Pediatric burn prevention: Determining provider knowledge of pediatric burn epidemiology and prevalence of education at well child visits.

Elizabeth Blasi
St. John Fisher College, ecb03882@sjfc.edu

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Pediatric burn prevention: Determining provider knowledge of pediatric burn epidemiology and prevalence of education at well child visits.

Abstract
Objective: Pediatric burns are costly and traumatic injuries; however, increased education may reduce the prevalence. The purpose of this study was to determine pediatric primary care providers’ awareness of the pervasiveness of pediatric burns and discern if specific education is done at office visits. Methods: Eighteen providers participated in an education session regarding pediatric burns and took a pre-test and post-test. Results were analyzed to determine if the education led to an increase in provider knowledge of burns as well as in increase in motivation to educate their patients. Results: The education session led to an increased awareness of burn causality, age group affected, and prevention strategies as well as an increased motivation to educate patients about burn prevention. Conclusion: Educating providers about burn prevention increases their knowledge of pediatric burns and their desire to provide burn prevention education. More research is needed to determine if education of primary care providers will result in a decrease in burn incidence.

Document Type
Thesis

Degree Name
M.S. in Advanced Practice Nursing

First Supervisor
Christine Nelson Tuttle

Second Supervisor
Heather McGrane Minton

Subject Categories
Nursing

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Pediatric Burn Prevention: Determining Provider Knowledge of Pediatric Burn Epidemiology and Prevalence of Education at Well Child Visits.

By

Elizabeth C. Blasi, RN, BSN

Submitted in partial fulfillment of the requirements for the degree
Master’s in Advanced Practice Nursing
 Supervised by Dr. Christine Nelson-Tuttle and Dr. Heather McGrane-Minton

Wegmans School of Nursing
St. John Fisher College
December, 2017
Title Page

Complete manuscript title: Pediatric burn prevention: Determining provider knowledge of pediatric burn epidemiology and prevalence of education at well child visits.

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University of Rochester Medical Center

Possible conflicts of interest:
None

Disclosure of funding received:
None
Blinded Title Page

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Abstract

Objective: Pediatric burns are costly and traumatic injuries; however, increased education may reduce the prevalence. The purpose of this study was to determine pediatric primary care providers' awareness of the pervasiveness of pediatric burns and discern if specific education is done at office visits. Methods: Eighteen providers participated in an education session regarding pediatric burns and took a pre-test and post-test. Results were analyzed to determine if the education led to an increase in provider knowledge of burns as well as in increase in motivation to educate their patients. Results: The education session led to an increased awareness of burn causality, age group affected, and prevention strategies as well as an increased motivation to educate patients about burn prevention. Conclusion: Educating providers about burn prevention increases their knowledge of pediatric burns and their desire to provide burn prevention education. More research is needed to determine if education of primary care providers will result in a decrease in burn incidence.
Introduction

Childhood burns are devastating injuries which can lead to a lifetime of physical and emotional difficulties, social rejection, and decreased quality of life. Patients often face long and difficult recoveries and live with deformities, loss of function, and negative psychosocial consequences long into adulthood (World Health Organization [WHO], 2008). Furthermore, over 300 children are treated in emergency departments every day as a result of being burned, and more than 700 children die every year due to burn injuries in the United States (Center for Disease Control and Prevention [CDC], 2012). In addition, burns are the leading cause of unintentional death in the home for children (American Burn Association [ABA], 2011). Burns also place an economic burden on healthcare services in the United States. It is estimated that hospitalization costs for burn injuries range from $1,187 to $4,102 per admission (WHO, 2015). Children and families face additional costs for repeated hospitalizations and long-term rehabilitation.

Fortunately, burn injuries are highly preventable; therefore, it is important to establish the common factors leading up to burns to target where prevention education will be most beneficial. By enriching the knowledge and understanding of how these injuries happen, alternative solutions and prevention methods can be developed to decrease the prevalence and extent of these crippling injuries in children. A comprehensive literature review was completed to determine the epidemiology of pediatric burns internationally. Studies revealed most burn injuries occur in the home under parent supervision; therefore, the most effective means for reducing the prevalence of pediatric burns may be through increasing parents’ awareness of burn prevention (D’Souza et al., 2009; Fernandez et al., 2012; Kemp et al., 2014; Shah et al., 2011; Shields et al., 2008; Xin et al., 2006).
Parents receive child safety education during well-child visits from their child's primary care provider, but it is unknown whether pediatricians and advanced practice providers are educating caregivers about pediatric burn prevention. It is useful to ascertain whether pediatric providers are aware of the prevalence of pediatric burns and if they are currently educating their patients' families about pediatric burn prevention.

**Purpose**

The purpose of this study was to determine whether providers are aware of the common causes of burn injuries and common age groups affected, and if they are offering burn prevention education to their patients and families.

**Methods**

Data was obtained from the burn center database at University of Rochester Medical Center (URMC). Patients' ages and mechanism of burn injury were collected from the electronic medical record utilizing a retrospective chart review from July 1, 2015 through April 1, 2017. The information was inputted into graphs demonstrating the age group most frequently affected as well as the most common mechanism of injury. The results presented in the graphs demonstrated children birth to five were most frequently burned, and the most common mechanism of burn injury was due to scalding from hot food or beverage. The results from the literature review were consistent with the findings from URMC’s database which also demonstrated that children birth to five were most frequently burned (Alnabtabah et al., 2011; D'Souza et al., 2009; Kemp et al., 2014; Shah et al., 201; Shields et al., 2008; Spinks et al., 2008; Xin et al., 2006; Fernandez et al., 2012), and the most common cause of burns were due to scald injuries (Alnabtabah et al., 2011; Fernandez et al., 2012; Kemp et al., 2014; Shah et al., 2011; Spinks et al., 2008; Xin et al., 2006).
This information was compiled into a PowerPoint slideshow and presented in person to pediatric primary care providers in the Rochester area. Providers participated in a pre-test survey and a post-test survey (See Appendix A). The pre-test survey examined whether providers were aware of the age group most commonly burned, the most common mechanism of burn injury, where to target prevention education, and whether they currently educate their patients regarding burn prevention. The post-test was administered following the in-person education session. The purpose of the post-test was to determine whether there was evidence of learning in these areas, and if the education session motivated the providers to educate their patients about burns in the future.

Snowball sampling was used to recruit pediatric providers in the area to participate. Participants were identified by acquaintances who recruited future subjects to participate. The sample consisted of 18 pediatric primary care providers in Rochester, NY. Specialty providers and those who care exclusively for adult patients were excluded from the study.

The pre-test and post-test each consisted of four questions. The first three questions were knowledge based multiple choice questions. They asked providers to identify: (1) the most common mechanism of burn injury, (2) the most common age group affected by burns, and (3) best method of education for prevention. For each participant, a total score was calculated for questions one through three. A paired sample t-test was conducted to calculate the mean difference from pre-test to post-test. Question four on the pre-test asked if providers currently educate their patients, and question four on the post-test asked if providers plan to educate patients in the future as a result of the education they received. Descriptive statistics were calculated to show the distribution for question four on the pre-test and post-test. All analyses were conducted using SPSS version 24 (IBM SPSS 24, 2016).
Results

Table 1 shows the proportion of correct versus incorrect answers for questions one through three before and after the education session. For question one, 83% (n=15) of providers chose the correct answer on the pre-test, and 100% chose the correct answer on the post-test. For question two, 89% (n=16) of providers chose the correct answer on the pre-test, and 100% chose the correct answer on the post-test. For question three, 67% (n=12) of providers chose the correct answer on the pre-test, and 88.9% (n=16) chose the correct answer on the post-test.

