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Original Research Article

PREVALENCE & PATTERN OF HEALTH PROBLEMS AMONG CHILDREN RESIDING IN CHILD CARE INSTITUTIONS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Children residing in Child Care Institutions constitute a vulnerable population because parental loss, poverty, family disruption, inadequate nutrition, overcrowding and limited individualized care may increase their risk of illness, malnutrition and anaemia. Evidence regarding their comprehensive health status is essential for planning appropriate institutional health services. The aim is to assess the prevalence and pattern of health problems among children residing in Child Care Institutions. **Materials and Methods:** An institution-based cross-sectional study was conducted among 433 children aged 6-15 years residing in 12 selected Child Care Institutions in Dharwad district from June 2018 to May 2019. Institutions and participants were selected using purposive sampling. Data were collected using a pretested, semi structured questionnaire, interviews, institutional records, anthropometric measurements, general and systemic examinations and haemoglobin estimation by Sahli's method. Nutritional status was classified using BMI-for-age, while anaemia was categorized according to WHO criteria. Data were analysed using descriptive statistics, chi-square test, Fisher's exact test and independent-samples t test. Effect estimates were reported with 95% confidence intervals, and $p<0.05$ was considered statistically significant. **Result:** Among 433 children, 219 (50.6%) were males and 214 (49.4%) were females. The prevalence of a current clinical health problem was 16.4% (95% CI: 13.2%-20.2%). Respiratory conditions were the most frequent clinical morbidity (7.9%), followed by ear-related (2.1%), skin (1.4%), gastrointestinal/oral (1.2%) and cardiac conditions (0.9%). Inadequate calorie and protein intake were observed in 99.1% and 56.1%, respectively. Abnormal BMI-for-age was present in 40.6%, including wasting in 15.5% and severe wasting in 16.2%. Anaemia was detected in 27.9% of children and was significantly more common among females than males (40.2% versus 16.0%; OR=0.28, 95% CI: 0.18-0.45; $p<0.001$). Mean haemoglobin was also lower among females (11.80±1.11 versus 12.55±1.08 g/dL; $p<0.001$). Anaemia was significantly associated with age ($p=0.042$), parental status ($p<0.001$) and sibling co-residence ($p<0.001$). Double orphans had the highest anaemia prevalence (48.0%) and significantly greater odds than children whose parents were both present (OR=6.26, 95% CI: 3.09-12.69). **Conclusion:** Although the prevalence of active clinical morbidity was relatively low, children residing in CCIs experienced a considerable burden of inadequate dietary intake, abnormal nutritional status and anaemia. Regular comprehensive screening, improved dietary planning, growth monitoring, anaemia prevention and treatment, dental services and institutional infection-control measures are required. Adolescent girls, undernourished children and double orphans should receive particular attention.

INTRODUCTION

Children residing in Child Care Institutions (CCIs) constitute a particularly vulnerable population because many have experienced parental loss, abandonment, poverty, family disruption, abuse, neglect or other adverse social circumstances before institutional placement. Under the Juvenile Justice

(Care and Protection of Children) Act, 2015, CCIs include children's homes, open shelters, observation homes, special homes, places of safety and specialized adoption agencies that provide care and protection to children in need.[1] Although these institutions fulfil essential needs such as shelter, food, clothing, education and supervision, institutionalized children may remain at increased risk of nutritional deficiencies, anaemia, skin diseases, dental disorders, respiratory and gastrointestinal infections, visual problems and psychosocial or behavioural difficulties. These health problems may arise from inadequate dietary intake, overcrowding, shared facilities, poor hygiene, incomplete immunization, insufficient caregiver attention and limited access to preventive healthcare. Growth and development during childhood are strongly influenced by nutrition, environmental conditions, emotional support and timely medical care. Prolonged institutionalization, particularly when accompanied by inadequate stimulation and individualized care, may adversely affect physical growth, cognitive development and psychological well-being. Studies conducted among institutionalized children in India have reported undernutrition, anaemia, dental caries, skin infections and various behavioural and emotional problems.[2,3] Singh et al. also documented unmet health needs among orphaned children and emphasized the importance of organized health screening and referral services within residential institutions.[4] Anaemia is an important public-health concern among school-aged children and adolescents because it can impair physical growth, immunity, attention, learning capacity and academic performance. Its detection requires age- and sex-appropriate haemoglobin classification according to recommended standards.[5] Regular assessment of anthropometric measurements, nutritional status, haemoglobin level, personal hygiene, morbidity patterns, immunization status and institutional health facilities is therefore necessary. Information regarding the prevalence and pattern of health problems can help identify common and preventable conditions, guide institution-specific interventions and support periodic medical examinations, nutritional supplementation, health education and timely referral. However, locally generated evidence regarding the comprehensive health status of children residing in CCIs remains limited. The present cross-sectional study was therefore undertaken to estimate the prevalence of health problems and describe their pattern among children residing in selected Child Care Institutions, thereby providing evidence for planning appropriate preventive, promotive and curative health services.

Aim: To assess the prevalence and pattern of health problems among children residing in Child Care Institutions.

Objectives

1. To estimate the prevalence of health problems among children residing in Child Care Institutions.
2. To describe the pattern of nutritional, haematological and clinical health problems among the study participants.
3. To determine the association of selected sociodemographic and institutional factors with the health problems identified among the children.

