Adverse Events Related to Medical Care Utah: 1995-99

JUNE 2001

Utah Department of Health
Utah Health Data Committee
Center for Health Data

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Definitions

The following terms are used in this report:

- "Medical error" or "error" - The failure of a planned action to be completed as intended or the use of a wrong action to achieve an aim. Errors can include problems in practice, products, procedures, and systems.
- "Adverse outcomes" - Undesirable and unintended outcomes of care such as death, disability, or temporary disability.[1]
- "Adverse events" - Undesirable and unintended incidents in care that may result in adverse outcomes or may require additional care efforts to thwart an adverse outcome.[2]
- "Adverse drug event" - an adverse event attributable to the administration of a drug.
- "Adverse event indicators" - the 3 broad and 37 refined categories indicating misadventures of surgical and medical care, complications of surgical and medical procedures, and adverse drug events, which are listed in Table 1.
- "Preventable adverse events" - a subset of adverse outcomes that are judged to have been avoidable if appropriate and reasonable steps had been taken.[3]
- "Near misses" - Events in which the unwanted consequences were prevented because the failure was identified, and corrected. Such a recovery could be by a planned or unplanned barrier.[4]
- "System" - Set of interdependent elements interacting to achieve a common aim. These elements may be both human and nonhuman (equipment, technologies, etc.).[6]
- "Complications of medical care"- Concurrence of injuries, lesions, or diseases with another disease due to medical care.

Executive Summary

The United States' healthcare system, while known to offer the most technically advanced healthcare, is characterized by unacceptably high levels of adverse events due to medical errors. Proper investigation, data collection and analysis are critical first steps to effective prevention.

This report is the first attempt in Utah to use the hospital discharge abstracts and International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes, including E-codes, to estimate the frequency of occurrence, trends and patterns of risk of adverse events related to medical care. This report should help inform healthcare workers of the existence and potential value of these data, and attract their attention to the problem of patient safety. The report also proposes a classification scheme for adverse events, using ICD-9-CM codes. Although limited, the proposed classification should prompt dialogue and feedback to further refine this classification scheme. In the interim, this scheme can equip analysts with a tool to sensibly categorize adverse events.

Methods

This report captures assessments and evaluations from the 1995-99 inpatient hospital discharge abstract from acute care hospitals in Utah. ICD-9-CM codes currently used in hospital discharge records have been used to identify three main categories and 37 subcategories of adverse events. Tables and graphs depict variations in numbers and rates of adverse events by risk factors such as age, sex, and hospital characteristics (urban vs. rural, teaching vs. non-teaching, and accredited by Joint Commission for Accreditation of Health Organizations (JCAHO) vs. non-JCAHO).

Limitations

These data have important limitations, including:

- our inability to separate adverse events prior to hospitalization from those occurring during hospitalization,
- our inability to determine the clinical significance of the event, and
- our inability to distinguish variation in completeness of reporting from variation in true occurrence of adverse events.

Results

- From 1995 to 1999 in Utah, about one in 250 hospital discharges or 4,248 patients had a "misadventure of surgical and medical care," (a term used in the ICD-9-CM Codes Book to imply that the event occurred as a result of an error) with an overwhelming majority of those (93% or 3,939 discharges) comprising cuts, punctures, or perforations during medical care.
- A total of 60,000 (6 % of all discharges) involved other adverse events (ICD-9-CM category "complications of medical and surgical procedures").
- Finally, 25,000 discharges (2.5 %) involved complications of medications. (See Table 1)

- No substantial annual variation existed for any of the adverse events (See page 13.)
- A slightly greater proportion of males suffered adverse events than females. However, the actual number of adverse events was considerably higher for women because they were hospital more often than men (See page 14.)
- The rate of adverse events increased substantially with age. Older patients were at a higher risk, probably because they tended to have more complex conditions than other patients. (See page 16.)
- Patients in urban hospitals, teaching hospitals, and JCAHO-accredited hospitals reported higher rates of adverse events, particularly complications of medications. This is likely due to higher volume and acuity of patients, and possibly more accurate reporting of adverse events (See page 18.)

Conclusions

There is growing recognition that the health care system is not as safe as it can be. Information about frequency of errors and other adverse events is needed to guide and evaluate improvement in the healthcare system. This report used the available data from the Utah Hospital Discharge Database to provide information on adverse events during medical care.

Despite their limitations, these data add to the evidence presented in the Institute of Medicine's report, "To Error is Human", that the healthcare system can be made safer. The Utah Department of Health has been working in partnership with Utah hospitals and healthcare providers, to address this challenge. The Utah Hospital Association (UHA), jointly with Utah Medical Association, HealthInsight, and Utah Department of Health (UDOH), has organized a Utah Hospital Patient Safety Task Force

As part of its efforts, that Task Force has helped the Utah Department of Health to develop two proposed administrative rules. One of these proposed rules would call upon hospitals to establish a mechanism to prevent adverse drug events. The other calls upon hospitals to report sentinel health events and establish a review process for such events designed to identify and remedy their root causes. The Utah Department of Health's Utah Health Data Committee is committed to work collaboratively with these parties to provide information to assist with these efforts.

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Introduction

The United States' healthcare system, while known to offer the most technically advanced healthcare, is characterized by unacceptably high levels of adverse events due to medical errors. Medical injuries are an increasingly critical public health problem that imposes enormous burdens such as lost life, disability, and economic consequences. Proper reporting, and data collection and analysis are critical first steps to effective prevention. Statewide efforts for systematically reporting adverse events and related flaws in the system are at a primitive state at best. Only few hospitals in Utah have state of the art automated computerized systems for detecting adverse drug events (ADEs).[1-3] For other hospitals, the readily available source of electronic information on adverse events is their hospital discharge database.

This report is a first attempt to assess the ability of the hospital discharge abstract and utility of ICD-9-CM codes, including E-codes, in estimating the trends and patterns of variation in adverse events. The rates presented in this report are not meant to measure the true prevalence of adverse events. Rather, they reflect some combination of the effects of completeness of coding, efficiency of reporting adverse events, and prevalence of adverse events. The individual effect of any of these three components cannot be isolated from these data without comparisons with other sources such as chart reviews and root cause analysis.[4, 6-10]

The analyses in this report are aimed at informing healthcare workers of the existence of these data, thus attracting their attention to the problem of patient safety in general. The report also proposes a classification scheme using ICD-9-CM codes. Although limited, the proposed classification should prompt dialogue and feedback for further refinement of this classification scheme. In the interim, this scheme will equip analysts with a tool to group adverse events sensibly.

Background

In this section, we have reviewed Utah's current participation in existing reporting systems, current and soon-to-be adopted practices in monitoring patient safety, and finally, in the use of hospital discharge data for evaluating adverse events. All three of these areas provide good starting places and yield valuable data for monitoring and improving patient safety. However, these areas also present opportunities for expanded efforts.

Utah's participation in selected existing national reporting systems related to patient safety

JCAHO Accreditation: Voluntary reporting on sentinel events to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is one example of an existing system participating in national patient safety reporting systems. As of April 2001 in Utah, 35 out of 50, or 70 percent of the hospitals have been accredited by JCAHO. The Utah Department of Health accepts facilities and agencies accredited by JCAHO or Community Health Accreditation Program in lieu of the Annual Licensing inspection by the UDOH.[11] Hospitals only submit their JCAHO survey reports, excluding sentinel event report and root cause analysis, to the State of Utah. The Utah Bureau of Health Facility Licensure keeps the facility surveys as confidential data and only produces a summary related to licensure standards. If needed, the Bureau can review the JCAHO sentinel event reports at a hospital. The JCAHO sentinel event report system is designed to generate reports of severe patient injuries. Given low hospital participation in this reporting system, UDOH has not yet used the hospital-level JCAHO information for a broad patient safety intervention.

National Nosocomial Infections Surveillance: The Centers for Disease Control and Prevention (CDC) National Nosocomial Infections Surveillance (NNIS) system, launched in 1970 between CDC and participating hospitals, is a voluntary, hospital-based reporting system for monitoring emergent hospital-acquired infections. By 2001, 315 hospitals were participating in this reporting system compared to 285 hospitals in 42 states in 1999.[12] The data NNIS hospitals provide to CDC through the NNIS system is held confidential. The reporting institutions themselves may disclose their participant status and information to others at will. Utah requires hospitals to have an infection control program, including nosocomial infections; however, no Utah hospital is a NNIS member. The NNIS is no longer accepting applications for additional reporting facilities.[13]

The Drug Abuse Warning Network: (DAWN) includes a national probability survey of hospitals with emergency departments and a reporting system for the states' medical examiners to track the magnitude of drug abuse problems. Utah participates in DAWN only for reporting medical examiners' data.

MICAR: Mortality data from the National Center for Health Statistics (NCHS) Vital Statistics System provide considerable information on fatal outcomes from medical misadventures, complications, and adverse outcomes in therapy or devices that caused death. NCHS has developed a detailed coding scheme called MICAR (Mortality Medical Classification and Retrieval system) to assist states in coding underlying causes of deaths due to medical errors and to analyze medical error-related deaths at the national level.[14] Utah Bureau of Vital Records and Statistics started to use MICAR in 1996**.** Utah had 39 deaths in 1999, 28 of which occurred in hospitals, with medical errors listed as the underlying cause based on the International Classification of Diseases 10th Edition (ICD-10).

In sum, hospitals in Utah have limited participation in these national data systems. Also, only limited information on adverse events of medical care is captured by these systems and used by the state health department.

Existing state regulations and regulatory practices for patient safety in Utah

Statewide patient safety data collection has to occur at care rendering sites and be coordinated by an entity accepted by the medical and health industry community. State governments have regulatory authority over all licensed healthcare facilities, close contact, and collaborative relationships with hospitals. The states also legally protect confidential and sensitive information. Therefore, existing state regulations will influence the collection and use of patient safety information in a state.

