Qualitative expressions of probability: is there any real misunderstanding?

SIR,—I have read with great interest the paper by Shaw and Dear.¹ I think that this paper in fact addresses a very important and often neglected subject; I have however some misgivings about their results and their conclusions.

The qualitative expressions of probability used in the paper are obviously vague, but in real life they can be better defined by the context in which they are used, by the way words are uttered, by gestures, non-verbal language, prior and subsequent communications on the same subject, etc. I do not think that a physician, speaking to a mother, would say only 'Your baby is jaundiced, and will probably need phototherapy' (statement 1), and vanish. Judging an isolated statement is not representative of interpreting a real communication, so the conclusion that the use of these words can produce misunderstandings might stem from the rather artificial study context, and might not be warranted.

I am surprised that doctors differ in a systematic way from mothers in the interpretation of the qualitative expressions of probability used. These expressions are taken from everyday language, and have no specialised meaning in medicine. The differences between doctors and mothers could in part be due to artefactual factors: in particular, doctors could be more accustomed to the use of scales and to probability axioms. Using a 10 point scale as in the paper, it is natural to think that something having 0.3 (30%) probability to happen receives a '3' score, something having 0.8 probability an '8' score, etc. This requires a knowledge of the axiom that probability can assume values between 0 and 1 only, and this would not be so 'natural' among most people. In fact, Shaw and Dear report that the more educated mothers behave more similarly to doctors than the less educated mothers do. So, the problem could not lie in different interpretation of the same expressions, but rather in different ability to use the scale (that is, an artefact).

Finally, although I agree that in important decisions verbal expressions are to be avoided, I am not convinced that using numerical expressions of probability *per se* would resolve the problem. In fact, both doctors² and lay people³ seem to err frequently in handling numerical estimates of probability and important principles of quantitative inference.

After reading the Shaw and Dear paper, I carried out a small experiment: I asked 12 mothers of healthy neonates in our ward to answer the following written question: 'If the probability that a neonate undergo phototherapy for jaundice is 45%, do you think it more likely that he will undergo phototherapy or not?'. I obtained only four correct answers. I'm not claiming that this small sample dismisses the use of numerical probability expressions altogether, but it raises the possibility that also in numerical communication the context may be important, and the 'message sent' may differ from the 'message received'.

So, in the absence of further evidence, I suspect that numerical expressions of probability also do not convey information unambiguously between doctors and mothers. The question remains open.

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- 1 Shaw NJ, Dear PRF. How do parents of babies interpret qualitative expressions of probability? *Arch Dis Child* 1990;65:520-3.
- 2 Berwick DM, Fineberg HV, Weinstein MC. When doctors meet numbers. *Am J Med* 1981;71:991-8.
- 3 Tversky A, Kahneman D. Judgement under uncertainty: heuristics and biases. *Science* 1974;185:1124-31.

Drs Shaw and Dear comment:

Dr Gagliardi has raised some valid points concerning our recent paper, which prompt us to make the following further observations.

The first point we wish to make is that we are in full agreement that verbal communication is a complex process which is sensitive to context and that rarely, if ever, does an entire message hang on a single word. Nevertheless, the communication of probabilistic information must inevitably make use of either quantitative or qualitative expressions of probability and we defy anyone to avoid them altogether. Our aim was to show that a single qualitative expression of probability may mean quite different things to different people and to suggest that the accuracy of communication might be increased by eliminating as far as possible these differences. We would certainly encourage the pursuit of clarity by the use of other aids to communication and of repeated explanation, although the temptation to amplify the meaning of one vague term by the addition of another should be avoided. Asking the parents to 'play back' what they have understood is a useful technique that many doctors employ.

Dr Gagliardi's second point concerned the systematic difference in the interpretation of expressions between mothers and doctors. We think that his explanation for the difference is quite plausible, but whatever the cause of the difference it is its existence that matters in the present context and it is merely another reminder of the problems inherent in the use of qualitative expressions of probability.