MATERIALS AND METHODS

Source of Data: The data were obtained from children aged 6-15 years who were residing in selected Child Care Institutions in Dharwad district. Information relating to the children's sociodemographic characteristics, institutionalization, health history, immunization, nutritional practices and institutional health facilities was obtained from the children, institutional records and designated caregivers or institutional authorities.

Study Design: An institution-based, descriptive cross-sectional study was conducted.

Study Location: The study was conducted in selected government and non-government Child Care Institutions in Dharwad district, Karnataka. At the time of the study, the district had 32 CCIs, comprising 23 non-governmental and nine government institutions. Twelve eligible institutions that provided administrative permission and satisfied the study criteria were included.

Study Duration: The study was conducted over one year, from June 2018 to May 2019.

Study Population: The study population consisted of children aged 6-15 years who were residing in the selected Child Care Institutions during the study period.

Sample Size: A total of 433 children were included in the study. All eligible and consenting children who were available in the selected CCIs during the data-collection visits were assessed. Thus, the final analysed sample comprised 433 participants.

Sampling Technique: A purposive sampling technique was used to select the CCIs that granted permission and satisfied the eligibility criteria. Within the selected institutions, all children meeting the inclusion criteria and available during the scheduled visits were approached for participation.

Inclusion Criteria

- Children aged 6-15 years residing in the selected CCIs.
- Children who were present during the scheduled data-collection visit.
- Children who provided assent or verbal consent appropriate to their age and level of understanding.
- Children whose institutional authorities or caregivers permitted participation.
- Children who cooperated during the interview, physical examination and anthropometric assessment.

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Exclusion Criteria

- Children younger than six years or older than 15 years.
- Children who were severely ill or bedridden at the time of data collection.
- Children with severe physical or intellectual disabilities that prevented the planned assessment.
- Children known to have HIV infection or active tuberculosis where they were housed in specialized institutions outside the sampling frame.
- Children admitted under the Protection of Children from Sexual Offences Act when participation or disclosure could compromise confidentiality or protection.
- Children who declined participation or did not cooperate with the examination.
- Children whose institutional authorities did not provide permission.
- Children who were absent despite the scheduled institutional visit.

Data Collection

Data were collected using a predesigned, semi-structured and pretested questionnaire. The questionnaire included the following information:

- Age, sex, education and relevant sociodemographic characteristics.
- Parental status and reasons for institutionalization.
- Age at admission and duration of residence in the institution.
- Previous and current illnesses.
- Personal hygiene and health-related practices.
- Dietary pattern and nutritional intake.
- Immunization history, wherever records were available.
- Regularity of institutional health examinations.
- Availability and accessibility of healthcare services.
- Recent outbreaks of communicable diseases within the institution.
- Anthropometric measurements and haemoglobin level.
- Findings from general physical and systemic examinations.

Information was obtained through interviews with the children and verified, wherever possible, from institutional caregivers and available records. Confidentiality was maintained by assigning a unique identification number to each participant.

Procedure and Methodology: Permission to conduct the study was obtained from the District Child Protection Office and the heads of the selected CCIs. A mutually convenient date and time were fixed for each institutional visit. The purpose and procedure of the study were explained to institutional authorities, caregivers and participating children in a language they understood.

Rapport was established with each child before data collection. Age-appropriate assent or verbal consent was obtained before the interview and examination. Each participant was interviewed separately using the pretested questionnaire. Information concerning institutional services and health facilities was collected from the responsible caregiver or institutional informant.

A comprehensive health assessment was performed, including general physical examination and relevant systemic examination. The children were examined for pallor, icterus, cyanosis, clubbing, lymphadenopathy, oedema, skin diseases, scalp conditions, dental problems, eye and ear abnormalities, respiratory complaints, gastrointestinal conditions and other apparent health problems.

Height was measured without footwear using a non-stretchable measuring tape fixed vertically against a flat wall. The participant stood upright with the heels together, head positioned appropriately and the highest point of the head marked. Height was recorded to the nearest centimetre and converted into metres.

Weight was measured using a calibrated digital weighing scale placed on a firm, even surface. The scale was checked for zero error before each measurement. Children were weighed without footwear and in light clothing while standing at the centre of the scale. Weight was recorded in kilograms.

Body mass index was calculated using: Nutritional status was assessed using age- and sex-appropriate anthropometric criteria. Haemoglobin concentration was estimated using Sahli's haemoglobinometer under aseptic precautions. Anaemia was categorized according to the applicable WHO age- and sex-specific haemoglobin cut-offs.

A pilot study was conducted among ten children residing in a government CCI before the main data collection. The questionnaire and procedures were modified wherever necessary based on the findings of the pilot study. Children assessed during the pilot study were not included in the final analysis.

Sample Processing: The biological assessment was limited to capillary blood collection for haemoglobin estimation. The procedure was explained to each participant before collection. Under aseptic precautions, the fingertip was cleaned with an alcohol swab and allowed to dry. A sterile, single-use lancet was used to obtain capillary blood. The required volume of blood was collected in the graduated tube of Sahli's haemoglobinometer containing the prescribed quantity of hydrochloric acid. The blood and reagent were mixed and allowed sufficient time for conversion into acid haematin. Distilled water was subsequently added drop by drop until the colour matched the comparator standard. The haemoglobin value was recorded in g/dL.

