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# **Physical growth, cognitive development and time use of young children residing in a Babyhome in Tanzania**

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**INDEX**

- ABSTRACT ..... 2**
- INTRODUCTION ..... 3**
  - Nature of institutional care ..... 3
  - Effects of institutional care ..... 4
    - Physical growth ..... 4
    - Cognitive development ..... 6
    - Attachment security and indiscriminate friendliness ..... 7
  - Time use in institutional care ..... 8
  - Hypotheses ..... 8
- METHOD ..... 9**
  - The Babyhome ..... 9
  - Participants ..... 11
  - Procedure ..... 12
  - Measures ..... 12
- RESULTS ..... 16**
  - Physical growth ..... 16
  - Cognitive development ..... 17
  - Time use ..... 18
  - Associations between time use and physical and cognitive development ..... 23
- DISCUSSIE ..... 25**
  - Physical growth ..... 25
  - Cognitive development ..... 26
  - Time use ..... 26
  - Limitations and future directions ..... 28
  - Practical implications ..... 28
- REFERENCES ..... 31**
- APPENDIX A ..... 37**
- APPENDIX B ..... 43**

## **ABSTRACT**

The present study examined the physical growth, cognitive development and time use of 23 children between 12 and 35 months, residing in a babyhome in Tanzania, East Africa. The outcomes of the physical assessments of weight, height and head circumference were compared with the growth standards of the World Health Organization. The cognitive performance on the Bayley Scales of Infant Development was compared with the norm scores of the test. Time use was examined by spot observations and had the objective of getting insight on how the children spent their time and how many social interactions they have. Relations between the outcome variables have also been investigated. The results of the study showed that children residing in the Tanzanian babyhome lag behind in physical growth (weight, height and head circumference) and cognitive development. We found that the babies (aged 11.8 – 13.7 months) were on average more delayed in their physical growth compared with the toddlers (aged 15.2 – 34.1 months). Regarding time use we found that for all ages combined, the children spent on average 53.4% of the time they were awake, alone (without any interactions). Babies (63.7%) spent significantly more time alone than toddlers (48.5%). It was also demonstrated that the time children spent alone, was associated with the physical growth. Children who spent more time alone, were more delayed in height.

## INTRODUCTION

Worldwide an estimated 8 million orphaned and abandoned children grow up in institutional care. Extreme poverty, domestic violence and chronic illness or death of one of the parents, can be a reason that children do not have the chance to grow up with their parents or extended family (Save the children, 2009). Tanzania, with over 42 million inhabitants, is like other African development countries, largely affected by the HIV pandemic. Almost 1.4 million people, including 160.000 children, in Tanzania are infected with the virus and more than 1 million children are orphaned by AIDS (AVERT, 2011). Like in many other African countries, children who have lost one or both parents often live with extended family members. In Tanzania, grandparents care for around 40% of these orphaned children (UNICEF, 2007). Unfortunately, not all children have the possibility to live with extended family due to the multitude of orphans and the death of potential caregivers. A minority of the AIDS orphans and other vulnerable children therefore reside in institutional care facilities (Morantz & Heymann, 2009). Since many years research has repeatedly shown the detrimental effects of institutional care on the development of children. The studies of Goldfarb (1945) and Bowlby (1951) already reported about the emotional, behavioral and cognitive impairments that were seen in individuals who had been raised in institutional care. Johnson, Browne & Hamilton-Giachritsis (2006) reviewed more than 40 studies from 1940 till 2005, that examined the effect of institutional rearing on several domains of children's development, including attachment, brain growth, physical growth and cognitive development. They concluded that children that grow up in institutional care are at risk of harm. The lack of a one-to-one relationship with stable and consistent caregivers, is suggested to be a main cause of these adverse outcomes.

### ***Nature of institutional care***

The characteristics of institutional care, as became evident from studies conducted in different countries, almost inevitably deprive children of reciprocal interactions and long-term relationships with consistent caregivers due to the regimented nature and high child-to-caregiver ratio (Bowlby, 1951; The St. Petersburg-USA Orphanage Research Team, 2005; Zeanah, Smyke, & Settles, 2006). Although institutional care facilities vary between and also within countries in the quality of rearing environment, some typical features of institutional care are described in McCall, Van IJzendoorn, Juffer, Groark, & Groza (in press):

- Groups are likely to be large (typically 9-16 per ward) and so are the number of children per caregiver (approximately 8:1 to 31:1);
- Groups are often homogeneous with respect to ages and disability status;

- Children see anywhere from 50 to 100 different caregivers in the first nineteen months of life due to several reasons: a high staff turnover, caregivers may work long shifts and be off three days; caregivers may not be constantly be assigned to the same group and caregivers may get up to two months vacation;
- Children meet many other adults who tend to come and go in children's lives including medical and behavioral specialists, prospective adoptive parents, and volunteers who may visit for only a week or a few months.
- The caregivers typically receive little training and the training they do receive is more focused on health issues than on social interaction. They spend the vast majority of their hours feeding, changing, bathing, cleaning children and the room and preparing food rather than interacting with the children.
- Caregivers are often female, so children rarely see men.
- When caregivers perform their care giving duties, it is likely to be in business-like manner with little warmth, sensitivity or responsiveness to individuals children's emotional needs or exploratory initiatives.

It is not said that all institutional care facilities do have all these characteristics, but in many institutions, situations as described above are common. In view of the heterogeneity of institutional care facilities, Gunnar (2001) made a classification of institutions based on three levels of quality of rearing the institutions provide: 1) institutions characterized by global deprivation of the child's health, nutrition, cognitive stimulation and affectionate relationship needs; 2) institutions with adequate facilities regarding health and nutrition but a lack of cognitive stimulation and affectionate relationships; 3) institutions that meet all needs except from long-term relationships with consistent caregivers. A fourth level could be added, which would be an institutional environment that even provides in long stable relationships with caregivers and only deprives children of family life embedded in a regular social environment (McCall et al., in press).

### ***Effects of institutional care***

*Physical growth* Anthropometric measures of height, weight and head circumference are often used to indicate the physical growth of children. A child is *underweight* when the z-score for weight is smaller than -2, it is *stunted* when the height-for-age z score is smaller than -2 and it is *wasted* when the weight-for-height is smaller than -2. The height of children best reflects the overall nutritional condition of children, whereas weight and subcutaneous fat are more related to recent

nutritional intake. Head circumference is related to brain growth, and is therefore also an important growth index (Miller, 2005).

Many studies have demonstrated that the physical development of children brought up in institutions often shows delays (Ames, Fraser, & Burnamy, 1997; Dobrova-Krol, Van IJzendoorn, Bakermans-Kranenburg, Cyr, & Juffer, 2008; Dobrova-Krol, Van IJzendoorn, Bakermans-Kranenburg, & Juffer, 2010; Van IJzendoorn, Bakermans-Kranenburg, & Juffer, 2007; Van IJzendoorn & Juffer, 2006; Van den Dries, Juffer, Van IJzendoorn, & Bakermans-Kranenburg, 2010). Johnson (2000) found that children lost one month of linear growth for every three months they spent in institutional care. Besides malnutrition, it is widely believed that the delayed growth of height, weight and head circumference is a result of psychosocial neglect (Groark, Muhamedrahimov, Palmov, Nikiforova, & McCall, 2005; Johnson, 2000; Miller, 2005; The St. Petersburg-USA Orphanage Team, 2008). In the Bucharest Early Intervention Project (BEIP) the physical growth of 136 healthy, (former) institutionalized children between five and thirty-two months in Romania was studied. All children were institutionalized prior to the study and then randomly assigned (which makes the study unique) to go into foster care or to stay in the institution. The average age of the children at placement in foster care was 21 months. The children who went to foster care showed a rapid increase in height and weight after twelve months whereas the children who remained in institutional care showed no improvement. Height catch-up improved when placement in foster care occurred before the age of twelve months (Johnson et al., 2010). More evidence of the detrimental effects of institutional rearing on physical development is provided by the meta-analysis of Van IJzendoorn et al. (2007). They reviewed 33 papers which included 122 study outcomes on children placed for international adoption, most of whom had been institutionalized prior to adoption. Large growth delays in height, weight and head circumference were documented at the time of the adoptive placement ( $d = -2.39$  to  $-2.60$ ,  $n = 1331 - 3753$ ). For height was found that the more time children spent in institutional care, the more they lagged behind in physical growth ( $d = 1.71$ , 95% CI: 0,82- 2,60,  $n = 893$ ) which points to a dose-response relation. After the adoption, the children demonstrated a considerable catch-up growth, particularly in height and weight. The older the children were at arrival in their adoptive families, the catch-up of height and weight was less complete though. With regard of head circumference, the catch-up appeared to go slower and remained incomplete.

Most research on the development of (post) institutionalized children is based on children adopted from Eastern-Europe and Asia. Only a few studies with regard to physical growth of institutionalized children were conducted in Africa. A study in which Ethiopian orphanage children between 5 and 14 years old were compared with family-reared children, showed that the orphanage children were more likely to be stunted than family-reared children (Aboud, Samuel, Hadera, &

Addes, 1991). In a study in Kenya (Otieno, 2001) the pattern of growth and development of 82 institutionalized infants was investigated. The growth of the abandoned infants was compared with that of infants living with their biological mothers. For every abandoned infant, two mothered infants were matched on gender and age. The results showed that abandoned babies were significantly wasted and stunted in their growth. These findings indicate that also in African countries institutionalized infants have poorer growth compared to mothered infants.

*Cognitive development* For normal development, mammalian brains require an optimal level of environmental input, a so called “expectable” environment, which includes access to responsive caregivers. In institutional care children are not exposed to such environments due to unfavorable caregiver-to-child ratios, highly regimented routines, impoverished language and cognitive stimulation and unresponsive caregiving practices (Cicchetti & Valentino, 2006; Curtis & Nelson, 2003; Nelson et al., 2007). Since many years studies have shown that cognitive performance of children in institutions lags behind compared with children’s IQ who grow up in family care. Dennis (1973) studied children who were abandoned immediately after birth and were reared in children’s homes in Lebanon. Some of them were adopted around the age of three and others remained in children’s homes. Of both groups their intellectual development was assessed at the age of eleven and the results were remarkable: the children that were adopted had an average IQ that was within the range of normally developing children, whereas the children who remained in institutional care were diagnosed as mentally retarded.

More recent studies also have demonstrated the delayed cognitive performance of children who are being reared in institutional care compared with family-reared children (Castle et al., 1999; Dobrova-Krol et al., 2010; Van den Dries et al., 2010; Vorria et al., 2003). In the Bucharest Early Intervention Project (see also before), the development of institution-reared children was compared with institution-reared children who went to foster care. It was found that at the age of 42 and 54 months the foster children outperformed the institutionalized children on the cognitive performance test (Nelson et al., 2007). In a meta-analysis of Van IJzendoorn, Luijk and Juffer (2008), the intellectual development of children growing up in institutional care was compared with that of children living with their (foster) families. The study included 75 studies on more than 3888 children. The results showed that children living in children’s homes were having significant lower DQ/IQ’s (average 84) than children living in a family (average IQ of 104). Several factors were associated with the size of the delay. First of all, age of assessment seemed to be relevant: children that were assessed before their second birthday were more delayed than children that were assessed after their second birthday and this difference remained significant with the fourth birthday as cut-off. Age at admission to the orphanage was also of influence: the cognitive delay of children that were

admitted to institutional care before the age of 12 months was significantly larger than children who entered the orphanage after 12 months. Another interesting outcome was that the socioeconomic level of development of the country made a difference. Countries with a high HDI (Human Development Index) demonstrated smaller delays in children's cognitive development than countries with a lower HDI. Furthermore, the studies from the countries with the lowest HDI, which were Eritrea, Ethiopia and Kenya, did not show discrepancies between the cognitive development of family-reared and institution-reared children (Van IJzendoorn et al., 2008).

