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EARLY INTERVENTION FOR PREMATURE INFANTS IN NEONATAL INTENSIVE CARE UNIT

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SUMMARY

Background: Each year, 14.9 million children are born prematurely all over the world. Preterm infants are at greater risk of mortality, morbidity, and lifespan sequelae. Early intervention in neonatal intensive care units is applied in order to minimize short-term and long-term consequences of prematurity. The aim of this article is to illustrate early intervention for children born prematurely in neonatal intensive care units as well as to present effectiveness of the most frequently used interventions, such as: Kangaroo Care, Newborn Individualized Developmental Care and Assessment Program (NIDCAP), and music therapy (MT).

Results: Early intervention is very important because it not only provides a better chance for survival, but also offers the compensation of development opportunities. Kangaroo Care, NIDCAP and music therapy (MT) have positive effects for the child's health, the parents' perception, as well as the bond between them in the first year of life.

Conclusions: Much research has shown significant positive effects of NICU's early intervention on mortality and medical health. Previous studies have evidenced that Kangaroo Care, NIDCAP and MT influence children's medical status, psychomotor development and parental attachment positively. With regard to the methodological quality of studies, some of the evidence was limited. Further studies are needed to confirm the obtained results and to examine longer-term therapeutic effects.

Key words: infant, premature, early intervention, Kangaroo-Mother Care, Music Therapy, Newborn Intensive Care Units, NIDCAP

PREMATURITY

Preterm birth (also referred to as preterm parturition syndrome) is defined as birth before 37 completed weeks of gestation. The Born to soon report, published in 2012 based on studies involving 184 countries from 1990 to 2010, demonstrated that more than 1 in 10 of the world's newborns are born prematurely, corresponding to 14.9 million „preemies" each year. The global average preterm birth rate oscillates around 11.1% worldwide, from about 5% in Northern European countries to 18% in Malawi. Every year more and more children are born prematurely all over the world, wherein the preterm birth mean percentage depends on country development: for low-income countries – 11.8%, for middle-income countries – 11.3%, for upper middle-income countries – 9.4%, for high-income countries – 9.3%. In regard to the mean preterm birth rate for the world's regions the order from the highest to the lowest is as follows: Southeastern Asia – 13.6%, Southern Asia – 13.3%, Sub-Saharan Africa – 12.3%, Caribbean – 11.2%, Western Asia – 10.1%, Caucasus and Central Asia – 9.2%, Latin America – 8.4%, Oceania – 7.4%, Northern Africa – 7.3%, and Eastern Asia – 7.2% (Blencowe et al., 2012; 2013a). The etiology of preterm birth is not completely understood, however some risk factors are known. The preterm parturition syndrome has a variety of causes. Predictors can be classified into two broad subtypes: spontaneous preterm birth and provider-initiated preterm birth. It is assumed that for the spontaneous preterm birth domain there are the following risk factors: 1) age at pregnancy and pregnancy spacing (lower than 18 years and advanced age, short inter-pregnancy interval); 2) multiple pregnancy (because of increased rates of twin, pregnancies with assisted reproduction); 3) infection or underlying maternal chronic medical conditions (such as: diabetes, anemia, thyroid disease, hypertension, asthma); 4) nutritional (such as: undernutrition and micronutrient deficiencies); 5) lifestyle and work conditions (smoking, alcohol consumption, drug use, excess physical work and activity); 6) maternal psychological health; 7) genetic component; 8) other (such as: cervical incompetence, intra-uterine growth restriction, congenital abnormality). Predictors related with provider-initiated preterm birth are: 1) medical induction or cesarean birth for obstetric indication and fetal indication; 2) others (non-medically indicated) (Blencowe et al., 2013a).

CHILDREN BORN PREMATURELY

Premature infants are a heterogeneous clinical group regarding gestational age (GA). The total burden is classified into extremely preterm (<28 weeks), very preterm (28 - <32 weeks), and moderate preterm (32 - <37 completed weeks of gestation). In many countries, the boundary of live birth and stillbirth has changed over time. Particularly in high-income countries the minimum GA at which an infant can survive is becoming lower and lower. The lower cutoff for stillbirth registration varies from 18 to 28 weeks, where early stillbirth is defined as birth weight ≥ 500g or ≥ 22 GA, and late stillbirth as birth weight ≥ 1000g or ≥ 28 GA

