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Incidence, Characteristics and Risk Factors for Household and Neighborhood Injury among Young Children in Semi-Urban Ghana: A Population-Based Household Survey

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Abstract

Background—There are few population-based studies on household child injury in African countries.

Objectives—To determine the incidence, characteristics and risk factors of household and neighborhood injury among children in semi-urban communities in Kumasi, Ghana.

Methods—We conducted a cross-sectional population-weighted survey of 200 randomly selected caregivers of children under-18, representing 6801 households. Caregivers were interviewed about moderate to severe childhood injuries occurring within the past 6 months, for which the child staying home from school or activity, and/or required medical care. Multivariable logistic regression was used to identify factors associated with injury risk.

Results—Annual injury incidence was 593.5 injuries per 1000 children. Common causes of injury were falls (315.7 injuries per 1000 children), followed by cuts/lacerations and burns. Most injuries (93.8%) were of moderate severity. Children whose caregivers were hourly workers (AOR=1.97;95% CI:1.06,3.68) had increased odds of sustaining an injury compared to those of unemployed caregivers. Girls had decreased odds of injury (AOR=0.59;95% CI:0.39,0.91). Cooking outdoors (AOR=0.45;95% CI:0.27,0.76) and presence of cabinet/cupboards (AOR=0.41;95% CI:0.24,0.70) in the house were protective. Among children under 5 years of

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age, living in uncompleted accommodation was associated with higher odds of injury compared to living in a rented single room (AOR=3.67;95% CI 1.17,11.48).

Conclusions—The incidence of household and neighborhood child injury is high in semi-urban Kumasi. We identified several novel injury risk factors (hourly work, younger children) and protective factors (cooking outdoors, presence of cabinet/cupboards). These data may identify priorities for household injury prevention.

Keywords

incidence; household child injury; semi-urban; Kumasi

INTRODUCTION

Injury is a major cause of death and disability worldwide,^{1, 2} and the burden of injury falls heavily on children. Globally, injuries account for 13.5% of deaths among children aged 1–4 years.^{1, 3} The burden of child injury disproportionately affects poor families living in low- and middle-income countries (LMIC).⁴ In addition to those who die each year, millions more may develop disabilities exacting a profound toll on the individual, family, and society.⁵

Most injury deaths among younger children occur in or around the home.^{6–8} To continue to make progress in global commitments to the Millennium Development Goal 4, progress must be made in the identification and control of injury hazards in the child's home environment.

The global burden of under-five deaths is increasingly concentrated in Sub-Saharan Africa (SSA).⁹ While there is recognition that effective injury prevention strategies are needed to reduce global morbidity and mortality for children, there are very few developing countries with population-based surveillance data on child injury, and even fewer studies that report on household child injury (HCI) in African countries.^{10–13} In Ghana, the burden of household injuries in children is not well described even though it is likely to be as high as in other developing countries.

The purpose of this population-based household study was to determine child injury incidence, describe causes of child injury, and characterize potentially modifiable factors associated with HCI risk in semi-urban communities in Ghana.

METHODS

Survey design

We designed a cross-sectional population-based study of household risk factors and injury incidence among Ghanaian children in semi-urban communities in Kumasi.

Study Area

The study was conducted in the Asawase sub-metropolis of Kumasi, Ghana. Asawase is the Ghana site for the Family Health and Wealth Study (FWHS) within which our study was

nested. The FHWS is a multi-country longitudinal open cohort study, operating across five African countries, that aims to examine how family size affects health and wealth. Asawase, a semi-urban setting with characteristics typical of such settings in developing countries – limited social amenities, poor housing, densely populated and occupied mainly by people of lower socio-economic status.

Most families in Asawase live in compound houses. Compound houses are large houses with rooms rented out to different families all of whom usually share the same basic utilities such as toilets and bathrooms. Very few multi-storey compound houses exist in Asawase.

Many households do not have properly constructed kitchens. In some compound houses there is a separate structure used by all families for cooking. Some cook outside their homes in the open and others do their cooking indoors or on an adjoining porch that has been enclosed and partially walled-off from sleeping areas.

For the purposes of the FHWS, Asawase was divided into four communities, and 40 electoral areas were randomly selected using population proportional to size sampling. Twenty families/households per electoral area were randomly selected from a sampling frame of households constructed for each of the 40 electoral areas. The households recruited for the injury study were randomly selected from the FHWS sampling frame. Asawase has a total population of 312,258.¹⁴

Study Population

Using the prevalence of injury of 12.6% reported by Atak et al.¹⁵, a 95% confidence interval and a margin of error of 10%, a sample size of 170 was calculated. We chose 200 to allow for incomplete entries.

For the parent study, 200 households containing children under-18 were randomly sampled from each of four communities (Figure 1). We designed an injury-specific survey module that was administered to 50 households randomly sampled from each community.