*Attachment security and indiscriminate friendliness* Bowlby (1951, p. 11) stated in his publication 'Maternal care and mental health' that "the infant and young child should experience a warm, intimate, and continuous relationship with his mother (or permanent mother substitute) in which both find satisfaction and enjoyment" and that not to do so may have significant and irreversible mental health consequences. This *maternal deprivation theory* has been highly influential in recognizing the importance of attachment relationships for children's development in the literature. Several studies have shown that children reared in institutions have difficulties in forming secure relationships (Vorria et al., 2006; Zeanah, Smyke, Koga, Carlson, & BEIP Core Group (2005). Although many institutions provide fairly clean environments, good health care and adequate nutrition, the rotating shifts and high child-to-caregiver ratios limit the development of stable and warm relationships between children and caregivers (St. Petersburg - USA Orphanage Research Team, 2008). Children in institutional care attach to their caregivers, but these attachments are often disrupted and do not have the same depth or quality as attachments developed in a loving family (Miller, 2005). Behavior that seems to be typical of institutionalized children is disinhibited or indiscriminate friendliness which was first described by Tizard (1977) as "behavior characterized by affectionate and friendly behavior toward all adults (including strangers), without fear or caution that is characteristic of normally developing children". Provence & Lipton (1962) suggested that any adult was sufficient as long as the child's needs were met. Indiscriminate friendly behavior is relatively often seen among children who were institutionalized for longer than 6 months in the first two years of life (Chisholm, 1998; Zeanah et al., 2005). For children living in institutional care indiscriminate friendliness can have adaptive advantages as friendly children may receive what little attention caregivers have time to give (Chisholm, 1998). The function of indiscriminate friendliness after adoption is less clear (McCall et al., in press). However, it should be noted that some consider indiscriminate friendliness as an attachment disorder (O'Connor, Rutter, & the ERA study team, 2000) whereas others argue that it may represent an independent problem rather than a type of reactive attachment disorder as suggested by DSM-IV criteria (Chisholm, 1998; Zeanah et al., 2005; Zeanah & Gleason, 2010).



### ***Time use in institutional care***

Children reared in institutional care often do not receive the kind of nurturing and stimulating environment that is necessary for a normal development in regards of physical growth, cognitive development and psychological well-being (McCall et al., in press). Although many studies have demonstrated this, there is only a limited number of empirical studies on how these children spend their time and how many social interactions they have with caregivers or others. A pilot study in Romania compared time use of 16 children aged 8-34 months with a matched sample from an American day-care centre. Children in the Romanian institution spent significantly more time alone (70% vs. 37%), were more often unmonitored (36% vs. 11%) and had less adult-led time (53 % vs. 24%) than the American day-care children (Daunhauer & Cermak, 2005). Tirella, Chan, Cermak, Litvinova, Salas and Miller (2007) examined time use in three babyhomes in Russia. For all ages combined (1-48 months), children spent on average 50% of their time alone. Children younger than 12 months of age spent significantly more time alone than toddlers (13-24 months) and preschoolers (25-48 months). The infants did have the highest proportion of receiving 1:1 attention, but they also had the highest proportion of unmonitored time. One of the other aspects that was investigated was the activity of the child. The amount of time spent in meaningful play significantly increased across age groups (infants 10%, toddlers 25%, and preschoolers 36%). The study demonstrated that activities were dominated by routinized schedules and care despite the fact the institutions were well staffed with qualified professionals and caregiver-to-child ratios similar to those in the St. Petersburg study (The St. Petersburg –USA Orphanage Research Team, 2005).

### ***Hypotheses***

The main purpose of this study is to assess the physical growth, cognitive development and time use of infants residing in a babyhome in Tanzania and the way they are associated. We tested the following hypotheses:

- (a) Children growing up in the Tanzanian Babyhome show delays in physical growth compared to the World Health Organization standards;
- (b) Children growing up in the Tanzanian Babyhome are delayed in their cognitive development compared the norm scores of the Bayley Scales in Infant Development;
- (c) Infants spend more time alone without any interactions than toddlers;
- (d) Children who relatively spend more time alone during time use observations are more delayed in physical growth than the children who are relatively less alone during time use observations;
- (e) Children who relatively spend more time alone during time use observations are more delayed in cognitive development than the children who are relatively less alone during time use observations.

## METHOD

### *The babyhome*

The current study took place in a babyhome nearby Arusha in Tanzania in 2010. The babyhome was established in 2005 by an American woman and is funded by private donations from all over the world, mostly from America. The home provides a temporary home for infants and toddlers up to three years old. The majority of the children that reside in the babyhome have lost their mother at birth or shortly after birth and in many cases their death was caused by AIDS. Fathers or extended family often cannot afford infant formula; therefore children are admitted to the babyhome for temporary care until the child is able to eat solid food. When the children reach the age of two or three years, they leave the babyhome. The majority of the children return to family care. Some children are being relinquished by their families for adoption because the family will not be able to take care of their child in the future. Children who have been abandoned will as well be available for adoption. When the children have not been adopted by the age of three they will be transferred to another orphanage, where they will spend the rest of their childhood.

The babyhome was newly built in 2005 and nowadays consists of two buildings: the main house and a newborn unit. The main house offers space for around 35-40 children who are between approximately 7 months and 3 years old. The house consists of two playrooms, three bedrooms (equipped with approximately 13 cots per room), a changing / toileting room, a medical room, a kitchen, a laundry room and an office. All the babyhome facilities are on the ground floor. On top of this building there is an apartment where volunteers live. The second building (built in 2009) houses a classroom for the preschoolers and a newborn unit. The newborn unit provides care to newborn and premature babies until they are about 6 months of age. When they are able to eat porridge, they will be transferred to the main house. The nursery can house twelve babies. It only consists of one room in which all the caretaking of the babies take place: sleeping, feeding, bathing and changing.

The permanent staff of the babyhome are all local people and consists of a supervisor, 23 nannies, a nurse, a cook, a cleaner and two laundry ladies. The nannies work in rotating shifts, while the other staff in the babyhome work during office hours on week days. In the main house there are three groups of nannies who work in rotating shifts. The shift-schedule has a cycle of 9 days: first they have 3 dayshifts (9am-5pm), followed by three nightshifts (5pm-9am) and then they have 3 days off. There are always six nannies per shift, which means that the caregiver- child ratio is about 1:6 / 1:7 depending on how many children reside in the main house. The nannies either have toddlers or babies assigned to them. In the nighttime one of the nannies who works in the main house goes over to the nursery to support the nanny in the night with taking care of the newborns. In the nursery

there is during daytime only one member of staff. Volunteers are assigned to a shift-schedule for nursery dayshifts, so there are always at least two people working in the nursery. In the nighttime a nanny of the main house will support the nanny on the nightshift. The caregiver-child ratio in the nursery is therefore 1:6. A lot of volunteers from all over the world work in the babyhome. The length of stay of the volunteers varies from a few weeks until a year. The role of volunteers is helping where needed: helping with feeding, playing and cuddling with the children or supporting the nurse in taking sick babies to the clinic. When a nanny is absent for a longer period due to sickness or holiday, a volunteer can be assigned to the shift schedule to replace the nanny. The number of volunteers can vary per day: on some days there can be more than 10 volunteers, on other days there are only a few.

The daily routine of the children in the main house is different for the two age groups, the babies (the ones that cannot walk yet) and the toddlers (the children that are able to walk). For the babies the day starts at 6 am when they get a bottle of milk, which they have to hold themselves, while they are still laying in their beds. One by one they are taken out of their beds and are changed, washed and dressed. After they have been changed they are brought to the baby-room where they are put in a baby bouncer chair, a baby swing or the playpen. At this time the children are often unmonitored as the nannies are busy with changing the other children and themselves as their shifts end at 8 am. At 9 am it is breakfast time. All infants are carried to the eating room where they are put in their highchair and have to wait their turn. After breakfast, the infants are one by one taken out of their chairs, get changed and are put in their beds until it is almost lunchtime (12 am). When lunchtime is over, the children have time to play. Some children are put in a swing or bouncing chair while others have a chance to crawl around and play with toys that are offered. During playtime, the children get changed and washed before naptime at 2 pm. The babies are taken out of their beds around 3.30 pm, and are put in the babyroom for playing until 5 pm, when they get another meal. After this meal, the children have little time to play as they are prepared for their bedtime. At 6.30pm all the babies are in their beds.

The day of the toddlers also starts at 6 am when they are all woken up, and guided to the changing room. Here they have to wait their turn to get changed and dressed. During the waiting the children get a cup of hot milk. When the children are dressed they have time to play until breakfast time at 9 am. Only about 8 toddlers are able to feed themselves, the others have to wait their turn to be fed. When breakfast time is finished, the toddlers are gathered in the changing room where the older ones are put on a potty and the other children have to sit and wait on the floor till it is their turn to be changed. Around 10.30 am the toddlers have time to play. At this time there are often many volunteers that have come to play and cuddle with the children. At noon the children get lunch, and after that it is naptime from about 1 pm till 2.30 pm. After naptime the children have time

to play again and the oldest toddlers on some days go to preschool, led by a volunteer. Mealtime is at 5 pm and when all meals are finished the children have some more time to play and are prepared for the night. Around 7 pm all the toddlers go to bed.

The children are provided three meals a day: for breakfast and at dinnertime they get 'uji', a local porridge made from maize flour and sweetened with sugar. At lunchtime they always get a warm meal that consists of potatoes, rice or pasta with fresh vegetables. Meat is rarely on the menu. The majority of the children cannot eat by themselves yet and need to be fed. Some children who have to wait their turn express their impatience by crying or screaming, which results in caregivers and volunteers often being rushed in feeding all the children. Besides the meals the children get, depending on their age, milk or either fresh fruit juice and water. On some days the nannies take the kids, mostly the toddlers, into the garden to get fresh oranges or berries from the trees. In the evenings the toddlers always get a little snack like an egg, cucumber, tomato or a piece of bread.

### ***Participants***

All children who resided at the Babyhome at the time of the study were eligible for participation. Because of restricted time limits though, only the children that were above one year old, or turned one within a month after the start of the research, were included in the study. Four children were excluded: a girl with cerebral palsy, a three-year-old boy suffering from an unknown syndrome which made him look like an infant, a 18-month-old boy who only lived at the babyhome since a few days when the research started and a four-year-old HIV+ boy with severe stunted growth (height-for-age z-score < -5). This resulted in 22 participants, 9 boys and 13 girls. Of two participants their exact date of birth was unknown. At their admission to the Babyhome the director had estimated their age. At the start of the research the children were between 11.8 and 34.2 months old (M=19.49months; SD=7.12 months). Age groups in the babyhome were organized by the ability to walk: children who were able to walk (toddlers) had a different day schedule than children who were not yet able to walk (babies). The toddler group consisted of 15 children who had an average age of 22.65 months (SD=6.51 ). The other 7 children who were included in the study were part of the baby group. Their average age was 12.74 months (SD=0.76). The duration of stay in the babyhome for the participating children varied between 3.8 months and 29.8 months (M=15.63; SD=7.12 months). The mean duration of stay for the toddlers was 18.05 months and for the babies 10.58 months. The age at admission to the babyhome varied from a few days old till almost 2 years old. The mean age at admission for all ages combined was 3.82 months, for toddlers 4.59 months and for babies 2.16 months. The difference of age at admission between the age groups was not significant. More specific, 14 children were admitted before the age of 6 weeks, 6 children between

the age of 6 weeks and 9 months and 2 children were admitted when they were 1 year or older. Analyses revealed that the age of the children at admission was not normally distributed. This is caused by the two children that were admitted to the Babyhome when they were already older than 1 year. Further inspection showed that their outcome measures did not have impact on the mean outcome measures so the decision was made to include them in the study. The weight of the children at their admission was known for 13 children, 9 toddlers and 4 babies, who all were admitted before the age of six weeks. The z-scores of their weight at admission varied between -5.54 and 0.30 with a mean z-score of -3.10 (SD=1.77). The mean weight-for-age z-score at admission was for the toddler group -3.31 (SD=1.95) and for the baby group -2.63 (SD=1.39), which was not a significant difference (see Table 1). The files on the history of their admission showed that 16 children were admitted because their mother or even both parents had died, three children were admitted because their mother had run away, of two children their mother had psychiatric problems and one child was abandoned in the hospital. Among the children were several multiples: two boy-girl twins and girl triplets (two of them are identical twins). One child was infected with HIV.

