

REGULAR ARTICLE

Early parenting intervention promotes 24-month psychomotor development in preterm children

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Abstract

Aim: Although parenting is key to promoting healthy development of at-risk preterm infants, parents have often restricted access to neonatal intensive care units (NICUs). This study aimed to assess the effect of an early parenting intervention on the psychomotor outcome in preterm children at 24 months of corrected age.

Methods: Forty-two preterm children and their parents were consecutively recruited at a level III NICU in Northern Italy and randomly allocated to early intervention (two educational peer-group sessions and four individual infant observation sessions) or care as usual (no educational or infant observation sessions). During NICU stay, parents provided information on daily holding and skin-to-skin. Psychomotor development was measured at 24 months of corrected age using the Griffith Mental Development Scales.

Results: There were no significant differences in socio-demographic and clinical variables between early intervention (n = 21; 13 females) and care as usual (n = 21; 12 females) groups. At 24 months of corrected age, children in the early intervention arm had greater scores for global psychomotor development as well as for Hearing-Speech and Personal-Social sub-scales, compared to those in the care as usual group.

Conclusion: The present NICU parenting intervention was found to be associated with better psychomotor outcomes in preterm children at 24-month age. The effects were especially evident for domains related to language and socio-emotional functioning. Results are promising and should be retested with more heterogeneous and representative preterm sample.

KEYWORDS

developmental quotient, early intervention, neonatal intensive care unit, parenting, preterm birth

Abbreviations: DQ, developmental quotient; GMDS, Griffith Mental Development Scales; NICU, neonatal intensive care unit.

The members of the Early Intervention Group are Giada Ariaudo, Linda Gasparini, Ivana Olivieri, Silvia Spairani and Giovanna Tritto (Child Neurology and Psychiatry Unit, IRCCS Mondino Foundation, Pavia, Italy) and Lina Bollani and Chryssoula Tzialla (NICU, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy)

1 | INTRODUCTION

Preterm birth is one of the major challenges for the healthcare systems worldwide, representing the leading cause of long-lasting morbidities in infants and children.¹ Preterm infants are especially at risk for detrimental developmental consequences, mainly due to their immature central nervous system and to higher probability perinatal injuries.² The infants' long-term hospitalisation in the neonatal intensive care unit (NICU) often results in early separation from the parents, thus making it difficult to establish immediate bonding and attachment.³ During the NICU stay, preterm infants are exposed to several sources of stress, such as high-intensity lights and sounds, invasive procedures and painful stimulations. Overall, NICU-related stress may further increase the risk of suboptimal and comorbid developmental outcomes.⁴

The NICU environment can be especially stressful for the parent-child system. On the one hand, the neurobehavioural and communicative signals of the preterm infants may be less pronounced and difficult to be interpreted by parents.^{5,6} On the other hand, the early separation from the infant and the need of specialised intensive medical and nursing actions may lead the mothers and the fathers to feel less confident in caregiving and more alienated in their parental role.⁷⁻⁹ Thus, it is not surprising that skin-to-skin and holding care approaches are promoted to increase the physical proximity and emotional closeness between parents and infants, and to facilitate attachment processes that are crucial for healthy development.¹⁰⁻¹² Specifically, the parental caregiving ability to read infants' signals, respond contingently and provide support to emotional regulation is early interactive behaviours that may be challenged in the NICU.¹³⁻¹⁵ Moreover, it should be highlighted that the needs of both mothers and fathers have to be addressed in NICU to support their engagement in the early caregiving and to promote an adaptive post-discharge transition to home.¹⁶⁻¹⁸

As such, early interventions that focus on providing information and psychoeducational guidelines for parents should be prioritised in the NICU environment.¹⁹ Mother-focused parenting programmes have been found to be successful in improving the cognitive and behavioural outcomes of preterm-born children up to five years of age.²⁰ When maternal involvement in caregiving is greatly supported, this can lead to increased scores in the psychomotor profile of preterm children at 18 months of age.²¹ A meta-analytic study suggests that early parenting interventions in the NICU are successful in promoting the psychomotor developmental outcomes of preterm children with a peak between 24 and 36 months.²² Notably, the effects were much more pronounced for language and personal-social domains, rather than physical performance. While these results are promising, previous research in this field has mainly focused on parenting interventions delivered to mothers rather than to both the parents of preterm infants.^{23,24}

