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Original Research

Exposure rate of children to environmental violence in the Thamar University Hospital area in Yemen

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Abstract

Background: Background: Children in Yemen face significant risks of environmental violence due to socio-political instability and lack of resources. This study evaluates the incidence, types, and risk factors of environmental violence-related injuries among children in the Al-Wahdah Teaching Hospital, Yemen.
Methods: A cross-sectional study involving 151 children under 18 years was conducted. Data collection included structured questionnaires addressing demographics, injury types, injury sites, and associated risk factors. Data were collected over six months (January–June 2023) from 151 children under 18 years presenting to Al-Wahdah Teaching Hospital, Thamar University, Yemen. Sociodemographic, injury-related, and socioeconomic variables were analyzed using SPSS.
Results: Most children were male (77.5%) with a predominant age range of 10–14 years (34.4%). Road traffic accidents (38.4%) were the leading injury cause, particularly among older children, followed by falls (28.5%) and burns (6%). Injuries predominantly occurred on public roads (52.3%), with urban areas (49.7%) and low-income households (68.2%) disproportionately affected. Most parents lacked formal education (54.3%), underscoring socioeconomic vulnerabilities. Significant associations were found between injury type and socio-economic factors ($p < 0.001$). Also, Statistical significance ($p<0.05$) highlighted associations between injury types, age groups, and environmental factors.
Conclusion: Environmental violence significantly impacts children, emphasizing the need for targeted interventions. Road safety, urban planning, and poverty alleviation emerge as critical intervention targets to reduce the Environmental violence that significantly impacts children These findings advocate for child-sensitive public health strategies in conflict settings and prioritization of environmental safety in humanitarian and policy responses to mitigate preventable injuries and their long-term physical consequences.

Keywords: Environmental violence, child injuries, conflict zones, road traffic accidents, Yemen.

1. Introduction

Environmental violence, defined as exposure to unsafe or hostile conditions, disproportionately affects children, (1) particularly in conflict-affected regions like Yemen. The ongoing conflict, poor infrastructure, and lack of resources have exacerbated the risks of injury and violence among children.

The World Health Organization (WHO) estimates that globally every 5 seconds a human life is cut short as a result of an injury (2). Estimates from the Global Burden of Disease (GBD) study show that in 2010 more than 3.5

million individuals died as a result of unintentional injuries(3). Additionally, millions more often survive but are disabled, accounting for 202 million disability-adjusted life years (DALYs) in 2020 (4). Road traffic crashes are the leading cause of unintentional injuries, and are estimated to contribute to more than 3 600 deaths on the world's roads every day (5). Moreover, they account for nearly a quarter of all injury and violence-related deaths globally. Estimates from WHO suggest that road traffic injuries (RTIs) will become the fifth leading cause of death by 2030 unless action is taken to curb this growing epidemic (5).

Violence that causes intentional injuries including self-harm, interpersonal violence and war-related injuries account for another one-third of the mortality due to injury and violence globally, totalling about 1.4 million deaths in 2012 and marginally down from 1.5 million in 2000 (6).

Over half of these deaths were suicides, and nearly one-third were homicides.

Similar to RTIs, suicide and homicide are predicted to rise in the ranking to become the 12th and 18th leading causes of death, respectively, in the world by 2030 (4). Both injury and violence burden disproportionately affect low- and middle-income countries where 90% of the global burden lies(7, 8).

RTI deaths in EMR (3%) as compared to the global estimate (2%). When examining the distribution of injury deaths by cause, the proportion of injury and violence deaths due to RTIs in EMR (27%) is slightly higher than the global proportion (24%) While other leading causes of unintentional injury, including drowning, burns and poisonings, are responsible for similar fractions of regional mortality as the global distribution, the proportion of deaths caused by falls in EMR was only a third of the global estimate (5% vs. 14%). For deaths due to violence, the fraction of homicides is marginally smaller than the global estimate, while suicides are reported to be less than half of the global figure (6% vs. 17%) (9). These differences might be attributed in part to more conservative sociocultural attitudes toward suicide and homicide in the Region

Child environmental violence has become a major public health problem, especially in developing countries. These environmental violence-related injuries (EVRIs) are preventable, but many children die as a result. Children, especially those under five, are most vulnerable to environmental violence. Globally, an estimated 2 million children aged 0 to 14 die each year from environmental violence. Most of these deaths and injuries take place in low- and middle-income countries (LMICs) (10).

