Diverse Physical Growth Trajectories in Institutionalized Portuguese Children Below Age 3: Relation to Child, Family, and Institutional Factors

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Objective To identify and analyze diverse longitudinal trajectories of physical growth of institutionalized children and their relation to child, family, and institutional factors. **Methods** 49 institutionalized children were studied for 9 months after admission. Weight, height, and head circumference were measured on 4 occasions, beginning at admission. Data were analyzed using latent class analysis, yielding diverse patterns of growth for each feature, and relations with child characteristics, early family risk factors, and institutional relational care were investigated. **Results** For each growth feature, 4 classes emerged: ''Persistently Low,'' ''Improving,'' ''Deteriorating,'' and ''Persistently High.'' Younger age at admission was a risk factor for impaired physical growth across all domains. Physical characteristics at birth were associated with trajectories across all domains. Lower prenatal risk and better institutional relational care were associated with Improving weight over time. **Conclusions** Discussion highlights the role of children's physical features at birth, prenatal risk, and caregiver's cooperation with the child in explaining differential trajectories.

Key words children; longitudinal research; parenting.

Introduction

In 2007, in Europe and Central Asia, more than 600,000 children grew up in institutions, apart from their families. Of those, a significant number were aged 3 years or less (UNICEF, 2010). In Portugal around 12,000 children younger than 18 years of age were living in institutions in 2009, with the majority of those (57%) staying there for more than 1 year. Children 3 years and younger, however, were institutionalized for shorter periods, usually (61%) for less than 1 year. Parental neglect, abandonment, physical abuse, alcoholism, impoverishment, and family breakdown were frequent reasons for admission (Instituto de Segurança Social, 2010; Oliveira et al., 2012). As in other countries, the Portuguese institutions show high variability in quality. Based on Gunnar's (2001)

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hierarchy of levels of privation in terms of institutional experiences, Portuguese institutions could be classified into level 2, an institution wherein children's nutrition and health needs are met, but those for stimulation and relationship are not, and level 3, an institution that provides all support except for the need of a consistent and longstanding relationship with a specific caregiver.

Growth failure, or suppression in height, weight, and head circumference, has been repeatedly linked to children's experience in institutional care in different countries (Johnson & Gunnar, 2011; Rutter, 1998; Smyke et al., 2007; The St. Petersburg-USA Orphanage Research Team, 2008; Van Ijzendoorn, Bakermans-Kranenburg, & Juffer, 2007). For instance, Groze and Ileana (1996) found that 72% of previously institutionalized children from Eastern Europe were described by their adoptive families as having low weight at the time of adoption, and that 80% were below normal in height. Consistent with these figures are the results from Rutter and the ERA Study Team (1998). In a sample of previously institutionalized Romanian children subsequently adopted in the UK, 51% were below the 3rd percentile in length, 34% in weight, and 38% in head circumference. Although most of the studies focused on Romanian orphans, the adverse effects on linear growth owing to institutionalization have been reported worldwide, such as in studies with adoptees from the former Soviet Union (Albers, Johnson, Hostetter, Iverson, & Miller, 1997) or from China (Johnson & Traister, 1999). Of note, height seems to be more susceptible to the adverse effects of institutional care than weight or head circumference (Dobrova-Krol, van Ijzendoorn, Bakermans-Kranenburg, Cyr, & Juffer, 2008).

Considering the well-documented detrimental effects of institutionalization, an important issue concerns determinants of individual differences in response to institutionalization, including child, preinstitutionalization family, and institutional factors, especially interpersonal relational ones. This would seem to be especially important in light of the fact that catch-up in physical growth seems to be possible and rapid when children experience more nurturing environments (Johnson & Gunnar, 2011). Consistent with this claim is evidence from Kim and colleagues (2003) that institutionalized Korean newborns assigned to an experimental group who were subjected to 15 min of auditory, tactile, and visual stimulation twice a day for 1 month improved in terms of weight, height, and head circumference immediately after the intervention relative to a routine-care control group; this beneficial effect was still evident at 6 months of age. In the same line, an intervention designed to promote positive social–emotional relationships in baby homes in Russia served to improve children's physical development (The St. Petersburg-USA Orphanage Research Team, 2008). Clearly, then, the quality of the relational care received by the children while institutionalized seems to make a difference in their physical growth recovery.

