Neonatal intensive care provision in the United Kingdom 1992–3

D W A Milligan, on behalf of the British Association of Perinatal Medicine

Abstract

Medical neonatal units in the United Kingdom were surveyed in 1994 to determine for 1992–3 the number of cots, medical and nursing staff, workload, the ability of units to retrieve data and to assess any changes that might have occurred since the NHS reforms. There was an 84% response rate. Many units were unable to provide workload and birthweight specific information. Cot occupancy, and therefore the exposure of individual neonatal nurses to babies requiring intensive care, increased in direct proportion to unit workload. In spite of this a third of all neonatal intensive care, even for babies of <1000 g, is provided by units with ventilator workloads of 50 or fewer babies a year. There was a 25% increase in intensive care level 1 (ICL1) cot provision between 1989 and 1993, but no change in the total number of cots. Consistent maintenance of a common dataset by all units undertaking neonatal intensive care would do much to assist future planning.

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The provision of neonatal care in the United Kingdom has evolved through a series of local initiatives. A parliamentary report published in 1980[1] proposed that there should be many local secondary services feeding a small number of strategically placed tertiary services. Two factors have since emerged to destabilise this model: the increasing numbers of doctors with accredited training in neonatal medicine appointed to consultant posts; and the NHS reforms, both of which have encouraged the development of autonomous neonatal intensive care facilities in small to medium sized district general hospitals. Information about the national provision of neonatal services is scanty. A survey of neonatal transfers carried out in 1986–7[2] found that intensive care provision had doubled since 1980 but that problems remained with regard to availability of cots in tertiary units, especially for the smallest babies. An unpublished survey by the Joint Standing Committee of the former British Paediatric Association and the Royal College of Obstetricians and Gynaecologists in 1992 found a continuing small increase in intensive care provision. The author noted the poor yield of detailed data, particularly on workload and recommended the introduction of improved definitions of intensive care. The survey reported here extends the scope of the 1992 study, and was designed to establish the infrastructure (staffing and cot provision), the workload, the ability of individual units to retrieve and supply data items and any changes which had occurred since the introduction of the NHS reforms.

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Methods

A postal questionnaire was sent to the consultant in charge of 251 identified medical neonatal units in the United Kingdom in October 1994. Each unit was asked to give details of cot provision, staffing, workload and transfers (form available from the authors, on request). Respondents were asked to complete a total for each of the categories even if they did not have the information broken down by birthweight. Follow up telephone calls were made to non-responders after two months. If these elicited no response a further questionnaire was sent with a copy to the senior nurse on the unit. Persistent non-responders were telephoned at least three times. The questionnaire was closed in October 1995.

Returned questionnaires were analysed for completeness of data. Responses were divided into those with complete data for specific questions, those with totals only, those with missing data and those with responses that were uninterpretable. The data were analysed separately for 1992 and 1993 except for the questions on staffing where a specific year had not been identified in the questionnaire.

Cot numbers and transfers were compared with those in 1989–91 for those units completing data for both surveys.

Results

Two hundred and eleven (84%) units had responded by October 1995. Responses were received from both units in the Channel Isles, 13/14 in Wales (93%), 176/204 in England (86%), 16/22 in Scotland (73%), 4/7 in Northern Ireland (57%) and 0/1 units in the Isle of Man. No complete set of responses was received from any one health region.

COMPLETENESS OF DATA

The results for data completion rates are shown for 1993 in table 1, ranked by the rate for completion of total figures for each question only. The results for both years showed a similar pattern, but response rates for every question in 1993 were consistently higher than those for 1992. Workload data stratified by birthweight scored worst and cot and staffing numbers

Table 1 Responses ranked by rate of completeness (1993)

Category	*Complete*	*Totals only*	*Blanks*	*?*	*Percentage with all data*	*Percentage with totals*
Cots	206	3	0	2	98	99
Doctors	197	9	5	0	93	98
Admissions (total)	192	11	3	5	91	96
Nurses	191	0	10	10	91	91
Postnatal transfers	161	22	19	9	76	87
Ventilated babies	130	52	26	3	62	86
Nurse skill mix	177	0	25	9	84	84
Booked babies	131	45	26	9	62	83
IU transfers	148	20	40	3	70	80
Ventilator days	102	53	52	4	48	73
ICL 1 babies	110	43	53	5	52	73
ICL 1 days	81	66	62	2	38	70
Transfers out	112	0	13	86	53	53

