Social Communication Skills: Comparative Study between Preterm and Full-term Infants.

Juliana M. S. Borsato, Jacy Perissinoto, and Amélia M. N. dos Santos

Federal University of Sao Paulo, Brazil

Author Note:

Juliana M.S. Borsato, Department of Speech, Language, and Hearing Pathology, Federal University of Sao Paulo; Jacy Perissinoto, Department of Speech, Language, and Hearing Pathology, Federal University of Sao Paulo; Amélia M.N. dos Santos, Department of Neonatal Pediatrics, Federal University of Sao Paulo.

Juliana M.S. Borsato is now at Ajax, Ontario.

Correspondence concerning this article should be addressed to Juliana M.S. Borsato, 11, Hawker CRT, L1T 3N1, Ajax, Ontario, Canada.

E-mail: julianamaria.simoes@gmail.com

Abstract

We verified the development of 37 prematurely born infants between 8 and 18 months of chronological age, in comparison with 21 full-term infants, in relation to Social Communication Skills, namely joint attention, behavioral request and social interaction, as well as examined the factors associated with these skills. We analyzed the performances regarding Social Communication Skills, the differences between genders, the differences among ages ranging from 8 to 11, 12 to 15 and 16 to 18 months, as well as influences of age, possible risk and protection factors in the group’s performances. We observed that full-term infants had advantages mainly in joint attention and behavioral request skills. There were associations between performance and age, performance and risk factors as well as between performance and protection factors. The results suggest vulnerability of premature infants’ Social Communication Skills, prompting the need for early assessment. Further research focusing on infants at low risk for language, cognitive and social impairments could contribute to establishing references to identify individuals at high risk for these developmental issues.

*Keywords*: Infant, Premature, Nonverbal communication, Infant behavior, Language development, Gesture.

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1. Introduction

Research has demonstrated that prematurity, low birth weight, perinatal and neonatal intensive care needs are high-risk factors for language as they influence several aspects that hinder the development of basic skills such as auditory and motor development from an early age, aspects of central auditory processing, language acquisition, language subdomain skills, attention, memory and cognitive, social and symbolic development (Barre, Morgan, Doyle, & Anderson, 2011; Jansson-Verkasalo et al., 2003; Oliveira, Lima, & Gonçalves, 2003; Reilly et al., 2006; Rose, Feldman, & Jankowski, 2009).

From another point of view, pre-verbal intentional social communication behaviors, such as gestures and vocalizations, are strongly related to subsequent language performance and cognitive and social development (Kraljević, [Cepanec](http://www.sciencedirect.com/science/article/pii/S0163638314000095) & Simlesa, 2014; McCathren et al., 1999; Mundy & Sigman, 2006; Watt, Wetherby, & Shumway, 2006). The poor development of Social Communication Skills represents an additional indicator of possible future difficulties in language development, which reinforces the idea of correlation between pre-verbal communication skills and later language progress (Hohm, Jennen-Steinmetz, Schmidt, & Laucht 2007; Iverson & Goldin-Meadow, 2005; Wetherby, Cain, Yonclas, & Walker, 1988). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders – DSM-5 (American Psychiatric Association, 2013) has added the new diagnosis Social (Pragmatic) Communication Disorder to identify individuals who present “persistent difficulties in the social use of verbal and nonverbal communication…” (p. 47). The definition states that the disorder starts “(…) in the early developmental period (but deficits may not become fully manifest until social communication demands exceed limited capacities)” (p. 48). This statement illustrates the difficulty of early identification of individuals who will potentially develop this sort of impairment and suffer from its consequences concerning language and social development, which prompts the need for research on young populations.

The skill losses preterm infants are subjected to are consequences of biological and environmental risks to which premature infants are exposed and that interfere in their neurological maturation (Isotani, Azevedo, Chiari, & Perissinoto, 2009; Jennische & Sedin, 1999, 2003; Reissland & Stephenson, 1999; Weijer-Bergsma, Wijnroks, & Jongmas, 2008), thus harming their development and pace of social communicative behaviors, which are also found to be damaged (Mundy & Sigman, 2006; Mundy et al. 2007; Olafsen et al., 2006; Ulvund & Smith, 1996). The literature indicates the negative impact of premature birth and associated risks on language’s neurological foundations. Peña, Pittaluga and Mehler (2010) analyzed brain responses in full-term and preterm exposure either to their maternal language, a rhythmically close language and a rhythmically distant language and found that preterm infants take longer to distinguish between their native language and rhythmically similar languages when compared with full-term infants. However, premature infants demonstrated discrimination responses to language exposure, achieving a similar level as full-term infants, which demonstrates the importance of neural maturation to language development at this early stage of life. Lind et al. (2010) analyzed the relation between brain volumes vs. premature births’ neuropsychological skills, the results of psychological assessments and a parental questionnaire on executive functioning, language, memory and motor skills. The results display associations between a smaller volume of total brain tissue and poorer executive functions, between a smaller cerebellar volume and poorer executive functions as well as motor skills, and between a larger volume of brainstem and poorer language functions. According to the authors, those findings suggest that altered brain volumes at term equivalent age appear to affect the development of very low birth weight (VLBW) children up to 5 years of age. Adams-Chapmans (2009) reports in a review article about risks to the premature brain that the brain grows and is formed throughout the gestational period. Moreover, the end of the gestation is crucial for the brain’s development and maturation, and consequently, premature infants’ brains are vulnerable to several neurodevelopment issues.

With regard to the foundation for the development of Social Communicative Skills, the following systems are also present at birth: sensory-motor accuracy, integrated perception, and social and object orientation. These will later serve the Social Communicative Skills, imitation, and sound recognition, which in turn allow reasoning and learning development from 18 to 36 months. Therefore, these systems, present at birth, are part of communication skills building and, in sequence, are also part of language development (Bates & Dick, 2002; Bates, 2004; Brooks & Meltzoff, 2005; Crais, Douglas, & Campbell, 2004; Hohm et al. 2007; Iverson & Goldin-Meadow, 2005; McCathren, Yoder, & Warren, 1999; Morales, Mundy, & Rojas, 1998; Mundy & Acra, 2006; Mundy et al., 2007; Reilly et al., 2006; Rose et al., 2009; Strid, Tjus, Smith, Meltzoff, & Heimann, 2006).

One of the most important aspects of intentional pre-verbal communication found in the literature as being associated with the later development of language is joint attention, namely the ability to share attention with respect to an object, event, or idea with a communication partner either through initiative or response skills, using vocalizations, gestures or verbal language. Such behaviors have been considered predictors of later receptive and expressive language, as well as of social behavior (Bates & Dicks, 2002; Kraljević, [Cepanec](http://www.sciencedirect.com/science/article/pii/S0163638314000095) & Simlesa, 2014; McCathren et al., 1999; Mundy & Acra, 2006; Mundy & Sigman, 2006; Mundy et al., 2007; Watt, Wetherby, & Shumway, 2006). According to the emerging social-cognitive revolution described by Tomasello (1996), from as early as 8 months of age, a child with normal development begins to understand other people's intentions and behaviors and starts sharing attention. Other authors have confirmed the emergence of gestures as communicative social behavior from 8 months; moreover, the use of the gesture system evolves in different communicative functions until it is gradually replaced by words (Bates & Dick, 2002; Kraljević, [Cepanec](http://www.sciencedirect.com/science/article/pii/S0163638314000095) & Simlesa, 2014; Reilly et al., 2006; Wetherby et al., 1988).

