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Injury Prevention: Burns

Michael C. Watson, PhD, Caroline A. Mulvaney, PhD

University of Nottingham, United Kingdom

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Introduction

Many children die each year as a result of a burn; many more suffer burn-related disabilities and disfigurements leading to considerable personal and economic effects for both individuals and their families. A range of factors put children at particular risk of burns including age, gender, and environmental issues such as supervision and housing. However, by applying successful primary preventive public health interventions that encompass educational, environmental, and legislative approaches and appropriate medical care, it is possible to reduce the mortality and morbidity from burns.

Subject

The World Health Organization (WHO) defines a burn as “an injury to the skin or other organic tissue caused by thermal trauma” which occurs when “the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns) or flames (flame burns).”[1] Similar injuries due to radiation, radioactivity, electricity, friction or contact with chemicals are also considered as burns.

Globally, burns are a major cause of death with more than 95,000 children aged under 20 years dying annually from burn related injuries.[2] Generally, children under 5 are at greatest risk of

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burns related mortality with global rates of 10.1 and 6.8 deaths per 100,000 population for children under 1 year old and aged 1 to 4 years old, respectively.[2]

Problems

Inequalities exist in childhood death and injury rates from burns. Worldwide death rates from burns in low- and middle-income countries are eleven times higher than that in higher income countries.[2] Moreover, such inequalities persist within countries. In the UK children of families in the lowest socioeconomic group are 37.7 times more likely to die from exposure to smoke, fire and flames than children from families in the highest socioeconomic group.[3] In the UK and Australia, children from more deprived areas are more likely to suffer a burn-related injury and be admitted to hospital for a burn or scald than children from less deprived areas.[4-6]

The risk factors for burns and consequent prevention practices differ with age and development of a child, thus requiring a continual process of risk assessment. While infants are at greater risk of scalds from hot liquids and burns from house fires, older children, especially boys, are at greater risk due to playing with fire and access to smokers materials. Girls' greater participation in cooking, possibly on open fires increases their risk of burns injury.[2]

The consequences of a nonfatal burn can be significant and long term. The injured child may have to cope with physical and psychological effects of a burn such as pain and lack of self-esteem due to scarring.[7,8] Burns on the hands can result in severe functional impairment. Severe burns may require long term or repeated hospitalizations which cause psychological and economic stress on the family. In terms of health care, burns can be very costly.[9-11]

Research Context

In relation to other public health problems, burns provide a large and diverse research environment. In terms of prevention, research is needed for primary, secondary and tertiary prevention and there are a considerable number of mechanisms to be researched, as evidenced by the range of risk factors. The picture is further complicated by the need for priorities at different ages. The existence of inequalities both between and within countries necessitates the investigation of potential risk factors and culturally-appropriate prevention approaches for diverse population groups.

Key Research Questions

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How do we address the inequalities in burns related morbidity and mortality?

How can we demonstrate links from an intervention to injury outcomes rather than intermediate outcomes?

How do we enable policy makers and practitioners to implement what is known to be effective?

Recent Research Results

Three general approaches are advocated for reducing burn injuries in children; education, environmental (including engineering) and legislation.[1]

A recent systematic review found that home safety education with the provision of safety equipment, is effective in increasing burn prevention practices.[12] Risk Watch, a school-based educational program improved fire and burn safety knowledge and skills in children[13] and an information folder to the relatives of young children increased their knowledge on risks of burns.[14] However, the effect of these educational interventions on burn injury rates is unknown.

An audit of first aid treatment received by children attending a hospital in Australia for a burn injury found that while 80.2% received cold water as a first treatment, only 12.1% had cold water applied for the recommended 20 minutes.[15]

While 95% of US households reported having at least one installed smoke alarm and 52% a fire escape plan, only 15% tested their alarm once a month and 16% practiced their escape plan once every 6 months.[16] Authors of a large scale smoke alarm giveaway program conclude that such programs are of little benefit unless alarm installation and maintenance is assured.[17] A recent systematic review found that families receiving home safety education were more likely to possess a functioning smoke alarm than control group families who did not receive education, with a larger effect size for studies that also provided smoke alarms.[12]

Smoke alarms are a relatively cheap and easy-to-install burns prevention tool. However, they rely on regular testing to ensure they are fully functioning and careful positioning to reduce the likelihood of false alarms,[18] hence the importance of home safety education as an essential element of any smoke alarm intervention.[12]

Legislation has successfully regulated the installation of smoke detectors, reduced the temperature of hot tap water and promoted child-resistant lighters.[2,10,19,20] In New South Wales,