In Yemen, injuries are the main leading cause of morbidity and mortality among children. However, there is little evidence on the pattern of violence-related injuries among children (11). Violence-related health injuries (permanent disabilities and death) among children worsen their health conditions and affect their social participation, academic performance, and behavioral status (anxiety, depression, etc.).

The ongoing conflict has disproportionately affected children, though prior studies on children's health have primarily concentrated on the consequences of malnutrition and infectious disease. While children are not the main participants of violence, they are significantly affected by it, often through environmental violence.

Environmental violence-related injuries worsen other stressors and may have long-term impacts on physical as well as mental health. It is important to understand the burden and risk factors of environmental violence-related injuries so that child-sensitive conflict interventions can be designed.

Thus, thorough research on violence-related child injuries is urgently needed for developing suitable preventive measures. This cross-sectional study aims to investigate the incidence and risk factors of environmental violence-related injuries among children in Yemen.

2.Motheds

A cross-sectional study was conducted over six months (January–June 2023) at Thamar University - Al-Wahdah Teaching Hospital (TUWTH), Dhamar governorate, Yemen. TUWTH is the teaching Hospital of Thamar University Faculty of Medicine (TUFM). The study included collected data on 151 children under 18 years of age who presented with environmental violence-related injuries to the Emergency Department of TUWTH during the above period.

Environmental violence-related injuries were defined using the WHO definition. Additional checks are applied for correctness and completeness. A pre-tested structured questionnaire was used to collect information on child sociodemographic characteristics, residency, Socio-economic and educational factors (monthly family income, parental occupation and education level), injury types (road traffic accidents, falls, burns, etc.) and injury sites (home, school, public roads).

Statistical analysis

The data were analyzed using SPSS version 25. The data were analyzed across various categories, including age groups, geographic regions, gender, education level, and socioeconomic status. The data were divided into risk factors, which include child-related factors, environmental factors, family-related factors, and access to treatment and resources. Statistical measures such as chi-square (X^2) and p-values (P) were used to test the significance of observed differences. A probability value of ($p < 0.05$) was considered statistically significant.

Ethical Considerations

The approval of the study protocol was obtained from the Thamar University Medical Ethics Committee (TUMEC). Before commencing the study, the survey's objectives were explained to all the participants and their Parents/guardians. The participants were informed that their participation was voluntary and that the data was subjected to strict confidentiality as well as the freedom to

withdraw at any time during the study period. Parents/guardians provided written informed consent.

3. Results

Figure 1 shows the distribution of injury types (Road traffic accidents: 38.4%, falls: 28.5%, burns: 6%, other injuries: 27.1%).

Figure 2 shows injuries by age group (Road traffic accidents: highest in 10-14 years, burns: highest in 5-9 years.

The table 1 show, males constituted the majority of cases (77.5%), while females accounted for 22.5%. The majority of affected children were aged 10–14 years (34.4%), followed by 5–9 years (28.5%) and 15–18 years (22.5%).

Road traffic accidents represented (38.4%), the main cause of injuries, especially among children aged 10-14 years, (43.1%). Falls represented (28.5%), with falls evenly distributed across age groups but slightly higher among younger children. Burns followed (6%), most common among children aged 5-9 years, and often occurring at home. Other injuries were (27.1%), including injuries caused by violence, explosions, and other environmental hazards.

The table 2 show, the majority of the cases fall in the 10-14 age group (52 out of 151 total Cases). Most children are categorized as "Normal" (149 out of 151), with only 2 classified as "H.M" (likely "High Risk" or similar). The majority of children are "Students" (46 out of 151), with a significant number also being "Both" (students and workers, 31 out of 151). Most families are categorized as "Non" (109 out of 151), indicating no significant family-related risk factors. Access to T & R: Access is mostly "Easy" (131 out of 151), with only 20 reporting "Difficult" access.

