

Review of Mortality of Very Low Birthweight Infants at the University Hospital of the West Indies over the Past Four Decades

H Trotman

ABSTRACT

A review of two previously published studies done at the University Hospital of the West Indies, an unpublished study and annual perinatal statistics was conducted to detect trends in the mortality of very low birthweight infants at the institution over four decades. Mortality decreased from 54% to 38% over the time period, the decrease was greater for infants weighing 1001–1500 g (40%) than those weighing ≤ 1000 g (28%). Despite increased access to mechanical ventilation over time, there was no appreciable decrease in mortality for infants weighing ≤ 750 g. There was a statistically significant decrease in mortality with increasing birthweight for the time period 1987–2002, $p < 0.001$. The mean \pm SD weight of survivors 1.18 ± 0.24 kg was significantly greater than that for non-survivors 0.89 ± 0.21 kg for the same period. Further decrease in mortality of very low birthweight infants will involve measures aimed at decreasing mortality in infants weighing ≤ 750 g and increasing the availability of parenteral nutrition and the accessibility of surfactant.

Keywords: mortality, very low birthweight infants

Examen de la Mortalidad en Neonatos de Peso muy bajo al Nacer en el Hospital de West Indies en las Últimas Cuatro Décadas

H Trotman

RESUMEN

Se llevó a cabo un examen de dos estudios previamente publicados realizados en el Hospital Universitario de West Indies, un estudio inédito, y las estadísticas perinatales anuales, con el propósito de detectar las tendencias en la mortalidad de los neonatos de muy bajo peso al nacer en la institución en un período de cuatro décadas. La mortalidad disminuyó de 54% a 38% durante ese periodo de tiempo. La disminución fue mayor para los infantes que pesaban 1001 – 1500 g (40%) que para aquellos que pesaban ≤ 1000 g (28%). A pesar del aumento del acceso a la ventilación mecánica con el tiempo, no se produjo una disminución apreciable en la mortalidad de infantes cuyo peso era ≤ 750 g. Hubo una disminución estadísticamente significativa de la mortalidad en relación con el aumento del peso en el período de 1987 – 2002, $p < 0.001$. El peso \pm SD promedio de los sobrevivientes (1.18 ± 0.24 kg) fue significativamente mayor que el de los no sobrevivientes (0.89 ± 0.21 kg) para el mismo periodo. Una ulterior disminución de la mortalidad en neonatos de muy bajo peso al nacer implicará medidas encaminadas a disminuir la mortalidad en neonatos de peso ≤ 750 g y a aumentar la disponibilidad de la nutrición parenteral y la accesibilidad de los surfactantes.

Palabras claves: mortalidad, neonatos de muy bajo peso al nacer

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From: Department of Child and Adolescent Health, The University of the West Indies, Kingston 7, Jamaica.

Correspondence: Dr H Trotman, Department of Child and Adolescent Health, The University of the West Indies, Kingston 7, Jamaica. E-mail: helen.trotmanedwards@uwimona.edu.jm

INTRODUCTION

Improvement in perinatal care of high risk mothers and advances in neonatal intensive care have resulted in improved survival of very low birthweight (VLBW) infants (≤ 1500 g) in developed countries (1–4). Outcome of these infants in developing countries has not mirrored their counter-

parts in developed countries due to budgetary constraints limiting the necessary technological advances needed to optimally care for these infants. However, there have always been survivors despite the absence of technology driven neonatal intensive care measures. The aim of this study was to determine the trend in mortality of VLBW infants at the University Hospital of the West Indies (UHWI) over four decades.