Survey Methods

Parents/caregivers were interviewed about the occurrence of childhood injury within the past 6 months and injury severity. Mock et al.¹⁶ proposed a 1–3 month recall period for surveys of less severe injuries in developing countries whereas for more severe or fatal injuries, they proposed a one-year recall period. For this study, a recall period of six months was used as a compromise to capture injuries of all levels of severity. We used the injury severity classification proposed by the UNICEF Innocenti Research Centre.³ Potentially modifiable risk factors measured were generated from the 2008 Ghana Demographic and Health Survey household questionnaire.¹⁷ Our questionnaire was based in part on a prior injury questionnaire¹⁶, that had been used extensively in Ghana, and for which the wording of questions had been well-worked out for the local culture and for which consistency on repeat visits was found to be acceptable.^{18–20} Questions were updated, modified, and expanded for the current study. Figure 2 describes the theoretical model used to derive the survey questionnaire on household injury. We pretested the current study instrument at Krofofrom in Kumasi; Krofofrom has characteristics similar to that of the study area.

Pretesting showed that the study tool was acceptable and easily understood. Enumerators collected demographic and household characteristics on ownership of consumable goods and physical characteristics of the household, that were used to construct a wealth index using principal component analysis (PCA). Scores generated by the PCA were divided into quintiles, the first quintile representing the poorest households of the distribution. Oral informed consent was obtained from all respondents. The study was approved by the Institutional Review Boards of the Kwame Nkrumah University of Science and Technology and the University of Washington.

Data Analysis

Analyses utilized survey-sampling weights, adjusted for clustering by community and household.

Total household size for each of the four communities was estimated from the Ghana 2010 Housing and Population Census data prior to the start of the larger study. Household level weights (W_{Hi}) and household with child weights (W_{HCi}) were estimated for each community. The overall weight (W_{TOTi}) was obtained by multiplying W_{Hi} and W_{HCi} . Stratified variables were compared using chi-square test. Since the survey recall period was 6 months, annualized incidence rates were calculated by multiplying injury incidence by 2. All analyses were done using survey weights in STATA 11 (StataCorp, College Station, TX).

The primary outcome variable was presence or absence of any injury, defined as an injury sustained by a child under-18, occurring within 200m of the house, that prevented the child from going to school or work or for which treatment was sought. We considered 200m as the furthest distance that most children under five would get away from the house.

Multiple injuries sustained by a child were counted once for each mechanism of injury and separately for different mechanisms. For regression analysis, we considered whether the child had sustained any injury at all. We performed univariate logistic regression to assess the relationship between risk factors and injury occurrence using Wald's test. Multivariate logistic regression models incorporated variables that were independently significant in the univariate analysis (p -value ≤ 0.05) as well as variables that were felt to be important or confounding (e.g. age and sex of the child, caregiver level of education). The non-significant but important characteristics were controlled for in the backward regression model whose results are reported here. The fitted model was assessed using Hosmer and Lemeshow's goodness-of-fit test ($p \geq 0.10$). We utilized generalized linear mixed models to account for clustering by household and community.

Secondary multivariate regression models were performed for the subset of children under-five.

RESULTS

Table 1 summarizes the characteristics of the caregivers and households. We sampled 200 households with children under-18, representing a total 6801 households across the four

communities. Majority (85.2%) of the caregivers were biological mothers of the children. The mean age of the respondents was 33.8 ± 7.0 years. Basic education (66.4%) was the highest level most respondents attained and hourly work (68.4%) was the main occupation. A high proportion of the caregivers lived in a rented single room with their families while 21.8% lived in a rented flat. The main fuel used for cooking was charcoal and cooking was mostly done in the house.

We considered cooking surfaces within one meter from the floor as accessible to a child under-five; in 69.7% of the households, the height of the stove or cooking surface was within reach of a child while 78.8% of the households had cabinets or cupboards for safe keeping of chemicals.

There were 637 children under 18 years in the sample, representing a total of 20575 children in Asawase (Table 2). Fifty-two percent were females and 37.2% were within 1–4 years of age. The overall household injury rate among children was 29.7% in the past six months. Almost all the injuries (93.8%) were of moderate severity. There were no deaths.

The most common mechanism of injury was falls (53.2%) followed by cuts/lacerations (20.1%). Burns, assault and falling objects, as mechanisms, occurred with a proportion of 5.3%, 4.6% and 2.8% respectively.

The annual incidence of injury among children was estimated as *593.5 injuries/1000 children/year*. Falls contributed significantly to the annual burden of injury with an estimated incidence of *315.7 injuries/1000 children/year*. Corresponding incidence for cuts/lacerations and burns were *119.2* and *31.2 injuries/1000 children/year* respectively. Males experienced a higher incidence (*686.7 injuries/1000 children/year*), compared to females (*505.8 injuries/1000 children/year*). The injury incidence rate included multiple injuries, suffered by 5.1% of the children (Tables 3 and 4).

