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ORIGINAL RESEARCH

Availability of Infection Prevention Measures and Occurrence of Infections in Childcare Centres in Sagamu Local Government Area, Ogun State, Nigeria

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Abstract

Background: The establishment of Childcare Centres (CCs) has increased as several parents leave their homes to work and need a place to keep their children. CCs are expected to make available equipment and materials for infection prevention.

Objective: To assess the facilities for infection prevention in CCs and the occurrence of common infections among children attending CCs.

Methods: Quantitative research approach was used. The study was conducted among care providers in CCs in Sagamu Local Government Area, Ogun State, Nigeria. The data were obtained using an observation checklist and a validated questionnaire with Cronbach's alpha coefficient of 0.831.

Result: The mean age of the care providers was 35.3±9.4 years. Most (92.4%) care providers worked at private school-owned CCs. The features of infection commonly exhibited by the children included running nose (73.3%), blocked nose (49.6%), cough (66.8%), and sneezing (53.1%). Most (238; 90.8%) of the CCs had suitable structures, while 160 (61.0%) had none of the required essential structures. There was a significant positive relationship between the availability of essential structures in CCs and the occurrence of infection in the children ($r = -0.153$; $p < 0.001$) and a significant positive relationship between the availability of essential equipment and the occurrence of infection in CCs ($r = 0.313$; $p < 0.001$).

Conclusion: Emphasis should be placed on providing more infection prevention measures in CCs. This should include relevant policies, guidelines and monitoring mechanisms.

Keywords: Childcare Centres, Childhood Infections, Infection Control, Infection Prevention Practices.

Introduction

Ideally, childcare centres (CCs) render care to children for optimal growth, where the environment significantly influences the children's development, including their health. In CCs, newborns, toddlers, and young children under five are cared for. A childcare

centre (also known as a creche', daycare centre, 'childcare, or 'preschool') is where children are cared for by persons who are not their biological parents. ^[1,2] The environment of the CC is expected to be nurturing, and the centre is expected to be facilitated by enabling environments of policies, services, community, and family. ^[3] In today's society, a large

percentage of children under the age of five attend CCs, whereas attending CCs puts the child at a high risk of contracting infectious diseases. The reasons for the latter risk include overcrowding and a low carer-children ratio. [4] Added to this is children's increased susceptibility due to environmental influences and low immune status.

Globally, children attending CCs have a higher risk for various infections. Some common infections exhibited are respiratory tract infections, diarrheal diseases, cytomegalovirus infections, hepatitis A, and bacterial meningitis. [5] In the United States, acute infectious diarrhoea and upper and lower respiratory tract infections, including acute otitis media and pneumonia, are two to three times more likely in CCs attendees than in age-matched children cared for at home. [5] CC attendees also have a median of 14 (range 2–43) infectious episodes at ages 0 to 3 years. [6] Children are more likely to acquire infectious diseases as they experience an average of six to twelve episodes of infectious illness within a year, resulting in absenteeism from the CCs. [7] In Finland, it was reported that children in CCs had only slightly more sick days per month (mean 5.54, SD 4.07) when compared with children cared for at home (mean 4.80, SD 3.39). [8] CC environment also plays a role in the transmission of infectious agents, which has resulted in the absence of children from schools and CCs in Japan. Most of the time, the absenteeism is due to illnesses. [9] The availability of infection preventive measures in CCs may reduce the occurrence of infection in the centres. Appropriate hand hygiene by caregivers and children has been investigated, proven, and implemented in Germany to reduce the spread of illnesses and, subsequently, the number of absent days. To ensure good hand washing practices, the availability of equipment and materials such as running water, wash hand basins, tissue rolls, disinfectants, and personal protective equipment are crucial. [10]

It is worth noting that several studies have identified schools and CCs as transmission hubs in models of the spread of diseases such as influenza in a community. [11–14] This happens because there is a chance of spreading infections when children are together. This is especially true among infants and toddlers, who are likely to use their hands to wipe their noses or rub their eyes and then handle toys or touch other children. These children then touch their noses and rub their eyes, so the virus goes from the nose or eyes of one child by way of hands or toys to the next child, who then strokes his own eyes or nose. Without strategies to curb infections, children get sick in the first five years of life as their bodies build immunity to diseases. [15] This has been observed in Nigeria [9–10] and globally. Several studies have identified the factors responsible for the increase in infection rate among children cared for at CCs compared to those cared for at home. [8] Some of the enabling factors are poor prior knowledge of the requirements for establishing a creche, lack of essential materials for infection prevention, unhygienic environment, poor hand washing habit of carers, insufficient water supply, inadequate waste disposal facilities, lack of screening of carers, and lack of screening of children before allowing them into the nurseries. [4]

