CardioChek® Plus

Comparison Study Summary

Tuality Healthcare
324 SE 9th Ave. Suite E
Hillsboro, OR 97123
July 30, 2014

1. PROTOCOL

This study was conducted on July 24th, 2014 at Tuality Healthcare, Hillsboro, OR. The study consisted of a side-by-side comparative analysis of two CardioChek® Plus analyzers using PTS Panels® Lipid + eGLU Smart Bundle™ test strips. The CardioChek Plus analyzers were purchased by Tuality and this evaluation also serves as a validation of those. This study compared the CardioChek Plus analyzers to the Roche Integra and the Beckman DXC using twenty-three (23) participant samples. Participants were fasting.

This study also consisted of a side-by-side comparative analysis of the A1CNow®+ multi-test A1C system to the Tosoh G7 and the Beckman using eleven (11) participant samples. Participants were fasting.

At the test site, two (2) Tuality phlebotomists performed a venipuncture and collected one (1) red top serum clot tube, one (1) green top lithium heparin tube, and one (1) lavender top EDTA tube. The red top tubes were allowed to clot for 30 minutes then centrifuged. The green top tubes #1-7 were centrifuged as well. Immediately following the venipuncture, a fingerstick was performed by a PTS employee.

The CardioChek Plus and the A1CNow+ systems were run in duplicate. Immediately after the fingerstick, the eGLU test strip was dosed on both CardioChek Plus analyzers. Following this, blood samples were obtained using the Sampler and mixed well before standing the Sampler on the table. The sample was then dispensed on the A1CNow+ monitors. The fingerstick site was then wiped, and a 40µl sample was collected using a heparinized capillary collection tube and dosed to the Lipid Panel test strip on the first CardioChek Plus analyzer. Next, another 40µl sample was collected in a new heparinized capillary tube from the same fingerstick and the Lipid Panel test strip was dosed on the second CardioChek Plus analyzer. The CardioChek Plus analyzers were alternated for first dose.

The green top lithium heparin (plasma) tubes #1-7 and the red top tubes #8-24 were analyzed on the Beckman for lipid panel and glucose, and the lavender tubes were analyzed on the Beckman for A1C. Once completed, serum from the red top tubes was aliquoted for overnight shipment to PTS-Indiana to be analyzed on the Integra.

Using the green top lithium heparin tubes, whole blood was aliquoted for overnight shipment to PTS-Sunnyvale to be analyzed on the Tosoh G7.

Analyte	Testing Range
Total Cholesterol	133-261 mg/dL
HDL Cholesterol	32-101 mg/dL
Triglycerides	47-207 mg/dL
Glucose	72-233 mg/dL
A1C	4.2-8.0 mg/dL

Testing range based on Roche Integra testing for Lipid + Glucose, and Tosoh for A1C

<u>Results</u>

Evaluation by Average Difference

The following graphs and tables show the detailed analyses of the relationship of the results from the CardioChek Plus test system, the Roche Integra, and the Beckman DXC.

The difference between the CardioChek Plus result and the laboratory result is calculated in a pair-wise fashion. The average of the differences is calculated. The **<u>average difference</u>** is expected to be:

<div align="center">

Total cholesterol: ±10%
HDL cholesterol: ±12%
Triglycerides: ±15%
Glucose evaluated according to the current 2003 ISO Standard:
Values up to 75 mg/dL: ±15mg/dL
Values >75 mg/dL: ± 20%

</div>

The average of the actual paired % bias with the **Integra** analyzer:

(((Comparator Result – Integra Lab Result) ÷ Integra Lab Result) x 100) are as follows:

Average Paired % Biases				
vs Integra	**Beckman**	**CC Plus 1**	**CC Plus 2**	**Averaged CC Plus 1 and 2**
Total Cholesterol	1.9%	-0.3%	-0.9%	-0.6%
HDL Cholesterol	-6.5%	6.7%	4.0%	5.2%
Triglycerides	-2.9%	0.9%	0%	0.5%
Glucose	0.2%	-6.7%	-5.9%	-6.3%

The average of the actual paired % Bias with the Beckman DXC analyzer

(((Comparator Result – Beckman) ÷ Beckman Result) x 100) are as follows:

Average Paired % Biases			
vs Beckman	**CC Plus 1**	**CC Plus 2**	**Averaged CC Plus 1 and 2**
Total Cholesterol	-2.1%	-2.8%	-2.5%
HDL Cholesterol	14.7%	11.6%	13.1%
Triglycerides	1.6%	0.7%	1.1%
Glucose	-6.9%	-6.0%	-6.4%

NOTE: This value is the average difference of a population; differences between individual results are expected to vary both below and above the average difference value.

