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Commentary

R Is for Rocket … or "Is 'R' … for the Strength of a Correlation?"

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Abstract: In assessing linear relationships between variables, the r value (aka–correlation coefficient) is insufficient by itself to determine if one measurement can be replaced by another measurement.

Keywords: statistics; correlation coefficient; slope; intercept

1. Main Text

"*R is for Rocket*" is a 1962 collection of short stories from the famed American science fiction writer Ray Bradbury (1920–2012). This anthology's title has nothing to do with my present missives; however, it may entice you to read more.

I read with interest the cover of a recent professional association journal reporting that 'the measurement of a specific analyte in venipuncture serum compared with its measurement in capillary-drawn serum exhibited a strong correlation (e.g., $r > 0.99$)' [1]. If one were *not* to turn to the full article, what critical information might be missed?

I begin by recalling that the correlation coefficient (r) is a measure of the strength of association between two variables [2].

If the relationship between the 2 variables best fits a straight line (e.g., $y = mx + b$), a high correlation indicates that the points fall on top of, or very close to, the regression line. To know the true strength of the correlation, we must calculate r^2. Indeed, if r is 0.99, r^2 (being ~0.98 in this example) indicates that ~98% of the variation in the dependent variable (y) is due to variations in the independent variable (x). Is this sufficient to judge that the 2 measurements are "equivalent" and that either measurement is satisfactory for clinical use? "Equivalent" could be defined as "equal in value, amount, function, or meaning" [3].

One might say: "Not so fast …" What the correlation coefficient itself does not tell the reader is the slope (m) or the intercept (b) of the linear relationship [4]. Yes, one could observe a "perfect" positive correlation ($r = 1.0$), yet the 2 measurements were not identical, and one measurement could not be substituted for the other. Therefore, you must assess the slope (m) and the intercept (b) to know if the 2 measurements are "interchangeable." In the specific instance noted above, the authors did provide the slope and intercept of the correlation, and they determined the average bias, percent bias and calculated the average bias (which was not statistically significant in the published paper).

The take home message is not complex: any time a laboratorian, scientist or clinician is assessing the agreement (aka–equivalence) between two methods of measurement of a single analyte, one must seek out the slope (m) of the linear relationship, the y intercept (b) of the regression line, as well as, the correlation coefficient.

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