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Chapter 9

EARLY INTERVENTION: EFFECTS OF THE MULTISENSORY ENVIRONMENT ROOM SNOEZELEN IN CHILDREN WITH CEREBRAL PALSY AND AT RISK OF NEUROLOGICAL DAMAGE

Gabriela Medina and Feggy Ostrosky-Solís*

Laboratory of Neuropsychology and Psychophysiology, National Autonomous University of Mexico, Mexico D. F., Mexico

Abstract

Background: recently, there has been an increasing interest in Early Intervention Programs (EIP) that attempt to improve neurological development of children who are at risk of presenting developmental deficits due to cerebral damage. The effectiveness of new early intervention therapies such as the Multisensory environment room snoezelen (MERS) is still under investigation. The MERS is being used at the Centro de Rehabilitación Infantil in México as part of a complete EIP for children with neurological damage or at risk of presenting it.

Aim: To evaluate the neurodevelopmental effects of the MERS in children with quadriplegic-spastic cerebral palsy and children at risk of presenting neurological damage

Study design: Retrospective study

Subjects: A sample of 206 children was selected from the Centro de Atención Infantil. 108 children presented quadriplegic-spastic cerebral palsy (mean age: 21.6 [12.3 sd] months) and 98 children were at risk of presenting neurological damage (mean age: 5.9 [5.5 sd] months). These children were divided into an experimental group (those who received the MERS therapy) and a control group (those who did not receive the MERS therapy).

Outcome measures: Children were evaluated at the beginning and at the end of the program with the Battelle Developmental Inventory which includes adaptations for handicapped children.

Results: All the children that attended the MERS presented low birth weight compared to the control group. The experimental group presented lower scores than the control group in all

* E-mail address: feggy @servidor.unam.mx. Address correspondence to: Feggy Ostrosky-Solis, Laboratory of Neuropsychology and Psychophysiology, National Autonomous University of Mexico. Rivera de Cupia 110-71, Lomas de Reforma, México, D. F., 11930, Mexico.

the areas assessed by the Battelle Developmental Inventory both in the quadriplegic-spastic cerebral palsy group and the group at risk.

Conclusions: There were no neurodevelopmental differences between quadriplegic-spastic cerebral palsy children and the group at risk who attended a regular EIP and those who also attended de MERS as part of their EIP.

Key Words: Early intervention, cerebral palsy, children at risk, snoezelen.

Introduction

Neonatal and child mortality have decreased significantly due to scientific progress in neonatology and pediatrics, which in turn, has led to an increase in morbidity that gives rise to maturity dysfunction (Montes, 2003). According to statistical studies, in 2002, 12.1% (1 out of 8) of all live births registered in the United States were classified as pre-term; 7.8% (1 out of 13) showed low birth weight; and 1.5% were considered as extremely low weight (National Center for Health Statistics, 2002). In developing countries like Mexico, in 2002, a pre-term birth rate of 13.7% was reported in third level (specialized) hospital centers (Vargas et al, 2002).

Children born under unfavorable conditions (e.g. premature birth, low weight, hypoxic events), are classified as High Neurological Risk because of the probability of manifesting consequences during their development. One of the major consequences is Child Cerebral Palsy (CP), which is defined as a non-progressive disorder of the posture and movement, and which is frequently associated with epilepsy, speech, vision and intellect disorders (Behrman et al., 2002).

There are various sub-types of CP, the spastic form is the most frequent (60 to 75%), it main characteristic is hypertonia, with a continuous resistance to movement, this manifestation is due to an affectation of the motor cortex, mostly the pyramidal tract *(Koman et al. 2004; Pierre-Lin, 2005;Teeter & Semrud-Clikeman, 1997).* Given its characteristics, CP is a disorder that is not easy to diagnose; consequently, it is reported until the age of 2 or 3 (Bax et al. 2005; Dimirijevic and Jocic, 2005; Pueyo and Vendrell, 2002; Muzaber and Schapira, 1998).

