Original Article

Dominican Children with HIV not Receiving Antiretrovirals: Massage Therapy Influences their Behavior and Development

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Forty-eight children (M age = 4.8 years) infected with HIV/AIDS and living in the Dominican Republic were randomly assigned to a massage therapy or a play session control group. The children in the massage therapy group received two weekly 20-min massages for 12 weeks; the children in the control group participated in a play session (coloring, playing with blocks) for the same duration and length as the massage therapy group. Overall, the children in the massage therapy group improved in self-help abilities and communication, suggesting that massage therapy may enhance daily functioning for children with HIV/AIDS. Moreover, the HIV infected children who were six or older also showed a decrease in internalizing behaviors; specifically depressive/anxious behaviors and negative thoughts were reduced. Additionally, baseline assessments revealed IQ equivalence below normal functioning for 70% of the HIV infected children and very high incidences of mood problems (depression, withdrawn) for 40% of the children and anxiety problems for 20% of the children, suggesting the need for better monitoring and alternative interventions in countries with limited resources to improve cognition and the mental health status of children infected with HIV/AIDS.

Keywords: children – behavior, development – HIV – massage

Introduction

Epidemiology of HIV and HAART

In the United States, and other countries that have wide availability to highly active antiretroviral therapy (HAART), the mortality rate associated with HIV/AIDS has been reduced appreciably, as has disease progression and morbidity (1,2). However, in developing countries where HAART is not widely available, HIV continues to pose grave health, developmental and psychosocial risks, especially for young children.

The Dominican Republic, a Carribean island that shares borders with Haiti, has one of the highest HIV prevalence rates (2.3% of adults), with HIV/AIDS being the leading cause of death for women of child-bearing age (3). Although the mother-to-child transmission of HIV infection in the Dominican Republic has been significantly reduced in the last few years through nevirapine and zidovudine (4,5), it is estimated that at least 5000 children under 15 years of age are currently infected with HIV and over 33 000 Dominican children are currently orphaned as a result of HIV/AIDS (6).

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An earlier study by our group on a sample of Dominican children infected with HIV and not receiving HAART revealed that 30% had impaired motor/sensory abilities and 70% had lower mental functioning scores (7). In a subsequent study that assessed the intellectual development of a sample of Dominican children under 11 years of age infected with HIV, close to 60% of the children tested classified as having significant mental retardation (8). Perhaps this is not surprising given that HIV invades the central nervous system, which places very young children infected with HIV at risk for (i) impaired cognitive and motor functioning (9,10), although the degree of impairment varies (11) (ii) language/communication problems (12) and (iii) mood and behavioral disorders (13,14).

In individuals with HIV infection, the restoration of immune function associated with HAART appears to attenuate many of the impairments reported in the preceding paragraph (for a review see 15). One reason for the improvement following HAART may be that boosting the immune system reduces physical symptoms associated with HIV, and this in turn facilitates improved quality of life, which may improve cognitive and affective symptoms (15).

Overall, children with HIV who are not receiving HAART appear to experience greater delays and have higher morbidity and mortality rates than HIV infected children receiving HAART treatment (16,17). Without HAART, children who have acquired the HIV virus are likely to experience a dysregulated immune system, which raises the risk for opportunistic infections and deterioration of health. The immune dysregulation may, in part, explain the impairments and deficits in physical and mental development reported for children with HIV infections.

Massage Therapy and the Immune System

Massage therapy, an alternative and complementary intervention consisting of rubbing, kneading, squeezing and stretching of muscles, has not been traditionally prescribed for HIV or AIDS, although it has been shown to enhance immune functions and the physical development of individuals with varying medical conditions, including children and individuals with HIV (for a review see 18 and 19). For example, adolescents with HIV who received 3 months of twice-weekly massages showed increased CD4, CD4/CD8 ratio and Natural Killer (NK) cell number (20). The adolescents also reported feeling less anxious and less depressed. Increased NK cells have also been observed following massage therapy for adults with HIV (21) and women with breast cancer (22). A recent review paper posits that the mechanism of NK cell activation by massage therapy and other complementary and alternative medicine (CAM) agents is unknown but may relate to (i) increase of cytotoxic molecules in NK cells and/or (ii) up-regulation or activating NK cell

receptors or down-regulation of inhibitory NK cell receptors (23). In a recent pilot study, HIV infected Dominican children not on HAART who received massage therapy showed better immune preservation than a comparison group of HIV infected Dominican children (without access to HAART) assigned to a control group; the children in the control group showed an extensive decline in CD4 count and lymphocyte loss by the end of the study (24).

