

Neonatal Mortality at the University Hospital of the West Indies Over Six Decades: Trends and Causes

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ABSTRACT

Aim: To describe the pattern of neonatal mortality at the University Hospital of the West Indies (UHWI) over the past six decades.

Methods: Data from previously published studies on neonatal mortality at the UHWI, monthly perinatal statistics (1987, 1996) and the annual perinatal statistics for the UHWI (2005–2010, 2014, 2015) were reviewed to detect trends in neonatal mortality at the UHWI. Descriptive analyses were performed.

Results: There has been a decrease in the neonatal mortality from 21.9/1000 live births during the period 1953–1962 to 14.7/1000 live births in 2015. The percentage of total live births represented by neonates weighing between 1001 and 1500 g has doubled between 1976–2015 and tripled for neonates ≤ 1000 g. Neonates ≤ 1500 g accounted for 64% of overall mortality although they represented less than 5% of live births and neonates ≤ 1000 g accounted for 46% of overall mortality although they represented less than 2% of live births. While the contribution of intrapartum anoxia/perinatal asphyxia to mortality has decreased, the contribution of prematurity and the complication of hyaline membrane disease/respiratory distress syndrome HMD/(RDS) has steadily increased across the decades.

Conclusion: There has been a decrease in the neonatal mortality rate (NMR) over the past six decades but further intervention is needed to achieve the “Every Newborn Action Plan” goal of less than ten neonatal deaths per thousand live births at the UHWI.

Keywords: Mortality, neonatal mortality, neonatal outcome

Mortalidad Neonatal en el Hospital Universitario de West Indies Durante Seis Décadas: Tendencias y Causas

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RESUMEN

Objetivo: Describir el patrón de mortalidad neonatal en el Hospital Universitario de West Indies (UHWI) en las últimas seis décadas.

Métodos: Los datos de estudios publicados previamente sobre mortalidad en el UHWI, las estadísticas perinatales mensuales (1987, 1996) y las estadísticas perinatales anuales de UHWI (2005–2010, 2014, 2015) fueron revisados para detectar las tendencias en la mortalidad neonatal en el UHWI. Se realizaron análisis descriptivos.

Resultados: *Se ha producido una disminución en la mortalidad neonatal de 21.9/1000 nacidos vivos durante el período 1953–1962 a 14.7/1000 nacidos vivos en 2015. El porcentaje del total de nacidos vivos representado por neonatos que pesan entre 1001 y 1500 g se ha duplicado entre 1976–2015 y triplicado en los neonatos \leq 1000 g. Los neonatos \leq 1500 g representaron el 64% de la mortalidad general, aunque representaron menos del 5% de los nacidos vivos; y los neonatos \leq 1000 g representaron el 46% de la mortalidad general, aunque representaron menos del 2% de los nacidos vivos. Si bien la contribución de la anoxia intraparto/asfixia perinatal a la mortalidad ha disminuido, la contribución de la prematuridad y la complicación de la enfermedad de la membrana hialina/síndrome de dificultad respiratoria (HMD)/(SDR) ha aumentado constantemente a través de las décadas.*

Conclusión: *Se ha producido una disminución de la tasa de mortalidad neonatal (TMN) en las últimas seis décadas, pero se necesita más intervención para lograr el objetivo de desarrollo sostenible de menos de diez muertes neonatales por cada mil nacidos vivos en UHWI.*

Palabras clave: Mortalidad, mortalidad neonatal, resultado neonatal

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INTRODUCTION

Decreasing neonatal mortality remains on the agenda for the Sustainable Developmental Goals. The first 28 days (neonatal period) is a crucial time in a child's life, during this period a child is at highest-risk of dying. Every year approximately three million neonates die worldwide, of these, 50% die in the first 24 hours after-birth and 75% by the end of the first-week (1). Over 80% of the deaths are attributable to three causes, complications of prematurity, intrapartum related events including asphyxia and neonatal infections (2). One of the goals of the World Health Organization's (WHO) Every Newborn Action plan is to end preventable newborn deaths and achieve a target of less than 10 neonatal deaths per 1000 births by 2035 (2).

The Perinatal Morbidity and Mortality Survey of Jamaica 1986–1987 documented a neonatal mortality rate (NMR) of 17.9 per 1000 live births disaggregated into early neonatal mortality rate (ENMR) and late neonatal mortality rates (LNMR) of 16.0 and 1.9 per 1000 live births, respectively (3). Fifty-six per cent of deaths occurred within the first 24 hours. The commonest cause of death was problems of immaturity, 39%, and asphyxia related deaths, 35% (3). A review of perinatal mortality in Jamaican hospitals done by the Ministry of Health in 2003 documented 557 early neonatal deaths and 40 563 live births yielding an ENMR of 13.7 per 1000 live births (4). McCaw-Binns *et al* in their review of perinatal and under five mortality data for 2008 documented a NMR of 16.1/1000 live births, an ENMR of 14/1000 live births and a LNMR of 2.1/1000 live births (5). If Jamaica is to achieve the goal of a NMR of less than 10 per 1000

live births individual healthcare institutions will have to audit their neonatal care to determine action points for targeted intervention to decrease neonatal mortality.