Each result was documented against the participant's unique identification number. Used lancets were placed immediately in a puncture-proof sharps container, while blood-contaminated cotton, swabs and other materials were discarded in appropriate

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biomedical-waste containers. No biological specimen was stored after haemoglobin estimation.

Statistical Methods: The collected data were checked for completeness, coded and entered into Microsoft Excel 2010. Data analysis was performed using IBM SPSS Statistics version 21.0.

Categorical variables were summarized using frequencies and percentages. The overall prevalence of health problems was calculated as:

Continuous variables such as age, height, weight, BMI and haemoglobin level were summarized using mean and standard deviation or median and interquartile range, depending on their distribution. The chi-square test was used to assess associations between categorical variables. Fisher's exact test was applied when expected cell frequencies were small. The independent-samples t test was used to compare the means of two independent groups when the assumptions of normality were satisfied. Correlation analysis was performed for relevant continuous variables.

All statistical tests were two-tailed. A p value <0.05 was considered statistically significant, and effect estimates were reported with 95% confidence intervals, wherever applicable.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee of Karnataka Institute of Medical Sciences, Hubballi. Administrative permission was obtained from the District Child Protection Office and the heads of the participating CCIs. Age-appropriate assent or verbal consent was obtained from every participating child. Privacy and confidentiality were maintained throughout the study. Children found to have health problems were informed sensitively, and the findings were communicated to the responsible institutional authorities for appropriate treatment or referral.

RESULTS

Table 1: Overall demographic, institutional and health profile of children residing in Child Care Institutions (N=433)

Study parameter	n (%) or Mean (SD)	95% CI	Test of significance	P value
Age group, years			χ^2=30.02†	<0.001*
6-9	99 (22.9%)	19.2%-27.1%		
10-12	142 (32.8%)	28.6%-37.4%		
13-15	192 (44.3%)	39.7%-49.0%		
Gender			χ^2=0.06†	0.810
Male	219 (50.6%)	45.9%-55.3%		
Female	214 (49.4%)	44.7%-54.1%		
Educational status				
No formal education	2 (0.5%)	0.1%-1.7%	Descriptive	
Primary school	299 (69.1%)	64.6%-73.2%		
Secondary school	132 (30.5%)	26.3%-35.0%		
Age at institutionalization, years	9.52 (2.79)	9.26-9.78‡	One-sample descriptive estimate	
Duration of institutionalization, months	27.65 (27.65)	25.05-30.25‡	One-sample descriptive estimate	
Residing with sibling	166 (38.3%)	33.9%-43.0%	χ^2=23.56†	<0.001*
Not residing with sibling	267 (61.7%)	57.0%-66.1%		
History of illness during preceding year	165 (38.1%)	33.7%-42.8%	χ^2=23.80§	<0.001*
No illness during preceding year	268 (61.9%)	57.2%-66.3%		
Current health problem present	71 (16.4%)	13.2%-20.2%	z=-15.26¶	<0.001*
No current health problem	362 (83.6%)	79.8%-86.8%		
CCIs reporting a recent scabies outbreak (N=12)	6 (50.0%)	25.4%-74.6%	Exact binomial test vs 50%	1.000

†Chi-square goodness-of-fit test.
‡95% CI for the mean.
§Comparison of children with and without a history of illness.

One-sample proportion test against the previously reported 53% prevalence used for sample-size estimation.

[Table 1] presents the demographic, institutional and health characteristics of 433 children residing in Child Care Institutions. The largest proportion belonged to the 13-15-year age group (44.3%), followed by 10-12 years (32.8%) and 6-9 years (22.9%). This age-group distribution differed significantly from an equal distribution (χ^2=30.02, p<0.001). The gender distribution was nearly equal, with 219 (50.6%) males and 214 (49.4%) females, and no statistically significant difference was observed (χ^2=0.06, p=0.810). Most children were attending primary school (69.1%), while 30.5% were in secondary school and only 0.5% had no formal education. The mean age at institutionalization was 9.52±2.79 years, and the mean duration of institutionalization was 27.65±27.65 months. Overall, 38.3% of children resided with their siblings, whereas 61.7% did not; this difference was statistically significant (χ^2=23.56, p<0.001). A history of illness during the preceding year was reported by 38.1% of children, while 61.9% had no such history (χ^2=23.80, p<0.001). At the time of assessment, 71 (16.4%; 95% CI: 13.2%-20.2%) children had a current health problem, whereas 362 (83.6%) had no current problem. The observed prevalence was significantly lower than the previously reported reference prevalence of 53% (z=-15.26, p<0.001). Six of the 12 institutions had reported a recent scabies outbreak, corresponding to

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50.0% (95% CI: 25.4%-74.6%); this proportion did not differ from 50% (p=1.000).

