C01

Meat Chemistry Program

6-04-19 (Shipment Date)

7-12-19 (Report Issue Date)

Proficiency Testing Provider
Certificate 1782.01

AOAC INTERNATIONAL
Arlene Fox, Senior Director
2275 Research Blvd. ste 300
Rockville, MD 20850
+1-301-924-7077 LPTP@AOAC.org

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Report Authorization

This report has been authorized by Arlene Fox, Senior Director of the AOAC laboratory Proficiency Testing Program.

REPORT TO PARTICIPANTS IN
THE AOAC® LABORATORY PROFICIENCY TESTING PROGRAM

MEAT CHEMISTRY PROGRAM

SITE IDENTIFICATION:

1.0 Introduction

Test materials for the Meat Chemistry Program were shipped to participants on June 4, 2019. Each laboratory was given a site identification number in order to maintain confidentiality. An Instruction packet on how to use the confidential online data submission system was posted online. The participants were to submit an electronic response online to verify the condition of the test materials upon receipt. Participants were also instructed to report methods and results electronically. Participants were instructed to analyze the test materials according to procedures routinely used in their laboratories. The results were to be recorded and submitted to AOAC INTERNATIONAL by June 19, 2019.

2.0 Preparation of Test Materials

Each set of test materials included two samples, each containing approximately 70 grams of a frozen meat sample. The samples were duplicate samples. Each shipment in this program includes ground or processed meat chosen to provide a range of analytes from shipment to shipment.

Ten quantitative samples were randomly selected and analyzed in duplicate to verify the homogeneity of the test material (Appendix I) for fat, moisture, sodium, and iron. Homogeneity testing was completed prior to shipment. The requirements of ISO/IEC Standard 17043:2010(E) Conformity Assessment - General requirements of proficiency testing schemes were met.

Samples were prepared by the following laboratory:

Silliker Solution Center
3600 Eagles Nest Drive, Bldg. A
Crete, IL 60417

3.0 Analyses Requested

% Moisture	% Sodium	Nitrite (ppm) *
% Fat	% Salt	Calories (cal/100 g)
% Protein	Potassium (ppm)	% Saturated Fat
% Ash	Magnesium (ppm)	% Monounsaturated Fat
% Carbohydrate (By calculation)	Iron (ppm)	% Polyunsaturated fat
Cholesterol (mg/100 g)	% Calcium	% Trans Fatty Acids (% of the total sample)
pH *		

* Currently not under scope of accreditation.

The participants had the option of marking the analysis as “Not Tested” for any test. Information on the method used for each analyses was requested.

4.0 Calculation and Interpretation of z-scores:

For each individual result, a z-score was calculated as follows:

$$z = \frac{(x - X)}{s}$$

where:

z = the z score (standard score)

x = the reported value of analyte

X = the assigned value, the best estimate of the “ true” Concentration

s = the estimate of variation (standard deviation)

The robust procedure from *ISO 13528:2005 (E), Statistical methods for use in proficiency testing by interlaboratory comparisons* is used in processing the result data. Robust statistics relies on medians rather than means, and uses more information from the central than from the outlying observations. This approach is being used to minimize the effect of extreme results on the calculation of z-scores. There are two types of extreme results in these analyses: “Blunders” and “Outliers”. Blunder results were likely due to errors, such as transcription errors, incorrect sample identification, or a major problem performing the analysis. Blunders are defined as results that differ from the initial median of the participant’s by a factor of 2. These results have been labeled as "pre-screened as an outlier."

The assigned value was determined by the consensus of the majority after the removal of outliers by the robust procedure. Outlier results have been labeled “Outlier: Z beyond 3”. The assigned value, standard deviation, and the z-scores were recalculated without the outliers. The blunder results and outlier results were still evaluated within the proficiency scheme and given the appropriate performance rating. Measurement uncertainty (standard uncertainty of the assigned value) has also been provided.

The following interpretation of z-scores for each individual test result is provided in of ISO/IEC Standard 17043:2010(E) Conformity Assessment - General requirements for proficiency testing schemes common examples of application of z-scores:

Results Obtained	Rating
$\lvert z \rvert \leq 2$	Satisfactory
$2 < \lvert z \rvert < 3$	Questionable
$\lvert z \rvert \geq 3$	Unsatisfactory

AOAC has calculated z-scores according to methodology for the % Moisture and % Fat analyses. All statistics for the % Moisture and % Fat have been computed according to methodology when more than 10 participants specified the same method. When participants specified a method used by fewer than 10 participants (O for %Moisture, OF for % Fat, and OP for % Protein), z-scores for their results were based on all results for the specific analysis. Calculations for z scores based on the data presented in the results sheet might be slightly different from the z-scores assigned by AOAC. The z-scores assigned by AOAC are based on calculations that use more significant figures than is possible to display on the results sheet.

5.0 Results

5.1 General Discussion of Results

Confidentiality of results will be maintained by issuing site identification codes to the participants. Results in reports will only be identified by the site identification code. Z-scores have been provided for moisture, fat, protein, ash, and salt. AOAC believes its participants should be evaluated based on only those samples which pass *all* the rigorous testing and ISO 13528 criteria (for homogeneity, stability, and participant results). AOAC requires at least 12 data points, without blunders, for z-scores to be provided for an analyte. All available information on the distribution of results for the other analytes has been provided. Some tests had fewer participants submitting results because some of the laboratories do not routinely perform all the analyses. At the recommendation of food and nutrition experts the carbohydrate analyses will not be used for evaluation. Results for % Saturated, % Monounsaturated, % Polyunsaturated, and % Trans Fatty Acids should be presented as % of the total sample, not % of total fat. Parts per million (ppm) Nitrite is currently not under AOAC INTERNATIONAL's scope of accreditation. Due to participant requests, statistical data has been provided for nitrite; however, results should not be used for evaluation. The assigned value was determined by the consensus of the majority after outliers were removed.

AOAC is instituting an approach to provide information on the performance of the different methods used by participants. Results from equivalent methods have been grouped together. More specific method information will be requested from participants in the future. Participants will have to make sure that their method number is correctly transcribed so that their results are scored with the correct group in the future.

If a participant would like to appeal against the assessment of their performance in this proficiency testing scheme please contact staff at LPTP@AOAC.org

Individual laboratory results are in Appendix A

Moisture:

The table below indicates which methods were grouped together for statistical computation of % Moisture. There was an insufficient number of participating laboratories using Method B (AOAC 985.14 and CEM 985.14.), and therefore, results have not been calculated specifically based on Method B.

% Moisture Method Indicated in Individual Result Section	% Moisture Methods Included
Method A	**Method A includes AOAC 950.46 and FSIS 3.001.**
Method O*	**All Other Methods**

* When participants specified a method used by fewer than 10 participants (O for % moisture), z-scores for their results were based on all results for the specific analysis.

A table has been provided to compare the standard deviations and assigned values for the various methods. There is inadequate data to compare Method A to Method O, because Method O represents all other methods.

% Moisture	Sample 1	Sample 2
Method A Standard Deviation	**0.288**	**0.446**
Method O Standard Deviation	**0.606**	**0.713**
Method A Assigned Value	**58.592**	**58.460**
Method O Assigned Value	**58.508**	**58.323**

Fat:

The table below indicates which methods were grouped together for statistical computation of % Fat. There was an insufficient number of participating laboratories using Method BF (AOAC 985.15, Microwave Oven Method, and CEM 985.15.), and therefore, results have not been calculated specifically based on Method BF.

%Fat Method Indicated in Individual Result Section	% Fat Methods Included
Method AF	**Method AF includes AOAC 960.39, Solvent Extraction, Soxhlet Method and FSIS 3.005.**
Method OF*	**All Other Methods**

* When participants specified a method used by fewer than 10 participants (OF for % Fat), z-scores for their results were based on all results for the specific analysis.

A table has been provided to compare the standard deviations and assigned values for the various methods. There is inadequate data to compare Method AF to Method OF, because Method OF represents all other methods.

% Fat	Sample 1	Sample 2
Method AF Standard Deviation	**0.298**	**0.689**
Method OF Standard Deviation	**0.473**	**0.724**
Method AF Assigned Value	**21.490**	**21.452**
Method OF Assigned Value	**21.347**	**21.438**

Protein:

There were insufficient laboratories using a specific method for the Protein analyses, therefore protein results for this round are based only on method “OP” (All Other Methods).