SUBJECTS AND METHODS

Data from two previously published studies on mortality in VLBW infants done at the UHWI, (5, 6) one unpublished study and the annual perinatal statistics from the UHWI were reviewed to detect trends in the mortality of VLBW infants at the UHWI. Only neonates delivered at the UHWI were included in the study. All infants with congenital or chromosomal abnormalities were excluded. Six four-year time periods spanning four decades were utilized: 1974–1977, 1987–1990, 1991–1994, 1995–1998, 1999–2002 and 2007–2010. The age of viability has moved from 28 completed weeks of gestation to 24 completed weeks of gestation or a birthweight greater than or equal to 500 g over the periods in review. The ventilatory support offered to these infants at the

Statistical Analysis

Descriptive analyses were performed, mortality was expressed as percentages and comparison of means was done using the independent Student *t*-test. Differences in mortality by weight categories were analysed using the Chi-squared test. Analyses were performed using the Statistical Package for the Social Sciences version 14. Statistical significance was taken at the level $p < 0.05$.

RESULTS

Over the time period under review, there has been a slow but steady increase in the percentage of live births that is accounted for by VLBW infants; this had risen from 1.7% in the seventies to 4.1% in 2007–2010 (Table 1). There has also been a concomitant increase in the percentage of infants weighing less than 1000 g in the cohort of VLBW infants moving from 39% in 1974–77 to 49% and 43% in 1999–2002 and 2007–2010, respectively (Fig. 1).

There has been a steady decrease in mortality of VLBW infants from 54% in 1974–1977 to 38% in 2007–2010 (Table 1). For infants weighing 1001–1500 g, there has been a 40% decrease in mortality between 1974–1977 and 2007–2010 whereas for infants weighing 1000 g and less

Table 1: Mortality of very low birthweight infants at the University Hospital of the West Indies 1974–77, 1987–2002, 2007–2010

	1974–1977	1987–1990	1991–1994	1995–1998	1999–2002	2007–2010
Live Births (n)	9008	11 482	12 480	11 995	9953	9236
VLBW n (%)	152 (1.7)	147 (1.3)	184 (1.5)	255 (2.1)	258 (2.6)	375 (4.1)
VLBW Dead (n)	82	70	87	100	101	143
Mortality %	54.0	47.6	47.3	39.2	39.1	38.1

UHWI has also changed over time, moving from oxygen *via* head box in the seventies to the use of bubble continuous positive airway pressure (CPAP) on the Newborn Special Care Nursery in the early eighties, then in the late eighties some infants were mechanically ventilated in the main ICU and since August 2001 infants have been mechanically ventilated in the neonatal intensive care unit (NICU). Surfactant became available from 2001 onwards but due to financial constraints was not accessible to most of the infants and total parenteral nutrition was not consistently available for administration.

Case Definition

VLBW – a neonate weighing less than and equal to 1500 g.

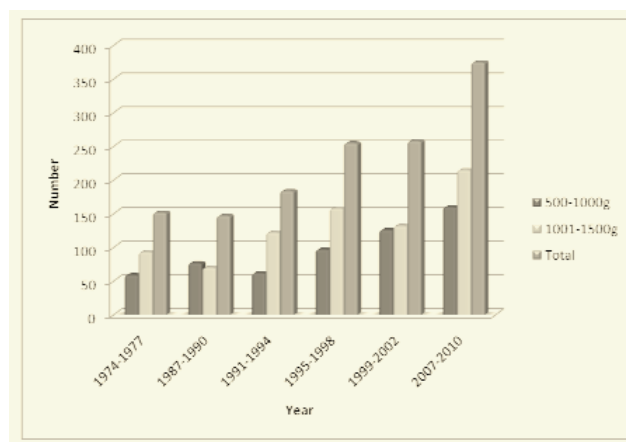


Fig. 1: Total number of very low birthweight infants born at the University Hospital of the West Indies during the review period.

there has been a 28% decrease in mortality over the same time period (Table 2).

