



Review



Developmentally supportive care in neonatology: Correlational study of the knowledge and declared practices of professionals

Naima Faez^{a,b,*}, Fouzia Hmami^{d,e}, Widade Kojmane^{b,d}, Samir Atmani^{b,c}

^a Faculty of Science and Technology, Sidi Mohamed Ben Abdelah University, Fez, Morocco

^b Laboratory of Epidemiology and Research in Health Science, Faculty of Medicine and Pharmacy / Sidi Mohamed Ben Abdelah University, Fez, Morocco

^c Medico-surgical Unit of Pediatric Cardiology, Pediatric Cardiac Catheterization, Hassan II University Hospital, Mother and Child Department, General Pediatrics and Pediatric Cardiology, Fez, Morocco

^d Neonatology and Intensive Care Unit, Hassan II University Hospital, Mother and Child Department, General Pediatrics, Fez, Morocco

^e Human Pathology, Biomedicine and Environment Laboratory, Faculty of Medicine and Pharmacy / Sidi Mohamed Ben Abdelah University, Fez, Morocco

1. Introduction

In the Neonatal Intensive Care Unit (NICU), premature newborns and sick term newborns require hospitalization to receive individualized care aimed at achieving and maintaining their well-being. These children have increased neurodevelopmental risk in the form of motor, cognitive and language difficulties, and behavioral or attention disorders [1,2]. Thus, the care environment contains many stressors due to maternal deprivation and over-stimulation, which conflict with the demands of brain development. However, neonatal stress has become a potential risk factor; hence the need for care that meets the developmental needs of the child as an integral component of quality neonatal care [3,4]. The aim of professionals is not only to ensure the reduction of mortality and morbidity but also to engage in performance improvement to optimise prognosis and further development [5,6].

Following a World Health Organisation (WHO) report, the results of a National Population and Family Health Survey (NPFHS-2018) conducted by the Ministry of Health in Morocco, showed that out of every 1000 live births, 18 children die before reaching their first birthday. Three-quarters of these could be prevented with routine interventions that are both effective and inexpensive, even without resorting to intensive care. Many survivors suffer lifelong disabilities, including learning, visual and hearing impairments [7]. Yet, improvements in perinatal and neonatal intensive care have decreased neonatal mortality rates. For this reason, neonatal teams must participate in the development of multidisciplinary prevention and/or early intervention actions, hence the integration of Supportive Developmental Care (SDC) [8]. Multidisciplinary collaboration seems to be essential for the proper functioning of services. However, ensuring the support of the child and family requires a greater level of competence and sensitivity. In the

absence of a specific program for this approach in the Moroccan national health system, learning and capacity building strategies for professionals are needed. In this perspective, the present study, the first to address this issue, attempts to elucidate the possible articulations in this universe, through the study of the relationship between the knowledge and the declared practices of professionals with regard to SDC in the Resuscitation and Neonatal Intensive Care Department at the Hassan II University Hospital of Fez, Morocco. And this can contribute to establish a diagnosis that could open up other tracks of reflection.

2. Materials and methods

2.1. Research quote

This is a quantitative correlational descriptive study carried out in the neonatology department of the Hassan II University Hospital in Fez, the only level III neonatal intensive care medical-surgical centre in the central, northern and eastern region of Morocco. The sampling was based on an exhaustive selection of all the staff working in the department (60): 17 doctors, 27 nurses, 16 caregivers [9,10]. The data collection tool chosen was a self-administered, tested and validated questionnaire divided into four sections and based on a Likert scale of five statements [11,12]. Data were collected between April 2020 and January 2021 and entered using Excel and SPSS. v.25 software. Descriptive and correlational statistical analyses were presented in the form of frequency measures, means, correlation coefficients and minimum and maximum values.

* Corresponding author. Laboratory of Epidemiology and Research in Health Science, Faculty of Medicine and Pharmacy / Faculty of Science and Technology / Sidi Mohamed Ben Abdelah University, Fez, 30000, Morocco.

E-mail address: naima.faez@usmba.ac.ma (N. Faez).

