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Recommended Citation

Oyetunji, T. A., Stevenson, A. A., Oyetunji, A. O., Onguti, S. K., Ames, S. A., Haider, A. H., Nwomeh, B. C. Profiling the ethnic characteristics of domestic injuries in children younger than age 5 years. *The American surgeon* 78, 426-431 (2012).

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Published in final edited form as:

Am Surg. 2012 April ; 78(4): 426–431.

Profiling the Ethnic Characteristics of Domestic Injuries in Children Younger Than Age 5 Years

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Abstract

The home remains a very common location for deadly injuries among children younger than 5 years. The aim of this study is to describe the demographic and injury characteristics of domestic injuries in children younger than 5 years. The National Trauma Data Bank's National Sample Program data set was queried for children younger than 5 years with the injury site classified as home. Bivariate analysis was performed to determine unadjusted differences by ethnicity. Appropriate weight was applied to the sample to determine accurate national estimates. A total of 7,364 children, representing 32,033 children, were analyzed. Overall mortality was 1.6 per cent. Among whites, blacks, Hispanics, Asians, and Native Americans, intentional injuries accounted for 6.5, 12.8, 10.2, 5.2, and 19.0 per cent of all injuries by intent, respectively ($P < 0.003$). Burn injury was disproportionately higher in blacks (24.1%) followed by Native Americans and Asians (15.3 and 11.5%, $P = 0.008$). On multivariate analysis, black ethnicity was associated with increased length of stay. Intentional injuries were significantly higher in blacks and Native Americans with black patients sustaining a disproportionately higher proportion of burn injury. Therefore, greater attention is needed to provide more effective home safety interventions to children among high-risk ethnic groups.

In the United States, injuries remain the leading cause of death for children after the first year of life.¹⁻³ In this same population, the home has been identified as the most common site of these injuries.^{2, 4} Furthermore, the most common mechanisms of injury in the residential setting have also been documented. A study conducted by Mack et al. found falls to be the leading cause of nonfatal unintentional injuries for infants followed by being struck by an object and then fire or burn injuries.⁵ In addition, the most common mechanisms of death were identified as fire or burns, drowning, suffocation, choking, unintentional firearm injuries, falls, and poisoning, in no particular order.⁶ In studying domestic injuries in children and adolescents, studies have found that in general, younger children are more at risk than their older counterparts.^{2, 3} Other studies have concluded that, more specifically, children younger than 5 years of age had the highest rate of emergency department visits for unintentional injuries occurring in the home.^{1, 3}

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Presented at the Southeastern Surgical Congress 2011 Annual Scientific Meeting, Chattanooga, TN, February 12–15, 2011.

As more studies on injuries to young children emerge, differences across ethnic groups have also been elucidated. An analysis of mortality data from the National Vital Statistics System from 1985 to 1997 identified black ethnicity and male sex as risk factors for death after residential injuries in children. Furthermore, the study demonstrated that despite a decline of death rates for all ethnic groups over this time period, mortality rates for black children continued to be twice that of white children.² However, the study did not include an analysis of injury characteristics in this same population. In contrast, the study by Phelan et al. provided a description of injury characteristics but did not describe these differences across ethnicities.³

Thus far, no single study has analyzed differences across ethnic groups while accounting for injury severity, a gap that this study attempts to fill. Furthermore, this study investigates the pattern of nonaccidental injuries and different ethnic groups. Determination of injury patterns by ethnic and socioeconomic categories could help direct further research and improve the design of injury prevention strategies for at-risk groups. Using a national database, this study builds on previous data by identifying the injury patterns as well as profiling ethnic characteristics of injuries among U.S. children younger than 5 years of age.

Materials and Methods

Data Set

We examined data between 2003 and 2006 from the National Sample Program (NSP) of the National Trauma Data Bank (NTDB). The NTDB NSP is maintained by the American College of Surgeons Committee on Trauma with support from the Centers for Disease Control and Prevention. It is a national probability sample of 100 Level I and II trauma centers in the United States. The goal of the NTDB NSP is to enhance current injury information by providing nationally representative baseline estimates of trauma care to meet the needs of trauma care assessment, clinical outcomes research, and injury surveillance. It is a resourceful database that includes information on trauma patients such as admission and discharge status, patient demographics, injury and diagnosis, procedure codes, Injury Severity Scores (ISSs), and outcome variables (for example, length of stay, intensive care unit days, payment method).

Inclusion/Exclusion Criteria

Included were children who were younger than 5 years old whose injury site was classified as "home." Records with missing information on vital status were excluded.

