HSOA Journal of Neonatology and Clinical Pediatrics

Research Article

The Definition of Life: The Impact of Physicians' Reporting Practices on Neonatal Mortality Rate in New York City

Sharon M Ramsay[1]* and Shyamal K De[2]

[1]*Graduate School of Education, Binghamton University, State University of New York, Vestal Parkway East, Binghamton, New York, USA*

[2]*School of Mathematical Sciences, National Institute of Science Education and Research, Bhubaneswar, Odisha, India*

Abstract

A factor often ignored in analyses of neonatal mortality rate is the reporting practices of hospitals. This study examined hospital reporting practices by comparing hospitals where the reporting requirement of New York City Department of Health was followed and all births were reported regardless of gestational age and hospitals where gestational age was taken into account in the reporting.

In 2008, a survey was conducted among neonatologists in charge of neonatal intensive care units and obstetricians in charge of departments of obstetrics in New York City maternity hospitals. The survey collected information on hospitals' definitions of live birth and fetal death, their resuscitation practices for extremely premature infants, and their reporting practices for live births and infant deaths.

Data from the 2008 survey and New York City's linked live birth/neonatal death data sets for 2007-2009 were used to examine the impact of hospitals' reporting practices on neonatal mortality rate. The neonatal mortality rate for hospitals where gestational age was taken into account was significantly lower than the hospitals where all live births were reported regardless of gestational age (2.68 versus 3.54, p=0.0033). Removal of infants born at less than 23 weeks gestation resulted in almost equal neonatal morality rates (2.53 versus 2.77, p=0.41).

When the data was separated by race and insurance coverage, the difference in reporting practices resulted in significantly lower neonatal morality for births to white mothers (p=0.0032) and women covered by Medicaid (p=0.0005).

Keywords: Fetal death; Infant mortality reporting; Neonatal deaths; Pediatric resuscitation; Premature birth

***Corresponding author:** Sharon M Ramsay, Graduate School of Education, Binghamton University, State University of New York, Vestal Parkway East, Binghamton, New York, USA, Tel: +1 6072058214; E-mail: smr2159@gmail.com

Citation: Ramsay SM, De SK (2016) The Definition of Life: The Impact of Physicians' Reporting Practices on Neonatal Mortality Rate in New York City. J Neonatol Clin Pediatr 3: 014.

Received: November 19, 2015; **Accepted:** January 25, 2016; **Published:** February 08, 2016

Introduction

Neonatal Mortality Rate (NMR) is defined as the number of deaths in a year among infants who are less than 28 days old per 1,000 live births in the same year. In 2008, neonatal mortality rate in New York City (NYC) was 3. 6 [1], after decreasing 38% between 1997 and 2007 [2]. However, over the same period (1997-2007), prematurity-related infant deaths increased 32% in NYC.

Neonatal mortality rate is a function of gestational age. Based on the 2007-2010 linked live birth/infant death data set for the United States (US), the neonatal mortality rate for infants born at less than 24 weeks gestation was 16 times that of infants born at ≥ 24 weeks gestation [3]. Premature infants that survive have high morbidity rates, which include significant risk of brain injury [4]. For example, a longitudinal study of 4,004 infants born at 20-25 weeks gestation in the United Kingdom and Ireland from March to December 2005 found that only 811 infants survived to be admitted to the Neonatal Intensive Care Unit (NICU) [5]. Only 314 of the 811 infants survived to be discharged (7.8% of the original cohort). Of the discharged infants, a follow up at 30 months found disabilities of about 50% among those still alive. Of the 236 children followed to age six, 63 children classified at 30 months as having severe disabilities had moderate or severe disabilities at age six [6].

The morbidities associated with premature births have financial implications; the annual economic burden associated with premature births in the US in 2005 was at least $26.6 billion [7]. This represents a 357% increase from 2001, when a study conducted using hospital discharge data from the 2001 Nationwide Inpatient Sample estimated preterm birth/low birth weight cost at $5.8 billion [8]. Concerns about the high social and economic costs of premature births led the US Congress to pass the Prematurity Research Expansion and Education for Mothers who deliver Infants Early (PREEMIE) Act in 2006 [9]. In 2013 Congress reauthorized the PREEMIE Act through 2017 with revisions to enhance research and surveillance activities [10]. The Act authorizes the Centers for Disease Control and Prevention to conduct epidemiological studies on preterm births, conduct activities to improve national data to aid with surveillance, and bolster efforts aimed at preventing preterm births.

