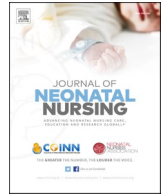




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Maintaining parent-infant skin-to-skin contact during peripheral intravenous catheter insertion in a Dutch neonatal unit

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ABSTRACT

Peripheral intravenous cannulation is a widespread and often repeated experience for infants nursed in a neonatal unit. The procedure, involving pain and discomfort for the infant and anxiety for the parents, is associated with increased exposure to physiological and emotional stress. These stresses can adversely affect parent satisfaction, emotional well-being, and infant neurodevelopmental outcomes.

Interventions such as kangaroo mother care and skin-to-skin contact reduce overall stress experiences for parents and their infants and improve long-term outcomes. The practice challenge is ensuring the continuity of these supportive interventions during medical procedures that have traditionally interrupted parent-infant contact. This article provides a comprehensive overview of one Dutch neonatal unit's approach toward maintaining parent-infant skin-to-skin care during routine peripheral intravenous catheter insertion.

1. Introduction

Peripheral intravenous catheter (PIVC) insertion is a repeatedly common medical procedure for sick and preterm infants, providing essential access to the blood circulation for administering medications, fluids, and blood products (Sundquist Beaman and Swanson, 2006). However, when performed in the context of a neonatal intensive care unit (NICU), this procedure can be challenging. This is partly due to this patient population's unique physical and physiological characteristics (van Rens et al., 2021). PIVC placement contributes to increased episodes of physiological imbalance, discomfort, and pain in infants (van Rens et al., 2021; Chen, 2022). For parents (we use the word 'parent' inclusively to mean 'mother, father' or other 'primary caregiver'), vascular access can be a source of disquiet. This can amplify existing emotional stress and anxiety associated with preterm birth and NICU admission (Gallagher et al., 2018; Schecter et al., 2020; McKeown et al., 2023; Voulgaridou et al., 2023).

To alleviate stress and improve upon the adverse outcomes associated with prematurity, numerous neuroprotective and developmentally supportive interventions have been developed for neonatal nursing practice (Altimier and Phillips, 2016; Chan et al., 2016; British Association of Perinatal Medicine BAPM, 2021; Dai et al., 2023). Foremost

among these is the concept and practices of kangaroo mother care (KMC) (Rey and Martínez, 1983; World Health Organisation WHO, 2003).

Initially, KMC was targeted at low birth weight and preterm infants to improve physiological stability, breastfeeding, and survival ((World Health Organisation WHO, 2003)). KMC advocates for early, uninterrupted, and prolonged parent-infant skin-to-skin contact, exclusive breastfeeding or breastmilk feeding, parent involvement and support, and early NICU discharge (World Health Organisation (WHO), 2023a; World Health Organisation (WHO), 2003). Universal implementation of KMC, particularly in high-resource settings, has proved elusive, and the reasons for this are multifactorial and complex (Donald, 2017; Skene et al., 2019; Stefani et al., 2022), but include definitional differences (Chan et al., 2016). While many of the core elements of KMC are incorporated into other neurodevelopmentally protective practice models, KMC is distinct from them.

Critically, the term KMC is not synonymous with kangaroo care (KC) (also known interchangeably as skin-to-skin care) (Chan et al., 2016; Stefani et al., 2022). In the confines of the NICU, the need to balance competing priorities is a commonplace dilemma faced by nurses and doctors. For example, applying the evidence base for safe and effective PIVC placement while avoiding iatrogenic harm and ensuring a low risk

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of infection traditionally led in our unit to temporary parent and infant separation during the procedure. This approach left little opportunity to consider timely support of parents' information and emotional needs. A situation that can lead to poorer collaborative relationships and increased parental anxiety and complaints (Gallagher et al., 2018; Ferreira et al., 2021; Adama et al., 2022).