Statistical Analysis Summary

The summary of the linear regression and predicted bias data is shown below. The regression statistics are displayed for each individual instrument used. These data are then used to calculate the predicted biases for each analyte at specific clinical decision values.

Actual predicted % differences with the Integra analyzer (((Comparator Result – Integra Lab Result) ÷ Integra Lab Result) x 100) were calculated before rounding the predicted value (shown), and are as follows:

2. CHOLESTEROL

Total Cholesterol				
vs Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Avg
N	23	23	23	23
slope	1.02	1.10	1.12	1.11
intercept	-0.5	-19.0	-22.7	-20.9
R	0.992	0.965	0.980	0.979
vs Beckman		CC Plus 1	CC Plus 2	CC Plus Avg
slope		1.06	1.07	1.07
intercept		-14.2	-18.4	-16.4
R		0.952	0.970	0.967

Total Cholesterol Predicted Biases				
vs Integra	Beckman	% Bias	CC Plus Avg	% Bias
160	163	1.7%	157	-2.1
200	204	1.8%	201	0.6
240	244	1.8%	246	2.3
280	285	1.8%	290	3.5
	Average % bias	1.8%		1.1%

Total Cholesterol Predicted Biases		
vs Beckman	CC Plus Average	% Bias
160	155	-3.2
200	198	-1.2
240	240	0.2
280	283	1.1
Average % bias		-0.8%

Predicted and average % biases are calculated using non-rounded values.
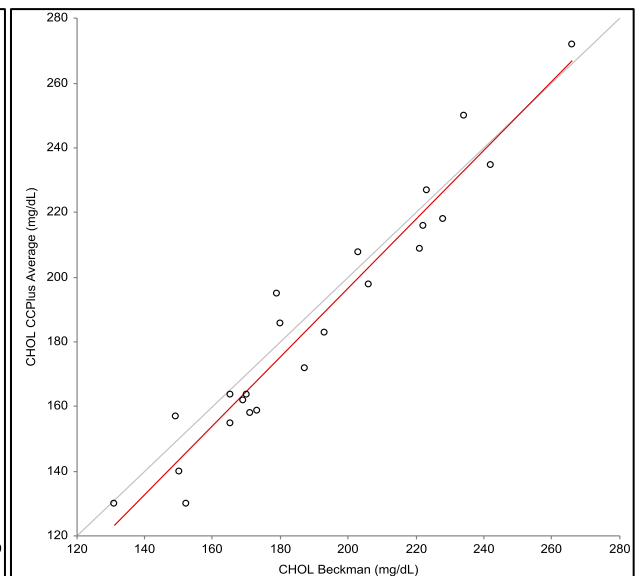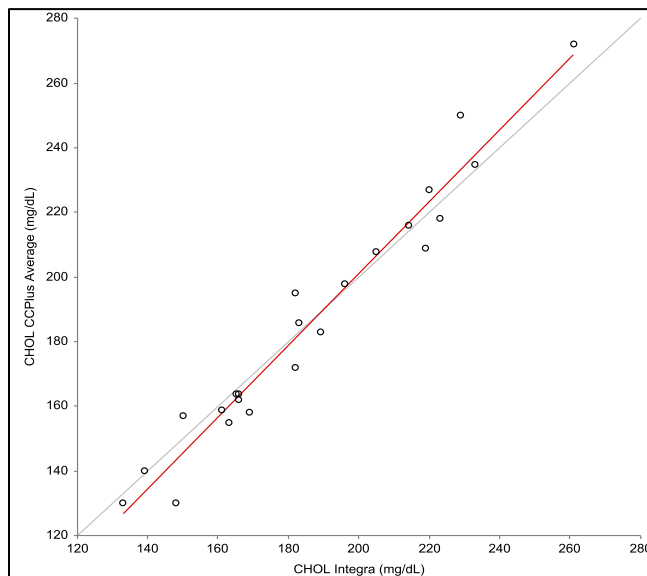
3. HDL CHOLESTEROL

HDL Cholesterol				
vs Integra	**Beckman**	**CC Plus 1**	**CC Plus 2**	**CC Plus Avg**
N	23	22	21	22
slope	0.87	1.0	1.13	1.04
intercept	3.6	3.9	-4.9	0.7
R	0.985	0.962	0.978	0.978
vs Beckman		**CC Plus 1**	**CC Plus 2**	**CC Plus Avg**
slope		1.2	1.38	1.26
intercept		-2.5	-13.5	-6.5
R		0.950	0.978	0.971