The Utah Department of Health, Bureau of Licensing, completes an on-site, unannounced inspection annually of five percent of the non-JCAHO hospitals to ensure compliance with administrative regulations. Registered nurses, environmental health scientists, life safety specialists, and social workers conduct the inspections and review a sampling of records. An annual survey is not required for JCAHO hospitals; however, state inspectors attend the JCAHO CEO Summation conference and may require the facility to submit a Plan of Correction on any Type 1 recommendations. Between 1998-2000, 9 hospitals were inspected and 36 deficiencies were cited.

Hospitals are required to establish quality improvement programs. These programs include documenting complications, hospital acquired infections, unfavorable reactions to medications, treatments, and anesthesia, and infectious diseases.[15]Despite the hospitals' own efforts, patient complaints actually drive the

implementation of Utah current regulations on patient safety in hospitals. The state investigates all patient complaints. During 1998-2000, Utah hospitals reported only four incidents to the UDOH. However, 38 patient complaints were investigated in 21 different hospital settings statewide; 5 of those complaints (13 percent) were substantiated.

Recently, the Utah Department of Health has proposed two new administrative rules, which, upon their promulgation in the summer of 2001, will require hospitals to set up the patient safety reporting program. The sentinel patient safety event reporting rule (R380-200) will require hospitals and ambulatory surgical centers to report deaths directly related to any clinical service, surgery on the wrong part, discharge of an infant to the wrong family, rape, or intentional injury to a patient. The incident facility will conduct root cause analysis of the sentinel event. The second proposed rule (R380-200), dealing with facility patient safety program, will require hospitals to implement processes to effectively identify and report to UDOH the incidence of all adverse drug events (ADE). Under these two rules, information produced or collected by a facility and reported to UDOH will be confidential and privileged. Given public interest in fostering health care systems improvements, UDOH will exercise its discretion in releasing data under the state statutes. To reduce facilities' reporting burden, UDOH encourages hospitals to report the ADE events through the existing statewide, electronic hospital discharge, emergency department, and ambulatory surgery data reporting system. Thus, the state intends to facilitate a new regulatory patient injury reporting and reduction program by using an existing patient care quality information system.

State hospital discharge reporting system – Patient safety information

The hospital discharge data system is the only available statewide database containing population-based healthcare information that is associated with all hospitals in a state. As of 1999, 42 states collected hospital inpatient discharge records, 26 states collected ambulatory surgery data, and 18 states did emergency department encounters.[16] Utah Department of Health collects all three types of data. All hospitals in Utah participate in the discharge data reporting system. The Utah Hospital Discharge Database has been developed under the Utah Health Data Authority Act (Utah Code 26-33a) since 1992. The Utah Health Data Committee (UHDC) requires all 50 hospitals and 13 ambulatory surgery centers in Utah to report quarterly on inpatient discharge and encounter records from emergency departments, as well as selected outpatient surgical procedures.

The potential of E-code data for assessing adverse events has not been systematically explored across the 42 state databases. However, identifying the nature and the prevalence of medical errors is an important, yet complex task.[17] Research investigators have used a variety of recording and tracking systems to track medical errors, including manual, paper-based records of sentinel events in JCAHO participating hospitals, administrative records of hospital discharges, manual review of medical charts, and computerized surveillance systems. Medical chart reviews are widely used as one of the most reliable tools in identifying adverse events and complications of care. [4 7-10 18] However, such chart reviews have been criticized for placing financial burden on providers.[19-21]

Patient Safety Studies

Prevalence, cost, and mortality

It is readily apparent from existing studies that medical errors occur frequently in hospital care [6, 7, 26 28-31] with many resulting from substandard care.[28] The IOM report estimated that 44,000 to 98,000 people die in US hospitals and over one million are injured each year due to medical errors.[1, 32] In addition to death and suffering, medical errors result in significant financial cost. Medical errors are estimated to cost the nation over $37.6 billion each year, of which $17 billion are attributable to preventable errors.[6]

Studies based on Utah and Colorado data have estimated the total cost of adverse events to exceed $661 million annually (in discounted 1996 dollars), of which $308 million was due to preventable adverse events.[8] The death, suffering, and cost of errors, indicate both the gravity of the problem and the need to address the issue adequately.

Existing studies reveal the prevalence of adverse events in selected hospitals. The Harvard Medical Practice Study used medical records from 51 acute care hospitals in New York. The rate of adverse events was 3.7 percent of hospitalizations, with 27.6 percent due to negligent care, and 13.6 percent leading to death of the patient.[28] The Australian study, replicating the Harvard Medical Practice Study found the prevalence rate to be much higher— 16.6 percent of admissions. This study reported that over half of the adverse events (51 percent) were preventable.[33]

Recently, researchers used the hospital records from 1992 in Utah and Colorado to replicate the Harvard Medical Practice Study.[6 8 26] Incidence rate for adverse events was estimated at 2.9 percent, 32.6 percent of which was due to negligent care in Utah, compared to 27.4 percent in Colorado. Death occurred in 6.6 percent of patients with adverse events. The risk of death was higher (8.8 percent) for adverse events that resulted from negligent care.[26]

Adverse drug events

Adverse drug events (ADEs) are also common in hospital care[34 35] and medication errors play a key role in these ADEs.[35] Classen et al studied adverse drug events among patients in a Salt Lake City, Utah Hospital using a computerized surveillance method. The study found that ADEs complicated 2.43 percent of hospital admissions. These complications elevated hospital cost (an excess $2,013 per admission), prolonged hospital stays, and yielded higher risk of mortality.[9] Elsewhere, ADEs occurred in 1.43 percent of admissions, 28 percent of which were preventable.[35] Investigations are focusing greater attention to reducing risks of ADEs in Utah.[36]

Risk Factors

Identifying risk factors underlying medical errors and adverse events is an important first step in their prevention. Individual risk factors include age, insurance status, minority group membership, severity of sickness and complexity of care. In their study of Utah and Colorado patients, Thomas and Brennan (2000) found that the incidence of preventable adverse events was significantly higher among elderly patients.[6] Another study found that older adults and poor were more likely to suffer negligent care, but were less likely to pursue litigation.[10]

Wilson et al, in their Australian study found that patients with complex cases and those with illnesses requiring urgent care were at greater risk of death and preventable adverse events.[33] In the Utah and Colorado study, although women did not have a significantly elevated risk of adverse events compared to men, the proportion of female discharges with adverse events and preventable adverse events was slightly higher than for men.[8]

Some characteristics of the hospital as well as the stay are also important risk factors. For instance, extending duration of stay by one day increased the risk of an adverse event by six percent.[37] Low volume of certain surgeries performed in hospitals may also be linked to unfavorable outcomes.[38] Cases involving certain specialties are known to have a higher risk of adverse events.[28 33] Hospital ownership was found to be significantly associated with adverse drug events. Adverse drug events are more likely to occur to patients in for-profit, non-teaching, and government hospitals.[39] Patients being cared for in emergency rooms also suffer frequent adverse events.[40 41] When a patient is known to have a certain risk factor, modification in his or her medical management can reduce the risk of some complications.[7]

Sources of data for tracking adverse events

Identifying the nature and the extent of medical errors and determining their preventability is an important, yet complex, task.[42] A variety of recording and tracking systems have been used by investigators including manual paper based recordings of sentinel events in JCAHO participating hospitals, administrative records of hospital discharges, manual review of medical charts and computerized surveillance systems.

Medical chart reviews are widely used as one of the most reliable tools for identifying adverse events, adverse drug events, and complications of care.[4 6-10] However, they have been criticized for being expensive, placing additional financial burden on providers.[24 43] Chart reviews have also been criticized for their inability to identify preventability of medical errors.[26]

Hospital discharge abstracts use ICD-9-CM codes to classify the nature of injuries using N-codes, with a subset of conditions for which E-codes are also reported to describe the external cause of injury. ICD-9-CM E-codes and N-codes can be instrumental in identifying adverse events as medical diagnoses, thus providing an inexpensive and readily available means of identifying cases with a high likelihood of adverse events.[24 26 27 28]

Many studies have used ICD-9 codes for screening and flagging adverse events in hospital discharge records.[4 6-10 24 26 27 44] For instance, Weingart et al, (2000) used E-codes and N-codes contained in standard discharge to screen and flag cases with potential complications using data from 41 California and 21 Connecticut hospitals. Chart review confirmed the presence of complications in 68.4 percent of the flagged surgical and 27.2 percent of the flagged medical cases. The study found that among cases with confirmed complications, 35.8 percent of surgical and 43.8 percent of medical cases were associated with quality of care problems.[27]

Although ICD-9-CM E-codes in the hospital discharge abstract are an inexpensive source of data on complications of care and adverse events, studies have found that these data have their limitations. Administrative data are mainly generated for billing purposes. Financial incentives may dictate the selection and order of codes. Since E-codes are not used for payment purposes, those codes are not entered into the

database or are deleted during the data management processes.[25] The clinical validity of ICD-9-CM codes in identifying complications of care has also been questioned.[4] They have been further criticized for being untimely, inaccurate, and failing to distinguish between complications resulting from current as opposed to previous discharges.[26] While acknowledging, that ICD-9-CM codes may suffice for screening surgical complications, opponents contend that those codes lack validity as a sole tool in identifying medical complications.[24] ICD-9 codes are also prone to bias due to patient complexity and the vagueness of definitions. Finally, comparison across providers may be difficult due to variations in coding practices and coder reliability.[27]

Despite these limitations, outcome statistics related to adverse events derived from administrative data can be invaluable in providing a preliminary understanding of patient care and patterns of adverse events. It is imperative to investigate the extent to which E-codes collected in administrative data, alone or in combination with N-codes, can serve as basis for a viable reporting system. According to a recent report by the National Academy for State Health Policy, such efforts are underway in other states as well.[29]

Data and Methods

Data

Currently 40 acute care hospitals in Utah submit UB-92 administrative hospital inpatient discharge records to the Utah Department of Health. The primary source of data for this report was the Utah Inpatient Hospital Discharge Data, 1995-99 File. Analysis was restricted to acute care hospitals, excluding specialty hospitals such as rehabilitation, psychiatric, and surgical hospitals, for at least two reasons. First, the exploratory analysis showed a noticeable variation in e-code reporting between specialty and acute care hospitals. Secondly, specialty hospitals tend to have have different patient case-mix than acute care hospitals.

