NEONATOLOGY TODAY

News and Information for BC/BE Neonatologists and Perinatologists

Volume 7 / Issue 2
February 2012

The Impact of Earmuffs on Vital Signs in a Neonatal Intensive Care Unit

By Rawia Abujarir, MD; Husam Salama, MD; William Greer, PhD; Mariam Al Thani, BSc; and Flenor Vlisda, RN

Introduction

The Neonatal Intensive Care Unit (NICU) is a place where humans and technology come together to produce a unique and sometimes unbearable level of noise that can cause a significant level of discomfort. Noise has been a major concern among neonatal professionals, who are concerned about the effect of noise on already compromised, fragile and helpless newborn infants.[1] In the past two decades, the survival rate of very low birth weight infants has dramatically improved.[2] However, as more of these preterm infants reach school age, the high incidence of neurodevelopmental problems is becoming more apparent[3] and there is growing concern that such problems may, in part, stem from an unfavorable neonatal intensive care unit (NICU) environment, particularly excessive noise exposure.[4,5]

The NICU is often characterized by loud and unpredictable noise from extraneous sources such as alarms, ventilators, telephones and staff conversations, air-handling units and visitors. Even the routine communication facilities and waste bin can produce significant disturbing abrupt noise to which pre-term infants are especially vulnerable.[4] In addition, the self-generated sound of the infant crying can be a significant source of noise, because loud sounds tend to be amplified within the incubator.[6,7] In a recently published study,[8] the author demonstrated a 40% increase in the noise level from the operation of a popular high-frequency oscillatory ventilator. In addition, it was demonstrated that just as double-walled incubators tend to keep outside noise away from the baby, so they also augment the noise generated from within the incubator itself .

There has been continual speculation that the intensive care environment itself may have a detrimental effect on the resident neonates, and this has been reflected by an increasing body of work supporting developmental care practice within the NICU.[9-12] The spectra of interventions and care packages in the NICU are aimed at improving the stability of the newborn infant by improving the long-term developmental outcomes based on the hypothesis that brain development is adversely affected by the surrounding environment.[9] The American Academy of Pediatrics recommended that noise level >45 dB is of concern. Ideally, as proposed by the US Environmental Protection Agency, a noise level exceeding 45 dB is best avoided.[9] Several strategies have been suggested to reduce the

> ***"Noise has been a major concern among neonatal professionals, who are concerned about the effect of noise on already compromised, fragile and helpless newborn infants.[1]"***

IN THIS ISSUE

The Impact of Earmuffs on Vital Signs in a Neonatal Intensive Care Unit
by Rawia Abujarir, MD; Husam Salama, MD; William Greer, PhD; Mariam Al Thani, BSc; and Flenor Vlisda, RN
Page 1

DEPARTMENTS

Medical News, Products & Information
Page 9

Physicians on the Move
Page 10

Global Neonatology Today Monthly Column
Page 11

NEONATOLOGY TODAY

Editorial and Subscription Offices
16 Cove Rd, Ste. 200
Westerly, RI 02891 USA
www.NeonatologyToday.net

Neonatology Today (NT) is a monthly newsletter for Neonatologists and Perinatologists that provides timely news and information regarding the care of newborns and the diagnosis and treatment of premature and/or sick infants.

Upcoming Medical Meetings
(See website for additional meetings)

Perinatal Pediatrics Spring Workshop 2012
Mar. 30-Apr. 1, 2012; Scottsdale, AZ, USA
www2.aap.org/sections/perinatal/Workshop/SW12.html

3rd International Conference on Clinical Neonatology
May 24-26, 2012; Torino Italy
www.tncneoconf.com

Recruitment Ads: Pages 3

direct effect of noise on patients in NICUs. One of these tools is using earmuffs to cover babies' ears. Although, using earmuffs has been advocated by many NICU centers, very little evidence-based literature is available to judge the validity of its application. In a review by Wachman and Lahav,[13] several researchers compared the effect of noise on heart rate, blood pressure and respiratory rates in full-term and pre-term infants. All showed negative effects on these vital signs. A few uncontrolled trials examined the effect of using an external ear barrier on the newborn stability.

Methods

Study Design and Exclusion Criteria: This was a controlled prospective study, conducted at a tertiary neonatal intensive care unit in the Women's Hospital (Doha, Qatar) during a period of three months from November 2009 until January 2010. The admission rate to the NICU is approximately 1,600 cases annually. All term and preterm infants older than or equal to 26 weeks' gestation newly admitted were included in the study. Patients with ear or face anomalies and neonatal encephalopathy, and those receiving inotropic support, regular sedation, or being ventilated with high frequency oscillation were excluded for the study. Also, parents had the right to exclude their infants.

Patient Recruitment and Randomization: The NICU was physically divided into two similar areas: Area A, for neonates assigned to the earmuffs (EM) group, and Area B, for neonates assigned to the non-earmuffs group (NEM) group. The two areas were exposed to similar noise levels contained the same number of incubators and staff, and provide similar (tertiary level) NICU patient care. During the study period, the nurse in charge strictly alternated all new admissions; infants meeting the selection criteria were recruited into the study. Infants in one area (EM) were allocated earmuffs, while those in the other area (NEM) would not. The earmuffs used in this study (Natus Medical) provided noise intensity reduction of 7dB, and they were applied to the infant's ears as recommended by the manufacturer. All infants inside the NICU received their care in double-walled incubators.

Data Capture: Data recording began as soon as the infants were admitted to their NICU incubator and ended 72 hours later. During this period, the infants' vital signs (heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate, temperature and oxygen saturation) were collected every hour from a multiple-channel monitor by a physician who transcribed these results into an Excel spreadsheet. The number of days of oxygen requirement and the "cry pain score" were observed and calculated manually and also entered into the same spreadsheet.