<https://doi.org/10.1016/j.amsu.2022.104928>

Received 25 August 2022; Received in revised form 29 October 2022; Accepted 13 November 2022

Available online 17 November 2022

2049-0801/© 2022 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2.2. Ethical aspects

The ethical principles of scientific research were taken into consideration, including: a) Obtaining prior written approval from the Ethics Committee of the University Hospital of Fez as well as from those in charge of the study department, b) Free and informed consent of the participants, c) Right to self-determination, d) Respect for anonymity and confidentiality, and e) Fidelity to research resources.

3. Results

3.1. Socio-demographic and professional characteristics

The participation rate was 92% (55), represented by 45.5% (25) of the nurses, 27.3% (15) of the doctors and 27.3% (15) of the nurses' aides. For the socio-demographic variable related to age, 63% (35) were aged between 25 and 45 years. In terms of seniority, 70.9% (39) have less than 5 years at professional level and 44 (80%) at the level of the neonatology department.

3.2. Knowledge of Supportive Developmental Care

According to the data collected, 58.2% have not received any training and 100% never received training on observing the behavior of the new-born. These results underline the inadequacy, or even absence, of training (Table 1).

As for the definition of SDC, 45.5% stated that it was medical and nursing technical care. Only 12.7% agreed with the notion of positioning adapted to the clinical condition, 9.1% with skin-to-skin carrying and 12.7% for oral stimulation (Table 2).

3.3. Attitudes and practices related to environmental strategies

For daily attitudes and behaviours related to environmental noise, there was a statistically significant positive correlation (0.426**) at the two-sided level (0.01) between training in the care environment and the distance between caregivers. On the other hand, this training did not have a positive impact on the attitudes of professionals regarding the handling of materials, which was marked by the negative correlation between the two items (-,188). Other practices have positive correlations with variable training but are not statistically significant. The results are positive but do not show a statistically significant correlation between training and noise practices (Table 3).

Concerning the daily behaviors related light use, 29 (52.7%) sometimes have a positive attitude to decrease the light intensity and create a day-night cycle. 23 (41.8%) sometimes ensure darkness during sleep. 17 (30.9%) rarely adapt the light intensity to the visual abilities of the Neonate. While, 15 (27.3%) never shielded the baby's eyes during care and 29 (52.7%) often keep the light normal to facilitate the application of care and monitoring of the newborn without taking into consideration this environmental factor.

Table 1
Distribution of participants according to training topics.

Variables/Statements	Yes	No
Care environment and clinical practice	11 (20,0)	44 (80,0)
Sensory system development and protection	6 (10,9)	49 (89,1)
Neonate's behavior observation	0 (0,0)	55 (100,0)
Physical contact	20 (36,4)	35 (63,6)
Pain assessment and management	15 (27,3)	40 (72,7)
Newborn positioning and handling	18 (32,7)	37 (67,3)
Parental attachment process	6 (10,9)	49 (89,1)
Newborn sleep wake cycle	5 (9,1)	50 (90,9)
Orality and feeding	13 (23,6)	42 (76,3)
Management hospitalized newborn interdisciplinary	4 (7,3)	51(92,7)

Table 2
Strategies to promote SDC.

Variables/Statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Preparation of an environment favouring the well-being of the new-born	21 (38,2)	32 (58,2)	2 (3,6)	0 (0,0)	0 (0,0)
Positioning adapted to the clinical condition of the new-born	8 (14,5)	41 (74,5)	6 (10,9)	0 (0,0)	0 (0,0)
Newborn behavior observation	3 (5,5)	24 (43,6)	23 (41,8)	4 (7,3)	1 (1,8)
Integration of parents into care	4 (7,3)	25 (45,5)	11 (20,0)	13 (23,6)	2 (3,6)
Skin-to-skin carrying	5 (9,1)	31 (56,4)	19 (34,5)	0 (0,0)	0 (0,0)
Oral stimulation	7 (12,7)	23 (41,8)	24 (43,6)	1 (1,8)	0 (0,0)
Newborn pain assessment and treatment	10 (18,2)	35 (63,6)	10 (18,2)	0 (0,0)	0 (0,0)

3.4. Attitudes and practices related to developmental strategies

Regarding the techniques to support the newborn's development, only 12.7% often practice the grouping of care, 40% have never given a massage to the newborn. Thus, oral and peri-oral stimulation are rarely practiced (29.1%) (Table 4).

