

# A Comprehensive Evaluation of Goslings-II: A Sustainable Early Language and Literacy Program for NICU Parents

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## ABSTRACT

This program evaluation aimed to assess the impact of a streamlined and less expensive version of *Goslings-I* (a NICU parent education program) on parents' early language and literacy practices and their confidence in interacting with their infants. This evaluation used a single-group, pre- and posttest, mixed-methods design. Sixty-three parents completed pre- and postprogram questionnaires on the frequency of language and literacy activities, confidence in understanding infant signals, and program satisfaction. Seven parents participated in follow-up interviews. Interview participants reported on interaction with their infants 1–2 weeks after attending the program. *Goslings-II* resulted in self-reported positive behavioral changes in parent–infant interactions, increased early language and literacy activities, and enhanced confidence. Parents also reported they could apply *Goslings-II* skills to other parent–infant interactions, like diapering. Positive results from this evaluation are similar to the original program, *Goslings-I*, demonstrating program effectiveness at a more affordable price.

**Keywords:** education; research; development; family-centered care/parenting

In the delicate realm of neonatal care, the survival and subsequent neurodevelopmental outcomes of preterm infants are in a fragile state of balance in the NICU. Preterm infants often face numerous challenges in their developmental journey, with language delay being a significant concern.<sup>1–3</sup> Infants in open-bay NICUs are often exposed to high levels of environmental noise and may experience disruptions to the parent–infant attachment process, thus impacting infant

development.<sup>4–7</sup> Single-family room (SFR) NICUs, while designed to enhance privacy and family involvement, may inadvertently exacerbate language delay issues by limiting exposure to a rich linguistic environment.<sup>8,9</sup> Considering these challenges, the *Mother Goose on the Loose Goslings* program (*Goslings-I*) was created to improve early language and literacy outcomes for preterm infants and increase parental support in the NICU. The program sought to teach parents to

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talk, sing, and recite nursery rhymes using a Goslings family kit containing books and visual manipulatives to encourage early language and literacy development with their infants. The novelty of Goslings-I was the additional education it provided parents about modulating activities according to their infant's medical status and behavioral signals of readiness for interaction (i.e., approach, coping, and avoidance signals). To enhance provider communication with parents about an infant's medical status and readiness for interaction, the program utilized a "traffic light" symbol in which red means voice only, yellow means voice and touch, and green means voice, touch, and show. This combination enables parents to minimize detrimental overstimulation and engage in enriching interactions when the infant is medically and behaviorally most receptive. Clinical staff received information on Goslings-I before program initiation (e.g., in-service training and bulletin board). Goslings-I was implemented and previously evaluated in a level IV SFR NICU. Further information on the development of Goslings-I can be found in the *Children and Libraries*<sup>10</sup> article, and details regarding program evaluation can be found in an earlier publication in *Neonatal Network*.<sup>11</sup>

While Goslings-I significantly increased parent intention to engage in more early language and literacy practices, increased parent-reported knowledge of how and when to interact with their infants, and increased parent-reported engagement in these practices, Goslings-I was not fiscally sustainable for the number of families we wanted to reach. The present program evaluation used parent interviews to evaluate Goslings-II to determine if changes made to improve fiscal sustainability impacted program effectiveness in a level IV SFR NICU.

## LITERATURE REVIEW

Goslings-I was implemented in a level IV SFR NICU located in a major urban area in the Mid-Atlantic region of the United States, after it transitioned from a multibed unit to SFRs. While the noise and environment of a traditional multibed NICU model have potential adverse effects on neonates, such as physiologic instability,<sup>12</sup> disturbed sleep, and auditory deficits,<sup>13</sup> private NICU rooms may negatively impact neonatal language development, potentially due to decreased language exposure in a quieter environment.<sup>8,9</sup> In a recent SFR NICU study, infants with low parent visitation and lower sensory stimulation had lower language scores at 2 years of age compared with infants in traditional multibed rooms.<sup>8,9</sup> Thus, increasing parent-infant engagement and parent voice exposure may positively impact a neonate's language and literacy skills. Studies have also shown that

preterm infants are at risk for poor academic performance and language delay later in life.<sup>3,14,15</sup> Children born very preterm and/or with very low birth weight have also been found to have weak early language skills that may persist into adolescence.<sup>16,17</sup> Another study found that exposure to caretaker voices and more frequent parent visitation helped stabilize an infant's physiologic status.<sup>18</sup> These findings are important in understanding how to buffer the effects of early risk factors for delayed language and literacy development.