Due to the indexes of the population with CP or at risk of developing any other kind of consequence, in recent years there has been increased interest in Early Intervention Programs (EIP). The purpose of EIPs is to prevent the consequences or to rehabilitate the affected individual, which is essentially based on using the activation of the Central Nervous system (CNS) (Peñaloza, 2001). It is believed that the stimulation provided by EIPs can have positive effects on neurodevelopment, because the cerebral plasticity permits adaptive structural and functional changes (Blackman, 2002; DiPietro, 2000). Cerebral plasticity is understood as the adaptive capacity of the nervous system that makes it possible to minimize the effects of lesions by modifying its own structural and functional organization (Galaburda, 1990),

The EIPs integrate a number of therapies; the most important are physiotherapy, occupational therapy and language therapy (Palmer, 1997; Michaud et al, 2004). There are studies that have sought to test the effects of EIPs on development based on these therapies, and different populations have been used, such as children with speech problems (Ward et al. 1999) extreme low weight pre-term children (Brooks-Gunn et al. 1997; Salokorpi et al. 2002; Sajaniemi et al. 2000) and with CP (García-Navarro et al. 2000; Sarduy et al. 2003).

Ward et al. (1999) tested the effectiveness of an EIP in children with language development problems. The sample included 119 children aged 8 to 21 months (mean age: 10.6 months) divided into control (n=59) and experimental (n=60). The EIP was applied at home daily for 30 minutes by the parents who received training in specific language activities (e.g. playing with rattles, singing, naming objects of interest to the child). They were visited 2 weeks after starting the program and then every 4 weeks. Both groups were evaluated a year and two years after the initial evaluation, until the subjects reached the age of 3. The Receptive Expressive Emergent Language Scale (REEL) was used in the first evaluation, the Reynell Developmental Language Scales (RDLS) was used in the second and third evaluation. The general level of development was evaluated with the Parent Infant Progression Charts (PIP). At 3 years of age, 5% of the experimental group and 85% of the control group evidenced language deficits. The results of this study show the beneficial effects of an EIP on language development.

Brooks-Gunn et al. (1997) carried out a study with 874 premature, extreme low weight children (< o = at 37 weeks of gestation and < or equal to 2500 g. of birth weight) followed for 8 years. The sample was divided into a control group (538 children) and an experimental group (336 children); each group was, in turn, subdivided into more weight (2001-2500 g.) and less weight (< o = to 2000 g.). The EIP lasted for 3 years and consisted of: home visits (every week for the first year and every two weeks for the following two years) where the parents were taught techniques in behavior management and play activities to promote, language, cognitive and social development. Attention centers were visited 5 days a week, as from 12 months, where the activities performed were focused on reinforcing the work done by the parents at home; and group meetings of parents every two months during the 1st and 2nd year, in which subjects like health and safety were reviewed. The evaluations were made by using the WISC III; the Peabody Picture Vocabulary Test-Revised; the Woodcock-Johnson Test of Achievement-Revised; Child Behavior Checklist; Child General Health Survey; and parents' reports on academia achievement, behavior and health. At the age of 3, the experimental group had better scores in intelligence tests, receptive vocabulary and fewer behavioral problems than the control group; these results were more evident in the lower weight subgroups. At the age of 5 (2 years after ending the EIP), there were no significant differences between the groups. Only in the subgroups of higher weight, the experimental group had higher scores in the complete IQ scale (4 points), in the verbal scale (4 points) and in receptive vocabulary (6 points) than the control group. At the age of 8 (5 years after ending the EIP), there were no major differences between the groups. The experimental group had higher scores in receptive vocabulary and total IQ than the control group only in the higher weight subgroup. These differences were less than those found at the age of 5. The beneficial effects decreased over time; nevertheless, the authors conclude that this difference reduces the percentage of children classified as intellectually deficient or with borderline intelligence.

Sajaniemi et al. (2000) evaluated the effects in cognitive performance and attachment patterns 4 years after early occupational intervention in children born with extremely low weight. They included 100 children with extremely low weight (<1000 g.) randomly placed in control and experimental groups at 3 months of age, paired according to the pre-perinatal risk score. The intervention group received 60-minute occupational therapy sessions per week, at home, from 6 to 12 months, in which normal sensorial-motor development, play development and social-emotional development to help parent-child interaction were promoted. The control group did not receive intervention. Evaluations were made at 2 and 4 years of age, cognitive performance was evaluated at 2 with the Bayley Scales for Infant Development; and the WPPSI was used at 4. The attachment pattern was evaluated with the Preschool Assessment of Attachment (PAA).

The results showed that at 2 years of age, there were no differences in cognitive performance or in the attachment pattern between the groups. At the age of 4, there were significant results in cognitive performance and the normative attachment pattern that favored the intervention group. The researchers concluded that it must be borne in mind that the positive accumulative effects could take longer to become evident and the EIP should focus on the parents' skills because this could lengthen and broaden its benefits in development.

