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Caregiver characteristics in childhood burns: A prospective analytical cross sectional study

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Abstract
Introduction: Unintentional childhood burns are prevalent in sub-Saharan Africa. We sought to determine the characteristics of the caregivers involved in the setting of these injuries.
Methods: A prospective analytic cross-sectional study of the characteristics of caregivers and households of children with burns presenting to our department from January 2019 to January 2020. Primary outcome was caregiver at time of burn injury. Secondary outcomes were the nature of burn, severity of burn and the time to presentation. Chi square and Fisher's exact test were used for analysis as appropriate. Multivariate analyses of the factors predictive of the outcome variable were performed. Significant values were set at $p<0.05$.
Results: Sixty children were seen within the study period. The caregivers at the time of the injury were predominantly the mothers [N=39 (65%)]. School age children, caregivers other than mothers and burns in the bedroom were significant predictors of occurrence of flame burns (P=0.02,0.02 and 0.04 respectively). The severity of the burns bore no significant relationship with the caregiver characteristics. Children who were looked after by their mothers had a higher prevalence of reporting to the clinic on the day of burn than other relatives (49% vs 19%). The occurrence of burns at night was a significant predictor of delay in presentation (p=0.01).
Conclusion: Mothers were the predominant caregivers. Children not under the care of their mothers were more likely to sustain flame injuries. Burns that occurred at night resulted in a delay in presentation.

Keywords- *Caregivers, Child, Burns, health behaviour*

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Introduction

Unintentional injuries in children are prevalent in sub Saharan Africa and is of public health concern [1]. Although children, by reason of their mental and physical characteristics are vulnerable to accidents,

these accidents and unintentional injuries are preventable if they are under the care of a responsible adult [2]. Supervision has been defined as behaviors relating to attention and proximity and continuity [3]. Child supervision is crucial to preventing harm therefore burn injury in children suggests either lack of supervision or inappropriate supervision. A study from southeastern Nigeria reported that 88.7% of burns in children occurred while in the presence of a competent adult [4]. This calls to question the competency of the caregiver in child supervision. Either lack of adequate supervision by the caregiver or a lack of understanding of risky environments may have been responsible. Burn occurring in children has been considered a form of negligence by the care giver [5].

There appears to be an overlap between definitions of negligence and abandonment. In relation to burn injuries negligence could mean the absence of protection against an injurious situation while abandonment which could be partial is a type of abuse in which the caregiver is absent and exposes the child to a risky situation [6]. These two terminologies in the occurrence of childhood burns need further exploration. Understanding the interplay of caregiver characteristics in childhood burns will guide further qualitative studies and prevention strategies. Bearing in mind that the occurrence of childhood burns are really the responsibility of the caregiver, we sought to determine the characteristics of the caregivers at the time of the burn injury in children.

Methods

Study design and setting

We performed an analytical cross sectional study of the characteristics of caregivers of children with burns presenting to our service from January 2019 to January 2020. Data were collected prospectively with the aid of a study questionnaire which was investigator administered. Caregivers of children presenting with burn injuries were the study participants. All participants gave consent to participate in the study and the study adhered to the Helsinki declaration. This study was performed in the department of Plastic, Reconstructive and Aesthetic surgery of a government owned tertiary institution in south western Nigeria.

Variables

Outcome variables were the nature of burn, severity of burn and the time to presentation.

The severity of the burn was classified according to the American Burn Association classification of Total Burn Surface Area (TBSA) in the young into minor (<5%TBSA), moderate (5-10% TBSA) and major (>10% TBSA) [7]. Time to presentation was categorized into presentation on day of burn and not on the day of burn. Patients who did not present on the day of burn were termed to have delay in presentation

Bias

In situations where the child presented with a parent who was not the caregiver at the time of the injury, reported accounts on the incident were obtained which may have introduced some bias to the reporting of the actual circumstances surrounding the burn incident.

