

Origin of Adverse Drug Events in U.S. Hospitals, 2011



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Origin of Adverse Drug Events in U.S. Hospitals, 2011

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Introduction

Prescription medications are widely used to treat a variety of acute and chronic medical conditions, and their use has increased substantially in the United States over the past 20–25 years.¹ In the years 1988–1994, approximately 38 percent of the U.S. population reported that they had used a prescription drug in the past 30 days; this increased to nearly 48 percent of the population in the period from 2005 to 2008.² Prescription drug use has increased among all age groups, reaching 25 percent of children and 90 percent of the elderly in the years 2005–2008.³ Moreover, the number of medications per patient also has increased. For example, in the period from 1988–1994, just over one-third of the elderly used three or more prescription drugs in the past 30 days, compared to nearly two-thirds in the years 2005–2008.⁴

The intention of prescription medications is to help cure disease or alleviate symptoms; however, sometimes the drugs can cause patient injury, known as an *adverse drug event* (ADE). With the substantial rise in the use of medications, there has been a concomitant increase in the occurrence of ADEs reported to the FDA.⁵ However, the FDA's Adverse Event Reporting System only requires drug manufacturers to report ADEs while many ADEs are often reported in hospitals instead. Between 2004 and 2008, there was a 52 percent increase in the number of ADEs reported in U.S.

Highlights

- In 2011, adverse drug events (ADEs) in U.S. hospitals were three times more likely to be present on admission (388 per 10,000 discharges) than to originate during the hospital stay (129 per 10,000 discharges).
- The most common general causes of ADEs that were *present on admission* (POA) were antibiotics and anti-infectives (23.4 percent of all ADEs), systemic agents (13.6 percent), nonspecific ADE causes (12.9 percent), and hormones (11.9 percent).
- The most common general causes of ADEs that *originated during the stay* were antibiotics and anti-infectives (28.0 percent of all ADEs), nonspecific ADE causes (16.6

hospitals.⁶ Adverse drug events increase the risk of death, the length of hospitalization, and the cost of care.^{7,8}

Hospital stays involving ADEs have been reported for a range of drugs, including hormones, analgesics, antibiotics, and cardiovascular drugs, among others.⁹ Adverse drug events may be a reason for admission to the hospital—that is, the ADE was present on admission (POA). Alternatively, ADEs may originate during the hospital stay because of medications administered during hospitalization. Adverse drug events are the most common nonsurgical adverse events in hospitals.¹⁰ In 2008, about 14 percent of Medicare patients experienced an adverse event originating during their hospital stay, costing an estimated \$3.8 billion a year, with about a third of the events being ADEs.¹¹ This Statistical Brief presents more recent data on national ADE rates over all payers in 2011.

In 32 of 46 States participating in the Healthcare Cost and Utilization Project (HCUP), the data indicate whether diagnoses are POA or originate during the hospital stay. In these States, inpatient data can be used to chart the frequency of in-hospital events and to report the frequency of community-occurring ADEs that are serious enough to require hospitalization and be observed at admission. This Statistical Brief presents data from these 32 States. The 2011 rates are reported for general classes as well as the specific types of drugs that cause ADEs.¹²

All numbers noted in the text and included in the tables are actual values, not estimates, because the data include a census of discharges rather than a sample of discharges. In other words, we count the actual number of hospital stays with ADEs in the 32 States. Because we analyze numbers for the actual population rather than a sample, there is no need to estimate how well the sample represents an underlying population. As a result, there is no sampling error associated with the calculated values presented, and significance testing is not necessary.¹³

percent), hormones (16.1 percent), and analgesics (12.6 percent).

- Overall, the most common specific ADEs were related to *clostridium difficile* infection (95 per 10,000 discharges), antineoplastic drugs, and steroids (each at a rate of 57 per 10,000 discharges).
- Almost all ADEs were more likely to be POA than to originate during the stay. The largest differences were observed for antidepressants (17.6 times more likely to be POA) and central nervous system drugs (13.5 times more likely to be POA).
- ADEs due to CNS depressants and anesthetics were nearly two times more likely to originate during the stay than to be POA. Antibiotic-related ADEs were equally likely to be POA as to originate during the stay.