Environmental Factors: The X^2 is 115.850 with a p-value <0.001, indicating a highly significant association. Family-Related Factors: The X^2 is 7.071 with a p-value of 0.630, indicating no significant association. Access to T & R: The X^2 is 1.389 with a p-value of 0.708, indicating no significant association.

The data suggests that environmental factors are significantly associated with the age groups, particularly in the younger age groups (<5 and 5-9 years), where neglect and unknown factors are more prevalent. Family-related factors and access to treatment and resources do not show a significant association with age groups in this dataset.

The table 3 show, males dominate the dataset (117 out of 151), compared to females (34). Both genders have a similar proportion of "Normal" classifications. Males are more likely to be "Students" (40 out of 117) or "Both" (27 out of 117), while females are more likely to be "Neglected" (12 out of 34). Access to T & R: Access is mostly "Easy" for both genders, with males having slightly better access (103 out of 117).

Environmental factors and F.R. to the family show statistically significant differences between males and females ($p < 0.05$). Child-related factors and Access to T & R do not show significant differences between genders ($p > 0.05$). The only statistically significant result ($p < 0.001$) is for environmental factors in the "<5" age group, suggesting a strong association between neglect and this age group. Other factors (child-related, family-related, and access to treatment) do not show significant associations in the "<5" age group ($p > 0.05$).

Younger children (<5 years) are more likely to be neglected and face environmental risk factors. Older children (10-14 years) are more likely to be engaged in both schooling and work.

As demonstrated by the outcomes of our study, Nearly half of the participants (49.7%) were from Gehran, an urban area with high traffic density, while the remaining were from rural areas with limited infrastructure and healthcare access.

Gehran has the highest number of observations (75 out of 151), followed by Anis (29), Alhada (23), and Others (34). Environmental factors: In Gehran, the majority are "Students" (18) or "Both" (15), while in Anis, most are "Students" (8). Family-related factors: Gehran has the highest number of families categorized as "Non" (61 out of 75), indicating fewer family-related risks. Access to T & R: Access is predominantly "Easy" across all regions, with Gehran having the highest number (74 out of 75).

Family-related factors and access to T & R show significant associations ($p < 0.001$) in the Anis region. The Gehran region has the highest number of cases, with most individuals having easy access to T & R. The Alhada and Others regions show similar patterns, with easy access to T & R being more common.

The data suggests that geographical regions differ in terms of risk factors and access to resources. The Anis region, in particular, shows significant associations in family-related factors and access to resources, which may indicate specific challenges or strengths in that area. The Gehran region, with the highest number of cases, may require further investigation to understand the underlying factors contributing to its high numbers.

The results of our research also showed that the majority of children are in Primary school (75 out of 150), followed by Pre-school (29), Secondary school (13), and Not involved (33). Child-related factors: All pre-school children are classified as "Normal." Environmental factors: Pre-school children are mostly "Neglected" (19 out of 29), while primary school children are mostly "Students" (42 out of 75). Access to T & R: Access is mostly "Easy" across all education levels.

Most individuals across all educational levels are categorized as "Normal" rather than "High Risk" (H.M.). The chi-square test ($X^2 = 1.290$, $p = 0.732$) suggests no significant association between educational level and child-related risk factors. There is a significant association between educational level and environmental factors ($X^2 = 172.191$, $p < 0.001$). Pre-school children are mostly students (19 out of 29). Primary school children are a mix of students (42), workers (5), and both (22). Not-involved individuals are mostly workers (12) or neglected (10).

No significant association is observed between educational level and family-related factors ($X^2 = 8.068$, $p = 0.527$). Most individuals across all educational levels are

categorized as "Non" (no family-related risk factors). No significant association is observed between educational level and access to treatment/resources ($X^2 = 0.366$, $p = 0.947$). Most individuals across all educational levels report "Easy" access to treatment and resources.

