

## Differences Between the Family-Centered “COPCA” Program and Traditional Infant Physical Therapy Based on Neurodevelopmental Treatment Principles

Tineke Dirks, Cornill H. Blauw-Hospers, Lily J. Hulshof, Mijna Hadders-Algra

**Background.** Evidence for effectiveness of pediatric physical therapy in infants at high risk for developmental motor disorders is limited. Therefore, “Coping With and Caring for Infants With Special Needs” (COPCA), a family-centered, early intervention program, was developed. The COPCA program is based on 2 components: (1) family involvement and educational parenting and (2) the neuromotor principles of the neuronal group selection theory. The COPCA coach uses principles of coaching to encourage the family’s own capacities for solving problems of daily care and incorporating variation, along with trial and error in daily activities.

**Objective.** The purpose of this study was to evaluate whether the content of sessions of the home-based, early intervention COPCA program differs from that of traditional infant physical therapy (TIP) sessions, which in the Netherlands are largely based on neurodevelopmental treatment.

**Setting.** The study was conducted at the University Medical Center Groningen in the Netherlands.

**Design.** A quantitative video analysis of therapy sessions was conducted with infants participating in a 2-arm randomized trial.

**Patients and Intervention.** Forty-six infants at high risk for developmental motor disorders were randomly assigned to receive COPCA (n=21) or TIP (n=25) between 3 and 6 months corrected age. Intervention sessions were videotaped at 4 and 6 months corrected age and analyzed with a standardized observation protocol for the classification of physical therapy actions. Outcome parameters were relative amounts of time spent on specific physical therapy actions.

**Results.** The content of COPCA and TIP differed substantially. For instance, in TIP sessions, more time was spent on facilitation techniques, including handling, than in COPCA sessions (29% versus 3%, respectively). During COPCA, more time was spent on family coaching and education than during TIP (16% versus 4%, respectively).

**Limitations.** The major limitation of the study was its restriction to the Netherlands, implying that findings cannot be generalized automatically to other countries.

**Conclusion.** The COPCA program differs broadly from TIP as applied in the Netherlands. Studies on the effectiveness of this family-centered program are needed.

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In the United States, services for infants with special needs and their families are provided in a comprehensive, coordinated, and family-centered way in line with governmental regulations on early intervention.<sup>1</sup> As a result, “family centeredness” is a crucial aspect of interventions applied in infants and young children.<sup>2–10</sup> However, little is known about the way in which therapists interpret and apply family centeredness in daily practice.<sup>11</sup>

Multiple intervention programs are used for the treatment of infants with or at risk for developmental motor disorders such as cerebral palsy (CP). In the Netherlands, regular care for infants at high risk for developmental disorders after discharge from the hospital is provided by local physical therapists. The

physical therapists are certified for the treatment of children from birth to 18 years of age. The large majority also have completed the basic neurodevelopmental treatment (NDT) course and the specialized infant course based on NDT, which means that traditional infant physical therapy (TIP) in the Netherlands is largely based on NDT. Traditionally, infant physical therapy in the Netherlands frequently is applied in the home situation.

The original philosophy of NDT—the basic assumptions and clinical concepts in infancy—can be attributed to Karl and Bertha Bobath<sup>12</sup> and Elsbeth Köng.<sup>13</sup> Mary Quintin was responsible for a major part of the practical implementation of the Bobath principles in infant treatment, whereas Lois Bly undertook

the actual description of infant treatment.<sup>14</sup> Due to the “living concept” nature of NDT,<sup>15</sup> numerous modifications and changes in the implementation of infant treatment have occurred.

Notwithstanding the occurrence of substantial changes in NDT treatment in infancy, 3 recent systematic reviews on the effect of early intervention in infants at high risk for developmental disorders indicated that application of NDT does not result in improved developmental outcome.<sup>16–18</sup> The reviews also indicated that best results are achieved by application of specific motor training programs and general developmental programs. These findings and novel insights into the biological and psychological principles governing motor development after a lesion of the brain at early age,<sup>19,20</sup> along with an evolving shift in the manner in which family-centered care is delivered, have inspired us to develop “Coping With and Caring for Infants With Special Needs” (COPCA), a family-centered, early intervention program for families of infants at high risk for developmental motor disorders after term age.<sup>21</sup> The theoretical content of COPCA differs broadly from TIP (ie, from infant treatment based on NDT). Before we move on to the actual study, we first summarize the differences between the principles of the COPCA program and TIP.

### Theoretical Differences Between COPCA and TIP

Both COPCA and TIP are rooted in the framework of the *International Classification of Functioning, Disability and Health for Children and Youth* (ICF-CY).<sup>22</sup> Accordingly, the programs address competencies and limitations in body, motor, individual, and social dimensions. However, the 2 approaches differ largely in the focus of guidance. Traditional infant physical therapy emphasizes that

### The Bottom Line

#### What do we already know about this topic?

The evidence of the effectiveness of traditional physical therapy, based on neurodevelopmental treatment, in infants with special needs is inconclusive.

#### What new information does this study offer?

This study describes the family-centered program “Coping With and Caring for Infants With Special Needs” (COPCA), which is based on (1) family autonomy and educational parenting and (2) the neuromotor principles of the neuronal group selection theory. The study used a computer-based video analysis of COPCA sessions and sessions of traditional infant physical therapy applied to 46 infants at high risk for developmental disorders at 4 and 6 months corrected age. Compared with traditional infant physical therapy, the COPCA program spent more time on family coaching and education and less time on facilitation techniques.

#### If you're a caregiver, what might these findings mean for you?

If you are caring for a child who has a developmental disorder or is at risk for a developmental disorder, your physical therapist might encourage you to come up with your own problem-solving strategies using the COPCA approach, allowing your child to learn through trial and error in daily activities.

**Table 1.**

Overview of Differences Between the Coping With and Caring for Infants With Special Needs Program (COPCA) and Traditional Infant Physical Therapy (TIP) Based on Neurodevelopmental Treatment (NDT)

Variable	COPCA (Family-Relationship Focused)	TIP Based on NDT (Child Focused)
Theoretical frameworks <ul style="list-style-type: none"> <li>• Family involvement</li> <li>• Family education</li> <li>• Child development</li> <li>• Education of the infant</li> </ul>	<ul style="list-style-type: none"> <li>• Family autonomy<sup>6</sup></li> <li>• Transactional model<sup>53</sup> and ecological model<sup>54</sup></li> <li>• Neuronal group selection theory<sup>27</sup></li> <li>• Individuality in parenting<sup>9,23</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Family-centered care guided by professional expertise<sup>15</sup></li> <li>• Professional-client didactic relationship<sup>15,42</sup></li> <li>• Mix of neuromaturation, dynamic systems, and neuronal group selection theory<sup>15</sup></li> <li>• General parenting principles<sup>24</sup></li> </ul>
Primary focus of guidance	<ul style="list-style-type: none"> <li>• Decision-making process of the family</li> </ul>	<ul style="list-style-type: none"> <li>• Optimizing child development</li> </ul>
Role of family	<ul style="list-style-type: none"> <li>• Key factor in process of coaching</li> </ul>	<ul style="list-style-type: none"> <li>• Member of the team</li> </ul>
Role of therapist	<ul style="list-style-type: none"> <li>• Coach</li> </ul>	<ul style="list-style-type: none"> <li>• Key person in guidance</li> <li>• Teacher</li> </ul>
Education of infant	<ul style="list-style-type: none"> <li>• Coaching of caregiver</li> <li>• Educational perspective</li> </ul>	<ul style="list-style-type: none"> <li>• Therapist teaches infant and trains caregiver</li> </ul>
Key words of motor learning	<ul style="list-style-type: none"> <li>• Variation</li> <li>• Self-exploration</li> <li>• Challenge, testing the limits</li> <li>• Trial and error</li> <li>• Acceptance of atypical strategies</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to sensorimotor experience</li> <li>• Facilitation of typical motor behavior, avoidance of atypical behavior</li> <li>• Hands-on → hands-off techniques</li> </ul>
Communication	<ul style="list-style-type: none"> <li>• Bidirectional, equal partnership, and open dialogue</li> </ul>	<ul style="list-style-type: none"> <li>• Open information exchange between a source of information (the professional) and a receiver (the caregiver)</li> </ul>

impairment is the starting point of therapeutic guidance and that improvement of impairment is a means to facilitate activity and participation.<sup>14,15</sup> The COPCA program takes activities and participation of the family as a starting point. It aims to promote activities and participation of the family, including the infant with special needs, while taking into account the limitations imposed by the infant’s bodily impairments.