Several studies have been carried out on infection occurrence in CCs. Despite the findings on improving the infective prevention practices of caregivers, there needs to be more literature on the assessment of equipment and structures of CCs in relation to the occurrence of infections. This study assessed the availability of the facilities (requisite structure, materials, and equipment) for infection prevention in CCs. Also, it evaluated the occurrence of infection among the attendees of the CCs.

Methods

A descriptive, cross-sectional study was conducted among CCs within Sagamu Local Government Area. Sagamu Local Government is bounded by Odogbolu Local Government to the East, Ikenne Local Government to the North, Obafemi-Owode Local Government to the West, and Lagos State to the South, respectively. The Local Government Area is divided into 15 administrative wards, and the projected population, as of 2018, is about 355,900. The Sabo area of Offin, Sagamu, can be mistaken for any typical northern town of language, culture, and setting. [16, 17]

Different forms of CCs in Sagamu can be classified into private primary-school-owned, public primary-school-owned, and private standalone CCs. The public primary school-owned CCs are attached to public primary schools and are known as preschool classes.

In Ogun State, the total number of public and private schools as of August 2022, according to the State Ministry of Education, Science and Technology, is 5,641. The number of CCs owned by public and private schools was 614, consisting of 60 public primary schools and 554 private primary schools.

Public primary school-owned CCs are regulated by the State Ministry of Education, Science and Technology and the State Universal Basic Educational Board. The care providers are primarily teachers with lower academic qualifications. The establishment of CCs in public primary-owned CCs by the government derived from the National Educational Research and Development Council (NERDC)'s policy on the nation's early childhood and education program of 2007.

The private primary school-owned CCs belonged to the owners of the same private schools. Similarly, the care providers are either teachers with the minimum academic qualifications or experienced elderly mothers who are non-academic staff of the school. The private standalone CCs are owned by private individuals and unrelated to public or private schools. The proprietors are usually women,

experienced mothers, retired teachers or female religious leaders. Unlike those attached to schools, this type of CCs often provides 24-hour service.

Inclusion criteria: The respondents included care providers and teachers in CCs attached to public or private primary schools. The care providers and teachers were aged above 18 years.

Exclusion criteria: The CCs attached to religious places and workplaces, unregistered CCs attached to primary schools and standalone CCs.

Sample size determination

This sample size was calculated using Slovin's formula with a confidence interval of 95% and an error tolerance of 0.05:

$$n = N / (1 + Ne^2) = 244.$$

$N = 614$ (The number of CCs in Sagamu local government), and 'e' was 0.05.

10% of the calculated minimum sample size was added to address non-response.

Therefore, the total number of participants after adding 10% of 244 was $244 + 24.3 = 267.3 \approx 267$.

Based on this computation, a total number of 267 CCs were recruited.

Sampling Technique

The study utilised a multistage sampling technique.

Stage 1: Selection of the local government in Ogun State. Non-probability purposive sampling technique was used to select Sagamu local government in Ogun State. Sagamu Local Government was chosen for the unique characteristics of the central location and the interconnectivity with neighbouring states compared to other local government areas in the State.

Stage 2: Selection of the number of CCs. Since two strata (public school-owned CCs and private school-owned CCs) were considered in this study, a proportionate stratified sampling technique was used to select the number of CCs from the two strata. This was done using the formula

$(\text{Number in the group} / \text{Total population}) \times$
calculated sample size

Twenty-six samples were selected from the public school-owned CCs and 241 CCs from private school-owned CCs.

Stage 3: Selection of samples. The samples were selected using systematic sampling techniques from the register obtained from the education board as the framework to guide selection. The sample interval was calculated for each population using the statistical formula: $K = N/n$. Where K = Sample interval; N = Total population in the sample frame; n = sample size.