The only significant association found is between educational level and environmental factors ($p < 0.001$). This suggests that the environment in which children or individuals are raised (e.g., being a student, worker, or neglected) varies significantly based on their educational level. Other factors, such as child-related factors, family-related factors, and access to treatment/resources, do not show significant associations with educational level in this dataset.

Our research results also showed that most of the affected children (68.2%) were from low-income families. The dataset is almost evenly split between Low (67 out of 148) and Medium (81 out of 148) socio-economic status. Environmental factors: Low socio-economic status individuals are more likely to be "Neglected" (23 out of 67), while medium socio-economic status individuals are more likely to be "Students" (29 out of 81). Access to T & R: Access is mostly "Easy" for both groups, but low socio-economic status individuals report slightly more "Difficult" access (13 out of 67).

The data is divided into three groups: Low, Medium, and Total socio-economic status. The total number of individuals in the study is 148 (67 in the Low group and 81 in the Medium group). In the Low socio-economic group, all 67 individuals were classified as "Normal." In the Medium socio-economic group, 79 were "Normal," and 2 were "High Risk." The chi-square test ($X^2 = 1.677$, $p = 0.195$) indicates no significant association between socio-economic status and child-related risk factors.

In the Low group, 16 were students, 10 were workers, 11 were both, 23 were neglected, and 5 were unknown. In the Medium group, 29 were students, 7 were workers, 20 were both, 6 were neglected, and 17 were unknown. The chi-square test ($X^2 = 22.284$, $p < 0.001$) indicates a significant association between socio-economic status and environmental factors.

In the Low group, 12 were affected by tribe war, 7 by parental parity, 1 by both, and 47 by none. In the Medium group, 8 were affected by tribe war, 9 by parental parity, 2 by both, and 62 by none. The chi-square test ($X^2 = 2.142$, $p = 0.543$) indicates no significant association between socio-economic status and family-related factors.

In the Low group, 54 had easy access, and 13 had difficult access. In the Medium group, 75 had easy access, and 6 had difficult access. The chi-square test ($X^2 = 4.215$, $p = 0.030$) indicates a significant association between socio-economic status and access to treatment and resources. Individuals in the Medium socio-economic group were more likely to have easy access compared to the Low group.

Environmental factors and access to treatment and resources are significantly associated with socio-economic status. Child-related factors and family-related factors do not show a significant association with socio-economic status in this study. Individuals with Medium socio-economic status tend to have better access to treatment and resources compared to those with Low socio-economic status.