For pain management, pharmacological protocols are often used by 29 (52.7%). But, non-pharmacological protocols are rarely used by 45 (81.8%). The organisation of the time and duration of care based on the baby's behavior, skin-to-skin care with integration of the parents and the assessment of pain by a valid tool were never practiced by the participants.

Regarding the grouping of care, clinical practice by the same discipline is done by 40 (72.7%). It is often between doctors and nurses only for 11 (20%) and 12 (21.8%) between nurses and caregivers. But multidisciplinary teamwork is often done by only 4 (7.3%).

As For the integration of parents in care, 24 (43.6%) often practice it at the time of breastfeeding/feeding. 19 (34.5%) sometimes include it in communication about their child's health status. But 46 (83.6%) never included parents in essential care or resuscitation activities and decision making.

For factors hindering the integration of SDC integration according to the participants, lack of specific training and work overload are the most important factors 90.9%, followed by 89.1% for lack of time, 78.2% for organizational problems and 70.9% for lack of motivation.

For a better determination of the correlation, it proved wise to create two scales summarizing the first ones the practices and the second ones the knowledge and to test afterwards the different correlations that exist between the treated items. This operation shows that the participants who declared to have benefited from the trainings scored an average of 28.667 of the practices in Developmental Care. While those, having reached the peak of the averages 31.154, are at the average level of knowledge in Developmental Supportive Care. Certainly, 22.241 is the lowest level on both dimensions. The point to note about these variations in means that professionals who are most engaged in Supportive Developmental Care practices have only an average level of knowledge in this area (Fig. 1).

To summarize, the results show the existence of statistically significant correlations at the 0.01 level (two-tailed) between the training on the theme of the environment and the two independent explanatory variables, namely, practices (with 0.461**) and knowledge (with 0.764**). These figures reveal the positive impact of the said training on both dimensions, while having a greater influence on the improvement

Table 3
Correlations: Practical behaviors related to environmental noise.

		Decreasing Volume of the alarms	Muting alarm during care	Whisper near the incubators	Switching the incubator to air mode	Handle with care The material	Muting the phone	Removing interactions between personnel
Training: Care Environment	Pearson correlation Sig. (bilateral) N	,011 ,938 55	,189 ,167 55	,172 ,209 55	,092 ,502 55	-,188 ,168 55	,039 ,775 55	,426** ,001 55

** The correlation is significant at the 0.01 level (two-tailed).

* The correlation is significant at the 0.05 level (two-tailed).

Table 4
Development support techniques.

Variables/ Statements	Frequently	Almost evry time	Sometimes	Rarely	Never
Newborn behavior observation	3 (5,5)	8 (14,5)	9 (16,4)	19 (34,5)	16 (29,1)
Care grouping	0 (0,0)	7 (12,7)	25 (45,5)	18 (32,7)	5 (9,1)
Pain management and assessment	3 (5,5)	16 (29,1)	20 (36,4)	8 (14,5)	8 (14,5)
Asymmetric flexion posture	0 (0,0)	14 (25,5)	23 (41,8)	8 (14,5)	10 (18,2)
Massage practice	0 (0,0)	0 (0,0)	8 (14,5)	25 (45,5)	22 (40,0)
Skin to skin carrying	0 (0,0)	3 (5,5)	16 (29,1)	25 (45,5)	11 (20,0)
Oral and peri-oral stimulation	1 (1,8)	10 (18,2)	18 (32,7)	16 (29,1)	10 (18,2)
Respect for the awakening/sleep cycle	0 (0,0)	2 (3,6)	31 (56,4)	10 (18,2)	12 (21,8)
Watching over feeding	27 (49,1)	23 (41,8)	2 (3,6)	1 (1,8)	2 (3,6)
Care integration of the parents	1 (1,8)	0 (0,0)	12 (21,8)	31 (56,4)	11 (20,0)

