

## REVIEW ΑΝΑΣΚΟΠΗΣΗ

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### Message 5: “Know the dangers of fire”

Injuries due to burns, fire and flames are one of the leading causes of injury and death among children and older people over the age of 65. Although the most severe outcome of burns is death, accounting for a large proportion of mortality rates in the European Union (EU), burns can also cause permanent physical and psychological disabilities. Thus, raising the public awareness about the relevant risk factors and informing people about proper ways to behave in fire situations may reduce the severity or even the incidence of burn injuries. This paper aims: (a) to describe the magnitude and the socio-economic burden of fire related injuries in the countries of the EU, (b) to outline underlying risk factors and (c) to present evidence based preventive practices that reduce the likelihood of injury due to fire. Some of these measures are therefore included in the European Code Against Injuries (ECAI) aiming to raise public awareness regarding injury prevention.

#### 1. DEFINITION

According to the International Society for Burn Injuries and the World Health Organization (WHO), burns or thermal injuries are defined as the distraction of some or all different layers of cells forming the human skin, which is provoked by close contact with hot liquids resulting in scalds, hot solids resulting in contact burns or flames resulting in flame burns.<sup>1</sup> Respiratory insults resulting from smoke inhalation, are also considered burn injuries.<sup>1</sup> The more recent ICD classification (ICD-10) considers burns and corruptions of external body surface as the result of contact with electrical heating appliances, electricity, flame, friction, hot air/hot gases, hot objects, lighting, radiation, including ultraviolet radiation and chemical substances.<sup>2</sup>

The severity of burns depends on several factors including age, depth and surface area of the lesion, body region, simultaneous smoke inhalation and previous health-conditions; temperature of the causing factor (flame, hot liquid or solid) and duration of exposure.<sup>1</sup> According to their severity, burns are classified as first degree (erythema), second degree (blisters) or third degree (deep necrosis of

underlying tissue).<sup>2</sup> In general, the higher the temperature and the duration of the exposure the more severe the skin damage.

The present review focuses on effective prevention measures related to residential burns due to fire and flames as this is the most common type of morbidity and mortality due to burn injuries.<sup>3,4</sup>

#### 2. MAGNITUDE OF THE PROBLEM

Fire related injuries account for 6% of injury deaths and are responsible for approximately 240,000 fatalities worldwide each year.<sup>5</sup> Data from the Injury Statistics Portal, a user friendly database providing updated estimates on death data based on WHO statistics, show that approximately 4,500 citizens lose their lives annually due to a fire/flame injury, in the EU-27.<sup>6</sup> In the USA the annual toll amounts to 2,900<sup>4</sup> lives, in the EU-27 member states, however, mortality rates for burns vary significantly with low and middle-income countries reporting over 30 times higher mortality rates than those in the high income ones (Figure 1).<sup>4,5</sup> Indeed,

ARCHIVES OF HELLENIC MEDICINE 2008, 25(Suppl 1):34–39  
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2008, 25(Συμπλ 1):34–39

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Μήνυμα 5: «Ενημερωθείτε για τους κινδύνους της φωτιάς»

Περίληψη στο τέλος του άρθρου

#### Key words:

Accident  
Burn  
European Code Against Injuries  
Fire  
Injury  
Practice  
Prevention  
Scalds

three of the new member states, namely, Estonia, Latvia and Lithuania present the highest mortality rates due to fire and burns, whereas the Netherlands, Luxemburg and Italy the lowest.<sup>6</sup>

Burns are the most disfiguring type of injury and one of the most physically and psychologically devastating forms of trauma.<sup>7</sup> In many cases the healing process can cause hypertrophic scars and contractures that may lead to functional disabilities.<sup>8</sup> It has been estimated that fire related burns account for approximately 10 million Disability Adjusted Life Years lost globally each year.<sup>5</sup>

