

Risk of Unintentional Ingestion of Harmful Chemicals among Under-five Children in Calabar South Local Government Area of Cross River State

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ABSTRACT

Introduction: Unintentional chemical poisoning contributes significantly to under-five morbidity, mortality, and disability with an incidence rate of 442/100,000 children age 0–5 years, in low- and middle-income countries. Unintentional ingestion of harmful chemicals by under-five children can be prevented if some risk factors that predispose under-five children to unintentional chemical poisoning are modified. The aim of this study is to determine the risk of unintentional ingestion of harmful chemicals among under-five children in Calabar South Local Government Area (LGA) of Cross River State. **Materials and Methods:** Analytic epidemiology (case–control) design was employed in this study, 120 under-five children living with their parents in Calabar South LGA, Cross River State, were recruited through the use of multistage and simple random sampling technique by balloting. A structured questionnaire was used for data collection after being validated and its reliability tested. Cases were matched with controls using frequency matching. Multivariate analysis in the binary logistic regression model was used to test the hypotheses. **Results:** The result revealed that under-five children in Calabar South LGA, below 25 months of age are 2 times more likely to have unintentional ingestion of harmful chemicals (odds ratio [OR] = 2.786, $P = 0.032$). Under-five children under the care of a mother/caregiver below 36 years of age are 1.654 times more likely to experience unintentional ingestion of harmful chemical (OR = 1.654, $P = 0.026$). Under-five children who are under the care of a mother/caregiver without any formal educational attainment are 2 times more likely to experience unintentional ingestion of harmful chemical (OR = 2.000, $P = 0.040$). Under-five children residing in non-comfortable apartments with their mothers/caregivers are 2 times more likely to experience unintentional ingestion of harmful chemicals (OR = 2.707, $P = 0.043$). Under-five children whose mothers/caregivers have no designated place where chemicals are kept are 2 times more likely to have unintentional ingestion of harmful chemicals (OR = 2.281, $P = 0.040$). Under-five children are 5 times more likely to have unintentional ingestion of harmful chemicals when the container of the chemical has no airtight/child-resistant cover on it (OR = 5.364, $P = 0.041$). Household cleaning agents were the most ingested chemical substances (25.0%) among under-five children in Calabar South LGA, Cross River State. **Conclusion:** Based on the findings, the researcher recommended that mothers/caregivers of under-five children should take more preventive measures in keeping household cleaning agents and other harmful chemical substances away from the reach of the under-five child. Furthermore, all household chemicals should be airtight/properly covered to avoid under-five children gaining access to it and possibly ingesting it. The researcher also recommended a childhood risk prevention and reduction program targeted at under-five children (especially those within the age of 1–3 years) to prevent and reduce the burden of unintentional ingestion of harmful chemicals among under-five children.

Key words: Calabar South, Nigeria, under-five children, unintentional ingestion of chemicals, unintentional injury

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INTRODUCTION

Unintentional injuries have replaced infectious diseases as a leading public health problem of children in the world today. Unintentional injury remains the leading cause of morbidity, mortality, and disability among under-five children worldwide accounting for nearly 40% of all deaths in this age group.^[12,14]

In World Health Organization,^[41] injury is defined as the physical damage to human body when subjected to energy in amounts that exceed the threshold of physiological tolerance, it can be chemical, thermal, or mechanical. However, injuries are categorized as intentional or unintentional injuries. Unintentional injury consists of the subset of injuries, for which there is no evidence of predetermined intent to cause harm.^[27] The most common unintentional injuries result from motor vehicle crashes, falls, burns, drowning, ingestion of poisonous substance, and aspirations.^[30]

In Nigeria, there is a dearth of data that shows the burden of unintentional poisoning among under-five children.^[39] Although a lot of studies have tried to characterize accidental poisoning patterns and its association among pediatric age group, few studies have determined quantitatively the relationship between these risk factors (risk disposing factors) and the risk (likelihood) of unintentional ingestion of chemical among under-five children.