One possible mechanism for massage benefits on the immune system may include a reduction in cortisol, inasmuch as cortisol has been noted to destroy immune cells (20). Preserving immune function may be another mechanism involved in attenuating mental deficits and impairments in children with HIV. A third mechanism explaining massage effects may relate to increased vagal activity, which is associated with reduced sympathetic activity (25), and may relate to the improvements in mood and physical development. Additional support for massage benefits include a study reporting better motor development, habituation responses, autonomic stability and fewer stress behaviors for HIV exposed neonates who received daily massages for 10 hospital days (versus a group who received standard care) (26). In another study, aromatherapy massage was associated with an increase in peripheral blood lymphocytes and a decrease in CD4+/CD8+ ratio (27).

In the current study, we evaluated massage therapy as an alternative and complementary treatment for enhancing varying behavioral and developmental domains of pre-school Dominican children with HIV infection who were not yet receiving HAART. The impetus for focusing on Dominican children was that no studies have tested the effects of massage on the development of children without HAART living in resource-poor countries. In a preliminary study of a new cohort of pre-school Dominican children infected with HIV, we found that between 40 and 45% of the group displayed symptoms of anxiety, depression, somatization and externalizing problems (28) and showed delays in physical development (29). We hypothesized that Dominican pre-school age children infected with HIV would show improved mood, fewer behavioral problems, and enhanced development following massage therapy.

Method

Ethical Consideration

Full Institutional Review Board (IRB) approval and ethical approval were obtained for the study from the University of Miami's School of Medicine and the Children and Mothers' Research Center (CENISMI) at the Robert Reid Cabral Children's Hospital in the Dominican Republic. The Miami and the Dominican

Republic teams received certification and/or training prior to the study on the ethical conduct of human subjects research and vulnerable populations. The children were pre-school to early elementary age children (M age $= 59.3$ months old) infected with HIV and attending the immunology clinic of the largest pediatric hospital in the Dominican Republic (the Robert Reid Cabral Children's Hospital). At the time of this study (2003–04), because of lack of resources, the children were not receiving antiretroviral treatment. The study was conducted in the Dominican Republic, with monthly site visits and supervision from the Miami team's key personnel.

Screening for Inclusion/Exclusion Criteria

The HIV infected children who were attending the immunology clinic were referred by their clinic physician (S.S.) to the study physician (J.B.) who described the study to the parent/caregiver, obtained informed consent and screened the children for inclusion/exclusion criteria. The inclusion criteria determined from medical chart review and caregiver interview were (i) HIV seropositive status confirmed by two Elisas, confirmed by western blot, or compliance with clinical criteria based on CDC definition (medical chart review), (ii) age 2–8 years as this was the largest age group attending the clinic and (iii) caregiver willingness and ability to travel to the hospital twice a week for 12 weeks for the intervention. The exclusion criteria also determined by medical chart review and caregiver interview included (i) undetermined HIV status, (ii) fever, new opportunistic infection or acute hospitalization in the past 30 days, (iii) massage therapy in the past 30 days, (iv) extensive skin lesions, (v) child abuse or (vi) pre-natal drug exposure.

Participating Children

Fifty-two parents/caregivers were approached about it and 52 consented to having their child participate in the study. This perfect acceptance rate might relate to the lack of availability of HAART or other treatment for children with HIV in the Dominican Republic at the time. Precautions against coercion were discussed with the Dominican team prior to initiating the study, and the consent process involved several phases to ensure that the parent/caregiver understood the details, including discussing the randomization to the control group and that no health benefits could be promised from participation.

Of the 52 children assessed for eligibility, all met the inclusion/exclusion criteria. Following stratification for age and gender, 26 children were randomly assigned to the massage therapy group and 26 to a play session/control group. Two children failed to complete the intervention or return for the final visit; One child failed to return for one of the assessments and, one HIV infected child who had been assigned to the massage group was dropped during the second week of the intervention because of aggressive behavior (kicking, biting). The final sample consisted of 48 Dominican children infected with HIV (M age $= 58.35$ months, SD $= 19.90$; range 24–95 months) who had been randomly assigned to the massage therapy ($n = 23$; M age $= 60.91$ months, SD $= 20.39$; range 27–95 months) or play session/control group ($n = 25$; M age $= 55.80$ months, SD $= 19.70$; range 24–95 months).