In both TIP and COPCA, 2 components can be distinguished: (1) a family involvement and educational parenting component and (2) a neurodevelopmental component. The differences between COPCA and TIP based on NDT are closely related to these 2 components (Tab. 1).

### The Family-Involvement and Educational Component COPCA

The family is the cornerstone of COPCA. Therefore, COPCA’s key

elements are family autonomy, family responsibility, and family-specific parenting. *Family autonomy* denotes the respect for the family, with its own criteria for quality of life. *Family responsibility* implies that the family is responsible for decisions and choices in the care of the infant and for the manner of collaboration with health care professionals. *Family-specific parenting* refers to the family-specific styles of caregivers used to educate the child to become an independent and responsible person.<sup>9,23</sup>

The COPCA program aims to encourage the family’s own capacities for solving the problems of daily care in naturally occurring parenting situations. To achieve these goals, principles of coaching are used. Coaching is COPCA’s major strategy. The term “coaching” has various connotations. In COPCA, it implies the promotion of creative exploration of the competencies of the family members, including the infant with special needs, in order to stimulate self-

made decisions during the daily processes of care. This strategy fits the parental expression “Don’t tell me what I can do, have to do, or must do, but help me to discover it by myself.” The coach creates a situation in which caregivers feel free to explore and discuss alternative strategies.<sup>4</sup> The coach does not have an instructional role but supports family members—on the basis of an ongoing, equal partnership—to uncover their competencies, goals, desires, hopes, and coping strategies. To this end, the coach listens, observes, suggests options, and informs. The coach uses focused bidirectional, nuanced, and detailed conversations while the caregiver is involved in daily routines with the child. Specific attention is paid to the role of siblings in care and play and to sibling well-being. To underscore the importance of coaching, we prefer to call the professional applying the COPCA program “coach” than “therapist.” The above implies that COPCA is *not* a program in which professionals, parents, or others are

engaged in “treating” the infant. The COPCA program coaches the family to deal in an autonomous way with the child with special needs and health care. Preliminary (unpublished) data indicated that caregivers of infants who received COPCA intervention were more satisfied with the services of health care professionals than the caregivers of infants who received TIP.

### TIP

The role of the family in the implementation of the TIP program has been eloquently expressed by Bly: “The more involved the family becomes, the more consistent therapeutic management becomes for the baby.”<sup>14(p8)</sup> This role means that the family is involved in the planning of the treatment program, carrying out treatment activities, and setting goals for the home situation. The therapist informs parents and other family members about references, such as changes in muscle tone (velocity-dependent resistance to stretch) and the baby’s behavior and response to being handled. In addition, the therapist provides information about what he or she is doing and furnishes parental assignments while treating the infant.<sup>14,15,24</sup> Coaching in TIP means that the therapist teaches within the framework of a didactic, confident instructor-learner interaction, with guidance and shared control of decision making.<sup>15</sup> It is the responsibility of the therapist to discover the best way for the infant to achieve his or her best potential, while anticipating the functional skills that the infant might achieve. In short, the therapist is the key person in the process of intervention.

Traditional infant physical therapy also aims to support the general management of the infant. This aim includes family education.<sup>15</sup> Family education, including parent training, is a key element in the TIP program. To this end, the therapist instructs

the caregiver in how to modify caregiving activities so that each daily task can be used to reinforce the improvement of motor patterns that the infant has learned during the therapy session. In the instruction, ample attention is paid to meaningful contexts.<sup>24</sup>

### The Neurodevelopmental Component

During much of the previous century, motor development basically was regarded as an innate, maturational process. Currently, 2 theoretical frameworks are most popular: the dynamic systems theory<sup>25,26</sup> and the neuronal group selection theory (NGST).<sup>27</sup> These frameworks share the opinion that motor development is a nonlinear process with phases of transitions, a process that is affected by many factors. Both theories acknowledge the importance of experiences and the relevance of the context. The 2 theories, however, differ in their opinion on the role of genetically determined neurodevelopmental processes. Genetic factors play a limited role in the dynamic systems theory, whereas genetic endowment, epigenetic cascades, and experience play equally prominent roles in NGST.<sup>19</sup>

### COPCA

The COPCA program uses NGST as theoretical frame of reference for principles of typical and atypical motor development. According to NGST, typical motor development is characterized by variation and the development of adaptive variability. *Variation* denotes the presence of a repertoire of strategies for each motor function in which the boundaries of the repertoire are set by the genome. Initially, during primary variability, the infant is not able to select from the repertoire of strategies the one that fits the situation best. Gradually, however, the infant develops the ability to select the most adaptive strategy for each situ-

ation (ie, the infant moves to the phase of secondary variability).

The process of selection is based on active trial-and-error experiences and associated sensory information, which implies that self-produced sensorimotor experience plays a pivotal role in motor development. To determine whether a movement is most adaptive, reference values are used, which most likely are function specific.<sup>19</sup> Atypical motor development due to an early lesion of the brain—according to NGST—is characterized by limited variation (ie, limited size of the repertoire of motor strategies) and a limited ability to vary motor behavior according to the specifics of the situation (ie, limited variability). The latter is induced by impaired selection. The impaired selection has a dual origin: it is related to the deficits in the processing of sensory information and to the fact that the best solution may not be available due to repertoire reduction. Due to absence of the “best” solution, the infant with an early lesion of the brain may have to choose a motor solution that differs from that of the infant who is developing typically. This choice implies that the different motor behavior of an infant with an early lesion of the brain should not *a priori* be regarded as deviant, that is, as something that deserves to be “treated away,” as it may be the infant’s best and most adaptive solution for the situation.<sup>28</sup> The infant’s deficits in the processing of sensory information result in a need for tenfold to a hundredfold more active motor experience compared with children who are developing typically need for the selection of the most appropriate strategy.<sup>29</sup>

We suggest that the principles of NGST have the following consequences for guidance of infants with special needs due to an early brain lesion. Neuronal group selection the-



ory explicitly emphasizes the need for ample active trial-and-error exploration in a variety of conditions. Facilitation of movements by means of hands-on techniques is useless, or rather should be avoided, as these techniques interfere with the infant's own activity and processes of motor learning. Challenging the child in a variety of conditions serves the child's exploration of the possibilities in daily activities and thus the opportunity to learn to adapt to daily life conditions. During the latter, the child uses his or her own set of situation- and function-specific reference values. In addition, it is conceivable that exposure to variation may result in an increase of the child's motor repertoire.<sup>30</sup> Whether the latter is possible is unclear.<sup>31</sup> Presumably, repertoire reduction will remain a limitation of children with an early brain lesion. We acknowledge these limitations. Consequently, COPCA focuses on functionality and does not pay attention to the quality of motor performance.

