



**Principles and Practices of  
Developmentally Supportive Care (DSC)  
in the NICU  
& Clinical Applications  
in Neonatal Medicine**



**2<sup>nd</sup> Edition, May, 2018**

*Chief Scientific Editor*  
**Dr Amitava Sengupta**

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## An Initiative

What began as an opportunity for an NICU posting for Amy Carroll in the year 2013, led to an extraordinary interdisciplinary collaboration with the Paras Hospital NICU team.

The Neonatal group at Paras Hospitals, Gurgaon (NCR), India, delivers state of art and quality care to Preterm, Fragile and/or critically ill infants in their NICU.

There was consideration of the developmental needs of the preterm /fragile or critically ill infants and eventually, an extended role for Amy Carroll as a facilitator of an inter-professional Developmentally Supportive Care (DSC) team evolved. The team embarked on a DSC knowledge translation journey which initially included review of volumes of current DSC literature and related evidence based best practices in the NICUs across the globe. The effort was supported academically by the Occupational Therapy Doctoral Program at Thomas Jefferson University, Philadelphia, USA, as Amy Carroll was completing her Doctorate in the same program.

Two years of dedicated research and clinical work by the DSC team culminated in the creation of a 5 week program for the nursing staff through knowledge translation methods.

The knowledge translation consisted of: weekly training sessions, integrated practice of techniques, and strength-based strategic planning sessions tailored to the Paras Hospital setting. The Paras DSC vision was, and still is, to create a "Culture of Developmentally Supportive Care" that is relevant and useful for all families and NICUs across the NCR and India. We are ever closer to realizing that vision due to the amazing efforts of all NICU staff including the Consultants, Resident Specialists, the NICU Nursing Staff and the DSC team. We hope that this information will be a useful catalyst for DSC in other NICUs across our country and abroad!

We would like to thank the Secretary NNF India (2013-14), Dr Vikram Datta for his intense and unconditional support and encouragement, which has made our endeavor possible.

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## Preface

It is with great deal of modesty as well as satisfaction, that we present the 2<sup>nd</sup> edition of the Textbook on "Principles and Practices of Developmentally Supportive Care (DSC) in the NICU & Clinical Applications in Neonatal Medicine".

The field of Neonatology has experienced some remarkable progress over the last four decades in care of the newborn. This has reflected with dramatic reductions in both neonatal and infant mortality and has enabled the neonatal team to save more babies of lower gestational age and extremely low birth weight (ELBW). In the present times, the incidence of prematurity is high in both western and eastern worlds. However, morbidity rate of neurodevelopmental impairment has not decreased for this population.

The preterm infant experiences a hostile environment in the intensive care (NICU) setting as compared to the womb. The in-utero environment of a developing fetus is characterized by generalized extremity flexion and containment, limited light and noise exposure, sleep cycle preservation, and unrestricted access to mother via somatosensory, auditory, and chemosensory pathways. This environment is favorable for positive sensory input which is crucial for normal fetal brain development.

A newborn preterm infant is deprived of these basic developmental needs upon transition from the womb to the environment of the newborn intensive care unit. This environment is typically characterized by painful procedures, excessive light and noise exposure, interrupted and inadequate sleep, and separation from mother. Negative replaces positive sensory input into the developing fetal brain which, as research shows, can permanently alter normal brain development.

Developmentally Supportive Care (DSC) practices are evidence based interventions that promote newborn brain and neurobehavior development. They minimize the stress of NICU environment, support autonomic stability, normal motor, sensory neurological development and promote behavior state organization.

In the present edition 2018 of the textbook we have added a new section on "Clinical Applications in Neonatal Medicine". The aim of adding this section is not to address all aspects of neonatology, but to discuss those clinical areas that are more novel and have greater relevance to preterm medicine and supportive care of the newborn. A chapter on natal and neonatal teeth has also been included in this section as it is indeed a mystifying subject. This book has been designed to provide an in depth knowledge of the various facets of Developmentally Supportive Care (DSC) in section 1 and Clinical Applications relevant to care of preterm infants/sick newborns in section 2.

I have intensely enjoyed working with each of the authors who contributed to this book and reading their state – of – the – art contributions. I hope the reader will share my appreciation for the outstanding quality of each of the chapters. I am also very grateful to Mr Rakesh Ahuja from Process & Spot, New Delhi for designing and producing this masterpiece book.

I acknowledge with extreme gratitude each of the authors for their outstanding contribution.

Our goal should be to improve functional outcome, have positive neuro developmental outcome and achieve the gold standard of "INTACT SURVIVAL" of the preterm, fragile and/or critically ill infants.

Finally I would like to dedicate this book to all newborns

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## Foreword

One of the most important career choices I made in my early days is to become an intensivist. Pediatric intensive care was still in its infancy those days. I somehow gravitated towards this discipline and finally made it my area of super specialization. Since then I have been a witness to the continuous development of the field, a key feature of which has been the gradual emergence of PICU and NICU as separate entities functioning within the overall healthcare eco-system.

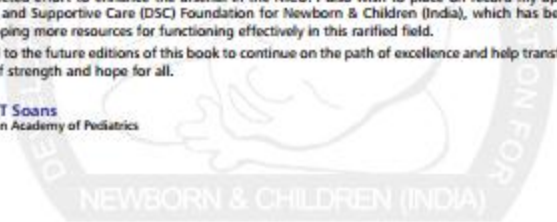
The NICU, especially, calls for expertise of a far higher order and it had initially suffered from a lack of regular feeds and updates to empower the neonatal intensivist to better deal with the unimaginable range of challenges one could be confronted with in NICU settings. Thankfully, this lacuna is now being filled by the increasing amount of medical literature coming out, which is focused exclusively on issues pertaining to NICU.