In the present study, we assessed the effects of an early and brief parenting intervention that includes both psychoeducational support on the psychomotor developmental outcomes of preterm children at 24 months of corrected age. We hypothesised that, compared to a

Key notes

- Preterm-born children are at high risk for suboptimal psychomotor development in the first years of life.
- An early parenting intervention was successful in promoting better psychomotor outcomes in preterm children at 24 months of corrected age.
- Parenting interventions are needed to be implemented precociously in order to improve the psychomotor outcomes of preterm children.

control group exposed to usual NICU care without any dedicated parenting support, the children of parents who received the early intervention would show better psychomotor development.

2 | METHODS

2.1 | Participants

Between January 2015 and December 2016, 42 preterm children from the NICU of the Fondazione IRCCS Policlinico San Matteo, Pavia, Italy, and their parents were enrolled in this study. All preterm infants with gestational age ≤ 32 weeks or birthweight ≤ 1500 grams were eligible for the study. Subjects were not considered eligible to the study if at least one parent was unable to converse in Italian, had psychiatric morbidities or reported alcohol/drug abuse, was less than 18 years old, and if the infants had any genetic syndrome. A complete flowchart of enrolment is reported in Figure 1. Twenty-one children and their parents were allocated to the early intervention arm, whereas twenty-one were allocated to the care as usual arm. In order to minimise the risk of biases related to the interactions among parents belonging to different groups, allocation occurred in two blocks: care as usual allocation occurred between January 2015 and May 2016, whereas early intervention allocation occurred between July and December 2016, with a wash-out period of one month during June 2016. Enrolment occurred as soon as the infant was not considered at risk for survival. The study was approved by the Ethical Committee of the Fondazione IRCCS Policlinico San Matteo and the IRCCS Mondino Foundation in Pavia, Italy. All the parents signed an informed consent.

2.2 | Study design and procedures

Figure 2 reports an overview of the study design. The parents of children allocated to the early intervention group participated in group and individual sessions (Table 1). A detailed description of the intervention is reported in Table S2, according to the Template for Intervention Description and Replication (TIDieR) checklist. Two psychoeducational group sessions of 60-90 minutes of duration were led by a paediatric