Table 1

Pre-test and Post-test Results (Questions 1 – 3)

<table>
<thead>
<tr>
<th>Question 1: What is the most common mechanism of injury causing pediatric burns?</th>
<th>Question 1: What is the most common mechanism of injury causing pediatric burns?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct: 15 (83.3%)</td>
<td>Correct: 18 (100%)</td>
</tr>
<tr>
<td>Incorrect: 3 (16.7%)</td>
<td>Incorrect: 0 (0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2: What age group is most commonly affected by burns?</th>
<th>Question 2: What age group is most commonly affected by burns?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct: 16 (88.9%)</td>
<td>Correct: 18 (100%)</td>
</tr>
<tr>
<td>Incorrect: 2 (11.1%)</td>
<td>Incorrect: 0 (0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3: To decrease the most common cause of pediatric burns, education should be focused on _____?</th>
<th>Question 3: To decrease the most common cause of pediatric burns, education should be focused on _____?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct: 12 (66.7%)</td>
<td>Correct: 16 (88.9%)</td>
</tr>
<tr>
<td>Incorrect: 6 (33.3%)</td>
<td>Incorrect: 2 (11.1%)</td>
</tr>
</tbody>
</table>
For each participant, a total score was calculated for questions one through three. A paired samples t-test was used to calculate the mean difference from pre-test to post-test. There was a statistically significant difference in the score for pre-test (M = 79.6, SD = 25.9) and post-test (M = 96.3, SD 10.8) (t (17) = -2.70, p = 0.015), indicating a significant increase in knowledge. A paired samples t-test for mean difference between pre and post test scores ranged from 33.3 to 100% for questions one through three (Table 2).

Table 2

Scores Distribution for Pre-test/Post-test (Questions 1 – 3)

<table>
<thead>
<tr>
<th></th>
<th>N = 18 (100%)</th>
<th>N = 18 (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD):</td>
<td>79.6% (25.9)</td>
<td>Mean: 96.3 (10.8)</td>
</tr>
<tr>
<td>Median:</td>
<td>100%</td>
<td>Median: 100%</td>
</tr>
<tr>
<td>Mode:</td>
<td>100%</td>
<td>Mode: 100%</td>
</tr>
<tr>
<td>Min:</td>
<td>33.3%</td>
<td>Min: 66.7%</td>
</tr>
<tr>
<td>Max:</td>
<td>100%</td>
<td>Max: 100%</td>
</tr>
</tbody>
</table>

Question four on the pre-test inquired if providers currently educate their patients about burn prevention. On the post-test, question four asked if providers planned to educate patients about pediatric burn prevention as a result of the education session. All nine respondents who reported no to question four on the pre-test replied yes to question four on post-test. Of those who reported yes on the pre-test, all reported yes on the post-test. One respondent did not reply to question four of the post-test and was excluded from the results (Table 3).
Table 3

Provider Response to Educating Patients about Burn Prevention (Question 4)

<table>
<thead>
<tr>
<th>N = 18 (100%)</th>
<th>N = 17 (94.4%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-test</strong></td>
<td><strong>Post-test</strong></td>
</tr>
<tr>
<td>Question 4: Do you educate your patients about pediatric burn prevention?</td>
<td>Question 4: Will you educate your patients about pediatric burns in the future because of the education you received today?</td>
</tr>
<tr>
<td>Yes: 9 (50%)</td>
<td>Yes: 17 (100%)</td>
</tr>
<tr>
<td>No: 9 (50%)</td>
<td>No: 0 (0%)</td>
</tr>
</tbody>
</table>

*missing data – one respondent did not reply to question four post-test and was excluded

Discussion

The purpose of the current study was to determine provider knowledge of pediatric burns and discern if providers are educating their patients about pediatric burn prevention. The study indicated that some providers are unaware of pediatric burn etiology. The results also provided evidence that the intervention successfully increased knowledge in burn prevention, indicating that this method is an appropriate teaching strategy. In addition, only half of providers reported that they currently educate their patients and families about pediatric burn prevention. However, all participants who responded reported intent to educate their patients about pediatric burn prevention in the future as a result of the education session. This suggests that participation in the study led to an increase in providers’ motivation to educate their patients about pediatric burns.

Burns are devastating injuries, and they are largely preventable. Primary care providers offer safety prevention education to their patients in hopes to prevent injury, disability, and death. It may be beneficial to incorporate pediatric burn prevention education as part of well
child visits in order to decrease these injuries in children. More information is needed to
determine whether an increase in burn prevention education from the primary care provider will
lead to a decrease in the occurrence of burns.

Limitations

The small sample size may be seen as a limitation of this study. In addition, the
credentials and background experience of the providers were not collected. Therefore, it is
unknown whether answers from the survey were influenced by provider education or experience.

Acknowledgments

The author of this study would like to thank the colleagues at the University of Rochester
Medical Center, St. John Fisher College, and to Susan Frederick and Dr. Heather McGrane
Minton for their assistance.
References


Characteristics of 1494 pediatric burn patients in Shanghai. *Burns, 32*(5), 613-618.
Appendix A

Pretest

What is the most common mechanism of injury causing pediatric burns?

a.) Contact burns  
b.) Flame  
c.) Scald (bathtub injuries)  
d.) Scald (hot food/beverages)

What age group is most commonly affected by burns?

a.) 0-5 years  
b.) 6-11 years  
c.) 12-18 years

To decrease the most common cause of pediatric burns, education should be focused on ________?

a.) Appropriate water heater temperature and bath time safety  
b.) Keeping hot food/beverages out of reach of young children  
c.) Talking to parents of teenagers about fire safety  
d.) Talking to parents of school age children about safe food handling  
e.) Talking to parents of toddlers about prevention of contact with hot surfaces

Do you educate your patients about pediatric burn prevention?

a.) Yes  
b.) No

Posttest:

What is the most common mechanism of injury causing pediatric burns?

e.) Contact burns  
f.) Flame  
g.) Scald (bathtub injuries)  
h.) Scald (hot food/beverages)

What age group is most commonly affected by burns?

d.) 0-5 years  
e.) 6-11 years  
f.) 12-18 years

To decrease the most common cause of pediatric burns, education should be focused on ________?
f.) Appropriate water heater temperature and bath time safety

g.) Keeping hot food/beverages out of reach of young children

h.) Talking to parents of teenagers about fire safety

i.) Talking to parents of school age children about safe food handling

j.) Talking to parents of toddlers about prevention of contact with hot surfaces

Will you educate your patients about pediatric burns in the future because of the education you received today?

a.) Yes

b.)

c.) No
Pediatric burn prevention: Determining provider knowledge of pediatric burn epidemiology and education at well child visits.