The multivariate logistic regression model (Table 5) showed that children of caregivers who were hourly workers had 97% increased odds of injury compared with those of unemployed caregivers. A year's increase in caregiver's age was associated with a 5% decreased odds of injury to the child. The sex and age of the child were found to be associated with child injury: compared with infants, children 1–4 years and 5–9 years had *4.6 times* and *3.1 times* increased odds of injury respectively. Female children had 41% decreased odds of injury compared with males. Moreover cooking outdoors and presence of cabinet/cupboards in the house had a protective effect of 55% and 59% respectively.

Table 6 shows a sub-group analysis among children under-five. As the children grew older, they were at increased odds of sustaining an injury. Children of age 1–2 years ($AOR=3.92; 95\% CI: 1.30, 11.79$) and those three years or older ($AOR=6.37; 95\% CI: 1.80, 22.56$) were at increased odds of injury compared with infants. Children whose caregivers were employed (hourly work) had *three times* increased odds of injury compared with those of unemployed caregivers.

Compared with children who lived in a rented single room, children who lived in uncompleted accommodation had *3.7 times* increased odds of injury. Compared with those

living in households where cooking was done indoors, children who lived in a household where cooking was done outdoors had 60% decreased odds of injury.

DISCUSSION

This study attempts to describe the burden of household injury among children under-18 in semi-urban communities of the Kumasi metropolis, Ghana. It also tries to characterize potentially modifiable factors associated with HCI risk.

The annual incidence of household injury among children in semi-urban Kumasi was estimated at 593.5 injuries/1000 children/year. Falls, cut/lacerations and burns accounted for almost 80% of HCI. The sex and age of the child, the primary caregiver's type of job, where cooking was done in the household and the availability of a cabinet in the house were found to significantly influence the odds of injury.

The study has some limitations. Firstly, there was no way to independently validate the accuracy of information reported by caregivers. A recall period of six months was also used as a compromise to capture injuries of all levels of severity. This might introduce a recall bias into our findings with under-estimates of incidence rates reported. A prior study in the same area estimated that using a 6-month recall period in comparison to a one-month recall period results in a 75% decrease in reporting of minor injuries, 40% reduction in reporting of moderate injuries, but no change in reporting of major injuries.¹⁶ Secondly, participants may have provided socially desirable responses. This may explain why no information was recorded relating to injuries that lead to permanent disability or death to a child. Thirdly, only information on injuries that occurred within 200 meters of the house was recorded. Hence motor vehicular and pedestrian injuries that occurred further away from the house were not reported. This may have led to the lower rates of injury reported among older children, who are more likely to be injured further from home. Fourthly, the study was cross-sectional. Hence although we detected associations between injury occurrence and some risk factors, we cannot draw conclusions about causality.

Our estimate of HCI burden is about ten times the 52.6 injuries/1000 children/year reported from the United States.²¹ The consequences of injuries to children (immediate effects of hospitalization; disability on children; economic costs to patients, relatives and to society) are well known.^{5, 22} We did not ask about the earnings/wages of caregivers in this study. It would thus be difficult to provide a fair estimate of the economic cost of child injury to the working parent in our study population. Fortunately, the overwhelming majority of HCI encountered in semi-urban Kumasi were of moderate severity.

From our study, boys experienced a higher incidence of injury per year compared with girls. Culturally, boys are given relatively greater freedom to explore their environment.^{23, 24} Studies show that with few exceptions, boys are more likely to sustain injury from all causes.^{25, 26}

As in previous reports,^{5, 15, 27} falls were the most common mechanisms of HCI, accounting for more than half of all injuries. Poor safety measures in and around the home may play a role. Of interest, none of the households surveyed was multi-storied.

Cut/lacerations accounted for 20% of HCI and were more common among girls. The highest rates were among children of age 1–4 and 5–9 years. Lack of adequate supervision may play a role here, as curious children may not sense the danger associated with sharp objects in general and kitchen knives in particular.

Fire-related burns have been reported as the second largest cause of injury-related child death in SSA, and its overall incidence of 8.7/100,000 has been reported as the highest worldwide.⁸ Burns as a mechanism of injury accounted for only 5.3% of HCI in semi-urban Kumasi and significantly no injury-related death was reported.

As predictors of injury, children whose primary caregivers engaged in hourly paying jobs were at increased odds of injury compared to those of unemployed caregivers. Lack of quality supervision of children, involving appropriate attention, proximity, and continuity²⁸, may explain this observation.^{29–32} Those engaged in hourly work are poorly paid and are unlikely to be able to contract the services of professional caregivers or pay for their children to stay in a school environment. Almost 70% of caregivers in semi-urban Kumasi engaged in small scale trading mostly close to their homes. They tend to divide their attention between work or other activities and child supervision or temporarily leave children under the care of older children.

