The Development of Emergency Department Patient Quality/Safety Indicators

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Overview

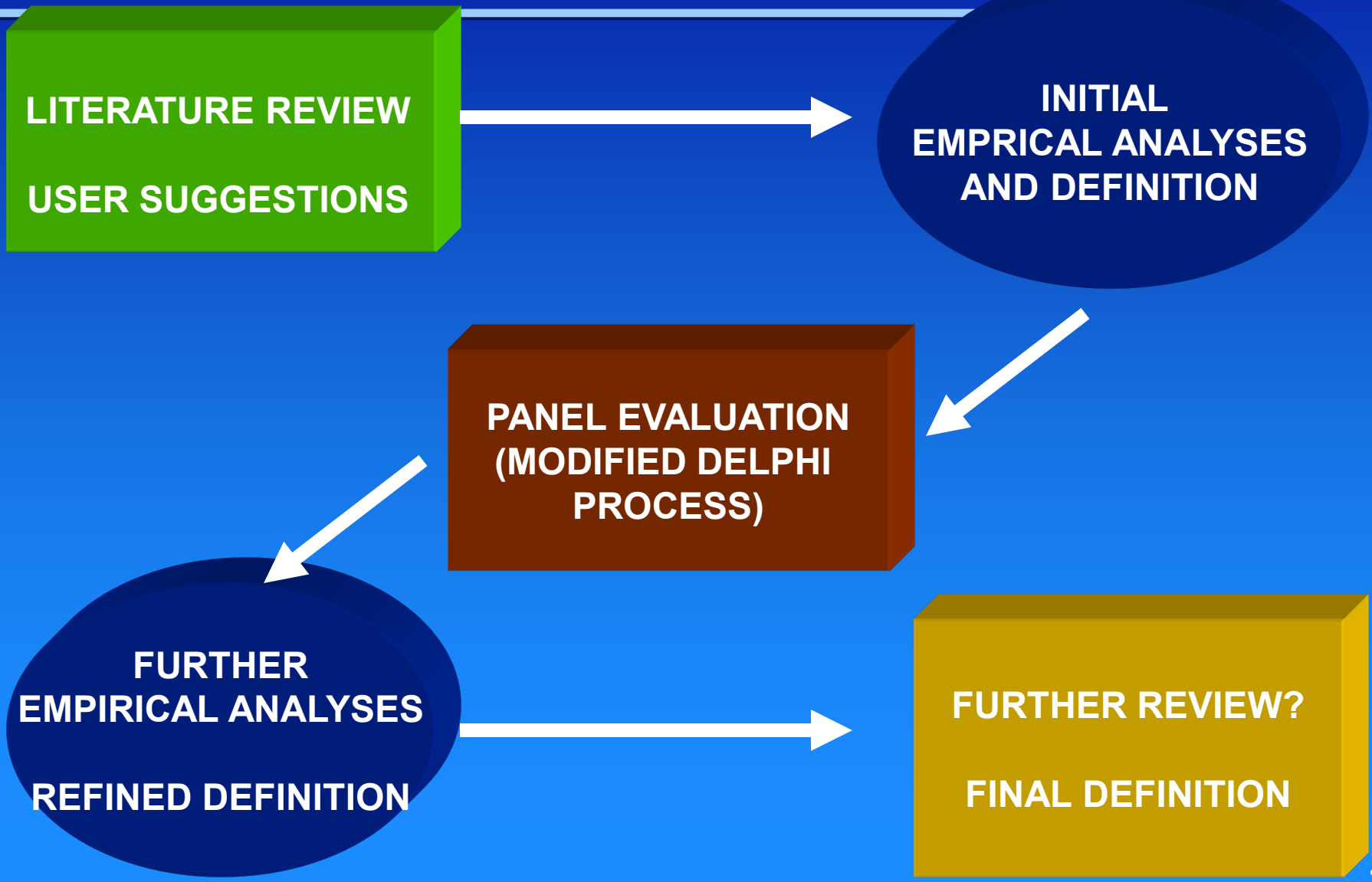
- Goals and scope of current project
- Conceptual frameworks
- Literature review
- Matrix of potential indicators
- Specification
- Preliminary results
- Recommendations and next steps

AHRQ Quality Indicators (QIs)