Introduction: The impact of childhood burns

- Childhood burns are devastating injuries
- Long and difficult recoveries
- Pretermtizes and loss of function
- Negative psychological consequences
- Fire and burns are the leading cause of unintentional death in the home
- Responsible for more than 2 deaths/day
- Economic burden on healthcare services in the United States

American Burn Association, 2011; Centers for Disease Control and Prevention, 2012

Introduction

- Burn injuries are PREVENTABLE
- Important to understand the epidemiology of burns when developing effective prevention strategies
- Majority of burns occur under parental supervision
- May be most beneficial to focus education on parents
- Empowering pediatricians and APPs to educate parents may be an effective strategy

D'Souza et al., 2009; Kemp et al., 2014; Sikes et al., 2008; Fernández et al., 2012; Shah et al., 2011

Purpose

- The purpose of this study was to determine
  - If providers are aware of the common causes of burns and common age groups affected
  - If providers are currently educating their patients and families about burn prevention
  - If providing education to providers on burn prevalence would cause an intentional change of practice in education of burns

Methods

- Comprehensive literature review was completed:
  - Children ages 0–5 most commonly burned
  - Most common mechanism of burn injury was scald
  - Retrospective chart review from URMC burn database July 1, 2015 to April 11, 2017
    - Children ages 0–5 most commonly burned
    - Most common mechanism of burn injury was scald

D'Souza et al., 2009; Kemp et al., 2014; Amatuzzio et al., 2011; Spinks et al., 2008; Sikes et al., 2008; Fernández et al., 2013; Shah et al., 2011

Methods

- Information was compiled into a PowerPoint presentation and disseminated to pediatric primary care providers in Kentucky
  - Discussed the impact of pediatric burns
  - The epidemiology of burns (age group, mechanism of injury)
  - Most appropriate education strategies for reducing burn incidence
  - Providers participated in a pre-test and a post-test
Methods

- Snowball sampling
- The sample of pediatric providers were provided with a questionnaire.
- A paired sample t-test was conducted to determine if the mean difference between pre-test and post-test scores was significant.
- All participants were compensated with $25 for their participation.

Results

- There was a statistically significant difference in the scores for pre-test (M = 76.2, SD = 35.9) and post-test (M = 96.3, SD = 10.4), t(152) = 2.42, p < 0.05, indicating a significant increase in knowledge.
- A paired sample t-test for mean difference between pre- and post-test scores ranged from 33.3 to 100% for questions 1 through 5.

Discussion

- Purpose: Determine provider knowledge of pediatric burn and extent of education they provide to their patients.
- Results:
  - Some providers are aware of pediatric burn etiology.
  - The intervention appears to be an effective teaching strategy as the intervention successfully increased provider knowledge.
- All providers who responded to the survey reported they intend to educate their patients as a result of the education session.
Discussion

- It may be beneficial to incorporate pediatic perinatal education as part of well-child visits in order to decrease these ongoing injuries in children.
- More information is needed to determine whether an increase in birth prevention education from the primary care provider will lead to a decrease in the age group of injury.

Limitations

- Small sample size
- Characteristics and background experience of respondents were not assessed/analysed. It is unknown whether survey responses were influenced by provider education or experience.

Acknowledgements

- IANMC
- St. John Fisher College
- Susan Perdew and Dr. Heather McGrane Winfield

References

- [List of references provided here]
<table>
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<tr>
<th>Citation</th>
<th>Xin, W., Yin, Z., Qin, Z., Jian, L., Tanuseputro, P., Gomez, M., ... Zhenjiang, L. (2006). Characteristics of 1494 pediatric burn patients in Shanghai. <em>Burns</em>, 32(5), 613-618.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>The purpose of the study is to analyze the epidemiological characteristics of pediatric burn patients in Shanghai in order to determine the targets for a pediatric burn prevention program.</td>
</tr>
<tr>
<td>#subjects</td>
<td>The sample size included 1,494 patients admitted to the hospital between the years of study.</td>
</tr>
<tr>
<td>Sample Characteristics</td>
<td>46% of patients were from the migrant population (non-registered temporary workers from rural areas outside of Shanghai). 63.3% of patients were aged 0 – 3 years. 905 were males, and 589 were female.</td>
</tr>
<tr>
<td>Yr. Data Collected</td>
<td>Data was collected between January 1980 and December 2002.</td>
</tr>
<tr>
<td>Study Design</td>
<td>A retrospective review of all medical records of pediatric burn patients (14 years old and younger) admitted to the Burn Center of the Ruijin Hospital was performed. Patient demographics, etiology of burn, mechanism of injury, extent and anatomical areas burned, number of operations, and length of stay (LOS) were recorded. The Chinese burn association categorize the severity of pediatric burns as mild, moderate, extensive, and critical based on % TBSA burned.</td>
</tr>
<tr>
<td>Data Collection Method</td>
<td>Information was entered into a database established by an author of this study.</td>
</tr>
<tr>
<td>Data Analysis Method</td>
<td>Student’s t-test and the Chi-square test was performed with SAS software for statistical analysis. Figures were expressed as averages using standard deviation and ranges.</td>
</tr>
<tr>
<td>Results</td>
<td>A total of 1,494 patients were admitted. Six hundred eighty-seven patients (46%) were from the migrant population. The main cause of pediatric burns among age groups was scalding. Scalding caused 84.3% of all pediatric burns. 91.2% of burns in the 0 – 3 age group were from scalds, whereas 63.8% of burns were due to scalds in the 7 – 14 age group. Children in the 0 – 3 age group were the most common victims of scalding, chemical burns, and contact burns. Flames were the most common cause of severe pediatric burns. 1,293 cases occurred in the home. The median TBSA was 4% for mild</td>
</tr>
</tbody>
</table>
burns, 10% for moderate burns, and 18% for extensive burns. The most common anatomical locations were head, neck, trunk, and right lower limb. The mean hospital stay was 16.1 days. There were 1.1% deaths (17 patients), mostly occurring from sepsis. The majority of patients were migrant children. The average age was 3.5 with a range of 4 days to 14 years. Males had a higher rate of admission than females. The highest incidence was in the 0 to 3 age group (63.3%). Most pediatric burn wounds healed without surgery (55.4%). Wounds were dressed with silver sulfadiazine Vaseline gauze and dressings were changed every 1 to 2 days. 44.6% required surgery, and 15.5% required 2 or more operations. Patients aged 7 to 14 required more operations and had increased LOS than other age groups.

**Implications**

Burn injuries have dropped 35.7% from the beginning of the study to the conclusion of the study. Most burns occurred in the domestic setting. The study reveals children from the migrant population have a disproportionately higher rate of burn injuries. Injury prevention campaigns should focus on the migrant population, temperature regulation of the water to avoid scald burns, and other potential hazards of the home environment in order to prevent the common causes of burn injuries.

**Strengths/Weaknesses**

The weaknesses of the article pertain to the fact that the study was performed in one city in China and may not necessarily be representative of all pediatric burn patients. The area of study had a large migrant population at increased risk for burns due to poor conditions and close proximity to dangerous work sites. Therefore, their data was reflective of this specific population. In addition, patients with burns considered to be lethal were excluded from this study. The strengths of the study include a large sample size of 1,494 patients over an extensive period of time (23 years).

