For quantitative schemes a score of 2 is acceptable and results are within the expected range. 1 is used for quantitative results just outside the expected range - these results are questionable as they are considered partially incorrect. 0 is given and considered unsatisfactory when results reported are completely outside the expected ranges (Table 1).

The statistics used to calculate the UKHSA scores for enumeration results is shown in the Table 1

Table 1: Shows the quantitative scoring applied to the enumeration results

Result type	Calculation	UKHSA scores for enumeration
Expected range	Median ± 0.5 $\log_{10}$ units or counts within 11th to 89th percentiles	2 (acceptable)
Outlying results (1)	Median ± >0.5 $\log_{10}$ units and in 6th to 10th or 90th to 95th percentiles	1 (questionable)
Outlying results (2)	Median ± >0.5 $\log_{10}$ units and in 0th to 5th or 96th to 100th percentiles	0 (unsatisfactory)

UKHSA scores are devised in such a way that they can be combined over a period of time; the cumulative results are summarised in the individualised distribution reports for the last six distributions. Those laboratories with cumulative scores that are less than 80% of the maximum possible score are likely to have some underlying problems with their examinations which should be investigated for a root cause. Participants with cumulative scores of between 80% and 99% are also encouraged to assess their lower scores.

In the individual scheme reports z-scores are also calculated and shown, however they have not been used to assess performance of the laboratories as part of this report.

Z-scores provide a statistical means of standardising data points on a single scale so they can be compared. Each z-score corresponds to a point in a normal distribution, describing how far each data point deviates from the consensus median. Table 2 shows the formula used. this information is presented in individual scheme reports and is not used to assess performance of the laboratories as part of this report.

Table 2 Shows the z-scores formulation

$$Z = \frac{(x_i - X_{pt})}{\sigma_{pt}}$$

Z scores formulation	Details
x_i	participants' result (expressed as a $\log_{10}$ value)
X_{pt}	assigned value (participants' consensus median expressed as a $\log_{10}$ value)
σ_{pt}	the fixed standard deviation for the examination (calculated by FEPTU)

The σ_{pt} -value expresses the acceptable difference between the individual participant's result and the participants' consensus median. The σ_{pt} -values have been calculated by FEPTU staff using data from previous distributions and the value of σ_{pt} = 0.35 is use.

Therefore, z-scores used in EQA are interpreted as follows:

- z = -1.99 to +1.99 **satisfactory**
- z = -2 to -2.99 or +2 to +2.99 **questionable**
- z = <-3.00 or >+3.00 **unsatisfactory**

4.4 Detection results (qualitative)

Scores awarded for detection results is shown in Table 3

Table 3 Shows the criteria for score awarded for qualitative results

Result	UKHSA score	Z-score
Fully correct result	2	0
False positive or false negative result	0	4

5. Results and Discussion

5.1 General observations

Not all laboratories consistently took all the distributions that were available, therefore the final numbers reporting a result varied by sample and by distribution.

One laboratory did not undertake testing using a detection method and only returned results for enumeration examinations.

Only one laboratory obtained an overall performance of 100% for all the distributions and samples examined.

Non-return of results have been excluded from the all performance calculations as this is not a measurement of a laboratory's testing capabilities.

Testing of three samples for stability after dispatch confirmed that the *Campylobacter* spp. in the samples were stable during the distribution period.

The overall performance by sample, the expected range and the levels of *Campylobacter* spp. (if present) is shown in Annex 4. Performance assessments were designed to identify laboratories with on-going problems with their examinations and were undertaken after every distribution. Scores were allocated to results reported for every sample to help assess participants' performance.

A laboratory's actual identification number was changed to maintain anonymity in Graphs 2, 4 and 5.

5.1.1. Statistical evaluation

The organiser advises that for a robust statistical evaluation at least 20 reported results are required for a parameter. Where statistical calculation is based on 10 – 19 results, the results should be interpreted with caution as they may be overly influenced by outlying values. For this bespoke scheme the number of laboratories participating in each sample distribution was usually less than 19.

5.2. Performance – enumeration examination (quantitative)

The laboratories were required to report the number of CFU obtained per mL. The expected range was then calculated using the participants' median ± 0.5 $\log_{10}$ units, or counts within 11th to 89th percentiles. A score of 2 was given to laboratories returning results within this expected range (Table 1). The sample content and the overall performance by sample obtained in the expected range is shown in Annex 4.

For enumeration results, a maximum of 19 laboratories (varied for each sample) reported a CFU count for the 26 enumeration samples that were sent out. Three enumeration samples (CPT009, CPT011 and CPT023) did not contain any isolates of *Campylobacter.*

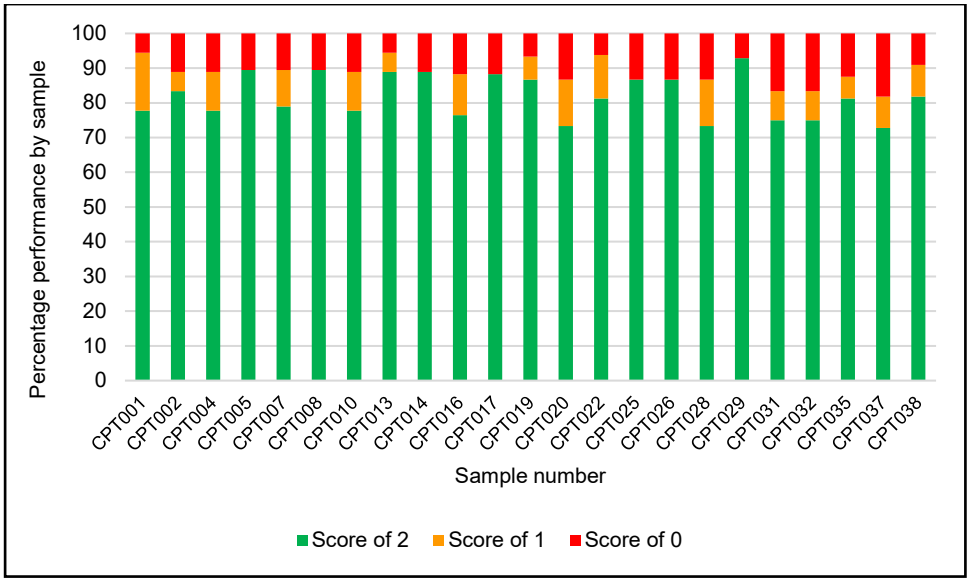
The enumeration performance was analysed in two ways; one by sample (5.2.1) and the other by laboratory (5.2.2).