To address this challenge, our unit sought to develop procedures and approaches to better integrate routine PIVC insertion with steps to ensure sustained KMC. Doing this would optimize infant and parent well-being by creating additional opportunities to maintain parent-infant contact during standard medical procedures and empower the same parents to become more integrated into partnership working with healthcare staff in caring for their infant. This article reports on one novel approach using skin-to-skin to improve care quality during PIVC insertion in a neonatal intensive care unit (NICU) in the Netherlands.

2. Inserting routine PIVCs

2.1. Context

The designated level 1/2 NICU referred to in this article has 1600 admissions per year and is situated in a maternity hospital with around 2500 deliveries per annum. Admissions come from several sources, including in-house, home/community referrals, and stepdown transfers from level 3/4 NICUs. Parents and infants are typically kept together in the same room after admission. Fig. 1 shows our unit's typical single and twin parent and infant accommodation.

2.2. Vascular access

In our practice, once the decision to insert a PIVC is correctly confirmed, the usual steps of selection of vein, assembly of equipment, preparation of the space, attention to infection control measures, correct patient identification, pain relief using sucrose, and obtaining parental consent/permission based upon international standards of best practice (e.g., Nickel et al., 2024) are followed and described in local guidelines. The team that inserts PIVCs consists of doctors and nurse practitioners (nurse specialists). The cot-side nurse assists the inserter, ensures catheter securement and dressing, and provides ongoing care following local guidelines. The support and care of the parents before, during, and after the insertion of the PIVC is a shared responsibility.

Vascular access during parent holding requires greater attention to these preliminaries to ensure the safety of infants, parents, and staff. Creating a conducive environment plays a significant role in promoting

successful PIVC insertion during KMC. For example, ensuring a comfortable temperature in a quiet, safe, and well-lit workspace within the constraints due to parent holding is helpful. In addition, minimizing distractions and interruptions during the procedure helps maintain a calm and focused atmosphere, contributing to a smoother experience for both the infant and parent. During this preparatory time, specific parental anxieties and questions can be answered. Commonly, in our experience, these include uncertainty over what is involved in peripheral vascular access, fear of infant pain, and needle phobias.

Developmentally appropriate parental supportive roles to provide comfort and reduce pain levels can be easily advocated for; doing these can distract anxious or needle-phobic parents from their own concerns by redirecting their focus onto their infant. Provenly effective non-pharmacological strategies for reducing procedural pain experiences such as breastfeeding, non-nutritive sucking, sucrose solutions, and other multisensory stimuli like auditory, optical, olfactory, and affectionate touch interventions (McNair et al., 2019; Cozzi et al., 2020; Carozza and Leong, 2021; Sharma and Samuel, 2023) can be readily used when parents are present (Balice-Bourgeois et al., 2020).

2.3. Skin-to-skin contact

Ensuring sustained periods of parent-infant skin-to-skin contact is central to implementing KMC. This is a desire facilitated by our unit design and practices, for example, ensuring periods of skin-to-skin contact for both parents. In our unit, parents are provided with a standard hospital-grade high-low bed and a VELA neonatal chair (VELA Medical, item 87,212, <https://vela-medical.com>), which is a fully adjustable chair ideally suited for prolonged comfortable sitting. This chair has the advantage that its height and position can be adjusted to improve the work environment for access and comfort for staff during procedures.

The proper positioning of both the holding parent and the infant is crucial for the procedure's success. The person holding the infant should be comfortably seated in a position that supports the infant and allows easy access to the insertion site. Ensuring proper anatomical positioning for needle insertion and ensuring the comfort of all involved becomes more compelling during skin-to-skin contact and vascular access. Healthcare staff usually stand (the VELA chair is height adjustable) during PIVC insertion but occasionally use an adjustable stool for comfort. However, doing this might preclude some venous sites or make repeated needle sticking if the first attempt is unsuccessful more difficult.

For planned PIVC insertion, infants are usually settled in a prone or



Fig. 1. Typical single and twin NICU room setup.

lateral position (left or right) on the parent's chest (World Health Organisation (WHO), 2023a; World Health Organisation (WHO), 2003), depending upon which position will facilitate access to the previously chosen site. This anticipatory planning ensures that infants experience minimal disturbance, but the success of PIVC insertion relies upon advanced cannulation skills to ensure first-attempt success.