**Table 1**

*Age at admission, age at time of study, duration of stay in the babyhome and weight-for-age z-score at admission by age group.*

	Total					Babies			Toddlers		
	<i>n</i>	min	max	M	(SD)	<i>n</i>	M	(SD)	<i>n</i>	M	(SD)
<b>Age at admission (in months)</b>	22	0.16	23.95	3.82	(5.82)	7	2.16	(3.28)	15	4.59	(6.65)
<b>Age at time of study (in months)</b>	22	11.83	34.14	19.49	(7.12)	7	12.74	(0.76)	15	22.65	(6.51)
<b>Duration of stay at babyhome (in months)</b>	22	3.81	29.80	15.67	(7.28)	7	10.58	(2.72)	15	18.05	(7.58)
<b>Weight-for-age z-score at admission</b>	13	-5,54	0.30	-3.10	(1.77)	4	-2.63	(1.39)	9	-3.31	(1.95)

### **Procedure**

The study took place between April 2010 and July 2010. During the research period the children were involved in cognitive development assessments, physical growth assessments and time-use observations. The time use observations and cognitive development assessments were done in order of the age of the children, starting with the oldest children. The physical growth assessments were not done at a specific moment nor in a specific order.

### **Measures**

*Physical growth* The physical growth of the children was examined by a measure tape and a baby scale. For measuring height and head circumference a measure tape was used. A digital baby scale of the brand Soehnle was used to weigh the babies. The measuring of the children took place in

the nurse room. The children were brought to the nurse room by their nanny just after they had their bath or when they were being changed. The height of the children was measured either when they were standing against a wall or lying down on a mattress, depending on their ability to stand up straight and follow instructions. Some children experienced the weighing and measuring as stressful. The reason for this could be that they were not used to be in this room or that they only have been in this nurse room when they were sick. A volunteer who was familiar with the children supported the researcher to comfort the children and to help with measuring and weighing the babies. During the research period most of the children were measured three times: mid April, May, and June. For several reasons only the data of the third measures were used for data analysis. First of all, the third time the measuring had become a routine for the researcher and the supporting volunteer as they had found out what was the best way for measuring the babies. Also for the children the weighing and measuring had become 'normal' and not stressful anymore which resulted in better cooperation from their side than during the first two assessments. This makes the results of the third assessment more reliable than the first two measurement moments. Another reason is that there are no missing data among the third assessment, whereas the data of the first and second measurements were not complete for all the children. The physical growth data were converted to z-scores, using Anthro statistical software (World Health Organization) to make it possible to compare the physical growth data of the children in the babyhome with the norms of the World Health Organization.

*Cognitive development* The Bayley Scales of Infant Development second edition (BSID-II; Bayley, 1993) was administered to the children for examining their cognitive development. Because the researcher was not able to speak the Swahili language and the children did not understand English very well, the non-verbal version was used. In this version nor the researcher nor the children do have to use spoken language. The test was administered in the mornings in the classroom. The older toddlers have preschool in this room four afternoons per week. For the children who did not attend preschool yet, this room was a new environment for them. The Bayley Scales of Infant Development exist of different tasks. The children started the test in a certain scale according to their age. Depending on their performance of the tasks it was decided whether the children had to go back to a lower scale, go further to a higher scale or that the cognitive development score could be calculated based on the appropriate age scale. For some children it was quite obvious that they could not start in the scale according to their age so they already got tasks presented of a lower age-scale. Children of who was known they were born premature were presented the tasks of the scale based on their corrected age. All children acquired a score for cognitive development by converting their raw scores into standard scores ( $M=100$ ;  $SD=15$ ). Children with standard scores below 55 were assigned a score of 54 (for a comparable practice see Van den Dries, et al., 2010).

*Time use* The time-use instrument was used to investigate how and with whom the children spend their time. The instrument was originally developed by Tirella et al. (2007). For the current study the instrument was adjusted to the situation of the babyhome. All the children have been observed one afternoon on a weekday by means of spot-observations: between 1 pm and 6 pm every ten minutes the researcher observed a child for approximately one minute. The observation got scored on ten different items and this was either done directly or the observation was filmed and scored on a later moment. The ten items of the observations were:

1. *WHO the child is interacting with.* In this category the child was categorized as being 'alone' when the child was not engaged in any interaction. An interaction is defined as eye contact, verbalization, playing or being fed. When a child was just sitting on someone's lap without getting any more attention, this was not categorized as interaction. When the child did have interaction, it was noted with whom this interaction was: another child, a caregiver, a volunteer or another adult.
2. *The ROLE OF THE ADULT(S) in the room.* In this category it was coded what the supervising adults in the room were doing. It was rated whether the adults were actively engaged with the children, if they were leading an activity, if they were providing 1:1 attention to the target child or if they were only monitoring the children or if there was no one monitoring at all.
3. *The ACTIVITY of the target child.* This category referred to what the child was doing at the time of the observation and was coded into one of the following categories: meaningful activity (e.g. playing, observing, exploring, engaged with something), non-meaningful activity (e.g. staring, doing nothing), motor-act, sleeping, eating or toileting (or being changed or washed).
4. *The AFFECT of the target child.* In this category the affect of the child was coded into one of the following categories: positive affect, negative affect, neutral or engaged.
5. *VOCALIZATIONS of the target child.* It was coded if the children were vocalizing and if so, to who they were 'talking': themselves, another child or to an adult.
6. *VOCALIZATIONS OF THE ADULT(S) in the room.* In this category the vocalizations of the adults in the room were coded into one of the following categories: vocalizations to another adult, to the group of children, to another child or to the target child.
7. *TONE OF VOICE of the adult.* If the adults were vocalizing during the observation it was rated whether their tone of voice sounded friendly, angry or neutral. If no adult in the room was vocalizing this category was noted as non-applicable.

8. *The presence and availability of MATERIALS for the child.* In this category it was coded if there were any materials present with the child, like toys, cups, food or other materials.
9. *The LOCATION of the target child.* During all observations it was rated where the child was, so it could be examined where the children spent their time.
10. *The GROUP activity in the room.* In this category the overall group activity was coded which served as a context for the individual observations. Group activities could be naptime, playtime, mealtime, educational time, toileting/ changing time or transition. Observations were rated in the transition category when the children were in transition from one activity to another or when half of the group was already doing a next activity while the target child was still waiting to get involved in the next activity.

Between the spot-observations the researcher left the room to prevent getting involved with the children or activities in the room. During the observations the researcher did not have interaction nor made eye contact with the children or adults in the room. Almost all the observations were filmed to make it possible to score it on a later moment as there was not always enough time to score everything directly.



## RESULTS

### *Physical growth*

On average the children in the babyhome displayed severe growth delays. For all ages combined the mean height-for-age z-score of the children was -2.03 and ranged from -3.06 to -0.56. The weight-for-age z-score ranged from -4.00 to 0.24 with an average of -2.26 (SD=1.19). The mean head-circumference-for-age z-score was -0.85 (SD= 1.03) and ranged from -2.52 en 1.33. We found significant differences with large effect sizes between the two age groups on all three growth parameters, what showed that babies lag more behind than toddlers. The weight-for-age for babies ( $z = -3.35$ ) was more delayed than for toddlers ( $z = -1.75$ ),  $t(20) = 3.734$ ,  $p = .007$ . The effect size of the difference was *Cohen's d* = 1.67. Babies were also more delayed in their height-for-age ( $z = -2.65$ ) than toddlers ( $z = -1.74$ ),  $t(20) = 2.979$ ,  $p = .001$ , the difference had an effect size of *Cohen's d* = 1.33. Weight-for-height-for age was also lower for babies ( $z = -2.83$ ) than toddlers (-1.23),  $t(20) = 3.538$ ,  $p = .002$ . The mean head circumference-for-age z-score for babies was -1.50 and for toddlers -0.54, this difference was also significant,  $t(20) = 2.245$ ,  $p = .036$ , with an effect size of *Cohen's d* = 1.00. The results are presented in Table 2. We found no effects for gender, the children's age at admission nor their weight at admission (when available).

Table 2

*Means and Standard deviations for physical growth and cognitive development by age group.*

	Total					Babies			Toddlers		
	<i>n</i>	min	max	M	(SD)	<i>n</i>	M	(SD)	<i>n</i>	M	(SD)
<b>Weight-for-age z-score</b>	22	-4.00	0.24	-2.26	(1.19)	7	-3.35	(0.37)	15	-1.75	(1.09)
<b>Height-for-age z-score</b>	22	-3.06	-0.56	-2.03	(0.78)	7	-2.65	(0.31)	15	-1.74	(0.77)
<b>Weight-for-height-for age z-score</b>	22	-3,97	0.69	-1.75	(1.21)	7	-2,83	(0,57)	15	-1,25	(1,11)
<b>Head circumference-for-age z-score</b>	22	-2.52	1.33	-0.85	(1.03)	7	-1.50	(0.77)	15	-0.54	(1.03)
<b>BSID-II DQ</b>	18	54	96	69.28	(12.20)	6	61.83	(7.20)	12	73.00	(12.7)

Correlations were found between height, weight and head circumference (see Table 3). Besides that we found associations between the children's age at research and their physical outcome measures: the older the children, the better their weight, height and head circumference. Duration of stay in the babyhome was associated with head circumference: the longer the children had lived in the babyhome, the better their age corrected head circumference-for-age. Associations between duration of stay and weight or height were not significant.

### Cognitive performance

Four children had missing values on the cognitive performance assessment, because they refused to cooperate with the cognitive development test. The results on the Bayley's Scales of Infant Development ranged from 54 to 96 with a mean of 69.28 (SD=12.20). This was 2.05 SD below average. No associations were found between cognitive performance and gender, age at admission, weight at admission or current weight, height or head circumference of the children. There was a difference on cognitive performance between toddlers (M=73.00; SD=12.68) and babies (M=61.83; SD=7.22), but this was a non-significant trend ( $p=0.065$ ). The effect size of this difference was *Cohen's d* = 1.08.

Table 3

*Correlations between the children's current age, age at admission, weight-for-age z-score at admission, duration of stay at the babyhome, physical growth and cognitive performance.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age at time of study	1								
2. Duration of stay in babyhome	<b>.67**</b>	1							
3. Age at admission	.38	<b>-.43*</b>	1						
4. Weight-for-age at admission	.13	.11	.38	1					
5. Weight-for-age	<b>.55**</b>	.36	.21	-.48	1				
6. Height-for-age	<b>.52*</b>	.41	.11	-.32	<b>.89**</b>	1			
7. Weight-for-height-for-age	<b>.53*</b>	.33	.24	-.52	<b>.97*</b>	<b>.77*</b>	1		
8. Head-circumference-for-age	<b>.75**</b>	<b>.74**</b>	-.01	.15	<b>.48*</b>	.39	<b>.51*</b>	1	
9. BSID Development Quotient	.35	.19	.41	.49	.39	.36	.38	.19	1

\* $p < .05$ ; \*\* $p < .01$

### Time use

Time use observations were conducted to investigate how and with whom the children spend their time and what the role of the present adult in the room was. The observations of the children took place between 1 pm and 6 pm and they were scored on ten different categories (see Method). All analyses were done for all ages combined, per age group and with and without naptime. *Who* In the category 'who' was coded if the children were actively engaged with another person in the room. On average the children spent 68.8% of their time between 1 pm and 6 pm without having any interaction with an adult or another child. The children spent on average 13.6% of their time with a caregiver, 7.8% with a volunteer, 3.1% with another adult (e.g. the nurse, visitor) and 3.1% with a child. When naptime was not included in the analyses, children still spent 53.4% of their time alone. Chi square tests, which were done based on the results without naptime, revealed that babies

(63.7%) spent significantly more time alone than toddlers (48.5%),  $\chi^2(4, N=451) = 14.20, p = 0.007$ .

The results are presented in Table 4.

