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Original Article

Socio-demographic factors which significantly relate to the prediction of burns severity in children

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Abstract: Background: Burns are considered one of the biggest wounds and the most devastating injuries humans can receive as they have prolonged consequences which are not only physical, but psychological in addition to the cost of treatment. The aim of the study was to explore the relationships between socio-demographic factors (SDF) and the incidence and mechanisms of burn injuries in children. The objectives were to identify the multiple and various factors responsible for the occurrence of significant burns in children; to explore and investigate the relationship between these factors; to critically analyse SDF on the incidence and mechanisms of burns and to develop a contextual model with a view to informing future health care policy and health promotion programmes. Methods: This observational, cross-sectional, descriptive study was performed in a UK Paediatric Burn Centre in the West Midlands. The research process followed the requirements for obtaining a PhD degree. The quantitative arm of this study consisted of a postal questionnaire sent to 228 parents and guardians who had visited the Burns Centre with a child during a one-year period (1st May 2011 to 30th April 2012). For the purpose of coding and analysis, a Statistical Package for the Social Science (SPSS) version-19-was used. Results: 160 completed questionnaires were returned and analysed. Several key SDF were identified that linked to an increase in the incidence of burns in children. Burn injuries was significantly higher in children ≤ 5 years old (P<0.001) and male children (58.1%). Burns were more frequent in minority ethnic groups (p<0.001); younger aged parents ≤ 25 years old (p=0.048); and children living with single parents (p=0.001). A majority of burns cases resulted from spills (74.4%) and during mealtimes (p<0.001). The distributions of the Index Multiple Deprivation (IMD) was not the same across ethnic groups (p<0.002), and burns in children was significant (p<0.0005) in families living in social accommodation. Conclusion: The findings potentially may have clinical utility in informing future health care policy and health promotion/education programmes. Consideration must be given to the timings of such programmes, which relate to treat significant burns in non-specialised hospitals.

Keywords: Scalds, burn*, Child*, paediatric, pediatric, socio-demographic factors, socioeconomic factors, prevention, burns, epidemiology

Introduction

Burns are considered one of the biggest wounds and the most devastating injuries humans can receive as they have prolonged consequences which are not only physical, but psychological in addition to the cost of treatment [1]. The effects and outcomes of burn injuries are predominantly severe when children are exposed to this type of insult. This severity can lead to disability, long-term grief, suffering, deformity, and pain, as well as deteriorating intellectual development [2].

Children are more vulnerable to thermal burns than any other age group [3]. This may be due to not recognising the risks and dangers associated with flames, hot fluids, and hot surfaces. In addition, they have a limited ability to react promptly and properly to these dangerous situations with slower withdrawal reflexes and thinner skin than adults [4, 5]. Consequently, this may result in deeper burns, which require long-term treatment.

Not all children are under the same risk of burns as some children are more susceptible [6-8]. These huge variations occur in the degree and the seriousness of burn incidences [9]. The variations of the occurrence of burns in children may relate to social and demographic factors. Some of these, such as age, gender and ethnic-

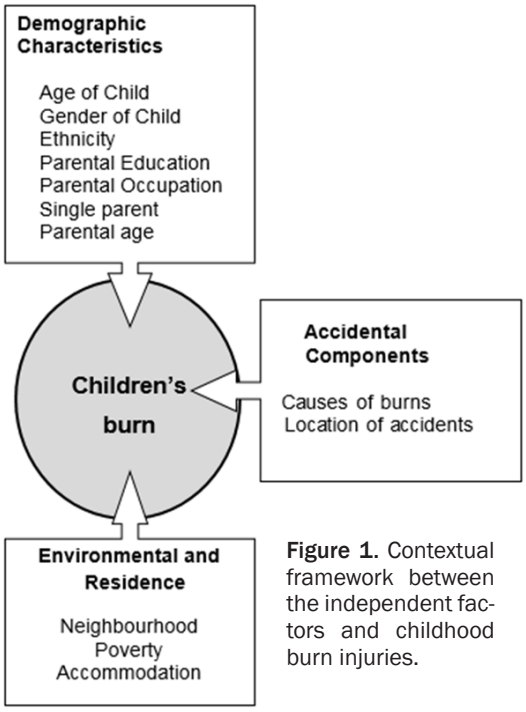

Figure 1. Contextual framework between the independent factors and childhood burn injuries.