**Literature Review**

**Topic: Epidemiology of Pediatric Burns**
| Purpose | The purpose of this study is to characterize the clinical and epidemiologic profile of children and adolescents who have suffered burn injuries and are admitted to a referral hospital in Joao Pessoa from January 2007 to December 2009. |
| #subjects | 289 patients were admitted to the burn care unit between 2007 and 2009. |
| Sample Characteristics | 37% of patients were infants, 33.2% were preschoolers, 13.5% were in elementary school, and 16.3% were adolescents. The majority of patients in this sample were boys (54%) and 55% came from the interior of the state. |
| Yr. Data Collected | Data was collected between July 2008 and December 2010. |
| Study Design | The study is a quantitative, retrospective study based on data from the Medical Record System and Statistics (SAME) at a public referral hospital for burn injuries. The inclusion criteria included medical records of children and adolescents of males and females with the diagnosis of burn injuries. Those who were excluded were those whose legal guardians had left against medical advice or treatment dropouts. Data was transcribed on a form divided in to three parts (demographic data, characteristics of burn injury, and deaths). |
| Data Collection Method | Data was collected from the medical records of children aged 0 to 19 years admitted to the Burn Care Unit (BCU) from January 2007 to December 2009, totally 289 medical records. |
| Data Analysis Method | Excel 2007 was utilized to analyze data. The results were presented by means of descriptive statistics and the variables were organized in tables by the distribution of absolute, relative, mean frequency and standard deviation. |
| Results | Most patients were infants (37%) to preschool age (33.2%) 13.5% were elementary schoolers, and 16.3% were adolescents. 54% were boys. The average length of stay was 5.87 days. The month of June had the highest number of incidents (22.4%), followed by March and February. 85.5% of |
burns occurred in the home environment. 90% were considered accidents, 1% was considered maltreatment, and 9% were not possible to identify due to lack of information. 69.6% of burn injuries occurred from contact with hot liquid. The second most frequent cause of injury was flame (14.9%). Burn injuries caused by heated surface made up 8.7% of the sample, 3.8% were due to electrical burns, and 1.7% of burn injuries were due to chemical substances. The most affected areas of the body were trunk and upper and lower limbs. 62.6% of burns were second degree. 24.2% of children developed complications. Secondary infection was the most common complication. Dehydration, necrosis, septic shock, and cardiac arrest were among other complications. A total of 5 deaths occurred during the timeframe of study.

<table>
<thead>
<tr>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>The circumstances of the most common burn injuries described in the study resulted from accidental causes in the home environment. Moreover, scald burns are the most frequent agents of burn injury. Due to physical and emotional complications, there is a need for preventative measures of burn injury. The authors explain that further research is necessary to indicate the prevalence and cause of burns in order to propose effective interventions for at risk populations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strengths/Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>The authors identify that there was information lacking in patient medical records that prevented them from further analysis. Omission of information may have resulted in underreporting and cases. The information was obtained over a 3 year period of time, but made up a small sample size. The study used convenience sampling from one hospital in Brazil, and is not necessarily representative of all pediatric burn patients.</td>
</tr>
</tbody>
</table>

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**Literature Review**

**Topic: Epidemiology of Pediatric Burns**
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>The purpose of this study is to examine epidemiological patterns and outcomes for pediatric burns presenting to an inner city Emergency Department (ED).</td>
</tr>
<tr>
<td>#subjects</td>
<td>During the 12-month period of study, 208 children between the ages of 0 and 16 presented to the ED with burns.</td>
</tr>
<tr>
<td>Sample Characteristics</td>
<td>All pediatric burns presenting to the ED during the period of study were included in the sample. Age ranged from 6 months to 16 years. The average age was 5, and more than half of patients were less than 3. 65% of the patients were boys, 50% were Asian, 47% were white, 2% were black, and 1% were &quot;other.&quot;</td>
</tr>
<tr>
<td>Yr. Data Collected</td>
<td>Data was collected between March 2003 to February 2004.</td>
</tr>
<tr>
<td>Study Design</td>
<td>For a 12-month time period, researchers collected information from all children aged 0-16 presenting to the Bradford Royal Infirmary (BRI) for burns. The ED registration computer system was monitored every day to ensure all children presenting with burns were registered in the system. Inpatient notes were utilized to complete data forms.</td>
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<tr>
<td>Data Collection Method</td>
<td>A burn registry data form was created for all patients. Either the physician or the nurse caring for the patient completed the form. All healthcare providers received prior training to assess the burns.</td>
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<td>Data Analysis Method</td>
<td>No information</td>
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<tr>
<td>Results</td>
<td>208 children presented to the ED during the year of study. There was an increase in burns during fall and winter months with the peak month being November. 55% of children presented to the ED within the hour of injury. 13% of children presented between 1-2 hours, 5% between 2 and 3 hours, and 9% presented after 24 hours of injury.</td>
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</table>
The age ranged from 6 months to 16 years. The average age was 5 years. More than half of burns occurred in children less than 3 years old. The largest group of children was one year olds. 65% of the patients were boys. 50% were Asian, 47% were white, 2% were black, and 1% was “other.”
97% of burns were considered accidents, 2% were assaults, and 1% was due to non-accidental injury. Scalds accounted for 51% of burns. 11% were flame/explosive injuries. Irons accounted for the most common cause of contact burns (24 cases), and 18 of those cases were among the Asian minority population.
1/3rd of children received no first aid before coming to the hospital. Cold water was applied in 50% of the cases. A dressing was applied in 5% of cases, toothpaste was applied in 4% of cases. Toothpaste was applied exclusively in the Asian population. 13% of patients were given pain medication, 87% received no pain medication.
The TBSA ranged from 0.1 to 23, with the average at 1.8%. 89% were considered partial thickness, 1% was full thickness, and 9% were both. 6% (11 patients) had erythema only. Most burns involved the upper limbs. 41% involved the wrist and hand, 18% involved other parts of upper limb, 9% involved multiple sites, 17% involved lower limb, 8% involved the trunk, and 7% involved the head and neck. 5% were discharged from the ED with no follow-up. 23% were sent to PCP for follow up. 58% were to return to the burn clinic. 4 patients were referred to the plastic surgery dressing clinic, none of which required surgery. 14 patients (7%) were admitted to the plastic surgery ward, and only one of these patients required surgery with grafting. Six patients required transfer to the regional burn center.

Implications

The authors believe the results of this study are important for understanding where to target burn prevention programs. They also believe it is important to track outcome data. 85% of children who presented to the ED were treated and then discharged. This study stresses the important of high quality initial assessment and treatment with appropriate follow-up and referrals. The outcome analysis showed that of the patients discharged with no follow up or follow-up by PCP, none (as of yet) presented back to ED, plastic surgery office, or burn center for up to 28 months after injury. The 4 patients who were referred to the plastic surgery clinic did not need surgical intervention. Only one patient required skin grafting. Five out of the 6 patients who were referred to the burn center...
went on to have grafting; therefore, the authors believe the ED did an appropriate job of making referrals to the center. 38% of patients were under 2 years old with the average age being 5. More males were burned than females. There was a large Asian populations presenting with burn injuries. This may be attributed to the high population in the metropolitan area being studied, the large family size, lack of education, and different cultural practices. Hot irons accounted for 18 of 39 burns in the Asian group.