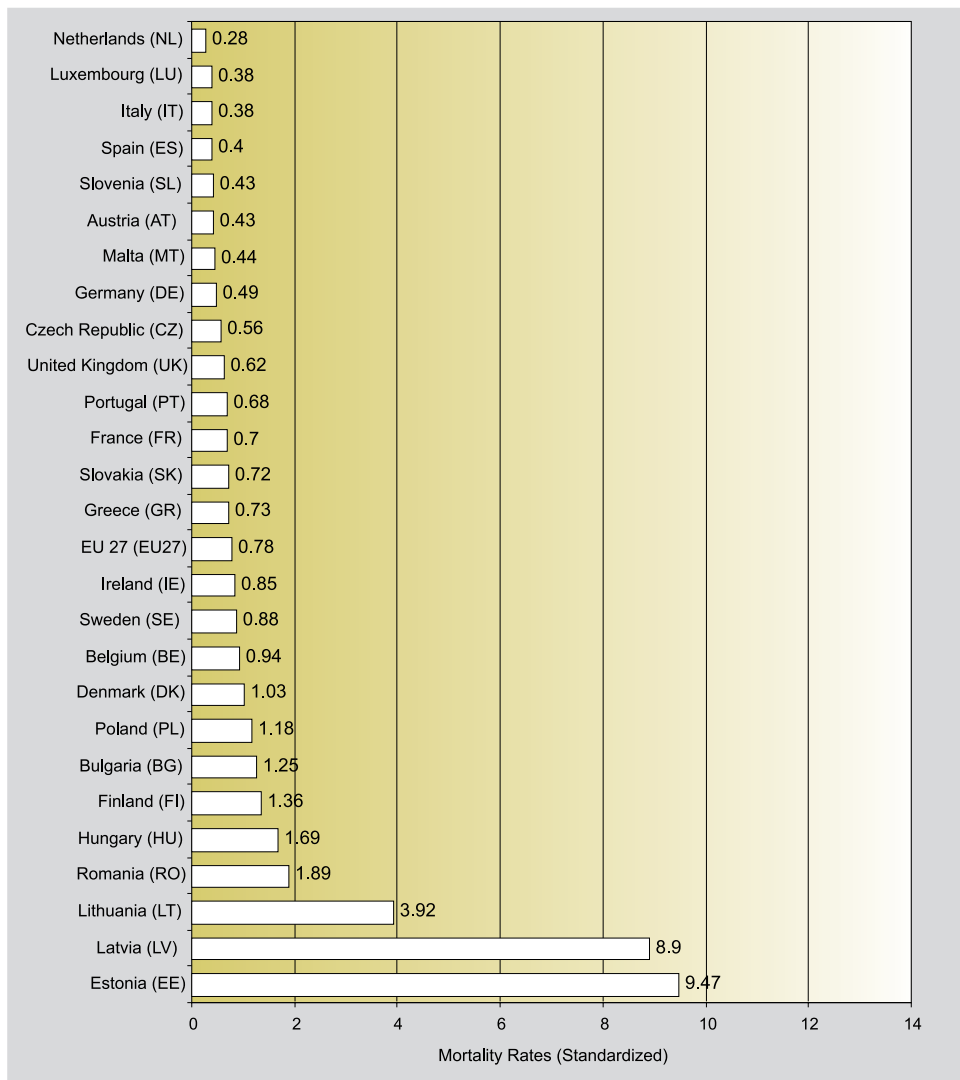
The overall societal costs from injuries due to fires and burns are especially high given that the lesions themselves constitute one of the most expensive types of injuries not only because of high hospitalization costs but also due to costs resulting from properties' demolition.<sup>9</sup> According

to the American Burn Association approximately 40,000 burn injuries require hospitalization annually, and more than 60% of hospitalized burn patients are admitted to a specialized burn unit.<sup>10</sup> The annual total cost of the damages provoked by residential fires in USA was estimated at \$5 billion.<sup>4</sup>

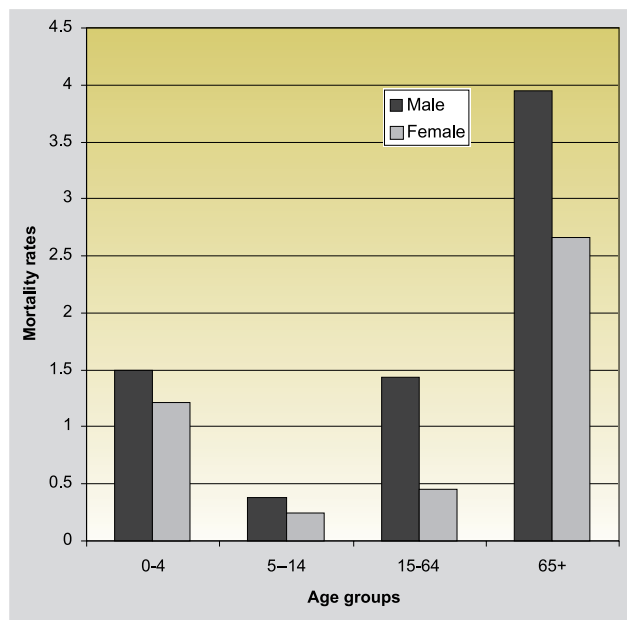
**3. RISK FACTORS**

**3.1. Demographic risk factors**

Age, gender and socio economic status are closely associated with fire related injuries. The age groups mostly suffering burns are children under the age of 5 and older people over the age of 65, in particular those over 80 year old, with same age distribution observed in both developed and developing countries (Figure 2).<sup>6,11-16</sup> Burns and



**Figure 1.** Mortality rates due to fire and burns per 100,000 people by EU member state; average of the last available three years (circa 2002–2004) (Source: WHO mortality database, adjusted by CEREPRI).