Another fact to be considered in language development is that although biological risk factors can affect elementary development in very young subjects (Bates & Dick, 2002; Bühler, Flabiano, Mendes & Limongi, 2007; Jansson-Verkasalo et al. 2003; Rose et al. 2009; Weijer-Bergsma et al. 2008), protective environmental factors, in the presence of a communicative partner, allow for Social Communication Skills development (Bates 2004; Mundy & Acra 2006).

Based on the aforementioned information, studies prove the existence of biological risks toward the premature infants’ neurological maturation, which is reflected in their language development. Furthermore, there are studies demonstrating the relationship among neurological systems at birth, Social Communication Skills and language development.

* 1. Aim of the study

Based on these considerations, we raised the hypothesis that if prematurely born infants are at risk for language disorder, they may present, in the same manner, a different pattern of pre-verbal social communicative development when compared with full-term born infants at a low risk for developmental disorders. This proposition leads to an important concern about investigating language predictors impairments that should be identified as an early alert that language is not evolving as it should.

Consequently, the present study investigated the development of Social Communication Skills in prematurely born infants by means of a comparative analysis with a group of full-term born infants, considering the components of Social Communication Skills, Joint Attention, Behavior Request and Social Interaction, and, at the same time, identifying biological risk and protection factors associated with those components for both groups.

1. Methods

The present research constitutes a comparative cross-sectional observational study between groups. It was approved by the Ethics and Research Committee of the Federal University of Sao Paulo – Brazil (UNIFESP).

* 1. Participants

The group with high risk for language development disorder, named group I (GI), consisted of preterm infants assisted by the Program for Premature Infants of the Neonatal Pediatrics Department of UNIFESP. Initially, the records of 156 premature infants born with a gestational age of less than 37 weeks (M = 31.6 weeks, SD = 3.32) and birth weight below 2,500 grams (M = 1.428 grams. SD =405 grams) according to pediatric evaluation records were analyzed. These subjects were born between July 2006 and October 2007 and had chronological ages ranging from 8 to 18 months at the time of evaluation. The study included subjects scheduled for clinic routine follow-up and those whose families volunteered to participate in the research. Subjects with syndromes, malformations, sensory disorders, incomplete records or who did not attend the appointment were excluded from the study, resulting in a final sample of 37 infants, with 19 males (51.4%) and 18 females (48.6 %).

The infants attending the Premature Program are assisted by a multidisciplinary team of health specialists. The evaluations these patients underwent included neurological, audiological and pediatric examinations. Fourteen infants (38%) presented altered neurological diagnostic records, including two patients with pyramidal abnormalities, one patient with pyramidal abnormalities and psychomotor development delay, one patient with hypotonia and psychomotor development delay, one patient with microcephaly and pyramidal abnormalities, one patient with hypotonia, one patient with lower extremity spasticity, one patient with patellar abnormal reflex and six patients with non-specified neurological disorders.

Thirty-six infants in GI presented normal hearing test results in their clinical records. One infant in GI presented a previous record of conductive hearing loss and then underwent an audiological behavior evaluation conducted by the main researcher on the same day of the evaluation. Reactions to instrumental sound stimuli were observed as proposed by Azevedo (1997), with stimuli presentation on lateral right and left planes, 20 cm below and above the ear of the infant, as well as verbal stimuli in different complexity levels. The infant’s responses were compared with the results expected for the respective age range, according to Azevedo (1997), and then considered as representative of normal auditory development.

The group at low risk for language development disorders, named group II (GII), consisted of infants aged 9 to 18 months, born between October 2005 and September 2007, with a gestational age greater than or equal to 37 weeks (M = 38.7, SD = 1.06).

From the initial sample of 35 infants, we excluded those who presented prenatal, perinatal or postnatal risk history, including previous stays at the Neonatal Intensive Care Unit, as well as those who presented visual or hearing disorders, central nervous system and craniofacial malformations, syndromes or other cognitive and language development-related factors. The final sample consisted of 21 infants born full-term, 12 females (57.1%) and 9 males (42.9%).

Hearing behavior observations according to Azevedo (1997) were performed in GII participants who had no examination records confirming normal hearing capabilities, according to the same procedure adopted for the subjects in GI. The auditory responses of all infants in GII were compared with the expected results for their age range and proved to be adequate.

* 1. Procedures
     1. Data Collection Procedure.

The GI subjects were evaluated by the Laboratory of Speech/Language and Hearing Investigations for Premature Children, in the Department of Speech/Language and Hearing Pathology, UNIFESP. The evaluations took place at the House of Premature Infants, UNIFESP.

The GII evaluations were conducted at private and public preschools or in the residence of volunteers who were not attending school but agreed to participate in the research. All of the evaluations took place in the State of Sao Paulo, Brazil.

The parents and/or legal guardians of the subjects in both GI and GII were informed about the aim of the study and the nature of the procedures. They voluntarily agreed to participate and signed a proper consent form.

Prenatal, perinatal and postnatal data history were obtained for both groups based on medical records of the infant and mother, interviews with the family, and a questionnaire answered by parents. A socioeconomic range classification using the Economic Classification Criteria Brazil (CCEB) of the National Association of Research Companies (ABEP, 2000) was also performed.

The early Social Communication Skills evaluation for both groups was performed by the main author, using the ESCS,[[1]](#footnote-1) which was translated to the Portuguese language by the researchers and used exclusively for this study.

* + 1. ESCS Administration.

The Early Social Communication Scale (ESCS; Mundy et al., 2003), briefly, is a semi-structured videotaped observation that takes 15 to 25 minutes to administer. It was conceived with the intent of outlining a communicative profile indicating the stages of different behaviors in the nonverbal communicative functions that are typically present in children with ages ranging from 8 to 30 months. The following communicative skills can be identified by the ESCS in the different types of tasks presented by the examiner: (a) Joint Attention: nonverbal skills in initiating or responding to interaction with others, sharing objects or event experiences. The child may use eye contact, pointing and showing to initiate joint attention (IJA) or follow the examiner’s pointing gesture, thus responding to joint attention (RJA). (b) Behavior Request: nonverbal skills for requesting aid to obtain an object or event or responding to the examiner’s behavior request. The child uses eye contact, reaching, giving or pointing to initiate behavior request (IBR) to obtain an object or event related to the object, or responds to behavior request (RBR) following the tester’s verbal or gestural commands to obtain an object or action. (c) Social interaction: the child's ability to engage in playing, performing turn-taking interactions (TT) with others. Initiating social interaction (ISI) may be observed in turn-taking games. Teasing behavior or eye contact and responding to gestures and turn-taking may be observed in response to social interaction (RSI) initiated by the tester. In addition, infants using words (W) accompanied or not by gestures with different communicative functions may be observed during administering of the scale. Such events were registered and assigned a communicative function corresponding to the use of language by the infants.

