



Observations and Recommendations Regarding the Neonatal Intensive Care Units at Rafidia Hospital and the Palestine Medical Complex

**PALESTINIAN HEALTH SECTOR REFORM AND
DEVELOPMENT PROJECT (FLAGSHIP PROJECT)**

SHORT-TERM TECHNICAL ASSISTANCE REPORT (FINAL)

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The Flagship Project

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ACRONYMS

BP – Blood Pressure

CMV – Conventional Mechanical Ventilation

CPAP – Continuous Positive Airway Pressure

ECMO – Extra Corporeal Membrane Oxygenation

Fr – French (unit of tubing diameter)

HFJV – High Frequency Jet Ventilation

HFOV – High Frequency Oscillatory Ventilation

ICU – Intensive Care Unit

IMV – Intermittent Mandatory Ventilation

IPPV – Intermittent Positive Pressure Ventilation

LLUCH – Loma Linda University Children’s Hospital

NICU – Neonatal Intensive Care Unit

NRP – Neonatal Resuscitation Program

PICC – Percutaneously Inserted Central Catheter

PICU – Pediatric Intensive Care Unit

PMC – Palestine Medical Complex

RH – Rafidia Hospital

RGH – Ramallah General Hospital

RN – Registered Nurse

RT – Respiratory Therapist

SIMV – Synchronized Intermittent Mandatory Ventilation

USAID – United States Agency for International Development

ABSTRACT

The consultant is a Professor of Pediatrics in Neonatology at Loma Linda University School of Medicine and a practicing neonatologist at Loma Linda University Children's Hospital. He consulted for the USAID/Flagship Project in Ramallah from July 4 – 24, 2010 as part of a neonatal intensive care unit (NICU) consultant team comprised also of a clinical nurse educator and respiratory therapist.

The consultant spent the first half of the consultancy evaluating the current status of the neonatal intensive care services at Rafidia Hospital in Nablus. The consultant provided technical advice to improve care at the NICU. The consultant provided educational lectures for staff and bedside education for the medical staff, residents, and nursing staff regarding care of the high risk neonate, infection control, communication, high frequency ventilation, and early enteral nutrition.

The consultant spent the second half of the consultancy at the Palestine Medical Complex (PMC) in both the NICU at Ramallah General Hospital (RGH) and the Children's Wing. The consultant participated in the morning report with the faculty and residents and in the daily rounds in the NICU at RGH. In addition, the consultant provided educational lectures for staff and bedside education for the medical staff, residents, and nursing staff regarding care of the high risk neonate, infection control, and gestational age assessment.

The consultant had multiple discussions with the Flagship Project staff and the NICU consulting team regarding the Project, how to continue with assistance, and how to improve NICU services at RH and the PMC.

SUMMARY OF RECOMMENDATIONS

Recommendations are presented in two categories: first, those that are feasible in the near-term and compatible with Flagship Project plans; and second, those that could benefit the quality of clinical services but are constrained at the current time by budgetary or other circumstances.

Recommendations for the Near-Term

1. Help both RH and PMC develop protocols, policies, and procedures for basic and advanced neonatal care.
2. Reinforce with hospital staffs the process for obtaining needed equipment and supplies through the approved MoH procedures.
3. Place a Blood Gas Analyzer in the NICUs at RH and PMC and train a staff member (e.g., nurse) to operate it and be responsible for blood gas testing.
4. Identify possible sources to acquire some basic equipment and supplies for both RH and PMC to better support the NICU:
 - a. Diaper Scales
 - b. Neonatal Pulse Oximeter Probes
 - c. Neonatal Oxygen Cannulae
 - d. Sterile Water
 - e. Oxygen Blenders
 - f. Alcohol Cleansing Units – for hand hygiene

Other Recommendations

5. Identify physicians to receive additional subspecialty training in neonatology for both RH and PMC.
6. Improve nurse to patient ratios in the NICU.
7. Develop ancillary support personnel for cleaning and stocking in the NICU at RH and PMC.
8. Develop interdisciplinary team building between physicians, nurses, and respiratory care.

SECTION I: INTRODUCTION

The Flagship Project is a five-year initiative funded by the U.S. Agency for International Development (USAID), designed and implemented in close collaboration with the Palestinian Ministry of Health (MoH). The Project's main objective is to support the MoH, selected non-governmental organizations, and selected educational and professional institutions in strengthening their institutional capacities and performance to support a functional and democratic Palestinian health sector able to meet its priority public health needs. The Project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

This consultancy was to assess the current status of neonatal intensive care in RH and PMC. It also provided education to the clinical staff (MD, RN) in both of these institutions. The assessment was used to create recommendations to improve the status of neonatal intensive care in these MoH hospitals.

This report contributes to Flagship Project Component 2, Objective 2.1 of the Flagship Project: *Improving the Quality of Essential Health Services for Palestinians*. This consultancy also contributed to the MoH IDP module number 1, *Create a Center of Excellence at the Palestine Medical Complex*; and module number 12, *Improve the Quality of Clinical Services in the Palestinian MoH Hospital System*.

SECTION II: ACTIVITIES CONDUCTED

The consultancy included daily clinical rounds in the RH and PMC NICUs. Additionally, the consultant provided didactic and interactive education with the physician (RH and PMC), nursing (RH and PMC), and respiratory therapy staffs (PMC). Several lectures were presented, including:

- Handwashing
- ECMO
- Chronic Lung Disease
- Oxygen Therapy Devices with Emphasis on the Oxyhood and Nasal Cannula

The consultant spent time with the Pediatric Department Heads at both RH and PMC. Processes to improve neonatal care and develop protocols were discussed. The consultant provided copies of numerous clinical guidelines and policies from Loma Linda University Children's Hospital (LLUCH) to the Flagship Project for later distribution to the hospital staffs. Focused discussions occurred on the topics of Thermoregulation and Infection Control and policies for those topics are appended to this report as a basis that could be adopted.

Plans for a new NICU at PMC were reviewed with Dr. Meriam Albasser, MD, Director of Pediatrics. The consultant also showed and discussed with Dr. Meriam a set of schematic drawings of the current LLUCH NICU. The functionality and flexibility that was part of the design of this unit was discussed. The consultant recommends for the new unit a minimum of 4 sinks, wide availability of alcohol cleansing stations, a minimum of 2 sets of gas outlets per patient, (3 sets of gas outlets per patient would be better), and a minimum of 12 electrical outlets per patient.

SECTION III: FINDINGS, CHALLENGES, RECOMMENDATIONS, AND NEXT STEPS

A. Findings

Many of the findings of this consultant had been previously noted by the Flagship Project and by prior consultants. They are reiterated here to re-validate them and to encourage the continuing efforts toward filling the identified needs.

1. Neonatologists – The PMC medical staff includes pediatricians that have some neonatology training, however neither the RH or PMC has a fully-trained neonatologist on staff.
2. Monitors – There is not a cardiorespiratory monitor for each baby in the NICU at either RH or PMC. Some of the monitors that are present are not being used, apparently because of faulty operation or staff not familiar with the equipment.
3. Nursing staff is currently as follows:
 - a. RH – Nurse : Baby ratio 1:7 – 1:10
 - b. PMC – Nurse : Baby ratio 1:4
 - c. Nursing personnel also perform non-nursing tasks, e.g. cleaning, stocking of supplies, in addition to their nursing responsibilities.
4. Facilities and Practice for Hand Hygiene – Hand hygiene practice in both RH and PMC would benefit with the addition of sinks and a consistent supply of soap and towels. At RH, garbage cans require the user to lift the lid of the can by hand in order to dispose of the towel that just dried the clean hand.
5. The consultant frequently noted absence or shortage of basic supplies and equipment that are necessary to implement best practices. Notable examples relevant to neonatal care services are:
 - a. Sterile water for ventilator humidifiers and isolettes. It would significantly improve the care delivered to high risk, critically ill infants to have sterile water for both the ventilator humidifiers and the isolettes.
 - b. Oxygen Blenders were not observed in use at any time during the consultancy. This means that anytime an infant requires oxygen without mechanical ventilator support, they are receiving 100% oxygen. Use of 100% oxygen has been shown to increase both mortality and morbidity.
 - c. Neonatal Nasal Cannulae – Both RH and PMC are using oxygen hoods for the delivery of oxygen that does not require pressure support (i.e., either CPAP or mechanical ventilation). Oxygen hoods deliver oxygen inconsistently. It is easy to deliver inadequate flow through the hood and develop increased carbon dioxide retention in the baby.
 - d. Pulse Oximeter Probes – It was observed that pediatric clip-on probes were used, instead of neonate-sized, which severely bruises infant's hands, arms, feet, and legs. Neonatal-sized pulse oximeter probes were not stocked in either RH or the PMC.

- e. Umbilical Arterial Catheters – Neither RH or PMC have umbilical arterial catheters (UAs).
 - f. Diaper Scales – Staff have no means of recording urine output, and thus cannot monitor accurate intake and output. Diaper scales are a quick and effective method of measuring patient output.
 - g. Percutaneously Inserted Central Catheters – Neither RH or PMC utilize PICC catheters.
6. High Frequency Ventilators – RH has a HFOV but this ventilator is not being used. It is recommended that this ventilator not be used until staff are fully trained to use it.
 7. Physician Rotation Schedule – At RH the physicians each take care of their own patients. At the PMC the physician who rounds in the NICU changes each day. With different physicians every day, the quality of care is inconsistent because there is no overall lead to direct patient care. Residents may also become confused when the specialists' approaches to management vary.
 8. Clinical Laboratory Services – Laboratory services are sometimes not available around the clock, due to staffing constraints.
 9. Neonatal Resuscitation Program Instructor – Staff would benefit from being trained in the NRP. There are currently no NRP trained care givers in either RH or PMC. A train-the-trainer model would be most effective to identify and certify a select group to become instructors, who will in turn provide education for the other staff.
 10. Respiratory Therapist – The PMC has a single respiratory therapist for all of its entities. RH has no respiratory therapist at all. Respiratory therapy is a new discipline in the West Bank. The consultant observed that the NICU and pediatric staff see the value of this role.
 11. Policies – There do not appear to be any written clinical guidelines and procedures for routine care in either RH or PMC NICUs. The consultant provided sample policies, including those related to thermal regulation and hand hygiene.
 12. Team Building – The consultant's observation was that nurses, physicians, and other paramedical personnel sometimes functioned independently, without an interdisciplinary, collaborative approach. The NICU consultants attempted to model effective interdisciplinary communication and collaborative interaction.