Scald injuries were most common. 51% were caused by hot liquids (water, tea, and coffee were most common). 14% occurred in the bathroom. The authors believe prevention education should include reducing the temperature of hot water heaters, and handing and preparing drinks in the kitchen. The authors state that first aid treatment and pain medication administration prior to presenting at the hospital was suboptimal. Only half of children had cold water applied prior to arrival, implying the need for first aid education. The authors explain that young children and minorities should be targeted for prevention education. In addition to education regarding scald burns, education regarding use of irons should also be implemented as well as first aid treatment of burns.

| Strengths/Weaknesses | This study was completed in a metropolitan area in the UK and may not necessarily be representative of all pediatric burn patients. In addition, this area has a large Asian population with cultural practices that may be attributed to an increased rate of burns in the area. Data was collected in an ED setting and did not include patients seen at their PCP or other medical centers. Another weakness was that this study did not include information regarding data analysis. One strength of this study was that the authors included all pediatric burns that presented to the facility for a year and audited charts weekly to ensure all data was entered appropriately. |

Literature Review

Topic: Epidemiology of burns in pediatrics
| Purpose | The purpose of this study was to investigate the epidemiology of pediatric burn injuries in United States emergency departments between 1990 and 2006. This study analyzed causative agents of burn injuries and other contributing factors along with patient demographics with the intention of revealing trends or patterns of burn injuries. The authors believe this is the first study which examines patterns of burn injuries in children, and perceive this information to be essential in order to target prevention education to vulnerable populations. |
| #subjects | The data in this article is a national estimate based on weighted data from 62,168 patients less than 20 years old who were treated for burns in US Emergency Departments from 1990 through 2006. An estimated 2,054,563 patients less than 20 years old were treated in Emergency Departments in the United States for burn related injuries during this time period. The data excludes subjects who were treated for burns in medical facilities other than Emergency Departments, patients greater than 20 years old, and those who suffered fatalities from burn injuries. |
| Sample Characteristics | Patient characteristics were broken down into age, gender, diagnosis, body part injured, disposition, locale (setting of burn injury), and consumer product involvement. More than half of the sample consisted of male patients who were less than 6 years old. 41% of patients were female. 26% of patients were between the ages of 6 and 15, and 16% of patients were 16 to 20 years old. |
| Study Design | This was a quantitative study. Data was obtained through the National Electronic Injury Surveillance System (NEISS), which is operated by the US Consumer Product Safety Commission. The NEISS receives data from a network of 100 hospitals, and using stratified probability sampling, represents data from 6,100 hospitals. This network includes rural, suburban, and urban hospitals. The estimates for this study were based on data from 62,168 patients less than 20 years old who presented to EDs in the US for burns. |
**Data Collection Method**

NEISS coders recorded data from Emergency Department (ED) medical charts including patients' age, race, gender, injury, locale, products involved, body parts injured, and disposition from the ED. The US Census Bureau data was used to calculate injury rates per 10,000 people less than 20 years old. All injuries recorded in NEISS were coded by numbers to represent the cause of burn (code 48: scald, code 51: thermal, code 49 chemical, etc.). Patients were categorized based on age group (less than 6 years old, 6-10, 11-15, and 16-20 years old). Body parts were also sorted into groups such as lower arm, head and face, hand and finger, foot and toe, lower leg, etc. Consumer products were identified and categorized into kitchen items, electrical appliances, bath related, chemicals, fuels, heaters, fireworks, electrical wiring, toys, and clothing. Locale, or location the burn occurred, and gender were also recorded. Disposition included whether the patient was admitted to the hospital, treated and discharged, or discharged from the ED without treatment (left AMA). A narrative of how the incident occurred was also recorded.

**Data Analysis Method**

Data was analyzed using SPSS 14.0. The Consumer Product Safety Commission used inverse probability weighting to assign weight to each case. Relative Risk (RR) with a 95% Confidence Interval (CI) was computed to represent data from 62,168 people.

**Results**

From 1990 to 2006, an estimated 2,054, 563 patients less than 20 years old were treated for burn related injuries. 58% of cases were boys. Children less than 6 years old sustained 57.7% of all injuries. 59.5% of burns were sustained from thermal injury (flames or hot surfaces). 25.5% occurred from scald injuries. More than half of scald injuries occurred from bath water. Radiation burns were 10 times more likely to affect patients 16 to 20 years old, and most radiation burns were caused by sunburn. Boys were 3.3 times more likely to sustain radiation burns than girls. 91.7% of injuries occurred in the home, and 7.5% occurred at schools or other public property. Adolescents were 3.2 times more likely to suffer burn injuries at school, sports centers, or other public places. Chemicals and kitchen appliances were the most common causes of burns in sports facilities and schools. Kitchen and other household electrical appliances were accountable for 53.5% of all burn injuries for all ages. However, children less than 6 years old were more likely to suffer burn injuries from kitchen and other electrical appliances in the home than children from other age groups. The hand and the finger were
most commonly injured (36%), followed by the head and face (21%). 6.1% of patients were hospitalized, and scald burns were 2.5 times more likely require hospital admission than other types of burn injuries.

Implications

The authors believe this study is the first to examine trends in burn injuries among children and adolescents on a national level. This study reveals that burn injuries most often occur among boys less than 6 years old. They suggest that the increased rate of burn incidence in younger children may be attributed to the fact that children have thinner skin, increasing their risk for burn injuries even when exposure time is limited. Thermal burns are the most common type of burn in all age groups; however, scald burns are more common among young children and twice as likely to cause hospitalization. Tap water, a common source of scald injury, can cause burns in less than 30 seconds at temperatures greater than 120°F. Therefore, it is important to educate families with young children to set their water heaters to lower temperatures to reduce scald injury. Using the information from the study that burns are most likely to occur in the home from baths and kitchen appliances, parents should be educated to prevent their children from preparing their own hot drinks, and running their own baths. This study found that adolescents were 3.2 times more likely to suffer burns from schools and sports facilities compared to young children. Therefore, this information could be used to educate faculty at schools and sports centers on burn prevention and safety in the teenage population. This study found that sunburn occurred more often in adolescents, implying that teens may benefit from education about sunburn prevention. Parents should remind their teenagers to use sunscreen to protect their skin. It is reported in this study that many burns occur in the home around kitchen appliances, and scald injuries occurring in the kitchen are common among young children. Children may sustain injuries from pulling handles or cords if they are not closely supervised. As a result, parents may require education of how to safely utilize kitchen equipment out of reach of children, and prevent children from playing unattended in the kitchen during food preparation. Primary care providers should inform parents about appropriate water heater temperatures, use of kitchen appliances around children, and use of sunscreen. Educational programs regarding burn prevention should be targeted to families with children less than 6 years old.
| Strengths/Weaknesses | The total number of burn injuries in the US was most likely underestimated by this study. The NEISS sampling only captured burn related injuries treated in EDs; therefore, excluded injuries treated by urgent cares, doctor’s offices, or other sources. This study also did not include burn fatalities. In addition, it is not realistic to sample all EDs in the US; therefore, the data in this study is based on estimates from a smaller sample size. Strengths of this study consist of the large, nationally representative sample. In addition, this study occurred over a 17 year period of time, allowing for a wide range of burn injuries to be captured. |

**Literature Review**

**Topic: Epidemiology of Pediatric Burns**
| Purpose | The purpose of this study is to analyze the epidemiology of pediatric burns in south central China, examine the differences between the rural and urban areas, and discover prevention methods to reduce burns in children. The authors believe it is important to understand the causes of burns in order to develop prevention methods. In addition, they aim to discover if there are differences in outcomes among urban and rural patients, and the reasons for any disparities in order to develop relevant prevention methods. |
| #subjects | 676 patients were hospitalized for burns during the three years of study. Ultimately, 278 were pediatric patients aged 0 to 16 who were included in the study. |
| Sample Characteristics | The age range of the sample was from 13 days to 16 years. 67% were males and 32% were females. The ratio of rural to urban residents was 2.12. The majority of patients in both the rural and urban groups were aged 1-3. |
| Yr. Data Collected | Data was collected between January 1, 2010 and December 31, 2012. |
| Study Design | This was a retrospective study. All data was collected from the burn unit at Xiangya Hospital (one of the largest burn centers in south central China). Medical records were reviewed and included all pediatric patients admitted to the hospital between 1/1/2010 and 12/31/2012. Patients were divided into urban groups (living in a city or town) and rural groups (living in countryside, migrant workers’ children). Data analyzed included age, gender, residential area, cause, first-aid treatment, location of occurrence, anatomical location, extent of burn, date of injury, number of surgeries, complications, length of stay (LOS), and cost. |
| Data Collection Method | Data was collected from electronic medical records during the years of study. |
Data Analysis Method

A descriptive analysis was performed. Pearson’s X² test was used to study differences in gender ratios, first aid treatments, cure rates, surgery rates, and complication rates between the rural and urban groups. The Mann-Whitney U-test was used to examine differences in LOS and cost between the two groups. Statistical analysis was conducted with SPSS version 17.0 for Windows. P <0.05 was considered statistically significant.