5.2 Discussion of Data Plots

z-Score Plots

z-score plots allow a visual comparison of z-score results from each separate laboratory against the entire distribution of all data for a given test. These plots are made up of three components. For each sample, the leftmost “stripe" is the entire set of reported z-scores. Each separate value is a thin horizontal line. Tightly clustered values show as dense, dark areas. The entire distribution can be seen spread above and below the mean of zero. A box-whisker plot is included to focus attention on several well-known descriptors, notably the median and the upper and lower quartiles (25th and 75th percentiles). The box in these plots itself represents the middle 50% of the data, while the whiskers give a sense of reasonable tails. Inside the box, the median is indicated by a horizontal line. The top whisker goes up to the largest data point which lies no further than 1.5 box-heights from the top of the box. The bottom whisker is analogous. The large black dot locates the individual z-score derived from the original value reported by the lab for each sample.
Distribution of Results Plots
For a given test, the minimum and maximum of all results (all samples combined) determine the range. The number of reported results falling into each bin is counted. The bars depict these counts as percentages of the total for each sample.

Individual laboratory z-score Plots and Distribution of Results Plots are in Appendix B

Appendix C

Instructions -C01 Meat Chemistry Proficiency Testing Program

Enclosed are two samples, each containing approximately 70 grams of processed meat (Beef). Samples should be stored frozen until analysis at -20 ^{O} Celsius.

RESULTS ARE DUE ON JUNE 19, 2019

If applicable to your laboratory, analyze each of the samples for the following:

1. % Moisture
2. % Fat
3. % Protein - Use protein factor 6.25
4. % Ash
5. % Carbohydrate (by calculation)
6. Cholesterol (mg/ 100 g)
7. % Sodium
8. % Salt
9. Nitrite (ppm) *
10. Potassium (ppm)
11. Magnesium (ppm)
12. Iron (ppm)
13. % Calcium
14. Calories (cal/100g)
15. % Saturated Fat
16. % Monounsaturated Fat
17. % Polyunsaturated Fat
18. % Trans Fatty Acids
19. pH *

* Nitrite (ppm) is currently not under scope of accreditation.

If you need assistance at any time, please contact Proficiency Testing Staff at LPTP@AOAC.org

Appendix D

Meat Chemistry (C01)
Hot Dog Matrix (Oscar Mayer - Uncured Jumbo Wieners)
Homogeneity Analysis
Sample Ship Date June 4, 2019

Fat (Soxhlet) %

Sample #	Fat 1,2 - Rep 1	Fat 1,2 - Rep 2
1	22.27	20.56
2	21.25	22.10
3	21.04	22.14
4	21.33	21.18
5	21.02	22.03
6	20.49	21.41
7	22.04	20.86
8	20.57	21.64
9	20.70	21.76
10	20.67	22.18

Average ($\bar{x}$)	21.36
S_x	0.23
S_w	0.80
S_s	0.00
	PASSED

Moisture (Forced Air Oven) %

Sample #	Moist. 1,2 - Rep 1	Moist. 1,2 - Rep 2
1	57.79	58.91
2	58.11	58.25
3	57.93	57.08
4	58.35	58.20
5	58.73	57.28
6	58.80	58.03
7	58.69	58.86
8	58.15	57.55
9	60.03	58.24
10	58.69	59.30

Average ($\bar{x}$)	58.35
S_x	0.51
S_w	0.66
S_s	0.21
	PASSED

Sodium (mg/100g)

Sample #	Sod. 1,2 - Rep 1	Sod. 1,2 - Rep 2
1	909	881
2	919	897
3	928	915
4	906	902
5	930	897
6	932	896
7	929	884
8	906	939
9	911	897
10	905	890

Average ($\bar{x}$)	909
S_x	9.24
S_w	19.20
S_s	0.00
	PASSED

Iron (ppm)

Sample #	Iron 1,2 - Rep 1	Iron 1,2 - Rep 2
1	13.1	13.8
2	13.5	13.4
3	13.0	13.2
4	13.4	13.0
5	13.3	12.9
6	13.4	13.3
7	13.1	13.1
8	12.3	12.4
9	13.7	13.3
10	13.7	13.2

Average ($\bar{x}$)	13.21
S_x	0.34
S_w	0.25
S_s	0.29
	PASSED

C01 Quantitative Results 06/04/2019

Site ID= xxxxx

Site ID	Test	Sample	Method	Reported result	Number of reported results	Minimum result	Lower quartile	Median	Upper quartile	Maximum result	Assigned value (Mean)	Standard deviation	Z-score	Standard uncertainty of the assigned value	Notes
xxxxx	% Moisture	1	A	58.24	17	58.100	58.450	58.560	58.860	59.380	58.592	0.288	***-1.226***	0.087	
		2	A	58.16	17	57.610	58.160	58.410	58.910	59.240	58.460	0.446	***-0.672***	0.135	
xxxxx	% Fat	1	OF	21.33	25	18.280	20.930	21.400	21.610	27.020	21.347	0.473	***-0.037***	0.118	
		2	OF	21.29	25	18.420	20.950	21.400	21.890	26.550	21.438	0.724	***-0.204***	0.181	
xxxxx	% Protein	1	OP	12.19	22	10.680	12.000	12.140	12.300	14.980	12.123	0.255	***0.262***	0.068	
		2	OP	12.12	22	10.680	12.050	12.235	12.430	15.070	12.238	0.295	***-0.401***	0.079	
xxxxx	% Ash	1		4.42	18	3.850	4.280	4.375	4.420	4.460	4.350	0.091	***0.774***	0.027	
		2		4.42	18	4.120	4.260	4.325	4.390	4.820	4.318	0.103	***0.988***	0.030	
xxxxx	% Carbohydrate	1		3.28	9	2.990	3.460	3.720	4.070	5.870	3.739	0.533	.	0.222	
		2		3.28	9	2.890	3.160	3.300	4.410	4.700	3.625	0.645	.	0.269	
xxxxx	mg/100 g Cholesterol	1		Not tested	5	55.500	69.000	69.100	83.000	84.580	72.236	13.521	.	7.558	
		2		Not tested	5	57.900	67.600	69.750	82.090	86.000	72.668	12.915	.	7.220	
xxxxx	% Sodium	1		Not tested	8	0.845	0.884	0.913	0.929	1.010	0.910	0.040	.	0.017	
		2		Not tested	8	0.850	0.863	0.914	0.933	0.947	0.902	0.044	.	0.019	
xxxxx	% Salt	1		1.97	18	1.820	1.970	2.015	2.040	2.200	2.006	0.058	***-0.633***	0.017	
		2		1.97	18	1.860	1.970	1.990	2.030	2.200	2.000	0.038	***-0.788***	0.011	
xxxxx	ppm Nitrite	1		Not tested	2	3.900	3.900	4.450	5.000	5.000	4.450	0.882	.	0.780	
		2		Not tested	2	3.900	3.900	4.450	5.000	5.000	4.450	0.882	.	0.780	
xxxxx	ppm Potassium	1		Not tested	6	7960.00	8360.00	9271.35	9330.00	10100.0	9102.9	773.941	.	394.950	
		2		Not tested	5	7570.00	9076.00	9190.00	9294.20	9610.00	9188.0	221.387	.	123.759	
xxxxx	ppm Magnesium	1		Not tested	5	133.000	138.700	140.000	143.000	162.000	140.34	5.647	.	3.157	
		2		Not tested	5	134.000	136.000	138.700	145.000	153.000	140.57	7.192	.	4.020	
xxxxx	ppm Iron	1		Not tested	7	12.000	12.700	13.210	14.300	14.700	13.233	0.959	.	0.453	
		2		Not tested	7	11.700	12.200	12.800	14.800	14.900	13.296	1.531	.	0.723	
xxxxx	% Calcium	1		Not tested	9	0.112	0.116	0.128	0.132	0.142	0.126	0.012	.	0.005	
		2		Not tested	9	0.113	0.120	0.126	0.130	0.137	0.125	0.008	.	0.004	
xxxxx	Number of Calories	1		255.00	8	252.000	252.500	255.600	256.965	257.570	254.96	2.634	.	1.164	
		2		255.00	8	252.000	253.180	256.000	257.250	260.940	255.61	3.078	.	1.360	
xxxxx	% Saturated Fat	1		Not tested	5	6.050	6.220	6.290	6.460	6.510	6.306	0.211	.	0.118	
		2		Not tested	5	5.970	6.140	6.160	6.330	6.790	6.228	0.244	.	0.137	
xxxxx	% Monounsaturated Fat	1		Not tested	5	7.730	8.080	8.250	8.280	8.600	8.216	0.305	.	0.171	
		2		Not tested	5	7.910	7.960	8.060	8.230	8.830	8.111	0.227	.	0.127	
xxxxx	% Polyunsaturated Fat	1		Not tested	5	5.480	5.760	5.770	5.830	6.060	5.780	0.112	.	0.062	
		2		Not tested	5	5.250	5.640	5.640	5.850	6.240	5.697	0.358	.	0.200	
xxxxx	% Trans Fatty Acids	1		Not tested	5	0.060	0.070	0.100	0.110	0.120	0.092	0.029	.	0.016	
		2		Not tested	5	0.060	0.070	0.100	0.120	0.120	0.094	0.032	.	0.018	

