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Original Study

Acute Hospital Admissions Because of Health Care–Related Adverse Events: A Retrospective Study of 5 Specialist Departments

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A B S T R A C T

Background: Health care–related adverse events (HCRAEs), which should not be confused with (blameworthy) medical errors, are common; they can lead to hospital admissions and can have grave consequences. Although they are sometimes potentially preventable, information is lacking on HCRAEs *leading* to admission to different departments.
Aim: This study aimed to gain insight into the incidence, type, severity, and preventability of HCRAEs (including adverse drug events) leading to hospitalization to the departments of internal medicine, surgery, orthopedics, neurology, and neurosurgery. Further, we explore if there are differences regarding these HCRAEs between these departments.
Methods: We retrospectively evaluated the medical records of all patients admitted through the emergency department (ED) in a 6-month period to the departments of internal medicine, surgery, orthopedics, neurology, and neurosurgery. All patients admitted because of HCRAEs were included.
Results: More than one-fifth (21.8%; range 12.0%–47.8%) of all admissions to the 5 departments were due to a HCRAE. Half (49.9%) of these HCRAEs were medication-related and 30.5% were procedure-related. In 6.5% of patients, the HCRAE led to permanent disability and another 4.4% of patients died during hospitalization. HCRAEs treated by internists and neurologists were usually medication-related, whereas HCRAEs treated by surgeons, orthopedic surgeons, and neurosurgeons were usually procedure-related.
Conclusion: Hospital admissions to different departments are often caused by HCRAEs, which sometimes lead to permanent disability or even death. Gaining insight into similarities and differences in HCRAEs occurring in different specialties is a starting point for improving clinical outcomes.

Health care–related adverse events (HCRAEs), which should not be confused with (blameworthy) medical errors, can have grave consequences and are, therefore, a serious problem. HCRAEs occur frequently *during* hospitalization. One systematic review showed that 10% of admitted patients are affected by a HCRAE.[1] Some HCRAEs are potentially preventable,[2–4] and, in addition, HCRAEs are expensive.[3,5] However, information on HCRAEs, not only adverse drug events (ADEs), *leading* to hospitalization is lacking.

We have previously shown that 28.7% of admissions to a department of internal medicine in the Netherlands through the emergency department (ED) were because of a HCRAE.[6] Most of these HCRAEs leading to hospitalization were medication-related, but 29.6% had

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other causes.[6] That study focused on HCRAEs leading to admission to a department of internal medicine. However, information is lacking on HCRAEs leading to admission to other departments; for example, surgery and neurology. We expect that all departments have to deal with HCRAEs, but that departments such as internal medicine and neurology more often have to deal with HCRAEs and with other types of HCRAEs than, for instance, orthopedics or neurosurgery. More insight into this problem could contribute to improvement in the quality and safety of care, as well as reduce health care–related costs. The aim of the present study was to gain insight into the incidence, type, severity, and potential preventability of HCRAEs leading to acute admission through the ED to the departments of internal medicine, surgery, orthopedics, neurology, and neurosurgery. In addition, we aimed to explore the differences in HCRAEs between the mentioned departments.

Methods

Patients and Study Design

The study was conducted in one university medical center in the Netherlands. Our hospital is a secondary and tertiary university medical care center. In the Netherlands, patients visiting the ED are referred most often by general practitioners or specialists. Others are high-urgency (ambulance) patients and, in some cases, self-presenters.[7] Internists specialized in acute care assess and treat all patients with problems related to general internal medicine, endocrinology, oncology, hematology, nephrology, gastrointestinal medicine, and rheumatology. Surgeons assess all patients with a trauma, if necessary in collaboration with a neurologist and/or a neurosurgeon. Furthermore, surgeons assess patients with general surgical problems, such as severe abdominal complaints. Orthopedic surgeons assess patients with orthopedic problems and trauma patients 2 days per week and 1 on 4 weekends (in rotation with the surgeons). Neurologists assess patients with general neurological problems, such as stroke and subdural hematoma, whereas neurosurgeons primarily assess patients with, for instance, problems with their cerebrospinal fluid shunt or ventriculoperitoneal drain.