To date, most work on institutionalization and its effects on physical growth is based on measurement during or after the institutionalization period, so it rarely includes measurements of children's physical status at time of admission. Additionally, most studies to date have not considered the influence that preinstitutionalization experiences may have on growth at admission or while institutionalized. These gaps in the literature compromise our understanding of the *development* of institutionalized children from admission onward by failing to take into account their developmental history before institutionalization. The present report on a prospective longitudinal investigation for 9 months after admission seeks to overcome them. Thus, the first aim of the empirical work reported herein is to identify different patterns of growth by measuring height, weight, and head circumference on four occasions across a 9-month period beginning at admission. The second aim is to investigate the potential determinants of differential growth, specifically, child characteristics, early family risk factors, and institutional relational care factors.

Methods

Participants

All children admitted in 15 Portuguese institutions in the north of Portugal were recruited for a broader prospective longitudinal study between March 2008 and October 2010. Inclusion criteria were (a) age at admission ≤21 months (to be ≤30 months at T3 assessment), (b) no genetic or neurological syndromes (e.g., Down syndrome), (c) no diagnosis of fetal alcohol syndrome, and (d) completion of research protocol at admission (T0) and three subsequent time points (T1, T2, and T3). Both (b) and (c) were determined by reviewing each child's medical records in the institution.

Based on these criteria, 49 children (25 boys, 51.0%) integrate the sample of this investigation. Children were 0–21 months ($M = 7.14$, $SD = 6.17$) at time of enrollment. Twelve children (24.5%) came to the institution directly from the maternity ward, having no experience of living with their biological (or any other) families; the other children were admitted to the institution under 7 months of age ($n = 12$), from 7 to 12 months ($n = 16$), or older ($n = 8$). In almost 75% of cases ($n = 36$), there were multiple reasons for admission, including child neglect and abandonment. The institutional caregivers included in this study were each responsible, on average, for 10 children ($SD = 4.03$, range = 2–21) when on duty. Most caregivers (67.3%) had irregular shifts, as opposed to the minority with regular schedules. On average, caregivers reported that they dedicated approximately 25 min of individual attention per day to each child ($SD = 21.91$, range = 0–120).

Procedure

After approval by the Portuguese Social Services Institution and the National Commission for Data Protection, the study was presented to the staff at each institution. Written informed consent was obtained from the biological parent, from the institution director, and from the participating caregivers. To enable characterization of children's early family risk circumstances before institutionalization, researchers gathered data from each child's file.

Measures

Child Assessments

Child's Physical Growth. Data on physical growth—height, weight, and head circumference—were collected from the children's medical records for four occasions, reflecting admission time (T0) and every 3 months thereafter for a total of three additional measurement occasions (T1–T3) during a 9-month period. To afford unbiased comparison of children of different ages, all anthropometric measures—height (supine length <24 months or standing height ≥ 24 months), weight, and head circumference—were converted to percentiles using the software program WHO Anthro Statistical Software (World Health Organization, 2009). Growth delay for height, weight, and head circumference was defined as standardized scores ≤ -2.

Child's Birth Measures. Medical records provided data on children's gestational age and height, weight, and head circumference at birth.

Early Family Risk Factors. A sociodemographic questionnaire about the child and his/her biological family was completed using information in the child's files at the institution. Three conceptually based contextual-risk composites, each based on four items, were created to capture sources of risk to the child in the family of origin. Each risk condition in each composite was scored as absent (0) or present (1). A minimum of three items was needed for a composite risk score to be computed for any child. The resulting composite risk score represented the proportion of items in a risk composite on which the child received a score of 1. Higher scores reflected greater risk.

Prenatal Risk. This composite reflected presence/absence of maternal physical disease (e.g., AIDS, hepatitis), substance abuse during pregnancy, pregnancy without medical surveillance, and premature birth.

Family Relational Risk. This composite reflected presence/absence of receipt of government financial aid, domestic violence (among any household members), social worker determination of family at risk (e.g., maltreatment, abandonment of other children), and previous institutionalization/adoption of child's sibling.

Emotional Neglect Risk. This composite, tapping on unavailability of the maternal figure, reflected presence/absence of parental neglect (as reason for institutionalization), prostitution by mother, maternal substance abuse, and maternal psychopathology or mental retardation.