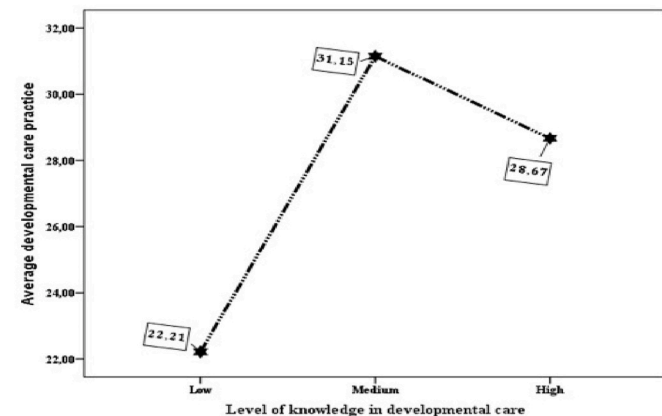


Fig. 1. Correlations between knowledge and developmental care practices.

of the level of knowledge of the professionals in contact with the neonatology department (Table 5).

4. Discussion

The integration of SDC is a transfer of knowledge, practice and philosophy of care between different actors [13,14]. The aim of this work is not to compare the three profiles of the participants, but to identify gaps and shortcomings. Regarding the level of knowledge about SDC, 58.2% recorded a low level, 32.7% had a medium level, but only

9.1% had a high level. These results may be related to certain socio-demographic and professional characteristics, such as the young age of the participants and a professional seniority not exceeding 5 years. Thus, some studies have shown a positive view of caregivers regarding their role, support to parents and the child’s well-being [15]. However, in neonatology, professionals need training to enable them to perform technical care, while reinforcing emotional support. An evolving vision of care based on these principles leads to better medical and neurobehavioural outcomes for the child and improved personal and professional development for caregivers [16,17].

Regarding the **practices related to environmental strategies**, the results show the presence of negative attitudes towards the use of light, ambient noise and the respect of the sleep/wake cycle. This is due to the fact that 80.0% revealed a remarkable lack of knowledge about environmental issues. In fact, 52.7% often kept the **light** normal throughout their practice, contrary to the recommendations of certain studies emphasizing the importance of lighting and its effects on the hospitalized child, as well as those proposed by some organizations to guide clinical practices related to light in neonatology [18] In this sense, constant dimmed lighting [19] recognized as a common attitude in neonatal units [20] as well as cyclic lighting have proven to have positive effects on hospitalized premature infants in terms of reduced activity level and lower heart rate [21].

Regarding **environmental noise**, almost half of the respondents rarely moved their interactions away from the incubators. These results are consistent with those of other studies confirming the negative effects of noise, both short and long term on the health of newborn hospitalized. In this context, the assessment of noise in the intensive care unit has shown that noise is a problem of concern because of its harmful effect, often caused by staff, visitors and equipment [22]. The exposure of the neonate to noise depends not only on the architectural and organizational constraints of the ward, but also on the attitudes, behaviors and practices of the care teams who are expected to reduce noise levels and to increase the use of systematic quiet periods [23].

Regarding practices related to **developmental strategies**, the results confirm a significantly positive association between the variables. The greater the level of knowledge, the greater the practice of Developmental Care will be. In this framework, for **behavioral observation**, no participant reported training in this topic. According to the literature, this technique is an important source of medical information. The organisation of an observation session in optimal environmental conditions allows not only the interpretation of the relational and behavioral reactions of the newborn but also the discovery of his or her skills [24]. Trained staff should analyse the child’s behavior before, during and after care in order to establish an individualized care programme in collaboration with the parents [25].

For **interdisciplinary management**, the results show the low level of care grouping (12.7%). Thus, SSD practice requires reflection on the role of each discipline involved in the care unit and analysis of hospital organisation and structures to foster multidisciplinary collaboration within the service. Professionals need to be involved to promote their own personal development, self-awareness and emotional maturity [17, 26]. They are a stakeholder in discussions and decision-making [27,28].

Table 5
Correlations between environmental training and the two variables knowledge and practice.