The usefulness of chemicals cannot be overemphasized as they are used in homes as preservatives, detergent, cosmetics, fuel, and medicinal product (root and herbs inclusive) (Scientific Committee on Consumer Safety).^[36] Availability, easy accessibility of these chemicals, storage, lack of parental supervision, ease of opening, and ingestion may have contributed to the occurrence of unintentional ingestion of chemicals among this age group.^[22] Hence, it is on these grounds that the researcher has designed this study, using analytic epidemiology (case-control) design to determine quantitatively the risk of unintentional chemical ingestion among under-five children in Calabar South Local Government Area (LGA) of Cross River State, with a view of developing a prevention and health promotion program to prevent and control the occurrence.

MATERIALS AND METHODS

Case-control (retrospective) study design was used to explore the relationship between a range of potential risk factors for unintentional chemicals poisoning among under-five children and the risk of unintentional ingestion of chemicals among under-five children in Calabar South LGA of Cross River State.^[1] A total of 120 under-five children living with their parents in Calabar South LGA, Cross River State, were recruited through the use of multistage and simple random sampling

technique by balloting. A structured questionnaire was used for data collection after being validated and its reliability tested.

A structured self-administered questionnaire containing open-ended and closed-ended questions was developed and used for data collection. The questionnaire contained relevant information on “Risk of Unintentional Ingestion Chemicals among Under-Five Children in Calabar South LGA, Cross River State.” The questionnaire was divided into six major sections for ease of administration. The sections deal with the following; demographic data of the child, socioeconomic profile of the mother/caregiver, mode of storage of chemicals, accessibility of chemicals to under-five child, ease of opening of the container, and attractiveness of the chemical container/content. It was administered after explaining the purpose of the study to the mothers/caregivers of under-five children. Specific oral information on the purposes of the study was given to mothers, and their oral consent obtained before inclusion in the study. Confidentiality of information was maintained throughout the study. The completed questionnaire was collated and entered into the computer. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0 computer software and the results were presented in simple frequency and percentages. Bar chart was used to present remarkable information, odds ratio (OR) and Chi-square test were used to determine the relationship between potential risk factors and the risk of unintentional ingestion of harmful chemicals among under-five children. $P < 0.05$ was considered statistically significant.

RESULTS

Demographic status of under-five children in Calabar South LGA of Cross River State

Table 1 shows the demographic status of under-five children in Calabar South LGA of Cross River State. Six (5.0%) of the children are <1 month of age, 13 (10.8%) of children are within the age of 1–12 months, 20 (16.7%) of children are within the age of 13–24 months, 46 (38.3%) of the children are within the age of 25–36 months, 28 (23.3%) of the children are within the age of 37–38 months, and 7 (5.8%) of children are within the age of 49–59 months. Ninety (75.0%) are male while 30 (25.0%) are female under-five children. Birth order of the index child, 20 (16.7%) are the 1st child of their parents, 32 (26.7%) are the 2nd child of their parents, 49 (40.8%) are the 3rd child of their parents, 8 (6.7%) are the 4th child of their parent, and 10 (8.3%) are the 5th child of the parents.

Socioeconomic characteristics of mother/caregiver of under-five children in Calabar South LGA of Cross River State

Table 2 shows the socioeconomic characteristics of mother/caregiver of under-five children in Calabar South LGA of Cross River State. Among the mothers/caregivers of under-five children in Calabar South LGA of Cross River

Table 1: Demographic status of the under-five children in Calabar South LGA of Cross River State

General characteristics	Frequency (n=120)	Percentage
Age of the index child in months		
<1	6	5.0
1–12	13	10.8
13–24	20	16.7
25–36	46	38.3
37–48	28	23.3
49–59	7	5.8
Sex of the index child		
Male	90	75.0
Female	30	25.0
Birth order of the index child		
1	20	16.7
2	32	26.7
3	49	40.8
4	8	6.7
5	10	8.3

LGA: Local Government Area

Table 2: Socioeconomic characteristics of mother/caregiver of under-five children in Calabar South LGA of Cross River State

Socioeconomic characteristics of mother/caregiver	Frequency (n=120)	Percentage
Age of the mother/caregiver (years)		
<15	6	5.0
15–25	14	11.7
26–36	72	60.0
37–47	28	23.3
Gender		
Male	26	21.7
Female	94	78.3
Marital status		
Single	4	3.3
Married	111	92.5
Divorced	5	4.2
Parity (number of children given birth alive)		
1	10	8.3
2	30	25.0
3	42	35.0
4	20	16.7
5	18	15.0
>5	0	0

(Contd...)