Statistical analysis

Relationships between these outcome variables and the child and caregiver characteristics were sought with Chi square and Fisher's exact test as appropriate. Multivariate regression analyses of the factors predictive of the outcome variable were performed. We did not input the severity of the burn into the regression analysis because no significant values were obtained on the Chi square analysis. Significant values were set at $p<0.05$.

Results

Child, caregiver and injury characteristics

Sixty children were seen within the study period. There was a male predominance (N=35 (58.3%). The mean age of the children was 3.68 ± 3.50years and the mean total body surface area (TBSA) burned was 10.79±8.30%. The majority [N=42 (70.0%)] of the injuries was due to scald and occurred in the kitchen ($p<0.01$). The mean age of the caregivers was 35.93±12.14 years. The caregivers at the time of the injury were predominantly the mothers of the burned child [N=39 (65%)]. Other characteristics of the caregivers are seen in table 2.

Nature and Severity of burn

There was a predominance of scald injuries 42 (70.0%), table 1. The age of the child was significantly (Fisher's $p < 0.001$), associated with the nature of burns. School age children had predominantly flame injuries while infants, toddlers and preschool children had predominantly scald injuries, table 1. A higher proportion of flame injuries were seen when the caregiver was not the mother of the child compared to when the caregiver was the mother, ($p = 0.030$). The predominant location for the scald injuries was the kitchen while the

Table 1: Demographic characteristics of the child, caregiver, burn injury and location

Variable	Frequency N (%) (N= 60)	Variable	Frequency N (%) (N= 60)
Age		Caregiver	
Neonates	1(1.7	Mother	39(65.0)
Infants	21 (35.0)	Not mother	21(35.0)
Toddler	11 (18.3)	Caregiver's highest Level of Education	
Pre-school	15(25)	Primary	10(16.7)
School age	12(20)	Secondary	20(33.3)
Child's gender		Tertiary	24(40.0)
Male	35(58.3)	Not stated	6(10.0)
Female	25(41.7)	Caregiver responsible for other children	
Child started school		Yes	28(46.7)
Yes	40(66.7)	No	24(40.0)
No	20(33.3)	Not stated	8(13.3)
Time of incidence		Mother's Status	
Morning	18(30.0)	Working	41(68.3)
Afternoon	17(28.3)	Housewife	17(28.3)
Night	25(41.7)	Not stated	2(3.3)
Location of burn		Where about of caregivers	
Kitchen	30(50.0)	Incident site	22(36.7)
Sitting room	5(8.3)	Not at incident site	35(58.3)
Bathroom	4(6.7)	Not stated	3(5.0)
Outside	14(23.3)	Age of caregivers [Mean: 35.9]	
Bedroom	7(11.7)	Below 25 years	6(10.0)
Nature of burn		25 – 34 years	21(35.0)
Scald	42(70.0)	35 – 44 years	20(33.3)
Flame	15(25.0)	45 years or more	8(13.3)
Electric	1(1.7)	Not stated	5(8.3)
Contact	2(3.3)		
Severity of Burn			
Minor	17(28.3)		
Moderate	15(25.0)		
major	28(46.7)		
Days of interval before clinic visit			
Day of burn	23(38.3)		
Not day of burn	37(61.7)		

predominant location for the flame injuries was outside. The location of burn incidence was significantly associated with the nature of burns (p = 0.002). Other child, caregiver and site characteristics were not significantly associated with the nature of the burn injury, table 3. Although major burns were predominant across most of the variables, none of the child and caregiver characteristics were significantly associated with the severity of the burn injury. Noticeable patterns on the Chi Square analysis showed major buns were seen more following flame burns, in mothers who were housewives and in younger caregivers. Table 4.