Table 1. Positive values of skewness and kurtosis related to the non-normal distribution

Actual Age		
N	Valid	160
Median		2.0000
Skewness		1.504
Kurtosis		1.316
Minimum		0.17
Maximum		15.00
Percentiles	25	1.0808
	50	2.0000
	75	4.9150

ity, are related to children while others are related to their carers such as education, occupation, and marital status in addition to other factors related to geographical area [9]. The home environment represents an important source of fatal and early childhood exposures to biological, chemical, and physical agents [10]. A number of hazards in the home increase the risk of burn injury among children. Examples of such hazards include hot drinks, hot tap water, ovens, stoves, kettles, irons, heaters, open fires, matches, lighters, chemicals and electrical outlets or appliances [11].

Burn injuries therefore have severe economic and social consequences not only to the individuals, but also to their families and societies [12]. Even when burn injuries are not serious, they are considered one of the leading causes of ill health worldwide [13], in which 50% of these cases were among children aged 0-15 years [14].

This quantitative section of a PhD study has been carried out in a specialised UK Children's Hospital with a designated Burns Centre in the West Midlands. The West midlands region has a population of over 5 million populations. The diversities of ethnic minorities existing in this community make it appropriate to look at the relationships between burns and factors that may cause burns. The aim of this research is thus to explore the relationship between socio-demographic factors and mechanisms of burn injuries in children in this region subsequently to develop a contextual model with a view to informing future health care policy and health promotion programmes.

Methods

A survey questionnaire was designed to collect quantitative data about SDF and the incidence of burns. The questionnaire targeted parents and guardians of children that have been treated for burns in the Burns Centre. Questions were organized into three main independent components: demographics, accidental, and environmental/residence that may contribute to the occurrence of burn injuries among childrenin line with the contextual framework for the study (**Figure 1**). Face validity was conducted on the questionnaire, which is considered a more general measure as it requires an individual opinion and hence based commonly on accepted judgement or on an agreement of expert views [15].

The diversities of ethnic minorities existing in the region make it appropriate to look at the relationships between burns and additional factors that may cause burns. Once the University's Ethics committee had granted ethical approval, data collection commenced over a one-year period from May 2011 to April 2012 with the target group being parents/guardians of children who were admitted to the Burns Centre for treatment during this timeframe. The administration team from the Burns Centre contacted parents/guardians via phone to arrange consent for agreeing to undertake completion of the questionnaire. Once consent was

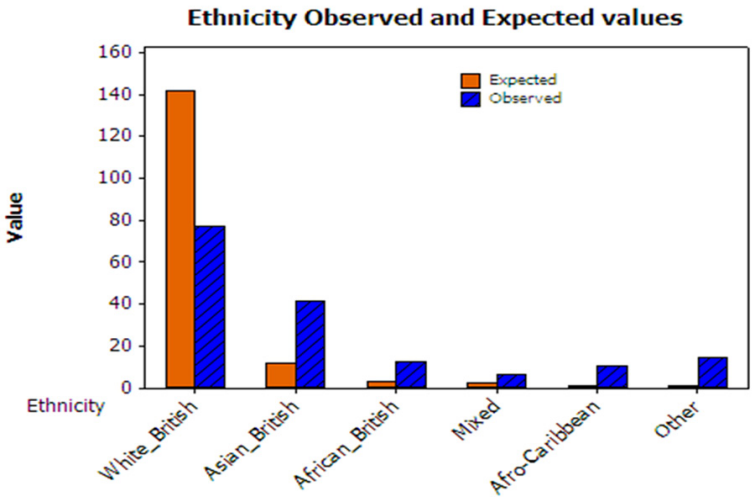

Figure 2. The distribution of the total number of burns across all the ethnic groups.

