Research Article
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# Environmental influence on preterm and term infants over rolling movement.

## A influência do ambiente no movimento de rolar de crianças nascidas pré-termo e a termo.

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**Abstract**

**Introduction:** Over a lifetime constant changes occur in the complexity and quality of the execution of motor actions, characterizing the motor development. External (environmental) factors may act positively or negatively in the course of some motor skill, such as the ability of rolling. **Objective:** It is about an analytical cross-sectional study aimed to analyze the positioning of the cradle of preterm and terms infants relating to the rolling movement. **Method:** The sample comprised 27 infants of both genders, divided into two groups (G1 and G2). G1 was composed of 8 premature infants included in a motor stimulation project and G2 was composed of 19 term infants enrolled in a nursery school. A questionnaire was sent to parents/caretakers and later a practical assessment was held in which the rolling motion was stimulated with rattles, three times for each side (left/right), observing the presence or absence of facilitation in this action. **Results:** It was found that in both groups, most of the cradles were placed with one of the sides against the wall and the statistical analysis of the data indicated a significant correlation to the placement of the cradle in space and the ease of rolling for preterm infants ($p<0.05$) and terms infants ($p<0.01$), while the stimulation was performed by the study researcher. **Conclusion:** Therefore, it was possible to conclude that there was an ease of rolling to the contralateral side of the wall, i.e. to the side of largest environmental stimulus, which emphasizes the importance of a sensory-rich environment in the course of a proper infant development.

**Keywords:** Psychomotor Performance; Environment; Infant, premature.

**Resumo**

**Introdução:** Ao longo da vida constantes alterações ocorrem na complexidade e na qualidade da execução das ações motoras, caracterizando o desenvolvimento motor. Fatores externos (ambientais) podem atuar positivamente ou negativamente no curso de alguma habilidade motora, tal como a habilidade de rolar. **Objetivo:** Analisar o posicionamento do berço de bebês pré-termos e a termos relacionando-o ao movimento de rolar. **Método:** Trata-se de um estudo transversal analítico. A amostra foi composta por 27 crianças, de ambos os gêneros, divididas em dois grupos (G1 e G2). O G1 foi integrado por 8 crianças prematuras inseridas em um projeto de estimulação motora e o G2 composto por 19 crianças a termo matriculadas em uma escola infantil. Houve a aplicação de um questionário aos pais/cuidadores e posteriormente uma avaliação prática a qual estimulou-se o rolar através de chocalhos, três vezes para cada lado (direito/esquerdo), observando a presença ou não de facilitação neste ato. **Resultados:** Constatou-se que nos dois grupos a maioria dos berços estavam posicionados com um dos lados encostados na parede e a análise estatística dos dados indicou correlação significativa para o posicionamento do berço no espaço e a facilidade de rolar em bebês pré-termos ($p<0,05$) e a termos ($p< 0,01$), quando a estimulação foi realizada pelo pesquisador do estudo. **Conclusão:** Houve facilidade do rolar para o lado contralateral à parede, ou seja, para o lado de maior estímulo ambiental, o que ressalta a importância de um ambiente rico em estímulos no curso do adequado desenvolvimento infantil.

**Palavras – chave**: Desempenho Psicomotor; Ambiente; Prematuro.

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## INTRODUCTION

Lifelong movement undergoes changes on the complexity and quality of execution of motor actions[1] This sequential and continuous process characterized motor development currently grounded by the juxtaposition of two main theories: a Neuromaturational and Dynamical Systems.

Several factors tend to negatively influence the course of motor development. Gallahue and Ozmun[1] highlight some of these such as prematurity and lack of stimuli. While Freitas, Costa and Formiga[2] recognize, in addition to prematurity, weak family ties, for example, an inappropriate relationship between parents and children.