Each gesture presented by the infants, also called code, was classified into one of two categories: 1 - Lower Level Behaviors (LL) - less complex communicative behaviors: eye contact, reaching, appeal, alternating, teasing without smile, or 2 - Higher Level Behaviors (HL) - more elaborate communicative behaviors: pointing, giving, showing, teasing with smile (with or without eye contact).

All interaction sessions between the subject and the main researcher, in the presence of the caregiver, were videotaped during the presentation of semi-structured tasks to infants to elicit communicative behaviors. During the sessions, we used toys suggested by the ESCS that were considered appropriate and interesting to the infants.

A Canon camera (model PowerShot S3 IS 6.0 megapixels) with SanDisk memory cards of 1 and 2 GB, fixed in a 5200 D tripod, was used for video-recording at resolutions of 320 x 240 @ 30 fps and 640 x 480 @ 15 fps.

We followed the recommended room setup even in different room layouts and environments where the scale was administered.

* 1. Analysis Procedures

We analyzed each videotape focusing on the target behaviors within the tasks presented. The analysis consisted in noting the frequencies of Joint Attention, Behavioral Request, and Social Interaction occurrences.

The average recording time was 20.9 minutes (SD = 4.09), with no significant differences between GI and GII videotaping times. Unclear behaviors were not rated. Ambiguity between joint attention and requests were generalized as a behavior request. When a behavior form was modified, the HL behavior was considered, e.g., when the infant made a gesture to reach and then immediately pointed, the only the HL behavior of pointing was considered.

* 1. Behavior Scoring

For initiative behaviors, the score could be obtained in three different ways, depending on the task: based on the total number of HL and LL behaviors occurrences, by the ratio between the frequency of initiative HL behaviors and the behaviors total (Ratio of Higher Level – RHL), and finally by assigning pre-established rates proposed by the ESCS to certain infant-initiated behaviors, e.g., infants could receive a 0 for no teasing behavior, 1 for a LL tease and 2 for a HL tease, independently of the number of teasing events that occurred.

Response skills scores could be obtained in two ways: based on the ratio between the number of adequate answers and the number of tasks presented by the tester, from which a percentage of fails and passes in following commands was obtained and also by assigning pre-established ratings proposed by the scale to the total number of correct answers, e.g., in a turn-taking game, the infant would score 0 for no turns, 1 for 1 to 3 turns and 2 for 4 or more turns.

* 1. Pilot Study

A pilot study was performed by the main author with one subject who joined the sample after the videotape was analyzed and re-analyzed. The pilot subject was female, aged 18 months and 5 days with no prenatal, perinatal or postnatal incidents; no sensory alterations or syndromes; or any malformation or diagnosis affecting her development. The scale administration procedures were studied and practiced by the main author before the examination. From the analysis of this pilot videotape, observations were made and incorporated into the subsequent video assessments.

* 1. Reliability

To analyze the reliability of the data obtained in this study, 16 (26.6%) subjects were randomly selected from GI and GII and thus were both study and control individuals in their own groups. The sample for the reliability analysis consisted of three male infants and four females in GI and six males and three females in GII. According to the Wilcoxon test, applied for the reliability analysis, there was no significant difference between the videotape analysis and re-analysis, which demonstrates that the analyses were reliable and trustworthy. The only exceptions were IBR HL (p = 0.045) and RBI total (p = 0.023). These items were reviewed and considered the subjects’ best scores.

* 1. Statistical Analysis

Nonparametric statistical techniques and tests were used for data analysis, as the conditions relating to normal distribution and variance homogeneity were not satisfied in this dataset.

* 1. Data treatment and organization
     1. Part 1.

Initially, the statistical analysis compared the performances of GI and GII for each Social Communication Skill. In addition, it considered the variable gender, face to possible developmental variations related to this aspect, the correlation between age versus Social Communication Skills, and, finally, the performance by age, separated into quarterly chronological ranges of 8 to 11, 12 to 15, and 16 to 18 months to characterize and detail behavior differences throughout development. To perform the analysis considering the subjects’ corrected ages, it would be necessary to match ages in GI and GII, which would thus require a longitudinal study so that a premature chronological age subject could be paired in the future with his/her corrected age to a full-term subject. Therefore, for the purpose of this cross-sectional comparative study, after comparing both groups by their chronological age range, another analysis was performed considering only GI subjects in the same pre-established ranges (8-11, 12-15, and 16-18 months) in both their chronological and corrected ages, i.e., GI subjects do not change their age ranges when they have their ages corrected. For this specific analysis, however, 18 subjects who changed their age range after having their chronological age corrected were excluded, resulting in a reduction of GI to N = 19. This analysis was designated Restrict Age Range. The entirety of this first data analysis stage was designated Part 1.

* + 1. Part 2.

Part 2 of the statistical analysis sought correlations between Social Communication Skills performance and the risk and protection factors for the entire sample (GI + GII = 58). The correlations were analyzed considering the whole sample, with the intention of increasing trustworthiness. The following biological risk factors were considered: (a) Birth variables, namely days of hospitalization, gestational age, birth weight, and Apgar score for the first and fifth minutes; (b) Neonatal complications: respiratory distress syndrome, Broncho pulmonary dysplasia, apnea, cerebral hemorrhage, sepsis, meningitis, neonatal anemia, and retinopathy of prematurity; (c) Neonatal intensive care: time spent at infant incubator, enteral nutrition, oxygen inhalation therapy, and phototherapy; and (d) Neurological diagnosis results. The following socioeconomic profile aspects were considered as protection factors: socioeconomic classification, attending school, time of school attendance (months), time spent at school (part-time vs. full-time), time spent with the caregiver, time spent with the mother, time spent with the father, and parental education level.

The Mann-Whitney Test was used for comparative analyses between groups. The Spearman Correlation Test was used to analyze the correlation level of risk and protection variables, and the Correlation Test was used to validate the correlations analyzed by the Spearman Correlation Test. A significance level of 0.05 (5%) was defined, and a 95% statistical confidence interval was established throughout the study.

The computer software SPSS v 11.5, Minitab 14 and Excel XP were used for statistical analysis. The results of each analysis will be presented in two parts, Part 1 and Part 2, in the following sequence: Joint attention, Behavior request and Social interaction.

1. Results
   1. Part 1

Comparisons were performed between GI and GII for Joint attention, Behavior request and Social interaction performance, comparison according to the variable gender, with correlation results between Social Communication Skills and age and comparison of performance of three distinct age ranges (8 to 11, 12 to 15 and 16 to 18 months).

* + 1. Performances of GI and GII in Joint Attention, Behavior Request and Social Interaction.

The results for Joint Attention, Behaviors Request and Social Interaction (Table 1) displayed significant differences between the performance of GI and GII, with GII performing better in all tested skills.

