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Utah Patient Safety Update

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"[Our] success will be indicated initially by seeing an increased number of events detected and reported across the state."

Scott D. Williams, MD
Deputy Director,
Utah Department of Health

Adverse Drug Events (ADEs) Among Hospitalized Patients in Utah, January 1, 2001 - June 30, 2002

This update describes the incidence of potential adverse drug events (ADEs) among hospitalized patients in 41 Utah acute care hospitals over three six-month time periods from January 2001 through June 2002. The update reflects efforts of the Utah Patient Safety Consortium to utilize the Hospital Inpatient Discharge Database to facilitate patient safety efforts in Utah's hospitals.

This update has three main objectives. First, it shows trends in the reported numbers and rates of ADEs. Second, the update also shows trends in the rates of rash as an example of a common ADE and in the rates of adverse effects of agents affecting blood constituents (such as anticoagulants) as an example of a potential high-harm ADE. Third, the update reports preliminary findings based on the chart review of hospital charts of inpatients hospitalized in any of the 41 Utah acute care hospitals in 2001.

One of the purposes of the chart review is to validate the ICD-9-CM codes for the 26 classes of ADEs described in this update as well as 40 additional classes of AEs not reported here. Physician reviews are being conducted on part of the sample of the charts reviewed by registered nurses trained in medical chart coding.

Like the previous updates, this update's objectives are to report some of the Consortium's findings to increase understanding of ADEs. Previous studies have indicated that adverse events may be underreported. The Consortium expects that better recognition, documentation, and reporting will lead to more accurate estimates of rates of ADEs.

About the Data

The Utah Hospital Discharge Database has nine fields for reporting ICD-9-CM diagnosis codes and one field for reporting the principal E-code. The database contains patient-level information about all hospitalizations that occur in all of Utah's licensed hospitals. The Utah Health Data Committee, through its staff in the Utah Department of Health, collects the data under the authority of the Utah Health Data Authority Act. This update compares hospital inpatient discharge data across three half-year periods: (1) January 1 through June 30, 2001 (discharges = 121,115), (2) July 1 through December 31, 2001 (discharges = 117,936), and (3) January 1 through June 30, 2002 (discharges = 123,960) (see Table 1, Table 2 and Figure 1). Information about each discharge, or hospitalization, includes patient characteristics, diagnosis codes, etc. Like the previous two updates, analysis for this update was restricted to hospitalizations in 41 Utah acute care hospitals, excluding specialty hospitals (such as rehabilitation and psychiatric hospitals).

About ICD-9-CM Codes

The International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) has diagnosis and procedure codes and E-codes. Diagnosis (DX) codes describe the nature of the patient's diagnosis whereas E-codes describe the possible external cause of the injury, where appropriate. For example, if a drug were thought to have caused a rash, the diagnosis code would address the rash (e.g., 782.1), while the E-code would describe the drug class that was the external cause of the rash (e.g., E943). While diagnosis codes play a critical role in determining how much a provider is paid for a service, E-codes are not directly related to reimbursement. Currently there is little financial incentive for E-code reporting. Therefore, ADEs identified by E-codes probably are under recorded.

The potential ADEs identified in this analysis may or may not have occurred prior to contact with a given hospital's personnel. While principal discharge diagnosis codes (the codes causing hospitalization) were excluded, secondary diagnosis and E-codes may represent potential ADEs that occurred before the patient was hospitalized or potential ADEs that occurred in the hospital.

Limitations of Using the Administrative Data and the ICD-9-CM Classification for Detecting Adverse Drug Events

- Unable to separate the events that occurred prior to current hospitalization from those that occurred during hospitalization
- Unable to categorize degree of harm
- Unable to capture near misses
- Unable to perform reliable inter-institutional comparisons due to coding variation among facilities

About Adverse Drug Events

Definitions: For the Utah patient safety project, an adverse event (AE) is defined as an undesirable and unintended injury resulting from a medical intervention (an act of care provided by the hospital or by the omission of necessary care), rather than from the patient's underlying disease process. An adverse drug event (ADE) is an adverse event associated with a drug.