The World Health Organization classifies as prematurity entire pregnancy under thirty-seven weeks period. A problem of great relevance because in addition to monitoring high mortality can restrict the quality of life of those who survive it, the difficulty of preterm infants interact with the environment, impacting on deficiencies/ delays neuropsicomotors.[1,2]

A weak family ties can also provide neuropsicomotor delays, once the development is built by the interaction of the child with other people in your environment, particularly those with more affectively and effectively involved in their care.[3] The interaction between mother and her child have been considered an important tool for studying the behavioral organization competencies and baby, clipping it because the quality of the interaction is considered an important mediating factor between perinatal events and its further development, particularly in relation to communication, socialization and cognition, moreover, can be a competent parent rich source of stimuli, triggering appropriate responses to the child.[4]

There are still factors that act positively in the course of child development, helping the child to interact with the environment in which it operates, among these stands out the global motor stimulation, which becomes especially beneficial when performed by the caretaker of the baby.[5,6] Freitas, Costa and Formiga[2] indicate the daycare/schools as favorable for the development of the child, which encompasses both physical and psychological, and intellectual and social environments.

The sequence of acquisition of motor skills is commonly unchanged in early childhood, although the pace with which they are purchased may vary.[1] One of the skills achieved over the child's development is the rolling motion, usually reached in the sixth month of life and is initially held in the block in which the child rolls the body as a whole, and then with dissociation pelvic and shoulder girdle.[1]

Despite the extensive relationship between the medium in which the child is embedded and its development, Oliveira, Almeida and Valentini[3] show that still little is known about the effects of the environment on the development of the baby, especially with regard to measures directed to motor learning. This study therefore aims to examine the relationship between the positioning of the cradle and rolling motion of preterm infants born at term and, also examining whether small actions like changing the baby in the crib (rotations) is connected in how this motor act (rolling) is performed. In addition, we intend to observe the action of other environmental aspects in the course of child development, such as the affective bond, according to published reports since this is a factor that tends to influence him strongly. These results will be important to guide caregivers on how best to position the cradle in the environment as well as the child to sleep.

## METHODS

This is an analytical cross-sectional study, evaluated and approved by the Ethics Committee in Research of the Universidade do Norte do Paraná – UNOPAR - under CAAE 22145513.5.0000.0108.

The sample comprised 27 children, divided into two groups: G1 and G2. The G1 integrated 8 preterm children entered into an extension project of the Universidade Estadual do Norte do Paraná - UENP - titled "Early stimulation of premature and low birth weight: Enabling parents (caregivers) for the implementation of preventive and control techniques future complications", which encompasses the cities of Andirá, Bandeirantes, Cambará, Carlópolis, Jacarézinho, Ribeirão Claro and Santo Antonio da Platina, all of Norte Pioneiro do Paraná, and whose goal is guided by ease/remedy the consequences of prematurity through the active participation of parents/caregivers with guidance and monthly monitoring of physiotherapists. Whereas G2 consisted of 19 term infants regularly enrolled in a nursery school in the town of Ourinhos (SP).

Children who showed evidence of neurological and/or orthopedic disorders, malformations, syndromes and confirmed congenital infections and sensory disabilities (visual and/or auditory) as well as children were excluded from the study whose families/guardians did not sign the informed consent (IC). Inclusion criteria for the G1 were children placed in the UENP extension project and therefore with lower gestational age ≥ 37 weeks, they had already acquired the rolling ability. Already the inclusion criteria for the G2 were children with a gestational age of 37 weeks, regularly enrolled in nursery school selected for the study and who had already acquired the rolling ability.

Firstly, the IC was introduced to the responsible for the child in order to guide them on the procedures used in this study. In the case of the term infants, assessed at school beyond the IC was the presentation of a letter of authorization and commitment to the School Director of the Institution, with the signing of this and it would

make a responsible teacher ratings of the child.

Once authorized the participation of children by parents/carers a questionnaire relating to the positions of the cradle in the space and the child in the cradle was applied. This sought whether cradle found himself leaning on one side of the bedroom wall, and if so, which side the next, right or left; addition to the questionnaire sought reports about the existence or not of revolutions (changes from the side) of the child in the cradle by the caregiver.