In recent years, other types of therapy have emerged that are being increasingly used, such as the Multisensory Environment Room Snoezelen (MERS). The MERS is an attractive room that has numerous visual, auditory, smell, and room stimuli (e.g. music, aromas, fiber optics, ball pool, waterbeds, textured walls). The concept of a multisensory environment started in the 1980s with two Dutch workers who created an activities room for patients with learning difficulties. The word Snozelen was used because it is derived from two Dutch words that mean "breathe and doze", sensations that are felt by those entering the room (Hulsegge & Verheul, 1987; Nasser et al. 2004; Lancioni et al. 2002).

The use of MERS has been analyzed in different pathologies like dementia (Livingston et al. 2005; Ball & Haight, 2005; Verkaik et al. 2005;) managing chronic pain (Schofield, 2002; Schofield & Davis, 2000), patients with the Rett syndrome (Lotan, 2006; Lotan & Shapiro, 2005), mental retardation (Martin et al. 1998; Matson et al. 2004; Hogg et al. 2001), learning problems (Lancioni et al. 2002; Kwok et al. 2003), among others. It has been observed that the MERS therapy offers beneficial physiological, cognitive and behavioral changes in children that have suffered severe creneoencephalic traumatism (Hotz et al. 2006), such as lower heart frequency and decreased muscular tone when they are in the MERS therapy. In children with autism, it has been found that there is a slight tendency towards greater socialization while they are receiving MERS therapy; however, these finding have not been significant and therefore the benefit has not been concluded in this population (McKee et al. 2007).

Lancioni et al. (2002) conducted a review of the application of MERS in persons with intellectual deficits. The authors concluded that although some studies found positive effects in the sessions, many of the studies had methodological problems, such as a limited number of sessions, little control over conditions and only using qualitative and descriptive data.

Analyses have also been made of the effects of MERS therapy in communication among adults with severe intellectual disability. Lindsay et al. (2001) tested the effectiveness of four kinds of therapy (relaxation therapy, aromatherapy, active therapy and snoezelen) to improve communication. Eight subjects were analyzed (6 men and 2 women) aged 23 to 62, with behavioral problems, incontinence, aggressive behavior, self-aggression, screaming and disabling mannerisms. All the subjects received 20 session of each kind of therapy with a duration of 20 minutes 3 times a week, followed by an occupational activity. The communication was assessed with a Likert-type scale that evaluated: friendly vocalization, soft touch, non-threatening look, smiling and positive responses. The results of the study showed that the relaxation and snoezelen therapies significantly increased the positive communication in all subjects, while also reducing negative behavior. The aromatherapy and active therapy, however, did not show any effects.

In Mexico there are Child Attention Centers that have an MERS in their EIP. There are no defined criteria, however, that consider the specific characteristics to decide on who should enter the MERS. The benefits reported are clinical appreciations assessed during the course of the therapy, such as muscular tone, posture, neck and torso straightening reactions, relaxation, increased follow-up and attention and more acute hearing. The therapy is believed to facilitate fine motor skills, increase concentration, adaptation and interaction capacities, in addition to fostering greater verbal and non-verbal communication, curiosity and searching. Nevertheless, to date there has been no quantification of these clinical changes or analyses of the populations that might benefit the most from this therapy.

The objective of this study was to determine the effects of MERS in the neurodevelopment of children with quadriplegic-spastic CP and at risk of neurological damage after 12 months of attendance in an EIP.

Method

Participants

A retrospective study was made. The sample included 206 patients attending a Chile Attention Center, 108 children with quadriplegic-spastic CP and 98 at risk of neurological damage, from 0 to 4 years of age. The inclusion criteria were: patients with quadriplegic-spastic CP or patients at risk of damage due to prenatal or perinatal causes, who had 2 neurodevelopment assessments (at the commencement and completion of the EIP). Patients with conditions acquired postnatally (e.g. traumatisms) and other kinds of CP (e.g. mixed ataxia, dyskenesis) were excluded.

Instruments and Procedures

The CP group of 108 children was divided in two: 19 control patients (participants who received EIP) and 89 experimental patients (participants who received EIP and entered the MERS). The 98 children of the risk group were divided into: 56 control patients (EIP) and 42 experimental patients (EIP plus MERS). The descriptive characteristics by groups are given in Tables 1 and 2.

