



CHARTBOOK ON PATIENT SAFETY

National Healthcare Quality and Disparities Report



This document is in the public domain and may be used and reprinted without permission. Citation of the source is appreciated. Suggested citation: National Healthcare Quality and Disparities Report chartbook on patient safety. Rockville, MD: Agency for Healthcare Research and Quality; July 2017. AHRQ Pub. No. 17-0037-EF.

NATIONAL HEALTHCARE QUALITY AND DISPARITIES REPORT PATIENT SAFETY CHARTBOOK

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Agency for Healthcare Research and Quality
540 Gaither Road
Rockville, MD 20850

AHRQ Publication No. 17-0037-EF

Updates 16-0015-2-EF

July 2017

www.ahrq.gov/research/findings/nhqrdr/index.html



ACKNOWLEDGMENTS

The National Healthcare Quality and Disparities Report (QDR) is the product of collaboration among agencies across the U.S. Department of Health and Human Services (HHS). Many individuals guided and contributed to this effort. Without their magnanimous support, the report would not have been possible.

Specifically, we thank:

Authors: Truven Health Analytics, Darryl Gray (AHRQ), Irim Azam (AHRQ).

Primary AHRQ Staff: Gopal Khanna, Sharon Arnold, Jeff Brady, Erin Grace, Karen Chaves, Nancy Wilson, Darryl Gray, Barbara Barton, Doreen Bonnett, and Irim Azam.

HHS Interagency Workgroup for the QDR: Girma Alemu (HRSA), Nancy Breen (NIH-NIMHD), Victoria Cargill (NIH), Hazel Dean (CDC), Kirk Greenway (IHS), Chris Haffer (CMS-OMH), Edwin Huff (CMS), DeLoris Hunter (NIH-NIMHD), Sonja Hutchins (CDC), Ruth Katz (ASPE), Shari Ling (CMS), Darlene Marcoe (ACF), Tracy Matthews (HRSA), Ernest Moy (CDC-NCHS), Curt Mueller (HRSA), Ann Page (ASPE), Kathleen Palso (CDC-NCHS), D.E.B Potter (ASPE), Asel Ryskulova (CDC-NCHS), Adelle Simmons (ASPE), Marsha Smith (CMS), Caroline Taplin (ASPE), Emmanuel Taylor (NCI), Nadarajen Vydelingum (NIH-NCI), Barbara Wells (NIH-NHLBI), and Ying Zhang (IHS).

Data Support Contractors: Booz Allen Hamilton (BAH), Social & Scientific Systems (SSS), Truven Health Analytics, and Westat, Inc.

PATIENT SAFETY

This Patient Safety Chartbook is part of a family of documents and tools that support the National Healthcare Quality and Disparities Reports (QDR). The QDR are annual reports to Congress mandated in the Healthcare Research and Quality Act of 1999 (P.L. 106-129). These reports provide a comprehensive overview of the quality of health care received by the general U.S. population and disparities in care experienced by different racial, ethnic, and socioeconomic groups. The purpose of the reports is to assess the performance of our health system and to identify areas of strengths and weaknesses in the health care system along three main axes: access to health care, quality of health care, and priorities of the National Quality Strategy.

The reports are based on more than 250 measures of quality and disparities covering a broad array of health care services and settings. Data are generally available through 2013, although rates of uninsurance have been tracked through the first half of 2015. The reports are produced with the help of an Interagency Work Group led by the Agency for Healthcare Research and Quality (AHRQ) and submitted on behalf of the Secretary of Health and Human Services (HHS).

Chartbooks Organized Around Priorities of the National Quality Strategy

- 1. Making care safer by reducing harm caused in the delivery of care.**
2. Ensuring that each person and family is engaged as partners in their care.
3. Promoting effective communication and coordination of care.
4. Promoting the most effective prevention and treatment practices for the leading causes of mortality, starting with cardiovascular disease.
5. Working with communities to promote wide use of best practices to enable healthy living.
6. Making quality care more affordable for individuals, families, employers, and governments by developing and spreading new health care delivery models.

Patient Safety is one of the six national priorities identified by the National Quality Strategy (<http://www.ahrq.gov/workingforquality/index.html>).

The National Quality Strategy has identified three long-term goals related to patient safety: reduce preventable hospital admissions and readmissions, reduce the incidence of adverse health care-associated conditions, and reduce harm from inappropriate or unnecessary care.

This chartbook focuses on adverse health care-associated conditions and harm from care. Preventable admissions and readmissions can result from problems with patient safety or problems with care coordination. We have chosen to include measures of preventable admissions and readmissions in the Care Coordination chartbook.

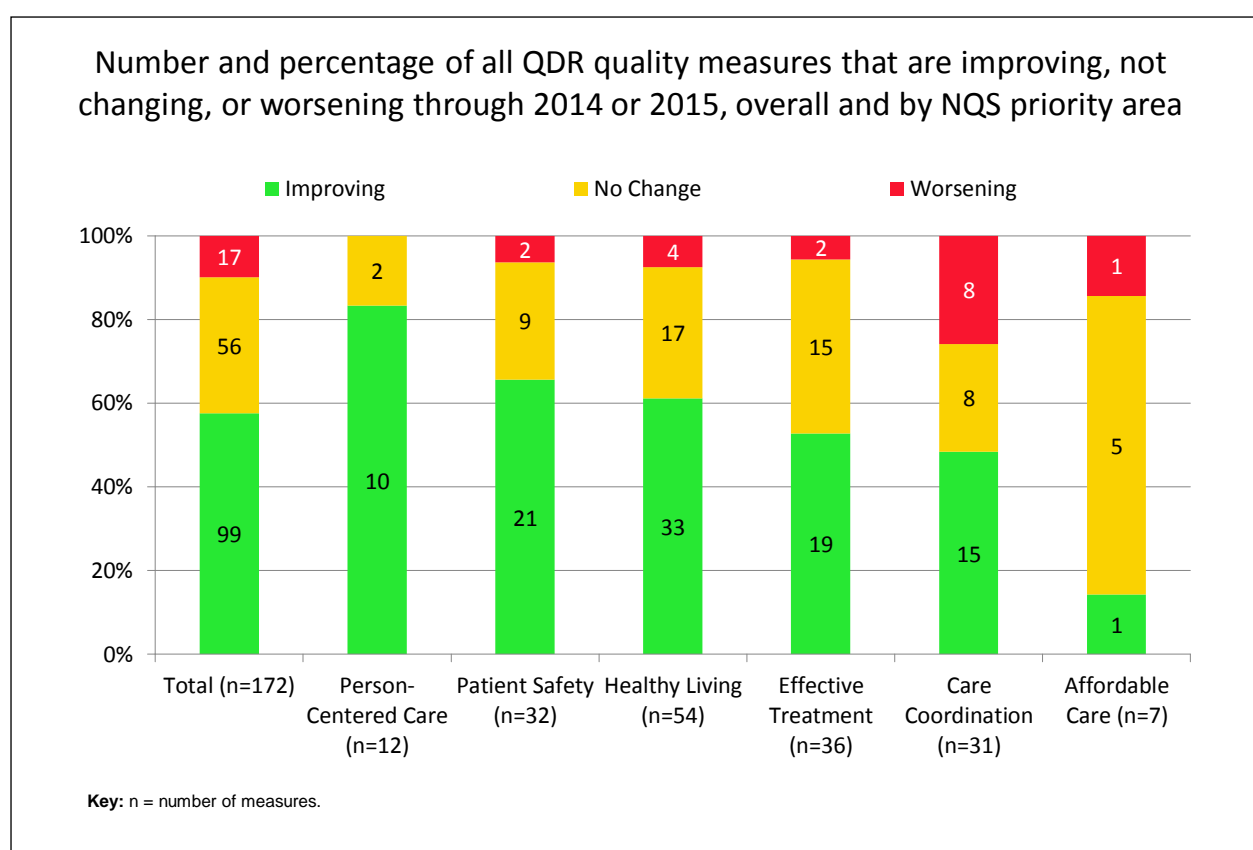
Chartbook Contents

This chartbook includes:

- Summary of trends across measures of patient safety from the QDR.
- Figures illustrating select measures of patient safety.
- Supplemental descriptions and data on patient safety measures from several outside sources.

[Introduction and Methods](#) contains information about methods used in the chartbook. A Data Query tool (<http://nhqrnet.ahrq.gov/inhqrdr/data/query>) provides access to most QDR data tables.

Summary of Trends Across National Quality Strategy Priorities

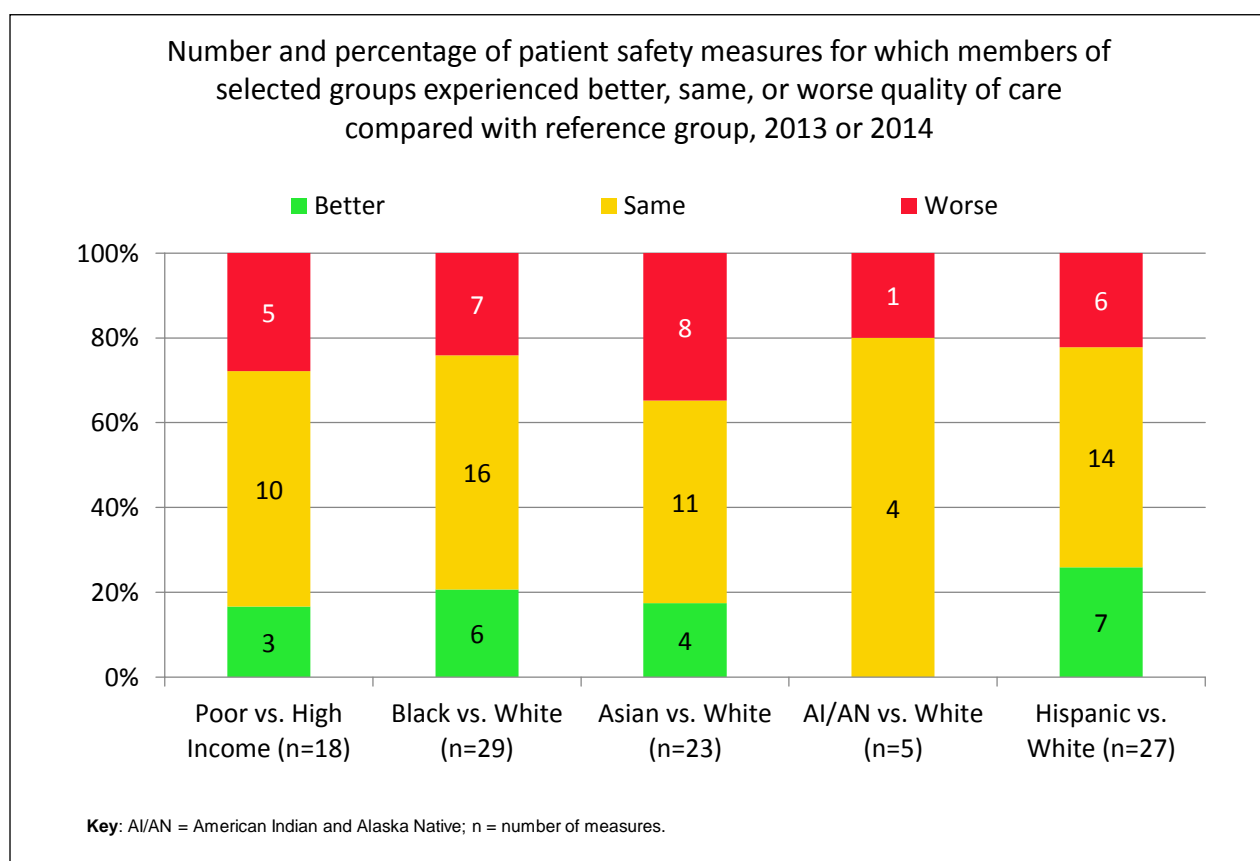


Note: For most measures, trend data are available from 2000-2002 through 2014 or 2015. For each measure with at least four estimates over time, unweighted log-linear regression is used to calculate average annual percentage change and to assess statistical significance. Measures are aligned so that positive change indicates improved access to care.

- **Improving** = Rates of change are positive at 1% per year or greater and are statistically significant.
- **No Change** = Rate of change is less than 1% per year or is not statistically significant.
- **Worsening** = Rates of change are negative at -1% per year or greater and are statistically significant.
- Through 2014 or 2015, across a broad spectrum of measures of health care quality, 58% showed improvement (green).
- About 83% of measures of Person-Centered Care improved.

- About two-thirds (66%) of measures of Patient Safety improved.
 - The two measures with worsening results were “Postoperative physiologic and metabolic derangements per 1,000 elective-surgery admissions, age 18 and over” and “Adult surgery patients with postoperative venous thromboembolic events, age 18 and over.”
- About 61% of measures of Healthy Living improved.
- More than half (53%) of measures of Effective Treatment improved.
- Nearly half (48%) of measures of Care Coordination improved.
- Only about 14% of measures of Affordable Care improved.
- Access measures are not represented on this slide.

Summary of Quality Disparities



Note: Numbers of measures differ across groups in part because of data limitations. The measures shown here are from 2013 or later. The relative difference between a selected group and its reference group is used to assess disparities. Poor indicates family income less than the Federal poverty level. High Income indicates family income four times the Federal poverty level or greater.

- **Better** = Selected group received better quality of care than reference group. Differences are statistically significant, are equal to or larger than 10%, and favor the selected group.
- **Same** = Selected group and reference group received about the same quality of care. Differences are not statistically significant or are smaller than 10%.
- **Worse** = Selected group received worse quality of care than reference group. Differences are statistically significant, are equal to or larger than 10%, and favor the reference group.

- People in poor households received worse care than people in high-income households for about 28% of patient safety measures.
- Blacks and Hispanics received worse care than Whites for more than 20% (24% and 22%, respectively) of patient safety measures.
- Asians received worse care than Whites for about one-third (35%) of patient safety measures.

Examples of Patient Safety Measures With Disparities That Were Getting Smaller Over Time

Note: Disparities are shown for the comparison group relative to the reference group. Low income and poor are based on the Federal poverty level (100%–<200% and <100% of FPL, respectively).