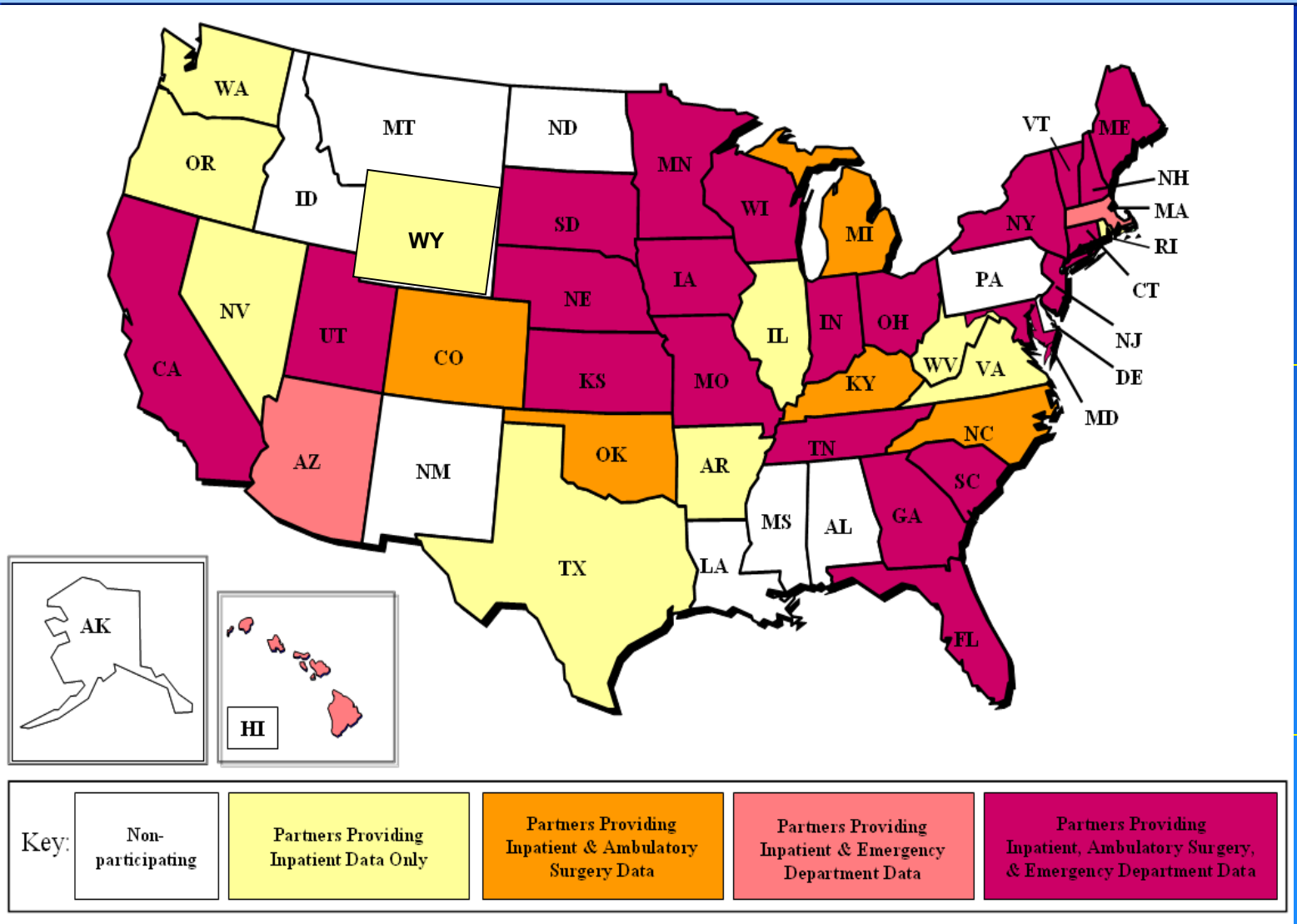
- Developed through contract with UCSF-Stanford Evidence-based Practice Center & UC Davis, maintained and extended through contract with Battelle
- Use existing HCUP (hospital discharge) data, based on readily available data elements
- Incorporate a range of severity adjustment methods, including APR-DRGs* and comorbidity groupings
- Disseminate software and support materials free via www.qualityindicators.ahrq.gov
- Provide technical support to users
- Continuous improvement through user feedback, annual coding updates, validation projects

* All Patient Refined - Diagnosis Related Groups

Evidence-based indicator development



The HCUP Partnership: A Voluntary Federal-State-Private Collaboration

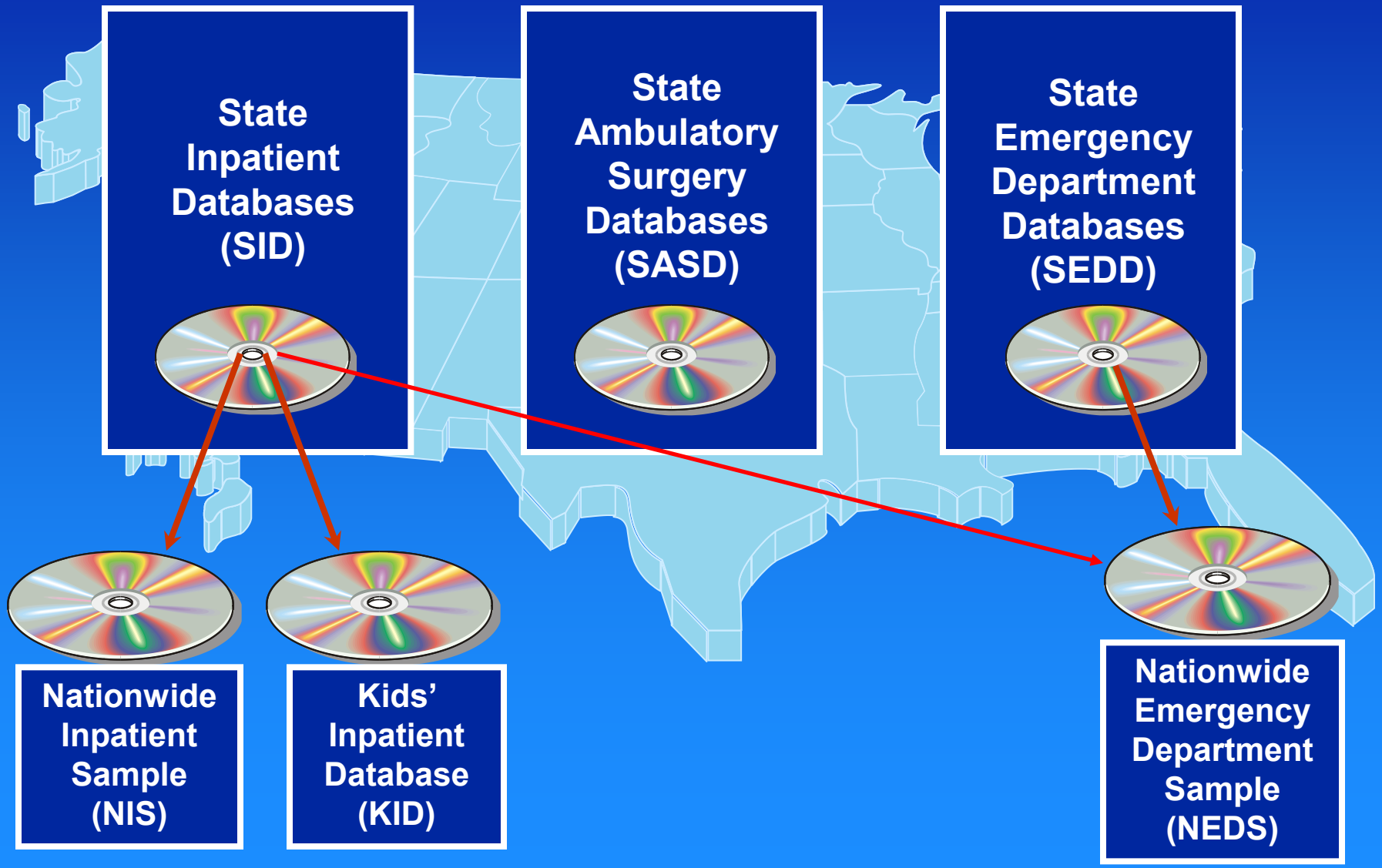


40+ states

90% of all discharges

24+ states submit ED encounters

Types of HCUP Databases



Goals and Scope

- Goals
  - Develop quality/safety indicators, using HCUP data, that are applicable to the emergency department setting of care
  - Set the stage for future incorporation into publicly available AHRQ QI software
- Scope
  - Implement the established AHRQ QI measure development process
  - Adapt existing AHRQ QI to ED setting when possible
  - Identify and evaluate new candidate indicators based on established measurement concepts