During this 5-year period, a total of 1,007,548 Utah residents were hospitalized in acute care hospitals. The Utah Hospital Discharge Database has nine fields for reporting ICD-9-CM diagnoses (N-codes). In addition, reporting of E-codes has been required since 1995. While hospital discharge data have only a 90 percent E-code completion rate, substantial improvement in E-code reporting has occurred over the past few years.

Computation of percentages

The rates presented in tables and graphs are the number of adverse events for a certain category, per hundred hospital discharges. As shown in the next subsection, both E-codes and N-codes were used to define the adverse events and complications of care. In addition, some E-codes are also reported in the N-code fields. An adverse events or a complications of care was counted when a code defining the events was found either in the e-code field or in any of the nine ICD-9 diagnoses fields. Consequently, multiple numbers of adverse events may have been detected in a single discharge. The reported numbers, therefore, should not be treated as the exact number of discharges with adverse events.

Classification of adverse events using ICD-9 codes

ICD-9 codes are not capable of capturing clinical details as well as some other sophisticated sources such as chart reviews. As a result, they are not used to identify adverse events where superior clinical information

exists for such purpose. Schemes to define and classify adverse events in terms of ICD-9 codes are also hard to find. Some studies using ICD-9 codes for screening potential cases of adverse events have identified codes for certain conditions considered markers of potential problems in healthcare; these conditions are not adverse events as such.

The classification of adverse events presented in Figure 1 below is our best, yet imperfect effort, to start a process to be refined later through expert feedback. According to the source of adverse events and specificity of the codes in their identification, we have identified three main categories, namely:

1. Misadventures of surgical and medical care
2. Complications of surgical or medical procedures (not listed in category 1)
3. Complications of medications (adverse drug events—ADEs).

The first category comprises a collection of codes indicating harm due to medical intervention that are easily classifiable as adverse events. They indicate harm due to medical intervention. For instance, causes of injury such as foreign object left in the body, mechanical failure of instruments or apparatus, and failure of sterile precautions, are clear examples of unintended injuries due to errors in medical management of the patients.

The second category includes codes showing complications of procedures that were not clearly classifiable as misadventures of care. There is not enough information about the nature of complication to determine whether it was triggered by poor quality of care such as apparatus failure, dosage failure, unclean environment, or otherwise management of the patient, or due to patient factors such as a difficult surgery or recovery complicated by comorbidities. The codes should be taken, at best, as markers of true prevalence. Given the comparable quality of coding, they can be useful in exploratory comparisons.

The third and final category is the most complex yet least refined. In some cases, not knowing the manner in which a medication was used makes the task of determining adverse drug events imprecise. For instance, it is often hard to determine whether poisoning by drug occurred due to mismanagement by the patient or healthcare professionals during current hospital stay or before an admission. Knowing whether sedatives and hypnotics resulted in harm due to patients' adventures or medical misadventures can be difficult as well. This category should be used with these limitations in mind.

In the absence of universally-applied, clinically detailed coding information on medical errors, administrative data takes precedence by default. However, the purpose of the hospital discharge abstract is directed toward billing, not clinical evaluation. Even where ICD-9 CM E-codes are noted, their selection and order may indicate financial priorities more than pure clinical diagnoses. Nevertheless, ICD-9-CM E-codes are an inexpensive and readily available source for a significant amount of information on medical diagnoses, including adverse events.[45] The results indicated in this report by ICD-9-CM codes should be considered in the context of these irregularities in data gathering. Thought should also be given to ways of improving the accuracy with which E-codes are assigned.

Figure 1: Classification of Adverse Events, Medical Errors, and Complications of Care

ADVERSE EVENTS, MEDICAL ERRORS, COMPLICATIONS CATEGORY	E-CODE	N-CODE
I. Misadventures of Surgical and Medical Care/Adverse Events	E870-876	N998.2, .4, .7
Cut, puncture, perforation during medical care	E870	N998.2
Foreign object left in body	E871	N998.4, .7
Failure of sterile precautions	E872	
Failure in dosage	E873	
Mechanical failure of instrument/apparatus	E874	
Contaminated or infected blood, substance	E875	
Other and unspecified	E876	
II. Complications of Surgical or Medical Procedures (not listed above)		
Surgical operation/procedure as cause of abnormal reaction and later complications	E878	
Other procedures, without mention of misadventure	E879	
Complications peculiar to certain specified procedures		N996.0 - 996.7
Infection, inflammatory reaction from device, implant, or graft		N996.6
Other complication of device,		N996.7
Mechanical complication of device, implant or graft		N996.0-996.5
Complications affecting specified body systems		N997.0-997.5, 997.9
Other complications of procedures		N998.0,.1,.3,.5,.6,.8,.9
Hemorrhage or hematoma		N998.1
Post-operative infection		N998.5
Other complications of medical care not elsewhere specified		N999

(Figure 1 Continues)

FIGURE 1 (Continued):

ADVERSE EVENTS, MEDICAL ERRORS, COMPLICATIONS CATEGORY	E-CODE	N-CODE
III. Complications of Medications (Adverse drug events)	E930-E949, E850-E858, except E850.1, E854.1,	N960-N979, except N965.01
Adverse effects of drugs, biological, medicinal substances in therapeutic use	E930-E949	
Accidental poisoning by drugs, medicinal/biological substances	E850-E858	
Poisoning by drugs, medicinal and biological substances		N960-979, except 965.01
—COMPLICATIONS OF MEDICATION BY TYPE OF MEDICATION—-		
Complications of antibiotics and other antiinfectives	E930-931, 856-857	N960-961
Complications of hormones and synthetic substitutes	E932, 858.0	N962
Complications of Insulins and antidiabetic agents	E932.3	N962.3
Complications of adrenal cortical steroids	E9320	N9620
Complications of primarily systemic agents	E933, 858.1	N963
Complications of antineoplastic agents	E933.1	N963.1
Complications of antiallergic/antiemetics	E9330	N9630
Complications of agents primarily affecting blood constituents	E934, 858.2	N964
Complications of anticoagulants	E934.2	N964.2
Complications of analgesics, antipyretics, antirheumatics	E935, 850.2 - 850.9	N965
Complications of anticonvulsants, anti-Parkinsonism drugs	E936, 855.0	N966
Complications of sedatives and hypnotics	E937, 851, 852	N967
Coded as in therapeutic use	E937	
Complications of psychotropic agents	E939, 853, 854.0, 854.3	N969.0-969.5, 969.8-969.9
Complications of other CNS depressants, stimulants, anesthetics, nervous system agents	E938, 940-941, 855.1-855.9	N968, 970-971
Complications of agents primarily affecting cardiovascular system	E942, 858.3	N972

Notes:
Excluded complications of transplantation and limb reattachment as situations where complications are nearly an expectation of a “rescue” treatment.
Excluded late amputation stump complications as expected with rescue treatment
e.g., 996.8 (complications of transplant-transplant rejection) 996.9 (comp of reattached extremity)
e.g., 997.6 late amputation stump complications

NOTE 1: The above classification scheme was developed by Robert T. Rolfs Jr., MD, MPH.
NOTE 2: Not all categories capture Medical Errors or adverse events; some are complications that may or may not have been preventable.

Post-operative infection	N998.5
Other complications of medical care not elsewhere specified	N999

Results

The frequency of medical misadventures, complications of care, and adverse drug events in acute care Utah hospitals are presented in Table 1.

Misadventures of surgical and medical care

- From Jan. 1, 1995 to Dec. 31, 1999, a total of 4,248 *misadventures of surgical and medical care*, occurred to Utah residents, constituting 0.42 percent of all discharges.
- Nearly 93 percent (3,939) of these were due to a cut, puncture, or perforation during medical care.
- Over the 5-year period, there were 128 instances of a foreign object left in the body during the surgery, or an annual average of 26 incidents.

Complications of medical or surgical procedures

- *Complications of medical or surgical procedures, not classified as misadventures of care,* were the most common adverse events (N=60,251), accounting for six percent of hospital discharges and nearly one-half of all adverse events.
- Complications affecting specified body parts occurred over 25,500 times, resulting in a rate of 2.5 per 100 discharges.
- Other leading complication types included other complications of procedures (1.9 percent), complications peculiar to certain specified procedures (1.7 percent) and surgical operations as a cause of abnormal reaction and later complications (1.4 percent).
- Some of the notable complications of surgical care were hemorrhage or hematoma (7,435, 0.7 percent), and post-operative infections (6,095, 0.6 percent).
- Device complications and infections (3 categories) occurred in 17,318 or 1.7 percent of hospitalizations.

Adverse drug events (ADEs) and complications of medications

- *Adverse drug events (ADEs) and complications of medications* occurred in 25,000 discharges, comprising 2.5 percent of hospitalizations and around one in five adverse events.
- Adverse events due to biological and medicinal substances in therapeutic use occurred in 1.83 percent of discharges.
- Poisoning by drugs complicated 0.6 percent of discharges.

The frequency of complications by type of drugs are presented in Table 1.