***Ethical Approval*:** This study was approved by the Human Research Ethics Committee of Hamad Hospital Corporation.

Data Analyses: The vital signs and associated variables were studied to assess the effects of earmuffs on neonates throughout their first 72 hours in the NICU. All variables were measured or assessed on an hourly basis and these values were entered into an Excel (Microsoft Corporation, USA) spreadsheets (one per variable), which were subsequently reorganized using JMP 8.0.2

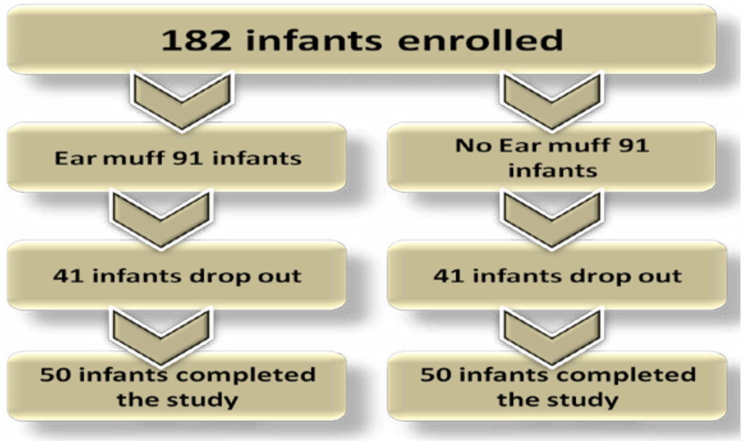

*Figure 1: Patient's recruitment progress. *The remaining 82 infants were excluded from the study because they were either transferred to stepped-down nursery care before the 72 hours period, received sedation drugs, inotropic support, their parents chose for their infants to wear earmuffs outside the study or the infant's condition required high frequency ventilation.*

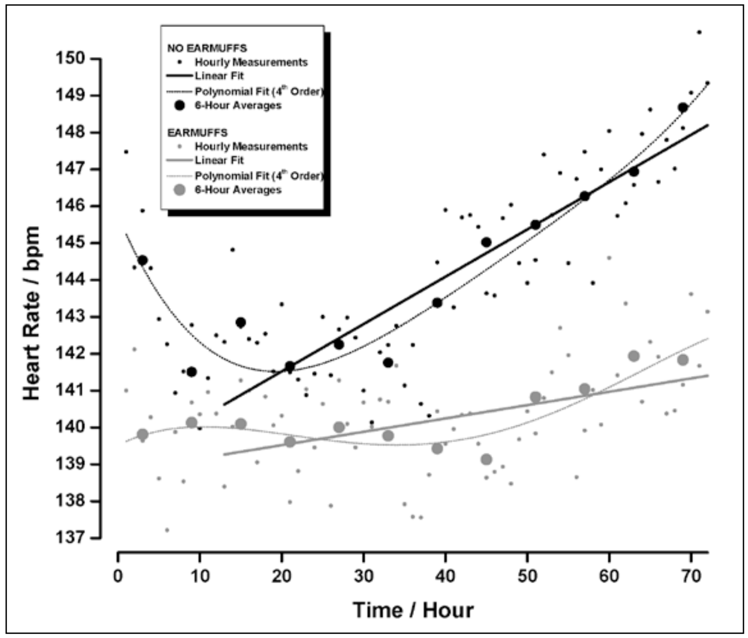

Figure 2: The time-course of heart rate for each group; also shown are the linear regressions through the EM and NEM groups.

Table 1: Comparison of Main Demographic Characteristics and Initial Characteristics Across Groups			
	EM	NEM	p
Infants	50	50	-
Male	22	34	0.026
Gestational Age	31.86 ± 4.44	30.90 ± 4.56	0.058
Birth Weight	1945.90 ± 905.2	1774.90 ± 854.5	0.038
Initial Conventional Mechanical Ventilation	14	20	0.291
Initial CPAP	20	14	0.291
Initial Oxygen Through Nasal Cannula	10	8	0.795
Surfactant Therapy	13	11	0.815

(SAS Institute Inc., USA) into datasets suitable for analysis. All statistical analyses were carried out within PASW Statistics 18 (IBM Inc., USA). Scientific plots and curve-fitting were carried out within OriginPro 8.1 (OriginLab Corporation). Continuous variables were expressed as means (±SD) and categorical data were expressed as proportions and/or percentages. Third or fourth-order polynomials were used to visualize and summarize the time-course of continuous variables and (where appropriate) linear regression analyses were subsequently used to compare the differences between groups by assessing the equality of their respective gradients. Fisher's Exact Test was used to compare the between-group proportions of demographic (binary categorical) variables. The independent t-test was used to assess the between-group differences of the initial 6-hour averages, the final 6-hour averages and their overall change during the 72-hour period. Hypotheses tests were regarded as statistically significant where $p<0.05$ and 95% confidence intervals were used throughout.

Results

Out of 312 infants admitted to NICU, 182 infants met the eligibility criteria and were included in the the study over a 3-month period (Figure 1); only 100 infants completed 72-hour period inside NICU, with 50 infants in each group. A comparison of the key demographic variables between the two groups is shown in Table 1. There were statistically significant differences between the gender proportions and birth-weights between groups, but not in gestational age. A between-group comparison of the baseline (i.e. average values over the first 6 hours) values reveals no statistically significant differences (Table 2).

The results for heart-rate (HR) up to 72 hours show a clearly increasing trend in the "No Earmuffs," which is lacking in the "Earmuffs" (EM) group, although this is complicated by an initial average decrease in HR for the first 12 hours in NEM patients (Figure 2). This decrease appears to bring both groups into a similar position at hour 13. From this point onwards, until 72 hours, there is a strikingly linear (and statistically significant) increase in HR among the NEM patients (gradient=0.128, SE=0.011) [$p<0.001$], compared to only a small increase in the EM patient group (gradient=0.036, SE=0.009) [$p= 0.001$].

Table 2: Intergroup Comparison for the Initial Six Hours Average of the Study			
	EM	NEM	P value
Heart-Rate (beat per minute)	139.81	144.53	0.1250
Diastolic Blood Pressure (mmH_2O)	36.15	35.23	0.5380
Systolic Blood Pressure (mmH_2O)	58.12	55.54	0.2780
Mean blood pressure (mmH_2O)	43.47	42.00	0.3753
Oxygen Saturation (%)	96.24	95.68	0.1700
Respiratory Rate (breath per minute)	54.54	57.44	0.2880
% Oxygen Requirement	36.67	31.00	0.5504
% Pain Free	67.67	74.67	0.4416