IOM Committee on the Future of Emergency Care in the United States Health System (2007)

- Called for "a standard national approach to the development of performance indicators"
- "The measures developed should include structure and process measures, but evolve toward outcome measures over time... (and) should be nationally standardized so that comparisons can be made across regions and states."
- "Measures should evaluate the performance of individual providers within the system, as well as that of the system as a whole… (and) be sensitive to the interdependence among the components of the system."
- "Performance data should be collected on a regular basis from all of the emergency care providers in a community" and then publicly disseminated…"

Conceptual framework for prioritization: Institute of Medicine, 2007

Domain	Application to the ED
Safe	High-risk, high-stress environment "fraught with opportunities for error"… frequent interruptions and distractions, crowding, need for rapid decision-making with incomplete information, barriers to effective communication and teamwork, difficulty obtaining timely diagnostic tests
Effective	Limited by deficiencies in pre-hospital care, unavailability of trained specialists, lack of access to patients' prior medical records, poor primary care follow-up, inability to coordinate care across settings
Patient-centered	Crowding, long wait times, boarding of admitted patients in hallways, design emphasis on visibility and monitoring rather than privacy
Timely	Designed to provide timely care for emergent medical problems, but often overwhelmed by the demand for their services…
Efficient	Frequently asked to provide care for which it is not the most efficient setting… primary care, urgent care for minor complaints, and inpatient care to admitted patients compromises efficiency
Equitable	EMTALA requires EDs to treat all patients equitably… (but) variation in resources and personnel across communities may create inequities in how patients in different EDs are treated

Conceptual framework for prioritization: Institute of Medicine, 2010

Crosscutting Dimensions	Components of Quality Care	Type of Care		
		Preventive Care	Acute Treatment	Chronic condition management
EQUITY / VALUE	Effectiveness			
	Safety			
	Timeliness			
	Patient/family-centeredness			
	Access			
	Efficiency			
	Care Coordination			
	Health Systems Infrastructure Capabilities			

Conceptual framework for prioritization:
ICES/Alberta Quality Matrix for Health, 2010

Domain	Examples
Acceptability	Health services are respectful and responsive to user needs, preferences and expectations.
Accessibility	Health services are obtained in the most suitable setting in a reasonable time and distance.
Appropriateness	Health services are relevant to user needs and are based on accepted or evidence-based practice.
Effectiveness	Health services are provided based on scientific knowledge to achieve desired outcomes.
Efficiency	Resources are optimally used in achieving desired outcomes.
Safety	Mitigate risks to avoid unintended or harmful results.
Healthy workplace	Provision of health services does not lead to an unhealthy work environment for health care staff.

Conceptual framework for prioritization:
American College of Emergency Physicians, 2009

Domain	Examples
Access to emergency care	Access to providers, access to treatment centers, financial barriers, hospital capacity
Quality and patient safety environment	State-supported systems, institutional barriers
Medical liability environment	Legal atmosphere, insurance availability, tort reform
Public health and injury prevention	Traffic safety and drunk driving, immunization, injury control, state injury prevention efforts, health risk factors
Disaster preparedness	Financial resources, state coordination, hospital capacity, personnel

Application of conceptual framework

	Structure	Process	Outcome
Effective	Nurse staffing and skill mix (RN/total) in ED	**Aspirin at arrival for AMI (TJC/CMS)**	Percentage of asthma encounters followed by revisit (or admission to hospital) within 3 days
Patient Centered	Use of survey data in PDSA cycles to improve patient centered care in ED	Percentage of patients undergoing painful procedures who have pain score documentation	**Percentage of patients leaving ED without being seen by a physician (proxy outcome, LSU Health Services)**
Timely	ED triage policies to ensure timely evaluation of high-acuity patients	**Median time from ED arrival to ED departure for admitted ED patients (CMS)**	Percentage of orthopedic pain patients with 3-point reduction in pain score within 60 minutes
Safe	Computerized physician order entry with decision support tools to detect medication errors	**Confirmation of endo-tracheal tube placement (Cleveland Clinic Foundation)**	**Death or disability due to air embolism from a medical device (NQF)**
Efficient	Availability of laboratory and radiologic support to facilitate rapid evaluation and disposition in ED	Percentage of low back pain patients with appropriate diagnostic test utilization	Dollars per episode of low back pain evaluated in the ED
Equitable	Availability of adequate interpreting services in ED	Percentage of non-English speaking patients for whom interpreting services are used	Disparity in any other outcome according to primary language

Literature review: strategy

Search goal:

- To find studies that introduced or used quality of care measures to assess patient safety in hospital emergency departments.

Search strategy using MESH headings in PubMed:

- ("Quality Assurance, Health Care"[Mesh] OR "Quality Indicators, Health Care"[Mesh] OR "Quality of Health Care"[Mesh] OR "Health Care Quality, Access, and Evaluation"[Mesh] OR "United States Agency for Healthcare Research and Quality"[Mesh] OR "Outcome Assessment (Health Care)"[Mesh])
  AND "Emergency Service, Hospital"[Mesh]
  AND ("Medical Errors"[Mesh] OR "Malpractice"[Mesh] OR "Safety"[Mesh] OR "Equipment Safety"[Mesh] OR "Safety Management"[Mesh])

Validation using title and/or abstract keywords:

- “patient safety” OR “adverse event” OR “avoidable condition”
  AND “quality”
  AND (“emergency room” OR “emergency department”
- For the most important papers, we searched for ‘all related articles’

Literature review: process

- PubMed:
  - 1,050 abstracts, decreased to 687 when limited to human subjects, English language, date within 10 yrs.
  - All abstracts were reviewed for relevance (i.e., describing one or more measures of ED quality/safety).
- Similar review by Alessandrini et al. for PECARN
- Organizations and websites
  - National Quality Measures Clearinghouse (AHRQ)
  - National Quality Forum
  - Federal: AHRQ QIs and CMS/QualityNet
  - ED: ACEP and SAEM
  - AMA: Physician Consortium for Performance Improvement
  - Other developers: NCQA and The Joint Commission
  - Institute of Medicine/National Academy of Sciences
  - Canada: Institute for Clinical Evaluative Sciences, Canadian Institute for Health Information