In COPCA, the principles of NGST are applied in the following way. The COPCA coach informs and coaches family members, while taking into account the family's educational perspective, on how the principles of NGST may be implemented in daily life. Family members receive suggestions for incorporating self-initiated motor behavior of the infant, exploration, variation, and trial and error in daily activities, as these behaviors may enhance the infant's motor repertoire and promote the ability to select the best strategy for different conditions. Self-initiated motor behavior of the infant also implies that COPCA is characterized by being "hands-off." In addition, suggestions are provided about the various ways in which the infant may be encouraged and challenged to explore the limits of his or her growing capacities. Interestingly, typical play with siblings usually is

an excellent means of promoting sensorimotor challenge, variation, and exploration. The COPCA program is not aimed at normalization of movement patterns or influencing muscle tone. Family members also are informed about basic principles of atypical development. Key elements are: (1) the notion that the appearance of motor behavior of the child with special needs may differ from that of a child who is developing typically, but this does not matter, as it is functional performance that counts, and (2) the idea that development implies trial and error during self-produced activity, in other words, that "error" production does not mean failure but the presence of an active learning process. Learning may be enhanced by verbal encouragement or nonverbal expressions of affection (eg, hugging, touching, tickling) by the caregiver. We would like to emphasize that the notions of NGST are not taught but are discussed by means of bi-directional, equivalent, and deliberate conversation, in line with the family involvement and educational component of COPCA.

### TIP

In NDT, the understanding of how typical development changes across the life span provides a critical framework for the problem-solving approach and the planning of treatment. Neurodevelopmental treatment uses problem solving to identify missing or atypical elements of functional movements and posture in infants at risk for a developmental disorder.<sup>15</sup> It is a living concept in which current concepts of dynamic systems theory and NGST both play a role. The inclusion of principles of NGST in NDT implies that neurodevelopmental principles of NDT and COPCA partially overlap. NDT and COPCA both underscore the need for active practice in varying situations. Both acknowledge the existence of reference value systems.

Major differences in implementation of theory in practice are the following. First, NDT pays considerable attention to atypical motor behavior, including atypical qualities of muscle tone,<sup>32</sup> as the atypical characteristics contribute directly to functional limitations. For instance, in line with dynamic systems theory, abnormal muscle tone may result in a change in the biomechanics of the musculoskeletal system and alter the functional movement strategy.<sup>15</sup> The dynamic systems theory directly supports the NDT strategy of reducing impairments in infant treatment. As a result, musculoskeletal components such as weight shift and control of antigravity extension, flexion, and rotation are important elements of specific treatment strategies.<sup>14</sup> Second, NDT assumes that a limited set of movement synergies will hinder progress in functional activity and should be prevented.<sup>15,33</sup> To achieve an optimal motor outcome, NDT uses active, self-generated, and guided or facilitated movements as a treatment strategy. This strategy implies for the implementation of NDT in daily practice that a broad repertoire of facilitation (hands-on) techniques such as handling may be used. The therapist treats the infant to reduce atypical functional activities in such a way that the infant will gain experiences of the best way to use movement synergies for age-specific function.<sup>14</sup>

Family members are informed about the background of the treatment strategies in terms of features such as abnormal muscle tone, symmetry and asymmetry, key points of control (hand placing), and tone-influencing patterns. The family, especially parents, is instructed on how to continue and integrate the specific treatment strategies at home.

It is becoming increasingly clear that it is difficult to prove the effect of pediatric physical therapy with the design of a randomized controlled

## An Early Intervention Program for Infants at High Risk for Developmental Motor Disorders

**Table 2.**

Perinatal and Social Characteristics of Both Study Groups<sup>a</sup>

Variable	COPCA Group (n=21)	TIP Group (n=25)
Sex, n (%)		
Male	9 (43)	11 (44)
Female	12 (57)	14 (56)
Gestational age at birth (wk), median (range)	29 (27–40)	30 (25–39)
Birth weight (g), median (range)	1,210 (585–4,750)	1,143 (635–3,460)
Maternal age (y), $\bar{X}$ (SD)	30.5 (6.2)	31.8 (4.3)
Firstborn child, n (%)	12 (57)	13 (52)
Twin pairs, n (%)	9 (43)	7 (28)
Abnormal cerebral ultrasound, <sup>b</sup> n (%)		
IVH grades 3–4	1 (5)	1 (4)
PVL grades 3–4	2 (10)	1 (4)
Cerebral palsy at 18 mo, n (%)	5 (24)	5 (20)
Maternal education, <sup>c</sup> n (%)		
Low	3 (14)	3 (12)
Middle	16 (76)	11 (44)
High	2 (10)	11 (44)

<sup>a</sup> COPCA=Coping With and Caring for Infants With Special Needs program, TIP=traditional infant physical therapy.

<sup>b</sup> IVH=intraventricular hemorrhage (grading according to Volpe<sup>55</sup>); PVL=periventricular leukomalacia (grading according to de Vries et al<sup>56</sup>).

<sup>c</sup> Levels of education: low=primary education/junior vocational training, middle=secondary education/senior vocational training, high=university education/vocational colleges. High vs middle + low education; chi square,  $P<.05$ .

trial.<sup>31,34–36</sup> The problems with the randomized controlled trial design in this area may be attributed to the multifactorial nature of the interventions applied and the extraneous influences and to the interaction of the intervention with personal and environmental factors.<sup>34</sup> Therefore, we embarked on the process analysis of pediatric physical therapy. We developed a standardized way to quantify the contents of physical therapy sessions.<sup>11</sup> This type of information is urgently needed, as a previous study revealed that what therapists actually do during treatment differs from what they think they are doing.<sup>11</sup> Therefore, the aims of the present study were: (1) to examine whether it is possible to implement the concepts of COPCA in daily physical therapist practice by specially trained pediatric physical therapists and (2) to determine whether

the practical content of COPCA sessions differs from that of TIP sessions in the Netherlands.

### Method Participants

Forty-six infants who had been admitted to the neonatal intensive care unit of the University Medical Center Groningen, Groningen, the Netherlands, between March 2003 and May 2005 and who had definitely abnormal general movements (GMs) at the age of 10 weeks corrected age (CA) were included in the study. General movement assessment was carried out by the senior author (M.H.A.) and a neonatologist (A.F.B.), who agreed on the infant's GM quality. The presence of definitely abnormal GMs indicates a high risk for developmental disorder, including CP.<sup>37</sup> Infants with severe congenital anomalies and infants

whose caregivers had insufficient understanding of the Dutch language were excluded from the study. All caregivers of the infants signed an informed consent statement.

Block randomization (full-term infants, blocks of  $n=2$ ; preterm infants, blocks of  $n=12$ ) allocated 21 infants to the experimental COPCA group and 25 infants to the control group. The infants who were randomized into the control group received TIP on indication of the pediatrician. As a result, 22 infants were referred to TIP, and 3 infants did not receive physical therapy. Each group contained 2 full-term infants; the other infants had been born preterm at gestational ages that varied from 25 to 36 weeks. Details of perinatal and social characteristics of both groups are provided in Table 2.

The randomized intervention was provided at between 3 and 6 months CA. The COPCA sessions were performed twice a week for 1 hour in the home environment by one of 4 COPCA coaches. The COPCA coaches were certified and registered pediatric physical therapists who had received specific education in the COPCA program. The educational curriculum of a COPCA course starts with 2 days of training in basic COPCA principles. These 2 days include discussions of videos of recent intervention sessions carried out by participants. Discussion of the videos allows for clarification of key characteristics of COPCA and the differences between COPCA and TIP. After the introductory 2 days, training proceeds with 4 one-day sessions with an interval of 6 weeks. During the interval, coaches-in-training videotape their own intervention activities. Again, the videos are the starting point for discussion of how the principles of COPCA may be applied in daily practice. The COPCA curriculum also involves obligatory reading. During the study,

COPCA coaches continued to receive supervision from the first author. In earlier phases of their careers, 3 of the 4 COPCA coaches had completed the NDT basic and infant course based on NDT principles. Seventeen pediatric physical therapists were involved in the TIP sessions. Sixteen of them had completed the basic and infant treatment course based on NDT. The frequency of TIP sessions varied from 2 to 28 times (median=9), and their duration varied from 12 to 50 minutes (median=29). The great majority of TIP sessions also were carried out in the home environment (n=20 [91%]). Therapists for both groups had at least 5 years of experience in treating infants and children with special needs. None of the infants received additional forms of therapeutic guidance.