		Care Environment	Developmental Care Practices	Knowledge of developmental support care
Training: Care Environment	Pearson correlation	1	,461**	,764**
	Sig. (bilateral)		,000	,000
	N	55	55	44
Developmental Care Practices	Pearson correlation	Pearson correlation	,461**	1
	Sig. (bilateral)	Sig. (bilateral)	,000	
	N			
Knowledge of developmental support care	Pearson correlation	Pearson correlation	,764**	,551**
	Sig. (bilateral)	Sig. (bilateral)	,000	,000
	N	N	44	44

** The correlation is significant at the 0.01 level (two-tailed).

For **pain assessment and management**, only 27.3% had average knowledge in this area. On the other hand, their practical knowledge did not exceed. These results are consistent with other studies that have addressed the impact of painful and stressful early life experiences on new-born neurobehavioral outcomes. Thus, pain and stress contributed significantly to neurobehavioral outcomes. This will help clinicians to develop targeted neuroprotective strategies and individualized interventions to improve infant developmental outcomes [29].

However, **asymmetric flexion positioning** is only respected by 14 (25.5%). Certainly, several studies have demonstrated the benefits of proper positioning for improving muscle tone and increasing sleep duration [30]. Thus, supine positions and manual restraint increased both parasympathetic activity and the complexity of autonomic adjustments, even in the presence of ambient noise greater than the recommended level, which also tends to increase sympathetic activity [31].

For **orality**, only 18.2% (10) practise oral and peri-oral stimulation. Certainly, oral-facial stimulation and the development of active feeding must be integrated into the care practice in order to support food autonomy and preserve oral pleasure at hospital discharge [32] (Bruwier et al., 2014). This practice is also necessary to minimize the risk of oral disorders [33] including a reduction in verbal difficulties and long-term eating disorders [34].

As far as respecting the **sleep/wake cycle** is concerned, only 3.6% often practise care that respects this day/night mode. There is much controversy about the harmful effects of sleep deprivation on the body, particularly on brain development [35]. In the Neonatal Intensive Care Unit, sleep is disorganized due to the frequency of sleep episodes during the day, due to the noise and light environment as well as the care practice. The biological and neuropsychiatric consequences of this sleep deprivation could have an impact on the morbidity of N. Born hospitalized [36].

For **parental attachment**, 83.6% (46) never included parents in care activities. Furthermore, it has been shown that babies carried skin-to-skin had better organisation of longer periods of quiet sleep and consequently better organisation and dwelling skills [37,38]. Hospitalization in a family room, by promoting baby wearing, skin-to-skin contact and parental involvement in care, has been shown to have an overall positive impact on the newborn, the family and the care team [39]. In summary, the results show statistically significant correlations between professionals' knowledge and their reported practices. Indeed, implementation of developmental care requires equitable access to educational resources and support within and beyond the NICU [40].

5. Conclusion

The relevance and feasibility of the subject matter was the primary force guiding the realization of this study. It represents a first initiative. One of the main limitations is related to the choice of a single tool. The questionnaire in no way reflects the actual behavior of the respondents. This research allowed us to identify a low level of knowledge and practices, and to target the real gaps, thus encouraging us to multiply efforts to update knowledge and strengthen professional skills. The

results of this significant correlational study can be used as a basis for clinical decisions for better SDC practice. In order to support the hospitalized newborn, the implementation of SDC seems to be a priority. It would be interesting to repeat an evaluation of knowledge and practice after the introduction of new programs and specific protocols for individualized management in neonatology.

Declaration of competing interest

All authors declare no conflict of interests.

Ethical approval

Ethical approval number 21/19 and a letter of permission were obtained from the ethics committee of the Hassan II University Hospital in Fes for the data collection. After a brief explanation of the type of study and the questionnaire, written informed consent in duplicate in Arabic and French was obtained from each study participant.

Sources of funding

Non.

Ethical approval

Research studies involving patients require ethical approval. Please state whether approval has been given, name the relevant ethics committee and the state the reference number for their judgement.