Table 2: (Continued)

Socioeconomic characteristics of mother/caregiver	Frequency (n=120)	Percentage
Highest education attained		
No formal education	1	0.8
Primary education	10	8.3
Secondary education	52	43.3
Tertiary education	58	48.3
Occupation		
None	16	13.3
Public servant	26	21.7
Business	45	37.5
Doctor	4	3.3
Nurse	9	7.5
Hair dresser	17	14.2
Seamstress	3	2.5
Mother/caregiver average monthly income		
<N18,000	32	26.7
N18,000–N36,000	15	12.5
N37,000–N55,900	28	23.3
N56,000–N74,900	16	13.3
N75,000–N93,900	14	11.7
N94,000–N112,000	11	9.2
>N112,000	4	3.3
Residential apartment		
One bedroom apartment	47	39.2
Two bedroom apartment	21	17.5
Three bedroom apartment	39	32.5
Four bedroom apartment	7	5.8

LGA: Local Government Area

State, 6 (5.0%), 14 (11.7%), 72 (60.0%), and 28 (23.3%) are <15 years old, 15–25 years old, 26–36 years old, and 37–47 years old, respectively. Ninety-four (78.3%) are female caregivers, while 26 (21.7%) are male caregivers of under-five children. Four (3.3%), 101 (92.5%), and 4 (4.2%) are single, married, and divorced mothers/caregivers of under-five children, respectively.

Among mothers/caregivers who responded to question on parity, 10 (8.3%), 30 (25.0%), 42 (35.0%), 20 (16.7%), and 18 (15.0%) have 1 live birth, 2 live birth, 3 live birth, 4 live birth, and 5 live birth, respectively. Ten (8.3) attained primary education, 52 (43.3%) attained secondary education, 58 (48.3%) attained tertiary education while 1 (0.8%) had no formal education. Among the mothers/caregivers who responded to questions on occupation, 16 (13.3%) had no occupation, 26 (21.7%) are public servant, 45 (37.5%) are into business, 4 (3.3%) are doctors, 9 (7.5%) are nurses,

17 (14.2%) are hair dresser while 3 (2.5%) seamstress. Among the mothers/caregivers who responded on mother/caregiver average income per month, 32 (26.7%) earn <N18,000/month, 15 (12.5%) earn N18,000–N36,900/month, 28 (23.3%) earn N37,000–N55,900/month, 16 (13.3%) earn N56,000–N74,900/month, 14 (11.7%) earn N75,000–N93,900/month, 11 (9.2%) earn N94,000–N112,900/month, and 4 (3.3%) earn higher than N112,900/month. Among mothers/caregivers who responded to question on residential apartment, 47 (39.2%) of mothers/caregivers live in one bedroom apartment, 21 (17.5%) of mothers/caregivers live in two bedroom apartment, 39 (32.5%) of mothers/caregivers live in three bedroom apartment, 7 (5.8) live in a four bedroom apartment while 6 (5.0%) live in communal apartment.

Chart 1 shows the various harmful chemical substances ingested by under-five children in Calabar South LGA of Cross River State. Household cleaning agent (liquid bleach, disinfectant, liquid soap, and detergent) was the most common type of harmful chemical substance ingested by under-five children ($n = 37$, 26.1%), followed by kerosene ($n = 14$, 9.9%), medicine ($n = 9$, 6.3%), cosmetics ($n = 11$, 7.7%), and pesticides ($n = 4$, 2.8%).

