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Inpatient costs of fire-related injuries in Finland



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ABSTRACT

The aim of this study was to approximate the direct health care costs of fire-related injuries in inpatient care in Finland.

Using the PERFECT costing method, cost data from both Finnish burn centres were linked to the fire-related injury patient data from the Finnish National Hospital Discharge Register (FHDR, 2001–2009). Additionally, a sample of 168 patients from the Helsinki Burn Centre was linked to the FHDR to examine the relation of %TBSA.

Burn was involved in approximately 77% of the cases, the remainder consisting mainly of combustion gas poisonings. Burns were generally much more expensive to treat. Fire-related injuries incurred EUR 6.2 million per year in inpatient costs for the whole country. Mean cost per burn patient was EUR 25,000 and for combustion gas poisoning it was EUR 3600. As expected there was a strong relationship between %TBSA and cost. Older age had a strong effect on costs. The most severe injuries cost over EUR 400,000 to treat. Approximately 7–8% of the most expensive cases constitute 50% of the total costs. Successful prevention of extreme cases would yield considerable savings in relation to total annual inpatient care costs. However, a cost–benefit analysis would be needed.

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1. Introduction

Fire-related injuries often have severe consequences; there have been on average 100 fire-related deaths annually during the period 2000–2009 in Finland. Additionally, roughly 300 cases of fire-related injuries annually lead to inpatient care. Data on their epidemiology have been published earlier by our research group [1].

Finland has a population of some 5.4 million. Its public health care and social welfare systems share many similarities with other Nordic countries [2]. Finland is geographically the size of Germany, but has a population density (16 inhabitants per km²) similar to that of Norway.

In Finland there are two specialised centres for severe burns: Helsinki University Hospital (HYKS) and Kuopio University Hospital (KYS). In total there are more than 30 central and district hospitals and five university hospitals [1,3]. The Finnish health care system covers the whole population and its services are mainly delivered by the public sector and financed through general taxation. The local government authorities, the municipalities are responsible for arranging and financing the health and social services.

It is well known that the costs of burns can be very high, though variation between studies is also seen (Table 2). There are no reports on the costs of fire-related injuries leading to inpatient care in Finland, which makes cost–benefit analyses impossible in the field of prevention.

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Table 1 – Coding in the Finnish National Hospital Discharge Register associated with fire-related injuries according to the International Classification of Diseases and Related Health Problems -classification system's 10th version (ICD-10) and definition of records related to fire-related injuries.

ICD-10 code	Meaning
00-X09	Exposure to smoke, fire and flames
X76	Intentional self-harm by smoke, fire and flames
X97	Assault by smoke, fire and flames
Y26	Exposure to smoke, fire and flames, undetermined intent
X47	Accidental poisoning by and exposure to other gases and vapours
T20-T32	Burns and corrosions
T58	Toxic effect of carbon monoxide
T59	Toxic effect of other gases, fumes and vapours
Definition used for fire-related discharge record (any of the following conditions is met):	
<ul style="list-style-type: none"> • E-code in the set of {X00-X09, X76, X97, Y26} • E-code is X47 while any of the N-codes are T20-T32 • Any of the N-codes are T20-T32 while simultaneously any of the other N-codes are T58-T59 	

Combustion gas poisoning is a minor but essential part of fire-related injuries [1]. Unfortunately there are only a few studies on the hospital costs of carbon monoxide (CO) poisoning, even though it is the most common element among combustion gas poisonings. We could only find one study that included hospital-cost estimates for CO poisoning. Iqbal et al. [12] found the mean cost of hospitalisation to be as high as USD 11,381 (EUR 8330) for accidental, non-fire-related CO poisoning (such as cooking appliances, fuel-powered equipment) in the USA in 2007.

This study aims to summarise, describe and give an overview of the costs of injuries due to smoke, fire and flames that required inpatient care in the whole country during a 9-year period, from 1 January 2001 to 31 December 2009.

2. Materials and methods

The Finnish National Hospital Discharge Register (FHDR) covers all university, general and mental hospitals, including inpatient wards of health centres, military and prison wards and private hospital wards nationwide. The data include personal identity numbers as well as information on age at admission, gender, hospital identifier code, admission and discharge dates, external cause of injury (E-code), and nature of injury (N-code) [13]. Basically, the FHDR covers all inpatient care in Finland. Furthermore, the FHDR is suitable for studying fire-related injuries [13]. Data were obtained on fire-related injury patients from the FHDR covering all inpatient care for the period 1 January 1999 to 31 December 2009.

All patients nationwide with a fire-related injury requiring inpatient care in the period 2001–2009 were included. Injured patients were identified in the FHDR as having at least one discharge record from inpatient care that referred to a fire-related injury. The authors defined fire-related injuries according to the International Statistical Classification of Diseases and Related Health Problems 10th revision [14], as presented in Table 1 defined similarly to that in the previous epidemiological study [1]. In principle, fire-related injuries are injuries caused by fire, flames (causing burn) or smoke from fire (causing mostly combustion gas poisoning). For example, injuries due to house fire or due to ignition of clothing are fire-related injuries.

Determining incident cases was done analogous to [1]. All inpatient care for the included patients was monitored from the beginning of 1999. A two-year clearance period was used to determine new incident cases; if a patient's care history did not contain inpatient care for potential fire-related injury within the previous two years, the episode under consideration was considered to indicate a truly new injury. If there was care within the previous two years, the episode under consideration was considered as a later operation. Therefore the earliest year for determining incident cases was 2001.

Table 2 – Summary of some burn cost studies. Studies with unknown year for the data are given according to the year of the study. Currencies exchanged to the latest data year's Euros if stated in other currency. Currency conversions were performed by OANDA currency converter using the exchange rate on the last day of the year [4].

Study/authors	Year of the data	Sample	Costs information
The true cost of burn/Ahn et al. [5]	2007–2010	20 patients	Mean AUD 71,056 (EUR 50,120), %TBSA 7.52 Largest AUD 842,419.09 (EUR 594,230), %TBSA 62
Burn care costing: The Welsh Experience/Hemington-Gorse et al. [6]	2005–2006	3 patients	Largest EUR 761,205, %TBSA 48 Smallest EUR 121,496, %TBSA 27
The epidemiology of patients with burns admitted to Norwegian hospitals in 2007/Onarheim et al. [7]	2007	874 stays for acute burn care	Mean EUR 11,800 per stay
Hospital Stays for Burns, 2004/Milenkovic et al. [8]	2004	32,500 hospital discharges	Mean USD 17,300 (EUR 12,680) per stay
The cost of extensive burn survival/Eldad et al. [9]	1992 (study year)	1 patient	USD 141,750 (EUR NA in 1992), %TBSA 95
Cost analysis of acute burn patients treated in a burn centre: the Gulhane experience/Sahin et al. [10]	2005–2008	43 patients	Mean USD 15,250 (EUR 12,010) per stay, average %TBSA 36
The cost of a major paediatric burn/Pellatt et al. [11]	2010 (study year)	3 patients	Mean GBP 63,157.22 (EUR 73,710) Range GBP 55,354.79–74,494.24 (EUR 64,610–EUR 86,950) %TBSA 30–40

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