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Economic burden of burn injuries in the Netherlands: A 3 months follow-up study

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ABSTRACT

Introduction: Burn care has rapidly improved in the past decades. However, healthcare innovations can be expensive, demanding careful choices on their implementation. Obtaining knowledge on the extent of the costs of burn injuries is an essential first step for economic evaluations within burn care. The objective of this study was to determine the economic burden of patients with burns admitted to a burn centre and to identify important cost categories until 3 months post-burn.

Patients and methods: A prospective cohort study was conducted in the burn centre of Maasstad Hospital Rotterdam, the Netherlands, including all patients with acute burn related injuries from August 2011 until July 2012. Total costs were calculated from a societal perspective, until 3 months post injury. Subgroup analyses were performed to examine whether the mean total costs per patient differed by age, aetiology or percentage total body surface area (TBSA) burned.

Results: In our population, with a mean burn size of 8%, mean total costs were €26,540 per patient varying from €742 to €235,557. Most important cost categories were burn centre days (62%), surgical interventions (5%) and work absence (20%). Flame burns were significantly more costly than other types of burns, adult patients were significantly more costly than children and adolescents and a higher percentage TBSA burned also corresponded to significantly higher costs.

Discussion and conclusion: Mean total costs of burn care in the first 3 months post injury were estimated at €26,540 and depended on age, aetiology and TBSA. Mean total costs in our population probably apply to other high-income countries as well, although we should realise that patients with burn injuries are diverse and represent a broad range of total costs. To reduce costs of burn care, future intervention studies should focus on a timely wound healing, reducing length of stay and enabling an early return to work.

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Introduction

Burn care has rapidly improved in the past decades, which is reflected by the fact that even patients with extensive burns can survive nowadays [1,2]. Examples of major improvements in burn care of the second half of the 20th century are the introduction of silver-containing topical antimicrobials, early excision and grafting, shock prevention and the multidisciplinary approach to burn care [3–5]. Further advances in wound healing, rehabilitation and psychological care are desirable to help burn survivors to reach an optimal quality of life. Unfortunately, healthcare innovations can be very expensive and in the current economic climate authorities have to make careful choices on the implementation of (new) treatments. Therefore the costs of new interventions should be calculated and balanced against their effectiveness. In other words,

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in the development of burn care improvements, cost-effectiveness analysis should also be taken into account.

A firststep in the economic evaluation of burn care is obtaining knowledge on the extent of burn care costs. We recently conducted a systematic literature review on the costs of burn care [6]. A surprisingly high number of studies (n = 156) could be included, unfortunately, the methodology of most studies was poor. Studies often provided limited information on cost calculations and components, and often used charges as a proxy to calculate costs. This impeded the presentation of total costs and cost distribution within burn care. Our review showed that the costs of burn patients per treatment or per day were often higher than other injuries [7–12]. Total burn care costs in high-income countries varied widely in the different studies with a mean of $88,218 (€64,112) per patient and a range of $704–$717,306 (€512–€521,298). Burn centre days and burn centre intensive care days proved to be major cost components [13–15] and amounted to 82% of the total burn care costs per patient. Surgery was another important cost category. The majority of studies calculated acute burn hospitalisation costs only. In two studies, from Sanchez et al., costs were described from a societal perspective, thus including caregiver, social and labour costs: medical costs represented only 10–20% of the total costs per patient, the other 80–90% of the costs related primarily to productivity losses and informal care [16,17]. Patient characteristics predicting high costs were both flame burns [18–20] and extensive burns, but no further increase was reported above 80% total body surface area (TBSA) burned [18–22].

Although existing literature gives a useful first impression of burn care costs, several questions remain. In the literature broad ranges of total burn care costs and burn centre days were presented, often based on hospital charges instead of real costs analyses. Therefore, it is questionable whether the mean burn care costs based on these study results correspond to burn care in a high-income country, such as the Netherlands. Furthermore, it is interesting to determine the extent of non-medical costs in patients with burns, and to see whether they are as high as predicted by Sanchez et al., [16]. Therefore, the objective of this study was to give a detailed overview of all costs of patients with burns admitted in a burn centre in the Netherlands, with a 3 months follow-up.