OR of risk-disposing factors (Demographic status of the child/socio-economic status of the mother/caregiver) for unintentional ingestion of chemical poisoning in relation to risk of unintentional ingestion of chemical among under-five children in Calabar South LGA of Cross River State

Table 3 shows the result of multivariate analysis in the binary logistic regression model, of risk disposing factors for unintentional chemical poisoning among under-five children, in relation to risk of unintentional ingestion of chemical among

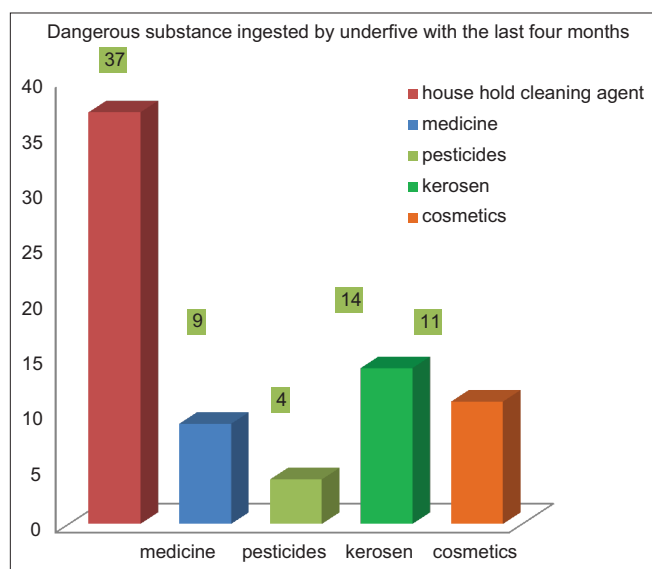


Chart 1: Various harmful chemical substances ingested by under-five children in Calabar South Local Government Area of Cross River State

under-five children in Calabar South LGA, Cross River State. The result showed that under-five children, 25 months of age and below, were more than 2 times more likely to have unintentional ingestion of chemicals substances (OR = 2.786; confidence interval [CI] = 0.298–26.043; $P = 0.032$) when compared with under-five children above 25 months of age. The result showed no risk for sex of the under-five child be it male or female, all have equal likelihood of experiencing unintentional ingestion chemical substance (OR = 0.093; CI = 0.015–0.597; $P = 0.012$). Furthermore, the result showed no risk for birth order of the child (OR = 0.196; CI = 0.005–7.7260; $P = 0.385$).

The result from this study showed no strong risk for age of the mother/caregiver as under-five children are only 1 time more likely to experience unintentional ingestion of chemicals when under the care of mothers/caregivers who <36 years of age when compared with those >36 years of age (OR = 1.654; CI 0.135–20.181; $P = 0.694$). Furthermore, the result from Table 3 shows that under-five children, with mothers/caregivers who had no formal education are 2 times likely to have unintentional ingestion of chemicals substances (OR = 2.000; CI = 2.046–1.000; $P = 0.040$) when compared with under-five children whose mothers/caregivers had formal education. Under-five children, with mothers/caregivers who have unskilled occupation are 4.587 times more likely to have unintentional ingestion of chemicals substances (OR = 4.587; CI = 0.3738–19.640; $P = 0.043$) when compared with under-five children whose mothers/caregivers have skilled occupation. Mothers/caregivers income per month showed no strong risk with unintentional ingestion of chemical among under five as under-five children whose mothers/caregivers earn <N75,000 are only 1 time more likely to experience unintentional ingestion of chemical substance when compared with those whose mothers/caregivers earn higher than N75,000/month (OR = 1.396; CI = 0.151–12.927; $P = 0.040$).

Under-five children, whose mothers/caregivers live in a non-comfortable (communal apartment, one bedroom, and two bedroom) residential apartment, are 2.707 times more likely to have unintentional ingestion of chemicals substances (OR = 2.707; CI = 0.373–19.640; $P = 0.043$) when compared with under-five children whose mothers/caregivers live in a comfortable (duplex, three bedroom, and four bedroom) residential apartment.