The control group only received the EIP, which lasted for 12 months, and consisted of physical, language and occupational therapy sessions. The number of session was arranged according to the characteristics of each patient. The experimental group was given the EIP plus MERS sessions lasting 30 minutes once a week.

The 206 participants were assessed at the starting and termination of the EIP by using the Battelle Development Inventory (Newborg et al. 1984) modified version (Cruz and González, 1998). This instrument evaluates the development skills of children aged 0-8. It consists of 341 items grouped in 5 areas: Personal-Social, Adaptive, Motor, Communication and Cognition, and there are adaptations for disabled children. It furnishes information on the strong and weak points and offers a development age for each area, as well as a global development age at the end of the Inventory. The scores were analyzed at the beginning and end of the program. There was also an analysis of the data included in the clinical history: the

APGAR at 5 minutes (score given to the newborn based on cardiac frequency, respiratory efforts, tone and coloring), hereditary family antecedents, income level, parents' education level, parents' age, psychomotor development, as well as the onset and symptomatology of the condition.

Table 1. Descriptive characteristics of subjects with CP.

	Control (CP) N = 19		Experimental (CP/MERS) N = 89			
	N	Mean	N	Mean	T	P
Age 1st eval (mths)	19	24.5 (13.1)	89	27.6 (12.6)	.941	.374
Global.Dev.Age. (mths)	19	7.8 (6.6)	89	7.4 (4.9)	.270	.794
Age 2nd eval (mths)	19	36.8 (15.1)	89	40.3 (12.5)	1.04	.298
Glob.Dev. Age (mths)	19	12.4 (9.1)	89	10.6 (6.2)	-.813	.305
Age of beginning program (mths)	19	19.8 (13.2)	89	22.0 (12.2)	.703	.484
Birth weight	19	3115.4 (643.9)	88	2496.6 (773.6)	-3.25	.002
Apgar 5 min.	12	8.0 (1.3)	53	7.0 (2.1)	-1.53	.131
Age of Detection	19	1.9 (2.7)	88	1.2 (2.4)	-1.07	.285
Age of mother	17	26.8 (5.6)	84	27.3 (6.1)	.316	.753
Mother's schooling.	19	9.7 (2.0)	87	10.0 (2.5)	.521	.604

The age and schooling of the father is not considered because there were insufficient data for the statistical analysis

Table 2. Descriptive characteristics of risk subjects.

	Control (Risk) N= 56		Experimental (Risk /MERS) N= 42			
	N	Mean	N	Mean	T	P
Age 1st eval (mths)	56	9.1 (4.7)	42	9.6 (6.6)	.444	.658
Glob. Dev. Age 1st (mths)	56	7.1 (3.3)	42	5.9 (2.5)	-1.98	.050
Age 2nd eval (mths)	56	19.4 (6.5)	42	20.5 (10.0)	.653	.515
Glob. Dev. Age 2nd (mths)	56	16.5 (5.8)	42	12.5 (6.3)	-3.18	.002
Age of beginning program (mths)	55	5.6 (4.8)	41	6.3 (6.5)	.626	.533
Birth weight	54	2634.2 (766.8)	42	2215.0 (840.1)	-2.54	.012
Apgar 5 min.	41	7.7 (1.6)	32	7.7 (1.1)	.805	.423
Age of Detection	56	.62 (1.7)	42	.31 (1.1)	-1.00	.319
Age of mother	52	27.3 (7.1)	41	26.9 (4.5)	-.364	.717
Mother's schooling.	56	10.1 (2.6)	41	10.9 (2.2)	.406	.163

The age and schooling of the father is not considered because there were insufficient data for the statistical analysis

Statistical Analysis

The scores obtained in each of the areas were analyzed before and after receiving the EIP by using the T test for independent samples in the CP and Risk groups, with a comparison of the data for the subjects in the control and experimental groups.

In order to quantify the absolute changes, the difference between the initial and final means of each area were analyzed (personal social, adaptive, motor, communication and cognitive), as well as the global development age in all the subjects, which were obtained by subtracting the scores obtained in the second evaluation from the scores in the first evaluation. Example:

Personal-Social 10 months - Personal-Social 15 months = 5 months of difference
1st Eval. 2nd Eval. (DIF)

A positive difference indicates an improvement in the evolution, while a negative difference shows a step back in development.