There have been several perinatal and neonatal mortality audits done at the UHWI. Thorburn in looking at neonatal death and pulmonary haemorrhage over a 10-year period (1953–1962) reported a total of 14 013 births and 301 neonatal deaths yielding a NMR of 21.9 per 1000 live births (6). Thorburn and Curzen reported a total of 5543 live births and 80 neonatal deaths giving a NMR of 14.4 per 1000 live births for the two-year period 1963–1965 (7). The most common cause of mortality was intrapartum anoxia, 30.3%, followed by hyaline membrane disease (HMD), 23.7%, and congenital malformations, 17.1% (7).

Lowry *et al* in their perinatal mortality review for the years 1973–1975 documented a NMR of 16.74 per thousand live births, 58% of these deaths occurred in the first 24 hours and 89% by the end of the first week of life (8). The most common causes of mortality were Respiratory Distress Syndrome (RDS), 19.7%, infection, 18.3%, and intrapartum anoxia, 11.7% (8). Sparke and Lowry's review of neonatal death reported a NMR of 16.86 for the four-year period 1974–1976 (9), common causes of death were congenital malformations, RDS, intrapartum hypoxia and infection (9).

Since 2001, the Departments of Obstetrics and Gynaecology and Child Health have been conducting annual perinatal/neonatal mortality audits. It is now timely to look at neonatal mortality across the decades at the UHWI to determine what advances have been made if any and what is left to be done to achieve a NMR of

less than 10 per 1000 live births. This study describes the pattern of neonatal mortality at the UHWI over the past six decades.

SUBJECTS AND METHODS

Data from previously published studies on neonatal mortality at the UHWI, (4–7), monthly perinatal statistics (1987, 1996) and the annual perinatal statistics for the UHWI (2005–2010, 2014, 2015) were reviewed to detect trends in neonatal mortality at the UHWI. Only neonates delivered at the UHWI were included in the study. The neonatal unit at the UHWI currently has a maximum capacity of 30 beds and consists of a 24-bed level II Newborn Special Care Unit and a six-bed level III neonatal intensive care unit (NICU). Three consultant paediatricians, two of whom have specialist training in neonatology, are responsible for medical care of the neonates. Paediatric residents in training rotate through the unit on a three monthly basis.

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 time period in review. The ventilatory support offered

to neonates at the UHWI has also changed over time moving from oxygen *via* head box in the sixties and seventies to the use of bubble continuous positive airway pressure (CPAP) on the Newborn Special Care Nursery in the mid-seventies and early eighties, then in the late eighties some infants were mechanically ventilated in the main intensive care unit (ICU) and since August 2001 infants are mechanically ventilated in the neonatal intensive care unit (NICU). Surfactant became available from 2002 onwards but due to financial cost has only been accessible to approximately 13% of neonates with RDS (10) and total parenteral nutrition is not consistently available for administration. The subspecialty of perinatology with the management of high-risk pregnancies has also grown over the latter years at the UHWI.

Very low birthweight infant (VLBW) – an infant weighing less than 1500 g at birth.

Extremely low birthweight infant (ELBW) - an infant weighing less than 1000 g at birth.

Statistical analysis

Descriptive analyses were performed; mortality was expressed as percentages and rates. Differences in

Table 1: Neonatal mortality rates for the UHWI over six decades: 1953–2015

Year	1953–1962	1963–1965	1974–1976	1987	1996	2005–2010	2014	2015
Total live births	14 013	5543	9008	2334	2892	14 178	1936	1629
Neonatal deaths	301	80	152	32	42	301	28	24
NMR per 1000 live births	21.9	14.4	16.9	13.7	14.5	21.2	14.5	14.7
ENMR per 1000 live births	-	13.2	14.1	11.1	12.1	17.1	11.9	11.7
LNMR per 1000 live births	-	1.2	2.8	2.6	2.4	4.2	2.6	3.0

Definitions

Neonatal Mortality Rate (NMR) – the number of babies dying within the first 28 days of life per thousand live births.

Early Neonatal Mortality Rate (ENMR) - the number of babies dying within the first seven days of life per thousand live births.

Late Neonatal Mortality Rate (LNMR) - the number of babies dying after day seven of life up to day 28 of life per thousand live births.