Classification: ADEs were detected in the Utah Hospital Discharge Database using a classification scheme validated by the project's expert panel for the ICD-9-CM Classification of Adverse Events. The scheme designates a set of approximately 420 ICD-9-CM codes including diagnosis codes (DX codes) and external-injury codes (E-codes) as potential ADE codes. These codes are classified into 26 ADE classes (see Table 1 and Table 3.)

Grouping: The 26 ADE classes fall into three groups: (1) clinical side effects of drugs (DX codes), (2) poisoning by drugs (DX codes and E-codes), and adverse effects of drugs (E-codes). While the clinical side effect classes describes similar clinical diagnoses, e.g., rash and dermatitis, the adverse effect and poisoning classes are grouped by type of drug, such as agents affecting blood constituents (see Table 1, Table 2 and Figure 1).

The Utah Patient Safety Consortium wishes to thank the hospitals for their cooperation in the pre-intervention chart review last year. HealthInsight will conduct the post-intervention chart review in late fall, 2003. We greatly appreciate the continued support from the participating hospitals.

TABLE 1

Number of Inpatient Discharges with Adverse Drug Event (ADE) by ICD-9-CM Code ADE Group and ADE Class and Six Month Time Period
Utah, 41 Acute Care Hospitals
January 1, 2001 through June 30, 2002

ICD-9-CM Adverse Drug Event Group and Class	Jan-July 2001	July-Dec 2001	Jan-June 2002
Total Discharges with At Least One Adverse Drug Event	**3,813**	**3,816**	**4,235**
Clinical Side Effects of Drug(s)	**885**	**921**	**1,029**
Drug psychoses	366	439	443
Dermatitis	236	224	261
Maternal causes of perinatal morbidity and mortality, drug reactions	21	15	18
Rash, spontaneous ecchymoses	264	252	310
Poisoning by Drug(s)	**678**	**718**	**765**
Poisoning by antibiotics and other antiinfectives	5	7	8
Poisoning by hormones and synthetic substitutes	16	26	33
Poisoning by primarily systemic agents	34	49	33
Poisoning by agents primarily affecting blood constituents	17	14	20
Poisoning by analgesics, antipyretics, antirheumatics	213	213	248
Poisoning by anticonvulsant and anti-Parkinsonian drugs	43	37	41
Poisoning by sedatives and hypnotics	46	63	68
Poisoning by other CNS depressants, stimulants, anesthetics	40	51	54
Poisoning by psychotropic agents	255	286	306
Poisoning by other agents	117	116	123
Poisoning (undetermined whether accidentally or purposely inflicted)	77	85	79
Adverse Effects by Drug(s)	**2,524**	**2,467**	**2,743**
Adverse effects of antibiotics and other antiinfectives	219	227	279
Adverse effects of hormones and synthetic substitutes	349	294	321
Adverse effects of primarily systemic agents	284	271	295
Adverse effects of agents primarily affecting blood constituents	208	207	230
Adverse effects of analgesics, antipyretics, antirheumatics	488	517	553
Adverse effects of anticonvulsant and anti-Parkinsonian drugs	72	64	81
Adverse effects of sedatives and hypnotics	97	101	137
Adverse effects of other CNS depressants, stimulants, anesthetics	112	95	135
Adverse effects of psychotropic agents	124	150	153
Adverse effects of agents primarily affecting the cardiovascular system	282	254	269
Adverse effects of other drugs, biological, medicinal substances	376	368	379
Total inpatient discharges for the 6-month period	**121,115**	**117,936**	**123,960**

Source: The Utah/Missouri Patient Safety Project, National Expert Panel for ICD-9-CM Classification of Adverse Events, 2002

TABLE 2

Percentage of Inpatient Discharges with Adverse Drug Event (ADE) by ICD-9-CM Code ADE Group and ADE Class and Six Month Time Period
Utah, 41 Acute Care Hospitals
January 1, 2001 through June 30, 2002

