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Missing patients in a regional trauma registry: Incidence and predictors

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ABSTRACT

Background: Trauma systems have data registries in order to describe and evaluate (the quality of) trauma care. If results between centres and countries (benchmarking) are to be compared, data has to be accurate, reliable and complete. All trauma registries deal with incompleteness. A contributor to incompleteness of the data is failure to include patients that fulfil the criteria; the so-called missing patients. The aim of this study is to assess the number of missing patients in our regional trauma registry and to identify predictors for being missing from the trauma registry.

Methods: A random sample was taken. Four calendar weeks from 2012 were selected and medical files of all consecutive presentations to the emergency department or trauma room during those weeks were studied. Patients who were already correctly included in the trauma registry were assigned to the 'included' group and patients who should have been but were not to the 'missing' group. Multivariable logistic regression analysis was performed to identify predictors for being missed from the trauma registry.

Results: Of a total of 338 patients, 50 (15%) were identified as missing. Characteristics of the missing patients did not differ substantially from the included patients. Transfer to another hospital after initial assessment and presentation in a Level 3 hospital compared to a Level 1 hospital were independent predictors for being missed from the trauma registry, with an adjusted odds ratio of 5.86 (95% CI: 2.08–16.52) and 6.64 (95% CI: 1.86–23.78), respectively.

Conclusions: Overall, 15% of the patients who met the inclusion criteria of the trauma registry were not included in the registry. Special attention should be paid to patients who are transferred to other hospitals in the network after initial assessment and to registration in Level 3 hospitals.

Background

Trauma systems have data registries in order to describe and evaluate (the quality of) trauma care which is aimed at trauma system improvement [1]. In addition to quality assurance and performance improvement, data from the trauma registry are used for outcome and trend of patient care in an individual institution, developing and evaluating trauma prevention programmes, and conducting outcome research [2], which includes benchmarking. In order to draw meaningful conclusions and to compare results between centres or countries (benchmarking), registered data has to be accurate, reliable and complete. Previous research showed that the reliability of the most important outcome measures of the regional trauma registry (injury coding, injury severity scoring and survival status) is high [3]. Another important aspect of trauma registry consistency is the completeness of the data. Different research groups have shown that all trauma registries deal with (some form of) incompleteness [4–7] and this is known to be a major barrier to the valid analysis of data [8]. It can be difficult to obtain complete data, especially with physiological data such as the Glasgow Coma Scale [6,9]. Failure to adhere to the inclusion criteria can be an important contributor to the incompleteness of the data as well. Adherence to the inclusion and exclusion criteria is yet another aspect of trauma registry consistency. The number of incorrectly included patients (i.e. those who do not fulfil the criteria) should be minimised, as should the number of patients who should have been included but who were not; the so-called missing patients.

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In our Trauma Care network, regular checks are performed to r emove the patients who were incorrectly included. However, no data are available on the number of missing patients. In addition, it is unknown whether the characteristics (patient and injury characteristics) of the missing patients differ from the included patients. Insight into the number of missing patients and the comparability of this patient group to the group of included patients is important if we are to determine whether the conclusions drawn from the trauma registry, and used for quality investigation procedures, are representative of all trauma cases. Should there be systematic differences in the types of patients captured in registries—referred to as case ascertainment—then differences in outcomes in centres might be related to differences in inclusion rather then differences in the quality of care [10].

The aim of this study was to assess the number of missing patients in our regional trauma registry and to identify predictors for being missing from the registry.

Methods

Trauma registry

The trauma registry is a prospective data collection which is completed according to the MTOS+ dataset [11]. All patients with injuries after trauma who are admitted to the hospital within 48 h after their trauma, who are referred to another hospital for admission or who die in the emergency department, are included in the trauma registry. Exclusion criteria include admission for poisoning, an insect bite, (self) intoxication and dislocation after a total hip replacement. Nine hospitals (ten locations) are part of the regional network and contribute to the registry; one Level 1 hospital, three Level 2 hospitals and five Level 3 hospitals. The region that is covered by the network encompasses part of the city of Amsterdam and an area to the north and northeast of 2300 km^2. Most of the area is densely populated with about 1.4 million inhabitants. Data for the registry is collected at each hospital by data managers, partially with electronic linking with the hospital information system.