Findings

Frequency of adverse drug events, 2011

Across a total of 20,172,966 discharges in the 32 States included in our analysis, there were 782,757 ADEs that were present on admission and 259,662 ADEs that originated during the hospital stay. Table 1 presents the rate and percentage of ADEs for a range of causes. Overall, ADEs observed during hospitalization were more likely to be present on admission (388 per 10,000 discharges) than to originate during the hospital stay (129 per 10,000 discharges). Among ADEs present on admission, the most common general causes were antibiotics and anti-infectives (23.4 percent of all ADEs), systemic agents (13.6 percent), nonspecific ADE causes (12.9 percent), and hormones (11.9 percent). Among ADEs that originated during the stay, the most prevalent general causes were antibiotics and anti-infectives (28.0 percent of all ADEs), nonspecific ADE causes (16.6 percent), hormones (16.1 percent), and analgesics (12.6 percent).

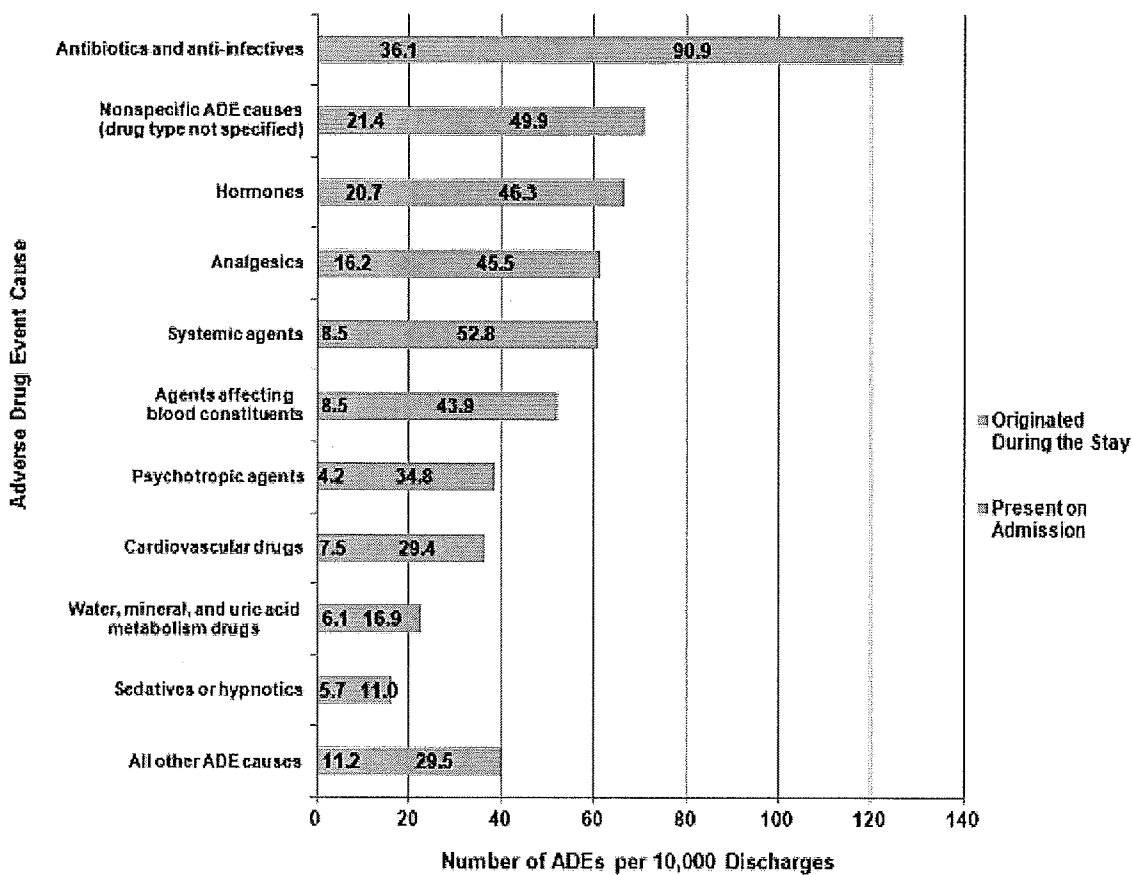
Adverse drug event cause ^a	ADEs based on diagnoses present on admission		ADEs based on diagnoses that originated during the hospital stay	
	Number of ADEs per 10,000 discharges	Percent of ADEs ^b	Number of ADEs per 10,000 discharges	Percent of ADEs ^b
Any ADE cause	388.0	100.0	128.7	100.0
Antibiotics and anti-infectives	90.9	23.4	36.1	28.0
Antibiotics	12.5	3.2	12.9	10.0
<i>Clostridium difficile</i> infection ¹⁴	73.1	18.8	21.9	17.1
Other anti-infectives	6.3	1.6	1.7	1.3
Hormones	46.3	11.9	20.7	16.1
Steroids	37.3	9.6	19.7	15.3
Insulin and hypoglycemics	7.1	1.8	0.8	0.6
Other hormones	3.0	0.8	0.3	0.2
Systemic agents	52.8	13.6	8.5	6.6
Antineoplastic drugs	49.2	12.7	7.8	6.0
Antiallergy and antiemetic drugs	3.1	0.8	0.7	0.5
Other systemic agents	0.8	0.2	0.1	0.1
Agents affecting blood constituents	43.9	11.3	8.5	6.6
Anticoagulants	40.6	10.5	6.7	5.2
Other agents that affect blood constituents	3.9	1.0	1.9	1.5
Analgesics	45.5	11.7	16.2	12.6
Opiates/Narcotics	18.8	4.9	11.2	8.7
NSAIDs	28.3	7.3	5.1	4.0
Anticonvulsants and anti-Parkinson drugs	11.0	2.8	1.5	1.2
Hydantoin	3.3	0.9	0.4	0.3
Other anticonvulsants	7.3	1.9	1.0	0.7
Anti-Parkinson drugs	0.8	0.2	0.1	0.1
Sedatives or hypnotics	11.0	2.8	5.7	4.4
CNS depressants and anesthetics	3.9	1.0	6.7	5.2
Psychotropic agents	34.8	9.0	4.2	3.2
Antidepressants	9.5	2.5	0.5	0.4
Antipsychotics	7.0	1.8	0.8	0.7
Benzodiazepine	18.1	4.7	2.2	1.7
Other psychotropic drugs	7.2	1.8	0.8	0.6

