The independence assumption has been found in practice to give very useful results even when it is known to be quite untrue, mainly because the estimated values of the pattern frequencies are regarded as unimportant, provided that they arrange the possible diagnoses in their correct order of relative likelihood. If the probabilities were to be used in conjunction with costs to make a quantitative estimate of the value of a test or the cost of a wrong decision an accurate estimate of their value would be needed.

Computers

An alternative approach which takes account of the interdependence of the tests, is to use brute computer force to examine all combinations of indicants and select those patterns which give the best discrimination between the groups. It is not usually practicable to grind out combinations of more than about five indicants because so many possible patterns exist that either the frequencies in any one pattern are too small to be reliable or the task is simply too big for present-day computers—for example, there are about 75m patterns of five in 100 two-state attributes. The relative usefulness of this approach and the independence assumption is still unsettled. In general the

combinatorial method produces much simpler rules that need no computer for their application, but is less accurate. Use of the independence assumption, if it is to improve on this, requires in practice a small computer and gives little or no understanding of what basic patterns are concerned. In any individual problem it is always worth trying both. Some other possible methods will be discussed in the last part of this series.

In spite of these complications it is hoped that this exposition has shown how clearly the use of Bayes's theorem sets out the essential elements in the quantitative evaluation of diagnostic tests.

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One of the best and least technical accounts of the ideas discussed in this paper is *Making Decisions* by Professor D V Lindley (New York, John Wiley Interscience, 1971). Some practical examples and further references are to be found in the *Journal of the Royal College of Physicians*, 1975, vol 9.

Clinical Topics

Low-birth-weight infants in Bradford 1972-9

P J CONGDON, G T LEALMAN

Many reports emphasise the improved outlook for low-birth-weight babies (those under 2500 g) as a result of using modern methods of intensive care,^{1 2} although the outlook for those weighing less than 1500 g may be no better than it was 15 years ago.³ Because these babies need such a high degree of care, regional perinatal centres have been developed to accept either the high-risk pregnancy before delivery⁴ or the ill newborn baby.⁵ It is, however, difficult to judge from figures published from referral centres the effect that modern intensive care has on reducing neonatal mortality rates in the regions they serve.

We report the outcome for all babies under 2500 g born and treated in two Bradford hospitals from January 1972 to 31 August 1979. Analysing our figures over this period should show the effect that the provision of improved perinatal care has had on altering neonatal mortality in a given community. Although only a relatively few infants needed respiratory support, the overall raising of standards has resulted in a consistent improvement in survival rates at all birth weights. For those under 1000 g, however, the mortality still remains very high.

Patients and methods

Bradford district with a total population of 343 200 (1978 estimate) is served by two maternity hospitals with a total of 5000-6000 deliveries a year. (This includes a net inflow to the Bradford Health District of about 500 maternity patients from surrounding districts, and these patients are included in our figures.) There is a large and increasing immigrant population with an estimated 44 000 New Commonwealth and Pakistani citizens (1978 figures). This is reflected in an increasing number of births to Asian parents, which in 1972 represented 19.7% of all deliveries in Bradford hospitals, but which had increased to 27.9% in 1978 (table I). Almost 99% of deliveries in the district now take place within these two hospitals with consultant and GP units sharing common delivery suites. Only 13.5% of births are to parents of social classes I and II while 34% are to those from social classes IV-V (Registrar-General's classification). There are two special-care baby units, one with 16 cots and one with 20 cots including three neonatal intensive-care cots, which provide ventilatory

TABLE I—Total numbers of births in Bradford January 1972-August 1979 with percentage of births born to Asian mothers

Year	Total No of births	% Asians
1972	6025	19.7
1973	5501	20.3
1974	5154	21.8
1975	4993	21.7
1976	5174	23.5
1977	5143	27.4
1978	5549	27.9
1979 (Jan-Aug)	4484	Not available

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support when necessary. The larger unit was opened in 1968, and the other had been established a few years earlier. Medical staffing is provided by four senior house officers (who invariably have no previous experience of intensive care), one registrar, and one senior registrar. There is 24-hour registrar cover, and consultant supervision is provided by a full-time paediatrician who devotes 60% of his time to these two units. Two other consultant paediatricians also undertake neonatal care, including night cover on a rota basis. At present 17 whole-time equivalent nursing staff are employed in the larger unit and 14 whole-time equivalent staff in the smaller one. These nurse-staff levels have only recently been achieved.

Continuous positive-airways pressure was first used in 1974, but ventilatory support was not properly established until 1976. Oral tracheal ventilation has been administered by either a Loosco or, more recently, by a Bourns pressure-limited ventilator. Our most frequent indication for continuous positive-airways pressure is an inability to maintain an arterial oxygen tension (P_{aO_2}) of 8 Kpa (60 mm Hg) in an oxygen concentration of 40-60%. The commonest indications for ventilation have been prolonged apnoea or an inability to maintain a P_{aO_2} of 7 Kpa (52 mm Hg) in more than 80% oxygen while on continuous positive-airways pressure. A blood-gas machine is sited on the unit, and facilities are available for the continuous monitoring of ECG, P_{O_2} , blood pressure, and temperature with microtechniques for biochemical investigations.