HDL Cholesterol Predicted Biases				
Integra	**Beckman**	**% Bias**	**CC Plus Average**	**% Bias**
40	38	-4.0%	42	5.8%
60	56	-7.0%	63	5.2%
80	73	-8.5%	84	4.9%
100	91	-9.4%	105	4.7%
	Average % bias	**-7.2%**		**5.1%**

HDL Cholesterol Predicted Biases		
vs Beckman	**CC Plus Average**	**% Bias**
40	44	9.8%
60	69	15.2%
80	94	17.9%
100	120	19.5%
Average % bias		**15.6%**

Predicted and average % biases are calculated using non-rounded values.
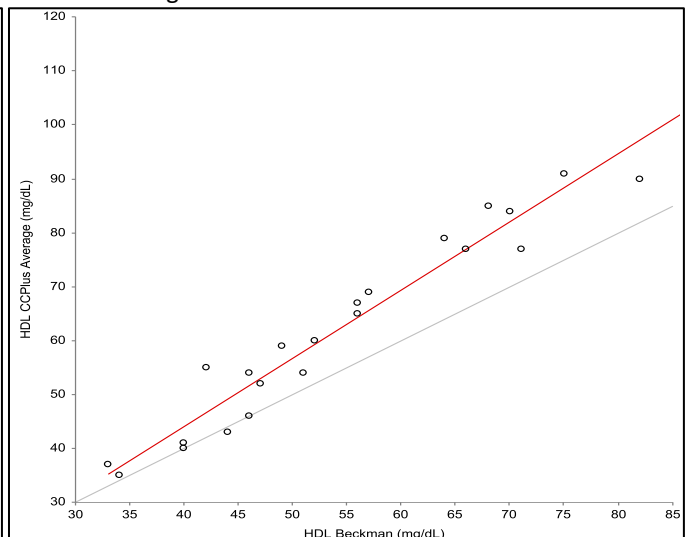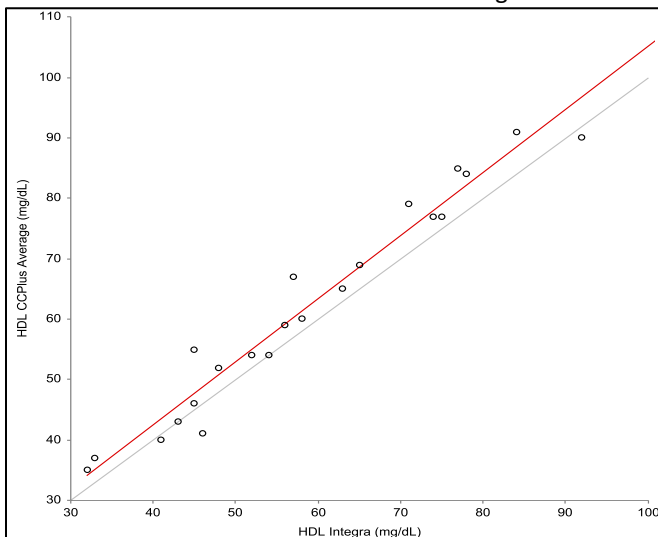
4. Triglycerides

Triglycerides				
vs Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Avg
N	23	21	21	21
slope	1.09	1.07	1.14	1.11
intercept	-10.6	-6.4	-14.5	-10.2
R	0.992	0.977	0.990	0.988
vs Beckman		CC Plus 1	CC Plus 2	CC Plus Avg
slope		1.0	1.05	1.03
intercept		1.9	-4.8	-1.2
R		0.975	0.981	0.982

Triglycerides Predicted Biases				
Integra	Beckman	% Bias	CC Plus Average	% Bias
100	98	-1.6%	101	0.8%
150	153	1.9%	156	4.2%
200	207	3.7%	212	5.9%
250	262	4.8%	267	6.9%
	Average % bias	2.2%		4.5%

Triglycerides Predicted Biases		
vs Beckman	CC Plus Average	% Bias
100	102	1.8
150	153	2.2
200	205	2.4
250	256	2.5
Average % bias		2.2%