Time of presentation

Being taken care of by mothers (p = 0.024) and time of incidence (p = 0.045) were significantly associated with presentation to the hospital on the day of burn injury, table 4. Children looked after by their mothers had higher prevalence of reporting to the hospital on the day of burn than those taken care of by relatives, 49% and 19% respectively. The prevalence of reporting to clinic on day of burn was found to

Table 2: Bivariate analysis of child, caregiver and site characteristics with nature of burn

	Nature of burn Scald	Flame	X^2	*p*
Age Group				
Infants	19 (90.5%)	2 (9.5%)		
Toddler	10 (100.0%)	0	22.04	< 0.001[Fi]
Pre-school	10 (76.9%)	3 (23.1%)		
School age	3 (25.0%)	9 (75.0%)		
Child's Gender				
Male	26 (74.3%)	9 (25.7%)	0.02	0.897
Female	16 (72.7%)	6 (27.3%)		
Caregiver				
Mother	30 (83.3%)	6 (16.7%)	4.69	0.030
Not mother	12 (57.1%)	9 (42.9%)		
Highest education of caregiver				
Primary	5 (62.5%)	3 (37.5%)	1.05	0.557[Fi]
Secondary	16 (80.0%)	4 (20.0%)		
Tertiary	18 (78.3%)	5 (21.7%)		
Mothers' employment				
Employed	28 (70.0%)	12 (30.0%)	1.59	0.206[Fi]
Housewife	13 (86.7%)	2 (13.3%)		
Caregivers responsible for other children				
Yes	19 (76.0%)	6 (24.0%)	0.01	1.00[Fi]
No	18 (75.0%)	6 (25.0%)		
Time of incidence				
Morning	15 (83.3%)	3 (16.7%)	1.29	0.562[Fi]
Afternoon	12 (70.6%)	5 (29.4%)		
Night	15 (68.2%)	7 (31.8%)		
Location of burn incidence				
Kitchen	26 (92.9%)	2 (7.1%)		
Sitting room	4 (80.0%)	1 (20.0%)	14.50	0.002[Fi]
Bathroom	3 (75.0%)	1 (25.0%)		
Outside	7 (50.0%)	7 (50.0%)		
Bedroom	2 (33.3%)	4 (66.7%)		
Whereabout of caregiver				
Incident site	18 (81.8%)	4 (18.2%)	1.70	0.230[Fi]
Not at incident site	21 (65.6%)	11 (34.4 %)		
Age of caregiver [Mean 35.9]				
Below 25 years	5 (83.3%)	1 (16.7%)		
25-34 years	16 (84.2%)	3(15.8)	3.89	0.301[Fi]
35-44 years	13 (68.4%)	6 (31.6%)		
45 years and above	4 (50.0%)	4 (50.0%)		

increase with increasing level of education of the caregivers; 42% among caregivers with tertiary education, 40% among caregivers with secondary education, and 20% among caregivers with primary education. The proportion of caregivers that reported to the hospital on day of burn was higher for housewives than working mothers; 41% and 37% respectively.

Younger caregivers were observed to have a higher prevalence of reporting burn cases on day of incidence, than older caregivers; 50% from group of caregivers not older than 24 years, 43% from group of caregivers aged 25 – 34 years, 35% among caregivers aged 35 – 44 years, and 25% from category of caregivers aged 45 years or more, table 4.

Day of presentation

Burns occurring at night was a significant predictor of delay in presentation to the hospital.

Patients taken care of by persons other than the mother were less likely to present to the hospital on day of incidence, than those who were under their mother's care (OR = 0.25). Burn cases occurring at

Table 3: Chi square analysis of the child caregiver and site characteristics with the severity of the burns