5.2.1 Analysis of enumeration examinations by sample type

For 26 of the samples in this scheme, an enumeration examination was required. However, only 23 samples contained a *Campylobacter* species, while three samples did not contain any *Campylobacter* isolates. The performance of each sample using the assessment criteria given in Table 1 shown in Figure 1.

The overall performance for each sample was calculated by combining the scores awarded (as defined in Table 1) for each sample examined, and then calculating the percentage out of the maximum score available for the number of samples analysed. It needs to be noted that the total number of data sets analysed for each sample varied as not all laboratories (between 11 – 19) returned results for every sample.

Figure 1: Overall performance by samples containing Campylobacter spp.. based on assessment criteria defined in Table 1.



The percentage of laboratories achieving expected results (score of 2) for each sample was between 73-93%, while the percentage of laboratories achieving scores of 1 ranged between 0-17%, and percentage of laboratories achieving scores of 0 ranged from 6-18%.

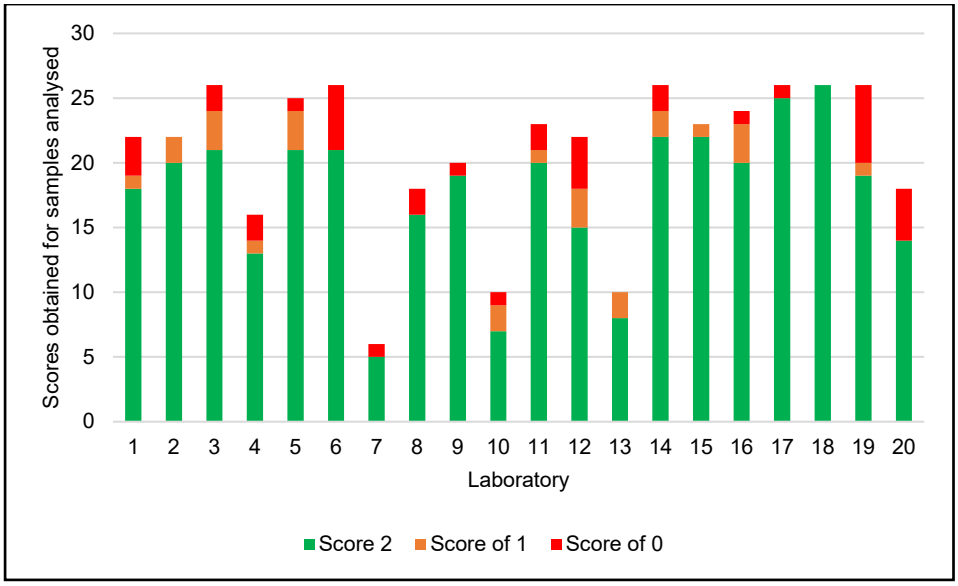
For the three samples (CPT009, 011 and 023) that did not contain isolates of *Campylobacter,* the overall performance was 100%.

5.2.2 Analysis of enumeration examinations by laboratory

A total of 20 laboratories were registered for this scheme. However, the number of laboratories that analysed each sample varied.

Figure 2 shows the scores obtained by each laboratory for the samples they analysed (maximum of 26). Criteria for scores awarded is defined in Table 1.

Figure 2 Scores awarded for each laboratory for samples analysed that required an enumeration examination



Only one laboratory reported all their counts within the expected range across all samples examined (laboratory 18).

As explained, not all laboratories returned results for all enumeration samples: for example, laboratories 4, 7, 10 and 13 did not analyse all enumeration samples sent to them so total scores for individual laboratories were calculated form the maximum samples the laboratory did analyse. All laboratories reported some counts outside the expected range, either in the questionable range (score of 1 given), or in the unsatisfactory range (score of 0 given) however the root cause of this was not within the Organiser's remit to determine.

Laboratory 19 contacted FEPTU early in the programme (before CPT4 dispatch) for some advice as their results were consistently outside the expected range. Following FEPTU advice, their performance significantly improved with most enumeration results being reported in the expected range from CPT4 onwards.

Information on the method used by laboratories was provided when they reported their EQA results online. Numerous options on method parameters were available for laboratories to select from (Annex 2). For the enumeration examinations all laboratories used ISO 10272-2:2017 Microbiology of the food chain — Horizontal method for detection and enumeration of *Campylobacter* spp. - Part 2: Colony-count technique. The media used was modified charcoal cefoperazone deoxycholate agar (mCCDA/CCDA) with an incubation at 41.5 ºC for 48 hours.

6. Performance – Detection results (qualitative)

The sample content and the overall performance by sample is shown in Annex 4. From the 13 detection samples sent to participating laboratories, Only one sample (CPT030) did not contain a *Campylobacter* species.

For detection results, a maximum of 19 laboratories (varied laboratory participation for each sample) reported a result.

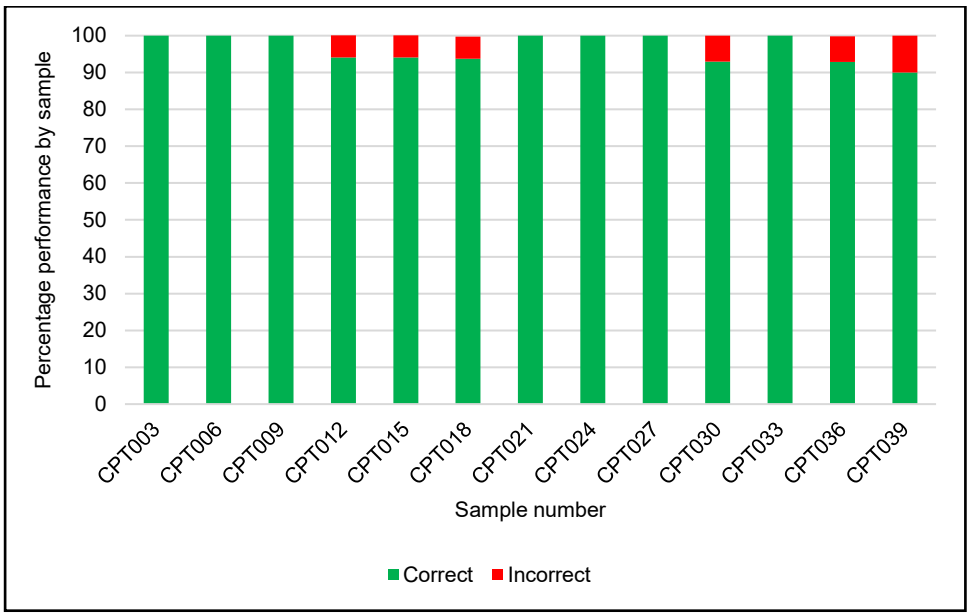
The detection performance was analysed in two ways; one by sample (5.3.1) and the other by laboratory (5.3.2).