B. Challenges

The challenges identified by this consultant parallel many of the findings noted above; and the recommendations enumerated in the next section flow out of the challenges.

Two major challenges encompass many of the particulars. They are

1. Shortage or lack of resources, human as well as material. Implementation of best practices is seriously hampered when proper equipment is not available for monitoring, for example,

and when staffing shortages are severe enough that patients cannot be properly attended to. Even the very best trained and most highly motivated nurses, for example, cannot properly care for 7-10 critically ill patients as they are sometimes required to do at both RH and PMC.

2. Limited sub-specialty expertise. Neonatal intensive care is a highly specialized and technical field that required skills, knowledge, and trainings beyond general pediatrics. Physicians and nurses require specific trainings in order to implement best practices in an NICU. The MoH is currently challenged in finding the means and resources to provide such trainings for physicians, nurses, and paramedical personnel such as respiratory therapists.

C. Recommendations

1. Indigenous neonatologists would significantly enhance the quality of neonatal services. Although hiring or trainings these sub-specialists is not a feasible prospect at this time, it is a valid long-term goal and efforts should be made toward first steps.
2. Continue to implement trainings and workshops to promote best practices in Infection Prevention and Control.
3. Shortages of nurse staffing could be partially alleviated by training other paramedical staff to perform some of the non-nursing functions that nurses are currently performing; e.g., clean isolettes, and restock supplies for each shift in the NICU.
4. High Frequency Oscillating Ventilators – Neither RH or PMC provide care for the types of patients who benefit from this modality. Some patients might benefit from high frequency jet ventilation, but first would need substantially more training in this modality before applying its use. . The HFOV might have better utilization elsewhere.
5. As previous consultants have identified, care could be enhanced in the NICU with more supplies and equipment. Efforts should be continued toward finding sources for the following items:
 - a. Both RH and PMC need a monitor for every patient in the NICU
 - b. Both RH and PMC need Umbilical Arterial Catheters 3.5 and 5 French
 - c. Both RH and PMC need neonatal pulse oximeter probes
 - d. Both RH and PMC need neonatal oxygen cannulae
 - e. Both RH and PMC need to have and use oxygen blenders to regulate oxygen delivery to the minimal amount that is needed rather than 100% oxygen
 - f. Both RH and PMC need to have sterile water readily available for both ventilator humidifiers and isolettes
 - g. RH – needs foot operated garbage cans
 - h. Both RH and PMC need alcohol cleansing units for hand hygiene throughout the NICU.
6. Work to improve Nurse:Baby ratios. While the ideal for NICUs is 1:2, even a 1:3 ratio would significantly improve care for critically ill newborns.

7. Develop at PMC a physician rotation schedule that promotes continuity care
8. Place a Blood Gas Analyzer in the NICUs at RH and PMC.
9. Develop NICU Policies, with first priority given to:
 - a. Hand Hygiene
 - b. Thermoregulation
 - c. Care of umbilical arterial catheter
10. Assess the possibility of assisting in the development of the respiratory therapy discipline in the MoH and West Bank.
 - a. Since the consultancy, PMC has begun some utilization of the single RT who is present at the PMC.
 - b. Potentially the Flagship Project could utilize the PMC RT as a consultant for the development of respiratory therapy utilization in the West Bank.
11. Continue to promote and encourage interdisciplinary team building. This could include:
 - a. Weekly Joint Physician/Nurses Rounds to discuss new or difficult cases
 - b. Monthly Journal Club
 - c. Daily Physician/Nurse rounds in the NICU
12. As circumstances allow, consider future NICU Consultants
 - a. It is important for the consultants to come as a team to model effective communication and collaboration. The consultants would also build upon the efforts begun by this consultant. The team would include:
 - i. Neonatologist
 - ii. Nurse
 - iii. Respiratory Therapist
 - iv. Consider a Neonatal Nurse Practitioner
 - b. Team should include members who can train local trainers for NRP, writing protocols, teach PICC line insertion and care, etc
 - c. Have the new local instructors train and certify all the care givers (MD, RN, RRT) in NICUs.
 - d. Embed the team in Nablus for several weeks to maximize their time spent with RH.

D. Next Steps

Of the recommendations above, the consultant advises that the most important for rapid implementation are

1. Encourage and facilitating development of policies for Hand Hygiene and Thermoregulation. The consultant provided protocols for each that could serve as models for policies (Annex E).

2. Develop a system for interdisciplinary team building, which may include:
 - a. Weekly Joint Physician/Nurses Rounds to discuss new or difficult cases
 - b. Monthly Journal Club
 - c. Daily Physician/Nurse rounds in the NICU
3. Encourage and facilitate developing a Hand Hygiene Policy in RH and PMC. This needs to include goals, a means to follow-up with compliance, and a reporting mechanism so that all care givers (MDs, RNs, etc) will know corporate compliance. The consultant provided a Hand Hygiene Protocol that could serve as a model for a policy (Annex E).
4. Encourage and facilitate developing a Thermoregulation Policy. The consultant provided a Protocol (Annex E) that could serve as a model for policy.to give them a template to do this.
5. Pursue ways to provide the most needed supplies, including sterile water for humidification, oxygen blenders, and diaper scales.

ANNEX A: SCOPE OF WORK

Short-Term Consultancy Agreement Scope of Work

SOW Title: Neonatology Consultancy

SOW Date: May 19, 2010

SOW Status: Final

Consultant Name: Douglas Deming, MD

Job Classification: Short-Term US Expatriate Neonatology Clinical Consultant

Reporting to: Paul Rader, MHA, Ph.D., Advisor, Hospital Management

I. Flagship Project Objective

The Flagship Project is a five-year initiative funded by the U.S. Agency for International Development (USAID), and designed in close collaboration with the Palestinian Ministry of Health (MoH). The Project's main objective is to support the MoH, select non-governmental organizations, and select educational and professional institutions in strengthening their institutional capacities and performance to support a functional, democratic Palestinian health sector able to meet its priority public health needs. The project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

The Flagship Project will support the MoH in implementing health sector reforms needed for quality, sustainability, and equity in the health sector. By addressing key issues in governance, health finance, human resources, health service delivery, pharmaceutical management, and health information systems, the Ministry will strengthen its dual role as a regulator and main health service provider. The Flagship Project will also focus on improving the health status of Palestinians in priority areas to the Ministry and public, including mother and child health, chronic diseases, injury prevention, safe hygiene and water use, and breast cancer screening for women.

II. Specific Challenges to Be Addressed by this Consultancy

The quality of Palestinian health services has been compromised by fragmentation among health service providers, resulting in multiple and varying clinical standards and norms. There has been little citizen participation and feedback solicited by the MoH, resulting in a gap between citizen expectations and MoH delivery of services. Improvement of pediatric services in MoH hospitals is a priority of the MoH and Flagship staff is committed to help initiate change and necessary reforms to deliver better secondary health care services to the Palestinian people.

III. Objective of this Consultancy

This consultancy will focus on improving MoH Neonatal Intensive Care Unit (NICU) services at the secondary health care level.

IV. Specific Tasks of the Consultant

Under this Scope of Work, the Consultant shall perform, but not be limited to, the specific tasks specified under the following categories:

- A. Background Reading Related to Understanding the Work and Its Context.** The Consultant shall read, but is not limited to, the following materials related to fully understanding the work specified under this consultancy:
- Previous Flagship Project technical reports, Work Plan, etc.
 - MOH National Strategic Health Plan
 - USAID Flagship Project Quarterly Reports
 - USAID Needs Assessment Report, December 2008
 - USAID MOH Institutional Development Plan
- B. Background Interviews Related to Understanding the Work and Its Context.** The Consultant shall interview, but is not limited to, the following individuals or groups of individuals in order to fully understand the work specified under this consultancy:
- Chemonics Project Management Unit (PMU), if appropriate
 - Chemonics Field Office Staff, as needed
 - Appropriate MOH Staff and others appropriate
 - Hospital Emergency Staff and others as appropriate
 - LLU Palestine Project leadership
- C. Tasks Related to Accomplishing the Consultancy's Objectives.** The Consultant shall use his/her education, considerable experience and additional understanding gleaned from the tasks specified in A. and B. above to:
- Work as a clinical consultant to help integrate and enhance neonatal intensive care services for the designated MoH hospital(s). Provide assessment report with recommendations for improving services
 - Mentor and advise MoH clinical staff while providing on-the-job clinical training for treatment of patients. Provide suggested clinical care guidelines
 - Conduct training and/or lecture on relevant neonatal intensive care medicine topics. Provide teaching aids (eg, slides, textbooks, handbooks)
 - Mentor and advise MoH medical and nursing staffs on interdisciplinary approach to NICU care.
 - Assess and make recommendations regarding integration of neonatal services with perinatal services in MoH hospital(s)
 - Assess and make recommendations regarding development of neonatology subspecialty training in the West Bank. Provide sample neonatology training curriculum.
 - Assess and make recommendations regarding continuing physician education in the West Bank
 - Contribute to the ongoing review, recommendation, and development of policies, procedures, guidelines, and educational materials for neonatal services. Provide sample policies, procedures, guidelines, materials.
 - Assess and recommend improvements to NICU unit filing systems, protocols, guidelines, organizational structure, and training programs
 - Assess status of neonatal referral patterns among regional hospitals and make relevant recommendations
 - If requested, conduct assessments at other MOH facilities of neonatal intensive care services

- Work closely with MOH hospital staff to create ways to improve neonatal intensive care services and the standard of care at MOH facilities
- Prepare assessment reports of any sites visited
- In the event that new priority tasks are introduced during the consultancy, the consultant will work with the Flagship project staff to revise the tasks and expected products to accommodate for the new priorities
- In addition to the above-listed tasks, the Flagship Project welcomes additional contributions and creative ideas in support of the Flagship objectives
- The consultant is encouraged to support the identification of additional STTA and scopes of work to help accomplish Flagship goals and objective where possible

V. Expected Products.

- Within four days of the consultant’s arrival, the consultant should provide the methodology for successfully completing the work (using Annex I: STTA Methodology).
- The substance of, findings on, and recommendations with respect to the above-mentioned tasks shall be delivered by the Consultant in a written report that includes a policy statement, strategy, action plan, training materials, etc., for submission to USAID (using Annex II: the Flagship-provided STTA report template). A **draft** of this trip report is due prior to the consultant’s departure. The final version of the report is to be completed no later than 7 business days after the consultant’s departure.