The instruments for data collection

Three instruments were used to collect data: the questionnaire, observation checklist and photographs.

Questionnaire: Interviewer-administered questionnaire was designed to collect data from the care providers /teachers in each CC to measure the occurrence of infection. The section consists of eleven common infections among the attendees of CC. The questions were constructed in a Likert scale format. The scale was scored from 1 to 4: Never (1), Rarely (2), Sometimes (3), and Always (4). The total obtainable score was 44, and the least score was 11. High occurrence of infections was determined by scores from 44 to 25, while low occurrence ranged from 24 to 4.

Observation Checklist: Data were collected on the situation of the available equipment and materials for infection prevention. The checklist was designed from relevant literature.^[19-21] The checklist consisted of three sections:

Section A captured data on the general assessment of the CC according to the requirements of the national regulatory body in Nigeria (Nigerian Educational Research and Development Council). This section consisted of 11 items which entailed the building type, reception space availability and toilet variety. Section B obtained data on the availability of essential structures consisting of nine items such as a wash hand basin, toilet for boys and

girls, sick bay, reception space, and playing ground. Each item had three options scored as follows: '1 = none available', '2 = available but inadequate', and '3 = available and adequate'. A score of 1-9 was classified as 'none available', 10-18 was classified as 'available but inadequate', while the scores for 'available and adequate' ranged from 19-36.

Section C entailed data on the availability of equipment/materials using 13 items, such as a pedal waste bin, apron, rubber gloves, latex gloves, disinfectants, liquid soap, and tissue rolls. Each item had three options scored as '1 = none available', '2 = available but inadequate' and '3 = available and adequate'. The availability scores of 1-13 were classified as 'none available', 14-26 were classified as 'available but inadequate', and scores 27-39 were classified as 'available and adequate'.

Photographs: Photographs of specific aspects of the facilities that described the situation and condition of a CC were taken to complement memory and facilitate accurate reporting. The inscriptions or means of the identity of the CCs were avoided while taking the pictures.

Data collection: Data collection was done over two weeks (12 to 19 September 2022). Six research assistants (all graduates) were trained on the methodology in a classroom setting.

Data Analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0. The data were coded and recoded as necessary. Descriptive and inferential statistics were employed to analyse the data. The descriptive analysis was employed to describe the respondent's demographic profile, while Pearson Product Moment of correlation (PPMC) was used for inferential statistics. The differences between the parameters of the estimate were deemed statistically significant at $p < 0.05$.

Ethical considerations

Ethical approval for the study was obtained from Babcock University Health Research Ethics Committee (BUHREC) with the

reference number NHREC/24/01/2020. Permission was also obtained from the Ogun State Ministry of Education, Science and Technology and the State Universal Basic Education Board. Written consent was also obtained from the participants, and confidentiality was maintained.

Results

Demography

Of the 267 schools visited, 262 accepted to participate in the study. These comprised 20 public school-owned CCs and 242 private school-owned CCs. The age of the care providers ranged from 20 to 60 years, with a mean of 35.3±9.4 years. Half (53.1%) of the CCs had a range of 11- 20 children in their centres, with a mean of 17±8.1. A total of 254 (96.9%) care providers were women possessing the minimum educational qualification of senior secondary education. Most (92.4%) care providers worked at private school-owned CCs, and most respondents were trained teachers (91.2%). Only seven care providers have had CC infection control training, as shown in Table I.

General structures available in the CCs

One hundred and twenty-six (48.1%) CCs had reasonably clean, modern buildings with good waste management facilities. Over three-quarters, (204; 77.9%) of the CCs were not well aerated with at least two doors and more than one window. Similarly, most (219; 83.6%) of the CCs did not have a diaper changing room (Table II). The overall grading of the general structure of the CCs showed that most (238; 90.8%) had a good structure.

Essential structures for infection prevention in the CCs

Over half (56.9%) of the CCs had inadequately sized rooms where the children were cared for, meaning that the size needed to be up to 16 square meters. The majority (223; 85.1%) did not have a bathroom, and only a few CCs (57;

21.8%) had separate toilets for boys and girls. One hundred and sixty-eight (64.1%) CCs needed an adequate sick bay; some had just an open space that needed to be equipped to serve that purpose. Only 61 (23.3%) of the 262 CCs had an adequate wash hand basin (Table III). Overall, 160 (61.0%) CCs had none of the essential structures and only 13 (5.0%) had the required essential structures inadequate State.

