

Research Article

The Magnitude of Hidden Hunger and Cognitive Deficits among Children Living in Orphanages in Kumasi, Ghana

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This study assessed the magnitude of hidden hunger (micronutrient deficiencies) and cognitive deficits of 130 school-aged children (6–13 years old) living in three selected orphanages in Kumasi, Ghana. Sociodemographic data assessment, anthropometric assessment (BMI for age and height for age), dietary assessment (3-day repeated 24-hour dietary recall), urinary iodine level assessment, and cognitive performance assessment (Raven's Coloured Progressive Matrices) were performed. Boys formed 50.8% of the study population, while girls formed 49.2%. The median age of participants was 10.50 years. About 12.3%, 7%, and 10.0% of participants were stunted, thin, and overweight/obese, respectively. The prevalence of mild iodine deficiency (i.e., 50–99 µg/L) was 16.2%. Iodine deficiency was significantly higher (23.6%) in participants who had lived for at least 7 years in the orphanage compared to those who had lived less than 7 years (10.7%) ($p = 0.047$). About 17% of the participants performed poorly (<50%) on the cognition test. Mean cognition test scores were significantly different among the orphanages ($p = 0.027$). The majority of participants, 89.2%, 54.6%, 76.9%, and 77.7%, had adequate intake of iron, zinc, vitamin C, and folate, respectively, whereas intake of vitamins A and B₁₂ was inadequate for the majority of participants (90.8% and 50.8%, respectively). There was no significant correlation between micronutrient intake and cognitive performance. However, mean cognition test scores were significantly different between participants with adequate and inadequate iron and vitamin A intake ($p = 0.007$ and $p < 0.001$, respectively). The findings of this study warrant a closer look at nutritional intakes in orphanages to improve hidden hunger and cognitive performance.

1. Introduction

Hidden hunger refers to deficiencies of vitamins and minerals, commonly called micronutrient malnutrition [1]. Hidden hunger is called so because the signs are subtle and not always obvious in those who suffer it [2]. Women of reproductive age and young children living in developing countries are most susceptible to deficiencies of vitamins and minerals (micronutrients) [2]. Deficiencies of iron, vitamin A, and iodine are the most prevalent micronutrient deficiencies globally [3]. Also, of significant public health importance are deficiencies of zinc, folate, vitamin B₁₂, and vitamin D [3]. It has been estimated that about 2 million people suffer chronic micronutrient deficiencies worldwide [4]. Hidden hunger is said to be responsible for about 7% of

the annual global disease burden [2]. Key findings from the Hidden Hunger Index showed that among the 20 countries with the highest occurrence of multiple micronutrient deficiencies, Ghana ranked tenth [2]. Usually, the aetiologies of the deficiencies of various micronutrients are common, (mostly resulting from inadequate consumption of vegetables and fruits, foods of animal origin, or nutrient losses secondary to frequent infections); thus, they tend to occur together in the same population [2].

Iodine deficiency, usually caused by inadequate dietary intake of iodine, is also a public health issue of concern globally [5]. Severe iodine deficiency in a population can lead to a 13.5 point loss in mean intelligence quotient that can impair intellectual abilities in school or at work and as much as up to 15% of the population can suffer cretinism (severe

physical and mental stunting) [5, 6]. Though on the verge of being eliminated, iodine deficiency is still the world's leading, albeit easily preventable, cause of impaired neurocognitive development in children [5].

It is estimated that more than 153 million children are orphans globally [7]. Research has shown that compared to their family-reared counterparts, institutionalized children and those who are adopted after early institutional care exhibit retarded physical growth [8–10]. Being orphaned also makes a child more vulnerable to undernutrition [11, 12]. The overall nutritional status, including micronutrient status, of children, plays a critical role in their health, cognition, and consequently their educational attainment [13]. Thus, micronutrient deficiencies can affect neurocognitive development. Research has shown that children institutionalized in orphanages experience language delays and lower intelligence quotient (IQ) [10, 14, 15].

Many studies have assessed the magnitude of mixed micronutrient deficiencies or individual micronutrient deficiencies among children under 5 years, women of reproductive age (15–49 years old), and pregnant women [16]. However, the same attention has not been given to vulnerable children living in various orphanages [17]. This study, therefore, sought to assess the prevalence of hidden hunger (micronutrient deficiency) and cognitive deficits among children living in selected orphanages in Kumasi, Ghana.