ICD-9-CM Adverse Drug Event Group and Class	Jan-July 2001	July-Dec 2001	Jan-June 2002
Total Discharges with At Least One Adverse Drug Event	**3.148**	**3.236**	**3.416**
Clinical Side Effects of Drug(s)	**0.731**	**0.781**	**0.830**
Drug psychoses	0.302	0.372	0.357
Dermatitis	0.195	0.190	0.211
Maternal causes of perinatal morbidity and mortality, drug reactions	0.017	0.013	0.015
Rash, spontaneous ecchymoses	0.218	0.214	0.250
Poisoning by Drug(s)	**0.560**	**0.609**	**0.617**
Poisoning by antibiotics and other antiinfectives	0.004	0.006	0.006
Poisoning by hormones and synthetic substitutes	0.013	0.022	0.027
Poisoning by primarily systemic agents	0.028	0.042	0.027
Poisoning by agents primarily affecting blood constituents	0.014	0.012	0.016
Poisoning by analgesics, antipyretics, antirheumatics	0.176	0.181	0.200
Poisoning by anticonvulsant and anti-Parkinsonian drugs	0.036	0.031	0.033
Poisoning by sedatives and hypnotics	0.038	0.053	0.055
Poisoning by other CNS depressants, stimulants, anesthetics	0.033	0.043	0.044
Poisoning by psychotropic agents	0.211	0.243	0.247
Poisoning by other agents	0.097	0.098	0.099
Poisoning (undetermined whether accidentally or purposely inflicted)	0.064	0.072	0.064
Adverse Effects by Drug(s)	**2.084**	**2.092**	**2.213**
Adverse effects of antibiotics and other antiinfectives	0.181	0.192	0.225
Adverse effects of hormones and synthetic substitutes	0.288	0.249	0.259
Adverse effects of primarily systemic agents	0.234	0.230	0.238
Adverse effects of agents primarily affecting blood constituents	0.172	0.176	0.186
Adverse effects of analgesics, antipyretics, antirheumatics	0.403	0.438	0.446
Adverse effects of anticonvulsant and anti-Parkinsonian drugs	0.059	0.054	0.065
Adverse effects of sedatives and hypnotics	0.080	0.086	0.111
Adverse effects of other CNS depressants, stimulants, anesthetics	0.092	0.081	0.109
Adverse effects of psychotropic agents	0.102	0.127	0.123
Adverse effects of agents primarily affecting the cardiovascular system	0.233	0.215	0.217
Adverse effects of other drugs, biological, medicinal substances	0.310	0.312	0.306
Total inpatient discharges for the 6-month period	**121,115**	**117,936**	**123,960**

Source: The Utah/Missouri Patient Safety Project, National Expert Panel for ICD-9-CM Classification of Adverse Events, 2002

FIGURE 1. PERCENTAGE OF INPATIENT DISCHARGES WITH AT LEAST ONE ADVERSE DRUG EVENT (ADE) BY ADE GROUP AND 6 MONTH TIME PERIOD UTAH, 41 ACUTE CARE HOSPITALS JANUARY 1, 2001 - JUNE 30, 2002

