

Method Bias in Calcium Measurement

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Introduction

The RCPAQAP offers a Liquid Serum Chemistry Program sourced from pooled serum from an individual male and female haemochromatosis donors which by definition is fully commutable. RCPA/AACB Harmonised Calcium reference intervals are widely adopted in Australia, so the assumption is that there are no significant method biases between analytical platforms. We report on method differences in the 2020 and 2021 Liquid Chemistry Program which could potentially impact patient care.

Methods

The medians, means and CV's for Calcium results for different methods submitted by participating laboratories for the 2020 (n=207) and 2021 (n=234) surveys were compared using RCPAQAP inhouse software.

Results

While most labs (>85 %) were within the Analytical Performance Specifications (+/- 0.10 mmol/L) method differences up to 0.17 mmol/L (between Siemens Atellica CH and Siemens Dimension EXL) at a median of 2.36 mmol/L were noted (Fig 1). Siemens Dimension EXL's had a negative bias compared to Siemens Atellica CH/Beckman Coulter AU480 group. Ortho Vitros analysers showed no significant difference (0.01 mmol/L) from the all results median. An increased scatter of results for all methods in the 2021 program (CV 2.4%) compared to the 2020 survey (CV 1.9%) was noted (Figs 2 & 3). A group of Abbott Architect labs were noted to have a negative bias in the 2021 survey, possibly due to a lot number difference (Fig 3). Analyser CV's ranged from 1.5-2.0% for the Siemens Dimension EXL's (n=9) and 1.0-2.7% for the Siemens Atellica CH/Beckman Coulter AU480 group (n=33 in 2020 and n=53 in 2021). The majority of participants used the Arsenazo dye analytical principle (n=167 in 2020 and n=196 in 2021) including the Siemens Atellica CH/Beckman Coulter AU480 group. The Siemens Dimension EXL group used a Cresolphthalein complexone reagent. All labs calibrated using the manufacturers recommendation.

Discussion

Australian and New Zealand laboratories are encouraged to use the AACB/RCPA common reference interval for calcium (2.10-2.60 mmol/L for adults). While the number of Siemens EXL labs was small (n=9), CV's of <2.0% indicate acceptable agreement within the group. Given the Liquid Serum Chemistry samples are commutable, the relative difference in results between the Siemens EXL (negative bias) and the Siemens Atellica CH/Beckman Coulter AU480 groups (positive bias) may be due to calibrator traceability/lot number or the specificity of the reagents.

Conclusion

Where laboratories use a common (harmonised) reference interval for a measurand with minimal biological variation, such as calcium, small changes are clinically significant, method biases should warrant further investigation.

