

Proposal for distinguishing dimensionless quantities of percent from fractions which differ by 100 but are not reliably distinguishable by their units – Gil Hill

In metrological terms, LOINC entries with the property of *FRACTION are considered to be dimensionless, or of dimension 1, so the results may legitimately be expressed either as a percent or as a decimal fraction. Thus, LOINC code 4548-4, HEMOGLOBIN A1C/HEMOGLOBIN.TOTAL, could be reported as, for example, either 6.5% or 0.065. In the US, the former (%) is preferred and appears to be almost universally used; in the SI world, the latter, decimal fraction is preferred, but is not universally used.

The fundamental problem is that because the fractions are dimensionless (unitless) there is no reliable way to distinguish between the two cases with a single LOINC code.

The magnitude of the problem: in the LOINC 2.15 database, there are 1385 *FR entries. These are divided into:

- NFR (number fraction) (e.g. eosiniphils/100 leukocytes) = 1018
- MFR (mass fraction) (e.g. HbA1c/hemoglobin.total) = 193
- CFR (catalytic fraction) (e.g. CKMB/CK.total) = 61
- VFR (volume fraction) (e.g. hematocrit) = 54
- SFR (substance [molar] fraction) (e.g. carnitine.free/carnitine.total) = 61

Within the total group of 1385, the example US units (EX_US_UNITS) field shows
% in 1165
ppm in 22
v/v in one
and is blank in 197

The collective "test menus" of one small part of the SI world, (the current eCHIN network) contain approximately 500 items of dimension 1, each of which may be expressed as a percent and/or as a decimal fraction. As the use of LOINC expands across the SI world, the number of items of dimension 1 will almost certainly increase, leading to local, probably incompatible solutions.

Assuming the case is accepted of the need for LOINC to differentiate entries that differ only in that the result can be expressed as a percent or as a decimal fraction, the challenge is to identify the process to bring this about.

LOINC term consists of six man name chunks. Four of them contain subparts. Thus the fully specified name contains the component name (with optional subparts), the property, the time aspect (with optional subparts), the system (with optional subparts), and the scale.

I suggest that an effective way to distinguish between components whose results are reported as a percent or as a decimal fraction is to permit the use of a subpart in the property field. The units are most specifically related to the property and this would be a

ratio. More specifically, I suggest that the scale QN could appear (1) without the subpart (the usual case), or modified with a subpart (2) DF (for decimal fraction) or (3) PC (for percent).

This would permit the inclusion into the database of almost-twin entries, such as:

4548-4 HEMOGLOBIN A1C/HEMOGLOBIN.TOTAL:MFR^PC:PT:BLD:QN

NEW-N HEMOGLOBIN A1C/HEMOGLOBIN.TOTAL:MFR^DF:PT:BLD:QN

714-6 EOSINOPHILS/100 LEUKOCYTES:NFR:PT:BLD^PC:QN

new-n EOSINOPHILS/100 LEUKOCYTES:NFR:PT:BLD^DF:QN

Gil will provide terms that he knows need SI fraction terms.

This proposal has the virtue of:

1. Permitting distinction between entries to be used when results are reported as a percent or as a decimal fraction; where units are not reliable distinguishable
2. Being immediately obvious to a LOINC coder.
3. Showing the difference in the fully specified name;
4. Not compromising any of the cardinal characteristics;
5. Not requiring any change in the use of the example US units field or what we hope to be a preferred units field.

I would assume all of the existing entries would be designated as PC, and the DF entries would be submitted as required. Of course an explanatory paragraph in the LOINC Manual section on Scale would be essential.

P.S. – some relevant trivia:

Percent The idea of percent had its origins in the Roman Empire, but the symbol % appears to have evolved from an Italian manuscript of 1425. Source: Weaver and Smith at <http://www.roma.unisa.edu.au/07305/symbols.htm>

Decimal fraction Fractions have been used for thousands of years, but they were almost always written as common fractions – that is, as ratios of integers. Decimal fractions, the extension of our decimal numeration system to numbers less than 1, was introduced into Europe in the 16th century by the Flemish scientist Simon Stevin (1548-1620).

Source: “e”: [The Story of a Number by Eli Maor](#) (page 7)