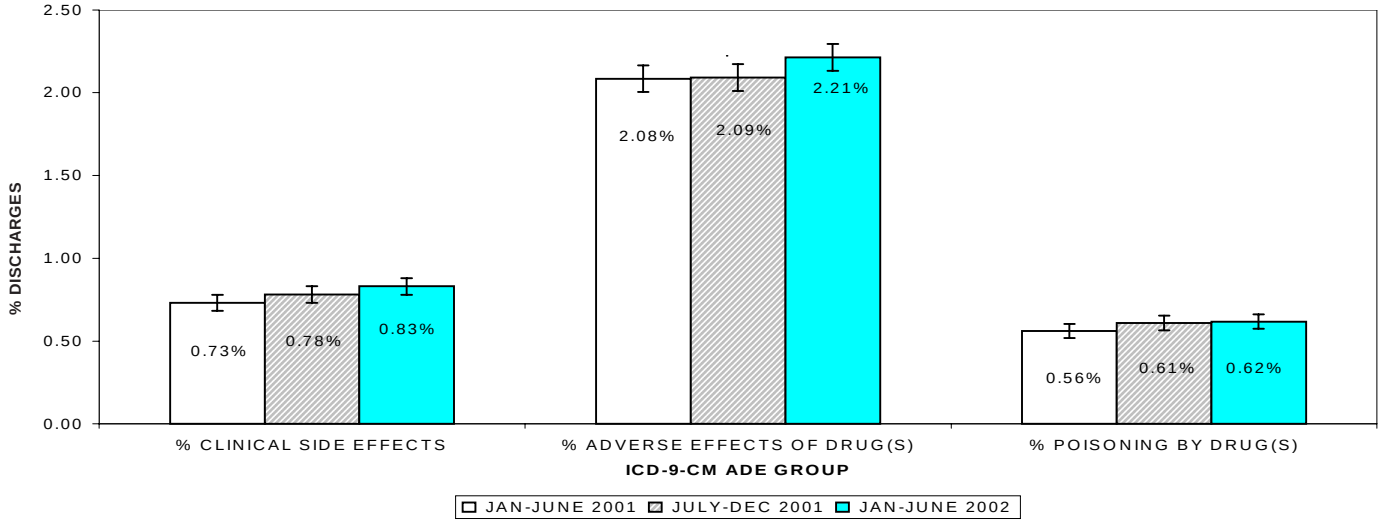


Table 1, Table 2, and Figure 1 show that number and percentage of inpatient discharges with at least one ADE have increased slightly over the three six month time periods. The confidence intervals (shown as an I symbol on the upper edge of each bar in Figure 1) indicate that one increase is statistically significant. The percentage of ADEs in the Clinical Side Effects of Drug group is significantly higher in the third six month time period than the other two time periods. The increases in the percentage of ADEs in the Poisoning by Drug group and the Adverse Effects of Drug ADE group are not statistically significant across the three time periods.

FIGURE 2. PERCENTAGE OF INPATIENT DISCHARGES WITH RASH BY 6 MONTH TIME PERIOD UTAH, 41 ACUTE CARE HOSPITALS JANUARY 1, 2001 - JUNE 30, 2002