Literature review: key themes

40 journal papers, 23 documents and reports

- Some TJC Core Measures address processes of care in ED management of pneumonia or myocardial infarction
- Critical trauma or shock care, generally based on detailed "peer" review of medical records to assess appropriateness and timeliness of diagnostic and therapeutic interventions
- Time-based measures of waiting time, total LOS in the ED, ED disposition time for admitted/transferred patients
- Appropriate prescribing and avoidance of medication errors for common conditions: asthma, bronchiolitis, acute GE, laceration
- Appropriate use of imaging studies, laboratory, ECG
- Appropriate assessment of pain, oxygenation, cognition
- “Left without being seen" or "left AMA" (premature ED discharge)
- “Missed diagnosis” identified by return within defined time window for a serious condition
- Revisits to ED within time window for same or related condition

Matrix of potential indicators
Inclusion/exclusion criteria

- Identified from published source
  - Literature review (40 journal articles)
  - Organizations and websites (if a consensus-based approach and/or modified Delphi approach was used)
- Address the domains of effectiveness and/or safety
  - A few measures of timeliness were included because the measure developer characterized them as having implications for safety in the ED
- Focus on care provided in the ED (not pre-hospital care)
- Clinical guidelines, standards of care, and ED decision rules were not included unless operationalized as indicators
- Can be implemented in at least one HCUP partner state using available HCUP data
- When ≥2 indicators addressed the same outcome, only the more recent and/or more clearly specified indicator was retained
- Excluded measures that were evaluated and discarded or rejected through a consensus-based expert panel process

Matrix of potential indicators
Application of existing inpatient PSIs

- Foreign body left in
- Iatrogenic pneumothorax
- “Postoperative” hip fracture
- “Postoperative” hemorrhage or hematoma
- Accidental puncture or laceration
- Transfusion reaction

Matrix of potential indicators
35 new candidate indicators

- Age range
  - 12 for children only
  - 10 for adults only
  - 13 for both children and adults
- Donabedian's typology
  - 11 process
  - 17 outcome (or proxy outcome such as revisit)
  - 6 hybrid ("missed serious diagnosis")
  - 1 patient experience or health risk behavior ("left AMA")
- Developer(s)
  - 20 Institute for Clinical Evaluative Sciences, specified in ICD-10-CA
  - 3 ACEP and/or PCPI
  - 3 CMS
  - 4 other organizations
  - 5 researchers
- Endorsement - 6 endorsed by NQF

Matrix of potential indicators
35 new candidate indicators

- Revisits - 13
  - 4 within 24 hours (1 specified as 24 hrs or 72 hrs)
  - 3 within 48 hours (2 specified as 48 hrs or 72 hrs)
  - 6 within 72 hours (1 specified as 72 hrs or 1 week)
- Missed serious diagnoses - 7
  - 1 unanticipated death within 7 days following ED care
  - 6 admission for missed diagnosis (AMI/ACS, SAH, ectopic pregnancy, traumatic injury, appendicitis)
- Appropriate use of diagnostic test or imaging – 5
- Acute complications of ED procedures – 3
- Time within ED awaiting definitive care – 3
- Appropriate admission for inpatient care – 2
- Appropriate use of treatment or intervention – 1
- Left “against medical advice” – 1

Challenges in specification and testing with HCUP data

- Identification of patients “at risk”
  - What procedures place patients at risk for hemorrhage, pneumothorax, or accidental puncture/laceration?
- Timing
  - Only 5 states (GA, MA, MN, NJ, TN) have POA in SEDD; only MA and TN also have PNUM
  - In SID, POA means “present at the time the order for inpatient admission occurs” and ED dx may be lost
- Low frequency with “true” frequency unknown
  - Unable to choose “best” specification
- Uncertain validity of utilization flag variables to identify patients who had specific procedures (US, ECG, CT)
- Unable to operationalize all specifications
  - Exclusion of “planned” (or “invited”) return visits to ED
  - All presenting symptoms for “missed diagnoses”

Iatrogenic pneumothorax 8 states, 2005-2008

STATE	Calendar year	Denominator	Numerator with POA Missing	Numerator with POA=N
A	2005-2008	6660	*	0
B	2005-2008	22518	14	0
C	2005-2008	1487	0	0
D	2005-2008	13120	36	0
E	2005-2008	235	0	0
F	2005-2008	35816	*	0
G	2005-2008	10172	*	*
H	2005-2008	2414	0	0

Eligible patients – central venous catheterization (including transvenous pacemaker); thoracentesis; pericardiocentesis; paracentesis; insertion of ETT with or without mechanical ventilation

Postoperative hemorrhage or hematoma 8 states, 2005-2008

STATE	Calendar year	Denominator	Numerator with POA Missing	Numerator with POA=N
A	2005-2008	77622	0	0
B	2005-2008	314272	16	0
C	2005-2008	15481	0	0
D	2005-2008	141246	18	0
E	2005-2008	1980	0	0
F	2005-2008	150588	*	0
G	2005-2008	97784	0	0
H	2005-2008	25427	0	0

Eligible patients – central venous or arterial catheterization; aspiration or I&D; thoracentesis or thoracostomy; pericardiocentesis; paracentesis; insertion of ETT or rectal tube; LP; nerve block, fecal disimpaction

EDPSI #4 Potentially Missed Acute Myocardial Infarction (AMI)

Numerator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 to 95 years, meeting the inclusion and exclusion rules for the denominator and dated no more than 7 days previous to the linked SID record, with an eligible diagnosis code for a chest pain-related condition in any ICD-9-CM diagnosis field.