### Video Recording and Video Analysis

At 4 and 6 months CA, a video recording of a physical therapy session was made. To minimize intrusion, the camera was positioned as far away from the therapist and infant as possible. Albrecht and coworkers<sup>38</sup> demonstrated that video recording scarcely affects the behavior of the people being filmed. In the COPCA group, 1 recording was missing at 4 months and 3 recordings were missing at 6 months due to logistical difficulties. In the TIP group, 1 recording was missing at 4 months (due to logistical difficulties), and 1 recording was missing at 6 months (treatment had already stopped). This process resulted in 41 video recordings at 4 months (COPCA group, n=20; TIP group, n=21) and 39 recordings at 6 months (COPCA group, n=18; TIP group, n=21).

Two people analyzed the contents of the sessions with a standardized observation protocol for the classification of physical therapy actions.<sup>11</sup>

Both assessors were blinded to group allocation. The analysis was performed with a Noldus software program (The Observer, version 5.0\*), a program specifically designed for behavioral observation. The program allows for the quantification of the duration, frequency, and serial order of defined actions. The therapeutic actions defined in the protocol reflect the specific components of COPCA and TIP (Appendix). The observation protocol classifies physical therapy actions into 8 main categories:

- (A) Family involvement and educational actions;
- (B) Communication;
- (C) Handling techniques;
- (D) Sensory experience;
- (E) Passive motor experience;
- (F) Self-produced motor behavior, no interference from physical therapist or caregiver;
- (G) Challenge to self-produce motor behavior where infant is allowed to continue activity; and
- (H) Challenge to self-produce motor behavior that flows over into therapeutic handling.

In addition, the position of the infant and the amount of postural support the infant received during the physical therapy actions were scored. The majority of outcome parameters resulted in relative amounts of time spent on physical therapy actions. Items from sections 1 to 3 of category A (Family involvement and educational actions, A1 to A3) were categorical data. Categories A and B describe aspects of family involvement and educational interaction in the intervention programs. In Categories C to H, the position and postural support parameters deal with

the neuromotor components of treatment.

Previously, we demonstrated that inter-assessor and intra-assessor agreement with the protocol were satisfactory.<sup>11</sup> The intraclass correlation coefficients on the relative duration of actions ranged from .76 to 1.00 for inter-assessor agreement and from .69 to .99 for intra-assessor agreement.<sup>11</sup> The assessors who participated in the reliability study also assessed the videos of the current study.

### Data Analysis

Statistical analyses were performed using the SPSS computer package (version 14.0).<sup>†</sup> Nonparametric statistics were used because none of the variables were normally distributed. The effect of age was assessed with the Wilcoxon signed rank test. Differences between COPCA and TIP were evaluated with a repeated-measures analysis of variance based on ranks or a chi-square test. Differences with a *P* value of <.05 were considered statistically significant.

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## Results

### Family Involvement and Educational Components of Intervention

The caregivers were involved in both types of intervention, albeit in different ways. During TIP sessions, caregivers were engaged especially in handling, and during COPCA, they were engaged in playing (Tab. 3). The difference in approach between

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\* Noldus Information Technology, PO Box 268, 6700 AG, Wageningen, the Netherlands.

† SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

## An Early Intervention Program for Infants at High Risk for Developmental Motor Disorders

**Table 3.**

Family Involvement During Coping With and Caring for Infants With Special Needs Program (COPCA) and Traditional Infant Physical Therapy (TIP) Sessions

Intervention	4 Months		6 Months	
	COPCA Group (n=20)	TIP Group (n=21)	COPCA Group (n=18)	TIP Group (n=21)
<b>Family involvement</b>				
<b>A.1</b> Family members involved in intervention session				
— Mother present only	13	13	15	11
— Father present only	1	1	2	0
— Both caregivers present, no other family members	4	3	1	3
— In addition to parents, other family members present <sup>a</sup>	2	4	0	7
<b>A.2</b> Role of parent, caregiver <sup>b</sup>				
— Physical therapist performs treatment by means of handling	1	15	0	15
— Physical therapist performs treatment (handling), and parent guides attention of infant	0	5	0	5
— Parent performs treatment by means of handling; physical therapist instructs how to handle	0	1	0	1
— Parent and physical therapist act together (hands-off); parent is playing with the infant; physical therapist observes parent-infant relationship; parent gives ample opportunities for exploration	13	0	14	0
— Parent is playing with infant (hands-off), ample opportunities for exploration	6	0	4	0
<b>A.3</b> Infant dressing <sup>c</sup>				
— Dressed	15	5	9	6
— Partially dressed	4	5	6	5
— Undressed (wearing underwear only)	1	11	3	10

<sup>a</sup> In the current study, the other people present were always grandparents.

<sup>b</sup> Role of parent, caregiver: small (first 3 categories) vs large (last 2 categories); chi square,  $P < .001$ .

<sup>c</sup> Infant dressing; chi square for trend,  $P < .001$ .

COPCA and TIP also was reflected in the way the child was dressed: infants were more often undressed during TIP than during COPCA, a difference that reached statistical significance at 4 months (Tab. 3). In both types of intervention, mothers usually were present during treatment sessions.

The time spent on various educational actions varied widely (Tab. 4, Figure). Age had only a minimal effect on family involvement and educational actions; therefore, we pooled the 4- and 6-month data for the evaluation of the differences between COPCA and TIP (Tab. 4).

More time was spent on educational actions during COPCA sessions (median value=16%) than during TIP sessions (median value=4%) ( $P < .001$ ). Not only did the duration of educational actions differ between the 2 treatments, but the contents also varied. During TIP sessions, educational actions more often consisted of actions during which the therapist interfered with the infant's activities, that is, corrected, interrupted, or facilitated the infant's activities. During COPCA sessions, most of the time was spent on coaching the caregivers, whereas this form of guidance did not occur in the TIP group ( $P < .001$ ).

In both groups, an equal amount of time was spent on communication. However, differences were present in the contents of the communication, especially in the type of information provided by the therapist (Tab. 4, Figure). During TIP sessions, the focus was on explaining facilitation (hands-on/hands-off) and the use of handling techniques including hand placing, tone influencing, asymmetry or symmetry, and typical movement patterns. During COPCA sessions, the emphasis was on explaining the importance of self-produced (hands-off) motor behavior, variation, the role of minimal support, exploration, and trial and