The practical assessment was then carried out in order to observe the rolling motion, about a month after the acquisition of this skill by children. To control this data was made contact with those responsible for the project in which preterm infants were included and teachers of preschool children who accompanied term, ascertaining the exact period in which each member of the sample group would be able the assessment.

For motion analysis the child was placed supine on a EVA mat (120x61cm) where it stimulated a total of six attempts to roll, three to the right and three to the left, having a maximum time of fifteen seconds each. To facilitate the implementation of such an analysis, the rolling motion was encouraged by two rattles of different colors (yellow and green), modified every three attempts so that the baby does not lose interest during the evaluation. At the end, quantification of the number of times that the child rolled right and left, and up to three possibilities for each side.

There were two assessments in a single day, with fifteen minute interval between them. The first was conducted by the researchers of the study and the second in the case of pre-term unborn occurred through caregiver who spent the most time with the child, in its most convivial place (home); whereas with the unborn term assessments occurred at the school in which they were enrolled, and the second evaluator was the child's responsible teacher.

It is noteworthy that not own toddler toys or school for the evaluation were used, since the sample group could already be accustomed to them, which tends to reflect a loss of interest during attempts to roll. Thus, the two rattles were used exclusively ported by the study investigators and loaned to caregivers and teachers who also perform assessment, so that both groups G1 and G2, obtained the same instrument as stimulating source (Figure 1).

Finally, the data were entered into SPSS, a software application (computer program) the scientific type, acronym of Statistical Package for the Social Sciences - statistical package for the social sciences. Data normality was tested using the Shapiro-Wilks test, noting to parametria them. For the correlation of the variables: positioning and rotation of the cradle of the child in the crib with the presence or absence of facilities in rolling motion we used the Linear Pearson test, adopting values of $p < 0.05$ for significant correlations $p < 0.01$ for very significant correlations.

## RESULTS

The sample comprised 27 children, 11 females and 16 males, and the G1 was constituted by 5 girls and 3 boys preterm and G2 for 6 girls and 13 boys to terms. Some authors (2,7,8) emphasized the importance of the use of corrected age in premature infants, since it suits

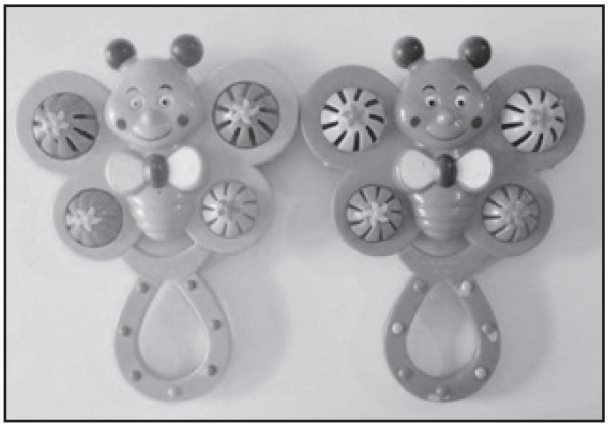

**Figure 1.** (Author data)

**Table I.** Correlation and frequency of the positioning of the cradle to the wall (right / left) and facilities in rolling motion (left / right / none).

| | Cradle side | | Facilities in rolling | | | *R* | *p* |
|---|---|---|---|---|---|---|---|
| | R | L | R | L | N | | |
| **Researcher** | | | | | | | |
| Term | 9 (47%) | 10 (53%) | 10 (53%) | 8 (42%) | 1 (5%) | -0.66 | 0.00** |
| Preterm | 2 (25%) | 6 (75%) | 3 (37.5%) | 2 (25%) | 3 (37.5%) | -0.832 | 0.01* |
| **Caregiver** | | | | | | | |
| Term | 9 (47%) | 10 (53%) | 1 (5%) | 0 (0%) | 18 (95%) | -0.24 | 0.30 |
| Preterm | 2 (25%) | 6 (75%) | 0 (0%) | 0 (0%) | 8 (100%) | 0.18 | 0.62 |

* Significative correlation 0.05; ** Significative correlation 0.01.
Subtitle: R = right; L = left; N = none.