Outliers are excluded from mean and standard deviation computation

C01 Quantitative Results 06/04/2019

Site ID= xxxxx

Site ID	Test	Sample	Method	Reported result	Number of reported results	Minimum result	Lower quartile	Median	Upper quartile	Maximum result	Assigned value (Mean)	Standard deviation	Z-score	Standard uncertainty of the assigned value	Notes
xxxxx	pH	1		6.49	5	6.270	6.330	6.480	6.490	6.590	6.432	0.147	.	0.082	
		2		6.47	5	6.270	6.340	6.470	6.470	6.580	6.426	0.138	.	0.077	

Outliers are excluded from mean and standard deviation computation

09:07 Wednesday, July 3, 2019

C01 06/04/2019 Z-score distribution analysis 07/03/2019 9:07:22

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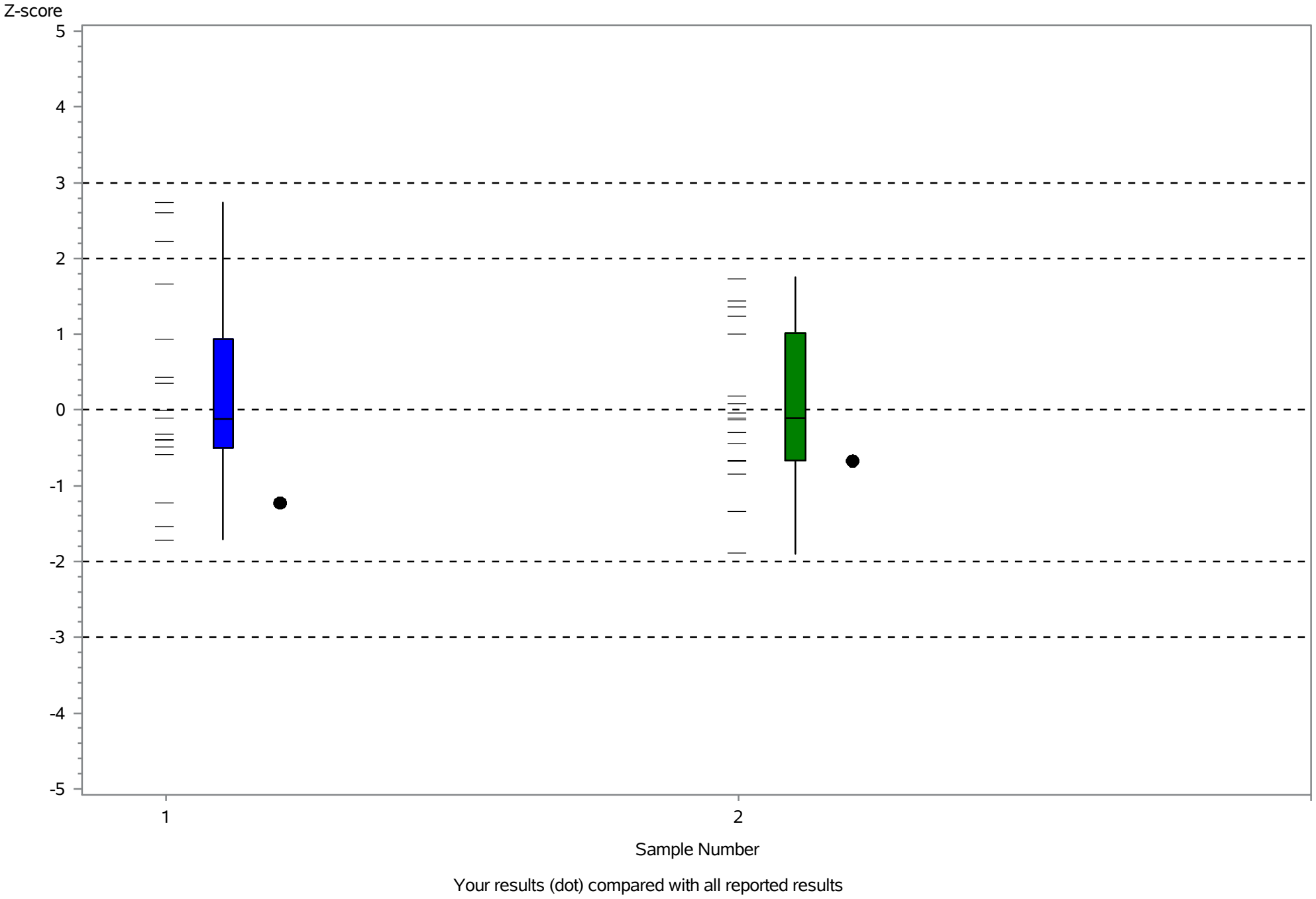

Your results (dot) compared with all reported results

09:07 Wednesday, July 3, 2019

C01 06/04/2019 Z-score distribution analysis 07/03/2019 9:07:22

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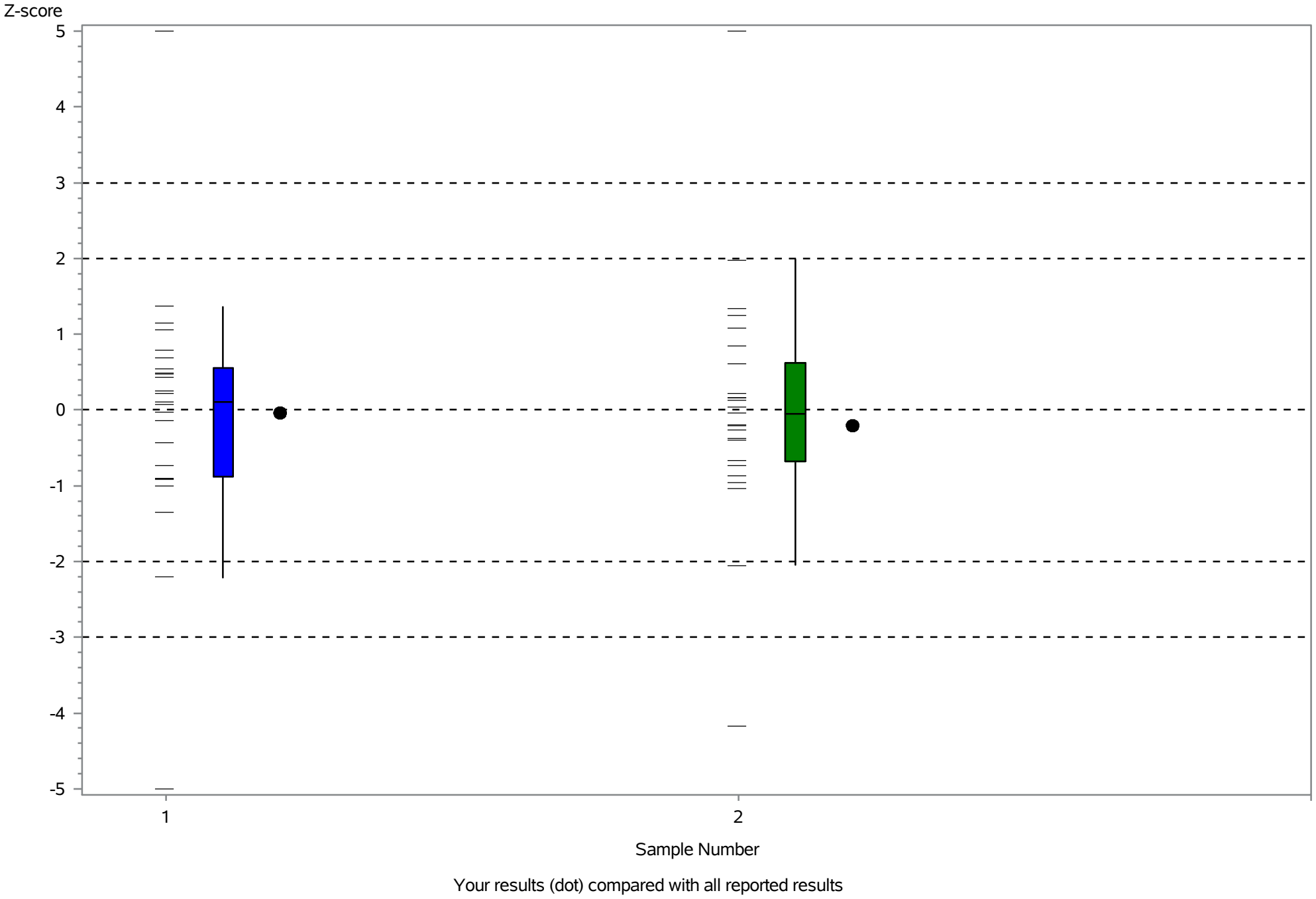

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09:07 Wednesday, July 3, 2019