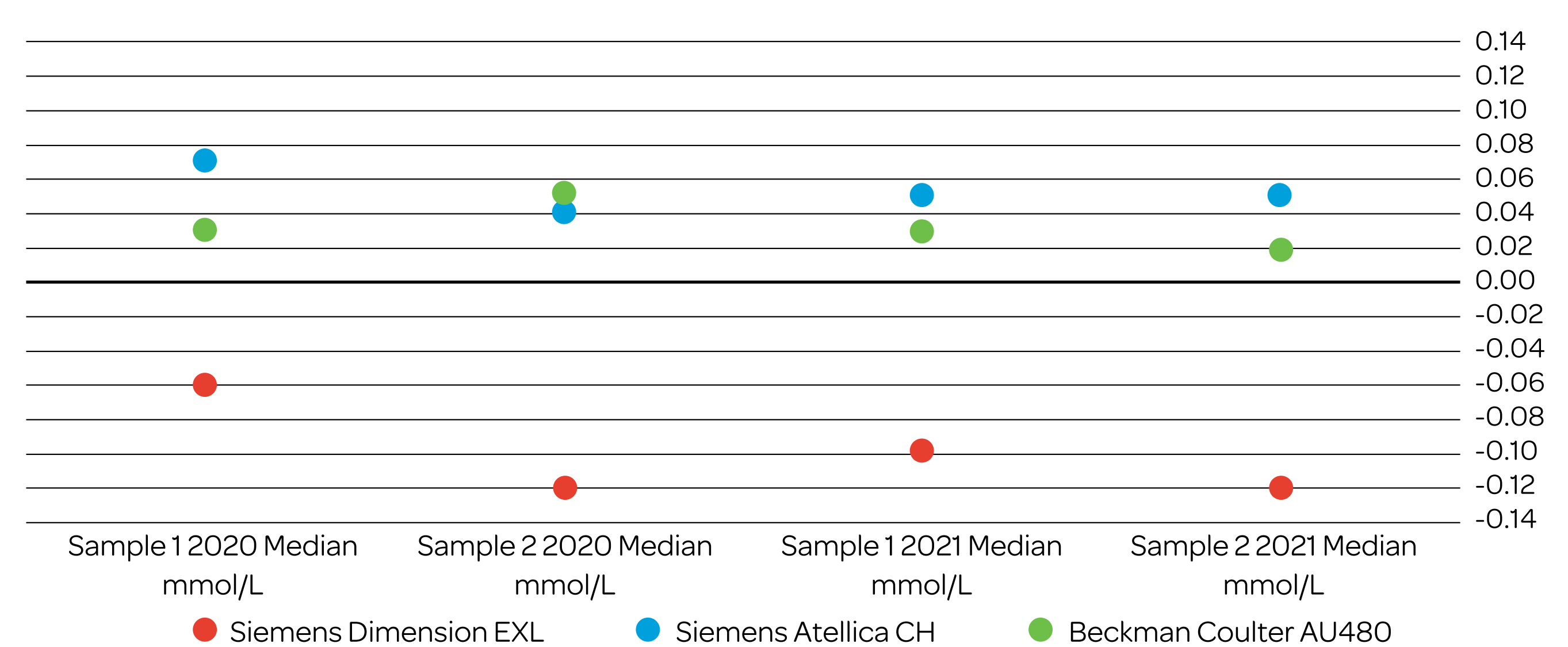


Figure 1. Difference plot of calcium medians for 2020 and 2021 surveys.

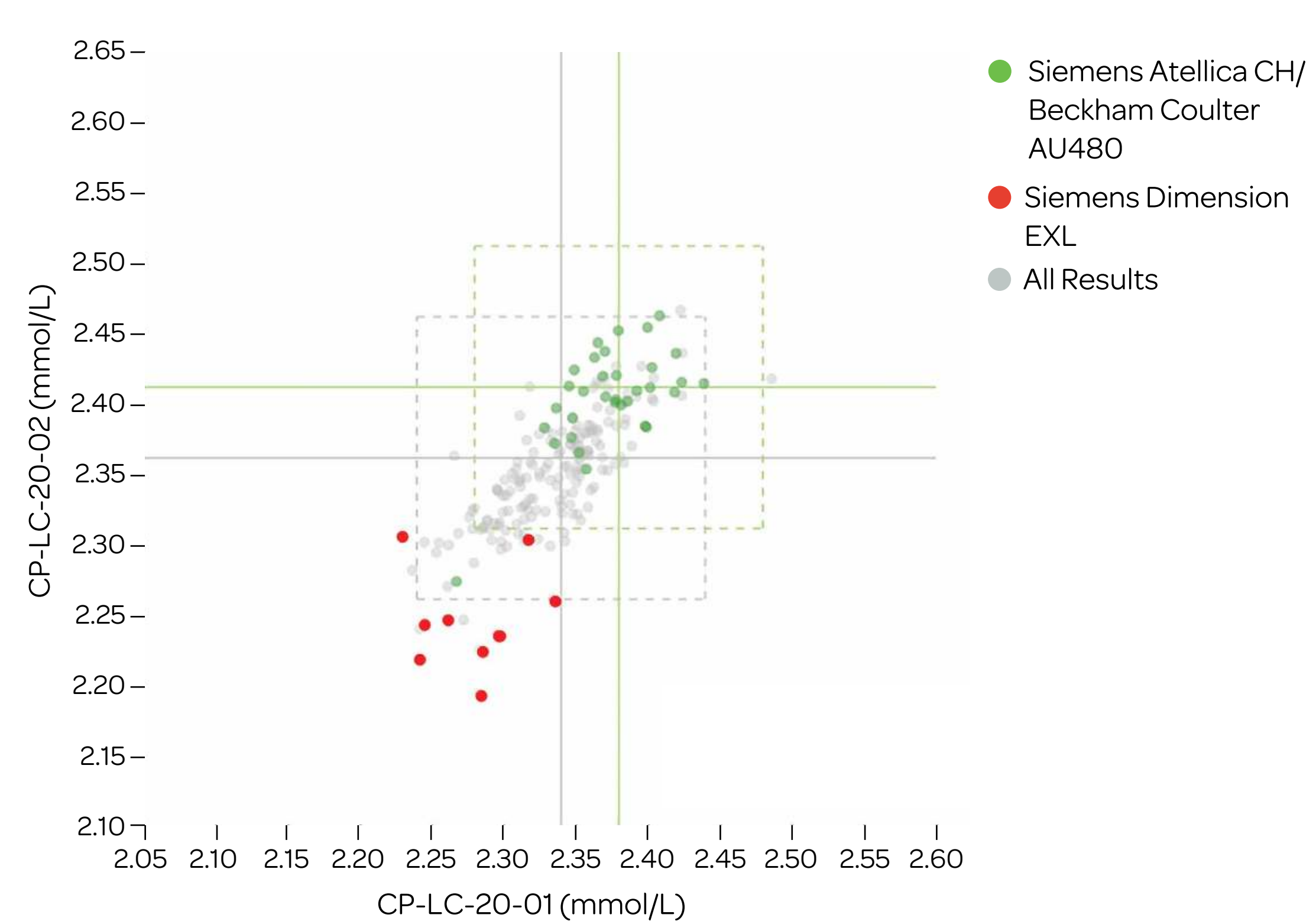


Figure 2. Youden plot of calcium results for the 2020 survey. The green cross hairs and dotted lines indicate the median and APS limits for the Siemens Atellica CH/Beckman Coulter AU480 group only. The grey cross hairs and dotted lines indicate the median and APS limits of all results.