Institutional Relational Care: Quality of Caregiver's Behavior. Highly trained observers used the sensitivity/insensitivity and cooperation/intrusiveness rating scales (Ainsworth, Blehar, Waters, & Wall, 1978) to assess the quality of the caregiver's behavior during each of three semistructured and videotaped 5-min interaction episodes designed to challenge the dyad: play with toys, play without toys (after caregiver's departure, stranger entry, stranger departure, caregiver entry), and play with ''difficult-to-use'' toys. Ratings were averaged to form separate composites of sensitivity and cooperation, which proved highly reliable, based on intraclass correlations (ICC) of codings by pairs of raters of approximately 30% of the interactions (for sensitivity, ICC = .91; for cooperation, ICC = .90). The caregiver chosen to interact with the child for the purposes of assessing sensitivity and cooperation was the one considered by the institution staff to be the child's assigned caregiver.

Results

Identifying Patterns of Growth

To identify subgroups of children with similar patterns of change over time, we used latent class analysis (LCA). The assumption behind LCA is that a certain number of distinct trajectories exists in time and that subjects can be grouped into a small number of clusters known as latent classes, based on their developmental profiles over time. LCA may be conceptually regarded as a categorical form of factor analysis (or cluster analysis) based on repeated measurements of the same construct. It is based on the assumption that the frequencies with which different developmental profiles occur in a dataset can be explained by the existence of a small number of mutually exclusive classes or subtypes. For a given latent class model, parameter estimates include class membership probabilities, which may be thought of as prevalence that reflects the likelihood that a characteristic (such as a specific percentile in weight or other developmental indicator) is endorsed by an individual, given membership in that class. When based on longitudinal data as in this study, the resultant latent classes are often referred to as latent profiles, which identify subgroups that have similar patterns of change over time.

Each child's percentile score for height, weight, and head circumference across the four measurement occasions was subjected to LCA (Latent Gold 3.0.6, Statistical Innovations, Belmont) to identify subgroups of children with similar patterns of physical growth for a particular feature of growth. LCA models with an increasing number of classes were fitted successively for each growth feature, and Bayesian information criteria (BIC), along with a likelihood χ^2, were used to evaluate the model goodness of fit (Clogg, 1995). When the test for the incremental χ^2 difference was nonsignificant, a model with n classes was considered as adequately fitting the data when compared with a model with $n+1$ classes; this usually happens when BIC reaches its lowest value. Incremental fit and goodness-of-fit indices, presented in Table I, indicated that for each of the three growth features, the five-group solution was not significantly better than the four-group solution; the four-group solution was thus always selected.

The latent class solution for each physical growth measure, including prevalence of assignment of children to each cluster, means, and standard deviation for each indicator, is presented in Table II. Figures 1–3 display the four distinct patterns of growth, separately for each growth feature. Percentiles of age/month-adjusted norms from WHO are represented on the Y-axis. The "Persistently Low" trajectory reflected consistently low (percentile) scores, whereas the "Persistently High" trajectory reflected the opposite; the "Deteriorating" trajectory reflected declining scores, whereas the "Improving" trajectory reflected improving scores.

Almost 25% of the sample ($n=12$) was in the same subgroup on all growth features; among these, five children were classified consistently as Persistently Low (10.2%), four as Improving (8.2%), and three as Persistently High (6.1%). No children were classified as Deteriorating across all features of growth. Nearly half of the sample ($n=24$) shared the same trajectory for height and weight; a further 20 children (40.8%) shared the same trajectory for weight and head circumference; and 18 (36.7%) shared the same trajectory for height and head circumference. In 10 cases (20.4%), trajectories were fully heterogeneous, with no shared classification across any two growth features.

Growth Patterns and Risk Factors

The four trajectory subgroups were compared, separately for each growth feature, on child characteristics, early family risk factors, and institutional relational care using nonparametric Fisher's exact test and one-way analyses of variance with post hoc Bonferroni multigroup comparison tests (STATA 12.0 StataCorp, College Station, TX); see Tables III and IV.

Table I. *LCA Incremental Fit and Goodness-of-fit Statistics for Each Solution*

	Class solution	#Parameters	LL	BIC (LL)	χ^2 difference
Weight	1 class	8	−950.38	1931.90	–
	2 class	17	−872.09	1810.35	<.05
	3 class	26	−833.37	1767.93	<.05
	4 class	35	−809.10	1754.41	<.05
	5 class	44	−802.04	1775.32	$\Delta=6.00$; $p=.74$
Height	1 class	8	−938.59	1908.32	–
	2 class	17	−836.07	1738.30	<.05
	3 class	26	−803.66	1708.51	<.05
	4 class	35	−786.76	1709.74	<.05
	5 class	44	−775.34	1721.93	$\Delta=9.00$; $p=.44$
Head circumference	1 class	8	−964.66	1960.44	–
	2 class	17	−904.30	1874.75	<.05
	3 class	26	−868.76	1838.71	<.05
	4 class	35	−859.09	1854.37	<.05
	5 class	44	−848.06	1867.36	$\Delta=11.00$; $p=.27$