	Burn Severity			X^2	*p*
	Minor	Moderate	Major		
Age Group					
Infants	7 (33.3%)	5 (23.8%)	9 (42.9%)	4.42	0.638[Fi]
Toddler	3 (27.3%)	4 (36.4%)	4 (36.4%)		
Pre-school	3 (20.0%)	2 (13.3%)	10 (66.7%)		
School age	4 (33.3%)	4 (33.3%)	4 (33.3%)		
Child's Gender					
Male	10 (28.6%)	7 (20.0%)	18 (51.4%)	1.25	0.535
Female	7 (28.0%)	8 (32.0%)	10 (40.0%)		
Caregiver					
Mother	10 (25.6%)	10 (25.6%)	19 (48.7%)	0.40	0.817
Not mother	7 (33.3%)	5 (23.8%)	9 (42.9%)		
Highest education of caregiver					
Primary	9 (37.5%)	5 (20.8%)	10 (41.7%)	3.27	0.521[Fi]
Secondary	6 (30.0%)	4 (20.0%)	10 (50.0%)		
Tertiary	1 (10.0%)	4 (40.0%)	5 (50.0%)		
Mothers' employment					
Employed	12 (29.3%)	12 (29.3%)	17 (41.4%)	1.44	0.500[Fi]
Housewife	4 (23.5%)	3 (17.6%)	10 (58.8%)		
Caregivers responsible for other children					
Yes	7 (25.0%)	8 (28.6%)	13 (46.4%)	0.62	0.733
No	8 (33.3%)	5 (20.8%)	11 (45.8%)		
Time of incidence					
Morning	5 (27.8%)	2 (11.1%)	11 (61.1%)	7.21	0.124[Fi]
Afternoon	2 (11.8%)	6 (35.3%)	9 (52.9%)		
Night	10 (40.0%)	7 (28.0%)	8 (32.0%)		
Location of burn					
Kitchen	7 (23.3%)	9 (30.0%)	14 (46.7%)	9.07	0.289[Fi]
Sitting room	4 (80.0%)	-	1 (20.0%)		
Bathroom	2 (50.0%)	-	2 (50.0%)		
Outside	2 (14.3%)	5 (35.7%)	7 (50.0%)		
Bedroom	2 (28.6%)	1 (14.3)	4 (57.1%)		
Where about of caregivers					
Incident site	6 (27.3%)	5 (22.7%)	11 (50.0%)	0.13	0.937
Not at incident site	11 (31.4%)	8 (22.9%)	16 (45.7%)		
Age of caregivers					
Below 25 years	2 (33.3%)	2 (33.3%)	2 (33.3%)	6.26	0.387[Fi]
25 – 34 years	4 (19.0%)	4 (19.0%)	13 (61.9%)		
35 – 44 years	8 (40.0%)	4 (20.0%)	8 (40.0%)		
45 years or more	1 (12.5%)	4 (50.0%)	3 (37.5%)		
Nature of burn					
Flame	3 (20.0%)	3 (20.0%)	9 (60.0%)	0.89	0.734[Fi]
Scald	12 (28.6%)	11 (26.2%)	19 (45.2%)		

afternoon and night periods were less likely to have been reported to the clinic on the day of incidence (OR = 0.43 & 0.10, for afternoon and night respectively), when compared to incidence occurring in the morning. Caregivers not at the incident site were less likely, than those who were present, to present on day of incidence (OR = 0.48).

Nature of burn

School aged children, caregivers who were not the mothers and burns occurring outside were significant predictors of the occurrence of flame injuries.

Pre-school aged patients were almost seven times more likely than the neonates/infants/toddlers to have suffered a flame burn (OR = 6.55); school aged

Table 4: Bivariate analysis of child, caregiver and site characteristics with day of presentation

