Web Tools for Agreement Statistics

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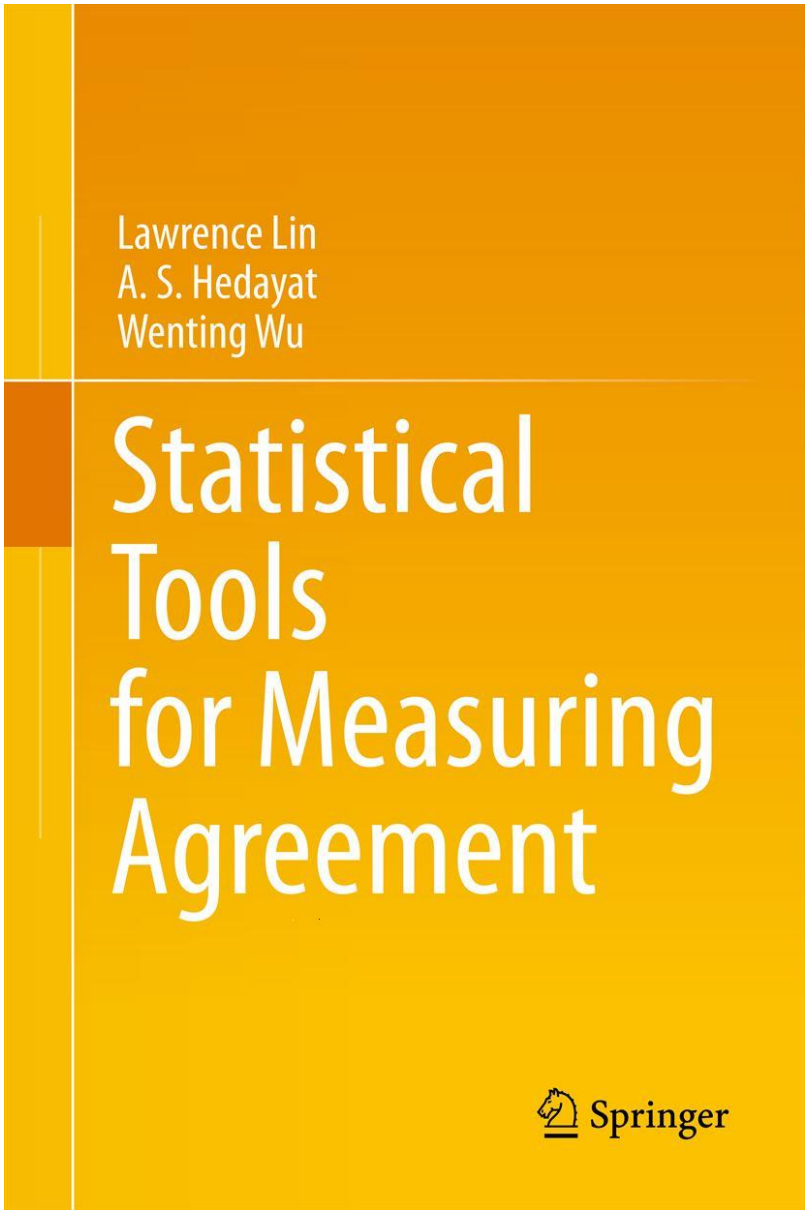
Lawrence I-Kuei Lin, Ph.D
JBS Consulting Services Inc.
University of Illinois at Chicago

Please see the book for detailed information



Agreement Statistics

- Coverage probability (CP): captures the proportion of paired observations that fall into the allowable deviation based on absolute differences or proportional changes
- Total deviation index (TDI): quantile of the allowable coverage probability based on absolute differences or proportional changes.
- Precision coefficient: Pearson correlation coefficient

Agreement Statistics

- Accuracy coefficient: measures the closeness of means as well as variances between the paired observations
- Concordance correlation coefficient (CCC): product of accuracy and precision coefficients measuring the closeness of observations from the identity or concordance line
- The above cover from the basic model ($k=2$, $m=1$) to unified model ($k\geq 2$, $m\geq 1$)