The gestational age at which aggressive costly therapies should be instituted for premature infants has been an ongoing ethical debate. The debate relates to the ethics of resuscitation, and the high costs associated with the care of extremely premature infants that are resuscitated. A 2006 report from the Nuffield Council on Bioethics, an independent United Kingdom organization, recommended that infants born at less than 22 weeks gestation should not be given intensive care and those born at 22 weeks should only be resuscitated after frank discussions with parents about survivability [11]. The European Resuscitation Council recommended that infants born at 25 or more weeks gestation should be resuscitated unless there are contra indications, and infants born at less than 23 weeks gestation and/or a birth weight of less than 400 grams should not be resuscitated [12]. The American Heart Association recommends that infants born at less than 23 weeks gestation and/or a birth weight of less than 400

grams should not be resuscitated and those born at 25 or more weeks gestation should almost always be resuscitated [13].

The extent of the impact of prematurity may not be evident in infant mortality data because the data are dependent on hospitals' reporting practices, which may be influenced by definitions of live birth that differ from standard definitions used in health departments' reporting requirements. If gestational age and/or viability are factors in the reporting of live births, this can significantly influence neonatal mortality data.

Almost all 57 US reporting areas have reporting requirements that include a definition of live birth, and all reporting areas require the reporting of live births regardless of gestational age [14]. The 2011 Revision of the Model State Vital Statistics Act and Regulations [15] defines live birth as follows:

The complete expulsion or extraction from the mother of a product of human conception, irrespective of the duration of pregnancy, which, after such expulsion or extraction, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.

The Guidelines for Perinatal Care [16], which is published jointly by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists has the above definition with the underlined sentence omitted. The definition in the Guidelines for Perinatal Care is shared by most countries [17], and is in the reporting requirements of 41 reporting areas including NYC [14].

On the other hand, fetal death definitions and reporting requirements vary. Twelve reporting areas, including NYC, require the reporting of fetal death regardless of gestational age; 25 reporting areas require reporting at 20 or more weeks of gestation; and the other 20 areas have reporting requirements that includes gestational age and/or birth weight.

The aim of this study was to examine the statistical impact of differences in hospitals' reporting practices on the neonatal mortality rate in NYC. This was done by combining the data from a survey conducted in 2008 with the NYC linked live birth/neonatal death data set for 2007-2009.

Method

The study protocol was approved by the institutional review boards of both Binghamton University and New York City Department of Health and Mental Hygiene (NYCDOH). Data on hospital's reporting practices were extracted from a survey conducted in 2008 [18]. The survey data was collected using a 15-minute telephone interview of hospital administrators. Administrators in obstetrics and neonatology were selected for the survey if they were responsible for hospital reporting policies, were involved in the training of new physicians regarding reporting policies and were involved in the care of extremely premature infants.

The survey collected detailed information regarding the hospitals' resuscitation practices and policies. The survey also collected information on parental involvement in resuscitation decisions and the use of birth weight versus gestational age. The hospitals had similar resuscitation practices and policies, but there were differences in reporting practices that related to infants born at less than 23 weeks gestation. Based on the survey data, the hospitals were divided into two groups as outlined in table 1. Physicians who said gestational age was a component of their hospital's criteria for live birth, but also indicated that they followed the NYCDOH requirement to report all live births regardless of gestational age were included in group 1.

Hospital Group	Description	Regional Perinatal Centers	Level 3 Hospitals	Level 2 Hospitals
Group 1 (n=32)	Hospitals where the administrators provided hospital reporting practices that were in agreement with the reporting requirements of NYCDOH. These hospitals reported all live births regardless of gestational age.	10 31.25%	19 59.38%	3 9.37%
Group 2 (n=6)	Hospitals where administrators reported gestational age as part of their hospital's criteria for live birth reporting. The administrators in these hospitals reported that they did not follow the NYCDOH requirement to report all live births regardless of gestational age.	1 16.67%	4 66.66%	1 116.67%

Table 1: Groups of hospitals surveyed.

