3.5 How probable is probable?

We all use a wide variety of terms to indicate uncertainty -'could', 'maybe', 'possible'- and so on. Can these be interpreted as numerical probabilities?

Interpretation of words   Read the following paragraph.

> Arthur was worried. It was almost certain there would be a maths test today, and he hadn't been paying much attention recently. Sally would probably get more marks than him, but there was a distinct possibility that Zak would mess up. The weather forecast said it might rain, so he took a coat, and as he walked to school he thought he was likely to meet Zak, who always played around, and could make him late. If he were late, he was certain to get into trouble. Perhaps there would be a fire drill to disrupt the test? But really there was little chance of that, and it was also extremely unlikely an asteroid would hit the school. It was going to be a bothering sort of day.

Underline the words or phrases that express uncertainty, such as 'could', 'likely' etc. Make a list of these words, and rank them in terms of highest to lowest probability. Put each word on the vertical probability scale below, for example if you think that 'almost certain' is near 50%, write it next to 50%.

Collect together the responses and discuss the ranges in opinions.

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
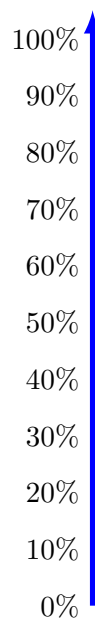
In the 60s, CIA analyst **Sherman Kent** recognized the problem of using imprecise statements of uncertainty; as actions can be taken or not based on overestimations or underestimations of the content of intelligence reports.

To deal with this, Kent proposed different graduations of probability. To each he assigned a percentage range. For example 'Probable' would mean 93% (give or take about 6%). In a later experiment, 23 Nato officers were asked about the different perception of terms expressing probability. The results are shown in figure 3.1
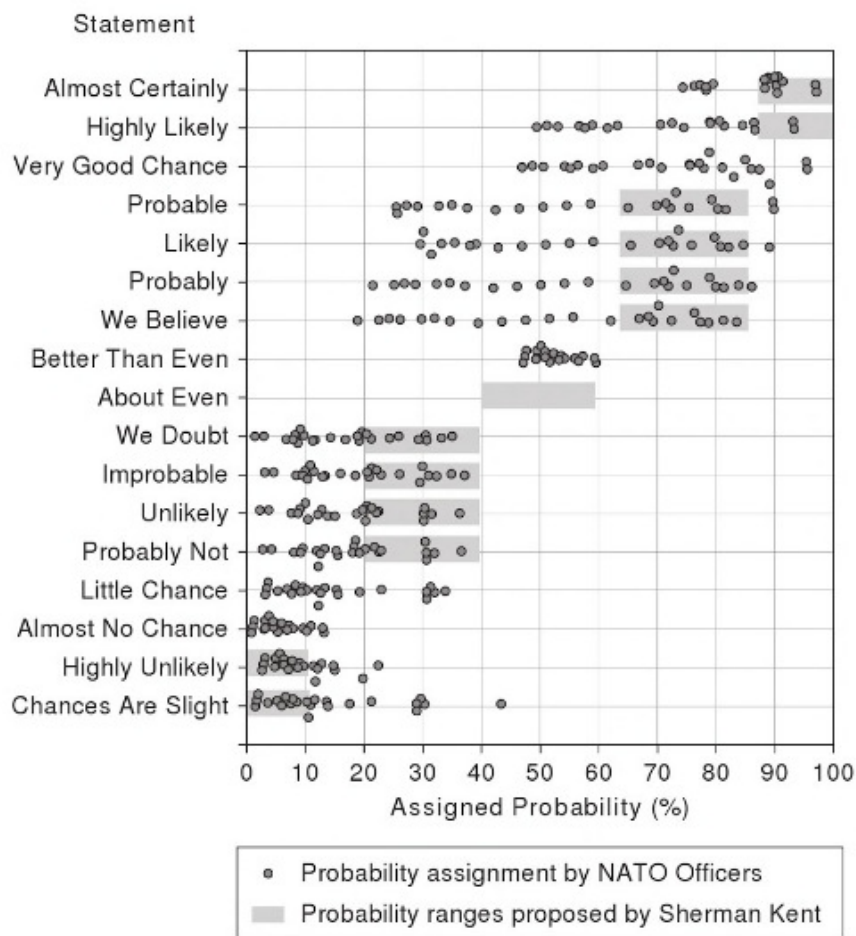
Figure 3.1 – Measuring perceptions of Uncertainty

Compare your group results with some of the terms. Can you find new terms to express probabilities?
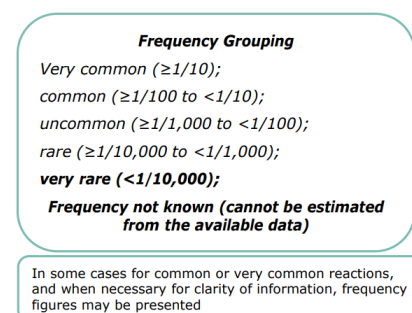
Drug side effects   Most medicines have occasional side effects
- the drugs may make some people drowsy, make their muscles
ache and so on. If you were told a side effect, say headache,
was 'common', how frequently do you think it would occur, as a
percentage of people taking the medicine? What is the headaches
were described as 'very common'?