**Table II.** Correlation and frequency of rotation of the child in the crible (yes / no) and facilities in rolling motion (left / right / none).

| | Child Rotation | | Facilities in rolling | | | *R* | *p* |
|---|---|---|---|---|---|---|---|
| | **S** | **N** | **D** | **E** | **N** | | |
| **Researcher** | | | | | | | |
| Term | 1 (5%) | 18 (95%) | 10 (53%) | 8 (42%) | 1 (5%) | 0.555 | 0.01* |
| Preterm | 0 (0%) | 8 (100%) | 3 (37.5%) | 2 (25%) | 3 (37.5%) | 0.424 | 0.29 |
| **Caregiver** | | | | | | | |
| Term | 1 (5%) | 18 (95%) | 1 (5%) | 0 (0%) | 18 (95%) | 0.056 | 0.82 |
| Preterm | 0 (0%) | 8 (100%) | 0 (0%) | 0 (0%) | 8 (100%) | 0.749 | 0.12 |

* Significative correlation 0,05.

his age to the degree of prematurity, making it possible for correct evaluation of the development of preterm infants in the first year of life . G1 in the average age was corrected six months, while the average chronological age, which is the actual age of the child was 8 months. G2 in the average chronological age was 6 months.

When analyzed variables: side of the crib (right / left) with the ease of rolling face the stimulation of a researcher of the study, there was a significant correlation in term infants ($p < 0.01$) and preterm ($p < 0.05$). However, there was no significant correlation between the side of the crib (right / left) with the ease of rolling forward to stimulation of the caregiver in both pre-term and full-term groups.

Through the Table II it is seen that the spin variables of the child in the crib and facilities in rolling motion were significantly correlated ($p < 0.05$) in term infants, when stimulation was performed by a study investigator. However, this did not happen with the pre-dread children, probably due to low sample size of this group (G1 = 8).

The stimulation performed by the caregiver showed no significant correlation with the presence of rotation of the child in the crib in any of the analyzed groups (G1 / G2).

## DISCUSSION

The neuromaturational theory contributed to the understanding and distinction between normal and pathological development, however, the explanations for developing the motor based only on neural maturation were not sufficient to explain this complexity.[9] Thus, the systems theory dynamic emerged around 80s to contradict based only on maturity of the central nervous system by developing cortex, advocating a motor behavior also influenced by extrinsic factors, such as psychological and environmental.[9,10]

Currently there is an intimate relationship between developmental theories, one of which favors the development of another. Therefore, as a result of experience profound changes may occur in the nervous system and maturational changes can change behavior of the body to assimilate environmental stimuli.[10]

Prematurity affects systemic immaturity in the neonate, which impairs its interaction with the environment and tends to generate neuropsicomotores delays.[1,2] In the present study although used the corrected age for preterm unborn verified the absence of deficits in children's development of these children, which probably stems from the fact that they form part of a global project of early motor stimulation, with active participation of parents/caregivers. According to literature reports the global motor stimulation is beneficial to prevent/remedy the sequelae of prematurity, becoming more efficient while it is held together with the child's caregiver.[5,6,8,10,11]

The first year of life is characterized by many changes. The development term applied to the child development means both structural growth, such as the acquisition of new skills.[11] Learning occurs in a progressive manner being influenced by many factors, including how the individual interacts with the environment.[2] Meanwhile, motor experiences are of great importance for the developing individual, these are characterized by any bodily activity performed at home, at school and at play.[12]

This study demonstrates that 18 of 19 terms children evaluated by a study investigator rolled more often, ie, to the side that were used to receiving greater environmental stimuli (visual and/or auditory). This is because throughout the G2 cradles were positioned with one side against the wall, beyond which almost all caregivers (95%) did not perform the rotation (alternation) of the child in the crib, which resonated deprivations motor and environmental experiences to one side. Thus, it was found that 95% of children had ease of rolling motion to the side contralateral to the wall on which the cradle was placed.