Available equipment and materials for the prevention of infection in the CCs

Over half (141; 53.8%) did not have at least one pair of rubber hand gloves, and 135 (51.5%) did not have aprons for cleaning and disinfecting the surfaces and environment. One hundred and fifty-six (59.5%) had no bleaching agent for disinfecting surfaces. Liquid soap for hand washing was inadequate (41.6%), while tissue rolls/ paper was also unavailable in 158 CCs. The majority (246; 93.9%) of the centres did not have a refrigerator to store expressed breast milk and other food items (Table IV). One hundred and seventy-eight CCs had only some of the identified items, while only 10 of the 262 had all the items available and adequate.

Occurrence of infection among children in the CCs

Table V depicts the frequency of common infections among children attending CCs as reported by the care providers. The most frequent symptoms included running nose (73.3%), blocked nose (49.6%), cough (66.8%), and sneezing (53.1%). Meanwhile, symptoms with minimal occurrence included diarrhoea (9.9%), high body temperature (17.3%), vomiting (3.1%) and abdominal ache (1.5%).

Relationship between the availability of essential structures and the occurrence of infections

Table VI indicates that there was a significant negative relationship between the availability of general structures of CCs and the occurrence of infections in the selected CCs ($r = -0.153$; $p < 0.001$). This implies that the availability of general structures for infection prevention had a significant negative relationship with the occurrence of infections in the selected CCs.

Table I: Frequency distribution of the participant's demographic data

Variable	Category	Frequency (n=262)	Percentage
Age (Years)	20-40	192	73.3
	41- 60	70	26.7
Gender	Male	8	3.1
	Female	254	96.9
Education	No education	3	1.1
	Primary	5	1.9
	Secondary	53	20.2
	Tertiary	201	76.7
Type of Centre	Public-school owned	20	7.6
	Private-school Owned	242	92.4
Duration* (Years)	1-5	119	45.4
	6-10	93	35.5
	11-15	28	10.7
	16-20	16	6.1
	21-25	5	1.9
	26-30	1	.4
Role	Nanny	23	8.8
	Teacher	239	91.2
Childcare training	Yes	3	14.9
	No	259	98.9
Infection control training	Yes	7	2.7
	No	255	97.3
If yes, who was the organiser?	School Proprietor	1	14.3
	Private organisation	6	85.7

Relationship between the availability of essential equipment and materials and the occurrence of infections

Table VII indicates a significant positive relationship between the availability of essential equipment and the occurrence of infection in CCs. ($r = 0.313$; $p < 0.001$). This implies a direct relationship between the availability of essential equipment and the occurrence of infection in CCs.

Discussion

The increase in the prevalence of infections in CCs has become an issue of public health

importance. [5] Further research into the causes of the infections is required. Hence this study is one of the few studies conducted in Nigeria to assess the quality of infection prevention measures in CCs. Only 2.7% of the respondents have ever received any training on infection prevention in CCs; this is abysmally low compared to the expectation that teachers/care providers must receive regular and adequate training. The training on infection prevention in CCs is expected to be organised by the government public health agencies and the head of the school. The training should be conducted before establishing the CCs and periodically after that to reinforce how to prevent infection within the CCs. [22]

Table II: General Assessment of the Childcare Center

<i>Variable</i>	<i>Category</i>	<i>Frequency n = 262</i>	<i>Percentage</i>
Condition of the facility & environment:	Dirty, old building without good waste management facilities	14	5.3
	Fairly clean, old building without good waste management facilities	62	23.7
	Dirty, modern building without good waste management facilities	20	7.6
	Fairly clean, modern building with waste management facilities	126	48.1
	Clean, modern building with adequate waste management facilities	40	15.3
Well-aerated with cross ventilation/with at least two doors	Yes	58	22.1
	No	204	77.9
Type of toilet facility	Pit latrine	75	28.6
	Bucket latrine	33	12.6
	Water-closet system	154	58.8
Availability of a reception space:	Yes	106	40.5
	No	156	59.6
Diaper changing room	Yes	43	16.4
	No	219	83.6
How many toilets are within the Childcare centre?	None	33	12.6
	Attached with other older age groups	43	16.4
	One toilet for both males and female	13	5.0
	More than one separate toilets	173	66.0
Source of water supply	Fetching	100	38.2
	Rainwater	14	5.3
	Well water	65	24.8
	Borehole water	83	31.7