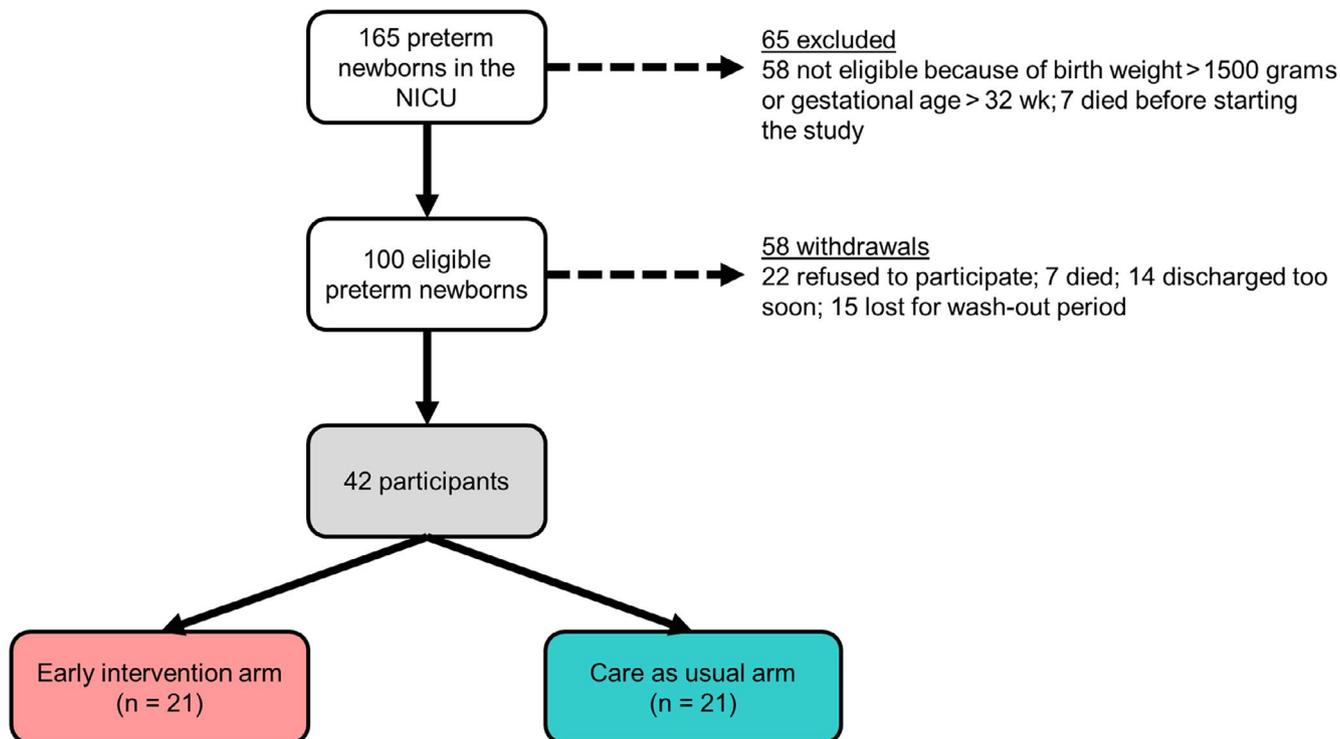


FIGURE 1 Flow-chart of enrolment

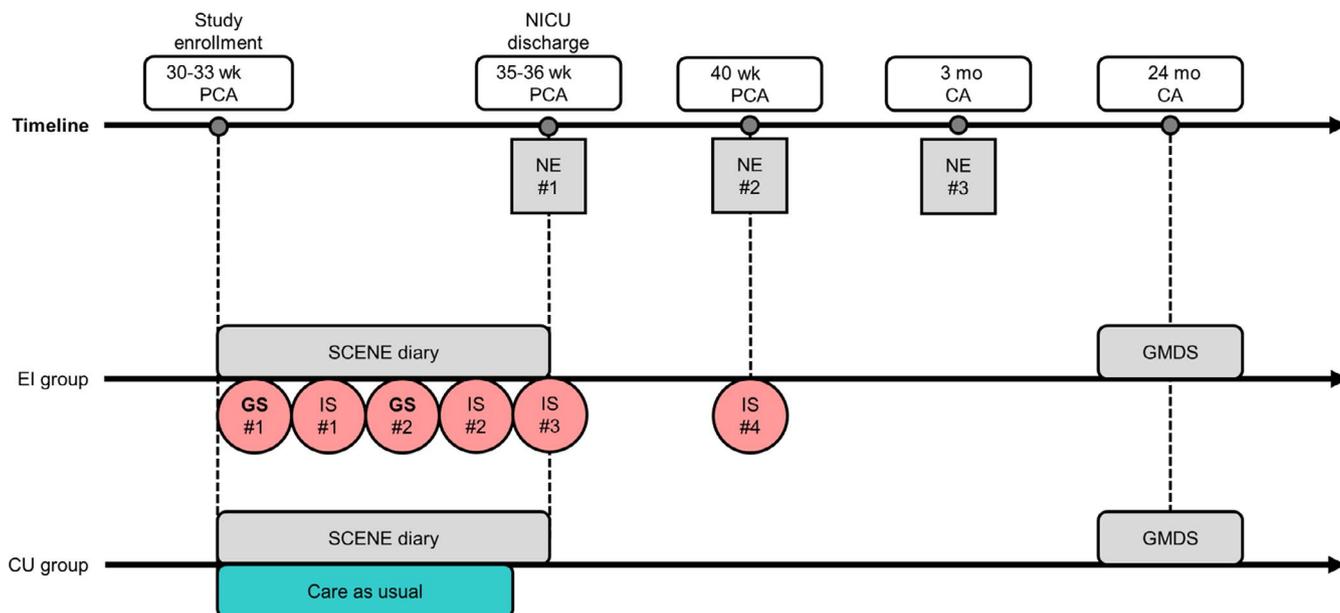


FIGURE 2 Timeline and procedures of the study. CA, corrected age; CU, Care as Usual; EI, Early Intervention; GMDS, Griffith Mental Development Scales; GS, Group Session; IS, Individual Session; NE, neurological examination; NICU, Neonatal Intensive Care Unit; PCA, post-conceptual age; SCENE, Separation and Closeness Experiences in the Neonatal Environment