Data from the linked live birth/neonatal death data sets for 2007-2009 were obtained from NYCDOH. The neonatal death file was used because NYCDOH would not include the post neonatal deaths due to concerns that these cases were potentially identifiable. The data sets included information on mother's insurance coverage, mother's race, and the infant's gestational age at birth. The data sets from 2007-2009 were used to increase the number of data points for computing the neonatal mortality rates. Further, based on responses in the survey, 70% of the administrators interviewed had been in practice at their current hospital for at least six years.

Birthing locations that were not surveyed were removed from the data sets. This resulted in the exclusion of hospitals with no NICU, municipal hospitals, federal hospitals, birthing centers and births at home. The resulting data set contained 361,146 live births, which was 94% of all reported live births (93% of neonatal deaths) in NYC for the 3-year period.

New York State Department of Health classifies hospitals based on their level of neonatal care. Table 2, shows the types of maternity hospitals surveyed and the percent of physicians surveyed from each. More than 97% of the neonatologists surveyed were in charge of a NICU in either a regional perinatal center or a level three hospital; the ones most likely to care for extremely premature infants.

The hospital of birth was the basis of the calculation of mortality rates. This was done to ensure that the mortality rates for the regional perinatal centers were not inflated by the inclusion of infants born at other facilities and later transferred.

Results

For the hospitals where NYC reporting requirement was followed and all live births were reported regardless of gestational age (Group 1 hospitals) the NMR was 3.54 versus 2.68 for hospitals where gestational age was a factor in live birth reporting (Group 2 hospitals). This difference in NMR was statistically significant at 5% level of significance (p=0.0033). A two sample Z-test for proportions was used to illustrate the significant statistical difference. Based on the survey

	Neonatologists (%) (n=32)	Obstetricians (%) (n=26)
Response rate	94	67
Type of hospital		
Public	31	19
Voluntary	69	81
Perinatal level of care of hospital		
Level 2	3	4
Level 3	66	65
Regional perinatal center	31	31
Years in practice		
1-5 years	0	8
6-10 years	9	11
More than 10 years	91	81
Years at current hospital		
1-5 years	19	42
≥ 6 years	81	58

Table 2: Characteristics of physicians surveyed.

data, a gestational age of 23 weeks was the most consistent gestational age cut-off of the majority of physicians surveyed. For example, 97% of the neonatologists surveyed said they always resuscitate at gestational age of ≥ 23 weeks. Exclusion of infants born at less than 23 weeks gestation resulted in neonatal mortality rates of 2.77 and 2.53 for Group 1 and Group 2 hospitals respectively; a difference in NMR that was not statistically significant (Table 3). The response rate among the neonatologist was much higher than that of the obstetricians, with almost all neonatologists (94%) taking part in the survey. Use of only the responses from neonatologists resulted in an increase in the NMR among Group 1 hospitals (3.89 versus 2.68, p<0.0001).

	Group 1 Hospitals (Births/ Deaths)	Group 2 Hospitals (Births/ Deaths)	Difference (95% Two-Sided Confidence Interval)	P Value
Neonatal mortality rates when all neonatal deaths are considered	3.55 (326,385/1,157)	2.68 (34,761/93)	0.87 (0.29, 1.45)	0.0033
Neonatal mortality rates when infants born at less than 23 weeks gestation are excluded	2.77 (326,114/902)	2.53 (34,753/88)	0.24 (-0.32, 0.79)	0.41
Neonatal mortality rates when only the responses of neonatologists are used	3.89 (273,690/1,064)	2.68 (34,761/93)	1.21 (0.62, 1.80)	<0.0001

Table 3: Differences in neonatal mortality rates between hospital groups.