Table 2: Prevalence of current health problems among children residing in Child Care Institutions (N=433)

Study parameter	Health problem present, n (%)	Health problem absent, n (%)	Effect estimate (95% CI)	Test of significance	P value
Overall prevalence	71 (16.4%)	362 (83.6%)	Prevalence: 16.4% (13.2%-20.2%)	One-sample z=-15.26†	<0.001*
Gender				χ^2=0.64	0.422
Male (n=219)	39 (17.8%)	180 (82.2%)	OR=1.23 (0.74-2.05)		
Female (n=214)	32 (15.0%)	182 (85.0%)	Reference		
Age group				χ^2=1.05	0.591
6-9 years (n=99)	19 (19.2%)	80 (80.8%)	Reference		
10-12 years (n=142)	24 (16.9%)	118 (83.1%)	OR=0.86 (0.44-1.67)		
13-15 years (n=192)	28 (14.6%)	164 (85.4%)	OR=0.72 (0.38-1.36)		

†The observed prevalence was compared with the 53% prevalence used in the study's original sample-size calculation.

[Table 2] shows that the overall prevalence of current health problems among children residing in CCIs was 16.4% (71/433; 95% CI: 13.2%-20.2%), while 83.6% had no health problem at examination. This prevalence was significantly lower than the 53% reference prevalence used in the original sample-size calculation (z=-15.26, p<0.001). Health problems were present in 17.8% of males compared with 15.0% of females. Although males had 1.23 times higher odds of a current health problem than females, the confidence interval included unity and the association was not statistically significant (OR=1.23, 95% CI: 0.74-2.05; χ^2=0.64, p=0.422). According to age, the prevalence was highest among children aged 6-9 years (19.2%), followed by those aged 10-12 years (16.9%) and 13-15 years (14.6%). Compared with children aged 6-9 years, the odds were lower among children aged 10-12 years (OR=0.86, 95% CI: 0.44-1.67) and 13-15 years (OR=0.72, 95% CI: 0.38-1.36). However, the overall association between age group and current health problems was not statistically significant (χ^2=1.05, p=0.591).

Table 3: Pattern of nutritional, haematological and clinical health problems among the children (N=433)

Health parameter	Overall n (%) or Mean (SD)	Male (n=219)	Female (n=214)	Effect estimate (95% CI)	Test of significance	P value
Dietary and nutritional findings						
Inadequate calorie intake	429 (99.1%)	216 (98.6%)	213 (99.5%)	OR=0.34 (0.03-3.28)	Fisher's exact test	0.623
Inadequate protein intake	243 (56.1%)	107 (48.9%)	136 (63.6%)	OR=0.55 (0.37-0.80)	χ^2=9.49	0.002*
Abnormal BMI-for-age	176 (40.6%)	106 (48.4%)	70 (32.7%)	OR=1.93 (1.31-2.85)	χ^2=11.05	<0.001*
Normal BMI-for-age	257 (59.4%)	113 (51.6%)	144 (67.3%)			
Wasting	67 (15.5%)	39 (17.8%)	28 (13.1%)	Prevalence: 15.5% (12.4%-19.2%)		
Severe wasting	70 (16.2%)	61 (27.9%)	9 (4.2%)	Prevalence: 16.2% (13.0%-19.9%)		
Risk of overweight	20 (4.6%)	1 (0.5%)	19 (8.9%)	Prevalence: 4.6% (3.0%-7.0%)		
Overweight	17 (3.9%)	5 (2.3%)	12 (5.6%)	Prevalence: 3.9% (2.5%-6.2%)		
Obesity	2 (0.5%)	0 (0.0%)	2 (0.9%)	Prevalence: 0.5% (0.1%-1.7%)		
Overall BMI-category distribution					χ^2=65.21	<0.001*
Height, cm		142.05 (26.87)	136.24 (17.67)	MD=5.81 (1.52-10.10)	Welch t=2.66	0.008*
Weight, kg		29.92 (9.78)	32.83 (9.76)	MD=-2.91 (-4.76 to -1.06)	Welch t=-3.10	0.002*
BMI, kg/m²	16.16 (3.79)	14.79 (2.97)	17.57 (4.01)	MD=-2.78 (-3.45 to -2.11)	Welch t=-8.18	<0.001*
Haematological findings						
Any anaemia	121 (27.9%)	35 (16.0%)	86 (40.2%)	OR=0.28 (0.18-0.45)	χ^2=31.49	<0.001*
Mild anaemia	76 (17.6%)	23 (10.5%)	53 (24.8%)	Prevalence: 17.6% (14.3%-21.4%)		
Moderate anaemia	45 (10.4%)	12 (5.5%)	33 (15.4%)	Prevalence: 10.4% (7.9%-13.6%)		
Normal haemoglobin	312 (72.1%)	184 (84.0%)	128 (59.8%)	Prevalence: 72.1% (67.6%-76.1%)		

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Haemoglobin, g/dL		12.55 (1.08)	11.80 (1.11)	MD=0.75 (0.54-0.96)	Welch t=7.10	<0.001*
Current clinical morbidity pattern						
Respiratory conditions	34 (7.9%)	19 (8.7%)	15 (7.0%)	Prevalence: 7.9% (5.7%-10.8%)	Fisher's exact test	0.593
Ear-related conditions	9 (2.1%)	7 (3.2%)	2 (0.9%)	Prevalence: 2.1% (1.1%-3.9%)	Fisher's exact test	0.175
Skin-related conditions	6 (1.4%)	2 (0.9%)	4 (1.9%)	Prevalence: 1.4% (0.6%-3.0%)	Fisher's exact test	0.445
Gastrointestinal/oral conditions	5 (1.2%)	2 (0.9%)	3 (1.4%)	Prevalence: 1.2% (0.5%-2.7%)	Fisher's exact test	0.682
Cardiac conditions	4 (0.9%)	3 (1.4%)	1 (0.5%)	Prevalence: 0.9% (0.4%-2.4%)	Fisher's exact test	0.623
Other current conditions	13 (3.0%)	6 (2.7%)	7 (3.3%)	Prevalence: 3.0% (1.8%-5.1%)	Fisher's exact test	0.785

*Statistically significant at $p<0.05$. MD: mean difference, calculated as male minus female.