- Age Gap: 65 years and older vs. 18–44 years of age
 - Admissions with central venous catheter-related bloodstream infection per 1,000 medical and surgical discharges of length 2 or more days
- Income Gap: Low vs. High
 - Adults with postoperative hip fracture per 1,000 surgical admissions who were not susceptible to falling
- Income Gap: Poor vs. High
 - Adults with postoperative hip fracture per 1,000 surgical admissions who were not susceptible to falling
- Location Gap: Medium Metro vs. Large Fringe Metro
 - Adults with postoperative physiologic and metabolic derangements per 1,000 elective surgical hospital discharges

Examples of Patient Safety Measures With Disparities That Have Worsened or Showed No Change Over Time

- Worsening:
 - Asian vs. White Gap: Obstetric trauma per 1,000 instrument-assisted vaginal deliveries
- No Change:
 - Hispanic vs. Non-Hispanic White Gap: Accidental puncture or laceration during procedure per 1,000 medical and surgical admissions, adults
 - Black vs. White Gap: Deaths per 1,000 hospital admissions with low expected mortality
 - Age Gap: 65 and Over vs. 18–44: Adults with postoperative pulmonary embolism or deep vein thrombosis per 1,000 surgical hospital discharges

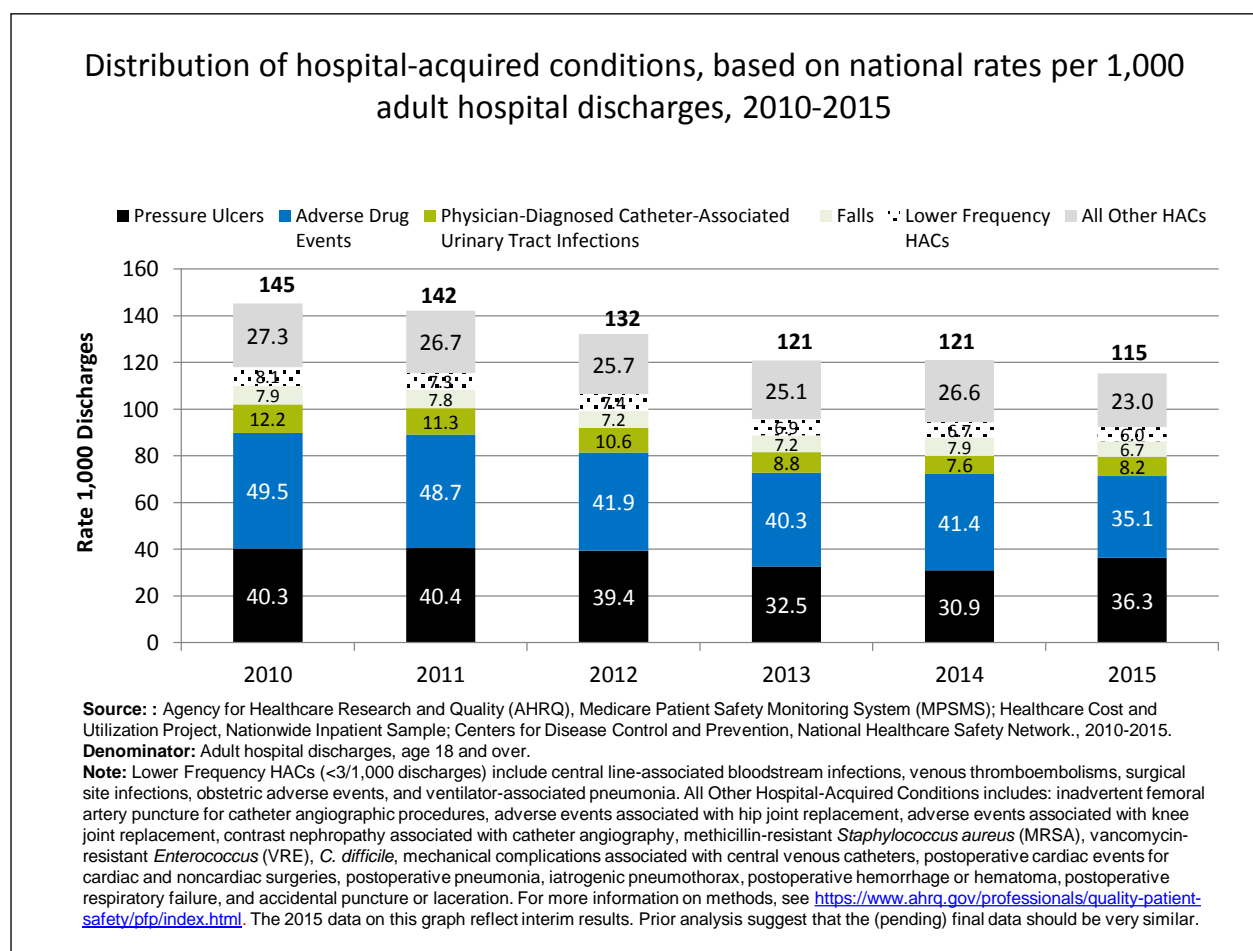
Measures of Patient Safety

- Summary of information on patient safety from the National Healthcare Quality and Disparities Report
- Individual measures of patient safety, overall and by age, sex, race, ethnicity, income, education, insurance, birth weight, health status, and presence of various health conditions
- Measures of patient safety by setting:
 - Hospitals
 - Home health
 - Ambulatory care
 - All settings: Infrastructure

Patient Safety in the Hospital Setting

- Hospitals are a common setting for patient safety events:
 - Many patients admitted to the hospital are in a clinically compromised state.
 - Care often includes the use of invasive devices and procedures, increasing patients' risk for infection and harm.
- Measures include:
 - Overall hospital-acquired conditions (HACs).
 - Healthcare-associated infections (HAIs).
 - Procedure-related events.
 - Adverse drug events.

Distribution of Hospital-Acquired Conditions



- **Importance:** Hospital-acquired conditions (HACs) are conditions that patients did not have upon hospital admission, but which developed during the patient's hospital stay. They can lead to poor patient outcomes and increased spending on health care. HACs are often preventable.
- **Overall Rate:**
 - In 2015, the overall HAC rate was 115 per 1,000 hospital discharges.
 - Adverse drug events (35.1 per 1,000 hospital discharges) accounted for 30.5% of total HACs and pressure ulcers (36.3 per 1,000 hospital discharges) accounted for 31.6% of the total.
 - Data on disparities seen within some specific individual measures appear in subsequent slides.
- **Trends:**
 - From 2010 through 2015, the overall rate of hospital-acquired conditions declined 20.7%, from 145 to 115 per 1,000 hospital discharges.

- Among the most frequent HACs, the rate of pressure ulcers decreased the most between 2010 and 2014, dropping from 40.3 per 1,000 discharges (more than 1.3 million events) to 30.9 per 1,000 discharges (about 1 million events). However, these events increased in 2015 to a level of 36.3 per 1,000 discharges (approximately 1.2 million events).
- During that same period, adverse drug events decreased from a rate of 49.5 per 1,000 discharges (more than 1.6 million events) to 35.1 per 1,000 discharges (fewer than 1.2 million events). The physician-diagnosed catheter-associated urinary tract infection rate (based on MPSMS definitions) seen across various inpatient unit types decreased from 12.2 to 8.2 per 1,000 discharges (400,000 and 270,000 events, respectively).
- Among the lower frequency HACs, central line-associated bloodstream infections had the greatest percentage decrease in rate (91%) between 2010 and 2015. The rates of venous thromboembolism, surgical site infections, and specific obstetric events also decreased, falling by 76%, 16%, and 10% respectively.

Healthcare-Associated Infections

- Infections acquired during a hospital stay are among the most common complications of hospital care (AHRQ, 2016).
- On any given day, about 1 in 25 hospital patients has at least one healthcare-associated infection (HAI) (CDC, 2016a).
- HAIs often increase the patient's length of stay in the hospital, risk of mortality, and hospital costs.
- New infections in critically ill infants, children, and other patients generally reduce their chances for recovery.
- For more information, go to the Patient Safety Primer: Health Care-Associated Infections at <https://psnet.ahrq.gov/primers/primer/7>.

Measures of Patient Safety in the Hospital Setting: HAIs

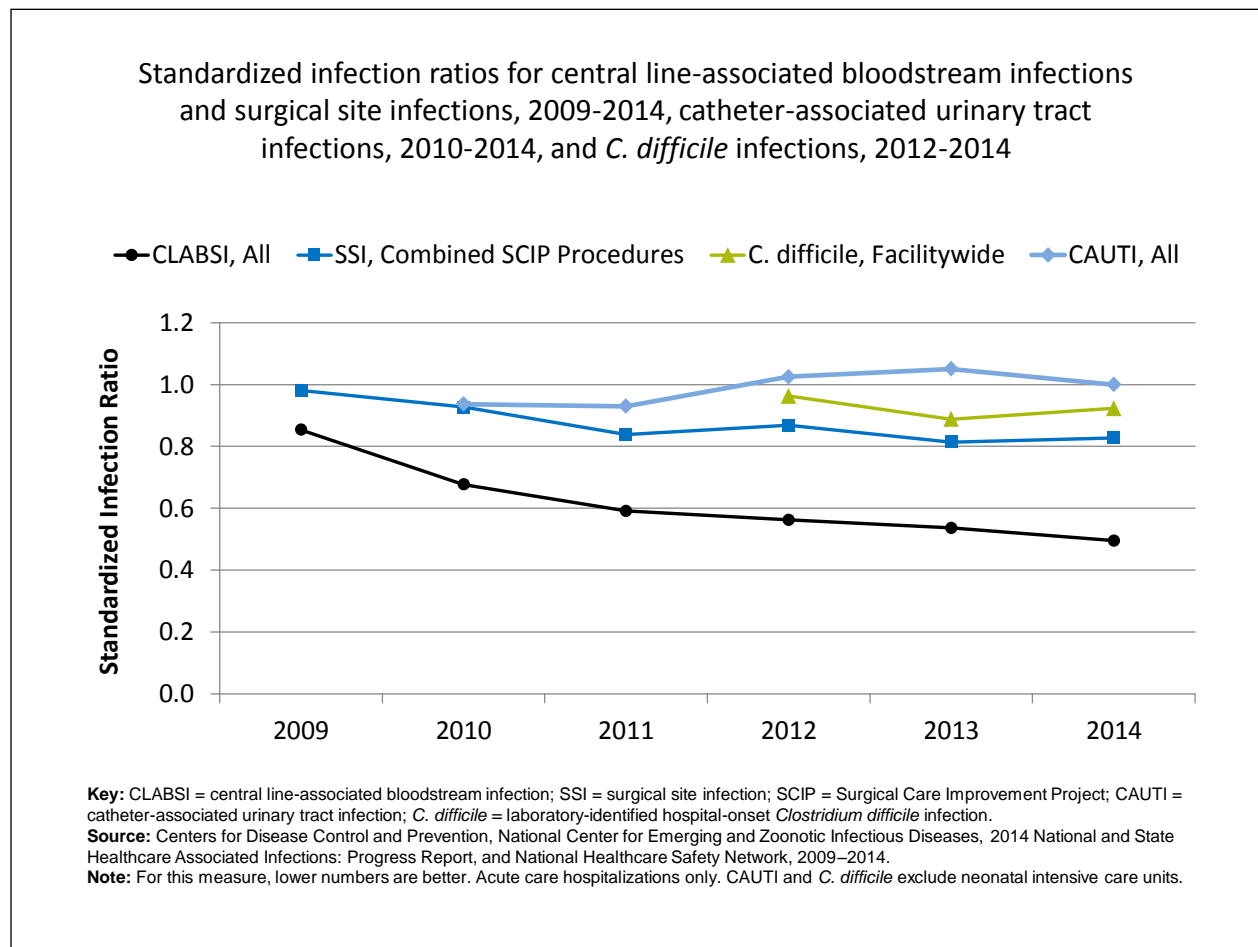
- Standardized infection ratios (SIRs) for central line-associated bloodstream infections, surgical site infections, NHSN-defined catheter-associated urinary tract infections (CAUTIs), and *C. difficile* infections
 - By hospital type
 - By critical care unit type
- Change in State SIRs for NHSN-defined CAUTIs

Standardized infection ratios (SIRs) compare the observed number of infections reported to the National Healthcare Safety Network (NHSN) during a year to the predicted number of infections based on the January 2006 to December 2008 referent period for central line-associated bloodstream infections (CLABSIs) and surgical site infections (SSIs), the calendar year 2009 referent period for catheter-associated urinary tract infections (CAUTIs), and the January 2010 to December 2011 referent period for laboratory-identified hospital-onset *C. difficile* infections.

Catheter-associated urinary tract infections (CAUTIs) in the hospital setting are caused by instrumentation of the urinary tract (CDC, 2016b). Potential complications resulting from the development of CAUTI include cystitis, pyelonephritis, endocarditis, septic arthritis, and meningitis.

The NHSN defines catheter-associated urinary tract infections (CAUTIs) based on symptomatic urinary tract infection (SUTI), asymptomatic bacteremic UTI (ABUTI), or urinary system infection (USI) criteria and using specific criteria related to the timing of catheter use and CAUTI diagnosis. These criteria, which differ from those used by MPSMS, can be found at <https://www.cdc.gov/nhsn/pdfs/pscmanual/7pscclauticurrent.pdf>.

Standardized Infection Ratios



- **Background:**

- NHSN data are predominantly from intensive care units, although general medical/surgical inpatient wards and other non-critical care locations are also represented. The numbers of units/facilities reporting to NHSN roughly quadrupled from 2009 to 2014.
- A central line-associated bloodstream infection (CLABSI) is a laboratory-confirmed bloodstream infection (LCBI) where a central line (CL) or umbilical catheter (UC) was in place for >2 calendar days on the date of event, with day of device placement being Day 1 **and** the line was also in place on the date of event or the day before. If a CL or UC was in place for >2 calendar days and then removed, the date of event of the LCBI must be the day of discontinuation or the next day to be a CLABSI (CDC, 2017). CLABSI data also include neonatal intensive care units but exclude long-term acute care hospitals and inpatient rehabilitation facilities.
- SCIP procedures are those performed on adults. Procedures include abdominal aortic aneurysm repair, peripheral vascular bypass surgery, coronary artery bypass graft with both chest and donor site incisions or with chest incision only, other cardiac surgery, colon surgery, rectal surgery, hip arthroplasty, abdominal hysterectomy, knee arthroplasty, and vaginal hysterectomy.
- Hospital-onset *C. difficile* infections are detected on the 4th day or later after admission to an inpatient location within the facility.

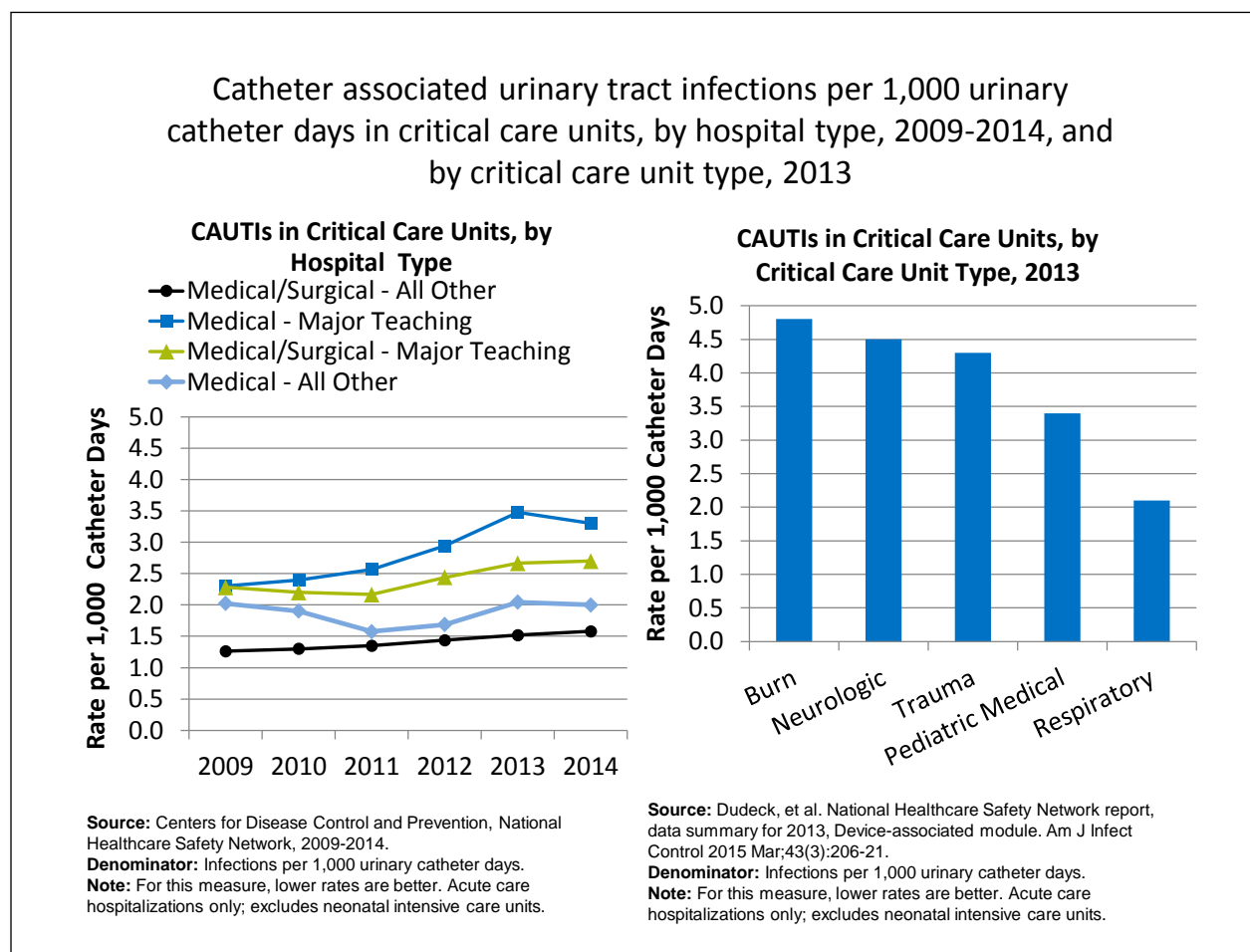
- **Overall Rate:**

- In 2014, the overall SIR for CLABSIs seen in intensive care units (including neonatal ICUs) and general hospital wards in acute care hospitals in the 50 States, District of Columbia, and Puerto Rico was 0.50. This means that roughly 50% fewer CLABSIs were observed in 2014 than were predicted based on patient and hospital characteristics seen in the 2006-2008 referent period. The CLABSI SIR has decreased more than 40% in 6 years, going from 0.85 in 2009 to 0.50 in 2014.
- The overall SIR for CAUTIs in 2014 was 1.00.
- The overall SIR for SSIs following 10 common procedures in adults was 0.83, and the overall SIR for *C. difficile* was 0.92.