2. Methods

2.1. Study Design, Study Site, and Study Population. An analytical cross-sectional study was conducted among randomly selected orphans living in the Kumasi Children's Home, a state-run institution, All Nations Orphanage Home, a privately run institution, and Cherubs Children's Home, another privately run institution, all located in the Kumasi Metropolis, Ashanti Region from April to June, 2021.

2.2. Sample Size Calculation. Minimum sample size was obtained based on the sample size calculation using Cochran's formula:

$$n = \frac{z^2 pq}{e^2}, \quad (1)$$

where n = sample size, z = confidence level 95% (1.96), p = estimated population proportion of malnourished children living in an orphanage in Accra is 5.9% [18], q = predefined ($1 - p$), and e = margin of error at 5%.

$$n = \frac{1.96^2 \times 0.059(1 - 0.059)}{0.05^2}, \quad (2)$$

$$= 85.3 \approx 85.$$

However, a total sample size of 130 was obtained for the study.

2.3. Inclusion and Exclusion Criteria. Children aged 6–13 years who had lived in the orphanage for a minimum of 12 months were included in the study, while children suffering from neurological disorders such as cerebral palsy or other chronic ailments such as type 1 diabetes and sickle cell anaemia were excluded.

2.4. Data Collection. A structured questionnaire was used to elicit information from participants. Prior to the start of the data collection, research assistants underwent training in the administration of the questionnaire and in how to properly conduct anthropometric and dietary assessments as well as the cognition test.

The heights of the participants were measured using a stadiometer (Seca 213 mobile stadiometer, Germany) to the nearest 0.1 cm. Weight was measured using a digital bathroom scale (Tanita digital bathroom scale) to the nearest 0.1 kg with participants wearing light clothing. BMI-for-age Z-scores (BAZ) and height-for-age Z-scores (HAZ) were computed and interpreted based on the WHO child growth standards [19] for determination of the nutritional status of the participants.

A three-day repeated (two weekdays and one weekend) 24-hour dietary recall method was employed to elicit information about participants' dietary intake. Participants were requested to recollect all meals, including drinks and snacks, eaten the previous day. Common household measures were used to estimate the actual quantities (grams/mL) of foods and drinks consumed by the participants. The nutritional composition of foods eaten was then analysed using the nutrient analysis template [20].

A sterile urine container with a screw cap was given to each participant to provide about 5 mL of their first urine of the morning. The samples were placed into cold boxes kept at eight degree celsius and transported quickly to the Clinical Analyses Laboratory, KNUST for analysis. The determination of urinary iodine concentration was done using the manual spectrophotometric measurement of the Sandell-Kolthoff reduction reaction. Iodine status for school-aged children (SAC) was defined according to the guidelines of the WHO [21] which categorizes urinary iodine levels of $<20 \mu\text{g/L}$ as severe iodine deficiency, $20\text{--}49 \mu\text{g/L}$ as moderate iodine deficiency, $50\text{--}99 \mu\text{g/L}$ as mild iodine deficiency, $100\text{--}199 \mu\text{g/L}$ as adequate iodine nutrition, $200\text{--}299 \mu\text{g/L}$ more than adequate intake of iodine and finally, $\geq 300 \mu\text{g/L}$ as excessive intake of iodine.

The Raven's coloured progressive matrices (RCPM) for non-verbal reasoning ability were adapted and used to assess the cognitive ability of the children. This assessment tool had previously been used in a population of Ghanaian school-aged children [22]. The test has 36 questions or problems divided into three sets of 12 questions each that increases progressively in difficulty. Each question involves a geometric pattern or design with a missing piece which participants have to provide from the list of six options. The first question of the test was used as a demonstration for the participants to help them understand the concept of the test. Cognition status was defined as follows: $<50\%$ poor

cognitive performance, 50% to 69.99% good cognitive performance, and $\geq 70\%$ excellent cognitive performance.

2.5. Statistical Analysis. Data were entered into Microsoft Excel and analysed with the Statistical Package for the Social Sciences (SPSS) version 25. Data were checked for normal distribution using the Shapiro–Wilk test. Dietary intakes of macronutrients and micronutrients were analysed with the Nutrient Analysis Template Software. Sociodemographic characteristics, anthropometric measurements, and other sections of the data obtained were analysed using descriptive statistical analysis. Pearson’s correlation and chi-square tests were conducted to analyse associations between various variables. Mean differences in cognitive test scores were compared with the independent-sample *t*-test and oneway analysis of variance test. $p < 0.05$ was considered to be statistically significant for all analyses performed.