Demographic factors such as race and income are related to both infant mortality and prematurity. In 2004, almost 50% of the deaths of infants of non-Hispanic black mothers were prematurity related [19]. The extent to which differences in reporting practices impact this high rate is not known. A study of infant mortality using data from New York City maternity hospitals estimated that if black mothers delivered in the same hospitals as white mothers there would be a 34.5% reduction in the black/white disparity in very low birth weight neonatal deaths [20].

In our study, the NMR among white mothers was 34% lower in Group 2 hospitals than in Group 1 hospitals (Table 4); a reduction that was statistically significant (p=0.0032). For infants born to black mothers the NMR was 19.4% lower in group 2 hospitals than in group 1 hospitals, but this difference was not statistically significant (p=0.1793). We used insurance coverage as an indicator of income level; with use of Medicaid serving as an indicator of poverty status. The NMR among mothers with Medicaid in Group 1 hospitals was 1.5 times that of those in Group 2 hospitals (p<0.001).

	NMR Group 1 Hospitals (Births/ Deaths)	NMR Group 2 Hospitals (Births/Deaths)	Ratio (Group 1 / Group 2)	P Value
Mother's race				
Black	**5.67** (91,053/516)	**4.57** (7,447/34)	1.24	0.1793
White	**2.73** (182,276/497)	**1.80** (21,635/39)	1.51	0.0032
Other	**2.71** (53,056/144)	**3.52** (5,679/20)	0.77	0.3236
Mother's insurance				
Medicaid	**3.81** (175,058/667)	**2.54** (22,796/58)	1.5	0.0005
Non-Medicaid	**3.24** (151,327/490)	**2.93** (11,965/35)	1.11	0.5498
Gestational age				
<23 weeks	**940.96** (271/255)	**625.00** (8/5)	1.51	0.0658
23-27 weeks	**219.13** (2,154/472)	**242.42** (198/48)	0.9	0.1914
28-36 weeks	**5.87** (29,491/173)	**7.21** (3,328/24)	0.81	0.3799
>36 weeks	**0.65** (294,415/192)	**0.38** (31,220/12)	1.7	0.026

Table 4: Impact of race, insurance coverage and gestational age on NMR.

The NMR for black mothers was significantly higher than white mothers within each group of hospitals (Table 5). At 9.61 deaths per 1,000 live births, the NMR of non-Medicaid black mothers in Group 2 hospitals was higher than any other group; this NMR was 6 times that of white mothers not covered by Medicaid (p<0.001) and 5 times that of white mothers covered by Medicaid.

Study Limitations

Advances in NICU technology may be a factor impacting the data. Most (81%) of the maternity hospitals in NYC are either Regional Perinatal Centers (RPCs) or level 3 hospitals. Further, the majority (96%) of the hospitals included in this study were either RPCs or level 3 hospitals (Table 2). These high level hospitals have the technologies available to care for the most acutely ill infants. Therefore, it is likely that these hospitals will attempt to save more extremely premature infants. Despite the technological advances death rates remain high among extremely premature infants. Based on the 2007-2009 data set used, 92% of the infants born at less than 23 weeks gestation died within 24 hours of birth.

Fetal deaths at gestations of 18 weeks or more are reported to NYCDOH on a certificate of spontaneous termination. Examination of fetal deaths at ≥ 18 weeks gestation indicates the possibility that extremely premature infants that were not reported as live births by group two hospitals were reported as fetal deaths. This data was not analyzed for this study due to concerns regarding inconsistencies in the reporting of fetal deaths [21]. Based on the survey responses there was indication that some physicians who indicated lack of compliance

with live birth reporting requirements also lacked compliance with fetal death reporting requirements.

The data sets used for the study did not contain information on post neonatal deaths. However, it is unlikely that the inclusion of post neonatal deaths would have had a significant impact on the findings since the majority of the infants born at less than 23 weeks gestation did not make it to the post neonatal period. In addition, the analysis of the data sets with infants born at less than 23 weeks gestation excluded resulted in an insignificant difference between the two groups of hospitals (Table 3).

Discussion

This study highlights the impact of difference in reporting practices among maternity hospitals in NYC. As researchers continue to seek answers to the causes of the increase in premature births, the need for greater scrutiny of the data collection process becomes important [22]. A similar study that examines the impacts of reporting practices on a national basis could be very informative.