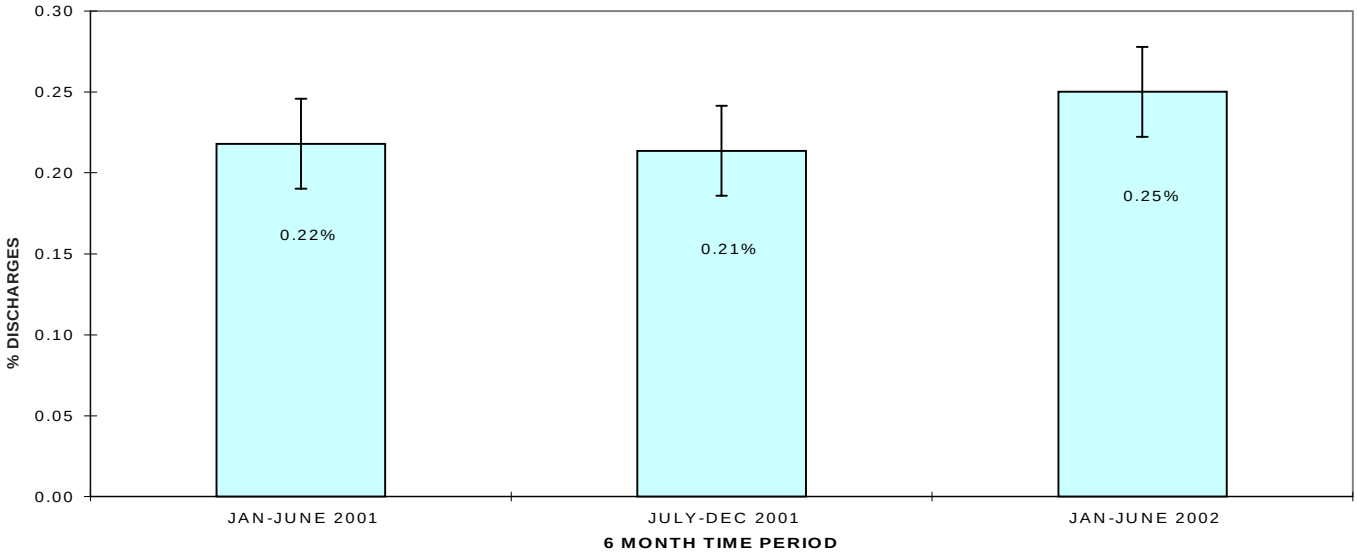


Figure 2 shows a slight overall increase in the percentage of inpatient discharges that have at least one ICD-9-CM code for the ADE Class of Rash. The confidence intervals (shown as an I symbol on the upper edge of each bar in Figure 2) indicate that the increase from the first and second time periods to the third time period approaches, but does not achieve, statistical significance.

FIGURE 3. PERCENTAGE OF INPATIENT DISCHARGES WITH ADVERSE EFFECTS OF BLOOD CONSTITUENTS BY 6 MONTH TIME PERIOD UTAH, 41 ACUTE CARE HOSPITALS JANUARY 1, 2001 - JUNE 30, 2002

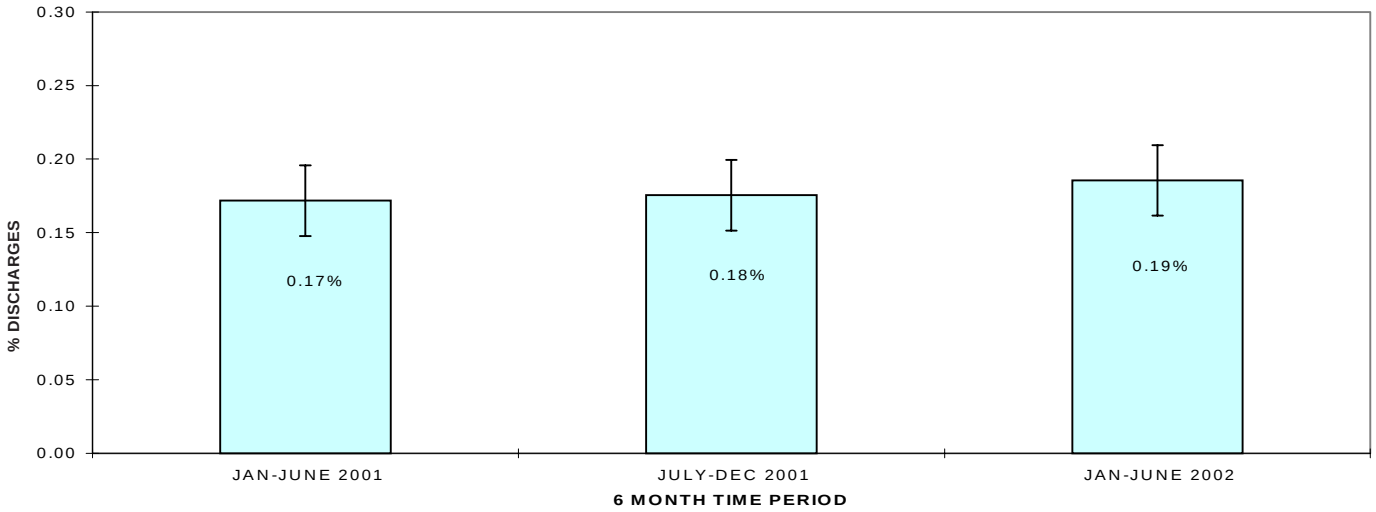
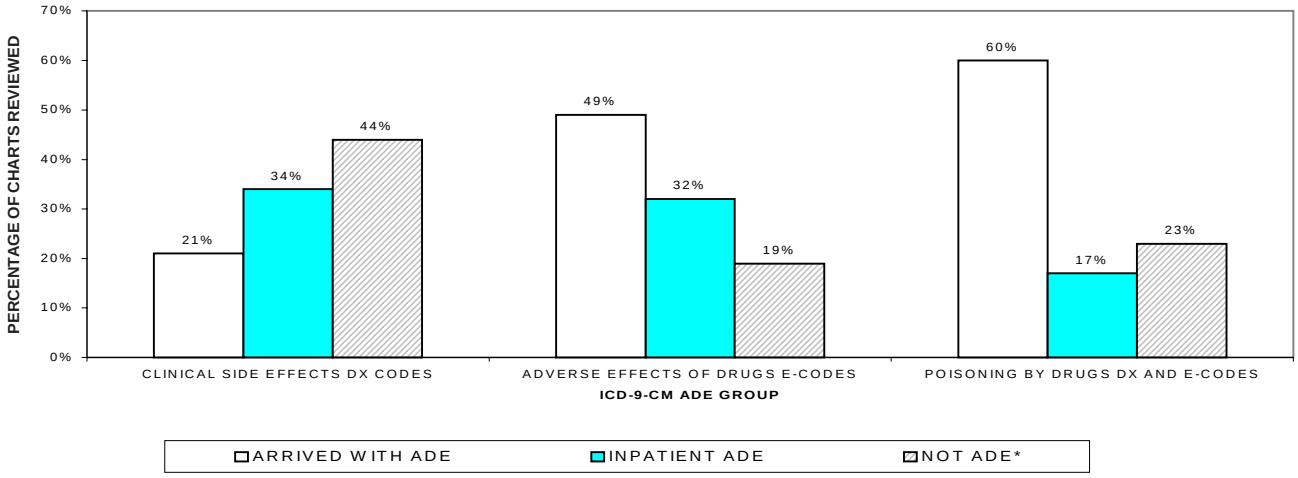