(Blencowe et al., 2012; 2013a). The highest estimated mean rate of premature live births was noted in low-income countries. In the USA a high rate of prematurity was estimated as well, because medical staff attempt to rescue children with lower GA more than elsewhere, leading to an increase in the total percentage of prematurity. It is important to add that the mean rate of premature birth is also determined by race (17.5% for black Americans in comparison to 10.9% for white Americans) (Blencowe et al., 2012). In addition to the variation in GA, premature newborns differ from each other in terms of birth weight. Infants are classified into the following weight groups: newborns with low birth weight (1500-2500g), very low birth weight (1000-1500g), and extremely low birth weight (<1000g). Sometimes an additional category, incredibly low birth weight (<750 g), is used (Bień et. al., 2009). It is important to add that all anthropometric measures are lower for premature babies in comparison to babies born at term (birth weight, length, circumference of head and chest). Currently a global increase in the survival of premature babies is observed, due to technological advances and the collaborative efforts of interdisciplinary teams. The infant mortality rate has been falling continuously, but some newborns (especially fetal infants) are not able to survive. Because of the consequences across the life-span many specialists consider what the limits of survivors are (Bieleninik, 2012).

Currently more than 1 million newborns die each year throughout the world. Despite the fact that more and more children with extremely low birth weight survive, prematurity is a risk factor for neonatal and postnatal death (at least 50%), and is a direct cause for 35% of all neonatal deaths. Indirect complications of preterm birth, particularly neonatal infections, were estimated as nearly 980000 deaths each year. In summary prematurity is the most important direct cause of death in the first months of life as well as the second leading cause of death during the first 5 years (Blencowe et al., 2013a). Risk of perinatal death for preterm infants is 120 times higher compared to infants born at term (Bieleninik, 2012). It is important to remember that the mortality rate is connected with GA and increases with decreasing GA. Previous studies have demonstrated that some children born at 22 weeks of pregnancy are able to survive (Hakansson et al., 2004; Tommiska et al., 2007; Doyle, 2004), but risk of mortality in this age group is the largest, and most children die. Dana Wechsler Linden et al. (2005) have demonstrated that survival is linked with GA and ranges from 20% for newborns born at 23 weeks of pregnancy to 65% for newborns, who were born at 25 weeks of pregnancy. The rate of morality based on GA is as follows: 80% for 23 GA; 35% for 25 GA; 25% for 26 GA; 15% for 29 GA; 5-10% for newborns between 30 and 33 GA, and about 5% for newborns between 34 and 36 GA (Wechsler Linden et al., 2005).

SEQUELAE OF PRETERM BIRTH

The specialist's challenge is to maintain the life of newborns as well as to conduct early intervention aiming to minimize long-term effects of prematurity. Chil-

dren born prematurely vary in the extent to which they develop from infancy to adulthood (Saigal & Doyle, 2008). Prematurity is associated with lifespan consequences, such as: specific physical effects (visual impairment, hearing impairment, chronic lung disease of prematurity, long-term cardiovascular ill-health and non-communicable disease); neuro-developmental/behavioral effects (mild disorders of executive functioning, moderate to severe global developmental delay, psychiatric/behavioral sequelae), family, economic, and social effects (impact on family as well as impact on health service intergenerationally) (Blencowe et al., 2013a). The differences in functioning of preterm infants in comparison to peers born at term are observed in the following areas: motor skills (Anderson et al., 2010), cognitive and language development (Pietz et al., 2004; Magill-Evans & Harrison, 2001; Jennische & Sedin, 2001; Anderson et al., 2010). In the first years children born prematurely are in the risk group of behavioral disorders and emotional problems (Hoff et al., 2004; Clark et al., 2008; Spittle et al., 2009). Many of them have learning disabilities during preschool and school age (Huddy et al., 2001; Chyi et al., 2008; Blencowe et al., 2013b), attention deficit hyperactivity disorder (Ornoy et al., 1993), hyperkinetic disorders (Moster et al., 2008; Linnet et al., 2006), and developmental coordination disorder (Geuze et al., 2001). Blencowe and al. (2013b) based on a systematic review and meta-analysis have indicated that of 13 million preterm children who survived beyond the first month, 567000 where estimated to have mild neurodevelopmental impairments, and 345000 were diagnosed to have moderate or severe neurodevelopmental impairments as well. The main consequence of neurological and neuropsychiatric preterm infants is cerebral palsy (Bracewell & Marlow, 2002). Saigal and Doyle (2008) have emphasized that neurodevelopmental disabilities play an important role in early childhood, while behavioral problems and school difficulties are more visible in adolescence. It is important to add that not all children born prematurely function lower than peers born at term. Disorders, disabilities, and impairments are linked with GA, birth weight and maturity, and these problems mostly affect children with the lowest GA and birth weight.