**Figure 2.** Mortality rates due to fire and burns per 100,000 people in the EU-27, by year and gender (Source: WHO mortality database, adjusted by CEREPRI).

scalds in Europe are the fifth leading cause of injury death for children<sup>13</sup> and the fourth leading cause of injury death for people aged over 65 years, accounting approximately for 5% of all types of injuries.<sup>6</sup> Male gender is the second strongest predictor of high mortality and morbidity due to fires; indeed, more than 60% of fire related injuries occur among males.<sup>5,6,15</sup> This might be attributed to the fact that boys tend to explore the environment with less sense of danger and fear. Lastly, socioeconomic adverse conditions such as poverty and segregation are frequently encountered among burn injury victims.<sup>17</sup> Likewise, residing in rural areas and belonging to minority groups are positive predictors of both high morbidity and mortality rates due to fires.<sup>4,5,15,18,19</sup>

### 3.2. Behavioural risk factors

Given the dependence of children upon their caretakers, the increased incidence of fire related injuries observed among young children can be possibly attributed to inadequate parental supervision; fire play with matches and lighters was found to account for 42% of all injuries and 62% of deaths in children 0–4 years.<sup>1,20,21</sup> Serious burn-related injuries occur among children aged 10–14, due to fireworks, whereas contemporary lifestyles may account for several types of burn injuries, as those related to motorcycle exhaust pipes.<sup>22,23</sup>

Among elderly, disability and/or cognitive impairment can lead to severe injuries from fire or hot equipments given the reduced sensory and cognitive abilities in this age group, not allowing prompt reaction.<sup>17</sup> The risk of death is higher in those households involving alcohol impaired people; alcohol use contributes to an estimated 40% of residential fire deaths.<sup>4,15,16,24</sup> Smoking is an underestimated risk factor for fatal injuries especially when in the bedroom.<sup>18</sup>

### 3.3. Environmental risk factors

Home is the principal environment where burns and fire-related injuries occur.<sup>4</sup> There is evidence that the most common modifiable risk factors for residential fires are the place of residence, mobile homes and homes with few or no safety features such as smoke detectors or telephone.<sup>15,23</sup> In addition, estimations show that residential fires usually occur at night and during the winter<sup>24,25</sup> especially in poorest countries where people still use traditional heaters (fireplace, stove).<sup>17</sup> Other environmental risk factors that have been identified include lack of water supply, storage of flammable substances at home, cooking equipments in the kitchen that are reachable from children, and housing that is located in slums and congested areas.<sup>26</sup>

## 4. EFFECTIVE PREVENTIVE PRACTICES

The best manner to address the problem of burn injuries is to prevent them. A significant number of burn accidents could have been prevented,<sup>8</sup> as there is evidence to show that prevention programs for domestic accidents had the potential to prevent up to 70% of children's deaths caused by burns.<sup>27</sup> A few of the most effective practices for the prevention of fire and burns are the following:

### Smoke detector

Smoke alarms are particularly effective at preventing fire-related death and injury.<sup>4,10,15,16,28,29</sup> The chances of a fatal injury occurring in a residential fire are reduced to half when a smoke alarm is used.<sup>16,30</sup> Moreover, there is evidence to show that smoke detectors have contributed in reducing residential fires by 71%.<sup>24</sup> However, installation of smoke alarms on each level of the house building is an effective strategy provided that it is maintained properly.<sup>24,27</sup> More specifically, smoke detectors should be regularly tested according to the manufacturer's instructions, replaced at least every 10 years and its batteries should be replaced at least annually and should not be used for other devices.<sup>31</sup>

## Fire extinguisher

Given that a vast majority of residential fires start from the kitchen, a portable fire extinguisher can save both human lives as well as property by putting out at least the small fires.<sup>32-35</sup> Nevertheless, if the fire cannot be extinguished within one minute, the residence should be evacuated, as the rapid accumulation of heat and smoke can be particularly dangerous.<sup>33</sup>