A study that conducted a regional comparison of infant mortality in England found that regional variation in physician reporting practices for infants born at less than 24 weeks gestation had an impact on infant mortality rates nationally [23].

This issue has international significance as well because of the high cost of prematurity and the high rates of prematurity internationally. Almost 10% of infants worldwide are born premature with the highest rates in Africa and North America [24].

Many large cities, including NYC, use the perinatal period of risk approach to address infant mortality rate. This model involves examination of births, infant deaths and fetal death. Unfortunately, fetal death is often not reported. New York City is one of only 12 reporting areas that require the reporting of fetal death regardless of gestational age. The underestimation of fetal death is a major issue internationally as well, making it difficult to accurately compare infant mortality rates of different countries [25]. In our study, 20% of the administrators surveyed indicated that gestational age and/or birth weight was part of their definition of fetal death, and therefore a factor in their fetal death reporting practices.

Though fetal death is underreported, it bears a portion of the high cost of prematurity. A study that examined costs at maternity hospitals in Michigan over a ten-year period found that the average cost of fetal deaths was $750 higher than the average cost of live births [26].

The data on the impact of race and insurance coverage (Table 5) led to questions that could not be answered based on the data used in this study. One such question is why Black mothers with Medicaid in Group 2 hospitals did not have an NMR comparable to white mothers with Medicaid. Answers could potentially lie in the attitudes of physicians or in racial differences in attitudes towards infant deaths. A qualitative study that includes chart reviews and physician consultations for all neonatal and fetal deaths in one year across all maternity hospitals could provide answers.

New York City is one of 57 reporting areas in the US. As a reporting area the population density and high concentration of high level hospitals makes monitoring of compliance by NYCDOH relatively efficient. As a result only a small number of hospitals indicated a lack of compliance with NYCDOH requirements for the reporting of the deaths of extremely premature infants. However, the difference in reporting practices still led to a significant difference in mortality rates. That the reporting of infant deaths among extremely premature infants accounts for most of the difference has important policy implications, which will hopefully be address by actions of the Centers for Disease Control and Prevention as authorized by the PREEMIE Act.

	Black NMR (Births/Deaths)	White NMR (Births/Deaths)	Ratio (Black NMR /White NMR)	P Value
Insurance				
Medicaid	5.08 (67,526/343)	2.83 (97934/277)	1.8	0.0001
Non-Medicaid	6.68 (30974/207)	2.44 (105,977/259)	2.73	0.0001
Hospitals				
Group 1	5.67 (91,053/516)	2.73 (182,276/497)	2.08	0.0001
Group 2	4.57 (7,447/34)	1.80 (21,635/39)	2.53	0.0009
Hospital and Insurance				
Group 1				
Medicaid	5.13 (61,848/317)	2.98 (84,313/251)	1.72	0.0001
Non-Medicaid	6.51 (29,205/190)	2.51 (97,963/246)	2.59	0.0001
Group 2				
Medicaid	4.58 (5,678/26)	1.91 (13,621/26)	2.4	0.006
Non-Medicaid	9.61 (1,769/17)	1.62 (8,014/13)	5.92	0.0007

Table 5: Within hospital differences in NMR based on race and insurance coverage.