Early intervention for children born prematurely

Early intervention 'consists of multidisciplinary services provided to children from birth to 6 years of age to promote child health and well-being, enhance emerging competences, minimize developmental delays, remediate existing or emerging disabilities, prevent functional deterioration, and promote adaptive parenting and overall family functioning' (Blauw-Hospens & Hadders-Algra, 2005, p. 421). A variety of different techniques is used in early intervention, based on psychotherapy, developmental psychology, clinical psychology, occupational therapy, and rehabilitation psychology. The major reason for success of early intervention is that the brain is very plastic at this early stage. Neuropsychological rehabilitation is justified by the fact that the state of the child's brain is not in a sustained state and may be subject to various changes. According to brain plasticity, the structure and function of the brain are changing dynamically, and

this ability allows responding to changes in the environment or within the body itself (Pąchalska, 2009).

Early intervention is very important for all newborns vulnerable to developmental disorders and children born with developmental disabilities. Premature infants belong to a risk group due to low GA, low birth weight, and biological immaturity of all organs. Lawn et al. (2013) have shown that all over the world:

1. 80% of premature babies are born between 32 and 36.99 weeks of pregnancy, giving 12.6 million babies who need extra care for small babies. These moderate and late preterm children are at risk of long term effects including non-communicable disease.
2. 10% of the population of premature babies are born between 28 and 31.99 weeks gestation, giving 1.6 million babies who need care for preterm babies with complications. This population is particularly exposed to mild long-term disability such as learning or behavior difficulties.
3. 5% of premature babies are born before 28 weeks of gestation, giving 780000 babies who need intensive neonatal care for survival. This population of premature babies is particularly at risk of moderate or severe long-term disability.

Because of the high risk of mortality and various ranges of disabilities each baby born prematurely needs life-saving essential care and extra newborn care. Essential care includes: thermal care based on: drying, warming, skin-to-skin and delayed bathing; hygienic cord and skin care at birth and home care: hand washing and other hygiene, delayed cord clamping, consider chlorhexidine; early and exclusive breastfeeding as well as neonatal resuscitation if not breathing at birth. Extra care for preterm babies includes extra thermal care based on Kangaroo Care, baby huts, blankets, overhead heaters, incubators; extra attention to infection prevention and skin care such as: chlorhexidine or emollients; extra support for breastfeeding: expressing and cup or tube feeding, supplemented breast milk; and safe oxygen use (Lawn et al., 2013). Chrzan-Dętkoś and Bogdanowicz (2007) underlined that children born prematurely require intervention not just in the first three years of life, but also in the kindergarten years.

It is important to remember that premature birth has an influence on the whole family system and early intervention should include three domains: 1) psychosocial support of parents aiming to decrease stress, anxiety, depressive symptoms, increase self-efficacy, maternal sensitivity and responsiveness in interactions with their children; 2) educational interventions based on an increase in parental knowledge and abilities in taking care of preterm children and subsequently increase self-efficacy, decrease stress as well. This domain can include: information about growing and developing; demonstration of infant behavior and discussion; active involvement of the interaction between parent and child based on constructive feedback; 3) therapeutic developmental support for the child (Benzies et al., 2013). Based on the aim of this study, the authors took into consideration these types of intervention, which are involved directly with newborns in neonatal intensive care units.

NEONATAL INTENSIVE CARE UNIT

Worldwide, almost 50% of premature babies are born at home. Even though they are born in facilities, mortality, morbidity, and future development depend on various aspects, for example access to the neonatal intensive care unit (NICU). It is important to emphasize that not all hospitals have NICUs as well as tertiary care centers, particularly in low-income countries and in rural agglomeration. Medical staff seek to assist physical processes in the following steps: prevention, protection, anticipation, and minimal handling. They sustain life first and next monitor vital functions. Clinical observation together with monitoring of vital functions is necessary (weight, head circumference, breath, heart function, skin color, body temperature, newborn's behavior) to make the decision on implementation of treatment. Because the natural process of maturity was stopped in the womb environment, the intervention aims to imitate intrauterine conditions as well.