3. Results

3.1. Sociodemographic and Anthropometric Characteristics, Iodine, and Cognition Status of Participants. Table 1 presents the sociodemographic and other characteristics of participants. Median age of 10.50 years was recorded, with the majority (71.5%) of participants aged 9 to 13 years. The study had just over half of the participants being boys (50.8%). The majority of the participants reported no challenges with their stay in the orphanage (78.5%), and desired no change in their livelihood (66.2%). The combined prevalence of stunting and severe stunting was 12.3%. The combined prevalence of severe thinness and thinness was 2.3%. Overall, close to half of the participants (49.2%) had excellent cognitive performance. With respect to iodine status, 16.2% of all participants recorded mild iodine deficiency.

3.2. Association between Nutritional Status and Sociodemographic and Cognition Status. Table 2 presents prevalence of nutritional deficiencies based on participants’ age, gender, length of stay in the orphanage and cognition status. The prevalence of iodine deficiency was significantly higher in participants who had lived in the orphanage for 7 years or more compared to those who had lived in the orphanage for 6 years or less (23.6% vs 10.7%, $p = 0.047$). The girls demonstrated better nutrition outcomes than the boys though the differences in prevalence of stunting, thinness and iodine deficiency were not statistically significant.

3.3. Micronutrient Intake of Participants. The adequacy of participants’ dietary intake of various micronutrients was assessed, and results are presented in Table 3. Overall, micronutrient deficiency status was significantly different between the three orphanages ($p = 0.003$). Overall, majority of the participants, 89.2%, 54.6%, 76.9%, and 77.7%, had adequate micronutrient intakes for iron, zinc, vitamin C, and folate, respectively. Intake of vitamins A and B₁₂ was inadequate for majority of participants (90.8% and 50.8%, respectively).

TABLE 1: Characteristics of participants.

Variable	Frequency (<i>n</i>)	Percentage
Age (years)		
6–8	37	28.5
9–13	93	71.5
Median (IQR)	10.50 (8.00–13.00)	
Gender		
Boy	66	50.8
Girl	64	49.2
Orphanage stay (years)		
1–6	75	57.7
7+	55	42.3
Challenges		
Financial	15	11.5
Inadequate food	6	4.6
Other	7	5.4
None	102	78.5
Desired livelihood changes		
Nothing	86	66.2
Adequate food/clothing	2	1.5
Financial support	9	6.9
Dormitory/washroom completion	5	3.8
Education/play materials	23	17.7
Leave orphanage	5	3.8
Education		
Primary	95	73.1
Junior high school	35	26.9
Ethnicity		
Akan	116	89.2
Others	14	10.8
Religion		
Christian	127	97.7
Muslim	3	2.3
BMI for age		
Severe thinness/thinness	3	2.3
Normal	114	87.7
Overweight/Obese	13	10.0
Height for age		
Severely stunted/stunted	16	12.3
Normal	113	86.9
Maybe abnormal	1	0.8
Iodine status		
Mild deficiency	21	16.2
Adequate	109	83.8
Cognition status		
Poor	22	16.9
Good	44	33.8
Excellent	64	49.2

3.4. Comparing Differences in Cognition Test Scores. The mean cognition test scores of participants were compared by sociodemographic characteristics, nutritional status, micronutrient intake adequacy, and intake deficiency status (Table 4). The average cognition test score for participants aged 9–13 years was significantly higher than those aged 6–8 years ($p < 0.001$). Among participants in the three orphanages, the mean differences in cognition test scores were significant only between O2 and O3 ($p = 0.020$) after a post hoc analysis. The differences

TABLE 2: Nutritional deficiencies by age, gender, length of stay in orphanage, and cognition status.

