still trying to do much of his own social casework or is merely unaware of the need for it. The Seeborn Report⁶ and subsequent legislation in Britain that emphasised the need for good links between family doctors and social workers are currently proving ineffective.

Hospital bed availability, the community's greater faith in hospital technology, the absence of a domiciliary nursing team, and society's greater anxiety about ill people at home are probable major reasons why an Iowan patient is 10 times more likely to go to hospital on the same day that he attends his doctor than this English counterpart. All the above reasons, plus the fact that, because of a quirk of the insurance system, hospital investigations are cheaper for the patient in Iowa, probably reflect why he is three times more likely to go to hospital later.

Conclusion

The rather sombre conclusions that must be drawn from this survey are that neither group of doctors can be particularly happy with the results. The English and American ill patients do not appear to be very different in that their age structures and the percentages of acute and chronic illness they present are similar. The differences are apparent when the general practitioner appears on the scene. American doctors are more orientated towards a ritualistic clinical approach leaning heavily on investigation and hospital support. Their system must be

expensive. English doctors seem to operate at a less definitive level of diagnosis. During the last few years the behavioural aspects of medicine and the importance of psychosocial factors have been emphasised. These the English doctor has accepted to the neglect, some would say, of due attention to clinical expertise and the identification of latent disease.

Analyses of process unsubstantiated by assessment of outcome are unacceptable as measurements of the quality of medical care. This investigation emphasises the need for further outcome studies to identify and compare what ultimately happens to the patient, which, after all, is what matters.

We acknowledge with thanks a grant from the research committee of the College of Medicine, University of Iowa, USA. We are also greatly indebted to the 53 American and English doctors who painstakingly completed the survey forms.

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Statistics at Square One

II—Mean from frequency distribution

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British Medical Journal, 1976, **1**, 1325-1326

Last week the mean urinary lead concentration in children was calculated by adding up the observed values and dividing by the number of them. The total of the values obtained in the first study was 22.5 $\mu\text{mol}/24\text{ h}$, which was divided by their number, 15, to give a mean of 1.5 $\mu\text{mol}/24\text{ h}$. This familiar process is conveniently expressed by the following symbols:

$$\bar{x} = (\sum x)/n.$$

$\bar{x}$ (pronounced x bar) signifies the mean; x is each of the values of urinary lead; n is the number of these values; and Σ , the Greek capital sigma, denotes "sum of."

Calculation of mean

When Dr Green extended his study and obtained the urinary lead concentrations from 140 children, he tabulated the findings as shown in the first two columns of table 2.1, which are the same as in table 1.2.

TABLE 2.1—Calculation of mean lead concentration in urine of 140 children

(1) Lead concentration $\mu\text{mol}/24\text{ h}$	(2) Number of children	(3) Midway points of col (1)	(4) Col (3) $\times$ col (2)
0—	2	0.2	0.4
0.4—	7	0.6	4.2
0.8—	10	1.0	10.0
1.2—	16	1.4	22.4
1.6—	23	1.8	41.4
2.0—	28	2.2	61.6
2.4—	19	2.6	49.4
2.8—	16	3.0	48.0
3.2—	11	3.4	37.4
3.6—	7	3.8	26.6
4.0—	1	4.2	4.2
4.4			
Total	140		305.6

Mean lead concentration = $305.6/140 = 2.18\text{ } \mu\text{mol}/24\text{ h}$.

To calculate the mean of the 140 lead concentrations it is of course possible to add up individually the original results obtained in the laboratory and to divide them by 140. A less laborious method, and one that follows naturally from the tabulation of the results in a frequency distribution, is illustrated in table 2.1. Two assumptions are made. The first is that the lead concentrations can take any numerical value in the range, though the sensitivity of the apparatus used to measure them does in practice impose some limits on the continuity. (Continuous and discrete variables will be discussed more fully later.) The second

assumption is that the results within any given class interval (for example, the 7 results in the interval 0.4 up to 0.8) are distributed evenly along the interval. The midway point represents that interval better than points nearer its top or bottom. Thus 7×0.6 will, on the average, give a better estimate of the sum of those 7 results than 7×0.4 or 7×0.79 or $7 \times$ any other number in between. For this reason the midway points of the class intervals are set out in col (3). In col (4) the value of each midway point is multiplied by the number of children in the class. The sum of the lead concentrations is then put at the bottom of col (4)—namely, 305.6. To find the mean lead concentration in the 140 specimens, this sum is divided by 140, giving $2.18 \mu\text{m}/24 \text{ h}$.