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following the introduction of regulations requiring that all new water installations should have hot water tap temperatures not exceeding 50ºC, hospital admission rates for scalds from hot tap water has reduced by 6% a year.[21]

The incidence of burn injuries from hair straighteners is increasing. Straighteners have been found to stay dangerously hot for up to 44 minutes after being turned off.[22] This raises burn prevention issues for both parents and manufacturers to address.[23]

An examination of cooking-related burn injuries found that the most common mechanism for injury resulted from a child pulling down a hot liquid from a higher level.[24] A study in America found that of 104 non tap water scalds in children, 8.7% were caused by children aged between 18 months and 4 years who removed hot liquid from a microwave.[25] Microwave doors should be adjusted so they cannot be opened by young children.[25]

Thermostatic mixing valves fitted in the homes of families in disadvantaged communities have recently been found to be effective at reducing bath hot tap water temperatures.[26]

Research Gaps

There should be further research into the role of alcohol in incidents leading to burn injuries and parents' ability to supervise children.[27]

Studies are needed to investigate the barriers and facilitators to implementing known effective burns prevention interventions.

In relation to home safety education, especially with the provision of safety equipment, large well-conducted observational studies are needed.[12]

Studies are also needed to investigate the effectiveness of community-based injury prevention programs to prevent burns and scalds in children.[28]

Conclusions

Epidemiological evidence indicates that burns are a leading cause of death, disability and suffering in children. In addition, it is clear that some children are at much greater risk of burn injury than others and that the risk factors associated with a burn depend both on the child's culture and developmental age. The consequences of a severe burn are significant and long term.

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In parts of certain high-income countries much has been done to lower the burden of burn injury. Effective strategies exist for primary prevention and advances in medical care ensure survival rates after burns have improved significantly for children in high-income countries.[29]

Current research findings indicate that broad approaches such as environmental modification (including engineering), legislation and education can be effective in reducing burn injuries. However, a combination of these approaches may be most effective.[30] It is vital that burn prevention is given higher priority by policy makers and the general public.

Implications for Parents, Services and Policy

A coordinated and multifaceted public health approach is needed linking primary, secondary and tertiary prevention. The health and economic benefits for children, families and society are significant. Effective burn prevention and care is multidisciplinary and multi-sectoral and includes fire fighters, health providers, the housing sector, local and national government, and burn survivor groups. Partnerships are essential to fully address burn prevention.

Legislation and policies on burn prevention are needed particularly in relation to smoke detectors, hot water heaters, cigarette lighters, reduced ignition propensity cigarettes and flame-resistant children's sleepwear.

Parents should ensure that they have a working smoke alarm on every level of their home, that bath water temperature is correctly controlled, that matches and cigarette lighters are kept out of young children's reach, and that hot drinks are kept away from young children. Local public health programs will need to support families in their burn-prevention activities by providing education and possibly safety equipment.

References

1. Sethi D, Towner E, Vincenten J, Segui-Gomez M. *European report on child Injury prevention*. Geneva, Switzerland: World Health Organization; 2008.
2. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Branche C, Falzlur Rahman AKM, Rivara F,Bartolomeos K, eds. *World report on child injury prevention*. Geneva, Switzerland: World Health Organization; 2008.
3. Edwards P, Roberts I, Green J, Lutchmun S. Deaths from injury in children and employment status in family: analysis of trends in class specific death rates. *BMJ* 2006;3333(7559):119.
4. Hippisley-Cox J, Groom L, Kendrick D, Coupland C, Webber E, Savelyich B. Cross sectional survey of socioeconomic variations in severity and mechanism of childhood injuries in Trent 1992-7. *BMJ* 2002;324(7346):1132.
5. Poulos R, Hayen A, Finch C, Zwi A. Area socioeconomic status and childhood injury morbidity in New South Wales, Australia. *Injury Prevention* 2007;13(5):322-327.

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6. Mulvaney C, Kendrick D, Towner E, Brussoni M, Hayes M, Powell J, Robertson S, Ward H. Fatal and nonfatal fire injuries in England 1995-2004: time trends and inequalities by age, sex and area deprivation. *Journal of Public Health* 2009;31(1):154-161.

7. Davydow DS, Katon WJ, Zatzick DF. Psychiatric morbidity and functional impairments in survivors of burns, traumatic injuries, and ICU stays for other critical illnesses: A review of the literature. *International Review of Psychiatry* 2009;21(6):531-53.

8. Corry N, Pruzinsky T, Rumsey N. Quality of life and psychosocial adjustment to burn injury: Social functioning, body image, and health policy perspectives. *International Review of Psychiatry* 2009;21(6):539-548.