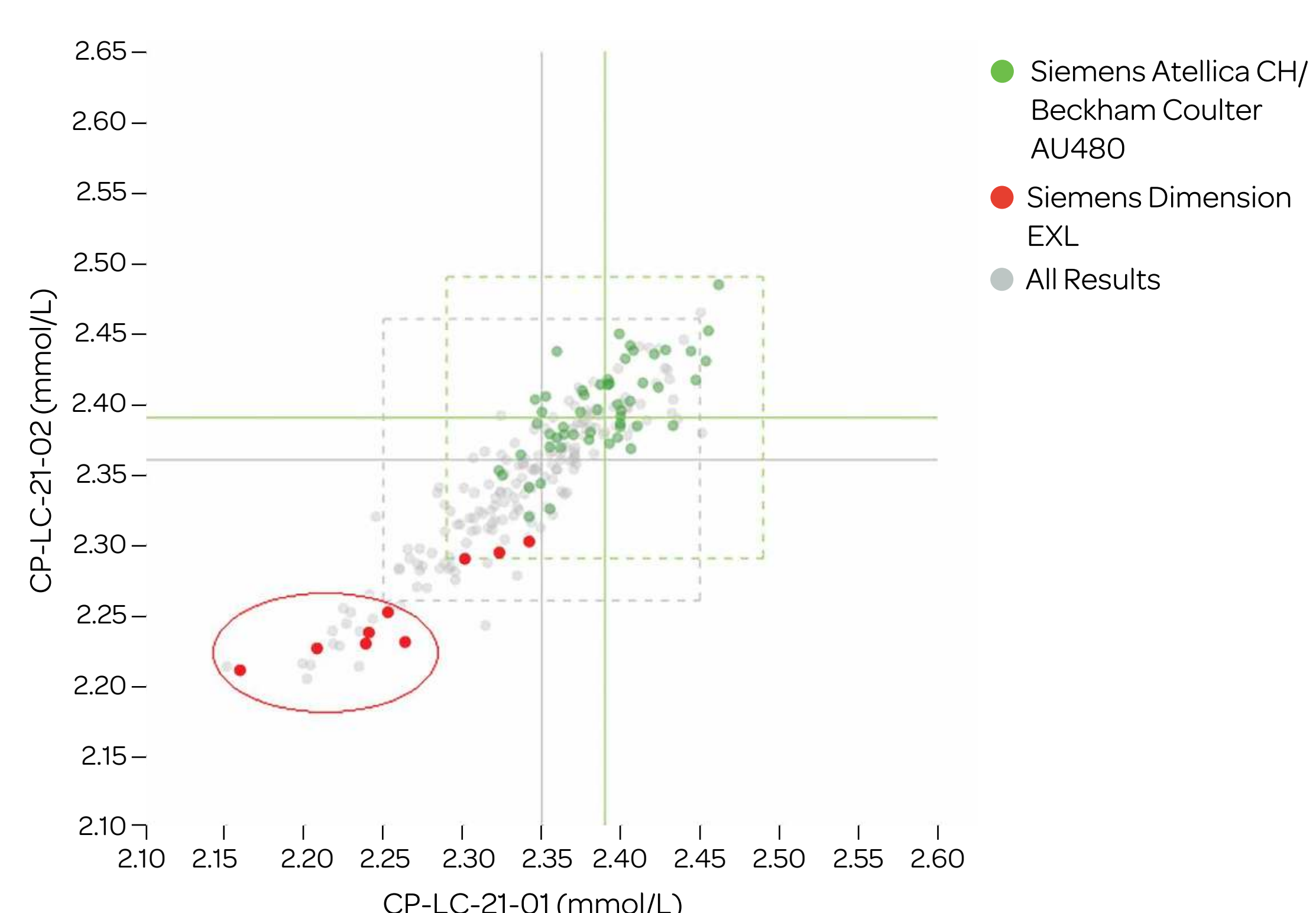


Figure 3. Youden plot of calcium results for the 2021 survey. The green cross hairs and dotted lines indicate the median and APS limits for the Siemens Atellica CH/Beckman Coulter AU480 group only. The grey cross hairs and dotted lines indicate the median and APS limits of all results. Abbott Architect results (circled in red) contributing to scatter (n=14).