Statistical Analysis

Univariate analysis was used to describe the demographic, injury characteristics, and disposition of the children. Demographic variables included age, race, gender, and insurance status. The clinical variables included the ISS, vital status, injury type, mechanism of injury, disposition at the emergency department, and presence of head injury or extremity injury. Injuries were also assessed by intent. Bivariate analysis was performed to determine unadjusted differences by ethnicity in the study population. The primary outcome variable for this study was in-hospital mortality. Multivariate analysis was conducted adjusting for patient age, gender, race/ethnicity, insurance status, injury severity and injury type, mechanism of injury, year of admission, presence of head injury, extremity injury, and shock. Appropriate weights were applied to the sample to determine accurate national estimates. All analyses were performed using STATA MP Version 11 (College Station, TX).

Results

A total of 7,364 index records met the inclusion criteria, representing a national weighed estimate of 32,033 children. The mean age was 1.7 years. Close to two thirds of patients were male (58%). The majority of patients were white (55%) followed by Hispanic (14%) and black ethnicity (13%). Mean ISS was 7 with an overall mortality of 1.6 per cent. Thirteen per cent of patients were uninsured. One of 10 children in this study presented with severe head injury (Abbreviated Injury Score = 3) and approximately 14 per cent sustaining severe injuries (ISS = 15) (Table 1). Floor admission, intensive care unit, and operating room were the three leading emergency room dispositions, excluding transfers (38.7, 17.3, and 9.7%, respectively) (Table 2). Among whites, blacks, Hispanics, Asians, and Native Americans, intentional injuries accounted for 6.5, 12.8, 10.2, 5.2, and 19.0 per cent of all injuries by intent, respectively ($P < 0.003$). Burn injury was disproportionately higher in blacks (24.1%) followed by Native Americans and Asians (15.3 and 11.5%, $P = 0.008$). Falls remained the leading mechanism across all ethnicities followed by pedestrian injuries (Table 3). Overall mortality was less than 2 per cent. On multivariate analysis, there was no significant difference in the length of stay among male and female children and those with or without head injury. Children with severe ISS (ISS = 15) were likely to stay 2 days longer than those with ISS less than 9. Those with very severe ISS (ISS = 25) were likely to stay 4 more days than those with ISS less than 9 (Table 4). Black children stayed 1 day longer regardless of injury severity compared with white children with Asian/Pacific Islanders spending half a day less in the hospital compared with the white population.

Children with penetrating and burn injuries were significantly more likely to stay on an average of 2 more days on admission than children with burns (Table 4).

Discussion

Residential injuries remain the leading cause of mortality in children younger than 5 years of age in the United States. Although mortality is indeed a significant outcome, injuries in this population also affect factors such as hospital length of stay as well as possibly impact the life of the child and family. Although several studies have described several aspects of domestic injuries in this population, they have focused either on the injury pattern or the ethnic distribution among different populations. This study integrates an analysis of both injury characteristics and the different ethnic patterns of domestic injury among children younger than 5 years using a national database.

Ethnicity

Our study found that regardless of ethnicity, falls were the most common mechanism of injury in this population. In line with our findings, several studies also concluded that falls were the leading cause of nonfatal unintentional injuries for infants.³⁻⁵

Black Ethnicity

Several studies have demonstrated ethnic differences in mortality rate among children with residential injuries. More specifically, a study conducted by Nagaraja et al. found the death rate for black children to be twice greater than that of white children.² In addition, this same study found black children to have a higher death rate as a result of residential fires compared with whites or other races. Moreover, Pressley et al. found that black children also exhibited the highest mortality rates as a result of residential fire/flame that were nearly fourfold higher than those of white children.⁷ Our data are consistent with these findings, demonstrating that despite blunt trauma being the most common injury type across all ethnicities, burn injuries were most common in black children (24%) as compared with other

ethnicities. However, this study did not focus on mortality because it was a very infrequent outcome at less than 2 per cent.

Although studies suggest that black children have a higher proportion of intentional injuries across ethnic groups,^{7, 8} our study found that although intentional injury in black children was more common than their white counterparts (12.8 vs 6.5%), intentional injuries were most common in Native American children. With respect to injury type, some studies have shown that black children had a higher proportion of penetrating injury.^{8, 9}

In contrast, our study showed that overall penetrating injuries were most common in white and Hispanic children as a result of a preponderance of stab wounds. However, we found that, consistent with existing literature, gunshot wounds were least common among whites. In Pressley's study, gunshots were responsible for mortality rates among black and American Indian/Alaskan Native children that tripled those of white children. In contrast, we found that these injuries were most common in Asian patients (2.7%) as compared with their black and Hispanic counterparts at 1.3 and 0.9 per cent, respectively.