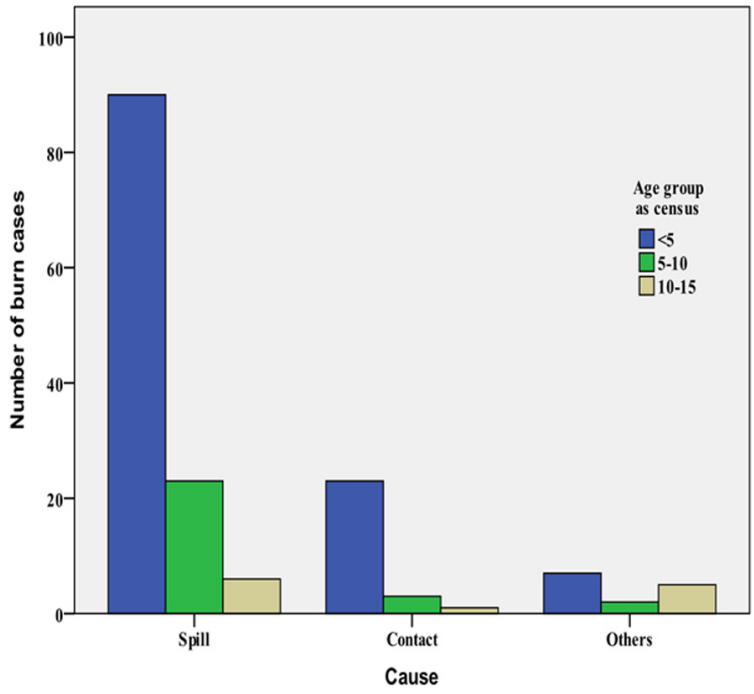

Figure 3. Distributions of burns cases according to causes and children's age.

provided, study envelopes were sent via post. The envelopes contained an invitation letter, participant's information sheet, information on anonymity and confidentiality, consent form, and the 2-page questionnaire. Anonymity and confidentiality of the data collected was preserved throughout the study by using the researcher's personal computer to store them.

For the purpose of coding and analysis, a Statistical Package for the Social Science (SPSS) version-19-was used.

Results

A total of 228 questionnaires were posted to participants' addresses which covered all admissions during the calendar year. Of these, 160 completed questionnaires were returned with a response rate of 70.2%. The majority of burn cases (n=120) were children ≤ 5 years of age. Male children were 51.2%, the median being 2.0 years of age. The lower quartile included 1-year age group and upper quartile 4.9-year age group (**Table 1**).

The age of children were grouped into three different categories ≤ 5 years; > 5-10 years; and > 10-15 years of age. This grouping was similar to the National Census Distribution to enable comparison of the sample results with the West Midlands (WM) population [16]. The home environment may be a factor as 50% of admitted cases involved children aged 2 years with burns caused at home. The null hypothesis (H_0) for the study is rejected when the *p*-value is ≤ 0.05. A Chi-Square Goodness-of-Fit test (X^2) showed that the observed burns cases were more than expected for both genders ($p<0.001$), while there was no significant difference ($p=0.483$) between the two genders and incidence of burns. The distribution of total number of burns across all the ethnic groups as reported by participants was significantly different ($p<0.001$) from the census distribution of ethnic groups (**Figure 2**). The difference was more obvious when compared to the distribution of the population in the WM. The incidence of burns was greater than