The clinical categories were consolidated from the individual diagnoses reported in the original morbidity table.

[Table 3] demonstrates a substantial nutritional burden among the children. Nearly all participants had inadequate calorie intake (99.1%), with comparable proportions among males (98.6%) and females (99.5%; Fisher's exact p=0.623). Inadequate protein intake was observed in 56.1% of children and was significantly more frequent among females than males (63.6% versus 48.9%). Males had approximately 45% lower odds of inadequate protein intake than females (OR=0.55, 95% CI: 0.37-0.80; χ^2=9.49, p=0.002). Abnormal BMI-for-age was detected in 40.6% of children and was significantly more common among males than females (48.4% versus 32.7%; OR=1.93, 95% CI: 1.31-2.85; χ^2=11.05, p<0.001). Overall, 15.5% had wasting, 16.2% had severe wasting, 4.6% were at risk of overweight, 3.9% were overweight and 0.5% were obese. Severe wasting was markedly more frequent among males (27.9%) than females (4.2%), whereas risk of overweight, overweight and obesity were relatively more frequent among females. Consequently, the overall BMI-category distribution differed significantly by gender (χ^2=65.21, p<0.001). The mean height was significantly greater among males than females (142.05±26.87 versus 136.24±17.67 cm), with a mean difference of 5.81 cm (95% CI: 1.52-10.10; t=2.66, p=0.008). In contrast, females had significantly higher mean weight than males (32.83±9.76 versus 29.92±9.78 kg; MD=-2.91 kg, 95% CI: -4.76 to -1.06; t=-3.10, p=0.002). Mean BMI was also significantly higher among females than males (17.57±4.01 versus 14.79±2.97 kg/m²; MD=-2.78, 95% CI: -3.45 to -2.11; t=-8.18, p<0.001).

Anaemia was identified in 121 (27.9%) children, including 17.6% with mild anaemia and 10.4% with moderate anaemia. Its prevalence was substantially higher among females than males (40.2% versus 16.0%). Males had 72% lower odds of anaemia than females (OR=0.28, 95% CI: 0.18-0.45; χ^2=31.49, p<0.001). The mean haemoglobin concentration was correspondingly higher among males (12.55±1.08 g/dL) than females (11.80±1.11 g/dL), with a mean difference of 0.75 g/dL (95% CI: 0.54-0.96; t=7.10, p<0.001).

Respiratory conditions were the most common current clinical morbidity, affecting 7.9% of children, followed by ear-related conditions (2.1%), skin conditions (1.4%), gastrointestinal or oral conditions (1.2%) and cardiac conditions (0.9%). Other conditions were observed in 3.0% of participants. None of these grouped clinical conditions differed significantly between males and females, as all corresponding p values were greater than 0.05.

Table 4: Association of selected sociodemographic and institutional factors with identified health problems (N=433)

Factor	Health problem/anaemia present, n/N (%)	Effect estimate (95% CI)	Test of significance	P value
Association with any current clinical health problem				
Male gender	39/219 (17.8%)	OR=1.23 (0.74-2.05)	χ^2=0.64	0.422
Female gender	32/214 (15.0%)	Reference		
Age 6-9 years	19/99 (19.2%)	Reference	χ^2=1.05†	0.591
Age 10-12 years	24/142 (16.9%)	OR=0.86 (0.44-1.67)		
Age 13-15 years	28/192 (14.6%)	OR=0.72 (0.38-1.36)		
Association with anaemia				
Age 6-9 years	32/99 (32.3%)	Reference	χ^2=6.33†	0.042*
Age 10-12 years	47/142 (33.1%)	OR=1.04 (0.60-1.79)		
Age 13-15 years	42/192 (21.9%)	OR=0.59 (0.34-1.01)		
Male gender	35/219 (16.0%)	OR=0.28 (0.18-0.45)	χ^2=31.49	<0.001*
Female gender	86/214 (40.2%)	Reference		
Both parents present	23/179 (12.8%)	Reference	χ^2=39.44‡	<0.001*
Paternal orphan	18/53 (34.0%)	OR=3.49 (1.70-7.15)		
Maternal orphan	55/150 (36.7%)	OR=3.93 (2.27-6.80)		
Double orphan	24/50 (48.0%)	OR=6.26 (3.09-12.69)		
Residing with sibling	64/166 (38.6%)	OR=2.31 (1.51-3.55)	χ^2=15.05	<0.001*
Not residing with sibling	57/267 (21.3%)	Reference		

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†Overall test across the three age categories.
‡Overall test across all parental-status categories, including the single child recorded under guardian status.
*Statistically significant at $p<0.05$.