Patients and methods

The study was conducted in the burn centre of the Maasstad Hospital Rotterdam, the Netherlands, including all patients admitted with a burn related injury between 1 August 2011 and 31 July 2012. All children with burns over 5% and adults with burns over 10% TBSA could be referred. Additional referral criteria included burns of special areas (i.e. face, major joints), full thickness burns >5% TBSA, and burns with associated inhalation injury. During a part of the study period (26 February until 31 July) the burn centre was limitedly available due to renovation activities: admission was restricted to adults ≤40% TBSA burned and children <10% TBSA burned only. Data regarding patients' baseline characteristics and healthcare use were obtained from hospital patient records. Patients received a questionnaire 3 months post-burn with questions regarding extramural medical costs, and non-healthcare costs. Patients gave consent to participate in the study, for patients <18 years old, written informed consent was signed by the (both) parents/caregivers. Approval for the study was obtained from the ethics committee of the Maasstad Hospital (protocol 2011/34).

Costs analysis

The cost analysis was performed in accordance with the Dutch guidelines [23]. Costs were calculated from a societal perspective including direct healthcare costs (burn centre stay, other specialised burn care costs, and other healthcare costs), direct non-healthcare costs (patient costs and travel costs) and indirect non-healthcare costs (productivity loss). Real medical costs were calculated by multiplying the volumes of healthcare use with the corresponding unit prices. The costs applied to the financial year 2012.

The costs of *burn centre stay* consisted of personnel (including burn physicians), material (excluding wound care), equipment, food, laundry and medication costs per days including a 41.9% increase for housing and overhead. We included a minimum of categories in the burn centre day costs (mainly fixed costs). All costs, which could be calculated separately per patient, were left out of the day price and are described in the paragraph below. Unit prices of ICU and non-ICU burn centre days were calculated according to the bottom up approach, following the micro costing method of Gold et al. with prices derived from our financial department [24]. The unit price of day-care was determined using a proportion (37%) (according to Hakkaart-van Roijen et al., [23]) of the unit price for a non-ICU hospital day.

Other specialised burn care costs consisted of diagnostics, surgical treatment, wound care and blood products.

- *Costs of diagnostic procedures* were calculated based on charges derived Hakkaart-van Roijen et al., [23].
- The unit price of *surgery* was determined by micro-costing, taking into consideration the initial investment of equipment, investments during use, maintenance, number of years of use and discounting the number of procedures per year, material costs, personnel costs (per hour) and a 41.9% increase for housing and overhead in accordance with the guidelines. Personnel costs were determined by the average number of physicians, surgical and anaesthetic assistants per surgery, which was registered in a previous study [25].
- The unit prices of *wound care* were determined by microcosting; separate unit prices were calculated for patients with 1) hydrofiber wound dressings (often used in scalds <10% TBSA burned), 2) TBSA ≤20% (excluding patients defined as hydrofiber-patients), and 3) TBSA >20%. Cost estimation was based on a subset of patients (n = 30), with prices derived from our financial department.
- The unit price of *reconstructive surgery* was determined before by micro-costing [26].
- Unit prices of *blood products* (*erythrocytes*), *pressure garments*, *silicone therapy and splints* were derived from our financial department and Dutch guidelines [23].
- The unit prices of *inpatient and outpatient consultations* were derived from Dutch guidelines [23].

Other healthcare costs, including nursing-home care, rehabilitation centre care, visits to general practitioners and allied health professionals outside the hospital, were assessed by questionnaires, which were sent 3 months post-burn. Unit prices were derived from the Dutch guidelines [23].

Patient costs, including loss of economic productivity due to absence from work (by both patients and parents in case of patients <18 years of age) and travel costs, were assessed by questionnaires 3 months post-burn. Unit prices were derived from the Dutch guidelines, hourly wages of €32 were used for our population [23]. Productivity loss was estimated using the friction cost method, this method accounts for the fact that everybody is replaceable within a certain period of time, which is related to the unemployment rate and mobility of the labour market (friction period of 160 days) [23].

Statistical analyses

Data analysis was performed using SPSS Statistics 20.0. As cost data are typically highly skewed, non-parametric bootstrapping

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