TABLE 1

NUMBERS AND RATES OF HOSPITAL DISCHARGES, BY YEAR
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

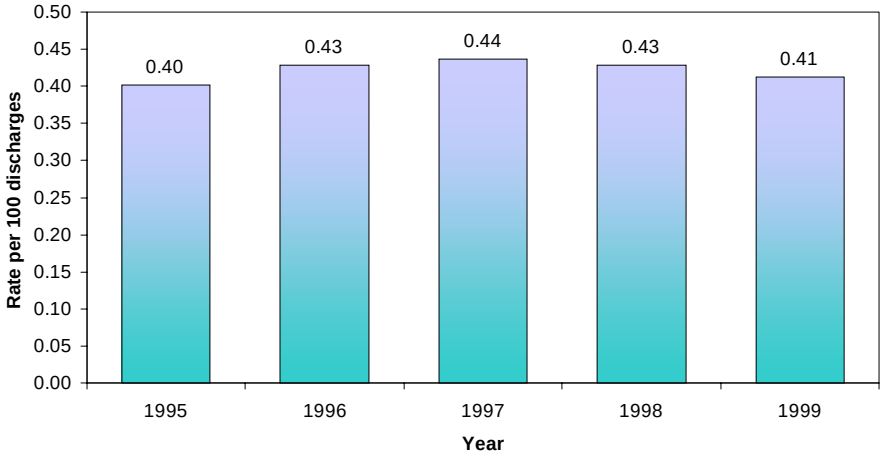
TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	NUMBER OF DISCHARGES	PERCENT OF ALL DISCHARGES
Misadventures of surgical and medical care	4,248	0.422
Cut, puncture, perforation during medical care	3,939	0.391
Foreign object left in body	128	0.013
Failure of sterile precautions	8	0.001
Failure in dosage	8	0.001
Mechanical failure of instrument/apparatus	29	0.003
Contaminated or infected blood, substance	4	0.000
Other and unspecified	150	0.015
Complications of surgical or med. procedures, (not listed above)	60,751	6.030
Surgical operation/procedure as cause of abnormal reaction and later complications	13,889	1.378
Other procedures, without mention of misadventure	3,820	0.379
Complications peculiar to certain specified procedures	16,759	1.663
Infection, inflammatory reaction from device, implant, or graft	7,402	0.735
Other complication of device, ..	4,981	0.494
Mechanical complication of device, implant or graft	4,935	0.490
Complications affecting specified body systems	25,541	2.535
Other complications of procedures	19,369	1.922
Hemorrhage or hematoma	7,435	0.738
Post-operative infection	6,095	0.605
Other complications of medical care	1,650	0.164
Complications of Medications (Adverse drug events)	25,188	2.500
Adverse effects of drugs, biological, medicinal substances in therapeutic use	18,433	1.829
Accidental poisoning by drugs, medicinal/biological substances	1,972	0.196
Poisoning by drugs, medicinal and biological substances***	6,730	0.668
Complications of antibiotics and other antiinfectives	2,305	0.229
Complications of hormones and synthetic substitutes	2,224	0.221
Complications of Insulins and antidiabetic agents	523	0.052
Complications of adrenal cortical steroids	1,517	0.151
Complications of primarily systemic agents	2,507	0.249
Complications of antineoplastic agents	2,000	0.199
Complications of antiallergic/antiemetics	477	0.047
Complications of agents primarily affecting blood constituents	1,570	0.156
Complications of anticoagulants	1,355	0.134
Complications of analgesics, antipyretics, antirheumatics	6,503	0.645
Complications of anticonvulsants, anti-Parkinsonism drugs	848	0.084
Complications of sedatives and hypnotics	912	0.091
Coded as in therapeutic use	449	0.045
Complications of psychotropic agents	3,874	0.384
Complications of other CNS depressants, stimulants, anesthetics, nervous system agents	1,478	0.147
Complications of agents primarily affecting cardiovascular system	2,162	0.215

Note: Subcategories are not mutually exclusive, and therefore totals for the subcategories will not add up to the totals for the main category.

Trend

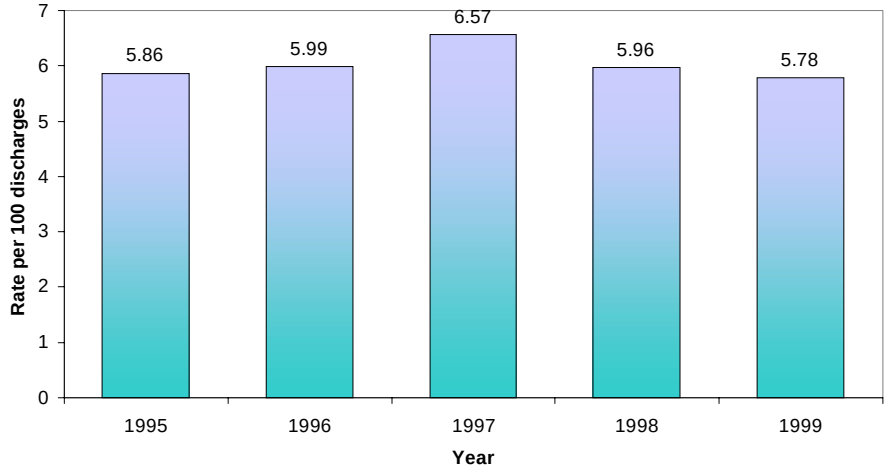
Overall, no substantial annual variation existed in *Misadventures of surgical and medical care* between 1995 and 1999. (Figure 2). However, number of foreign objects left in the body more than doubled from 17 in 1995 to 40 in 1998, declining back again to 22 in 1999. The slight variation in rates across years may be due to variation in reporting practices.

Figure 2: Rate of Misadventure of Surgical and Medical Care, per 100 Hospital Discharges in Utah Acute Care Hospitals: 1995-99



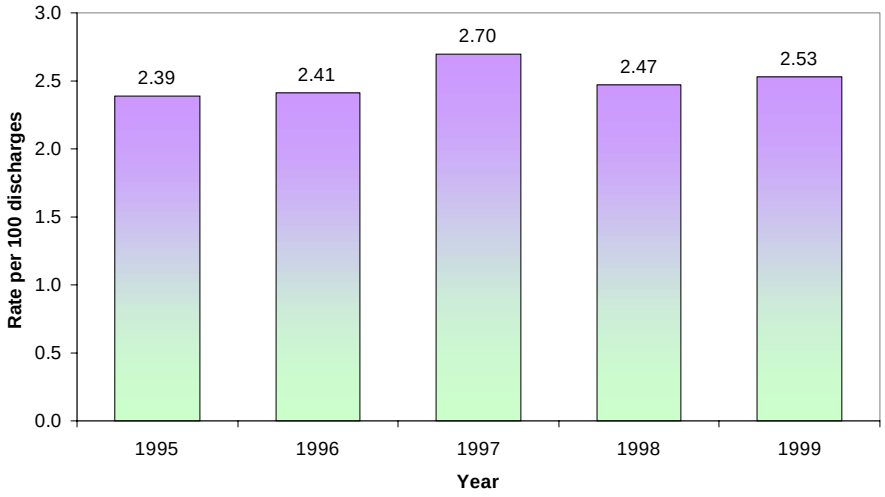
The percentage of discharges involving *complications of medical and surgical procedures not classified as misadventure* rose from 5.9 percent in 1995 to 6.6 percent in 1997 and then declined to 5.8 percent in 1999. Excepting the upturn in 1997, there was no significant variation in *complications of medical and surgical procedures* between 1995 and 1999.

Figure 3: Rate of Complications of Medical and Surgical Procedures, per 100 Hospital Discharges in Utah Acute Care Hospitals: 1995-99



Rates of *adverse drug events* also showed a similar pattern. They were lowest in 1995 and 1996 (2.40 percent), rose slightly in 1997 (2.70 percent), and retreated slightly in 1998 and 1999 (2.47 percent and 2.53 percent, respectively).

Figure 4: Rate of Complications of Medications per 100 Hospital Discharges in Utah Acute Care Hospitals: 1995-99

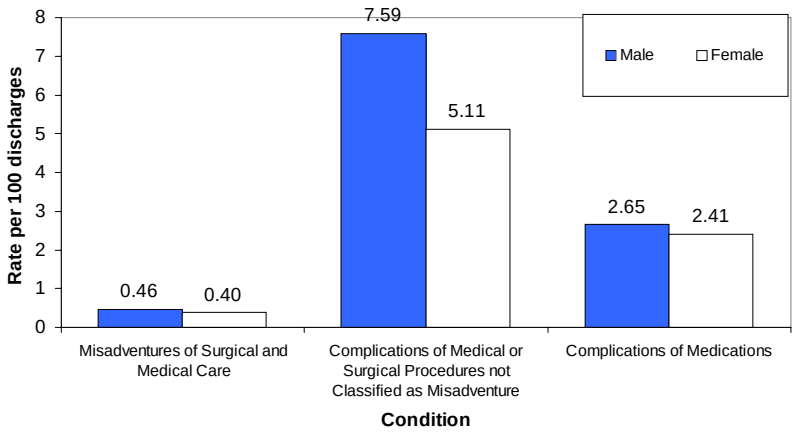


From 1995 to 1999 in Utah, about one in 25 hospital discharges or 4,248 patients had a "misadventure of surgical and medical care", with overwhelming majority of those (93% or 3,939 discharges) comprising cuts, punctures, or perforations during medical care. A total of 60,000 (6 % of all discharges) involved complications of medical and surgical procedures. Finally, 25,000 discharges (2.5 %) were complicated due to medications. No significant annual variation in rates of complications and adverse events was evident.

Variation by Gender

Although men appeared to be more likely to suffer complications or adverse events than women, the actual number of adverse events was considerably higher for women.