A multiple regression analysis was carried out with the variables obtained from the clinical records (e.g. sex, severity of the diagnosis, mother's schooling, income level, number of therapies received) to assess their contribution to the development of both groups; the CP and Risk groups.

Results

When analyzing the descriptive characteristics of the CP control and experimental groups, as can be seen in Table 1, the results showed that there was a significant effect in the birth weight (F=-3.25, p< .002), 618.8 kg less in those given the MERS therapy. No significant effects were found in the Age at 1st Assessment, 1st global Development Age, Age at 2nd Assessment, Age of beginning the program, APGAR, Age of Detection, Age of Mother and Mother's Schooling.

Table 3. Means and standard deviations of the DIFF of the Battelle Development Inventory for the CP group.

DIF	Experimental (EIP/MERS)	Control (EIP)	T	P
	Mean	Mean		
Personal Social	4.9 (3.7)	5.8 (5.6)	-.901	.369
Adaptive	2.9 (3.2)	4.4 (3.5)	.300	.082
Motor	1.6 (3.2)	3.5 (5.7)	-1.3	.182
Gross Motor	1.9 (5.3)	3.5 (6.0)	-1.15	.250
Fine Motor	2.0 (4.1)	4.1 (7.0)	-1.23	.230
Communication	3.3 (4.8)	4.5 (5.5)	-1.00	.317
Receptive Comm.	4.4 (6.1)	3.8 (7.1)	.35	.723
Expressive Comm.	2.8 (6.3)	4.7 (5.7)	-1.17	.242
Cognitive	3.4 (4.4)	4.1 (5.0)	-6.01	.549
Global Dev. Age	3.2 (2.7)	4.6 (4.2)	-1.82	.070

A T test was run for independent samples with the DIFF means (2nd assessment minus 1st assessment) of the score obtained in each area evaluated with the Battelle to determine the absolute change in development. The means and standard deviations are shown in Table 3. The results show that although averages of the personal-social, adaptive, motor, gross motor, fine motor, communication, expressive communication and the cognitive area are higher for the control group, they only became significant in the adaptive area (*F* = .300 p<.082) and in the age of global development (*F* = -1.82, p<.070) with an average higher than for the control group (no MERS). The difference found in the means was only higher in the receptive communication area in the experimental group (CP with MERS), although it was not statistically significant (*F* = .35, p<.723).

The descriptive characteristics were analyzed in the Risk group, between the control and experimental groups. Statistically significant differences were found in the birth weight (*F* = -2.54, p<.012) 419.2 kg less for the experimental group (Risk with MERS); the development age at the first assessment (*F*=1.98, p<.050) 1.2 months less for the experimental group; and in the global development age at the second assessment (*F* =-3.18, p<.002), 4 months less in the experimental group.

Table 4. Means and standard deviations of the DIFF of the Battelle Development Inventory for the Risk and Risk with MERS group

DIF	Experimental (Risk/MERS)	Control (Risk)	T	P
	Mean	Mean		
Personal Social	7.7 (4.4)	8.9 (4.5)	.661	.197
Adaptive	5.6 (4.2)	8.4 (5.4)	.260	.008
Motor	5.3 (5.7)	9.8 (5.9)	.611	.000
Gross Motor	4.9 (5.3)	9.4 (5.9)	.643	.000
Fine Motor	6.7 (6.9)	10.7 (7.1)	.272	.007
Communication	6.2 (6.9)	7.9 (5.6)	.881	.188
Receptive Comm.	8.8 (7.0)	10.6 (5.8)	.385	.171
Expressive Comm.	5.2 (7.2)	7.3 (7.3)	.294	.176
Cognitive	6.5 (6.5)	9.0 (5.2)	.644	.037
Global Dev. Age	6.6 (5.2)	9.3 (4.9)	.652	.010

Table 4 shows the means and standard deviations of the T test for independent samples of the DIFF in areas evaluated by the Battelle. The results revealed significant statistical differences in the adaptive areas (*F*= .260, p<.008), motor (*F*= .611, p<.000) gross motor (*F*= .643, p<.000), fine motor (*F*= .272, p<.007), cognitive (*F*= .644, p<.037) and in the global development age (*F*= .652, p<.010) between the control and experimental groups, with higher averages for the control group in all cases. No significant differences were found in the personal-social, communication, receptive communication and expressive communication areas.