The official European Medicines Agency scale defines 'common' as
frequency between 1% and 10%, and 'very common' as anything
above 10% (figure 3.2).

What do you think of this?   [1]

> **Frequency Grouping**
> *Very common (≥1/10);*
> *common (≥1/100 to <1/10);*
> *uncommon (≥1/1,000 to <1/100);*
> *rare (≥1/10,000 to <1/1,000);*
> **very rare (<1/10,000);**
> **Frequency not known (cannot be estimated from the available data)**

> In some cases for common or very common reactions, and when necessary for clarity of information, frequency figures may be presented

Figure 3.2 – Frequency Grouping according to the European Medicines Agency[1]

[1] to lead someone to, to make someone think something

Amniocentesis   Pregnant women usually have a screening test
for possible problems with their foetus. A test result that shows
any probability above 1 in 150 (0.6%) [5] of having a baby with
Down's syndrome is called a 'higher rist'on the NHS Choices
website. Such women are offered an amniocentesis to confirm or
rule out the diagnosis, but this procedure carries some risk of
causing a miscarriage - this risk is estimated to be about 1%, and
is described as a 'small associated risk' by NHS choices[4].

What do you think of this? Why do you think this wording has
been used? [2]

[2] to encourage someone to

IPCC scale   Many organisations have tried to standardise terms expressing uncertainty. Table 3.1 shows the scale used by the *Intergovernmental Panel on Climate Change* (IPCC)[3].

[3] You might be more familiar with the french name 'GIEC' **Groupe d'experts intergouvernemental sur l'évolution du climat**

Table 3.1 – IPCC scale

Verbal expression	Numerical probability range
virtually certain	99-100%
extremely likely	95-100%
very likely	90-100%
likely	66-100%
more likely than not	50-100%
about as likely as not	33-66%
unlikely	0-33%
very unlikely	0-10%
extremely unlikely	0-5%
exceptionnally unlikely	0-1%

For example in their recent report, they claimed that 'It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century'.

What do you think of this scale? How does it fit with the numbers assessed by the class at the start of this chapter?

[4]

[4]   consistency=cohérence

to set guidelines(établir des directives)

to ignore guidelines

to provide numerical translation alongside text

to improve the scale we should/can

Possible answers and ideas

Interpretation of words   These should be reasonably good agreement for terms like 'extremely unlikely', but 'could' could mean almost anything. [3]

more terms to convey probablity   probable (85%), expected (75%), uncertain (25%),improbable (15%), tossup, seldom (not often, rarely). Using adverbs adds even more nuance :

1. somewhat likely
2. likely
3. very likely
4. rather likely
5. quite likely
6. fairly likely
1. good chance
2. fighting chance
3. little chance
4. pretty good chance
5. slight chance
6. strong chance
7. not much chance
8. almost no chance
9. fair chance

There is also problem of preception of numbers (couple, few, some, several, a lot, many, dozens, scores of)!

Drug side effects   This is an example where the 'official' definition of a word has little resemblance to its use in everyday language, and could lead to patients believing side effects occur far more often than intended.

Amniocentesis   Higher risk is numerically smaller than small risk. The wording may have been chosen to encourage women to have an amniocentesiss if they have a positive screening test, and not worry too muchabout the risk of miscarriage.

IPCC scale   Too many verbal expression of probability can be confusing to follow. We can improve the scale by using less terms.

Providing numerical translation alongside reports or text containing verbal probailities should encourage consistency.

Giving numerical expressions of probabiliyy can mislead people. Some think that a statement like probability is 70% means it is inevitable.

References

[1]   European Medicines Agency. *Section 4.8: Undesirable effects.* 2015. URL: https://www.
       ema.europa.eu/en/documents/presentation/presentation-section-48-undesirable-
       effects_en.pdf (see p. 15).

[2]   Jenny Gage Gage and Spiegelhalter David. *Teaching Probability.* 1st edition. Cambridge mathe-
       matics teaching. City: Publisher, Aug. 2016, pages 164–149 (see p. 1).

[3]   The Guardian. *How probable is 'probable'?* 2015. URL: https://www.theguardian.com/news/
       datablog/2015/aug/14/how-probable-is-probable (see p. 17).

[4]   National Health Service. *Amniocentesis.* URL: https://www.nhs.uk/conditions/
       amniocentesis/ (see p. 15).

[5]   National Health Service. *Screening for Down's syndrome, Edwards' syndrome and Patau's
       syndrome.* URL: https://www.nhs.uk/pregnancy/your-pregnancy-care/screening-for-
       downs-edwards-pataus-syndrome/ (see p. 15).