Ethical approval number 21/19 and a letter of permission were obtained from the ethics committee of the Hassan II University Hospital in Fes, Morocco for the data collection. After a brief explanation of the type of study and the questionnaire, written informed consent in duplicate in Arabic and French was obtained from each study participant.

Please state any sources of funding for your research

The authors declare the non-existence of any financial and material support for research, work, writing and editorial assistance from internal or external bodies, including commercial companies.

Author contribution

This study was carried out in collaboration between all authors. The lead author (Faez Naima) conceived the idea of the title, developed the proposal, analysed the data, interpreted the result and prepared the manuscript for publication in your journal. The 2nd author (Hmami Fouzia) approved the idea of the title, participated in the comments, assisted in the analysis of the data and interpretation of the result. The third author (Kojmane Widade) participated in the comments, assisted in the analysis of the data and interpretation of the result. The 4th author (Atmani samir) participated in the comments, editing of the manuscript, assisted in the analysis of the data, interpretation of the result and

sending for publication in your journal Provenance and peer review.

Please state any conflicts of interest

The authors declare that they have no competing interests.

I hereby certify that the document was approved by all authors and that it was not offered to other journals.

Registration of research studies

1. Name of the registry: Note Applicable
2. Unique Identifying number or registration ID: Note Applicable
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): Note Applicable

Guarantor

Pr Atmani Samir (Professor of higher education teacher in Faculty of Medicine and Pharmacy/Medico-surgical unit of pediatric cardiology. Pediatric cardiac catheterization. Hassan II University Hospital, Mother and Child Department, General Pediatrics and Pediatric Cardiology – Fez. Morocco.

Consent

Not applicable.

Acknowledgments

The authors would like to thank all the staff of the neonatology department of the Hassan II University Hospital of Fez- Morocco, for their commitment and involvement throughout this study.