Comparative Agreement Statistics: TIR

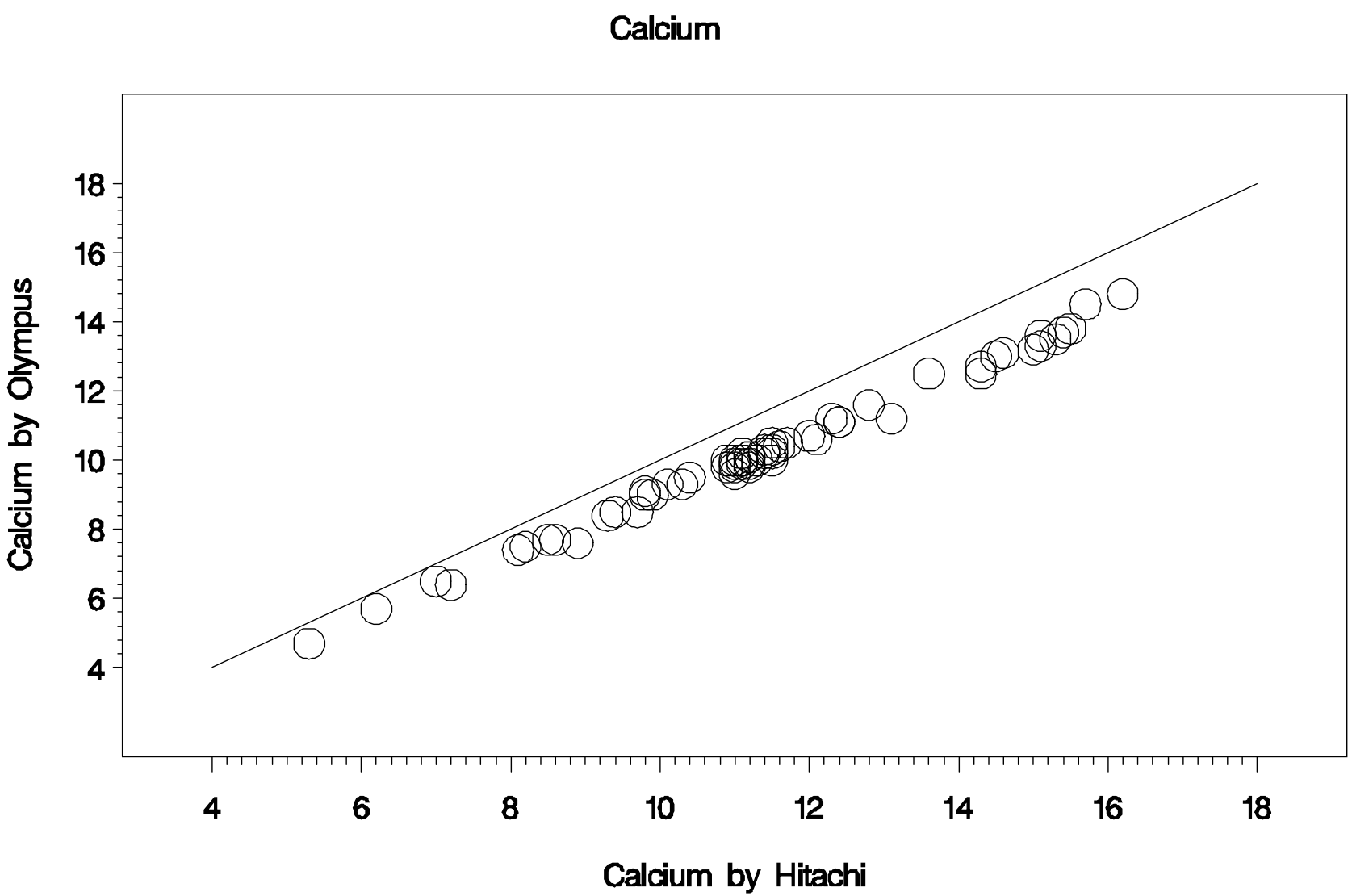
- The TIR is a non-inferiority assessment such that the mean squared differences (MSD) of individual readings from different raters can not be inferior by a certain margin to the MSD of the replicated readings within raters
- For a TIR example, to assess the individual bioequivalence, the MSD of test and reference compound is assessed relative to the MSD of within reference compound

Comparative Agreement Statistics: IIR

- The IIR is a classical assessment such that the intra-MSD of selected assays/raters can be better, equal, or worse than that of other assays/raters
- For an IIR example, in the medical device environment, we often want to know if the within device MSD of a newly developed device is better, equal, or worse than that of the gold standard device

Continuous Data Example: Basic model, Constant Error

- Calcium (mg/dL) of test and reference instruments were paired measured from 60 samples
- Precise but inaccurate
- CLIA 1171 wants 95% coverage probability (CP) of absolute paired differences or % changes within ATE
- PTC=1 mg/dL was used as ATE
- CLIA also wants the 95% lower limit of CP being >0.92


Calcium
Calcium by Olympus
18
16
14
12
10
8
6
4
4
6
8
10
12
14
16
18
Calcium by Hitachi