Involving parents in these practices early on in an infant's life can also benefit parent-infant attachment. NICU mothers are at high risk for postnatal depressive symptoms and less secure mother-infant attachment in comparison with mothers of healthy newborns because of the disruption the NICU can cause to the attachment process.<sup>19-21</sup> Providing early interventions to promote parent engagement with their infant even while in the NICU has shown benefit in enhancing parent-infant closeness and improving postnatal depressive symptoms.<sup>22,23</sup> Additionally, socioeconomic limitations and parental involvement have emerged as important variables influencing language and literacy development in the preterm population. Parent engagement has also been found to serve as a protective factor for language and literacy development among preterm infants of lower socioeconomic backgrounds.<sup>18,24</sup> Providing NICU parent education programs may narrow socioeconomic gaps in preterm outcomes.

The previously stated findings are the foundation of Goslings-I and Goslings-II, which prioritize increasing early language and literacy exposure and improving parent-infant interactions in the NICU. The primary goal of Goslings-I and Goslings-II is to encourage parents to talk, read, sing, and recite nursery rhymes to their infants to improve early language and literacy development. Neri and colleagues explored the impact of a NICU book-reading intervention on preterm infants and found that the program resulted in more stable language scores at 12, 18, and 24 months in comparison with the control group.<sup>25</sup> Music therapy and singing are more examples of early language interventions that improve neonatal cognitive development and reduce both parental and infant distress.<sup>26-29</sup> Overall, shared book reading is one of the most prevalent early language interventions in the NICU, where literacy materials and education on early language exposure are provided to parents. Beginning the practice of language and literacy intervention early in the NICU stay can motivate parents to remain engaged in care and increase literacy practices even after discharge, thus improving parent-infant attachment.<sup>30-33</sup>

As previously mentioned, to serve more families with level funding, we needed to revise Goslings-I. The implementation and expansion of hospital education programs like Goslings-I remain crucial for safeguarding parent and infant well-being, especially during formative perinatal and early childhood years. The literature emphasizes that programs unable to adapt or effectively manage their resources face a higher risk of financial instability and discontinuation.<sup>34</sup> Ongoing program revisions, whether driven by budget constraints or performance improvements, are integral to initiatives seeking long-term financial viability and effective goal fulfillment.<sup>35</sup> Thus, revision of Goslings-I was imperative to maintaining program longevity in a manner that allowed us to reach more preterm and medically fragile infants and their parents.

The present program evaluation addressed the following question: What is the impact of Goslings-II, a streamlined and less expensive version of Goslings-I, on program satisfaction, parents' confidence to interpret their infants' signals of readiness for interaction, parents' intent to implement early language and literacy activities, and parents' use of the information and strategies 1–2 weeks after the session?

## METHODS

### Design

This evaluation used a single-group, pre- and post test, mixed-methods design with parents as the primary participants. This evaluation was reviewed by the institutional review board; the pre- and posttest portion of the evaluation was deemed as not human subjects research and the interview portion was considered exempt. Verbal consent was obtained from all participants.

### Intervention

Goslings is available at no cost to families, and expenses are covered through grant funding. After reflecting on the results of our Goslings-I evaluation and the associated costs, Dr Hussey-Gardner and Dr Diamant-Cohen realized they could serve more families, with level funding, if they lowered the cost of program implementation. Expenses related to Goslings-I included the family kit and staff time to facilitate sessions. As session facilitation costs stayed the same regardless of the number of families served, they focused on reducing the cost of the kit. The cost of the Goslings-I kit was \$55 and included a Goslings Family Guide containing the songs and rhymes taught during the session,

*Understanding My Signals* (a booklet describing infant signals and interpretation), one red/white/black picture book, one animal picture book, and two of the following items (one for the parent and one for the child to use with the parent at an older age): colorful scarf, egg shaker, tube shaker, wrist rattle, and monkey finger puppet. All items were presented to the families in a cinch bag.

The revised program, Goslings-II, included all the same principles while simplifying content based on parent feedback from the first evaluation. Dr Hussey-Gardner and Dr Diamant-Cohen removed the least popular Goslings-I activities (i.e., five songs, one rhyme) and their associated manipulatives (i.e., scarf, tube shaker, and wrist rattle) and simplified three songs. They also reduced the number of remaining manipulatives to one of each, as families indicated they did not need two. This reduced the cost of the kit to \$25. In addition, they simplified the traffic light instructions from developmentally appropriate definitions for red, yellow, and green for each Goslings activity to the same definition across all Goslings activities (i.e., red means voice only, yellow means voice and touch, and green means voice, touch, and show).