- **Trends:**

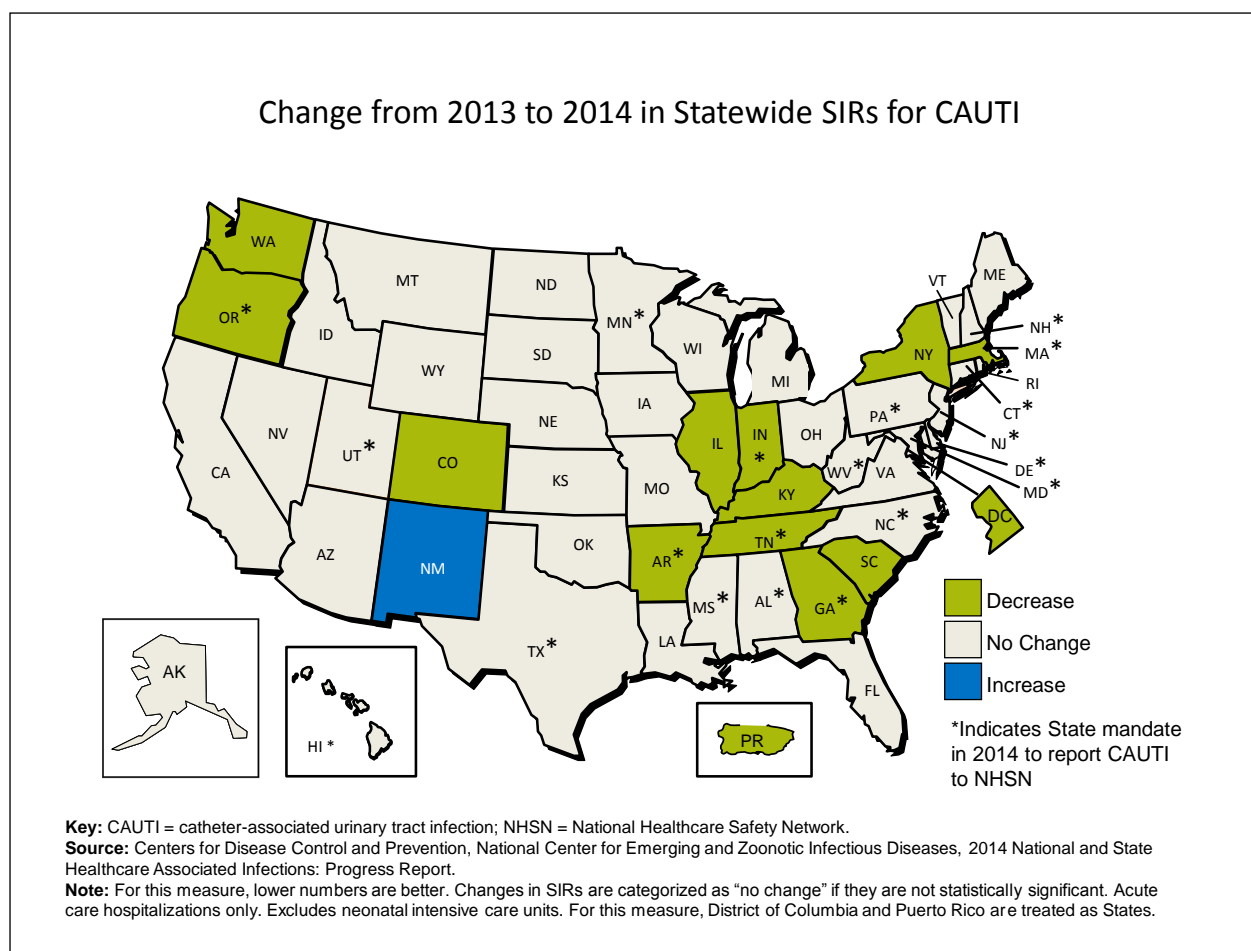
- The CLABSI SIR decreased more than 40% between 2009 and 2014.
- The SSI SIR decreased 16% between 2009 and 2014.
- The *C. difficile* SIR decreased 4% between 2012 and 2014.
- Between 2010 and 2014, there was no statistically significant change in the CAUTI SIR.

Catheter-Associated Urinary Tract Infections



- Background:** Compared with other hospital-acquired infections, CAUTI rates are more highly variable among units in the same hospital (Dudeck et al., 2015). ICU patients differ from non-ICU patients in their underlying health status, their risks of contracting CAUTIs, and the consequences of CAUTIs that occur. CAUTI rates and the rates at which they have changed over time also differ between these two types of settings.
- Overall Rates:**
 - In 2014, the pooled mean rates of CAUTI in critical care units were 3.3 infections per 1,000 urinary catheter days for medical ICUs in major teaching hospitals, 2.7 for medical/surgical ICUs in major teaching hospitals, 2.0 for medical ICUs in all other acute care hospitals, and 1.6 for medical/surgical ICUs in all other acute care hospitals.
 - In 2013, acute care hospital patients in Burn, Neurologic, and Trauma critical care units had CAUTI rates of 4.8, 4.5, and 4.3 per 1,000 urinary catheter days, respectively. Patients in Pediatric Medical and in Respiratory critical care units had CAUTI rates of 3.4 and 2.1 per 1,000 urinary catheter days, respectively.

Change in Statewide SIRs



- Geographic Variation for 2014 (data not shown):** In 2014, 16 of 52 reporting States (including State-equivalent jurisdictions) had statewide SIRs greater than 1, indicating that, on average, their hospitals had more CAUTIs than hospitals of similar type and size had reported during the 2009 referent period. That year, 19 States had statewide SIRs less than 1, indicating that, on average, their hospitals had fewer CAUTIs than hospitals of similar type and size had reported during the 2009 referent period. The remaining 17 States had SIRs of 1, indicating that their hospitals had roughly the same number of CAUTIs as hospitals of similar type and size had reported during the 2009 referent period.
- Trends:** Of the 52 reporting States, 37 had no change in CAUTI SIRs from 2013 to 2014, while 14 SIRs decreased, and 1 increased.

Tools for Reducing Central Line-Associated Bloodstream Infections

- Purpose: To help hospitals prevent central line-associated bloodstream infections (CLABSIs) and improve safety culture
- Methods: Implementing evidence-based, practical resources and concepts from the Comprehensive Unit-based Safety Program (CUSP)
- Intended users: Hospital facilities
- Available tools: Checklists, preventable incidence calculators, audit forms, event report templates
- Impact:
 - Through use of the CUSP toolkit and CLABSI tools, more than 100 intensive care units in Michigan have nearly eliminated CLABSIs.
 - Nationwide, the use of this toolkit has helped more than 1,000 hospitals reduce rates of CLABSI by 41% in aggregate. See <http://www.ahrq.gov/workingforquality/pias/mhhakcpia.htm>.
- Link: <http://www.ahrq.gov/professionals/education/curriculum-tools/clabsitools/index.html>.

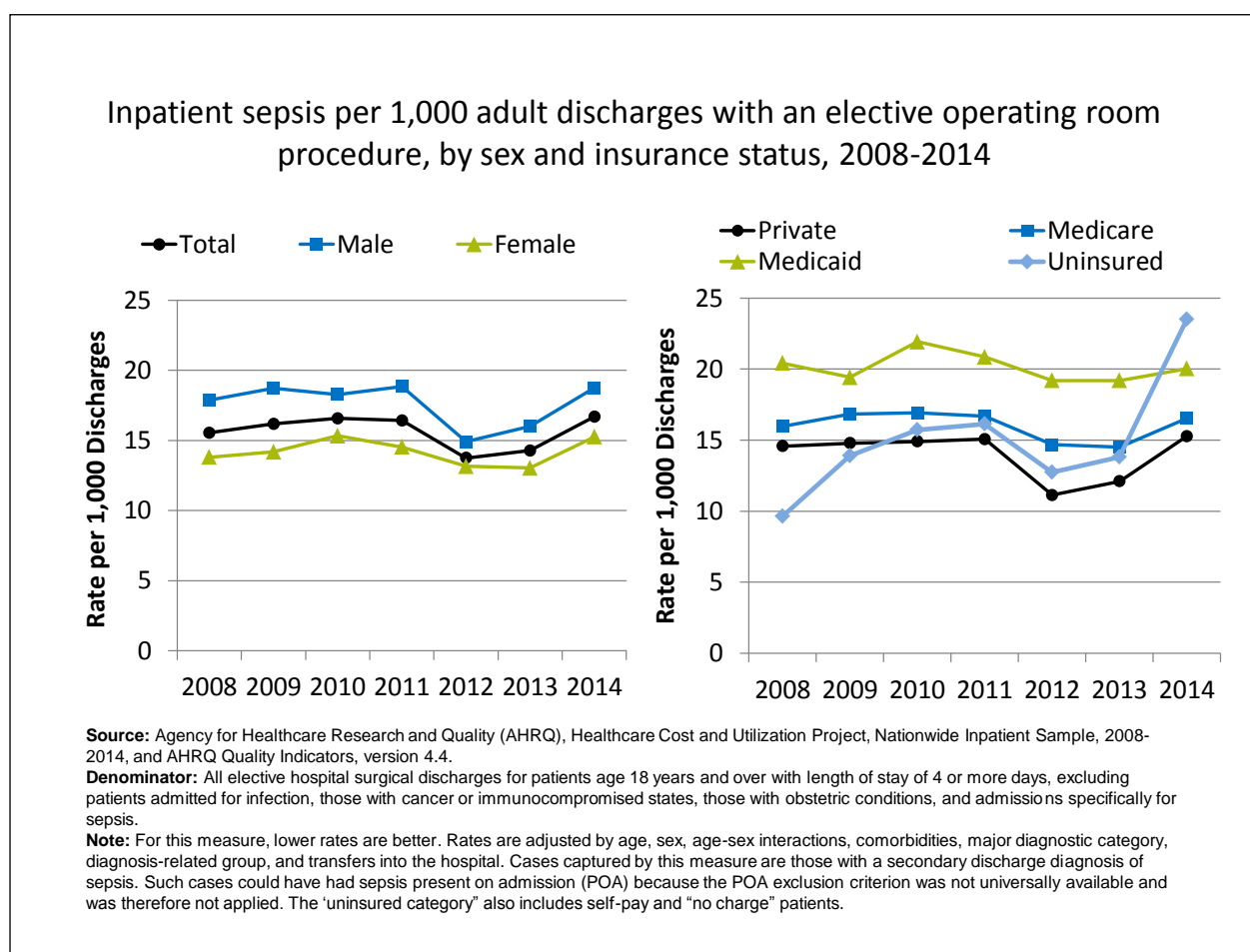
Tools for Reducing Catheter-Associated Urinary Tract Infections in Hospitals

- Purpose: To help hospitals prevent catheter-associated urinary tract infections (CAUTIs) and improve safety culture
- Method: Implementing evidence-based, practical resources and concepts from the Comprehensive Unit-based Safety Program
- Intended users: Hospital facilities
- Available tools: Guides, checklists, webinars, learning modules, data interpretation guides
- Potential Measures of Effectiveness:
 - Number of symptomatic CAUTIs attributable to each unit by month
 - Days since last CAUTI
- Link: <http://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/cauti-hospitals/Index.html>

Procedure-Related Events

- More than 40 million operative procedures are performed in the United States each year.
- Postoperative adverse events are not uncommon and increase both hospitalization length and cost (AHRQ, 2013).
- Measures include:
 - Inpatient sepsis per 1,000 adult discharges with an elective operating room procedure.
 - Obstetric trauma per 1,000 vaginal deliveries.
 - Percentage of adult patients receiving hip joint replacement due to fracture or degenerative conditions who experienced adverse events.
 - Risk-adjusted mortality at 30 postoperative days for colorectal surgery performed in adults.

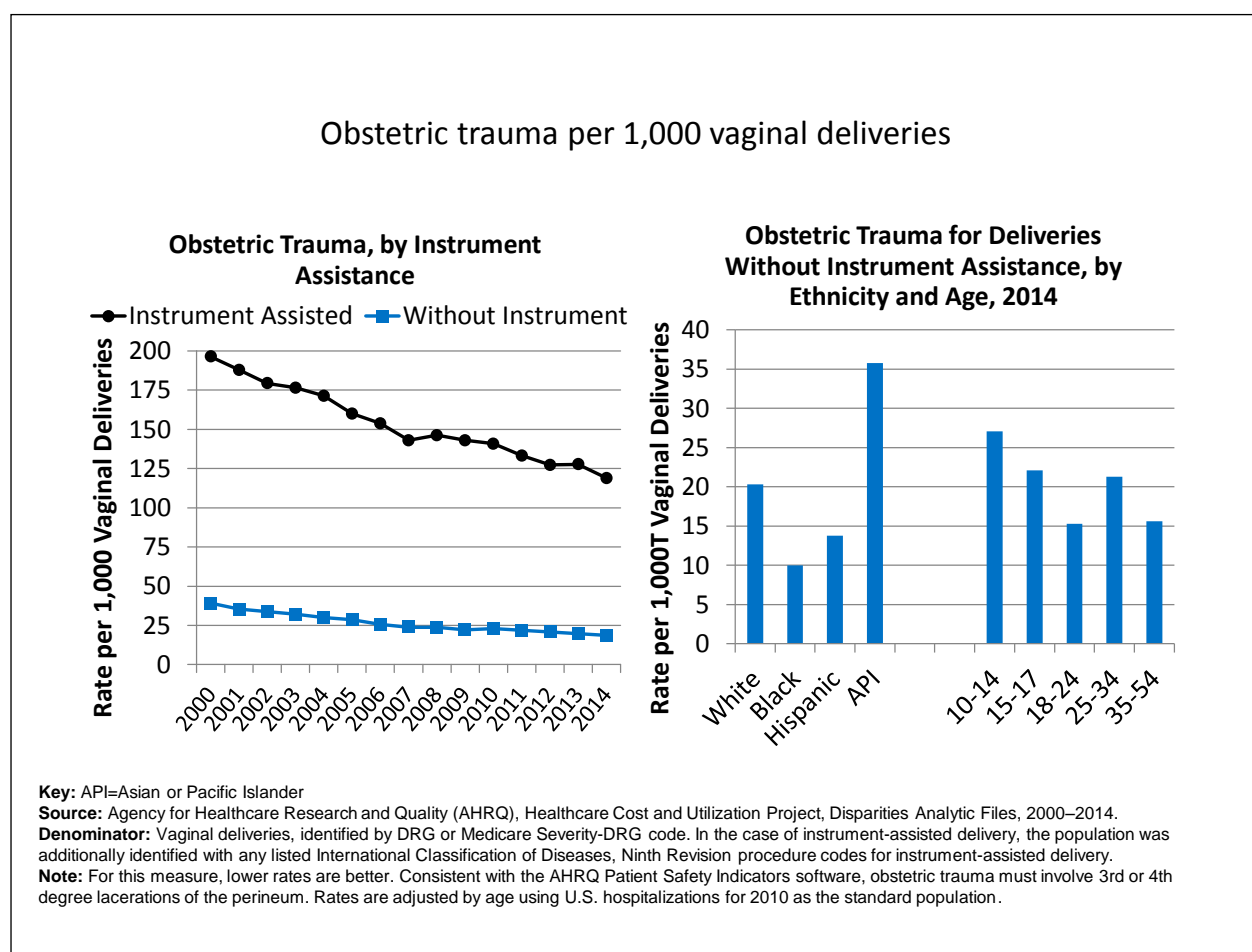
Inpatient Sepsis



Note: Cases of sepsis diagnosed before surgery or cases resulting from infections acquired but not diagnosed before surgery could not necessarily be excluded. However, such cases should be rare among elective surgical patients not meeting the exclusion criteria noted above.