References

- [1] G. McNulty, F.H. Duffy, S. Kosta, et al., School-age effects of the newborn individualized developmental care and assessment program for preterm infants with intrauterine growth restriction: preliminary findings, *BMC Pediatr.* 13 (1) (2013) 25.
- [2] Y.-H. Lin, Y.-C. Hsu, C.-H. Chen, Newborn individualized developmental care: neuroprotective care for preterm infants, *Pediatr. Neonatol.* (2021), S1875957221001340.
- [3] L. Altimier, R. Phillips, The neonatal integrative developmental care model: advanced clinical applications of the seven core measures for neuroprotective family-centered developmental care, *N.born Infant Nurs. Rev.* 16 (4) (2016) 230–244.
- [4] F.D. Harillo Acevedo, J.I. Rico Bcerra, Á. López Martínez, The philosophy of the developmental centred care of the premature infant (NIDCAP), *eglobal* 16 (4) (2017) 577.
- [5] D. Robert, M.D. White, The newborn intensive care unit environment of care: how we got here, where we're headed, and why - ScienceDirect, *Semin. Perinatol.* 35 (Issue 1) (2011) 2–7. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0146000510001448>.
- [6] Helga Fogstad, Des pratiques sanitaires dangereuses et le manque de respect continuent de nuire aux femmes et aux nouveau-nés les plus vulnérables | Nations Unies, *Chronique ONU*, 2021, 16 Septembre.
- [7] Enquête Nationale sur la Population et la Santé Familiale - Rapport ENPSF, 2eme édition - Ministère de la Santé DPRE/DPE/SEIS Rabat, Maroc, 2018.
- [8] Leslie Altimier, Carole Kenner, Karla Damus, The wee care neuroprotective NICU program (wee care): the effect of a comprehensive developmental care training program on seven neuroprotective core measures for family-centered developmental care of premature neonates | elsevier enhanced reader, *N.born Infant Nurs. Rev.* 15 (Issue 1) (2015) 6–16.
- [9] Haute Autorité de Santé - Méthodes quantitatives pour évaluer les interventions visant à améliorer les pratiques. . Guide méthodologique, service des recommandations professionnelles, CEDEX, Collège de la Haute Autorité de santé, 2007.
- [10] Carmen G. Loiselle, Joanne Profetto-McGrath, Denise F. Polit, Cheryl Tanato Beck, Méthode de recherche en science infirmières, approche quantitatives et qualitatives, Livre, 2007.
- [11] G.M. Sullivan, A.R. Artino, Analyzing and interpreting data from likert-type scales, *J. Grad. Med. Educ.* 5 (4) (2013) 541–542.
- [12] A. Desrosières, La partie pour le tout : comment généraliser ? La préhistoire de la contrainte de représentativité, *Stat. Anal. Données*, tome 13 (2) (1988) 93–112.
- [13] Nathalie Ratynski, Minguy et Sylvie, Individualized developmental care in the NICU: training and educational aspects, *Devenir* 29 (1) (2017) 17–25.
- [14] Lama Charafeddine, Saadieh Masri, Sima Fatima Sharafeddin, Lina Kurdahi Badr, Implementing NIDCAP training in a low-middle-income country: comparing nurses and physicians' attitudes, *Early Hum. Dev.* 147 (2020).
- [15] J. Sizun, I. Olivard, N. Ratynski, An early, individualized, family-centered developmental care program: the NIDCAP, *Devenir* 29 (1) (2017) 5–15.
- [16] Veronique Pierrat, Anaëlle Coquelin, Marina Cuttini, Babak Khoshnood, Isabelle Glorieux, Olivier Claris, Mélanie Durox, Monique Kaminski, Pierre-Yves Ancel, Catherine Arnaud, The EPIPAGE-2 Neurodevelopmental Care Writing Group *Pediatr Crit Care Med*, vol. 17, 2016, pp. 957–967, 10, Translating Neurodevelopmental Care Policies Into Practice: The Experience of Neonatal ICUs in France- The EPIPAGE-2 Cohort Study. Oct 3.
- [17] R. Mosqueda-Peña, D. Lora-Pablos, A. Pavón-Muñoz, et al., Impact of a developmental care training course on the knowledge and satisfaction of health care professionals in neonatal units: a multicenter study, *Pediatr. Neonatol.* 57 (2) (2016) 97–104.
- [18] V. Lebel, M. Aita, Qu'en est-il de l'éclairage à l'unité néonatale, *Rech. Soins Infirm.* 106 (3) (2011) 32–39.
- [19] W. Liu, S. Laudert, B. Perkins, et al., The development of potentially better practices to support the neurodevelopment of infants in the NICU, *J. Perinatol.* 27 (2007) S48–S74.
- [20] Samantha Butler, Heidelise Als, Individualized developmental care improves the lives of infants born preterm, *Acta Paediatr.* 97 (2008) 1173–1175.
- [21] R.D. White, Lighting design in the neonatal intensive care unit: practical applications of scientific principles, *Clin. Perinatol.* 31 (2) (2004 Jun) 323–330.