Table 1

Comparison of Performances of GI and GII in Different Social Communication Skills (SCS) Tested with the ESCS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | SCS |  | n | M | *Mdn* | SD | Q1 | Q3 | CI | *p* |
| Joint Attention | IJA LL | GI | 37 | 18.5 | 16.0 | 10.66 | 12.0 | 23.0 | 3.44 | .046 |
| GII | 21 | 22.3 | 20.0 | 8.59 | 17.0 | 28.0 | 3.68 |
| IJA HL | GI | 37 | 1.2 | 0.0 | 2.23 | 0.0 | 1.0 | 0.72 | <.001 |
| GII | 21 | 4.5 | 3.0 | 4.47 | 2.0 | 6.0 | 1.91 |
| IJA Total | GI | 37 | 19.7 | 16.0 | 11.03 | 13.0 | 25.0 | 3.55 | .007 |
| GII | 21 | 26.8 | 26.0 | 9.66 | 20.0 | 33.0 | 4.13 |
| IJA RHL | GI | 37 | 0.1 | 0.0 | 0.12 | 0.0 | 0.1 | 0.04 | .001 |
| GII | 21 | 0.2 | 0.1 | 0.15 | 0.1 | 0.2 | 0.06 |
| IJA 1W | GI | 37 | 0.2 | 0.0 | 0.63 | 0.0 | 0.0 | 0.20 | .001 |
| GII | 21 | 1.2 | 1.0 | 1.57 | 0.0 | 2.0 | 0.67 |
| RJA 1W | GI | 37 | 0.1 | 0.0 | 0.52 | 0.0 | 0.0 | 0.17 | .044 |
| GII | 21 | 0.6 | 0.0 | 1.75 | 0.0 | 0.0 | 0.75 |
| Behavior Request | IBR HL | GI | 37 | 5.4 | 3.0 | 6.13 | 0.0 | 9.0 | 1.97 | <.001 |
| GII | 21 | 17.3 | 15.0 | 8.79 | 13.0 | 23.0 | 3.76 |
| IBR TOTAL | GI | 37 | 24.0 | 22.0 | 11.22 | 14.0 | 33.0 | 3.62 | <.001 |
| GII | 21 | 37.4 | 38.0 | 8.23 | 32.0 | 43.0 | 3.52 |
| IBR RHL | GI | 37 | 0.2 | 0.1 | 0.18 | 0.0 | 0.3 | 0.06 | <.001 |
| GII | 21 | 0.4 | 0.4 | 0.19 | 0.3 | 0.5 | 0.08 |
| IBR 1W | GI | 37 | 1.5 | 0.0 | 3.16 | 0.0 | 2.0 | 1.02 | .031 |
| GII | 21 | 4.6 | 1.0 | 6.71 | 0.0 | 9.0 | 2.87 |
| RBR passes (%) | GI | 37 | 42.6 | 36.4 | 34.70 | 7.7 | 80.0 | 11.18 | <.001 |
| GII | 21 | 81.0 | 92.9 | 27.02 | 76,9 | 100,0 | 11,55 |
| RBR fails (%) | GI | 37 | 57.4 | 63.6 | 34.70 | 20.0 | 92.3 | 11.18 | <.001 |
| GII | 21 | 190. | 7.2 | 27.02 | 0.0 | 23.1 | 11.55 |
| Social Interaction | ISI TT | GI | 37 | 0.1 | 0.0 | 0.39 | 0.0 | 0.0 | 0.13 | .020 |
| GII | 21 | 0.3 | 0.0 | 0.48 | 0.0 | 1.0 | 0.21 |
| RSI HL | GI | 37 | 2.8 | 2.0 | 2.46 | 1.0 | 5.0 | 0.79 | .004 |
| GII | 21 | 4.7 | 6.0 | 2.05 | 3.0 | 6.0 | 0.88 |
| RSI TOTAL | GI | 37 | 4.4 | 3.0 | 2.48 | 2.0 | 6.0 | 0.80 | .001 |
| GII | 21 | 6.8 | 7.0 | 2.02 | 6.0 | 8.0 | 0.87 |

*Note.* SCS= Social Communication Skill tested; IJA= Initiating Joint Attention; LL= Lower level; HL=Higher level; RHL= Ratio of higher level; 1W=use of 1 word; RJA=Responding to Joint Attention; IBR= Initiating Behavior Request; RBR=Responding to Behavior Request; ISI= Initiating Social Interaction; TT= Turn-Taking; RSI=Responding to Social Interaction; 95% Confidence Interval.

* + 1. Gender.

Although gender differences existed in all of the performance results, they were not considered significant.

* + 1. Age.

Table 2 shows positive correlations between age vs. skills, i.e., scores increased as age increased. There are positive moderate (≥ 40%) and good (≥ 60%) correlations for Joint Attention and Social Interaction and good correlations (≥ 60%) for Behavior Request, with greater correlations for response behavior. Significant good negative correlations (≥ 60%) between age and behavior request (fail to follow command) were observed, which indicate a failure reduction as infants advance in age. Significant correlations between age and HL behaviors are observed.

Table 2

Age Correlation with Different Social Communication Skills Tested with the ESCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS |  |  | R (N=58) | *p* |
| Joint Attention | IJA | HL | 50.6% | .000 |
| RHL | 48.5% | .000 |
| RJA | FPP | 53.3% | .000 |
| FLR | 66.0% | .000 |
| TOTAL (FPP+FLR) | 68.3% | .000 |
| Behavior Request | IBR | HL | 68.0% | .000 |
| Total | 62.6% | .000 |
| RHL | 64.1% | .000 |
| RBR | passes | 74.5% | .000 |
| fails | -74.5% | .000 |
| Social Interaction | ISI | TT | 40.6% | .002 |
| RSI | HL | 80.0% | .000 |
| Total | 74.4% | .000 |

*Note.* SCS= Social Communication Skill tested; IJA= Initiating Joint Attention; HL=Higher Level; RHL= Ratio of Higher Level; RJA=Responding to Joint Attention; FPP= Following Proximal Pointing; FLR= Following Line of Regard; IBR=Initiating Behavior Request; RBR=Responding to Behavior Request; ISI= Initiating Social Interaction; TT=Turn-Taking; RSI= Responding to Social Interaction.

The most valuable significant correlations found were for RSI HL and total RSI, RBR, IBR HL, IBR RHL and total RJA. Important but less valuable correlations were found for IJA HL and IJA RHL and ISI turn-taking.

* + 1. Comparison of age ranges.

Table 3 shows significant differences in several items for initiating and responding behavior requests and in two items for social interaction response tasks for the 8-to-11-month age range.