Goslings-II was conducted at the same level IV SFR NICU located in a major urban area in the Mid-Atlantic region of the United States, as Goslings-I. All parents and relatives of infants in the NICU were eligible to attend. Families were made aware of the program through posted flyers or a personal verbal invitation from a nurse or the developmental specialist. As with Goslings-I, Goslings-II was facilitated in the NICU family lounge by an individual who had expertise in delivering early childhood programs and specialized training to deliver Goslings-II.

### Procedures

During each session, families were informed about the evaluation portion of the program and encouraged to complete anonymous questionnaires before and after the program if they met the inclusion criteria. Adolescent parents, participants who did not speak English, and those who arrived late or left early were not included in the evaluation but were still welcome to take part in the session. Participants were informed that evaluation participation was voluntary and would not affect their involvement in Goslings-II or the care they received in the NICU. Only a small number of parents declined to complete the questionnaires. The exact number of refusals was not formally documented.

Parents who filled out the questionnaires were invited to participate in an interview 1–2 weeks after the session

to share their experiences with implementing Goslings activities. Interviews were coded and analyzed alongside recruitment. Interview recruitment continued until themes reached saturation, or no new themes emerged. Data collection began in September 2021 and concluded in October 2022.

## Participants

A total of 63 family members (Table 1) of 72 infants (Table 2) completed the pre- and postprogram questionnaires. Seven parents (all mothers) participated in semistructured follow-up interviews (Table 3).

## Measures

**Pre- and Postprogram Questionnaires.** This study utilized the same questionnaires that were used to evaluate Goslings-I.<sup>11</sup> Immediately before the Goslings-II

**TABLE 1 ■ Adult Participant Demographics (N = 63)**

Variable	Percent (N)
Relation to infant	
Mother	84 (53)
Father	14 (9)
Other	2 (1)
Race/ethnicity	
Black	41 (26)
White	44 (28)
Black and White	5 (3)
Other	10 (6)
Marital status	
Married	56 (35)
Single	41 (26)
Other	2 (1)
Omitted	2 (1)
Highest level of education	
Middle school or less	2 (1)
Some high school	5 (3)
High school or GED	27 (17)
Some college credit	21 (13)
Trade/technical/vocational training	8 (5)
Associate's degree	6 (4)
Bachelor's degree	24 (15)
Master's degree	6 (4)
Doctoral degree	2 (1)

Abbreviation. GED = General Educational Development.

**TABLE 2 ■ Infant Participant Demographics (N = 72)**

Variable	Percent (N)
Gender	
Male	56 (40)
Female	44 (32)
Length of NICU stay at the time of participation	
<7 days	3 (2)
1–2 weeks	38 (27)
3–4 weeks	19 (14)
1–2 months	21 (15)
>2 months	13 (9)
Omitted	7 (5)
First born	
Yes	56 (40)
No	44 (32)
Birth weight (g)	
≤1,000	26 (19)
1,001–1,500	28 (20)
1,501–2,000	28 (20)
2,001–2,500	1 (1)
>2,500	11 (8)
Omitted	6 (4)

**TABLE 3 ■ Interview Participant Demographics (N = 7)**

Variable	Percent (N)
Relation to infant	
Mother	100 (7)
Race/ethnicity	
Black	43 (3)
White	43 (3)
Other	14 (1)
Marital status	
Married	29 (2)
Single	71 (5)
Highest level of education	
High school or GED	14 (1)
Trade/technical/vocational training	14 (1)
Associate's degree	14 (1)
Bachelor's degree	57 (4)

Abbreviation. GED = General Educational Development.

session, participants reported demographic information about themselves and their infant(s). They also rated the frequency with which they engaged in several early language and literacy activities with their infant in the past week and their confidence in interacting with their infant. Immediately after the program, participants rated their satisfaction with the program and intention to engage in early language and literacy activities with their infant. They also responded to two open-ended questions regarding what they liked most about the program and what they would change.