- **Overall Rate:** In 2014, the inpatient sepsis rate was 16.7 per 1,000 adult discharges with an elective operating room procedure.
- **Groups With Disparities:**
 - In 2014, the rate of inpatient sepsis was lower for female patients than for male patients.
 - Also in 2014, the rate of inpatient sepsis was worse for patients with Medicaid or no insurance than for patients with private insurance.
 - From 2008 to 2014, there were no statistically significant changes in the gap between males and females.
 - From 2008 to 2014, the gap between privately insured patients and uninsured patients worsened.

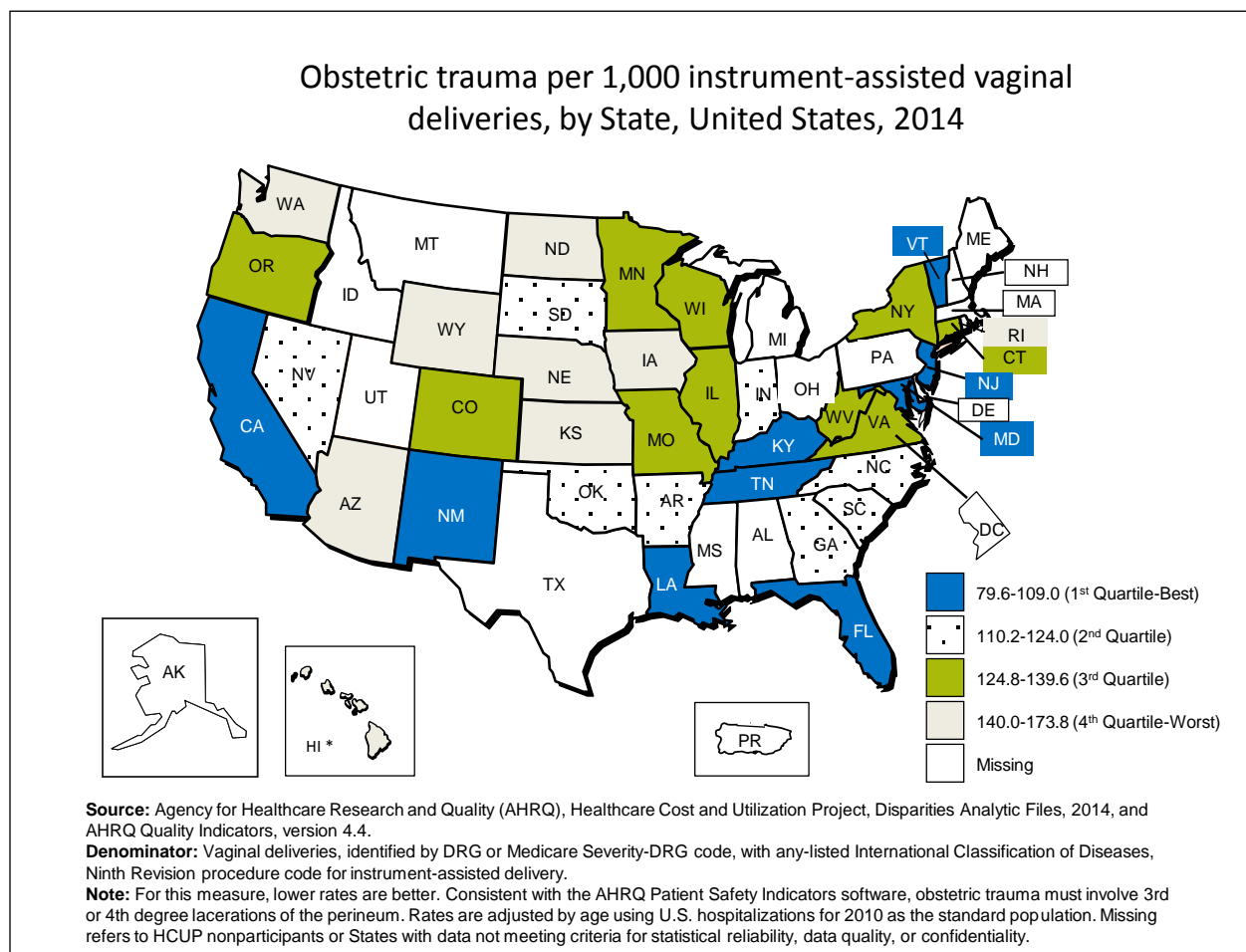
Obstetric Trauma



- **Importance:** Obstetric trauma occurring to the mother during childbirth can extend a patient's hospital stay after giving birth, may cause additional procedures to be performed, and may lead to poorer health outcomes for both the mother and child (Hines & Jiang, 2012). Vaginal deliveries that involve instruments, such as forceps and vacuums, are more likely to result in obstetric trauma, such as third and fourth degree lacerations of the perineum.

- **Overall Rate:** In 2014, the rate of obstetric trauma was 119.0 for instrument-assisted vaginal deliveries and 18.7 per 1,000 vaginal deliveries without instrument assistance.
- **Trends:** From 2000 to 2014, obstetric trauma rates improved for vaginal deliveries both with and without instrument assistance.
- **Groups With Disparities:**
 - In 2014, the rate of obstetric trauma for vaginal deliveries without instrument assistance was worse for Asians and Pacific Islanders (APIs) (35.8 per 1,000 vaginal deliveries) compared with Whites (20.3 per 1,000 vaginal deliveries).
 - In 2014, the rate of obstetric trauma for deliveries without instrument assistance was better for Blacks (10.0 per 1,000 vaginal deliveries) and Hispanics (13.8 per 1,000 vaginal deliveries) than for Whites (20.3 per 1,000 vaginal deliveries).
 - In 2014, the obstetric trauma rate for vaginal deliveries without instrument assistance was worse for patients ages 10-14 years (27.1%), 15-17 years (22.1%), and 25-34 years (21.3%) compared with patients ages 18-24 (15.3%) and 35 to 54 (15.6%).

State Variation in Rate of Obstetric Trauma

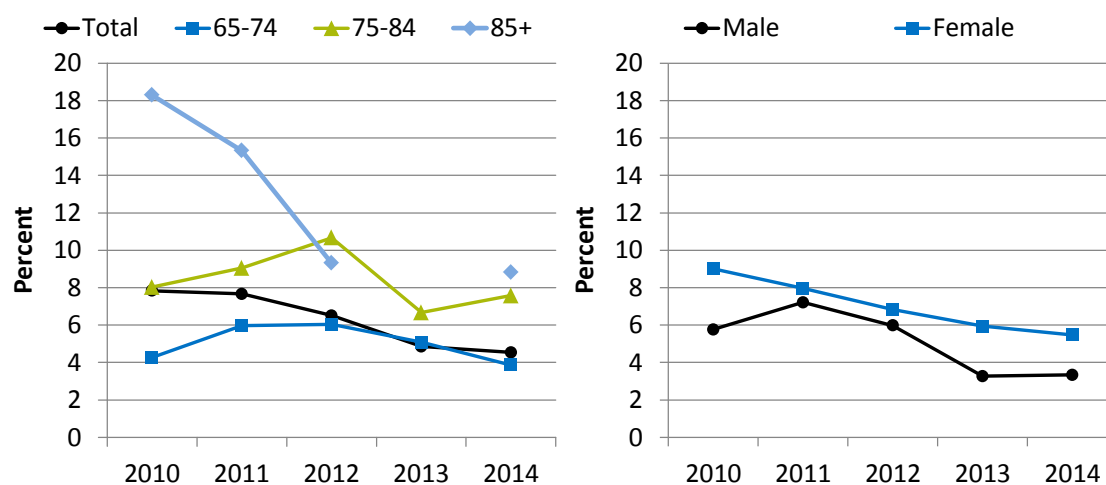


Note: The HCUP Disparities Analytic Files used in this and the preceding chart are limited to data from States (and hospitals within those States) meeting specified criteria for consistent coding of race/ethnicity. States listed as “missing” in this slide include several that did not meet these criteria in 2014.

- **Overall Rate:** In 2014, the national average was 119.0 obstetric trauma events occurring per 1,000 instrument-assisted vaginal deliveries.
- **Differences by State:** Interquartile ranges follow:
 - First quartile (lowest): 79.6-109.0 (CA, FL, KY, LA, MD, NJ, NM, TN, VT)
 - Second quartile (second lowest): 110.2-124.0 (AR, GA, IN, NV, NC, OK, SC, SD)
 - Third quartile (second highest): 124.8-139.6 (CO, CT, IL, MN, MO, NY, OR, VA, WV, WI)
 - Fourth quartile (highest): 140.0-173.8 (AZ, IA, KS, NE, ND, RI, WA, WY)
 - In 2014, Vermont had the lowest obstetric trauma rate at 79.6 events per 1,000 instrument-assisted vaginal deliveries; Nebraska had the highest rate at 173.8.

Adverse Events After Hip Joint Replacement

Adult patients receiving hip joint replacement due to fracture or degenerative conditions who experienced adverse events, by age and gender, 2010-2014



Source: Agency for Healthcare Research and Quality (AHRQ) and Centers for Medicare & Medicaid Services (CMS), Medicare Patient Safety Monitoring System (MPSMS), 2010-2014.

Denominator: All patients age 18 years and over in the MPSMS sample who had a surgical procedure performed to replace a hip joint due to degenerative conditions or a fractured hip.

Note: For this measure, lower percentages are better. Hospitals in Puerto Rico, the Virgin Islands, and Maryland were not included in the annual samples. Samples were drawn from the CMS Hospital Inpatient Quality Reporting program and consist of medical records for discharges following hip arthroplasty procedures as defined by the Surgical Care Improvement Project. Rates for patients age 85 years and over in 2013 and for ages 18-64 years old for all years are not shown because the data did not meet the criteria for statistical reliability, data quality, or confidentiality.

- **Importance:** Hip replacement is most common among older adults, who have an increased risk of adverse events after these procedures.
- **Overall Percentage:** In 2014, 4.5% of patients receiving a hip joint replacement due to fracture or degenerative conditions experienced adverse events.

- **Trends:**

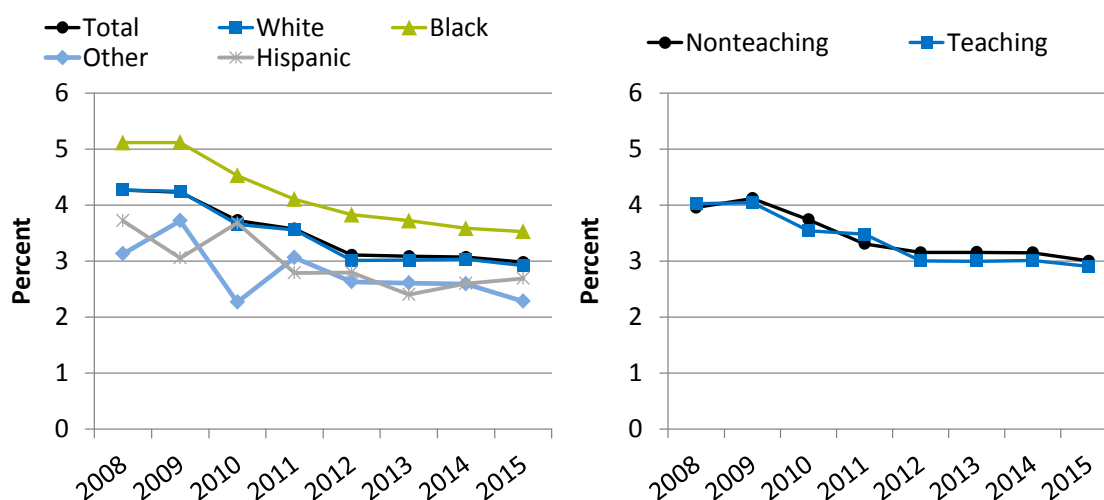
- From 2010 to 2014, there was an overall decrease in the frequency of adverse events among patients who had a hip joint replacement due to fracture or degenerative conditions.
- From 2010 to 2014, the percentage of patients experiencing adverse events decreased for females who had a hip joint replacement due to fracture or degenerative conditions.

- **Groups With Disparities:**

- In 2014, there were no statistically significant differences by age or gender in the percentage of hip replacement patients who had adverse events.
- From 2010 to 2014, there were no statistically significant changes in the gap between patients ages 75-84 and those ages 65-74 in adverse event frequencies. Similarly, there were no statistically significant changes in disparities between male and female patients.

30-Day Postoperative Mortality

Risk-adjusted mortality rate within 30 days post-operation for adults undergoing colorectal surgery in ACS NSQIP participating hospitals in the United States, by race/ethnicity and hospital teaching status, 2008-2015



Source: American College of Surgeons (ACS), National Surgical Quality Improvement Program (NSQIP), 2008-2015.

Denominator: Adults age 18 years and over.

Note: For this measure, lower percentages are better. The participation in the ACS NSQIP is voluntary and current participation is weighted when calculating rates. Participating hospitals have changed over time; 209 hospitals participated in 2008 and 578 hospitals participated in 2015. Other includes Asian, American Indian or Alaska Native, and Native Hawaiian or Other Pacific Islander. White, Black, and Other are non-Hispanic. Hispanic includes all races.

- **Importance:** Colorectal procedures have high rates of postoperative complications. Non-adherence to evidence-based best practices is associated with an increased risk of these complications (Arriaga, et al., 2009).
- **Overall Rate:** In 2015, the risk-adjusted mortality rate was 3.0% among patients undergoing colorectal surgeries at ACS NSQIP participating hospitals.
- **Trends:** From 2008 to 2015, 30-day postoperative mortality after colorectal surgery improved. The rate also improved for both White patients and Black patients.
- **Groups With Disparities:**
 - In 2015, the percentage of colorectal surgery patients with 30-day postoperative mortality was worse for Blacks (3.5%) compared with Whites (2.9%). The percentage of patients with 30-day postoperative mortality was better for Asians, American Indians or Alaska Natives, and Native Hawaiians or Other Pacific Islanders, combined (2.3%), compared with Whites (2.9%).

Adverse Drug Events

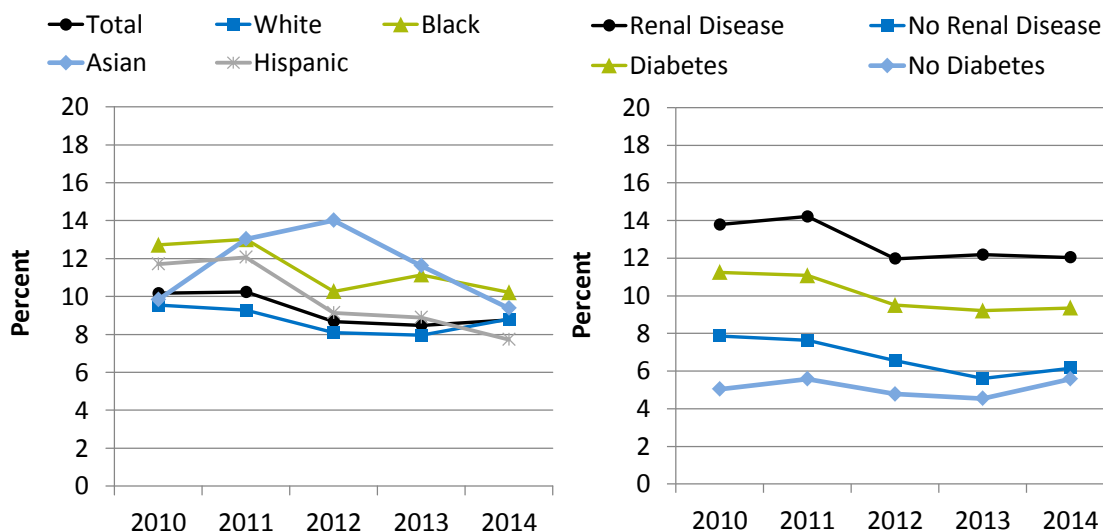
- An estimated 400,000 preventable ADEs occur each year in U.S hospitals, generating additional costs of \$3.5 billion in 2006 dollars (IOM, 2007).
 - An ADE is an injury—including physical harm, mental harm, or loss of function—resulting from medical intervention involving a drug.
 - For more information, go to the Patient Safety Primer: Medication Errors <https://psnet.ahrq.gov/primers/primer/23/medication-errors>.
- The three initial targets of the HHS National Action Plan for Adverse Drug Event Prevention are:
 - Anticoagulants and related bleeding.
 - Diabetes agents and related hypoglycemia.
 - Opioids and accidental overdose, oversedation, and respiratory depression.