Children born prematurely have biological immature organs, and therefore they are vulnerable to various difficulties in the postnatal period. Respiratory disorders are one of the most important clinical problems, because are directly linked with threat to life. There is a widespread conviction that lung immaturity, lack of surfactant, low GA and low birth weight are causes of respiratory distress syndrome (RDS), pneumonia, apnea, and bronchopulmonary dysplasia. Lawn and al. (2012) have indicated that about 5 to 10% children need assistance to start breathing at birth. Basic resuscitation reduces mortality by about 10% (Lawn et al., 2012, per: Lee et al., 2011). Premature babies are at higher risk of mortality and morbidity once they get an infection (including sepsis). It is estimated that about 50% of children who were born between 23 and 26 GA, 30% between 26 and 29 GA, and 15% between 30 and 33 GA are vulnerable to infection, while survivor percentage oscillates around 75% (Wechsler Linden et al., 2007). Thermal homeostasis is limited due to immaturity of the thermoregulatory system, low level of brown adipose tissue, lack of caloric reserve, loss of temperature through the skin, and tendency to adopt the environment temperature, and therefore premature babies should be placed in incubators. One of the most important principle of infant care is thermal care, which includes: drying, wrapping, increasing the environmental temperature, covering the newborn's head and feet, skin-to-skin contact (see: Kangaroo Care), and delaying bathing (Lawn et al., 2013). Children born prematurely also have feeding difficulties due to a lack of coordinated sucking and swallowing. Breastfeeding is recommended because it reduces mortality (Bhutta et al., 2008), protects from infection and necrotizing enterocolitis as well as improves neurodevelopmental outcomes (Edmond et al., 2007; Hurst, 2007). Some newborns need extra support for feeding such as: cup, spoon, and parenteral or enteral feeding.

Environmental factors in NICUs differ a lot from the home environment. Even if mothers are able to be with their babies all the time, the conditions in a hospital are completely different. The largest difference concerns that babies are located in incubators, where they do not have direct contact with parents; they do not

have the possibility to feel their parents' skin or smell. Because of the separation, children have a lack of opportunity to experience normal relationships because of limited social interaction with parents, lack of security, a sense of loneliness and even abandonment. The children's stressful situation may lead to disabilities in motor functioning, hearing, eyesight, eating, and abnormal behavior or psychological disorders. Additionally, medical procedures (which are necessary for survival) may increase the level of children's stress and pain. Hospitalized children are also exposed to overstimulation as well as experiencing a lack of appropriate stimulation. Additionally, the child's sensory system has to maturate in an extrauterine environment, where many conditions can break their development. Vandenberg (2007, pp. 435-436) has suggested practice guidelines to provide appropriate sensory development. She recommended the following conditions:

1. Light in the NICU: "avoid direct light of infant care space except for procedures; avoid sensory overstimulation in the NICU environment; individualize light exposure — provide several choices for light reduction at each bedside through small shields, covers for incubator; protect and facilitate REM sleep; support quiet alertness and restful sleep; support for smooth transition from sleep to wake and vice versa; note each infant's level of threshold for light via behavioral signals for disorganization/stress; know light equipment lux levels of brightness and adjust to reduce infant exposure (i.e., warming lights during bath time should be directed from back of infant, not side or front facing head on); provide for day/night cycling with protocols for lower lights during night time hours; limit intense competing stimuli from other NICU sources and noise." (p. 435)
2. Noise in the NICU: "provision of minimal background noise and sound absorption in infant care spaces; sound levels shall not exceed 50 dB and hourly L10 of 55 dB; transient sounds should not exceed 70 dB; equipment in NICU should have noise levels of b40 dB; spaces and adjacent areas to NICU should not amplify sound levels; creation of a developmental multidisciplinary team to facilitate staff agreement to reduce and monitor sound reduction in NICU." (p. 436)