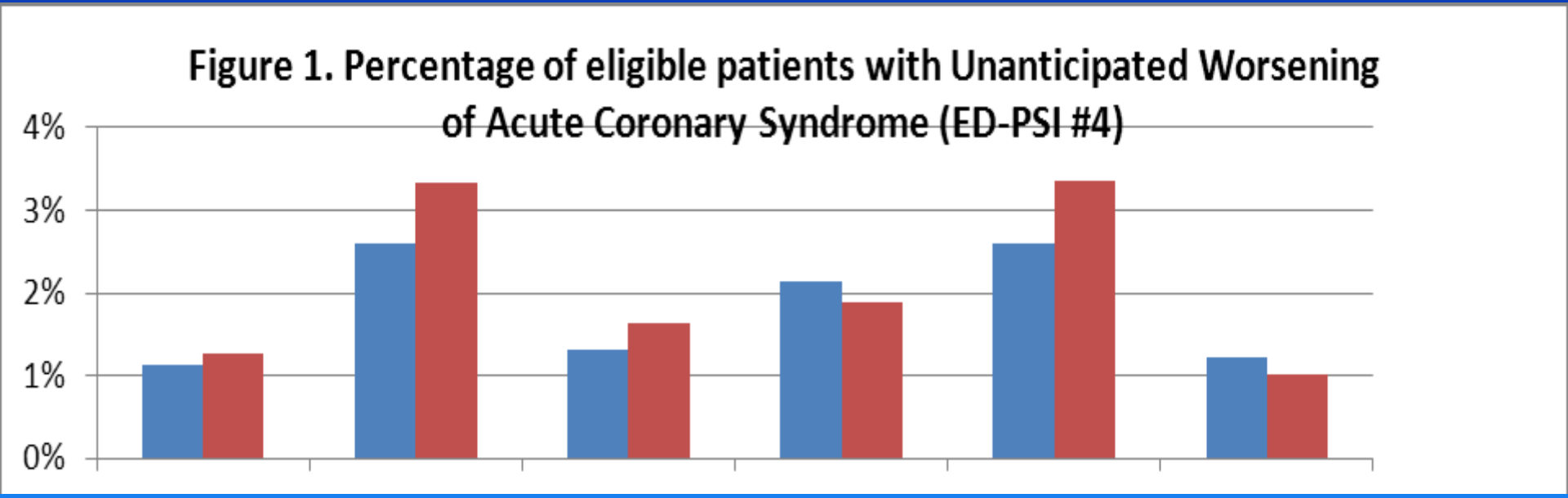
Denominator

STATE INPATIENT DATABASES: All hospital discharges, age 18 to 95 years, with an eligible diagnosis code of acute myocardial infarction (AMI) in the ICD-9-CM principal diagnosis field and HCUP_ED>0.

Exclude all records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any AMI diagnosis (ICD-9-CM 410.00-410.92) on any linked SID record in the 12 months before this admission (if linked data are available).

Variation across states and years



Blue = 2007
Red = 2008

CV = 0.38-0.49
Year-year corr = 0.94

EDPSI #5 Electrocardiogram for Non-Traumatic Chest Pain

Numerator

Emergency department discharges meeting the inclusion and exclusion rules for the denominator with a utilization flag (U_EKG>0) indicating that an electrocardiogram (ECG) was performed and billed (based on an NUBC revenue code of 730 [EKG/ECG], 731 [Holter monitor], or 739 [Other EKG/ECG]; or an ICD-9-CM procedure code of 89.51 [rhythm electrocardiogram] or 89.52 [electrocardiogram]).

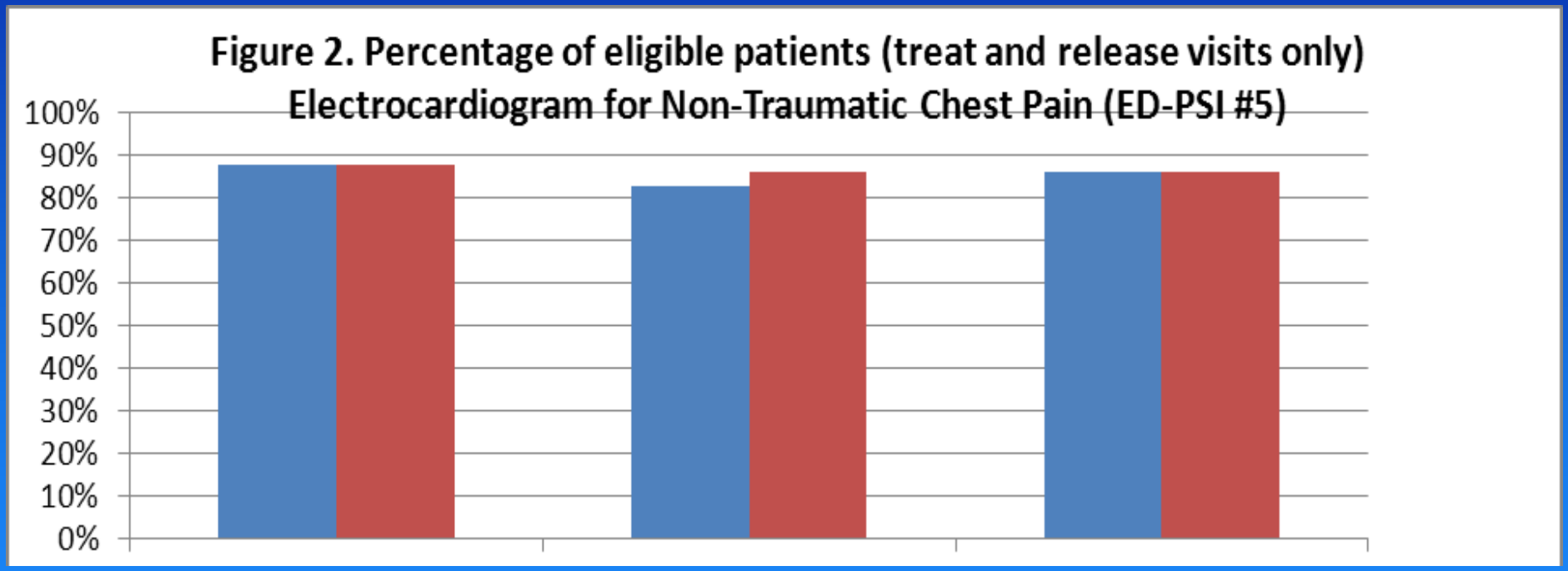
Denominator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 40 years or older, with an eligible diagnosis code of nontraumatic chest pain in any ICD-9-CM diagnosis field and HCUP_ED>0.

Exclude all records with:

- A principal or secondary diagnosis of ventricular fibrillation (427.41), ventricular flutter (427.42), or cardiac arrest (427.5).
- Any procedure of cardiopulmonary resuscitation, not otherwise specified (99.60), or closed chest cardiac massage (99.63).
- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any documentation indicating death in the ED (DISPUNIFORM=20).
- Any documentation indicating patient left the ED against medical advice (DISPUNIFORM=7).