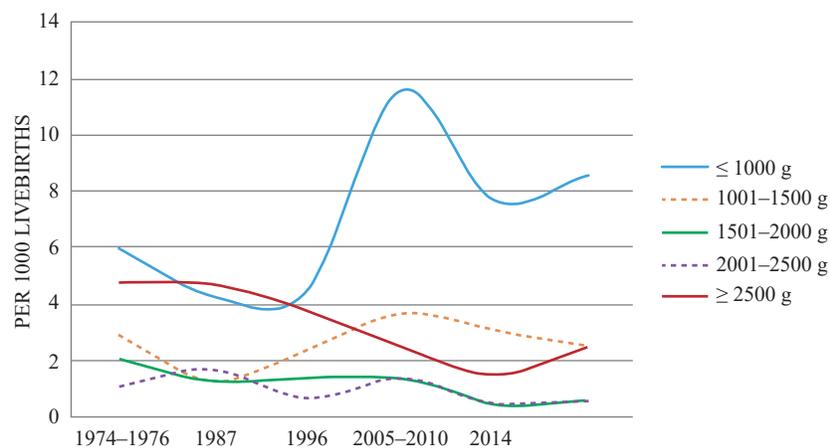


Fig. 1: Birthweight specific neonatal mortality rates for the UHWI: 1974–2015.

mortality by weight categories were analysed and trends described. Changes in causes of mortality over the time were also documented.

Ethical approval

The UWI Mona Research Ethics Committee granted approval use of the data from the annual perinatal audits.

RESULTS

There has been a decrease in neonatal mortality from 21.9/1000 live births during the period 1953–1962 to 14.7/1000 live births in 2015 (Table 1).

There was an initial decrease in NMR to 14.5/1000 live births in 1996 but during the period 2005–2010 it increased to 21.2/1000 live births and then decreased again to 14.5/1000 live births in 2015. During the period 2005–2010 there was a doubling of the weight-specific NMR for neonates ≤ 1000 g from 6.5/1000 live births in 1976 to 11.6/1000 live births in 2010. For neonates weighing between 1001 and 1500 g birthweight-specific-mortality rate also doubled between 1976 (2.8/1000 live births) and 2010 (6.2/1000 live births) but subsequently decreased to a low of 2.5/1000 live births in 2015 (Fig. 1).

Birthweight-specific-mortality rate decreased over time (1976–2015) for all categories greater than 1500 g (Fig. 1). The percentage of total births represented by neonates greater than 1500 g has remained the same between 1976–2015 (Table 2).

The percentage of total live births represented by neonates weighing between 1001 and 1500 g has approximately doubled over the same time period and

tripled for neonates ≤ 1000 g (Table 2). Neonates ≤ 1500 g accounted for 64% of overall mortality (1976–2015) although they represented less than 5% of live births and neonates ≤ 1000 g accounted for 46% of overall mortality although they represented less than 2% of live births.

In the sixties, 90% of the neonatal deaths occurred within the first seven days of life. This decreased in the seventies to 83% and has remained between 80–83% up to 2015 (Table 1). The major causes of mortality are seen in Table 3. While the contribution of intrapartum anoxia/perinatal asphyxia to mortality has decreased, the contribution of prematurity and the complication of hyaline membrane disease/respiratory distress syndrome HMD/(RDS) has steadily increased across the decades (Fig. 2).

DISCUSSION

The NMR has decreased over the past six decades to a low of 14.7/1000 live births in 2015 but it has not been

Table 2: Live births by birthweight categories for the UHWI 1976–2015

Year	1976	2010	2014	2015
Total live births	2478	2091	1936	1629
≤ 1000 g No Born (%)	18 (0.7)	41 (1.96)	39 (2.0)	36 (2.2)
1001 – 1500 g No Born (%)	27 (1.0)	46 (2.2)	40 (2.1)	27 (1.7)
1501 – 2000 g No Born (%)	96 (3.9)	69 (3.3)	63 (3.3)	42 (2.6)
2001 – 2500 g No Born (%)	157 (6.3)	140 (6.7)	152 (7.9)	127 (7.8)
> 2500 g No Born (%)	2178 (88)	1795 (86)	1636 (85)	1397 (86)