The sensory systems' development follows a specific order, from touch, kinesthetic/ proprioception, vestibular, smell and taste to vision. Stimulation of each system is very important in the child's progress, but if one system is stimulated to occur out of the order, that system interferes with the development of the next system (Vandenberg, 2007). Thus, providing optimal conditions in the NICU environment is necessary. Many studies have investigated the developmental benefits of sensory system stimulation. Some of them have reported significant effects, others no evidence. Findings by Madlinger-Lewis et al. (2014) have shown that the effect of positioning is evident before NICU discharge and an effective positioning reduces asymmetry in preterm infants. Nesting decreases length in hospital stay (Beckman, 1997), while swaddling influences on higher behavioral maturation at 34 weeks corrected age (Short et al., 1996). Tactile stimulation has positive effects on weight gain (Scott et al., 1983; Helders et al.,

1989) and shorter length of time to full oral feeding (Fucile et al., 2005). Auditory stimulation has shown no evidence of effects on physiological parameters (Zahr & de Traversay, 1995) and growth (Champan, 1984). Vestibular stimulation has an impact on newborns' quality of sleep (i.e., more frequent quiet sleep state and longer period of quiet sleep; Thoman et al., 1991), positive effect on lower heart rate, respiratory rate, and higher neuromuscular maturity score (Keller et al., 2003). Other data indicated no significant impact of vestibular stimulation on quality of feeding (Saigal et al., 1986), weight gain (Saigal et al., 1986; Keller et al., 2003), neurodevelopment (Clark et al., 1989; Saigal et al., 1986), as well as age at discharge (Thoman et al., 1991). Blackburn and Patteson (1991) have reported that reduced light level has positive effects on heart rate, activity, biologic rhythms, feeding, quality of sleep, and weight.

In summary the main aim of care in NICUs is reducing infant mortality, morbidity, as well as providing appropriate extra-uterine conditions and stimulation. A second purpose is to focus on improving and enhancing the quality of life of children as well as parents. When the child's health state is stable, specialists implement appropriate therapeutic actions. Research on the effects of Kangaroo Care, NIDCAP and music therapy with infants born prematurely has shown numerous benefits, and these interventions are used most frequently in NICUs.

Kangaroo Care

The initiator of Kangaroo Care (KC) was Dr. Edgar Rey Sanabria, who introduced this approach at Instituto Materno Infantil in Santa Fe de Bogotá in Columbia in 1978 in order to minimize the high rate of mortality and infection. The aim of this new approach was to change traditional care and hospital conditions. Dr. Edgar Rey Sanabria assummed that KC provides warmth and stimulation to the child and consequently contributes to the reduction of postnatal mortality. His results were so satisfying that skin-to-skin contact was introduced into various hospitals in Western Europe during the 1980s. KC is now approved by WHO and UNICEF, and is used in hospitals all over the world (Bieleninik, 2012).

KC is based on holding the baby in such a way that there is skin-to-skin contact between the child and the person holding (mother, father or another person). Every baby has basic needs such as: warmth, closeness, breathing, nutrition, and protection, and KC provides all of them. For children born prematurely, special holding is practiced for two to three hours per day over an extended time period in early infancy. When children are medically stable, there is no time limit. Research has indicated that sensorimotor stimulation (such as: rocking, massaging, extra holding, sleeping on waterbeds) has positive influence on weight, feeding abilities and interactive behavior (Feldman & Eidelman, 1998; Ferber et al., 2002; Field, 1995; Leduc, 2001; Lindrea & Stainton, 2000). A systematic review and meta-analysis of 13 randomized controlled trials and 19 non-randomized studies has shown that KC is safe for children born prematurely and provides benefits for their growth and development (Dodd, 2005). Skin-to-skin

contact has positive effects not just for the child's health (Ludington-Hoe, 2011), but also for parents (Fegran et al., 2008; Feldman et al., 2002, 2003).