C01 06/04/2019 Z-score distribution analysis 07/03/2019 9:07:22

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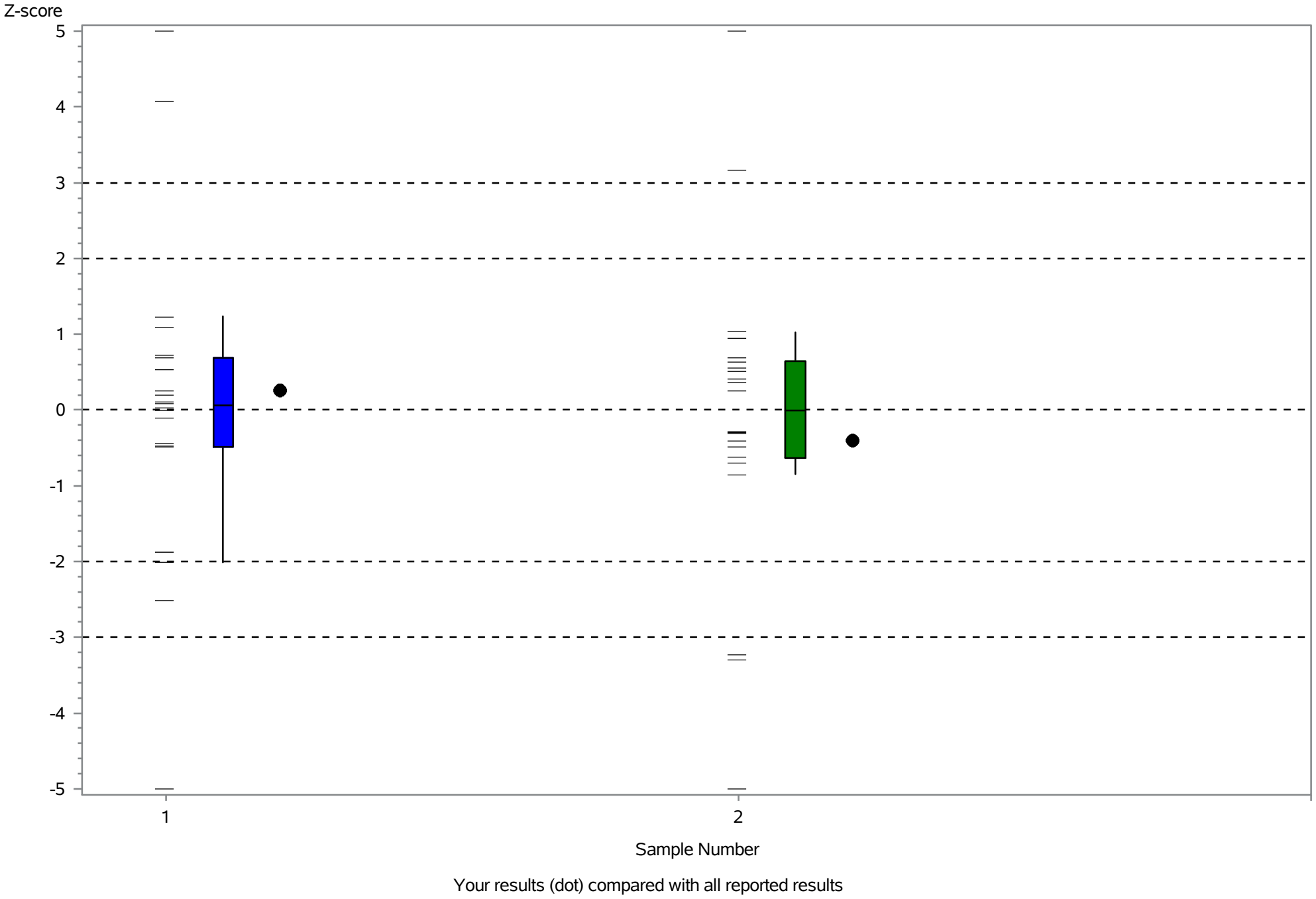

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09:07 Wednesday, July 3, 2019

C01 06/04/2019 Z-score distribution analysis 07/03/2019 9:07:22

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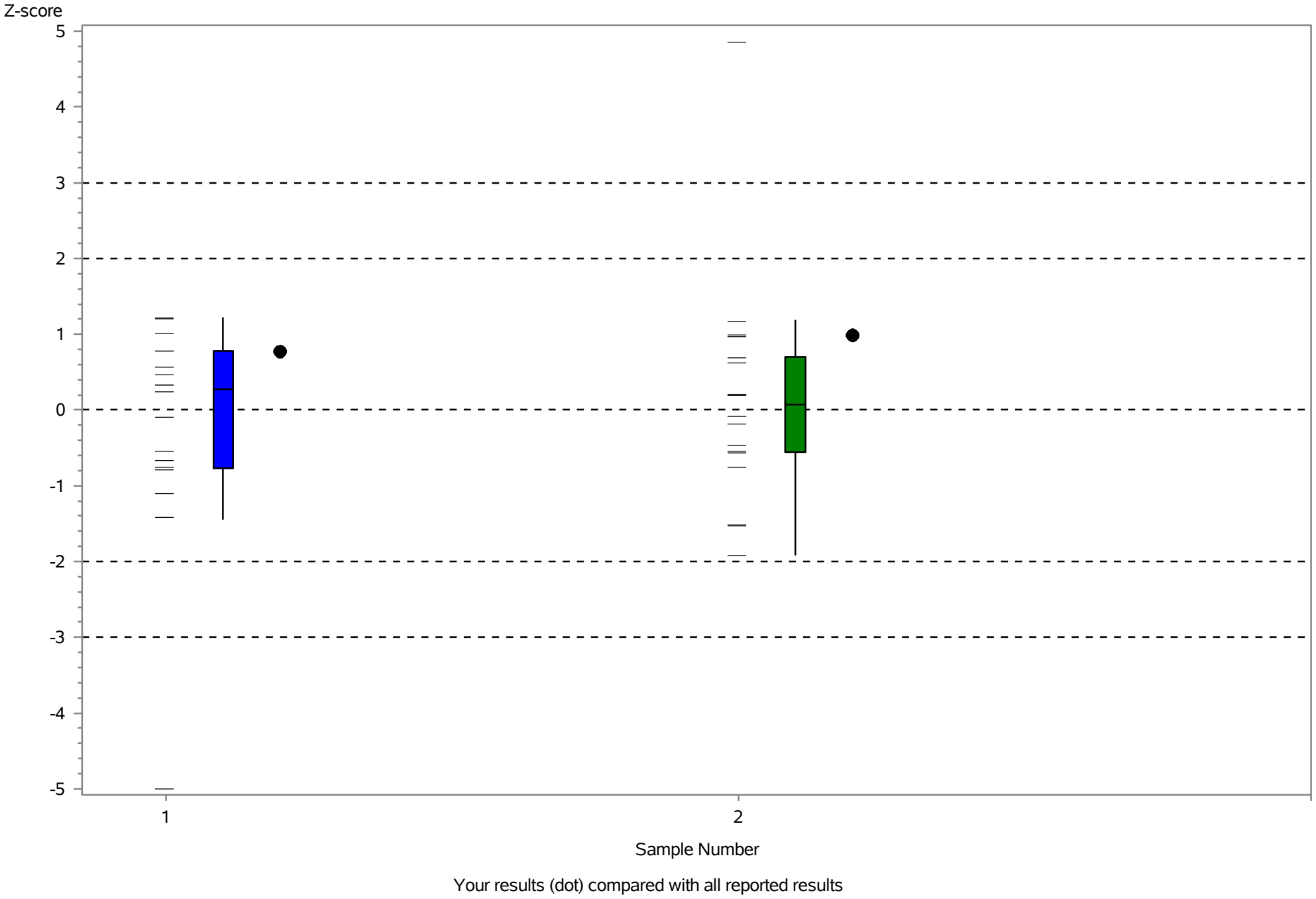