Results

From January 1972 to August 1979 42 017 births occurred of which 3577 were under 2500 g—representing 8.5% of all births (national average 1972-8: 7%).⁶ In Bradford data from the obstetric and neonatal notes have been held on computer tape since 1968. Deaths are recorded up to 42 days of age, and all our figures concern this period of survival. Death certificates for the period 1972-9 have been checked to ensure that these figures are complete. Throughout the period basic nursing and medical techniques have improved—for example, more efficient resuscitation, better temperature control, earlier feeding, and closer biochemical monitoring of ill babies. In Bradford, however, the use of intensive care in the form of ventilatory support has evolved slowly over the past three and a half years. In 1972-3 neither continuous positive-airways pressure nor ventilation were used, in 1974-5 continuous positive-airways pressure was given occasionally, and by 1976-7 both techniques were being increasingly used. Five babies were ventilated in 1976, 16 in 1977, 31 in 1978, and 23 up to August 1979.

The six-week survival rate for January 1972-August 1979, in 500-g weight bands, is shown in table II. It is in the 1001-1500-g group that modern practice has had its most pronounced effect. In 1972-3 mortality was 64%, but this has been reduced over successive years and for the past 20 months is now 25%. During 1972-7, of 104 births under 1000 g, only 10 survived (9.6% survival), while in the past 20 months with the more frequent use of ventilation, seven of 36 have survived (19.4% survival).

From January 1978 to August 1979, 47 infants under 2500 g were ventilated and 25 survived, resulting in a 53% survival rate (table III). The social-class distribution for the parents of those ventilated reflects our population with 40% from social classes IV and V. Of the 22 deaths, 16 (73%) had respiratory distress syndrome, eight having an associated intraventricular haemorrhage. Three infants, including one with respiratory distress syndrome, had major congenital abnormalities, and the deaths in the four remaining infants were from pulmonary haemorrhage, meconium aspiration, birth asphyxia, and hydrops fetalis of unknown cause. In the first eight months of 1979 23 infants were ventilated and, excluding two dying with congenital abnormalities, 70% survived.

Table IV shows the mortality rate for all births under 2500 g over

TABLE III—Numbers surviving to six weeks/total numbers ventilated according to birth weight. (% survival in parentheses)

Year	Birth weight (g)				Total
	<1000	1001-1500	1501-2000	2001-2500	
1978-9	4/11 (36.4)	5/13 (38.5)	12/17 (71.1)	4/6 (66.7)	25/47 (53.2)

TABLE IV—Deaths under six weeks/total births under 2500 g by year (% mortality) with deaths from congenital abnormalities excluded 1976-9

Year	Deaths/total births <2500 g	% Mortality	% Mortality with congenital abnormalities excluded
1972	81/542	14.9	
1973	49/505	9.7	
1974	39/471	8.3	
1975	39/376	10.4	
1976	34/401	8.5	7.8
1977	35/428	8.2	7.0
1978	39/472	8.3	7.2
1979 (8 months)	22/342	6.4	4.7

this period. In Bradford from January 1976 to August 1979 congenital abnormalities accounted for 9-27% of deaths each year. If these are excluded our present mortality rate is 4.7%.

Discussion

The ill low-birth-weight baby needs scrupulous nursing and medical care, but in Britain there are regrettably major deficiencies in the treatment of these infants resulting in preventable neonatal deaths.^{7,8} Recently there has been discussion whether neonatal care should be provided on a regional^{9,10} or area basis.⁸ We have undertaken this review to assess the efficacy of intensive care provided locally. Our results are tabulated in two-yearly periods, partly because of the few infants in each weight band, but also because it usefully reflects our changing practice and expertise. Virtually no babies were ventilated before 1976, although some did receive continuous positive-airways pressure from 1974 onwards; 21 were ventilated in 1976-7 and 52 in 1978-9 (including those over 2500 g). The most pronounced improvement in survival occurred in those babies weighing 1001-1500 g. For each two-year period survival has improved by about 15% (table II). This improvement started before the introduction of ventilation, and our recent policy of more active intervention has not altered this trend. So many changes in neonatal care have occurred in the period under review that it is difficult to identify with certainty any one factor contributing to this improvement.

The outlook for infants weighing less than 1000 g is still poor but better than in 1972. We hope like others¹¹ that the better results seen in the infants of 1001-1500 g will soon be reflected in those less than 1000 g. Few infants under 850 g have been ventilated for two reasons: partly because of the uncertain long-term outlook for these infants, many of whom are in poor condition at birth, but also because it has not been possible to maintain adequate nursing ratios for all infants in the special-

TABLE II—Six-week survival rate for various birth weights 1972-9

Year	<1000 g			1001-1500 g			1501-2000 g			2001-2500 g		
	Births	Survivors	% Surviving	Births	Survivors	% Surviving	Births	Survivors	% Surviving	Births	Survivors	% Surviving
1972-3	37	4	10.8	64	23	35.9	183	152	83.1	763	738	96.7
1974-5	33	2	6.1	50	25	50.0	160	144	90.0	604	598	99.0
1976-6	34	4	11.8	44	28	63.6	147	131	89.1	604	597	98.8
1978/Aug '79	36	7	19.4	55	41	74.5	183	169	92.3	580	576	99.3

care baby units despite recommendations.⁹ The main problem at present is poor recruitment of trained and experienced nurses.