Studies have shown that KC reduces mortality and nosocomial infection (Charpak et al., 1997; Conde-Argudelo, 2003). Additionally, KC has a positive impact on the following: lower heart rate (Gray et al., 2000), less hypothermia (Cattaneo et al., 1998), higher temperatures during holding (Ludington-Hoe et al., 1991; Chwo et al., 2002; Bauer et al., 1997), higher weight gain (Cattaneo et al., 1998; Tessier et al., 1998; Ramanathan et al., 2001), greater head growth (Charpak et al., 2001), higher oxygen saturation levels (Legault & Goulet, 1995; Fohe et al., 2000; Gazzolo et al., 2000), higher HR (Fohe et al., 2000; Ludington-Hoe et al. 1991). This is very important because improvement of psychophysical parameters is associated with improved medical conditions. KC also has a positive influence on successful and longer breastfeeding (Cattaneo et al., 1998; Charpak et al. 2001; Ramanathan et al., 2001). This aspect is very important because feeding difficulties belong to the basic problems of the child. Improvement of feeding abilities provides optimal and favorable conditions for the maturation of oral reflexes, sucking, and swallowing mechanisms, and coordination with the rhythm of their breathing. Outcomes have demonstrated that KC also has significant positive effects on child's behavior states, including: less crying (Gray et al., 2000; Chwo et al,. 2002), more quiet sleep (Lundington-Hoe et al., 1994, Chwo et al., 2002; Ludington et al., 1999, Messmer et al., 1997; Bauer et al., 1998), inactive awake (Chwo et al., 2002), less awake time (Messmer et al., 1997). KC is related with shorter hospital stay (Cattaneo et al., 1998), which also has benefits for institutions reducing treatment costs. Some research has suggested that KC has a significant positive impact on infants' perceptual-cognitive and motor development at 6 months (e.g., Feldman et al., 2002). The authors speculated that KC has a direct impact on parents by improving parental mood, perception, and interactive behavior. Further studies have shown that KC enhances attachment and bonding between mother and child (Tessier et al., 1998) and is associated with higher maternal comfort with care (Cattaneo et al., 1998), more positive perception of birth, greater sensitivity for the infant, greater confidence and lower need of social support (Tessier et al., 1998).

It is important to mention that some authors have found no significant differences between KC and control conditions in the following areas: in temperature during KC (Legault & Goulet, 1995; Mooncey et al., 1997; Neu et al., 1999), heart rate regulation (Bauer et al., 1996; Ludington et al., 1999; Messmer et al., 1997), and respiratory stability (Bosque et al., 1995; Fischer et al., 1998; Ludington et al., 1999; Ludington-Hoe et al., 1991; Messmer et al., 1997).

NEWBORN INDIVIDUALIZED DEVELOPMENTAL CARE AND ASSESSMENT PROGRAM

Dr. Heidelise Als established the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) at the Brigham and Women's Hospital in

Boston in the late 1980s. Her aim was to provide education and training in developmental observation and assessment for staff members who take care of high-risk preterm infants. The purpose was minimization of sensory overload and overstimulation through outside stressors, adding an extra dimension by regular observations of the behavior and estimating the nervous system's ability to tolerate the environment, and care-giving events. The obtained data contributed to the creation of the new individualized approach for newborns and whole families. The major aim was to improve and enhance the bond between children and parents in a hospital environment as well as to emphasize family-centered care.

The effects of NIDCAP are not entirely clear. There are some studies emphasizing significant effects as well as some research indicating no significant impact. Research on the effects of NIDCAP has shown numerous medical and nursing benefits, including: increased respiratory regularity (Als et al., 2003; Fisher et al., 1995; Westrub et al., 2000), increased weight gain, greater length and larger head circumferences (Als et al., 2003), decreased medical complications (Als et al., 2003; Westrub et al., 2000), and decreased length of stay (Fleshier et al., 1995). NIDCAP significantly supports psychomotor and neurobehavioral development, electrophysiology, and brain structure advantages during the inpatient period (Kleberg et al., 2002; Als et al., 2003; 2004; 2012). Research by Als et al. (2012) has shown better self-regulation for NIDCAP-treated intrauterine growth restriction of preterm infants compared to a control group at 42 weeks. The benefits include self-regulation signals on a higher level (such as: hand-to-face and hand-to-mouth, sucking, foot bracing, hand-grasping), higher motor system functioning (such as: reflexes, cuddling, crawling, modulation of movement, motor competence and decreased motor stress signals). NIDCAP has a positive impact on mothers' perception as well (Als et al., 2003; Kleberg et al., 2007). Mothers in NIDCAP perceive more closeness to their babies (Kleberg et al., 2007) and have lower levels of stress (Als et al., 2003).