Results

278 children under 17 years old were hospitalized for burns during the three-year study. 67.27% were male, 32.73% were female. The ratio of rural to urban residents was 2.12. Most patients were aged 1-3 years.

Among patients from rural areas, 52 of 189 (27.51%) used cold water as first aid treatment. 36 of 89 or 40.45% of rural patients had been treated with cold water after their burn. Other first aid treatments included wine, animal oil, soy sauce, toothpaste, or no treatment at all. 48.68% of rural patients received no treatment at all, and 23.81% of rural patients received incorrect treatments. 39.33% of urban patients received no treatment at all, and 20.22% of urban patients received incorrect treatment.

53.24% of burns occurred in the living room, 16.19% occurred outdoors, 10.79% occurred in the dining room. Scalds were the most common mechanism of action. Boiling water, hot soup, and hot milk caused the majority of scald burns. 174 patients (62.59%) of patients were burned by hot fluid. The second most common cause of burn was flame (49 patients, 17.63%). Most flame burns were caused by stoves used for warmth. 9.71% were caused by fireworks, 5.76% were caused by electricity. Chemicals burns attributed for 4.32% or 12 patients. No difference was detected in etiology among rural and urban patients.

Burn incidence peaked in January and February (coldest season), and again in July and August.

The upper extremities were the most commonly affected areas in both rural and urban patients (52.24%, 148 patients). 133 patients had injuries involving the head and neck (47.84%), 128 patients had injuries to their trunk (46.04%), and 111 patients had injuries to their lower extremities (39.93%). 29 patients had injuries to their genital area (10.43%). 61.51% of patients had multiple injury sites (171).

154 patients had a TBSA of less than 10%, 91 patients had a TBSA between 10% and 29%, 25 patients had a TBSA between 30% and 49%, and eight patients had burns with a
<table>
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<th>Implications</th>
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<td>Pediatric patients comprised 43% of all burn admissions. The amount of children from rural areas was almost double that of children from urban areas which may be attributed to poor living conditions or lack of education and safety awareness. Boys incurred burn injuries much more than girls which may be attributed to the higher birth rate of boys in China, or that boys tend to be more active than girls. Children aged 1-3 had the highest incidence of burns. The authors speculate this may be due to the fact they children this age are just learning to walk, are curious about their environment, and have no awareness of hazardous situations. First aid treatment at home is important in reducing burn damage. Urban patients received more treatment before hospitalization which may be due to the increased education level. This study suggests that the community may benefit from education regarding first aid burn treatment. Many patients were burned in the living or dining rooms which may be because the kitchen, living room, and dining room are not separate in some Chinese homes. Scalding was the most common cause of burns. This study had a higher rate of firework burns than other studies which may be because a large number of fireworks are produced in China with little quality control. Burns may be highest in winter and summer months in China because people are trying to keep warm with furnaces. There is also a festival with many fireworks this time of year. More rural patients needed surgery, and more rural patients suffered complications and delayed hospitalization. Rural patients were hospitalized longer at a greater cost. Overall, the study found that boys, less than three years of age, from rural areas were most vulnerable to burns. Scalding was most common, and burns most commonly occurred in the home, and in winter months. This information may be used to prevent burns and raise awareness about first aid treatment, especially in rural communities. This information can be used to raise awareness about the importance of improving living conditions and education for children in rural areas.</td>
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<td>TBSA of greater than 50%. There was no difference between the rural and urban populations. 110 of 278 underwent surgery. Children from rural areas were more likely to undergo surgery. Complications included inhalation injury, infection, sepsis, bone or tendon exposure, and amputation. The average length of stay was 15 days for rural patients and 12 days for urban patients. The median cost for urban patients was $1,547, and $2,139 for rural patients.</td>
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conditions in rural areas, promoting first aid knowledge, and increasing education about infant and child supervision.

| Strengths/Weaknesses | This study which was conducted over a three-year period of time, had a large sample, and gave us a lot of information regarding burn injuries. The authors also compared and contrasted information from two different populations within the sample in order to gain a better understanding of risk factors. This study had some limitations. The authors explain that the birth rate of boys in China is higher than girls; therefore, the gender differences may not be representative of all burn populations. In addition, China has a large population of migrant workers living in poor conditions in rural communities. The authors explain that many children from rural areas are raised by the grandparents and often lack appropriate supervision. This study, conducted in south central China, may not necessarily be representative of all pediatric burn patients. |

Topic: Epidemiology of burns in pediatrics
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<td>Purpose</td>
<td>The purpose of this study was to evaluate the epidemiology and outcomes of pediatric burns in the region of North Texas of a 35-year period of time.</td>
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<tr>
<td>#subjects</td>
<td>5,959 patients who were 18 years old or younger were admitted to the Parkland Burn center over the course of 35 years.</td>
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<td>Sample Characteristics</td>
<td>42% of the patients were Caucasian, 31% were Hispanic, 24% were African American, and 3% were “other.” 33.8% of patients were female.</td>
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<tr>
<td>Yr. Data Collected</td>
<td>Data was collected between January 1974 and August 2010.</td>
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<tr>
<td>Study Design</td>
<td>The institutional burn database contains information from the 35 years of study. Researchers retrospectively reviewed the data. Patients 18 and older were excluded from the study. All patients aged 18 years and younger who were admitted to the Parkland Burn Center were included in this study. Patient gender, race, age, Texas resident status, mechanism of injury, TBSA, length of stay (LOS), CPS referral, discharge and mortality information was included. Census data was obtained from the Texas Department of State Health Services. Incidence of burn was calculated per 100,000 Texas residents.</td>
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<td>Data Collection Method</td>
<td>Data was collected from the institutional burn database and entered into Microsoft Excel (2010).</td>
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<td>Data Analysis Method</td>
<td>The revised Baux score was used to compare outcomes over the 35 years of study. Chi-square, ANOVA, linear regression, and multivariable logistic regression was used where appropriate. Systat Sigma Plot (12.5), and SPSS PASW Statistics (17) were used to analyze data.</td>
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<td>Results</td>
<td>98.6% of patients were residents of Texas. Burn incidence peaked in 1979 and has been declining since the 80s. Burn size and LOS has also been decreasing. Short stay admissions (1-2 days) increased from 10% of admissions to 50% of admissions. Electrical injuries decreased overtime. Inhalation injury was seen in 177 children and was always associated</td>
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with flame. 42% of patients were Caucasian, 31% were Hispanic, 24% were African America, and 3% were other. The amount of Hispanic children admitted increased 0.5% per year since 1990, but overall, the incidence of injuries in the Hispanic population has decreased over the 35 year period. The incidence of burn injuries in African Americans has also decreased over the 35 year period.