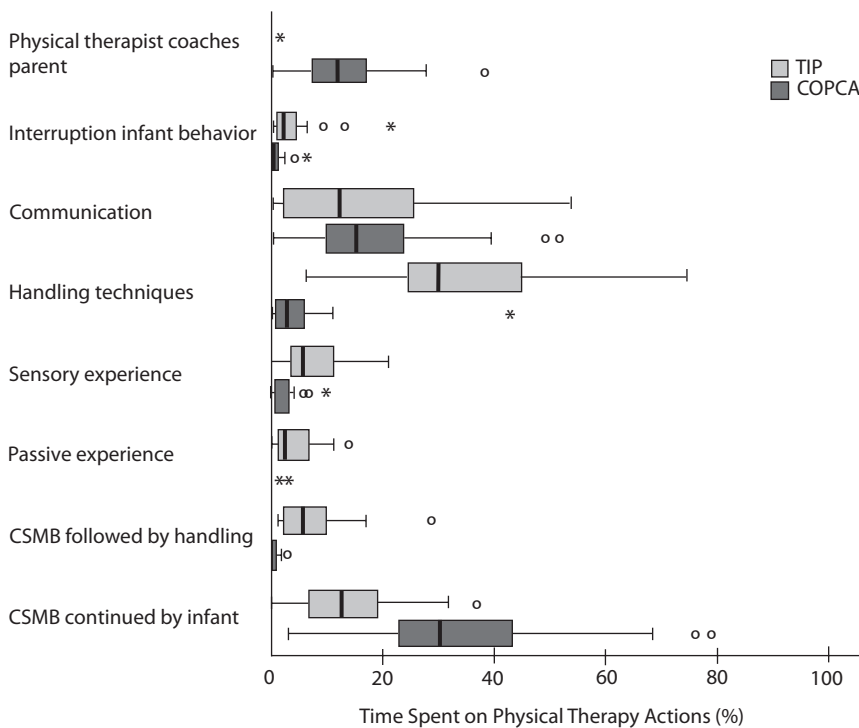
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**Table 4.**

Contents of Traditional Infant Physical Therapy (TIP) and Coping With and Caring for Infants With Special Needs Program (COPCA) Interventions at 4 and 6 Months Corrected Age: Percentage of Time Spent on Various Actions<sup>a</sup>

Intervention	TIP						COPCA					
	4 mo		6 mo		Pooled 4 and 6 mo		4 mo		6 mo		Pooled 4 and 6 mo	
	Median	Range (%)	Median	Range (%)	Median	Range (%)	Median	Range (%)	Median	Range (%)	Median	Range (%)
<b>Family involvement and educational component</b>												
<b>A.4</b> Educational actions	4.1	1–37	3.8	1–22	4.0	1–37	17.0	0–44	12.7	0–36	16.0*	0–44
– Caregiver interferes with infant’s activities	0.0	0–1	0.0	0–2	0.0	0–2	<b>0.3</b>	0–3	<b>0.9</b>	0–5	0.6*	0–5
– PT interferes with infant’s activities	2.1	0–32	2.0	0–17	2.1	0–32	0.4	0–8	0.2	0–7	0.2*	0–8
– PT guides the infant	0.0	0–10	0.2	0–10	0.2	0–10	0.0	0–7	0.0	0–0	0.0*	0–7
– PT gives caregiver training	0.1	0–13	0.0	0–5	0.0	0–13	0.0	0–3	0.0	0–1	0.0	0–3
– PT coaches the caregiver	0.0	0–1	0.0	0–1	0.0	0–1	12.4	0–43	11.3	0–35	11.9*	0–43
<b>B.</b> Communication	10.5	0–55	15.6	0–45	12.4	0–55	17.6	0–50	14.7	2–52	15.7	0–52
<b>B1.</b> Information exchange	1.6	0–16	1.3	0–14	1.4	0–16	1.8	0–9	0.9	0–9	1.3	0–9
<b>B2.</b> Contents of information												
– Developmental education	0.7	0–20	1.4	0–31	1.3	0–31	1.0	0–20	2.1	0–31	1.3	0–31
– Handling	0.4	0–10	0.3	0–14	0.4	0–14	0.0	0–1	0.0	0–0	0.0*	0–0
– Variation	0.0	0–1	0.3	0–14	0.0	0–1	1.6	0–9	0.5	0–8	1.3*	0–90
– ADL handling	0.0	0–10	0.0	0–5	0.0	0–10	0.0	0–0	0.0	0–0	0.0*	0–0
– ADL variation	0.0	0–0	0.0	0–0	0.0	0–0	0.0	0–2	0.0	0–7	0.0*	0–7
<b>B3.</b> Instruct												
– Assign	0.2	0–3	0.2	0–3	0.2	0–3	0.9	0–12	1.0	0–6	1.0*	0–12
– Give hints	0.0	0–4	0.0	0–1	0.0	0–4	<b>2.5</b>	0–11	<b>2.1</b>	0–5	2.3*	0–11
<b>B4.</b> Provide feedback	3.5	0–17	3.1	0–11	3.3	0–17	3.7	0–14	5.1	0–13	4.5	0–14
<b>B5.</b> Impart knowledge	2.3	0–17	1.4	0–10	1.7	0–17	<b>2.8</b>	0–14	<b>1.7</b>	0–9	1.7	0–14
<b>Neuromotor component</b>												
<b>C.</b> Facilitation techniques	31.7	5–74	28.1	7–54	28.6	5–74	2.6	0–43	3.3	0–11	2.9*	0–43
– Handling	16.0	4–57	16.5	3–42	16.3	3–57	0.4	0–32	0.3	0–4	0.4*	0–32
– Pressure techniques	6.3	0–25	5.3	0–24	6.2	0–25	0.0	0–5	0	0–8	0.0*	0–8
– Support device	0.0	0–25	0.0	0–15	0.0	0–25	0.0	0–5	1.8	0–5	0.0*	0–5
– Transition	3.6	0–17	4.0	1–16	3.8	0–17	1.8	0–5	0	0–1	1.8*	0–5
<b>D.</b> Sensory experience	8.5	1–21	6.1	0–36	6.1	0–36	1.9	0–11	1.7	0–7	1.8*	0–11
<b>E.</b> Passive motor experience	4.6	0–20	2.0	0–19	2.4	0–20	0.0	0–4	0.0	0–1	0.0*	0–44
<b>F.</b> Self-produced motor behavior; no interference	21.3	0–43	21.3	1–83	21.3	0–81	41.0	2–71	52.5	7–69	44.3*	2–71
<b>G.</b> Challenge to self-produce motor behavior; action continued by infant	15.9	0–32	12.3	2–38	13.2	0–38	35.2	3–81	30.8	17–70	31.0*	3–81
– Little variation	12.4	0–28	8.3	1–30	9.1	0–30	10.7	0–34	2.4	0–41	6.5	0–41
– Large variation	1.3	0–16	0.0	0–27	1.0	0–27	26.5	2–59	25.5	7–37	25.8*	2–59
<b>H.</b> Challenge to self-produce motor behavior with overflow into handling	<b>5.5</b>	1–25	<b>5.6</b>	1–37	5.6	0–37	0.0	0–6	0.0	0–5	0.0*	0–6
– Little variation	<b>4.9</b>	0–23	<b>3.7</b>	0–37	4.9	0–37	0.0	0–6	0.0	0–1	0.0*	0–6
– Large variation	0.0	0–25	0.0	0–6	0.0	0–25	0.0	0–1	0.0	0–4	0.0	0–4
<b>I.</b> Unspecified actions	1.9	0–13	3.5	0–11	3.2	0–13	2.9	1–9	3.1	1–9	3.1	1–9

<sup>a</sup> Bold type indicates a significant age effect; Wilcoxon signed rank test,  $P < .05$ . Differences between TIP and COPCA repeated-measures analysis of variance based on ranks; \* $P < .01$ . ADL=activities of daily living, PT physical therapist.



**Figure.** Data on the relative duration (%) of time spent on 8 categories of physical therapy actions during treatment sessions. The horizontal lines represent ranges, the boxes represent the interquartile ranges, and the vertical bold bars represent median values. CSMB=challenged spontaneous motor behavior, TIP=traditional infant physical therapy, COPCA=Coping With and Caring for Infants With Special Needs program. Asterisks indicate differences ( $P<.01$ ) between COPCA and TIP; small circles denote outliers.

error. The COPCA coaches more often used the strategy of “suggesting opportunities” than did therapists in the TIP group.