Measures of Patient Safety in the Hospital Setting: Adverse Drug Events

- Percentage of hospitalized adult patients who received a hypoglycemic agent and had an adverse drug event
- Percentage of hospitalized adult patients who had an anticoagulant-related adverse drug event to warfarin

Adverse Drug Events With Hypoglycemic Agents

Hospitalized adult patients who received a hypoglycemic agent who had adverse drug events with hypoglycemic agents, by race/ethnicity, and by renal disease or diabetes status, 2010-2014



Source: Agency for Healthcare Research and Quality and Centers for Medicare & Medicaid Services, Medicare Patient Safety Monitoring System, 2010-2014.

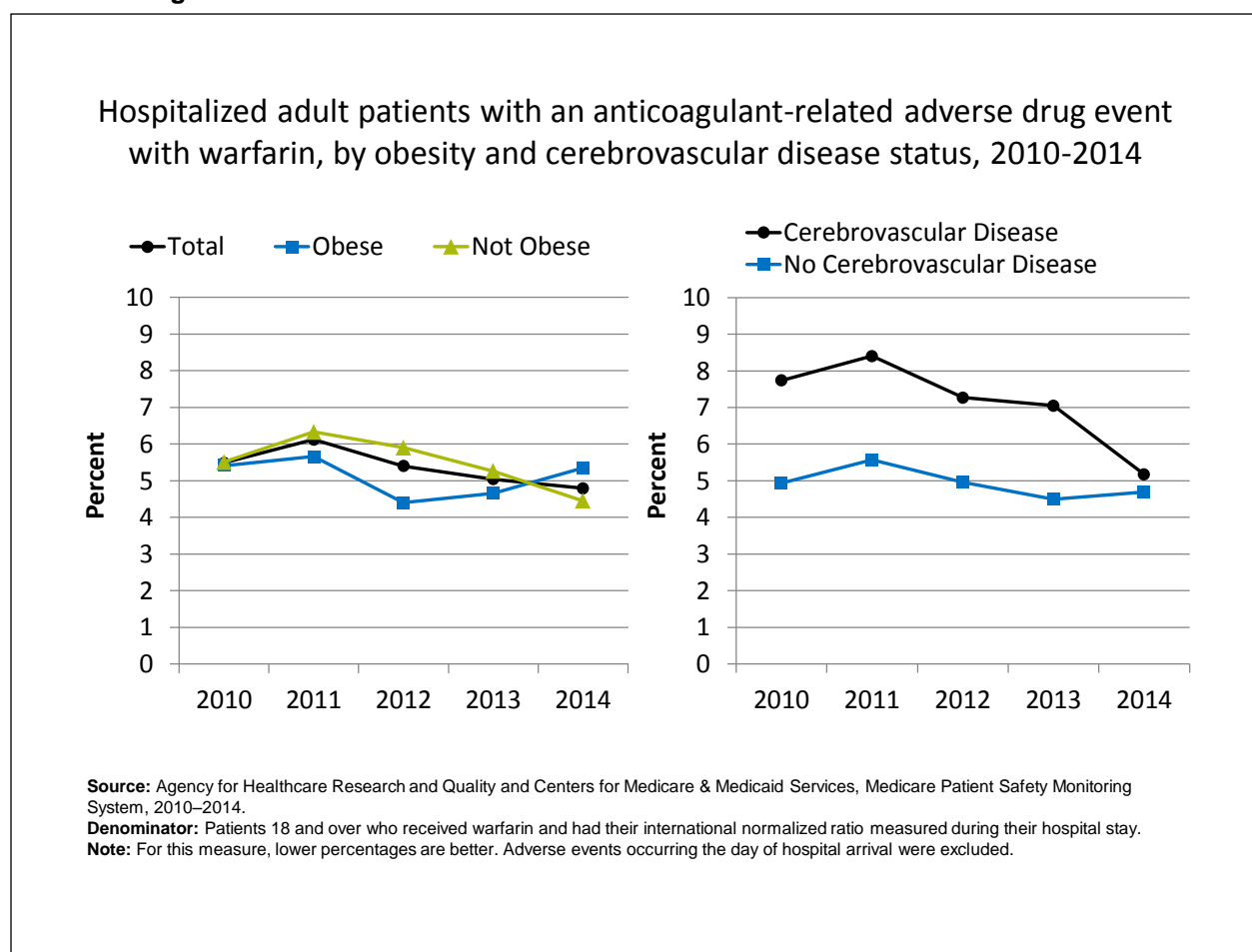
Note: For this measure, lower percentages are better. Hypoglycemic agents received by patients age 18 and over during a hospital stay include insulin, oral hypoglycemic agents, or both. White, Black, and Asian are non-Hispanic. Hispanic includes all races.

- **Importance:** Hypoglycemic agents, which are ingested orally, are typically used in patients with type 2 diabetes to control blood sugar levels. In some cases, diabetic patients use hypoglycemic agents together with insulin. The risk of chronic kidney disease increases twofold for people with diabetes, and renal impairment can increase the risk for adverse events related to hypoglycemic agents.
- **Overall Percentage:** In 2014, 8.8% of hospital patients receiving hypoglycemic agents had an adverse drug event.
- **Trends:**
 - The overall percentage of adverse drug events associated with hypoglycemic agents improved from 2010 to 2014.
 - From 2010 to 2014, the percentage of adverse drug events associated with hypoglycemic agents improved for patients with diabetes and for those with and without renal disease.
 - From 2010 to 2014, the percentage of patients experiencing an adverse drug event with hypoglycemic agents improved for Whites and Blacks.

- **Groups With Disparities:**

- In 2014, the percentage of hospital patients who had adverse drug events with hypoglycemic agents was higher for those with renal disease (12.0%) than for those without renal disease (6.2%).
- Also in 2014, the percentage of hospital patients who had adverse drug events with hypoglycemic agents was higher for those with diabetes (9.4%) than for those without diabetes (5.6%).
- From 2010 to 2014, there were no statistically significant changes in the gap between minority groups and Whites in the percentage of patients who had adverse drug events associated with hypoglycemic agents. Similarly, there were no statistically significant changes in the gap between those with renal disease and those without.

Adverse Drug Events With Warfarin



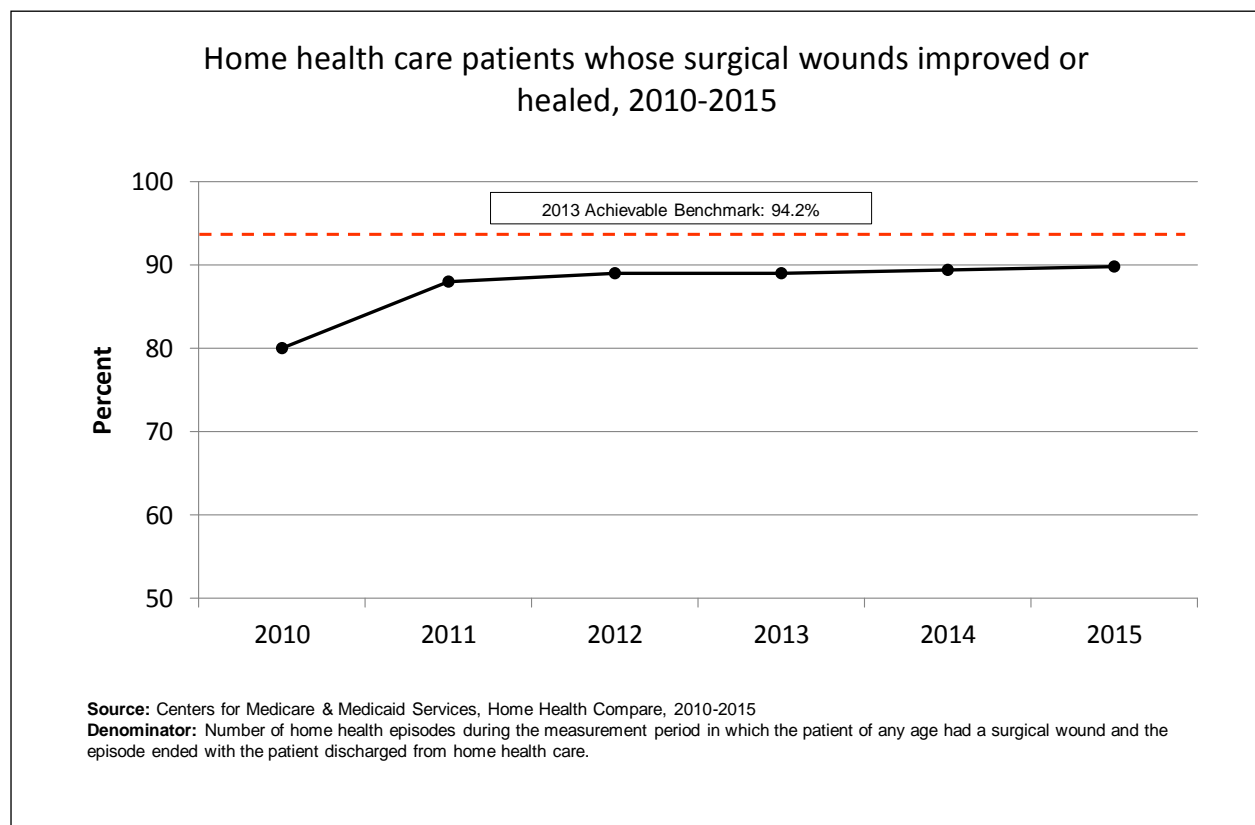
- **Importance:** Blood clots in arteries and veins can cause a blockage of blood flow and lead to strokes and heart attacks. Survivors of stroke have an increased risk of another stroke, and individuals who are obese are at higher risk of blood clots. Anticoagulants, such as warfarin, reduce this risk but pose an increased risk of bleeding.

- **Overall Percentage:** In 2014, 4.8% of adult hospital patients using warfarin experienced an anticoagulant-related adverse drug event.
- **Trends:** From 2010 to 2014, there were no statistically significant changes in the overall percentage of hospital patients with an adverse drug event related to warfarin.
- **Groups With Disparities:**
 - In 2014, there were no statistically significant differences by obesity status or cerebrovascular disease status in the percentage of hospital patients who had an adverse drug event related to warfarin.
 - From 2010 to 2014, there were no statistically significant changes in the gap between obese patients and patients who were not obese in the percentage of patients who had a drug event related to warfarin. Similarly, there were no statistically significant changes in the gap between those with cerebrovascular disease and those without cerebrovascular disease.

Patient Safety in the Home Health Setting

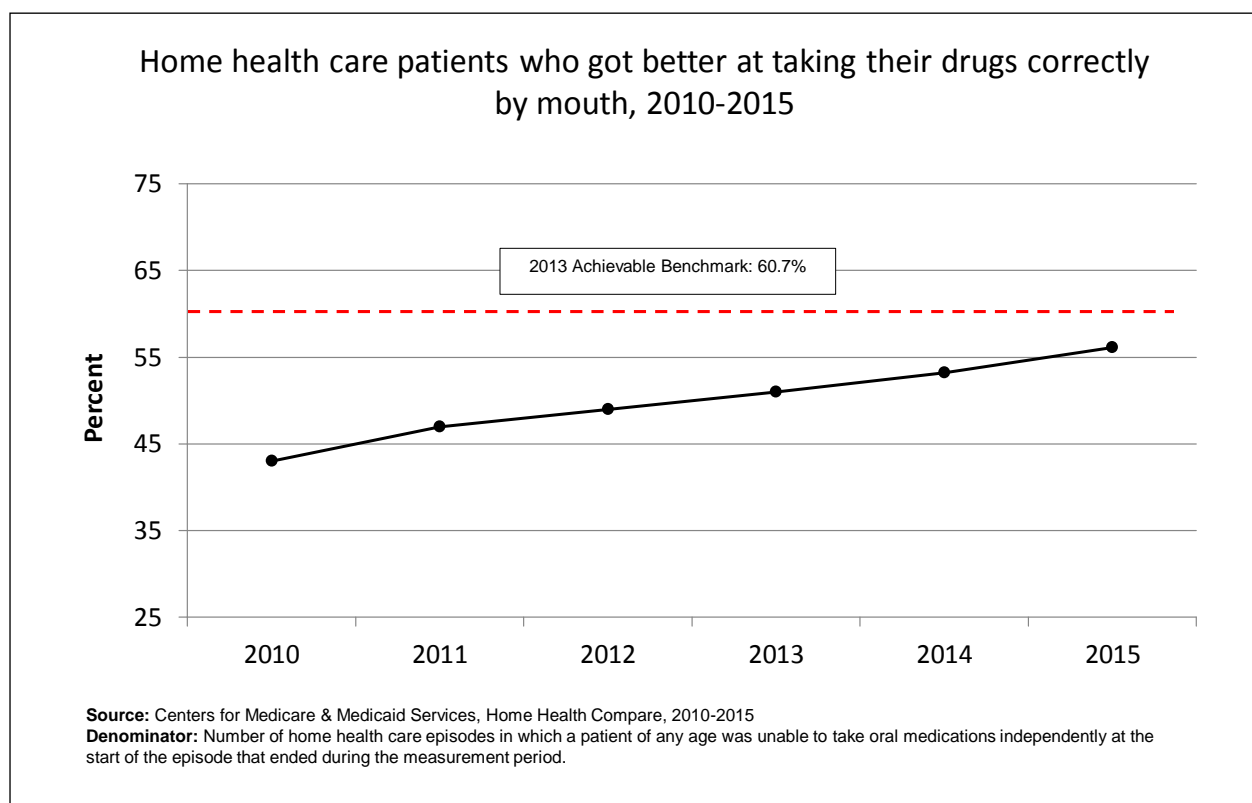
- Home health agencies provide services to beneficiaries who are homebound and need skilled nursing care or therapy.
- Approximately 12 million individuals receive home health care from more than 33,000 providers for causes including acute illness, long-term health conditions, permanent disability, or terminal illness (NAHCH, 2010).
- Improvements among home health patients can reflect the quality of care from home health agencies.
- Measures include:
 - Home health care patients whose surgical wounds improved or healed, 2010-2015.
 - Home health patients with improvements in their ability to take medications orally, 2010-2015.
 - Interstate variation in rates of improvement in home health patients' ability to take medications correctly by mouth, 2010-2015.