References

1. Bureau of Vital Statistics (2010) Summary of vital statistics 2008 - The City of New York. Bureau of Vital Statistics, New York City Department of Health and Mental Hygiene, New York, USA.
2. Bureau of Vital Statistics (2008) Summary of vital statistics 2007 - The City of New York. Bureau of Vital Statistics, New York City Department of Health and Mental Hygiene, New York, USA.
3. Centers for Disease Control and Prevention (2011) Linked birth/infant death data set 2007-2010. Centers for Disease Control and Prevention, Atlanta, USA.
4. Volpe JJ (2009) Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. Lancet Neurol 8: 110-124.
5. Wood NS, Marlow N, Costeloe K, Gibson AT, Wilkinson AR (2000) Neurologic and developmental disability after extremely preterm birth. EPICure Study Group. N Engl J Med 343: 378-384.
6. Marlow N, Wolke D, Bracewell MA, Samara M, EPICure Study Group (2005) Neurologic and developmental disability at six years of age after extremely preterm birth. N Engl J Med 352: 9-19.
7. Behrman RE, Butler AS (2008) Preterm Birth - causes, consequences and prevention. Institute of Medicine (US) Committee on Understanding Premature Birth and Assuring Healthy Outcomes. National Academies Press, Washington DC, USA.
8. Russell RB, Green NS, Steiner CA, Meikle S, Howse JL, et al. (2007) Cost of hospitalization for preterm and low birth weight infants in the United States. Pediatrics 120: 1-9.
9. 109th Congress of the United States of America (2006) S. 707-The Prematurity Research Expansion and Education for Mothers who Deliver Infants Early Act, or "PREEMIE Act". Congress of the United States of America, Washington DC, USA.
10. 113th Congress of the United States of America (2013) S.252 - PREEMIE Reauthorization Act. Congress of the United States of America, Washington DC, USA.

11. Teasdale D (2007) Ethical decisions in fetal medicine and neonatal intensive care. Paediatr Nurs 19: 34-36.

12. Richmond S, Wyllie J (2010) European Resuscitation Council Guidelines for Resuscitation 2010 Section 7. Resuscitation of babies at birth. Resuscitation 81: 1389-1399.

13. Kattwinkel J, Perlman JM, Aziz K, Colby C, Fairchild K, et al. (2010) Part 15: neonatal resuscitation: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 122: 909-919.

14. Kowaleski J (1997) State definitions and reporting requirements - For live births, fetal deaths, and induced terminations of pregnancy 1997 revision. US Department of Health and Human Services. Centers for disease control and prevention. National Centre for Health Statistics. Hyattsville, Maryland, USA.

15. National Center for Health Statistics (2011) Model state vital statistics act and model state vital statistics regulations 2011 revision. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, Hyattsville, Maryland, USA.

16. Lockwood C, Lemons J (2007) Guidelines for Perinatal Care. (6thedn), American Academy of Pediatrics, Elk Grove Village, IL, USA.

17. United Nations Statistics Division (1985) Handbook of Vital Statistics Systems and Methods Volume II: Review of National Practices. United Nations Statistics Division, New York, USA.

18. Ramsay SM, Santella RM (2011) The definition of life: a survey of obstetricians and neonatologists in New York City hospitals regarding extremely premature births. Matern Child Health J 15: 446-452.

19. MacDorman MF, Callaghan WM, Mathews TJ, Hoyert DL, Kochanek KD (2007) Trends in preterm-related infant mortality by race and ethnicity, United States, 1999-2004. Int J Health Serv 37: 635-641.

20. Howell EA, Hebert P, Chatterjee S, Kleinman LC, Chassin MR (2008) Black/white differences in very low birth weight neonatal mortality rates among New York City hospitals. Pediatrics 121: 407-415.

21. Lee E, Toprani A, Begier E, Genovese A, Madsen A, et al. (2015). Implications for improving fetal death vital statistics: Connecting reporters' self-identified practices and barriers to third trimester fetal death data quality in New York City. Maternal and Child Health J.

22. Barfield WD, Committee on Fetus and Newborn (2011) Standard terminology for fetal, infant, and perinatal deaths. Pediatrics 128: 177-181.

23. Smith L, Draper ES, Manktelow BN, Pritchard C, Field DJ (2013) Comparing regional infant death rates: the influence of preterm births <24 weeks of gestation. Arch Dis Child Fetal Neonatal Ed 98: 103-107.

24. Beck S, Wojdyla D, Say L, Betran AP, Merialdi M, et al. (2010) The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. Bull World Health Organ 88: 31-38.

25. Frøen JF, Gordijn SJ, Abdel-Aleem H, Bergsjø P, Betran A, et al. (2009) Making stillbirths count, making numbers talk - issues in data collection for stillbirths. BMC Pregnancy Childbirth 9: 58.

26. Gold KJ, Sen A, Xu X (2013) Hospital costs associated with stillbirth delivery. Matern Child Health J 17: 1835-1841.