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Do we need all the decimals?

MEDICINE AND NUMBERS

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If we use too few decimal places, the result will be imprecisely reported. On the other hand, if we use too many decimals, we give the impression that the result is more precise than it really is.

How many decimals to use should be a conscious choice. Using more decimals than necessary is not wrong per se. However, an unnecessarily large number of decimals gives the impression that issues of measurement uncertainty or random variation have not been handled purposefully. Moreover, it conceals the message – the results are swamped by a surfeit of figures.

The height of adults is normally reported in whole centimetres. Bjørnely et al. studied changes in body mass index in adolescents from 1966 to 1997 (1). They reported height in centimetres with one decimal, with a mean of 180.1 cm and a standard deviation of 7.0 cm for the 499 boys who were 18 years old. Although each individual measurement can be given in whole centimetres, the mean will have greater precision, and in this case it made sense to report it with one decimal place. If one wanted to report a 95 % confidence interval for expected height, it would be from 179.5 to 180.7. Note that here we have the same number of decimal places in the mean, the standard deviation and the confidence interval. When we have an absolute scale, this makes sense.

Furthermore, the number of decimal places depends on the measurement scale. If we reported height in metres instead of centimetres, we would need three decimals instead of one. This is quite obvious here, but is not so for all measurement scales.

Decimals or significant figures?

The number of decimals is the number of digits after the decimal point, while the number of significant figures is the number of digits after any leading zeros. The mean and the standard deviation in the example above are reported with one decimal place, but with four and two significant figures respectively. When we have an absolute scale, it is usually most relevant to focus on the number of decimals. In other situations, such as for relative quantities or *p*-values, the number of significant figures might be more relevant.

Powers of 10

Sometimes it is appropriate to report figures in the standard form, for example an estimate as 4.4×10^{-5} and a confidence interval as 0.36×10^{-5} to 8.4×10^{-5}. For reasons of readability it is sensible to use figures with the same power of 10, i.e. not like this: 3.6×10^{-6} to 8.4×10^{-5}.

Significant figures for relative risk

Risk can be measured as the probability of an adverse event, odds of an adverse event, incidence rate or mortality. When comparing exposed and unexposed individuals (or an intervention group and a control group), we often report the risk ratio (RR), odds ratio (OR), incidence rate ratio (IRR) or hazard ratio (HR). When we have two distinct groups, it is common to report relative risk with one or two decimal places, for example an estimate of 1.75 and a 95 % confidence interval of 1.22 to 2.50. If the confidence interval is wide and not close to 1, one decimal may be sufficient. However, more decimals may be needed when reporting the relative risk per unit for a continuous variable, such as per year (2). In a study of patients admitted with acute colonic diverticulitis at Levanger hospital, the incidence rate per five-year age interval in women was 1.059 with a 95 % confidence interval from 1.045 to 1.057 (3). Here, it made sense to use three decimals; with two decimals, the estimate and the confidence interval would have been 1.05 and 1.05 to 1.06 respectively, and a confidence interval that coincides with the point estimate does not give a good picture of the uncertainty. Moreover, the reported incidence ratios correspond to an increase of 5.1 % (95 % confidence interval 4.5 % to 5.7 %) per five years, and only two of the four significant figures actually provide any relevant information.

Percentages

If the total number is below 100, percentages will have to differ by at least one per cent. In this case, percentages should be given without any decimals, e.g. 9 % (7/79). For larger numbers, one decimal place may be relevant, e.g. 2.8 % (16/580).

P-values

If practicable, we should report the actual p-value, not just $p < 0.05$ or $p < 0.01$ for example. It is common to report up to two significant figures and a maximum of three decimal places, such as $p = 0.12$, $p = 0.035$, $p = 0.006$ and $p < 0.001$.

Some examples of suitable and less suitable numbers of decimal places are shown in Figure 1.

59.7 kg

186.37 cm

$p < 0.001$

$p = 0.0118$

HR = 0.46 (95 %-CI 0.36 to 0.59)

RR = 1.0 (95 %-CI 1.0 til 1.1)

OR = 1.27

Figure 1 Examples of suitable and less suitable numbers of decimal places.

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