neuropsychiatrist and a neurodevelopmental therapist. These sessions provided information on typical characteristics of preterm infants, special needs in caregiving and the procedures used by the NICU staff. The group sessions were interspersed with up to four individual sessions that were led by a trained neurodevelopmental therapist. These sessions lasted approximately 45 minutes and consisted of a joint observation of the infant by focusing on behaviours, temperament,

communicative signals, signs of distress and regulation processes. The joint observation sessions were informed by the methodological approach of Dr Boukydis, namely the collaborative consultation with Parents and Infants in the Perinatal Period,²⁵ which integrates principles from evidence-based infant research and well-validated neurobehavioural assessments. These principles included both guidelines for the joint observation of the infant and communicative skills to support

TABLE 1 Description of the early intervention

| Session | Description | Participants | Main themes |
|-----------------------|-------------------------------------|--|---|
| Group Session #1 | Psychoeducational intervention | Parents Child neuropsychiatrist Neurodevelopmental therapist | Dealing with unexpected birth Preterm newborn skills Physiological needs Neurobehavioural states |
| Group Session #2 | Psychoeducational intervention | Parents Child neuropsychiatrist Neurodevelopmental therapist | Stability needs Communicative cues Caregiving actions Sensory profile and stimulations |
| Individual Session #1 | Conjoint collaborative consultation | Parents Neurodevelopmental therapist | Reading the baby signals and co-regulation principles |
| Individual Session #2 | Conjoint collaborative consultation | Parents Neurodevelopmental therapist | Holding, handling, wrapping Sensitive stimulations |
| Individual Session #3 | Conjoint collaborative consultation | Parents Neurodevelopmental therapist | Tailored hints for neurobehavioural stability |
| Individual Session #4 | Conjoint collaborative consultation | Parents Neurodevelopmental therapist | Transition to home |

parenting. On the one hand, the therapists were trained to focus on maternal regulatory behaviours, infant communicative signals, mutual dyadic processes, sensitive caregiving and intrusive behaviours. On the other hand, specific relational skills included asking examples from the parents, elicit their own view of the infant and themselves in the interaction, active listening by the therapist, and stimulating parents' curiosity about infants' signals and behaviour. The parents allocated to the care as usual group received no structured parenting support, and there were no differences in how the NICU staff cared for the infants. Any parents of the care as usual group who reported high levels of psychological distress could be referral for a psychotherapist consultation.

2.3 | Socio-demographic variables and clinical variables

The following socio-demographic variables were collected: infants' sex, gestational age, birthweight, Apgar score at the first and fifth minute, parental age and educational level measured as years of study. The clinical characterisation of the children included the following variables: vaginal or Caesarean delivery, being small for gestational age, intrauterine growth restriction, bronchopulmonary dysplasia, retinopathy of prematurity, periventricular leukomalacia, ultrasound scan results and clinical outcomes of neurological examinations at discharge, term-equivalent age and 3 months of corrected age.

2.4 | Parental presence, holding and skin-to-skin care

Parents were asked to complete the parental closeness diary²⁶ starting from the day of enrolment up to discharge, to control for differences related to the amount of skin-to-skin and holding between the

two groups. Mothers and fathers completed the diary separately. The parental closeness diary allows the collection of quantitative data on the presence of parents, time spent holding the infant and time spent in skin-to-skin contact. This instrument has been used in previous research with NICU parents.²⁶ The holding time score was computed as the percentage of the total time spent by parents holding the infant with respect to the time they were present in the unit. The skin-to-skin time score was computed as the percentage of the total time spent by parents in skin-to-skin contact with respect to the time they were present in the unit. The absolute values (in minutes) for presence, holding and skin-to-skin are reported in Table S1.

2.5 | Psychomotor outcome

The Griffith Mental Development Scales (GMDS) is a well-validated and standardised tool for assessing psychomotor development of children up to 8 years. It is based on five subscales that provide scores for the following domains: locomotor, personal-social, hearing-speech, hand-eye coordination and performance. A standardised developmental quotient (DQ) score (range: 50-150) is obtained for each domain (mean = 100, standard deviation = 16) and for the global score (mean = 100, standard deviation = 12). The GMDS has been extensively used in previous research with preterm infants and children.^{13,22} The clinician administering the GMDS was blind to the random allocation.

