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Original Article

# Systematically assessed symptoms as outcome predictors in emergency patients

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ABSTRACT

*Introduction:* It is known that symptoms are predictive of mortality in "nonsurgical" emergency patients. It is unknown whether a prospective, systematic, and "unscreened" assessment of all symptoms is of any prognostic value. Therefore, we aimed to examine the association between symptoms and outcomes in an all-comer population.
*Methods:* Data were acquired during 6 weeks at the ED of the University Hospital Basel, a tertiary hospital. Consecutive patients presenting to the ED were included. Symptoms at presentation were systematically assessed using a comprehensive questionnaire.
*Results:* A consecutive sample of 3960 emergency patients with a median age of 51 years (51.7% male) was studied. The median number of symptoms was two. In the group of patients with the most prevalent symptoms, the median number of symptoms ranged between two and five. Overall, hospitalisation rate was 31.2%, referral to intensive care was 5.5%, in-hospital-mortality was 1.4%, and one-year mortality was 5.8%. In-hospital mortality ranged from 0% to 4.3%, and one-year mortality from 0% to 14.4% depending on the presenting symptoms. Dyspnoea and weakness were significant predictors of one-year mortality (14.4% and 9.2%, respectively).
*Discussion:* Most emergency patients indicated two or more symptoms. Systematically assessed symptoms at presentation can be used for prediction of outcomes. While dyspnoea is a known predictor, weakness has not been identified as predictor of mortality before. This knowledge could be used to improve risk stratification–thereby reducing the risk of adverse outcomes.


## 1. Introduction

Symptoms assessed at presentation are cornerstones of patient-centred care. Their careful assessment is a pivotal part in the diagnostic process [1]. Symptoms are "low-cost" information, immediately accessible and therefore relevant for triage and resource allocation [2]. This is crucial in acute care settings, where a decrease in quality of care, timeliness, and safety was shown as a result of crowding [3–6].

It is known that "presenting complaints" are predictive of mortality in nonsurgical patients, being associated with use of resources and hospitalisation [7]. However, two issues limit the present literature: First, there is little knowledge about the association between the extensive range of presenting symptoms and their related outcomes. A limited number of "chief complaints" have been associated with certain diagnoses and outcomes [8]. However, the definition of "chief complaint" depends on the physicians' judgement, as presenting complaints conveyed by patients are often processed and filtered by recording physicians or nurses [7]. Therefore, the second limitation is even more significant: There is no information on systematically assessed or "unscreened" symptoms at presentation – neither to their occurrence, nor to their associated outcomes.

Therefore, the main objective of our study was to assess the prevalence of the most common symptoms and their related outcomes in this prospective all-comers study.

## 2. Methods

### 2.1. Study design

The data for this prospective consecutive all-comers study was acquired over a period of 6 weeks at the Emergency department (ED) of the University Hospital Basel, a tertiary hospital with approximately 700 beds and a yearly census of over 50′000 patients. The first dataset was collected from October 21st to November 11th, 2013, and the second from February 1st to February 23rd, 2015. Acute patients with medical and surgical problems are seen in this ED. Obstetric, paediatric, and ophthalmologic patients are treated nearby. The study protocol was

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approved by the local ethics committee (236/13, www.eknz.ch) and included patients had to consent.

### 2.2. Selection of participants

All patients presenting to the emergency department were eligible. Patients who were unconscious, intoxicated, or had language problems, severe dementia, or active life support, and patients who declined to participate were not included. During the study period, data were collected consecutively 24 h a day, 7 days a week. A study team consisting of medically trained staff received instruction on how to gather data from the hospital's electronic health records (EHR) and how to systematically interview patients.

### 2.3. Data collection

All patients presenting to the ED were immediately registered using an EHR. According to the German version of the Emergency Severity Index (ESI) [2], a reliable and valid triage algorithm, every patient was triaged by either a triage nurse or an emergency physician. Structured interviews with patients were immediately carried out after triage by the study team.

All patients were systematically asked at presentation whether they suffered from any of the following 35 symptoms at the very moment in a fixed order; multiple answers were allowed: fever, skin rash, headache, dizziness, acute visual disorder, acute hearing disorder, nasal discharge, dysphagia, cough, expectoration, dyspnoea, chest pain, abdominal pain, nausea, vomiting, diarrhoea, obstipation, dysuria, back pain, neck pain, arm pain, leg pain, joint pain, flank pain, joint swelling, leg swelling, altered mental status, numbness, paralysis, gait disorder, speech disorder, fatigue, weakness, loss of appetite, sleeping disorder. This list of symptoms was chosen based on textbooks [9] and published protocols (www.emergencystandards.com), and refined by a panel of experts using a modified Delphi method. Printed questionnaires were used to report all results. Data in the questionnaires were check-boxed on a machine-readable product provided by HCRI (Health Care Research Institute AG, Zürich, Switzerland). Validation was done by an internal review of each individual form, followed by an external validation by the company providing the technology. Demographics such as age, sex and ethnic origin, disposition (e.g. intensive care), as well as in-hospital mortality, were retrieved from the EHR.