Dr Gagliardi's third point is supported by evidence from a small experiment. Perhaps it loses in the translation but the statement employs a relatively complex construction which could confuse. It also makes use of a percentage which we deliberately avoided because percentages are not as familiar to many people as those who use them regularly might assume. The choice of numerical representation of probability statements is very important and our experience is that scores are more widely comprehended than percentages. If Dr Gagliardi had presented his subjects with the following statement he would surely have reported a higher level of comprehension: 'Out of 20 jaundiced babies, nine will need treatment with phototherapy but the remaining 11 will not'.

Serum immunoglobulins in acute lymphoblastic leukaemia

SIR,—Serum immunoglobulin concentrations in normal children increase with age, as Jackson *et al* have confirmed.¹ Many investigators of the immune status of children with acute lymphoblastic leukaemia have reported low concentrations of immunoglobulins after treatment has started.²⁻⁴ Attention has been drawn to the 'masking' effect of the intrinsic variation in concentrations with age when interpreting results from groups of these children.⁴ Jackson *et al*, in the second of their papers on antibodies to endotoxin core glycolipid argue: 'Furthermore, total IgG concentrations were not significantly reduced in chil-

dren with acute lymphoblastic leukaemia, suggesting that the reduction in specific antibody was not a reflection of the total immunoglobulin concentrations'.⁵ From the preceding sentences of that paragraph, this statement appears to refer specifically to children with acute lymphoblastic leukaemia on treatment. However their own data suggest that IgG concentrations during continuing treatment are lower than those in controls ($p < 0.05$; their analysis). Age related data might show an even greater discrepancy.

As to the importance of anti core glycolipid antibody titres before treatment started, they use in their argument the observation that total IgG concentrations are not significantly reduced yet, on the other hand, allude to abnormally low anti core glycolipid antibody titres at diagnosis despite the lack of a significant difference in these specific antibodies between patients with acute lymphoblastic leukaemia and controls. This is not meant necessarily to detract from their hypothesis that pre-existing and/or treatment induced abnormalities of the immune system may result in abnormally low titres of anti core glycolipid antibodies in some patients; but could they clarify their argument?

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- 1 Jackson SK, Parton J, Shortland G, Stark JM, Thompson EN. Serum immunoglobulins to endotoxin core glycolipid: establishment of normal concentrations. *Arch Dis Child* 1990;65:768-70.
- 2 Chandra RK. Serum immunoglobulin levels in children with acute lymphoblastic leukaemia and their mothers and sibs. *Arch Dis Child* 1972;47:618-20.
- 3 Rapson NT, Cornbleet MA, Chessells JM, Bennett AJ, Hardisty RM. Immunosuppression and serious infection in children with acute lymphoblastic leukaemia: a comparison of three chemotherapy regimes. *Br J Haematol* 1980;45:41-52.
- 4 Reid MM, Craft AW, Cox JR. Immunoglobulin concentrations in children receiving treatment for acute lymphoblastic leukaemia. *J Clin Pathol* 1981;34:479-82.
- 5 Jackson SK, Parton J, Shortland G, Stark JM, Thompson EN. Serum immunoglobulins to endotoxin core glycolipid: acute leukaemia and other cancers. *Arch Dis Child* 1990;65:771-3.

Drs Jackson, Parton, Shortland et al comment: We acknowledge the queries raised in Dr Reid's letter. First, while it is true that the total IgG fell to just significant concentrations in children with acute lymphoblastic leukaemia on maintenance chemotherapy, the total IgG concentration in children with acute lymphoblastic leukaemia as a whole were not significantly decreased. However, the specific antiendotoxin core glycolipid IgG was significantly reduced in this group of patients as a whole, and more significantly reduced in those on maintenance chemotherapy. Indeed, we also found total IgG was the least affected immunoglobulin class in this group of patients. Therefore we feel that these antiendotoxin antibodies are specifically depressed in children with acute lymphoblastic leukaemia.

Secondly, although there are variations in publications of total immunoglobulin concentrations in children with acute lymphoblastic leukaemia,¹⁻³ the specific anti core glycolipid antibodies were consistently reduced in our study at diagnosis. Furthermore, concentrations of anticore glycolipid antibodies at