One third of the patients were female, with no change over the 35 years studied. Boys were more likely to incur injury due to electricity or flame. Scald injuries were 1.5 times more common in boys than girls. The average age did not vary over time. Older children were more likely to sustain injury due to flame or electricity, whereas younger children more frequently incurred scald injuries. The average age of children with scald injuries was 1.7, and the average age of children with contact injuries was 1.6.

78% of suspected abuse cases were due to scald mechanism, 11% were due to flame, and 7% were due to contact. Children with suspected non-accidental trauma had a higher percentage of mortality.

There were 163 deaths. Early deaths were due to shock or respiratory failure, whereas later deaths were primarily due to sepsis or pulmonary complications.

Implications

The authors believe the decreasing incidence of burns may be attributed to education programs in the community or improved standards of safety. There has also been a decreased incidence of burns in the Hispanic and African American populations, as well as a decrease in the size, LOS, and TBSA.

The authors believe this may be attributed to more aggressive outpatient therapies. The authors report the most common cause of admission among the pediatric population was scald, followed by flame and contact, with no change overtime. They explained that scalds were more common in younger children whereas flame was more common in older children. Contact burns and scalds were associated with a lower rate of mortality, whereas intentional burns were correlated with a higher mortality risk. Overall, the mortality rate was low (2.5%) with a decrease in mortality overtime. This information may be utilized to develop prevention programs within the community.

Strengths/Weaknesses

The data from this study was obtained from one hospital in Texas and may not represent the large pediatric burn population. In addition, data was taken from an in-patient burn center and did not include patients seen in the Emergency
Department or managed on an outpatient basis. The authors explain that the possible decline in burn rates could be attributed to a greater increase in outpatient management throughout the years of study. The strength of this study is that it was completed over a 35 year time period and includes a large representative sample.

Literature Review

Topic: Epidemiology of Pediatric Burns
| Purpose | The purpose of this study is to examine the epidemiology of pediatric burns overtime by studying injuries over a 15-year time period. The goal of this study is to look at trends in intervals and explore the extent of how certain characteristics are related to admissions. The authors believe this research is important in order to prioritize prevention efforts. |
| #subjects | During the 15 years of study, 9,438 children presented to Red Cross War Memorial Children’s Hospital (RCH) with a burn injury. |
| Sample Characteristics | 58% of the sample was male. The mean age was 3.1. 80% of injuries occurred in children between the ages of 0 to 4. More than one third of the sample was 12 months old. The study only included children less than 13 years of age. |
| Study Design | This was a quantitative study that utilized retrospective analysis. Childsafe South Africa is an organization that records all childhood injuries that present to RCH. Data that was collected included age, gender, cause of injury, location of occurrence, severity of injury, and disposition from the emergency department (ED). Etiology of burn was categorized as scald, flame, contact, chemical, electrical, explosion, and other. Severity of injury was classified using the abbreviated injury score (AIS) which uses mild, moderate, severe and death to categorize severity of burns. Disposition was described in terms of admission to the hospital, discharge from the ED, or fatality. |
| Data Collection Method | Collectors from Childsafe collected data on all children presenting with burn injuries to RCH from January 1995 to December 2009 using the trauma surveillance system. |
| Data Analysis Method | Data was entered into a Microsoft Access database. Data was analyzed using STATA 11.0. Descriptive analyses were performed to analyze demographic data and mechanism of injury data. The Chi Square test was used to assess differences |
for dichotomous variables, the t-test was used to assess differences of continuous variables. Age was analyzed in intervals (0-4, 5-9, 11-12), and in one year intervals. To determine annual incidence of injuries, the South African census data was used. Poisson regression models were used to analyze trends in burn injuries over the 15 years of study. The p value was set at less than 0.5 to signify significance. Logistic regression was used to describe factors associated with admission (age, gender, AIS score, cause, and anatomical location of burn). Three regression models (model A, model B, and model C), were created from the data set to estimate trends. The authors used the Akaike Information Criterion (AIC) to compare the goodness of fit of competing predictive models, then they chose the model with the lowest AIC score. This is how they chose the model with the best differentiation.

**Results**

58% of the children were male. The mean age was 3.1. 80% of burns occurred in children aged 0-4. 1/3 of children were one year olds. Boys were 1.39 times more likely to suffer a burn than girls.

The majority of burns were moderate in severity (68%). 39% of burns were minor, 5% were severe. There were 11 deaths, 9 of which were related to flame. 90% of burns occurred in the home. 0.4% of burns occurred at school.

3/4 of burn injuries were scalds. Flame injury was the second most common cause (11%). Scaloid injury rates decreased as age increased. Scaloid injuries made up 79% of injuries in children aged 0-4 years, 61% in children 5-9, and 51% in children 10-12. The percentage of flame injuries increased as age increased.

¼ (27%) of injuries occurred in the head and neck, trunk, and upper extremity. 17% occurred in the lower extremity. Overall, the rate of burns decreased over the 15-year time period.

Almost half (49%) of the children were admitted, and this included all severely injured children.

**Implications**

The region where this study was performed has the highest pediatric burn mortality rate in the world. Therefore, the aim of this study is to utilize the data to develop prevention methods that target at risk populations. By obtaining and interpreting data over a 15-year period, this study is able to provide data regarding risk factors and the changing patterns associated with burns in children.

The study displayed that the majority of children presenting with burns were between the ages of 0 and 4. 45% of burns
between ages 0-4 were one year olds. Therefore, the authors conclude that one year olds should be considered a risk group. In addition, boys sustained more burn injuries than girls, scald burns were most common, and burns most commonly occurred in the home. Authors believe that the findings from this study should be utilized to support other studies, inform policy, and implement changes to at risk populations in order to reduce the burden of burn injuries in children across the globe.

Strengths/Weaknesses

This study was conducted in South Africa; therefore, the results may not necessarily be representative of all burn populations. In addition, the authors explain that this area has a very high rate of mortality due to burn injury. In addition, root causes of scalds were not discussed in the study; however, the authors explain that other studies from South Africa have shown a high rate of scald injuries due to hot liquids poured on stoves in overcrowded housing. This mechanism of action may have led to an increase in the percentage of scald injuries in this region and may not necessarily be generalized to all pediatric burn injuries. The authors explain that one limitation of their study was that information was only collected from RCH’s ED. Therefore, mortality, morbidity, and length of stay were not captured. Their severity was measured by AIS and not TBSA which is a more commonly known measurement of burn severity. The authors also explain that because the study was performed over a 15-year period of time, there may have been changes that impacted the data such as clinical practice changes or resource allocation. They also state that a trauma hospital opened in 1997 which may have led to the sharp decline in burn injuries presenting to RCH. In addition, they added that in 2007, there was a national policy change which sought to strengthen the care at primary care offices; therefore, more people may have sought care for burns from a PCP instead of the hospital.

Strengths of this study include the fact that it had a large sample. In addition, the study was completed over a long period of time which potentially allowed for a more representative sample.