Table 4

*Who: percentage of observation times children spent interacting with others by age group.*

Who	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
alone	68,8	65,8	75,1	53,4	48,5	63,7
caregiver	13,6	13,8	13,4	20,4	20,7	19,9
volunteer	7,8	8,4	6,5	11,8	12,8	9,6
child	6,7	8,0	4,1	9,8	11,8	5,5
others	3,1	4,1	0,9	4,7	6,2	1,4

$\chi^2(4, N=451) = 14.20, p < 0.010$ ;

*Note:* N refers to the number of observations.

*Role of the adult* During every spot observation it was examined if there was an adult in the room and what the adult was doing. When naptime was not included in the analysis, an average of 10.6% of the observed time an adult in the room provided 1:1 attention to the target child, in 18.2% of the time an adult in the room led an activity in which the target child was involved and in 26.4% the adult led an activity in which the target child was not involved (this could also be an activity in which the adult was not engaged with any child in the room, e.g. cleaning up). An average of 18.6% of the time the adults were feeding or changing other children in the room. In 10.7% of the observed time the adults in the room were only monitoring the children, and in more than half of these cases they had a child on their lap without having interaction with this child. Children were not monitored at all for 15.5% of the observed time. A chi-square test revealed differences in the role of the adult between the two age groups,  $\chi^2(6, N=451) = 30.81, p < 0.001$ . The percentage of time that adults provided 1:1 attention to the target child was slightly higher in the baby group (12.3%) than in the toddler group (9.8%). The proportion of time that adults spent in activities in which the target child was involved also differed between age groups: toddlers spent (21.3%) more time in an adult-led activity than babies (11.6%). Adults spent 35.6% of the observed time of the babies in leading an activity without the target child being involved, against 22.0% of the observed time in the toddler group. Children from the toddler group spent more time without being monitored (17%) than children of the baby group (12.3%) (see Table 5).

Table 5

*Adult role: percentage of observation time for the role of adult by age group.*

Adult role	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
monitoring with child on lap	4,0	2,2	7,8	6,0	3,3	11,6
monitoring without child	10,7	13,1	5,5	4,7	5,9	2,1
no monitor	35,3	34,8	36,4	15,5	17,0	12,3
adult led activity	12,0	14,0	7,8	18,2	21,3	11,6
adult led activity excl. target child	18,5	15,7	24,4	26,4	22,0	35,6
1:1 attention to target child	7,2	6,7	8,3	10,6	9,8	12,3
changing/feeding other child	12,3	13,5	9,7	18,6	20,7	14,4

$\chi^2(6, N=451) = 30.81, p < 0.001$

*Activity of the child* This category represents what the children were doing at the time of the observation. The majority of the observed time (52.1%) the children spent in meaningful activity (e.g., playing, exploring, observing and cuddling) followed by non-meaningful activity (19.5%) like staring and doing nothing. About 20% of the time children were involved in activities of daily living like eating (10.6%) and washing and changing (8.0%). Differences in what the children were doing were significant between age groups,  $\chi^2(6, N=451) = 16.80, p=0.01$ . Babies spent more time (26.7%) in non-meaningful activity than toddlers (16.1%). Toddlers (20.6%) spent more time in activities of daily living than babies (14.3%). The results are presented in Table 6.

Table 6

*Activity: percentage of observation times children spent on different activities by age group*

Activity	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
sleep	25,2	28,2	18,9	0,7	1,0	0,0
meaningful activity	35,9	34,0	40,1	52,1	50,8	54,8
motor act	4,7	5,6	2,8	7,1	8,5	4,1
non-meaningful activity	20,5	16,8	28,6	19,5	16,1	26,7
eating	7,0	8,0	5,1	10,6	12,1	7,5
changing/ bathing / toileting	5,3	5,6	4,6	8,0	8,5	6,8
other (agression/ self stimulating behavior)	1,3	1,9	0,0	2,0	3,0	0,0

$\chi^2(6, N=451) = 16.80, p=0.010$

*Affect* During the observations the children were scored on the affect they displayed on their faces. Positive affect was coded in 13.1% and negative affect in 7.8% of the observed time. Almost 40% of the time children had a neutral expression on their face, and in 39.5% of the observed time the children exhibited an affect of curiosity. Differences were found between the affect of toddlers and children from the baby group:  $\chi^2(3, N=451) = 8.54, p = 0.036$ . Toddlers displayed more neutral affect (42.3% vs. 34.2%) and curiosity (40.7% vs. 37%) than babies, while the children of the baby group on

their turn displayed more positive (18.5%) affect than toddlers (10.5%). Also negative affect was displayed more by the baby group (10.3%) than the toddler group (6.6 %). The results are presented in Table 7.

Table 7

*Affect: percentage of observation times for affect of the target child by age group.*

Affect	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
positive affect (smile/ laugh)	8,8	7,1	12,4	13,1	10,5	18,5
negative affect (frown/cry)	5,3	4,5	6,9	7,8	6,6	10,3
neutral	58,8	61,5	53,0	39,7	42,3	34,2
engaged / curious	27,1	26,9	27,6	39,5	40,7	37,0

$\chi^2 (3, N=451) = 8.54, p = 0.036$

*Adult vocalizations* The use of language by the adults in the room was also coded during the observations. The results are presented in Table 8. On average 14.0% of the observed time an adult was speaking to the target child, 30.2% of the time to another child and in 26.4% of the time the adult spoke to another adult. Adults did not vocalize in 25.1% of the observations. There was a significant difference between age groups:  $\chi^2 (4, N=451) = 14.32, p = 0.006$ . Adults spoke more to other adults during the observations of babies (36.3%) than during the observations of toddlers (21.6%). Vocalizations directed to the target child were more observed in the toddler group (16.1%) than in the baby group (9.6%).

Table 8

*Adult vocalizations: percentage of observation time adults vocalized.*

Adult vocalizations	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
adult to adult	22,3	20,0	27,2	26,4	21,6	36,3
adult to target child	9,4	10,8	6,5	14,0	16,1	9,6
adult to other child	20,2	20,4	19,8	30,2	30,5	29,5
adult to group/ other	2,9	3,7	1,4	4,4	5,6	2,1
no vocalizations	45,2	45,2	45,2	25,1	26,2	22,6

$\chi^2 (4, N=451) = 14.32, p = 0.006$

*Child vocalizations* Vocalizations of the target child were scored during the observations. In Table 9 the results are presented. For all ages combined on average 70.1% of the time the children were not vocalizing, 8.2% of the time the target child vocalized to another child, 9.1% they vocalized to themselves and 11.5% of their time they vocalized to an adult. Toddlers vocalized more than babies,  $\chi^2 (3, N=451) = 34.07, p < 0.001$ . Babies did not vocalize for 80.8%, toddlers not for 66.6% of the observed time. Toddlers vocalized more to other children (11.5%) and to adults (15.4%) than babies (respectively 1.4% and 3.4%). Vocalizations to themselves or a toy more observed in the baby group (6.6%) than in the toddler group (14.4%).

Table 9

*Child vocalizations: percentage of observation time for vocalizations of the target child by age group.*

Child vocalizations	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
child to other child	5,9	8,0	1,4	8,2	11,5	1,4
child to self / other vocalizations	7,3	6,2	9,7	9,1	6,6	14,4
child to adult	7,9	10,5	2,3	11,5	15,4	3,4
no vocalizations	78,9	75,3	86,6	71,2	66,6	80,8

$\chi^2 (3, N=451) = 34.07, p < 0.001$

*Materials* This category examined what materials were in use or in the direct proximity of the children during the observations. For all ages combined 45.2% of the time there were no toys in the proximity of the children. In 16.6% of the observations the children had a toy and in 16.9% of the time, toys were available but the target child did not play with it. The children had food in 7.5% of the time and a bottle or cup in 4.9% of the time. The availability of toys differed among age groups,  $\chi^2 (5, N=451) = 18.39, p = 0.003$ : during the observation time of babies, toys were not available for 58.2% of their time, while for toddlers there were no toys available in 39.0% of the observation time. The children from the toddler group (19.0%) played with toys more often than children from the baby group (11.6%). Food and bottles or cups were also more present in the toddler group than in the baby group (see Table 10).

Table 10

*Percentage of observation time for use of materials by age group.*

Materials	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
non available	63,6	60,0	71,4	45,2	39,0	58,2
toys	11,0	12,5	7,8	16,6	19,0	11,6
bottle/cup	3,2	3,7	2,3	4,9	5,6	3,4
none	11,1	11,0	11,5	16,9	16,7	17,1
food	5,0	6,0	2,8	7,5	9,2	4,1
other	6,0	6,9	4,1	8,9	10,5	5,5

$\chi^2 (5, N=451) = 18.39, p = 0.003$

*Where* The babyhome consisted of different rooms. During the observations it was examined in which room the children were spending their time. Babies and toddlers did have a different day schedule and used different rooms during the day, therefore results are only reported per age group (see Table 11). Chi-square tests were not performed as this seemed not relevant. Both groups have their own room for playing: the playroom for toddlers and the babyroom for the babies. Because toddlers are able to move freely in the babyhome, they spend their time in many different places and they can go from one room to another. The toddlers spent most of their time (when naptime is not

included) in the playroom (29.2%), in their chairs in the eating room (13.5%), and in the changing room (12.8%). Babies spend much time in the babyroom: mostly on the floor of the babyroom (30.1%), in the swing (16.4%), or on the lap of a nanny or volunteer (9.6%). In 15.1% of the observed time they were sitting in their chairs in the eating room. Both groups spent some time outside in the garden: toddlers 9.8% and babies 8.9% of the time.

Table 11

*Percentage of observation times for location of the target child by age group.*

Where	Naptime included		Naptime excluded	
	toddlers	babies	toddlers	babies
playroom	19.1	0.5	29.2	0.7
classroom	6.2	0.0	9.5	0.0
laundry room	0.2	0.0	0.3	0.0
kitchen	1.1	0.5	1.6	0.7
baby room - floor	3.4	20.3	5.2	30.1
baby room - swing	0.0	11.1	0.0	16.4
baby room - on lap	0.0	6.5	0.0	9.6
changing room	6.9	5.1	10.5	7.5
bedroom for playing	1.7	0.5	2.6	0.7
bedroom for sleeping	37.2	35.5	4.6	4.1
corridor	5.4	0.5	7.9	0.7
nurse room	0.9	0.0	1.3	0.0
eating room in chair	8.4	10.1	12.8	15.1
eating room on the floor	3.0	3.7	4.6	5.5
outside	6.5	6.0	9.8	8.9

*Group* In this category it was noted what the activity of the group was during the observations. From 1pm to 6pm in the afternoon the children had on average 33.9% naptime, toddlers (34.4%) a bit more than babies (32.7%). Both groups did have a lot of playtime: the time the children were not supposed to sleep, the babies had 55.5% of their time for playing and for toddlers this was 42%. It must be noted though, that during playtime the children were in a play area (with or without toys presented) and just had time for playing. The children were in most cases not actively stimulated or entertained by the nannies. Toddlers also had some educational time, on average 6% of their time. This was the time the older toddlers attended preschool on some afternoons. A substantial part of the time the children were in a transition from one activity to another: toddlers 18% of their time and babies 23.3%. See Table 12 for other group activities.

Table 12

*Percentage of observation times for group activity by age group.*

Group	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
naptime	33.9	34.4	32.7	n.a.	n.a.	n.a.
mealtime	10.0	10.1	9.7	15.1	15.4	14.4
playtime	30.6	27.5	37.7	46.3	42.0	55.5
singtime	0.6	0.9	0.0	0.9	1.3	0.0
educational time	4.1	6.0	0.0	6.2	9.2	0.0
bathing / toileting / changing	6.2	6.9	4.6	9.3	10.5	6.8
transistion / preparation	13.0	11.8	15.7	19.7	18.0	23.3
other	0.3	0.4	0.0	0.4	3.7	0.0

*Tone of voice* In almost 80% of the observations, adults were vocalizing either to other adults or to the children. The tone of voice of these vocalizations were noted. The tone of the adults was mostly neutral (40.8%), often friendly (33.5%) and only sometimes angry (2.2%). Chi-square tests revealed there were no differences in tone of voice of adults between observations of toddlers or babies:  $\chi^2 (3, N=451) = 1.12, p = 0.77$ .