Improvement in Surgical Wounds



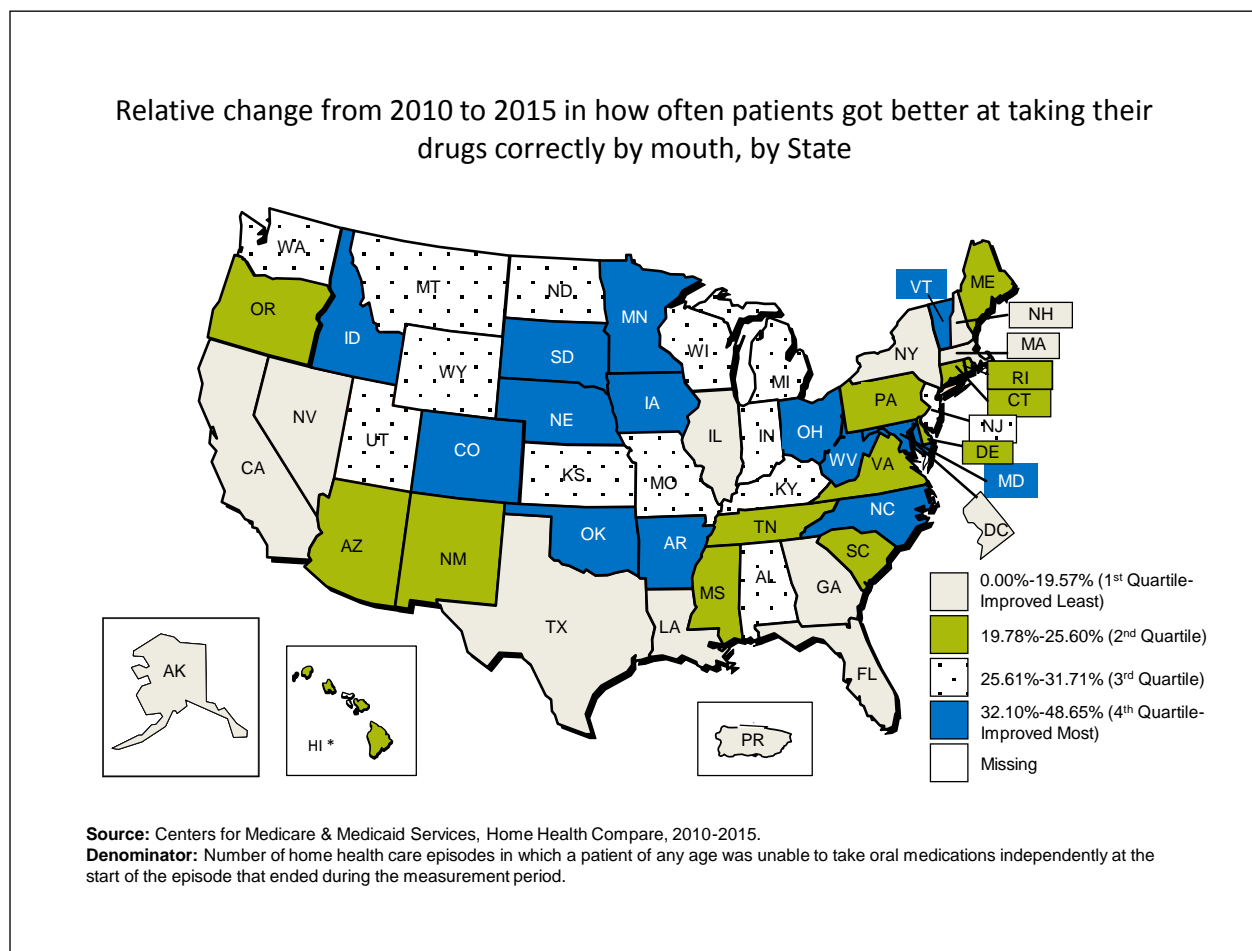
- **Importance:** Normal wound healing after an operation is an important marker of good care. The home health team should regularly change wound dressing and teach the patient about wound care.
- **Overall Percentage:**
 - In 2015, the percentage of home health patients with improvement in their surgical wounds was close to 90% (89.8%).
- **Achievable Benchmark:**
 - The 2013 top 5 State achievable benchmark for improvement in surgical wounds was 94.2%. The States and State-equivalent jurisdictions that have contributed to this benchmark are Idaho, Massachusetts, Mississippi, Puerto Rico, and South Carolina.
 - Based on current trends, the total population of home health patients with improvement in or healing of surgical wounds is estimated to reach the benchmark in 2017.

Improvement in Ability To Take Medication Orally



- **Importance:** Taking medications correctly is important to the health status and quality of life of individuals living in the community. The home health team can help teach a patient ways to organize drugs and take them properly.
- **Overall Percentages:**
 - In 2015, the percentage of home health patients with improvement in their ability to take medications orally was 56.3%, compared with 46% in 2010.
- **Achievable Benchmark:**
 - In 2013, the achievable benchmark for improvement in taking drugs correctly by mouth was 60.7%. The States that contributed to the achievable benchmark are Iowa, Massachusetts, New Jersey, North Dakota, and South Carolina.
 - Based on current trends, the total population of home health patients with improvement in their ability to take drugs correctly by mouth is estimated to reach the benchmark in 2017.

Improvement in Ability To Take Medication Orally, by State



- Overall:** This map shows overall trends from 2010 to 2015 across 52 State-equivalent jurisdictions in relative increases in the percentage of home health patients with improvement in their ability to take medications orally. Increasing rates of change are preferable, although a State that performed well in 2010 would have less room for improvement. From 2010 to 2015, the relative rate of change across States ranged from 0.0% to 48.7%.
- Differences by State:**
 - First quartile (lowest amount of change): 0.0%-19.57% (AK, CA, DC, FL, GA, IL, LA, MA, NV, NH, NY, PR, TX)
 - Second quartile (second lowest amount of change): 19.78%-25.60% (AZ, CT, DE, HI, ME, MS, NM, OR, PA, RI, SC, TN, VA)
 - Third quartile (second highest amount of change): 25.61%-31.71% (AL, IN, KS, KY, MI, MO, MT, NJ, ND, UT, WA, WI, WY)
 - Fourth quartile (highest amount of change): 32.10%-48.65% (AR, CO, ID, IA, MD, MN, NE, NC, OH, OK, SD, VT, WV)

- The change from 2010 to 2015 in the percentage of home health patients with improvement in their ability to take medications orally was lowest for patients in the District of Columbia (0.0% increase) and highest for Idaho (48.65% increase).
- Most of the States in the Midwest and Mountain regions improved the most (in the 3rd or 4th quartiles).

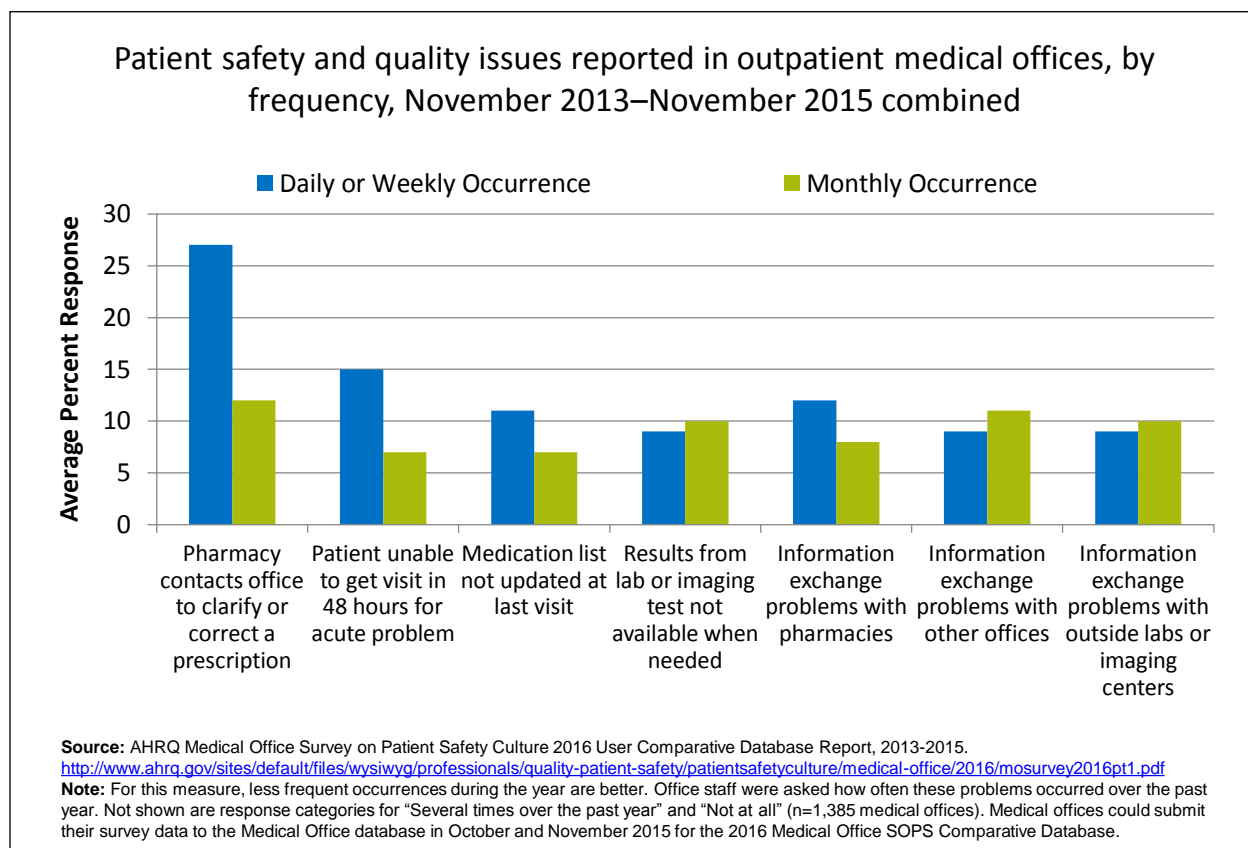
Patient Safety in the Ambulatory Setting

- Although patient safety initiatives frequently focus on inpatient hospital events, adverse effects of medical care may be identified and treated in outpatient settings.
- Adverse effects of medical care can follow care or procedures in hospitals, emergency departments, physician offices, or other settings.
- For more information, go to the Patient Safety Primer: Patient Safety in Ambulatory Care at <https://psnet.ahrq.gov/primers/primer/16/patient-safety-in-ambulatory-care>.

Measures of Patient Safety in the Ambulatory Setting

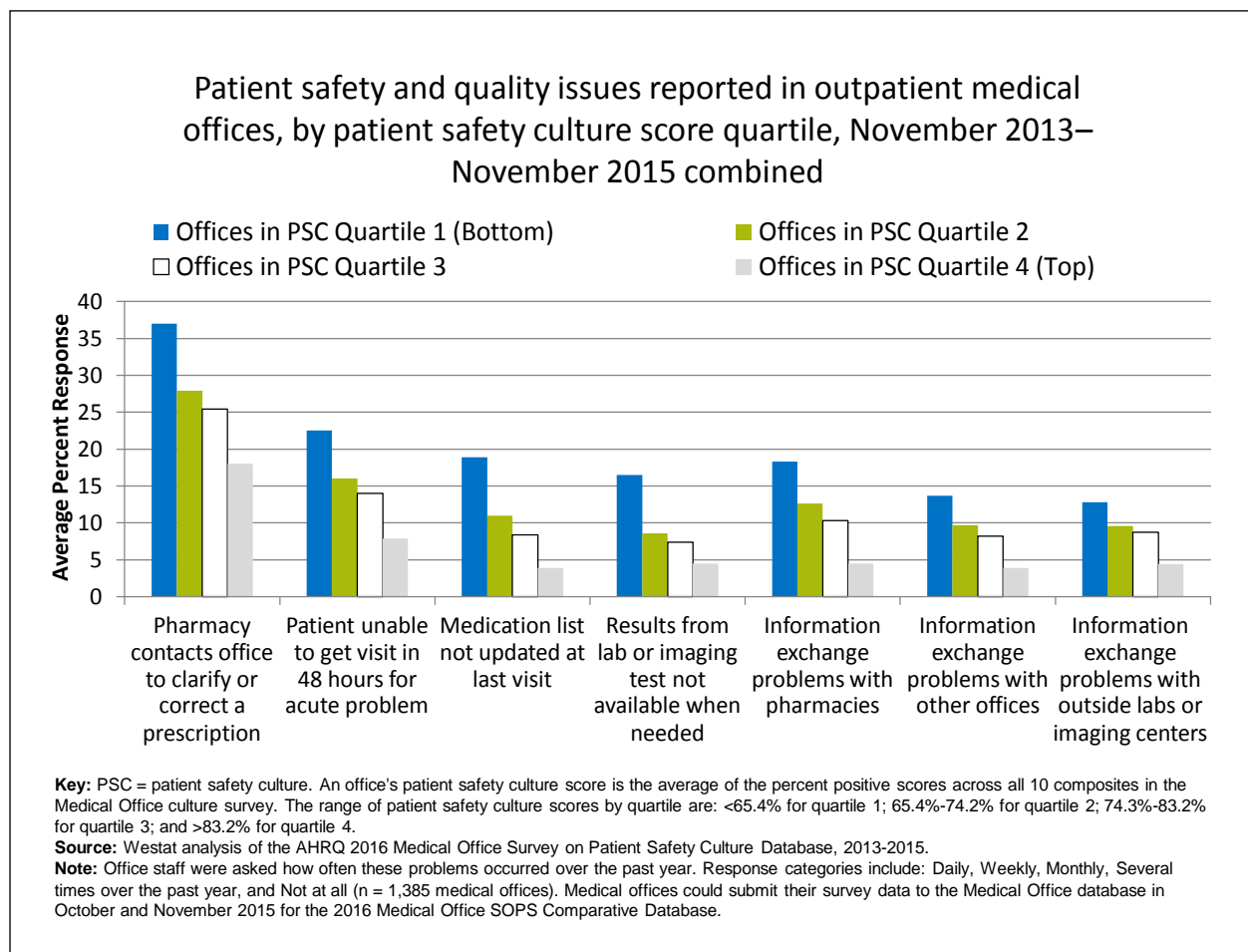
- Patient safety and quality issues in outpatient medical offices, relative to safety culture
- Adults age 65 years and over who received potentially inappropriate prescription medications during the calendar year
- Percentage of hemodialysis patients with vascular catheter in use for 90 days or longer
- Events reported by ambulatory surgical facilities in Pennsylvania, by type and harm

Patient Safety and Quality Issues



- **Importance:** Most health care takes place in the outpatient (ambulatory care) setting. Lack of access to care and lack of access to timely and accurate medical information and test results may contribute to patient safety events such as missed or delayed diagnoses, medication errors, failure to order appropriate diagnostic or laboratory tests, incorrect interpretation of tests, and inadequate followup on results.
- **Overall Percentage:**
 - More than one-quarter (27%) of medical offices participating in the AHRQ Medical Office Survey on Patient Safety Culture from November 2013 to November 2015 reported daily or weekly occurrences of being contacted by the pharmacist for clarification or correction of a prescription.
 - In terms of daily or weekly issues, medical offices were next most likely to report patients being unable to get an appointment within 48 hours for an acute or serious problem (15%), medical office having an information exchange problem with pharmacies (12%), and patients not having their medication list updated during their visit (11%).

Patient Safety and Quality Issues

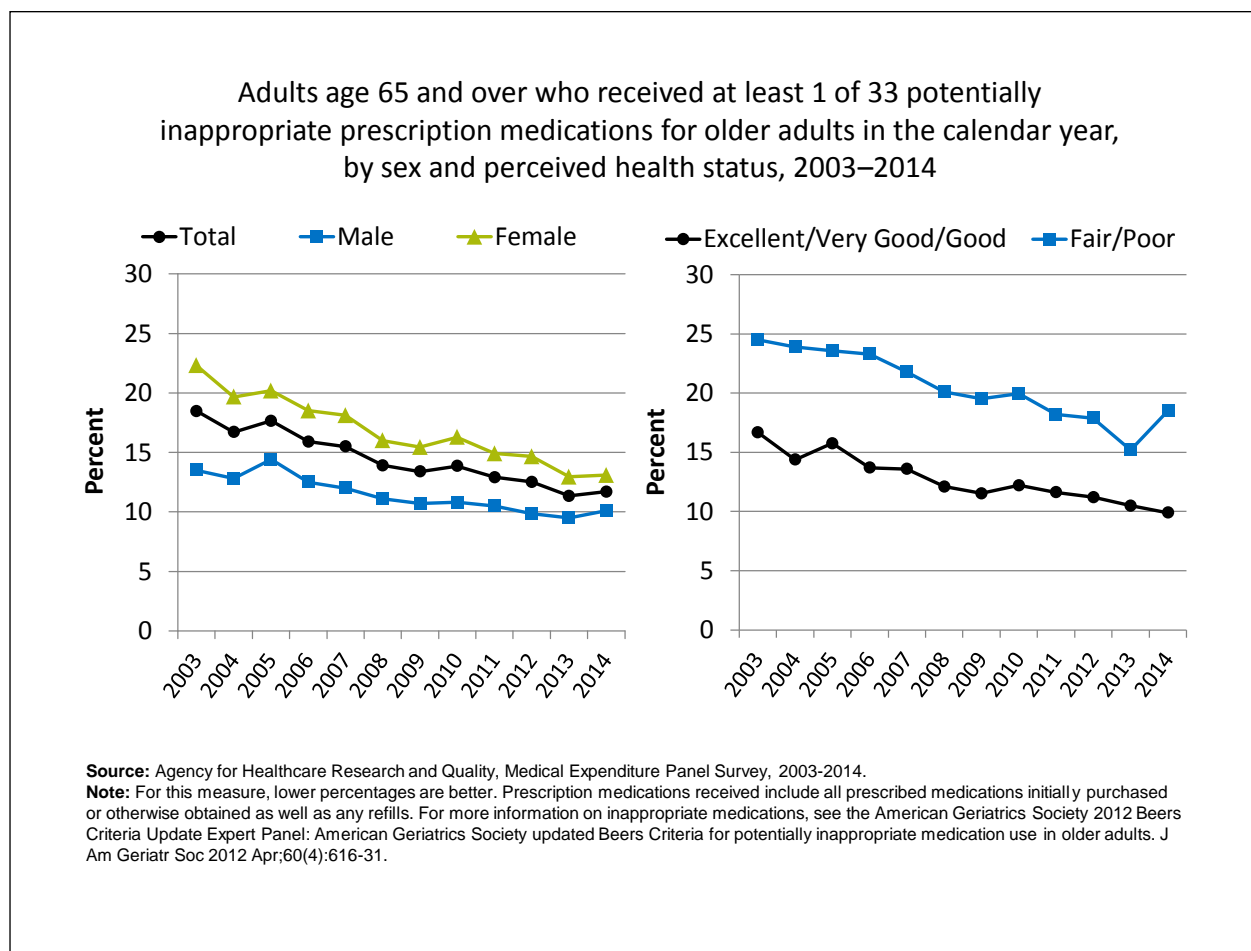


- **Importance:** As medical offices aim to improve their performance, there is growing recognition of the importance of establishing a culture of patient safety.