	Day of presentation		X^2	*p*
	Day of burn	Not day of burn		
Age Group				
Infants	13 (61.9%)	8 (38.1%)	7.83	0.057[Fi]
Toddler	2 (18.2%)	9 (81.8%)		
Pre-school	5 (33.3%)	10 (66.7%)		
School age	3 (25.0%)	9 (75.0%)		
Child's Gender				
Male	15 (42.9%)	20 (57.1%)	0.73	0.394
Female	8 (32.0%)	17 (68.0%)		
Caregiver				
Mother	19 (48.7%)	20 (51.3%)	5.08	0.024
Not mother	4 (19.0%)	17 (81.0%)		
Highest education of caregiver				
Primary	2 (20.0%)	8 (80.0%)	1.54	0.501[Fi]
Secondary	8 (40.0%)	12 (60.0%)		
Tertiary	10 (41.7%)	14 (58.3%)		
Mothers' employment				
Employment	15 (36.6%)	26 (63.4%)	0.11	0.743
Housewife	7 (41.2%)	10 (58.8%)		
Caregivers responsible for other children				
Yes	10 (35.7%)	18 (64.3%)	0.02	0.894
No	9 (37.5%)	15 (62.5%)		
Time of incidence				
Morning	11 (61.1%)	7 (38.9%)	6.19	0.045
Afternoon	6 (35.3%)	11 (64.7%)		
Night	6 (24.0%)	19 (76.0%)		
Location of burn				
Kitchen	13 (43.3%)	17 (56.7%)		
Sitting room	4 (80.0%)	1 (20.0%)		
Bathroom	1 (25.0%)	3 (75.0%)	6.27	0.201[Fi]
Outside	3 (21.4%)	11 (78.6%)		
Bedroom	2 (28.6%)	5 (71.4%)		
Whereabout of caregiver				
Incident site	11 (50.0%)	11 (50.0%)	1.97	0.161
Not at incident site	11(31.4%)	24(68.6%)		
Age of caregiver [Mean: 35.9]				
Below 25 years	3 (50.0%)	3 (50.0%)		
25-34 years	9 (42.9%)	12 (57.1%)	1.22	0.801
35-44 years	7 (35.0%)	13 (65.0%)		
45 years and above	2 (25.0%)	5 ((75.0%)		

patients exceedingly more likely to have suffered a flame burn than the neonates/infants/toddlers (OR = 289.76). Children of working mothers were less likely than those whose mothers were housewives to have suffered flame burns (OR = 0.04).

Burns occurring in the bathroom (OR = 3.82), outside the house (OR = 17.95) and in the bedroom (OR = 131.37) were more likely to have been flame burn than those suffered from the kitchen. Children whose caregivers were not at incidence site were more likely to have suffered a flame burn than those who had their caregivers at incident site (OR = 1.14).

Discussion

We set out to identify relationships between burn injury in children and characteristics of the caregiver and household at the time of the injury. We found that mothers were the predominant caregiver at the time of the incidence and the kitchen was the predominant location of burn injuries. We were able to identify other patterns in caregiver characteristics

which were related to the predetermined outcome variables of burn injuries in these children.

Very similar to another study in West Africa that found that burn injuries in children occurred predominantly in the kitchen (51%) and house yard (36%)[8]. Most of the injuries in our study occurred in the kitchen (50.0%) and in the compound (23.3%). Forjouh et al reported that maternal education had a small protective effect on the risk of childhood burns [9]. A similar finding was also seen in the Delgado report which was a population-based study [10]. Vendrusculo et al also identified the occurrence of burns in children to be higher in mothers with low level of education [6]. While these studies suggest that the ability to discern potentially risky environments for the occurrence of burn in children is related to the level of education, the findings in this study did not corroborate this. We found a predominance of childhood burns with caregivers of higher educational status. We therefore support Tse et al's position that burn education should be given to all irrespective of educational status [11].

Nature of burn

It is well established, as also seen in this study, that scald injuries are commoner in children under five years of age while flame injuries are commoner in older children [1,4,8,10,12]. Scald is usually sustained during times of cooking and eating making them to occur more frequently in the kitchen [1,2,6,13]. These findings were also seen in this study. The high occurrence of scald in the kitchen, achieving significant values as seen in this study, suggests that there is a need to regulate the entry of this vulnerable group into the kitchen. Tse *et al* however found 68% of the scald injuries in their paediatric population were sustained in the living room [11]. This was adduced to the structural design of the houses in their setting. Fukunishi reported the majority of scald occurred in the bathroom in their study [14]. Scald occurring more in the bathroom are seen more in high income countries. Less well reported are the caregivers associated with the nature of burns in children. Most studies on care givers in burns focus on the competency of the adult, underaged or elderly as caregivers. The exact relationships between the caregiver and the burned child as explored in this study are not usually examined. Delgado reported that the mother was present at the time of the burn injury in over 50% of the cases and the father in 22% [10]. Other studies have reported that burns in the children occurred in the presence of a competent adult in over 80% of cases [4,13]. Further description of these adults was not given. We found in this study that flame injuries were more likely to occur in children if the caregiver was not the mother. Another study finding, similar to ours, also found that flame injuries in children occurred more when the parents were not present [10].