VI. Timeframe for the Consultancy.

The timeframe for this consultancy is on or about July 5, 2010 to on or about July 24, 2010 in the West Bank.

VII. LOE for the Consultancy.

The days of level of effort are estimated to be 2 days for travel and 24 days for work in the West Bank (6 day work week maximum). Unless otherwise specified, up to two (2) days may be allocated for preparation of the work and up to two (2) days upon conclusion of work in West Bank to complete the assignment.

VIII. Consultant Qualifications.

The Consultant shall have the following minimum qualifications to be considered for this consultancy:

Educational Qualifications

- Shall be a currently licensed physician in good standing
- Shall be board certified in Pediatrics and sub-board certified in Neonatal/Perinatal Medicine

Work Experience Qualifications

- Minimum of three years of work in neonatal intensive care
- Successful involvement and participation in international health and/or development

ANNEX B: ASSIGNMENT SCHEDULE

7/12/2010 – MoH meeting with Naim Sabra, MD; Issa Bandak; Harry Gunkel, MD; Dorothy Forde, RN, MSN; Carter Tong, RRT

7/13/2010 – Flagship Project meeting with Damianos Odeh, PhD; Jihad Mashal, MD; Issa Bandak; Harry Gunkel, MD; Dorothy Forde, RN, MSN; Carter Tong, RRT

7/24/2010 – USAID meeting with Suzi Srouji, MD, MPH; Pilar, Jihad Mashal, MD; Dorothy Forde, RN, MSN; Carter Tong, RRT

DATE	ACTIVITY	LOCATION
Sunday, 7/4/2010	Depart	Loma Linda
Monday, 7/5/2010	Arrive	Tel Aviv
Tuesday, 7/6/2010	FLAGSHIP PROJECT OFFICE ORIENTATION Rafidia Hospital	Ramallah Nablus
Wednesday, 7/7/2010	Rafidia Hospital Met with Flagship Project Personnel	Nablus Ramallah
Thursday, 7/8/2010	Rafidia Hospital	Nablus
Friday, 7/9/2010	Muslim Holiday, worked on STTA report and education in hotel	Ramallah
Monday, 7/12/2010	Rafidia Hospital	Nablus
Tuesday, 7/13/2010	Rafidia Hospital	Nablus
Wednesday, 7/14/2010	Rafidia Hospital	Nablus
Thursday, 7/15/2010	PMC	Ramallah
Friday, 7/16/2010	Worked in Flagship Project Office	Ramallah
Sunday, 7/18/2010	PMC	Ramallah
Monday, 7/19/2010	PMC	Ramallah
Tuesday, 7/20/2010	PMC /Flagship Project Office	Ramallah
Wednesday, 7/21/2010	PMC / Flagship Project Office	Ramallah
Thursday, 7/22/2010	PMC / Flagship Project Office	Ramallah

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Friday, 7/23/2010	Meet with USAID Personnel Departure	Tel Aviv Tel Aviv
Saturday, 7/24/2010	Arrive	Loma Linda

ANNEX C: CONSULTANT CV

Douglas Deming, MD
Curriculum Vitae

revised June 2010

printed 12/15/2010 9:45:00 AM

Personal

Birthday	██████████
Birthplace	████████████████████
Business Address	Loma Linda University School of Medicine Department of Pediatrics Loma Linda, CA 92350

Present Title

Professor of Pediatrics
Medical Director, ECMO Program
Medical Director, Neonatal Respiratory Care

Fellowship Training

1/82 - 6/82	Research Fellow Cardiovascular Research Institute University of California at San Francisco San Francisco, CA 94131
7/81 - 6/82	Fellow in Neonatology Children's Hospital of San Francisco Division of Neonatology San Francisco, CA 94117
3/79 - 6/81	Fellow in Neonatology Loma Linda University Medical Center Division of Neonatology Loma Linda, CA 92350

Residency Training

1/77 - 2/79

Resident in Pediatrics
Loma Linda University Medical Center
Department of Pediatrics
Loma Linda, CA 92350

Internship

1/76 - 12/76

Intern in Pediatrics
Loma Linda University Medical Center
Department of Pediatrics
Loma Linda, CA 92350

Education

1975

Doctor of Medicine
Loma Linda University
School of Medicine
Loma Linda, CA 92350

1972

Bachelor of Arts in Religion and Philosophy
Walla Walla College
Walla Walla, WA

Certifications:

2009

Maintenance of Certification
American Board of Pediatrics
Sub-board in Neonatal-Perinatal Medicine

2002

Recertification
American Board of Pediatrics
Sub-board in Neonatal-Perinatal Medicine

1996

Recertification
American Board of Pediatrics
Sub-board in Neonatal-Perinatal Medicine

1981

American Board of Pediatrics
Sub-board in Neonatal-Perinatal Medicine

1980

American Board of Pediatrics

1977

National Board of Medical Examiners

Licensure

1977 - Present California

Academic Appointments

2002 - Present Professor of Pediatrics
Loma Linda University
School of Medicine
Loma Linda, CA 92350

1994 - 2002 Associate Professor of Pediatrics
Loma Linda University
School of Medicine
Loma Linda, CA 92350

1982 - 1994 Assistant Professor of Pediatrics
Loma Linda University
School of Medicine
Loma Linda, CA 92350

1981 - 1982 Instructor in Pediatrics
Loma Linda University
School of Medicine
Loma Linda, CA 92350

Society Memberships

2004 – 2006 Program Services Committee
Inland Empire Region
March of Dimes

2002 – present San Bernardino County Medical Society
California Medical Association
American Medical Association

2001 – 2003 Editor, News letter
California Association of Neonatologists

12/2001 Nominating Committee, Chairman
California Association of Neonatologists

7/1999 – 2002 Executive Committee
California Association of Neonatologists

10/89 – present Subsection of Perinatal Medicine
American Academy of Pediatrics

10/83 - present	American Thoracic Society
3/83 - 1992	San Bernardino County Medical Society
3/83 - 1992	California Medical Association
3/83 - 1992	Hinterland Pediatric Society
1/83 - present	Fellow, American Academy of Pediatrics

Professional Experience

7/2003 – Present	Director, ECMO Program Loma Linda University Children’s Hospital Loma Linda, CA 92350
7/83 – 9/2003	Director, Training Program in Neonatal-Perinatal Medicine Loma Linda University Medical Center Department of Pediatrics Loma Linda, CA 92350
8/82 - Present	Medical Director, Neonatal Respiratory Care Loma Linda University Medical Center Loma Linda, CA 92350
1988 – 1/90	Medical Staff Riverside Community Hospital Riverside, CA
7/82 – 9/99	Medical Staff Riverside General Hospital University Medical Center Riverside, CA
7/82 - Present	Medical Staff Loma Linda University Medical Center Loma Linda, CA 92350

Committees

Medical Center Committees

1/2008 - present	LLUCH Patient Care Committee, Chairman
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7/2003 – present	Critical Care Committee
3/2003 – present	Physician Well-being Committee
2003 – present	Pediatric Bronchoscopy Committee
4/2002	Medical Staff Nominating Committee, Chairman
6/1998 – 6/2000	Institutional Review Board
1995 – 6/1998	Alternate to Institutional Review Board
1982 - 1997	Respiratory Care Committee
1988 - 1998	Graduate Medical Education Committee
1988 to 1990	Physician Order Entry Subcommittee Chairman
1989 - 1994	Patient Care Subcommittee

**Department of Pediatrics
Committees**

1988 - 1989	Space Committee
1/90 to 1991	Equipment and Space Committee

Miscellaneous Activities

1982 - 1988	Design specifications of LLUMC NICU
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Programming

1988 - 1989	Design specifications for NICU patient tracking databases Diagnosis tracking Location tracking Physician tracking
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1989 - 1995	Maintenance of NICU patient tracking databases
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Classes

1989	MS-DOS Nine session class on the Microsoft Disk Operating System Given for faculty and trainees in the Division of
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Neonatology and Department of Pediatrics

- 1989 *MS-Word*
Eighteen session class on Microsoft Word
Given for faculty and secretaries of the
Department of Pediatrics
- 1992 *An Introduction to the Research Process Design,
Statistics, and Writing*
33 Session Class to the Neonatology Fellows
(Text) Bland, M. *An Introduction to Medical
Statistics*. Oxford Medical Publishers, 1989.
Oxford University 33 Press
(Text) Zeiger, M. *Essentials of Writing Biomedical
Research Papers*. 1991. McGraw-Hill, Inc.
- 1996 *Scientific Writing*
12 Session Class to Neonatology Fellows
(Text) Zeiger M, *Essentials of Writing Biomedical
Research Papers*. 1991. McGraw-Hill, Inc
- 1998 *Research Design and Statistics*
10 Session Class to Neonatology Fellows
(Text) Bland M, *An Introduction to Medical Statistics*.
1995, Oxford Medical Pub.
- 1999 *Introduction to Research Design & Methodology*
8 Session Class to Neonatology Fellows &
Respiratory Care Department
- 2000 *Respiratory Physiology and Mechanical Ventilation*
10 Session Class to Neonatology Fellows &
Respiratory Care Department
- 2000 *Introduction to Biomedical Statistics*
14 Session Class to Neonatology Fellows,
Respiratory Care Department, & Pediatric Faculty
(Text) Bland M, *An Introduction to Medical Statistics*.
3rded 2000, Oxford Medical Pub.
- 2001 *Scientific Writing*
12 Session Class to Neonatology Fellows
(Text) Zeiger M, *Essentials of Writing Biomedical
Research Papers*. 1991. McGraw-Hill, Inc
- 2002 *Introduction to Biomedical Statistics*
14 Session Class to Neonatology Fellows,
Respiratory Care Department, & Pediatric Faculty
(Text) Bland M, *An Introduction to Medical Statistics*.