Procedure

Following informed consent and screening, the study physician (J.B.) referred the child to a Miami team member (G.Z.) who used a computer to generate random assignment. After learning of the child's group assignment, the study physician advised the child's caregiver, and constructed an individualized schedule for the child to receive the intervention (massage therapy or play session/control group) for the 12 weeks of the study. The children were identified with a unique subject number, and assignment was concealed from all key personnel, except the study physician who coordinated the intervention sessions and the nurses who delivered the intervention.

Assessments

Immediately after obtaining consent, the study physician interviewed the parent/caregiver to obtain background/demographic information using a questionnaire format (see subsequently). Subsequent to the background session, the child's behavior and development were assessed via the Child Behavior Check List (CBCL) and the Developmental Profile (DP-II) by a trained psychologist (R.M. or R.C.) prior to the child's first intervention session and after the last intervention session. The psychologists were unaware of the children's group assignment and were not involved in any other aspect of the study.

Background/Demographics

The following information was obtained: (i) age of the child, (ii) gender, (iii) whether the child attended school and years in school, (iv) caregiver relationship, (v) age of caregiver, (vi) household income and (vii) living conditions, including the number of children and adults living in the same household as the HIV infected child and whether the HIV infected child had his/her own bed.

Child Behavior Checklist (CBCL, 30)

This checklist assesses behavioral problems or maladaptive behaviors in pre-school age (1.5–5 year olds) and school age children (6–18 year olds), as well as competencies and adaptive functioning. This instrument was selected because

of its applications in clinical and research settings, and because it has been validated with Spanish speaking children from varying social groups, and with varying physical and mental health conditions (31–33).

The pre-school version of the CBCL (1.5–5 years) features five Diagnostic and Statistical Manual of Mental Disorders (DSM)-oriented scales, which are consistent with psychiatric and psychological diagnoses for: *Affective* problems (dysthymia and major depression), *Anxiety* problems (generalized anxiety, separation anxiety disorder, specific phobia), *Pervasive Developmental* problems (Asperger Disorder, Autistic Disorder), *Attention Deficit/Hyperactivity* problems and *Oppositional/Defiant* problems. In addition, the CBCL pre-school version contains eight empirically based scales that examine *Internalizing* (emotionally reactive, anxious/depressed, somatic complaints and withdrawn), *Externalizing* problems (attention problems and aggressive behavior) and *Total* problems (Other Problems and Sleep scales). Acceptable validity has been reported for this instrument, including content validity and criterion-related validity, discriminating between referred and non-referred children (30).

For the 6- and 7-year-old children they were assessed on the CBCL/6–18 (year) version, which has different scoring profiles for boys and girls and features nine syndrome scales, including *Internalizing* problems (anxious/depressed, withdrawn/depressed, somatic complaints), *externalizing* problems (rule breaking behavior and aggressive behavior) and *Total* problems (social, thought, attention and other problems). Because a large percentage of children in the study were not enrolled in school or engaged in sports or social club activities, the competence scales of the CBCL/6–18 were not administered. Content validity, criterion-related validity and construct validity are well supported for the CBCL/6–18 (30).

For this study, and because of the lower socio-economic status and educational level of parents/caregivers (59% had less than a ninth grade education), the psychologists administered a Spanish authorized version of the CBCL by reading each item to the caregiver and asking them to respond '0' (Not True), '1' (Somewhat or Sometimes True) or '2' (Very True or Often True) (see 28 for details on the administration). The psychologists were trained to present each question and item in a neutral manner so as not to influence the parent/caregiver's response. Raw scores and *T*-scores were computed following the manual's instructions and from these, percentages were computed on the number of children scoring within the 'normal' versus the 'borderline-clinical' range at baseline and at the end of the study for each individual scale and the clusters (internalizing, externalizing and total problems).

