Multiple Uses of an ICD-9-CM Adverse Event Classification for Patient Safety Improvement

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Introduction

Medical injuries (adverse events) are a leading cause of death and hospitalization in the nation. The Utah and Missouri Patient Safety Consortium conducted a validation study on classification of 1,003 ICD-9-CM adverse event codes (AE codes) using medical charts selected from the two states' hospital inpatient discharge databases.

Method

Sample: Utah's medical charts were randomly selected among all inpatients from all 41 acute care hospitals. Missouri's charts were randomly selected among surgery inpatients from 36 out of 123 acute care hospitals. A total of 14,119 charts were selected, about half from each state for the years 2002 and 2004.

Definition: An adverse event (AE) is an undesirable and unintended injury resulting from a medical intervention, rather than from patient's underlying disease process, and leading to patient harm.

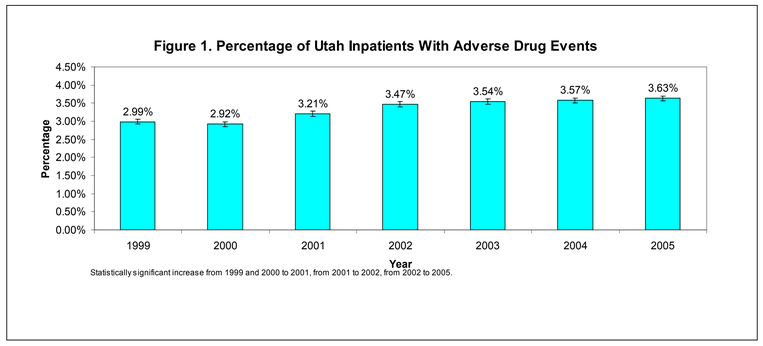
Chart review: Using a structured chart review tool, trained nurses reviewed the sampled charts and documented any AEs. After each review, the nurses examined the hospital-assigned ICD-9-CM codes for each chart. The reviewer recorded whether any of the AE codes indicated a true AE and, if so, whether the AE caused the admission (arrived-with AE) or occurred during the hospital stay (in-hospital AE).

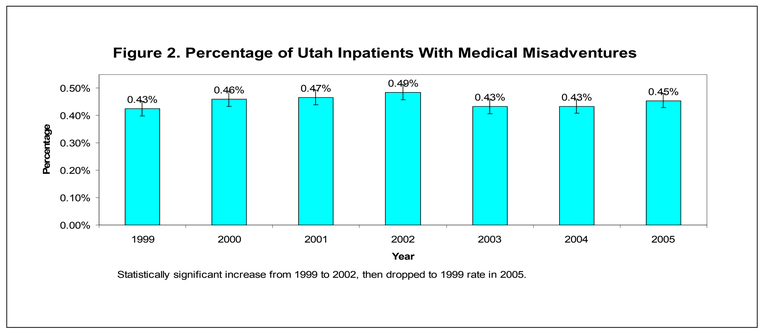
Positive Predictive Values (PPV) for Adverse Event Codes by Category and Level of Adverse Event (AE)

Adverse Event Type	All Patients (Utah)	Surgical Patients (Missouri)
1. Adverse Drug Events	64.9%	87.8%
Arrived-with	45.1%	58.3%
In-hospital	19.7%	29.4%
2. Medical Device AEs	56.8%	61.5%
Arrived-with	38.2%	41.3%
In-hospital	18.6%	20.2%
3. Infections	14.7%	63.9%
Arrived-with	7.1%	20.1%
In-hospital	7.6%	43.9%
4. Surgical AEs	25.3%	66.1%
Arrived-with	11.5%	15.3%
In-hospital	13.8%	50.8%
5. Other AEs	29.0%	88.1%
Arrived-with	15.9%	45.8%
In-hospital	13.1%	42.3%
6. Misadventures	77.4%	92.4%
Arrived-with	1.9%	19.9%
In-hospital	75.5%	72.5%
Example of Class Level in Misadventure Type		
998.2, E870.0-E876.9 Accidental cut, puncture, perforation or hemorrhage	76.0%	92.2%
Example of Code Level		
998.2 Accidental cut or laceration	78.8%	75.3%

PPV=100*true AEs/potential AEs
True AEs: potential AEs that nurses validated during the medical chart review.
Potential AEs: events to which the AE codes referred at the type, class or code level.

Arrived-with: present at the patient's admission to the hospital.
In-hospital: occurred during the patient's hospital stay.





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Findings

For all six AE types, overall AE positive predictive value (PPV) was higher among surgical inpatients than all inpatients.

PPV was higher for arrived-with ADEs and medical device AEs than these kinds of in-hospital AEs.

PPV was lower for arrived-with misadventures than in-hospital misadventures.

PPV was similar for arrived-with and in-hospital infections, surgical AEs and other AEs.

Conclusions

Performance of the AE codes is not ideal. However, they still have utility for assessing statewide patient safety status and trends (see Figures 1 and 2). Trends may indicate the impact of patient safety initiatives that encourage transparency.

AE codes are better predictors for a surgical inpatient population than for an entire inpatient population. PPV of any level (type, class, or code) of AE may be used as sample weights for estimating AE rates in a population.

We recommend the initial use of this classification to report patient safety event rates at the state or community level and to study trends over time.