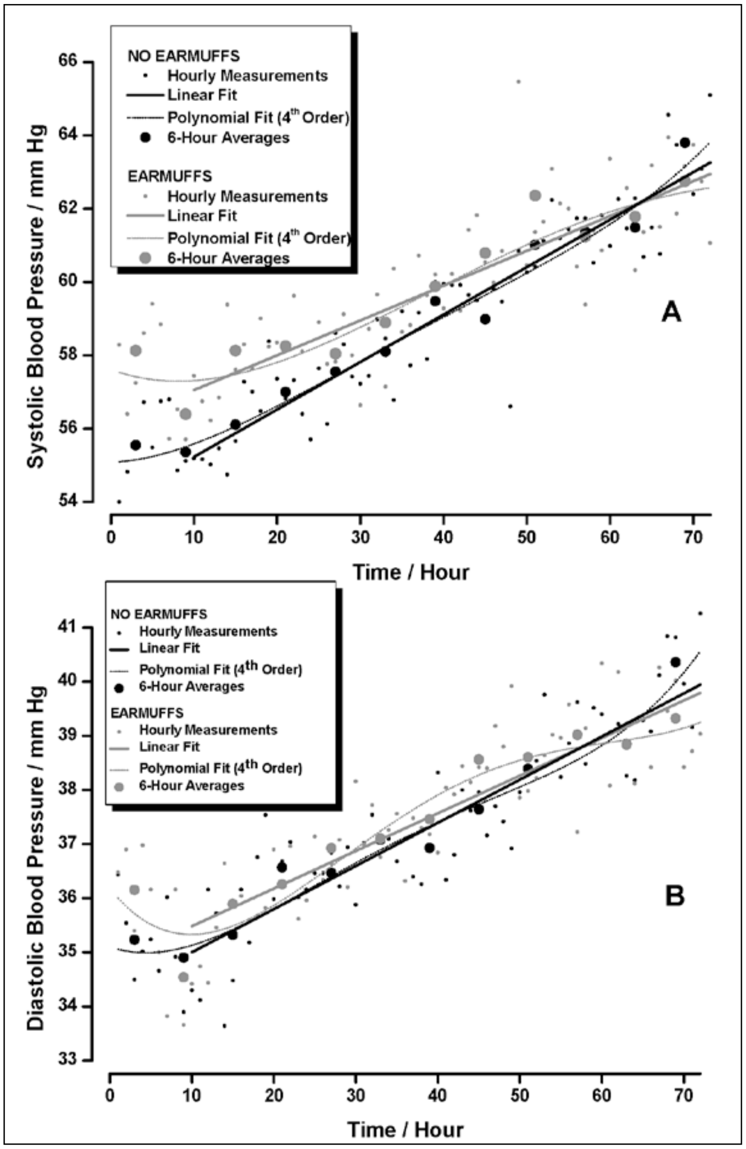

Figure 3: The time-course of (A) systolic and (B) diastolic blood pressure for each group; also shown are the linear regressions through the EM and NEM groups.

Over the same period of 72 hours, diastolic blood pressure increases at a similar rate in both the EM (gradient=0.069) and the NEM (gradient=0.079) groups (Figure 3A), although, once again, there appears to be an initial "settling-in" period of approximately 9 hours. There is no statistically significant difference between these gradients (p=0.16). After a similar initial delay, the systolic blood pressure also exhibits a linear rise (Figure 3B). Although the rise of systolic blood pressure within both the EM (gradient = 0.095) and the NEM (gradient=0.129) groups have different starting points, the statistically significant difference in their gradients (p<0.001) ensures that they reach a similar position by the end of 72 hours.

The average respiratory rate among the infants in the EM group remains lower than that in the NEM group throughout the entire 72-hour period. A 4th-order polynomial fit to the data (Figure 4) suggests that the average difference remains approximately constant during the entire 72 hour period, effectively synchronizing the two waveforms, but this difference is statistically different from zero (p=0.001).Temperature, on the other hand, fluctuated only very slightly during the study (Figure 5). It exhibits some evidence of a gradual reduction (mean of first 10-hours vs. last 10-hours), but there is no evidence of any mean-

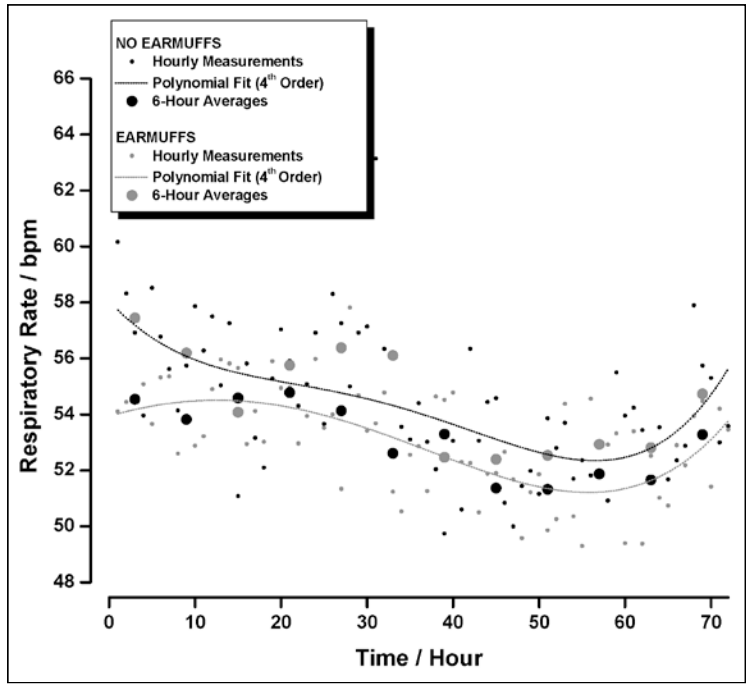

Figure 4: The time-course of the respiratory rate for each group.

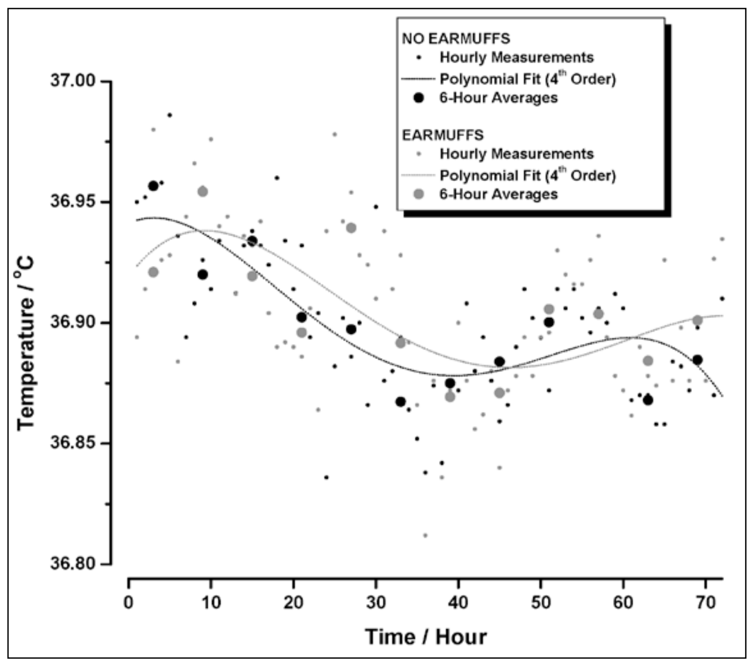

Figure 5: The time-course of the temperature for each group.

ingful difference between the two groups. The O_2 saturation does not display any initial settling-in period (Figure 6). The average O_2 saturation for the EM infants exhibits a slight linear increase (gradient=0.0097, p=0.04) across the entire range, while the linear trend for the NEM group is not statistically different from a constant value (gradient = -0.00035, p=0.505). The difference between these two gradients is statistically significant (p<0.001).