Developmental Profile-II (34)

This scale was designed to evaluate children from birth through 9 years of age in five key areas of functioning: (i) physical age (e.g. strength, stamina, sequential motor skills), (ii) self-help age (e.g. dressing, eating, working), (iii) social age (ability for interpersonal relations), (iv) academic age (intellectual ability) and (v) communication age (expressive and receptive communication skills). In addition, an intelligence quotient IQ equivalence was computed (academic age/chronological age). This instrument contains 186 items and was completed from interviews with the parent/caregiver and direct observations of the child by the psychologists in an attempt to reduce caregiver bias in reporting on the children's Developmental Profile (DP) and to have more than one source of information on how the children were developing. The children were directly observed by the psychologists on a number of pre-determined items, which were identified during the training on the DP-II and which may be obtained from the authors. At the basic level, the DP-II profiles developmentally 'advanced' or 'delayed' areas for the child. The DP-II was constructed using normative data from a sample of over 3000 children and has been used and found to be successful with diverse populations (34). The DP-II was designed to be free of sexual and racial bias, and takes 20 to 40 min to complete. Acceptable content, criterion-related and construct validity have been reported for the DP-II and it has been shown to be sensitive to detecting pre-post intervention effects (34).

Interventions

The children received their massage therapy or play session in a quiet, private room in the Mother-Infant Research Center (CENISMI) of the Robert Reid Cabral Children's Hospital. This large room was air-conditioned, and prior to the session was set up by the nurse with a massage table or materials for the play session (books, blocks, toys, etc.). The parent/caregiver always accompanied and remained with the child during the session, but was not involved in it. Each child was individually scheduled to attend two 30-min sessions (massage therapy or play sessions) per week for 12 consecutive weeks, and parents/caregivers were paid a small monetary incentive ($5 USD) for bringing the child to the session. The $5 reimbursement was recommended by the hospital staff as an appropriate amount to cover transportation for the caregiver and child to and from the hospital and pay for a small meal or snack. Morning and afternoon sessions were made available for the convenience of the parent/caregiver. Nurses were trained to conduct the massage therapy and play sessions.

Massage Therapy Training

Four Dominican Republic (DR) nurses with experience in pediatric HIV were trained on the massage protocol by the first author (M.H.R) and by two certified massage

therapists from the United States who remained in the D.R. during the training period. The massage routine was designed by the first author and by two massage therapists from the United States (Rebecca Kessler and Alexa Nunez) who had experience with child massage routines. The nurses' training consisted of (in the following order) (i) a workshop, which covered a brief history of massage, hygiene, preparing the room for massage, contraindications (lesions) and basic draping techniques, (ii) observing a videotape of the massage treatment protocol, (iii) reviewing and practicing the step-by-step written instructions on the massage treatment protocol, (iv) conducting a mock massage treatment while receiving feedback from a US trained massage therapist, (v) conducting five practice massages on their own followed by (vi) videotaping the DR nurse conducting the massage on a child (not HIV infected) and later reviewing the videotape with the nurse for adherence to protocol. All four nurses completed the training session and were found to adhere to the protocol at the videotaping session. Additionally, the nurses' compliance with the massage protocol was checked at random times during the monthly site visits.

The Massage Therapy Protocol

The child and parent were greeted by a trained nurse and brought into the private room. On the first session, the nurse explained the purpose of the visit and showed the child the massage table and bottle of oil. The nurse also demonstrated what the massage would feel like on the child's arm. The nurse helped the child undress (except for undergarments, which always remained on), including removal of shoes and socks. During the undressing, the nurse took note of skin lesions, if any, to avoid during the massage. The child was placed prone (face down) on the massage table, which had been draped with a clean cotton sheet, and the child was covered with a small towel for warmth and security. The children were always asked for permission to conduct the massage, and the nurses periodically checked with the child about the pressure of the massage.