6.1 Analysis of detection examinations by sample

For 13 of the 39 samples in this scheme a detection examination was required. The performance of each sample using the assessment criteria given in Table 3 is shown in Figure 3.

Figure 3 shows the scores obtained by laboratory for the samples analysed (maximum of 26).

Figure 3 Performance by sample for a detection method.



The number of laboratories that reported results for each detection sample varied between 9-18. For the 13 samples sent to laboratories for detection examination, the percentage of laboratories obtaining the correct result (score 2) was between 90 –

100% and the percentage of laboratories obtaining the incorrect result (score 0) was between 0 – 10% as shown in Figure 3. Only 12 out of 13 detection samples contained isolates of *Campylobacter* spp.. The average percentage of laboratories achieving the correct result for these samples was 97%. For the one sample (CPT030) that did not contain *Campylobacter* spp. 13/14 (93%) laboratories reported the correct result. The overall average percentage of laboratories achieving the correct score for all 13 samples was 97%

Two laboratories (14 and 15) reported a false negative result for two samples: Laboratory 14 for samples CPT036 and CPT039 and Laboratory 15 for samples CPT015 and CPT018. Two laboratories (10 and 12) reported a false negative result for one sample.

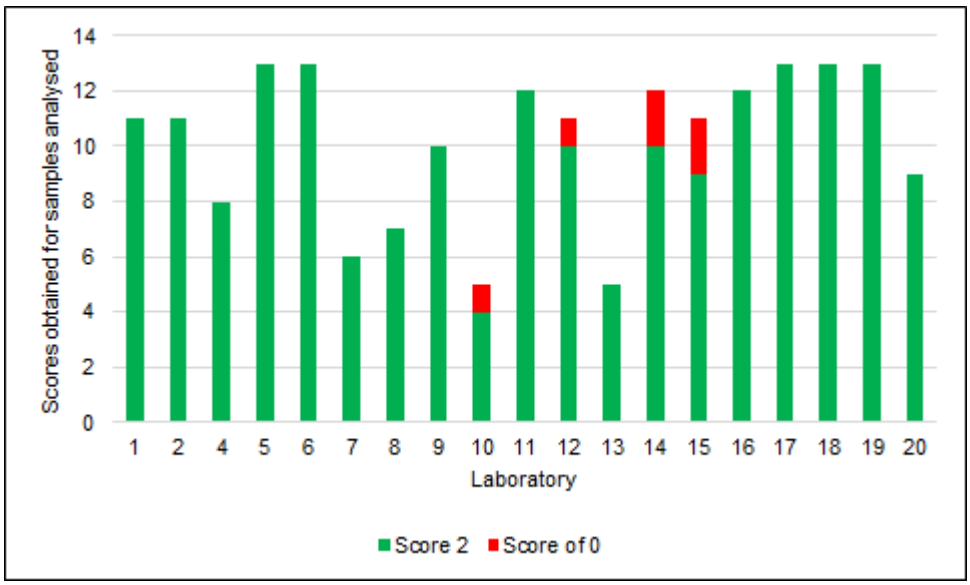
Laboratory 12 also reported a false positive result for the one sample (CPT030) that did not contain a *Campylobacter* spp..

6.2 Analysis of detection examinations by laboratory

A total of 19 laboratories were registered for this scheme. However, the number of laboratories that analysed each sample varied.

Figure 4 shows the scores obtained by laboratory for the samples analysed (maximum of 13). Criteria for scores awarded was defined in Table 3.

Figure 4 Scores awarded for each laboratory for samples analysed that required an detection examination.



The overall laboratory performance across all 13 samples is 97% with fifteen laboratories obtaining a score of 2 for all samples they examined.

Four laboratories reported an incorrect detection result, two laboratories on one occasion and two laboratories on two occasions as shown in above Figure 4

As explained, not all laboratories returned results for all detection examinations: for example, laboratories 4, 7, 8, 10 and 13 did not analyse all enumeration samples sent to them. Total scores for individual laboratories were calculated form the maximum samples the laboratory did analyse. Laboratories 10, 12, 14 and 15 reported results outside the expected range in the unsatisfactory range (score of 0 given), however the root cause of this was not within the Organiser's remit to determine.

Laboratory 3 did not examine any samples using a detection method (only did enumeration tests) so is not shown in Figure 4.

Annex 2 lists the numerous options for method parameters available for laboratories to select from. For detection examination all laboratories used ISO 10272-2:2017 Microbiology of the food chain — Horizontal method for detection and enumeration of *Campylobacter* spp. – Part 1: Detection method without any variation to the method. A mixture of media was used by the laboratories but all had used mCCDA/CCDA, and six laboratories also used an additional media. Generally, the enrichment broths used were either Preston or Bolton.