Predicted and average % biases are calculated using non-rounded values.
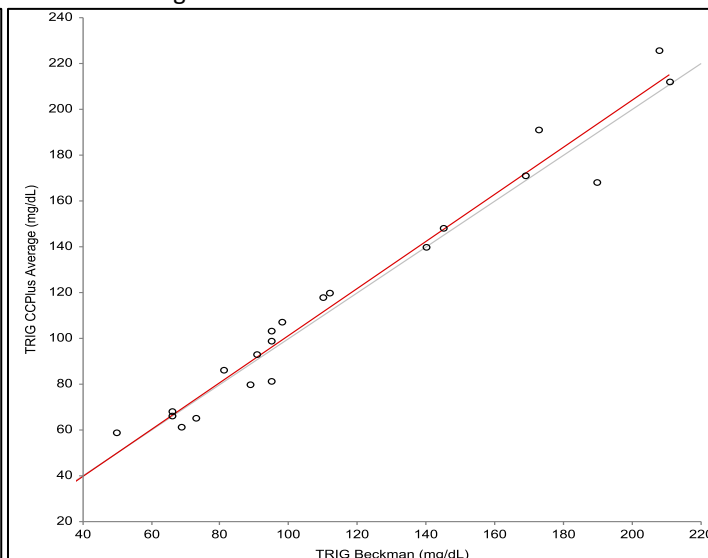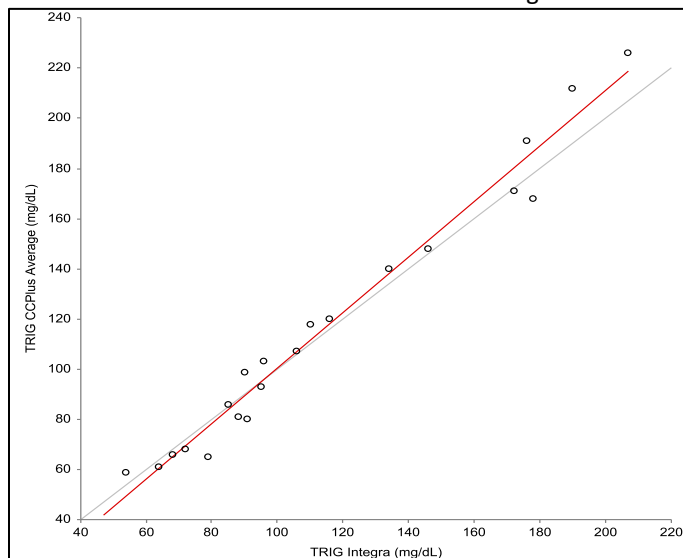
5. GLUCOSE

Glucose				
vs Integra	**Beckman**	**CC Plus 1**	**CC Plus 2**	**CC Plus Avg**
N	23	23	23	23
slope	1.01	0.82	0.88	0.85
intercept	-0.7	10.7	5.8	8.3
R	0.998	0.974	0.983	0.984
vs Beckman		**CC Plus 1**	**CC Plus 2**	**CC Plus Avg**
slope		0.81	0.87	0.84
intercept		11.2	6.8	9.0
R		0.977	0.981	0.984

Glucose ISO Guidelines

Glucose evaluated according to the current 2003 ISO Standard:

Values up to 75 mg/dL: $\pm$15mg/dL

Values >75 mg/dL: $\pm$20%

Bias Plot (Integra mg/dL)