2010. One hundred and seven infants received bubble CPAP, 60 (56%) infants weighing ≤ 1000 g and 47 (44%) infants

Table 2: Mortality of very low birthweight infants at the University Hospital of the West Indies 1974–77, 1987–2002, 2007–2010

	1974–1977	1987–1990	1991–1994	1995–1998	1999–2002	2007–2010
500–1000 g						
Born (n)	59.0	77.0	62.0	97.0	126.0	160.0
Dead (n)	54.0	54.0	53.0	64.0	85.0	105.0
Mortality (%)	92.2	70.0	85.5	66.0	67.5	65.6
1001–1500 g						
Born (n)	93.0	70.0	122.0	158.0	132.0	215.0
Dead (n)	28.0	16.0	34.0	36.0	16.0	38.0
Mortality (%)	30.1	22.9	27.9	22.8	12.1	17.7

If the mortality of infants weighing 1000 g and less is disaggregated, it is seen that there has been little change in mortality for infants weighing 750 g and less, the decrease in mortality for infants 1000 g and less is solely due to decrease in mortality of infants weighing 751–1000 g over the time period (Table 3). For infants weighing greater than 1001 g,

weighing 1001–1500 g. Seventy per cent of those weighing ≤ 1000 g died while 30% of those weighing 1001–1500 g died.

The mean \pm SD weight of survivors 1.18 ± 0.24 kg was significantly greater than that for non-survivors 0.89 ± 0.21 kg for the time periods 1997–2002 ($p < 0.001$). Mortality of

Table 3: Mortality of infants weighing 1000 g and less at the University Hospital of the West Indies 1987–2002 and 2007

	1974–1977	1987–1990	1991–1994	1995–1998	1999–2002	2007*
500–750 g						
Born (n)	–	28.0	16.0	32.0	60.0	13.0
Dead (n)	–	24.0	15.0	27.0	52.0	12.0
Mortality (%)	–	85.7	93.8	84.4	86.7	92.3
751–1000 g						
Born (n)	–	49.0	46.0	65.0	66.0	20.0
Dead (n)	–	30.0	38.0	37.0	33.0	12.0
Mortality (%)	–	61.0	82.6	56.9	50.0	60.0

*Data for one year only

decrease in mortality is contributed to by both infants weighing 1001–1250 g who had a 55% reduction in mortality and those weighing 1251–1500 g who experienced a 35% reduction in mortality over the time period.

During the study period there was a 50–70% decrease in the number of infants mechanically ventilated in 1991–1994 and 1995–1998 when compared to the number ventilated in 1987–1990 (Fig. 2). There was then a rapid increase in the number of infants ventilated in 1999–2002 and 2007–2010 to seven times the number ventilated in 1995–1998 (Fig. 2). There was a concomitant increase in the mortality rate of those ventilated in the latter time periods, 61% and 70% compared to 50% in previous time periods (Fig. 2). During the time period 2007–2010, thirty-four (9%) VLBW infants received surfactant therapy.

Data on the number of VLBW infants managed by bubble CPAP were only available for the time period 2007–

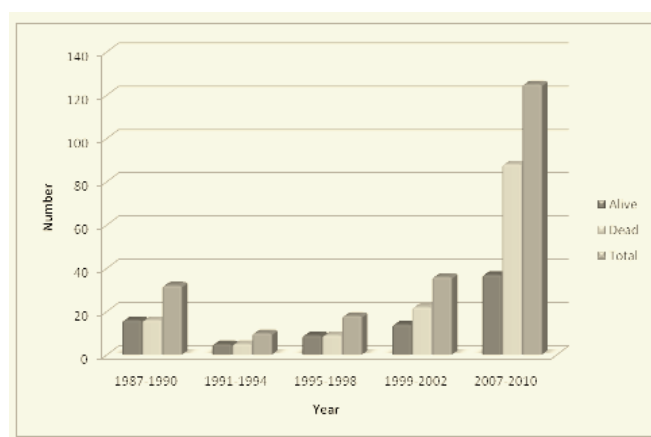


Fig. 2: Outcome of very low birthweight infants ventilated at the University Hospital of the West Indies during the review period.

VLBW infants significantly decreased with increasing birthweight for the period 1997–2002, $p < 0.001$ (Table 4).