Variation across states and years



Blue = 2007
Red = 2008

CV = 0.01-0.03
Year-year corr = 0.79

EDPSI #6 Electrocardiogram For Stroke

Numerator

Emergency department discharges meeting the inclusion and exclusion rules for the denominator with a utilization flag (U_EKG>0) indicating that an electrocardiogram (ECG) was performed and billed (based on an NUBC revenue code of 730 [EKG/ECG], 731 [Holter monitor], or 739 [Other EKG/ECG]; or an ICD-9-CM procedure code of 89.51 [rhythm electrocardiogram] or 89.52 [electrocardiogram]). Exclude numerator records with an ICD-9-CM procedure code for electrocardiogram (89.52) dated after the date of admission to the hospital.

Denominator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 years or older, with an eligible diagnosis code of stroke in any ICD-9-CM diagnosis field and HCUP_ED>0.
STATE INPATIENT DATABASES: All hospital discharges, age 18 years or older, with an eligible diagnosis code in the ICD-9-CM principal diagnosis field and HCUP_ED>0.

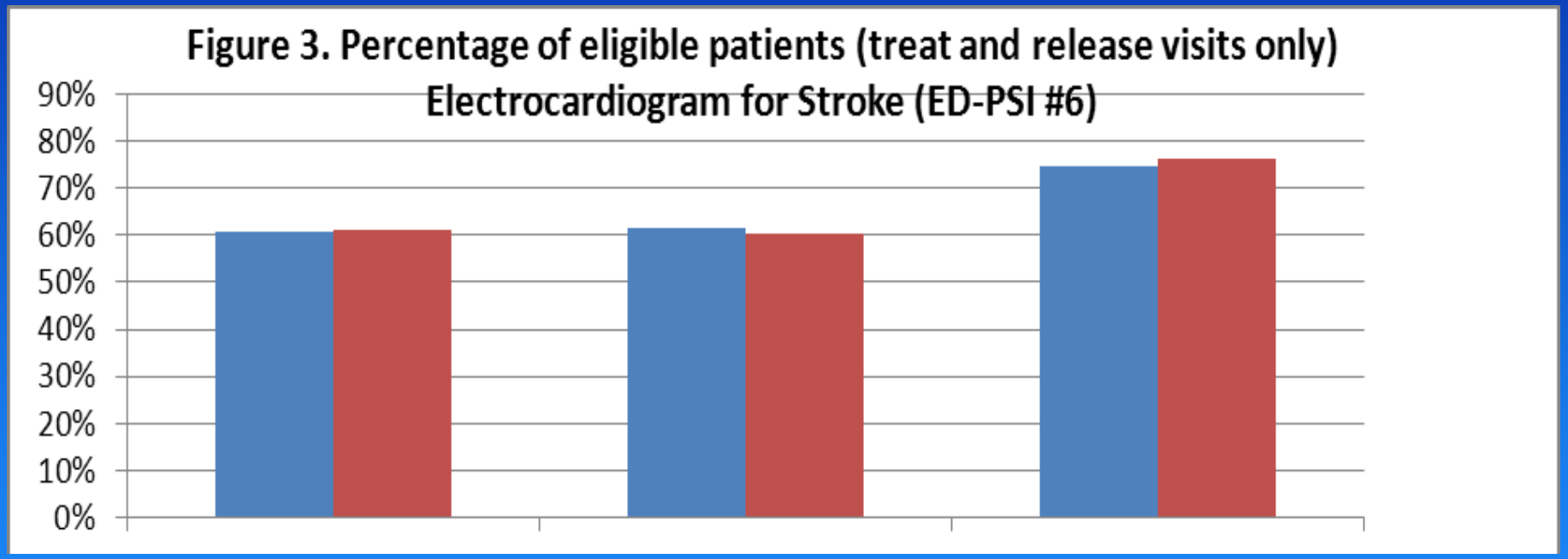
Exclude all SEDD records with:

- A principal or secondary diagnosis of ventricular fibrillation (427.41), ventricular flutter (427.42), or cardiac arrest (427.5).
- Any procedure of cardiopulmonary resuscitation, not otherwise specified (99.60), or closed chest cardiac massage (99.63).
- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any documentation indicating death in the ED (DISPUNIFORM=20, DIED=1).
- Any documentation indicating patient left the ED against medical advice (DISPUNIFORM=7).

Exclude all SID records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.