Native American and Asian Ethnicity

Our study showed that motor vehicle collision injuries were highest in Native American children and lowest in black children. Also, pedestrian injuries were most common in Native American children, in line with findings by Pressley et al.⁷ Also, similar to Pressley's study, we found that intentional injury was least common among Asian children.⁷ In addition, our study identified Native Americans as the most commonly victims of intentional injury (19%).

Despite previous data citing a significantly higher rate of firearm-related injuries among Native American children,⁷ we found just the opposite with gunshot wounds being lowest in Native American children in our study population. This provides some reassurance that, similar to other ethnic groups, Native Americans have benefited from the recent trend toward a reduction in firearm violence in the United States.⁷

Hispanic Ethnicity

Pressley's study also showed that Hispanic rates of injury were similar to those of non-Hispanic white children with a few exceptions.⁷ With regard to mechanism of injury, our study showed Hispanic and non-Hispanic white children having similar rates as well with the exception of motor vehicle collision, which was more common in white children (1.3 vs 0.3%). In comparing Hispanic children and white children with respect to injury type, our study also showed similar results for both groups. In further comparing both groups, there was a difference in intentional injuries, however, in which our study found that intentional injury was more common in Hispanic children than white children (10.2 vs 6.5%).

Insurance Status

There have been few studies that investigated insurance status as it relates to residential injury in children younger than 5 years. We found that uninsured patients had odds of mortality six times greater than those with private insurance. Although there have not been many studies that address insurance status in our population of interest, it has been documented in other trauma studies that uninsured patients have increased odds of death. A study by Haider et al. showed that insurance status and race were both independent predictors of worse outcomes after trauma with lack of insurance being the strongest predictor.¹⁰ Our study demonstrated that lack of insurance was most common in the Native American population (23.2%) with the Asian patients having similar rates (20%). Furthermore, our study demonstrated that white patients were the least likely to be

uninsured. When comparing insurance status with injury, we found that head injury was also most common in Native American patients with Asian patients having similar rates as well. Moreover, Native American patients in our study were most likely to have an ISS score greater than 25.

Injury Severity Score and Shock

The relationship between ISS and mortality has been well documented as well as the relationship between shock and mortality. This study demonstrated that children with a higher ISS score had increased odds of mortality. Moreover, patients who experienced shock had odds of mortality 30 times greater as compared with those patients without shock. These findings are consistent with the current data that has concluded that higher ISS and shock are both correlated with increased mortality.

Length of Stay

This study provides insight on the association between race and length of stay in this population. We found that black patients had a longer length of stay (LOS) of approximately 1 day as compared with their white counterparts. Consistent with these findings, a study conducted by Pines et al. showed that black patients had a longer LOS as compared with non-blacks.¹¹ In contrast to both of these findings, a study by Bekmezian et al. demonstrated an association between prolonged length of stay and Hispanic ethnicity.¹² Moreover, Asians/Pacific Islanders in our study demonstrated a shorter LOS at approximately half a day less than their white counterparts. Bekmezian's study had similar findings to ours, showing that Asian patients had decreased odds of having a prolonged LOS.¹² LOS, however, does not necessarily predict severity of the injury admission, because this was controlled for in this study or quality of care. For parents of black children, this represents a significant time away from work and revenue generation for the family unit. In addition, although school may not be applicable to the population of interest, many children younger than 5 years of age do attend daycare or participate in early childhood development programs. It is indeed possible that prolonged LOS may affect their experience secondary to decreased interactions with their peers as well as less time participating in activities designed for their growth and development. The study design did have some limitations. The sample size may not have been optimal leading to insufficient power to support some findings to a level of statistical significance. Although the sample size was relatively small as compared with other similar studies, we solely included children younger than years of age as compared with studies that included a wider range of ages in their study sample. Moreover, as a result of the retrospective nature of the data set, long-term outcomes of patients were not addressed in the study. Despite these limitations, this study is the first, to our knowledge, to use the NTDB to delineate epidemiologic differences in children younger than 5 years experiencing different mechanisms of domestic injuries.