Table 3

Comparison of Performances Between GI and GII for Different Social Communication Skills Tested with the ESCS in the Age Range of 8 to 11 months

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS 8 to 11 | | | n | M | *Mdn* | SD | Q1 | Q3 | CI | *P* |
| Behavior Request | IBR LL | GI | 10 | 13.7 | 12.5 | 6.45 | 11.3 | 19.3 | 4.00 | .019. |
| GII | 4 | 24.3 | 23.5 | 6.60 | 21.5 | 26.3 | 6.47 |
| IBR HL | GI | 10 | 0.3 | 0.0 | 0.48 | 0.0 | 0.8 | 0.30 | .002 |
| GII | 4 | 8.8 | 8.5 | 4.27 | 6.3 | 11.0 | 4.19 |
| IBR Total | GI | 10 | 14.0 | 13.5 | 6.53 | 11.3 | 19.3 | 4.05 | .005 |
| GII | 4 | 33.0 | 30.5 | 10.03 | 27.0 | 36.5 | 9.83 |
| IBR RHL | GI | 10 | 0.0 | 0.0 | 0.03 | 0.0 | 0.0 | 0.02 | .002 |
| GII | 4 | 0.3 | 0.3 | 0.08 | 0.3 | 0.3 | 0.08 |
| RBR passes | GI | 10 | 5.8% | 0.0 | 8.97 | 0.0 | 8.8 | 5.56 | .050 |
| GII | 4 | 51.7% | 58.3 | 38.15 | 37.5 | 72.5 | 37.39 |
| RBR  fails | GI | 10 | 94.2% | 100.0 | 8.97 | 91.3 | 100.0 | 5.56 | .050 |
| GII | 4 | 48.3% | 41.7 | 38.15 | 27.5 | 62.5 | 37.39 |
| Social Interaction | RSI HL | GI | 10 | 0.2 | 0.0 | 0.63 | 0.0 | 0.0 | 0.39 | .004 |
| GII | 4 | 1.8 | 1.5 | 0.96 | 1.0 | 2.3 | 0.94 |
| RSI Total (LL+HL) | GI | 10 | 2.0 | 2.0 | 0.47 | 2.0 | 2.0 | 0.29 | .002 |
| GII | 4 | 4.5 | 4.0 | 1.73 | 3.8 | 4.8 | 1.70 |

*Note.* SCS= Social Communication Skill tested; IBR= Initiating Behavior Request; LL= Lower level; HL=Higher level; RHL= Ratio of Higher Level; RBR=Responding to Behavior Request; RSI=Responding to Social Interaction; 95% Confidence Interval.

Table 4 shows, for the 12-to-15-month age range, significant differences between the groups in the three Social Communication Skills items tested. For Joint Attention initiative and response, six items presented significant differences. For Behavior Request, also in initiative and response, five items presented significant differences, and for Social Interaction, there is a significant difference in three combined items of initiative and response.

Table 4

Comparison of Performances Between GI and GII for Different Social Communication Skills Tested with the ESCS in the Age Range of 12 to 15 months

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS 12 to 15 | | | n | M | *Mdn* | SD | Q1 | Q3 | CI | *P* |
| Joint Attention | IJA HL | GI | 18 | 0.7 | 0.0 | 1.13 | 0.0 | 1.0 | 0.52 | <.001 |
| GII | 6 | 7.2 | 6.0 | 5.67 | 3.0 | 9.0 | 4.54 |
| IJA RHL | GI | 18 | 0.1 | 0.0 | 0.12 | 0.0 | 0.1 | 0.06 | .002 |
| GII | 6 | 0.3 | 0.2 | 0.13 | 0.2 | 0.4 | 0.11 |
| 1W | GI | 18 | 0.1 | 0.0 | 0.24 | 0.0 | 0.0 | 0.11 | .001 |
| GII | 6 | 1.5 | 2.0 | 1.22 | 0.5 | 2.0 | 0.98 |
| RJA FLR | GI | 18 | 22.2% | 0.0% | 35.24% | 0.0 | 50.0 | 16.28 | .038 |
| GII | 6 | 58.3% | 50.0% | 37.64% | 50.0 | 87.5 | 30.12 |
| RJA 1W | GI | 18 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | — | .012 |
| GII | 6 | 0.3 | 0.0 | 0.52 | 0.0 | 0.8 | 0.41 |
| Behavior Request | IBR HL | GI | 18 | 3.9 | 3.5 | 3.41 | 1.0 | 6.8 | 1.58 | .001 |
| GII | 6 | 19.8 | 19.0 | 9.87 | 15.0 | 25.3 | 7.90 |
| IBR TOTAL | GI | 18 | 23.2 | 22.0 | 9.00 | 17.0 | 30.0 | 4.16 | .005 |
| GII | 6 | 37.3 | 37.5 | 6.62 | 31.5 | 42.0 | 5.30 |
| IBR RHL | GI | 18 | 0.2 | 0.2 | 0.14 | 0.0 | 0.2 | 0.06 | .002 |
| GII | 6 | 0.5 | 0.5 | 0.25 | 0.4 | 0.7 | 0.20 |
| RBR passes | GI | 18 | 43.5% | 43.2% | 29.21% | 23.6 | 67.5 | 13.49 | .014 |
| GII | 6 | 80.2% | 78.9% | 15.89% | 77.1 | 89.6 | 12.72 |
| RBR  fails | GI | 18 | 56.5% | 56.8% | 29.21% | 32.5 | 76.4 | 13.49 | .014 |
| GII | 6 | 19.8% | 21.1% | 15.89% | 10.4 | 22.9 | 12.72 |
| Social Interaction | ISI TT | GI | 18 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | — | .002 |
| GII | 6 | 0.5 | 0.5 | 0.55 | 0.0 | 1.0 | 0.44 |
| RSI HL | GI | 18 | 2.6 | 2.0 | 1.50 | 1.3 | 4.0 | 0.69 | .002 |
| GII | 6 | 5.3 | 6.0 | 1.21 | 5.3 | 6.0 | 0.97 |
| RSI Total (LL+HL) | GI | 18 | 4.1 | 3.5 | 1.73 | 3.0 | 5.8 | 0.80 | .001 |
| GII | 6 | 7.2 | 7.0 | 0.75 | 7.0 | 7.8 | 0.60 |

*Note.* SCS= Social Communication Skill tested; IJA= Initiating Joint Attention; HL=Higher level; RHL= Ratio of Higher Level; 1W= use of 1 word; RJA=Responding to Joint Attention; FLR= Following Line of Regard; IBR= Initiating Behavior Request; RBR=Responding to Behavior Request; ISI= Initiating Social Interaction; TT= Turn-Taking; RSI=Responding to Social Interaction.

Finally, Table 5 shows, for the 16-to-18-month age range, a significant difference in two items of response skills, only for Joint Attention and Behavior Request. There was no significant difference for Social Interaction.

Table 5

Comparison of Performances between GI and GII for Different Social Communication Skills Tested with the ESCS in the Age Range of 16 to 18 months

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS 16 to 18 | | | n | M | *Mdn* | SD | Q1 | Q3 | CI | *P* |
| Joint Attention | RJA (%) | GI | 11 | 97.7% | 100.0% | 7.54% | 100.0 | 100.0 | 4.45 | .021 |
| GII | 11 | 77.3% | 75.0% | 26.11% | 62.5 | 100.0 | 15.43 |
| RJA (frequency) | GI | 11 | 9.9 | 10.0 | 0.30 | 10.0 | 10.0 | 0.18 | .019 |
| GII | 11 | 9.0 | 9.0 | 1.10 | 8.0 | 10.0 | 0.65 |
| Behavior Request | RBR passes | GI | 11 | 82.1% | 84.6% | 8.10% | 78.9 | 86.6 | 4.79 | .004 |
| GII | 11 | 92.1% | 100.0% | 20.40% | 100.0 | 100.0 | 12.06 |
| RBR  fails | GI | 11 | 17.9% | 15.4% | 8.10% | 13.4 | 21.1 | 4.79 | .004 |
| GII | 11 | 7.9% | 0.0% | 20.40% | 0.0 | 0.0 | 12.06 |

*Note.* SCS= Social Communication Skill tested; RJA=Responding to Joint Attention; RBR=Responding to Behavior Request.

