even low concentrations of autoantibodies to Tg and TPO can be reliably detected in dried blood spots stored at 4°C or -20°C when assayed by the sensitive antibody assays. However, because of the variability in the proportion of antibody recovered from the spots, we consider the technique more useful for qualitative than for quantitative studies.

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The Significance of Significant Figures

To the Editor:

Deciding the appropriate number of decimal places (or significant figures) for the reporting of numerical data is a difficult task that is often resolved on the basis of arbitrary reasons of habit rather than any statistical consideration. We present a simple calculation and comparison that may provide a more rational answer to this problem.

Reporting of data to more decimal places is desirable when rounding would deprive the clinician of important interpretative information. For example, the apparent difference between reported figures of 6.2 and 6.1 might obscure a true difference of as little as 0.01 (6.15-6.14) or as much as 0.19 (6.24-6.05). If, from a statistical standpoint, the minimum difference deemed significant is 0.19 or greater, then no additional information is given by the extra decimal place, and reporting to one place lessens the risk of overinterpretation. On the other hand, if the minimum significant difference is less than 0.19, reporting to two decimal places enables the question of significance to be addressed.

When monitoring a patient's progress, consecutive results can be expected to vary because of both analytical and biological (in this case, intrapatient) variation. For 95% confidence that consecutive results differ by more than this expected variation, the difference must exceed \(2.77 \times \sqrt{SD^2 + SD^2}\), where \(SD\) is the standard deviation of the intra-individual variation and \(SD\) is the standard deviation of the analytical variation (cf. ref. 1). It is this expression that governs the number of decimal places to which results should be reported. When \(2.77 \times \sqrt{SD^2 + SD^2} < 0.19\), i.e., \(\sqrt{SD^2 + SD^2} < 0.07\), then reporting the second decimal place is important.

Application of this principle to serum cholesterol results, as discussed previously by others (1,2), confirms that because the total standard deviation \(\sqrt{SD^2 + SD^2}\) is 0.5 mmol/L (>0.07 mmol/L), the second decimal place cannot be justified. However, the use of one decimal place is justifiable on the ground that the total standard deviation is less than 0.7 mmol/L.

The desirability of applying this type of calculation to a wide range of laboratory data seems clear. Ideally, its use should help the laboratory decide how best to report numerical results and clinicians how best to interpret them. In routine application, however, a difficulty arises in obtaining the appropriate intra-individual variation for particular patients' groups or situations. A practicable solution, in keeping with a suggestion of Whitby et al. (3), is to substitute 3 \(\times SD\) for 2.77 \(\times \sqrt{SD^2 + SD^2}\). However, one must be mindful that this simplification carries with it the risk of overinterpretation.

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Variable Citrate Interference in Arsenazo III Dye Assays of Total Calcium in Serum

To the Editor:

Gawoski and Walsh (Clin Chem 1989;35:2140-1), reporting on the interference of sodium citrate with several total calcium assays, found total calcium measured by atomic absorption, o-cresolphthalein complexone in the Technicon SMAC, and o-cresolphthalein complexone in the DuPont acu II was not affected by citrate concentrations as great as 5.3 mmol/L in a plasma pool. However, the potentiometric determination by Nova 7 electrode and the arsenazo III dye method on the Kodak Ektachem 700 were severely affected. Because we routinely use an arsenazo III dye wet chemistry method for total calcium, as opposed to the dry-slide technique of the Ektachem 700, we were interested in determining the effect of citrate in our assay. The reference interval for serum citrate concentrations in non-transfused people is 0.09-0.14 mmol/L (1). During cardiopulmonary bypass operations, serum citrate concentrations have been reported to peak at more than 6.0 mmol/L (1).

We prepared two plasma pools, divided each in half, and added disodium citrate or citric acid to a final concentration of 6.6 mmol/L to one lot. We then mixed with this various amounts of the non-citrated pool to give a range of citrate concentrations. We quantified total calcium in plasma by using the alkaline o-cresolphthalein complexon method on an SMAC (Technicon Instruments Corp., Tarrytown, NY 10591) with dialysis, and by the arsenazo III dye (1,8-dihydroxynaphthalene-3,6 -diisulfooacid-2,7-bis(azo-2)phenylarsonic acid) method on a Synchron CX-5 (Beckman Instruments, Brea, CA 92621) and a Kodak Ektachem 700 (Eastman Kodak Co., Rochester, NY 14650).

In the CX-5 method, samples are diluted 100-fold with the reagent at pH 5.6, and absorbance at 650 nm is read between 700 and 1000 nm after sample addition. The Ektachem method applies 10 μL of sample directly onto the dry chemistry slide, after which the calcium is dissociated from the proteins and reacts with the dye at pH 5.6. All assays were calibrated with their manufacturers' standards.

As Figure 1 shows, the SMAC calcium method was not affected by increasing citrate concentrations in plasma. The total calcium results from the Ektachem 700 method were severely affected by increasing concen-