2.6 | Plan of analysis

Both groups were compared for socio-demographic and clinical variables as well as for holding and skin-to-skin percentage scores by means of pair-wise mean comparisons (continuous variables), non-parametric Mann-Whitney test (discrete variables) and

chi-square test (dummy variables). General linear models were used to assess the presence of significant group differences in the total and domain DQ scores of the GMDS. Statistical analyses were carried out using SPSS Statistics for Windows, version 25 (SPSS Inc.) setting $P < .05$.

3 | RESULTS

Descriptive statistics for the socio-demographic and clinical characteristics as well as for holding and skin-to-skin percentage scores are reported in Table 2. There were no significant differences between the two groups for any of these variables. Apgar score at the first ($W = 381.00, P > .05$) and fifth minute ($W = 432.50, P > .05$) did not significantly differ between early intervention.

A significant difference emerged for the total GMDS score ($t(40) = 2.40, P = .02$) (Figure 3). Children from parents in the early intervention arm had higher global DQ compared to those in the care as usual arm. Moreover, a significant multivariate effect was detected ($F(5,36) = 4.49, P = .003, \eta^2_p = 0.38$). Significant univariate differences emerged for two domains: personal-social ($F(1,40) = 14.93, P < .001, \eta^2_p = 0.27$) and hearing-speech ($F(1,40) = 5.36, P = .026, \eta^2_p = 0.12$). For both the domains, children of parents in the early intervention group had higher DQ scores compared to those in the care as usual group. These effects persisted even when the analyses were restricted to children without cerebral palsy.

4 | DISCUSSION

In the present study, we report on the effects of an early NICU psychoeducational parenting intervention including both mothers and fathers on the psychomotor outcome of preterm infants at 24 months of CA. Children of parents who took part in the early intervention programme had greater global DQ and higher scores in the personal-social and hearing-speech domains of the GMDS assessment.

Previous research has showed that early interventions that actively involve the parents in informative and/or psychoeducational programmes have the greatest long-term efficacy in reducing detrimental psychomotor and cognitive outcomes.²⁷ Moreover, the effect of maternal caregiving support may be especially observed between 24 and 36 months, with the greatest benefits reported for socio-emotional and behavioural domains.²² Our findings further extend previous evidence and suggest that engaging both parents in an early and brief parenting intervention by providing informative support and psychoeducational guidance in understanding the infant's communicative and behavioural signals may be significantly beneficial for the psychomotor development of preterm children.

The finding that parental support may be more effective in improving social-related domains, rather than motor or physical competences, resonates with previous reports in older children.²⁸ This specific effect may suggest pathways of neuroprotection. First, one

may speculate that promoting parental knowledge through a psychoeducational training aimed at improving caregiving skills may benefit the quality of early parent-infant relationship so that the infant receives adequate stimulations and contingent responses. From this perspective, the evidence that social-related domains are the ones most impacted by early parenting interventions is not surprising. Second, the lack of significant effects on motor and physical performance domains further highlights the need to develop more integrated programmes capable of acting on multiple levels of the developmental trajectories of the preterm child. Consistently, future research should explore the role of parental engagement in physical therapies for preterm infants and children.

Notably, this intervention contributes to the existing literature on the importance of early family-centred interventions in the NICU.^{12,29,31} The intervention reported here moves from theoretical and methodological principles of the collaborative consultation approach and adopted both psychoeducational group sessions and tailored joint infant observation sessions with parents. The main goal of the intervention was to increase parental knowledge of factors related to infant's development and to improve both mothers and fathers' skills in reading the baby's signals, responding contingently and supporting emotional regulation. As previously suggested,^{33,33} investing resources in improving parental involvement in NICU is a critical protective factor for the development of preterm infants and children. Although these findings promisingly support the relevance of early parenting interventions in the NICU, in the light of the limited sample size and the dropout rate reported for the present study, they should be retested with more heterogeneous and representative preterm samples in future research.