The infants' requirement for oxygen was initially categorized into five groups, in increasing order of importance: room air (RA), nasal cannulae (NC), nasal CAPA, conventional mechanical ventilation, and high-frequency ventilation; only one infant (NEM group) required high-

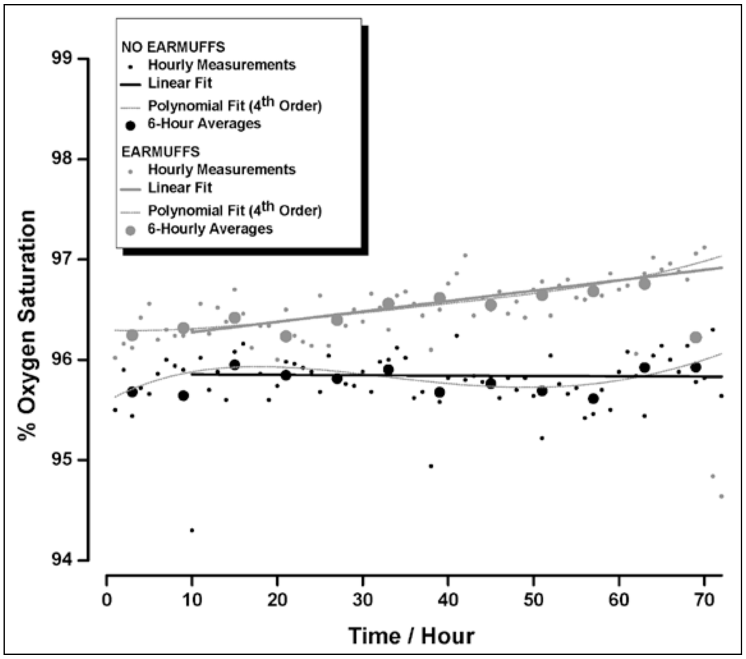

Figure 6: The time-course of % oxygen saturation for each group; also shown are the linear regressions through the EM and NEM groups.

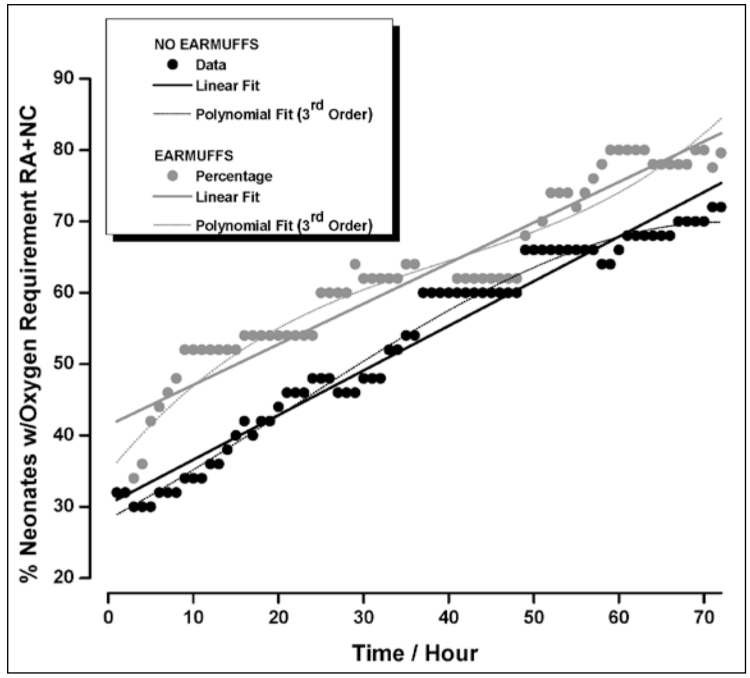

Figure 7: The time-course of the percentage of infants within each group who only required room-air and nasal cannulae; also shown are the linear regressions through the EM and NEM groups.

frequency ventilation. These five groups were subsequently collapsed into a binary variable which separated the first two groups (RA+NC), from the three "higher" groups; this specific threshold was selected so that the resulting binary variable would display the largest change across the 72-hour analysis period. The change in the percentage of infants within each group who only required RA+NC across their first 72 hours in the NICU is shown in Figure 7. The percentage of infants in both groups is initially similar at 30% but the percentage in the EM group quickly rose to more than 50% and then subsequently continues to rise almost linearly (gradient = 0.568) to approximately 80% at 72 hours. By contrast, the percentage of NEM infants rises almost linearly with a similar gradient (0.625) across the entire range, reaching a maximum of 72% at 72 hours. The difference between these gradients is statistically significant (p=0.0295). The initial change in oxygen requirement in the EM group appears to be primarily due to the larger number of infants who changed from nasal CAPA to nasal cannula.

The initial percentage of pain-free NEM infants (74%) was only slightly higher than among the EM infants (70%) (Figure 8), and for most of study, both groups appear to have followed a similar time-course, culminating in almost 95% of the infants in each group being pain-free at 72 hours. A summary comparison of all fitted lines is presented in Table 3.