A systematic review of randomized controlled trials by Ohlsson et al. (2013) took into consideration 627 children born prematurely and did not find any evidence of NIDCAP's effectiveness on children's outcomes. According to the authors NIDCAP has no significant impact on medical and neurodevelopmental results, on long-term and short-term outcomes. Another systematic review by Jacobs et al. (2002) demonstrated that NIDCAP improves neurodevelopmental outcomes at 9 and 12 months, but has no positive effect at 2 years and at school-age. Authors have indicated that this treatment influences the requirement for supplemental oxygen. A third systematic review reported that NIDCAP-treated individuals showed higher outcomes for cognitive and psychomotor development, but the authors underlined that the evidence of this impact was limited due to the methodological quality of the included studies (Wallin & Eriksson, 2009). Symington and Pinelli (2000) confirmed that a major part of the evidence for NIDCAP has methodical limitations, such as small sample size or lack of blinding. The authors indicated that the evidence of the effect of NIDCAP on respiratory support is conflicting (three of five trials confirmed a significant effect). Taking

into consideration neonatal outcomes, Symington and Pinelli (2000) have found significant effects on moderate to severe chronic lung disease and necrotizing enterocolitis, while they have found no evidence on pneumothorax, patent ductus arteriosus, intraventricular hemorrhage (III°, IV°), sepsis, retinopathy of prematurity. None of the five trials had proved a significant influence of NIDCAP on feeding and growth. It is important to emphasize that many studies confirmed the effectiveness of the NIDCAP approach, but some of the benefits were limited (Symington & Pinelli, 2000)

MUSIC THERAPY

Music therapy (MT) is used in NICUs as a medical treatment and has in some places become a part of standard care during the last 20 years. According to Standley (2001), research on the effects of MT with babies born prematurely and parents has demonstrated numerous benefits including five types of MT: 1) sustained music, live or recorded, provided individually; 2) music to reinforce non-nutritive sucking using a "pacifier activated lullaby" device; 3) music and multimodal stimulation; 4) infant stimulation; 5) parent counseling to train parents' use of music with their child. Music therapy techniques are effective across a wide range of medical and developmental issues for premature infants. An advantage of MT in comparison to traditional medical care is that this intervention takes into consideration the psychosocial state of the child as well as the needs of the whole family.

Findings have demonstrated various benefits for premature infants. Significant improvements were observed across several psychophysical parameters. Previous studies have evidenced that MT has positive effects on: regulating heart rate (Cassidy & Standley, 1995; Arnon et al., 2006; Bozzette, 2008; Keller, 2008; Whipple, 2008; Loewy et al., 2013), increasing respiratory rate (Cassidy & Standley, 1995; Farhat et al., 2010), improving oxygen saturation levels (Cassidy & Standley, 1995; Arnon et al., 2006; Farhat et al., 2010), increasing weight gain (Caine, 1991; Cevasco & Grant, 2005; Standley & Swedberg, 2011), and increasing caloric intake (Caine, 1991). MT impact on shorter hospital stay was observed in many trials (Caine, 1991; Cevasco, 2008; Standley et al., 2010; Standley & Swedberg, 2011), and this has benefits for institutions as well reducing treatment costs. Many studies have shown that MT is beneficial in the aspect of feeding ability (Standley et al., 2010; Loewy et al., 2013), regulating sucking patterns (Cevasco & Grant, 2005; Loewy et al., 2013), as well as increasing breastfeeding rates (Vianna et al., 2011). Breastfeeding is the optimal way of feeding that provides full health and proper development of every newborn. Breastfeeding ensures not only bonding with the mother, but also provides better assimilation of the basic nutrients, increases the resistance of the child, and protects from infections. In addition, it is observed that babies fed by mother's milk are more active, their psychomotor development is faster, they have better concentration, a greater readiness to explore the environment, better learning ability, less aggression, more self-confi-

dence and self-control, and better interpersonal relationships in the future (Bieleninik, 2012). Trials have demonstrated significant positive effects of MT on children's behavior states (Arnon et al., 2006; Bozzette, 2008; Keller, 2008; Whipple, 2008; Loewy et al., 2013).

MT is also beneficial for premature mothers. This is very important because premature labor is perceived by mothers as a stressful and traumatic situation. Parents experience many crises, insecurity and powerlessness. Premature labor can impact on posttraumatic stress disorder and depression, and therefore parents need special care and support (emotional, instrumental, informative; Bieleninik, 2012). MT has positive impact on decreasing parental stress perception (Loewy et al., 2013), mothers' well-being, and coping (Whipple, 2000; Cevasco, 2008). Additionally, the separation of mother and newborn after birth has negative consequences on the attachment and bond between them. Research has shown that MT promotes the relation between parent and children (Whipple, 2000), the bond between them (Whipple, 2000), and attachment (Edwards, 2011). This is very important because the relationship between child and mother in the early period determines the child's future social functioning.

