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Accuracy of commercial reporting systems to monitor quality of care in burns

Amer Hussain, Ken W. Dunn *

University Hospital South Manchester, Southmoor Road, Manchester M23 9LT, United Kingdom

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ABSTRACT

Introduction: Capse Healthcare Knowledge Systems (CHKS) is a global commercial organisation that operates health benchmarking programmes in the UK and internationally. In absence of a specialty-specific quality monitoring programme for burn services, CHKS has been producing comparative quality data for burn services for a number of years. The major quality indicator reported by CHKS is mortality as a Risk Adjusted Mortality Index (RAMI). The accuracy of RAMI is unknown in comparison to published burn-specific mortality prediction models.

Methods: A retrospective study design was used to collect data for patients admitted to the Adult Burn Service at University Hospital South Manchester (UHSM) between January 2006 and December 2010. Data was collected from two sources, CHKS and Manchester Burn Injury Database (MBID). The demographic and injury characteristics of survivors and non-survivors were compared and Receiver Operator Curve (ROC), equivalence and non-inferiority analyses were used to assess accuracy of RAMI in comparison to Abbreviated Burn Severity Index (ABSI), Belgian Outcome of Burn Injury (BOBI) score, Baux score (Baux) and McGwin score (McGwin).

Results: The accuracy of RAMI to discriminate between survivors and non-survivors (area under curve = 0.79, 95% CI 0.50–0.81) was significantly inferior to that of ABSI, BOBI, Baux and McGwin scores. Equivalence and non-inferiority testing of ROC curves also showed RAMI score to be inferior to ABSI, BOBI, Baux and McGwin scores at 5% significance level.

Conclusion: CHKS RAMI provides an inaccurate and inferior monitoring of mortality as a quality indicator in burn patients compared to burn specific mortality prediction models. This study raises concerns about the ability of commercially reported systems to accurately monitor quality indicators of relevance to burn care.

1. Introduction

Similar to many global healthcare systems the National Health Service (NHS) in the United Kingdom is currently in the midst of fundamental changes aimed at improving the quality of care in an environment of financial austerity [1–3]. These efforts have renewed focus on the use of information on outcomes as a consequence of clinical care to monitor performance of service providers to drive improvements in quality [4]. As an on going progression of such initiatives, more recent emphasis has been on the use of performance indicators to identify service providers with ''outlying'' or suboptimal performance [5]. Consequently there is currently increasing pressure on service providers, including burn services, to produce ''quality accounts'' and ''quality dashboards'' that document, monitor and evaluate the results of their clinical activity [6]. Burn services in the UK are currently

* *Corresponding author*. Tel.: +44 161 291 6323; fax: +44 161 291 6323.
E-mail addresses: amh@doctors.net.uk (A. Hussain), ken.dunn@uhsm.nhs.uk (K.W. Dunn).
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in the midst of developing a service-specific quality assurance and performance monitoring systems to be operated via the international Burn Injury Database (iBID) [7]. In the absence of such a specific quality assurance programme, public/private organisations have been producing comparative data on burn services for a number of years utilising routinely collected administrative data sources [8,9]. One such organisation, Capse Healthcare Knowledge Systems (CHKS) Ltd, works with clients in more than 15 countries and operates healthcare benchmarking programmes across all 4 UK countries and internationally. Within the UK it has been providing benchmarking information to hospitals since 1989 and actively works with 70% of acute NHS trusts including many burn services [9]. CHKS supplies service providers with data on quality indicators that allows them to compare their performance relative to other providers in their designated peer group. For benchmarking of burn services the principle quality indicator produced by CHKS is inpatient mortality, which is reported as a Risk Adjusted Mortality Index (RAMI), a ratio of observed to predicted mortality. RAMI utilises a proprietary risk-adjustment methodology and little is known of the accuracy of this prediction methodology compared to conventionally employed mortality prediction models developed specifically for use in burn patients. Hence the aim of this study is to examine the accuracy of RAMI prediction model against more widely accepted burn-specific mortality prediction models to ultimately determine the accuracy and robustness of this commercial monitoring and reporting system.