Figure 5: Rate of Adverse Events and Complications of Hospital Care per 100 Hospital Discharges in Utah Acute Care Hospitals by Gender: 1995-99



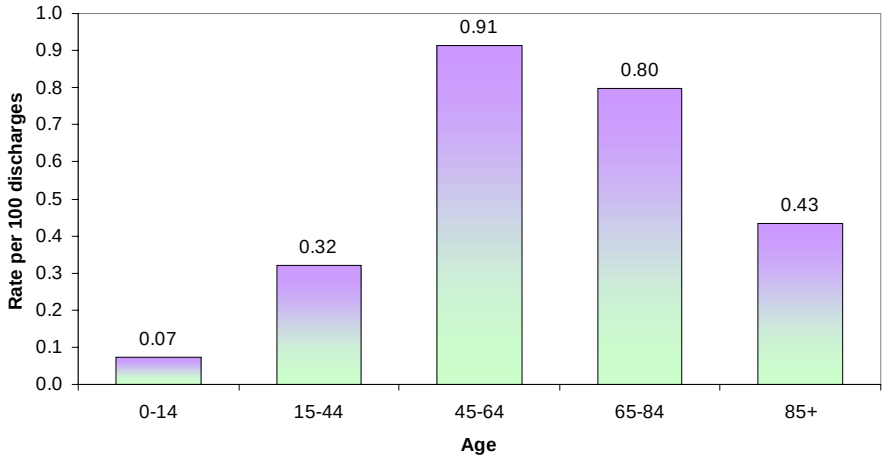
- Misadventures of surgical and medical care were reported in 1,709 male discharges (0.46 percent), and 2,539 female discharges (0.40 percent) with only minimal gender variation in rates.
- The frequency of complications of medical and surgical care not classified as misadventures was higher among women (32,455) than men (28,293), whereas the rate was higher for men. (7.6 vs. 5.1 percent). The rate difference between men and women was highest for this category.
- Consistent with this pattern of variation, the percentage of discharges involving medication complications was slightly higher among men than women (2.7 vs. 2.4 percent), though the number of such complications was greater for women than men (15,306 vs. 9,882).
- As shown in Table 4, post-operative hemorrhage or hematoma was more prevalent among men (0.9 percent) than women (0.6 percent).
- Complications of psychotherapeutic agents appeared to be the only type of complication for which both frequency and percentage were slightly higher among women (2,476, and 0.39 percent) than men (1,398, and 0.38 percent).

A slightly greater proportion of males suffered adverse events than females. However, the actual number of adverse events was considerably higher for women because they use more hospital services than men do.

Variation by age

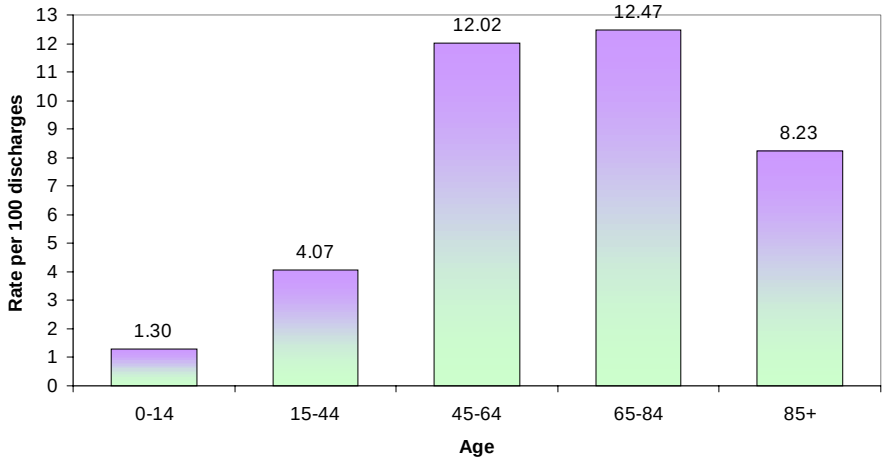
The pattern of variation in rate of misadventures of surgical and medical care by age is roughly curvilinear. The percentage of discharges involving misadventures of surgical and medical care increased steadily with age, reaching a peak in age group 45-64 (0.91 percent) followed by continuous declines to 0.80 percent for patients in age group 65-84, and 0.43 percent for patients 85 years and older (Figure 6.).

Figure 6: Rate of Misadventures of Surgical and Medical Care per 100 Hospital Discharges in Utah Acute Care Hospitals, by Age: 1995-99



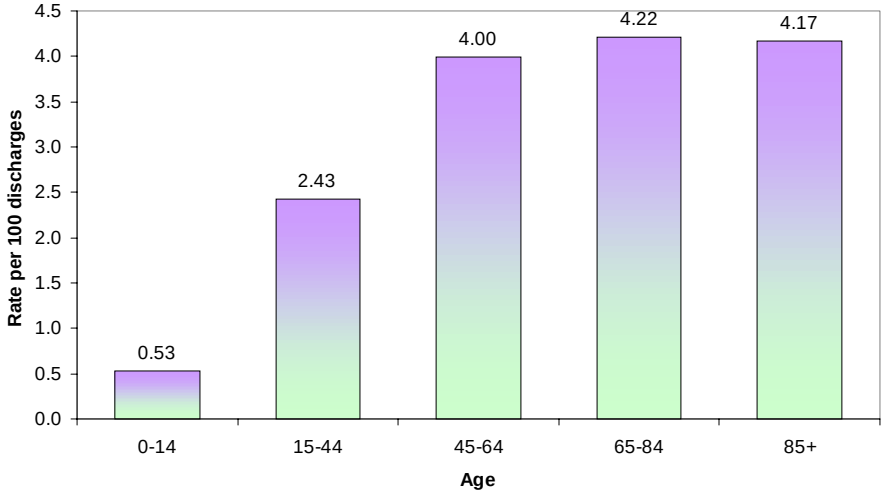
Rates of complications for surgical and medical procedures showed a slightly different pattern with age. The rates rose gradually from 1.3 percent among patients less than 15 years of age, to 4.1 percent in patients aged 15 to 44 years, then tripling to 12.0 percent for patients aged 45 to 64 and remaining roughly stable (12.5 percent) in age group 65 to 84. The rates then decline by about one-third to 8.2 percent among patients 85 and older.

Figure 7: Rate of Complications of Medical and Surgical Procedures per 100 Hospital Discharges in Utah Acute Care Hospitals by Age: 1995-99



Medication complications increased steadily with age, from 0.5 percent among patients 0 to14 years of age to 2.4 percent for the 15-44 years of age to around 4 percent in those in older age groups.

Figure 8: Number of Complications of Medications per 100 Hospital Discharges in Utah Acute Care Hospitals by Age: 1995-99

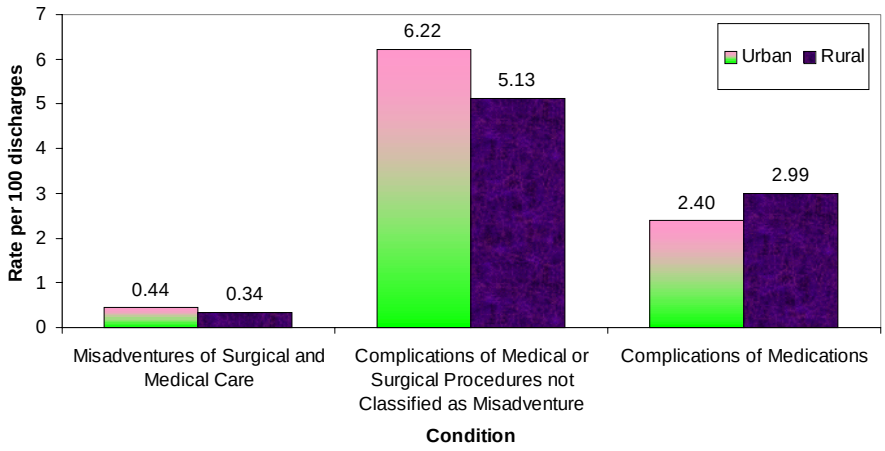


The rate of complications of care and adverse events increased with age, with a greater variation between age groups <15 to 45-65, and slight variation across middle ages and older adult subgroups. Older patients were at a higher risk, probably because they tended to have more complex conditions than other patients. These findings corroborate earlier findings.[6 10] Age appears to be one of the strongest risk factors for adverse events.

Variation by hospital characteristics

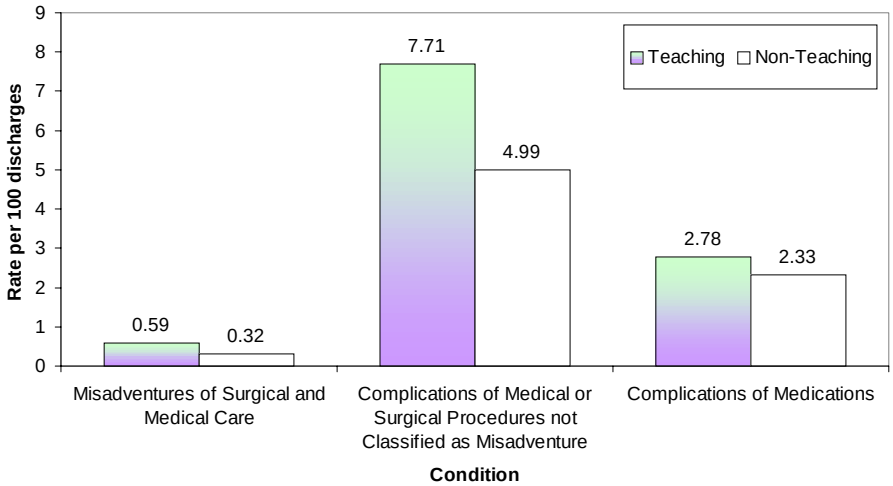
Urban vs. rural location: The percentage of discharges involving misadventures of care, shows an interesting pattern (Figure 9). Urban hospitals have slightly higher rates of misadventures (0.44 percent vs. 0.34 percent) and complications of surgical and medical procedures (6.21 percent vs. 5.21 percent) than rural hospitals, perhaps due to higher volume of procedures in urban hospitals. However, the rate of complications due to medications is slightly higher in rural hospitals than urban hospitals (3.00 vs.2.40 percent).