- [22] F. Angoultant, I. Claudet, S. Dauger, et al., Setting up a pediatric emergency medicine research network, *Arch. Pediatr.* 24 (1) (2017) 1–2.
- [23] P. Kuhn, Etude de la sensibilité auditive du nouveau-né grand prématuré aux stimulations sonores issues de son environnement, 2012, p. 209.
- [24] N. Ratynski, G. Cioni, L. Franck, Y. Blanchard, J. Sizun, The neonatal behavioral observation : a pertinent source of medical informations, *Arch. Pediatr.* 9 (Issue 12) (2002).
- [25] Janellea Santos, Sarah E.a,b Pearce, Annemariae,b,c Stroustrup, Impact of hospital-based environmental exposures on neurodevelopmental outcomes of preterm infants, *Curr. Opin. Pediatr.* 27 (2) (2015) 254–260.
- [26] J.-B. Muller, V. Castaing, S. Denizot, G. Caillaux, A. Frondas, L. Simon, J.-C. Roze, C. Flamant, NIDCAP (newborn individualized developmental care and assessment program). Principles and theory, *Mot. Cérébrale : Réadaptat. Neurol. Dev.* 35 (Issue 1) (2014) 41–43.
- [27] L. Honoré, Travail en situation et prise en compte du risque : le cas des services de réanimation néonatale, *Manag. Avenir* 75 (1) (2015) 89.
- [28] E.A. Lilo, R.J. Shaw, J. Corcoran, A. Storf-Isler, S.M. Horwitz, Does she think she's supported? Maternal perceptions of their experiences in the neonatal intensive care unit, *Patient Exp. J.* 3 (1) (2016) 15–24.
- [29] Xiaomei Cong, Jing Wu, Dorothy Vittner, Wanli Xu, Naveed Hussain, Shari Galvin, Megan Fitzsimons, Jacqueline M. McGrath, Wendy A. Henderson, The impact of cumulative pain/stress on neurobehavioral development of preterm infants in the NICU, *Early Hum. Dev.* 108 (2017) 9–16.
- [30] Y. Kitase, Y. Sato, H. Takahashi, M. Shimizu, C. Ishikawa, H. Yamamoto, M. Hayakawa, A new type of swaddling clothing improved development of preterm infants in neonatal intensive care units, *Early Hum. Dev.* 112 (2017 Sep) 25–28, 2017 Jul 1. PMID: 28675824.
- [31] E.L.F.D. Gomes, C.M.D. Santos, A.D.C.S. Santos, A.G.D. Silva, M.A.M. França, D. S. Romanini, M.C.V. Mattos, A.F. Leal, D. Costa, Autonomic responses of premature newborns to body position and environmental noise in the neonatal intensive care unit, *Rev. Bras Ter Intens.* 31 (3) (2019) 296–302. PMID: 31618347; PMCID: PMC7005950.
- [32] S. Bruwier, V. Pâques, I. Poot, et al., Stimulation de l'oralité, in: J. Sizun, B. Guillois, C. Casper, G. Thiriez, P. Kuhn (Eds.), *Soins de développement en période néonatale: De la recherche à la pratique*, Springer Paris, Paris, 2014, pp. 129–137.
- [33] C.J. Fischer, A. Beissel, J.F. Tolsa, Pédiatrie. 1. Comment favoriser le développement de l'oralité en néonatalogie? [Pediatrics. How can we improve oral feeding in the neonatal intensive care unit?], *Rev. Med. Suisse* 9 (369) (2013) 132–133. French. PMID: 23409651.
- [34] C. Thibault, L'éducation gnoso-praxique orale précoce au sein de l'accompagnement orthophonique chez le jeune enfant né prématuré, *Contrastes* 41 (1) (2015) 253.
- [35] A. van den Hoogen, C.J. Teunis, R.A. Shellhaas, S. Pillen, M. Benders, J. Dudink, How to improve sleep in a neonatal intensive care unit: a systematic review, *Early Hum. Dev.* 113 (2017 Oct) 78–86. Epub 2017 Jul 15. PMID: 28720290.
- [36] X. Drouot, A.-W. Thille, Altérations du sommeil en unité de soins intensifs, *Reanimation* 22 (S2) (2013) 374–382.
- [37] R.R. Kostandy, S.M. Ludington-Hoe, The evolution of the science of kangaroo (mother) care (skin-to-skin contact), *Birth Defects Res.* 111 (15) (2019 Sep 1) 1032–1043. Epub 2019 Aug 16. PMID: 31419082.
- [38] Eun-Sook Cho, Shin-Jeong Kim, Myung Soon Kwon, Haeryun Cho, Eun Hye Kim, Eun Mi Jun, Sunhee Lee, The effects of kangaroo care in the neonatal intensive care

- unit on the physiological functions of preterm infants, maternal–infant attachment, and maternal stress, *J. Pediatr. Nurs.* 31 (Issue 4) (2016) 430–438.
- [39] E. Kainiemi, P. Hongisto, L. Lehtonen, B. Pape, A. Axelin, Effects of single family room architecture on parent–infant closeness and family centered care in neonatal environments—a single-center pre–post study, *J. Perinatol.* 41 (9) (2021) 2244–2251.
- [40] Nadine Griffiths, Spence Kaye, Claire Galea, Psaila Kim, Maralyn Foureur, Lynn Sinclair, The effects of education levels of developmental care in Australia: perceptions and challenges, *Aust. Crit. Care* 34 (Issue 4) (2021) 370–377.