Table 13

*Percentages of observation times for tone of voice of adults.*

Tone of voice	Naptime included			Naptime excluded		
	total	toddlers	babies	total	toddlers	babies
friendly	22.1	21.7	23.2	33.5	33.1	34.2
angry	1.8	2.2	0.9	2.2	2.6	1.4
neutral	32.0	23.2	31.3	40.8	40.0	42.5
non applicable	44.1	43.9	44.7	23.5	24.3	21.9

$\chi^2 (3, N=451) = 1.12, p = 0.77$ .

#### *Associations between time use and physical and cognitive development*

To investigate whether there was a relation between the time use scores of the children and their mental development and physical growth it was analyzed whether there were differences between children who spent the most time alone (without any interaction) and the children who spent the fewest time alone. Therefore the physical outcome measures and the results on the cognitive performance tests of the 25% children that were most alone were compared with these results of the 25% of the children that were least alone. We found that the children that were most alone were more delayed in all the investigated outcome measures. Children that were most alone, were significantly younger than children that were least alone. Height-for-age differed significantly



between the two groups, with children being most alone showing a greater delay,  $t(11)=2.566$ ,  $p=0.03$ . The effect size of this difference was *Cohen's d* = 2.53. The other differences were not significant. The results including effect sizes are presented in Table 14.

Table 14

*Differences between the children that were least alone and most alone on outcome variables.*

	Time-use	n	M	(SD)	t-tests	Cohen's d
<b>Age at research</b>	25% least alone	7	22,88	(7,39)	t (10)=2.631, p = 0.023	1.51
	25% most alone	6	14,43	(2,77)		
<b>BSID Development Quotient</b>	25% least alone	7	69,43	(9,03)	not significant	0.40
	25% most alone	5	66,40	(5,46)		
<b>Weight-for-length z-score</b>	25% least alone	7	-1,42	(0,95)	not significant	0.82
	25% most alone	6	-2,33	(1,24)		
<b>Weight z-score</b>	25% least alone	7	-1,80	(1,01)	not significant	1.08
	25% most alone	6	-2,90	(1,02)		
<b>Height z-score</b>	25% least alone	7	-1,57	(0,69)	t (11) = 2.566, p = 0.026	-2.53
	25% most alone	6	-2,49	(0,58)		
<b>Headcircumference z-score</b>	25% least alone	7	-0,67	(1,23)	not significant	0.65
	25% most alone	6	-1,32	(0,68)		

## DISCUSSION

The present study examined the physical growth, cognitive development and time use of 22 children between 12 and 35 months, residing in a babyhome in Tanzania, East Africa. We compared the outcomes of the physical measurements with the standards of the World Health Organization and their cognitive performance with the norm scores of the test, the Bayley Scales of Infant Development. Time use was examined by spot observations and had the objective of getting insight on how the children spent their time and how many social interactions they had. Moreover, associations between the physical development, cognitive performance and time use have also been investigated.

### *Physical growth*

The results showed that the children lag behind in weight ( $z = -2.25$ ) and height ( $z = -2.03$ ) and in lesser degree in head-circumference ( $z = -0.85$ ) compared to the World Health Organization standards. This finding confirms the first hypothesis and is similar to studies from other parts of the world that investigated physical growth of institutionalized children (Balkaran, 2010; Dobrova-Krol et al., 2010; Van IJzendoorn et al., 2007). We found significant differences in growth between the two age groups. The younger age group ( $M=12.7$  months) had more severe delays in weight, height, and head circumference than the older age group ( $M=22.7$ ). Effect sizes of the differences were large, according to conventional criteria (Cohen, 1988), for all three growth parameters. The finding is partly in line with the outcomes of Dobrova-Krol et al. (2008) who found that among institutionalized children in Ukraine, growth delays were most severe during the first two years of life. A likely explanation for this outcome, suggested by Dobrova-Krol (2008), is that older children have more capacities in adapting to their environments, and as a result are more able in taking care of their own needs for food and stimulation. In the current research the difference between the two age groups in the Tanzanian babyhome is their ability to walk. When a child is walking, it has much more possibilities to seek attention from caregivers to have these needs fulfilled. Therefore this explanation seems relevant.

We also found that a longer duration in the babyhome was strongly and significantly associated with a larger head circumference. This finding is in contrast with the finding in the meta-analysis of Van IJzendoorn et al. (2007) that longer duration in institutional care was associated with a more delayed growth in height, pointing to a dose-response relation. Because duration of stay in the babyhome was strongly related to the age of the children it is hard to determine whether this result of a better head circumference-for-age is more associated with age or with the influence of the institution.

For thirteen children we knew the weight of when they were admitted to the babyhome. We found that weight-for-age at admission was not associated with current growth outcomes: some children were having better growth outcomes than when they were admitted whereas others growth-for-age was worsened since their admission. This finding indicates that individual differences and the genetic makeup of the children may also play an important role in growth development of children in institutions.

### *Cognitive development*

The results on the Bayley Scales of Infant Development demonstrated that the children in the babyhome have severely delayed intellectual development, with an average score of  $DQ = 69.3$  ( $SD=12.2$ ). This outcome confirmed the second hypothesis that the children in the babyhome in Tanzania are delayed in their cognitive development and is similar to findings of other studies that investigated intellectual development of children in institutions (Dennis, 1973; Castle et al., 1999; Loman et al., 2009). We also examined whether there were any differences between the two age groups in cognitive performance. The results showed that the average score of the toddlers on the development test was higher ( $M=73.0$ ) than the average score of the babies ( $M=61.3$ ), but this difference was not significant. Since the difference seems quite substantial (given the effect size of *Cohen's d* =1.08), this being non-significant is probably due to the fact that group sizes are small.

### *Time use*

One of the objectives of this study was to empirically document the time-use patterns of children in a babyhome in Tanzania. Observations revealed that the children in the babyhome in Tanzania spent on average almost 54% of their time alone (not interacting with another person). The finding is comparable with the result of a Russian babyhome, where children spent on average 50% of their time alone (Tirella et al., 2007). In the study of Daunhauer et al. (2005), the children in the Romanian institution children spent on average 70% of their time alone, while the children in the US daycare center were alone for 37% of their time. We found that in our study the percentage of being alone was higher for babies (63.7%) than for toddlers (48.5%). Differences between age groups, with younger children being more alone, were also found in the Russian and Romanian studies. Children in our study had interactions with caregivers in about 20% of the time and 11% of the time with volunteers. In Tirella's study, with similar caregiver-to-child ratio (7:1) as in the current study, interaction with caregivers was observed in 27% of the time. This finding raises the question whether caregivers in the Tanzanian babyhome step back when volunteers are around or if they just don't have more time to interact with children.

Regarding the role of the adult, we found that children were unmonitored for 15.5% in the current study versus 12% in the Russian babyhome and 27% in the Romanian babyhome. We found toddlers being more unmonitored which is in contrast with Tirella's study (Daunhauer et al., 2005; Tirella et al., 2007). A possible explanation is that the toddlers in our study were often moving from one area to another, away from where caregivers were monitoring or interacting with children. Caregivers provided one-to-one attention to the target child in 10.6% of the time whereas in the Russian babyhome this was 14%. Regarding the activities of the observed children we found that children were on average 52.1% occupied in meaningful activities. Children in Tirella's study were involved in meaningful play in 27% of their time. The difference between the two studies in time spent on meaningful activity might be explained by a different definition. In the current study not only playing was considered as being 'meaningful activity' but besides that also exploring, observing others, being engaged with an object, cuddling or seeking interaction, while in Tirella's study meaningful play was defined by developmentally appropriate learning based task. Almost 20% of the time, children spent in non-meaningful activities with a higher percentage for babies (26.7%) than toddlers (16.1 %). In the Russian babyhome, non-meaningful activities also occurred more in the younger age groups.

Although many toys were available in the babyhome, we found that for the babies in 60% of their time the children did not have access to them, while toddlers did not have access to toys in 39% of their time. Toys were often available on the floor but when children were in the swing or in a baby bouncer chair, they could not reach for it.

Regarding group activities we found that for babies 32.7% of the observed time was naptime, while they were only sleeping in 18.9% of their time. Babies had two naptimes per day and the observations included the second naptime. This indicates that children were often put in bed while they were not even tired, indicating a lack of attention to the children's individual needs.

An important result of this study is that we were able to provide evidence that the number of interactions the children had, was related to the physical growth of children. Children who were the most alone had significantly more delayed growth in height than children who were the least alone during the observations. The effect size of the difference is large, Cohen's  $d = -2.53$ . The differences on weight-for-age and head-circumference-for-age between the group that were most alone and least alone, were not significant. This is probably due to the small groups as the differences seem quite substantial (given the effect size of *Cohen's*  $d = 1.08$  for the difference in weight-for-age and an effect size of  $d = 0.65$  for head circumference-for-age). However, we found an effect for the age of children: the children that were least alone were significantly older than the children that were most alone. This raises the question whether the children in the babyhome are lagging behind in physical growth because of neglect (being more alone) or just because they are younger? As mentioned

before, a plausible explanation might be that because they are younger, they are more alone due to the fact that they cannot walk yet and therefore they cannot actively for attention to fulfill their needs.

#### *Limitations and future directions*

The major limitation of the current study is the modest sample size. The age at admission of the children was not equally distributed, but excluding the outliers would result in a smaller group. Due to the modest sample size it was not possible to draw strong conclusions. We found for example that age, duration at the babyhome and number of interactions were related to physical growth but we were not able to draw conclusions on the unique contribution of each of these variables on these outcomes. Multiple regression analysis would have been useful but the group was too small to do so. More studies in other institutions with larger samples are needed to be able to determine the influence of these variables.

Another limitation is that we were not able to conduct growth curves, as previous data on physical growth were scarcely present. Growth curves would give us the possibility to see how growth develops and more specifically when the growth delay decreases or increases. Some children resided in the home since they were only a few days or weeks old. They then first resided in the nursery, together with a maximum of 11 other newborns. At a certain age, when they were able to eat solid food, they moved to the main house to the babygroup and next, when they were able to walk, they were moved to the toddler group. Growth curves would have given us insight in how these changes from one group to another have affected their growth.

The fact that we did not have a control group of children living in family care can also be considered as a limitation. We compared the physical growth of the children with WHO standards and the results of the cognitive performance test with norm scores of the test based on normally developing children from Western societies. Previous studies have shown that in countries with a low HDI, there is no discrepancy in IQ between children growing up in institutions compared with children reared in family care (Aboud et al., 1991; Otieno et al., 1999; Wolff et al., 1995).

An aspect of child development that has not been examined in the current study is attachment of the children. The lack of stable and warm relationship with a caregiver seems to play an important role in the development of young children (Bowlby, 1951; Groark, Muhamedrahimov, Palmov, Nikiforova, & McCall, 2005). This might also affect the physical and cognitive development of children.

### *Practical implications*

Our results demonstrated that spending more time alone, is associated with more severe physical growth delays. This has important practical implications concerning the way the caregivers and other adults like volunteers interact with the children and respond to their needs. Especially younger children, who are not able yet to actively seek for attention to have their needs met, demonstrated the most severe delays in physical growth and cognitive performance. In the study of Groark et al. (2005) two interventions were implemented in baby homes in Russia, with the goal of promoting positive social emotional relationships between caregivers and children. One intervention consisted of training caregivers to promote warm and responsive caregiving and the other intervention was altering staffing schedules and changing the physical environment to support relationship building. The interventions resulted in improvements in physical growth, cognitive performance and other developmental aspects. A meta-analysis on interventions in orphanages conducted by Bakermans-Kranenburg, Van IJzendoorn and Juffer (2008) showed that interventions in orphanages have been quite successful in enhancing children's cognitive development, although intervention studies in Africa are lacking in the literature.

Besides increased sensitivity from caregivers, another important aspect that involves improved cognitive performance is the quality of play. In a study of Taneja et al. (2002) it was demonstrated that short daily sessions of play can significantly improve the cognitive development of children. Also Vygotsky (1978) stated that children require varied play opportunities, a range of play objects, and adult interactions to enhance cognitive development.