### Neuromotor Components of Intervention

The application of physical therapy at 4 and 6 months was characterized by heterogeneity (Tab. 4). The relative duration of the majority of physical therapy actions in both groups at 4 months did not differ significantly from that at 6 months (Tab. 4). The only exception was a slight increase for “Challenge to self-produce motor behavior with overflow into therapeutic handling” in the TIP group from 4 to 6 months. In light of the minimal effect of age, we considered it justified to pool 4- and 6-month data in our evaluation of the differ-

ences between COPCA and TIP (Tab. 4, Figure).

During TIP sessions, most of the time was spent on facilitation (median value=28%), especially on handling. Handling techniques were almost absent in the COPCA group (median values: TIP group=16.3%, COPCA group=0.4%), meaning that the difference in time spent on handling techniques between TIP and COPCA sessions was highly significant ( $P<.001$ ). The difference in handling also was present in the subgroup of 10 infants who developed CP (median values: TIP group=13.5%, COPCA group=1.5%;  $P<.01$ ). During TIP sessions, a substantial amount of time also was spent on granting the infant time to produce motor behavior by himself or herself,

either entirely spontaneously (21%) or challenged (13%). During COPCA sessions, even more time was spent on granting the infant time to produce motor behavior by himself or herself, either entirely spontaneously (44%; difference with TIP:  $P<.001$ ) or challenged (31%; difference with TIP:  $P<.001$ ). We noted a qualitative difference between the 2 groups during the periods of entirely spontaneous activity. In the TIP group, this finding meant that the infant was left unattended while the therapist and caregivers were engaged in communication. In the COPCA group, this finding meant that the therapist and caregivers observed and discussed the infant’s activities. When the infants during COPCA sessions were challenged by toys or the face of the physical therapist or caregiver to explore their own movement possibilities, considerably more variation was used than during TIP sessions (median values: COPCA group=26%, TIP group=1%;  $P<.001$ ). During COPCA sessions, little time was spent on challenging of motor behavior flowing over into handling techniques, sensory stimulation, and passive experiences; these actions occurred significantly less often than during TIP sessions (Tab. 4, Figure).

The position of the infant during treatment varied with treatment type and age. With increasing age, infants were somewhat less frequently treated in the supine position and more often treated in prone and sitting positions (Tab. 5). The age-related increase in time spent in the prone position occurred in both groups, but the increase in time spent in the sitting position occurred only in the TIP group, as sitting already was applied frequently at an early age in the COPCA group. During TIP sessions, infants were treated significantly more often in the supine position with the pelvis slightly lifted and in the prone posi-

**Table 5.**

Infant Position and Degree of Postural Support in Sitting During Traditional Infant Physical Therapy (TIP) and Coping With and Caring for Infants With Special Needs Program (COPCA) Sessions: Percentage of Time Spent in Various Positions<sup>a</sup>

Position	TIP					COPCA				
	4 Months <sup>b</sup>		6 Months <sup>b</sup>			4 Months		6 Months		
	Median	Range (%)	Median	Range (%)	P Value for Age Effect	Median	Range (%)	Median	Range (%)	P Value for Age Effect
Supine with pelvis not lifted	38.9	2–66	27.9	5–60	.070	45.6	7–92	34.3	0–55	.680
Supine with pelvis slightly lifted	16.5	0–47	9.5	0–32	.210	0.0**	0–27	0.0**	0–7	.070
Prone	<b>15.6</b>	7–35	<b>29.4</b>	12–43	.002	<b>5.6**</b>	0–29	<b>14.2*</b>	0–38	.008
Side lying	5.6	0–43	4.0	0–15	.200	3.8	0–27	5.5	0–33	.950
Sitting	<b>14.5</b>	3–83	<b>25.3</b>	9–50	.020	36.7**	0–72	44.9**	5–85	.280
Sitting with no support	<b>0.0</b>	0–0	<b>0.0</b>	0–2	.002	<b>0.0</b>	0–5	<b>0.4*</b>	0–15	.002
Sitting with minimal support	<b>0.3</b>	0–9	<b>3.5</b>	0–32	.030	13.6**	0–42	19.8**	1–48	.150
Sitting with clear support	5.9	0–32	11.6	0–41	.100	17.6*	0–38	10.2	1–26	.230
Sitting with full support	7.0	0–42	4.0	0–32	.470	1.4	0–25	1.4	0–34	.520

<sup>a</sup> Repeated-measures analysis of variance based on ranks. Bold type indicates a significant age effect,  $P < .05$ . Differences between COPCA and TIP: \* $P < .05$ , \*\* $P < .01$ .

<sup>b</sup> Months corrected age.

tion than during COPCA sessions; this finding was true for both ages. During COPCA sessions, infants were more often placed in sitting position, particularly at 4 months. It is well known that young infants need postural support during sitting. It was interesting, therefore, to note that during COPCA, more time was spent on sitting with minimal support (Tab. 5).

### Discussion

The present study demonstrated that the contents of COPCA and TIP sessions differed widely, suggesting that it is possible to implement COPCA in daily practice by pediatric physical therapists who have received special training in the COPCA program. The differences found correspond to the theoretical frameworks of the 2 approaches. They included differences in the approach to families, the role of the caregiver and pediatric physical therapist, the application of educational actions toward the infant, and activities to stimulate the infant’s sensorimotor development.

### Physical Therapy Considerations

The videos of the intervention sessions illustrated that what theory describes does not perfectly match to how service providers work in daily practice. The videos of the COPCA sessions indicated that caregivers took care of or played with the infant (in a hands-off manner) to provide the infant with ample opportunities for self-exploration regardless of the presence of atypical behavior. The COPCA coach encouraged the caregivers to discover their own problem-solving strategies by listening, observing, and suggesting options during the intervention. In contrast, therapists in the TIP group usually treated the infant using therapeutic handling techniques in a hands-on/hands-off manner. The observed treatment strategies corresponded to the practical descriptions of baby treatment based on NDT principles by Bly.<sup>14</sup> During the treatment, the therapist provided parents with references about what he or she was doing: why the infant needed specific handling and how and what parents could do in daily

practice. Indeed, the videos corroborated the important distinctions between COPCA and TIP on the role of the therapist and the family: (1) in COPCA, the role of the family is not restricted to parental involvement in the decision making in terms of functional treatment goals and management of the infant at home, and (2) COPCA refrains from teaching caregiver intervention techniques.<sup>39–41</sup>

Our data on the daily practice of therapists who use the TIP approach indicate that typical therapeutic guidance in the Netherlands in general is characterized by child-focused care with a unilateral dominance of the professional in determining the functional actions in treatment. Thus, the TIP approach corresponds to direct teaching activities of the infant, which is in line with the findings of McBride and Petersen on the role of the interventionist in home-based early intervention.<sup>4</sup> The discrepancy between current theory (family focus) and daily practice matches the findings of O’Neil and Palisano,<sup>42</sup> which indicated that

therapists, who acknowledged the importance of family-centered services, focused their professional attention on the child's impairment.

We propose that the critical determinant for family-centered services, as suggested by COPCA, is family autonomy. This proposition implies that professionals should step back and restrict their role to coaching. In COPCA, the family is the center point of the service delivery process, and relationships between parents and professionals are based on equal partnership.<sup>6</sup>

The differences observed in activities to stimulate the infants' sensorimotor development between the 2 groups correspond to the theoretical frameworks of the 2 approaches, including the differential application of the framework of NGST. The videos demonstrated that the COPCA approach creates a rich and varied world of opportunities, allowing the infant to explore variable motor behavior (hands-off) with or without atypical behavior.