Table 2 Distribution of units by cot numbers in neonatal units

Cots per unit	*1992 (n=206)*			*1993 (n=206)*			*Non-responders (n=40)*		
	Level 1	*Level 2*	*Level 3*	*Level 1*	*Level 2*	*Level 3*	*Level 1*	*Level 2*	*Level 3*
0	35	44	38	31	41	39	14	1	0
1-3	91	50	5	92	53	4	92	3	3
4-6	51	54	24	51	58	27	51	2	3
7-9	18	15	39	21	14	42	21	1	5
10-12	7	21	41	11	20	44	11	0	10
13-15	2	4	30	0	3	28	0	0	10
16-18	0	8	16	0	8	15	0	0	5
19-21	0	4	5	0	4	2	0	0	0
22-24	0	3	3	0	3	3	0	0	2
> 24	0	1	1	0	1	1	0	0	0
Total cots	672	1083	1791	712	1075	1753	95	23	446

Table 3 Relation between unit ventilator workload and birthweight specific workload

Unit workload (ventilated babies/year)	*No of units*	*< 1000 g*		*1000 - 1499 g*		*> 1499 g*	
		% work	*d/baby*	*% work*	*d/baby*	*% work*	*d/baby*
≤ 25	35	15	3	23	4	61	3
26-50	42	19	11	27	7	54	4
51-75	8	18	12	23	5	59	4
76-100	7	25	16	28	10	47	4
> 100	10	26	21	25	9	49	5

highest. Only one third of units were able to retrieve data by birthweight for intensive care days[4] and one third could not retrieve data for even total intensive care days.

COT PROVISION 1992–3 AND NON-RESPONDERS

The number of cots by British Association of Perinatal Medicine category,[3] for 1992 and 1993, are shown in table 2 together with the profile for the non-responding units (derived separately from CNA Medical Data Ltd). Half of the 206 units supplying data had ≤3 IC level 1 cots. There were fewer units in 1993 with no IC level 1 cots. No unit had >12 IC level 1 cots in 1993. There was a similar distribution of cots in the non-responding units.

WORKLOAD

The total workloads in those units returning the relevant data for 1995 comprised: 9095 ventilated babies (183 units); 59 819 ventilator days (158 units); 10 530 IC level 1 babies (155 units); and 87 138 IC level 1 days (150 units).

In the 59 units providing information linking ventilator and ICL1 babies and days, there was a twofold difference in the average length of time spent on a ventilator or in IC level 1 care among the three birthweight groupings (< l000 g 20 IC level 1 days/baby and 17 ventilator days/baby; 1000–1499 g 9 and 8 days/baby; >1499 g 5 and 4 days/baby).

Table 3 illustrates the distribution of ventilator workload by birthweight, ranked by unit workload (ventilated babies), in the 84 units supplying both numbers of ventilated babies and ventilator days. The proportion of ventilated babies of <l000 g in each grouping doubled between the least and most busy (15% to 26%), but the proportion of ventilator days/baby increased sevenfold (3%-21%).

Seventy per cent (59/84) of the units cared for from one to 50 ventilated babies every year. A third of all ventilated babies in this dataset (1433/3954) and a quarter of all ventilator days (7624/30 250) were attributable to these units. This tendency was true even for the smallest babies weighing <l000 g of whom 255/859 were ventilated for 2139 /13 563 days (16% of all ventilator days <1000 g).

IC level 1 cot occupancy increased in direct proportion to the number of IC level 1 cots. (one to three cots 25%, four to six cots 55%, >six cots 71%).

There was a close correlation between IC level 1 and ventilator care. A third of IC level 1 care was attributable to reasons other than ventilation.