* + 1. Restrict age range analysis.

The following analysis simulates the age pairing between groups GI and GII, keeping in GI only those subjects whose corrected age does not cause a change in the age range after age correction (GI + GII = 40).

As shown in Table 6, there was no significant difference for Joint attention within the 8-to-11-month age range. There were significant differences between the groups in initiative items for Behavior Request and in response items for Social Interaction.

Table 6

Comparison of Performance of GI and GII in Restricted Age Ranges of 8 to 11 Months for Different Social Communication Skills Tested with the ESCS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS 8 to 11 months** | | | **N** | **M** | ***Mdn*** | **SD** | **Q1** | **Q3** | **CI** | ***p*** |
| Behavior Request | IBR LL | GI | 7 | 14.9 | 12.0 | 4.78 | 11.5 | 18.5 | 3.54 | .029 |
| GII | 4 | 24.3 | 23.5 | 6.60 | 21.5 | 26.3 | 6.47 |
| IBR HL | GI | 7 | 0.1 | 0.0 | 0.38 | 0.0 | 0.0 | 0.28 | .004 |
| GII | 4 | 8.8 | 8.5 | 4.27 | 6.3 | 11.0 | 4.19 |
| IBR Total | GI | 7 | 15.0 | 13.0 | 4.69 | 11.5 | 18.5 | 3.47 | .008 |
| GII | 4 | 33.0 | 30.5 | 10.03 | 27.0 | 36.5 | 9.83 |
| IBR RHL | GI | 7 | 0.0 | 0.0 | 0.03 | 0.0 | 0.0 | 0.02 | .004 |
| GII | 4 | 0.3 | 0.3 | 0.08 | 0.3 | 0.3 | 0.08 |
| Social Interaction | RSI HL | GI | 7 | 0.3 | 0.0 | 0.76 | 0.0 | 0.0 | 0.56 | .017 |
| GII | 4 | 1.8 | 1.5 | 0.96 | 1.0 | 2.3 | 0.94 |
| RSI Total | GI | 7 | 2.1 | 2.0 | 0.38 | 2.0 | 2.0 | 0.28 | .005 |
| GII | 4 | 4.5 | 4.0 | 1.73 | 3.8 | 4.8 | 1.70 |

*Note*. SCS= Social Communication Skill tested; IBR= Initiating Behavior Request; LL= Lower level; HL=Higher level; RHL= Ratio of Higher Level; RSI=Responding to Social Interaction.

According to Table 7, in the 12-to-15-month age group, there were significant differences observed between GI and GII for Joint Attention and Behavior Request in initiative items, and there was no difference in response items for both skills. There was no significant difference for Social Interaction.

Table 7

Comparison of Performance of GI and GII in Restricted Age Ranges of 12 to 15 Months for Different Social Communication Skills Tested with the ESCS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS 12 to 15 months | | | n | M | *Mdn* | SD | Q1 | Q3 | IC | *p* |
| Joint Attention | IJA HL | GI | 8 | 1.3 | 0.0 | 2.19 | 0.0 | 1.5 | 1,52 | .040 |
| GII | 8 | 5.5 | 4.0 | 5.71 | 1.8 | 7.0 | 3,95 |
| IJA RHL | GI | 8 | 0.1 | 0.0 | 0.10 | 0.0 | 0.1 | 0,07 | .027 |
| GII | 8 | 0.2 | 0.2 | 0.16 | 0.1 | 0.3 | 0,11 |
| IJA 1 W | GI | 8 | 0.1 | 0.0 | 0.35 | 0.0 | 0.0 | 0,24 | .029 |
| GII | 8 | 1.3 | 1.5 | 1.16 | 0.0 | 2.0 | 0,81 |
| Behavior Request | IBR HL | GI | 8 | 6.4 | 6.0 | 5.15 | 2.5 | 8.5 | 3,57 | .010 |
| GII | 8 | 18.5 | 15.5 | 8.73 | 14.5 | 23.8 | 6,05 |
| IBR Total | GI | 8 | 26.5 | 26.0 | 7.58 | 21.5 | 30.8 | 5,25 | .007 |
| GII | 8 | 38.4 | 40.0 | 5.93 | 34.5 | 42.3 | 4,11 |
| IBR RHL | GI | 8 | 0.2 | 0.2 | 0.16 | 0.1 | 0.3 | 0,11 | .021 |
| GII | 8 | 0.5 | 0.4 | 0.23 | 0.4 | 0.6 | 0,16 |

*Note*. SCS= Social Communication Skill tested; IJA= Initiating Joint Attention; HL=Higher level; RHL= Ratio of Higher Level; 1W= use of 1 word; IBR= Initiating Behavior Request.

There was no significant difference for Joint Attention or Social Interaction in the age group of 16 to 18 months, as shown in Table 8. There are significant differences for Responding Behavior Request.

Table 8

Comparison of Performance of GI and GII in Restricted Age Ranges of 16 to 18 Months for Social Communication Skills Tested with the ESCS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS 16 to 18 months | | | n | M | *Mdn* | SD | Q1 | Q3 | IC | *p* |
| Behavior Request | RBR passes | GI | 4 | 87.0% | 87.9% | 5.41% | 84.3 | 90.6 | 5,30 | .011 |
| GII | 9 | 97.8% | 100.0% | 6.67% | 100.0 | 100.0 | 4,36 |
| RBR fails | GI | 4 | 13.0% | 12.1% | 5.41% | 9.4 | 15.7 | 5,30 | .011 |
| GII | 9 | 2.2% | 0.0% | 6.67% | 0.0 | 0.0 | 4,36 |

*Note.* SCS= Social Communication Skill tested; RBR = Responding to Behavior Request.

* 1. Part 2 - Correlation between biological risk and protective factors vs. Social Communication Skills
     1. Birth variables vs. Social Communication Skills.

There was a moderately negative correlation between the use of 1 word (p = 0.001) and number of days of hospitalization for Joint Attention. For Behavior Request, a moderately negative correlation was observed between days of hospitalization and IBR higher level (p = 0.000), Total IBR (p = 0.000), IBR higher level ratio (p = 0.000), IBR use of 1 word (p = 0001), and RBR passes in following commands (p = 0.000). These findings indicate that the longer the period of hospitalization, the worse was the performance in the tested skills above. Moreover, there were moderate positive correlations between each behavior mentioned above and gestational age, birth weight (p <0.002), fifth-minute Apgar score and RJA use of 1 word (p = 0.000). The RBR fails to follow commands rate was positively correlated with number of hospitalization days (p = 0.000) and negatively correlated with gestational age and birth weight (p <0.002).

* + 1. Neonatal complications vs. Social Communication Skills.

Among all of the correlations examined, the only moderately significant correlation found was for the social communication skills and the variable sepsis. Therefore, negative correlations were observed for IJA higher level (p = 0.000), IJA higher level ratio (p = 0.001), IBR higher level (p = 0.000), Total IBR (p = 0.002), IBR ratio of higher level (p = 0.000), and for RSI higher level and total (p = 0.000). Consequently, the occurrence of sepsis was correlated to the worst performance in Social Communication Skills.