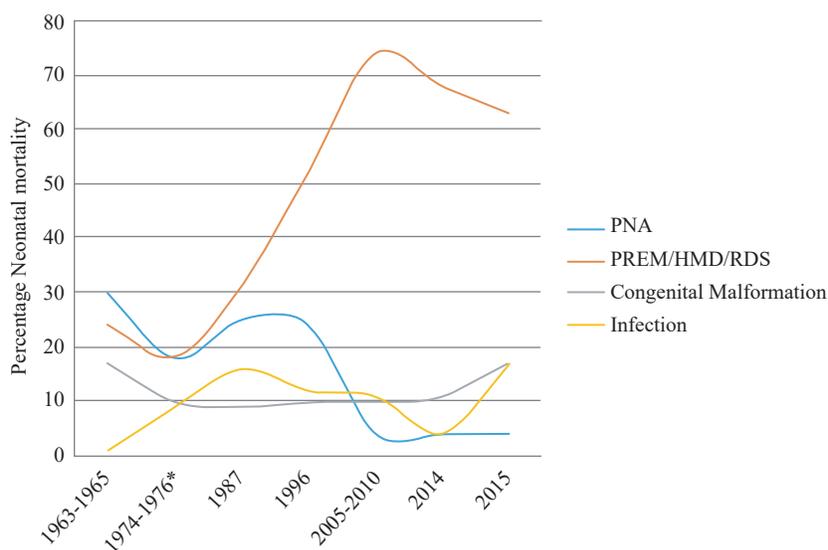


Fig. 2: Main causes of neonatal mortality at the UHWI: 1963 to 2015.

a steady decrease. During the time period 2005–2010 the NMR was similar to that of the sixties. Several factors may have contributed to this high NMR during this time period, these include doubling of the weight specific NMR for neonates ≤ 1000 g which may be as a direct result of their higher percentage contribution to total live births. This increase in the number of neonates ≤ 1000 g cannot simply be explained by the change in definition of the age of viability over time. Resuscitative efforts now offered to those neonates on the edge of viability, who were previously denied, may be an important explanation. However, the growing subspecialty of perinatology at the UHWI may also be contributory to this trend as women with high-risk pregnancies are increasingly being transferred to the institution for management. In future, prospective studies are needed to determine the effect of *in utero* transfers on the NMR for the UHWI.

During the same time period (2005–2010) the birth-weight-specific-mortality rate for neonates between 1001 and 1500 g also doubled. As these neonates also have a high-risk of mortality and they accounted for a greater percentage of live births an increase in NMR at that time is not surprising. It is important to note the NMR trending back down in 2014 and 2015; the major contributor to this is the 50% decrease in birthweight-specific-mortality for babies between 1001 and 1500 g between 2010 and 2015. This speaks to the impact of the improvement of neonatal care on this group at the institution. The current NMR, however, is slightly higher than that reported for Jamaica in 2003, it is expected for the NMR at the UHWI to be higher than the national NMR as the UHWI is a tertiary level referral centre for high-risk pregnancies.

The finding of 80% of neonatal deaths occurring within the first seven days in 2015 is in keeping with data from other countries (1) and with previous time periods at the UHWI, though lower than that seen in the sixties and early seventies (7, 8). The major causes of mortality are similar to those reported in the literature (2) and have remained the same over the six decades although the relative contribution of individual causes has changed. The increasing contribution that prematurity and its complications has made to mortality over the six decades alludes to the increase in the numbers of babies ≤ 1500 g delivered at the institution over the period. The decreasing contribution to mortality by perinatal asphyxia speaks to the improvement in Obstetric care, particularly intrapartum monitoring and intervention when the fetus is deemed to be at risk.

It also reflects improved neonatal resuscitation of neonates who do not experience a smooth transition from *in utero* to *extra utero* life and improved management of the complications of anoxic injury. Prospective studies are needed to determine if there is a true decrease in the overall incidence of perinatal asphyxia and not just a decrease in mortality of affected neonates. The increase in infection as a cause of mortality noted in 2015 was as a result of an outbreak of nosocomial infection on the neonatal unit.

If the UHWI is to achieve a NMR of less than 10/1000 live births, measures will need to be implemented to address mortality in ELBW (< 1000 g) and VLBW (< 1500 g) infants that presently account for approximately 60% of mortality. Obstetric measures to decrease the number of neonates delivered prematurely will need to address the risk factors for the delivery of these infants. In our setting, this will include management of women with hypertensive diseases of pregnancy and women with multiple gestation. Neonatal management of these premature infants would include the judicious provision of mechanical ventilation combined with the use of bubble CPAP to provide ventilatory support for these infants. Increasing accessibility of surfactant replacement therapy at the UHWI by advocating for surfactant to be provided free of cost for neonates born at the UHWI as it is provided in all government hospitals on the Island is important. Increasing the availability of total parenteral nutrition for these neonates, as nutrition is a key component in the survival of these infants is vital. Robust infection control measures to prevent nosocomial infection must be maintained. There must be provision of appropriately trained staff to care for these neonates and the use of evidence based procedures and protocols in the management of these neonates.

CONCLUSION

There has been a decrease in the neonatal mortality rate over the past six decades but further intervention is needed to achieve the “Every Newborn Action Plan” goal of less than ten neonatal deaths per thousand live births at the UHWI.

Authors contribution

H Trotman conceived the paper, oversaw the data collection, wrote the manuscript and approved the final version. AO Olugbuyi participated in analysis and critical review of the manuscript and approved the final version

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