A case in point is the challenge of postural behavior by the provision of as little support as possible. Preliminary results of a study on the effect of COPCA and TIP on postural development in early infancy suggest that COPCA may enhance the selection of a functional postural strategy.<sup>43</sup> The TIP approach also aims at facilitating motor behavior produced by the infant; however, our study indicated that therapists in the TIP group frequently incorporated techniques of handling with carefully graded stimulation (hands-on). The therapists in the TIP group applied age-related positions such as prone and sitting to prepare the infant's motor capacities for a specific function. This approach was reflected, for instance, in the use of treatment in the supine position with the pelvis slightly lifted during TIP sessions,

whereas this type of positioning was virtually absent during COPCA sessions. This specific handling technique aims to facilitate component goals such as elongation of the spinal extensors and shoulder flexion with elbow extension and functional goals such as reaching and grasping in the midline.<sup>14,44</sup> The positioning also is used to influence muscle tone. It should be noted, however, that the question of how increased muscle tone is related to activity limitations and postural control is a matter of debate.<sup>45-47</sup> Analogous to the findings in the family care domain, our findings in the neuromotor domain match those of O'Neil and Palisano.<sup>42</sup> Despite the presence of a shift to more functional therapy, therapists in infant treatment generally pay more attention to movement quality than to functionality to achieve a better long-term outcome.<sup>14,15</sup>

### Methodological Considerations

The major strength of the study is the standardized, video-based analysis of the contents of the 2 forms of infant physical therapy that allows for quantification of differences between the 2 approaches. Other strengths of the study lie in the identical ages of the infants at inclusion in the study and at video assessment and identical limitations at study entry, that is, the presence of definitely abnormal GMs. The presence of definitely abnormal GMs at 3 months postterm is associated with a high risk of developmental motor disorders such as CP.<sup>37,48</sup>

It may be regarded a weakness of the study, however, that only about a quarter of the infants developed CP (Tab. 2). This is not an unusual situation in infants treated because of high biological risk for developmental disorders. In addition, it should be realized that most of the children who did not develop CP showed the complex form of minor neuro-

logical dysfunction at 18 months, which puts them at risk for learning and behavioral disorders.<sup>49</sup> Children with minor forms of neurological dysfunction also may benefit from early intervention.<sup>16,50</sup> The outcome data of our randomized trial indicated that children with CP may benefit more from physical therapy actions according to the principles of COPCA than children without CP.<sup>31,36</sup>

It may be well thought a weakness of the study that the therapists who applied COPCA had received specific COPCA training shortly before the study started, whereas training of the therapists who applied TIP had taken place at longer and more variable periods prior to the beginning of the study. Nevertheless, the great majority of therapists who applied TIP received certified NDT training, including an infant treatment course. It is well known that therapists practicing NDT develop a personal, eclectic approach as their experience increases.<sup>51</sup> This development was reflected in the variation in percentage of time spent on specific actions during the treatment sessions—a variation that partly blurred the contrast between TIP and COPCA. Yet, by using a control group of therapists applying regular TIP, we were able to demonstrate that the contents of COPCA sessions differed from currently practiced infant physical therapy in the Netherlands.

Another limitation of the study was the different number of interventionists in the 2 groups. The substantially larger number of therapists in the TIP group may have resulted in a larger heterogeneity in actions in the TIP group than in the COPCA group. The heterogeneity in the TIP group reflects how home-based early intervention in the Netherlands is provided. The 2 methodologically superior alternatives (ie, having a TIP



group with only 4 therapists or a COPCA group with about 17 therapists), however, were not feasible.

The difference in treatment frequency may be regarded as another limitation, as frequency of treatment has been associated with outcome.<sup>52</sup> At the time of the study, the current design had the highest level of feasibility. In our analysis of the effect of intervention, we took frequency of treatment into account.<sup>36</sup>

Infant physical therapy differs across countries and varies with the cultural context of families. These differences mean that the findings of the present Dutch study cannot immediately be generalized to other countries.

The randomized design of the study was associated with a high degree of similarity for both groups of infants (Tab. 2). Despite randomization, the level of maternal education differed between the 2 groups. This difference may be considered a weakness of the study, as contents of a treatment session may be affected by the level of maternal education.

## Conclusions

Bertha and Karl Bobath were well aware of the possibility of future progress in ideas on family care and motor development. They encouraged therapists to incorporate new ideas into daily application of therapy. In a way, it could be said that the authors of the COPCA program followed the advice of the Bobaths: they developed COPCA. The current study indicates that COPCA and TIP, which is largely based on NDT, differ widely in the Netherlands.

Our study underscores the notion that the application of standardized, computer-based video analysis of treatment sessions is an invaluable tool in the understanding of the daily practice of pediatric physical ther-

apy. Evaluation of the videos taught us that physical therapists often do things other than what they think or say they are doing.<sup>11</sup> This finding means that only the evaluation of real action and communication can provide insight into the reality of practice.

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## Appendix.

Observation Protocol: Classification of Pediatric Physical Therapy Actions

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The physical therapy actions are classified into 8 main categories that contain various subcategories (second level of observation). For each specific action, one or more examples of concrete physical therapist or caregiver actions are provided (third level of observation).

### A. Family involvement and educational actions

The extent to which the family is involved in the treatment of the infant and the extent of guidance, interference, coaching, or training by the physical therapist or the caregiver during the treatment session.

#### A.1 Family members participating in guidance of infant<sup>a</sup>

Family members involved in the treatment session.

##### Examples of concrete actions:

- Mother present only.
- Father present only.
- Both caregivers but no other family members present.
- In addition to parents, other family members also present.

#### A.2 Role of caregiver<sup>a</sup>

The extent to which the family is involved in the treatment.

##### Examples of concrete actions:

- Physical therapist performs treatment by means of handling techniques.
- Caregiver and physical therapist act together in handling techniques; the physical therapist performs the treatment (hands-on) while the caregiver guides the attention of the infant.
- Caregiver performs handling techniques, thereby controlling the infant's actions. The physical therapist instructs the caregiver in how to handle.
- Caregiver and physical therapist act together (hands-off); caregiver is playing with the child and may provide the infant with minimal support but leaves the infant always with ample opportunities for exploration. Physical therapist observes the caregiver-infant relationship and may give hints.
- Caregiver is playing with the infant (hands-off) and leaves the infant with ample opportunities for exploration.

#### A.3 Infant dressing<sup>a</sup>

The way in which the infant is dressed during the treatment session.

##### Examples of dressing:

- Infant is dressed.
- Infant is partially dressed.
- Infant is undressed (wearing underwear only).

#### A.4 Educational actions

A.4.1 The extent of interference by the physical therapist or the caregiver with the infant's activities.

##### Examples of concrete actions:

- Physical therapist or caregiver interrupts activities of the infant.
- Physical therapist or caregiver corrects when the infant fails.
- Physical therapist or caregiver assists when the infant has difficulties performing an action.

(Continued)

### Appendix.

Continued

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#### A.4.2 The extent of guidance of the infant by the physical therapist

##### Examples of concrete actions:

- Physical therapist creates motor situations without challenge (eg, presents toys at close distance, easy to grasp).
- Physical therapist provides excessive postural support or assistance.
- Physical therapist trains motor performances on the basis of chronological age and on the basis of the infant's capacities.

#### A.4.3 Caregiver training

All actions during which the physical therapist instructs caregivers on how to handle the infant, with the aim being that caregivers can continue treatment strategies during daily life activities or in the home environment. The physical therapist (teacher) provides parents with references about what he or she is doing or what a parent could do while the therapist treats the infant (hands-on).

##### Examples of concrete actions:

- Physical therapist demonstrates therapeutic handling action to caregiver.
- Physical therapist demonstrates action to caregiver; variable options provided.
- Physical therapist practices with caregivers, teaching them how to continue some of the handling techniques in daily life at home.

#### A.4.4 Caregiver coaching

All actions during which the physical therapist coaches the caregiver. Coaching aims to empower caregivers so that they can make their own educational decisions during daily care activities in the home environment. The coach listens, informs, and observes (hands-off) while the caregiver is involved in daily routines with the child, including play, thereby creating a situation in which caregivers feel free to explore and discuss alternative strategies.