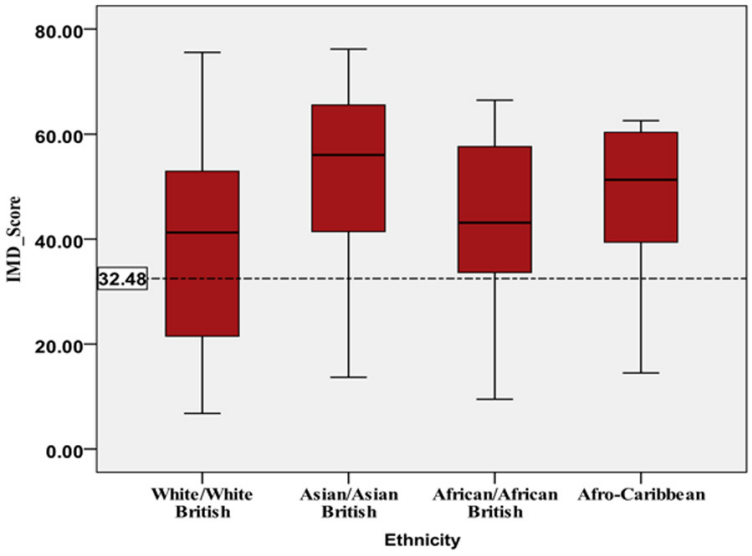

Figure 4. Mean Index of Multiple Deprivations scores by ethnic origin for all burn injury cases.

among their children than parents with a lower level of education (GCSE and lower) and in employment. There was also no significant difference (p= 0.689) when looking at the incidence of Significant Burns (> 5% of BSA) in children living with non-employed parents than children living with employed parents.

Around 74.4% of burns cases resulted from spills (scalds) (n=119). Burns were significantly higher (P<0.001) in younger children (≤ 5 years old) of all causes of burns compared to other age group children (> 5-10 and > 10-15 years old) (**Figure 3**).

expected for Asian/Asian British, African/Afro-Caribbean British, and other groups.

The assessment used to measure skin burns in this study was the Body Surface Area (BSA). The classification used was BSA ≤ 1%, BSA ≤ 5%, and > 5% BSA full thickness burn (Significant Burns). The majority of burn cases 60% (n=96), were between 1% and 5% Body Surface Area (BSA). However, the BSA affected was not statistically significant between males and females (p=0.6). The medium parental age was 30 years. 31.9% (n=47) parents were aged ≤ 25 years old, 52.6% (n=80) between 26-39 and 16.4% (n=25) over 40 years of age. A non-parametric, Mann-Whitney test was applied to test the H_o that the distribution of BSA was the same across categories of parents' age group. The test rejected H_o (p=0.048) and showed that significant burns (> 5% of BSA) were found more in children who had younger aged parents (≤ 25 years old) than older parents (26-39 and ≥ 40 years old). The results of X^2 test showed that the incidence of childhood burns in single parents from the non-White British group was significantly higher (p=0.001) than the White British group. The test also showed that significant burns in children living with single parents was significantly higher (p=0.001) than other children who lived with both parents.

Parents with a high level of education (A-level and degree) and in employment had no statistical difference (p=0.32) in Significant Burns

A Kruskal Wallis test was applied to test the distributions of the IMD were the same across ethnic groups. The test rejected the null hypothesis (p<0.002) as the distribution was not the same (**Figure 4**). The median IMD score of the Asian group (52.5 IMD) was notably higher than other ethnic groups which is more than the national medium 32.48 (people who are living in areas lower than median are attributed as living in a more affluent neighbourhood). It was notable that of the 160 families, 81 families were living in rental accommodations and 66 of the 81 families were living in social accommodations. The significant burns between these families living in social housing was significantly higher (p<0.0005) compared to those families in the sample who owned their houses or privately rented (**Table 2**).

The binary model of Logistic Regression test was applied to find the variable, which significantly related to the prediction of significant burns. The tests showed that some of the independent variables such as non-White British, social housing and single-parent family were significantly related (p=0.03, p=0.0005 and p=0.001 respectively) to the significant burns (**Figure 5**).