Using moderate, firm pressure, the massage was conducted to the following body areas: *legs* – (i) using a non-scented mineral oil (Johnson & Johnson baby oil) and both hands together (right in front of left hand), stroking the left leg, from the foot to the hips, and then from the hips down to the foot again (repeat six times); (ii) using the palms of the hands, pressing (compression) from the left foot to the hip and then gliding strokes down from the hip to the foot (repeat six times); (iii) repeating steps 1 and 2 on the right leg; (iv) starting at the feet, with one hand on each foot walking and pressing the hands up the legs, until reaching the lower back, stopping briefly and then continuing to walk and press the hands until reaching the shoulders. *Back* – (i) applying oil to hands, and placing one hand on either side of the spinal cord, stroking downward from the shoulders to the lower back, and then back to the shoulders (repeat four times); (ii) starting at the lower back, with hands on either side of the spinal cord, stroking upward toward the shoulders, and returning to the lower back (repeat four times); (iii) placing one hand on each shoulder, gently kneading the shoulders (four times), then kneading down both arms simultaneously until reaching the hands. With the child faced up (supine): *Feet/Legs* – (i) massaging the left foot from the heel to the toes; (ii) gently, pressing and then pulling each toe slowly; (iii) massaging the ankle and front of foot using circular thumb motions; (iv) forming a 'c' shape by cupping the hand, and alternating one hand at a time to enclose as much of the leg as possible, massaging the left leg from the foot to the inner thigh (six times); (v) pressing with both hands (compression) from the foot to the hips and returning with stroking motions to the foot (three times); (vi) repeating steps 1–5 to the right foot/leg. *Chest/Shoulders/Neck* – (i) placing one hand gently on the stomach area and another on the chest, rocking back and forth slowly (five times); (ii) gently, placing both hands on sternum, stroking upwards from sternum to shoulders (repeat three times); (iii) moving to stand at the head of the table, placing hands under the child's shoulders and gliding hands from shoulders to neck and then holding/supporting the head for 5 s. *Head/Face* – (i) shampooing or making small circular stroking slowly to the entire scalp; (ii) rubbing/stroking both ears at the same time from top of ears to earlobes; (iii) stroking the forehead by starting at the center of forehead with both hands and gliding the hands toward sides of forehead; (iv) using index and middle fingers on each hand, stroking from top of nose, down and under cheekbones and out to sides of face (repeat two times); (v) cupping the chin with both hands, stroking upwards (repeat two times); (vi) pressing the scalp using fingertips. *Arms* – using oil, (i) massaging the palm of the left hand using circular thumb motions; (ii) pressing gently and then slowly pulling each finger of the left hand (repeat two times); (iii) using circular thumb motions, rubbing the wrists and then the top of the hands; (iv) stroking the left arm from the wrist to the shoulder using one hand at a time in an alternating fashion (repeat six times); (v) pressing (compression) with both hands from the wrist to the top of the left arm, and then stroking from the top of the arm back to the wrist (repeat three times); (vi) repeating steps 1–5 on the right arm/hand. The end of the massage was always signaled by long, raking-like finger stroking from the top of the head toward the toes. The child was allowed to remain on the massage table for a few minutes after the end of the session prior to being dressed.

The Play Session/Control Group Protocol

The same trained nurses also met the children assigned to the friendly visit group. On the first session, the nurse explained that she wanted to play with the child and

offered the child a choice of (i) coloring/drawing, (ii) playing with blocks, (iii) playing cards or (iv) reading children's books. The nurse was instructed to allow the child to choose and lead the activity. The nurses recorded the activity the child engaged in at each session. A review of these records revealed that some children always engaged in the same activity whereas others switched back and forth between activities in a session or between sessions. Nurses were also instructed that social touch was acceptable (e.g. pat on the head or shoulder), but that children in the play session/control group were not to be massaged during the study period. The reason for instructing the nurses about acceptable 'social touch' for the play session/control group and refraining from massaging the children in the control group was to reduce the likelihood of confounding the study by having the nurses inadvertently massage both the experimental (massage) and control groups.

The children were alerted by the nurse when 5 min were left in the session so that they would not be distressed by a sudden end to playing. At the end of the study, parents/caregivers who were interested in learning to massage their children were offered a workshop on massage therapy.

Results

Background/Demographics

The background and demographic data were compared between groups, and no significant differences emerged, suggesting that the randomization was successful as the two groups of children were similar at the start of the study (Table 1). Additional data analyses revealed that 52% of the children were being raised by a caregiver other than their mother, as a result of maternal death. Most of the HIV infected children were females (64%), lived in a in a two-bedroom house (71%) shared by 2–3 adults (75%) and 2–3 other children (85%), and only 35% of the infected children slept alone in their own bed. Although the majority of the children were eligible for pre-school or elementary school, only ~40% of the children were attending school.