2. Materials and methods

A retrospective observational study design was used to review prospectively collected data for all patients admitted to the Northwest Regional Adult Burn Service at University Hospital South Manchester (UHSM). Data was obtained from two sources, CHKS and Manchester Burn Injury Database (MBID), for the period between January 2006 and December 2010.

CHKS provided data for all admissions attributed to the burn service over the study period which were identified using burn related primary diagnosis International Classification of Diseases (ICD) codes i.e. T20–T32. The variables included in the dataset were age, gender, length of stay (LOS), outcome (survivors or non-survivors) and individual RAMI-predicted mortality scores. No details were provided by CHKS about the RAMI prediction model including its constituent variables.

MBID is an institutional clinical database that contains real time data for individual patients admitted to the Adult and Paediatric burn services. Data is entered using iBID software available to all burn services in the UK and is checked by clinical staff during the admission and at discharge for completeness and errors. The database includes information on more than 200 demographic (age, gender, ethnicity, address), injury [type of burn, causation, %total body surface area (TBSA), %deep dermal/full thickness (DD/FT) burn, first aid], co-morbidity, treatment (mechanical ventilation, surgical episodes, other interventions) and outcome (complications, LOS, mortality, cost) variables. MBID also utilises several published risk-adjusted mathematical models to predict mortality specifically for use in burned patients. These models produce an individual risk of mortality for each patient admitted to the service and include Abbreviated Burn Severity Index (ABSI) [10], Belgian Outcome of Burn Injury (BOBI) score [11], Baux score (Baux) [12] and McGwin score (McGwin) [13]. The variables incorporated in these models include many demographic and injury descriptors that are available on admission of a patient to the burn service e.g. patient age, sex, %TBSA, inhalation injury, co-existent trauma and presence of FT burn (Table 1). However McGwin also uses 'pneumonia' as an additional variable in the mortality prediction model, information on which is only available during the course of patient's hospitalisation or on discharge. Hence ABSI, BOBI and Baux provide a prospective outcome prediction on admission where as McGwin provides a probability of outcome retrospectively on patient discharge or once the complication has developed.

MBID was used to construct a dataset of all admissions to the adult burn service over the study period.

CHKS and MBID datasets were linked using FileMaker Pro 11 (FileMaker Inc.) and information on relevant variables, including RAMI, ABSI, BOBI, Baux and McGwin scores, for

Table 1 – Mortality prediction models employed by Manchester Burn Injury Database (MBID).

Score	Model	Comments
ABSI	Probability of death = 1/1 + exp(−2 s); S = B0 + B1 × (summed score); Summed score = age (0–20 = 1; 21–40 = 2; 41–60 = 3; 61–80 = 4; 81–100 = 5) + %TBSA (0–10 = 1; 11–20 = 2; 21–30 = 3; 31–40 = 4; 41–50 = 5; 51–60 = 6; 61–70 = 7; 71–80 = 8; 81–90 = 9; 91–100 = 10) + inhalation injury (yes = 1, no = 0) + full thickness burn (yes = 1, no = 0) + gender (female = 1, male = 0)	Abbreviated Burn Severity Index (ABSI); score 2–3 (very low risk, >99% probable survival), 4–5 (moderate risk, 98% probable survival), 6–7 (moderately severe risk, 80–90% probable survival) 8–9 (Serious risk, 50–70% probable survival) 10–11 (Severe risk, 20–40% probable survival), 12–13 (maximum risk, <10% probable survival).
BOBI	Age + %TBSA + inhalation injury	Age if <50 = 0, 50–64 = 1, 65–79 = 2, ≥80 = 3; % TBSA if <20 = 0, 20–39 = 1, 40–59 = 2, 60–79 = 3, ≥80 = 4; inhalation injury; yes = 3, no = 0
Baux	Age + %TBSA	Baux score ≥ 75 = LA50 (i.e. 50% mortality)
McGwin	Probability of death = 1/1 + exp(logit); logit = −7.3406 + (0.0556 × age) + (0.0654 × %TBSA) + (1.334 × inhalation injury) + (0.2052 × co-existent trauma) + (0.5177 × pneumonia)	Inhalation injury, co-existent trauma and pneumonia are binary variables (1 if present otherwise 0)