All patients who were admitted through the ED during a 6-month period (May–October 2010) to the departments of, respectively, internal medicine, surgery, orthopedics, neurology, and neurosurgery because of a HCRAE were included in our analysis. Patients also were included if the HCRAE resulted from a treatment and/or intervention started or performed by other medical specialists than those working at the admitting department.

A HCRAE was defined as “any event or state during or following treatment by a specialist or a general practitioner that influenced the health of the patient in such a way that renewed treatment was necessary or that it led to damage.” The Dutch Internal Medicine Association, the Dutch Neurology Association, the Dutch Orthopaedic Association, the Dutch Surgery Association, and the Dutch Neurosurgery Association use this definition.[7–11] The different types of the HCRAEs were divided into categories in relation to the department to which the patients were admitted.

The Medical Ethics Committee of the Maastricht University Medical Centre+ approved this study.

Data Collection

From the patients' medical records, we retrospectively retrieved the type of all HCRAEs. Further information was obtained from the discharge letter; for example, length of hospital stay and severity of the HCRAE. The severity of the HCRAE was scored as (1) complete recovery, (2) recovery with disability, or (3) death during hospital stay. In addition, to obtain more insight into the medical condition of the patient before admission, the medical history of each patient was retrieved from which the Charlson Comorbidity Index (CCI) was calculated. The CCI, which quantifies comorbidity,[12] and its recent update[13] have been developed to predict mortality within 1 year after hospital admission in patients without trauma. In case the patient was admitted for more than one HCRAE (n = 13), the HCRAE with the most serious consequences was scored.

Two independent investigators evaluated if a HCRAE could potentially have been preventable. The first investigator was a resident in internal medicine, and the second investigator was a medical specialist of each of the 5 departments that admitted the patients (an internist, a surgeon, an orthopedic surgeon, a neurologist, and a neurosurgeon). If there was no consensus between the first investigator and the consultant, a third investigator, another specialist of the department to which the patient was admitted, decided on the issue.

To assess potentially preventable medication-related adverse events, we used the algorithm by Schumock and Thornton.[14] For more than half (387/676, 57.2%) of the HCRAEs, this algorithm could be used (including diabetes mellitus–related AEs). The judgment of potential preventability of the other types of HCRAEs was based on the opinion of the investigators, because, as far as we know, no algorithm is available. It turned out that consensus was rather difficult to reach, because a third reviewer was often needed (n = 145, 21.4%). Therefore, we decided first to assess and report the judgment and agreement of reviewers 1 and 2, and then to assess and report on the agreement after the third reviewer decided on the issues in case the first 2 reviewers disagreed. This analysis allowed us to show the range of agreement/uncertainty of the judgment on potential preventability of HCRAEs.

Examples of HCRAEs we judged potentially preventable are complaints while on a waiting list and cerebral infarction in patients not using anticoagulants while having an indication for these drugs. An infection after surgery was judged to be not potentially preventable if the procedure and the postoperative care had been adequate. Also, drain dysfunction or occlusion of a shunt or stent was judged to be not potentially preventable if the right procedures for use had been followed. The online supplement (Table 4) gives more insight into the HCRAEs that were judged to be potentially preventable.

Statistics

SPSS Statistics version 18 (SPSS Inc, Chicago, IL) was used to obtain medians, ranges, means, and SDs. Further, to measure the reliability of consistency between the reviewers on the assessment of a potentially preventable HCRAE, we used kappa statistics. Expected (agreement by chance) and observed agreement, and the Cohen kappa were all calculated.[15]

We used χ^2 tests to investigate whether there were differences in the proportion of admittances because of a HCRAE among the 5 departments.

Results

During the study period, there were 3095 admissions through the ED to the departments of internal medicine, surgery, orthopedics, neurology, and neurosurgery. Of these, 676 admissions were due to a HCRAE (21.8%; range per department 12.0%–47.8%; Table 1). Most patients with a HCRAE were admitted to the department of internal medicine (411/676; 60.8%), followed by the departments of surgery (144/676; 21.3%), neurology (64/676; 9.5%), orthopedics (35/676; 5.2%), and neurosurgery (22/676; 3.2%) (Figure 1).

A total of 323 (47%) of all patients admitted to the hospital because of a HCRAE were female and the median age was 66 years (range