Child Behavior Checklist (CBCL)

The CBCL is scored using different profiles and scoring templates for children under 6 years of age versus children 6 and older, thus the data were analyzed separately for each age group. Because the data were skewed and because of the pilot nature of the study, including a small sample size, non-parametric tests were used.

1.5–5 Year Olds

DSM-Oriented Scales—Table 2 displays the percent of children under 5 years of age in the *massage therapy* and *play/control* group who met criteria for a DSM psychiatric disorder on the first day of the study.

Empirically Based Scales—Non-parametric analyses on the individual scales (emotionally reactive, anxious/depressed, somatic complaints, withdrawn, attention problems, aggressive behaviors, other problems and sleep problems) revealed no significant changes in

Table 1. Mean values (standard deviations in parentheses) for background and demographic variables for the massage therapy and play (control) group

Variables	Massage therapy	Play group	P-values	
			t-test	X^2
Parent/Caregiver				
Age (years)	40.7 (13.4)	38.6 (14.9)	0.60	
Household income (in Dominican $)	2891 (2415)	2952 (1569)	0.92	
No of adults living at home	2.7 (1.2)	2.8 (1.3)	0.69	
No of other children living at home	2.1 (1.9)	1.8 (2.2)	0.62	
Child				
Age (months)	60.9 (20.4)	55.8 (19.7)	0.38	
Gender				
Males	35%	36%		0.93
Females	65%	64%		
Has own bed				0.93
Yes	35%	36%		
No	65%	64%		
Attends School				0.81
Yes	43%	40%		
No	57%	60%		

Table 2. Percent of children with HIV infection under 5 years of age who met criteria for DSM psychiatric criteria (normal versus borderline-clinical) on the first day of the study for the massage therapy versus play (control) group

	Massage (%)	Play group (%)
Affective		
Normal	69	83
Borderline-clinical	31	17
Anxiety		
Normal	85	78
Borderline-clinical	15	22
Pervasive developmental		
Normal	85	89
Borderline-clinical	15	11
Attention deficit		
Normal	100	94
Borderline-clinical	0	6
Oppositional defiant		
Normal	85	89
Borderline-clinical	15	11

behaviors from the intervention for the younger children (all P's > 0.05).

6 ± Year Olds

Syndrome Scales—The analyses on the older children, using Wilcoxon signed ranks tests within groups to determine percent of children who increased (or decreased) in maladaptive behaviors from baseline (first day) to the final day of the study (last day) revealed significant decreases for the massage group in the following: (i) anxious/depressed behaviors (75%), $Z = 2.23$, $P = 0.026$; (ii) negative thoughts (50%), $Z = 1.89$, $P = 0.059$ (two-tailed) and (iii) overall internalizing scores (63%), $Z = 2.39$, $P = 0.02$ (two-tailed). Interestingly, 100% of the children in the play control group showed an increase in their score on rule breaking behaviors (from $M = 1.25$ to $M = 1.57$), $Z = 2.00$, $P < 0.05$, although this was not clinically meaningful.

Secondary Analyses

Overall CBCL T-Scores

Collapsing the data for the older and younger children on the major computations revealed that 44% of the group scored borderline-clinical on *internalizing problems (*e.g. *anxious/depressed, withdrawn, somatic complaints)*, 24% scored borderline-clinical on *externalizing problems (aggressive behaviors)* and 36% of the children revealed *total problem* scores in the borderline-clinical range, suggesting that a significant percent of children in the study were presenting with clinical behavioral problems (Table 3).

Table 3. Percent of all children scoring in the normal versus the clinical range on the CBCL internalizing, externalizing and total problems scores for the massage therapy versus the play (control) groups at baseline and at the end of the study (final)

Variables	Massage therapy		Play group	
	Baseline (%)	Final (%)	Baseline (%)	Final (%)
Internalizing				
Normal	62	62	50	44
Clinical	38	38	50	56
Externalizing				
Normal	69	77	83	83
Clinical	31	23	17	17
Total problems				
Normal	62	69	67	67
Clinical	38	31	33	33

Developmental Profile (DP-II)

The scores on the DP-II reflect the number of months old at which the child is functioning in the specific area. For example, a 58-month-old child coded as 50 months in physical age, is considered to be 8 months delayed in physical functioning. The chronological age in months (that is, the child's actual or current age in months at time of testing) and functional DP-II age (that is, the child's functioning age in months at time of testing) in the five areas (Physical, Self-Help, Social, Academic and Communication) at baseline and at the end of the study (Final) are displayed in Fig. 1. An IQ equivalence was computed as a ratio of academic age/chronological age, with 100 being the mean score, and a score below 85 being below average. Overall, 70% of the children scored below 85 on the IQ equivalence test.