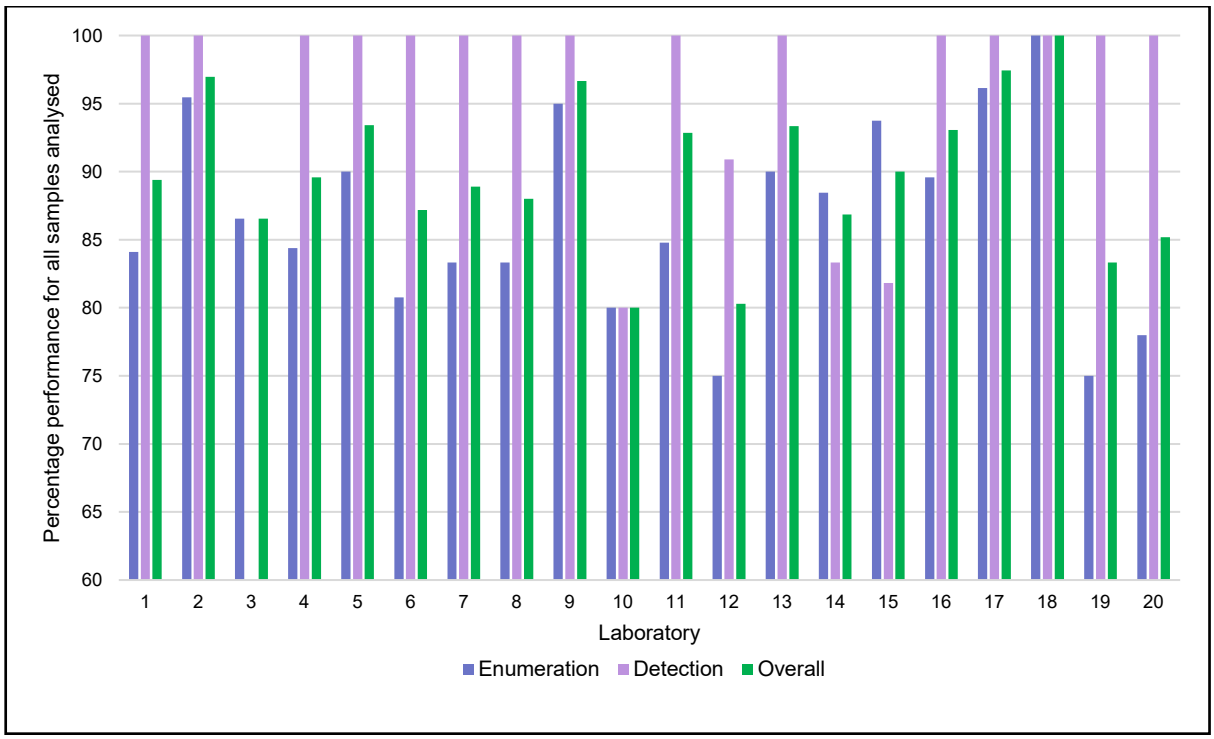
6.3 Combining enumeration and detection examinations to find overall performance

The percentage performance of laboratories for all samples and examinations (where reported) is shown in

An overall performance across all samples examined was calculated. This was done by totalling all the scores awarded for both enumeration and detection examination for samples examined (including scores in the questionable range) and a percentage calculated from the total maximum score available.

The laboratory's score for each sample and overall performance for all samples examined is shown in Annex 5.

Figure 5 Overall percentage performance by laboratory for all the samples analysed



The number of laboratories reporting results for each sample varied between 9 to 19.

The overall percentage performance of laboratories where a result was reported and a score of either 2 (acceptable) or 1 (questionable) was awarded ranged from 80 – 100%. On average, laboratories returned an acceptable or questionable result for 90% of samples examined.

Some of the obvious findings for some laboratories determined are:

Only one laboratory (18) reported all their counts within the expected range, obtaining an overall performance of 100% for all the distributions and samples examined.

Laboratory 5 reported a count outside the expected range for four samples out of the 25 enumeration samples analysed. On three occasions these were in the questionable range (score of 1 given) and once in the unsatisfactory range (score of 0 given). Their overall performance for the 38 samples analysed (including any questionable results scoring 1/2) was 71/76 (93%).

Laboratory 19 contacted FEPTU early in the programme (before CPT4 dispatch) for some advice as their results were consistently outside the expected range. Following FEPTU advice, their performance significantly improved with most enumeration results being reported in the expected range from CPT4 onwards.

Laboratory 20 only joined this scheme from CPT 3 onwards and reported CFU counts outside the expected range (score of 0 or 1) on four occasions. Their overall performance for the 18 samples they analysed was 46/54 (85%).

7. Conclusion

Food testing laboratories play a vital role in protecting the public's health, by helping to ensure public health monitoring is accurately done.

FSA commissioned FEPTU and UKHSA to provide an EQA for 20 laboratories selected by the FSA to ensure the results of their testing for *Campylobacter* in chicken was accurate. Distributions sent to the laboratories contained samples that could be used for either enumeration or detection examinations.

There were no issues encountered with the preparation of the simulated specimens/samples. Homogeneity, stability and viability were consistent throughout all the stages of production and distribution.

The *Campylobacter* spp. strains chosen to simulate food samples varied and contained the common species(*jejuni* as well as *lari* and *coli*). High levels of background organisms were included to simulate the contents of a raw chicken. There was no evidence, through quality control checks done in the FEPTU laboratory, that the background flora included in the samples competed with the *Campylobacter* spp..

There was variation in the enumerations results reported, even though all laboratories claimed the same method was used. However, it is widely known that variations in results can be obtained with *Campylobacter* spp. testing, as the media used has inherent performance variability.

One laboratory at the start of the EQA programme consistently reported high counts for *Campylobacter* spp., (CPT1, CPT2 and CPT3) and FEPTU's advice was sought on the methodology. Since this intervention, the laboratory improved their performance and most counts reported since CPT4 were within the expected range.

This shows the educational benefits that can be gained by addressing failures in an EQA. It is an important consideration for laboratories who are looking for continuous improvement.

Laboratories not returning a result or not examining samples were excluded from the overall performance calculations because it was not a measurement of their testing capabilities: one laboratory did not take part in this EQA from distribution CPT4 onwards, two laboratories did not take part from CPT7 onwards and four laboratories did not register for all the distributions available.

Further analysis was done to determine if the counts reported outside the expected range was attributed to the levels of *Campylobacter* spp. in the sample. *Campylobacter* spp. are a group of fastidious organisms, and it is known that media used in enumeration methods can vary from batch to batch as well as variability existing between different manufacturers. The conclusion drawn was that there was no substantive evidence that *Campylobacter* spp. presence in samples was a root cause for reporting results outside the expected range.

Overall, the performance of laboratories participating in the 2019 - 2021 EQA was greater than 80% . There were no issues identified for the detection of *Campylobacter* spp.. However, it must be noted that these samples contained varying levels of this organism to simulate the natural levels found in raw chicken, therefore for samples with high levels of a *Campylobacter* spp. the detection method/s may not have been challenged sufficiently to identify issues if they did exist.

This scheme has been useful to demonstrate the capabilities of laboratories for detecting and enumerating samples for *Campylobacter* spp.. Only one laboratory obtained a total performance of 100% for all samples examined suggesting that there is room for improvement for all the other laboratories.

EQA provides laboratories with an independent external assessment of their performance. Regular participation in EQA schemes is an important part of laboratories quality procedures and helps to ensure that the results of their tests are accurate. Satisfactory performance with EQA can provide assurance to laboratories

that they are compliant with testing standards, thereby meeting and maintaining accreditation requirements. It also provides an assurance step for their clients.

Regular EQA participation will allow laboratories to keep a check with any changes to operating conditions such as media, staffing levels. Addressing gaps identified through an EQA will help ensure that public health incidents are detected early and managed effectively.