Figure 3 shows slight increases in the percentage of inpatient discharges that have at least one ICD-9-CM code for the ADE Class of Adverse Effect of Agents Affecting Blood Constituents across the three six month time periods. The confidence intervals (shown as an I symbol on the upper edge of each bar in Figure 3) indicate that these increases are not statistically significant.

FIGURE 4. ADVERSE DRUG EVENTS (ADEs) IDENTIFIED BY ICD-9-CM CODES PRELIMINARY FINDINGS FROM INPATIENT CHART REVIEW BY ADE GROUP AND REVIEW GROUP UTAH, 41 ACUTE CARE HOSPITALS JANUARY 1, 2001 - DECEMBER 31, 2001



Note: The analysis includes reviewed charts with at least one ICD-9-CM ADE code as a secondary diagnosis code and excludes the reviewed charts that have the same ICD-9-CM ADE code group as the primary diagnosis. NOT ADE* means that the chart was flagged as likely to include an ADE but the reviewer determined that an ADE was not present.

Figure 4 shows higher portions of ADEs that occurred in the hospital (inpatient ADEs) in two of the three ADE groups, Clinical Side Effects of Drug (34%) and Adverse Effects of Drug (32%). In contrast, a lower portion of the Poisoning by Drug group (17%) occurred in the hospital (inpatient ADEs). Higher portions of ADEs in the Poisoning by Drug group were present when the patient was admitted to the hospital (arrived with ADEs). These findings suggest that ICD-9-CM codes in the Clinical Side Effects of Drug and Adverse Effects of Drug groups are stronger predictors of inpatient ADEs than the ICD-9-CM codes in the Poisoning by Drug group.

TABLE 3 The ICD-9-CM Codes of Adverse Drug Events (ADE) by ADE Class
Utah, 41 Acute Care Hospitals, 2002 Version