Discussion

Estimates vary for the actual burn injuries admitted to the Burns Centre each year. A rigorous approach therefore was to conduct the

Table 2. Cross tabulation between housing types and severity of burn between children

			BSA			Total
			≤ 1%	> 1%-≤ 5%	> 5%-≤ 20%	
Your House	The owner	Count	18	57	4	79
		% within Your House	22.8%	72.2%	5.1%	100.0%
	Social rent	Count	4	31	31	66
		% within Your House	6.1%	47.0%	47.0%	100.0%
	Private rent	Count	2	8	5	15
		% within Your House	13.3%	53.3%	33.3%	100.0%
Total		Count	24	96	40	160
		% within Your House	15.0%	60.0%	25.0%	100.0%

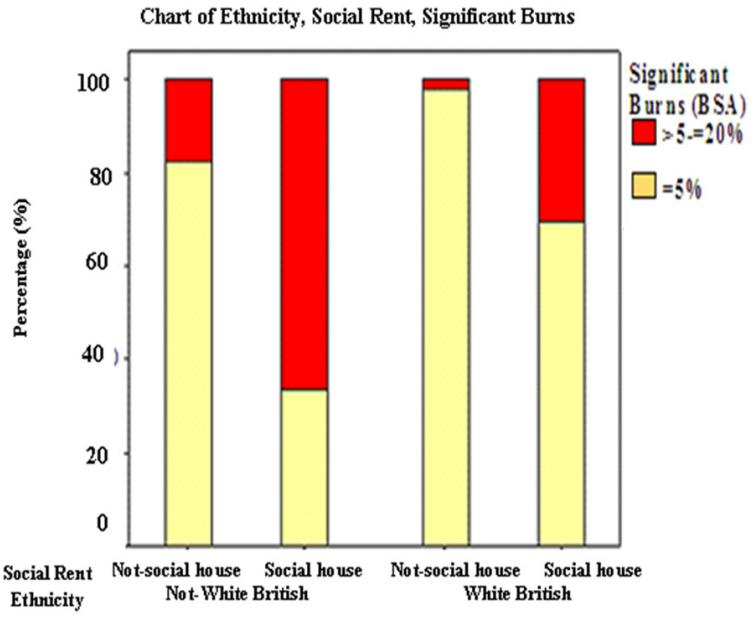

Figure 5. Interacting of the ethnicity and social housing with significant burns.

study over a whole calendar year. This ensured a greater insight as to the types of burn cases and causes of burns admitted to the centre. Achieving such a high response rate 70.2% enhanced the confidence in the research results [17].

Factors related to gender differences were also evident which may explain why injuries are more common in boys than girls. These factors are behavioural differences such as risk taking and exposure to hazards, which are increased in young males, as they like to explore new environments [18]. It is also suggested that cognitive development may occur at different rates in males and females and intensive parental supervision is less in males as they take pleasure in their independence [18].

The result has showed that 50% children aged 2 years with burns caused at home. This age group spent more time at home and thus was more vulnerable to scalds and other domestic traumas. This finding was similar to research conducted by others [19, 20] as injuries related to thermal and falls were more common among infants and children less than 5 years of age within their homes.

Thermal injuries such as burns and scalds were most likely to occur at home among preschool children from both genders [18]. It has been ascertained that the exposure of children to specific situations such as burns, falls, or road traffic accidents were all recognized as factors related to age and having the influence on injury risk rather than gender [21].

The incidence of burns was greater than expected for Asian/Asian British, African/Afro-Caribbean British, and other groups. The majority of these differences may be related to poor housing, economic conditions, and unsatisfactory heating and electrical structures [22]. Other researchers [23, 24] related the differences to immigration as they found it increased the risk of burn injuries among non-English speakers in the United States and among gypsy children in Greece. Previous studies also found this relationship and relate burns to the

lack of parenting skills as some of these parents had not learned the necessary skills to be a good parent [25, 26]. Teenager parents, for instance, might have insensible vision about how much attention and care new-borns and younger children need [27].