- **Overall Percentage:**

- Patient safety and quality issues were less likely to be reported as occurring on a daily or weekly basis among medical offices with the highest patient safety culture (PSC) scores (PSC quartile 4) compared with medical offices with the lowest scores (PSC quartile 1).
- The difference in frequency of reporting daily or weekly issues by medical offices with the lowest PSC scores compared with offices with the highest scores was more than fourfold for medication lists not being updated and information exchange problems with pharmacies; more than threefold for lab and imaging test results not being available and information exchange problems with other offices; and more than twofold for the other issues.

Potentially Inappropriate Prescriptions for Older Adults

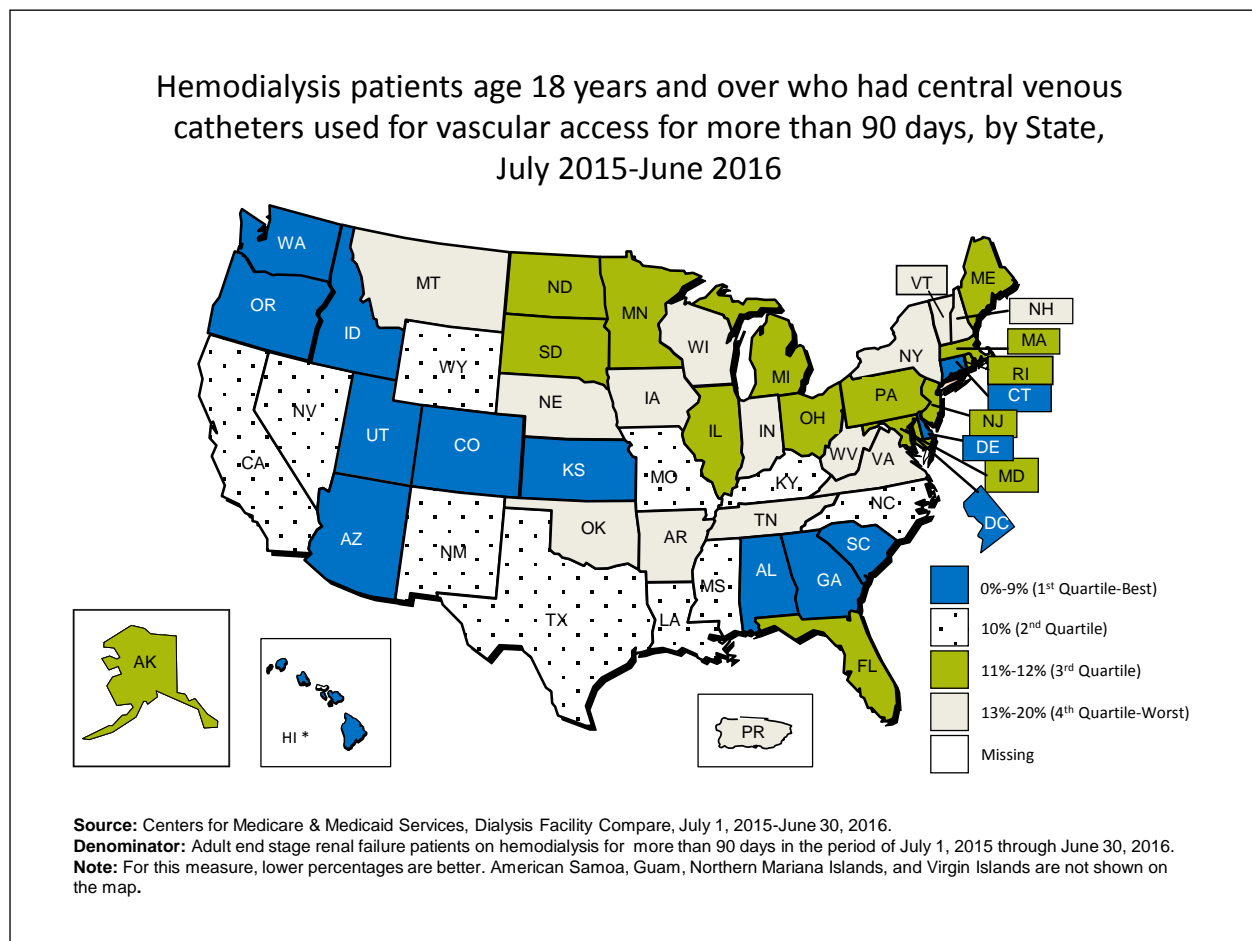


- **Importance:** Some drugs that are prescribed for older patients are known to be potentially harmful for this age group.
- **Overall Percentage:** In 2014, the percentage of adults age 65 years and over who received potentially inappropriate prescription medications was 11.7%.
- **Trends:** From 2003 to 2014, the percentage of adults age 65 years and over who received potentially inappropriate prescription medications improved overall, for both sexes, and for people with excellent/very good/good health status and people with fair/poor health status.

- **Groups With Disparities:**

- In all years, the percentage of patients receiving potentially inappropriate medications was higher among females than males. This gap has not narrowed significantly over time.
- In all years from 2003 to 2014, the percentage of patients receiving potentially inappropriate medications was higher among people with fair/poor health status compared with people with excellent/good health status. This gap has not narrowed significantly over time.

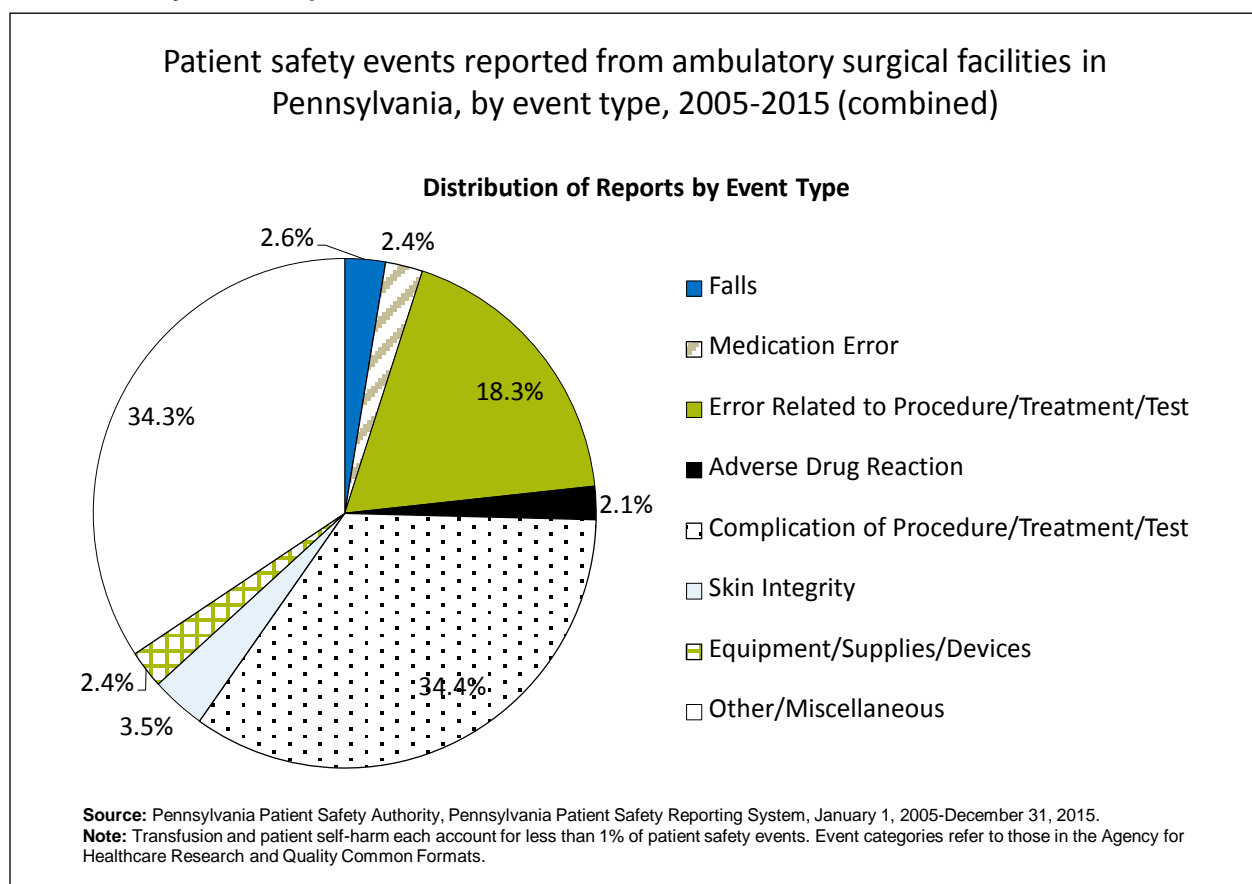
Long-Term Catheter Use in Dialysis Patients



- **Importance:** In hemodialysis patients, central venous catheters (CVCs) are frequently used for vascular access until a fistula or graft is ready for use. Compared with other forms of vascular access for hemodialysis, CVC use is associated with higher rates of infection and other adverse events (Pisoni, et. al., 2015). To decrease the likelihood of adverse events, CVCs should be used for 90 days or less.
- **Overall Percentage:** Nationally, among adult end stage renal failure patients on any form of hemodialysis for 90 or more days during the observation period of July 1, 2015, through June 30, 2016, an average of 10% used CVCs for more than 90 days.

- Differences by State:** Percentages for State-equivalent jurisdictions and U.S. territories were provided as whole numbers (with multiple tied values). Therefore, the quartiles have varying numbers of States, and ranges are approximate.
 - First (lowest) quartile: 0%-9% (AL, AS, AZ, CO, CT, DC, DE, GA, HI, ID, KS, MP, OR, SC, UT, VI, WA)
 - Second (next to lowest) quartile: 10% (CA, GU, KY, LA, MS, MO, NV, NM, NC, TX, WY)
 - Third (next to highest) quartile: 11%-12% (AK, FL, IL, ME, MD, MA, MI, MN, NJ, ND, OH, PA, RI, SD)
 - Fourth (highest) quartile: 13%-20% (AR, IN, IA, MT, NE, NH, NY, OK, PR, TN, VA, VT, WV, WI)
 - Kansas and the U.S. Virgin Islands had the lowest nonzero percentages of dialysis patients using CVCs 90 days or longer (7%). At 20%, Puerto Rico had the highest percentage of long-term CVC use.

Patient Safety Event Reports



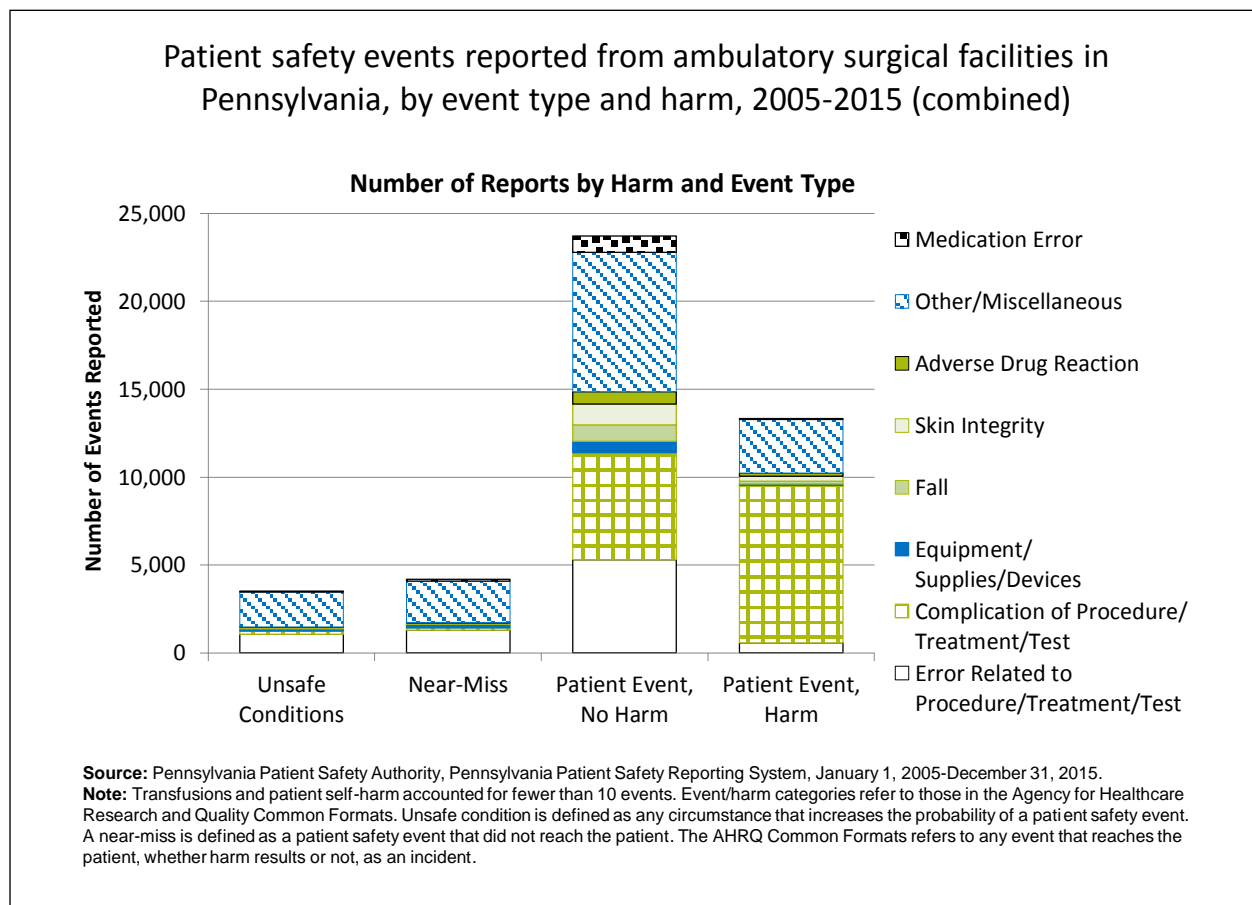
- Importance:** Surgical procedures are frequently and increasingly performed in ambulatory settings. In 2010, ambulatory surgery cases in the United States totaled 18.7 million and accounted for almost two-thirds of all operations. Understanding the frequency of various types of events and the level of harm associated with each can aid providers and policymakers in setting priorities for improving safety in these settings. The Pennsylvania

Patient Safety Authority analyzed patient safety events reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS) between 2005 and 2015. The chart shows the distribution of reports by event type.

- **Common Types of Events:**

- Pennsylvania ambulatory surgical facilities (ASFs) reported a total of 44,718 patient safety events between January 1, 2005, and December 31, 2015.
- The three most commonly reported event types were Complication of Procedure, Treatment, or Test (34.4%), Other/Miscellaneous (34.3%), and Error Related to Procedure, Treatment, or Test (18.3%).
- The top three areas within the Complication of Procedure, Treatment, or Test event type category for ASFs were return to the operating room, healthcare-acquired infections, and IV complications.
- During this 11-year time period, more than 15,300 events reported were classified in the “Other/Miscellaneous” category. This category captures events that may not fit into the PA-PSRS taxonomy (e.g., inappropriate discharge, electric shock to patient), as well as events that fit into the existing PA-PSRS taxonomy but are not reported in the appropriate category. The latter situation may occur because the reporter is unfamiliar with the full PA-PSRS event type taxonomy.