Literature Review

Topic: Epidemiology of pediatric burns in children
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<tr>
<td>Purpose</td>
<td>The purpose of this study is to describe the epidemiology of pediatric burns and describe the financial burden of burn related hospitalizations in children 18 and younger in the United States. Additionally, the authors describe the healthcare utilization by burn patients and calculate national rates of pediatric burn hospitalizations in the United States.</td>
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<tr>
<td>#subjects</td>
<td>Data was collected on 5,156 children younger than 18 years old who were admitted to the hospital with burns. An estimated number of 10,000 children less than 18 were admitted to U.S. hospitals in the year 2000 for burn related injuries.</td>
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<tr>
<td>Sample Characteristics</td>
<td>Characteristics were broken down based on child’s age, gender, race, and income. Two age groups were studied (children 2 and younger, and children age 3 to 17 years). Race was grouped into categories including white, black, and other.</td>
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<tr>
<td>Yr. Data Collected</td>
<td>Data was collected between January 1st, 2000, and December 31st, 2000.</td>
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<td>Study Design &amp; Data Collection Method</td>
<td>This was a quantitative research study which used retrospective data analysis using the Healthcare Cost and Utilization Project Kids’ Inpatient Database (KID) to analyze information. National estimates were obtained using discharge weights using the American Hospital Association AHA universe. Length of stay (LOS), degree of burn, TBSA burned, age, gender, cause of burn, race, income level, location of burn, region of the US, hospital location and hospital type were studied. The 2000 KID sample includes information from all discharges of children from 2,784 hospitals from 27 states representing each region of the United States from January 1, 2000 to December 31, 2000. All cases in KID 2000 with the Major Diagnostic Category equal to 22 (Burns) aged 18 and younger were included in the study. The data was analyzed using demographic, clinical, hospital, and financial information from the database. E-codes, as listed in the ICD-9-CM coding manual, describe mechanism of injury (fire, hot</td>
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</table>
Data was analyzed using SAS software (version 9.1) and SUDAAN software (version 9.0.1). SAS survey procedures were used to calculate frequencies, percentages, means, and 95% confidence intervals (CI) for the means. SUDAAN was used to perform chi square analysis, calculate quartiles, odds ratios, and 95% CIs for point estimates. Analysis of variance was used to compare LOS and charges for different mechanism of injury using Scheffe pos hoc or the Kruskal-Wallis test. The level of significance was 0.05. Ordinary least squares regression analyses were performed for LOS, total charges, using Strata/SE software (version 8.0).

The KID 2000 collected data on 5,156 children less than 18 years old who were hospitalized for burns in the year 2000. These hospitalizations represent an estimated 10,000 children admitted to US hospitals for burn injuries during the year 2000. 49.9% of children were 2 or younger. 48.8% were white and 63.7% were male. The median income for patients was between $25,000 and $44,999 for 63% of cases. Children less than 2 years old were more likely to be nonwhite. Burn admissions were distributed evenly throughout the year. An estimated 0.6% of patients died in the hospital. 66.5% of patients had a TBSA of less than 10%, and 95.8% had less than 30% TBSA burn. 63.6% sustained second degree burns, and 33.2% sustained third degree burns. Children 2 or younger were more likely to sustain second degree burns, and children 3 to 17 were more likely to sustain third degree burns. Children 2 years old or younger were more likely to suffer a burn of hand or wrist. Children 3 to 17 suffered more leg injuries. 94% of hospitals were located in urban areas and were teaching hospitals (83.5%). Children 2 or younger were more likely to be burned by hot liquids or vapors or contact with hot substances/objects. Children 3 to 17 were more likely to be burned by fire/flames. 71.4% of children who died were burned by fire/flame. The LOS was longest for patients whose clothing caught on fire. The total charges were highest for patients whose clothing caught on fire and those who were burned by fire/flame. The charges for those who were burned by hot liquid or vapor were higher. The place of occurrence was documented in only 41.5% of cases. Of these cases, 91.4% occurred in the home. 79 cases were documented as intentional injury. Male children were 1.5 times more likely to
be hospitalized for burn injuries. Black children had twice the rate of whites, and children 2 or younger had 5.3 times the rate of admission compared to children 3 to 17. The mean length of stay was 6.6 days, and ranged from 0 to 163 days. For the estimated 10,000 pediatric burn hospitalizations for the year 2000 in the US, the total charges were $211,772,700. The mean total for the hospitalizations was $21,840 and ranged from $25 to $985,951. Only 10% of patients had charges more than $47,300.

**Implications**

The authors believe this is the first national study on healthcare utilization for pediatric burns in the US that uses KID data. They estimated that 10,000 children less than 18 were admitted to US hospitals in 2000. They spent 66,200 days in the hospital, costing $211,772,700. The authors state the rates of hospitalization are higher in burns than other types of traumas. The researchers found differences in burn hospitalizations based on age, race and gender (children less than or equal to 2, males, and non-whites accounted for more burns). Burns from hot liquid/vapor and fire/flames accounted for 98% of all intentional burns. All but one intentional burn injury occurred in the home, and 58% of perpetrators were the victims’ parents. Burns were more common among families from lower socioeconomic status groups. Overall, the most frequent mechanism of injury was from hot liquids/vapors (58%), contact with hot substances/objects (16%), and fire/flame (12%). Children 2 and younger were more likely to be burned from hot liquid while children 3 to 17 were more likely to be burned from fire/flame. Charges were associated with LOS, degree of burn, %TBSA, age, and region of the US. In order to decrease the national utilization by pediatric burns, the incidence of burns must decrease. The authors believe future research should be directed towards passive prevention strategies that target young minority children from low-income areas. In addition, they believe burn care programs and early discharges with daily outpatient care should be encouraged.

**Strengths/Weaknesses**

This study provides a broad overview of healthcare resource utilization for pediatric burn injuries in the US. There was a large sample size used for the study and reliable tools and research methods. There were several limitations of this study. Limitations of the KID 2000 prevented the authors from taking into consideration preexisting conditions and complications that may be associated with increased cost. In addition, data in KID 2000 is discharge-level data. Therefore,
people who are hospitalized multiple times will have multiple records in the KID, and were unable to be identified.

Literature Review

Topic: Epidemiology of Pediatric Burns
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<tr>
<td>Purpose</td>
<td>The purpose of this study was to report the trends, incidence rates, demographics, and causes of burn injuries requiring hospitalization, and burn related deaths. The authors identify a need for epidemiological data regarding burn injuries in order to develop strategies to reduce burn frequency and severity.</td>
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<tr>
<td>#subjects</td>
<td>Over a ten year period, there were 494 deaths from burns in children aged 0 to 19 and 10,229 children where admitted to a Canadian hospital because of a burn injury.</td>
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<td>Sample Characteristics</td>
<td>Factors studied included patient age, gender, mechanism and cause of injury, length of stay, percentage with full thickness burns, and site of injury. The data included 7,204 males, and 3,519 females. Most hospitalized patients were less than 5 years old.</td>
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<tr>
<td>Yr. Data Collected</td>
<td>Data was collected between from 1994 to 2003. Census data from the years 1991, 1996, and 2001 were used to obtain population estimates of age and gender for each year from 1994 to 2003.</td>
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<tr>
<td>Study Design</td>
<td>This study uses quantitative research methods. The Canadian Institute of Health Information provided details of injury resulting in admission from the years 1994 to 2003. Information included age, gender, length of stay, mortality, diagnosis (thickness, location), and cause of injury. Data was coded using the ICD Versions 9 and 10. Population estimates were used from Canadian census data. International Classification of Disease (ICD) codes were used to categorize cause of burn (Fire, hot substance, etc.). Information on injury related deaths was obtained from Statistics Canada for the years 1994 to 2003.</td>
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<tr>
<td>Data Collection Method</td>
<td>The Canadian Institute of Health Information holds data for every hospital admission as part of mandatory reporting requirements. The dataset includes injury resulting in admission for the given timeframe. Age, gender, LOS, mortality, and diagnosis and cause of injury is included. All data was sourced from administration datasets for all hospitals in Canada for this study.</td>
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