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Paediatric burn unit in Portugal: Beds needed using a bed-day approach

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ABSTRACT

Introduction: Despite the high burden of children with burns, there is not a paediatric burn unit (PBU) in Portugal. We aimed to estimate the Portuguese health care providing needs on paediatric burns.

Methods: We performed a nation-wide retrospective study, between 2009 and 2013, among less than 16 years-old inpatients with burns that met the transfer criteria to a burn unit in Portugal. A bed-day approach was used, targeting an occupancy rate of 70–75%, and possible locations were studied. The primary outcome was the number of beds needed, and secondary outcomes were the overload and revenue for each possible number of beds in a PBU.

Results: A total of 1155 children met the transfer criteria to a burn unit, representing a total of 17,371 bed-days. Occupancy rates of 11-bed, 12-bed, 13-bed and 14-bed PBU were, respectively, 79.7%, 75.3%, 71.0% and 66.8%. The 13-bed PBU scenario would represent an overload of 523 bed-days, revenue of more than 5 million Euros and a ratio of 1 PBU bed per 123,409 children.

Conclusions: Using a groundbreaking approach, the optimal number of PBU beds needed in Portugal is 13. However, as half of the patients who met burn transfer criteria are not transferred, this bed number might be overestimated if this pattern maintains, despite the underestimation with our method approach. If a PBU is to be created the preferable location is Porto. Cost-effectiveness studies should be performed.

1. Introduction

Burns are one of the most traumatic injuries with inherent morbidity that leads to a decrease in the patients' quality of life [1]. This is particularly worrying in children – an age group especially vulnerable – with burns representing the 11th leading cause of death (in children aged 1–9 years) and the 5th most common cause of non-fatal childhood injuries [2]. In fact, children younger than 15 years hospitalised for burns have a 1.6 times greater rate of mortality than those with no injury [3]. Even when burns are non-fatal the results are devastating, usually leading to disfigurement, disability, long hospitalisation periods and often stigma and rejection [2]. Furthermore, the emotional impact and disrupting effect on their families (e.g. missed work hours by the parents, arrangements for home-care, premature mortality) should

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also be considered, and all efforts should be made to mitigate them [4].

Severe burns should be admitted to burn units. Even those intensive care units (ICUs) that also provide burn care lack several requirements (e.g. optimal wound care) [5]. General ICUs do not have equipment, personnel or expertise to provide an optimal burn care [4]. Moreover, differences such as patients' isolation, rooms with positive air pressure, dedicated operating rooms, wide range temperature settings and total isolated facilities make burn units particularly effective on infection prevention. In fact, burn centres have developed requirements and resources to address the novel improvements in the burn care, improving significantly the quality of care provided for burn patients [6].

Cost-effectiveness of burn units should also be considered and is not well-studied [4]. Nevertheless, it is known that early transfer of children with severe burns to a burn centre might truncate hospitalisation periods and reduce costs, furthermore it is also known that, in some cases, paediatric burn care can be a profit centre for the hospital [7,8].

In Portugal, one-fifth of burn admissions are from children aged 0–4 years old [9]. Although the number of admissions and the hospitalisation rate have decreased in children <15 years old, the latter seemed to stabilise after 2008 [9]. Still, there is not any paediatric burn unit (PBU) in Portugal. In fact, the possible need of a paediatric burns centre had already been pointed out [9].

Our aim was to estimate the Portuguese health care providing needs on paediatric burns, i.e. the number of beds on PBU and its possible location; and to analyse associated occupancy, overload, revenue, and bed ratio per resident children.

2. Patients and methods

We conducted a retrospective observational study, using the Portuguese hospitalisation database from mainland public hospitals provided by the Portuguese Ministry of Health's Authority for Health Services. We included inpatient hospitalisations in children with less than 16 years-old from 2009 to 2013 and with a main or secondary diagnosis of burns, coded as 940.xx-949.xx using the International Classification of Diseases – 9th Revision – Clinical Modification (ICD-9-CM).

To subset our population of children with transferal burn criteria to a burn unit, we followed the European Burns Association (EBA) guidelines (third version—Hannover) that takes into account the percentage of TBSA by age groups, anatomical site, aetiology, depth, required treatment, concomitant comorbidity or injury and other specific diseases (e.g. toxic epidermal necrolysis, necrotizing fasciitis, staphylococcal scalded child syndrome) [10]. To subset the population, the EBA guidelines were favoured over the Portuguese normative report from the Authority for Health Services [11].

The administrative database used does not allow the level of detail for some issues of the EBA guidelines. Therefore, and following a more conservative approach with narrower criteria, the episode selection for transfer to a PBU was made as follows: (1) over 10% of TBSA in children 0–9 years of age and over 20% of TBSA in children 10–15 (second degree); (2) burns on the face, hands, genitalia or major joints; (3) third degree burns (any percentage of TBSA); (4) burns with a suspicion of inhalation injury; (5) electrical burns; or (6) chemical burns. Table 1 shows the ICD-9-CM codes' selection used to describe these criteria.

After selection of eligible episodes for PBU, we calculated the number of patients for each day in the 5 year period (1826 days) as if they were admitted in a PBU.

A bed-day is a day during which a person is confined to a bed and in which the patient stays overnight in a hospital [12], e.g. 3 bed-days may be 3 beds in 1 day or 1 bed in 3 days.

We estimated the number of available bed-days by multiplying the total number of days (i.e. 1826 days) for each possible number of beds between the minimum and the maximum of possible occupancy e.g. number of available bed-days for a 6-bed PBU = 6 beds × 1826 days = 10,956 (available) bed-days.

Already knowing the number of needed beds for each day in the 5 years studied, based on episodes, we calculated the number of occupied bed-days for each possible number of

Table 1 – ICD-9-CM codes of the characteristics used for the selection of burn children who met the European Burns Association (EBA) burn transferal criteria for a burn unit.

Burn transferal criteria	ICD-9-CM codes
Second degree burns	(941.2X OR 942.2X OR 943.2X OR 944.2X OR 945.2X OR 946.2X OR 949.2X) AND
TBSA ≥ 10%	(948.10 OR 948.20 OR 948.30 OR 948.40 OR 948.50 OR 948.60 OR 948.70 OR 948.80 OR 948.90)
TBSA ≥ 20%	(948.20 OR 948.30 OR 948.40 OR 948.50 OR 948.60 OR 948.70 OR 948.80 OR 948.90)
Burns on the face	940.XX OR 941.X2 OR 941.X3 OR 941.X4 OR 941.X5 OR 941.X7
Burns on the hands	944.XX
Burns on the genitalia	942.X5 OR 947.4
Burns on the major joints	943.X2 OR 943.X4 OR 943.X5 OR 945.X3 OR 945.X5
Third degree burns	948.X1 OR 948.X2 OR 948.X3 OR 948.X4 OR 948.X5 OR 948.X6 OR 948.X7 OR 948.X8 OR 948.X9 OR 941.3X OR 941.4X OR 941.5X OR 942.3X OR 942.4X OR 942.5X OR 943.3X OR 943.4X OR 943.5X OR 944.3X OR 944.4X OR 944.5X OR 945.3X OR 945.4X OR 945.5X OR 946.3X OR 946.4X OR 946.5X OR 949.3X OR 949.4X OR 949.5X
Inhalation injury	506.X OR 947.0 OR 947.1 OR 947.9
Electrical burns	E925.X OR E958.4 OR E988.4
Chemical burns	E958.7 OR E988.7 OR 940.0 OR 940.2 OR 940.3

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