8. References

None

9. Annexes/Appendices

Annex 1: Sample information

A total of 13 distributions were dispatched each containing three samples.

Total of 39 samples were sent, 26 for enumeration testing and 13 for detection examination.

All levels are presented as colony forming units (CFU) per ml reconstituted sample unless indicated otherwise.

Wild strains of organisms were used unless indicated otherwise.

CPT1: 18 March 2019

Sample number	CPT001	CPT002	CPT003
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($1.1x10^2$) *Enterococcus faecalis* ($3.5x10^3$) *Escherichia coli* ($7.9x10^3$) *Pseudomonas aeruginosa* ($5.0x10^2$)	*Campylobacter coli* ($8.3x10^($) *Cryptococcus albidus* ($1.6x10^3$) *Pantoea agglomerans* ($3.4x10^4$) *Pseudomonas luteola* ($1.2x10^5$)	*Campylobacter jejuni* ($2.3x10^2$) *Escherichia coli* O157 ($4.4x10^2$) *Salmonella* Essen (35 per disc) *Escherichia coli* ($1.1x10^4$) *Klebsiella oxytoca* ($1.7x10^4$) *Lactococcus lactis* ($8.7x10^4$)

CPT2: 7 May 2019

Sample number	CPT004	CPT005	CPT006
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter coli* ($5.4x10^2$) *Enterococcus gallinarum* ($3.2x10^4$) *Hafnia alvei* ($5.7x10^3$) *Micrococcus* sp. ($1.5.x10^5$)	*Campylobacter jejuni* ($1.4x10^4$) *Aerococcus viridans* ($2.3x10^3$) (NCTC 8251) *Citrobacter braakii* ($3.2x10^3$)	*Campylobacter coli* ($5.6x10^3$) *Enterococcus faecium* ($1.4x10^5$) *Pantoea agglomerans* ($9.1x10^4$)

CPT3: 8 July 2019

Sample number	CPT007	CPT008	CPT009
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($6.8x10^3$) *Enterococcus faecalis* ($3.9x10^5$) (NCTC 5957) *Escherichia coli* ($5.3x10^5$) *Pseudomonas putida* ($4.9x10^2$)	*Campylobacter coli* ($2.4x10^4$) *Lactobacillus paracasei* ($1.3x10^5$) *Pseudomonas aeruginosa* ($7.2x10^4$)	*Campylobacter jejuni* ($8.4x10^3$) *Klebsiella pneumonia* ($1.5x10^5$) *Providencia rettgeri* ($6.8x10^5$) (NCTC 7475) *Staphylococcus aureus* ($2.7x10^5$)

CPT4: 9 September 2019

Sample number	CPT010	CPT011	CPT012
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($2.6x10^3$) *Micrococcus luteus* ($1.3x10^5$) (NCTC 4819) *Serratia liquefaciens* ($2.0x10^4$) *Staphylococcus epidermidis* ($5.0x10^4$)	*Penicillium chrysogenum* ($2.8x10^3$) *Enterobacter cloacae* ($2.1x10^4$) *Escherichia coli* ($5.2x10^4$) *Enterococcus faecalis* ($6.8x10^3$) *Lactobacillus paracasei* ($2.2x10^4$)	*Campylobacter coli* ($2.2x10^3$) *Leuconostoc mesenteroides* ($1.8x10^4$) *Pantoea species* ($1.0x10^5$) *Pseudomonas aeruginosa* ($6.1x10^4$)

CPT5: 11 November 2019

Sample number	CPT013	CPT014	CPT015
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($4.5x10^4$) *Citrobacter braakii* ($1.6x10^4$) *Aerococcus viridans* ($3.8x10^3$) (NCTC 8251)	*Campylobacter coli* ($2.5x10^5$) *Pseudomonas aeruginosa* ($3.6x10^5$) *Staphylococcus sciuri* ($9.3x10^5$)	*Campylobacter lari* ($4.0x10^3$) (NCTC 11845) *Cryptococcus albidus* ($2.0x10^4$) *Enterobacter amnigenus* ($5.3x10^5$)

CPT6: 13 January 2020

Sample number	CPT016	CPT017	CPT018
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($1.4x10^4$) *Escherichia coli* ($5.2x10^5$) *Klebsiella oxytoca* ($3.7x10^3$) *Lactobacillus brevis* ($2.7x10^5$)	*Campylobacter coli* ($3.0x10^4$) *Enterobacter aerogenes* ($3.4x10^5$) *Enterococcus faecalis* ($3.4x10^5$) *Escherichia coli* ($8.0x10^4$) *Pseudomonas fluorescens* ($3.5x10^5$)	*Campylobacter coli* ($4.8x10^5$) *Pseudomonas fluorescens* ($3.6x10^5$) *Staphylococcus sciuri* ($9.3x10^5$)

CPT7: 17 February 2022

Sample number	CPT019	CPT020	CPT021
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($6.9x10^3$) *Escherichia coli* ($1.0x10^5$) *Pseudomonas aeruginosa* ($2.4x10^5$) *Staphylococcus saprophyticus* ($2.4x10^5$)	*Campylobacter coli* ($1.5x10^5$) *Enterobacter cloacae* ($1.2x10^5$) (NCTC 10005) *Kocuria kristinae* ($7.1x10^4$) (NCTC 11038) *Pseudomonas fluorescens* ($1.1x10^6$) (NCTC 3756)	*Campylobacter lari* ($4.0x10^3$) (NCTC 11845) *Cryptococcus albidus* ($2.0x10^4$) *Enterobacter amnigenus* ($5.3x10^5$)

CPT8: 25 January 2021

Sample number	CPT022	CPT023	CPT024
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($1.4\ x10^4$) *Citrobacter braakii* ($1.5x10^3$) *Pseudomonas aeruginosa* ($3.6x10^4$) *Staphylococcus epidermidis* ($7.1x10^3$)	*Candida tropicalis* ($1.3x10^5$) *Escherichia. coli* ($9.5x10^3$) *Enterobacter aerogenes* ($5.5x10^3$) *Enterococcus faecalis* ($3.4x10^4$) *Lactobacillus brevis* ($2.2x10^4$)	*Campylobacter lari* ($7.3x10^3$) (NCTC 11845) *Bacillus cereus* ($3.4x10^4$) *Escherichia coli* ($6.1x10^4$)