##### Examples of concrete actions:

- Caregiver patiently observes the infant's actions.
- Caregiver challenges motor performances just at the limit of the infant's abilities.
- Caregiver provides as little postural support as possible; challenges postural behavior of the infant.
- Caregiver tries to evoke pleasure in the infant.

### **B. Communication**

All communication between the physical therapist and the caregiver that is related to the guidance of infant and family.

#### **B.1 Information exchange**

All communication during which information is exchanged regarding experiences, worries, and the role of the physical therapist.

##### Examples of concrete actions:

- Physical therapist provides opportunity for caregivers to tell about experiences related to the neonatal intensive care unit stay and to express worries and concerns about the infant and family matters.
- Physical therapist provides information about the role of physical therapist and caregiver.
- Physical therapist asks whether specific problems exist.

*(Continued)*



## Appendix.

Continued

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### **B.2 Contents of information**

All communication that explains the background of the treatment strategies, including developmental education.

#### Examples of concrete actions:

- Physical therapist explains handling in terms of typical movement patterns, typical development, posture, muscle tone, asymmetry or symmetry, and hand placing.
- Physical therapist explains the need for variation, minimal support, exploration, trial and error, challenge, and patience.
- Physical therapist explains the need to explore communication.
- Physical therapist discusses the application of intervention strategies to daily routines in terms of handling.
- Physical therapist discusses the application of the intervention to daily routines in terms of variation, exploration, and motor challenge.

### **B.3 Instruct**

All communication in which the caregiver is given assignments or hints regarding treatment strategies.

#### Examples of concrete actions:

- Physical therapist assigns, gives advice what to do.
- Physical therapist gives hints, provides a suggestion or clue in a very indirect way so that caregivers feel free to explore ample variable opportunities.

### **B.4 Provide feedback**

All communication in which the treatment or the performances of infant and caregiver are evaluated.

#### Examples of concrete actions:

- Physical therapist tells the caregiver what went right or wrong.
- Physical therapist evaluates the procedure.
- Physical therapist asks and listens to the opinion of the caregiver.

### **B.5 Impart knowledge**

All communication that provides the caregiver with knowledge about the therapeutic actions that are performed.

#### Examples of concrete actions:

- Physical therapist asks about performance action.
- Physical therapist explains the ins and outs of an action.
- Physical therapist asks about understanding.
- Physical therapist asks about ability of caregiver to perform an action and listens to caregiver's comments on actions.

## **C. Facilitation techniques**

All therapeutic hands-on actions of the physical therapist or caregiver aimed at guidance of movement or maintenance of the infant's posture by gently placing the hands on specific parts of the infant's body, thus providing the infant with sensorimotor experience and controlling movement output.

*(Continued)*

**Appendix.**

Continued

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**C1. Handling**

Specific hands-on techniques to give the infant sensorimotor experience to improve the quality and repertoire of the infant's movements.

Examples of concrete physical therapist or caregiver actions:

- In supine or sitting position. Shoulders function as key point: handler's hands guide shoulders of the infant in protraction to control tone and to facilitate hand-hand contact and symmetry.
- In supine position. Proximal or distal leg functions as key point: the infant's hip is passively brought into semi-flexion while adducting the leg across the midline to facilitate head righting and rolling.
- In supine position. Pelvis functions as key point: the infant's pelvis is slightly lifted to elongate the extensor muscles of the trunk and to control tone; in this way, hand-foot contact and symmetry are facilitated.
- In prone position. Shoulder functions as key point: the arms are placed in puppy position to facilitate head righting, midline orientation, and body alignment.
- In sitting position. Shoulder functions as key point: the shoulders are moved alternately forward and backward to dissociate and facilitate independent arm movements.

**C.2 Pressure techniques**

All handling techniques that produce intermittent pressure to stimulate and gain control over muscle tone, posture, and movement.

Examples of concrete physical therapist or caregiver actions:

- In a sitting position: intermittent downward pressure on shoulders in the direction of the pelvis to facilitate extension of the trunk.
- In a sitting position: slight intermittent pressure movements on abdominal region in direction of the sacrum to facilitate contraction of the ventral muscles.

**C.3 Transition**

All handling techniques that result in the change of position of the infant.

Examples of concrete physical therapist or caregiver actions:

- From supine to side, from supine to prone, from supine to sitting, from side to sitting, from prone to supine, from sitting to supine, and so on.

**C.4 Support devices**

All handling techniques that use additional devices to support the infant.

Examples of concrete or additional devices:

- Bolster or ball.
- Supporting sling.

**D. Sensory experience**

All tactile and vestibular stimulation given to the infant during treatment—without the aim of facilitation, tapping, or passive motor experience—to provide him or her with the perception of body awareness.

Examples of concrete physical therapist or caregiver actions:

- Touching skin with toy.
- Tickling.
- Tapping on muscles.

*(Continued)*

**Appendix.**

Continued

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**E. Passive motor experience**

All handling techniques induced by the physical therapist or the caregiver in which no activity of the infant is required in the performance of the actions.

Examples of concrete physical therapist or caregiver actions:

- Passive movements of arms.
- Repetitive movements of the upper arm toward (frontal) support surface.
- Passive rocking, small sideways movements.

**F. Self-produced motor behavior, no interference from physical therapist or caregiver**

All actions during which the infant is given ample opportunities to explore toys or other aspects of the environment or his or her body, without interference from the physical therapist or caregiver.

Examples of concrete physical therapist or caregiver actions:

- Placing an infant activity play center over the infant and letting the infant explore the effect of movements of arms, hands, legs, and feet.
- Infant is given opportunity for spontaneous exploration with or without toy.
- Postural challenges; infant spontaneously explores postural capacities.

**G. Infant is challenged to produce motor behavior by himself or herself; infant is allowed to continue activity by himself or herself**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver to experience a variety of motor activity that is continued by the infant himself or herself.

**G.1 Little variation**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver to explore one strategy to reach and grasp, to control posture, to roll, and so on.

**G.2 Large variation**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver; the infant is challenged to explore multiple strategies to reach and grasp, to control posture, to roll, and so on.

**H. Infant is challenged to produce motor behavior by himself or herself; activity flows over into therapeutic handling**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver to experience a variety of motor activity that is followed by a handling technique.

**H.1 Little variation**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver to explore one strategy for reaching and grasping, for controlling posture, for rolling, and so on.

**H.2 Large variation**

All actions in which the infant is challenged by toys or the face of the physical therapist or caregiver; the infant is challenged to explore multiple strategies for reaching and grasping, for controlling posture, for rolling, and so on.

*(Continued)*

**Appendix.**

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**I. Not specified**

All time during the treatment session that cannot be classified into the 8 defined categories.

Examples:

- Comforting the infant.
- Changing the treatment situation.

**Postural support in prone, side-lying, and sitting positions**

— **No postural support:**

Physical therapist or caregiver leaves it to the infant to adjust posture independently (hands-off).

— **Minimal postural support:**

Physical therapist or caregiver provides as little support as possible in order to challenge postural behavior of the infant.

Example of concrete action:

- Physical therapist or caregiver challenges motor performance just at the verge of the infant's abilities (ie, the infant has to "work" to maintain balance).

— **Clear postural support:**

Physical therapist or caregiver provides support on multiple parts of the body or the trunk. Minimal active involvement of the infant to adjust posture is required.

Example of concrete action:

- Physical therapist or caregiver provides support at the neck and shoulder girdle or upper part of the trunk.

— **Full postural support:**

Physical therapist or caregiver supports all parts of the body of the infant that play a role in postural adjustments. No active involvement of the infant is required.

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<sup>a</sup> Independent variable: the value of this variable is not supposed to change during the course of an observation. It gives the observer the opportunity to summarize briefly the important characteristics of the observation.