9. Department of Trade and Industry. C*onsumer safety research: Burns and scalds in the home*. London, UK: Department of Trade and Industry; 1999

10. Han RK, Ungar WJ, Macarthur C. Cost-effectiveness analysis of a proposed public health legislative/educational strategy to reduce tap water scald injuries in children. *Injury Prevention* 2007;13(4):248-253.

11. Miller TR, Romano EO, Spicer RS. The cost of childhood unintentional injuries and the value of prevention. *The Future of Children* 2000;10(1):137-163.

12. Kendrick D, Smith S, Sutton AJ, Mulvaney C, Watson M, Coupland C, Mason-Jones A. The effect of education and home safety equipment on childhood thermal injury prevention: meta-analysis and meta-regression. *Injury Prevention* 2009;15(3):197-204.

13. Kendrick D, Groom L, Stewart J, Watson M, Mulvaney C, Casterton R. "Risk Watch": cluster randomised controlled trial evaluating an injury prevention program. *Injury Prevention* 2007;13(2):93-98.

14. Gimeniz-Paschoal S, Pereira D, Nascimento E. Effect of an educative action on relatives' knowledge about childhood burns at home. *Revista Latino-Americana de Enfermagem* 2009;17(3):341-346.

15. Cuttle L, Kravchuk O, Wallis B, Kimble RM. An audit of first-aid treatment of pediatric burns patients and their clinical outcome. *Journal of Burn Care & Research* 2009;30(6):1028-1034.

16. Ballesteros MF, Kresnow MJ. Prevalence of residential smoke alarms and fire escape plans in the U.S.: results from the Second Injury Control and Risk Survey (ICARIS-2). *Public Health Reports* 2007;122:224-231.

17. DiGuiseppi C, Roberts I, Wade A, Sculpher M, Edwards P, Godward C, Pan H, Slater S. Incidence of fires and related injuries after giving out free smoke alarms: cluster randomised controlled trial. *BMJ* 2002;325(7371):995.

18. Roberts H, Curtis K, Liabo K, Rowland D, DiGuiseppi C, Roberts I. Putting public health evidence into practice: increasing the prevalence of working smoke alarms in disadvantaged inner city housing. *Journal of Epidemiology & Community Health* 2004 58(4):280-285.

19. Erdmann TC, Feldman KW, Rivara FP, Heimbach DM, Wall HA. Tap water burn prevention: the effect of legislation. *Pediatrics* 1991;88(3):572-577.

20. Smith LE, Greene MA, Singh HA. Study of the effectiveness of the US safety standard for child resistant cigarette lighters. *Injury Prevention* 2002;8(3):192-196.

21. Harveya LA, Poulosb RG, Finch CF, Olivierd J, Harveye JG. Hospitalised hot tap water scald patients following the introduction of regulations in NSW, Australia: Who have we missed? *Burns*. In press.

22. Breuning E, Papini R. Hair straighteners: a significant burn risk. *Burns* 2008;34(4):703-706.

23. Foong DPS, Bryson AV, Banks LN, Shah M. Thermal injuries caused by hair straightening devices in children: a significant, but preventable problem. *International Journal of Injury Control and Safety Promotion*. In press.

24. Dissanaike S, Boshart K, Coleman A, Wishnew J, Hester C. Cooking-related pediatric burns: risk factors and the role of differential cooling rates among commonly implicated substances. *Journal of Burn Care & Research* 2009;30(4):593-598.

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25. Lowell G, Quinlan K, Gottlieb LJ. Preventing unintentional scald burns: moving beyond tap water. *Pediatrics* 2008;122(4):799-804.

26. Stewart J, Kendrick D, Smith S, et al. Reducing bath hot tap water scalds in families with young children in social housing: A randomised controlled trial of thermostatic mixer valves (TMVs). Paper presented at: The First Injury Prevention Conference for the UK and Ireland. September 13-14, 2007. Bristol, UK.

27. Department for Children Schools and Families. Accident prevention amongst children and young people: A priority review. Cheshire, UK: Department for Children, Schools and Families; 2009.

28. Turner C, Spinks A, McClure R, Nixon J. Community-based interventions for the prevention of burns and scalds in children. *Cochrane Database Syst Review*; 2004:CD004335.

29. Sheridan RL, Remensnyder JP, Schnitzer JJ, Schulz JT, Ryan CM, Tompkins RG. Current expectations for survival in pediatric burns. *Archives of Pediatrics & Adolescent Medicine* 2000;154(3):245-249.

30. Towner E, Dowswell T, Mackereth C, Jarvis S. *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review*. London, UK: Health Development Agency; 2001.

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