Although in the current babyhome in Tanzania the caregivers were supported by many volunteers, the physical and cognitive development of the children was severely delayed and children often did not have interactions with others. These volunteers came from all over the world to help in the babyhome, and cuddle and play with the babies. The question rises what the benefits are of utilizations of volunteers. In McCall et al. (in press) it is argued that since one-to-one interactions between a child and adult are often limited in institutional care, utilization of volunteers can augment child-adult interactions. Volunteers should be screened and trained before coming into contact with the children. Although volunteer use can be beneficial it can also contribute to instability and be a safety issue when volunteers are unreliable and do not have training in child development and other necessary skills (Rosas & McCall, 2009).

Children in institutions are considered at being at risk of harm (Johnson, 2006). The present study confirms this conclusion. On the other hand, the children from the current study have nowhere else to go. Without the support of the babyhome the babies who lost their mothers at birth would have had a hard time in surviving at home without proper nutrition. Although in many studies on (post)institutionalized children family care is considered to be the best environment for children to

grow up, the few studies from Africa have showed unequivocal results (Aboud et al., 1991; Whetten et al., 2009; Wolff & Fesseha, 2005). In a study from Botswana (Morantz & Heymann, 2010) children were interviewed on their experiences of living in a residential facility. The children reported on the importance of having access to food, shelter and schooling and a sense of belonging. However, they also revealed a profound ambivalence towards their caregivers and described feeling disconnected from the community at large and missing their families. All children have the right to family life. Article 9 and other articles of the UN Convention on the Rights of the Child (1989) state that children have a right to family relations and to be with their parents unless this is proven to be not in their best interests. Institutions cut children off from their families and take away their critical role in promoting children's care and well-being. Therefore, institutional care should always be the last resort for children (Save the children, 2009).

## REFERENCES

- About, F., Samuel, M., Hadera, A., & Addus, A. (1991). Intellectual, social and nutritional status of children in an Ethiopian orphanage. *Social Science Medicine*, 33(11), 1275–1280.
- Ames, E.W., Fraser, S., & Burnamy, B.C. (1997). *The development of Romanian orphanage children adopted to Canada*. British Columbia: Simon Fraser University.
- AVERT. Averting HIV and AIDS. HIV and AIDS in Tanzania. Retrieved August 17, 2011, <http://www.avert.org/hiv-aids-tanzania.htm>
- Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H., & Juffer F. (2008). Earlier is better: A Meta-analysis of 70 years of intervention improving cognitive development in institutionalized children. *Monographs of the Society for Research in Child Development*, 73(3), 279-293.
- Bayley, N. (1993). *Bayley Scales of Infant Development Second Edition*. San Antonio: The Psychological Corporation.
- Bowlby, J. (1951). *Maternal care and mental health*. World Health Organization Monograph, 2. Geneva: World Health Organization.
- Castle, J., Groothues, C., Bredenkamp, D., Beckett, C., O'Connor, T., & Rutter, M. (1999). Effects of qualities of early institutional care on cognitive attainment. *American Journal of Orthopsychiatry*, 69, 424–437.
- Chisholm, K. (1998). A three year follow-up attachment and indiscriminate friendliness in children adopted from Romanian orphanages. *Child Development*, 69, 1092-1106.
- Cicchetti, D., & Valentino, K. (2006). An ecological transactional perspective on child maltreatment: Failure of the average expectable environment and its influence upon child development. In D. Cicchetti, & D. J. Cohen (Eds.), *Developmental psychopathology: risk, disorder, and adaptation* (Vol. 3, pp. 129–201). New York: Wiley.
- Clark, F., & Monasch, R. (2004). Grandparents' growing role as carers. *Ageing and Development*, 16, 6-7. <http://www.helpage.org/download/4d066c9d482ed/> Accessed September 2011.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York. Academic Press.



- Curtis, J.W., & Nelson, C.A., (2003). In Luthar, S. (Ed.) *Resilience and Vulnerability: Adaptation in the context of childhood adversities*. Cambridge University Press, London.
- Daunhauer, L.A., Boloton, A., & Cermak, S. (2005). Time Use patterns of young children institutionalized in Eastern Europe. *OTJR: Occupation, Participation and Health*, 25 (1), 33-40.
- Dennis, W. (1973). *Children of the creche*. New York: Appleton-Century Crofts.
- Dobrova-Krol, N.A., van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., & Juffer, F. (2010). Effects of Perinatal HIV Infection and Early Institutional Rearing on Physical and Cognitive Development of Children in Ukraine. *Child Development*, 81(1), 237-251.
- Dobrova-Krol, N.A., van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., Cyr, C., & Juffer, F. (2008). Physical growth delays and stress dysregulation in stunted and non-stunted Ukrainian institution-reared children. *Infant behavior & Development*, 31(3), 539-553.
- Goldfarb, W. (1945). Effects of psychological deprivation in infancy and subsequent stimulation. *American Journal of Psychiatry*, 102, 18-33.
- Groark C.J., Muhamedrahimov R.J., Palmov O.I., Nikiforova N.V., & McCall R.B. (2005). Improvements in early care in Russian orphanages and their relationship to observed behaviors. *Infant Mental Health Journal*, 26(2), 96-109.
- Gunnar, M.R. (2001). Effects of early deprivation. In C.A. Nelson, & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (pp. 617–629). Cambridge, MA: MIT Press.
- Johnson, D.E. (2000). Medical and developmental sequelae of early childhood institutionalization in Eastern European adoptees. In C. A. Nelson (Ed.), *The effects of early adversity on neurobehavioral development* (pp. 113–162). Minnesota Symposia on Child Psychology, 31.
- Johnson, D.E., Guthrie, D. Smyke, A.T., Koga, S.F., Fox, N.A., Zeanah, C.H., & Nelson, C.A. (2010). Growth and associations between auxology, caregiving environment, and cognition in socially deprived Romanian children randomized to foster vs ongoing institutional care. *Archives of Pediatrics and Adolescent Medicine*, 164 (6), 507-516.

- Johnson, R., Browne, K., & Hamilton-Giachritsis, C. (2006). Young children in institutional care at risk of harm: A review. *Trauma, Violence and Abuse, 7*, 34-60.
- Loman, M.M., Wiik, K.L., Frenn, K.A., Pollak, S.D., & Gunnar, M.R. (2009). Post institutionalized Children's Development: Growth, Cognitive, and Language Outcomes. *Journal of developmental and behavioral pediatrics, 30*, 426-434.
- McCall, Van IJzendoorn, M.H., Juffer, F., Groark, C.J., & Groza, V.K. (Eds.) (in press). Children without permanent parental care: research, practice and policy. *Monographs of the society for research in child development*.
- Miller, L.C. (2005). *The handbook of international adoption medicine. A guide for Physicians, Parents, and Providers*. Oxford: Oxford University Press.
- Morantz, G., & Heymann J. (2010). Life in institutional care: the voices of children in a residential facility in Botswana. *AIDS Care, 22*, 10-16.
- Nelson, C., Zeanah, C.H., Fox, N.A., Marshall, P.J., Smyke, A.T., & Guthrie, D. (2007). Cognitive recovery in socially deprived young children: The Bucharest early intervention project. *Science, 318*, 1937–1940.
- O'Connor, T.G., Rutter, M. Beckett, C., Keaveney, L., Kreppner, J.M., & The English and Romanian Adoptees Study Team (2000). The effects of global severe privation on cognitive competence: extension and longitudinal follow-up. *Child Development, 71*, 376–390.
- Otieno, P.A., Nduati, R.W., Musoke, R.N., & Wasunna, A.O. (1999). Growth and development of abandoned babies in institutional care in Nairobi. *East African Medical Journal, 76*, 430–5.
- Provence, S., & Lipton, R.C. (1962). *Infants in institutions*. New York: International Universities Press.
- Save the Children, Keeping Children out of Harmful Institutions: Why we should be investing in family-based care, Save the Children, UK: London. November 2009.
- Rosas, J., & McCall, R.B. (2009). Characteristics of institutions, interventions, and resident children's development. Unpublished manuscript, authors. Pittsburgh, PA: University of Pittsburgh Office of Child Development.

- Taneja, V., Sriram, S., Aggarwal, R., Kaur, R., Beri, R.S., & Puliyel, J.M. (2002). 'Not by Bread Alone': Impact of a structured 90 minute per day playsession on development of children in an orphanage. *Child: Care, Health and Development*, 28, 95–100.
- The St. Petersburg–USA Orphanage Research Team (2005). Characteristics of children, caregivers, and orphanages for young children in St. Petersburg, Russian Federation. *Journal of Applied Developmental Psychology*, 26, 477–506.
- The St. Petersburg–USA Orphanage Research Team (2008). The effects of early social-emotional and relationship experience on the development of young orphanage children. *Society for Research in Child Development Monograph*, 73 (3, Serial No. 291).
- Tirella, L., Chan, W., Cermak, S., Litvinova, A., Salas, K., & Miller, L. (2007). *Child: Care, Health and Development*, 34 (1), 77-86.
- Tizard, B. (1977). *Adoption: a second chance*. London: Open Books.
- UNICEF, 2007. *The state of the world's children*. New York, NY: UNICEF.
- United Nations (1989). *Conventions and the Rights of a child*. <http://www.unicef.org/crc/> Accessed on August 16, 2011.
- Van den Dries, L., Juffer, F., Van IJzendoorn, M.H., & Bakermans-Kranenburg, M.J. (2010). Infants' physical and cognitive development after international adoption from foster care or institutions in China. *Journal of Developmental & Behavioral Pediatrics*, 31, 144-150.
- Van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., & Juffer, F. (2007). Plasticity of growth in height, weight, and head circumference: Meta-analytic evidence of massive catch-up after international adoption. *Journal of developmental and behavioral pediatrics*, 28(4), 334-343.
- Van IJzendoorn, M.H., & Juffer, F. (2006). The Emanuel Miller Memorial Lecture 2006: Adoption as intervention. Meta-analytic evidence for massive catch-up and plasticity in physical, socio-emotional, and cognitive development. *Journal of Child Psychology and Psychiatry*, 47, 1228–1245.

- Van IJzendoorn, M.H., Luijk, M.P.C.M., & Juffer, F. (2008). IQ of children growing up in children's homes: A meta-analysis on IQ delays in orphanages. *Merrill-Palmer Quarterly- Journal of developmental Psychology*, 54, 341.
- Vorria, P., Papaligoura, Z., Dunn, J., van IJzendoorn, M.H., Steele, H., Kontopoulou, A., & Sarafidou, Y. (2003). Early experiences and attachment relationships of Greek infants raised in residential group care. *Journal of Child Psychology and Psychiatry*, 44(8), 1208–1220.
- Vorria, P., Papaligoura, Z., Sarafidou, J., Kopakaki, M., Dunn, J., Van IJzendoorn, M.H., & Kontopoulou, A. (2006). The development of adopted children after institutional care: a follow-up study. *Journal of Child Psychology and Psychiatry*, 47 (12), 1246–1253.
- Vygotsky, L.S. (1978) *Mind in society*. Harvard University Press, Cambridge MA, USA.
- Whetten, K., Ostermann, J., Whetten, R.A., Pence, B.W., O'Donnell, K., Messer, L.C., Thielman, N.M., & The Positive Outcomes for Orphans (POFO) Research Team (2009). A comparison of the wellbeing of Orphans and abandoned children ages 6-12 in institutional and community-based care settings in 5 less wealthy nations. *PLoS ONE* 4(12): e8169.doi: 10.1371/journal.pone.0008169
- Wolff, P.H., & Fesseha, G. (1998). The orphans of Eritrea: Are orphanages part of the problem or part of the solution. *American Journal of Psychiatry*, 155, 1319-1324.
- Wolff, P.H., Tesfai, B., Eyasso, H., & Aradom, T. (1995). The orphans of Eritrea: a comparison study. *Journal of Child Psychology and Psychiatry*, 36, 633-644.
- World Health Organization. WHO Anthro software. Available at: [www.who.int/childgrowth/software/en/](http://www.who.int/childgrowth/software/en/) Accessed January 2011.
- Zeanah, C. H., & Gleason, M. M. (2010). Reactive attachment disorder: A review for DSM-V. <http://www.dsm5.org/Proposed%20Revision%20Attachments/APA%20DSM-5%20Reactive%20Attachment%20Disorder%20Review.pdf> Accessed September 2011.