3rded 2000, Oxford Medical Pub.

Scientific Writing

12 Session Class to Neonatology Fellows

(Text) Zeiger M, *Essentials of Writing Biomedical Research Papers*. 1991. McGraw-Hill, Inc

2003

Introduction to Research Design & Methodology

8 Session Class to Neonatology Fellows

2004

Respiratory Physiology and Mechanical Ventilation

10 Session Class to Neonatology Fellows

2005

Research Design & Methodology

4 Session Class to Neonatology Fellows

Visiting Professorships

4/2007	Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
10/2008	Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China

Outside Classes Taught on a Yearly Basis

1988 – present	<i>Neonatal Lung Disease</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
2001 – 2008	<i>Surfactant Therapy</i> Perinatal/Pediatric Respiratory. Care Specialist Program
2001 - present	<i>Neonatal Surgical Emergencies</i> <i>Lung Development</i> <i>Respiratory Distress Syndrome</i> <i>Chronic Lung Disease in the Newborn</i> Perinatal/Pediatric Respiratory. Care Specialist Program
2007 – present	<i>Respiratory Distress Syndrome</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
2008 – present	<i>Hypoxic Respiratory Failure in the Newborn</i> Perinatal/Pediatric Respiratory. Care Specialist Program

Selected Lectures

4/1988	<i>Neonatal Respiratory Care</i> Continuing Medical Education Doctor's Hospital Montclair
1/1989	<i>Clinical Research in Bronchopulmonary Dysplasia</i> School of Nursing Loma Linda University

2/1989	<i>Aerosol Usage in Neonates: Witchcraft and Science</i> High Sierra Critical Care Conference Reno, Nevada
9/1989	<i>Aerosol Usage in Neonates</i> Pediatric Grand Rounds Loma Linda University Medical Center
11/1989	<i>Pathophysiology of Bronchopulmonary Dysplasia</i> School of Respiratory Care Loma Linda University
12/1989	<i>High Frequency Ventilation</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall
2/1990	<i>High Frequency Ventilation</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall
5/1990	<i>Respiratory Management of the Neonatal Patient</i> Advanced Neonatal Respiratory Class Jerry L. Pettis Memorial Veterans Hospital
5/1991	<i>Respiratory Management of the Neonatal Patient</i> Advanced Neonatal Respiratory Class Jerry L. Pettis Memorial Veterans Hospital
2/1992	<i>Pulmonary Function Testing</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall
5/1992	<i>Respiratory Management of the Neonatal Patient</i> Advanced Neonatal Respiratory Class Jerry L. Pettis Memorial Veterans Hospital
5/1992	<i>Bronchopulmonary Dysplasia. Role of Steroids in Treatment</i> Grand Rounds Loma Linda University Medical Center
4/1993	<i>Pulmonary Function Testing</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall

9/1993	<i>High Frequency Ventilation</i> Swedish Pediatric Association Örebro, Sweden
2/1994	<i>Bronchopulmonary Dysplasia: Pathophysiology</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall
3/1994	<i>Pulmonary Function Testing</i> Advanced Neonatal Respiratory Class School of Respiratory Care Nichols Hall
4/1994	<i>High Frequency Ventilation</i> Pediatric Grand Rounds Loma Linda University Medical Center
3/1995	<i>High Frequency Ventilation</i> 3 rd Annual Conference on Mechanical Ventilation Sao Paulo, Brazil
3/1995	<i>Physiology of Mechanical Ventilation in Infants</i> 3 rd Annual Conference on Mechanical Ventilation Sao Paulo, Brazil
5/1995	<i>Synchronized Ventilation in Infants</i> 22 nd Annual Conference on Care of the High Risk Neonate UCI, Orange County, CA
9/1996	<i>Respiratory Management of Surgical Emergencies in the Newborn</i> Perinatal/Pediatric Respiratory Specialist Program School of Allied Health Professions
9/1996	<i>Research Opportunities for the Respiratory Care Practitioner</i> Respiratory Care Fall Symposium Loma Linda University Medical Center Randall's Visitor Center
9/1997	<i>Bronchopulmonary Dysplasia (BPD)</i> Advanced Neonatal Respiratory Care Class School of Allied Health Professions
3/1997	<i>Pulmonary Function Tests in the Newborn Infant</i> Advanced Neonatal Respiratory Care Class School of Allied Health Professions

4/1997	<i>Common Respiratory Diseases in the Newborn</i> Pediatricians, Primary Care Specialists Columbia Los Robles Hospital/Medical Center
6/1997	<i>Management of Respiratory Support/Symposium on the ELBW</i> Pediatric Grand Rounds Loma Linda University Medical Center
8/1997	<i>Normal Gas Transport</i> LLUCH Neonatal & Pediatric ECMO Program Workshop
9/1997	<i>Neonatal Surgical Emergencies</i> 7 th Annual Perinatal/Pediatric Resp. Care Specialist Program
9/1997	<i>Chronic Lung Disease in the Newborn</i> 7 th Annual Perinatal/Pediatric Resp. Care Specialist Program
9/1997	<i>Lung Mechanics</i> 7 th Annual Respiratory Care Symposium, LLUMC
4/2000 6/2000	<i>RDS, Surfactant, and the New Millennium</i> Grand Rounds for the Department of Gynecology and Obstetrics and Department of Pediatrics
10/2000	<i>Pharmacotherapy for the Newborn Lung.</i> California Society of Health Systems Pharmacists – Palm Springs, CA
12/2000	<i>Congenital Heart Disease: a Neonatologists Perspective.</i> Cardiothoracic Surgery Teaching Conference
3/2001	<i>Neonatal Anatomy and Physiology.</i> California Society for Respiratory Care – Rancho Mirage, CA
9/2001	<i>Don't Need No Stinking Tubes</i> <i>No More Aerosols</i> 2 lectures for the Respiratory Care Fall Symposium Loma Linda University Medical Center
5/2002	<i>FRC and the Zen of Mechanical Ventilation</i> Pediatric Grand Rounds
10/2002	<i>Neonatal Surgical Emergencies</i> <i>FRC and the Zen of Mechanical Ventilation</i> 2 lectures for the annual Respiratory Care Symposium

5/2003	<i>Respiratory Distress Syndrome</i> Transport Nurses & Physicians Loma Linda University Medical Center
6/2003	<i>Respiratory Distress Syndrome: The current state of surfactant therapy</i> University of Connecticut Hartford, CN
9/2003	<i>Respiratory Distress Syndrome: The current state of surfactant therapy</i> Brigham and Women's Hospital Boston, MA
9/2004	<i>Respiratory Distress Syndrome: The current state of surfactant therapy</i> George Washington University Hospital Washington, DC National Children's Hospital Washington, DC
9/2004	<i>A New Look at Thyroid Function in Preterm Newborns.</i> Academic Day for Neonatologists of Southern California, Irvine, CA
3/2006	<i>Lung Disease in the Term Infant</i> Alumni Postgraduate Convention Loma Linda, CA
4/2007	<i>Chronic Lung Disease in the Newborn</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Differential Diagnosis of the Unusual Appearing Infant</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Lung Development</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Lung Function and Mechanics</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Mechaniical Ventilation</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China

4/2007	<i>Lung Disease in the Newborn</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Respiratory Distress Syndrome</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
4/2007	<i>Persistent Pulmonary Hypertension of the Newborn</i> Zhejiang Province Pediatric Directors Meeting Hangzhou, Zhejiang Province, China
4/2007	<i>Cardiopulmonary Failure and ECMO</i> Grand Rounds Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
5/2008	<i>Survey of Newborn Lung Disease</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
5/2008	<i>Respiratory Distress Syndrome</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
6/2008	<i>Advanced Ventilation Strategies</i> Pediatric Surgery Grand Rounds Loma Linda, CA
8/2008	<i>Advanced Ventilation Strategies</i> Anesthesiology Grand Rounds Loma Linda, CA
8/2008	<i>Respiratory Distress Syndrome: The current state of surfactant therapy</i> Arizona Society for Respiratory Care Phoenix, AZ
10/2008	<i>Chronic Lung Disease in the Newborn</i> Chinese Neonatology Society Hangzhou, Zhejiang Province, China
10/2008	<i>Pulmonary Hypertension in the Newborn</i> Chinese Neonatology Society Hangzhou, Zhejiang Province, China
10/2008	<i>Death, Dying, and Grief</i>

	Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
10/2008	<i>Total Parenteral Nutrition</i> Zhejiang University Children's Hospital Hangzhou, Zhejiang Province, China
2/2009	<i>Collegiality and Conflict Resolution</i> Neonatology Fellow's Symposium California Association of Neonatologists San Diego, CA
5/2008	<i>Survey of Newborn Lung Disease</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
5/2008	<i>Respiratory Distress Syndrome</i> Combined Schools of Respiratory Care Crafton Hills College Victor Valley College
6/2009	<i>Pulmonary Hypertension in the Newborn</i> California Society for Respiratory Care Riverside, CA

Refereed Articles

1. McCann EM, Lewis K, Deming DD, Donovan MJ, and Brady JP: Controlled trial of furosemide therapy in infants with chronic lung disease (CLD). *Journal of Pediatrics*, 106(6):957, 1985
2. Brady JP, Deming DD, and McCann EM: Neonatal endotracheal flow meter for tidal volume, airway pressure, and end-tidal gas. *Journal of Applied Physiology*, 58(3):1023, 1985
3. Ward SL, Keens TG, Chan LS, Chipps BE, Carson SH, Deming DD, Krishna V, MacDonald HM, Martin GI, Meredith KS, Merritt TA, Nickerson GB, Stoddard RA, and van der Hal AL: Sudden infant death syndrome in infants evaluated by apnea programs in California. *Pediatrics*, 77(4):451, 1986
4. Hopper AO, Nystrom GA, Deming DD, Brown WR, Peabody JL: Infrared end-tidal carbon dioxide measurement does not accurately predict or trend arterial carbon dioxide values in rabbits with lung injury. *Pediatric Pulmonology* 17(3): Mar 1994
5. Job L, Emery JR, Hopper AO, Deming DD, Nystrom GN, Clark SJ, Nelson JC. Serum free thyroxine concentration is not reduced in premature infants with

respiratory distress syndrome. *Journal of Pediatrics* 131(3):489-492, 1997.