In relations to the incidents of childhood burns in single-parent families, researchers [28, 29] from America supported this result that in the US children's death resulting from injuries is 3 times more likely when they are living with single mothers and they are at risk of abuse and neglect.

However, the results in this study differ from results of other studies as low parental education was found in different studies to be linked with increased incidence of childhood burns [30-32]. For instance, there was an increase in Significant Burns in children and worse outcomes following treatment of illiterate women in Egypt [33]. Additionally, it has also been reported that high levels of education among parents is more likely associated with a decrease in burn-related incidents [34]. The difference in these findings may be related to the small sample size used in this study or to incorrect information reported by parents in the questionnaires.

The majority of studies support the results about the spills and cited spills (scalds) as one of the primary specific causes for childhood burns [25, 34-36]. A report from the US found that children younger than five sustained scalding caused by skin contact with hot liquids more than any other age group [37]. Research from Peru [5] and from Turkey [25] show burn cases resulting from scalds were 75% and 73% respectively.

The link between neighbourhoods and accidental injuries among children has been highlighted in previous studies [23, 26, 38]. It was shown that critical injury ratios due to burns, falls or pedestrians were higher in urban areas, while cases of critical injuries resulting from car owners were more prevalent in rural areas. In addition, the occurrence of childhood injury was also found to be linked with perception of neighborhoods as the risk of suffering injury that required medical or hospital treatment was increased when children (older children) recognised that the area they lived in was insecure [39, 40]. The Jonckheere-Terpstra's test was conducted to test the linear trend in IMD scores on the distribution of IMD score as to whether it was the same across categories of BSA. The test rejected the null hypothesis ($p=0.02$) and found a significant ascending order of the significant burns with the IMD. This may be due to deprived families being rarely employed or were getting access to information, which helped them to promote the safety and protection of their children as poverty may manipulate parents' behaviors, which have knock-on effects on their children [18].

Children living in social accommodations and those in older houses attended primary care more often than those living in newer housing or houses owned by their families [18, 41]. Others related the occurrences and severity of injuries among children to the type of housing. An association has been shown between poverty and housing status [42]. However, the result of the present study that linked type of housing whether detached, semi-detached, terrace, flat or bungalow did not relate significantly with significant burns. This may be due to the cases being distributed between all housing types with no dominant type, although there was a slightly higher number in terraced houses.

Significant burns as shown by logistic regression test among children in the West Midlands has been found to have increased 10 fold in children living with families in social housing and 5 fold more when children are from the non-White British ethnic group.

Conclusion

The results of this survey revealed that the majority of burn cases were found to be in younger children ≤ 5-year old. Non-White British children had an increased incidence of burns than children from the White British group. Children living with younger parents or single parents also sustained burns more often than children living with older parents. Spills were responsible for the majority of cases particularly children living in poverty as reflected by the IMD scores with the greatest percentage of children from the Asian ethnic background followed by children from the African group. The results also showed significant burns ≥ 5% BSA can be predicted in the West Midlands, with

children living in social accommodations and from non-White British backgrounds having greater probabilities of being significantly burned. The possibility of this prediction is also increased among children living in a single parent family.

The main purpose of this study was to provide a greater understanding of these predisposing factors from different perspectives and to explain effective interventions to prevent burns among children. These findings are used to inform the qualitative arm of the study to explore these factors in greater detail and so provide a deeper insight into such factors as parent's experiences; family characteristics; social norms; practices; attitudes; behaviours and the circumstance as to why the injuries occurred more commonly among particular children in specific locations.

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References

[1] Drago DA. Kitchen scalds and thermal burns in children five years and younger. Paediatrics 2005; 115: 10-6.

[2] Silfen R, Chemo-Lotan M, Amir A, Hauben DJ. Profile of the pediatric burn patient at the Schneider Children's Medical Center of Israel. Isr Med Assoc J 2000; 2: 138-41.