Table II. *Latent Class Solutions and Class Assignment Prevalence*

Height	Persistently low ($n=18$, 36.7%) *M* (*SD*)	Deteriorating ($n=9$, 18.4%) *M* (*SD*)	Improving ($n=14$, 28.6%) *M* (*SD*)	Persistently high ($n=8$, 16.3%) *M* (*SD*)
Percentile T0 (admission)	3.17 (4.47)	44.51 (27.02)	15.00 (10.00)	76.41 (32.50)
Percentile T1	4.52 (5.24)	49.52 (12.37)	18.17 (11.54)	71.26 (29.18)
Percentile T2	2.32 (2.67)	21.44 (9.64)	29.14 (26.88)	72.82 (14.49)
Percentile T3	4.56 (4.39)	23.83 (15.70)	32.47 (12.18)	78.42 (20.35)
Weight	Persistently low ($n=10$, 20.4%) *M* (*SD*)	Deteriorating ($n=12$, 24.5%) *M* (*SD*)	Improving ($n=16$, 32.7%) *M* (*SD*)	Persistently high ($n=11$, 22.5%) *M* (*SD*)
Percentile T0 (admission)	1.23 (1.60)	19.04 (28.63)	24.02 (26.42)	59.45 (32.81)
Percentile T1	3.91 (6.52)	20.85 (23.25)	27.92 (26.82)	55.95 (27.71)
Percentile T2	2.11 (3.39)	15.48 (21.87)	27.42 (28.85)	52.71 (26.30)
Percentile T3	4.39 (6.07)	17.83 (18.47)	30.13 (23.98)	58.06 (28.73)
Head circumference	Persistently low ($n=11$, 22.5%) *M* (*SD*)	Deteriorating ($n=9$, 18.4%) *M* (*SD*)	Improving ($n=16$, 32.7%) *M* (*SD*)	Persistently high ($n=13$, 26.5%) *M* (*SD*)
Percentile T0 (admission)	5.92 (6.72)	34.43 (29.00)	40.42 (26.75)	68.93 (24.39)
Percentile T1	6.13 (6.35)	42.92 (29.14)	55.36 (24.56)	90.05 (8.58)
Percentile T2	10.05 (8.55)	37.79 (28.21)	60.50 (12.84)	89.58 (9.33)
Percentile T3	14.62 (13.79)	18.02 (14.35)	66.05 (15.10)	91.18 (7.89)

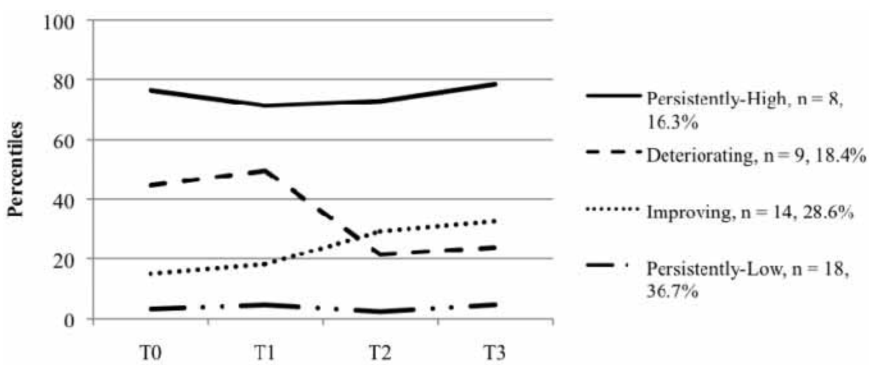

Figure 1. Height trajectories.