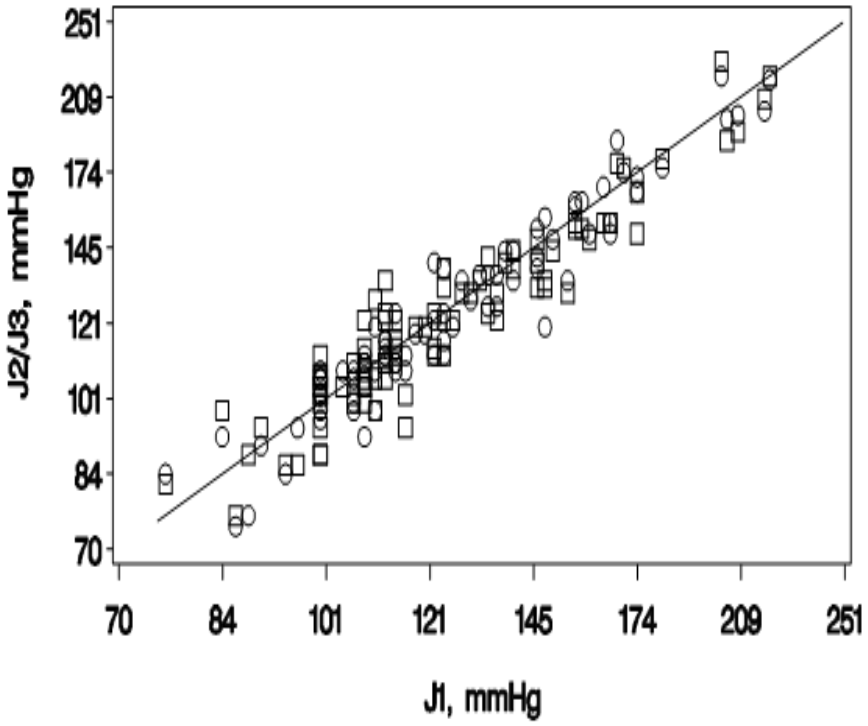
Continuous Data Example: Automatic Blood Pressure Meter, Proportional Error

- This example is obtained from Table 1 of Bland and Altman (1999)
- Systolic blood pressure data from a study in which simultaneous triplicate measurements were made by each of two experienced nurses (denoted by J and R) using a sphygmomanometer (gold standard) and by a semi-automatic blood pressure monitor (denoted by S)

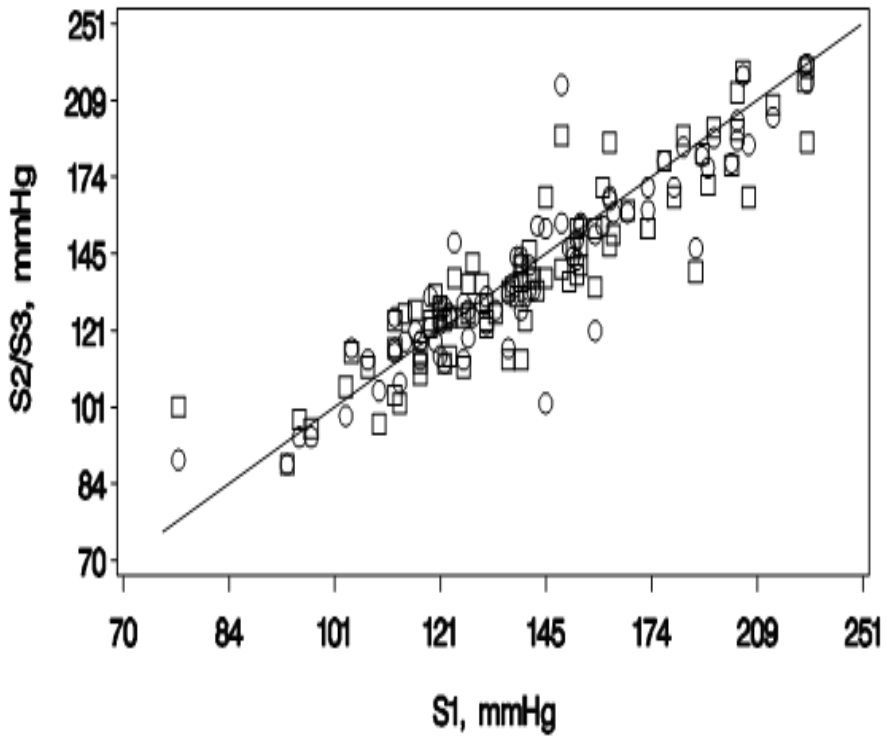
Example: Automatic Blood Pressure Meter

- This data set has *k = 3 and m = 3.* Readings by J and R were almost identical. For unified agreement, we analyzed this data set between J and S, or *k = 2 and m = 3.* For comparative agreement, we compare J & R to S.