**Semistructured Interview.** Parents who consented to follow-up were interviewed 1–2 weeks after attending Goslings-II to discuss their implementation of early language and literacy activities, how Goslings-II impacted their knowledge and engagement, if and how they used their infant’s signals during their interactions, and any impact Goslings-II had on their confidence interacting with their infant. This study utilized the same interview questions and similar probes as the original Goslings study.<sup>11</sup>

## Statistical Analysis

**Questionnaires.** Quantitative data from pre- and postquestionnaires were entered into SPSS 28 by a trained research assistant (T.C.) and analyzed through paired samples *t*-tests. Responses to open-ended questions were transcribed and categorized according to theme.

**Interviews.** Parent interviews were transcribed by the same trained research assistant who was not involved in the evaluation of Goslings-I (T.C.). Two members of the research team independently coded transcripts for themes using inductive thematic analysis, where themes are derived from interviews rather than a predetermined coding scheme.<sup>36</sup> Discrepancies were resolved through repeated discourse. Emerging categories were used to refine interview questions and delineate themes. Enrollment continued until the saturation of themes, at which time no new themes emerged.<sup>37</sup> The final thematic coding scheme was developed by the two coders.

## RESULTS

One hundred percent of the 63 parents completing the questionnaires stated they were satisfied or strongly satisfied with Goslings-II and would recommend it to other NICU parents. In response to what they liked most about the program, the top two themes were the

songs (56%,  $n = 35$ ) and the knowledge they learned about infant signals (30%,  $n = 19$ ). Most parents (97%,  $n = 61$ ) felt the program did not need any changes for improvement. However, two parents did offer suggestions, including a request for more information on infant milestones and development and additional songs.

## Quantitative Analysis

Parents indicated that, after attending Goslings-II, they were significantly more likely to implement early language and literacy activities with their infant, compared with the reported frequency before the program. Parents reported increased intention to talk ( $t[62] = 3.24, p < .001$ ), read ( $t[61] = 13.36, p < .001$ ), recite nursery rhymes ( $t[61] = 15.04, p < .001$ ), and sing ( $t[61] = 8.81, p < .001$ ) to their infants.

Parents reported that, after attending Goslings-II, they were significantly more knowledgeable about infant signals of readiness for interaction ( $t[62] = 8.90, p < .001$ ) and were significantly more confident about understanding these cues ( $t[62] = 8.52, p < .001$ ). As one parent noted, their favorite part of the program was learning about “the signals your baby shows and how to accommodate those signals.”

## Qualitative Analysis

Theoretical saturation was reached after seven parents were interviewed. Five themes emerged: increased interactions, parent wisdom, infant not ready, program strengths, and barriers to program implementation. Four of the seven parents interviewed were successfully contacted after analysis for member checks and agreed with these themes.

**Increased Interactions.** Five categories emerged within the theme of increased interactions: materials used, activity type, activity frequency, increased confidence, and intent to increase activity. All seven parents interviewed reported they utilized Goslings-II materials and activities with their infants: “...now that I have the little booklet with different songs, it’s helped [me sing more expressively]”.

They specifically highlighted Goslings-II songs and books as their most used items along with singing, talking, and reading as their favorite activities: “...before I wasn’t reading to her at all, so I did start after I went to that meeting. I started reading to her more”.

All parents also discussed engaging in more early language and literacy activities after attending the program. In particular, most parents noted that they sang and read to their infants more often: “[I sing] every

day...I think I was more bashful about [singing] before... [now] I don't care if the nurses hear me or not..."

Several parents also expressed increased confidence and comfort interacting with their infant, despite previous reservations due to their infant's medical status: "Before I attended the class, I don't even know if I can sing or anything like that so...Goslings, for me, gave me the courage to..."

Additionally, almost all parents expressed intent to increase activity frequency in the future as their infant became medically ready: "I plan to still use what I learned in Goslings to read to him more often..."

**Parent Wisdom.** Three categories emerged within the theme of parent wisdom: knowledge of infant signals, generalizability, and self-awareness. All parents noted they were able to correctly identify examples of approach, coping, and avoidance signals in their infants and provided appropriate examples of each: "Now I [realize] this, what he just did with his arm, that's telling me this or that...if he puts it up in front of his eyes. So, he's telling me he doesn't want something right now".

Over half of the parents shared examples of times they generalized their knowledge of signals beyond Goslings activities. For instance, parents understood their infant's avoidance signals as a response to other stressors, such as diaper changes and bright lights, and made appropriate changes: "With his hands in front of his face [during cares], like he doesn't want to be bothered. Like I realize, oh you don't want to be bothered but you've got to get changed sir".