Reaching out to the importance of an environment rich in stimuli, there is the child who showed no G2 ease the rolling motion, ie, also rolled both sides (right / left). For though this was the cradle positioned with one side against the wall, the caregiver / guardian performed their rotation in the same (cradle), which may have influenced that there was no restriction on motor and environmental experiences, culminating in such results.

As G2, all of preterm cradles were positioned with one side against the wall and no caregiver performed the rotation of the child thereon. Thus, 5 of 8 children of G1 more frequently rolled to the side contralateral to the wall where received higher daily environmental stimulus. And 3 of 8 children not rolled to either side (right/left) during evaluation with a study investigator, probably the absence of affective ties have influenced this situation.

The interactions between environmental stimuli and responses that the individual produces determines its behavior, encouraging him to adaptations in various situations.[13] One can see this through the study of the behavior of some children, causing them found a most favorable to the rolling motion (along with the greater environmental stimulus), and did it a behavioral choice, where even being promoted to the right and left alike, revealed their preference for one side.

Corroborating this, some studies show the effects of external factors on motor behavior, such as children six months who performed better in the act of reaching objects when a greater postural control was offered through a chair with support in region pelvic and lower limb support.[14]

Moreover, several studies demonstrate the ability of children changing their behavior due to environmental changes; in most of these studies means that the child was stimulated or deprived of certain environmental implications were used.[15,16] where their children behavior change due to an external stimulus, can be said to have acquired knowledge of the relationship between their actions and the effects were produced.[17]

The stages of child development have a clear genetic basis, but the innate potentialities developed only to the extent that the newborn finds a favorable environment for this to occur.[17,18] The learning is progressive, setting up and adapting to various factors that should be considered. Among them, the caregiver's role in handling and encouragement of the child from the first days of life.[12]

In the present study it was found that when stimulated by the caregiver/guardian own children in both groups, G1 and G2 showed no facility to rolling motion and therefore the affective bond overlapped to the influence of the environment - as regards positioning the cradle and the absence of this speed. Differentiating itself, so that was verified by the assessment conducted by the researchers. Thus, 100% of children in G1 also rolled both sides, right and left, when stimulated by the caregiver, while in G2 95% of children showed no ease in rolling motion when stimulated by the teacher/head of kindergarten, which passes most of the time with them.

An experiment with newborns still in the nursery, where they have little contact with his mother, showed that there were changes to the registry suction maternal voice, and that this was discriminated and preferred by children, which indicates the ability of learned behavior early.[19] This study also showed behavioral changes in children when stimulated caregiver/guardian, which was evident mainly in G1. Thus, it can be seen that the development organization begins at conception, and motor domains, affective and social (personal-social behavior) and cognitive (language and adaptive behavior) will gradually differentiating.

During early childhood linkages, and the necessary care to the growth and development incentives are provided by the family.[19] The home environment is therefore considered the primary factor for developing motor, cognitive, social and language.[20,21]

However, the child's interaction with other children is a key element for proper stimulation, so households with only children tend to offer few social stimuli and motor models to allow for a proper development, as there will be fewer opportunities to observe and play activities than other infants to older age groups already perform.[21,22] In contrast, infants who have low chances of stimulation in the home, but attend daycare, suffer positive influence on motor development, since they seem to be more exposed to different situations physical and social. Bradley and Vandell[22] highlight the experiences of children in daycare interact with their experiences in the family and with the characteristics of the child to produce the results in developing and Santos et al[23] state that the child is in daycare and motor challenged cognitively in activities, interaction with people, contact with objects and stimuli different from those found in their home environment.

According to the literature a biological problem can be aggravated by a non-stimulating environment, as well as an environment with multiple stimuli can reduce the effects of biological problem.[24] This was evidenced in this study, which demonstrated the influence of external factors on course of rolling motion, presenting as restrictors elements to move the placement of the cradle against the wall beside the lack of rotation of the child in the same charge, and how positive feature already established emotional bond between children and caregivers/teachers.

Therefore, it is essential that the family, school and / or social environments there are concerns in structuring possibilities of motor experiences to which the child is widely encouraged to master their movements.[25,26]

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