DISCUSSION

Demographic status of the child in relation to risk of unintentional ingestion of chemicals among under-five children in Calabar South LGA of Cross River State

In this study, the age of the child showed a relationship with risk of unintentional ingestion of chemical. Under-five children aged 25–36 months old had the highest number 24 (52.2%) of unintentional ingestion of chemical among

Table 3: Odds ratio for unintentional ingestion of chemical in relation to risk disposing factors among under-five children in Calabar South LGA of Cross River State

Risk disposing factors	Total (n)	Proportion %	P-value	OR	95% CI Low-High
Age of the child in months					
<25	39	32.5	0.032	2.786	0.298–26.043
>25	81	67.5		1.00	
Sex of the child					
Male	90	75.0	0.012	0.093	0.015–0.597
Female	30	25.0		1.00	
Birth order the child					
<3	89	74.2	0.385	0.196	0.005–7.726
>3	31	25.8		1.00	
Age mother/caregiver					
<36 years	92	76.7	0.694	1.654	0.135–20.181
>36 years	28	23.3		1.00	
Marital status mother/caregiver					
Living with your husband	111	92.5	0.051	0.008	0.000–1.023
No husband	9	7.5		1.00	
Parity					
<3 (1,2,3)	92	76.7	0.170	0.063	0.001–3.274
>3 (4,5)	18	15		1.00	
Highest education attained by mother/caregiver					
Informal education	60	50.0	0.040	2.000	2.046–1.000
Formal education	60	50.0		1.00	
Occupation					
Unskilled occupation	81	67.5	0.010	4.587	0.290–72.500
Skilled occupation	39	32.5		1.00	
Mother's income per month					
<N75,000	91	75.8	0.040	1.396	0.151–12.927
>N75,000	29	24.2		1.00	
Residential apartment					
Non-comfortable homes (communal apartment, one bedroom, two bedroom)	74	61.7	0.043	2.707	0.373–19.640
Comfortable homes (duplex, three bedroom, four bedroom)	46	38.3		1.00	

LGA: Local Government Area, CI: Confidence interval, OR: Odds ratio

this age group (0–59 months), followed by those within the age of 13–24 months old 20 (16.7%), as shown in Table 1, the findings from the study also showed that under-five children <25 months of age are 2 times more likely to have unintentional ingestion of chemicals statistically significant at $0.032 < P > 0.05$, as shown in Table 3. This possibly may have resulted from developmental millstone peculiar to under-five children within 24–36 months and below, which includes the ability to find things even when hidden under two or three covers and ability to copy others, especially adults. This result was in correspondence with Adnan *et al.*^[2] which

reported that under-five children 0–3 years old (68.3%) are vulnerable to unintentional poisoning. Findings from this study showed that 50 (55.6%) under-five male children had more unintentional ingestion of chemical more than their female counterparts 10 (33.3%), although this was statistically significant ($0.035 < P > 0.05$), the odds of having unintentional ingestion of chemical were relatively low when compared to female under-five children. However, this was in line with the result of a retrospective study on the contribution of social and demographic factors to accidental poisoning in 262 children by Osaghae and Godwin,^[30] which revealed that

males and females under-five children accounted for 56.9% and 43.1%, respectively, to unintentional chemical poisoning.

The result in Table 3 showed no statistically significant relationship between birth order and risk of unintentional ingestion of chemical among under-five children in Calabar South LGA, Cross River State ($0.348 > P > 0.05$). The result was surprising because Osaghae and Godwin^[30] posited that age, socioeconomic status of families, and birth order of the child are the key factors that contribute to increased incidence of poisoning in children, however, one can infer that the variation in this findings may have resulted by chance or difference in geographical location of the subjects.

Relationship between socioeconomic status of the mother/caregiver and risk of unintentional ingestion of chemicals among under-five children in Calabar South LGA of Cross River State

The result from Table 3 shows a significant relationship between the age of the mother and risk of unintentional ingestion of chemicals ($0.032 < P > 0.05$). Forty-two (58.3%) and 13 (46.4%) children whose mothers were within 25–36 years and 15–25 years, respectively, experienced unintentional ingestion of chemical also. However, age of the mother showed high odds to risk of unintentional ingestion of chemicals among under-five children in Calabar South, under-five children born to mothers who are <25 years are 2 times more likely to experience unintentional ingestion of chemicals. This finding is in line with that of Peden^[32] and Schmertmann *et al.*^[34] which stated that young maternal age, unsafe use of chemicals, and overcrowding are strong risk factors associated with increased risk of childhood unintentional injuries.