[Table 4] examines the association of selected factors with current clinical health problems and anaemia. The prevalence of any current clinical health problem was slightly higher among males than females (17.8% versus 15.0%), but the difference was not statistically significant (OR=1.23, 95% CI: 0.74-2.05; χ^2=0.64, p=0.422). Current health problems decreased numerically from 19.2% among children aged 6-9 years to 16.9% among those aged 10-12 years and 14.6% among those aged 13-15 years. Nevertheless, age group was not significantly associated with current clinical morbidity (χ^2=1.05, p=0.591).

Anaemia showed significant associations with age, gender, parental status and sibling residence. Its prevalence was 32.3% among children aged 6-9 years, 33.1% among those aged 10-12 years and 21.9% among those aged 13-15 years. The overall age-group association was statistically significant (χ^2=6.33, p=0.042), although the category-specific confidence intervals included unity. Female children had a considerably higher prevalence of anaemia than males (40.2% versus 16.0%). Male gender was associated with significantly lower odds of anaemia (OR=0.28, 95% CI: 0.18-0.45; χ^2=31.49, p<0.001).

Parental status was strongly associated with anaemia (χ^2=39.44, p<0.001). Anaemia affected 12.8% of children whose parents were both present, compared with 34.0% of paternal orphans, 36.7% of maternal orphans and 48.0% of double orphans. Relative to children with both parents present, the odds of anaemia were 3.49 times higher among paternal orphans (95% CI: 1.70-7.15), 3.93 times higher among maternal orphans (95% CI: 2.27-6.80) and 6.26 times higher among double orphans (95% CI: 3.09-12.69). Anaemia was also more frequent among children residing with siblings than among those not residing with siblings (38.6% versus 21.3%). Children residing with siblings had 2.31 times higher odds of anaemia (95% CI: 1.51-3.55; χ^2=15.05, p<0.001).

DISCUSSION

Demographic, institutional and health profile

The present study included 433 children residing in Child Care Institutions, with the largest proportion aged 13-15 years (44.3%). The almost equal representation of males (50.6%) and females (49.4%) minimized gender imbalance in the study population. The predominance of older school-age children was comparable to Reddy and Ramya (2017),[1] who studied children residing in orphanages in Karnataka, and to Chowdhury et al. (2017),[2] whose study from Dhaka included a large proportion of children aged 12-18 years. The present finding that 69.1% attended primary school and 30.5% attended secondary school indicates that almost all institutionalized children had access to formal education. Similar school participation was described by Kamath et al. (2017),[3] whose institutionalized children were distributed between primary and secondary education.

The mean age at institutionalization was 9.52±2.79 years, while the mean duration of institutional residence was 27.65±27.65 months. The wide variation in duration suggests that the sample included both recently admitted children and long-term residents. DeLacey et al. (2020),[4] emphasized that age at admission, duration of institutional residence, health status before entry and quality of institutional care may jointly influence subsequent growth and morbidity. The fact that 61.7% of the children did not reside with their siblings may indicate disruption of family and sibling support networks. However, the psychosocial implications of sibling separation could not be established from the present cross-sectional data.

A history of illness during the preceding year was reported by 38.1% of children, whereas only 16.4% had an identifiable health problem at the time of examination. This difference may reflect the episodic nature of childhood infections, treatment received before examination and the distinction between annual morbidity and point prevalence. The observed current morbidity was lower than the broad morbidity burden described by Reddy and Ramya (2017),[1] and Karam et al (2021).[5] Differences in the definition of morbidity, season of examination, number of clinical domains assessed and availability of healthcare within institutions could explain this variation.

Half of the participating CCIs reported a recent scabies outbreak. Although this was an institution-level observation and did not represent a 50% prevalence among individual children, it indicates the potential for rapid transmission of communicable skin conditions in congregate settings. Rafi et al. (2025),[6] detected scabies in 31.6% of 471 children residing in orphanages in Bangladesh. They identified male gender, overcrowding and close contact with affected peers as significant risk factors. Their findings support the need for simultaneous examination and treatment of cases and contacts, environmental cleaning, reduction of crowding and continued surveillance after an outbreak.

Prevalence of current health problems

The prevalence of current health problems in the present study was 16.4% (95% CI: 13.2%-20.2%). This was substantially lower than the 53% reference prevalence used in the original sample-size estimation. However, this statistical comparison should be interpreted cautiously because the reference and present studies may have used different definitions and methods for identifying unhealthy children. A low point prevalence does not exclude substantial nutritional, haematological or subclinical morbidity, as demonstrated by the higher prevalence of abnormal BMI-for-age and anaemia in the same participants.

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Current morbidity was slightly higher among males than females (17.8% versus 15.0%), but the difference was not statistically significant. Likewise, morbidity declined numerically from 19.2% in children aged 6-9 years to 14.6% among those aged 13-15 years, without a significant age-group association. The systematic review by DeLacey et al. (2020),[4] found inconsistent relationships between gender and the health or nutritional status of institutionalized children. Some studies reported greater morbidity or malnutrition among boys, others among girls, and several found no significant difference. Therefore, the absence of a significant gender association in the present study is consistent with the heterogeneous international evidence.

Carolin et al (2022),[7] although studying children attending Anganwadi centres rather than CCIs, also demonstrated that childhood morbidity estimates varied according to age, nutritional status and the specific illnesses included in the definition. The lower prevalence in the present study could reflect regular institutional health examinations, easier access to treatment and exclusion of severely ill or bedridden children. It could also result from assessing only clinically evident conditions on a single visit.