This study had limitations. First, the sample size was relatively small. As such, we could not include more complex models in our statistical plan to control for potential confounders such as life events, parental educational style and socio-economic conditions. Nonetheless, the two groups were not significantly different in terms of socio-demographic and clinical characterisation, which indirectly indicates the robustness of the study and the reliability of findings. Second, parenting a preterm infant is often associated with increased levels of stress, depression and anxiety.^{30,34,35} We could not exclude that affective problems may have had a role in moderating the effects of the intervention on children outcomes. For example, parents with significant depressive and/or anxious symptomatology may be less able to engage in psychoeducational programmes focused on parent-child interaction. Third, the selected sample included low-risk families, as single parents and those with psychiatric morbidities were not eligible for the study. As such, our findings only have partial generalisability to the broader population of families of preterm infants hospitalised in the NICU. Finally, the domain specificity of these findings indirectly suggests that a potential process underlining the effectiveness of the intervention may be ascribed to the improved daily quality of parent-child interaction or at least to sensitive and protective parenting behaviour.²² As such, we suggest that future studies assessing the psychomotor outcomes of early parenting interventions in the NICU should include

TABLE 2 Descriptive statistics for socio-demographic, clinical and NICU care activities variables

| | Intervention arms | | | | | | | | Group comparison | |
|---|--|------|------|------|-----------------------------------|------|------|------|------------------|-------|
| | Early Intervention (EI) group (N = 21) | | | | Care as Usual (CU) group (N = 21) | | | | | |
| | Mean | SD | Min | Max | Mean | SD | Min | Max | t test | sig |
| Socio-demographic characteristics | | | | | | | | | | |
| Infants' gestational age (wk) | 29.6 | 3.0 | 23.0 | 34.0 | 30.4 | 2.8 | 24.0 | 35.0 | 0.91 | 0.367 |
| Infants' birthweight (grams) | 1244 | 345 | 630 | 1700 | 1309 | 307 | 654 | 1695 | 0.65 | 0.521 |
| Maternal age (y) | 34 | 5 | 25 | 39 | 35 | 5 | 28 | 43 | 1.76 | 0.087 |
| Maternal education (years of study) | 15 | 4 | 5 | 22 | 16 | 4 | 5 | 22 | 0.23 | 0.818 |
| Paternal age (y) | 35 | 4 | 26 | 43 | 38 | 5 | 27 | 47 | 2.12 | 0.041 |
| Paternal education (years of study) | 14 | 4 | 5 | 22 | 15 | 4 | 5 | 22 | 0.69 | 0.497 |
| | N | % | | | N | % | | | χ^2 | sig |
| Infants' sex (females) | 13 | 61.9 | – | – | 12 | 57.1 | – | – | 0.10 | 0.753 |
| Couple marital status (cohabitant) | 21 | 100 | – | – | 20 | 95.2 | – | – | 1.02 | 0.311 |
| | N | % | | | N | % | | | t test | sig |
| Clinical characteristics | | | | | | | | | | |
| Small for gestational age (SGA) | 2 | 9.5 | – | – | 1 | 4.8 | – | – | 0.36 | 0.549 |
| Intrauterine growth restriction (IUGR) | 2 | 9.5 | – | – | 2 | 9.5 | – | – | 0.00 | 1.000 |
| Bronchopulmonary dysplasia (BDP) | 7 | 33.3 | – | – | 5 | 23.8 | – | – | 0.47 | 0.495 |
| Retinopathy of prematurity (ROP) | 5 | 23.8 | – | – | 3 | 14.3 | – | – | 0.62 | 0.432 |
| Periventricular leukomalacia (PVL) | 0 | 0.0 | – | – | 1 | 4.8 | – | – | 1.02 | 0.311 |
| Severe anomalies at ultrasound scan | 0 | 0.0 | – | – | 1 | 4.8 | – | – | 1.20 | 0.549 |
| Cerebral palsy | 1 | 4.8 | – | – | 1 | 4.8 | – | – | 0.00 | 1.000 |
| Abnormal neurological examination (discharge) | 7 | 33.3 | – | – | 8 | 38.1 | – | – | 0.10 | 0.747 |
| Abnormal neurological examination (term-equivalent age) | 9 | 42.9 | – | – | 7 | 33.3 | – | – | 0.89 | 0.346 |
| Abnormal neurological examination (3 mo) | 6 | 28.6 | – | – | 2 | 9.5 | – | – | 2.47 | 0.120 |
| | Mean | SD | Min | Max | Mean | SD | Min | Max | t test | sig |
| NICU care activities (%) | | | | | | | | | | |
| Maternal holding | 45 | 28 | 13 | 79 | 31 | 24 | 1 | 79 | 1.59 | 0.120 |
| Maternal skin-to-skin | 25 | 27 | 3 | 99 | 9 | 13 | 2 | 46 | 1.87 | 0.074 |
| Paternal holding | 37 | 22 | 2 | 83 | 28 | 27 | 1 | 85 | 0.96 | 0.344 |
| Paternal skin-to-skin | 14 | 9 | 4 | 24 | 6 | 6 | 1 | 19 | 1.77 | 0.101 |
| Parental holding | 39 | 23 | 10 | 82 | 32 | 25 | 5 | 82 | 0.84 | 0.411 |
| Parental skin-to-skin | 15 | 8 | 4 | 22 | 8 | 10 | 2 | 35 | 1.04 | 0.321 |