Most parents also reported increased self-awareness of how their interactions impacted their infant and modified their behavior accordingly. For example, self-awareness of overstimulation led parents to change how they sang or read to their infant by decreasing volume, speed, and other simultaneous stimulation time (e.g., stroking and rocking): "It taught me how to [sing]...slow it down, not so fast which I didn't even realize that would overstimulate them [before]"

**Infant Not Ready.** Four categories emerged within the theme of infant not ready: lack of alertness, physical barriers, developmental stage, and cares. Over half of the parents limited the frequency or extent of early language and literacy activities because they believed their infant was not yet ready for interaction based on their observations or other limitations. Parents appropriately limited Goslings-II activities when their infant was sleeping instead of rousing them: "[Reading] is definitely

something I want to do more often but...he's a heavy sleeper".

A few parents stated they had difficulty incorporating activities due to the physical barrier of the isolette and ventilation machines: "I just feel with the isolette, I can't really get in there to have it be like so far in front of them and stuff...". Or because of time constraints when priority was focused on feeding or other cares: "The time I'm able to spend with him is usually right around cares...so we're busy trying to...feed him".

Parents' understanding of their infant's developmental stage also influenced the activities they chose to partake in. For instance, knowledge learned from Goslings-II about what colors infants could see at their age influenced which book parents used for reading and showing: "The other book [with] the color pictures...I haven't used that yet just because they were talking about what colors they can and can't see right now".

**Program Strengths.** Three categories emerged within the theme of program strengths: program content, facilitator, and parent-to-parent attachment. All parents stated that they were satisfied with the program content, expressing how it provided them with important knowledge and activities to bring back to their infant: "They gave us different tools to use with the nursery rhymes and how to deal with the red day, green day cues, and stuff like that. It was very knowledgeable".

Four of the parents specifically mentioned how much they liked the program facilitator, expressing appreciation for her enthusiasm and noting how that helped them become more engaged during the program: "I'm very shy...but since I attended Goslings, and the lady was like, well I was once like you guys, I don't want to [sing in public]...So I was like, OK, if she can do it then definitely I can also do it, so let me just try from there".

Notably, two parents valued the parent-to-parent attachment during the session, sharing that the NICU can be an isolating and stressful environment, but having a group activity with other parents helped them feel like they were "not alone": "It got other mothers to talk to each other there...learn about their story so that you don't feel like you're alone here all the time".

**Barriers to Program Implementation.** Three categories emerged within the theme of barriers to program implementation: traffic light, time, and parent preference. Over half of the parents understood the "traffic light" as a way to determine their infant's medical readiness for interaction. However, only a few parents stated that

they actively used the terminology with the medical team: “No, they haven’t brought it up or anything...Well, maybe [it would help], even if it was posted somewhere”.

Some parents also noted limited time in their schedules as a barrier to implementing Goslings-II activities, especially if they were balancing work and/or other children at home: “...So I hold him for a little and then put him back and then I have to pump and head back... so I feel like my days are so tight”.

Parent preference also played a role in parent–infant interactions. For example, over half of the parents preferred singing or reading over reciting nursery rhymes: “I haven’t done any nursery rhymes...I think our favorite is just the singing portion right now”.

## DISCUSSION

Like many intervention programs in healthcare settings,<sup>38</sup> the Goslings program required budgetary adaptations to serve more families with level funding. Despite a smaller family kit and a streamlined program, Goslings-II successfully increased participants’ confidence in interpreting their infants’ signals, their intention to engage in early language and literacy activities, and their self-reported use of Goslings strategies at follow-up, replicating the evaluation results from Goslings-I.<sup>11</sup> Program satisfaction in both Goslings-I and Goslings-II was very high, suggesting that the changes that were made to cut costs did not negatively impact participant experiences. By critically examining the core elements of our program that were important to preserve when making cuts, we continued serving families without sacrificing materials and session content that were central to the goals of the Goslings program.

This evaluation builds the evidence base for the Goslings program’s potential to increase appropriate infant stimulation in SFR NICUs. This is important because SFRs, while conducive to privacy, may understimulate infants in the absence of appropriately guided caregiver interactions.<sup>8</sup> Exposure to caregiver voice and language, in general, is important for neonatal cognitive development,<sup>26</sup> especially among infants born preterm and/or are medically complex, who are at greater risk for developmental delay.<sup>3,15,39</sup> This evaluation is similar to other NICU studies that demonstrated the physiologic, developmental, and parent–infant attachment benefits of music therapy or book-reading interventions in the NICU.<sup>25–31</sup> However, Goslings is unique in that it utilizes multiple early literacy activities (i.e., talking, singing, reading, and reciting nursery rhymes) and guides parents

on how to adapt these activities according to the infants’ medical stability and readiness signals. Our preliminary findings demonstrate enhanced parental engagement, with parents reporting higher rates of singing and reading to their infants. This indicates that these early literacy and language activities can be taught through targeted interventions like Goslings, which may positively impact development.