A multiple regression analysis was performed including the variables of sex, beginning at program, socioeconomic status, severity of diagnosis, birth condition, age at problem detection, APGAR at 5 minutes, mother’s age, mother’s schooling, and the number of language, cognitive and occupational therapy sessions, in the advance of development. It was found that this model accounted for 9% in the CP group. The birth condition variable (pre- or post-term) was the most important variable in the equation; however, it was not significant. In the risk group, the model explained 14% of the development progress. Language therapy was the most important variable; however, it was not significant either.

Discussion

In recent years, considerable amounts have been spent to support countless EIPs aimed at improving the growth and development of children who present biological sufferings and/or environmental conditions that make them prone to some form of disability in the future. The most important elements of the EIPs are physiotherapy, occupational therapy and language therapy; however, new proposals such as MERS have emerged that are now being used in a number of pathologies (Livingston et al. 2005; Ball & Haight, 2005; Verkaik et al. 2005; Schofield, 2002; Schofield & Davis, 2000; Lotan, 2006; Lotan & Shapiro, 2005; Martin et al. 1998; Matson et al. 2004; Hogg et al. 2001).

The purpose of this study was to determine the effects of MERS on the neurodevelopment of children with CP and at risk of neurological damage. The results revealed that there were age differences when the EIP was started among the groups (CP and Risk); the risk group had a lower chronological age at the initiation of the EIP. This age difference was caused by the criteria used for a definitive diagnosis of CP, which is around the age of 2; consequently, in younger ages, even though there are indications of a deterioration in motor functions (principally), CP is not diagnosed and they are regarded as children at risk of damage (Bax et al. 2005; Dimirijevic & Jocic, 2005; Pueyo & Vendrell, 2002; Muzaber & Schapira, 1998).

Differences were also found in the birth weight of children who received a regular EIP and those who received the regular EIP plus MERS. The children who received MERS also had lower weight. These results followed a similar pattern in the CP and risk group, which suggest that the Child Attention Center tends to give MERS therapy to children with this characteristic.

Age differences were also found in the Risk group in the global development age at the first assessment, even when there was no chronological age difference between the groups. The highest score was for the group that only received EIP regularly (which was also the group with the highest birth weight). These differences were also noted in the global development age at the second assessment where the score differences were still higher for the children who did not have MERS. There are studies indicating that the birth weight has a significant impact on the development results obtained after receiving an EIP, where higher birth weights lead to more benefits and their consequent influence on long-term development (Sajaniemi et al., 2001; Brooks-Gunn et al., 1994; Alvarez & Martínez, 2002; Sajamiemi et al., 2000; Gianni et al. 2006).

No differences were found in the development areas between the CP groups that received the EIP and those that were given the EIP plus MERS in the Battelle inventory scores; nevertheless, the scores were slightly higher for those who attended a regular EIP (higher birth weight), except in the receptive communication area, where the mean favored those who had MERS. These results are consistent with those reported by Lindsay et al. (2000), where MERS benefited communication in persons with intellectual disability; nevertheless, it most be borne in mind that this study was conducted in an adult population.

Differences were found in the Risk group in the adaptive, motor, gross motor, fine motor and cognitive areas and in the global development age among those who had an EIP and those who also had MERS therapy. These results coincide with those reported by in the child population where changes in social, cognitive and motor areas were found (Hotz et al. 2006, Mckee et al. 2007).

In this study, no variables were found that could explain the variation in the CP group, which was probable due to the complexity of the CP disorder, which is not a single disorder, but a series of symptoms where the most important affectation is in the motor skills; nevertheless, it is also associated with epilepsy, speech, vision and intellect disorders (Behrman et al. 2002). Consequently, given the characteristics of the disorder, the samples cannot be totally homogenous, even when there is the same pathology, and it is difficult to find a variable that explains the change seen in behavior. Birth condition (full term, pre-term and post-term) was the variable with the greatest weight in predicting development progress, and it is once again associated with birth weight. The variable with the greatest weight in explaining the variation in the Risk group was attendance to language therapy; however, it was not significant.

The Attention Centers with MERS try to provide regular support in addition to the EIP. MERS implies a sizeable economic investment and, given its characteristics, it can only be used by one patient in each session. There has been a significant increase in the demand for the MERS because of the population attending the Attention Centers. Entering the MERS has become show and it is probable not used to full benefit; consequently, it is import to determine the benefits offered by the MERSs, which populations could make best use of this resource and to reserve it only for those for whom it implies a tool that favors development.