Bias Plot (Beckman mg/dL)
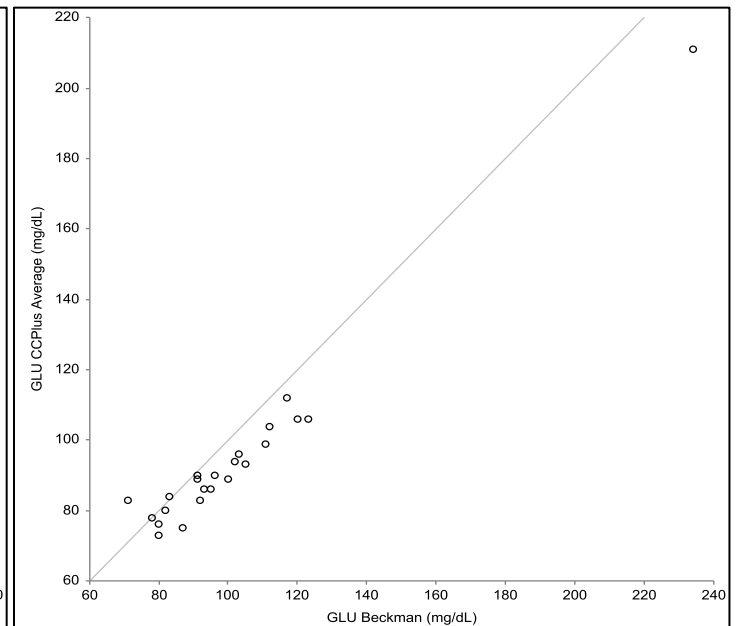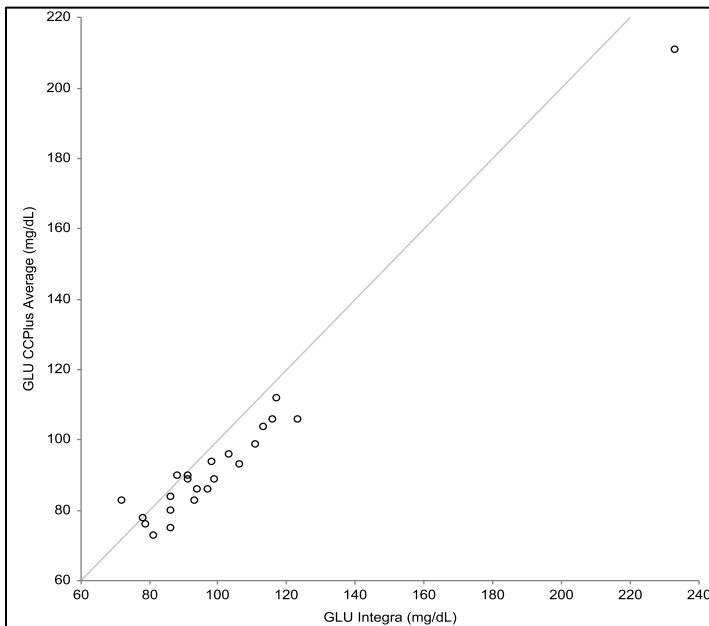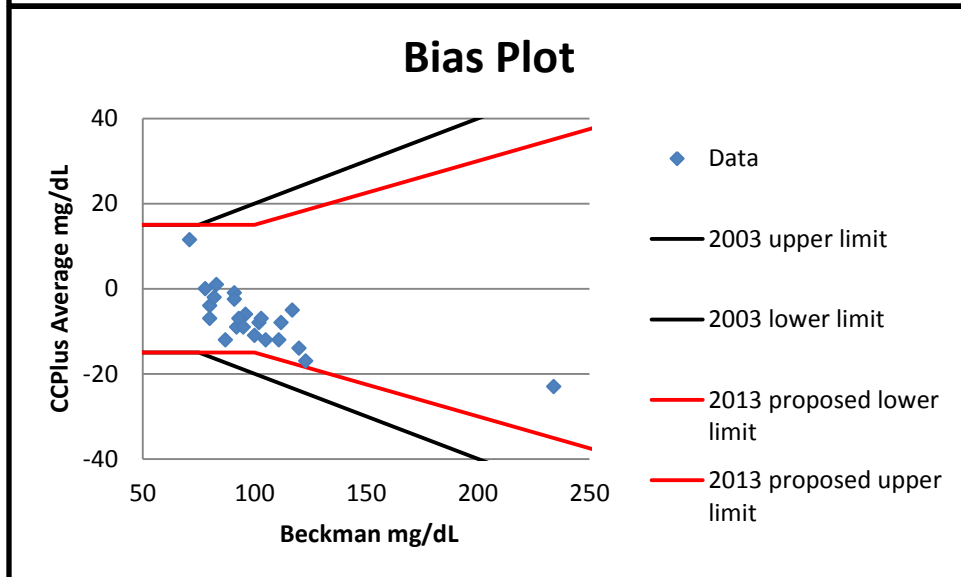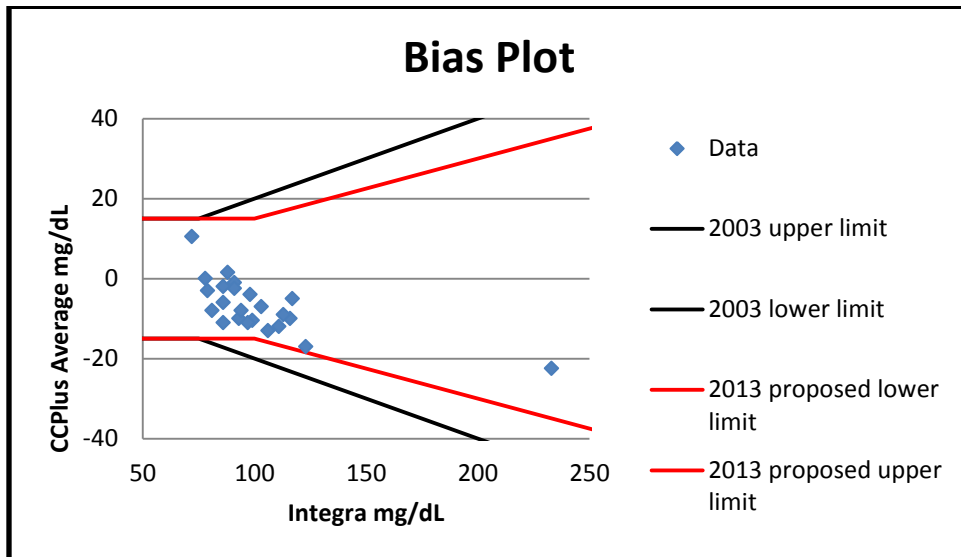
6. %A1C