## Avoid smoking in the bedroom

Evidence shows that the use of cigarettes and smoking materials in general is the leading cause of fire deaths both in the U.S and Europe.<sup>15,24,36</sup> Fatal home smoking-related fires are more likely to start in the living room or in the bedroom and 39% of those fires are related to the fact that the smoker fell asleep.<sup>36</sup> Moreover, a significant number of smoking-material fire deaths involve victims with a prior consumption of alcohol or drugs or had some degree of physical or mental impairment due to old age.<sup>36,37</sup> Older adults are at the highest risk of death or injury from smoking-material fires despite the fact that they are less likely to smoke than younger adults. This is why it is strongly recommended that smoking should be avoided inside the bedroom, burning cigarettes should never be left unattended, and cigarette ends should always be checked to make sure they are completely extinguished.<sup>36-39</sup> Moreover, in order to prevent cigarette fires it is preferable that if an individual is drowsy, drunk, or has taken any medication or other drugs does not smoke inside the house.<sup>37,39</sup>

## Make and practice fire escape plans

Fire can spread rapidly leaving little or no time to plan a safe escape. Thus the ability of residents to get out depends on advance warning from smoke alarms, and advance planning of a home fire escape plan.<sup>14,34</sup> For this reason, it is suggested that occupants should develop escape plans that include the identification of two exits from each living

area and should practice exit drills regularly.<sup>30,32-34</sup>

## Store matches out of reach of children

Children should be taught from a young age that matches and lighters are not toys to play with. Matches, lighters, gasoline and all other flammable materials should always be stored out of the reach of young children, preferably in locked cabinets, high off the ground. Moreover, matches or lighters should never be left in the bedroom or any other place where children may enter without adult supervision.<sup>14,32,40</sup>

## 5. CONCLUSION

The majority of severe and fatal burn injuries result from residential fires. In addition to resulting fatalities numerous victims result hospitalized, impaired, or disabled, while others suffer disfigurement and long-term psychological effects. There are a number of practices that can reduce the risk of burns mainly at home. Proper use of functional smoke detectors, along with good knowledge and effective practice of fire escape mechanisms and other safety measures can prevent from many deaths, disabilities, impairments and hospitalizations from residential fires and burns. More specifically it is recommended to:

- Install a smoke detector in your house and regularly test it.
- Avoid smoking in the bedroom or other areas of the home when sleepy and after having a few drinks.
- Store matches, lighters and other flammable materials out of reach of children.
- Get a fire extinguisher and learn how to use it. Tackle only the smallest fires yourself; your first thought should always be to call the fire brigade.
- Make and practice a fire escape plan so that everyone in the household knows how to get out and where to meet in the event of a fire.

## ΠΕΡΙΛΗΨΗ

### Μήνυμα 5: «Ενημερωθείτε για τους κινδύνους της φωτιάς»

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Αρχεία Ελληνικής Ιατρικής 2008, 25(Συμπλ 1):34–39

Τα εγκαύματα είναι μία από τις κύριες αιτίες τραυματισμού και θανάτου παιδιών και ηλικιωμένων άνω των 65 ετών. Παρόλο που η πιο σοβαρή έκβαση ενός εγκαύματος είναι ο θάνατος, εξηγώντας ένα μεγάλο ποσοστό θνησιμότητας στην Ευρωπαϊκή Ένωση, τα εγκαύματα μπορούν να προκαλέσουν μόνιμες σωματικές και ψυχολογικές βλάβες. Επομένως, η ενημέρωση του γενικού πληθυσμού σε ό,τι αφορά τους παράγοντες κινδύνου και τους ορθούς τρόπους αντιμετώπισης της φωτιάς μπορεί να έχει θετικά αποτελέσματα στη μείωση της σοβαρότητας ή ακόμα και της συχνότητας των εγκαυμάτων. Αυτή η εργασία στοχεύει: (α) να περιγράψει την έκταση του προβλήματος και τις κοινωνικο-οικονομικές επιπτώσεις των εγκαυμάτων στις χώρες της Ευρωπαϊκής Ένωσης, (β) να επισημάνει τους υποκείμενους παράγοντες κινδύνου, και (γ) να παρουσιάσει τις επιστημονικά αποδεδειγμένες πρακτικές που μειώνουν την πιθανότητα εγκαυμάτων. Μερικές από αυτές τις πρακτικές έχουν συμπεριληφθεί στον Ευρωπαϊκό Κώδικα Κατά των Ατυχημάτων, προκειμένου το κοινό να ενημερωθεί σχετικά με την πρόληψη των ακούσιων τραυματισμών.

**Λέξεις ευρητηρίου:** Ατύχημα, Έγκαυμα, Ευρωπαϊκός Κώδικας Κατά των Ατυχημάτων, Κάψιμο, Πρακτική, Πρόληψη, Τραυματισμός, Φωτιά,

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