Communication with parents is vital throughout the procedure (pre-, during, and post). Healthcare providers should explain the procedure to the parents, address concerns, and obtain oral consent. It's also an opportunity to involve them in the care process, allowing them to ask questions and express their preferences. During this step, providers can incorporate neurodevelopmental care principles by discussing strategies to minimize the infant's stress and discomfort, such as using soothing touch or providing non-nutritive sucking options. Fig. 2 illustrates PIVC insertion during infant skin-to-skin positioning with a parent.

Post-insertion regular monitoring of the catheter site using technology or observational mnemonics is the usual standard of practice to aid early detection of complications such as dislodgment, phlebitis, and PIVIE (Legemaat et al., 2016; van Rens et al., 2021). Parents can be informed about what to look for and when to summon assistance, thus providing an additional layer of observation that might aid earlier detection of complications and limit their severity.

These procedure steps highlight the comprehensive approach to PIVC insertion during KMC, focusing on balancing the technical aspects of the procedure and the well-being of the infant and parents. By incorporating neurodevelopmental care principles, healthcare providers can create a positive experience that supports the infant's neurodevelopmental growth while facilitating parent involvement and attachment.

Timing the PIVC insertion procedure during KMC requires consideration of both the infant's and parents' readiness. Choosing a time when the infant is calm, settled, and not excessively hungry or sleepy is essential. This increases the likelihood of a successful and uninterrupted KMC session, allowing for effective parent involvement and facilitating a positive bonding experience.

PIVC insertion during KMC offers numerous benefits. However, healthcare providers must be aware of frequently encountered (see Legemaat et al., 2016; van Rens et al., 2021, 2022) and emergent complications. Emergent complications include elevated parent stress responses (including syncope and extreme reactivity), suboptimal infant posture, and postural discomfort experienced by the person cannulating or their assistant. To mitigate these risks, it is essential to anticipate them and develop detailed guidelines and response training. By

considering these factors and tailoring the PIVC insertion process to the unique needs and circumstances of the infant and their parents during KMC, healthcare providers can ensure a patient-centred approach that maximizes comfort, fosters bonding, and promotes positive outcomes.

3. Discussion

The rationale behind incorporating neurodevelopmental care into vascular access procedures lies in the vulnerability of the developing newborn brain and the potential long-term impact of stressful experiences on this patient population. By utilizing strategies that are physically, psychologically, and emotionally supportive and neuroprotective, it is possible to create a nurturing, soothing environment for the benefit of infants, parents, and staff alike (Flacking et al., 2012; Altimier and Phillips, 2016; Carozza and Leong, 2021).

Stressful experiences during NICU hospitalization, including adverse environmental stimuli, repeated acute and prolonged pain experiences, and maternal separation, have long-lasting effects on the health and well-being of infants (van Dokkum et al., 2021). How biological mechanisms bring about these effects is a subject of intense study, particularly about how alterations in DNA methylation bring about short and longer-term epigenetic changes affecting bodily biological processes (Malin et al., 2023). However, these explanations are not fully understood, and this hampers detailed measurement of the effects of preventative or remedial care interventions, such as those associated with developmental and neuroprotective care strategies.

The effects of stress extend to parents. Several studies report on the high prevalence of post-traumatic stress disorder (PTSD) amongst mothers and fathers of infants in NICUs (McKeown et al., 2023; Schecter et al., 2020). Parents report that feeling excluded from their infant's presence, care decisions, and being unable to protect their infant from pain and discomfort are particularly upsetting and stressful. Our more holistic approach to routine peripheral vascular access acknowledges the intricate links between medical procedures, pain, stress, comfort, involvement, and the well-being of infants and parents. It might help to mitigate the causes of PTSD amongst parents, though further detailed research is required.