Dietary and nutritional findings: The most striking dietary finding was that 99.1% of the children had inadequate calorie intake, while 56.1% had inadequate protein intake. Protein inadequacy was significantly more frequent among females than males (63.6% versus 48.9%, p=0.002). Riaz et al. (2021),[8] similarly found that children living in orphanages consumed inadequate protein, iron and fat relative to recommended dietary allowances. El-Kassas and Ziade (2017),[9] reported that approximately half of institutionalized school-age children in Lebanon had inadequate protein, fruit and vegetable consumption, while 92% had inadequate milk and dairy intake. These comparisons indicate that institutional meals may satisfy regular meal frequency without necessarily meeting age-specific requirements for energy, protein and micronutrients.

Abnormal BMI-for-age was identified in 40.6% of participants. Wasting and severe wasting affected 15.5% and 16.2%, respectively, giving a combined wasting burden of 31.7%. In comparison, Karam et al. (2021),[5] reported undernutrition in 39.4%, thinness in 27% and stunting in 20% of 563 children residing in CCIs in Puducherry. Reddy et al. (2019),[10] found malnutrition in 57.7% and stunting in 53.3% of institutionalized children in Bhubaneswar. Chowdhury et al (2017),[2] reported that 60.3% of children in a Dhaka orphanage were malnourished. Thus, although the prevalence varied between studies, all demonstrated a considerable burden of undernutrition among institutionalized children.

Soudhabi et al (2017),[11] found that 23% of children residing in an orphanage were underweight, 74% had a healthy weight and 1% were obese. The present study showed a lower proportion with normal BMI-for-age (59.4%) and a higher combined prevalence of wasting. Kamath et al (2017),[3] reported stunting in 18.6%, wasting in 15.7%, underweight in 22.9% and thinness in 17.1% among institutionalized children. Their wasting prevalence was close to the 15.5% wasting observed in the present study, although the additional 16.2% with severe wasting indicates a greater degree of nutritional severity in the current population.

The present study also identified risk of overweight in 4.6%, overweight in 3.9% and obesity in 0.5%. El-Kassas and Ziade (2017),[9] reported a combined overweight and obesity prevalence of 9.2%, which was comparable to the combined 9.0% prevalence of risk of overweight, overweight and obesity in the present study. This simultaneous occurrence of wasting and excess weight demonstrates a double burden of malnutrition. DeLacey et al (2020),[4] found that institutionalized children could experience undernutrition, micronutrient deficiencies and overweight within the same care setting, emphasizing that nutritional programmes should address diet quality rather than merely increase the quantity of food.

The BMI-category distribution differed significantly between males and females. Severe wasting was much more common among males, whereas risk of overweight and overweight were more frequent among females. Reddy et al (2019),[10] also observed greater malnutrition among boys, whereas the review by DeLacey et al (2020),[4] found that gender-related nutritional differences were inconsistent across institutions and countries. Such variation may be related to age distribution, pubertal development, physical activity, dietary allocation, pre-institutional nutritional status and sociocultural practices.

Haematological findings

Anaemia was present in 27.9% of the children, comprising 17.6% with mild and 10.4% with moderate anaemia. This was lower than the 37.4% prevalence reported by Reddy and Ramya (2017),[1] but greater than the approximately 21.7% reported in a rural Karnataka orphanage study. Karam et al (2021),[5] detected palmar pallor in 26.8% of CCI residents, closely corresponding to the present anaemia prevalence. Soudhabi et al (2017),[11] reported clinical signs suggestive of anaemia in a much larger proportion of institutionalized children. However, their assessment relied mainly on pallor, nail changes and angular stomatitis, whereas the present study used haemoglobin estimation, making direct comparison difficult.

Anaemia was markedly more common among females than males (40.2% versus 16.0%). Correspondingly, mean haemoglobin was significantly lower among females by 0.75 g/dL. The difference may be explained by the predominance of adolescents in the sample, menstrual blood loss, rapid pubertal growth and inadequate intake of iron- and protein-rich foods. The significantly higher prevalence of protein inadequacy among females provides further support for a nutritional

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contribution. Nevertheless, iron indices, menstrual blood loss, stool examination and vitamin B_{12} or folate levels were not assessed; therefore, the cause of anaemia cannot be confirmed.

DeLacey et al (2020),[4] reported wide variation in anaemia prevalence among children in institutional care, ranging from approximately 3% to 90%, reflecting differences in age, diet, infection, diagnostic thresholds and underlying health conditions. A subsequent multi-site analysis by DeLacey et al (2021),[12] also showed that nutritional deficits among children in institution-based care were heterogeneous across locations and frequently required individualized assessment. Thus, routine haemoglobin screening should be accompanied by dietary evaluation and investigations for iron deficiency, parasitic infection and other causes where clinically indicated.

Clinical morbidity pattern: Respiratory conditions were the most frequent current morbidity, affecting 7.9% of children. Ear-related conditions affected 2.1%, followed by skin, gastrointestinal/oral and cardiac problems. Reddy and Ramya (2017),[1] similarly identified a mixture of nutritional deficiencies, anaemia, dental disease, respiratory morbidity and other physical conditions among children in orphanages. Karam et al (2021),[5] found dental problems in 61%, skin infections in 8% and prolonged cough in 4.6% of CCI residents. The lower proportions in the present clinical morbidity table may be related to its narrower grouping of active conditions and exclusion of some screening findings from the definition of current morbidity.