Variable	Stunting	<i>p</i> value	Thinness	<i>p</i> value	Iodine deficiency	<i>p</i> value
Age (years)						
6 to 8	3 (8.1)	0.358	1 (2.7)	0.850	7 (18.9)	0.589
9 to 13	13 (14.0)		2 (2.2)		14 (15.1)	
Gender						
Boy	9 (13.6)	0.640	2 (3.0)	0.577	12 (18.2)	0.523
Girl	7 (10.9)		1 (1.6)		9 (14.1)	
Length of stay (years)						
1 to 6	8 (10.7)	0.506	2 (2.7)	0.750	8 (10.7)	0.047
7+	8 (14.5)		1 (1.8)		13 (23.6)	
Cognition status						
Poor	3 (13.6)	0.086	0 (0.0)	0.701	5 (22.7)	0.274
Good	9 (20.5)		1 (2.3)		9 (20.5)	
Excellent	4 (6.3)		2 (3.1)		7 (10.9)	

Cognition status was defined as follows: <50% poor cognitive performance, 50% to 69.99% good cognitive performance, and ≥70% excellent cognitive performance. The bold value in Table 2 depicts a significance difference because the *p* value is less than 0.05.

TABLE 3: Micronutrient intake of participants.

Nutrient intake	Total (<i>n</i> = 130)	O1 (<i>n</i> = 35)	O2 (<i>n</i> = 45)	O3 (<i>n</i> = 50)	<i>p</i> value
Iron, RDA					
Inadequate	14 (10.8)	6 (17.1)	4 (8.9)	4 (8.0)	0.360
Adequate	116 (89.2)	29 (82.9)	41 (91.1)	46 (92.0)	
Zinc, RDA					
Inadequate	59 (45.4)	28 (80.0)	11 (24.4)	20 (40.0)	<0.001
Adequate	71 (54.6)	7 (20.0)	34 (75.6)	30 (60.0)	
Vitamin C, RDA					
Inadequate	30 (23.1)	3 (8.6)	0 (0.0)	27 (54.0)	<0.001
Adequate	100 (76.9)	32 (91.4)	45 (100)	23 (46.0)	
Folate, RDA					
Inadequate	29 (22.3)	7 (20.0)	3 (6.7)	19 (38.0)	0.001
Adequate	101 (77.7)	28 (80.0)	42 (93.3)	31 (62.0)	
Vitamin B ₁₂ , RDA					
Inadequate	66 (50.8)	35 (100.0)	12 (26.7)	19 (38.0)	<0.001
Adequate	64 (49.2)	0 (0.0)	33 (73.3)	31 (62.0)	
Vitamin A, RDA					
Inadequate	118 (90.8)	35 (100.0)	43 (95.6)	40 (80.0)	0.003
Adequate	12 (9.2)	0 (0.0)	2 (4.4)	10 (20.0)	
Micronutrient intake deficiency status					
No deficiency	12 (9.2)	0 (0.0)	2 (4.4)	10 (20.0)	0.003
Deficiency	118 (90.8)	35 (100)	43 (95.6)	40 (80.0)	

Data are presented as frequency (column percentage). *p* value in bold is significant. AMDR: acceptable macronutrient distribution ranges; RDA: recommended dietary allowance. O1: orphanage 1, O2: orphanage 2, O3: orphanage 3.

in mean cognition scores between those who had adequate and inadequate iron and vitamin A intakes were significant ($p = 0.007$ and $p < 0.001$, respectively), as well as for those who had no micronutrient intake deficiencies and those who had deficiencies ($p < 0.001$). Again, the mean cognition test score was significantly higher for participants who had a single micronutrient intake deficiency compared to those who had multiple micronutrient intake deficiencies ($p = 0.013$).

3.5. Association between Micronutrient Intake, Urinary Iodine Levels, and Cognition Test Scores. A weak negative association was observed between the number of micronutrient intake inadequacies and cognition test scores. However, the

association was not significant. Similarly, no significant association was recorded between any of the other variables and cognition test scores (Table 5).

4. Discussion

The aetiologies of micronutrient deficiencies, thus hidden hunger, are common, primarily resulting from inadequate consumption of micronutrient-rich foods including vegetables, fruits, and foods of animal origin or nutrient losses secondary to frequent infection [2, 5, 19]. It is of utmost importance that recommended quantities of micronutrients are consumed daily to avert deficiencies. Inadequate intakes were recorded for all six micronutrients assessed in this

TABLE 4: Comparing mean cognition test scores.