Your results (dot) compared with all reported results

09:07 Wednesday, July 3, 2019

C01 06/04/2019 Z-score distribution analysis 07/03/2019 9:07:22

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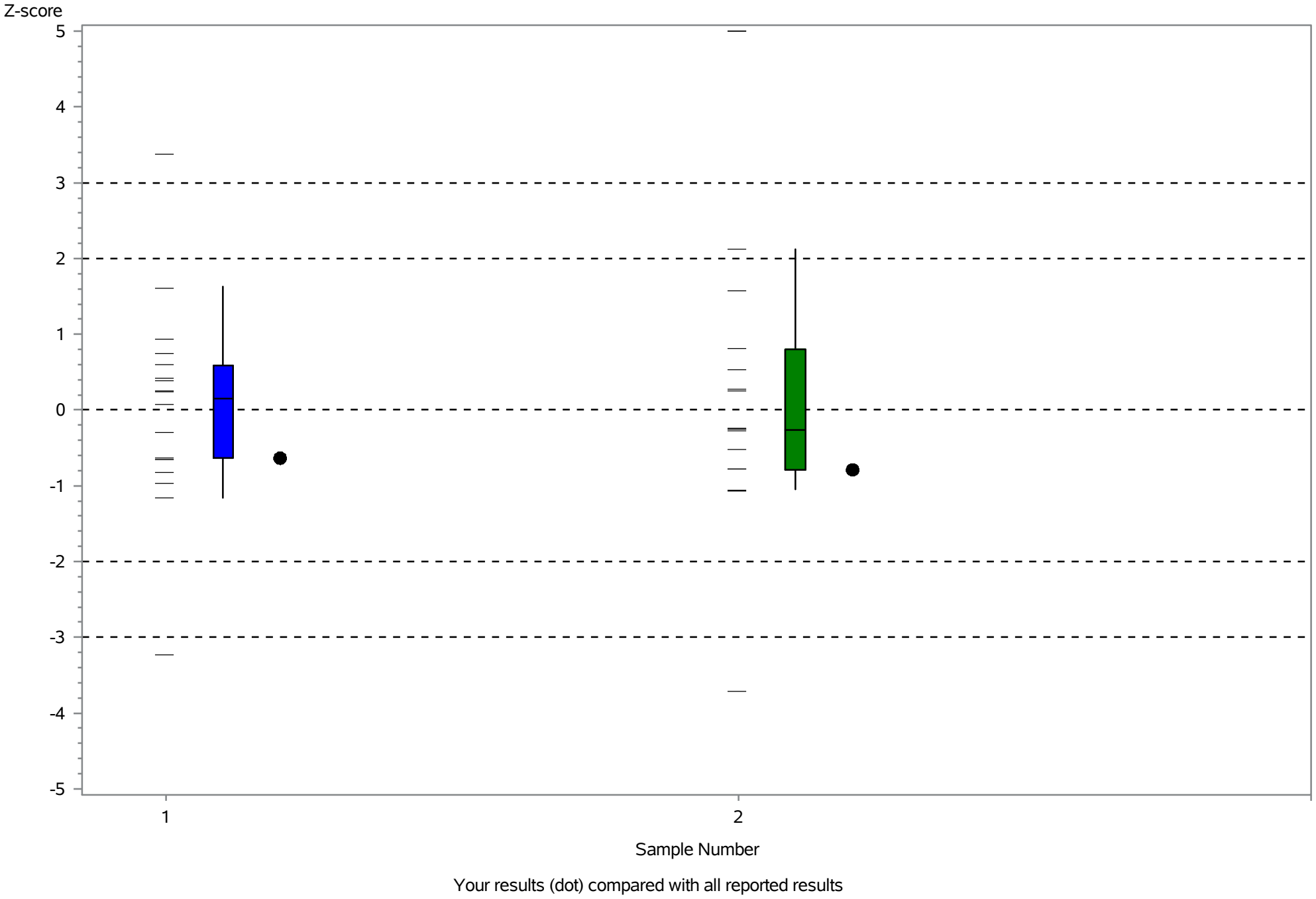

Your results (dot) compared with all reported results

09:07 Wednesday, July 3, 2019

C01 **06/04/2019** **07/03/2019 9:07:22**

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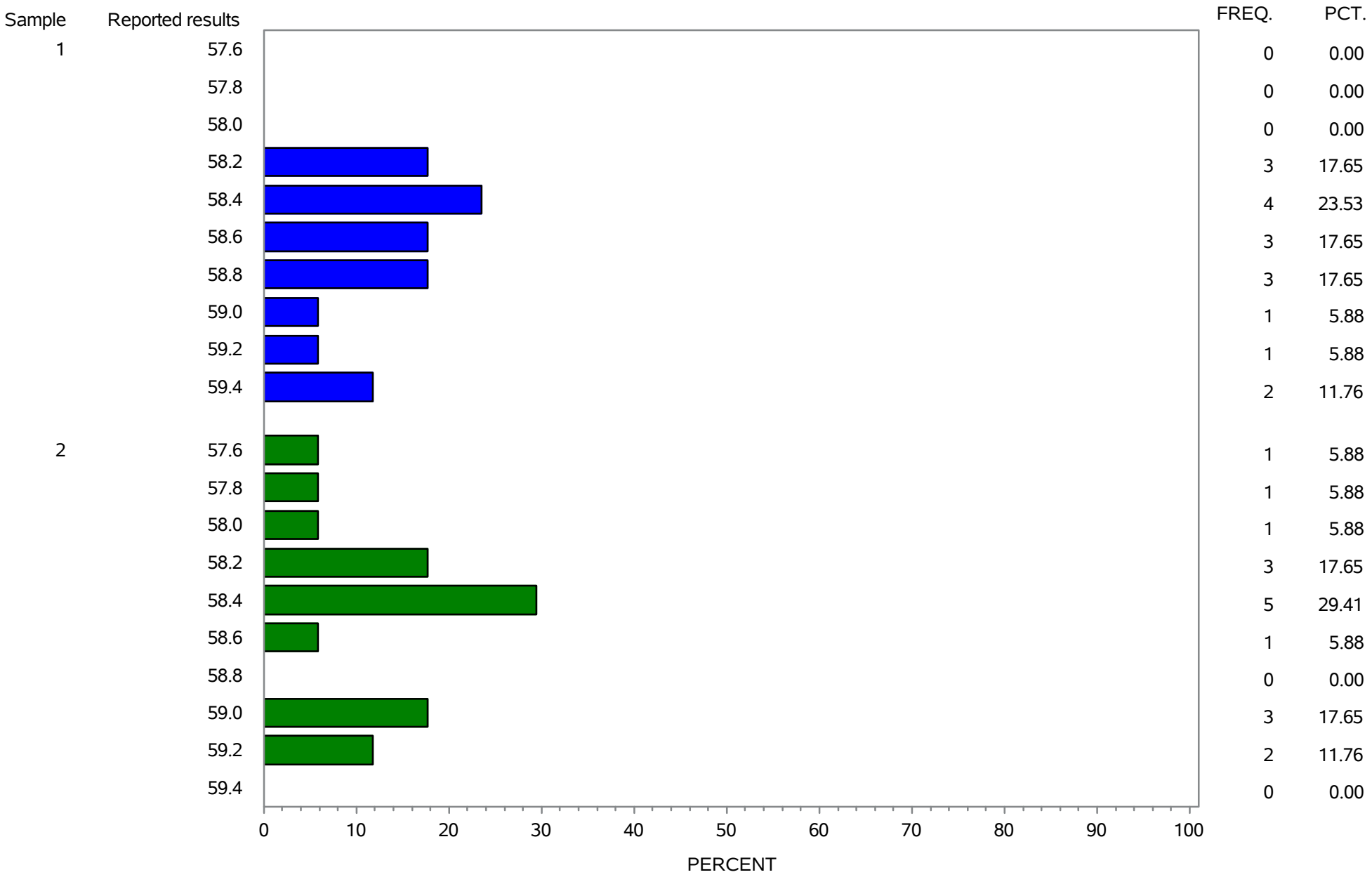