## Limitations and Future Directions

Despite successful results, this study needs to be interpreted within the context of its limitations. Our program was conducted in an SFR NICU, which allowed parents more privacy than afforded in an open-bay NICU. Parent comfort utilizing the Goslings-II kit and strategies in an open-bay NICU remains unknown, as does the potential impact of increased auditory stimulation and distractions during parent–infant interactions. Future researchers should evaluate the feasibility of implementing Goslings-II in an open-bay NICU. An additional constraint is that our follow-up interviews relied on parental self-reporting, which may introduce social desirability bias. To address this limitation, future research should incorporate direct observational measures by providers or researchers to assess parent–infant interaction in the NICU before and after participating in Goslings-II.

Interestingly, interviews revealed that the Goslings-II traffic light concept was used by parents to self-assign a color to their infant based on their own interpretation of their infant’s immediate medical well-being rather than serving as a communication tool for the medical team to share information about an infant’s medical status with the family. While the parents appeared to do so correctly, that was not the intent of Goslings; the goal was for providers to use the traffic light concept when communicating medical readiness with families. One parent recommended that we post a traffic light sign in the room so that her medical team could easily indicate her infant’s status. Future research should evaluate the feasibility of doing so, when accompanied with the appropriate medical staff education.

Finally, we have not yet examined long-term follow-up with Goslings-II families. Thus, we cannot yet ascertain whether Goslings-II strategies are implemented after discharge or if the program impacts child development. Given the increasing concern of delayed language development in preterm infants, a crucial goal for future research is to thoroughly investigate the long-term developmental impact of NICU parent education programs such as Goslings-II.

## CONCLUSIONS

Goslings-II is a shorter and less expensive version of Goslings-I. Evaluation of Goslings-II yielded positive results similar to Goslings-I, demonstrating program effectiveness at a more affordable price. As we look ahead to the program's future, we have considered creative methods to strengthen its sustainability, such as fundraisers to gather Goslings kit supplies like books and rattles. This is important to consider both at our medical center and outside NICUs interested in implementing extensions of our program. The success of Goslings-II lies in its ability to offer comprehensive support, education, and resources to parents navigating the challenges unique to the NICU environment. By providing families with this multifaceted foundation, Goslings-II (known as Goslings Family Hour in our NICU) may not only foster early language and literacy development for infants but may also lay the groundwork for sensitive and responsive parent-infant interactions in the years to come.