6. Hopper AO, Pageau J, Job L, Heart J, Deming DD, Peverini RL. Extracorporeal membrane oxygenation for perioperative support in neonatal and pediatric cardiac transplantation. *Artif Organs* 23(11):1006-1009, 1999
7. Kuhn MA, Jutzy KR, Deming DD, Cephus CE, Chinnock RE, Johnston J, Bailey LL, Larsen RL. The medium term findings in coronary arteries by intravascular ultrasound in infants and children after heart transplantation. *J Am CollCardiol* 2000;36:250-4
8. Clark SJ, Deming DD, Emery JR, Adams LM, Carlton EI, Nelson JC. Reference ranges for thyroid function tests in premature infants beyond the first week of life. Accepted for publication 5/2001, *Journal of Perinatology* 2001; 21(8):531-6
9. Egger DW, Deming DD, Hamada N, Perkin RM, & Sahney S. Evaluation of the safety of short acting nifedipine in children with hypertension. *Pediatric Nephrology (2001)* 17:35-40
10. Chhina S, Peverini RL, Deming DD, Hopper AO, Hashmi A, Vyhmeister NR. QTc interval in infants receiving cisapride. *Journal of Perinatology* 2002; 22(2):144-8
11. Nazir S, Peverini RL, Deming DD, Hopper AO, Vyhmeister NR, Comparison of Two Iron Doses in Infants Receiving Recombinant Human Erythropoietin. *Arch Pediatr Adolesc Med.* 2002 Jun; 156(6):540-4
12. Kadri M, Shu S, Holshouser B, Deming D, Hopper A, Peverini R, Ashwal S. Proton Magnetic Resonance Spectroscopy Improves Outcome Prediction in Perinatal CNS Insults. *J Perinatol.* 2003 May;23(3):181-5..
13. Kuhn MA, Deming DD, Cephus CE, Mulla NF, Chinnock RE, Razzouk AJ, Larsen RL. Moderate acute rejection detected during annual catheterization in pediatric heart transplant recipients. *J Heart Lung Transplant* 2003;22:276-280
14. Rabin CW, Hopper AO, Job L, Peverini RL, Clark SJ, Deming DD, Nelson JC, Vyhmeister NR. Incidence of Low Free T₄ as Determined by Direct Equilibrium Dialysis. *J Perinatol* 2004;24:640-4
15. Angeles DM, Wycliffe N, Holshouser B, Deming D, Pearce W, Sowers LC, Ashwal S. Use of Opioids in Asphyxiated Term Neonates: Effects on Neuroimaging and Clinical Outcome. *Pediatr Res* 2005; 57:1-6
16. Miller SP, Ramaswamy V, Michelson D, Barkovich AJ, Holshouser B, Wycliffe N, Gudden DV, Deming D, Partridge C Patterns of Brain Injury in Term Neonatal Encephalopathy *ObstetGynecolSurv* 2005; 60:576-577
17. Miller SP, Ramaswamy V, Michelson D, Barkovich AJ, Holshouser B, Wycliffe N, Gudden DV, Deming D, Partridge C Patterns of Brain Injury in Term Neonatal Encephalopathy *Journal of Pediatrics* 2005; 146(4):453-460

18. Angeles DM, Wycliffe N, Michelson D, Holshouser BA, Deming DD, Pearce WJ, Sowers LC, Ashwal S Use of Opioids in Asphyxiated term neonates: effects on neuroimaging and clinical outcome *Pediatr Res* 2005; 57(6);873-878
19. Deming DD, Rabin CW, Hopper AO, Peverini RL, Vyhmeister NR, Nelson JC. Direct equilibrium dialysis compared with two non-dialysis free T(4) methods in premature infants. *JPediatr* 2007;151(4):404-408
20. Angeles DM, Ashwal S, Deming D, Yellon S, Hopper A, Peverini R. Are elevated peripheral leukocytes markers of septic etiology in asphyxiated infants with neurological disability?*JPerinatol.* 2008 Jan; 28(1):85-6
21. Merritt TA, Deming DD Boynton BR The New Bronchopulmonary Dysplasia: Challenges and Commentary *Seminars in Fetal & Neonatal Medicine* 2009 pp 1-13

Chapters and Review Articles

1. Deming DD: Respiratory assessment of the newborn and the child. in*Clinical Assessment in Respiratory Care*, 1st edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. CV Mosby Co., 1985
2. McCarty KD, Wilkins RL, and Deming DD: Synopsis of clinical findings in respiratory disorders. in*Clinical Assessment in Respiratory Care*, 1st edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. CV Mosby Co., 1985.
3. Deming DD: Neonatal anatomy and physiology. in*Lung Sounds A Practical Guide*. Wilkins RL, Hodgkin JE, and Lopez B, editors. CV Mosby Co., 1988
4. Deming DD: Evaluation of the neonate. in*Lung Sounds A Practical Guide*. Wilkins RL, Hodgkin JE, and Lopez B, editors. CV Mosby Co., 1988
5. Deming DD: Respiratory assessment of the newborn and the child. in*Clinical Assessment in Respiratory Care*, 2nd edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. CV Mosby Co., 1990.
6. Deming DD: Respiratory assessment of the newborn and the child. in*Clinical Assessment in Respiratory Care*, 3rd edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. CV Mosby Co., 1995.
7. Job L, Deming DD, Hopper AO, Peverini RL. *Air transport in neonatal medicine.* *SeminNeonatol* 1999; 4:273-279
8. Job L, Deming DD, Hopper AO, Peverini RL. *Newborn Transport Around the World.* *SeminNeonatol* 1999; 4:219-235
9. Deming DD: Respiratory assessment of the newborn and the child. in*Clinical Assessment in Respiratory Care*, 4th edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. CV Mosby Co., 2000.

10. Deming DD: Neonatal and pediatrics respiratory disorders. in *Egan's Fundamentals of Respiratory Care*, 8thed, Wilkins RL, Stoller KJ, Scanlan CL editors. CV Mosby, Co 2003
11. Carriedo H, Deming D: Therapeutic Techniques: Neonatal ECMO. *NeoReviews* 2003;4:c212-214
12. Deming DD: Respiratory assessment of the newborn and the child. in *Clinical Assessment in Respiratory Care*, 5th edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. Esclvier, CV Mosby, 2005
13. Deming DD: Neonatal and pediatrics respiratory disorders. in *Egan's Fundamentals of Respiratory Care*, 9thed, Wilkins RL, Stoller KJ, Scanlan CL editors. CV Mosby, Co 2008
14. Deming DD: Respiratory assessment of the newborn and the child. in *Clinical Assessment in Respiratory Care*, 6th edition. Wilkins RL, Sheldon RL, and Krider SJ, editors. Esclvier, CV Mosby, 2009

Abstracts (* indicates acceptance for formal presentation)

1. Deming D, Mace J, and Crane M: Hypotension and hypernatremia: a new syndrome. *Clinical Research*, 26:169A 1978
2. Deming D, Georgeson K, and Vain N: Incidence of cholestatic jaundice in continuous and intermittent hyperalimentation: a prospective study. *Pediatric Research*, 15:530A, 1981
- * 3. Brady JP, Deming DD, and McCann EM: Is rapid ventilation better? *Clinical Research*, 31:133A, 1983. Presented at the Western Society for Pediatric Research, Carmel, California, February 1983
- * 4. McCann EM, Deming DD, and Brady JP: Lasix improves lung function in infants with chronic lung disease. *Clinical Research*, 31:141A, 1983. Presented at the Western Society for Pediatric Research, Carmel, California, February 1983
5. Sobel BD, Lewis K, Deming DD, and McCann EM: Does dexamethasone improve lung function in infants with chronic lung disease? *Clinical Research* 31:143A, 1983.
- * 6. McCann EM, Deming DD, and Brady JP: Controlled trial of lasix therapy in infants with chronic lung disease (CLD). *Pediatric Research* 17:385A, 1983. Presented at the Society for Pediatric Research, Washington, DC, May 1983.
7. Sobel DB, Lewis K, Deming DD, and McCann EM: Dexamethasone improves lung function in infants with chronic lung disease. *Pediatric Research*, 17:390A,