A1C				
vs Tosoh G7	**Beckman**	**A1CNow+ 1**	**A1CNow+ 2**	**A1CNow+ Avg.**
N	11	11	11	11
slope	0.93	1.14	0.99	1.06
intercept	0.4	-0.6	0.2	-0.1
R	0.991	0.980	0.979	0.981
vs Beckman	N=24	**A1CNow+ 1**	**A1CNow+ 2**	**A1CNow+ Avg.**
slope		1.22	1.08	1.14
intercept		-0.9	-0.2	-0.5
R		0.974	0.960	0.974
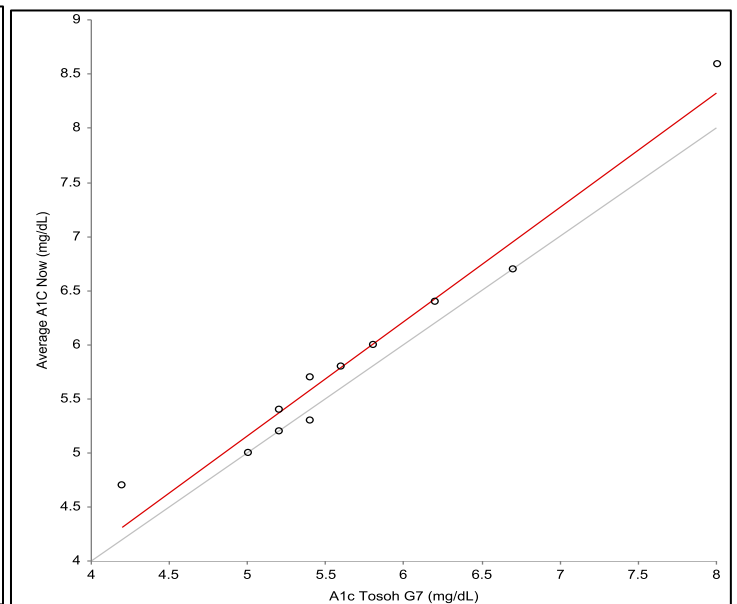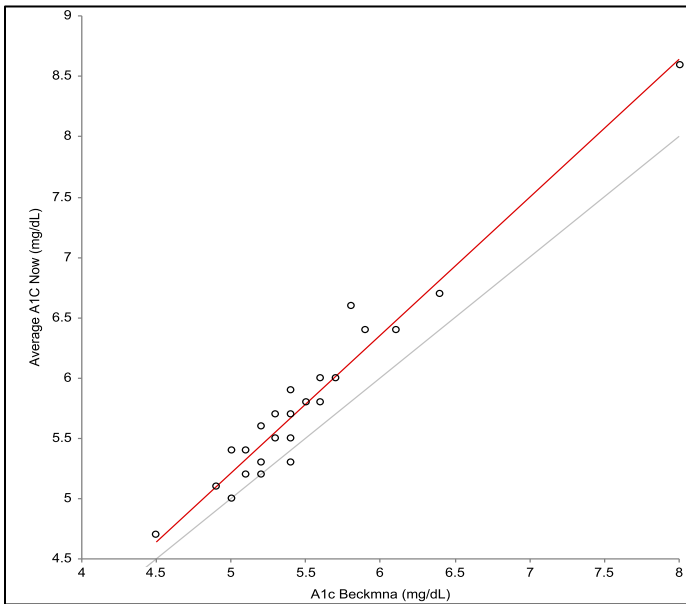
7. Precision Analyses

Precision analyses were performed by testing ten (10) replicates of three (3) samples using the Lipid + eGLU Smart Bundle test strips.