An important finding from this study is that only 0.8% of the sampled mothers/caregivers of under-five children had no formal educational background as shown in Table 2, this showed the possibility of relatively high literacy level among mothers/caregivers of under-five children in Calabar South LGA of Cross River State. However, under-five children whose mothers had no formal education or only primary education are 2 times more likely to experience unintentional ingestion of chemical. It is left to be explored if this high literacy level translates into good knowledge of health promotion and disease preventive approaches with regard to risk reduction to unintentional ingestion of chemicals among under-five children. Furthermore, findings in Table 3 showed a strong statistical relationship ($0.010 < P > 0.05$) between occupational status of the mother and risk of unintentional, 27 (60.0%) under-five children whose mothers do business as occupation experienced unintentional ingestion of chemical have ingestion of chemicals, also under-five children are 4.587 times more likely to experience unintentional ingestion of chemical when their mothers/caregivers do business or other unskilled occupation. This finding supported that of

Ugwu *et al.*^[39] in their study done to determine the pattern of childhood poisoning in the Central Hospital Warri, Niger Delta Region of Nigeria, also found out that most of the patients (under-five children) who had accidental childhood poisoning were from the low socioeconomic class and that most of the poisoning was unintentional and occurred through ingestion (97.6%). Residential apartment also showed a strong statistical relationship ($0.043 < P > 0.05$) with risk of unintentional ingestion of chemical among under-five children, under-five children whose mothers/caregivers live in a one bedroom apartment, two bedroom apartments, and in communal apartment are 2 times more likely to experience unintentional ingestion of chemicals. This is not surprising because Edelu *et al.*^[17] in their study done to ascertain the frequency and pattern of accidental childhood poisoning in Enugu, showed that the prevalence of unintentional childhood poisoning was higher among those with low socioeconomic background.

Findings from this study show that household cleaning agents (liquid bleach, liquid soap, and detergent) were the most ingested chemical substance among under-five children in Calabar South LGA of Cross River State, this shows a shift from kerosene ingestion reported by Edelu *et al.*^[17] and Ugwu *et al.*^[39] The reasons for this shift are yet to be ascertained.

CONCLUSION

The findings of this study showed a strong relationship between some risk factors of unintentional ingestion of chemicals among under-five children and risk of unintentional ingestion of chemicals among under-five children in Calabar South LGA of Cross River State. The findings above showed that collection of data for unintentional ingestion of chemicals substance by under-five children at the community level is feasible. The result showed the possibility of reducing the burden of unintentional injuries due to poisoning among under-five children by appropriate preventive training and modification of these risk disposing factors such as covering of chemical container with child-resistant or airtight cover, having a designated place in the house where household chemicals are kept, removing chemical container away from the reach of the under-five child immediately after use, and storing household chemicals in its original/customized container and proper supervision of the under-five child by the mother/caregiver, especially when they are <3 years of age.

Recommendations

1. Mothers/caregivers of under-five children should take more preventive measures in keeping these household cleaning agents and other chemical substances away from the reach of the under-five child and also storing these chemicals in their original customized container
2. All household chemicals should be properly covered/

airtight to avoid under-five children gaining access to it and possibly ingesting it

3. Other members of the family should also give support/assistance to mothers/caregivers of under-five children in whatever way they can in order to prevent unintentional ingestion of chemical by their under-five child
4. Childhood risk prevention and reduction program targeted at under-five children (especially those within the age of 1–3 years) must be developed to prevent and control unintentional ingestion of chemicals substance, especially among under-five children in Calabar South LGA of Cross River State.

COMPETING INTEREST

Authors have declared that no competing interest exists.

AUTHORS' CONTRIBUTIONS

Nwachukwu Christian C. conceived the study, designed the questionnaire, and performed data collection. Abanobi O.C. supervised the work and also contributed to the drafting of the manuscript. Ebirim CIC performed the statistical analysis. Ibe SNO participated in reviewing of related literature and critical review of the manuscript. Ukwajunor Judith I. participated in critical review of the manuscript.

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