09:07 Wednesday, July 3, 2019

C01 **06/04/2019** **07/03/2019 9:07:22**

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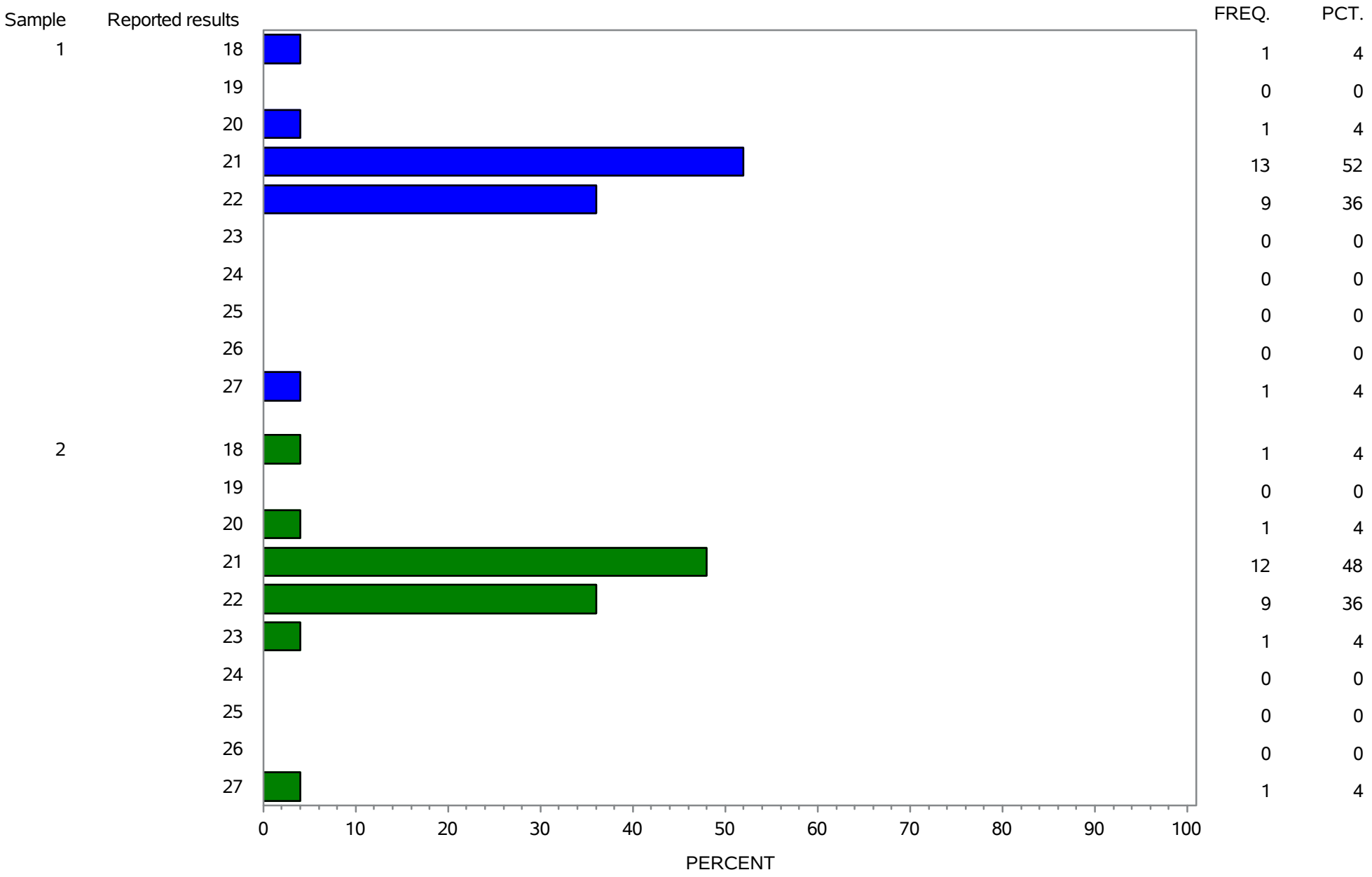

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C01 **06/04/2019** **07/03/2019 9:07:22**

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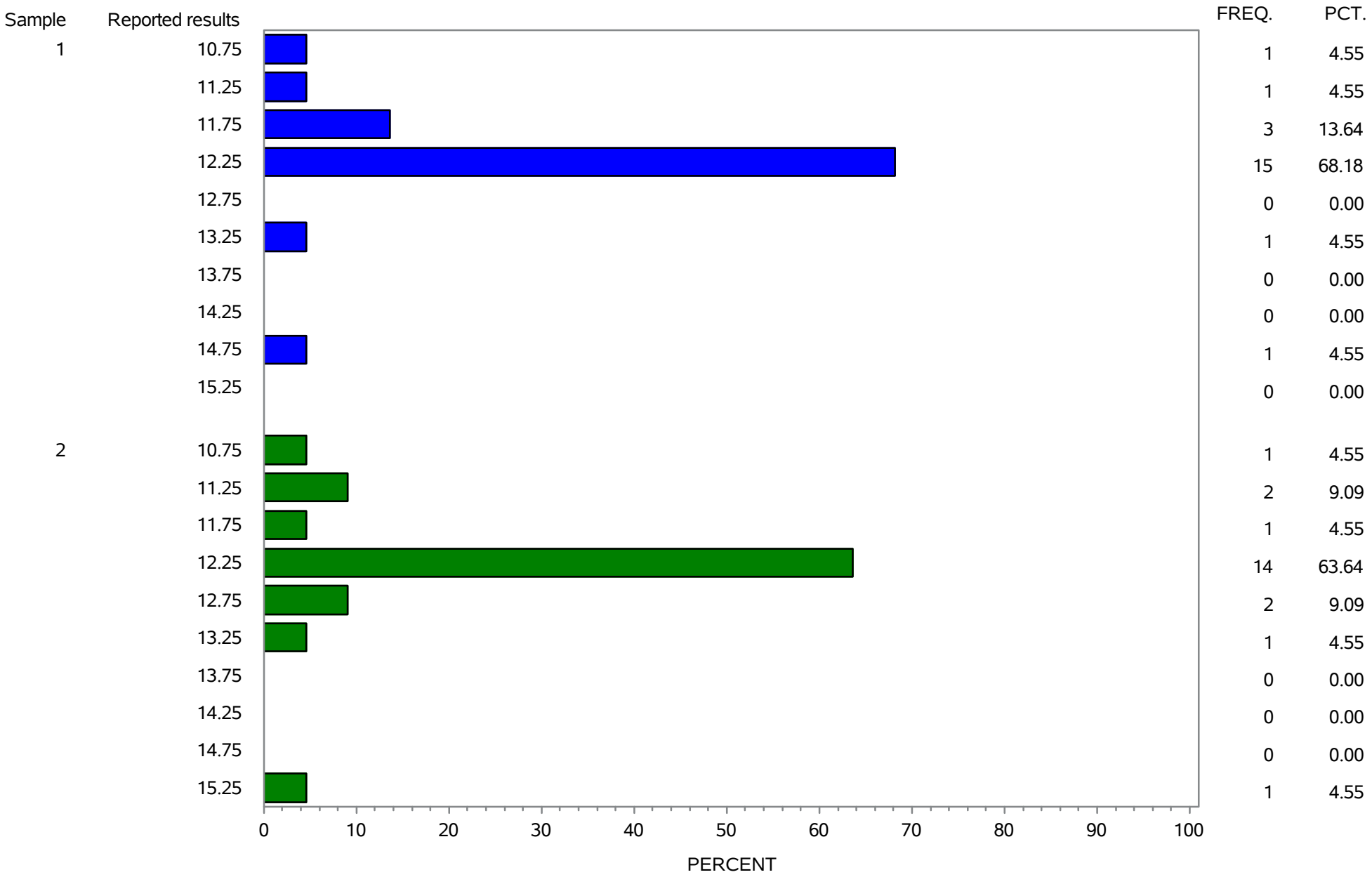

09:07 Wednesday, July 3, 2019

C01 **06/04/2019** **07/03/2019 9:07:22**

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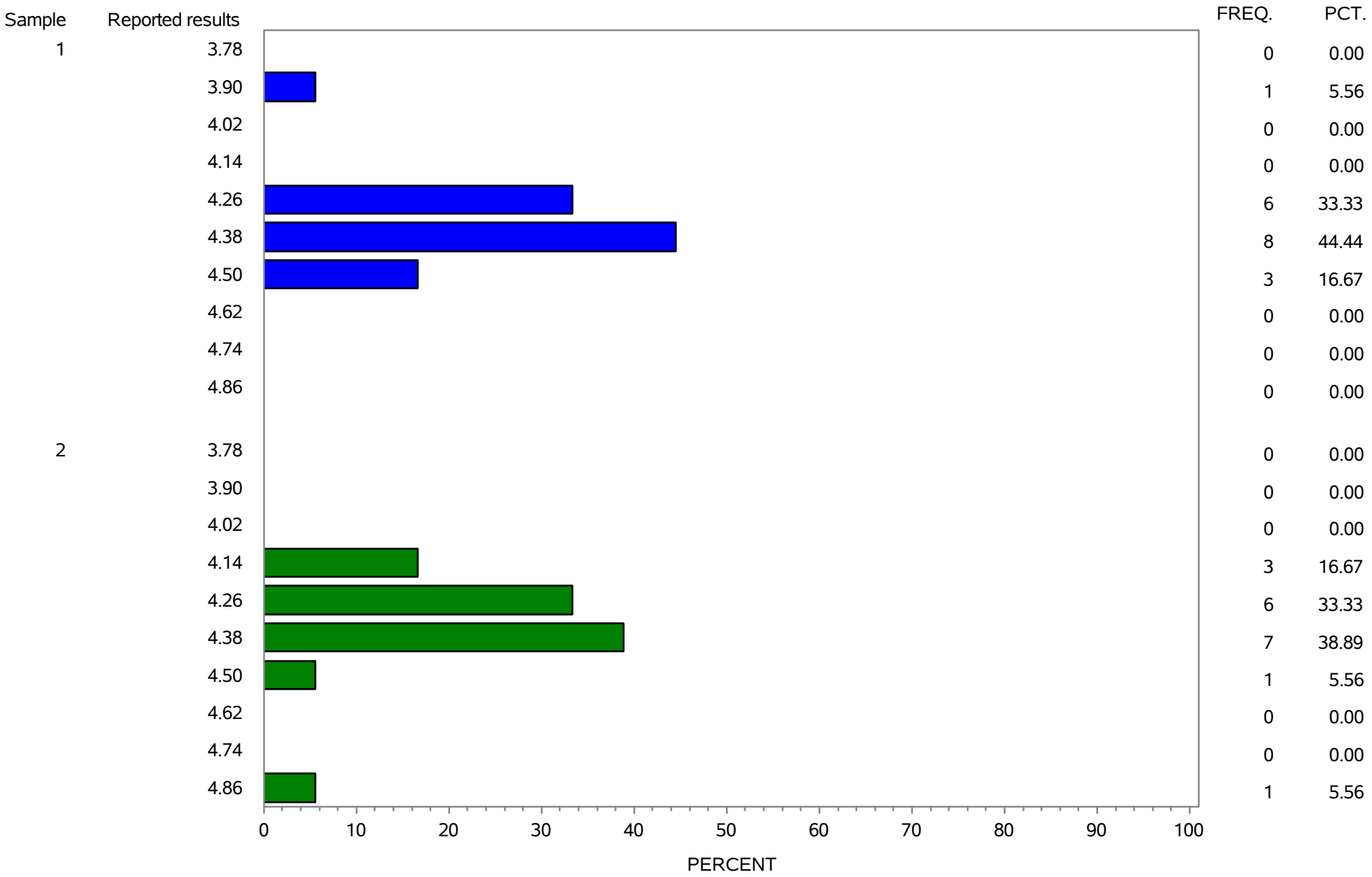