CC Plus - SN5102228				
Sample ID	**10**	**10**	**10**	**10**
Analyte	**CHOL**	**HDL**	**TRIG**	**eGLU**
1	202	84	91	82
2	203	78	84	80
3	195	80	89	78
4	199	72	83	82
5	189	72	87	80
6	199	79	80	80
7	182	77	84	76
8	183	78	86	78
9	202	78	86	80
10	187	70	71	82
Number	**10**	**10**	**10**	**10**
Average	194.1	76.8	84.1	79.8
SD	8.2	4.3	5.5	2.0
%CV	4.2	5.6	6.6	2.5

CC Plus - SN5102228				
Sample ID	**23**	**23**	**23**	**23**
Analyte	**CHOL**	**HDL**	**TRIG**	**eGLU**
1	268	48	193	100
2	273	51	219	98
3	273	53	227	112
4	263	49	228	102
5	277	47	208	100
6	263	52	224	98
7	275	47	221	96
8	257	46	211	97
9	287	55	216	99
10	234	56	201	95
Number	**10**	**10**	**10**	**10**
Average	267	50.4	214.8	99.7
SD	14.4	3.5	11.5	4.8
%CV	5.4	7.0	5.4	4.8

A1CNow+		
Sample ID	**12**	**14**
Analyte	**A1C**	**A1C**
1	8.6	5.1
2	8.8	4.8
3	8.2	5.3
4	8.0	4.9
5	8.1	4.9
6	8.4	5.3
7	8.5	5
8	8.5	5.1
9	8.0	5.2
10	8.7	4.9
Number	**10**	**10**
Average	8.4	5.1
SD	0.3	0.2
%CV	3.5	3.5

Raw Data Table
Total Cholesterol

Sample #	Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Average
1	220	223	229	225	227
2	205	203	204	212	208
3	196	206	195	200	198
4	233	242	231	238	235
5	139	150	137	143	140
6	150	149	161	153	157
7	161	173	162	155	159
8	214	222	217	215	216
9	229	234	252	247	250
10	189	193	189	176	183
11	182	179	198	191	195
12	165	165	160	168	164
13	148	152	130	130	130
14*					
15	182	187	168	175	172
16	219	221	203	215	209
17	223	228	216	220	218
18	163	165	166	144	155
19	166	169	160	163	162
20	166	170	167	160	164
21	169	171	152	163	158
22	133	131	131	129	130
23	261	266	277	266	272
24	183	180	189	183	186

*Sample 14 was omitted from analysis due to the serum being mishandled.

Raw Data Table
HDL Cholesterol

Sample #	Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Average
1	101	99	>100	>100	>100
2	45	46	45	46	46
3	74	71	73	80	77
4	43	44	44	42	43
5	32	34	37	33	35
6	57	56	68	66	67
7	41	40	40	40	40
8	77	68	85	84	85
9	92	82	90	>100	90
10	75	66	81	72	77
11	71	64	80	77	79
12	45	42	61	49	55
13	46	40	41	41	41
14*					
15	63	56	69	61	65
16	54	51	54	53	54
17	65	57	67	70	69
18	56	49	59	58	59
19	52	46	56	52	54
20	33	33	36	38	37
21	58	52	61	59	60
22	84	75	88	93	91
23	48	47	54	49	52
24	78	70	80	87	84

*Sample 14 was omitted from analysis due to the serum being mishandled.

Raw Data Table
Triglycerides

Sample #	Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Average
1	178	190	163	173	168
2	134	140	132	147	140
3	88	95	78	83	81
4	190	211	221	203	212
5	64	69	64	58	61
6	110	110	120	115	118
7	90	95	104	93	99
8	95	91	94	91	93
9	91	89	83	76	80
10	85	81	86	86	86
11	176	173	193	189	191
12	96	95	107	99	103
13	52	45	<50	<50	<50
14*					
15	106	98	111	102	107
16	172	169	165	176	171
17	72	66	69	67	68
18	54	50	58	59	59
19	116	112	121	118	120
20	146	145	148	147	148
21	68	66	68	64	66
22	47	27	<50	<50	<50
23	207	208	213	238	226
24	79	73	59	71	65

*Sample 14 was omitted from analysis due to the serum being mishandled.

