Hospitals and health care professionals aim to provide the safest care possible. However, things may go wrong, harm can be done, and patients can inadvertently be hurt as a consequence of inpatient care. Such adverse events have become important markers of quality of care and are included in clinical performance indicators. By identifying and studying adverse events, we can learn lessons and change practice in ways that will make such events less likely in the future, and hence improve the safety of patients and the quality of care. Adverse event, or iatrogenic injury, is defined as unintended injury or harm to a patient caused by health care management rather than by a disease process, leading to prolongation of hospital stay, morbidity or disability at discharge, or death (1). These events include unexpected death, hospital acquired infections, postoperative wound infection, postoperative pulmonary embolism, medication errors, anesthetic events, transfusion mishaps, falls of patients, and pressure sores. Since the definition is rather stringent, it is possible that there is an underestimate of adverse events since many do not result in injury because they are caught in time, the patient is resilient, or because of good luck. Adverse events should be distinguished from unfavorable side effects, which are unpredictable or unavoidable complications that may occur during the appropriate application of the best practice, whereas the former result from error. Review of medical records was found to be a reliable and valid method for discovering, studying, and categorization of most adverse events (1,2). Some studies used this method in the attempt to quantify the rate of adverse events and to categorize them.

In the Harvard Medical Practice Study, review included 31,429 records of patients discharged from acute care hospitals in New York State in 1984 (3). The study identified an adverse event in 3.7% of admitted patients; 43% of those adverse events caused at least moderate impairments to patients. Another study using the same method of reviewing medical records found that an adverse event occurred in 16.6% of 14,179 admissions to the hospitals in New South Wales and South Australia in 1995, resulting in permanent disability in 13.7% of affected patients and death in 4.9% (4). In 51% of the cases, the adverse events were considered preventable (ie, implying error), as opposed to events considered to be non-preventable, ie, anticipated and unavoidable complications. In both studies, surgery was the source of the adverse events in almost 50% of the cases, followed by complications resulting from medication treatment, therapeutic mishaps, and diagnostic errors. Medication errors caused 20% of all injuries, with 18% of these considered to be preventable. Most errors (56%) occurred during drug ordering (prescribing a wrong drug or incorrect dosage) and 24% during drug administration in which non-availability of the drug, omission to give the drug when available, and giving the wrong dose were the types of error that predominated. As to therapeutic mishaps and diagnostic errors, those of omission outnumbered those of commission by two-fold. Errors of omission were failure of action (e.g., missed diagnosis, delayed evaluation, or failure to prescribe needed drug treatment), whereas that of commission was an incorrect action, such as administering the wrong drug to the wrong patient at the wrong time. Another replication of the Harvard Study reviewed 14,565 records of patients discharged from acute care hospitals in Utah and Colorado in 1992 (5). This study found a rate of 3.2% adverse events, of which 44.9% were postoperative, whereas adverse medication events were the leading cause (19.3%) of non-operative events. Two latter studies (Australia, and Utah and Colorado) found a similar score of serious adverse events, but disparity in rates, which was explained by different thresholds of admission and discharge and other differences in methodology and did not necessarily imply that quality of care in Australia was poorer (6). In two teaching hospitals in Boston, researchers using a similar methodology but focusing on adverse medication events only found that 6.5% of patients suffered such an event, in 1% fatal, in 12% life threatening, in 30% serious, and in 57% significant; 42% of such events (classified as life threatening or serious) were considered to be preventable (7). Observational prospective studies, which are more expensive, produce even higher rates. For example, 46% of patients followed at the general surgical units of a Chicago teaching hospital experienced an adverse event (8). In the medical-surgical intensive care unit of a teaching hospital in Israel, observers at patient beds identified 544 errors of doctors and nurses over 4 months, or 1.7 errors per patient daily (9).
Risk factors for the occurrence of adverse events have also been studied. It was found that in patients over 64 years of age adverse events are more common (probably because of the clinical complexity of their case) and carry a greater risk of serious injury than in younger patients, probably because of a greater burden of comorbidity. Certain surgical interventions signal high risk (cardiothoracic, vascular, and neurosurgery); the severity and complexity of the patient’s underlying disease, as well as inherent hazards of certain procedures, may increase the likelihood of adverse events. The longer the patient stays in hospital, the greater the risk of suffering an adverse event. Care in a hospital emergency department causes many adverse events (8,10-12).