Patient Safety Event Reports, by Event Type and Harm



- **Importance:** Surgical procedures are frequently and increasingly performed in ambulatory settings. In 2010, ambulatory surgery cases in the U.S. totaled 18.7 million and accounted for almost two-thirds of all operations. Understanding the frequency of various types of events and the level of harm associated with each can aid providers and policymakers in setting priorities for improving safety in these settings. The Pennsylvania Patient Safety Authority analyzed patient safety events reported through the Pennsylvania Patient Safety Reporting System between 2005 and 2015. The chart shows the number of reports by level of harm and event type.
- **Common Types of Event and Harm:**
 - Events that reached the patient—with or without harm—were the most frequently reported overall.
 - Between 2005 and 2015, the event type accounting for the largest share of reported events involving harm or death was Complication of Procedure, Treatment, or Test.

Innovations Related to Ambulatory Surgery Facility Cancellations and Transfers

- **Issue:** Comorbidities and lack of screening criteria place ambulatory surgery patients at risk for day-of-surgery (DOS) cancellations and medical complications that may require unexpected transfers to acute care inpatient facilities.
- **Intervention:** Between December 2012 and June 2013, nurses at 11 freestanding ambulatory surgery facilities in Northeastern Pennsylvania used an evidence-based checklist to perform preoperative screening and assessments. Optional additions to the checklist included:
 - Calling patients preoperatively to review procedure-related responsibilities (e.g., colonoscopy preparation), and
 - Using health literacy principles to enhance patient understanding of procedure-related activities.
- **Outcomes:** Use of nursing-based preoperative screening and assessment led to fewer DOS cancellations with no significant reduction in transfers to acute care inpatient facilities.
- **Background:** This intervention was motivated in part by analyses of patient safety events reported by ambulatory surgery facilities through the Pennsylvania Patient Safety Reporting System. The results indicated that 43% of event reports related to preoperative screening or assessment from June 2004 to December 2008 involved patient harm (i.e., reported as a Serious Event), most often a complication requiring transfer to an acute care setting. In addition, a lack of screening or assessment processes was identified as contributing to day-of-surgery (DOS) cancellations. DOS cancellations may directly affect patient safety and result in delayed care. They can also lead to interruptions and distractions in the surgical schedule and in daily workflow.
- **Intervention Results:** For DOS cancellations, there was a statistically significant relative reduction of 9.7%, going from 29.6/1,000 completed procedures in the pre-intervention phase (July-November 2012) to 26.8/1,000 during the intervention phase (December 2012-June 2013). This reduction included transportation-related DOS cancellations, protocol-related DOS cancellations, and no-show DOS cancellations. While unexpected DOS transfers to acute care inpatient facilities fell from 1.21 to 1.03 transfers per 1,000 ambulatory surgery center admissions, this 14.7% relative reduction was not statistically significant.

- **Resources:**

- Evaluation of the intervention may be accessed at http://patientsafety.pa.gov/ADVISORIES/Pages/201403_15.aspx.
- Ambulatory surgery facility tracking tools to prevent DOS cancellations and transfers to acute care inpatient facilities may be accessed at http://patientsafety.pa.gov/ADVISORIES/Pages/201409_109.aspx.

Patient Safety Infrastructure

- Efforts to improve patient safety have been accompanied by various infrastructure enhancements.
- One example of continued growth and maturation is shown by AHRQ's Patient Safety Organizations, which can aggregate data across providers to identify patterns of hazards from care delivery and accelerate learning.

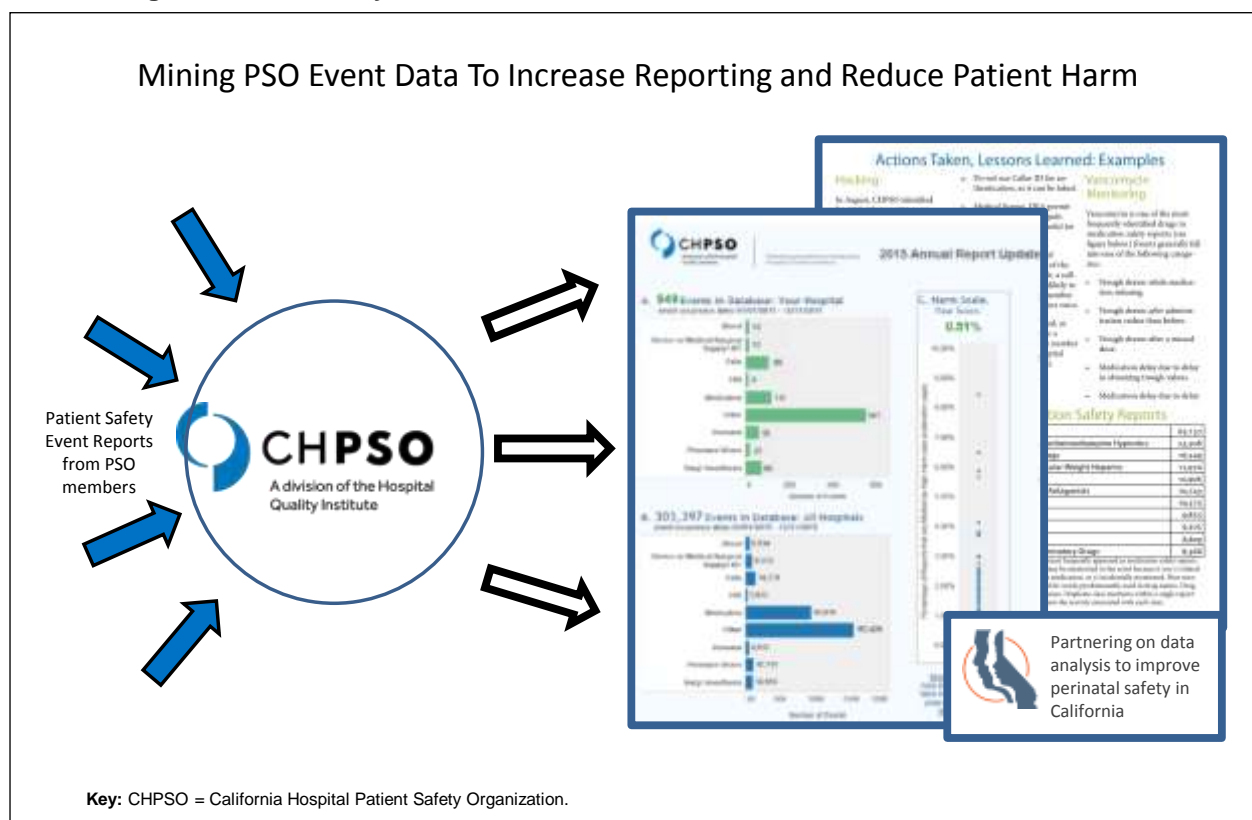
Patient Safety Organizations

- Patient safety organizations (PSOs) aim to reduce preventable adverse events, near-misses, and unsafe conditions in all health care settings.
- PSOs provide an environment for health care providers to voluntarily report, discuss, and learn from patient safety events and quality analyses on a privileged and confidential basis.
- Measures include:
 - Number of patient safety event reports submitted to PSOs.
 - Trend in reports of high-harm events relative to all patient safety events submitted to the California Hospital Patient Safety Organization.
- More information about the PSO program is available at: <https://www.pso.ahrq.gov/>.

Patient Safety Organizations: AHRQ Common Formats

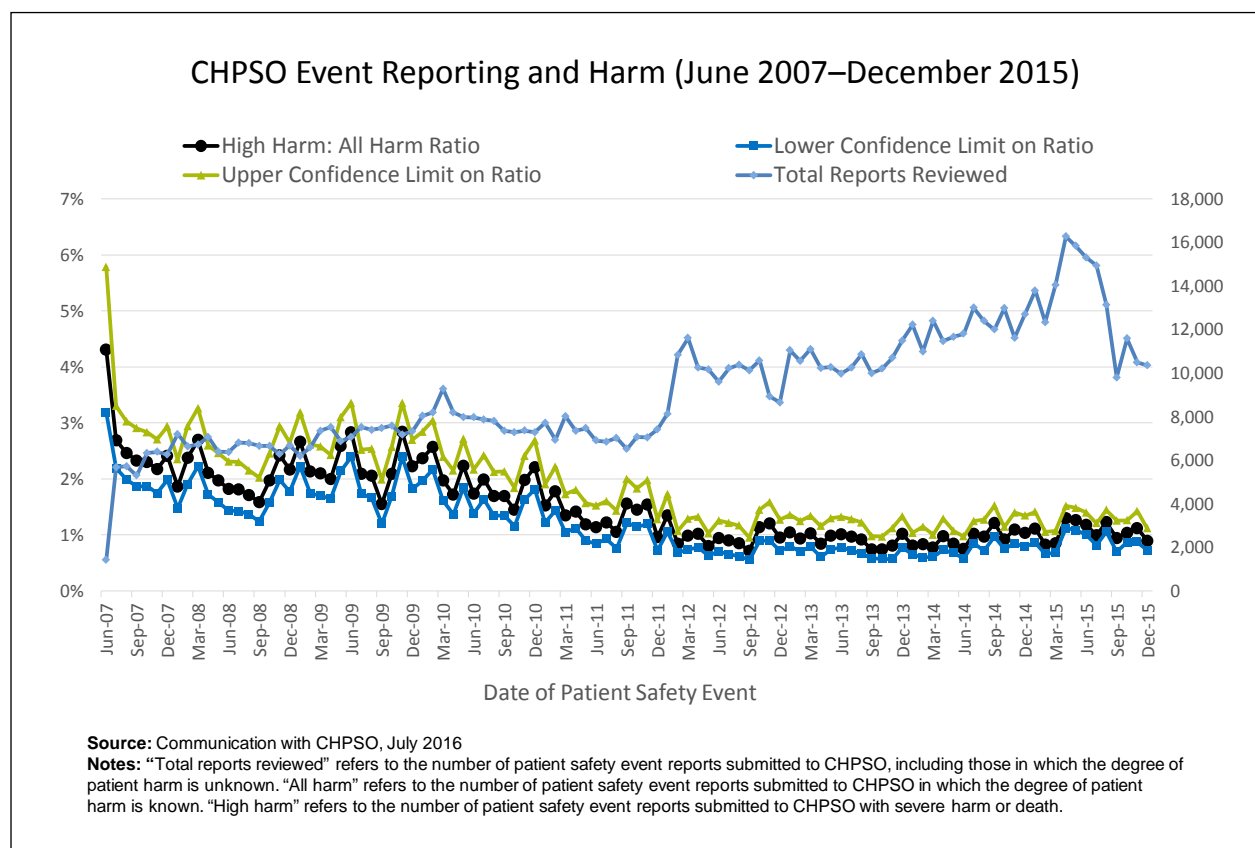
- AHRQ Common Formats provide a standardized method for PSOs, health care providers, and other organizations to collect and report patient safety events.
 - Data element standards are important for aggregating and analyzing events across providers.
- AHRQ Common Formats have been developed for a variety of settings of care:
 - Hospitals
 - Nursing homes
 - Community pharmacies
- More information about the Common Formats is available at <https://pso.ahrq.gov/common>.

Data Mining for Patient Safety



- **Background:** The California Hospital Patient Safety Organization (CHPSO) is a component of the Hospital Quality Institute. CHPSO provides an example of how PSOs can mine the data they collect from members to improve patient safety and encourage reporting.
- **Uses of Patient Safety Event Reports:**
 - CHPSO generates patient safety dashboards that feed back a variety of event-related metrics (e.g., event types, harm, top drug classes involved) for each member provider compared with all members. Members share this information internally with safety, quality, and risk management teams and with their board of directors. The dashboard also encourages event reporting to have more reliable data.
 - CHPSO makes learning from aggregated event report information available to the general public through its annual report. The publicly available annual report showcases patterns of event reports for all member hospitals, as well as PSO and member actions to improve safety based on the analyses. For example, a recent annual report presented evidence that medication errors involving Vancomycin were often associated with testing and monitoring.
 - CHPSO leverages their database for high-priority research in their home State. The Hospital Quality Institute received funding from the California HealthCare Foundation to mine CHPSO data in order to identify vulnerabilities in perinatal care and cesarean deliveries. Findings are of value to hospitals and insurers, as recent policy changes link rates to participation in the State health insurance exchange.

Patient Safety Organization Event Reporting



• Background

- Two cornerstones of health care quality and safety improvement programs in the United States are reporting events and reducing patient harm from events.
- The California Hospital Patient Safety Organization (CHPSO) uses a measure, the harm ratio, that encourages reporting of patient safety events. It reflects the ratio of patient safety event reports with high harm to all event reports where the degree of harm is known and is calculated for PSO members individually and in aggregate.
- High-harm events, when they occur, tend to get reported because they are very visible and required or incentivized by various regulatory and accrediting agencies. However, reporting of unsafe conditions, near-misses, and lower harm events is very important because the information can shed light on mechanisms for preventing events from reaching the patient and causing harm.

• Overall Trends:

- The number of patient safety event reports submitted to CHPSO has steadily increased over time from 5,673 reports of events that occurred in July 2007 to 10,357 reports of events that occurred in December 2015. The drop in volume for events that occurred after May 2015 is attributed to the lag in time for submitting events.

- In July 2007, more than 4% of event reports involved high harm to the patient. This number declined to less than 1% by December 2015, indicating that the number of non-high-harm events reported had more than quadrupled compared with high-harm events during the 10 years.

References

Agency for Healthcare Research and Quality. Health Care–Associated Infections.

<https://psnet.ahrq.gov/primers/primer/7>. Last updated July 2016. Accessed July 19, 2017.

Agency for Healthcare Research and Quality. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Comparative Effectiveness Review No. 211. Rockville, MD: Agency for Healthcare Research and Quality; March 2013. AHRQ Publication No. 13-E001-EF.

<http://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/evidence-based-reports/services/quality/ptsafetyII-full.pdf>. Accessed July 19, 2017.

Arriaga AF, Lancaster RT, Berry RW, et al. The better colectomy project: association of evidence-based best-practice adherence rates to outcomes in colorectal surgery. *Ann Surg* 2009 Oct;250(4):507-13.

<http://www.ncbi.nlm.nih.gov/pubmed/19734778>. Accessed July 19, 2017.

Centers for Disease Control and Prevention. Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and non-central line-associated Bloodstream Infection).

https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf. Last updated January 2017. Accessed July 19, 2017.

Centers for Disease Control and Prevention. Healthcare-associated Infections (HAI) Progress Report.

<https://www.cdc.gov/hai/surveillance/progress-report/index.html>. Last updated March 2016a. Accessed July 19, 2017.

Centers for Disease Control and Prevention. Urinary Tract Infections (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events. Device-associated module. 2016b.

<http://www.cdc.gov/nhsn/pdfs/pscmanual/7pscclauticurrent.pdf>. Accessed July 19, 2017.

Dudeck MA, Edwards JR, Allen-Bridson K, et al. National Healthcare Safety Network report, data summary for 2013, Device-associated Module. *Am J Infect Control* 2015;43(3):206-21.

<http://doi.org/10.1016/j.ajic.2014.11.014>. Accessed July 19, 2017.

Hines AL, Jiang HJ. Rates of obstetric trauma, 2009. Healthcare Cost and Utilization Project, Statistical Brief #129.

Rockville, MD: Agency for Healthcare Research and Quality; April 2012. <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb129.pdf>. Accessed July 19, 2017.

Institute of Medicine. Preventing Medication Errors: Quality Chasm Series. 2007.

<http://www.nap.edu/catalog/11623/preventing-medication-errors-quality-chasm-series>. Accessed July 19, 2017.

National Association for Home Care & Hospice. Basic Statistics About Home Care. Updated 2010.

http://www.nahc.org/assets/1/7/10hc_stats.pdf. Accessed July 19, 2017.

Pisoni RL, Zepel L, Port FK, et al. Trends in U.S. vascular access use, patient preferences, and related practices: an update from the U.S. DOPPS practice monitor with international comparisons. *Am J Kidney Dis* 2015;65(6):905-15.