Different types of MT techniques may have different effects (Standley, 2001). Recorded lullaby music in the infant's incubator is linked with improving the oxygen saturation level, increasing weight gain and decreasing the length of the hospital stay. Live singing and multimodal stimulation is related to shorter stay in hospital and increased tolerance for stimulation. Parent training is associated with reducing overstimulation, increasing visitation time in hospital, and promoting bond. Pacifier Activated Lullaby is connected with reinforcing non-nutritive sucking, and increasing feeding rates of poor feeders. Music listening after medical procedures is related to reducing signs of distress and accelerates pacification (Standley, 2001). Additionally, Cassidy and Standley (1995) and Standley and Moore (1995) have proven that sustained music has a positive impact on respiratory regularity, and oxygen saturation, while Coleman et al. (1997) have indicated a relation with decreasing distress behavior. Pacifier activated lullaby also has a positive effect on feeding ability including an increase of sucking endurance (Standley et al., 2010), and is linked with reducing pain perception (Whipple, 2008). Standley (1998) has revealed that music and multimodal stimulation play an important role for increasing tolerance to stimulation and decreasing length of hospital stay. Haslbeck (2014) based on qualitative analysis has shown that creative music therapy has a positive impact on premature babies in communicative musicality resulting from responsiveness. Haslbeck (2014) has indicated that infants' smiles during sessions may have social meaning in comparison to general knowledge on infant development, but in accordance with other study results (Cecchini et al., 2011, Miller & Holditch-Davis, 1992, Kawakami & Yanaiharab, 2012, Miller & Holditch-Davis, 1992, per: Haslbeck, 2014). According to Haslbeck, creative music therapy supports premature infants' development, growth, and self-regulation balance. Additionally the author has highlighted the importance of including parents in music therapy sessions, because this im-

proves their quality of relation as well as facilitates the babies' physical and psychological health. MT supports parents by enhancing their quality of relation between them and their child during sessions, improving the attachment, as well as positively influencing well-being and self-confidence. The therapeutic process depends on the child's health and should be adapted to the child's possibilities.

Research based on randomized controlled trials has shown numerous benefits of MT with premature babies in various areas: the child's physiological and behavioral parameters, the child's physiological stability and behaviors, and the relation between parent and child. It is important to mention that not all trials have found statistically significant positive effects of MT on infant's medical health. For example research by Alipour et al. (2013) has indicated no effect of MT on respiratory rate, heart rate, oxygen saturation, and behavioral states. Additionally some of the studies have limitation due to heterogeneity of populations, interventions and outcomes (Hartling et al., 2009). Overall, there is preliminary evidence to suggest some therapeutic benefits, but these should be confirmed in methodologically rigorous trials.

CONCLUSION

It is difficult to present early interventions' worldwide situation for infants born prematurely. A major gap in trials is obvious, as most published studies come from high-income countries. The greatest rate of premature birth and prematurity was estimated in low-income countries, where women have no access to neonatal care units, as well as having no attendance and support. The high global average rate of prematurity (11.1% worldwide) confirms that this subject is valid and relevant. It seems that more and more children with low GA and low birth weight will require early intervention in the future. Because infants born prematurely are vulnerable to mortality, morbidity and various disorders there is a need to sustain their life first and then promote their psychological and physical development in the postnatal period.

Early intervention provides a better chance for survival, offers compensation of developmental opportunities for infants, and supports parents. Results justify the necessity of therapeutic interventions in NICU. Current trials have proven that KC, NIDCAP, and MT have a significant positive effect for both infants, and parents. Significant improvements were observed across the following domains: child's health, child's physiological and behavioral development, relation between parent and child, parents' perception and well-being.

This overview of early interventions in NICUs indicates that some of the evidence was limited due to the methodological quality of studies. Mostly, trials focused on the effectiveness in the postnatal period, and long-term effects were rarely examined. The most important challenge now is to investigate early interventions' effects over time. Additionally, it is necessary to conduct studies in low-income countries to obtain a global, worldwide overview. Further research is needed to confirm the obtained results and to examine long-term therapeutic ef-

fects as well as the stability of early intervention's impact over time. Awareness of the importance of early intervention for children born prematurely in NICUs should be promoted so that all children at risk can receive specialized therapeutic support.

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