## REFERENCES

1. Tinoco Mendoza G, Stack J, Abdel-Latif ME, Raman S, Garg P. Language outcomes at 4 years of linguistically diverse children born very preterm: an Australian retrospective single-centre study. *BMJ Paediatr Open*. 2023;7(1):e001814. <https://doi.org/10.1136/bmjpo-2022-001814>
2. Palumbi R, Peschechera A, Margari M, et al. Neurodevelopmental and emotional-behavioral outcomes in late-preterm infants: an observational descriptive case study. *BMC Pediatr*. 2018;18(1):318. <https://doi.org/10.1186/s12887-018-1293-6>
3. Zambrana IM, Vollrath ME, Jacobsson B, Sengpiel V, Ystrom E. Preterm birth and risk for language delays before school entry: a sibling-control study. *Dev Psychopathol*. 2021;33(1):47–52. <https://doi.org/10.1017/S0954579419001536>
4. Capriolo C, Viscardi RM, Broderick KA, et al. Assessment of neonatal intensive care unit sound exposure using a smartphone application. *Am J Perinatol*. 2022;39(2):189–194. <https://doi.org/10.1055/s-0040-1714679>
5. Hernández-Salazar AD, Gallegos-Martínez J, Reyes-Hernández J. Level and noise sources in the neonatal intensive care unit of a reference hospital. *Invest Educ Enferm*. 2020;38(3):e13. <https://doi.org/10.17533/udea.icc.v38n3e13>
6. Adama EA, Bayes S, Sundin D. Parents' experiences of caring for preterm infants after discharge with grandmothers as their main support. *J Clin Nurs*. 2018;27(17–18):3377–3386. <https://doi.org/10.1111/jocn.13868>
7. Cardoso SMS, Kozłowski L de C, Lacerda A de, Marques JM, Ribas A. Newborn physiological responses to noise in the neonatal unit. *Braz J Otorhinolaryngol*. 2015;81(6):583–588. <https://doi.org/10.1016/j.bjorl.2014.11.008>
8. Pineda RG, Neil J, Dierker D, et al. Alterations in brain structure and neurodevelopmental outcome in preterm infants hospitalized in different neonatal intensive care unit environments. *J Pediatr*. 2014;164(1):52–60. <https://doi.org/10.1016/j.jpeds.2013.08.047>
9. Pineda R, Durant P, Mathur A, Inder T, Wallendorf M, Schlaggar BL. Auditory exposure in the neonatal intensive care unit: room type and other predictors. *J Pediatr*. 2017;183:56–66. <https://doi.org/10.1016/j.jpeds.2016.12.072>
10. Diamant-Cohen B, Sonnenschein S, Sacks D, Rosswog S, Hussey-Gardner B. Mother goose in the NICU: support for the neediest infants and their families. *Child Libr*. 2018;16(1):3–7. <https://doi.org/10.5860/cal.16.1.3>
11. Shanty L, Dowling R, Sonnenschein S, Hussey-Gardner B. Evaluation of an early language and literacy program for parents of infants in the NICU. *Neonatal Netw*. 2019;38(4):206–216. <https://doi.org/10.1891/0730-0832.38.4.206>
12. Hassanein SMA, El Raggal NM, Shalaby AA. Neonatal nursery noise: practice-based learning and improvement. *J Matern Fetal Neonatal Med*. 2013;26(4):392–395. <https://doi.org/10.3109/14767058.2012.733759>
13. Lahav A, Skoe E. An acoustic gap between the NICU and womb: a potential risk for compromised neuroplasticity of the auditory system in preterm infants. *Front Neurosci*. 2014;8:381. <https://doi.org/10.3389/fnins.2014.00381>
14. Twilhaar ES, de Kieviet JF, Aarnoudse-Moens CS, van Elburg RM, Oosterlaan J. Academic performance of children born preterm: a meta-analysis and meta-regression. *Arch Dis Child Fetal Neonatal Ed*. 2018;103(4):F322–F330. <https://doi.org/10.1136/archdischild-2017-312916>
15. Putnick DL, Bornstein MH, Eryigit-Madzwamuse S, Wolke D. Long-term stability of language performance in very preterm, moderate-late preterm, and term children. *J Pediatr*. 2017;181:74–79. <https://doi.org/10.1016/j.jpeds.2016.09.006>
16. Joensuu E, Munck P, Setänen S, et al. Associations between language at 2 years and literacy skills at 7 years in preterm children born at very early gestational age and/or with very low birth weight. *Child*. 2021;8(6):510. <https://doi.org/10.3390/children8060510>
17. Nguyen T-N-N, Spencer-Smith M, Zannino D, et al. Developmental trajectory of language from 2 to 13 years in children born very preterm. *Pediatrics*. 2018;141(5):e20172831. <https://doi.org/10.1542/peds.2017-2831>
18. Hersey A, Hoffman L, Tucker R, Vohr B. Enhancing the NICU language environment with a neonatal cuddler program. *J Perinatol*. 2021;41(8):2063–2071. <https://doi.org/10.1038/s41372-021-01037-2>
19. Ozdil M. Postpartum depression among mothers of infants hospitalized in the neonatal intensive care unit during the COVID-19 pandemic. *Cureus*. 2023;15(8):e44380. <https://doi.org/10.7759/cureus.44380>
20. Karamanou A, Varela P, Nanou C, Deltsidou A. Association between maternal-infant bonding and depressive symptoms in neonatal intensive care unit mothers: a case-control study. *Enferm Intensiva*. 2022;33(4):165–172. <https://doi.org/10.1016/j.enfic.2021.07.002>
21. Garg D, Chaudhury S, Saldanha D, Kumar S. Stress, postpartum depression, and anxiety in mothers of neonates admitted in the NICU: a cross-sectional hospital-based study. *Ind Psychiatry J*. 2023;32(1):48–58. [https://doi.org/10.4103/ipj.ipj\\_93\\_22](https://doi.org/10.4103/ipj.ipj_93_22)