The average caregiver age was 33 years and a year decrease in caregiver age was associated with a 5% increased odds of HCI. Inexperience of the caregiver and poor attitudes towards hazards in and around the house, particularly to younger children, may explain the observation. Younger caregivers are also likely to be engaged in multi-tasks at all times leaving little room for child caregiving.

Children 1–4 years and those 5–9 years were at increased odds of injury compared to infants. A potential explanation is their curiosity to experiment and explore their surroundings coupled with an inability to perceive danger.^{33, 34} The burden of injury is greater among them since they have more years ahead of them to be affected by disability.³³ Ironically injuries in these children receive less attention from policy makers since the focus is more on under-five mortality from infectious diseases, an ongoing serious situation in LMICs.³⁵ Majority (71%) of households in semi-urban Kumasi lived in rented single rooms within compound houses. In half of all households cooking was done on the enclosed adjoining porch. Cooking outdoors reduced the odds of HCI by 55% compared to cooking indoors. We believe cooking outdoors is protective compared to cooking indoors because it allows younger children more room to move about without encountering the cooking area. Future injury prevention work in Ghana should target design of cooking areas. The absence of a cabinet in the home was associated with increased odds of injury. Utilization of rooms for multiple functions, particularly absence of a separate kitchen has been identified as a major risk for HCI.^{36–38}

Most of the injuries were more commonly seen in children under-five. The age of the child, the primary caregiver's type of job, where cooking was done and the availability of a cabinet in the house were all found to significantly influence their odds of HCI. In addition children living in uncompleted accommodation had 3.7 times increased odds of household injury

compared to those living in rented single rooms. In Ghana, due to lack of easily available credit, many buildings are constructed in stages, sometimes over years, as families put aside small amounts of money. Often times, people start living in these as soon as one part of the building is habitable. Similar findings have been reported in other SSA countries with informal settlements comprising of apartment buildings with unprotected windows and precarious wiring or informally constructed shacks with restricted internal space.³⁸ Such settlements expose children to more injury hazards as they have very limited safe recreational spaces.^{30, 39, 40}

CONCLUSION

There is a high incidence of HCI in semi-urban Kumasi that demands urgent action. This is particularly so given children's increasing exposure to risk of injuries, and possibly death, as a result of rapid urbanization. The lack of reliable data, such as presented in our study, may contribute to the little attention paid to this public health issue.

IMPLICATIONS

There is the need to increase awareness about the high incidence of HCI in semi-urban Kumasi. Providing community child-care facilities may relieve caregivers of their supervision role while engaged in economic activities. Ensuring that homeowners provide separate structures to serve as kitchens will likely reduce potential injury hazards that cooking indoors in the absence of a kitchen present to children. Finally, standards must be enforced to reduce the number of uncompleted houses within which some families live.

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REFERENCES

1. Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012; 380(9859):2095–2128. [PubMed: 23245604]
2. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012; 380(9859):2197–2223. [PubMed: 23245608]
3. Linnan, M.; Giersing, M.; Cox, R., et al. *Child Mortality and Injury in Asia: An overview*. Florence: UNICEF Innocenti Research Centre; 2007.
4. Ebel BE, Medina MH, Rahman AK, Appiah NJ, Rivara FP. Child injury around the world: a global research agenda for child injury prevention. *Inj Prev*. 2009; 15(3):212. [PubMed: 19494104]
5. de Sousa Petersburgo D, Keyes CE, Wright DW, Click LA, Macleod JB, Sasser SM. The epidemiology of childhood injury in Maputo, Mozambique. *Int J Emerg Med*. 2010; 3(3):157–163. [PubMed: 21031039]
6. Forjuoh SN, Guyer B, Smith GS. Childhood burns in Ghana: epidemiological characteristics and home-based treatment. *Burns*. 1995; 21(1):24–28. [PubMed: 7718113]