Central nervous system drugs	4.9	1.3	0.4	0.3
Autonomic nervous system drugs	2.6	0.7	0.7	0.5
Cardiovascular drugs	29.4	7.6	7.5	5.8
Digoxin	4.8	1.2	0.6	0.5
Antiadrenergics	4.2	1.1	1.1	0.9
Other cardiovascular drugs	21.6	5.6	5.9	4.6
GI system drugs	1.3	0.3	0.5	0.4
Water, mineral, and uric acid metabolism drugs	16.9	4.4	6.1	4.8
Saluretics	5.2	1.3	0.7	0.5
Other diuretics	10.7	2.8	4.6	3.6
Other drugs affecting mineral and uric acid metabolism	1.6	0.4	0.9	0.7
Smooth muscle and respiratory drugs	4.0	1.0	1.1	0.8
Skin, eye, mucous membrane drugs	1.0	0.3	0.3	0.3
Vaccines	0.3	0.1	0.1	0.1
Other specific drugs	0.2	0.1	0.0	0.0
Nonspecific ADE causes (drug type not specified)	49.9	12.9	21.4	16.6
Abbreviation: NSAIDs, nonsteroidal anti-inflammatory drugs.				
^a General ADEs are in bold; specific ADEs are indented.				
^b The sum may be greater than 100% because some hospital stays may involve more than one ADE.				
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) for 32 States, 2011.				

General causes of adverse drug events, 2011

The general causes of adverse drug events that were present on hospital admission and those that originated during the stay are provided in Figure 1. The order of the list is from the most to least frequently occurring cause overall. The most frequent general causes of ADEs were antibiotics and anti-infectives (127 events per 10,000 discharges), nonspecific ADE causes (71 events), hormones (67 events), and analgesics (62 events). Across all general causes, ADEs were substantially more likely to be present on admission than to originate during the stay.

Figure 1. General causes of adverse drug events (ADEs), 2011



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) for 32 States, 2011

Figure 1. General causes of adverse drug events, 2011. This is a stacked bar graph, showing the number of adverse drug events per 10,000 discharges by the cause of the adverse drug event, for those that originated during the stay and those that were present on admission. Antibiotics and anti-infectives: 36.1 originated during the stay and 90.9 were present on admission. Nonspecific adverse event causes, drug type not specified: 21.4 originated during the stay and 49.9 were present on admission. Hormones: 20.7 originated during the stay and 46.3 were present on admission. Analgesics: 16.2 originated during the stay and 45.5 were present on admission. Systemic agents: 8.5 originated during the stay and 52.8 were present on admission. Agents affecting blood constituents: 8.5 originated during the stay and 43.9 were present on admission. Psychotropic agents: 4.2 originated during the stay and 34.8 were present on admission. Cardiovascular drugs: 7.5 originated during the stay and 29.4 were present on admission. Water, mineral, and uric acid metabolism drugs: 6.1 originated during the stay and 16.9 were present on admission. Sedatives or hypnotics: 5.7 originated during the stay and 11.0 were present on admission. All other adverse drug event causes: 11.2 originated during the stay and 29.5 were present on admission. Source: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, State Inpatient Databases for 32 States, 2011.