Research suggests that KMC has several physiological, cognitive, nutritional, and emotional benefits. In the short term, these include improved thermoregulation, physiological stability, parent-infant attachment, breastfeeding uptake, and continuation rates, and reduced mortality (Cho et al., 2016; Cristóbal Cañadas et al., 2022; Bisanalli et al., 2023; Zengin et al., 2023). There is strong evidence that the



Fig. 2. Inserting a PIVC during parental skin-to-skin contact
All pictures are used with permission from parents and staff involved.

benefits of KMC are sustained in the longer term. One study (Charpak et al., 2017) revisited participants from a randomized clinical trial of KMC versus standard care conducted in the 1990s. Their analysis of the effects on infants born at less than or equal to 1800g birth weight included in the study ($n = 264$) who had received KMC compared to standard care revealed long-lasting beneficial cognitive, social, and behavioural effects on children and their parents some 20 years later (Charpak et al., 2017).

The beneficial effects of KMC in reducing infant procedural pain responses are widely acknowledged in the research literature (e.g., Johnston et al., 2003; Choudhary et al., 2016; Johnston et al., 2017). However, evidence from one small ($n = 82$ analysed) randomized clinical trial (Dezhdar et al., 2016) involving preterm-born infants receiving KMC, swaddling, or usual care during needle sticking reported no statistical difference ($P \geq 0.05$) in pain scores between the KMC and swaddled groups, but less pain than in the usual care group. While avoiding over-interpretation is essential, this finding suggests that the mechanisms through which KMC operates its pain alleviation effects require further explanation.

Since its earliest manifestations, the understanding of KMC as a theoretical concept and how it can be implemented in practice has continued to evolve (Kostandy and Ludington-Hoe, 2019). This situation has led to a lack of definitional consensus and notable heterogeneity in its implementation in different settings (Chan et al., 2016; Donald, 2017; Stefani et al., 2022). Healthcare practitioners encounter considerable challenges when moving from localised implementation of KMC to universal system-wide implementation (Stefani et al., 2022). The recently published WHO guidance on KMC implementation strategy recognizes this challenge (World Health Organisation, 2023b). A key feature of this new guidance is that it has been adapted for diverse cultural and country contexts. Consequently, this guidance now provides a more contextually nuanced and flexible approach to implementing KMC when compared to previous approaches (World Health Organisation, 2023b). Our approach to maintaining parent-infant skin-to-skin contact during a routine medical procedure (PIVC insertion) highlights an often-missed opportunity to improve the care experience for parents and their infants. It provides insight into how other units could adapt their practices to accommodate KMC better. Furthermore, this article adds to the debate about the best ways of organising neonatal care to achieve optimal developmentally beneficial outcomes.

4. Conclusions

Incorporating neurodevelopmental care into routine medical procedures provides an opportunity to optimize the quality-of-care experience for infants and their parents. However, doing so can be challenging, partly due to embedded ways of working and differing priorities. Nevertheless, successful, sustainable changes in how care is organized and delivered can bring about reduced stress, improved sensory and nurturing interactions, and potentially better outcomes for parents and their infants and bring about a more holistic approach to care provision. This manuscript's exact processes and approach might not be appropriate for other neonatal care settings with different physical and staff resources. However, the core principle of ensuring, wherever possible, parent-infant contact and engagement are readily transferable to other NICUs and could provide evidence supporting quality-of-care claims.

Declaration of competing interest

We have no conflicts of interest to declare.

