ARTICLE

The changing face of neonatal intensive care in South Africa

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In 1991 a cut-off weight of 1 000 g and/or 28 weeks' gestation for neonatal intensive care unit (NICU) admission was decided on by attending neonatologists at a Priorities in Perinatal Care Conference. These recommendations were not based on published evidence. At the time there were few data on the outcome of babies born in the public sector who received NICU.

Aim. The aim of this study was to describe the demographic data (mother and baby) and outcomes of babies admitted to a tertiary NICU.

Methods. During 1992 - 1996 (1992 cohort) and 1999 - 2000 (1999 cohort) two cohorts of babies treated in the NICU at Tygerberg Hospital, Western Cape, South Africa, were studied. Demographic data were collected prospectively on all admissions with a birth weight of less than 1 501 g and a gestational age of less than 32 weeks. Outcome data were survival, days of ventilation and NICU stay.

Results. There were 455 babies in the 1992 cohort and 272 in the 1999 cohort. The mothers' mean income was R892 per month and was higher in the 1999 cohort.The 1999 cohort comprised significantly smaller babies, at a mean birth weight of 1 119 g v. 1 198 g. The mean gestational age in the 1999 cohort was lower (29.2 v. 30.3 weeks), but so was the mortality rate (21.6% v. 26.1%). The main differences between the survivors and non-survivors were in their birth weight and gestational age and the mean income of their mothers. The mean number of ventilation days needed by these infants was low at 8.5 days, with an average stay in the NICU of 13 days.

Discussion. Babies admitted to an NICU have a good chance of survival at a low mean number of ventilation and NICU days. The increase in survival in the 1999 cohort, in spite of low income, is in keeping with international trends and underlines the good short-term outcome of these small babies.

The infant mortality rate (IMR) in South Africa (SA) has lagged behind the best international standards.[1] In the past decade the ability to deliver neonatal intensive care in SA has decreased.[2-4] There is a paucity of information on the availability of equipment and the long-term outcome of infants who are not accommodated in a neonatal intensive care unit (NICU).[5] We do know that outcome of survivors is good in the limited number of neonates who have access to neonatal care.[6-8]

Because of financial constraints, there has been a steady loss of neonatal intensive care facilities for public sector patients in a time of increasing urbanisation.[9,10] There is an increasing demand for tertiary care, which is driven by better facilities in the primary health care arena and increased patient expectations.[11] This raises questions about the rationale of allocating intensive care to selected neonates only. Intensive care may be allocated so as to give the best chance of survival if a good outcome is likely, or it can be allocated to benefit as many babies as is physically possible, as is the case in the SA public health sector. This does not relieve the government of its responsibility to maintain and upgrade health care facilities.[12] At the 1991 Priorities in Perinatal Care Conference in South Africa a policy was formulated not to treat babies weighing less than 1 000 g in government hospital NICUs. These recommendations were made before surfactant therapy became available. After its introduction, the survival rates of babies admitted to a NICU with birth weights between 855 g and 1 000 g rose and are currently the same as those of babies weighing more than 1 000 g.

Most premature and small-for-dates neonates in SA are born to the poorer socio-economic group,[13] who are dependent on the public health services for their care.

Aim

The aim of this study was to describe the patient population in the Tygerberg Hospital (TBH) NICU during two time periods, 1992 - 1996 (1992 cohort) and 1999 - 2000 (1999 cohort), and to describe the outcome of the babies treated.

Patients and methods

All infants admitted to the NICU during the two time periods who either had a gestational age less than 33 weeks or a birth weight less than 1 501 g were prospectively evaluated. All demographic data, as well as outcome measures such as death, time spent on the ventilator and the development of bronchopulmonary dysplasia, were documented. The two time periods were compared to evaluate any changes in outcomes.

The TBH NICU has 12 beds, and the medical staff consists of a full-time neonatologist, two rotating registrars and one rotating junior doctor. The NICU is mainly a ventilation facility

and few patients are admitted unless they need ventilation. High care is provided in a separate ward. Surfactant and nitric oxide are available. Standard volume-cycled ventilators and oscillators are available. After weaning onto either head-box oxygen or continuous positive-pressure (CPAP) ventilation, the babies are discharged to the high-care ward. Our policy for routine care has been recorded by Smith *et al.*[14]

The TBH NICU has between 600 and 800 admissions a year with a mortality rate of 18% for babies born at TBH. For babies weighing less than 1 500 g, or younger than 32 weeks' gestation, the mortality rate was 26% in 1992 - 1996. One quarter (26%) of NICU admissions are referred from rural areas and 15% from the metropolitan antenatal clinics. The remaining 59% are born at TBH.