I see this book, Principles and Practices of Developmentally Supportive Care (DSC) in the NICU, as a valuable addition to the repertoire of scientific material dealing with NICU. The latest and vastly expanded edition also has the benefit of a supplementary section on Clinical Applications in Neonatal Medicine. The book is an excellent compilation of highly relevant subjects, which are dwelled upon in a comprehensive and credible manner by authors of repute. The presentation is well organized, neat and pleasing to the eye. I am especially impressed by the high quality of the content which should certainly fill the NICU specialist with confidence.

I congratulate all members of the editorial team, especially the Chief Scientific Editor, Dr Amitava Sengupta on their well directed effort to enhance the arsenal in the NICU. I also wish to place on record my appreciation for Development and Supportive Care (DSC) Foundation for Newborn & Children (India), which has been taking the lead in developing more resources for functioning effectively in this rarified field.

I look forward to the future editions of this book to continue on the path of excellence and help transform the NICU into a place of strength and hope for all.

**Dr Santosh T Soans**  
President, Indian Academy of Pediatrics







## Message from President - National Neonatology Forum (INDIA)

Dear Dr. Amitava Sengupta,

It gives me immense pleasure to know that under your leadership such a high quality training programme is being carried out on "Developmentally Supportive Newborn Care in Neonatal Intensive Care Units" with the help of able faculty from all over the country and overseas.

With the initiative of Government of India, almost each district is having 12-20 bedded or larger neonatal units, fully equipped for Level II Newborn care with adequate space, equipment and manpower. Here small and sick newborns are receiving standard care and are surviving. This is like a dream coming true for my age Neonatologists.

With advances and improvement in perinatal care (accompanied by "State of Art" Obstetric care), more and more extremely preterm and ELBW babies are surviving. The quality of life in such babies is at times under question.

Preterms in NICUs are exposed to hostile and painful environment compared to the calm and protected intrauterine environment. This definitely affects their survival and subsequent life. Developmentally supportive care for these babies is as essential as their survival.

You have not only developed such supportive care tools for your unit, but also taken the initiative to spread this message by organizing such workshops of immense importance in different corners of our country with the help of International and National faculty. GOI has now also incorporated the quality and developmentally supportive issues in their India Newborn Action Plan (INAP), launched in September 2014.

The National Neonatology Forum (India) recognizes your efforts and supports such extraordinary endeavours for intact and quality survival of sick and healthy newborns of country. Prematurity is emerging out to be a leading cause mortality and morbidity not only in India but the world over also. Hence these intense workshops are most appropriate in today's neonatal scenario.

The compilation of such an extraordinary effort can be clearly seen in your second edition of the book "Principles and Practices of Developmentally Supportive Care in NICU and Clinical Applications in Neonatal Medicine" edited by you. I wish to congratulate you Dr. Amitava Sengupta.

NNF and I personally wish you all the best not only for the present workshop but for many more such workshops in future as well for your excellent compilation.

**Dr B D Bhatia**, MD, DCH, FICU, FIAP, FAMS, FNNF  
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WORLD OF PEDIATRICS & CHILDREN (INDIA)



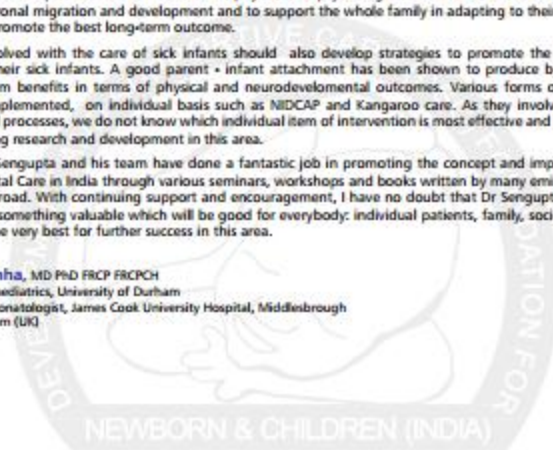
## Message from Overseas

It is increasingly clear that newborn babies respond to and are affected by the environment around them. Compared with the womb, even the best designed modern Neonatal Intensive Care Unit (NICU) is a hostile, noisy and dangerous environment which is challenging to the immature homeostatic mechanisms of a preterm baby. It is the duty of all neonatal practitioners to minimize the physical and psychological disturbance to the baby during a time of rapid neuronal migration and development and to support the whole family in adapting to their circumstances in order to promote the best long-term outcome.

All units involved with the care of sick infants should also develop strategies to promote the attachment of parents to their sick infants. A good parent - infant attachment has been shown to produce both short term and long-term benefits in terms of physical and neurodevelopmental outcomes. Various forms of interventions are being implemented, on individual basis such as NIDCAP and Kangaroo care. As they involve a number of physiological processes, we do not know which individual item of intervention is most effective and hence the need for continuing research and development in this area.

Dr Amitava Sengupta and his team have done a fantastic job in promoting the concept and implementation of Developmental Care in India through various seminars, workshops and books written by many eminent doctors in India and abroad. With continuing support and encouragement, I have no doubt that Dr Sengupta and his team will bring in something valuable which will be good for everybody: individual patients, family, society and nation. I wish him the very best for further success in this area.

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