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References

- Adama, E.A., Adua, E., Bayes, S., Mörelus, E., 2022. Support needs of parents in neonatal intensive care unit: an integrative review. *J. Clin. Nurs.* 31 (5–6), 532–547. <https://doi.org/10.1111/jocn.15972>.
- Altimier, L., Phillips, R., 2016. The neonatal integrative developmental care model: advanced clinical applications of the seven core measures for neuroprotective family-centered developmental care. *Newborn Infant Nurs. Rev.* 16 (4), 230–244.
- Balice-Bourgeois, C., Zumstein-Shaha, M., Simonetti, G.D., Newman, C.J., 2020. Interprofessional collaboration and involvement of parents in the management of painful procedures in newborns. *Front. Pediatr.* 8, 394. <https://doi.org/10.3389/fped.2020.00394>.
- Bisanelli, S., Balachander, B., Shashidhar, A., Raman, V., Josit, P., Rao, S.P., 2023. The beneficial effect of early and prolonged kangaroo mother care on long-term neurodevelopmental outcomes in low birth neonates - a cohort study. *Acta Paediatr.* <https://doi.org/10.1111/apa.16939>.
- British Association of Perinatal Medicine (BAPM), 2021. Family Integrated Care a Framework for Practice. BAPM, London. <https://www.bapm.org/resources/ficar-e-framework-for-practice>.
- Carozza, S., Leong, V., 2021. The role of affectionate caregiver touch in early neurodevelopment and parent-infant interactional synchrony. *Front. Neurosci.* 14, 613378. <https://doi.org/10.3389/fnins.2020.613378>.
- Chan, G.J., Valsangkar, B., Kajeepeta, S., Boundy, E.O., Wall, S., 2016. What is kangaroo mother care? Systematic review of the literature. *J. Glob. Health* 6 (1), 010701. <https://doi.org/10.7189/jogh.06.010701>.
- Charpak, N., Tessier, R., Ruiz, J.G., Hernandez, J.T., Uriza, F., Villegas, J., Nadeau, L., Mercier, C., Maheu, F., Marin, J., Cortes, D., Gallego, J.M., Maldonado, D., 2017. Twenty-year follow-up of kangaroo mother care versus traditional care. *An. Pediatr.* 139 (1), e20162063. <https://doi.org/10.1542/peds.2016-2063>.
- Chen, J.-Y., 2022. Peripheral intravenous cannulation in infants and children. *Pediatr. Neonatol.* 64 (1), 1–2. <https://doi.org/10.1016/j.pedneo.2022.12.001>.
- Cho, E.-S., Kim, S.-J., Kwon, M.S., Cho, H., Kim, E.H., Jun, E.M., Lee, S., 2016. 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 (4), 430–438. <https://doi.org/10.1016/j.pedn.2016.02.007>.
- Choudhary, M., Dogiyal, H., Sharma, D., Datt Gupta, B., Madabhavi, I., Choudhary, J.S., Choudhary, S.K., 2016. To study the effect of kangaroo mother care on pain response in preterm neonates and to determine the behavioral and physiological responses to painful stimuli in preterm neonates: a study from western Rajasthan. *J. Matern. Fetal Neonatal Med.* 29 (5), 826–831. <https://doi.org/10.3109/14767058.2015.1020419>.
- Cozzi, G., Valerio, P., Kennedy, R., 2020. A narrative review with practical advice on how to decrease pain and distress during venipuncture and peripheral intravenous cannulation. *Acta Paediatr.* 110 (2), 423–432. <https://doi.org/10.1111/apa.15526>.