7. Lasi S, Rafique G, Peermohamed H. Childhood injuries in Pakistan: results from two communities. *J Health Popul Nutr.* 2010; 28(4):392–398. [PubMed: 20824983]
8. Peden, M.; Oyegbite, K.; Ozanne-Smith, J., et al. World report on child injury prevention. Geneva: World Health Organization; 2008.
9. You D, Wardlaw T, Salama P, Jones G. Levels and trends in under-5 mortality, 1990–2008. *Lancet.* 2010; 375(9709):100–103. [PubMed: 19748116]
10. Howe LD, Huttly SRA, Abramsky T. Risk factors for injuries in young children in four developing countries: the Young Lives Study. *Tropical Medicine & International Health.* 2006; 11(10):1557–1566. [PubMed: 17002730]
11. Mock C, Peden M, Hyder AA, Butchart A, Krug E. Child injuries and violence: responding to a global challenge. *Bulletin of the World Health Organization.* 2009; 87:326. [PubMed: 19551244]
12. Roman IM, Lewis ER, Kigwangalla HA, Wilson ML. Child burn injury in Dar es Salaam, Tanzania: results from a community survey. *Int J Inj Contr Saf Promot.* 2012; 19(2):135–139. [PubMed: 22054222]
13. Stewart KA, Groen RS, Kamara TB, et al. Traumatic Injuries in Developing Countries: Report From a Nationwide Cross-Sectional Survey of Sierra Leone. *JAMA Surg.* 2013:1–7.
14. Ghana Statistical Service. 2010 Population and Housing Census: Summary report of final results. Accra. 2012
15. Atak N, Karao lu L, Korkmaz Y, Usubütün S. A household survey: unintentional injury frequency and related factors among children under five years in Malatya. *Turk J Pediatr.* 2010; 52:285–293. [PubMed: 20718187]
16. Mock C, Acheampong F, Adjei S, Koepsell T. The effect of recall on estimation of incidence rates for injury in Ghana. *International journal of epidemiology.* 1999; 28:750–744. [PubMed: 10480706]
17. Ghana Statistical Service (GSS) GHSG, ICF Macro. Ghana Demographic and Health Survey. 2008 <http://www.measuredhs.com/pubs/pdf/FR221/FR221%5B13Aug2012%5D.pdf>.
18. Mock CN, Abantanga F, Cummings P, Koepsell TD. Incidence and outcome of injury in Ghana: a community-based survey. *Bull World Health Organ.* 1999; 77(12):955–964. [PubMed: 10680242]
19. Mock CN, Forjuoh SN, Rivara FP. Epidemiology of transport-related injuries in Ghana. Accident; analysis and prevention. 1999; 31(4):359–370.
20. Sethi, D.; Habibula, S.; McGee, K., et al. Guidelines for Conducting Community Surveys on Injuries and Violence. Geneva: WHO; 2004.
21. Phelan KJ, Khoury J, Kalkwarf H, Lanphear B. Residential injuries in U.S. children and adolescents. *Public Health Rep.* 2005; 120(1):63–70. [PubMed: 15736333]
22. Afukaar FK, Antwi P, Ofosu-Amaah S. Pattern of road traffic injuries in Ghana: implications for control. *Inj Control Saf Promot.* 2003; 10(1–2):69–76. [PubMed: 12772488]
23. Peden M. World report on child injury prevention calls for evidence-based interventions. *Int J Inj Contr Saf Promot.* 2009; 16(1):57–58. [PubMed: 19145537]
24. Morrongiello BA, Dawber T. Mothers' responses to sons and daughters engaging in injury-risk behaviors on a playground: implications for sex differences in injury rates. *J Exp Child Psychol.* 2000; 76(2):89–103. [PubMed: 10788304]
25. Ruiz-Casares M. Unintentional childhood injuries in sub-Saharan Africa: an overview of risk and protective factors. *J Health Care Poor Underserved.* 2009; 20(4 Suppl):51–67. [PubMed: 20168033]
26. Balan B, Lingam L. Unintentional injuries among children in resource poor settings: where do the fingers point? *Arch Dis Child.* 2012; 97(1):35–38. [PubMed: 21949014]
27. Fatmi Z, Kazi A, Hadden WC, Bhutta ZA, Razzak JA, Pappas G. Incidence and pattern of unintentional injuries and resulting disability among children under 5 years of age: results of the National Health Survey of Pakistan. *Paediatric and Perinatal Epidemiology.* 2009; 23(3):229–238. [PubMed: 19775384]
28. Saluja G, Brenner R, Morrongiello BA, Haynie D, Rivera M, Cheng TL. The role of supervision in child injury risk: definition, conceptual and measurement issues. *Inj Control Saf Promot.* 2004; 11(1):17–22. [PubMed: 14977501]