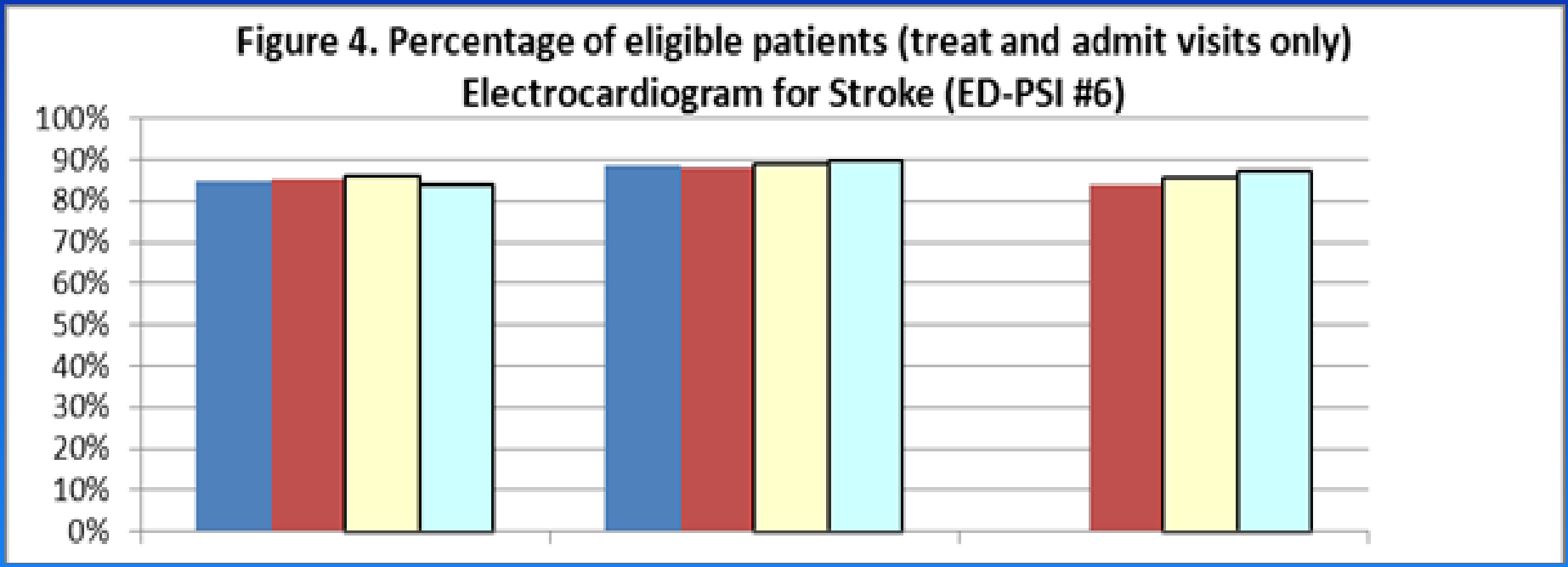
Variation across states and years



Blue = 2007
Red = 2008

CV = 0.12-0.14
Year-year corr = 0.99

Variation across states and years



Blue = 2005
Red = 2006
Gold = 2007
Cyan = 2008

CV = 0.02-0.03
Year-year corr = 0.77-0.98

EDPSI #7 Electrocardiogram For Syncope

Numerator

Emergency department discharges meeting the inclusion and exclusion rules for the denominator with a utilization flag (U_EKG>0) indicating that an electrocardiogram (ECG) was performed and billed (based on an NUBC revenue code of 730 [EKG/ECG], 731 [Holter monitor], or 739 [Other EKG/ECG]; or an ICD-9-CM procedure code of 89.51 [rhythm electrocardiogram] or 89.52 [electrocardiogram]).

Denominator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 60 years or older, with an eligible diagnosis code of syncope in any ICD-9-CM diagnosis field and HCUP_ED>0.
STATE INPATIENT DATABASES: All hospital discharges, age 60 years or older, with an eligible diagnosis code in the ICD-9-CM principal diagnosis field and HCUP_ED>0.

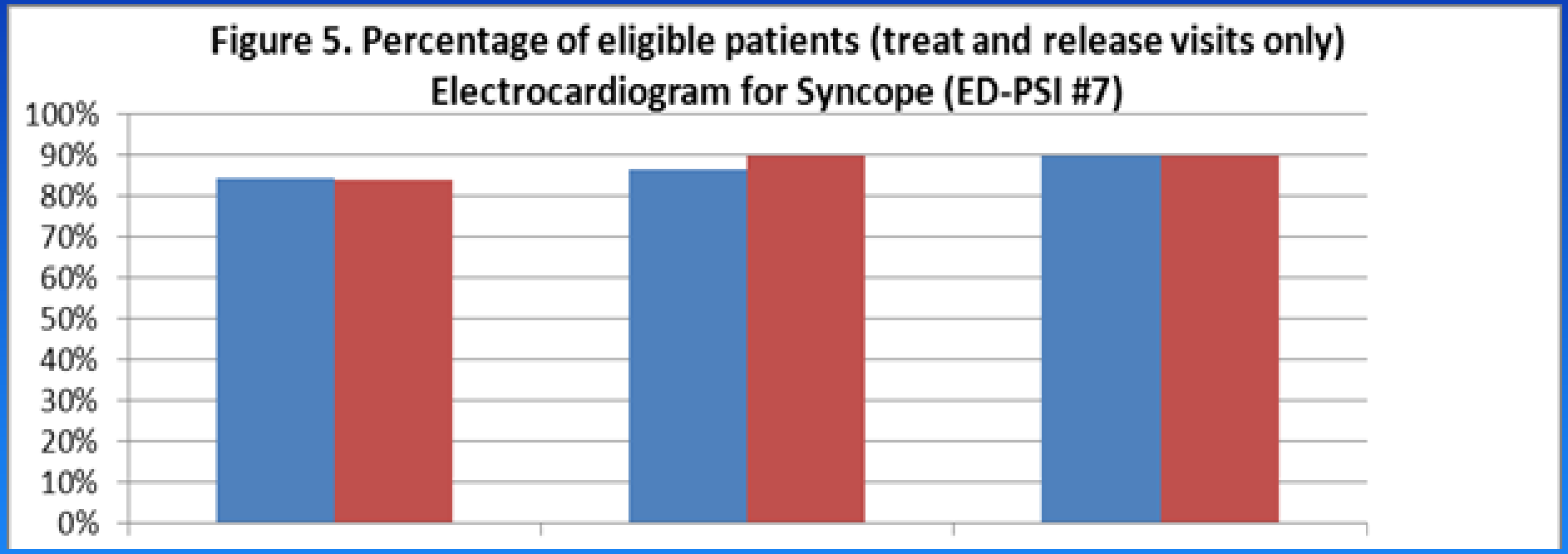
Exclude all SEDD records with:

- A principal or secondary diagnosis of ventricular fibrillation (427.41), ventricular flutter (427.42), or cardiac arrest (427.5).
- Any procedure of cardiopulmonary resuscitation, not otherwise specified (99.60), or closed chest cardiac massage (99.63).
- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any documentation indicating death in the ED (DISPUNIFORM=20, DIED=1).
- Any documentation indicating patient left the ED against medical advice (DISPUNIFORM=7).

Exclude all SID records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.