Class #	Adverse Event Class	ICD-9-CM Codes Included
1	Drug psychoses	292
2	Dermatitis	692.3,692.9,693.0,693.8,693.9
3	Maternal causes of perinatal morbidity and mortality, Drug reactions and intoxications specific to newborn	760.72,760.74,763.5,779.4
4	Rash, spontaneous ecchymoses	782.1,782.7
5	Poisoning by antibiotics and other antiinfectives	960-961, E856-857
6	Poisoning by hormones and synthetic substitutes	962, E858.0
7	Poisoning by primarily systemic agents	963, E858.1
8	Poisoning by agents primarily affecting blood constituents	964, E858.2
9	Poisoning by analgesics, antipyretics, antirheumatics	965, E850
10	Poisoning by anticonvulsant and anti-Parkinsonian drugs	966, E855.0
11	Poisoning by sedatives and hypnotics	967, E851-852
12	Poisoning by other CNS depressants, stimulants, anesthetics, nervous system agents	968, E855.1-855.9
13	Poisoning by psychotropic agents	969, E853, E854
14	Poisoning by other agents	909.0, 970-979, E858.3-858.9, E929.2
15	Adverse effects of antibiotics and other antiinfectives	E930-E931
16	Adverse effects of hormones and synthetic substitutes	E932
17	Adverse effects of primarily systemic agents	E933
18	Adverse effects of agents primarily affecting blood constituents	E934
19	Adverse effects of analgesics, antipyretics, antirheumatics	E935
20	Adverse effects of anticonvulsant and anti-Parkinsonian drugs	E936
21	Adverse effects of sedatives and hypnotics	E937
22	Adverse effects of other CNS depressants, stimulants, anesthetics, nervous system agents	E938, E940-941
23	Adverse effects of psychotropic agents	E939
24	Adverse effects of agents primarily affecting the cardiovascular system	E942
25	Adverse effects of other drugs, biological, medicinal substances in therapeutic use	E943-E949.909.5
26	Poisoning (undetermined whether accidentally or purposely inflicted)	E980.0-E980.5,E980.9

Source: The Utah/Missouri Patient Safety Project, National Expert Panel for ICD-9-CM Classification of Adverse Events, 2002

Table 3 shows the classification of 420 ICD-9-CM DX codes and E-codes in 26 classes of ADEs as described in this report's section, "About Adverse Events." A detailed list of the codes for these 26 ADE classes, as well as the other 40 classes of adverse events, is available on the website health.utah.gov/psi.

Health Care Facility Patient Safety Program and Administrative Rule

The Utah Hospitals and Health Systems Association (UHA), jointly with the Utah Medical Association (UMA) and Utah Department of Health (UDOH), established a patient safety task force in 2000. This task force initiated the discussion of and endorsed the administrative rule on patient safety that went into effect on October 1, 2001.

The Health Care Facility Patient Safety Program Rule requires that:

1) Each facility shall implement processes to effectively identify and report to the Department the incidence of all: a) adverse drug events.
2) Reporting to the Department may occur through established, statewide, electronic health care facility reporting systems managed by the Department.
3) The report shall include codes applicable to the event from the current International Classification of Diseases Clinical Modification (ICD-CM) diagnosis coding, including codes for external cause of injury (E-codes) and codes for place of occurrence.

A variety of methods are available for detecting and tracking adverse drug events. They are:

- Traditional incident reporting
- Retrospective chart review
- Automated detection based on clinical response
- Daily pharmacist chart review
- Hospital discharge data reporting

Hospitals can select any of the methods and report quarterly the aggregated number of ADEs to the Utah Department of Health.

FIGURE 5. PERCENTAGE OF INPATIENT DISCHARGES WITH AT LEAST ONE ADVERSE DRUG EVENT (ADE) BY ADE CLASS, UTAH, 41 ACUTE CARE HOSPITALS, JANUARY 1, 2002 - JUNE 30, 2002