The children in both groups were expected to show developmental gains over the 12-week study as a function of time, or maturation. However, the massage therapy group was expected to show greater developmental gains than the control group. The data for the DP-II revealed normal distributions and thus, repeated measures ANOVAs were conducted, with time (first day, last day) as the repeated within-group measure and group (massage, play) as the between-group factor. The ANOVAs revealed a significant effect of time, suggesting the expected maturation effect, $F(6, 39) = 17.00$, $P < 0.001$. To accommodate for developmental maturation over the study period, change scores were computed by subtracting the chronological age at time of test from the baseline scores and the final scores for the five developmental domains (excluding the IQ score). The change scores, which were compared within-groups (baseline minus final) using paired t-tests, are displayed in Fig. 1. The massage therapy group showed improvement over the 12 weeks in self-help, $t(21) = 7.14$, $P < 0.05$ and communication, $t(21) = 4.21$, $P < 0.05$. The play
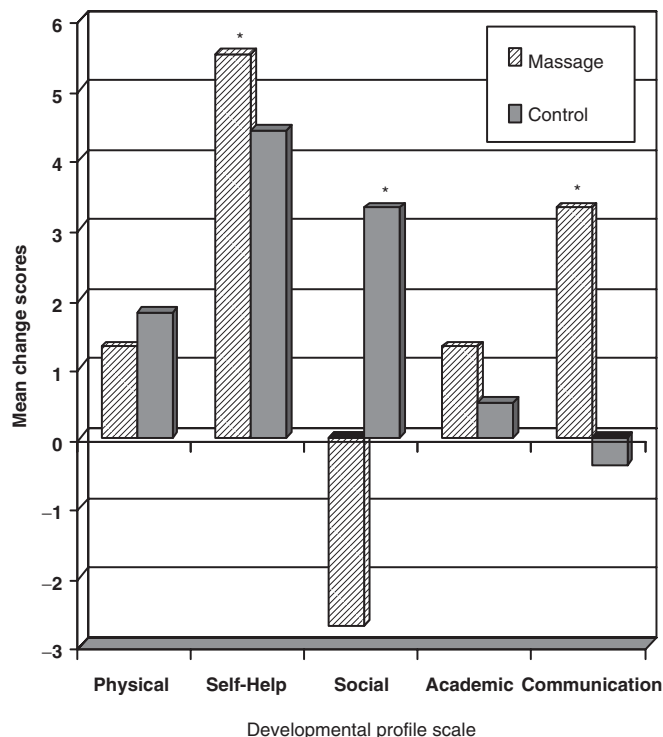
Figure 1. The DP-II change scores (in months) following from baseline to the last day of the study for the massage therapy and the play group for the five developmental domains. *$p < 0.05$.

group showed an improvement in social development, t (24) = 4.45, $P = 0.05$. The analyses on the IQ data revealed a marginally significant increase for the massage group from baseline ($M = 78.7$, SD = 12.8) to final ($M = 82.6$; SD = 9.6), t (22) = 1.90, $P = 0.07$. The play group showed no significant increase in IQ from baseline ($M = 78$; SD = 12.6) to final ($M = 80$, SD = 12.8), t (23) = 1.01, $P > 0.10$.

Discussion

This is the first randomized control trial to examine massage therapy for enhancing development and decreasing maladaptive behaviors in young Dominican children infected with HIV, who because of lack of resources were not receiving antiretrovirals. The children were between 2 and 8 years of age, very low income, and more than half of them had lost their mothers to HIV/AIDS and were living with an alternate caregiver. An IQ equivalence score suggested that in our sample, 70% of the children infected with HIV were experiencing cognitive impairment, although this must be taken with caution as IQ tests are known to be biased and not always representative of general intelligence, especially for a population whose normal intelligence functioning is unknown. A background screening revealed that the children were living in crowded conditions, most living in

two-bedroom homes that they shared with five or more other people, and only about one-third of the children having their own bed. The crowded conditions and the children's HIV infection, in addition to that a large percentage of the children were living with someone other than their mothers, are factors that may be contributing to the children's lower intelligence scores. A future larger scale study that controls for these factors is needed.