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- * 8. Grill BB, Van Allen K, Deming DD: Clinical profile of infants with apnea and gastroesophageal reflux. *Clinical Research*, 33:183A, 1985
- * 9. Davidson Ward SL, Keens TG, Chan LS, Chipps BE, Carson SH, Deming DD, Krishna V, MacDonald HM, Martin GI, Meredith KS, Merritt TA, Nickerson BG, Stoddard RA, and van der Hal AL: Sudden infant death syndrome in infants evaluated by apnea programs in California. *Clinical Research*, 34(1):125A, 1986.
- * 10. Berk LS, Georgeson GD, Eby WC, Nehlsen-Cannarella SL, Swarner OW, Deming DD, Sancho N, Vorce D, Bailey, LL: Human cord and neonate blood are decreased in natural killer cell cytotoxicity relative to normal adult blood. Presented at the XVIII International Congress of Pediatrics, Honolulu, Hawaii, July 1986.
- * 11. Nystrom GA, Deming DD, Peabody JL: Postnatal β -agonist therapy in premature rabbits: effects on selected lung functions and lung water content. *Clinical Research*, 36:232A, 1988.
- 12. Nystrom GA, Deming DD, Yoo BH, Peabody JL: Postnatal β -agonist therapy in premature rabbits: effects on selected lung functions and lavage surfactant. *Pediatric Research*, 23:517A, 1988
- 13. Nystrom GA, Deming DD, Peabody JL: Postnatal β -agonist therapy in premature rabbits: effects on selected lung functions and lung water content. *Pediatric Research*, 23:517A, 1988
- 14. Gonzalez F, Shelton C, Peterson L, Deming D, Carlstrom J: Effects of altitude on arterial blood gases during mechanical ventilation. *Pediatric Research*, 23:507A, 1988
- * 15. Brown W, Geller D, Nystrom G, Deming D, Yoo B, Hopper A: Aerosol generator efficiency, driving flow, and position affect aerosol delivery through a neonatal ventilator circuit. *J Aerosol Med*, 1:220, 1988. Poster presentation at the Seventh International Congress on Aerosols in Medicine, Rochester, NY, September 1988
- * 16. Brown W, Nystrom G, Geller D, Deming D, Yoo B, Hopper A: The effect of changes in ventilator rate, peak pressure, inspiratory time, and endotracheal tube size on aerosol delivery in neonatal ventilator circuits. *J Aerosol Med*, 1:221, 1988. Poster presentation at the Seventh International Congress on Aerosols in Medicine, Rochester, NY, September 1988
- 17. Nystrom GA, Brown WR, Deming DD: Aerosol generator performance characteristics in neonatal ventilator circuitry. *American Review of Respiratory Diseases*, 139(4):568A, 1989
- 18. Nystrom GA, Brown WR, Deming DD: Effect of ventilator settings on aerosol delivery through a neonatal ventilator circuit. *Pediatric Research*, 25(4):321A,

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Palestinian Health Sector Reform and Development Project (Flagship Project)

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19. Hopper AO, Nystrom GA, Deming DD, Brown WR: Accuracy of infrared end-tidal CO₂ monitors in estimating P_aCO₂ in small ventilated animals. *Pediatric Research*, 25(4):315A, 1989
- * 20. Brown WR, Hopper AO, Nystrom GA, Deming DD: Accuracy of neonatal infrared end-tidal CO₂ monitors in estimating P_aCO₂ in small ventilated animals. *Respiratory Care*, 1989. Presented at the National Association of Respiratory Therapy, Anaheim, California, November 1989
- * 21. Brown WR, Nystrom GA, Hopper AO, Deming DD: Aerosol generator performance in a ventilator circuit. *Respiratory Care*, 1989. Presented at the National Association of Respiratory Therapy, Anaheim, California, November 1989
- * 22. Brown WR, Nystrom GA, Hopper AO, Deming DD: Effect of ventilator settings on aerosol delivery through a ventilator circuit. *Respiratory Care*, ;, 1989. Presented at the National Association of Respiratory Therapy, Anaheim, California, November 1989
23. Nystrom GA, Deming DD, Brown, WR: Ventilator circuit flow affects inspiratory lung mechanics of ventilated breaths in premature infants. Submitted to The Society for Pediatric Research January 1990
- * 24. Nystrom GA, Deming DD, Brown WR: Ventilator circuit flow affects inspiratory lung mechanics of ventilated breaths in premature infants. *Clinical Research*, 38(1):197A, 1990. Presented at the Western Society for Pediatric Research, Carmel, California, February 1990
25. Hopper AO, Deming DD, Nystrom GA, Brown WR: Neither infrared nor mass spectrometer measured end-tidal CO₂ accurately estimate P_a CO₂ in small ventilated animals with lung injury. *Clinical Research*, 38(1):196A, 1990
- * 26. Deming D, Nystrom G, Brown W, Bhatt J, Job L: Dexamethasone does not improve long term lung function or improve outcome in infants with early chronic lung disease. *Clinical Research* 40(1):41A, 1992 Presented to the Western Society for Pediatric Research, Carmel, California. February, 1991
- * 27. Deming D, Nystrom G, Brown W, Bhatt J, Job L: Dexamethasone does not improve long term lung function or improve outcome in infants with early chronic lung disease. *Pediatric Research* 29(4):210A, 1992, Presented to the Society for Pediatric Research, New Orleans, Louisiana. April 28 - May 2, 1991
- * 28. Dajnowicz A, Emery J, Nystrom G, Deming D: Time to cardiac transplantation impairs neonatal head circumference. *Clinical Research* 40(1):116A, 1992 Presented to the Western Society for Pediatric Research, Carmel, CA. February 5-8, 1992

- * 29. Dajnowicz A, Emery J, Nystrom G, Deming D: Time to cardiac transplantation delays neonatal head growth. *Pediatric Research* 31(4):10A, 1992, Presented to the Society for Pediatric Research, Baltimore, Maryland. May 4-7, 1992
- * 30. Rasmussen M, Hopper A, Deming D, Nystrom G, Grill B: Esophageal pH monitoring fails to accurately predict tracheal aspiration in premature mechanically-ventilated infants. *Pediatric Research* 31(4):218A, 1992, Presented to the Society for Pediatric Research, Baltimore, Maryland. May 4-7, 1992
- * 31. Hopper AO, Rasmussen MR, Deming DD, Nystrom GA, Grill BB: Is twenty-four hour esophageal pH monitoring necessary for detecting gastroesophageal reflux in premature mechanically-ventilated infants? *Clinical Research* 41(1):16A, 1993, Presented to the Western Society for Pediatric Research, Carmel, CA, February 1992
- * 32. Job L, Nystrom G, Deming D: Better response to modified natural surfactant than to synthetic surfactant--real difference or "learning curve"? *Clinical Research* 41(1):29A, 1993, Presented to the Western Society for Pediatric Research, Carmel, CA, February 1993
- * 33. Job L, Nystrom G, Deming D: Better response to modified natural surfactant than to synthetic surfactant--real difference or "learning curve"? *Pediatric Research* 33(4):216A, 1993, Presented to the Society for Pediatric Research, Washington DC, May 1993
- 34. Ackerman DL, Hopper AO, Emery JR, Deming DD: Heart transplantation causes prolonged but reversible suck/swallow dysfunction. *Pediatric Research* 33(4):97A, 1993
- * 35. Awadalla JK, Hopper AO, Deming DD, Assaad A, Grill BB: Is twenty-four esophageal pH monitoring necessary for detecting gastroesophageal reflux in premature mechanically-ventilated infants? Presented to the Society for Pediatric Research 1994, *Pediatric Research* 1994; 35:124A
- 36. Solarte D, Peverini RL, Nystrom GA, Deming DD: Greater risk of failure of one course of indomethacin therapy in more premature infants, but greater morbidity with failure in the more mature infants. submitted to the Society for Pediatric Research 1994, *Pediatric Research* 1994; 35:256A
- * 37. Elmendorf EN, Perkin RM, Downey R, Deming DD. Frequency of OSA symptoms in a craniofacial clinic. Presented to the Conference on Apnea of Infancy, Jan 1995 (PedsPulmonol)
- * 38. Solarte D, Peverini RL, Nystrom GA, Deming DD. Dexamethasone fails to show synergism with indomethacin in the treatment of patent ductus arteriosus in premature infants. Presented to the Society for Pediatric Research 1995, *Pediatric Research* 1995; 37:237A
- * 39. Peverini RL, Hopper AO, Nystrom GA, Deming DD, Myruski K, Shirali GS,

- Solarte D. Inhaled nitric oxide improves oxygenation but worsens lung mechanics in experimental respiratory distress syndrome. Presented to the Society for Pediatric Research 1995, *Pediatric Research* 1995; 37:345A
- * 40. Deming DD, Peverini RL, Hopper AO, Nystrom GA, Millen SE, Berlioz JL, Nazir S, Fagoaga OR, Nehlsen-Cannarella SL. Inhaled nitric oxide does not activate systemic inflammatory markers in premature lambs. Presented to the Society for Pediatric Research 1996, Washington, DC, *Pediatric Research* 1996; 39:287A
 - 41. Peverini RL, Deming DD, Hopper AO, Nystrom GA, Millen SE, Berlioz JL, Nazir S. Inhaled nitric oxide does adversely affect lung mechanics in experimental respiratory distress syndrome. *Pediatric Research* 1996; 39:345A
 - * 42. Waggoner, J, Hopper AO, Nystrom GA, Peverini RL, Deming DD, Johnson L. Cost of implementing an extracorporeal life support program. Presented to *13th Annual Children's National Medical Center Symposium on ECMO & Advanced Therapies for Respiratory Failure*, Keystone, CO, February 1996
 - * 43. Kuhn MA, Jutzy KR, Deming DD, Cephus CE, Bailey LL, Chinnock RE, Larsen RL. The medium term findings in coronary arteries by intravascular ultrasound in infants and children after heart transplantation. Presented at *the American College of Cardiology Annual Session*, March 1998
 - * 44. Berlioz JL, Job L, Deming DD, Hopper AO, Nehlsen-Cannarella S, Nelson JC. Effect of prenatal steroids on inflammatory markers and adrenal function in extremely low birth weight premature infants. Presented to the *Perinatal Section of American Academy of Pediatrics*, San Francisco, October, 1998
 - * 45. Deming DD, Larsen RL, McLeary MS, Pageau J, Hopper AO. ECMO cannulae position: Comparison of chest radiograph and echocardiogram. Presented to the *15th Annual Children's National Medical Center Symposium on ECMO & Advanced Therapies for Respiratory Failure*. Keystone, CO, February 1999
 - 46. Kuhn M, Deming D, Cephus C, Larsen R, Bailey L, Aortic Remodeling After Orthotopic Heart Transplantation in patients Requiring Aortic Arch Reconstruction Presented to the International Society for Heart and Lung Transplantation 19th Annual Meeting San Francisco, CA, April 1999
 - * 47. McLeary M, Deming D, Larsen R. Pageau J, Hopper A. Evaluation of ECMO catheter position in the neonate: Chest radiography versus echocardiography. Presented to the ARRS, New Orleans, LA, May 1999
 - * 48. McLeary M, Deming D, Larsen R. Pageau J, Hopper A. Evaluation of ECMO catheter position in the neonate: Chest radiography versus echocardiography. Presented to the *Society of Pediatric Radiology*, Vancouver, British Columbia, Canada, May 1999
 - * 49. McLeary M, Deming D, Larsen R. Pageau J, Hopper A. Evaluation of ECMO