Khattab et al (2023),[13] found that institutionalized orphan children had a greater dental-caries experience and higher unmet treatment needs than parented schoolchildren. Their study attributed this burden to inadequate supervision, poor diet, insufficient preventive services and delayed treatment. Although gastrointestinal and oral problems formed only 1.2% of active morbidity in the present table, a single clinical examination may underestimate chronic dental disease unless a structured dental assessment is undertaken.

The absence of statistically significant gender differences across respiratory, ear, skin, gastrointestinal/oral and cardiac categories suggests that current clinical morbidity was distributed relatively evenly between males and females. However, some categories had very small numbers, resulting in wide uncertainty and low statistical power. Consequently, nonsignificant findings should not be interpreted as proof that gender differences were absent.

Factors associated with morbidity and anaemia

Neither gender nor age was significantly associated with the presence of any current clinical health problem. This suggests that routine health screening should cover all institutionalized children rather than target only a particular age or gender group. By contrast, age was significantly associated with anaemia, with the highest prevalence among children aged 10-12 years and the lowest among those aged 13-15 years. However, individual age-category odds ratios were not statistically significant, indicating that the overall association was modest and should be interpreted cautiously.

Parental status showed a strong graded association with anaemia. Compared with children whose parents were both present, the odds increased among paternal orphans, maternal orphans and double orphans, reaching the highest level among double orphans. This pattern may represent cumulative social disadvantage before institutional admission, including poverty, food insecurity, inadequate healthcare, recurrent infection and delayed entry into protective services. DeLacey et al (2020),[4] noted that many children enter institutional care with pre-existing nutritional, medical and developmental problems. Therefore, the observed association may reflect conditions preceding institutionalization rather than an independent effect of orphan status.

Children residing with siblings had higher odds of anaemia than those not residing with siblings. This finding should not be interpreted as evidence that sibling co-residence causes anaemia. Siblings are likely to share parental loss, poverty, dietary deprivation, infection exposure and reasons for institutional placement. Furthermore, the analysis was unadjusted for age, gender, orphan status, duration of stay and dietary intake. Multivariable logistic regression would be necessary to determine whether sibling residence remained independently associated with anaemia after controlling for these potential confounders.

Overall, the findings agree with the literature that children in institutional care experience overlapping nutritional, haematological and infectious health problems. The relatively low prevalence of active clinical morbidity should therefore not obscure the high prevalence of inadequate dietary intake, abnormal BMI-for-age and anaemia. Periodic comprehensive examinations, standardized growth monitoring, haemoglobin screening, individualized dietary planning, menstrual and iron-health services for adolescent girls, deworming, dental care and institution-wide infection-control measures are warranted.

CONCLUSION

The study found that 16.4% of children residing in Child Care Institutions had at least one current clinical health problem. Respiratory conditions were the most frequent clinical morbidity, followed by ear-related, skin, gastrointestinal/oral and cardiac conditions. Despite the relatively low prevalence of active clinical illness, nutritional and haematological problems were substantial. Nearly all children had inadequate calorie intake, more than half had inadequate protein intake, 40.6% had abnormal BMI-for-age and 27.9% had anaemia. Severe wasting was more common among males, whereas females had significantly greater protein inadequacy, higher BMI and a markedly higher prevalence of anaemia. Anaemia was significantly associated with age, gender, parental status and sibling co-residence, with the highest prevalence among double orphans. These findings emphasize the need for periodic comprehensive health examinations, standardized growth monitoring, dietary improvement, haemoglobin screening, iron supplementation, deworming, dental care and effective infection-control measures in CCIs. Particular attention should be given to adolescent girls, undernourished children and children with complete parental loss.

Limitations

1. The cross-sectional design established associations but could not determine temporal relationships or causality.
2. The study was conducted in selected CCIs from one district; therefore, the findings may not be generalizable to all institutionalized children.
3. Purposive selection of institutions may have introduced selection bias.
4. Children who were absent, severely ill, bedridden, unwilling to participate or unable to cooperate were excluded, possibly underestimating the true morbidity burden.
5. Illness during the preceding year was based partly on recall and available institutional records and was therefore subject to recall and documentation bias.
6. Current morbidity was assessed during a single examination; seasonal or episodic illnesses may have been missed.
7. Dietary intake was assessed using a 24-hour recall, which might not represent usual long-term dietary consumption.
8. Haemoglobin was measured using Sahli's method, which is less precise than automated haematology analysers.
9. Anaemia was classified using haemoglobin concentration alone. Serum ferritin, peripheral smear, vitamin B_{12}, folate and stool examination were not performed to determine its cause.
10. Nutritional assessment was mainly based on BMI-for-age. Height-for-age, weight-for-age, mid-upper arm circumference and biochemical micronutrient indicators were not comprehensively evaluated.
11. The study did not assess mental health, emotional well-being, developmental status, substance use, abuse, neglect or quality of caregiver-child interaction.
12. Several clinical conditions had small numbers, resulting in limited statistical power and imprecise estimates.
13. The reported associations were based mainly on unadjusted analyses. Residual confounding by age, pubertal status, duration of institutionalization, diet, menstruation, socioeconomic background and previous illness could not be excluded.

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