Most ill babies can now, with efficient transport techniques,¹² receive expert care in regional neonatal intensive-care units. Good anticipation and initial treatment is essential before referral. These features have certainly developed in our units since intensive care was started and might not be maintained if the most challenging and ultimately rewarding cases were to be diverted elsewhere. Referral of such cases could, by affecting both morale and training, affect the recruitment of suitable medical and nursing staff. This is experienced to a small extent in our own district, where it is more difficult to maintain staff training on the special-care baby unit that does not provide intensive care. We hope, therefore, that not only will referral centres publish the outcome for those infants referred to them, but will also show that such a policy is reflected in falling mortality rates in the referring districts.

When infants are admitted to special-care baby units there is concern to obtain satisfactory parent-infant bonding. Bonding is more likely to be established if the infant remains close to the parental home, especially with economically deprived families. Frequent visiting is often difficult and expensive, especially if there are other children in the family. This is highlighted by one local family who travelled 1800 miles in the three months that their child spent in our special-care baby units.

So long as a district serves a large population, we believe that satisfactory care can be given within that district. The development of regional neonatal intensive-care units may starve both obstetric and paediatric units in district general hospitals of finance and incentive and lead to deteriorating standards. By providing such a service we believe that the outlook for all

babies has been improved. This should result in both lower morbidity and mortality.

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What are the risks to the fetus of a diet that excludes meat and fish?

The exclusion of meat and fish from the diet in pregnancy should not have any adverse effect on the fetus provided that the mother takes protein from other sources, such as milk, cheese, eggs, etc.

What effect do amitriptyline (Tryptizol), flurazepam (Dalmane), mefruside (Baycaron), and saccharine have on the metabolism of glucose in diabetics and in normal people?

Occasional instances of diabetes mellitus, aggravation of existing diabetes, abnormal glucose tolerance, glycosuria, and hyperglycaemia have been reported after the use of antidepressants, such as amitriptyline, benzodiazepines, and diuretics. Mefruside is said to cause less trouble than the earlier thiazide diuretics. Saccharine has no effect on the metabolism of glucose, and indeed it has been used for long periods by diabetics without harm.

Is there any risk to the baby in giving norethisterone to a nursing mother?

Norethisterone is a progestogen, and as such will be excreted in human milk in small amounts. The little evidence available¹ suggests that lactation, once established, will not be diminished or suppressed by progestogens; the oestrogenic contraceptive hormones, on the other hand, may have this adverse effect. Whether or not progestogens cause any difference in the composition of milk is at present uncertain, two studies having given conflicting results.² Obviously harmful effects on the baby have not been reported,^{2,3} but in general further more detailed work and long-term follow-up would seem prudent before norethisterone can be given absolute sanction. Progestogens have been given to lactating mothers, however, in many parts of the world.

What causes heartburn?

Heartburn is usually caused by reflux of acid-peptic juice into the oesophagus. It may be caused by reflux of alkaline digestive juices—for example, after gastrectomy or in patients with pernicious anaemia. The cause of the pain is not the alkalinity of the juice but constituents such as bile. Bile may be an important element in producing reflux symptoms even when the juice is acid. Bile reflux into the stomach is common in women suffering from pregnancy heartburn, though the juice refluxed into the oesophagus is usually acid.¹ Atlay *et al*² suggested that drinking hydrochloric acid might relieve heartburn in pregnancy, though their results do not show a much greater response to acid medicine than to alkali, or even to placebo. Possibly relief came mainly because refluxed juice was washed out of the gullet. It seems more rational to suppress reflux—for example, by alginate compounds—and encourage swallowing and salivation by chewing aluminium-containing antacid tablets, which may also bind bile salts.

¹ Castro L de P. Study of the etiopathogenesis and treatment of heartburn in pregnancy. *Am J Obstet Gynecol* 1967;**98**:1-10.

² Atlay RD, Weekes ARL, Entwistle GD, Parkinson DJ. Treating heartburn in pregnancy: comparison of acid and alkali mixture. *Br Med J* 1978;**iii**:919-20.

The frequent application of hot-water bottles is a common home treatment for backache. Used over a long period is this treatment hazardous?

Chronic irritation of the skin by heat can lead to the development of squamous carcinoma, but it will depend on the length of contact (which must be prolonged), the temperature, the site affected, and the age of the subject. It is occasionally seen on the legs of elderly people who huddle in the same position close to the fire. The changes, however, of erythema ab igne with reticular erythema and pigmentation and later some hyperkeratosis will always be present at such a site before squamous carcinoma will develop. Erythema ab igne can occur where a hot water bottle has been applied, but the contact must be prolonged and always in exactly the same area. Theoretically, a squamous carcinoma could arise at such a site, but the occurrence must be rare indeed.

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