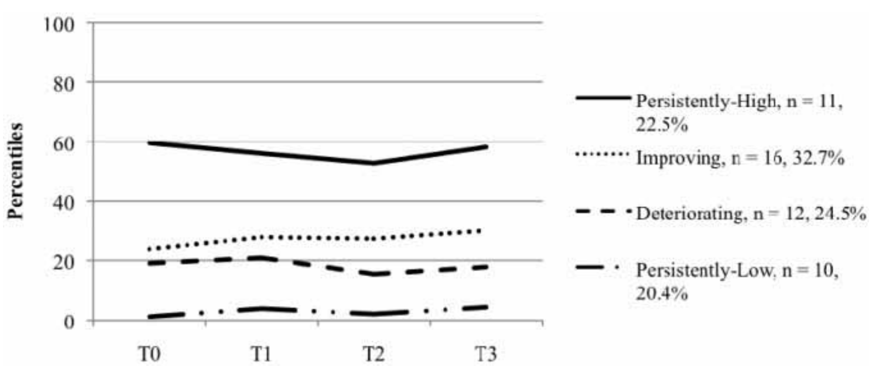

Figure 2. Weight trajectories.

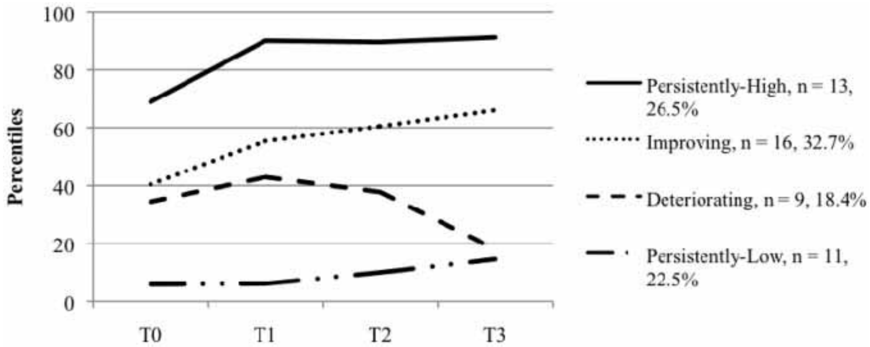

Figure 3. Head circumference trajectories.

Table III. *Associations Between Height Developmental Trajectories and Child Characteristics, Early Family Risk Factors, and Institutional Relational Care*

Variables	Persistently low (PL) (*n* = 18) *M* (*SD*)	Deteriorating (D) (*n* = 9) *M* (*SD*)	Improving (I) (*n* = 14) *M* (*SD*)	Persistently high (PH) (*n* = 8) *M* (*SD*)	Statistics
Child characteristics					
Age at T0 (months)	4.44 (5.22)	8.67 (4.97)	7.07 (6.53)	11.62 (6.55)	F (3,48) = 3.10, p = .036, PH > PL
Gestational age (weeks)	36.83 (2.96)	39.11 (1.90)	37.00 (2.96)	39.00 (1.20)	F (3,48) = 2.57, p = .066
Height at birth (cm)	45.39 (3.05)	47.43 (2.10)	45.49 (4.86)	49.71 (1.95)	F (3,48) = 3.26, p = .030, PH > PL
Weight at birth (kg)	2.59 (0.61)	3.15 (0.44)	2.57 (0.55)	3.49 (0.55)	F (3,48) = 6.32, p < .001, PH > PL, I
Head circumference at Birth (cm)	32.31 (2.37)	34.10 (1.12)	32.65 (1.95)	35.11 (0.72)	F (3,46) = 4.76, p = .006, PH > PL, I
Boy, *n* (%)	12 (66.7)	3 (33.3)	7 (50.0)	3 (37.5)	Fisher's Exact test, p = .333
Admission before 6 months, *n* (%)	13 (72.2)	2 (22.2)	7 (50.0)	2 (25.0)	Fisher's Exact test, p = .041
Early family risk factors					
Prenatal risk	0.46 (0.28)	0.18 (0.23)	0.39 (0.30)	0.19 (0.20)	F (3,45) = 2.95, p = .043[a]
Family relational risk	0.48 (0.30)	0.53 (0.25)	0.51 (0.20)	0.47 (0.31)	F (3,46) = 0.11, p = .490
Emotional neglect risk	0.29 (0.19)	0.34 (0.27)	0.46 (0.18)	0.39 (0.18)	F (3,47) = 2.05, p = .120
Quality of caregiver's behavior during child–caregiver interaction					
Caregiver's sensitivity	−0.18 (0.75)	−0.04 (0.65)	0.25 (0.51)	0.29 (0.85)	F (3,46) = 1.35, p = .270
Caregiver's cooperation	4.31 (6.94)	7.18 (5.78)	10.82 (11.71)	4.81 (7.31)	F (3,48) = 1.72, p = .177

[a]Although the analysis of variance reached statistical significance; the post hoc Bonferroni multigroup comparison tests did not detect differences between subgroups.