STAFFING

Nurses

Seventy six per cent of H grades, 85% of G, 79% of F, 46% of E and 16% of D grades had a specialist neonatal qualification (ENB 904, 405, 997). There was a strong correlation between total unit workload (IC level 1 days) and the number of potential IC level 1 days experienced by each nurse (IC level 1 days/nurse) (fig 1). Nurses working in units undertaking >500 IC level 1 days/year had nearly four times the potential IC level 1 experience as those working in units with smaller workloads.

A normalised distribution of nurses to cots (fig 2) was obtained by applying the validated Northern Region formula for basic staffing[4] (which does not make allowance for extra staff needed for emergencies, transport, or one to one care). A zero value was allocated to a ratio of 0.5 nurses/intensive care level 1 cot and 0.25 nurses/CL 2 or special care cot. The distribution for units with one to three and four to six cots is normal, with a median at around −4, suggesting that most of these units are minimally staffed. The larger units (more than six cots) have a wide scatter of staffing ratios and seem to be better staffed.

Doctors

The questionnaire asked for numbers of whole time equivalent doctors by grade. Nearly all respondents interpreted the question on a contractual level and gave the same figure for whole time equivalents as for numbers of doctors. Altogether 600 consultants, 104 senior registrars, 259 registrars, 892 senior house officers and 138 other grades were involved in neonatal care in the 197 units who supplied information.

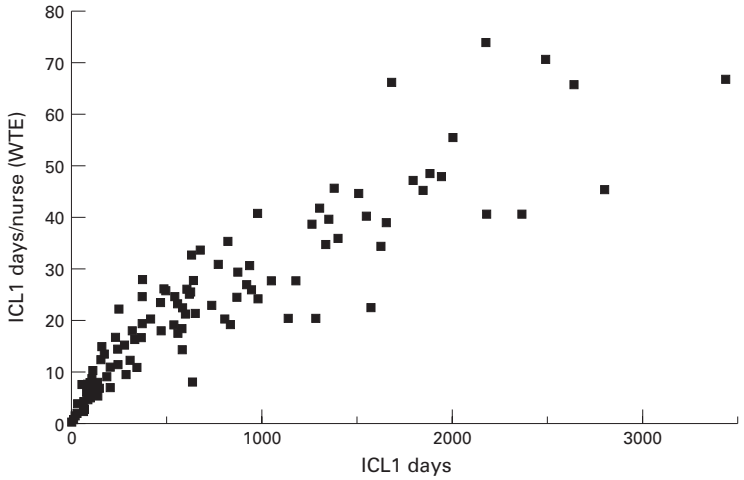

Figure 1 Effect of unit workload (n=139) on experience of individual nurses.

1989–91/1992–3 COMPARISON

Table 4 shows changes in cot provision and transfer activity over the five years 1989–93 for the units who provided data for both questionnaires. There was a steady rise in intensive care cot numbers, amounting to a 25% increase between 1989 and 1993. The step change in levels 2 and 3 between 1991 and 1992 reflects the changes in the BAPM definitions which came into force in 1992. There was a small increase in antenatal transfers over the same time period, but little change in postnatal transfers.

Discussion

A large proportion of neonatal units either do not routinely record, or are unable to retrieve, standard workload data. It is perhaps not surprising that birthweight specific workload data were not available as this implies linkage to individual babies—a task which is difficult, if not impossible, in retrospect. An unexpected finding was that nearly 10% were unable to retrieve admission numbers by birthweight as this is information normally recorded in admission books. Data items which are easy to obtain were usually available; nearly every unit could count its neonatal cots. But, although cot numbers may be easy to count, they do not represent a simple variable because they are a result of two factors: the workload and the ratio of nurses to workload that happens to be locally acceptable. They are therefore not strictly comparable between units unless a correction is made for these two confounding variables.