Zeanah, C.H., Smyke, A.T., & Settles, L.D. (2006). Orphanages as a developmental context for early childhood development. In K. McCartney, & D. Phillips (Eds.) *The Blackwell Handbook of Early Childhood Development*. USA : Blackwell Publishing.

Zeanah, C.H., Smyke, A.T., Koga, S.F.M., Carlson, E., & BEIP Core Group (2005). Attachment in institutionalized and non-institutionalized Romanian children. *Child Development*, 76, 1015-1028.

**Case study 1.**

**The physical development of all children residing in the Tanzanian babyhome.**

In the main study we reported on the physical growth of 22 children (>12 months) residing in a Tanzanian babyhome. During the research, physical growth information of children younger than 12 months was also collected. We did not include this data in the results of the main study because due to restricted time, we had not acquired information on the cognitive development and time use of these children. In this case study we report on the physical development of the total group of children residing in the babyhome in Tanzania.

**Method**

*Participants*

All children who resided in the babyhome at the start of the research were eligible for participation. Four children were excluded: a girl with cerebral palsy, a three year old boy suffering from an unknown syndrome which made him look like an infant, a 18 month old boy who only lived at the babyhome since a few days when the research started and a four year old HIV+ boy with severe stunted growth (height-for-age z-score < -5). This resulted in 37 participants, 18 boys and 19 girls. The age of the children ranged from 3.1 – 35.8 months with an average age of 15.6 months (SD=8.9). The age on admission was on average 2.8 months (SD=4.7) and varied between 0.1 – 24.0 months. In the babyhome children are divided three groups: newborns, babies and toddlers. Group differences on weight-for-age, height-for-age, weight-for-height-for-age and head circumference were compared with each other.

*Procedure*

The children's weight was measured by use of a Soehnle digital baby scale. Head circumference and height of the children were determined by use of a tape measure. Depending on the age of the child height was measured when they were either standing up or lying down. Scores were converted into z-scores, using Anthro statistical software.

## Results

For all ages combined the children showed severe growth delays in weight ( $z=-2.77$ ), height ( $z=-2.39$ ), weight-for-height ( $z = -1.95$ ), and head circumference ( $z =-1.03$ ). The results are presented in table 1.

Table 1

Means and standard deviations for age, length of stay at babyhome and physical growth-for-age.

	<i>n</i>	min	Total		
			max	M	(SD)
Age at admission (in months)	37	0.13	23.95	2.84	(4.68)
Age at time of study (in months)	37	3.12	35.84	15.62	(8.87)
Length of stay at babyhome (in months)	37	2.33	31.51	12.78	(8.07)
Weight-for-age z-score at admission	23	-6.19	0.3	-3.51	(1.77)
Weight-for-height-for-age	37	-4.44	.69	-1.95	(1.21)
Weight-for-age	37	-5.08	.24	-2.77	(1.28)
Height-for-age	37	-5.33	.03	-2.39	(1.13)
Head-circumference-for-age	37	-2.88	1.33	-1.03	(1.05)

We found positive and significant associations between the age of the children and the physical growth parameters: the older the child, the better their physical growth. This relation was the strongest for weight( $r=.58$ ), followed by head-circumference ( $r = .49$ ) and then height  $r = .45$ ). Significant correlations were also found between duration of stay at the babyhome and growth. This association was the highest for head circumference( $r = .53$ ). All correlations are presented in Table 2.

Table 2

Correlations between child characteristics and physical outcome measures.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Age at admission (in months)	1							
2. Age at time of study (in months)	<b>.43**</b>	1						
3. Length of stay at babyhome (in months)	.52	<b>.85**</b>	1					
4. Weight-for-age z-score at admission	-.34	.27	.31	1				
5. Weight-for-height-for-age	.21	<b>.36*</b>	.27	-.18	1			
6. Weight-for-age	.25	<b>.58**</b>	<b>.49**</b>	.08	<b>.81**</b>	1		
7. Height-for-age	.14	<b>.45**</b>	<b>.41*</b>	.25	<b>.37*</b>	<b>.82**</b>	1	
8. Head-circumference-for-age	.02	<b>.49**</b>	<b>.53*</b>	.29	<b>.61**</b>	<b>.61**</b>	<b>.41*</b>	1

In the babyhome the children are divided in three groups based on their age and development. Newborns reside in the nursery until they are about 6 or 7 months of age. It depends on their development and ability to eat solid food, on what moment they are being transferred to the main house. Premature babies and babies with low birth weight often reside longer in the nursery than healthy developing babies. The two other groups reside in the main house: when a

child is able to walk steadily he or she is part of the toddler group, when a child is not able to walk yet he or she is part of the baby group. The mean weight-for-age, height-for-age, weight-for-height and head circumference for age were calculated per age group. We found significant differences between groups on all of the physical growth parameters (see Table 3.)

Table 3  
Means and standard deviations for age, length of stay at babyhome and physical growth per age group.

	Newborns			Babies			Toddlers		
	<i>n</i>	M	(SD)	<i>n</i>	M	(SD)	<i>n</i>	M	(SD)
Age at admission (in months)	8	1.56	(1.36)	14	1.69	(2.45)	15	4.59	(6.65)
Age at time of study (in months)	8	<b>5.82<sup>a c</sup></b>	(1.41)	14	<b>11.87<sup>ab</sup></b>	(3.00)	15	<b>22.65<sup>b c</sup></b>	(6.51)
Length of stay at babyhome (in months)	8	<b>4.25<sup>a c</sup></b>	(1.45)	14	<b>10.18<sup>ab</sup></b>	(3.03)	15	<b>24.35<sup>b c</sup></b>	(7.58)
Weight-for-age z-score at admission	5	-4.98	(0.98)	9	-2.90	(1.59)	9	-3.31	(1.95)
Weight-for-height-for-age	8	-1.75	(0.92)	14	<b>-2.83<sup>b</sup></b>	(0.93)	15	<b>-1.25<sup>b</sup></b>	(1.11)
Weight-for-age	8	<b>-3.50<sup>c</sup></b>	(1.17)	14	<b>-3.43<sup>b</sup></b>	(0.75)	15	<b>-1.75<sup>b c</sup></b>	(1.09)
Height-for-age	8	<b>-3.23<sup>c</sup></b>	(1.68)	14	-2.61	(0.65)	15	<b>-1.74<sup>c</sup></b>	(0.77)
Head-circumference-for-age	8	-1.20	(1.02)	14	-1.46	(0.93)	15	-0.54	(1.03)

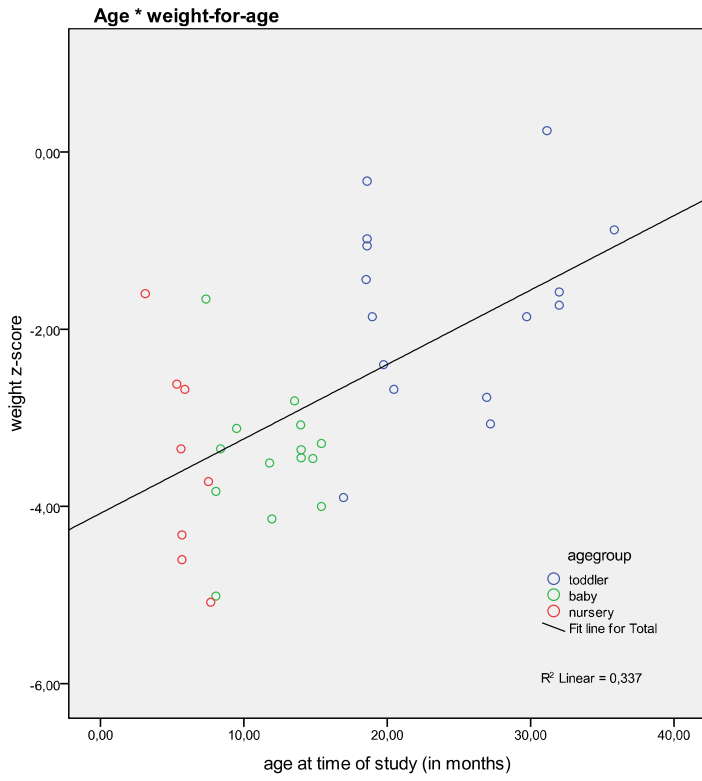
a: significant difference between newborns and babies at 0.05 level;  
b: significant difference between babies and toddlers at 0.05 level;  
c: significant difference between newborns and toddlers at 0.05 level.

We conducted paired t-tests to see how the weight-for-age of the children at admission differed from the current weight-for-age. All age groups combined we did not find a significant difference between the weight-for-age at admission and the weight-for-age at the time of the study. When we looked at the difference per age group (see Table 4) we found that the weight-for-age at admission of the nursery babies was significantly higher than the weight-for-age at the time of the study,  $t(4) = -6.472$ ,  $p = 0.03$ .

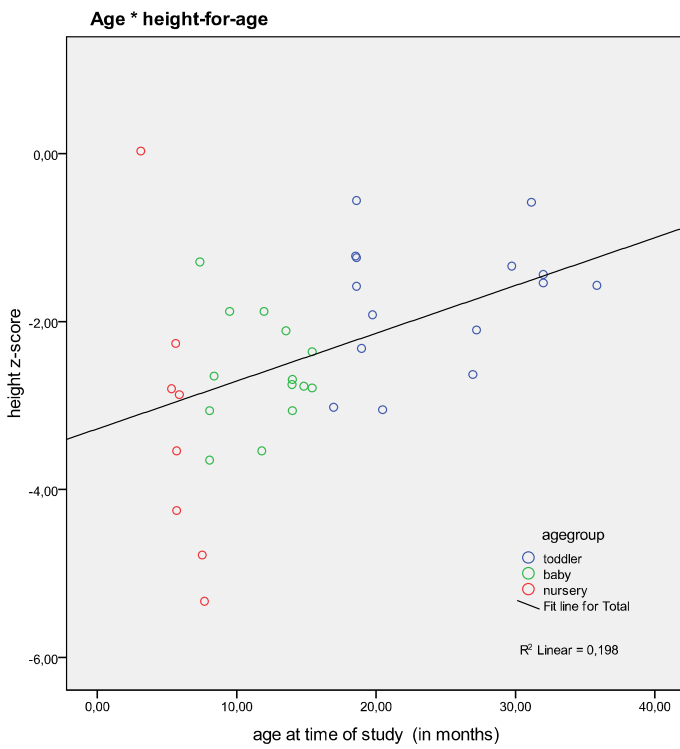
Table 4  
Weight-for-age at admission compared with weight-for-age at time of study.