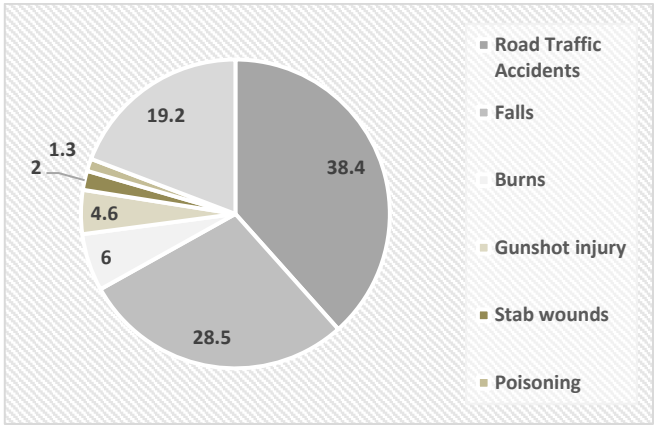

Figure 1 Distribution of injuries among study participants

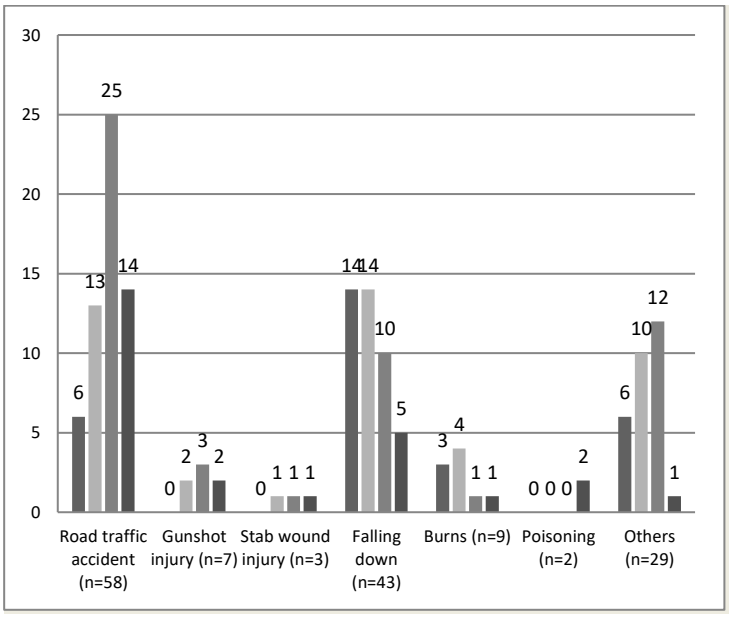

Figure 2 Distribution of injuries among the study participants by age group

Table 1 Summary of Demographics and Injury Patterns

Variable	n (%)
Gender	
Male	77.5
Female	22.5
Age Groups	
5–9 years	28.5
10–14 years	34.4
15–18 years	22.5
Injury Types	
Road Traffic Accidents	38.4
Falls	28.5
Burns	6.0
Other Injuries	27.1

Table 2 Demographic and risk factor analysis in personal data across age groups

Personal data		N	Risk factors																							
			Child related factors				Environmental factors								F. R. to the family						Access to T & R					
			Normal	H.M	X²	P	Student	Worker	Both	Neglected	Un known	S&N	X²	P	Tribe war	P. parity	Both	Non	X²	P	Easy	Difficult	X2	P		
Age group	<5	29	29	0			0	0	0	19	10	0			4	3	0	22			26	3				
	5-9	44	43	1			19	3	2	9	9	2			5	5	1	33			37	7				
	10-14	52	51	1	1.184	0.757	23	6	16	1	3	3	115.850	<0.001	8	6	0	38	7.071	0.630	44	8	1.389	0.708		
	15-18	26	26	0			4	8	13	0	1	0			4	4	2	16			24	2				
	Total	151	149	2			46	17	31	29	23	5			21	18	3	109			131	20				

Table 3 Demographic analysis and risk factors by gender of the participants

Personal data		N	Risk factors																							
			Child related factors				Environmental factors								F. R. to the family						Access to T & R					
			Normal	H.M	X²	P	Student	Worker	Both	Neglected	Un known	S&N	X²	P	Tribe war	P. parity	Both	Non	X²	P	Easy	Difficult	X²	P		
Gender	Male	117	116	1			40	14	27	17	14	5			19	17	3	78			103	14				
	Female	34	33	1	0.878	0.401	6	3	4	12	9	0	15.245	0.009	2	1	0	31	8.0464	0.045	28	6	0.740	0.390		
	Total	151	149	2			46	17	31	29	23	5			21	18	3	109			131	20				

4. Discussion

Environmental violent injury is a significant public health concern affecting victims' mortality and mental health status. Violence is recognized as a risk factor for disability and other injuries, highlighting its public health significance. Despite its seriousness, there has been minimal effort to identify the risk factors associated with environmental violence-related injuries. This study aims to investigate the incidence and risk factors of environmental violence-related injuries among children in Yemen. Injuries are the main cause of death and disability worldwide. in our finding, Males constituted the majority of cases (77.5%), while females accounted for 22.5%. This aligns with global trends where males are more likely to experience injuries due to higher engagement in risk-taking behaviors and outdoor activities. For instance, a study on transport injuries in China found that boys had a higher incidence of injuries compared to girls, with a faster decrease in mortality and DALYs rates among boys (12). Similarly, a systematic review on childhood unintentional injuries noted that males are disproportionately affected across various injury mechanisms, including road traffic accidents and falls (13).