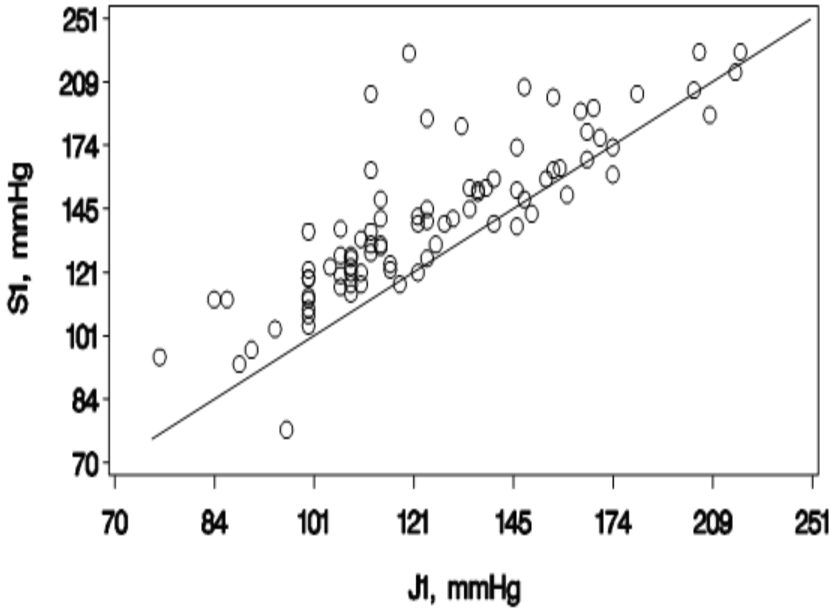
J2, J3 vs J1 (o = J2, □ = J3)



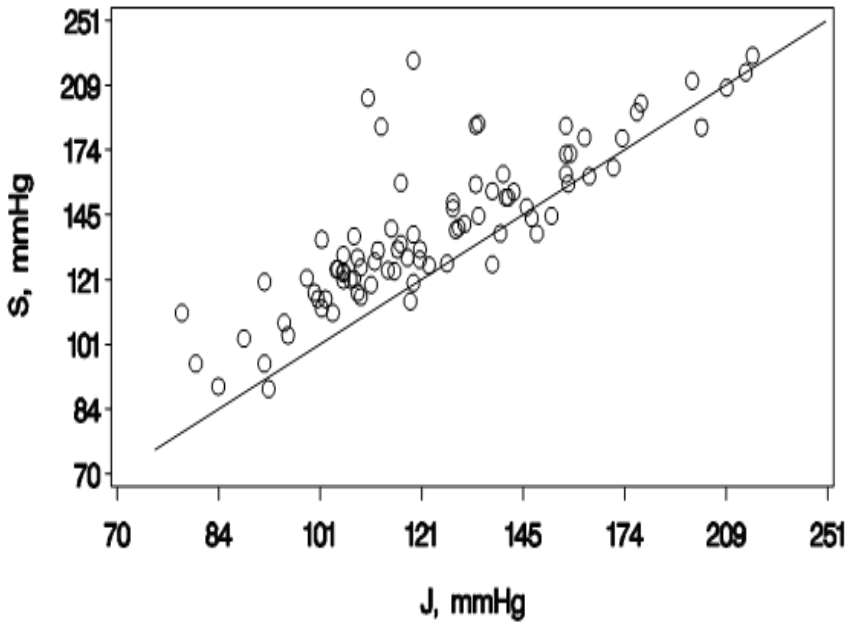
S2, S3 vs S1 (o = S2, □ = S3)



Between S1 and J1
(Reflecting Total Agreement)



Between S and J Averages
(Reflecting Inter Agreement)



Web Tools

- Free to use (limited to 25hrs/month of usage)
- Built using Shiny's shinyapps.io based on R
- Four web tools:
  - Basic agreement stats for constant error case (absolute difference) with agreement plot for continuous data: https://agreement-by-lin.shinyapps.io/Agreement_C/
  - Basic agreement stats for proportional error case (% change) with agreement plot for continuous data: https://agreement-by-lin.shinyapps.io/Agreement_P/
  - Unified agreement stats for continuous and categorical data: https://agreement-by-lin.shinyapps.io/Unified_Agreement/
  - TIR and IIR: https://agreement-by-lin.shinyapps.io/TIR_IIR/
- Contact Info: equeilin@gmail.com, 760-814-8891