If this procedure is carried out on a calculator with a memory, the figures in col (4) need not be written out. The multiplication of each value of lead concentration is done, the result added into the memory, and the sum extracted from the memory at the end. Further, if the class intervals in col (1) are carefully chosen, as recommended in Part I last week, it may be possible (as it is here) to see the midway point by inspection. Col (3) is then superfluous, and the calculation can be done with the aid of the calculator straight from table 1.2 without the need for additional columns.

Adding like and unlike

At the end of Part I the question was raised whether it was correct to make calculations on the total group of 140 children. In so far as they are children, the sources of these observations clearly belong to the same class of creatures and have much in common. But as parents have often had occasion to remark, children differ greatly among themselves. Some are boys, some are girls, some (in this group) were near the age of 1 and others nearly 16. Disparities of this kind often lie hidden but need to be thought of.

For example, according to the Registrar General's estimate for mid-1973, the population of the Birmingham hospital region was 5 163 200 and that for the South-western hospital region 3 246 200. But women constituted 50.49% of the Birmingham region and 51.80% of the South-western, a difference of 1.31%. This might be large enough to invalidate a comparison between the incidence of a disease in the two regions if women were particularly susceptible or relatively immune to it. Furthermore, while 35% of people in the Birmingham region were aged 45 or over, the figure for the South-western region was 41%. Susceptibility to many diseases varies with age, so that this difference too must be taken account of in any comparison between the regions. The figures for the total populations of these two regions conceal important dissimilarities between them.

Likewise when studying the urinary lead concentrations it would be advisable to analyse them according to the age and sex of the children. It is possible, for instance, that the younger children, having less judgment of what is safe to put in their mouths, might have higher lead concentrations than the older children; and boys, being more exploratory than girls, might have got more lead-contaminated material from a forbidden site.

Exercise 2. From the 140 children whose urinary concentration of lead he had investigated Dr Green selected the 40 who were aged at least 1 year but under 5. He found in the urine the following concentrations of copper in $\mu\text{mol}/24 \text{ h}$:

0.70,	0.45,	0.72,	0.30,	1.16,	0.69,	0.83,	0.74,
1.24,	0.77,	0.65,	0.76,	0.42,	0.94,	0.36,	0.98,
0.64,	0.90,	0.63,	0.55,	0.78,	0.10,	0.52,	0.42,
0.58,	0.62,	1.12,	0.86,	0.74,	1.04,	0.65,	0.66,
0.81,	0.48,	0.85,	0.75,	0.73,	0.50,	0.34,	0.88.

What is the mean when calculated (1) from the individual observations, (2) from a frequency distribution of the observations arranged at intervals of $0.1 \mu\text{mol}/24 \text{ h}$? *Answer:* (1) 0.6965, (2) 0.705 $\mu\text{mol}/24 \text{ h}$.

Problems of Childhood

Bottle-feeding

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British Medical Journal, 1976, 1, 1326-1331

Whenever possible mothers should be encouraged to breast-feed their babies—even as little as two weeks is valuable, but preferably it should continue for the first four to six months of life. If, however, the mother is unable or unwilling to do so the baby is bottle-fed. This article is concerned with “Which baby?” “When?” “How much?” “How?” “What?” and “What else?” of bottle-feeding. We have paid particular attention to “What?”—that is, What substitutes for breast milk are available?—because it is in this area that the most substantial changes have occurred recently.

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TABLE 1—Rule-of-thumb feeding categories

Feeding category	Birth weight (g) at gestational ages (completed weeks)				
	Preterm	Term		Post-term	
	<36	36-37	38-39	40-41	>41
Group 1, special care	All below 36 weeks require special care	<2300	<2400	<2500	All above 41 weeks require special care
Group 2, extra care	—	2300-2500	2400-2800	2500-2900	—
Group 3, normal	—	>2500	>2800	>2900	—

In group 1 the lower limit of weights for babies of 38-41 weeks are well below the 5th centile for gestational age—that is, they are very light-for-dates babies. Group 2 consists mainly of term babies who are moderately small for dates—from below the 5th centile up to the 10th centile. If born at home the individual circumstances will indicate whether extra care with feeding can be achieved or whether admission to hospital is necessary. The mother must have reasonable diligence and ability; a feeding record is necessary; three or four visits by the midwife or doctor during the first 48 hours are desirable, particularly if the baby is below 2500 g or of only 36 weeks' gestation. Group 3 consists of babies born at term or only just preterm and whose birth weight is above the 10th centile for gestational age. If the birth weight is more than 1400 g above the limits given in group 1 he is probably large for dates (>95th centile) and the possibilities of complications requiring special care should be borne in mind—for instance, infant of diabetic mother.