The results suggest that the MERS does not offer conclusive benefits for the development of children with quadriplegic-spastic CP. Only some areas benefited from the MERS in Risk children. Nevertheless, these results were affected by the birth weight bias found in allocating the MERS. Additionally, not many studies were found that proved the development effects of the MERS in the child population. Further studies are therefore suggested that prove the development effects of the MERS in the child population; consequently, additional research should be carried out where different populations are analyzed and with a prospective design for better control of the variables.

References

Ball, J. & Haight, B. (2005) Creating a Multisensory Environment for Dementia. *Journal of Gerontological Nursing*. **31**(10): 4-10.

Bax M., Goldstein M., Rosenbaum P., Levinton A., Paneth N. (2005) Proposed definition and classification of cerebral palsy. *Dev. Med. Child Neurology* **47**: 571-576.

Behrman, R. Kliegman, R. Jonson, H. (2002) *Nelson Manual de Pediatría*. Edit. McGraw-Hill Interamericana de España, S.A.U. Madrid, España.

Blackman, J. (2002) "Early Intervention: A Global Perspective". *Inf .Young Children*; **15**(2): 11-19

Brooks-Gunn J, McCarton C, Wallace I, Bauer CR, Bennett F, et al. (1997) Results at age 8 rears of early intervention in low-birth-weight premature infants. *JAMA* **272**: 1257-62.

Cruz, L. González, M. (1998) *Inventario de Desarrollo de Battelle, Manual de Aplicación*. Ed. Tea Ediciones, Madrid España.

Dimitrijevic, L. & Bosanka, J. (2005) The importance of early diagnosis and early physical treatment of cerebral palsy. *Medicine and Biology*. Vol. 12, No 3. pp. 119-122.

Galaburda A. (1990) Introducción to special issue: Developmental plasticity and recovery of function. *Neuropsychology*; **28**: 515-516.

Garcia-Navarro, M. Tacoronte, M. Sarduy, I. Abdo, A. Galvizú, R. Torres, A. (2000) "Influencia de la estimulación temprana en la parálisis cerebral" *Rev. Neurol*. **31** (8). 716-719.

Hogg J. Cavet, J. Lambe, L. Smeddle, M. (2001) The use of Snoezelen as multisensory stimulation with people with intellectual profound disabilities: a review of the research. *Res Dev Disabil* Sep-Oct 22 (5):353-72.

Hotz, G. Castelblanco, A. Lara, I. Weiss, A. Duncan, R. Kuluz, J. (2006) Snoezelen: a controlled multi-sensory stimulation therapy for children recovering from severe brain injury. *Brain Inj. Jul*; **20** (8): 879-88.

Hulsegge J, & Verheul A (1987) *Snoezelen: Another world.* ROMPA International Ltd, Chesterfield.

Janet A. DiPietro. (2000) Baby and the Brain: Advances in Child Development. *Annu. Rev. Health*. **21**:455-71.

Koman LA., Smith B., Shilt J. Cerebral Palsy. *Lancet* 2004; 363: 1619-1631

Kwok, H. To, Y. Sung, H. (2003) The application of a multisensory Snoezelen room for people with learning disabilities-Hong Kong experience. *Hong Kong Med J*. Apr; 9 (2):122-6.

Lancioni GE, Cuvo AJ, O'Reilly MF (2002) Snoezelen: an overview of research with people with developmental disabilities and dementia. *Disabil Rehabil*. 2002 Mar 10; 24(4): 175-84

Lindsay, W. Black, E. Broxholme S. (2001) Effects of tour therapy procedures on communication in people with profound intellectual disabilities. *Journal of Applied Research in Int Disabil*. **14**, 110-119.

Livingston, G. Johnston, K. Katona, C. Paton, J. Lyketsos, C. (2007) Systematic Review of Psychological Approaches to the Management of Neuropsychiatric Symptoms of Dementia. *Am. J. Psychiatry*; **162**:1996-2021.

Lotan, M. (2006) Management of Rett Syndrome in the Controlled Multisensory (Snoezelen) Enviroment. A Review with three case stories. *Scientific World Journal*. Jul. 8; 6: 791-807.

Lotan, M. & Shapiro, M. (2005) Management of young children with Rett Disorder in the Controlled multi-sensory (Snoezelen) environment. *Brain Development*; 27 Suppl 1: 588-594.

Martín, N. Gaffan, E. Williams, T. (1998). Behavioural effects of long multi-sensory stimulation. *Br J Clin Psychology*. **37** (Pt 1): 69-82.