29. Forjuoh SN. Burns in low- and middle-income countries: A review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. *Burns*. 2006; 32:526–537. [PubMed: 16621296]
30. Kobusingye O, Guwatudde D, Lett R. Injury patterns in rural and urban Uganda. *Inj Prev*. 2001; 7(1):46–50. [PubMed: 11289535]
31. Petrass LA, Finch CF, Blitvich JD. Methodological approaches used to assess the relationship between parental supervision and child injury risk. *Inj Prev*. 2009; 15(2):132–138. [PubMed: 19346426]
32. Ruiz-Casares M, Heymann J. Children home alone unsupervised: modeling parental decisions and associated factors in Botswana, Mexico, and Vietnam. *Child Abuse Negl*. 2009; 33(5):312–323. [PubMed: 19477517]
33. Bartlett SN. The problem of children's injuries in low-income countries: a review. *Health Policy Plan*. 2002; 17(1):1–13. [PubMed: 11861582]
34. Nath A, Naik VA. Minor injuries among under-fives in a South Indian village. *Indian Pediatr*. 2009; 46(7):621–623. [PubMed: 19430072]
35. Bose A, Konradsen F, John J, Suganthi P, Muliylil J, Abraham S. Mortality rate and years of life lost from unintentional injury and suicide in South India. *Trop Med Int Health*. 2006; 11(10): 1553–1556. [PubMed: 17002729]
36. Forjuoh SN, Guyer B, Strobino DM, Keyl PM, Diener-West M, Smith GS. Risk factors for childhood burns: a case-control study of Ghanaian children. *J Epidemiol Community Health*. 1995; 49(2):189–193. [PubMed: 7798049]
37. Kalayi GD. Mortality from burns in Zaria: an experience in a developing economy. *East Afr Med J*. 2006; 83(8):461–464. [PubMed: 17153661]
38. Van Niekerk A, Seedat M, Menckel E, Laflamme L. Caregiver experiences, contextualizations and understandings of the burn injury to their child. Accounts from low-income settings in South Africa. *Child Care Health Dev*. 2007; 33(3):236–245. [PubMed: 17439435]
39. Munro SA, van Niekerk A, Seedat M. Childhood unintentional injuries: the perceived impact of the environment, lack of supervision and child characteristics. *Child Care Health Dev*. 2006; 32(3):269–279. [PubMed: 16634972]
40. Zwi KJ, Zwi AB, Smettanikov E, Soderlund N, Logan S. Patterns of injury in children and adolescents presenting to a South African township health centre. *Inj Prev*. 1995; 1(1):26–30. [PubMed: 9345989]

Key messages**What is already known on this subject**

- The burden of child injury disproportionately affects poor families in LMICs.
- Little attention has been paid to child injuries in many African countries.

What this study adds

- The estimated annual incidence of HCI in periurban Kumasi was 593.5 injuries/1000 children with falls accounting for more than 50% of HCI.
- The modifiable risk factors of HCI in a LMIC; caregiver employment, cooking place, storage facilities and family residential accommodation.

Figure 1.
Study Design and Sampling Framework

Figure 2.
Conceptual framework

Table 1

Caregiver and Household Characteristics

	Unweighted		Weighted		
	Percent (%)	Frequency (n=200)	Percent	Frequency (n=6520)	95% CI
Caregiver Characteristics					
Mean Caregiver age in Years (SD)	33.9 (7.0)		33.8 (7.0)		
Relationship with child					
Mother	86.0	172	85.2	5554	80.3, 90.1
Father	11.0	22	11.7	763	7.5, 15.9
Other*	3.0	6	3.1	202	0.5, 5.7
Caregiver Education					
None	17.0	34	15.9	1038	10.8, 21.0
Basic	66.0	132	66.4	4333	59.4, 73.5
Senior high	15.5	31	16.0	1040	10.4, 21.5
Tertiary	1.5	3	1.7	109	-0.2, 3.6
Employment Status					
Unemployed	21.5	43	19.9	1294	14.2, 25.5
Hourly worker	66.5	133	68.4	4457	61.7, 75.1
Salaried worker	12.0	24	11.8	769	7.1, 16.5
Number of children under 18 years of age in the household					
1	10.0	20	10.2	668	5.9, 14.6
2	25.0	50	27.0	1759	20.6, 33.4
3	21.5	43	20.9	1360	15.0, 26.7
4	29.0	58	27.2	1771	20.8, 33.5
5	14.5	29	14.8	962	9.6, 19.9
Wealth Index (Quintiles)					
Lowest 1	20.3	40	21.2	1381	15.4, 27.6
2	19.8	39	21.2	1380	15.5, 27.5
3	21.8	43	21.3	1386	15.5, 27.6

	Unweighted		Weighted		95% CI
	Percent (%)	Frequency (n=200)	Percent	Frequency (n=6520)	
4	18.3	36	16.4	1070	11.4, 22.0
Highest 5	19.8	39	18.5	1204	13.2, 24.3
Missing	1.5	3	1.5	98	
Household Structure and Ownership					
Rented Single room	71.5	143	70.9	4619	64.2, 76.7
Rented flat	21.0	42	21.8	1425	16.6, 28.2
Uncompleted accommodation	7.5	15	7.3	476	4.5, 11.8

Number of Sleeping Rooms							
1	67.5	135	66.3	43120	59.2, 72.6		
2	30.5	61	32.2	2099	26.0, 39.1		
3	2.0	4	1.5	101	0.6, 4.2		
Type of Fuel use							
Charcoal	56.5	113	59.2	3856	51.8, 66.1		
Other [#]	43.5	87	40.8	2663	33.9, 48.2		
OTHER HH characteristics (stove, cabinet height)							
Cooking place							
In the house	52.0	104	50.1	3267	44.5, 55.7		
Separate building	15.5	31	15.8	1030	11.2, 21.8		
Outdoor	32.5	65	34.1	2223	28.3, 40.4		
Height of stove or cooking surface^{**}							
Not within reach of the child under 5	37.5	75	30.3	1975	24.8, 36.3		
within reach of the child under 5	62.5	125	69.7	4544	63.7, 75.1		
Cabinet/Cupboards							
No	21.0	42	21.2	1381	16.0, 27.5		
Yes	79.0	158	78.8	5139	72.5, 84.0		