Occurrence of adverse events is important because of their impact on patients: in the USA, medical error results in at least 44,000 and nearly 90,000 unnecessary deaths each year, and in a million avoidable injuries. In Australia, medical error results in 18,000 unnecessary deaths, and in disability in more than 50,000 patients each year (11). There is no reason to assume that in Europe the frequency of adverse events and their impact on patients is different. Indeed, a recent retrospective pilot study in Britain reviewed 1,014 records of patients admitted to two acute care hospitals in the Greater London area in 1998 (13). It was found that 10.8% of the patients experienced an adverse event, half of them deemed preventable, and a third causing moderate or greater disability or death. Adverse events also result in increased costs. In Australia, the total average cost of treating 12 conditions that resulted from adverse events was US$636,000 per 10,000 discharges (14); in Britain, the cost of adverse events is estimated at 1 billion pound sterling only in terms of additional bed days (13). Adverse event instances may indicate that a patient has received care of poor quality; hence their analysis provides an insight into the quality of care and an opportunity for improvement (15). How do we minimize the chance of error and how do we mitigate the effects of errors? What should we focus on to improve the safety of patient care effectively and efficiently?

Health care professionals are human and in spite of being experts and well trained in their field, they may make errors of judgment and mistakes, particularly when they are tired or stressed. One should, however, look beyond individual competence since adverse events may also occur because of poorly designed or badly implemented processes in a system within which individuals function. As mentioned earlier, half of adverse events in hospitals are related to surgery. For surgical procedures the competence of a surgeon is crucial; however successful surgery also requires a series of well designed and implemented processes, such as appropriate case selection, accurate preoperative diagnosis, specific preparation for surgery, skilled anesthesia, and good postoperative care. Hence, there are two approaches for the prevention of adverse events: via the person and via the system (16). The person approach focuses on individuals and aims through education and training to improve their competence and to reduce poor motivation, inattention, or carelessness. This approach also implies careful surveillance of practice or behavior before it causes harm. This strategy is directed at reducing unwanted variability. In a large teaching hospital in Switzerland, a high prevalence of nosocomial infections was found to be associated with staff’s low-level hand hygiene. Following an educational hospital-wide effort (with posters in 250 strategic areas, changed weekly) combined with the distribution of hand-rub solutions, compliance with hand hygiene increased from 66.2% to 74.6% and the prevalence of nosocomial infections decreased from 17% to 10% (17). The system approach focuses on conditions under which individuals work and on organizational processes that may lead to errors, particularly when hazardous technologies are involved. This approach builds on engineered barriers and safeguards (alarms, physical barriers, automatic shutdowns), reliance on people (surgeons, anesthetists, nurses), or on administrative controls. Anesthesiology pioneered modern research into the safety of patients based on such an approach (18). Anesthesiology, which has understood the importance of monitoring adverse events and “near misses”, giving attention to systems, may be regarded as well-functioning (19). Since complexity may cause error, another strategy of the system approach is the simplification of individual tasks or multitask processes (20), as well as elimination of delays, missing information, and other defects in operation (21).

These two approaches may be complementary. Prescribing medications may be improved through educational programs, many of which use the Medication Appropriateness Index of explicit criteria, which emphasizes choice, dosage, interaction, and cost of drugs (22). At the same time, a computer system provides doctors with a menu of medications, default doses, and a range of potential doses for each medication; all orders entered are legible, including signatures of physicians prescribing the drug (23). Furthermore, a system has been recently introduced that sends warnings when incompatible or otherwise dangerous drugs are prescribed (24). The ward pharmacy service, in which pharmacists visit wards to check the drug charts of patients and initiate supply of drugs not stocked, has improved both prescribing and administration (25). The use of the unit dose system also leads to a decrease in administration errors (26). Anesthesiology is another field that illustrates the combined approach: in addition to well-functioning monitoring equipment, the presence of a senior anesthesiologist throughout the procedure is the most important factor for detecting and mitigating critical incidents (27).

Because of adverse events, there is the possibility of malpractice suits undertaken by damaged patients and/or families. Hence, many institutions established a risk management service, which includes all activities intended to prevent legal claims. At the same time, it is a method for preventing or reducing adverse events. Doctors, nurses, and pharmacists on wards conduct the activities of the service: communication with families and patients at risk for an adverse event (such as dysphagia, tendency to fall, risk of
pressure sores or urinary infection), instructing them in preventive actions. In addition, when an adverse event occurs, it is checked whether it was appropriately documented, what examinations were performed after it (e.g., X-ray after a patient’s fall), to what extent the affected patient was dependent on others and whether staff acted according to guidelines. These activities contribute to the prevention of events and at the same time enable staff to be prepared for legal questions (28).

Errors indicate a breakdown in the system or wrong decision-making. Errors cannot be ignored. They must be recognized, their causes analyzed, and preventive measures taken. We should try to understand the causes of errors, to install an informative reporting system of adverse events as an essential prerequisite (29), to measure them, and to choose the best approaches for minimizing the harm to the patients. Patient safety is to be improved by our collective effort.

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