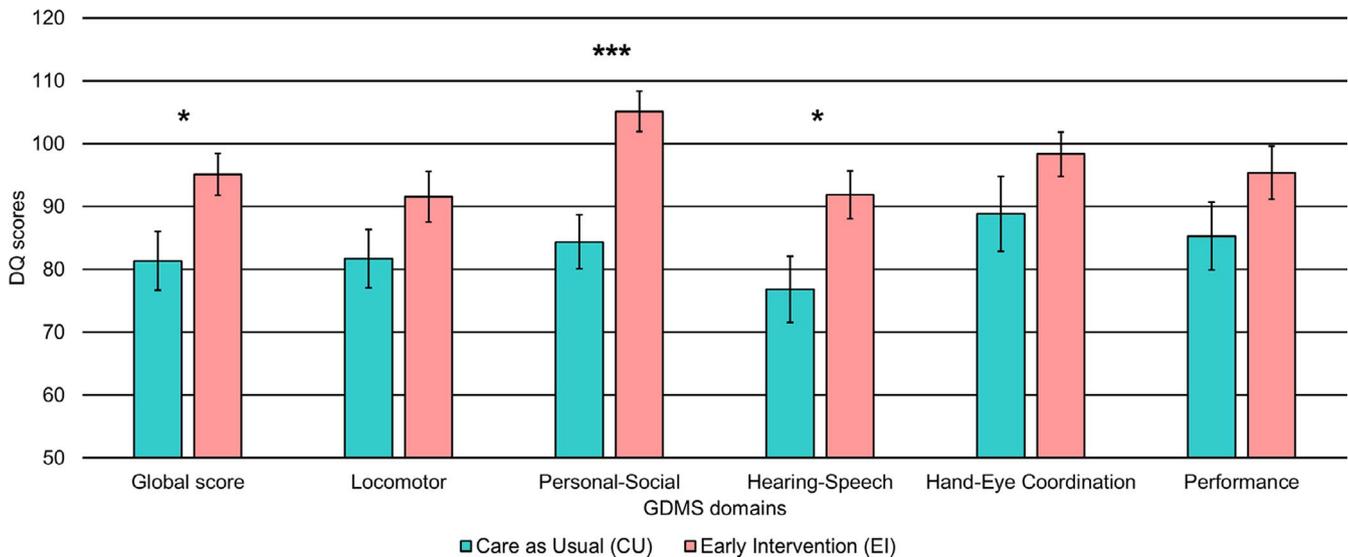


FIGURE 3 Griffith Developmental Mental Scales (GDMS) Developmental Quotient (DQ) scores for children of parents in the Care as Usual (CU) or Early Intervention (EI) groups. Error bars represent Standard Errors. * $P < .05$; *** $P < .001$

video-recording of parent-child dyadic and triadic interactions to better highlight potential relational mechanisms of action.

5 | CONCLUSION

We found that a brief and early psychoeducational parenting intervention during the NICU stay was significantly associated with improved psychomotor outcome in children at 24 months of corrected age. Social-related domains were significantly improved, suggesting that the potential pathways of protective action may be related to improvements in the quality of parent-child relationships in the first months of life. As parenting is advocated to be the major preventive factor for the child health and well-being,³⁶ these findings suggest that investing in early parenting engagement and caregiving skills may be crucial to further promote better developmental outcomes in preterm children.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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