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ANNEX D: BIBLIOGRAPHY OF DOCUMENTS COLLECTED AND REVIEWED

1. Flagship Project Quarterly Report
2. MoH Institutional Development Plan
3. MoH Needs Assessment Report
4. National Strategic Health Plan
5. Orientation Packet
6. Y1Q4 (July-Sep09) Quarterly Report Draft
7. Year 2 Annual Implementation Plan – Revised Feb 12, 2010
8. Year 1 Annual Report Draft

ANNEX E: LIST OF MATERIALS DEVELOPED AND/OR UTILIZED DURING ASSIGNMENT

1. Residency Goals and Objectives*LLUCH Pediatric Residency – goals and objects for every clinical rotation
2. Resuscitation Videos with Critique*
 - Handouts of Lectures given*
 - Neonatal Sepsis
 - Handwashing and Hand Hygiene
 - Early Infant Enteral Nutrition
 - High Frequency Ventilation
 - Gestation Age Assessment
 - Introduction to ECMO
3. Handout for SBAR Communication Skills*
4. Gestational Age Assessment – Lecture and handouts*
5. Protocol for Cooling of Infants with Hypoxic Ischemic Encephalopathy*
6. Hand Hygiene Protocol and Lecture – multiple documents*
7. These documents include the lecture given at RH and PMC, as well as support documents given to RH and PMC personnel for implementing a Hand Hygiene program * †
8. Thermoregulation Protocol †

† Document attached

* Electronic copies placed on the Flagship Project shared network drive

The following books and supplies were provided to RH and PMC:

Item	Number
Guidelines for Perinatal care	2
Emergency Medicine Text Books	1
Perinatal and Pediatric. Respiratory Care	2
Neo Natal Resuscitation Textbook	2
Core Curriculum NICU Nursing	1
Care of the High Risk Neo natal	2
Manual of Neo natal Care	2
Egan's Fundamentals of Respiratory Care	2
NICU Manuals	9
Manual of Neonatal Care	2
Certification and Reviews Neonatal Intensive Care Nursing	2
Neonatology Management Procedures	2
Adult Laryngoscope	3
Neonatal Laryngoscope	2
Perinatal and Pediatric Respiratory Care	1
Core Curriculum Neonatal Intensive Care Nursing	1
Feeding tubes	90
Enteral feeding tube with stylet	12
Emergency Medicine Textbook	1
S.T.A.B.L.E. materials	

Infection Control Policy (see next page)



LOMA LINDA UNIVERSITY CHILDREN'S HOSPITAL OPERATING POLICY

DEPARTMENT:	NEONATAL ICU	Code:	(314) M-302
CATEGORY:	PATIENT CARE	Effective:	08/2007
SUBJECT:	INFECTION CONTROL	Replaces:	12/2005
		Page:	1 of 3

1. Those who may enter the NICU shall include the following:
 - 1.1 Persons directly involved in the care of or consulting regarding patients in the NICU.
 - 1.2 Persons involved in laboratory, x-ray or other approved studies involving patients in the NICU.
 - 1.3 Persons involved in providing supplies, housekeeping, food or medications.
 - 1.4 Other persons as per Nursing Policy (314) M-13 (Family Participation Guideline).
 - 1.5 Individuals with specific permission of one of the attending physicians or the Nurse Manager of the NICU.
2. Those who may not enter the NICU shall include the following:
 - 2.1 Persons not acknowledged by nursing and/or medical staff as having business in the NICU.
 - 2.2 Persons who have a known or suspected communicable illness.
3. The isolation rooms shall be used for transmission based precautions whenever indicated by Infection Control Policy M-50 (Standard and Transmission-Based Precautions)
4. Hands and arms shall be scrubbed for three minutes upon initial entry to the patient room for the purpose of direct interaction with an infant or equipment used in the care of infants. Alcohol liquid or foam may be used thereafter for non-soiled hand hygiene.
5. Appropriate gowning shall be required to enter the patient rooms for the purpose of direct interaction with an infant/equipment.
6. Only clean supplies and equipment may be taken into the patient rooms or to the supply lockers. Personal items e.g. staff purses, shall be stored in designated drawers in patient rooms.

DEPARTMENT: NEONATAL ICU

Code: (314) M-302

CATEGORY: PATIENT CARE

Page: 2 of 3

SUBJECT: INFECTION CONTROL

7. Employee unit approved apparel practice includes the following:

7.1 Employees are responsible for the purchase and maintenance of washable unit approved apparel.

7.2 The employee shall wear clean, hospital-provided cover gown when holding an infant.

7.3 Cover gowns are not required when leaving the unit.

7.4 Unit apparel shall not be considered personal protective equipment; therefore, it is imperative that for the protection of the employee that personal protective equipment be utilized appropriately as outlined in policy M-50 (Standard and Transmission-Based Precautions).

7.5 In the event an employee's clothing becomes saturated with blood or body fluids, the employee shall be provided with a clean pair of hospital scrubs to complete their shift.

7.6 The employee's personal soiled unit approved apparel must be placed in a plastic bag to prevent further contamination with other surfaces. The employee may wash the scrubs in normal laundry cycles according to the recommendations of the manufacturer.

8. Attached Guidelines (314) M-302.A shall be followed for the following requirements:

8.1 Hand hygiene

8.2 Isolation room procedure

8.3 Infectious disease environmental safety

APPROVAL/SIGNATURES ATTACHED:



LOMA LINDA UNIVERSITY CHILDREN'S HOSPITAL GUIDELINES

DEPARTMENT:	NEONATAL ICU	Code:	314 M-302.A
CATEGORY:	PATIENT CARE	Page:	1 of 2
SUBJECT:	INFECTION CONTROL		

HAND HYGIENE PROTOCOL

1. **Hand Scrubbing:** As a person first enters the patient care areas of the unit he/she must remove all hand jewelry and watch and perform a thorough hand and forearm scrub/washing (including under nails) to decrease bacterial load.
2. **Subsequent Hand hygiene technique:**
 - Alcohol rub is as effective as good hand washing with antiseptic soap. It should be done with enough alcohol to rub and cover all fingers, hands and part of the forearm surfaces. It must be rubbed until dried. Hand washing when hands are soiled or when alcohol is not well tolerated. Hand washing should be performed for 15 seconds. Hands must be thoroughly dried thereafter.
3. **Timing of Hand Hygiene and Environment**
 - Perform hand hygiene immediately before *and* after touching the infant or his/her clean environment (objects in direct contact with the infant: bed, linen, covering blanket, stethoscope, monitors and ventilator). Hand hygiene must also be performed immediately before manipulating patient tubing that is inserted in sterile body sites (i.e. IV tubing, art lines, chest tubes)
 - Consider area around patient (i.e. chart, pen, computer, chair etc) "dirty environment for patient's sake". If having hands involved in direct patient care use a clean glove as a barrier to touch these objects discarding the glove before touching the patient again.
Consider the monitor alarms and the ventilator knobs clean to the patient. This means that anyone silencing alarms or adjusting the ventilator should use hand hygiene before and after, just as if they were touching the patient. If you touch these areas without washing, they should be cleaned immediately afterwards.
 - Allow proper bed spacing between patients. Beds should have enough separation to allow a caretaker to walk between the beds without touching them. This would help to maintain the clean environment as such for each infant
4. **Use of Gloves:**
 - Must wear gloves (CDC standard precautions) if touching non-intact skin, mucous membranes and body fluids (stool, urine, respiratory and oral secretions; i.e. Changing diaper, suctioning, feeding or placing NGs, dressing change, etc). Change gloves after diaper change before touching cleaner areas of the infant like NG and ET.
 - May wear gloves in direct patient care to enhance barrier and protect self, but still needs to wash or use alcohol before donning gloves for the initial patient contact and after discarding the gloves post patient contact.
5. No jewelry (rings, watches, bracelets of any kind) or acrylic nails are allowed when providing patient care. Bacterial count is several-fold higher in hands with these elements on. If physically unable to comply please talk with your manager to fill an exception petition form and wear gloves for all patient contacts.

Failing to perform proper hand hygiene, especially immediately after patient contact is not an oversight but a violation in patient care. Hand hygiene is considered your personal responsibility towards your patient.

DEPARTMENT: NEONATAL ICU

Code: (314) M 302.A

CATEGORY: PATIENT CARE

Page: 2 of 2

SUBJECT: INFECTION CONTROL

ISOLATION ROOM PROCEDURE

1. Always follow transmission-based precautions sign when entering the isolation room. Gown, glove and mask as indicated on sign (even if only entering for a moment).
2. Discard contaminated gown/mask/gloves inside and use hand hygiene (sanitation/washing) before leaving the room. Once outside the room, perform hand hygiene again.
3. Do not use your own pens, clipboard or calculators inside the room. The unit provides for these items inside every isolation room. If needing to have data outside may write it on paper and stick it to the glass window to be able to read it from the outside (Please omit the name for patient confidentiality reasons)
4. Do not take patient's charts outside the isolation room. If in need to write orders/notes use new, clean paper from the outside. Remember to stamp or hand write the correct patient's name on the order sheet before handing them to the isolation nurse.

INFECTIOUS DISEASE ENVIRONMENTAL SAFETY

1. No drinks or food are allowed in patient care areas

Thermoregulation Protocol

1. Ensure that the family understands the procedure, and answer their questions.
2. Identify the neonate using two patient identifiers.
3. Verify the prescribing practitioner's order.
4. Gather and prepare needed supplies and equipment.
5. Perform hand hygiene.