Figure 9: Rate of Adverse Events and Complications of Hospital Care per 100 Hospital Discharges in Utah Acute Care Hospitals by Urban/Rural Status of Hospital: 1995-99



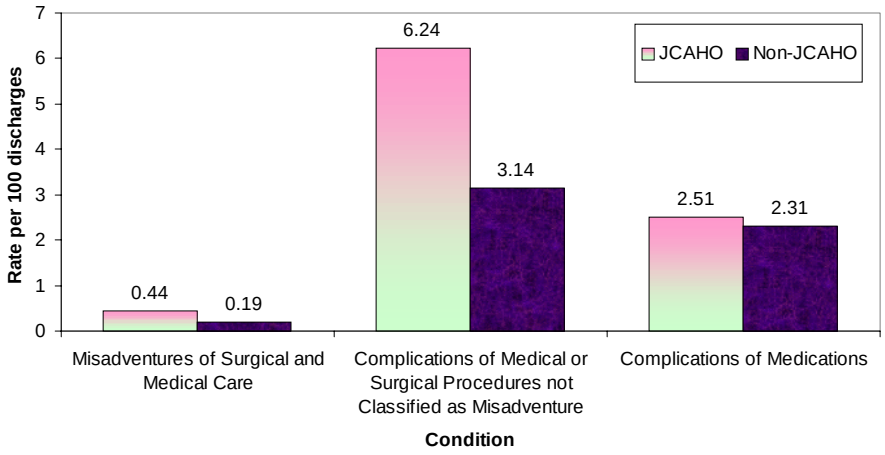
Teaching vs.non-teaching status: For all three components, the percentage of discharges with adverse events is higher in teaching hospitals than non-teaching hospitals, with the difference greatest for complications of surgical and medical procedures not classified as misadventures (7.7 vs. 5.0 percent) (Figure 10).

Figure 10: Rate of Adverse Events and Complications of Hospital Care per 100 Hospital Discharges in Utah Acute Care Hospitals by Teaching Status of Hospital: 1995-99



JCAHO accreditation status: Hospitals accredite by The Joint Commission for Accreditation of Health Organizations (JCAHO), exhibited higher rates of all three types of adverse events than those not accredited by JCAHO, with rates for complications of surgical and medical procedures in JCAHO accredited hospitals double that of in non-JCAHO hospitals (6.24 vs. 3.14 percent), as shown in Figure 11. Part of these differences may be due to difference in monitoring and reporting practices.

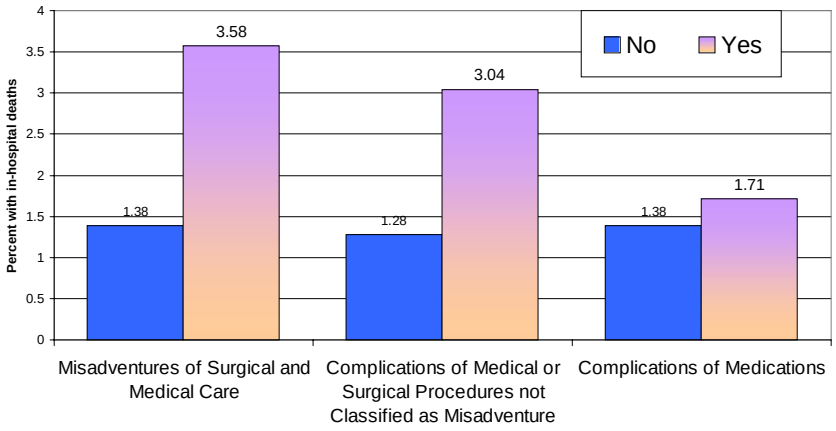
Figure 11: Rate of Adverse Events and Complications of Hospital Care per 100 Hospital Discharges in Utah Acute Care Hospitals JCAHO Participation of Hospital: 1995-99



The higher rates in urban hospitals, teaching hospitals, and JCAHO accredited hospitals are likely due to higher volume and acuity of patients, and possibly more accurate reporting of adverse events

Mortality: Patients with adverse events and complications were about 2.5 times more likely to die in the hospital than patients as a whole. While 1.39 percent of all patients were discharged dead, 3.5 percent of patients with misadventures of surgical and medical care, 3.04 percent with complications of medical and surgical procedures, and 1.71 percent with medication complications died in the hospital.

Figure 12: Percent of discharges with in-hospital deaths, by whether a complication of care/adverse event occurred, Utah Acute Care Hospitals, 1995-99



Conclusions

Through the Institute of Medicine (IOM) report,[6] there is growing recognition in healthcare research of room for improvement in patient safety, and the findings of this report indicates that Utah is no exception. Fortunately, Utah hospitals and Utah Department of Health are already partnering to address the issue of patient safety and to formulate practical solutions to alleviate the situation. The Utah Hospital Association (UHA), jointly with Utah Medical Association, HealthInsight, and Utah Department of Health (UDOH), has organized a Utah Hospital Patient Safety Task Force, taking leadership and initiatives to reduce medical errors in hospital care.

The purpose of this report is to validate data and establish an ongoing mechanism to measure the success of the patient safety improvement initiatives and efforts. The report proposes a classification scheme for adverse events and complications of care, using ICD-9-CM codes and examines variation across various subgroup using this classification. Although limited, the proposed classification should prompt dialogue and feedback for further refinement of this classification. In the interim, this can equip analysts with a tool to group adverse events sensibly.

The availability of relevant data is a necessary ingredient for meeting the patient safety challenges being pursued by the Patient Safety Task force and Utah hospitals. This study provides preliminary estimates of rates of adverse events and some subgroup differences. The report has several limitations. First, it uses administrative data that lacks validation with hospital chart reviews. Secondly, the ICD-9 codes used to

define adverse events and complication of care cannot differentiate between adverse events and complications that occur prior to hospitalization and those that occur while in hospital. Although the data source lack clinical details and do not reflect "true prevalence," the information presented in this exploratory study can play an important role in providing baseline information for all hospitals in the state and enhancing public awareness of the importance of addressing patient safety.

TABLE 2

NUMBERS OF HOSPITAL DISCHARGES, BY YEAR AND
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	1995	1996	1997	1998	1999
Misadventures of surgical and medical care	761	843	879	887	878
Cut, puncture, perforation during medical care	718	777	806	823	815
Foreign object left in body	17	23	26	40	22
Failure of sterile precautions	0	2	4	1	1
Failure in dosage	3	3	1	1	0
Mechanical failure of instrument/apparatus	3	6	10	4	6
Contaminated or infected blood, substance	0	1	2	1	0
Other and unspecified	22	34	35	24	35
Complications of surgical or med. procedures, (not listed above)	11,101	11,771	13,211	12,371	12,297
Surgical operation/procedure as cause of abnormal reaction, and later complications	1,976	2,632	3,837	2,549	2,895
Other procedures, without mention of misadventure	546	744	891	756	883
Complications peculiar to certain specified procedures	3,059	3,328	3,378	3,530	3,464
Infection, inflammatory reaction from device, implant, or graft	1,379	1,532	1,552	1,492	1,447
Other complication of device, ..	817	940	942	1,116	1,166
Mechanical complication of device, implant or graft	963	964	1,005	1,039	964
Complications affecting specified body systems	4,879	4,942	5,509	5,138	5,073
Other complications of procedures	3,449	3,721	4,112	4,078	4,009
Hemorrhage or hematoma	1,393	1,492	1,491	1,525	1,534
Post-operative infection	1,096	1,162	1,225	1,330	1,282
Other complications of medical care	290	328	329	362	341
Complications of Medications (Adverse drug events)	4,530	4,735	5,424	5,118	5,381
Adverse effects of drugs, biological, medicinal substances in therapeutic use	3,185	3,411	4,040	3,835	3,962
Accidental poisoning by drugs, medicinal/biological substances	377	365	420	347	463
Poisoning by drugs, medicinal and biological substances***	1,352	1,338	1,345	1,285	1,410
Complications of antibiotics and other antiinfectives	447	431	492	463	472
Complications of hormones and synthetic substitutes	385	381	443	458	557
Complications of Insulins and antidiabetic agents	111	90	107	114	101
Complications of adrenal cortical steroids	233	258	311	308	407
Complications of primarily systemic agents	444	490	587	508	478
Complications of antineoplastic agents	350	394	463	407	386
Complications of antiallergic/antiemetics	85	91	116	95	90
Complications of agents primarily affecting blood constituents	251	248	345	341	385
Complications of anticoagulants	213	192	303	302	345
Complications of analgesics, antipyretics, antirheumatics	1,072	1,287	1,421	1,345	1,378
Complications of anticonvulsants, anti-Parkinsonism drugs	126	177	189	192	164
Complications of sedatives and hypnotics	141	147	184	210	230
Coded as in therapeutic use	58	68	95	106	122
Complications of psychotropic agents	790	747	780	739	818
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	295	282	319	287	295
Complications of agents primarily affecting cardiovascular system	432	426	425	437	442