* Other caregivers included: Grandmother, Aunt, Older Sibling and Nanny

** Within 1 meter from the floor.

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Other fuel sources included liquid petroleum gas (42.5%), Kerosene (0.50%), Natural gas/biogas (0.5%)

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Table 2

Child Characteristics

	Unweighted		Weighted	
	Frequency (n=637)	Percent (%)	Frequency (n=20575)	Percent (%)
Age of child (Years)				
<1	40	6.3	1383	6.7
1-4	235	36.9	7645	37.2
5-9	175	27.5	5650	27.5
10-14	119	18.7	3790	18.4
15-18	68	10.7	2107	10.2
Median Child Age (25 th , 75 th percentile)	6(3, 11)			
Sex				
Male	305	47.9	9963	48.4
Female	332	52.1	10612	51.6
Injury Severity*				
Moderate injury	135	94.4	4564	93.8
Major injury	6	4.2	219	4.5
Serious injury	1	0.7	37	0.8
Severe injury	1	0.7	43	0.9
Death	0	0.0	0	0.0

* Injury severity: **Severe injury**-permanent disability; **Serious injury**-10 or more days of hospitalization, **Major injury** - hospitalized for 1-9 days due to injury; **Moderate injury** - missing school or work, seeking care from health practitioner but not being hospitalized.

Table 3

Mechanism of injury, by child age group

Mechanism	Weighted						Incidence Rate/1000 Children/years	Proportion of Injury %
	<1 (n=1383) %*	1-4 (n=7645) %*	5-9 (n=5649) %*	10-14 (n=3791) %*	15-18 (n=2107) %*	Injury frequency within 6 months for all ages (n=20575) %*		
Fall	5.5	22.8	19.7	6.4	3.2	15.8	315.7	53.2
Cut/Laceration	3.6	7.9	7.0	2.9	3.3	6.0	119.2	20.1
Burn	2.7	2.2	2.0	0	0	1.6	31.2	5.3
Injury from falling object	0	2.3	0	0	0	0.8	16.9	2.8
Assault	0	2.4	0.3	1.0	2.0	1.4	27.1	4.6
Animal injury	0	1.8	0	0	0.9	0.7	14.9	2.5
Near-drowning	2.4	1.0	0	0	0	0.5	10.3	1.7
Poisoning	0	1.4	0	0	0	0.5	10.6	1.8
Electric shock	0	1.1	0	0.5	0	0.5	9.8	1.7
Suffocation	0	1.0	0	1.0	0	0.5	10.7	1.8
MVI	0	0	1.0	0	3.3	0.6	12.0	2.0
Others	0	2.0	0	0	0	0.8	15.2	2.6
Total Injuries	14.2	45.8	30.0	11.7	12.7	29.7	593.5	100.0%

* The % shown is percentage of n; MVI: motor vehicular injury

Table 4

Mechanism of injury, by child sex

Mechanism	Weighted				P-value
	Male (n=9963) % *	Incidence rate/1000 children/year	Female (n=10612) % *	Incidence rate/1000 children/year	
Fall	19.8	396.3	12.0	239.9	0.001
Cut/Laceration	5.4	107.4	6.5	130.4	0.42
Burn	1.8	36.5	1.3	26.2	0.72
Injury from falling object	1.0	20.5	0.7	13.6	0.83
Assault	1.7	34.9	1.0	19.8	0.63
Animal injury	0.5	10.0	1.0	19.4	0.75
Near-drowning	0.4	7.4	0.7	13.0	0.84
Poisoning	0.8	15.3	0.3	6.2	0.77
Electric shock	0.3	6.6	0.6	12.8	0.85
Suffocation	0.7	14.7	0.3	7.0	0.80
MVI	0.7	14.5	0.5	9.4	0.89
Others	1.1	22.7	0.4	8.1	0.68
Total	34.3	686.7	25.3	505.8	0.001

* The % shown is percentage of n; MVI: motor vehicular injury

Table 5

Factors associated with household injury risk, children 0 through 18 years of age: Univariate and Multivariate Regression Models *