Severity of burns

The care of children requires undivided attention, more so in children who are under five years of age because they are naive and more exploratory in their behavior, therefore more likely to get into potentially injurious circumstances. The finding in our study of the majority of the children sustaining major injuries is a cause for concern particularly as these children require hospitalization, the morbidity is increased, and the scar burden the child would have to live with is higher. Considering that these major burns are sustained irrespective of who the caregiver is or the age of the caregiver, is a cause for further concern. A high number of children under the supervision of a caregiver has been identified as a risk factor for unintentional childhood injury [2]. Although there was a slightly higher occurrence of childhood burns amongst caregivers who had other children in their custody, the severity of the burn injury between the groups was similar. Grieshaber *et al* [15] noted that though children are under the supervision of a caregiver many child hood injuries occur with the caregiver not at the incident site. In 58.3% of cases in this study the caregiver was not at the incident site.

A study from Turkey [16] reported that though 66% of the parents were near the child at the time of the injury most were distracted with other activities such as doing household chores, eating and watching television. Another study from Brazil also found that the caregiver was either absent or not paying attention to the child at the time of the incidence [6]. It still needs to be determined to what extent these patterns of behaviours of the caregivers could be regarded as negligence. Demanding working conditions is reported to limit the ability of a caregiver to supervise a child [2]. Most of the mothers in our study were employed. The employment status of the mothers in our study was not associated with the occurrence or severity of burns. Delgado *et al* [10] identified that the risk of burn injury was higher amongst children who were not directly related to the head of the home. Also, children in high income countries but born to foreign parents were more vulnerable to sustaining burns in a report from Ireland [17]. These findings suggest the closer a child is to the caregiver, the stronger the bond and need to protect the child, reducing the

occurrence and severity of the burn injury. This analogy needs further exploration because our study showed that burn injury and its severity were similar between those caregivers who were the mothers and those who weren't.

Time to presentation

Early presentation for burn care bears a direct relationship with favourable outcomes [1,2, 18]. Factors influencing the time to presentation of burn injury could be distance to burn location and availability of transportation, perception of the severity of the injury and socioeconomic factors particularly in low- and middle-income countries where out of pocket payment for burn care is common. A study from southern Nigeria [19] reported that only a third of the children presented within 24 hours of the burn injury. Their setting being a tertiary centre like ours may however not have been the first place of presentation for care. We found the delay in presentation was more with mothers who were employed than mothers who were not working. We also identified that burns occurring in the night were significantly associated with delay in presentation. Lack of access to care at night may have been contributory to the delay in presentation on the day of the burn injury. In the United States of America telemedicine has provided a means of improving access to care for burn injuries [20]. The results of the study showed improved healing times and adherence to the recommended therapy. Other caregiver characteristics associated with early presentation for burn care seen in this study were; caregiver being the mother, higher educational status of the caregiver and younger age. These factors have not previously been identified in relation to time of presentation for burn care in children.

Limitations of the study

We did not identify the impact of socioeconomic status on our outcome variables. Low socioeconomic status has been identified as a barrier to health seeking behaviours of caregivers. Additionally, the number of hours post burn to presentation would impact more on the morbidity or mortality of the burn patient. This study did not look at the time to presentation in hours. It however still revealed that nighttime burns were a concern as delay in presentation was more likely.

Conclusion

The majority of the caregivers in our study were the mothers of the children and unfortunately irrespective of this, most of the children sustained major burns. The occurrence of the burn was not related to the educational status of the caregiver. Flame burns occurred more with caregivers who were not the mothers of the children. Night time burns were associated with a delay in presentation.

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