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 3

RATES OF HOSPITAL DISCHARGES, BY YEAR AND
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	PERCENT OF ALL DISCHARGES				
	1995	1996	1997	1998	1999
Misadventures of surgical and medical care	0.401	0.429	0.437	0.428	0.413
Cut, puncture, perforation during medical care	0.379	0.395	0.401	0.397	0.383
Foreign object left in body	0.009	0.012	0.013	0.019	0.010
Failure of sterile precautions	0.000	0.001	0.002	0.000	0.000
Failure in dosage	0.002	0.002	0.000	0.000	0.000
Mechanical failure of instrument/apparatus	0.002	0.003	0.005	0.002	0.003
Contaminated or infected blood, substance	0.000	0.001	0.001	0.000	0.000
Other and unspecified	0.012	0.017	0.017	0.012	0.016
Complications of surgical or med. procedures, (not listed above)	5.856	5.989	6.565	5.963	5.781
Surgical operation/procedure as cause of abnormal reaction, and later complication	1.042	1.339	1.907	1.229	1.361
Other procedures, without mention of misadventure	0.288	0.379	0.443	0.364	0.415
Complications peculiar to certain specified procedures	1.614	1.693	1.679	1.701	1.628
Infection, inflammatory reaction from device, implant, or graft	0.727	0.779	0.771	0.719	0.680
Other complication of device, ..	0.431	0.478	0.468	0.538	0.548
Mechanical complication of device, implant or graft	0.508	0.49	0.499	0.501	0.453
Complications affecting specified body systems	2.574	2.514	2.738	2.477	2.385
Other complications of procedures	1.819	1.893	2.044	1.966	1.885
Hemorrhage or hematoma	0.735	0.759	0.741	0.735	0.721
Post-operative infection	0.578	0.591	0.609	0.641	0.603
Other complications of medical care	0.153	0.167	0.164	0.174	0.160
Complications of Medications (Adverse drug events)	2.390	2.409	2.696	2.467	2.529
Adverse effects of drugs, biological, medicinal substances in therapeutic use	1.680	1.735	2.008	1.848	1.862
Accidental poisoning by drugs, medicinal/biological substances	0.199	0.186	0.209	0.167	0.218
Poisoning by drugs, medicinal and biological substances***	0.713	0.681	0.668	0.619	0.663
Complications of antibiotics and other antiinfectives	0.236	0.219	0.245	0.223	0.222
Complications of hormones and synthetic substitutes	0.203	0.194	0.220	0.221	0.262
Complications of Insulins and antidiabetic agents	0.059	0.046	0.053	0.055	0.047
Complications of adrenal cortical steroids	0.123	0.131	0.155	0.148	0.191
Complications of primarily systemic agents	0.234	0.249	0.292	0.245	0.225
Complications of antineoplastic agents	0.185	0.200	0.230	0.196	0.181
Complications of antiallergic/antiemetics	0.045	0.046	0.058	0.046	0.042
Complications of agents primarily affecting blood constituents	0.132	0.126	0.171	0.164	0.181
Complications of anticoagulants	0.112	0.098	0.151	0.146	0.162
Complications of analgesics, antipyretics, antirheumatics	0.565	0.655	0.706	0.648	0.648
Complications of anticonvulsants, anti-Parkinsonism drugs	0.066	0.090	0.094	0.093	0.077
Complications of sedatives and hypnotics	0.074	0.075	0.091	0.101	0.108
Coded as in therapeutic use	0.031	0.035	0.047	0.051	0.057
Complications of psychotropic agents	0.417	0.380	0.388	0.356	0.385
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	0.156	0.143	0.159	0.138	0.139
Complications of agents primarily affecting cardiovascular system	0.228	0.217	0.211	0.211	0.208

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 4

NUMBERS AND RATES OF HOSPITAL DISCHARGES, BY SEX AND
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	MALE		FEMALE	
	Number of Discharges	Percent of All Discharges	Number of Discharges	Percent of All Discharges
Misadventures of surgical and medical care	1,709	0.458	2,539	0.400
Cut, puncture, perforation during medical care	1,571	0.421	2,368	0.373
Foreign object left in body	55	0.015	73	0.012
Failure of sterile precautions	1	0.000	7	0.001
Failure in dosage	4	0.001	4	0.001
Mechanical failure of instrument/apparatus	15	0.004	14	0.002
Contaminated or infected blood, substance	2	0.001	2	0.000
Other and unspecified	69	0.019	81	0.013
Complications of surgical or med. procedures, (not listed above)	28,293	7.589	32,455	5.114
Surgical operation/procedure as cause of abnormal reaction, and later complications	6,519	1.749	7,370	1.161
Other procedures, without mention of misadventure	1,811	0.486	2,009	0.317
Complications peculiar to certain specified procedures	8,059	2.162	8,700	1.371
Infection, inflammatory reaction from device, implant, or graft	3,436	0.922	3,966	0.625
Other complication of device, ..	2,443	0.655	2,538	0.400
Mechanical complication of device, implant or graft	2,461	0.660	2,474	0.390
Complications affecting specified body systems	12,032	3.227	13,507	2.128
Other complications of procedures	8,824	2.367	10,543	1.661
Hemorrhage or hematoma	3,437	0.922	3,998	0.630
Post-operative infection	2,779	0.745	3,315	0.522
Other complications of medical care	667	0.179	983	0.155
Complications of Medications (Adverse drug events)	9,882	2.651	15,306	2.412
Adverse effects of drugs, biological, medicinal substances in therapeutic use	7,321	1.964	11,112	1.751
Accidental poisoning by drugs, medicinal/biological substances	872	0.234	1,100	0.173
Poisoning by drugs, medicinal and biological substances***	2,530	0.679	4,200	0.662
Complications of antibiotics and other antiinfectives	855	0.229	1,450	0.228
Complications of hormones and synthetic substitutes	813	0.218	1,411	0.222
Complications of Insulins and antidiabetic agents	215	0.058	308	0.049
Complications of adrenal cortical steroids	566	0.152	951	0.150
Complications of primarily systemic agents	1,110	0.298	1,397	0.220
Complications of antineoplastic agents	903	0.242	1,097	0.173
Complications of antiallergic/antiemetics	194	0.052	283	0.045
Complications of agents primarily affecting blood constituents	662	0.178	908	0.143
Complications of anticoagulants	570	0.153	785	0.124
Complications of analgesics, antipyretics, antirheumatics	2,499	0.670	4,004	0.631
Complications of anticonvulsants, anti-Parkinsonism drugs	351	0.094	497	0.078
Complications of sedatives and hypnotics	341	0.091	571	0.090
Coded as in therapeutic use	175	0.047	274	0.043
Complications of psychotropic agents	1,398	0.375	2,476	0.390
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	602	0.161	876	0.138
Complications of agents primarily affecting cardiovascular system	849	0.228	1,313	0.207

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 5

NUMBERS OF HOSPITAL DISCHARGES, BY AGE AND
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	AGE GROUP				
	0-14	15-44	45-64	65-84	85+
Misadventures of surgical and medical care	206	1,211	1,215	1,447	169
Cut, puncture, perforation during medical care	149	1,128	1,139	1,363	160
Foreign object left in body	4	42	35	45	2
Failure of sterile precautions	0	5	0	2	1
Failure in dosage	2	1	2	3	0
Mechanical failure of instrument/apparatus	8	8	6	6	1
Contaminated or infected blood, substance	0	2	0	2	0
Other and unspecified	43	32	35	34	6
Complications of surgical or med. procedures, (not listed above)	3,616	15,290	15,987	22,653	3,205
Surgical operation/procedure as cause of abnormal reaction, and later complication	1,747	4,270	3,554	3,889	429
Other procedures, without mention of misadventure	358	1,016	993	1,279	174
Complications peculiar to certain specified procedures	1,449	3,762	4,196	6,270	1,082
Infection, inflammatory reaction from device, implant, or graft	824	1,436	1,601	2,966	575
Other complication of device, ..	447	1,281	1,286	1,667	300
Mechanical complication of device, implant or graft	228	1,185	1,457	1,824	241
Complications affecting specified body systems	809	5,828	6,947	10,526	1,431
Other complications of procedures	917	5,565	5,296	6,793	798
Hemorrhage or hematoma	312	1,841	1,862	3,036	384
Post-operative infection	276	1,938	1,811	1,879	191
Other complications of medical care	235	383	335	601	96
Complications of Medications (Adverse drug events)	1,477	9,115	5,318	7,656	1,622
Adverse effects of drugs, biological, medicinal substances in therapeutic use	1,004	4,478	4,262	7,174	1,515
Accidental poisoning by drugs, medicinal/biological substances	284	937	363	312	76
Poisoning by drugs, medicinal and biological substances***	457	4,601	1,059	497	116
Complications of antibiotics and other antiinfectives	346	733	454	627	145
Complications of hormones and synthetic substitutes	97	606	564	833	124
Complications of Insulins and antidiabetic agents	28	155	93	203	44
Complications of adrenal cortical steroids	62	362	441	585	67
Complications of primarily systemic agents	169	958	716	637	27
Complications of antineoplastic agents	132	595	660	592	21
Complications of antiallergic/antiemetics	35	352	49	36	5
Complications of agents primarily affecting blood constituents	45	185	334	835	171
Complications of anticoagulants	15	135	287	761	157
Complications of analgesics, antipyretics, antirheumatics	293	2,817	1,335	1,658	400
Complications of anticonvulsants, anti-Parkinsonism drugs	85	424	148	166	25
Complications of sedatives and hypnotics	64	448	174	191	35
Coded as in therapeutic use	47	120	96	157	29
Complications of psychotropic agents	169	2,404	782	436	83
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	83	843	220	289	43
Complications of agents primarily affecting cardiovascular system	73	197	339	1,163	390