Table III: Essential structures for infection preventive measures (n = 262)

<i>Items</i>	<i>Non-available</i>	<i>Available but inadequate</i>	<i>Available and adequate</i>
Adequate size of the rooms (16 square meters) for 20-25 children.	25 (9.5)	149 (56.9)	88 (33.6)
Presence of playground	86 (32.8)	135 (51.5)	41 (15.6)
Bathrooms	223 (85.1)	21 (8.0)	18 (6.9)
Functioning Washing Wash hand basin	91 (34.7)	110 (42.0)	61 (23.3)
Toilet for boys/ girls separately	81 (30.9)	124 (47.3)	57 (21.8)
Kitchen	209 (79.8)	35 (13.3)	18 (6.9)
Special bed/space/room for sick children	51 (19.5)	169 (64.5)	42 (16.0)
Sick bay	60 (22.9)	168 (64.1)	34 (13.0)

Table IV: Equipment and materials for prevention of infection available in the CCs (n = 262)

Items	Expected quantity	None available	Inadequate	Available
Refrigerators per room	1	246 (93.9)	0 (0.0)	16 (6.1)
Pedal Waste bin per room	1	202 (77.1)	45 (17.2)	15 (5.7)
Rubber Hand gloves	1	141 (53.8)	104 (39.7)	17 (6.5)
Apron	2	135 (51.5)	99 (37.8)	28 (10.7)
Disinfecting equipment (mopping sticks, buckets)				
For the kitchen	1	51 (19.5)	163 (62.2)	48 (18.3)
For the toilet	1	62 (23.7)	140 (53.4)	60 (22.9)
For children's space	1	59 (22.5)	148 (56.5)	55 (21.0)
Bleach or bleaching powder	More than 1 Litre	156 (59.5)	70 (26.7)	36 (13.7)
Alcohol hand sanitiser	1 Litre	65 (24.8)	133 (50.8)	64 (24.4)
Liquid soap in a dispenser for use during hand washing	1 Litre	76 (29)	109 (41.6)	76 (29)
Tissue roll/paper	3 Rolls	158 (60.3)	79 (30.2)	25 (9.5)

Table V: Occurrence of infections among the children attending the CCs

Symptoms	Never	Rarely	Sometimes	Always	Mean	St.D
Diarrhoea	85 (32.4)	90 (34.4)	61 (23.3)	26 (9.9)	2.1069	0.9728
Abdominal ache	90 (34.4)	64 (24.4)	104 (39.7)	4 (1.5)	2.0840	0.8930
Vomiting	55 (21.0)	84 (32.1)	113 (43.1)	10 (3.8)	2.2846	0.8312
Fever	23 (8.8)	27 (10.3)	166 (63.3)	46 (17.6)	2.8969	0.7883
Sore throat	114 (43.5)	58 (22.1)	80 (30.5)	10 (3.8)	1.9466	0.9453
Catarrh	23 (8.8)	7 (2.7)	39 (14.9)	193 (73.6)	3.5344	0.9122
Stuffed/Blocked nose	19 (7.3)	15 (5.7)	98 (37.4)	130 (49.6)	3.2939	0.8718
Cough	11 (4.2)	7 (2.7)	69 (26.3)	175 (66.8)	3.5573	0.7444
Sneezing	11 (4.2)	14 (5.3)	98 (37.4)	139 (53.1)	3.3931	0.7743
Skin infection	97 (37.0)	50 (19.1)	109 (41.6)	6 (2.3)	2.0916	0.9342
Skin rashes	85 (32.4)	59 (22.5)	109 (41.6)	9 (3.4)	2.1603	0.9249

St.D - Standard deviation

Table VI: Correlation analysis on the relationship between the available general structures of CCs and the occurrence of infections in the CCs

Essential structures	Prevalence of infection
Pearson Correlation	-0.153
p-value (2-tailed)	0.014
N	260

Table VII: Correlation analysis on the relationship between the available essential equipment and materials and the occurrence of infections in the CCs.