Raw Data Table
Glucose

Sample #	Integra	Beckman	CC Plus 1	CC Plus 2	CC Plus Average
1	88	91	90	89	90
2	91	96	97	83	90
3	86	87	80	70	75
4	116	120	100	112	106
5	98	102	91	97	94
6	99	100	88	89	89
7	72	71	85	80	83
8	113	112	101	107	104
9	103	103	96	96	96
10	93	92	84	82	83
11	111	111	99	99	99
12	233	234	207	214	211
13	78	78	78	78	78
14*					
15	117	117	112	111	112
16	91	91	87	90	89
17	81	80	72	74	73
18	79	80	76	75	76
19	123	123	107	104	106
20	106	105	88	97	93
21	94	93	81	90	86
22	86	82	78	82	80
23	97	95	85	87	86
24	86	83	82	86	84

*Sample 14 was omitted from analysis due to the serum being mishandled.

Raw Data Table
%A1C

Sample #	Tosoh G7	Beckman	A1CNow+ 1	A1CNow+ 2	A1CNow+ Average
1		5.2	5.3	5.3	5.3
2		5.4	5.7	6.0	5.9
3		5.4	5.5	5.5	5.5
4		5.9	6.2	6.5	6.4
5		5.3	5.7	5.2	5.5
6		5.1	5.2	5.2	5.2
7		4.9	5.1	5.1	5.1
8	5.4	5.4	5.7	5.7	5.7
9	5.6	5.5	5.7	5.8	5.8
10	5.4	5.4	5.3	5.3	5.3
11	6.2	6.1	6.4	6.3	6.4
12	8.0	8.0	8.8	8.4	8.6
13	5.2	5.2	5.2	5.2	5.2
14	5.0	5.0	4.9	5.1	5.0
15	5.8	5.7	6.3	5.7	6.0
16		5.6	5.8	5.8	5.8
17		5.3	5.6	5.7	5.7
18	4.2	4.5	4.6	4.7	4.7
19	6.7	6.4	6.8	6.6	6.7
20		5.8	6.6	6.5	6.6
21		5.0	5.4	5.4	5.4
22		5.2	5.5	5.7	5.6
23		5.6	6.2	5.8	6.0
24	5.2	5.1	5.4	5.3	5.4

Overview of Evaluation and Analyses

Evaluation Site
Tuality Healthcare
324 SE 9th Avenue, Suite E
Hillsboro, OR 97123

Third Party Comparison (X-axis)
Beckman DXC – 1-7 Plasma, 8-24 Serum
Roche Integra – Serum
Tosoh G7 – Whole Blood (A1C)

PTS Technical Support Specialist
Chris Campbell

Reagents Used
Lipid + eGLU Smart Bundle: Lot Q303
Multi-Chemistry Controls Lot: MC18
HDL Cholesterol Controls Lot: HC18
A1CNow+ Lot: 1404238 (cartridge & monitor)
NOVA-ONE® Diagnostics Liquid Whole Blood HbA1c Diabetes Controls Lot: 5286J004

Accuracy Instruments (Y-axis)
CardioChek Plus analyzer - SN 5105510 (CC Plus 1)
CardioChek Plus analyzer - SN 5105221 (CC Plus 2)
A1CNow+ system

Precision Instruments
CardioChek Plus analyzer - SN 5102228
A1CNow+ system

Data Analyses Performed
All analyses are completed by creating a 2-way table for each analyte and using StatisPro (CLSI guideline EP09-A2-IR) analysis software to generate the correlation statistics for the comparison of the Roche Integra and the Beckman DXC results to the CardioChek Plus analyzers. These data are available and can be evaluated graphically and for clinical interpretation of individual comparison data sets upon request.

Regression Statistics Summary

Statistical Definitions

Slope: The slope of a line in the plane containing the *x* and *y* axes is generally represented by the letter *m*, and is defined as the change in the *y* coordinate divided by the corresponding change in the *x* coordinate, between two distinct points on the line. (A perfect slope is "1")

Intercept: Where a straight line crosses the Y axis of a graph. (A perfect intercept is "0")

R Value: A statistic that gives a measure of how closely two variables are related, also known as the correlation coefficient. It represents the extent to which variations in one variable are related to variations in another or "goodness of fit."

Comparison Key Aspects

Any method comparison must be approached with a clear understanding of variables that affect the test results. The known variation of chemistry analytical systems must always be considered when evaluating observed bias. Such variation is not only evident between POCT and laboratory systems, but also between laboratory systems. Even in the most closely aligned systems, two methods may "correlate" but rarely "match." Identity is not a prerequisite for acceptance, but rather an understanding of the bias at clinical decision limits for the analyte in question and the clinical consequences of these biases.