Height

Cluster membership proved to be unrelated to institutional relational care, and while the four subgroups differed on one family factor, prenatal risk, Bonferroni tests revealed no significant difference between any pair of subgroups on this factor. Child factors did differentiate height-trajectory subgroups; however, children in the Persistently High cluster were bigger at birth in terms of height, weight, and head circumference than children in the Persistently Low or Improving subgroups ($p < .05$). The former children were also significantly older on admission ($M = 11.62$; $SD = 6.55$) than children in the Persistently Low subgroup ($M = 4.44$; $SD = 5.22$) ($p < .05$). Further, more children in the Persistently Low subgroup were young—less than 6 months of age—at the time of their institutionalization (72.2%) than those in the Deteriorating (22.2%), Improving (50.0%), and Persistently High (25.0%) subgroups (all $p < .05$).

Weight

Trajectory subgroups differed in some manner across all sets of risk factors. Regarding child factors, children classified as Persistently High were significantly older ($M = 12.72$; $SD = 4.73$) than children classified in all other clusters ($p < .01$) and were also bigger at birth in terms of weight and head circumference than children in the Persistently Low and Deteriorating subgroups ($p < .01$). The Persistently Low subgroup, relative to the Deteriorating, Improving, and

Table IV. *Associations Between Weight Developmental Trajectories and Child Characteristics, Early Family Risk Factors, and Institutional Relational Care*

Variables	Persistently low (PL) ($n = 10$) *M* (*SD*)	Deteriorating (D) ($n = 12$) *M* (*SD*)	Improving (I) ($n = 16$) *M* (*SD*)	Persistently high (PH) ($n = 11$) *M* (*SD*)	Statistics
Child characteristics					
Age at T0 (months)	6.00 (7.26)	5.25 (4.07)	5.44 (5.78)	12.72 (4.73)	F (3,48) = 4.84, p = .005, PH > I, D, PL
Gestational age (weeks)	36.30 (3.37)	37.00 (3.67)	38.13 (1.67)	38.91 (1.30)	F (3,48) = 2.15; p = .107
Height at birth (cm)	43.10 (5.22)	46.29 (3.14)	46.90 (2.04)	49.19 (1.93)	F (3,46) = 2.68, p = .059
Weight at birth (kg)	2.45 (0.73)	2.60 (0.61)	2.88 (0.46)	3.38 (0.51)	F (3,47) = 6.23, p < .001, PH > D, PL
Head circumference at birth (cm)	31.67 (3.04)	32.87 (2.33)	33.85 (1.23)	33.76 (1.37)	F (3,47) = 5.20, p = .004, PH > D, PL
Boy, *n* (%)	8 (80.0)	7 (58.3)	8 (50.0)	2 (18.2)	Fisher's exact test, p = .038
Admission before 6 months, *n* (%)	7 (70.0)	7 (58.3)	9 (56.3)	1 (9.1)	Fisher's exact test, p = .020
Early family risk factors					
Prenatal risk	0.51 (0.21)	0.47 (0.27)	0.30 (0.30)	0.13 (0.18)	F (3,45) = 4.97, p = .005, PL, D > PH
Family relational risk	0.50 (0.22)	0.45 (0.32)	0.51 (0.259	0.52 (0.26)	F (3,46) = 0.17, p = .092
Emotional neglect risk	0.40 (0.15)	0.32 (0.22)	0.28 (0.22)	0.50 (0.16)	F (3,47) = 3.03, p = .039, PH > I
Quality of caregiver's behavior during child–caregiver interaction					
Caregiver's sensitivity	0.02 (0.93)	−0.02 (0.65)	−0.05 (0.57)	0.25 (0.74)	F (3,46) = 0.41, p = .743
Caregiver's cooperation	−1.42 (3.40)	8.71 (3.33)	15.21 (7.58)	−0.13 (3.82)	F (3,48) = 28.89, p < .001, I > D > PH > PL

Persistently High subgroups, also had more children younger than 6 months of age at time of institutional admission (70.0% vs. 58.3% vs. 56.3% vs. 9.1%, respectively) and more males (80.0% vs. 58.3% vs. 50.0% vs. 18.2%, respectively) (in both cases, $p < .05$). Regarding early family risk factors, children in the Persistently Low and Deteriorating trajectory subgroups had significantly greater prenatal risk than children classified as Persistently High ($p < .01$). Emotional neglect risk was lower for children classified as Improving than Persistently High ($p < .05$).