09:07 Wednesday, July 3, 2019

C01 06/04/2019 07/03/2019 9:07:22

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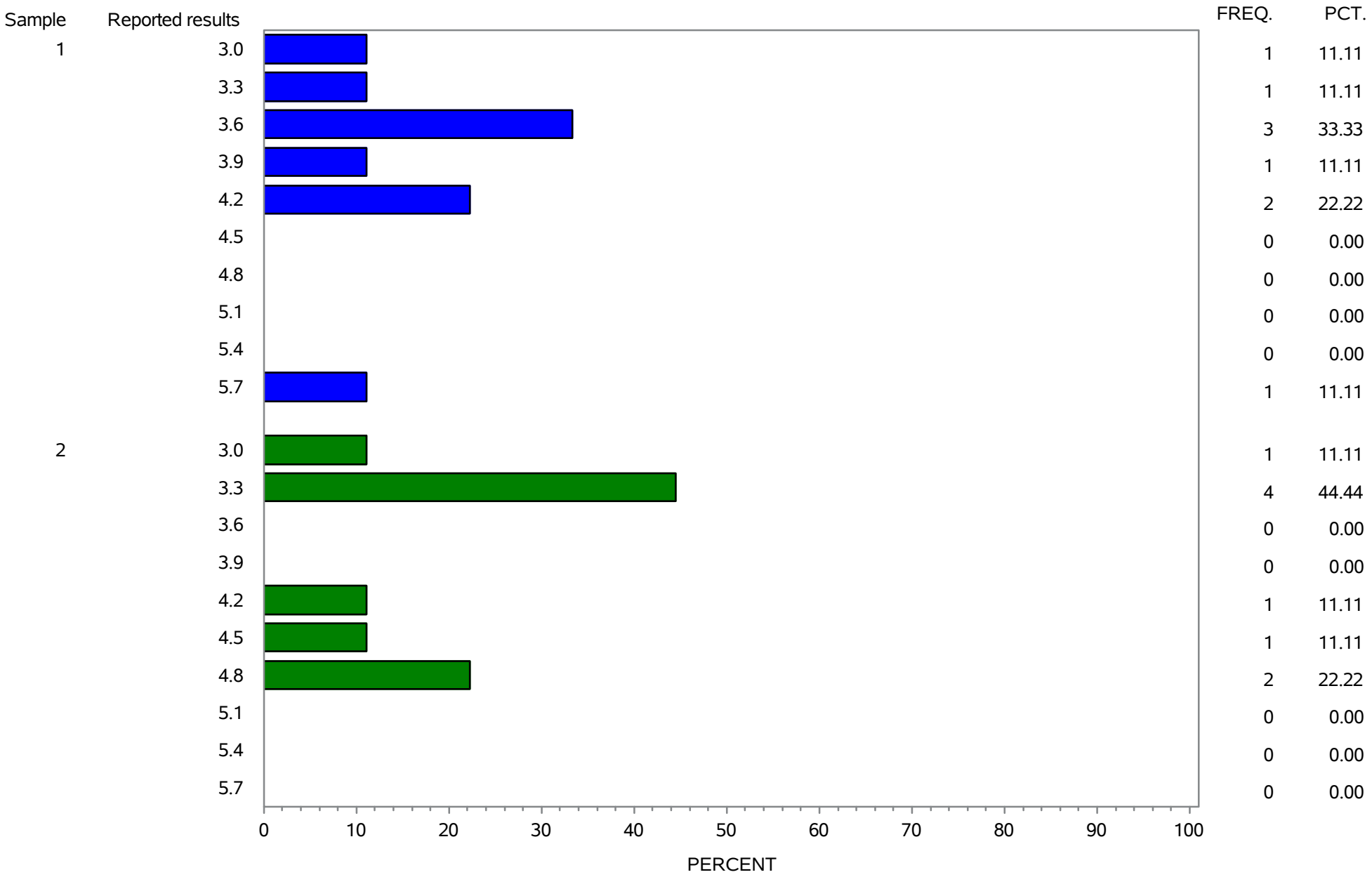

09:07 Wednesday, July 3, 2019

C01 **06/04/2019** **07/03/2019 9:07:22**

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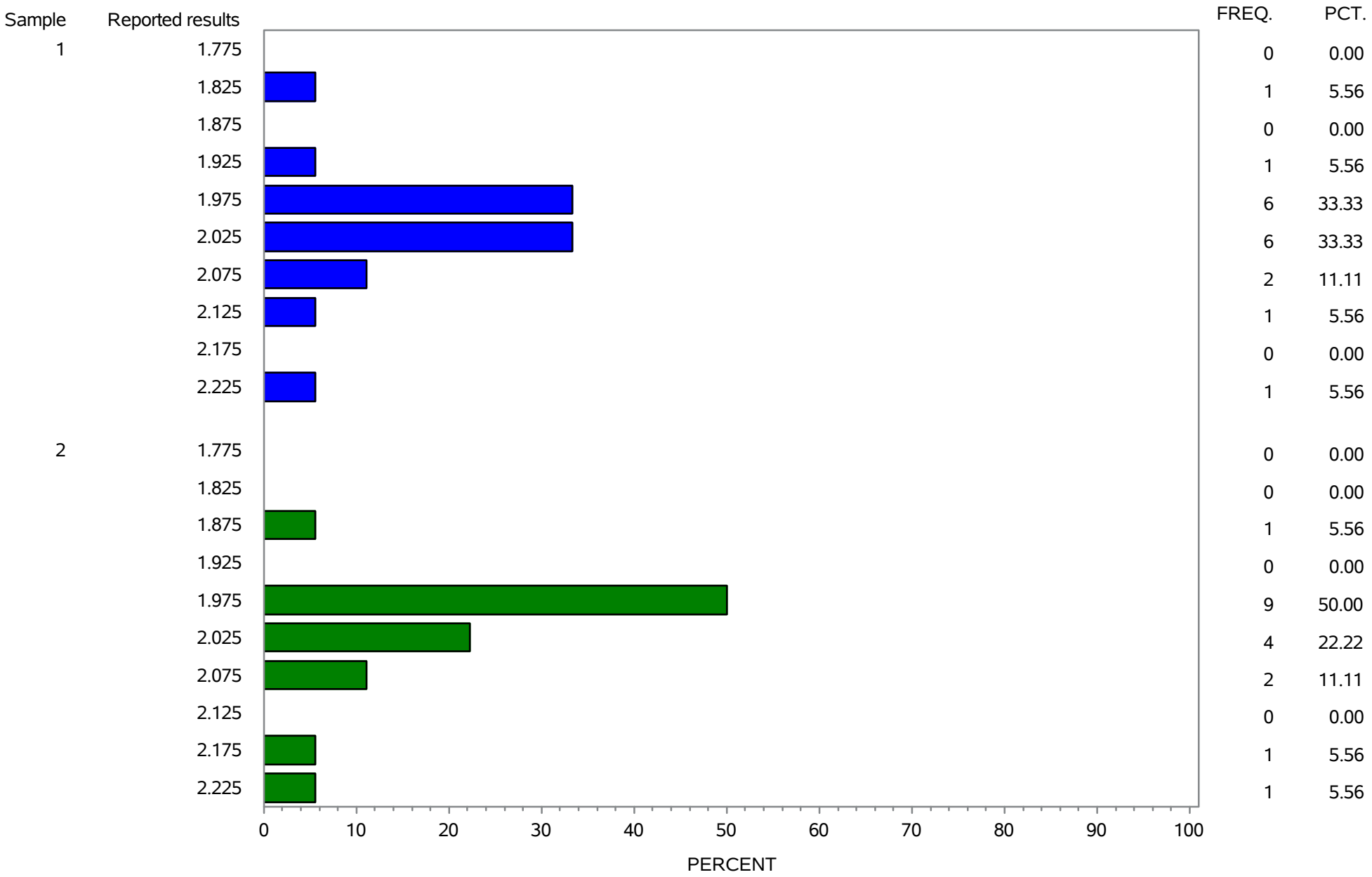