Admission criteria for the NICU

Inborn babies whose mothers have received antenatal care will routinely receive NICU care if they weigh over 999 g and/or have a gestational age of at least 28 weeks, if a bed is available. Unbooked babies have to weigh over 1 200 g or have a gestational age of at least 30 weeks. Babies of mothers with a poor obstetric history are often admitted even if they do not fulfil the above admission criteria.

Results

Data on 727 babies were analysed, 455 in the 1992 cohort and 272 in the 1999 cohort. The demographic data on the mothers and babies are presented in Table I.

The mean income of all mothers in the 1992 cohort of R892 per month was just more than the official minimum wage of R800 for domestic employees. The mean income of those who had an income was R1 098. The mean income in the 1999 cohort was R787 per month, which is less than the official minimum wage of R800 for domestic employees, and the mean income of those who had an income was R1 386.

The babies in the 1999 cohort had a mean weight of 1 169 g. The mean gestational age was significantly lower in the 1999 cohort (29.2 v. 30.3 weeks) than in the 1992 cohort. The data on the deliveries of these babies are presented in Table II.

Eighty-seven babies belonged to sets of twins and 4 to sets of triplets. The mortality rate in normally delivered babies was 24.7%, but 33.3% of forceps-delivered babies and 32.1% of breech deliveries died, as illustrated in Table III. Significantly fewer babies with premature rupture of membranes and fewer females were admitted in the 1999 cohort.

Of the babies 605 had been delivered at Tygerberg Hospital, 33 in the district services and 89 in the rural areas. There were 549 (24.4%) survivors and 178 deaths before discharge from hospital. In the 1992 cohort the mortality rate was 26.1% and in the 1999 cohort it was 21.6%.

The babies required a mean of 8.5 days of ventilation. Survival in relation to maternal and neonatal data is presented in Table IV.

There was no difference in survival related to either age or parity, but mothers of survivors had a higher income. The mean income of all mothers was very low. Neonatal mortality was similar in the mothers who had less than 3 babies and those who were grand multiparas.

Mean gestational ages and Apgar scores did not differ significantly between the survivors and non-survivors. There was, however, a significant difference in birth weight between survivors and non-survivors. Even though the absolute difference was small and insignificant at 94 g, the effect of this possibly combined with the half-week increase in gestational age made all the difference. There was no difference in duration of ventilation between the two groups (Table IV).

There were no differences in booking status, the incidence of positive serology for syphilis or duration of admission between the two groups (Table V). More boys than girls were admitted, and more boys died. Babies who died did not use more resources than survivors.

TABLE I. MATERNAL DATA

	1992 cohort			1999 cohort		
Parameter	Number	Mean (SD)	Range	Number	Mean (SD)	Range
Age of mother (yrs)	435	27.06 (5.88)	14 - 44	256	26.8 (6.3)	15 - 41
Parity	450	2.7 (1.53)	1 - 9	268	2.52 (1.58)	1 - 11
Income (rands per month)*	453	892.3 (1 180.9)	0 - 8 500	272	613 (1 272)	0 - 7 400
Birth weight (g)*	454	1 198.7 (196.28)	655 - 1 655	272	1 119 (214)	575 - 1 700
Gestational age (wks)*	454	30.3 (2.13)	25 - 36	275	29.2 (2.08)	24 - 36
1-min Apgar*	437	5.04 (2.83)	0 - 10	233	5.63 (2.56)	0 - 10
5-min Apgar	436	7.22 (2.11)	0 - 10	232	7.31 (2.08)	0 - 10

*$p = 0.001$ between 1992 and 1999 cohort.

Discussion

This study suggested that in making the decision which neonates should be admitted to neonatal intensive care units in the public sector, discrimination based solely on birth weight and gestational age may be flawed. If scarce resources are to be allocated to the baby with the best prognosis, factors such as gender,[15,16] booking status[17] and income of the parents[18] should to be taken into account in addition to birth weight[19,20] and gestational age.[21]

These may not be comfortable decisions, but involve more than just admitting a baby weighing 1 000 g and refusing another weighing 998 g. Discrimination based on income discriminates against the poorest of people and cannot be justified ethically. The survival in the 1999 cohort was similar to the 1992 one in spite of smaller babies in the latter. These findings could be used to motivate for more NICU beds from the Department of Health.

In the public sector, discrimination based solely on birth weight and gestational age may be flawed.

The significance of the lower income for mothers in the 1999 cohort would be influenced by how reliable the information provided by mothers was, but is a cause for concern. The effect of mothers' income on the outcome of their babies can only be estimated. The reason for the lowering in income might be the change in the NICU population, with an increased influx of migrant labourers from the Eastern Cape.[22]

These findings emphasise the increased requirements for medical care of the lower socio-economic group, which is served by the public sector in SA. These babies might be nutritionally impaired, or other factors may play a role.