* + 1. Neonatal intensive care vs. Social Communication Skills.

Correlations were only found for the following variables: time spent in infant incubator, enteral nutrition and time of oxygen inhalation therapy. Thus, a moderately negative correlation was found between incubator time and IJA higher level (p = 0.002) and between the use of enteral nutrition and IJA higher level ratio (p = 0.002). As for Behavior Request, there were moderately negative correlations between both IBR higher level and IBR higher level ratio with incubator time, enteral nutrition and time of oxygen therapy (p = 0.000). Furthermore, this was also true between Total IBR versus incubator time and days of oxygen therapy (p = 0.000), between IBR use of 1 word and days of oxygen therapy (p = 0.000), and finally, between RBR passes in following commands versus incubator and oxygen therapy times (p = 0.000).

* + 1. Diagnosis vs. Social Communication Skills.

A moderately negative correlation was found between altered neurological diagnosis and Total ISI (p = 0.008), which highlights that neurological disorders were inversely proportional to performance in Initiating Social Interaction.

* + 1. Socioeconomic profile vs. Social Communication Skills.

A moderately negative correlation was found between time spent with the mother and Total IBR (p = 0.001). Moderate positive correlations, instead, were observed between attending school, months of school attendance and time spent at school versus IJA higher level and IJA ratio of higher level (p <0.002), Total IBR (p<0.001), IBR higher level, IBR higher level ratio and RBR passes in follows commands (p = 0.000). Moreover, moderately positive correlations between Total IBR and father's education (p <0.001) and, finally, between Total RSI and months of school attendance were found (p = 0.001).

1. Discussion

The design of the present study enables the investigation of the association between prematurity and the development of Social Communication Skills, particularly for Joint Attention, Behavior Request and Social Interaction. The intent was to observe early Social Communication Skills in infants from 8 to 18 months, seeking the age window in which such skills emerge, develop, and reach the threshold of appearance of the first words. In addition, this study seeks to identify language impairment risk markers and investigates biological risk and environmental protection factors correlated with the development of Social Communication Skills.

The ESCS (Mundy et al., 2003) has been widely used internationally in studies with infants (Mundy et al., 2007; Olafsen et al., 2006; Strid et al., 2006; Ulvund & Smith, 1996) and enables the assessment of early Social Communication Skills. Although the instrument is not standardized for age reference, it is possible to outline the score and social communication skill profile of each assessed subject. In the present study, it was decided to compare the high-risk group (GI) with a reference group (GII) to verify the differences between them and then identify factors associated with skills performance.

* 1. Part 1
     1. GI vs. GII Social Communication Skills performance, age correlation and GI vs. GII age ranges.

There was a better performance by GII in various aspects for all three tested skills: Joint attention, Behavior Request and Social Interaction. This finding corroborates the study conducted by Olafsen et al. (2006), who found that the full-term group had higher scores than the preterm control group for Social Communication Skills. Even after intervention, the preterm group scored next but lower than the full-term group. De Groote, Roeyers, and Warreyn (2006) used the Autism Diagnostic Observation Schedule-Generic (ADOS-G) to assess response and initiative behavior on communication and social interaction between preterm and term infants and found worse performances in the premature group regarding social development, communication skills and joint attention. A study by Mundy et al. (2007), which longitudinally followed children with typical development and compared them with risk group children in the 9-to-18-month age range, found that typical children scored higher than the risk group for initiating and responding to joint attention skills that were associated with language scores assessed at 24 months and for initiating behavior request. The findings of Rose et al. (2009) also highlighted significant differences between preterm and full-term infants for several important language development skills, among which is the lesser use of communicative gestures by preterm infants.

The differences were mainly found for initiating joint attention and initiating and responding to behavior request skills. Fewer differences were found for social interaction. Studies have highlighted initiative and response to joint attention and behavior request skills as the most correlated skills to cognitive and language skills evaluated later (Mundy et al., 2007; Strid et al., 2006; Ulvund & Smith, 1996). The present study, as well as one by Wetherby et al. (1988), noted a higher frequency of initiative actions than response actions, but, on both, there were also more frequent encouragements of initiative instead of response actions. For social interaction, there was also a significant difference between the groups, but the frequency of behaviors on this skill was significantly lower than for joint attention and behavior request skills. The literature highlights a greater number of actions on these two last skills when compared to social interaction actions (Ulvund & Smith, 1996; Wetherby et al., 1988).

In the current study, the differences between the groups are concentrated in higher level skills, demonstrating premature infants’ difficulties with more complex activities that require more evident social intention, which corroborates Weijer-Bergsma et al. (2008), who state that as cognitive processes become more complex, the difficulties of premature infants become more apparent.

* + 1. Gender correlation.

Gender differences between groups were not significant in this study. However, there is still much controversy in the literature about this variable (Foster-Cohen, Edgin, Champion, & Woodward, 2007; Jennische & Sedin, 2003; Olafsen et al., 2006; Oliveira et al., 2003; Reilly et al., 2006). The small sample size of this study does not lead to definitive conclusions, but it is important not to overlook the gender aspect, as this variable may also contribute to individual differences for Social Communication Skills (Mundy et al., 2007).

* + 1. Age correlation.

Regarding age influence, there are positive correlations between increasing age and better performance for the tested skills, which corroborates Crais, Douglas and Campbell (2004), Reilly et al. (2006) and Wetherby et al.’s (1988) findings. The correlations observed indicate a decreasing trend for lower level behaviors and increasing trend for higher level as chronological age increases, i.e., there is an evolution of more complex behaviors, highlighting the development of social cognition (Mundy & Acra, 2006).

* + 1. GI vs. GII age ranges.

Regarding the comparison of groups by separated age ranges, there was no observed difference for joint attention behaviors for ages between 8 and 11 months, but there was for behavior request and social interaction behaviors, which corroborates Crais et al.’s (2004) findings in which the communicative regulatory and social interaction acts appeared before the joint attention communicative acts along the age groups. In the age range of 12 to 15 months, differences also appeared for joint attention skills. For behavior request, the differences for lower level behaviors disappeared. In general, in this age range, a significant increase was observed for the frequency of initiative behaviors and the percentage of correct responses for both groups compared with the previous range. On the other hand, the lower p values for various skills reflect greater differences between GI and GII. It is interesting to note that there was a difference for word emission in IJA and RJA favoring GII, which reinforces the idea of a speech delay in preterm infants (Foster-Cohen et al., 2007; Jansson-Verkasalo, 2003; Jennische & Sedin, 1999; Oliveira et al. 2003; Pereira & Funayama, 2004; Reissland & Stephenson, 1999). Ulvund and Smith (1996) did not find, in the analysis of their sample, any premature infant emitting words at 13 months. The advantage of GII at this age still corroborates the findings of Rose et al. (2009).

The results in the current study indicate that the majority of skills with significant differences are concentrated in the 12-to-15-month age group. In Reilly et al.’s (2006) findings, the infants had an increase in their skills at 12 months mainly concerning the use of gestures, which supports the existence of a huge increase in communication skills between 8 and 12 months of age. There was an evolution in GI, as indicated by the increase in the frequency of behaviors and percentage of correct responses. However, these scores were always lower when compared with GII.