09:07 Wednesday, July 3, 2019

C01 06/04/2019 07/03/2019 9:07:22

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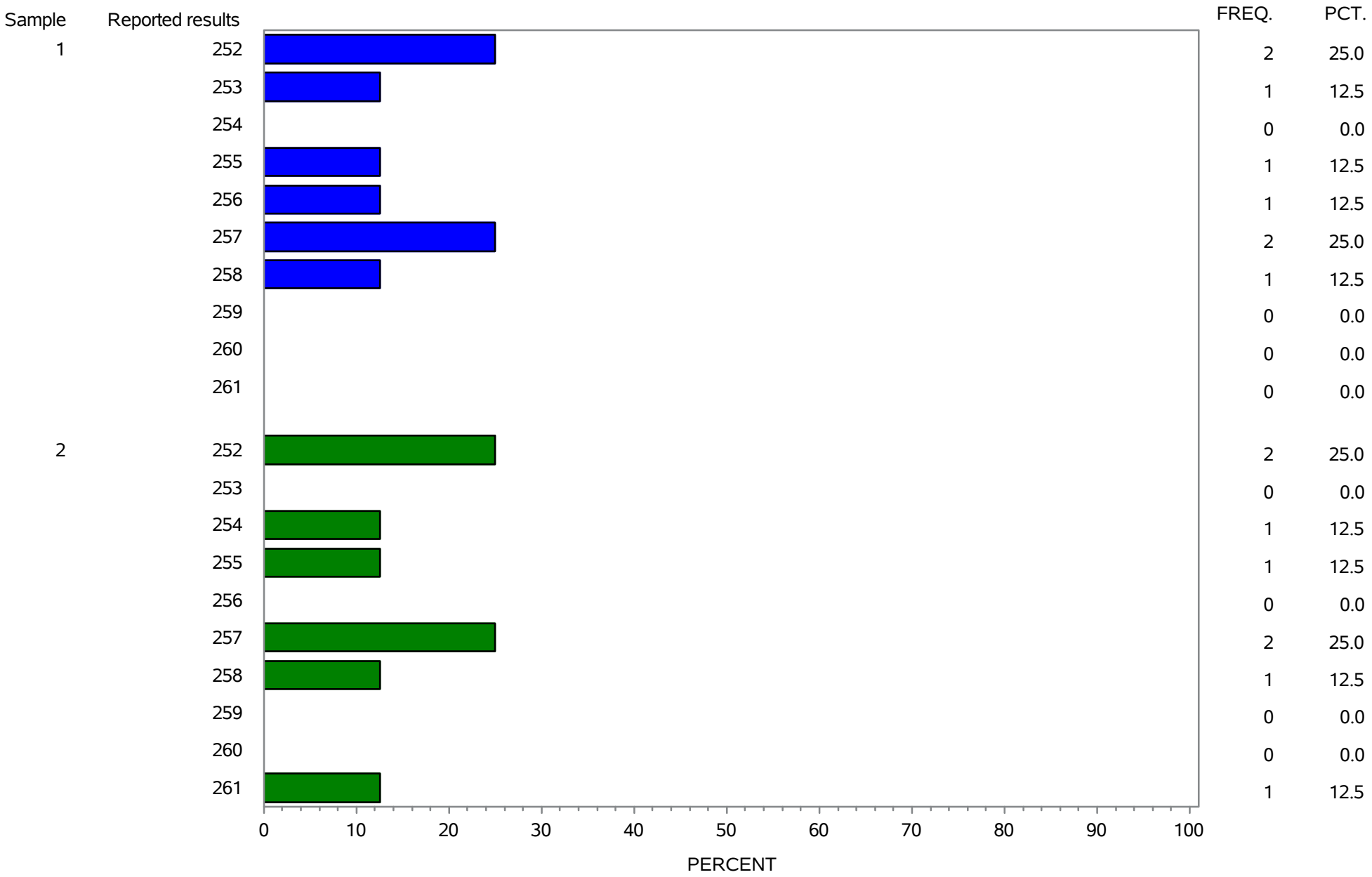
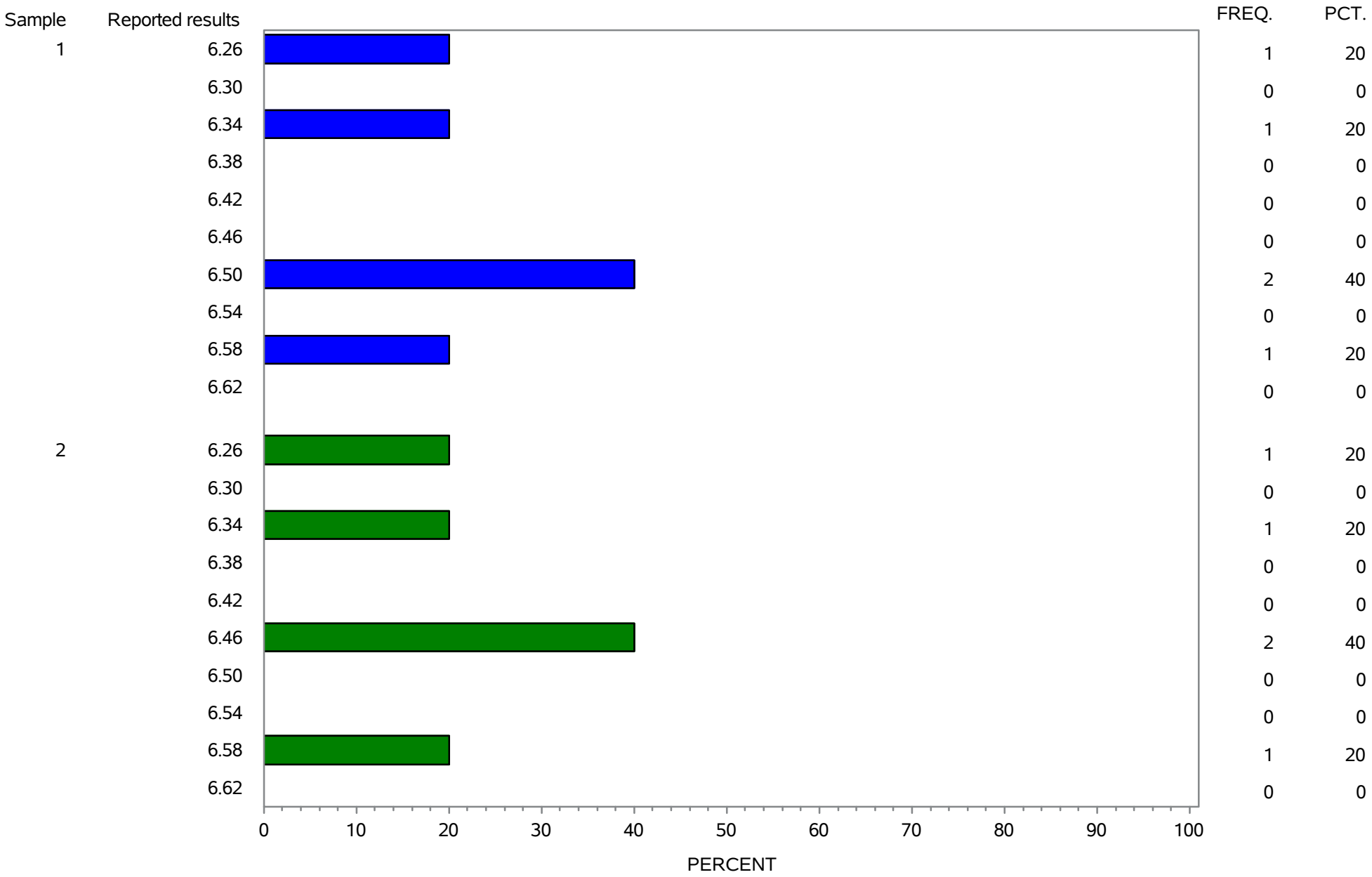


09:07 Wednesday, July 3, 2019

C01 **06/04/2019** **07/03/2019 9:07:22**

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