The role of HIV was not investigated, as the prevalence was very low during the time the study was done. Being exposed to HIV does not seem to have a detrimental effect in the short-term outcome of premature neonates, unless they are born with sepsis.

TABLE II. DELIVERY DATA

	1992 cohort			1999 cohort		
Parameter	Total number	Positive	Negative	Total number	Positive	Negative
Antenatal care ($p = 0.080$)	449	365	84	268	216	52
Syphilis serology ($p = 0.17$)	433	26	407	259	25	234
Admission time (< 12 h) after birth ($p = 0.32$)	455	360	95	271	212	59
Prolonged rupture of membranes ($p = 0.0008$)	396	36	360	256	13	243
Gender (M:F)* ($p = 0.08$)	455	238	217	272	160	112
Multiple births	455	60	395	272	31	241

*$p < 0.05$ between 1992 and 1999 cohort.

TABLE III. SURVIVAL ACCORDING TO TYPE OF DELIVERY

	1992 cohort			1999 cohort		
Type of delivery	Survivors	Non-survivors	Deaths (%)	Survivors	Non-survivors*	Deaths (%)
Caesarean	187	64	25.4	96	29	23.2
Vaginal normal	130	43	24.8	96	21	17.9
Forceps	2	1	33	0	0	0
Breech	17	11	39.2	21	7	25

*Incomplete data on 2 male infants.

The fact that this NICU 'penalises' babies for not having received any antenatal care affects the predictive strength of this variable. If the mother does not receive antenatal care, the baby's birth weight and the gestational age have to be higher for it to be admitted. The group that did not receive antenatal care therefore comprised more mature babies.

Prolonged rupture of membranes also significantly influences outcome.[23-25] This underlines the need for improved antenatal care and the need for mothers to be informed on all the possible problems that need urgent attention in preterm labour.

It is of interest that factors traditionally associated with a bad outcome, such as teenage mothers,[26-28] congenital syphilis,[29] low Apgar scores[30,31] and multiple births[32] do not show any relevance to outcome in this study. The difference in outcome in the 1999 cohort compared with the 1992 cohort could be explained by improved care such as availability of surfactant in 1999.

Neonatal intensive care in the public sector is restricted. The risk factors identified in this study should be evaluated further in larger studies and used to formulate ethically acceptable selection criteria. The improvement of the socio-economic status of our population would address major risk factors such as inadequate maternal income.

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TABLE IV. MATERNAL AND NEONATAL DATA – SURVIVAL ANALYSIS

	1992 cohort			1999 cohort		
Variable	Survivors Mean (SD)	Non-survivors Mean (SD)	p	Survivors Mean (SD)	Non-survivors Mean (SD)	p
Age of mother (yrs)	27 (5.84)	27.23 (6)	> 0.10	27 (6.4)	26.01 (5.97)	> 0.1
Parity	2.62 (1.46)	2.73 (1.7)	> 0.10	2.5 (1.6)	2.61 (1.5)	0.1
Income (R)	958.68 (1 267.77)	706 (867.28)	< 0.05	642.74 (1 310)	507 (1 130.9)	> 0.1
Birth weight (g)	1 223.33 (182.4)	1 129.16 (217.55)	0.001	1 135.65 (208.76)	1 061.94 (228.66)	> 0.1
Gestational age (wks)	30.43 (2.1)	29.9 (2.2)	0.10	29.27 (1.77)	28.74 (1.81)	> 0.1
1-min Apgar	5.06 (2.82)	4.96 (2.87)	0.10	5.66 (2.5)	5.54 (2.5)	> 0.1
5-min Apgar	7.26 (2.04)	7.11 (2.32)	0.10	7.32 (2.1)	7.52 (2.04)	> 0.1
IPPV duration	7.98 (10.77)	9.87 (14.2)	0.081	4.78 (4.2)	5.34 (4.1)	> 0.1

TABLE V. OTHER NEONATAL VARIABLES – SURVIVAL ANALYSIS

Variables (positive/negative)	Survivors 1992 cohort	Survivors 1999 cohort	Non-survivors 1992 cohort	Non-survivors 1999 cohort	Difference between 1992 and 1999 p-values
Antenatal care	262/72	169/41	103/14	47/11	0.023*
Syphilis serology	18/303	20/186	8/104	5/48	0.55
Admission time (< 12 hours)	266/70	162/50	94/25	50/9	0.92
Prolonged rupture of membranes	25/258	9/195	11/87	4/48	0.61
Gender (M/F)	166/170	120/93	72/47	40/19	0.048†
Multiple births	41/295	25/188	19/100	6/53	0.37

*OR 2.02 (CI 1.05 - 3.39).

†OR 1.57 (CI 1 - 2.46).

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