Variable	Cognition test score Mean ± SD	<i>p</i> value
Age (years)		
6–8	19.11 ± 6.46	<0.001
9–13	26.62 ± 5.91	
Gender		
Boy	23.70 ± 7.04	0.190
Girl	25.30 ± 6.79	
Orphanage [#]		
O1	24.71 ± 5.98	0.027
O2	26.40 ± 7.91 ^a	
O3	22.60 ± 6.94 ^a	
BMI for age		
Thin	24.00 ± 4.36	0.903
Not thin	24.50 ± 7.00	
Height for age		
Stunted	22.44 ± 4.83	0.209
Not stunted	24.77 ± 7.16	
Iodine status		
Mild deficiency	22.95 ± 8.57	0.271
Adequate	24.78 ± 6.59	
Iron		
Inadequate	19.75 ± 7.47	0.007
Adequate	25.05 ± 6.69	
Zinc		
Inadequate	24.71 ± 6.08	0.735
Adequate	24.30 ± 7.62	
Vitamin C		
Inadequate	25.07 ± 6.06	0.602
Adequate	24.31 ± 7.20	
Folate		
Inadequate	24.76 ± 6.17	0.810
Adequate	24.41 ± 7.17	
Vitamin B ₁₂		
Inadequate	24.26 ± 6.14	0.706
Adequate	24.72 ± 7.73	
Vitamin A		
Inadequate	25.25 ± 6.61	<0.001
Adequate	17.00 ± 5.72	
Micronutrient intake deficiency		
No deficiency	17.00 ± 5.72	<0.001
Deficiency	25.25 ± 6.61	
Deficiency type		
Single deficiency	27.38 ± 6.36	0.013
Multiple deficiency	24.19 ± 6.51	

Mean differences were compared with the independent-sample *t*-test except for [#] where one-way ANOVA was used. *p* values in bold are significant at *p* < 0.05. Post hoc analysis revealed a significant mean difference in cognition scores between the two orphanages with the same letter 'a' (*p* = 0.020). O1: orphanage 1, O2: orphanage 2, O3: orphanage 3.

study, with as high as a 90.8% inadequate intake prevalence for vitamin A. Annan et al. [23] similarly observed inadequate intakes in all six micronutrients they assessed, with vitamin A recording the highest inadequate intake prevalence of 61.3% among SAC in the Kumasi Metropolis. It appears the issue of the high prevalence of vitamin A deficiency seems not to get better as previous studies in Ghana among SAC have also reported high levels of vitamin A

TABLE 5: Correlation between dietary micronutrient intake, urinary iodine levels, and cognition test scores.

Variable	Cognition test scores <i>r</i> (<i>p</i> value)
Iron	0.051 (0.565)
Zinc	0.080 (0.365)
Folate	0.043 (0.630)
Vitamin C	0.048 (0.589)
Vitamin B ₁₂	0.087 (0.330)
Vitamin A	0.108 (0.225)
Number of micronutrient intake deficiencies	−0.131 (0.140)
Urinary iodine	−0.005 (0.957)

Partial correlation analysis was performed between micronutrient intake and cognition test scores. Correlation is significant at *p* value ≤ 0.05 (2-tailed). Controlling variables: age and gender.

deficiency [24–26]. More needs to be done for SAC in Ghana to improve their vitamin A status.

Multiple micronutrient deficiencies do occur in vulnerable populations like SAC [2, 27], and there is substantial evidence of the role of the micronutrients iodine, iron, zinc, and vitamins A and B₁₂ in the brain and cognitive development [23]. It may therefore come as little surprise that in this study population of orphans, the average cognition test scores for people with multiple inadequate micronutrient intakes were significantly lower (*p* = 0.013) than those who had only one deficiency (Table 4). Similarly, Annan et al. [23] also found that SAC with an adequate intake of 5 to 6 out of 6 micronutrients had higher cognition scores than those who had an adequate intake of 0 to 2 micronutrients. This suggests that the coexistence of multiple micronutrient deficiencies more adversely impacts cognitive ability. Overall, the prevalence of poor cognition was 16.9% in this study compared to a higher prevalence (36.2%) reported by Annan et al. [23] and a much higher prevalence (84.8%) reported among SAC in fishing and farming communities in Kwahu Afram Plains South District [22]. It thus appears that the orphans in this present study have better cognitive performance than their non-orphaned counterparts in Kumasi and Kwahu Afram Plains South District.