- Cristóbal Cañadas, D., Parrón Carreño, T., Sánchez Borja, C., Bonillo Perales, A., 2022. Benefits of kangaroo mother care on the physiological stress parameters of preterm infants and mothers in neonatal intensive care. *Int. J. Environ. Res. Public Health* 19 (12), 7183. <https://doi.org/10.3390/ijerph19127183>.
- Dai, K., Fan, X., Shi, H., Xiong, X., Ding, L., Yu, Y., Yu, G., Wang, S., 2023. Application of family-centered empowerment model in primary caregivers of premature infants: a quasi-experimental study. *Front. Pediatr.* 11, 1137188. <https://doi.org/10.3389/fped.2023.1137188>.
- Dezhdar, S., Jahanpour, F., Firouz Bakht, S., Ostovar, A., 2016. The effects of kangaroo mother care and swaddling on venipuncture pain in premature neonates: a randomized clinical trial. *Iran. Red Crescent Med. J.* 18 (4), e29649. <https://doi.org/10.5812/ircmj.29649>.
- van Dokkum, N.H., de Kroon, M.L.A., Reijneveld, S.A., Bos, A.F., 2021. Neonatal stress, health, and development in preterms: a systematic review. *An. Pediatr.* 148 (4), e2021050414. <https://doi.org/10.1542/peds.2021-050414>.
- Donald, S.K., 2017. Critical analyses of the implementation of kangaroo mother care on a preterm infant. *J. Neonat. Nurs.* 23 (3), 159–168. <https://doi.org/10.1016/j.jnn.2016.10.001>.
- Ferreira, A., Ferretti, E., Curtis, K., Joly, C., Sivanthan, M., Major, N., Daboval, T., 2021. Parents' views to strengthen partnerships in newborn intensive care. *Front. Pediatr.* 9, 721835. <https://doi.org/10.3389/fped.2021.721835>.
- Flacking, R., Lehtonen, L., Thomson, G., Axelín, A., Ahlqvist, S., Moran, V.H., Ewald, U., Dykes, F., 2012. Closeness and separation in neonatal intensive care. *Acta Paediatr.* 101 (10), 1032–1037. <https://doi.org/10.1111/j.1651-2227.2012.02787.x>.
- Gallagher, K., Shaw, C., Aladangady, N., Marlow, N., 2018. Parental experience of interaction with healthcare professionals during their infant's stay in the neonatal intensive care unit. *Arch. Dis. Child. Fetal Neonat. Ed.* 103 (4), F343–F348. <https://doi.org/10.1136/archdischild-2016-312278>.
- Johnston, C.C., Stevens, B., Pinelli, J., Gibbins, S., Filion, F., Jack, A., Steele, S., Boyer, K., Veilleux, A., 2003. Kangaroo care is effective in diminishing pain response in preterm neonates. *Arch. Pediatr. Adolesc. Med.* 157 (11), 1084–1088. <https://doi.org/10.1001/archpedi.157.11.1084>.
- Johnston, C., Campbell-Yeo, M., Disher, T., Benoit, B., Fernandes, A., Streiner, D., Inglis, D., Zee, R., 2017. Skin-to-skin care for procedural pain in neonates. *Cochrane Database Syst. Rev.* 2 (2), CD008435. <https://doi.org/10.1002/14651858.CD008435.pub3>.
- Kostandy, R.R., Ludington-Hoe, S.M., 2019. The evolution of the science of kangaroo (mother) care (skin-to-skin contact). *Birth Defects Res* 111 (15), 1032–1043. <https://doi.org/10.1002/bdr2.1565>.