The primary objective of this study was to examine massage therapy for improving development in the Dominican children infected with HIV. Our findings revealed that massage therapy was effective in reducing maladaptive internalizing behaviors in children aged six and older infected with HIV, including reducing anxious depressed behaviors and negative thoughts in these children. In addition, overall the HIV positive children (2–8 years of age) who received massage demonstrated enhanced self-help and communication skills. The significant improvement in self-help suggested that the massaged children were becoming more proficient at doing things for themselves, such as dressing and eating. Better communication skills might have resulted from the children being able to do more for themselves and perhaps for others as well. These improvements may reflect better daily functioning and quality of life from twice weekly massages for these HIV-infected Dominican children. Interestingly, the control group who participated in twice weekly play sessions (coloring, playing with blocks, looking at picture books) showed improved social development, suggesting the benefits of pre-school activities for children with HIV. Interesting, unlike the children in the control group, those in the massage group remained at the same social developmental stage throughout the 3-months study (baseline = 59 months; final = 59 months), reflecting the 3-month negative mean change score reflected in Fig. 1. The lack of social development for the massage group suggests that the children in this group received little or no pre-school play activity during the 3-month study, which appears to be important for enhancing social skills. Sadly, most parents and caregivers reported that the children were not attending school, although they were eligible.

A second objective of our work was to determine the absence of antiretroviral treatment on the impact of HIV infected Dominican children's mood and behavior. The range and high incidence of mood and behavioral problems displayed by the children were perhaps not surprising given the hardships they faced. CBCL baseline assessments revealed *internalizing* problems (depressed, anxious, withdrawn) for 44% of the children, *anxiety disorders* for 18.5%, *externalizing* problems (aggressive behavior) for 24% and *other problems* (social problems, thought problems, maladaptive behaviors) for 35.5% of the sample. These problems might also relate to the

deleterious impact of HIV/AIDs on the children's central nervous system (9,13,14). However, from this study, it is difficult to determine whether the elevated mood and behavioral problems were related to the HIV virus or the children's disadvantaged background, grieving associated with the loss of their mother or other problems. A future study will need to include an alternate control group, perhaps comprised of HIV *affected* children (i.e. HIV negative children living with someone with HIV/AIDs) and a control group of infected versus non-infected children from a similar socioeconomic background as those here. This alternate comparison group should help clarify the incidence of mood and behavioral problems in untreated Dominican children with HIV/AIDS.

The lack of massage therapy's impact on the younger HIV-infected children's behaviors is puzzling since massage therapy has been documented in numerous studies to improve children's depressed mood and reduce anxiety levels (see 18 for a review). One possible reason for the null effects in herein might be that the behavioral assessment was not sensitive to detecting behavioral changes given that the CBCL has not been previously used with Dominican children with HIV infection and may therefore be invalid. Another possible reason for the null results might be that the parents/caregivers were not able to discern a change in the children's behavior, perhaps because of the parents/caregivers' own misfortunes and disadvantages. A future study might include reports from others (teachers, siblings) as reliability checks to the parents/caregivers perception. Perhaps the parents' or caregivers' null findings also reflected the despair they felt given the children's medical condition and lack of resources.

Anecdotally, the nurses who conducted the massages reported changes in the children over time, including better mood. The anecdotal improvement in mood supports the decreased anxious and depressed symptoms reported for the older children. Perhaps for younger children with HIV, changes in mood and/or behavior might require a more intense massage therapy protocol, such as more frequent or daily massage and/or massage of longer duration (more than 3 months).

In sum, for untreated children with HIV infection, massage therapy appears to be a viable therapy for promoting greater daily functioning and communication in HIV infected Dominican children and in helping reducing internalizing problems (anxiety, depressed mood, negative thoughts) for Dominican children who have no access to antiretrovirals. Massage therapy may be easily taught to nurses and other health professionals in resource poor countries. Massage therapy may also be administered by a parent or caregiver, making the therapy cost-effective and practical, particularly in resource-strained environments.

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