Discussion

In this quasi-randomized prospective controlled study, the authors explored the effect of noise reduction using ear-muffs on the physiological patterns of different vital signs that are routinely and commonly monitored inside the NICU. Earmuffs were clearly demonstrated to have a beneficial effect on several important vital signs: heart-rate, systolic blood pressure,

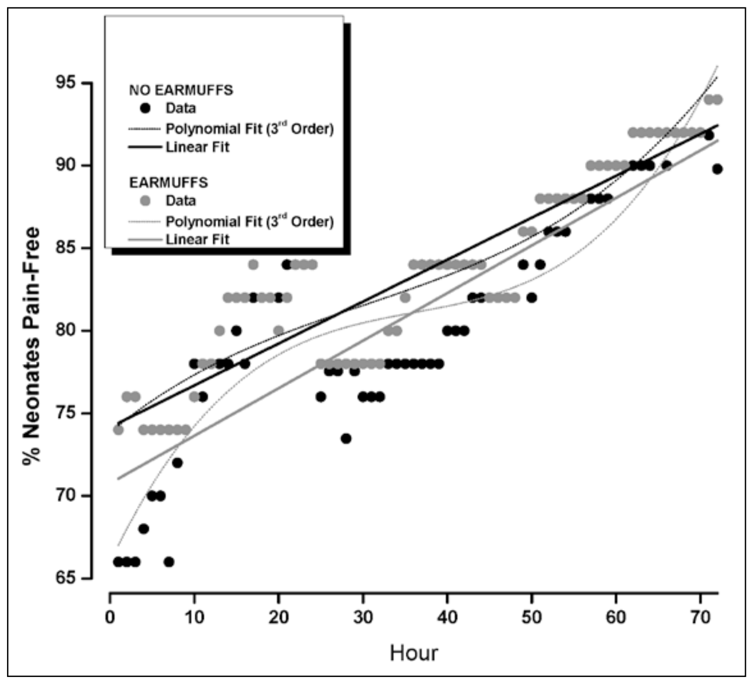

Figure 8: The time-course of the percentage of pain-free infants within each group; also shown are the linear regressions through the EM and NEM groups.

Table 3: Comparison of the Average Values of each Variable Across the Entire Study Period (72 hours) Between the EM and NEM Groups, and the Comparison of the Gradients of the Fitted Straight-lines Between These Two Groups					
	Total Average		Gradient		**P-value*
	EM	NEM	EM	NEM	
Heart Rate (beat per minute)	144.6 ±1.4	144±2.5	0.036 ±0,009	0.128±0.011	<0.001
Oxygen Saturation %	96.5±0.4	95.7±0.3	0.01±0.001	-3.5E-4±0.001	<0.001
Oxygen Requirement (days)	NA	NA	0.568±0.021	0.625±0.015	0.029
Systolic Blood Pressure	59.7±2.1	58.8±2.7	0.095±0.007	0.129±0.006	<0.001
Diastolic Blood Pressure	37.4±1.6	37.2±1.7	0.069±0.005	0.079±0.005	0.160
Mean Blood Pressure (mmHg)	44.8±1.7	44.4±2.0	0.08±.0.005	0.096±0.004	0.014
Respiratory Rate (breath per minute)	53.1±1.8	54.5±2.4	NA	NA	NA
Temperature (C◦)	36.9± .03	36.9± .03	NA	NA	NA
Cry Pain Score	NA	NA	10.288±.0.02	0.253±.0.013	0.144
The p-values refer to the comparison of the gradients.					

respiratory rate, O_2 saturation, and days of oxygen requirements. No significant difference was noted in blood pressure, pain score and/or temperature control between the two groups.

The observed rate of linear increase in heart rate was significantly reduced within the Earmuffs group, which also exhibited a similar significant decrease in systolic BP, although there was no evidence of any between-group effect for diastolic BP. The average RR in the EM group appeared lower than the NEM group for the entire 72-hour period, while temperature showed no significant difference between the two groups across the same time-period. Earmuffs also conferred a small but significant improvement in the gradual increase of the average O_2 saturation. Similar improvement due to earmuffs could also be seen in the infants' requirement for oxygen, although there appeared to be no sensible change in the pain-free index."

The thing to bear in mind is that because most vital signs show evidence of a trend across the 72-hour period, it would be misleading to compare the two treatments (EM vs NEM) by simply averaging all the measurements within the 72-hour period. Instead, since many of these measurements appear to exhibit an (approximately) linear trend, we have fitted linear models to these trends and compared the gradients of these models. Where the gradients are statistically significantly different indicates that one treatment has a more pronounced effect than the other.

It was noted during the first few hours that vital signs in both groups did not differ significantly; however, the difference was much more evident thereafter. This could, nevertheless, be explained during the first few hours inside the NICU, a sick infant would be handled more often and the infants needed more time for adaptation to extra uterine environment.

Synnes et al, demonstrated significant increase in incidence and severity of hearing impairment in a cohort of extreme low birth weight children from 5% to 13 % over a period of 24-year period.[14]

To combat noise exposure, the idea of small ear coverings for neonates was examined in by Zahr and Traversay where they compared 17 infants wearing ear-muffs with 13 infants from other hospitals as controls while they assessed their response to noise during intermittent intervals (3 hours/day) for 2 days; this study focused on oxygen saturation and sleep patterns, but the concept proved to have little measurable success in comparison to the risk, annoyance, and potential complications created by these devices for the premature infants on whom they were tested. They concluded that ear coverings may be beneficial in reducing noise for short-term events, they require a tight seal around the ear and long-term use introduces the potential for breakdown of the fragile skin of the neonate.[15] One recent observational study by Karlsson et al looked at the effect of sound and vibration on transported newborn infants, and showed a significantly lower heart rate in 17 infants wearing ear-muffs during their transportation period. Higher sound levels were found to be associated with a higher heart rate, which may reflect stress on the infant.[16]

Turk et al. used ear plugs on 34 very low birth weight infants to evaluate the effect of noise on their weight progress, showing a positive impact on weight gain.[17] In a review by Watchman and Lahav, several researchers compared the effect of noise on heart rate, blood pressure and respiratory rates in full-term and preterm infants, all showing a negative effect on these vital signs.[13] The current study focused on measuring the physiological effects of using earmuffs on the most common seven vital signs recorded inside the NICU continuously for longer period of time.

Limitations of the Study

The investigators overlooked the fact that the group wearing earmuffs had ones that reduce noise by 7-12 dB (the only type available in the market), instead of ones that reduce noise by 15 dB. It can be reasonably assumed that the latter would have reduced noise further. Mixing both premature infants with full-term infants did cause difference in gestation age and birth weight, although statistically significant in gestation age, such difference (1.7 week) is not clinically significant. The investigators did not dictate the length of stay of recruited infants inside the NICU as part of the unit policy to avoid over patient census.

"Based on the results presented in this paper, we are applying earmuffs routinely to all our infants admitted to our NICU in the Women's Hospital. A control trial should be conducted to assess the long-term outcome of using earmuffs on the neurodevelopmental outcome."

This caused a large number of drop out cases. The most common problem experienced among the infants in the earmuffed group was fitting the earmuffs to the ears and their frequent fall off. There were no reported cases of skin damage or infection in either group.