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 6

RATES OF HOSPITAL DISCHARGES, BY AGE AND
MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	AGE GROUP				
	0-14	15-44	45-64	65-84	85+
Misadventures of surgical and medical care	0.074	0.322	0.913	0.797	0.434
Cut, puncture, perforation during medical care	0.054	0.300	0.856	0.750	0.411
Foreign object left in body	0.001	0.011	0.026	0.025	0.005
Failure of sterile precautions	0.000	0.001	0.000	0.001	0.003
Failure in dosage	0.001	0.000	0.002	0.002	0.000
Mechanical failure of instrument/apparatus	0.003	0.002	0.005	0.003	0.003
Contaminated or infected blood, substance	0.000	0.001	0.000	0.001	0.000
Other and unspecified	0.015	0.009	0.026	0.019	0.015
Complications of surgical or med. procedures, (not listed above)	1.300	4.068	12.015	12.472	8.229
Surgical operation/procedure as cause of abnormal reaction, and later complications	0.628	1.136	2.671	2.141	1.102
Other procedures, without mention of misadventure	0.129	0.270	0.746	0.704	0.447
Complications peculiar to certain specified procedures	0.521	1.001	3.154	3.452	2.778
Infection, inflammatory reaction from device, implant, or graft	0.296	0.382	1.203	1.633	1.476
Other complication of device, ..	0.161	0.341	0.967	0.918	0.770
Mechanical complication of device, implant or graft	0.082	0.315	1.095	1.004	0.619
Complications affecting specified body systems	0.291	1.551	5.221	5.795	3.674
Other complications of procedures	0.330	1.481	3.980	3.740	2.049
Hemorrhage or hematoma	0.112	0.490	1.399	1.672	0.986
Post-operative infection	0.099	0.516	1.361	1.035	0.490
Other complications of medical care	0.085	0.102	0.252	0.331	0.246
Complications of Medications (Adverse drug events)	0.531	2.425	3.997	4.215	4.165
Adverse effects of drugs, biological, medicinal substances in therapeutic use	0.361	1.191	3.203	3.950	3.890
Accidental poisoning by drugs, medicinal/biological substances	0.102	0.249	0.273	0.172	0.195
Poisoning by drugs, medicinal and biological substances***	0.164	1.224	0.796	0.274	0.298
Complications of antibiotics and other antiinfectives	0.124	0.195	0.341	0.345	0.372
Complications of hormones and synthetic substitutes	0.035	0.161	0.424	0.459	0.318
Complications of Insulins and antidiabetic agents	0.01	0.041	0.070	0.112	0.113
Complications of adrenal cortical steroids	0.022	0.096	0.331	0.322	0.172
Complications of primarily systemic agents	0.061	0.255	0.538	0.351	0.069
Complications of antineoplastic agents	0.047	0.158	0.496	0.326	0.054
Complications of antiallergic/antiemetics	0.013	0.094	0.037	0.020	0.013
Complications of agents primarily affecting blood constituents	0.016	0.049	0.251	0.460	0.439
Complications of anticoagulants	0.005	0.036	0.216	0.419	0.403
Complications of analgesics, antipyretics, antirheumatics	0.105	0.75	1.003	0.913	1.027
Complications of anticonvulsants, anti-Parkinsonism drugs	0.031	0.113	0.111	0.091	0.064
Complications of sedatives and hypnotics	0.023	0.119	0.131	0.105	0.090
Coded as in therapeutic use	0.017	0.032	0.072	0.086	0.074
Complications of psychotropic agents	0.061	0.640	0.588	0.240	0.213
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	0.030	0.224	0.165	0.159	0.110
Complications of agents primarily affecting cardiovascular system	0.026	0.052	0.255	0.640	1.001

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 7

NUMBERS AND RATES OF HOSPITAL DISCHARGES, BY URBAN/RURAL STATUS OF HOSPITAL AND MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	RURAL HOSPITALS		URBAN HOSPITALS	
	Number of Discharges	Percent of All Discharges	Number of Discharges	Percent of All Discharges
Misadventures of surgical and medical care	579	0.335	3,669	0.440
Cut, puncture, perforation during medical care	518	0.299	3,421	0.410
Foreign object left in body	28	0.016	100	0.012
Failure of sterile precautions	1	0.001	7	0.001
Failure in dosage	5	0.003	3	0.000
Mechanical failure of instrument/apparatus	9	0.005	20	0.002
Contaminated or infected blood, substance	0	0.000	4	0.000
Other and unspecified	25	0.014	125	0.015
Complications of surgical or med. procedures, (not listed above)	8,863	5.124	51,888	6.217
Surgical operation/procedure as cause of abnormal reaction, and later complication	2,857	1.652	11,032	1.322
Other procedures, without mention of misadventure	647	0.374	3,173	0.380
Complications peculiar to certain specified procedures	1,542	0.891	15,217	1.823
Infection, inflammatory reaction from device, implant, or graft	661	0.382	6,741	0.808
Other complication of device, ..	501	0.290	4,480	0.537
Mechanical complication of device, implant or graft	428	0.247	4,507	0.540
Complications affecting specified body systems	4,062	2.348	21,479	2.574
Other complications of procedures	3,189	1.844	16,180	1.939
Hemorrhage or hematoma	1,004	0.580	6,431	0.771
Post-operative infection	872	0.504	5,223	0.626
Other complications of medical care	287	0.166	1,363	0.163
Complications of Medications (Adverse drug events)	5,166	2.986	20,022	2.399
Adverse effects of drugs, biological, medicinal substances in therapeutic use	3,768	2.178	14,665	1.757
Accidental poisoning by drugs, medicinal/biological substances	327	0.189	1,645	0.197
Poisoning by drugs, medicinal and biological substances***	1,440	0.832	5,290	0.634
Complications of antibiotics and other antiinfectives	522	0.302	1,783	0.214
Complications of hormones and synthetic substitutes	446	0.258	1,778	0.213
Complications of Insulins and antidiabetic agents	126	0.073	397	0.048
Complications of adrenal cortical steroids	281	0.162	1,236	0.148
Complications of primarily systemic agents	532	0.308	1,975	0.237
Complications of antineoplastic agents	384	0.222	1,616	0.194
Complications of antiallergic/antiemetics	138	0.080	339	0.041
Complications of agents primarily affecting blood constituents	356	0.206	1,214	0.145
Complications of anticoagulants	301	0.174	1,054	0.126
Complications of analgesics, antipyretics, antirheumatics	1,241	0.717	5,262	0.631
Complications of anticonvulsants, anti-Parkinsonism drugs	125	0.072	723	0.087
Complications of sedatives and hypnotics	155	0.090	757	0.091
Coded as in therapeutic use	71	0.041	378	0.045
Complications of psychotropic agents	763	0.441	3,111	0.373
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	339	0.196	1,139	0.136
Complications of agents primarily affecting cardiovascular system	518	0.299	1,644	0.197

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

TABLE 8

NUMBERS AND RATES OF HOSPITAL DISCHARGES, BY JCAHO PARTICIPATION OF HOSPITAL AND MEDICAL MISADVENTURES, COMPLICATIONS OF MEDICAL CARE, AND ADVERSE OUTCOMES
UTAH ACUTE CARE INPATIENT HOSPITAL DISCHARGES, 1995-99

TYPE OF MEDICAL ERROR, COMPLICATION, OR ADVERSE OUTCOME	Non-JCAHO Hospitals		JCAHO Hospitals	
	Number of Discharges	Percent of All Discharges	Number of Discharges	Percent of All Discharges
Misadventures of surgical and medical care	127	0.19	4,121	0.438
Cut, puncture, perforation during medical care	119	0.178	3,820	0.406
Foreign object left in body	6	0.009	122	0.013
Failure of sterile precautions	0	0	8	0.001
Failure in dosage	1	0.001	7	0.001
Mechanical failure of instrument/apparatus	0	0	29	0.003
Contaminated or infected blood, substance	0	0	4	0
Other and unspecified	3	0.004	147	0.016
Complications of surgical or med. procedures, (not listed above)	2,096	3.138	58,655	6.235
Surgical operation/procedure as cause of abnormal reaction, and later complications	230	0.344	13,659	1.452
Other procedures, without mention of misadventure	91	0.136	3,729	0.396
Complications peculiar to certain specified procedures	409	0.612	16,350	1.738
Infection, inflammatory reaction from device, implant, or graft	159	0.238	7,243	0.77
Other complication of device, ..	149	0.223	4,832	0.514
Mechanical complication of device, implant or graft	111	0.166	4,824	0.513
Complications affecting specified body systems	826	1.237	24,715	2.627
Other complications of procedures	838	1.255	18,531	1.97
Hemorrhage or hematoma	350	0.524	7,085	0.753
Post-operative infection	307	0.46	5,788	0.615
Other complications of medical care	89	0.133	1,561	0.166
Complications of Medications (Adverse drug events)	1,542	2.308	23,646	2.514
Adverse effects of drugs, biological, medicinal substances in therapeutic use	1,096	1.641	17,337	1.843
Accidental poisoning by drugs, medicinal/biological substances	98	0.147	1,874	0.199
Poisoning by drugs, medicinal and biological substances***	492	0.737	6,238	0.663
Complications of antibiotics and other antiinfectives	178	0.266	2,127	0.226
Complications of hormones and synthetic substitutes	151	0.226	2,073	0.22
Complications of Insulins and antidiabetic agents	54	0.081	469	0.05
Complications of adrenal cortical steroids	80	0.12	1,437	0.153
Complications of primarily systemic agents	75	0.112	2,432	0.259
Complications of antineoplastic agents	44	0.066	1,956	0.208
Complications of antiallergic/antiemetics	25	0.037	452	0.048
Complications of agents primarily affecting blood constituents	117	0.175	1,453	0.154
Complications of anticoagulants	101	0.151	1,254	0.133
Complications of analgesics, antipyretics, antirheumatics	382	0.572	6,121	0.651
Complications of anticonvulsants, anti-Parkinsonism drugs	61	0.091	787	0.084
Complications of sedatives and hypnotics	21	0.031	891	0.095
Coded as in therapeutic use	6	0.009	443	0.047
Complications of psychotropic agents	212	0.317	3,662	0.389
Complications other CNS depressants, stimulants, anesthetics, nervous system agents	79	0.118	1,399	0.149
Complications of agents primarily affecting cardiovascular system	208	0.311	1,954	0.208

Note: The total number of discharges for the sub-categories for each of the three main categories is not the same as the total for the main category because the subcategories are not mutually exclusive.

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