In the Delivery Room

6. If the temperature of the room can be adjusted, warm the delivery room to above 25° C (78.8° F). Also, close doors and adjust vents in the room.
7. Before delivery of the high-risk or preterm neonate, place a radiant warmer in the delivery room.
8. If the stabilization nursery is not next door to the delivery room, prewarm a transport incubator for use in moving the neonate to the nursery.
9. Place the radiant warmer in the delivery room, out of the way so that it is not in a walkway or near air drafts.
10. Turn on and prewarm the radiant warmer with manual settings to a temperature of 36.5° to 37° C (97.7°-98.6° F).
11. Place all supplies that will be used for resuscitation or will touch the neonate on the warmer. Warm the hands and stethoscopes.
12. Ensure that a head covering more than ½-inch thick is available.
13. Ensure that blankets from a nearby blanket warmer are available.
14. Once the neonate is born, catch or place the neonate in a warmed sterile towel or blanket.
15. If medically indicated, stop momentarily for the mother and family to see and touch the neonate, and then proceed to place the neonate in the radiant warmer.
16. If needed, use additional warming techniques, such as an occlusive polyethylene body bag or plastic wrap, immediately after delivery and during stabilization for a very-low-birth-weight neonate.
17. Dry the neonate quickly, remove the wet towels or blankets from the bed space, and wrap the neonate in dry warmed blankets. Cover the neonate's head with a ½-inch thick hat.
18. Allow the parents to touch the neonate, after warming their hands, if possible.
19. Provide oxygen support as needed.
20. Transport the neonate in a prewarmed double-walled incubator to the NICU.
21. On entry into the NICU, weigh the neonate. If the incubator does not come equipped with a scale, place a heater over the freestanding scale, and prewarm the cover on the scale. Perform the weight measurement quickly and smoothly, and place the neonate in an incubator or on a radiant warmer.

Use of a Double-Walled Incubator

22. Once the decision to bring the neonate to the NICU has been made, prewarm a double-walled incubator or radiant warmer on air control (manual) at 37° C (99° F). Then set the incubator to the thermoneutral range (differs for age and size). Once the neonate has been placed in the incubator, set the air control inside the incubator according to the gestational and postnatal age of the neonate. Place the neonate less than 1500 grams or thermally

- unstable on skin temperature control. Always set radiant warmers on skin or servo mode to prevent overheating.
23. Place the double-walled incubator in a bed space that is free of drafts and away from doorways or air vents and, if in the winter season, outside windows.
 24. Secure the temperature probe on the abdomen in accordance with the manufacturer's guidelines. Choose a site that is away from bony areas and where the neonate will not be positioned or lying on top of the probe. Switch the incubator to skin (servo) control, and set at 36.5° C (97.7° F).
 25. Take an axillary temperature for routine monitoring of core temperature. Hold the probe in place for 3 minutes or longer or in accordance with the manufacturer's recommendations for an accurate reading.
 26. Place all supplies that will be used to care for the neonate or will touch the neonate in the incubator. Warm the hands and stethoscopes.
 27. In a neonate of less than 30 weeks of gestation, add 70% to 90% humidity to a double-walled incubator for the first 7 days of life (depending on the gestation and the permeability of the neonate's skin). After the first week, continue humidity at 50% to 60% until the neonate reaches 30 to 32 weeks of postconception age.
 28. If recommended by the manufacturer, use sleeves on portholes, especially if the neonate is premature, is of low birth weight, or exhibits thermal instability.
 29. Perform more frequent monitoring of temperature regulation when the incubator is covered with blankets or is covered and then uncovered.

Use of a Radiant Warmer

30. Secure the temperature probe on the neonate's abdomen using a foil-backed shield in accordance with the manufacturer's guidelines. Choose a site that is away from bony areas and brown fat deposits; the neonate should not be positioned on top of the probe. Switch the radiant warmer to skin (servo) control set at 36.5° C (97.7° F).
31. Place all supplies that will be used to care for the neonate or will touch the neonate in the warmer. Warm the hands and stethoscopes.
32. Place a commercially approved chemical mattress or commercially approved warming pad with controlled heat settings under a neonate in a radiant warmer or incubator if an additional source of heat is required to maintain the neonate's temperature.
33. If needed, place a polyethylene bag or plastic wrapping over the neonate from chin to feet.

<http://app44.webinservice.com/NursingSkills/ContentPlayer/SkillContentInIFrame.aspx?...>
07/02/2010

Rewarming a Hypothermic Infant

34. Closely monitor the neonate's vital signs, level of consciousness, and acid-base status during rewarming.
35. If using an incubator for rewarming set the air temperature 0.5° to 1° C (0.9°-1.8° F) above the neonate's rectal temperature. Once the core temperature reaches the air temperature and the neonate remains stable, increase the air temperature 0.5° to 1.5° C (0.9°-1.8° F) again. Continue the process until the neonate's temperature is normothermic.
36. If using a radiant warmer for rewarming, set the servo control temperature at 36.5° C (97.7° F). Do not place a temperature probe over a bony surface.

Treating Hyperthermia

37. If a neonate becomes hyperthermic (a temperature over 37.5° C [99.5° F]), identify the cause (i.e., environment, dehydration, withdrawing, sepsis, maternal hyperthermia).
38. Closely monitor the hyperthermic neonate, and perform interventions to decrease temperature to normothermic range depending on the cause. (Decrease the temperature of the incubator or warmer, partially undress or uncover the neonate, remove positioning devices to allow for extension, and evaluate and treat for dehydration and infection.)

Skin-to-Skin Contact

39. If medically indicated, encourage skin-to-skin contact (SSC) in full-term and preterm neonates for mild hypothermia of 36° to 36.4° C (96.8°-97.5° F).
40. Have the mother wear clothing with the opening in the front. Place the neonate on the mother's bare chest between the breasts, upright, with head turned to the side in contact with the mother's skin, wearing only a diaper. Place a warm blanket over the neonate, and a hat on the neonate's head.

Bathing the Neonate

41. Delay bathing until the neonate's temperature has been stabilized in the normal range for 2 to 4 hours; consider the metabolic effects of temperature stability such as glucose needs and oxygen requirements. Remove excess vernix, but the removal of all vernix is not necessary for hygienic purposes.
42. Monitor temperature closely before, during, and after the bath. Ensure that warmed towels and bedding are available, and discontinue the bath if the neonate displays distress. Encourage SSC directly after the bath if medically indicated.

Weaning to an Open Crib

43. Carry out weaning to an open crib slowly. Decrease the incubator temperature by 1° to 2° C (1.8°-3.6° F) every 12 to 24 hours until the incubator is at room temperature.
44. During weaning, dress the neonate with a hat and two blankets.
45. Place the neonate in an open crib, and keep the neonate away from drafts. Monitor the axillary temperature closely during this time.
46. Document the procedure in the neonate's record.

Excerpted and adapted from Verger, J.T., & Lebet, R.M. (Eds.) (2007). *AACN procedure manual for pediatric acute and critical care*. St. Louis: Saunders.

Last Reviewed: November 2009

ALERT

The following findings in the neonate should be reported if they persist despite nursing interventions²¹ :

- Axillary core temperature less than 36.5° C (97.7° F)
- Incubator air temperature greater than 37.5°C (99.5° F)
- Increase of oxygen needs above baseline
- Weight loss or consistent inability to gain weight
- Temperature instability (hypothermia and hyperthermia)

OVERVIEW

High-risk and preterm neonates are often unable to stabilize and maintain body temperature without support; providing a neutral thermal environment allows conservation of limited resources for other necessary bodily functions.

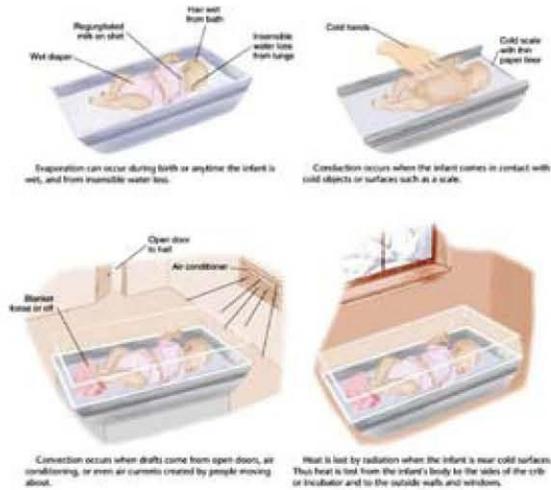
Infants at risk for developing hypothermia include those who are premature, small for gestational age, critically ill, or hypoglycemic; those with sepsis, electrolyte imbalance, nutritional issues, or open skin defects; and those receiving¹⁷ neuromuscular blocking agents.

The practitioner must be familiar with the anatomic and physiologic characteristics of the infant's skin. Some important risk factors for thermoinstability in infants include a large surface-to-weight ratio, limited brown fat stores, prematurity, and^{7,10,17,21} transepidermal water loss.

Understanding the principles of heat loss through the neonate's skin is important. Neonates can lose or gain heat through four different mechanisms: (1) heat transfer via direct contact with hot or cold surfaces, or conduction; (2) heat transfer via air flow over a large body mass, or convection; (3) heat transmission through absorption via indirect contact from emission of infrared rays, or radiation; and (4) heat loss that converts liquid into vapor, or^{7,10,14,17,19,21} evaporation. (Figure 1)

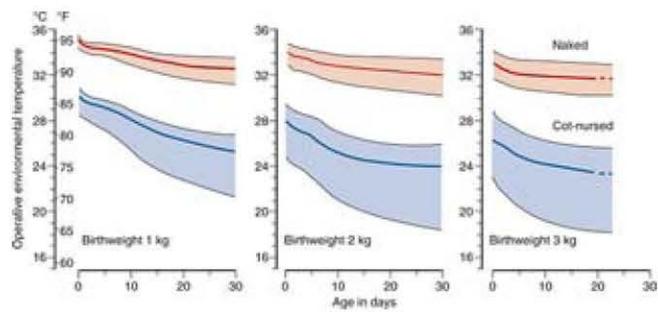
Newborns use nonshivering thermogenesis to generate^{7,14,17,19,21} heat. This process is accomplished by the metabolism of brown fat stores located in the neck area, around the kidneys, in the mediastinum, and in the scapular region.^{7,10,14,17,19} Although nonshivering thermogenesis is an efficient method of

Figure 1



Thermal protection of the newborn. Murray, S. (2006). *Foundations of Maternal-Newborn Nursing* (4th ed.). St. Lou Saunders.

Figure 2



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HAND WASHING LECTURE – PALESTINE MEDICAL COMPLEX