Changes along the age groups were observed, as differences between groups increased within the 12-to-15-month age range for several items, and there were fewer behaviors with differences in the 16-to-18-month age range. Mundy et al. (2007) demonstrate this trend toward an increase in skills between 12 and 15 months and a reduction in differences at 18 months. In the present study, differences between the groups were more evident in the 12-to-15-month age range, which is thus considered a higher risk age for Social Communication Skills disorders in preterm infants and, accordingly, deserving of special attention from professionals who deal with this population.

* + 1. GI vs GII restricted age range.

The results of the restricted age range analysis, which considered the corrected ages of the subjects of GI, revealed that differences are reduced between groups in relation to the analysis by chronological age, but nonetheless, differences still exist in favor of GII. This finding indicates that even with age correction, the damage prevailing in GI remains. In studies by Bühler, Flabiano, Mendes, and Limongi (2007), Foster-Cohen, Edgin, Champion and Woodward (2007), Reilly et al. (2006), Rose et al. (2009) and Ulvund and Smith (1996), the developmental delay of premature subjects is observed, despite the use of the subject’s corrected age. According to Pedromônico (1996), Oliveira et al. (2003), Pereira and Funayama (2004), age correction provides an unrealistic scenario in regard to language development, and moreover, it neglects delays and factors that threaten the language development of premature infants, which are present from pre-linguistic stages. The increase in the frequency of behaviors and percentage of correct answers across the age ranges in both chronological and correct age analysis in this study indicates that preterm infants do evolve but in a different pace and proportion as compared with full-term subjects (Pedromônico, 1996; Rose et al. 2009).

* 1. Part 2 – Correlation between biological risk and protection factors versus Social Communication Skills

To the best of our knowledge, very few studies have analyzed the correlation between biological risk and protection factors vs. Social Communication Skills, and even fewer study premature infants. The present study sought to investigate these associations.

* + 1. Correlation between birth variables vs. Social Communication Skills.

The results regarding variable days of hospitalization indicated a disadvantage for those infants who were hospitalized longer. Pedromônico (1996) found that premature infants with long hospitalization periods had a slower pace of development for behaviors related to communication. On the other hand, higher values for gestational age and birth weight appeared to positively influence infants’ performances. The correlation between weight and behavior request initiative is in agreement with Olafsen et al. (2006), whose findings indicated that lower weight infants were more intensely affected in behavior request nonverbal behaviors. The results regarding gestational age agree with Foster-Cohen et al. (2007), who reaffirm that the poor language performance of their sample may not be explained by weight, gender or multiple births, reinforcing the importance of gestational age for development.

* + 1. Correlation between neonatal complications vs. Social Communication Skills.

For the variable neonatal complications, there were correlations between higher frequency of sepsis and worse results on Social Communication Skills items. Jennische and Sedin (1999) found an association between sepsis and language difficulties in 6.5-year-old children, which may suggest that this risk factor not only influences early communication skills but can also result in damage manifested later in language development. In the present study, there was no significant correlation for the variable Respiratory Distress Syndrome. However, a study by De Groote et al. (2006) found that infants with this syndrome in their neonatal period presented poorer communication skills.

* + 1. Correlation between neonatal intensive care vs. Social Communication Skills.

It was found that the longer the period of incubator stay and orogastric tube use, the worse was the performance in IJA and initiating/responding to behavior request skills. Similarly, the longer the infant remained on oxygen therapy, the worse was the initiative and response to behavior request performance. The literature highlights that the severity of medical complications in preterm subjects has a negative influence on attention, which is essential for Social Communication Skills and language development (Rose et al. 2009; Weijer-Bergsma et al., 2008).

* + 1. Correlation between neurological diagnoses vs. Social Communication Skills.

Altered neurological diagnosis influenced the worse performance in initiating social interaction. This finding is consistent with Pedromônico’s (1996) results, who found significant differences in the communicative behaviors of infants with neurological disorders versus those with no disorders in this area. In Azevedo’s (1993) study, 9-to-13-month high-risk infants who presented neurological disorders did not recover in hearing development, unlike those without diagnosis of neurological issues. The results of the present study and those found by Azevedo (1993) again lead to a reflection on the damage of basic developmental elements in at-risk children, especially when diagnosed neurological disorders are present, affecting hearing development and evolution of elements of Social Communication Skills.

* + 1. Correlation between socioeconomic profile vs. Social Communication Skills.

The present results corroborate Reilly et al. (2006), who found an association between socioeconomic disadvantage and low communication skills scores for their infant sample, but they affirmed that the environment has a minimal impact on pre-linguistic communication at this developmental stage, stressing that the course of early communication development appears to be better determined by biological factors. Furthermore, Foster-Cohen et al. (2007) stated that the difficulties encountered by the 2-year-old children of their sample cannot be explained by family socioeconomic factors. The present study did not find correspondence in the literature for the association between communicative performance and paternal education. No associations were found between maternal education and skills, which corroborates the studies of Reilly et al. (2006), Olafsen et al. (2006) and Mundy et al. (2007). Moreover, in the present study, subjects who spent more time with their mothers had worse initiative behavior request results. Reissland and Stephenson (1999), in relation to their finding that premature infants’ mothers responded more often to their child’s vocalizations, stated that this behavior could override these infants’ turn-takings and therefore consider it detrimental to communication development. Thus, the importance of speech pathology guidance to these infants’ mothers must be considered, such that the quality of mother-child interaction may promote a healthy development of early communication skills and language, as suggested by Pereira and Funayama (2004) and as observed in Olafsen et al.’s (2006) study, where interventions for the parents during the neonatal period produced positive results in social communication development, as measured by the ESCS at 12 months. Finally, the influence of longer school attendance on better skills in the present study supports the school environment as a stimulator of communication development, as it naturally promotes learning situations.

When taking into account this study’s results and the current literature presented, it is clear that premature infants are vulnerable to impairment in the development of Social Communication Skills. The present study provides alerting elements that should be incorporated into the routine assessment of professionals working with this population, especially those who presented biological risks. The possibility of early identification of disorders in aspects related to language revolutionizes clinical practice, as it provides tools for an early intervention, when language is still under construction, which thus reduces language impairment for at-risk subjects.

Social Communication Skills studies with infants and children with normal development could contribute to building references that would make it easier to identify at-risk subjects.

1. Conclusions

- There was a difference in the development of Social Communication Skills between preterm subjects (GI) and full-term subjects (GII), with GII performing better, especially in Joint Attention and Behavior Request skills.

- Both GI and GII displayed an influence of age increase, with improvement in Social Communication Skills with time; however, preterm infants displayed a different evolution pace when compared to term infants and demonstrated difficulties.

- The biological risk factors, namely gestational age, weight, time of hospitalization, sepsis, time of incubation stay, oxygen therapy duration and altered neurological diagnosis, were associated with Social Communication Skills.

- The environmental protection factors, namely school attendance, schooling time, school-day period and parental education, were associated with Social Communication Skills.

- There were more risk variables than protection variables associated with Social Communication Skills.

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