Conclusions

In this study, the authors were able to document the positive effect of wearing earmuffs in 4 common vital signs of sick newborn infants inside the NICU. As well, application of earmuffs was not associated with any skin problems. Based on the results presented in this paper, we are applying ear-muffs routinely to all our infants admitted to our NICU in the Women's Hospital. A control trial should be conducted to assess the long-term outcome of using earmuffs on the neurodevelopmental outcome.

References

1. A. Darcy, L.E. Hancock, E. Ware. A descriptive study of noise in the Neonatal Intensive Care Unit. Ambient levels and perceptions of contributing factors. Advances in Neonatal Care, (2008), 8(5)16–26.
2. A.A. Fanaroff, B.J. Stoll, L.L Wright, et al. Trends in neonatal morbidity and mortality for very low birth weight infants. Am J Obstet Gynecol, (2007),vol 196,147.
3. N. Marlow, D. Wolke, M.A. Bracewell. et al. Neurologic and developmental disability at six years of age after extremely preterm birth. N Engl J Med, (2005),3(52), 9–19.
4. J.M. Perlman. Neurobehavioral deficits in premature graduates of intensive care – potential medical and neonatal environmental risk factors. Pediatrics(2001)108:1339–48.
5. J.F. Byers, W.R.Waugh, L.B. Lowman. Sound level exposure of high-risk infants in different environmental conditions. Neonatal Netw, (2006), 25 25–32.
6. E. Altuncu, I. Akman, S. Kulekci. et al. Noise levels in neonatal intensive care unit and use of sound absorbing panel in the isolette. Int J Pediatr Otorhinolaryngo, (2009), 73, 951–3.
7. C.V. Bellieni, G. Buonocore, I. Pinto, N. Stacchini, D.M. Cordelli et al. Use of sound-absorbing panel to reduce noisy incubator reverberating effects. Biol Neonate, (2003), 84, 293–6.
8. H. Salama, A. Azzam, S. Al Omar, K. Abdulhadi. The Impact of Incubators on Noise Transmission produced by high-frequency oscillatory ventilation inside the Neonatal Intensive Care Unit. e-Journal of Neonatology Research, vol 1 (2011).
9. American Academy of Pediatrics. Committee on Environmental Health. Noise: A hazard for the fetus and newborn. Pediatrics, (1997) 100 (4).
10. S Laudert, W.F., Liu, S. Blackington, B. Perkins, S. Martin, E. MacMillan-York, Graven, J. Handyside. Implementing potentially better practices to support the neurodevelopment of infants in the NICU. Journal of Perinatology (2007), vol 27 75–93.
11. Environmental Protection Agency, Office of Noise Abatement and Control. (1974). Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety (Report no. 5509-74-004). Washington, DC: Government Printing Office.
12. K. Stromswold, E. Sheffield. NICU noise & language development. Rutgers University Center for Cognitive Science Technical Report. New Brunswick: Rutgers University. (2004).
13. E.M.Wachman, A. Lahav (2011). The effects of noise on preterm infants in the NICU. Arch Dis Child Fetal, 96(4) 3059.
14. AR. Synnes , S Anson, J Baum, L Usher. Incidence and pattern of hearing impairment in children with ≤800 g birthweight in British Columbia, Canada. Acta Paediatr. 2011 Sept.
15. L.K Zahr, J .de Traversay . Premature infant responses to noise reduction by earmuffs: effects on behavioral and physiological measures. J Perinatol, 1995, 15(6).
16. B-M. Karlsson, M. Lindkvist, M. Lindkvist, R. Lundström, S. Håkansson, W. Urba, J.van den berg. Sound and vibration: Effects on infants' heart rate and heart rate variability during neonatal transport. Acta Pædiatric Sept (2011).
17. A.C. Turk, A.L. Williams, R.E. Lasky. A randomized clinical trial evaluating silicone earplugs for very low birth weight newborns in intensive care. J Perinatol, (2009). 2009, 29, 358–363.

NT

Corresponding Author and Principal Investigator

Husam Salama, MD
Senior Consultant Neonatology
Department of Pediatrics
Women's Hospital
Hamad Medical Corporation
Assistant Professor - Weill Cornell Medical School
PO Box 3050
Doha, Qatar
Phone: +974 4393249
Fax: +974 4396142

Hsalama1@hmc.org.qa

Rawia Abujarir, MD
Department of Pediatrics
Women's Hospital
Hamad Medical Corporation
Doha, Qatar

William Greer, PhD
Department of Clinical Planning
Sidra Medical Research Center
Doha, Qatar

Mariam Al Thani, BSc
Department of Clinical Planning
Sidra Medical Research Center
Doha, Qatar

Flenor Visda, RN
Women's Hospital
Hamad Medical Corporation
Doha, Qatar

Medical News Products and Information

New Study Shows Promise for Preventing Preterm Births

A new study co-authored by the University of Kentucky's Dr. John O'Brien found that applying vaginal progesterone to women who are at a high risk of preterm birth significantly decreased the odds of a premature delivery.

The new study, published in the *American Journal of Obstetrics and Gynecology*, described a two-prong strategy used by doctors: participating pregnant women underwent a measurement of the cervical length via transvaginal cervical ultrasound to define risk for preterm birth; and those found to have a short cervix were successfully treated with vaginal progesterone. A short cervix — defined as a length of 25 millimeters or less — is a major risk factor for preterm birth.

Approximately 12.9 million births worldwide are preterm which is defined as less than 37 weeks of gestation. The United States has the highest rate of preterm births in the world. "Early" preterm births -- those less than 32 weeks -- are associated with a high rate of neonatal complications and long-term neurologic disability. "Late" preterm births (between 34 and 36-6/7 weeks) represent 70% of all preterm births; and although they have a lower rate of complications than early preterm births, they are still a major health care problem.

The study showed that the vaginal application of progesterone gel significantly reduces the rate of preterm birth in women at less than 33 weeks of gestation, but also is effective at less than 28, 32 and 35 weeks. This means that vaginal progesterone reduces both "early" and "late" preterm births.

Vaginal progesterone administered to women with a short cervix detected via ultrasound also reduced the rate of admissions to the Newborn Intensive Care Unit; Respiratory Distress Syndrome; the need for mechanical ventilation; and a composite score of complications that included intracranial hemorrhage, bowel problems, respiratory difficulties, infection and death.