CPT9: 8 March 2021

Sample number	CPT025	CPT026	CPT027
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter coli* ($1.3x10^4$) *Candida tropicalis* ($4.8x10^4$) *Citrobacter braakii* ($1.6x10^5$) *Escherichia coli* ($6.1x10^5$)	*Campylobacter jejuni* ($4.8x10^2$) *Enterococcus faecalis* ($1.9x10^5$) *Lactococcus lactis* ($2.4x10^5$) *Staphylococcus epidermidis* ($1.6x10^5$)	*Campylobacter coli* ($2.1x10^3$) *Klebsiella oxytoca* ($3.8x10^5$) *Lactobacillus brevis* ($1.5x10^4$) *Pseudomonas aeruginosa* ($1.4x10^6$)

CPT10: 10 May 2021

Sample number	CPT028	CPT029	CPT030
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter coli* ($1.9x10^3$) *Klebsiella oxytoca* ($4.9x10^4$) *Lactobacillus brevis* ($1.5x10^4$)	*Campylobacter jejuni* ($3.4x10^3$) *Escherichia coli* (3.4x10 *Lactobacillus paracasei* ($2.8x10^5$) *Pseudomonas aeruginosa* ($2.1x10^5$)	*Aspergillus fumigatus* ($4.3x10^3$) *Citrobacter braakii* ($1.3x10^4$) *Escherichia coli* ($2.8x10^4$) *Lactococcus lactis* ($7.6x10^5$) *Enterococcus faecalis* ($3.4x10^4$)

CPT11: 5 July 2021

Sample number	CPT031	CPT032	CPT033
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter jejuni* ($4.9x10^5$) *Escherichia coli* ($4.5x10^3$) *Pediococcus pentosaceus* ($6.9x10^4$)	*Campylobacter coli* ($7.3x10^3$) *Escherichia coli* ($1.9x10^4$) *Bacillus circulans* ($2.2x10^4$) *Staphylococcus capitis* ($4.5x10^3$)	*Campylobacter jejuni* ($1.1x10^3$) *Candida tropicalis* ($1.4x10^4$) *Enterococcus faecium* ($2.4x10^3$)

CPT12: 6 September 2021

Sample number	CPT034	CPT035	CPT036
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Escherichia coli* ($1.6x10^3$) *Enterobacter cloacae* ($1.8x10^3$) *Enterococcus durans* ($8.0x10^2$) *Pseudomonas fluorescens* ($1.5x10^4$)	*Campylobacter coli* ($3.0x10^3$) *Enterococcus faecalis* ($4.0x10^2$) *Serratia liquefaciens* ($8.1x10^3$) *Aspergillus fumigatus* ($1.0x10^3$)	*Campylobacter jejuni* ($1.0x10^2$) *Escherichia coli* ($2.9x10^4$) *Klebsiella oxytoca* ($2.9x10^4$)

CPT13: 1 November 2021

Sample number	CPT037	CPT038	CPT039
Examination	*Campylobacter* spp. enumeration	*Campylobacter* spp. enumeration	*Campylobacter* spp. detection
Contents:	*Campylobacter coli* ($7.3x10^3$) *Bacillus circulans* ($2.2x10^4$) *Escherichia coli* ($1.9x10^4$) *Staphylococcus capitis* ($4.5x10^3$)	*Campylobacter jejuni* ($1.1x10^3$) *Candida tropicalis* ($1.4x10^4$) *Enterococcus faecium* ($2.4x10^3$)	*Campylobacter jejuni* ($4.9x10^5$) *Escherichia coli* ($4.5x10^3$) *Pediococcus damnosus* ($6.9x10^4$)

Annex 2: Example document of sample details

This was provided either in the UN box or sent electronically via email

Food and Environmental Proficiency Testing Unit

Laboratory identification no. (check): **<Lab No>** Dispatch date: **01 November 2021** Final date for return of results: **22 November 2021**

Contact details:
The Organisers - FEPTU
UK Health Security Agency
61 Colindale Avenue,
London, NW9 5EQ, UK.
Tel: +44 (0) 20 8327 7119
e-mail: foodeqa@phe.gov.uk

UKAS PROFICIENCY TESTING 0006

***Campylobacter* spp. Scheme - Request/Report Form**	
Distribution No.: CPT13	**Sample numbers: CPT037, CPT038 and CPT039**
Download the sample instruction sheet. A video on sample processing is located further down the webpage:	www.gov.uk/government/publications/standard-scheme-sample-instruction-sheets - instructions apply for this scheme, the only difference is that three vials are included in each distribution.
Download the safety data sheet:	www.gov.uk/government/publications/safety-data-sheet-freeze-dried-food
If you cannot examine any of these samples return your results as 'Not examined'	
Request:	I. Determine the level of *Campylobacter* spp. II. Examine for *Campylobacter* spp.

Food and Environmental Proficiency Testing Unit

Laboratory identification no. (check): **<Lab No>**

	Not examined	Enrichment media used / Conditions of incubation		Media used		Method used		Analyst	CPT037	CPT038	CPT039
Campylobacter spp. (*cfu g^{-1})	☐	☐	41.5°C/48h	☐	Chromogenic agar - please state	☐	ISO 10272-2:2017	Nominated result:			
		☐	Other– please specify	☐	Modified charcoal cefoperazone deoxycholate agar (mCCDA/CCDA)	☐	Other – please specify	Result 2:			
				☐	Preston agar						
				☐	Other– please specify			Result 3:			
Campylobacter spp.	☐	☐	Bolton Broth	☐	Chromogenic agar - please state	☐	ISO 10272-1:2017	Nominated result:			
		☐	Preston broth	☐	Modified charcoal cefoperazone deoxycholate agar (mCCDA/CCDA)	☐	PCR	Result 2:			
		☐	Other – please specify	☐	Preston agar	☐	VIDAS				
				☐	Other– please specify	☐	Other – please specify	Result 3:			

*colony forming unit

Microbiologist's comments:

Authorised by: **Date reported**

Annex 3: Sample instruction sheet

Available from the weblink provided in document in Annex 2

Food and Environmental Proficiency Testing Unit

The final date for return of results is indicated on the accompanying request/report form

Contact details:
The Organisers - FEPTU
UK Health Security Agency
61 Colindale Avenue,
London, NW9 5EQ, UK.
Tel: +44 (0) 20 8327 7119
e-mail: foodeqa@phe.gov.uk

UKAS PROFICIENCY TESTING
0006

www.gov.uk/government/collections/external-quality-assessment-eqa-and-proficiency-testing-pt-for-food-water-and-environmental-microbiology#standard-scheme

Standard Scheme – Instruction Sheet

*Each distribution consists of **two** evacuated glass vials containing mixtures of freeze-dried micro-organisms. The vial contents require reconstitution prior to examination.*

Important information to note:

You can now analyse and report up to three sets of results for any of the tests for the Standard Scheme you participate in.