22. Ahlqvist-Björkroth S, Axelin A, Setänen S, et al. Fewer maternal depression symptoms after the close collaboration with parents intervention: two-year follow-up. *Acta Paediatr*. 2022;111(6):1160–1166. <https://doi.org/10.1111/apa.16303>
23. Väliäho A, Lehtonen L, Axelin A, Korja R. Parental narratives of bonding and relational experiences with preterm infants born at 23 to 24 weeks—a qualitative descriptive study. *Children*. 2023;10(5):793. <https://doi.org/10.3390/children10050793>
24. Wild KT, Betancourt LM, Brodsky NL, Hurt H. The effect of socioeconomic status on the language outcome of preterm infants at toddler age. *Early Hum Dev*. 2013;89(9):743–746. <https://doi.org/10.1016/j.earlhumdev.2013.05.008>
25. Neri E, De Pascalis L, Agostini F, et al. Parental book-reading to preterm born infants in NICU: the effects on language development in the first two years. *Int J Environ Res Public Health*. 2021;18(21):11361. <https://doi.org/10.3390/ijerph182111361>
26. Lordier L, Meskaldji D-E, Grouiller F, et al. Music in premature infants enhances high-level cognitive brain networks. *Proc Natl Acad Sci USA*. 2019;116(24):12103–12108. <https://doi.org/10.1073/pnas.1817536116>
27. Kraft KE, Jaschke AC, Ravensbergen A-G, et al. Maternal anxiety, infant stress, and the role of live-performed music therapy during NICU stay in The Netherlands. *Int J Environ Res Public Health*. 2021;18(13):7077. <https://doi.org/10.3390/ijerph18137077>
28. Kobus S, Diezel M, Dewan MV, et al. Music therapy in preterm infants reduces maternal distress. *Int J Environ Res Public Health*. 2022;20(1):731. <https://doi.org/10.3390/ijerph20010731>
29. Kehl SM, La Marca-Ghaemmaghami P, Haller M, et al. Creative music therapy with premature infants and their parents: a mixed-method pilot study on parents' anxiety, stress and depressive symptoms and parent-infant attachment. *Int J Environ Res Public Health*. 2020;18(1):265. <https://doi.org/10.3390/ijerph18010265>
30. Latif M, Duarte Ribeiro AP, Blatz MA, et al. Encouraging our NICU to “read-a-latte”: leveraging a read-a-thon to launch a quality improvement initiative. *Adv Neonatal Care*. 2023;23(2):120–131. <https://doi.org/10.1097/ANC.0000000000001038>
31. Jain VG, Kessler C, Lacina L, et al. Encouraging parental reading for high-risk neonatal intensive care unit infants. *J Pediatr*. 2021;232:95–102. <https://doi.org/10.1016/j.jpeds.2021.01.003>
32. Erdei C, Klass P, Inder TE. Reading aloud with infants in the neonatal intensive care unit: a unit-based program to enhance language enrichment and support early foundational relationships. *Am J Perinatol*. 2023;40(3):255–259. <https://doi.org/10.1055/s-0041-1731043>
33. Braid S, Bernstein J. Improved cognitive development in preterm infants with shared book reading. *Neonatal Netw*. 2015;34(1):10–17. <https://doi.org/10.1891/0730-0832.34.1.10>
34. Patton M. *Developmental Evaluation Applying Complexity Concepts to Enhance Innovation and Use*. Guilford Publications; 2010.
35. Kapucu N. Interorganizational coordination in dynamic context: networks in emergency response management. *Connect J Int Netw Soc Netw Anal*. 2004;26(2):33–48.
36. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77–101. <https://doi.org/10.1191/1478088706qp063oa>
37. Kuzel AJ. Sampling in qualitative inquiry. In: Crabtree BF, Miller WL, eds. *Doing Qualitative Research*. Sage; 2021:33–45.
38. Miller CJ, Sullivan JL, Connolly SL, et al. Adaptation for sustainability in an implementation trial of team-based collaborative care. *Implement Res Pract*. 2024;5:26334895231226197. <https://doi.org/10.1177/26334895231226197>
39. Vassar R, Schadl K, Cahill-Rowley K, Yeom K, Stevenson D, Rose J. Neonatal brain microstructure and machine-learning-based prediction of early language development in children born very preterm. *Pediatr Neurol*. 2020;108:86–92. <https://doi.org/10.1016/j.pediatrneurol.2020.02.007>

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