Matson, J. Bamburg, J. Small, Y. (2004) An analysis of snoezelen equipment to reinforce persons with severe or profound mental retardation. *Res Dev Disabil*. Feb 25 (1): 89-95.

McKee, S. Harris, G. Rice, M. Silk, L. (2007) Effects of Snoezelen room on the behavior of three autistic clients. *Res Dev Disabil* May-Jun; 28 (3): 304-16.

Michaud, L. MD and Committee on Children with disabilities (2004) "Prescribing therapy services for children with motor disabilities". *Pediatrics* Vol. 113 No. 6 June 2004.

Montes, C. (2003). *Estimulación Múltiple Temprana*. En Chavez R. Neurodesarrollo Neonatal e Infantil, México. Ed. Panamericana; 303-329

Muzaber L. & Schapira I. (1998) Parálisis Cerebral y el Concepto de Bobath de Neurodesarrollo. *Rev. Hosp. Mat. Inf. Ramón Sardá*. Vol. 17, Nº 2.

Nacional Center for Health Statistics (2002) http://www.cdc.gov/nchs

Nasser, K. Cahana, C. Kandell, I. Kessel, S. Merrick, J. (2004) Snoezelen: children with intellectualy disability and working with the whole family. *Scientific World Journal Jul* **03**: 4:500-6.

Newborg, J. Stock, J. Wnek, L. Guidubaldi, J. Svinicki, J. Dickson, J. Markley, A. (1984) *Battelle Developmental Inventory*. Itasca, IL: The Riverside Publishing Co.

Palmer, F. (1997) Evaluation of Developmental Therapies in Cerebral Palsy. Mental Retardation and Development disabilities, *Research Reviews* **3**:145-152

Peñaloza-Ochoa, L. (2001) El Niño de 11 años con dificultad para la marcha. Bol Med Hosp Infant Mex, jun. vol.58, no.6. ISSN 1665-1146.

Pierre-Lin, J. (2003) The Cerebral Palsies: a Physiological Approach. J. Neurol. Neurosurgery. *Pshychiatry*, **74**; 23-29.

Pueyo, B. Vendrell, N. Bargalló, J. Mercader. (2002) *Neuroimagen y Parálisis Cerebral. Rev Neurol*; **35** (5): 463-469.

Sajaniemi, M. Makela, J. Salokorpi, T. Von Wendt, L. Hamalainen, T. Hakamies-Blomqvist, L. (2000) Cognitive performance and attachment patterns at four years of age in extremely low birth weight infants after early intervention. *European Child & Adolescent Psychiatry*. **10**:22-129

Salokorpi, T. Rautio, T. Kajantie, E. Von Wendt, L. (2002) Is early occupational therapy in extremely preterm infants of benefit in the long run? *Pediatric Rehabilitation*, vol. 5, No. 2, 91-98.

Sarduy, I. García, M. Tacoronte, M. Maragoto, C. Marín, T. (2003) Afectación del desarrollo psicomotor y respuesta al tratamiento en la parálisis cerebral espástica. *Rev. Mex. Neurociencias* vol. 4 no. 6, 421-426.

Schofield P. (2002) Evaluating Snoezelen for relaxation within chronic pain management. *British Journal of Nursing*, vol. 11, Iss. 12 pp. 812-821.

Schofield, P. & Davis, B. (2000) Sensory Stimulation (Snoezelen) versus relaxation: a potential strategy for the management of chronic pain. *Disability and Rehabilitation*, Vol. 22. No. 15, 675-682.

Teeter & Semrud-Clikeman, (1995) Integrating neurobiological, psychosocial, and behavioral paradigms: A transactional model for the study of ADHD. *Archives of Clinical Neuropsychology*, **10**, 433-461.

Vargas, G., Canales, M., Torres, G. (2002) "Nacimiento pretérmino por indicación Médica". Ginecol Obstet Méx, mar. Vol. 70. no. 3.

Verkaik R. Van J. Francke A. (2005) The effects of psychosocial methods on depressed, aggressive and apathetic behaviours of people with dementia: a systematic review. *Int. J. Geriatr Psychiatry*. **20**: 301-14.

Ward, S. (1999) An investigation into the effectiveness of an early intervention method for delayed language development in young children. *Int. J. Language & communication disorders*, vol. 34, no. 3, 243-264.