Please note as only 200g of simulated food is provided you are advised that for tests where an enrichment step is required, you will need to use the enriched sample for staff to examine from.

Refer also to the Safety Data Sheet:
www.gov.uk/government/publications/safety-data-sheet-freeze-dried-food

For a video on sample processing click on the link below and scroll to the bottom of the page:
www.gov.uk/government/publications/standard-scheme-sample-instruction-sheets

Storage:
Store the samples at **2 - 8°C** on receipt.

Safety Recommendation:
The samples contain micro-organisms of ACDP Hazard Groups 1 and 2. Your laboratory must undertake a risk assessment before handling these samples with particular consideration to the conditions and procedures for opening evacuated vials to prevent the risk of aerosol.

Opening Vials:
Remove the plastic tear-off seal by positioning the vial with the arrow on the plastic flip-top pointing away from you, flip the top up then carefully but deliberately pull downwards and to the right (or the left if you are left handed) until the seal separates; then still holding onto the plastic top, gently remove altogether and discard into a sharps container.

FEPTU5.05 Page 1 of 2

Reconstitution:

The samples are reconstituted in **200mL** nutrient broth (**pre-warmed** to 30 ± 2ºC) as follows:

- Aseptically remove the rubber stopper from the vial of the freeze-dried sample.
- Transfer approximately 1mL of the **200mL** warmed nutrient broth to the vial and allow to stand for 2 - 5 minutes.
- Transfer the vial contents back to the remaining nutrient broth.
- Rinse the vial a further 3 - 4 times with the **200mL** nutrient broth sample.
- Shake the reconstituted samples before examination.

Examination:

- **Each reconstituted sample is equivalent to a 200g food sample.**
- Undertake the examinations listed on the request/report form between 30 - 45 minutes after reconstitution.
- Examine in accordance with routine procedures.

Return of Results:

- Return your results on-line using the web-based reporting system.
- The distribution will be closed on the deadline date for return of results.
- Results cannot be accepted after the distribution has closed.

Annex 4: Overall performance by sample

Includes the expected range and the levels of *Campylobacter* spp. (if present)

CFU per g = colony forming units per gram

N/A = Not applicable

Expected range has been calculated as: Median ± 0.5 log10 units or counts within 11th to 89th percentiles (Table 1)

Distribution number **Date**	**Sample number**	***Campylobacter* spp. (levels shown are CFU per g)**	**Examination**	**Expected range (CFU per g)**	**Overall percentage performance for a fully correct score of 2** **N (%)**
CPT1 18 March 2019	CPT001	*Campylobacter jejuni* ($1.1x10^2$)	Enumeration	25 - $4.8x10^2$	14/18 (78)
	CPT002	*Campylobacter coli* ($8.3x10^3$)	Enumeration	$8.5x10^2$ - $8.5x10^3$	15/18 (83)
	CPT003	*Campylobacter jejuni* ($2.3x10^2$)	Detection	N/A	17/17 (100)
CPT2 7 May 2019	CPT004	*Campylobacter coli* ($5.4x10^2$)	Enumeration	82 - $8.9x10^2$	14/18 (78)
	CPT005	*Campylobacter jejuni* ($1.4x10^4$)	Enumeration	$1.0x10^3$ - $1.8x10^4$	17/19 (89)
	CPT006	*Campylobacter coli* ($5.6x10^3$)	Detection	N/A	18/18 (100)
CPT3 8 July 2019	CPT007	*Campylobacter jejuni* ($6.8x10^3$)	Enumeration	$1.2x10^3$ - $1.2x10^4$	15/19 (79)
	CPT008	*Campylobacter coli* ($2.4x10^4$)	Enumeration	$7.1x10^3$ - $7.1x10^4$	17/19 (89)
	CPT009	*Campylobacter jejuni* $8.4x10^3$	Detection	N/A	18/18 (100)
CPT4 9 September 2019	CPT010	*Campylobacter jejuni* ($2.6x10^3$)	Enumeration	$2.7x10^2$ - $5.2x10^3$	14/18 (78)
	CPT011	No *Campylobacter* spp.	Enumeration	N/A	18/18 (100)
	CPT012	*Campylobacter coli* ($2.2x10^3$)	Detection	N/A	16/17 (94)
CPT5	CPT013	*Campylobacter jejuni* ($4.5x10^4$)	Enumeration	$4.4x10^3$ - $4.5x10^4$	16/18 (89)

Distribution number **Date**	**Sample number**	***Campylobacter* spp. (levels shown are CFU per g)**	**Examination**	**Expected range (CFU per g)**	**Overall percentage performance for a fully correct score of 2** **N (%)**
11 November 2019	CPT014	*Campylobacter coli* ($2.5x10^5$)	Enumeration	$3.1x10^4$ - $3.1x10^5$	16/18 (89)
	CPT015	*Campylobacter lari* ($4.0x10^3$)	Detection	N/A	16/17 (94)
CPT6 13 January 2020	CPT016	*Campylobacter jejuni* ($1.4x10^4$)	Enumeration	$1.9x10^3$ - $2.3x10^4$	13/17 (76)
	CPT017	*Campylobacter coli* ($3.0x10^4$)	Enumeration	$3.5x10^3$ - $3.5x10^4$	15/17 (88)
	CPT018	*Campylobacter coli* ($4.8x10^5$)	Detection	N/A	15/16 (94)
CPT7 17 February 2020	CPT019	*Campylobacter jejuni* ($6.9x10^3$)	Enumeration	$1.5x10^2$ - $1.3x10^4$	13/15 (87)
	CPT020	*Campylobacter coli* ($1.5x10^5$)	Enumeration	$4.3x10^3$ - $1.0x10^5$	11/15 (73)
	CPT021	*Campylobacter lari* ($4.0x10^3$)	Detection	N/A	13/13 (100)
CPT8 25 January 2021	CPT022	*Campylobacter jejuni* ($1.4x10^4$)	Enumeration	$5.4x10^2$ - $6.0x10^3$	13/16 (81)
	CPT023	No *Campylobacter* spp.	Enumeration	N/A	16/16 (100)
	CPT024	*Campylobacter lari* ($7.3x10^3$)	Detection	N/A	15/15 (100)
CPT9 8 March 2021	CPT025	*Campylobacter coli* ($1.3x10^4$)	Enumeration	$2.9x10^3$ - $2.9x10^4$	13/15 (87)
	CPT026	*Campylobacter jejuni* ($4.8x10^2$)	Enumeration	20 - $7.6x10^2$	13/15 (87)
	CPT027	*Campylobacter coli* ($2.1x10^3$)	Detection	N/A	15/15 (100)
CPT10 10 May 2021	CPT028	*Campylobacter coli* (1.9x103)	Enumeration	$1.1x10^2$ - $2.6x10^3$	11/15 (73)
	CPT029	*Campylobacter jejuni* ($3.4x10^3$)	Enumeration	$2.1x10^2$ - $3.0x10^3$	13/14 (93)
	CPT030	No *Campylobacter* spp.	Detection	N/A	14/15 (93)