Occurrence of infection	Equipment/Materials
Pearson Correlation	0.313
p-value (2-tailed)	0.000
N	262

The general outlook of the CCs is generally adequate. However, aeration still has challenges due to insufficient windows to avoid airborne infections. To ensure infection prevention, specific materials, equipment and structures and building facility play significant roles in providing safe and infection-free environments. The present study revealed that more than half of the centres had inadequately sized rooms where the children are cared for as required in the NERD guidelines. This, alone, makes the children in CCs prone to infections in the setting of overcrowding. Overcrowding also serves as one of the enabling factors for the spread of infections. Therefore, the monitoring and evaluation of CCs by the school health service division of the public health department in the state Ministry of Health is crucial.

Schools and daycare centres have been identified as hot spots of infection spreading. Lack of hygiene and poor room conditions are some of the main causes of contamination among children, leading to the spread of microbes between children and among children, care providers, parents and people in the community. [23] Also, close to two-thirds of the centres studied needed an adequate sick bay; some had just an open space that needed to be equipped to serve that purpose. This denotes that ill and healthy children in such centres are kept together rather than isolating the sick ones, facilitating the spread of infections.

More than half of the centres did not have a bleaching agent for disinfecting surfaces, implying that they do not disinfect the environment. This observation differed from the study of Tahoun *et al.* [14] in Egypt, where a large proportion of the CCs (94.9%) used disinfectants such as bleach. This denotes that the CC environment provides opportunities for the replication of microbes. In assessing the availability of materials required for hand hygiene, only about a third of the CCs studied had an adequate supply of liquid soap despite

hand washing being the cheapest and easiest method of infection prevention. [24, 25]

Most of the centres in this study did not have a refrigerator, as against the finding in the study conducted in Egypt [4], where 96.6% had a fridge to preserve the children's meals. This difference may be attributed to the comparative research conducted in a more advanced cultural setting. The lack of a refrigerator in the present study may also be because CCs are attached to schools with regulated operation times, as against standalone CCs that operate for longer hours. The required equipment and materials were adequately available in only a few CCs, suggesting that most of the centres may not be investing in such materials and equipment for economic reasons or for lack of clear guidelines for infection prevention in CCs.

The children attending the studied CCs exhibited symptoms such as running nose, blocked nose, cough, and sneezing. Respiratory tract infections appeared the most frequent, similar to other studies where acute respiratory infections are the most frequent illnesses in childhood and the most frequent reason for children's visits to the hospital. Children generally experience three to eight episodes of cold a year, while daycare attendees may experience up to 12 episodes. [14, 26, 27] The prevalence of respiratory symptoms in CCs was reported to be 20.3% in Malaysia, and symptoms exhibited included cough and cold (53.9%), wheezing (38.2%) and cough with phlegm (28.7%). [28] A similar finding was made from a study carried out in Brazil. [29] The reasons for this pattern may include the high susceptibility of young children to viral respiratory tract infections due to their weak immunity and communal style of living, particularly with habits of mouthing and sharing toys and other objects without restriction. [30] The study has further emphasised the negative relationship between the availability of structures and the occurrence

of infections, implying that the occurrence of infections improved with the provision of more essential structures.

Conclusion

The general structure of some of the CCs was fair for use in caring for children. Still, there was a great inadequacy in the supply of materials and equipment required for infection prevention practices. The guideline and training programmes have proven to be an efficient solution to childcare centre attendance-related childhood infections. The government should conduct regular monitoring and evaluation exercises where some of the identified challenges can be addressed. Since buildings are subject to wear and tear, routine maintenance tips should be enforced to keep the buildings healthy; such maintenance can be performed during holidays. Since most of these materials required for infection control are consumables, regular stockings will improve cleanliness, reduce infections and improve the health of CCs attendees.

Authors' Contributions: AOE, KOJ, OTT, and ARO conceived the study, while AOE, KOJ and ARO designed the study. OTT and ARO did the literature review. AOE, OTT and ARO did the data analysis, while AOE and KOJ did the data interpretation. All the authors drafted the manuscript, revised the manuscript for sound intellectual content and approved the final version of the manuscript.

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