The findings from this study are important because they have built on previous studies and have also highlighted some variables that had not yet been addressed. Using this information, injury prevention programs can appropriately tailor their focuses to reduce rates of injury in the home. With regard to the types of injury across ethnicities, specific ethnic group education may be of value. We, along with several other studies, found that black children had a higher proportion of injuries secondary to residential fires more than any other ethnic group.^{2, 7} Black children were also victims of intentional injury more than their ethnic counterparts. In addressing the needs of this particular subgroup, it is important to consider socioeconomic, cultural, and environmental factors when developing an intervention program. Future studies should address the long-term outcomes of patients in this population. Future efforts to obtain information such as housing type and condition may also be of value, especially when investigating injury type. Continued surveillance and

diligent attention to trends will remain important because they will ensure that the needs of the population will be appropriately addressed.

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Table 1

Demographic Characteristics of the Study Population

Variable/Characteristic	Percent
Mean age (years)	1.7
Race/ethnicity	
White	55.0
Black	13.0
Hispanic	14.0
Asian or Pacific Islander	2.0
Native American or Alaskan Native	0.6
Other	15.0
Deaths	1.6
Insurance	
Private	35.0
Government	36.0
Uninsured	13.0
Other	16.0
Head injury	10.0
Extremity injury	6.0
Injury Severity Score category	
<9	60.0
9–14	26.0
15–24	10.0
25	4.0
Gender	
Male	58.0
Female	42.0
Injury type	
Blunt	83.0
Burn	11.0
Penetrating	6.0

Table 2

Emergency Department Disposition of the Study Population

Emergency Department Disposition	Percent
Floor	38.7
Other	21.9
Intensive care unit	17.3
Operating room	9.7
Home	5.1
Transfer	3.3
ED observation	1.7
Died in ED	0.4
Unknown	0.4
Burn	0.3
Dead on arrival	0.1
Telemetry	0.1
Not done	1.0

ED, emergency department.

Table 3
 Bivariate Analysis Comparing Demographic and Clinical Characteristics by Race/Ethnicity

	White	Black	Hispanic	Asian	Native American	Other	P
Females	42.7	38.6	40.5	44.0	65.0	41.9	0.208
Mortality	1.5	1.9	0.7	2.4	2.3	1.9	0.453
Insurance status							
Private	43.6	17.6	25.3	45.1	6.7	32.7	0.004
Government	29.2	55.1	39.9	22.6	48.6	45.5	
Uninsured	9.3	12.5	19.6	20.0	23.2	18.7	
Head injury	11.1	10.2	8.4	12.0	13.1	6.0	0.158
ISS category							
<9	59.3	63.2	59.3	56.4	35.8	66.8	0.122
9–14	26.4	25.5	27.7	32.3	24.2	21.9	
15–24	9.9	8.1	11.0	6.0	22.3	8.7	
25	4.3	3.2	2.0	5.3	17.8	2.5	
Intentional injuries	6.5	12.8	10.2	5.2	19.0	6.5	0.003
Injury type							
Blunt	84.7	72.4	85.4	85.6	79.0	80.3	0.008
Burn	9.3	24.1	9.2	11.5	15.3	10.2	
Penetrating	6.1	3.5	5.4	2.9	5.7	9.5	
Mechanism of injury							
MVC	0.0	0.1	0.3	0.3	1.5	0.7	0.347
Fall	52.8	41.2	51.5	65.6	36.3	44.1	
Pedestrian	1.7	2.4	2.1	0.5	6.8	3.7	
Cyclist	0.84	0.2	1.2	0.0	2.5	0.7	
Motorcyclist	0.02	0.0	0.5	0.0	0.0	0.0	
Stab	1.9	0.3	1.6	0.0	0.0	4.6	
Gunshot wound	0.2	1.3	0.9	2.7	0.0	0.4	

ISS, Injury Severity Score; MVC, motor vehicle collision.

Table 4

Multivariate Analysis for Length of Stay in Children Younger than 5 Years with Domestic Injuries

Variable	Coefficient	95% Confidence Interval		P
		Lower Limit	Upper Limit	
Age (years)	0.13	0.02	0.24	0.02
Injury Severity Score				
< 9	Ref			
9–14	1.07	0.53	1.61	0.00
15–24	2.24	1.49	3.00	0.00
> 24	4.06	2.59	5.54	0.00
Race/ethnicity				
White	Ref			
Black	1.04	0.22	1.86	0.01
Asian or Pacific Islander	–0.56	–1.07	–0.05	0.03
Type of injury				
Blunt	Ref			
Penetrating	1.86	0.69	3.04	0.01
Burn	2.62	1.24	4.00	0.00

Adjusted for patient age, sex, race, injury severity, insurance, type of insurance, year of admission, presence of head injury, and extremity injury.