For institutional relational care, children classified as Improving experienced higher levels of caregiver cooperation than children in any other subgroup ($p < .001$).

Head Circumference

Only child factors distinguished trajectory subgroups. More boys (80.0%) were members of the Persistently Low subgroup relative to each of the three other subgroups: Improving (50.0%), Deteriorating (58.3%), and Persistently High (18.2%) ($p < .05$). Likewise, more children in the Persistently Low subgroup (70%) were admitted to an institution before 6 months of age relative to those in the Improving (56.3%), Deteriorating (58.3%), and Persistently High (9.1%) subgroups ($p < .05$). Finally, children in the Persistently High subgroup were older ($M = 12.72$; $SD = 4.73$) than those in the Deteriorating subgroup ($M = 5.25$; $SD = 4.07$) ($p < .05$).

Because the modest sample size may have played a role in limiting the significance of the statistical comparisons, we conducted post hoc power analyses based on the means, between-groups comparison effect size observed for each pairwise comparison using GPower (Faul & Erdfelder, 1992; for a full description, see Erdfelder, Faul, & Buchner, 1996) with power ($1 - \beta$) set at 0.80 (Cohen, 1988) and $\alpha = .05$, two-tailed. This analysis revealed statistical power limitations in five of the pairwise comparisons and showed that sample sizes would have to increase up to $n = 92$ (age at baseline × height trajectories), $n = 80$ (height at birth × height trajectories), $n = 92$ (prenatal risk × height trajectories), $n = 108$ (height at birth × weight trajectories), and $n = 92$ (emotional neglect × weight trajectories) for group differences to reach statistical significance at the .05 level.

Discussion

Consistent with the study's first aim, results indicated that (four) distinct patterns of physical growth could be detected among institutionalized children during a 9-month period for each of three features of growth. For height, the most prevalent category was Persistently Low, which grouped children whose mean percentile fell below the 5th percentile at every assessment. The second biggest cluster was the Improving one, which included 14 children. Only a minority of children displayed the more favorable Persistently High trajectory, with mean percentiles close to the 80th over time. With respect to weight, the largest group with 16 children was the one displaying an Improving trajectory. Once again, those children grouped in the Persistently Low cluster exhibited a mean percentile below the 5th percentile. This time, however, the cluster with better weight development over time, Persistently High, fell short of the 60th percentile at all assessments. Head Circumference, on the other hand, emerged as the least impaired feature, even for those children grouped in the Persistently Low cluster, where mean percentile over time was never below the 5th percentile. In fact, 9 months after admission it was never below the 10th percentile, even for the most compromised subgroup. Furthermore, about one quarter of the sample, the Persistently High cluster, displayed a mean percentile over the 90th after admission.

Our findings pertaining to height and weight are, partially, in line with previous research on physical growth features in institutionally reared children (van IJzendoorn et al., 2007) and have led researchers to advance the psychosocial growth failure hypothesis (Johnson & Gunnar, 2011; McCall, 2011), a syndrome associated with neglect/abuse in both institutional and family settings. Nevertheless, and notably, for all three physical features, there is always a subgroup of children, the Persistently High cluster, whose longitudinal trajectory is favorable and another cluster where, even though their physical status was low at admission, their trajectory was an Improving one.

What might have accounted for the diverse patterns of growth detected? Addressing this issue was the second aim of this inquiry. With respect to individual child-based factors, being a boy emerged as a risk factor for compromised growth in terms of weight and head circumference. In some respects this result is not surprising, as boys have long been found to be more at risk for succumbing to adversity than girls. They are, after all, more likely to be spontaneously aborted, more likely to die soon after birth, and more likely to die in early childhood as well as across most of the life span (Kraemer, 2000).

Being younger at institutional admission apparently posed a significant risk factor for impaired physical development across the three domains. Growth seems to be age dependent, and it is possible that children admitted earlier will show gains throughout their lives. During the rapid growth phase from 0 to 18 months, children are more vulnerable to nutritional deficits, whereas after that phase nutritional intake is less crucial to growth rate (Johnson et al., 2010). The study of Dobrova-Krol et al. (2008) corroborates this hypothesis, as they observed in their sample of very young Ukrainian children a tendency for physical growth recovery after the age of 24 months, even in the absence of alterations in the depriving institutional context. This finding, coupled with the fact that during this period infants can do little to evoke care, led us to believe that younger infants in depriving contexts are highly susceptible to insufficient stimulation and support, thereby resulting in slower growth rates. However, younger age at admission per se might not be the reason why children fail to grow, given that catch-up in height and weight is more likely for children who are younger when they exit the institution (Johnson & Gunnar, 2011).