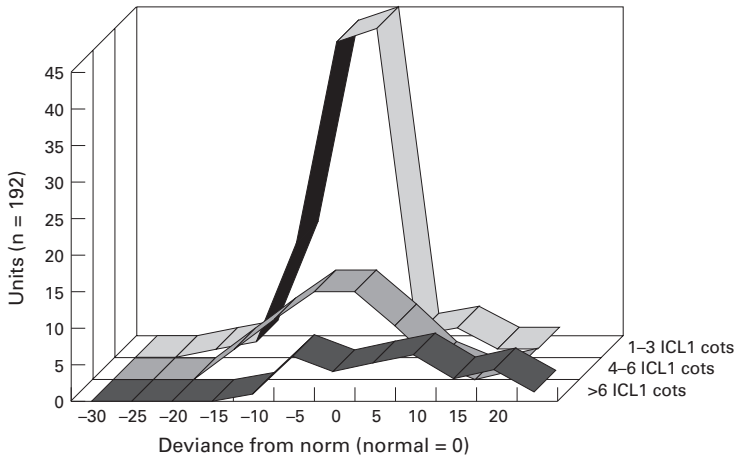

Figure 2 Correlation between normalised staffing and unit size.

Table 4 Cot provision and transfers in 76 units in 1989-93

	1989	*1990*	*1991*	*1992*	*1993*
Cots:					
Level 1	274	289	303	327	342
Level 2	149	164	169	512	510
Level 3	1017	990	971	628	597
Total	1439	1443	1443	1467	1449
Transfers:					
In utero	1368	1323	1508	1579	1558
Postnatal	1567	1764	1799	1510	1613

Ventilator workload, on the other hand, should be a robust predictor of resource provision (nasal continuous positive airways pressure, not in widespread use during 1992–3, probably needs separate definition) but over a quarter of units were unable to retrieve even total ventilator days. Consistent recording of workload data using the BAPM classification may be impeded by its complexity.[4]

Most intensive care is carried out in small to medium sized units with relatively small workloads. It is of some concern that this pattern holds true for even the lowest birthweight group. These babies are likely to be more ill, to develop multisystem problems which are likely to benefit from specialist input, and levy a disproportionate workload (table 3).[5] The balance of evidence suggests that the outcome for these babies is better in tertiary units[6] but good data are few. Babies of <1000 g treated in the less busy units spent less time on average in level 1 care or on the ventilator than their counterparts in the busier units. This could have been because they were transferred out, or that they were less sick, or that they were treated more effectively, or that more of them died. Clear interpretation would require a knowledge of the denominator figures including those babies who did not survive labour.

It might have been supposed that the higher numbers of nurses in the larger units would have compensated for the increased workload and effectively diluted individual clinical exposure to the same level as that seen in the smaller units. But this effect seems to be outweighed by the greater efficiency[7 8] and increased cot occupancy of the larger units, with the result that each nurse potentially acquires one extra day's experience of intensive care level 1 for every increment of 40 IC level 1 days in total unit workload (fig 3). These factors almost certainly account for the apparently higher staffing levels in the largest units (fig 1), but confirmation requires matching of nurses allocated to IC level 1 care and IC level 1 workload. They probably apply to medical staff as well, although the data in the current study are insufficiently detailed to confirm the possibility. The evidence that many units have levels of nurse staffing below that of recommended levels (fig 2)[4] is disturbing. Specifically focused studies are needed to establish whether staffing levels are related to outcome, as seems

to be the case in an adult intensive care unit (Tarnow-Modi, personal communication).

The 25% increase in cots designated level 1 intensive care between 1989 and 1993 remained within a stable number of total neonatal cots in the small sample studied. This may reflect an increase in provision of either plant or personnel, but it may equally result from a redistribution of some of the special care workload from the neonatal unit to the postnatal wards. Transfer patterns do not seem to have changed much over the five year period but the data sample may not be representative of the whole country.

Provision of resources for neonatal care should be cost efficient and clinically effective while maintaining minimum disruption for the families involved. There is evidence from this study that a substantial proportion of neonatal intensive care is currently provided by hospitals with limited experience and with unit sizes that do not allow for efficient deployment of nursing staff. Planning and monitoring cannot occur without a reliable information base. Further detailed studies are needed, perhaps incorporating outcome data and risk indices, to assess whether a change in the current pattern of service provision might improve clinical and cost effectiveness. The most useful single contribution at this stage would be the establishment of a carefully defined, and nationally agreed, core dataset which could be used by every unit undertaking neonatal intensive care.

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