[3] Hutchings H, Barnes PM, Maddocks A, Lyons R, James-Ellison MY. Burns in young children: a retrospective matched cohort study of health and developmental outcomes. Child care Heal Dev 2010; 36: 787-94.

[4] Argerova M, hadzhiyski O. Treatment of palm burns in children. Ann Burns Fire Disasters 2005; 18: 190-3.

[5] Delgado J, Ramírez-Cardich ME, Gilman RH, Lavarello R, Dahodwala N, Bazán A, Rodríguez V, Cama RI, Tovar M, Lescano A. Risk factors for burns in children: crowding, poverty, and poor maternal education. Inj Prev 2002; 8: 38-41.

[6] Vendrusculo TM, Balieiro CR, Echevarría-Guanilo ME, Farina Junior JA, Rossi LA. Burns in the domestic environment: characteristics and circumstances of accedents. Rev Lat Am Enfermagem 2010; 18: 444-51.

[7] Turner D. Qulitative interview design: apractical guide for novice investigators. Qual Rep 2010; 15: 754-60.

[8] Peleg K, Goldman S, Sikron F. Burn prevention-programs for children: do they reduce burn-related hospitalizations? Burns 2005; 31: 347-50.

[9] Dissanaike S, Rahimi M. Epidemiology of burn injuries: highlighting ciultural and socio-demographic aspects. Int Rev Psychiatry 2009; 21: 505-11.

[10] Breysse P, Farr N, Galke W, Lanphear B, Morley R, Bergofsky L. The relationship between housing and health: children at risk. Environ Health Perspect 2004; 112: 1583-8.

[11] Louis M, Rea Richard A, Parker. Designing and coducting survey research: a comprehensive guide. San Francisco: Jossey-Bass; 1997.

[12] Coughlan M, Corry M. The experiences of patients and relatives/significant others of overcrowding in accedent and emergency in Ireland: a qualitative descriptive study. Accid Emerg Nurs 2007; 15: 201-9.

[13] World Health Organization. A WHO plan for Burn Prevention and Care. 2102. http://apps.who.int/iris/bitstream/10665/97852/1/9789241596299_eng.pdf.

[14] Mulvaney C, Kendrick D, Towner E, Brussoni M, Hayes M, Powell J, Robertson S, Ward H. Fatal and non-fatal fire injuries in England 1995-2004: time trends and inequalities by age, sex, and area deprivation. J Public Health (Oxf) 2009; 31: 154-61.

[15] Wynd CA, Schmidt B, Schaefer MA. Two Quantitative approaches for estimating content validity. West J Nurs Res 2003; 25: 508-18.

[16] Office for National Statistics. Portrait of the West Midlands. 2012. https://www.ons.gov.uk/ons/rel/regional.../portrait-of-the-west-midlands.pdf.

[17] Draugalis JR, Plaza CM. Best practice for survey research reports revisited: implications of target population, probability sampling, and retrospective rate. Am J Pharm Educ 2009; 73: 142.

[18] Towner E, Mytton J. Prevention of unintentional injuries in children. Paediatr Child Health (Oxford) 2009; 19: 517-21.

[19] Pearson M, Hewson P, Moxham T. A systematic review of risk factors for unintentional injuries among children and young peopl aged under 15 years. Peninsual, Medical School, Universities of Exeter & Plymouth. Peninsual, Medical School, Universities of Exeter & Plymouth; 2009.

[20] World Health Organization. Europe. European report on child injury prevention. 2008. www.euro.who.int/__data/assets/pdf_file/0003/83757/E92049.pdf.