O'Brien, Division Chief of Maternal-Fetal Medicine at UK, says the progesterone treatment is safe because the natural pregnancy hormone is made by the placenta and the ovaries during pregnancy.

"For too long, little progress has been made in the prevention of premature births," said O'Brien. "However, this new large study shows that it's possible to both help women determine if they are at risk for preterm birth, and provide a safe and effective treatment to help prevent preterm births."

World's Tiniest Preemies are Growing up and Doing Fine

In 1989, Madeline Mann became the world's smallest surviving baby after she was born at Loyola University Medical Center. She weighed 280 g. (9.9 oz.) -- about the size of an iPhone.

In 2004, Rumaisa Rahmam set a Guinness World Record after she was born at Loyola, weighing 260 g. (9.2 oz.).

Remarkably, Madeline and Rumaisa both have normal motor and language development, Loyola physicians wrote in a case report in *Pediatrics,* the official journal of the American Academy of Pediatrics. The article was published online Dec. 12th.

Rumaisa remains the world's smallest surviving baby, and Madeline now is the world's fourth smallest surviving baby, according to a registry kept by the University of Iowa Children's Hospital. Rumaisa and Madeline are the smallest and second smallest surviving babies born in the United States. Also, Rumaisa and her twin sister, Hiba, are the world's smallest surviving twins. (Hiba weighed 1 pound, 5 oz. at birth).

Of the 85 smallest surviving babies in the United States, three were born at Loyola and five others were cared for by physicians trained at Loyola.

Lead author Jonathan Muraskas, MD, and colleagues caution that successful outcomes such as Madeline and Rumaisa are not necessarily typical. Many extremely low-birthweight preemies either do not survive or grow up with severe, lifelong disabilities such as cerebral palsy, mental retardation and blindness.

Comparing other micropreemies with Madeline and Rumaisa could "propagate false expectations for families, caregivers and the medico-legal community alike," Muraskas and colleagues wrote.

Madeline and Rumaisa had several advantages. Female preemies tend to do better than males. They had relatively long gestational ages for their birthweights. And their mothers were given steroids before birth, which helped their lungs and brains mature more quickly.

During their pregnancies, Madeline's and Rumaisa's mothers experienced preeclampsia (pregnancy-induced high blood pressure). There was decreased blood flow through the placenta, which restricted the babies' growth. Madeline was born at 26 weeks, six days, and Rumaisa was born at 25 weeks, six days. Under normal conditions, it would take a fetus just 18 weeks to reach their birthweights.

Madeline spent 122 days in Loyola's neonatal intensive care unit, and Rumaisa spent 142 days. They each have met developmental milestones at appropriate ages. Rumaisa, 7, is a first grader, and Madeline, 22, is an honor student at Augustana College in Rock Island, Il. Both, however, remain small for their ages.

Advances in neonatal care have allowed the resuscitation and survival of smaller and smaller newborns, Muraskas and colleagues wrote. They suggest that at the threshold of viability, three critical factors should be considered: gestational age, steroid treatment before birth and female gender.

"With Japan lowering its limit of viability to 22 weeks and public fascination with micropreemies, how small is too small? The medical, ethical and economic issues will continue to be vigorously debated."

Muraskas is Co-Medical Director of Loyola's neonatal ICU, and a Professor in the Departments of Pediatrics and Obstetrics & Gynecology, Divisions of Neonatology and Maternal/Fetal Medicine, of Loyola University Chicago Stritch School of Medicine. Co-authors are: Brian J. Rau, MD; Patricia Rae Castillo, MD; John Gianopoulos, MD and Lauren Boyd, MD.

Physicians on The Move

Nationwide Children's Hospital Adds Three to Neonatology Team

Nationwide Children's Hospital welcomes three new neonatologists to the Section of Neonatology: Thomas Bartman, MD, PhD, Susan Lynch, MD, and Nehal Parikh, DO, MS.

Thomas Bartman, MD, PhD, joins Nationwide Children's as the Director of Quality Improvement for the Section of Neonatology and an associate professor of Pediatrics. Dr. Bartman will be responsible for directing and coordinating quality improvement efforts throughout Neonatal Services' 191 bed network. Currently, these efforts occur in conjunction with the Vermont Oxford Network (VON), the Children's Hospital Neonatal Consortium (CHNC), the Ohio Perinatal Quality Consortium (OPQC), the Neonatal Research Network (NRN) and the Ohio Better Birth Outcomes (OBBO), in addition to internal efforts on improving safety of care. His areas of initial focus will be on reducing medication errors, reducing the readmission rate for recently discharged newborns and assisting OBBO in reducing the prematurity rate in our region. Dr. Bartman will also work with senior leadership to teach other Nationwide Children's faculty and employees about Quality Improvement Science.

He completed his pediatric residency and neonatal-perinatal medicine fellowship at The University of California, San Francisco (UCSF). His postdoctoral research, completed at UCSF's Cardiovascular Research Institute, focused on using zebrafish to discover that biomechanical forces in the developing embryonic heart control later steps of structural development. He continued his research founding the zebrafish research program at Cincinnati Children's Hospital and authored numerous peer reviewed publications and research studies.

Susan Lynch, MD, comes to Nationwide Children's and will serve as the Director of the Comprehensive Center for Bronchopulmonary Dysplasia (CCBPD) and an Associate Professor of Pediatrics. The CCBPD is comprised of an interdisciplinary team that addresses the medical, nutritional, developmental and social needs of patients and families in a single medical home. She completed her pediatric residency and a fellowship in neonatology and perinatal medicine at West Virginia School of Medicine. She has authored several professional publications on neonates with sleep disorders, hypotension and bronchopulmonary dysplasia among others.

Nehal Parikh, DO, MS, joins Nationwide Children's as a principal investigator in the Center for Perinatal Research of The Research Institute and as an associate professor of Pediatrics. His goal is to eliminate the neurodevelopmental disabilities that occur in the vast majority of very preterm infants. His lab focuses on developing accurate and reliable brain segmentation methods for advanced brain MRI, and employing epidemiologic principles to elucidate the etiology, pathogenesis and diagnosis of perinatal-neonatal brain injury in high-risk preterm and term infants.

He completed his pediatrics residency at Winthrop University Hospital of State University of New York at Stony Brook. Following his residency, Dr. Parikh completed a fellowship in neonatal-perinatal medicine at Thomas Jefferson University Hospital in Philadelphia and received an MS in Clinical Research from University of Texas Health Science Center at Houston. His research has been cited by the American Academy of Pediatrics, featured by NIH (NICHD web-based Outcomes Estimator) and published in the *New England Journal of Medicine*, *Pediatrics* and other widely cited journals. He is a study sub-committee member and site principal investigator for the NICHD Late Hypothermia Trial for newborns with hypoxic-ischemic encephalopathy.