Iodine deficiency is a public health concern in developing countries, and indeed, Ghana is situated in the iodine deficiency belt, as reported by Gyamfi et al. [28]. The prevalence of iodine deficiency in this study population of school-aged orphans was 16.2%, the same as the prevalence recorded by Gyamfi et al. [28] among 6 to 12 year old non-orphaned SAC in the Ejura-Sekyere-Dumase district in the Ashanti region of Ghana but much lower than the 57% prevalence reported among SAC in Southeast Ethiopia [29]. However, another study among SAC in Eastern Nepal recorded a lower prevalence of 9.8% [30]. Iodine is critical in the production of thyroid hormones, which are involved in brain and neurocognitive development [31]. Thus, iodine deficiency can impair cognitive performance. In Ghana, it has been estimated that about 120,000 children who are born each year stand the risk of developing intellectual deficits due to iodine deficiency, with a majority of these affected children growing with reduced intelligence and mental

problems that impair academic achievement and negatively impact the educational system in Ghana [32, 33]. This study observed that the prevalence of iodine deficiency was highest among participants with poor cognition and lowest among those with excellent cognition, though the comparison was not statistically significant. It can greatly benefit the cognitive abilities and subsequent academic performance of SAC (the orphans or non-orphans) if interventions to ensure adequate iodine intake like the universal salt iodization, which Ghana implemented in 1996, are ramped up. Indeed, the Ghana Health Service has previously indicated that iodine deficiency diseases persist in the country [34].

It was also observed among this study population that there was no record of the above-mentioned adequate or excessive intake of iodine, i.e., 200–299 $\mu\text{g/L}$ or $\geq 300 \mu\text{g/L}$, respectively. The risk of goiter, hypothyroidism, and hyperthyroidism, as well as autoimmune thyroid disease, are linked to excessive iodine intake [35]. A systematic review and meta-analysis by Xiu et al. [36] reported that among school-aged children, excessive iodine intake could lead to elevated goiter risk. In contrast to the absence of excessive iodine intake in this population of SAC, Gyamfi et al. [28] reported a prevalence of 34% and 28% among male and female SAC, respectively. While seeking to increase iodine consumption to prevent iodine deficiency diseases, care must be taken alongside effective monitoring to prevent excessive consumption, which can also be detrimental.

The stunting and thinness prevalence of 12.3% and 2.3%, respectively, reported in this study are lower than the 13.8% and 7.5% reported by Tandoh et al. [22] among non-orphaned children, and much lower than the 98% reported among orphans in Nairobi, Kenya [37]. Kamath et al. [38] also reported a thinness prevalence of 25.7% and a stunting prevalence of 31.4% among orphans in Mangalore, India. The better nutritional status of orphans in this current study may be attributed to better general care, as is quite evidenced by the fact that a vast majority of them reported no challenges in the orphanage and also did not desire any livelihood changes. Although the livelihood of orphans is typically troubled by low availability of food or food insecurity, reduced access to economic and educational opportunities, maltreatment, and discrimination, among others [39]. About two-thirds of orphans in this study did not desire any changes in their livelihoods. However, about 18% also desired the provision of educational and play materials and opportunities. Other livelihood changes that were desired included financial support, completion of accommodation facilities, and an increase in food provision.

4.1. Limitations. Firstly, due to the relatively small sample size, the findings may not be generalizable to the general orphan population in Ghana. The 24-hour dietary recall method of assessing dietary intake, especially from young children, may have introduced some over- or underestimation bias, but this has been proven to provide reliable estimates.

5. Conclusions

A high prevalence of inadequate intake of multiple micronutrients persists in the study population for which reason, a closer look needs to be taken at the nutritional intakes in orphanages. Although the occurrence of thinness was low, stunting occurrence and mild iodine deficiency were of notable concern. Cognitive performance was generally good in this population of school-aged orphans.

Data Availability

The dataset of this study will be available upon request from Dr. Marina Aferiba Tandoh (mtandoh@yahoo.com).

Ethical Approval

The Committee on Human Research Publications and Ethics of Kwame Nkrumah University of Science and Technology, School of Medical Sciences, and Komfo Anokye Teaching Hospital granted approval for this study (Ref: CHRPE/AP/080/21). Approvals to conduct the study were also granted by the Management of the Orphanages and the Department of Social Welfare. Participants who agreed to partake in the study appended their thumbprints to the consent form under the supervision of their caretakers at the orphanages.

Conflicts of Interest

The authors declare no conflicts of interest.

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