[21] Toon MH, Maybauer DM, Arceneaux LL, Fraser JF, Meyer W, Runge A, Maybauer MO. Children and burn injuries-assessment of trauma, ne-

glect, violence and abuse. J Inj Violence Res 2011; 3: 98-110.
[22] Istre GR, McCoy M, Carlin DK, McClain J. Residential fire related deaths and injuries amon children: fireplay, smoke alarms, and prevention. Inj Prev 2002; 8: 128-32.
[23] Shai D. Income, housing, and fire injuries: a census tract analysis. Public Health Rep 2006; 121: 149-54.
[24] Petridou E, Trichopoulos D, Mera E, Papadatos Y, Papazoglou K, Marantos A, Skondras C. Risk factors for childhood burn injuries: a case-control study from Greece. Burns 1998; 24: 123-8.
[25] Kut A, Basaran O, Noyan T, Arda IS, Akgün HS, Haberal M. Epidemilogic analysis of patients with burns presenting to the burn units of a University Hospital Network in Turkey. J Burn Care Res 2006; 27: 161-9.
[26] Shin S, Suh G, Sung J, Kim J. Epidemiologic characteristics of death by burn injury from 1991-2001 in Korea. J Int Soc Burn Inj 2004; 30: 820-8.
[27] Ruiz-Casares M, Trocmé N, Fallon B. Supervisory neglect and risk of harm. Evidence from the Canadian Child Welfare System. Child Abuse Negl 2012; 36: 471-80.
[28] Shai D, Lupinacci P. Fire fatalities among children: an anlysis across Philadelphia's census tracts. Public Health Rep 2003; 118: 115-26.
[29] Andronicus M, Oates RK, Peat J, Spalding S, Martin H. Non-accidental burns in children. Burns 1998; 24: 552-8.
[30] Groohi B, Rossignol AM, Barrero SP, Alaghehbandan R. Suicidal behaviour by burns among adolescents in Kurdistan, Iran: a social tragedy. Crisis 2006; 27: 16-21.
[31] Kumar V, Tripathi CB. Burnt wives: a study of homicides. Med Sci Law 2004; 44: 55-60.
[32] Daisy S, Mostaque AK, Bari TS, Khan AR, Karim S, Quamruzzaman Q. Socioeconomic and cultural influence in the causation of burns in the urban children of Bangladesh. J Burn Care Rehabil 2001; 22: 269-73.
[33] El-Badawy A, Mabrouk AR. Epidemiology of childhood burns in the burn unit of Ain Shams University in Cairo, Egypt. Burns 1998; 24: 728-32.
[34] Alnababtah KM, Davies P, Jackson CA, Ashford RL, Filby M. Burn injuries among children from a region-wide paediatric burns unit. Br J Nurs 2011; 20: 158-62.
[35] Chien WC, Pai L, Lin CC, Chen HC. Epidelogy of hospitalized burns patients in Taiwan. Burns 2003; 29: 582-8.
[36] Agran P, Anderson C, Winn D, Trent R, Walton-Haynes L, Thayer S. Rates of pediatric injury by 3-months intervals for children 0-3 years of age. Pediatrics 2003; 111: 683-92.
[37] American Burn Association Advanced Burn Life Support Course. 2011. http://maricopahealthfoundation.org/sites/default/files/abls-pdf-all.pdf.
[38] Edwards J. Focus: managemt of skin graft and donor sites. Nurs Times 2008; 103: 52-3.
[39] Reading R, Jones A, Haynes R, Daras K, Emond A. Individual factors explain neighbourhood variations in accidents to children under 5 years of age. Soc Sci Med 2008; 67: 915-27.
[40] Simpson K, Janssen I, Craig WM, Pickett W. Multilevel analysis of a ssocition between socioeconomic status and injury among Canadian adolescence. J Epidemiol Community Health 2005; 59: 1072-7.
[41] Child Casualties Report 2010 - A study into resident risk of children on roads in Great Britain 2004-08. www.boltonshealthmatters.org/.../child-casualties-report-2010-study-resident-risk-childr.
[42] Kendrick D, Watson M, Mulvaney C, Burton P. How useful are home safety behaviours for predicting childhood injury? A cohort study. Health Educ Res 2005; 20: 709-18.