Distribution number **Date**	**Sample number**	***Campylobacter* spp. (levels shown are CFU per g)**	**Examination**	**Expected range (CFU per g)**	**Overall percentage performance for a fully correct score of 2** **N (%)**
CPT11 5 July 2021	CPT031	*Campylobacter jejuni* ($9.4x10^4$)	Enumeration	$7.7x10^2$ - $4.8x10^4$	9/16 (75)
	CPT032	*Campylobacter coli* ($2.1x10^3$)	Enumeration	$1.6x10^2$ - $2.1x10^3$	9/16 (75)
	CPT033	*Campylobacter jejuni* ($1.1x10^3$)	Detection	N/A	9/9 (100)
CPT12 6 September 2021	CPT034	No *Campylobacter* spp.	Enumeration	N/A	16/16 (100)
	CPT035	*Campylobacter coli* ($3.0x10^3$)	Enumeration	$1.3x10^2$ - $2.5x10^3$	13/16 (81)
	CPT036	*Campylobacter jejuni* ($1.0x10^2$)	Detection	N/A	14/15 (93)
CPT13 1 November 2021	CPT037	*Campylobacter coli* ($8.6x10^2$)	Enumeration	$1.3x10^2$ - $2.5x10^3$	8/11 (73)
	CPT038	*Campylobacter jejuni* ($2.5x10^4$)	Enumeration	$1.5x10^3$ - $2.1x10^4$	9/11 (82)
	CPT039	*Campylobacter jejuni* ($4.9x10^5$)	Detection	N/A	9/10 (90)

Annex 5 - Performance Assessment Sheets for each laboratory

Performance assessments are designed to identify laboratories with on-going problems with their examinations and are undertaken after every distribution. Scores are allocated to results reported for every sample to help assess participants' performance. See Tables 1 and 2.

Non return of results have been excluded from the overall performance calculations.

NE = Not examined NR = No return of results N/A = Did not take distribution

A summary of the performance of each laboratory is shown below:

Laboratory 1:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	1	2	2	2	2	2	2	2	2	2	0	2	2	0	2	2	2	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
0	2	2	2	2	2	2	2	2				2	2	2				59	66	89

Laboratory 2:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	2	2	2	1	2	2				2	2	2				64	66	97

Laboratory 3:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2		2	2		1	2		0	2		2	2		2	2		1	2	

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2		2	2		2	2		0	2		2	2		2	1		45	52	87

Laboratory 4:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2	2	2	2	2	2	2	2				1	2	2	2	2	2	2	0	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
						2	2	2				2	0	2				43	48	90

Laboratory 5:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
1	1	2		0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	71	76	93

Laboratory 6:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	0	2	2	2	2	2	0	2	2	2	2	2	2	0	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
2	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	68	78	87

Laboratory 7:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	2	0	2												

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
																		16	18	89

Laboratory 8:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2	2	2	2	2	2	2	2	0	2	2									

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2				2	2	2	2	0		2	2		0	2	2	44	50	88

Laboratory 9:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2				2	2	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	2	2	2	0	2	2	2	2	2							58	60	97

Laboratory 10:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
			1	2	2	2	0	2	2	2	0	2	2	2	1	2	2			

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
																		24	30	80

Laboratory 11:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
2	2	2	2	2	2	1		2				2	2	2	0	0	2	65	70	93

Laboratory 12:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
1	2	2	0	2	2	2	2	2	2	2	2	2	2	2	0	0	2			

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	2	0	2	2	2	0	1	1	2	2	2	2				53	66	80

Laboratory 13:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2	2	2	2	2				1	2	2	2	2	2	1	2	2			

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
																		28	30	93

Laboratory 14:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	0	2	2	2	2	2	2	2	2	2	1	0	2	2	0	66	76	87

Laboratory 15:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	0	2	1	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
2	2	2	2	2	2				2	2		2	0	2	2	2	2	63	70	90

Laboratory 16:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	0	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
1	2	2	2	2	2				2	2	2	2	2	2	1	2	2	67	72	93

Laboratory 17:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	76	78	97

Laboratory 18

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	78	78	100

Laboratory 19:

CPT001	CPT002	CPT003	CPT004	CPT005	CPT006	CPT007	CPT008	CPT009	CPT010	CPT011	CPT012	CPT013	CPT014	CPT015	CPT016	CPT017	CPT018	CPT019	CPT020	CPT021
0	0	2	0	0	2	0	2	2	2	2	2	2	0	2	2	2	2	2	2	2

CPT022	CPT023	CPT024	CPT025	CPT026	CPT027	CPT028	CPT029	CPT030	CPT031	CPT032	CPT033	CPT034	CPT035	CPT036	CPT037	CPT038	CPT039	Total	Out of	Overall percentage
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	65	78	83

Laboratory 20:

CPT 001	CPT 002	CPT 003	CPT 004	CPT 005	CPT 006	CPT 007	CPT0 008	CPT 009	CPT 010	CPT 011	CPT 012	CPT 013	CPT 014	CPT 015	CPT 016	CPT 017	CPT 018	CPT 019	CPT 020	CPT 021
						2	2	2	2	2	2	2	2	2	0	2	2	2	2	2

CPT0 22	CPT0 23	CPT0 24	CPT0 25	CPT0 26	CPT0 27	CPT0 28	CPT0 29	CPT0 30	CPT0 31	CPT0 32	CPT0 33	CPT0 34	CPT0 35	CPT0 36	CPT0 37	CPT0 38	CPT0 39	Total	Out of	Overall percentage
2	2	2	0	0	2	0	2	2				2	2	2				46	54	85

End of report