Study design and sample size

First, the required sample size (comprised of both the included and the missing patients) was calculated with the formula depicted in Fig. 1. We calculated the sample size with a hypothesis of 30% missing patients, a confidence interval of 0.25–0.35 and a reliability of 95%. This resulted in a sample size of 340 patients. We randomly sampled calendar weeks from the trauma registry over the year 2012 to compensate for the inability to sample patients who are missed. The number of calendar weeks, plus or minus 30% missing patients, which were required to re-evaluate all 340 patients, was estimated at three (median number of included patients per week: 6165/52 = 119). As the frequency of trauma presentations is unequally distributed over time, four calendar weeks from 2012 were selected using the 'random sample of cases' option in IBM statistics software (IBM Corp., Armonk, NY, USA). The number of patients re-evaluated per hospital was proportionate to their inclusion contribution to the trauma registry. The minimum number of patients per hospital was set at 20. The corresponding weeks served as a guideline; when the required number of patients per hospital were re-evaluated the data managers stopped coding.

$$n = \frac{z^2\,(p\,q)}{e^2}$$

n= required sample size
z = 1,96 (level of confidence of 95%)
p = estimated percentage of 'missing patients' in the population
q = 100-p
e = accepted sampling error

Fig. 1. Formula that was used to calculate the required sample size.

Data collection

Data collection was performed by four qualified coders from our trauma network. The medical file of all the patients who were consecutively presented to the Emergency Department or Trauma Room after an injury (traumatic cause) in the randomly selected calendar week(s) was studied. The coders selected the patients who fulfilled the inclusion criteria of the trauma registry. The patients who were already included in the trauma registry were assigned to the 'included' group and the patients who should have been but were not were assigned to the 'missing' group.

Of the patients who were labelled missing, the following characteristics were collected: age, gender, trauma mechanism, physiological parameters and injury characteristics (number of injuries, number of injured region(s), severity of injuries, injury severity score (ISS)), length of hospital and Intensive Care Unit stay, and in-hospital mortality. Probability of survival was calculated with the TRISS method, which combines the ISS, revised trauma score (systolic blood pressure (SBP), Glasgow Coma Scale (GCS), respiratory rate (RR)) and age of the patient [12,13].

Statistical analysis

Data were analysed using IBM statistics software package version 20 (Armonk, NY: IBM Corp., USA). Categorical data were expressed as number (percentages). Normally distributed numerical data were expressed as mean (standard deviation (SD)) and non-normally distributed numerical data as median (p25–p75).

The chi-squared test was used for categorical variables. The Mann–Whitney *U* test and the unpaired *t*-test were used for continuous variables (non-normally distributed and normally distributed, respectively). A p-value <0.05 was considered statistically significant. We performed multiple imputation to deal with missing data (missing at random assumption) for the physiological parameter SBP. A regression model with the following variables was used to impute the data; gender, age, trauma mechanism, RR, SBP, GCS, department of admission, length of hospital and ICU stay, ISS and mortality. The range of p-values of the ten rounds of imputation was presented. Complete case analysis was performed for GCS.

Multivariable logistic regression analysis was performed to identify predictors for being missing from the trauma registry. A risk factor modelling approach was used to identify which variables to add to the model. We included only covariates that we considered important, based on clinical grounds, with a maximum of five variables simultaneously. The scale of the continuous variables was checked using fractional polynomials [14]. Odds ratios (OR) were presented with their 95% confidence interval.

Results

After exclusion of two patients who were included in the trauma registry but who were discovered not to fulfil the inclusion criteria during this quality control check, 338 patients remained for