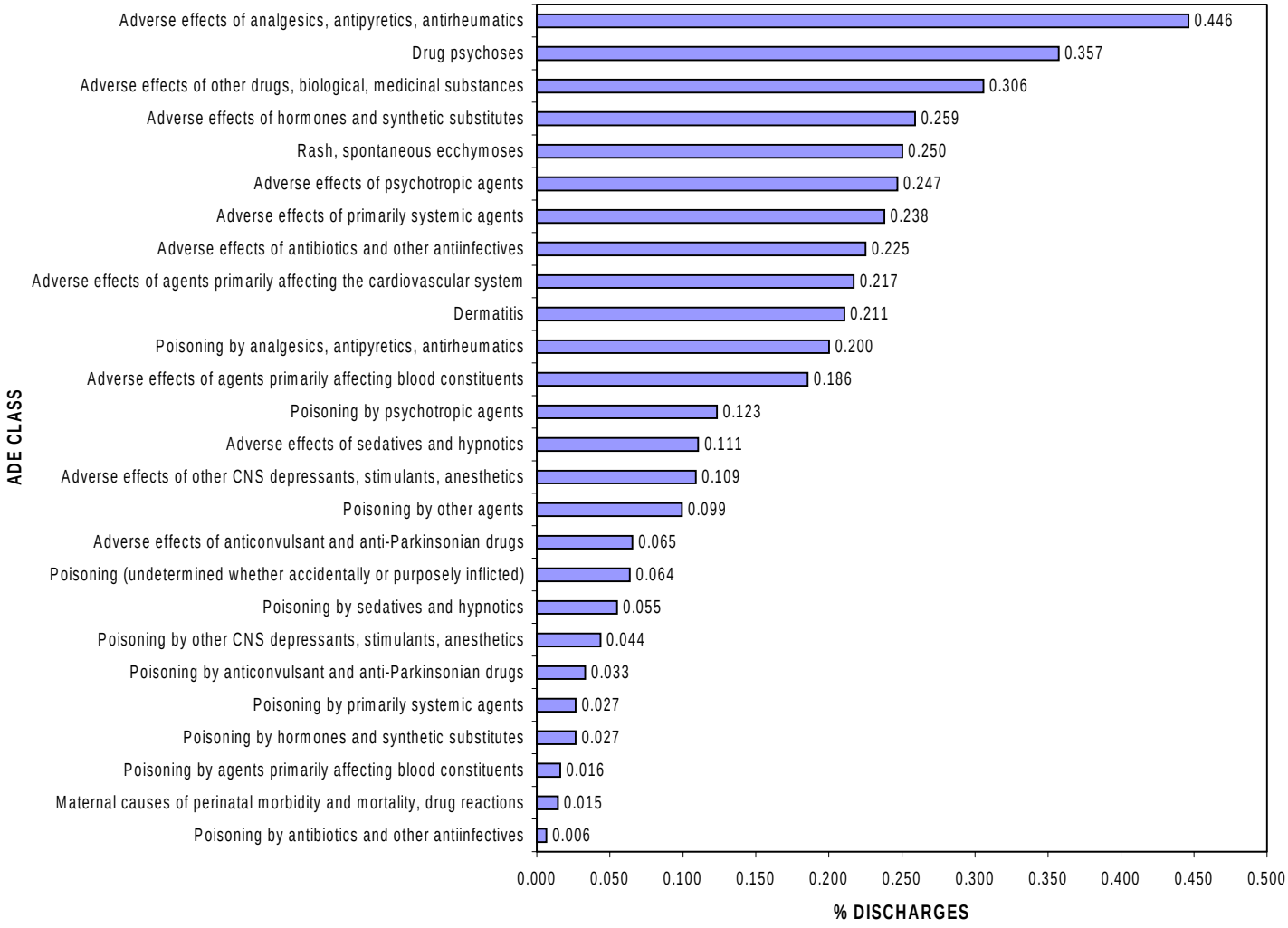


Figure 5 shows the rank order of the 26 ADE classes by percentage of inpatient discharges with at least one ADE. See Table 1 and Table 2 for trend data for these ADE classes. The values and rank ordering shown here for the first two quarters of 2002 are similar, though not identical, to those for all four quarters of 2000 shown in Patient Safety Update Vol. I, No. 1. For both years, percentage for **adverse effects** of a particular kind of drug (e.g. adverse effects of analgesics, antipyretics, antirheumatics) and **clinical side effects** (e.g., drug psychoses) tend to be higher than for **poisoning** by a particular kind of drug (e.g., poisoning by analgesics, antipyretics, antirheumatics).

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University of Missouri – Columbia, School of Medicine

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For more copies of this update, please go to http://health.utah.gov/psi/pubs/psup_v1n3.pdf.

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