- Legemaat, M., Carr, P.J., van Rens, R.M., van Dijk, M., Poslawsky, I.E., van den Hoogen, A., 2016. Peripheral intravenous cannulation: complication rates in the neonatal population: a multicenter observational study. *J. Vasc. Access* 17 (4), 360–365. <https://doi.org/10.5301/jva.5000558>.
- Malin, K.J., Gondwe, K.W., Fial, A.V., Moore, R., Conley, Y., White-Traut, R., Griffith, T., 2023. Scoping review of early toxic stress and epigenetic alterations in the neonatal intensive care unit. *Nurs. Res.* 72 (3), 218–228. <https://doi.org/10.1097/NNR.0000000000000652>.
- McKeown, L., Burke, K., Cobham, V.E., Kimball, H., Foxcroft, K., Callaway, L., 2023. The prevalence of PTSD of mothers and fathers of high-risk infants admitted to NICU: a systematic review. *Clin. Child Fam. Psychol. Rev.* 26 (1), 33–49. <https://doi.org/10.1007/s10567-022-00421-4>.
- McNair, C., Campbell-Yeo, M., Johnston, C., Taddio, A., 2019. Nonpharmacologic management of pain during common needle puncture procedures in infants: current research evidence and practical considerations: an update. *Clin. Perinatol.* 46 (4), 709–730. <https://doi.org/10.1016/j.clp.2019.08.006>.
- Nickel, B., Gorski, L., Kleidon, T., Kyes, A., DeVries, M., Keogh, S., Meyer, B., Sarver, M., Crickman, R., Ong, J., Clare, S., Hagle, M., 2024. Infusion therapy standards of practice. ninth ed. *J. Inf. Nurs.* 47 (1S Suppl. 1), S1–S285. <https://doi.org/10.1097/NAN.0000000000000532>.
- van Rens, M.F., Hugill, K., Mahmah, M.A., Bayoumi, M., Francia, A.L.V., Garcia, K.L.P., van Loon, F.H.J., 2021. Evaluation of unmodifiable and potentially modifiable factors affecting peripheral intravenous device-related complications in neonates: a retrospective observational study. *BMJ Open* 11 (9), e047788. <https://doi.org/10.1136/bmjopen-2020-047788>.
- van Rens, M.F., Hugill, K., Mahmah, M.A., Francia, A.L., van Loon, F.H., 2022. Effect of peripheral intravenous catheter type and material on therapy failure in a neonatal population. *J. Vasc. Access* 11297298221080071. <https://doi.org/10.1177/11297298221080071>.
- Rey, E.S., Martínez, H.G., 1983. Manejo racional del niño prematuro. In: *Universidad Nacional, Curso de Medicina Fetal, Bogotá, Colombia*. Cited in: World Health Organisation (WHO), 2003. Kangaroo mother care, a practical guide. WHO, Geneva.
- Schecter, R., Pham, T., Hua, A., Spinazzola, R., Sonnenklar, J., Li, D., Papaioannou, H., Milanaik, R., 2020. Prevalence and longevity of PTSD symptoms among parents of NICU infants analyzed across gestational age categories. *Clin. Pediatr. (Phila.)* 59 (2), 163–169. <https://doi.org/10.1177/0009922819892046>.
- Sharma, N., Samuel, A.J., 2023. A systematic review of multisensory stimulation on procedural pain among preterm neonates. *Pediatr. Phys. Ther.* 35 (3), 286–291. <https://doi.org/10.1097/PEP.0000000000001012>.
- Skene, C., Gerrish, K., Price, F., Pilling, E., Bayliss, P., Gillespie, S., 2019. Developing family-centred care in a neonatal intensive care unit: an action research study. *Intens. Crit. Care. Nurs.* 50, 54–62. <https://doi.org/10.1016/j.iccn.2018.05.006>.
- Stefani, G., Skopec, M., Battersby, C., Harris, M., 2022. Why is kangaroo mother care not yet scaled in the UK? A systematic review and realist synthesis of a frugal innovation for newborn care. *BMJ Innovations* 8 (1), 9–20. <https://doi.org/10.1136/bmjinnov-2021-000828>.
- Sundquist Beaman, S., Swanson, A., 2006. Neonatal infusion therapy: preventing complications and improving outcomes. *Newborn Infant Nurs. Rev.* 6 (4), 193–201. <https://doi.org/10.1053/j.nainr.2006.09.001>.
- Voulgaridou, A., Paliouras, D., Deftereos, S., Skarentzos, K., Tsergoula, E., Miltisakaki, I., Oikonomou, P., Aggelidou, M., Kambouri, K., 2023. Hospitalization in neonatal intensive care unit: parental anxiety and satisfaction. *Pan Afr. Med. J.* 44, 55. <https://doi.org/10.11604/pamj.2023.44.55.34344>.
- World Health Organisation (WHO), 2003. Kangaroo Mother Care, a Practical Guide. WHO, Geneva. <https://www.who.int/publications/i/item/9241590351>.
- World Health Organisation (WHO), 2023a. Kangaroo mother care: a transformative innovation in health care. Global Position Paper. WHO, Geneva.
- World Health Organisation (WHO), 2023b. Kangaroo Mother Care: Implementation Strategy for Scale-Up Adaptable to Different Country Contexts. WHO, Geneva.
- Zengin, H., Suzan, O.K., Hur, G., Kolukisa, T., Eroglu, A., Cinar, N., 2023. The effects of kangaroo mother care on physiological parameters of premature neonates in neonatal intensive care unit: a systematic review. *J. Pediatr. Nurs.* 71, E18–E27. <https://doi.org/10.1016/j.pedn.2023.04.010>.