Table 4: Outcome by weight for very low birthweight infants at the University Hospital of the West Indies 1987–2002

Weight (g)	Dead (%)	Alive (%)	Total
500 – 750	118 (87)	18 (13)	136
751 – 1000	138 (61)	88 (39)	226
1001 – 1250	65 (29)	160 (71)	225
1251 – 1500	37 (14)	220 (86)	257
TOTAL	358 (42)	486 (58)	844

$p < 0.001$

DISCUSSION

The increase in the percentage of VLBW infants over the time period is an interesting phenomenon which cannot be simply explained by the change in definition for the age of viability, as in the earlier studies birthweight greater than 500 g was the criterion used for inclusion in the study population and not gestational age. So infants who had a gestational age less than 28 weeks were included once their birthweight was greater than 500 g, however, some infants may have been classified as abortions and so not included in the statistics. The concomitant increase in the number of infants weighing ≤ 1000 g over the time period lends some credence to this postulate.

It is to be noted that the greatest increases in percentage took place in the latter years 1999–2010 when gestational age of 24 weeks and weight of 500 g and greater was being used. So there seems to be a true increase in the number of VLBW infants being delivered at the UHWI and prospective studies would need to be done to determine how much this is a reflection of *in utero* transfer of high risk pregnancies to the UHWI for perinatal management.

This study showed decreased mortality with increasing birthweight. Improved survival with increasing birthweight has been previously documented by several studies (4, 7–10). It is interesting to note that despite improvement in the ventilatory support offered to these infants, there has been no improvement in the mortality of infants weighing ≤ 750 g. Trotman and Barton have also shown that there was no improvement in survival rates for infants weighing ≤ 750 g post the establishment of the NICU at the UHWI (10). Nutrition plays a major role in the survival of these infants and the inability to support these infants totally with parenteral nutrition is a limiting factor in outcome. There is a need for the development of a consistent total parenteral nutrition programme at the UHWI for neonates. Georgieff *et al* have clearly shown the benefits of parenteral nutrition in the management of preterm infants and the positive effect on survival (11).

There was a rapid increase in the number of VLBW infants receiving mechanical ventilation with the advent of

the NICU; however, an increase in the mortality rate of ventilated infants was also noted. This is most likely related to the increased number of infants weighing ≤ 1000 g and even ≤ 750 g that have gained access to mechanical ventilation. In an atmosphere of budgetary constraint, management policies have to take into account goals of ventilatory support by mechanical ventilation for infants ≤ 750 g. Is mechanical ventilation offered because of the probability of a viable outcome or is it offered as part of a resuscitative effort for an infant who has made a poor transition from *in utero* to *extra utero* life?

The value of surfactant in improving outcome of neonates with respiratory distress syndrome, decreasing the length of ventilation and decreasing the incidence of some complications has been previously documented (12). Although surfactant is available in our setting, it is not accessible to the majority of parents because of cost; means of increasing accessibility of this drug needs to be explored for the future as in the long term, surfactant use will lead to decreased mortality of these infants.

Future studies are needed to determine the neurodevelopmental outcome of VLBW survivors at the UHWI. The only previous study by Moore and Lowry showed that these infants remained significantly physically smaller than matched controls at age 2–6 years despite correcting for gestational age. No significant physical handicaps were identified but more of the low birthweight children failed to pass a developmental screening test as “normal” than controls (13). Knowledge about neurodevelopmental outcome in this population is important data needed to develop evidence-based management protocols regarding resuscitation and mode of ventilatory support.

Overall, there has been a decrease in the mortality of VLBW infants over time at the UHWI; however, mortality of infants weighing ≤ 750 g has shown no appreciable decline despite increased access to mechanical ventilation. This has serious implications for the allocation of scarce resources, to maximise on benefits *versus* cost in an atmosphere of budgetary constraint, evidence-based management policies and protocols on which infants access intensive care measures must be developed and implemented.

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