"I am thrilled to welcome these world-class physicians to the Neonatology team here at Nationwide Children's Hospital," said Edward Shepherd, MD, Chief of the Section of Neonatology. "Each will be a valuable part of our team as we work toward not only treating, but ultimately preventing, all complications of prematurity, including BPD and neurodevelopmental abnormalities and ensuring quality standards in our NICUs."

The Section of Neonatology at Nationwide Children's Hospital has become one of the largest neonatal networks in the country. The main goal of this Section is to establish the resources and expertise necessary to provide extraordinary, family-centered care. Each program within the Section provides state-of-the-art capabilities for the diagnosis, treatment and follow-up of extremely premature and medically fragile neonates.

Global Neonatology Today Monthly Column - Millennium Development Goals: What's Happening in Russia?

By Dharmapuri Vidyasagar, MD, FAAP, FCCM

As one would expect, the United Nations Millennium Development Goals (MDGs) of Russia are the same as those prescribed by WHO (World Health Organization) in 1990:

- To reduce the mortality rate of children under five by at least 50% by 2015, as compared with 1990 (from 21.5 to 11 per 1000).
- To reduce maternal mortality by at least 50% in the period 1990-2015.

However, there are some difficulties in interpretation of data from Russia, as noted by United Nations Development Programme (UNDP). For example, Russia has not yet switched to the WHO's definition of "live birth," resulting in a problem of comparison with the European Union (EU), as well as with world statistics. The 1992 WHO definition of "live birth" is: the complete expulsion or extraction from its 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.

The "Soviet" definition of live birth excludes infants less than 28 weeks gestation and infants weighing less than 1000 gms, or with body length less than 35 cm. The "Soviet" definition also excludes infants outside these parameters who live less than seven days.

It is also important to note that the pregnancy term cannot always be accurately measured, and midwives may give varying estimates. Introduction of the WHO's definition is also impeded by the fact that, according to the Russian definition, breathing is the sole criterion of life. Because of these discrepancies, some children, who would be deemed live-born in other counties, are deemed still-born in Russia, and are not included in infant death statistics. Thus, monitoring of IMR (Infant Morality Rate) trend in Russia, and comparing it with other countries of the world is difficult.

According to WHO, IMR in Russia is understated by 12%, but estimates made using other approaches indicate that up to a third of all infant deaths may be unregistered. The official position of the Ministry of Health and Social Development is that the under-reporting is around 10-15%. An indicator that can be used in view of incomplete registration of IMR in Russia is an overall count that includes both infant mortality and still-births.

Source: National Human Development Report in the Russian Federation, 2010; Millennium Development Goals in Russia: Looking into the Future Moscow 2010 - www.undp.ru/nhdr2010/National_Human_Development_Report_in_the_RF_2010_ENG.pdf

The 2010 National Human Development Report (NHDR) for the Russian Federation has been prepared by a team of Russian experts and consultants. The analysis and policy recommendations in this report do not necessarily reflect the views of the UN and other institutions by which the experts and consultants are employed. Chief Author: Prof. Sergey N. Bobylev, Dr. Sc. (Economics), Faculty of Economics at Lomonosov Moscow State University; Chapter 5. Reduction of Child Mortality and Better Maternal Care. Health Priorities for Russia Alexey V. Bobrik, PhD (Medicine), Executive Director, Open Health Institute Foundation.

The Clock is Ticking !!!

NT

Dharmapuri Vidyasagar, MD, FAAP, FCCM
University of Illinois at Chicago
Professor Emeritus Pediatrics
Division of Neonatology
Phone: +312.996.4185
Fax: +312.413.7901
dvsagarmd@yahoo.com

NEONATOLOGY TODAY

ISSN: 1932-7129 (print); 1932-7137 (online). Published monthly.

Publishing Management
Tony Carlson, *Founder & Senior Editor*
Richard Koulbanis, *Publisher & Editor-in-Chief*
John W. Moore, MD, MPH, *Medical Editor*

FREE Subscription - Qualified Professionals
Neonatology Today is available free to qualified medical professionals worldwide in neonatology and perinatology. International editions available in electronic PDF file only; North American edition available in print. Send an email to: SUBS@Neonate.biz. Include your name, title(s), organization, address, phone, fax and email.

Manuscript Submissions
Send your manuscript to:
RichardK@Neonate.biz

Sponsorships and Recruitment Advertising
For information on sponsorships or recruitment advertising call Tony Carlson at 301.279.2005 or send an email to TCarlsonmd@gmail.com

824 Elmcroft Blvd., Ste. M
Rockville, MD 20850 USA
Tel: +1.301.279.2005; Fax: +1.240.465.0692
www.NeonatologyToday.net

From the Maker of Enfamil Products

#1 ENFAMIL #1 BRAND RECOMMENDED BY PEDIATRICIANS

NICU Innovation—strengthened by the power of protein

Innovation inspired by experts. Convenience designed for you.

Enfamil® Human Milk Fortifier Acidified Liquid

- 4 g protein/100 Cal when mixed with preterm human breast milk (25 mL)
- Commercially sterile, single-dose packaging meets ADA and CDC infant feeding preparation guidelines[1,2*]

Enfamil® Premature 30 Cal

- Customized nutrition to help meet the needs of the smallest infants
- One-step mixing with Enfamil® Premature High Protein 24 Cal for adjustment of caloric density and protein levels

Enfamil® Premature High Protein 24 Cal

- 3.5 g protein/100 Cal—to help meet the needs of rapidly growing VLBW and ELBW infants who may require high protein formula

Trust the Enfamil® portfolio of NICU products to meet the nutritional needs of your patients

ADA = American Dietetic Association
CDC = Centers for Disease Control and Prevention
VLBW = very low birth weight
ELBW = extremely low birth weight
*No endorsement of this product by the ADA or CDC is intended or implied.

References: 1. Steele C, et al. Microbiology and Infection Control. In: Robbins ST, et al eds. *Infant Feedings: Guidelines for Preparation of Human Milk and Formula in Health Care Facilities.* 2011;108-121. **2.** Baker RD. *Pediatrics*. 2002;110:833-835.

MeadJohnson™ Nutrition

HOSPITAL FEEDING SYSTEMS

Mead Johnson Nutrition... dedicated to pediatric nutrition