An individual patient ID number was used to match the study database with the EHR database. After matching, anonymization of the study database was performed.

### 2.4. Follow up

One-year follow-up was carried out by means of EHR data, phone-calls with patients, proxies, and primary care providers (PCPs), or by written communication with the PCP. For patients with residency in Basel, the date of death could be retrieved from the official registry. Date of death was recorded in the study database. One-year follow-up was described as the number of deaths related to the number of follow-ups. In case of drop-out of over 10%, a sensitivity analysis was to be performed, imputing lost cases.

### 2.5. Outcomes

Predefined outcomes were hospitalisation, intensive care unit admission, in-hospital mortality, and one-year mortality. Hospitalisation was defined as admission to any hospital in-patient department, including disposition to other hospitals directly from the emergency department. Intensive care unit admission was defined as admission to one of the hospital's medical or surgical intensive care units, intermediate care units, or stroke or neurosurgical intensive care. In-hospital mortality was defined as death after presentation and before discharge from the hospital (USB). One-year mortality was defined as death within 365 days after presentation.

### 2.6. Statistical analysis

The software used for the statistical analysis was SPSS (IBM SPSS Statistics for Windows, Version 24.0) and R version 3.3.2 (https://www.R-project.org/). To show the effect of the predictors (symptoms) on the four response variables, multivariable logistic regression models were performed, adjusting for age and sex. Results were presented as odds ratio with 95% confidence intervals and *p*-values. A p-value below 0.05 was considered to be significant.

## 3. Results

During the inclusion period 5634 patients presented to the ED, of which 931 cases were not screened for the following reasons: direct referrals to other departments (paediatric ED, obstetrics, and ophthalmology), “left-without-being-seen” patients, and shortage of study team capacity. A total of 4703 patients were screened by the study team. Additionally, 49 patients had to be excluded due to missing, double or wrong case numbers; 46 patients did not consent to participate. 4608 patients were enrolled in the study. 648 patients could not be interviewed for the following reasons: unconsciousness, intoxication, language problems, severe dementia, and active life support. This resulted in 3960 patients to be analysed (Fig. 1).

Demographics are shown in Table 1: The median age of the analysed cohort was 51 years (range 14-106) and 2048 patients were male (51.7%). Regarding ethnicity, 2727 patients were of northern or central European origin (69.1%); 1233 patients were immigrants of Mediterranean (10%), Turkish (6%), South-Eastern European (5%), Eastern European (4%), African (3%), Asian (3%), and other (1%) origins. The most frequently named symptom was headache, with 707 cases (20.4%). 1237 of all patients (31.2%) were hospitalised, 219 patients (5.5%) were transferred to intensive care, 55 patients (1.4%) died during hospital stay, and 215 patients of 3733 followed patients (5.8%) died within one year after presentation. We lost 227 patients (5.7%) after one year of follow-up (mean age 42.9 years, 57.7% male). A sensitivity analysis was carried out, in which patients lost to follow-up were imputed as living. The regression estimates calculated with these data (not shown) differed only slightly from the chosen conservative approach.

The twelve most frequent symptoms are shown in Table 2. None of the predefined 35 symptoms was identified in 488 patients (12.3%). The medians of the number of symptoms differed between “surgical symptoms”, such as arm pain and leg pain (two symptoms at presentation), “specific symptoms”, such as back pain, chest pain, abdominal pain, and dyspnoea (three symptoms at presentation), and “nonspecific symptoms”, such as dizziness, weakness, and fatigue (four to five symptoms at presentation). Absolute numbers and percentages of each symptom and its related outcomes are shown in Table 3. Weakness was positively associated with in-hospital mortality. Weakness and dyspnoea were positively associated with one-year mortality, whereas arm pain and leg pain were negatively associated with one-year mortality.

## 4. Discussion

The main results of our study were the high number of symptoms named by patients presenting to the ED, the differences in outcomes related to these symptoms, and the high prevalence of nonspecific symptoms, such as dizziness, weakness, and fatigue.

First, the high number of symptoms at presentation is worth discussing: Studies on multiple symptoms are so far unique to primary care [10] where they have been associated with mood-, anxiety-, and somatoform disorders [10–12]. This may be one of the reasons why prospective studies have focused on a single “chief complaint”. Psychiatric presentations tend to be benign in terms of acute morbidity and

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