The majority of affected children were aged 10–14 years (34.4%), followed by 5–9 years (28.5%) and 15–18 years (22.5%). This is consistent with studies showing that older children (10–14 years) are more exposed to environmental risks, such as road traffic accidents, due to increased independence and mobility. For example, research on transport injuries in China identified children aged 10–14 as the most vulnerable group, particularly for cyclist and pedestrian injuries (12). Younger children (5–9 years) are more prone to domestic injuries, such as burns and falls, as highlighted in a systematic review on unintentional injuries (13).

Road traffic accidents were the leading cause of injuries (38.4%), particularly among children aged 10–14 years (43.1%). Most injuries occurred on public roads (52.3%), followed by homes (28.5%) and schools (10.2%). The high

incidence of road traffic accidents (38.4%) reflects the lack of traffic regulations, poor road infrastructure, and limited awareness of road safety. Similar findings have been reported in other conflict-affected regions, such as Syria, where road traffic injuries account for 40% of child injuries (14).

This mirrors global trends where road traffic injuries are a leading cause of child morbidity and mortality. A study on transport injuries in China found that cyclist and pedestrian injuries were the primary causes of transport-related injuries among children, with boys being more affected (12). Similarly, a systematic review highlighted that low-income families are more likely to experience road traffic injuries due to limited access to safe transportation and infrastructure (13).

Globally, road traffic accidents are the leading cause of death among children aged 5–14 years, accounting for 10% of all child fatalities (WHO, 2020)(15). However, the burden is disproportionately higher in low- and middle-income countries (LMICs), where poor infrastructure and limited healthcare access exacerbate the problem.

The prevalence of burns (6%) and falls (28.5%) among younger children highlights the need for home safety interventions, such as fire prevention programs and safe play areas. Comparable study have identified similar patterns, with burns accounting for 8–10% of child injuries in low-income households (16). Falls were slightly higher among younger children, while burns were more frequent in children aged 5–9 years. Falls and burns are common among younger children due to their developmental stage and increased exposure to domestic hazards. A study on unintentional injuries in low-income families found that burns and falls were prevalent among children under 10 years, often occurring in home settings (13).

68.2% of injured children were from low-income households, and 54.3% of cases involved parents with no formal education. Socioeconomic status (SES) is a well-documented determinant of injury risk. A systematic review highlighted that low SES, including low family income and parental education, significantly increases the risk of childhood injuries (13).

Environmental factors showed a highly significant association with age groups ($p < 0.001$), particularly in younger children (<5 and 5–9 years), where neglect and unknown factors were more prevalent. This aligns with studies showing that younger children are more vulnerable to environmental hazards due to limited supervision and developmental immaturity. For example, a study on unintentional injuries in low-income families found that neglect and environmental hazards were significant risk factors for injuries among children under 5 years (13).

Nearly half of the participants (49.7%) were from Gehran, an urban area with high traffic density, while the remaining were from rural areas with limited infrastructure and healthcare access. Urban areas with high traffic density are often associated with higher rates of road traffic injuries, as seen in previous studies (17, 18). Rural areas, on the other hand, face challenges such as limited healthcare access and infrastructure, which can exacerbate injury outcomes (19).

This study is limited by its cross-sectional design and reliance on hospital-based data, which may not capture the full extent of environmental violence in the community. Future research should include community-based surveys and longitudinal studies to assess long-term outcomes and evaluate the effectiveness of interventions.

5. Conclusions

The findings presented the Males and older children are at higher risk of injuries, particularly road traffic accidents. Socioeconomic and Educational Factors: Low-income families and parental illiteracy significantly increase injury risk. Geographical Variations: Urban areas with high traffic density have higher injury rates, while rural areas face challenges related to healthcare access and infrastructure.

Recommendations

this study recommended the followings: implement traffic regulations, pedestrian crossings, and driver education programs to reduce road traffic accidents; promote fire safety measures, safe cooking practices, and supervised play areas to prevent burns and falls; address socio-economic disparities through poverty alleviation programs and adult literacy initiatives; and educate parents and caregivers about child safety and injury prevention.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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