	<i>n</i>	weight-for-age at admission (SD)	weight-for-age (SD)	difference
Nursery	5	-5.0 (1.0)	-4.1 (0.9)	+0.9
Babies	9	-2.9 (1.6)	-3.6 (0.6)	-0.7
Toddlers	9	-3.3 (2.0)	-1.7 (0.9)	+1.6

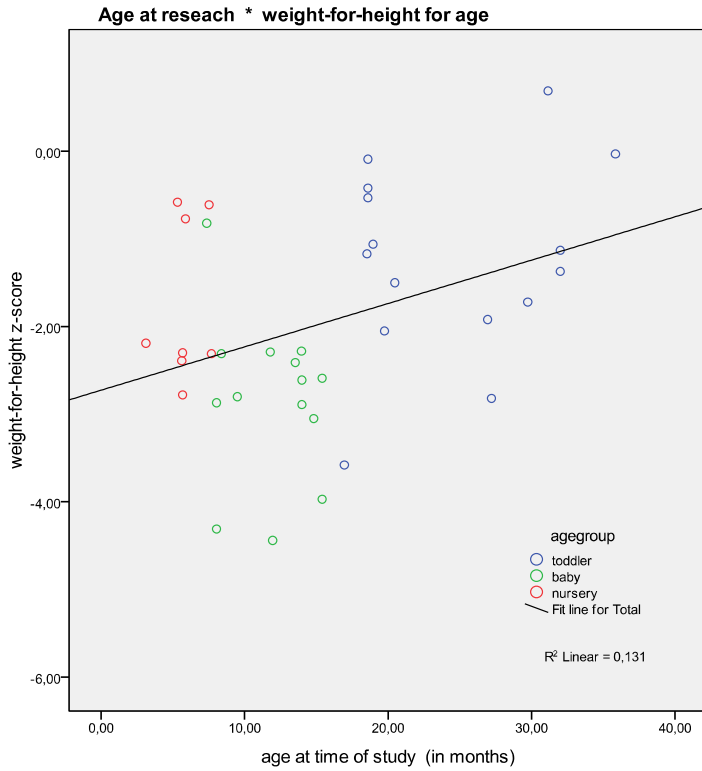




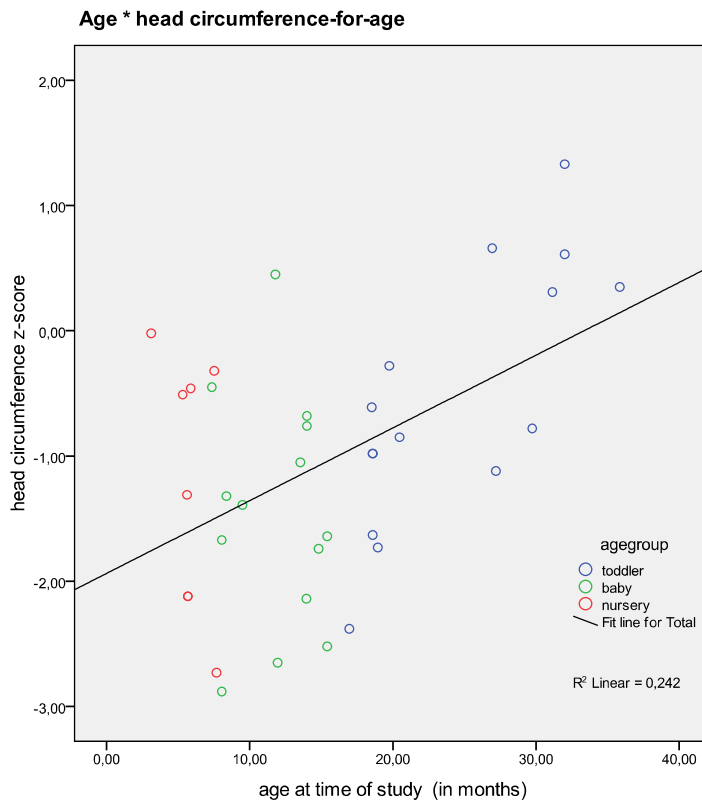
**Fig.1.** Weight-for-age related to age.



**Fig.2.** Height-for-age related to age.



**Fig.3.** Weight-for-height-for-age related to age.



**Fig.4.** Head circumference-for-age related to age.

## Discussion

Like in the main study we found significant correlations between the age of the children and their physical growth: the older the child, the better their growth. This is relevant for weight, height, weight-for-height and head circumference. The correlations in the current group of participants are not as high as in the main study though. When we look at the figures 1 to 4, it looks like including the children from the nursery results in weaker associations.

The differences we found in physical growth between toddlers and babies in the main study were still present when we included more children in the baby group although the differences were only significant for weight-for-age and weight-for-height-for-age in this sample.

We conducted paired t-tests to examine the differences in weight at the time of admission and their weight at the time of the study. We found that toddlers as well as nursery babies were on average catching up in their weight, while for the baby group the weight-for-age had become worse. An explanation would be that the nursery babies do get good care in the relatively quiet nursery, with sensitive caregivers and an individual schedule. Meanwhile the babies in the main house do not have an individual schedule anymore. They have become part of the group care in which they have to eat, play and sleep on fixed times and with less personal attention. This transition can be stressful for babies which can result in growth delays.

The nursery babies in this sample were on average having severe growth delays. These delays were in most cases caused by prematurity at not as much an effect of the conditions in the babyhome. It would be interesting to follow the growth of these babies and examine if they will catch up in growth during their time in the babyhome.

## **APPENDIX B**

### **Case study 2.**

#### **The physical development and indiscriminate friendliness of children adopted from a babyhome in Tanzania.**

In the main study we reported on the development of children residing in a babyhome in Tanzania. We were also interested in the development of the children who had been adopted from the babyhome and currently live in a family. First of all, we wanted to investigate their physical growth development. Are they lagging behind in physical growth like the children currently living in the babyhome? Secondly we were interested in the way the adopted children act when they meet new people. Indiscriminate friendly behavior towards new adults is common behavior for post-institutionalized children. In an institution this indiscriminate friendly behavior has adaptive advantages as friendly children may receive more attention from caregivers (Chisholm, 1998).

We hypothesized that children who had been adopted from the babyhome display a physical growth that is in the category of normal growth according to the WHO standards. We also expect that the children who were younger at the time of adoption, show the least physical growth delays. Regarding indiscriminate friendly behavior we hypothesized that children who were older than 12 months at the time of adoption have a higher score on indiscriminate friendliness than children who were younger than 12 months at the time of adoption.

### **Method**

#### *Participants*

In the files of the babyhome we found information on 31 children that had been adopted from the babyhome. Only the files of 23 children included contact details (e-mail addresses) of the adoptive parent(s). Eight files did not include contact details of the adoptive families of which seven were from Tanzania.

We contacted the adoptive parents of the other 23 children by e-mail, in which we enclosed a short questionnaire to retrieve information on the family characteristics, their physical growth and some questions regarding indiscriminate friendly behavior. We received replies from 9 families which included in total 14 children (response rate = 61%). Two families had adopted multiple children from

the current babyhome: one family two children, another family had adopted four children. None of the adopted children were biological siblings. One of the children suffers from cerebral palsy and was therefore not included in the study. This resulted in 13 participants, 8 girls and 5 boys. Parents from the children were mainly from the US, but also from Germany, Great Britain and Ireland. Six of the children are still living in Tanzania, six other children in the US and one child lives in Dubai. The average age of the children at the time of the study was 4 years and 5 months (SD=18.3 months) and ranged between 1 year and 3 months and 7 years and 9 months. On average the children had lived in the babyhome for 13.3 months (SD = 9.7 months) and the duration ranged from 3 months to 30 months. The age they were admitted to the babyhome varied from a few days till 15.5 months and was on average 3.7 months (SD = 4.2 months). Of 10 children the weight at admission was in their files: the average weight-for-age was  $z = -1,7$  (SD= -1,9) and ranged between: -5,0 and 1,2. The age of the children at time of placement in their families varied from 3.6 months to 35.9 months and was on average 17 months (SD =10.7 months). Weight at time of placement was known for five children. The average weight-for-age was  $z = -1.6$  (SD=1.6) and ranged from -4.1 to 1.2.

### *Procedure and Measures*

Adoptive families were contacted by e-mail. We send them a request to participate to the study and enclosed a short questionnaire. In this questionnaire we asked about the composition of the family, previous growth measures of the child and the current weight, height and head circumference of the child. We included a picture how to measure head circumference. The physical growth measures were converted to z-scores using Anthro statistical-software which was downloaded from the WHO website. The questionnaire also included the *Five item indiscriminately friendly behavior measure* from Chisholm (1998) in which parents are asked (1) whether their child wandered without distress, (2) whether their child was willing to go home with a stranger, (3) how friendly their child was with new adults, (4) whether their child was ever shy, and (5) what their child typically did upon meeting new adults. Every question had multiple answers and parents were asked to tick the answer that was most applicable to their child. A child was given a score of 1 if the parent gave an answer indicating indiscriminate friendliness.

## **Results**

### *Physical growth*

The average weight-for-age of the adopted children was  $z = 0.2$  ( $SD= 1.4$ ) and ranged from -1.9 to 2.6. The height-for-age ranged from -2.7 to 2.0 and was on average  $z = -0.2$  ( $SD=1.4$ ). The average weight-for-height-for-age was  $z = 0.02$  ( $SD=1.2$ ) and varied from -1.4 to 2.1. The head circumference of the children was on average  $z = 0.9$  ( $SD=1.7$ ) and ranged from -2.1 to 2.5. The hypothesis that the adopted children would display a normal growth according to the standards of the WHO was confirmed.

We did not find any significant correlations between current weight, height or head circumference and age at admission to the babyhome, the duration of stay in the babyhome, age at placement in adoptive family, the time living in the adoptive family or age at research. The second hypothesis, that the younger children were at time of adoption the better their physical growth would be, was therefore not confirmed.

Of some children information on the weight at admission and the weight at placement in the adoptive family was available. When this information was available, we compared this with their current weight. First we conducted a paired t-test ( $n=5$ ) to compare the weight-for-age of the children at admission ( $z=-2.5$ ) with the weight-for-age at placement in their families ( $z=-1.5$ ),  $t(4)=-1.905$ ,  $p>0.05$ . This difference was not significant. We also compared the weight-for-age of the children at admission to the babyhome ( $z=-1.7$ ) and the current weight-for-age ( $z=-0.2$ ) and we found that this difference was significant,  $t(9)=-2.792$ ,  $p=0.021$ . Lastly, we found a significant difference comparing the weight z-score at placement in the adoptive families ( $z=-1.6$ ) with the current weight z-score (0.1),  $t(6)=-3.694$ ,  $p=0.010$ .

#### *Physical growth of adopted versus non-adopted children*

When comparing the results with the children still residing in the babyhome (see case study 1), we found that the adopted children had significant better weight, height, weight-for-height and head circumference than the children in the babyhome (see Table 1).

Table 1  
Comparison of physical growth between adopted and non-adopted children.

	non-adopted			adopted			t-test
	n	M	(SD)	n	M	(SD)	
Age at admission (in months)	37	2.84	(4.68)	13	3.74	(4.17)	n.s.
Age at time of study (in months)	37	15.62	(8.87)	13	53.02	(18.32)	$t(48) = -9.700$ , $p=0.000$
Length of stay at babyhome (in months)	37	12.78	(8.07)	13	13.27	(9.68)	n.s.
Weight-for-age z-score at admission	23	-3.51	(1.77)	10	-1.72	(1.88)	$t(31) = -2.629$ , $p=0.013$
Weight-for-height-for-age	37	-1.95	(1.21)	8	0.02	(1.25)	$t(43) = -4.149$ , $p=0.000$
Weight-for-age	37	-2.77	(1.28)	13	-0.16	(1.36)	$t(48) = -6.961$ , $p=0.000$
Height-for-age	37	-2.39	(1.13)	12	-0.20	(1.36)	$t(47) = -5.545$ , $p=0.000$
Head-circumference-for-age	37	-1.03	(1.05)	8	1.68	(0.93)	$t(43) = -4.118$ , $p=0.000$

### *Indiscriminate friendliness*

The score on the indiscriminate friendliness measure varied from 0 to 5 and was on average 2.38. We compared the four children that were youngest at the time of adoption (M=5.9 months) with the four children that were oldest at the time of adoption (M=29.6) on their scores on the indiscriminate friendliness behavior. The children that were younger at the time of adoption had an average score of 1.25 on the indiscriminate friendliness measure whereas the older children had a score of 2.5. This difference was not significant, therefore the hypothesis that children older than 12 months at the time of adoption display higher scores on the indiscriminate friendliness measure, cannot be confirmed.

### **Discussion**

The current study demonstrated that on average the physical growth of the adopted children from the babyhome in Tanzania is within the normal range according to the standards of the World Health Organization. We also found that the average weight-for-age at the time of the adoption was significant lower than their weight-for-age at the time of the study which indicates that the children caught up in weight after their adoption. This finding is similar to previous studies (Van IJzendoorn, Bakermans-Kranenburg & Juffer, 2007).

When comparing the results with the growth of children that were still residing at the babyhome we found that the adopted children had significant better weight, height and head circumference. It should be noted though that first of all, the age of the time at the study between the two groups was different. The adopted children were much older than the children residing in the babyhome. Secondly, the average weight-for-age at admission of the adopted children was significantly higher than the weight-for-age at admission of the children still residing at the babyhome.