Variables	Univariate Model			Multivariate Model		
	Crude OR	P-value	(95% CI)	Adjusted OR	P-value	(95% CI)
Caregiver age (Years)	0.94	0.001	0.91, 0.97	0.95	0.05	0.92, 0.99
Relationship with child						
Mother (Ref)	1.00					
Father	0.87	0.65	0.48, 1.59			
Other**	0.96	0.95	0.30, 3.12			
Caregiver Education						
None (Ref)	1.00					
Basic	1.24	0.46	0.70, 2.22			
Senior high	1.37	0.37	0.69, 2.71			
Tertiary	2.16	0.42	0.33, 13.97			
Employment Status						
Unemployed (Ref)	1.00			1.00		
Hourly worker	1.39	0.26	0.78, 2.45	1.97	0.03	1.06, 3.68
Salaried worker	1.38	0.43	0.61, 3.10	1.76	0.16	0.79, 3.94
SES	0.92	0.26	0.78, 1.07			
Age of child (Years)						
<1 (Ref)	1.00			1.00		
1–4	3.91	0.01	1.44, 10.57	4.61	0.01	1.55, 13.76
5–9	2.63	0.06	0.94, 7.32	3.12	0.04	1.05, 9.31
10–14	0.81	0.69	0.29, 2.28	1.05	0.94	0.34, 3.20
15–18	0.94	0.92	0.27, 3.29	0.94	0.94	0.23, 3.94
Sex of child						
Male (Ref)	1.00					
Female	0.61	0.02	0.41, 0.91	0.59	0.02	0.38, 0.91
Cooking place						

Variables	Univariate Model			Multivariate Model		
	Crude OR	P-value	(95% CI)	Adjusted OR	P-value	(95% CI)
In the house (Ref)	1.00			1.00		
Separate building	0.51	0.07	0.25, 1.04	0.58	0.18	0.26, 1.29
Out door	0.54	0.01	0.34, 0.86	0.45	0.003	0.27, 0.76
Number of Sleeping rooms						
1 (Ref)	1.00					
2	1.20	0.40	0.78, 1.84			
3	0.31	0.28	0.04, 2.57			
Accommodation						
Rented single room (Ref)	1.00					
Rented flat	1.25	0.40	0.74, 2.13			
Uncompleted accommodation	1.44	0.28	0.71, 2.91			
Cabinet/Cupboard						
No (Ref)	1.00			1.00		
Yes	0.42	0.001	0.25, 0.69	0.41	0.001	0.24, 0.70

* Variables adjusted for: caregiver age and employment status, age and sex of the child, cooking place of the household, availability of cabinet in household. Age and sex of the child are confounders.

** Other caregivers included: Grandmother, Aunt, Older Sibling and Nanny

Table 6

Factors associated with household injury risk for children under 5 years of age: Univariate and Multivariate Regression Models*

Variables	Univariate Model			Multivariate Model		
	Crude OR	P-value	(95% CI)	Adjusted OR	P-value	(95% CI)
Caregiver age (Years)	0.97	0.14	0.94, 1.01	0.97	0.25	0.91, 1.02
Caregiver Education						
None	1.00			1.00		
Basic	1.46	0.34	0.67, 3.18	0.90	0.72	0.34, 2.35
Senior high	2.18	0.09	0.90, 5.29	1.98	0.25	0.71, 5.52
Tertiary	1.83	0.54	0.26, 12.64	1.36	0.88	0.25, 7.47
Employment Status						
Unemployed	1.00			1.00		
Hourly worker	1.52	0.19	0.81, 2.86	2.76	0.02	1.20, 6.37
Salaried worker	1.22	0.68	0.47, 3.21	1.43	0.61	0.48, 4.33
Socio-economic status	0.98	0.87	0.81, 1.20			
Age of child						
<1 year	1.00			1.00		
1–2 years	3.46	0.02	1.27, 9.43	3.92	0.02	1.30, 11.79
3 years	5.02	0.004	1.66, 15.17	6.37	0.004	1.80, 22.56
Sex of child						
Male	1.00					
Female	0.64	0.10	0.37, 1.10	0.59	0.11	0.30, 1.17
Number of Sleeping rooms						
1	1.00					
2	1.38	0.24	0.81, 2.36			
3	0.96	0.97	0.09, 9.96			
Accommodation						
Rented single room	1.00			1.00		
Rented flat	1.09	0.79	0.58, 2.04	0.98	0.99	0.49, 2.26

Variables	Univariate Model			Multivariate Model		
	Crude OR	P-value	(95% CI)	Adjusted OR	P-value	(95% CI)
Uncompleted accommodation	3.22	0.01	1.28, 8.12	3.67	0.05	1.17, 11.48
Cooking place						
In the house	1.00			1.00		
Separate building	0.40	0.02	0.18, 0.88	0.38	0.07	0.14, 1.01
Out door	0.47	0.02	0.25, 0.90	0.40	0.008	0.20, 0.83
Cabinet/Cupboard						
No	1.00			1.00		
Yes	0.40	0.002	0.22, 0.72	0.47	0.03	0.25, 0.88

* Variables adjusted for: caregiver age and education status, employment status of caregiver, age and sex of child, type of accommodation of household, cooking place of the household, availability of cabinet in the household. Age and sex of the child are confounders.