Children's physical status at birth was also significantly associated with their subsequent trajectories. Children in the Persistently High clusters for both height and weight were born longer, heavier, and with larger heads. These results highlight the relevance of taking into account biological vulnerability, a claim that is strengthened by the fact that higher prenatal risk was associated with poorer height and weight trajectories. Even before institutionalization, some children had already been exposed to early family risk that seemed to impair—or at least not enhance—their subsequent physical development. Although it is not surprising that institutional rearing tends to follow problematic preinstitutional experiences (Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011), these data make clear that the pre- and perinatal circumstances that precede institutionalization influence children's development *in* institutions. This is an important observation because it suggests that apparent adverse effects of institutionalization may really be a function of experiences and exposures before institutionalization. Only by considering preinstitutional factors and measuring growth at time of admission, is it possible to evaluate whether this is the case, as done in this study.

Turning to institutional relational care, weight trajectories were significantly associated with the caregiver's cooperation with the child during interaction. Better cooperation was associated with the Improving trajectory, clearly suggesting that catch-up growth is more likely in more nurturing environments characterized by better relational quality (McCall, 2011; Zeanah et al. 2003). We would even speculate that when the quality of interpersonal care is higher, children might benefit from improved caloric intake, as meals become more pleasurable, easy-going moments. This, in turn, will result in better weight gains.

In sum, our results on children's physical growth illustrate the multifinality principle recently highlighted by van IJzendoorn et al. (2011), in that all children experienced institutional deprivation but diverse developmental trajectories were nevertheless discerned (van IJzendoorn et al., 2011). Thus, despite common risks associated with being reared in an institution, diverse trajectories emerged for height, weight, and head circumference among some institutionalized children. Accounting for those different trajectories were child characteristics, early family risk factors, and, most interestingly, the caregiver's cooperation with the child during interaction. The fact that the most favorable weight trajectory was associated with better interactions with caregivers highlights the role of nonshared institutional influences. It is possible, and even understandable, that different children might elicit, actively or passively (e.g., through temperament), a more positive response from the institutional environment or caregivers that, in turn, is likely to protect them from risks associated with being institutionalized (van IJzendoorn et al., 2011).

The implications of our findings are all the more important if one thinks about the age of the children involved in this study, and in early institutional rearing for that matter. The first 2 years of children's lives seem to be a behavioral-sensitive period for development (Zeanah et al., 2011). However, emerging empirical evidence is now showing that if children leave a depriving environment before 6 months of age, adverse consequences can be reversed (Johnson & Gunnar, 2011; Rutter, & Sonuga-Barke, 2010).

This is the first empirical report on the physical growth of Portuguese institutionalized children, and the results of the present study are globally consistent with others showing that institutionalization has negative effects on child development. However, some limitations should be acknowledged.

Perhaps one of the main limitations is that the modest sample size could affect the results in that some otherwise significant associations might have not been detected owing to lack of statistical power. Conversely, some of the detected significant differences could potentially be spurious (i.e., Type I error). To account for both possibilities, we conducted post hoc power analyses, which showed that some of the tests of association lacked statistical power and thus should be interpreted carefully. It must be noted that the results presented here are particularly useful in the context of exploring a particular research question and to contribute to hypothesis building that can guide future research on this subject. For instance, it would be useful for questions like those asked herein be addressed—with a larger sample—using a multivariate statistical model.

Two further limitations of this study need to be pointed out. The first regards the way early family risk factors composites were created. One cannot be sure that the absence of a reason for admission means that the child did not experience that risk. The second is our inability to consider genetic polymorphisms as potential determinants of individual differences in response to institutionalization (Belsky & Pluess, 2009; Drury et al., 2012; Kumsta et al., 2010; Stevens et al., 2009).

In summary, it is important to re-emphasize the exploratory nature of this study, which owing to its limitations does not allow particularly strong conclusions to be drawn, but raises new questions and contributes to a better understanding of the reality of children living in institutions in Portugal. This, in turn, will hopefully lead to a broader discussion on (i) how the existing institutions might be improved for the children already placed there, and (ii) how to develop an alternative family-based welfare system for forthcoming children that might promote a consistent and longstanding relationship with a specific caregiver.

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