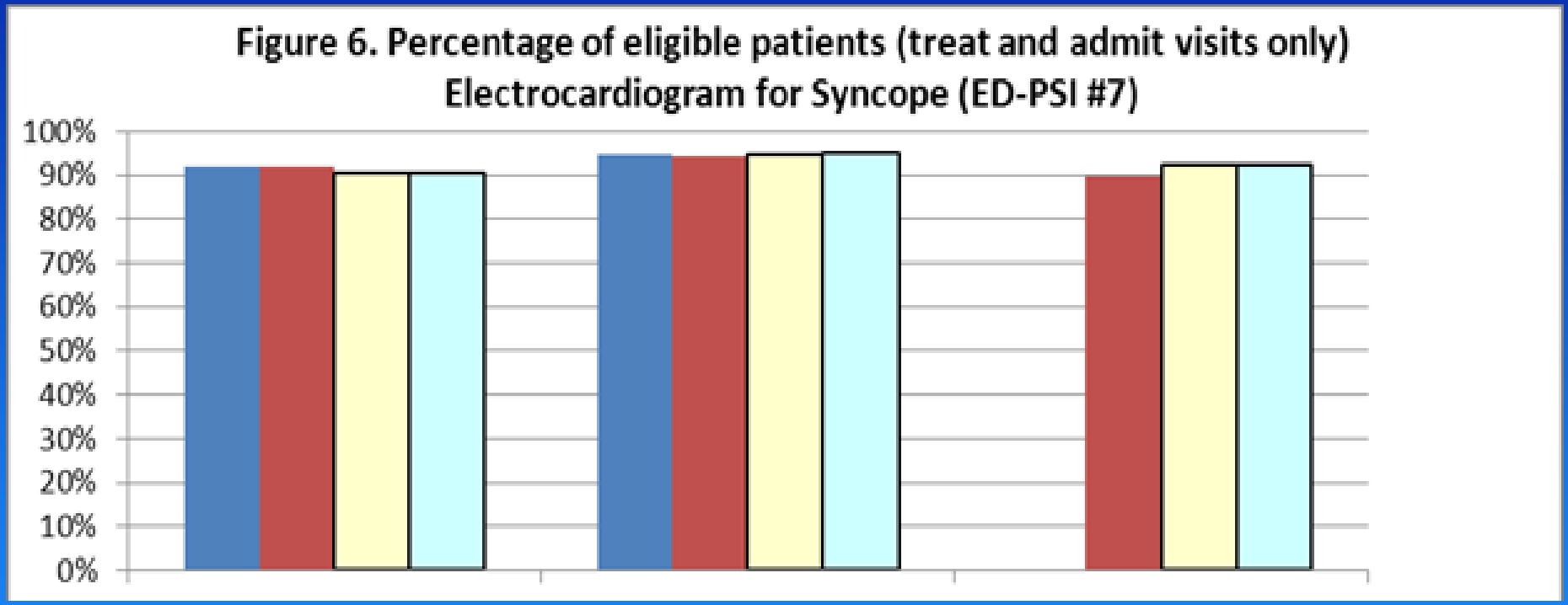
Variation across states and years



Blue = 2007
Red = 2008

CV = 0.03-0.04
Year-year corr = 0.76

Variation across states and years



Blue = 2005
Red = 2006
Gold = 2007
Cyan = 2008

CV = 0.02
Year-year corr = 0.51-0.999

EDPSI #8 Asthma Revisit

Numerator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 years or older, meeting the inclusion and exclusion rules for the denominator and dated no more than 1 day after the previous linked SEDD record, with an eligible diagnosis code of asthma or related symptoms in any ICD-9-CM diagnosis field, and HCUP_ED>0.
STATE INPATIENT DATABASES: All hospital discharges, age 18 years and older, with an eligible diagnosis code of asthma (493.00-493.12, 493.90-493.92) in the ICD-9-CM principal diagnosis field or in a secondary field with another qualifying diagnosis as the principal diagnosis, with an admission date no more than 1 day after the previous linked SEDD record, and HCUP_ED>0.

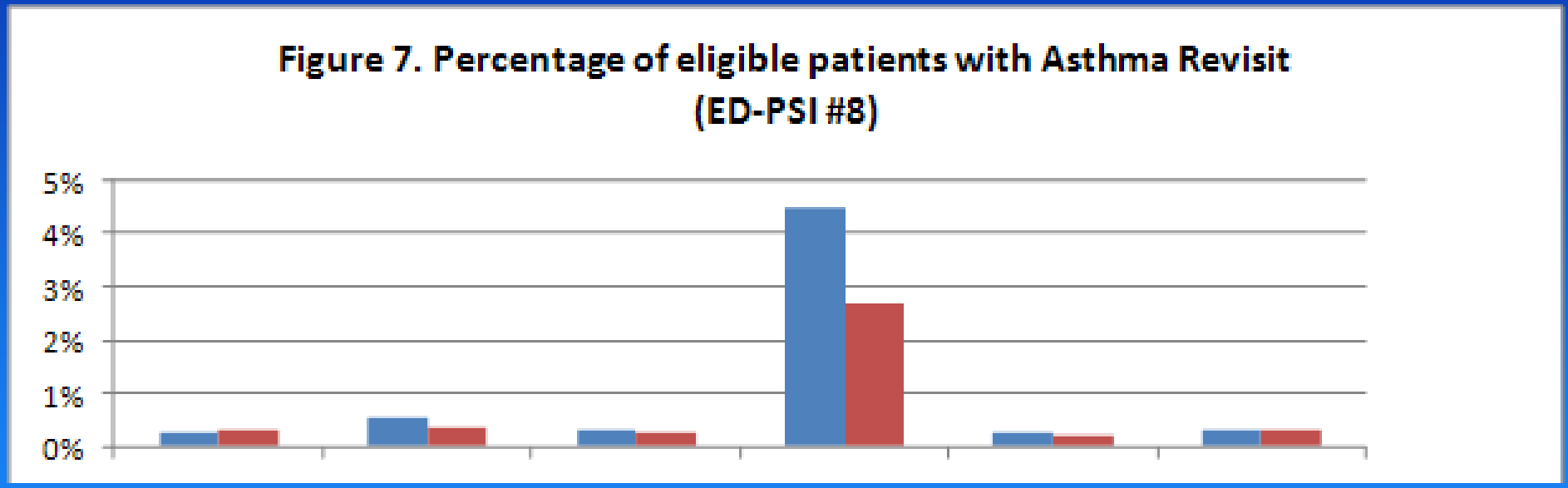
Denominator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 years or older, with an eligible diagnosis code of asthma or related symptoms in any ICD-9-CM diagnosis field, and HCUP_ED>0.

Exclude all records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any documentation indicating death in the ED (DISPUNIFORM=20)

Variation across states and years



Blue = 2007
Red = 2008

CV = 1.44-1.66
Year-year corr = 0.999

EDPSI #9 Missed Subarachnoid Hemorrhage (SAH)

Numerator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 years or older, with an eligible diagnosis code for a headache-related condition in any ICD-9-CM diagnosis field on a visit no more than 14 days previous to a denominator-qualifying SID record, and HCUP_ED>0.

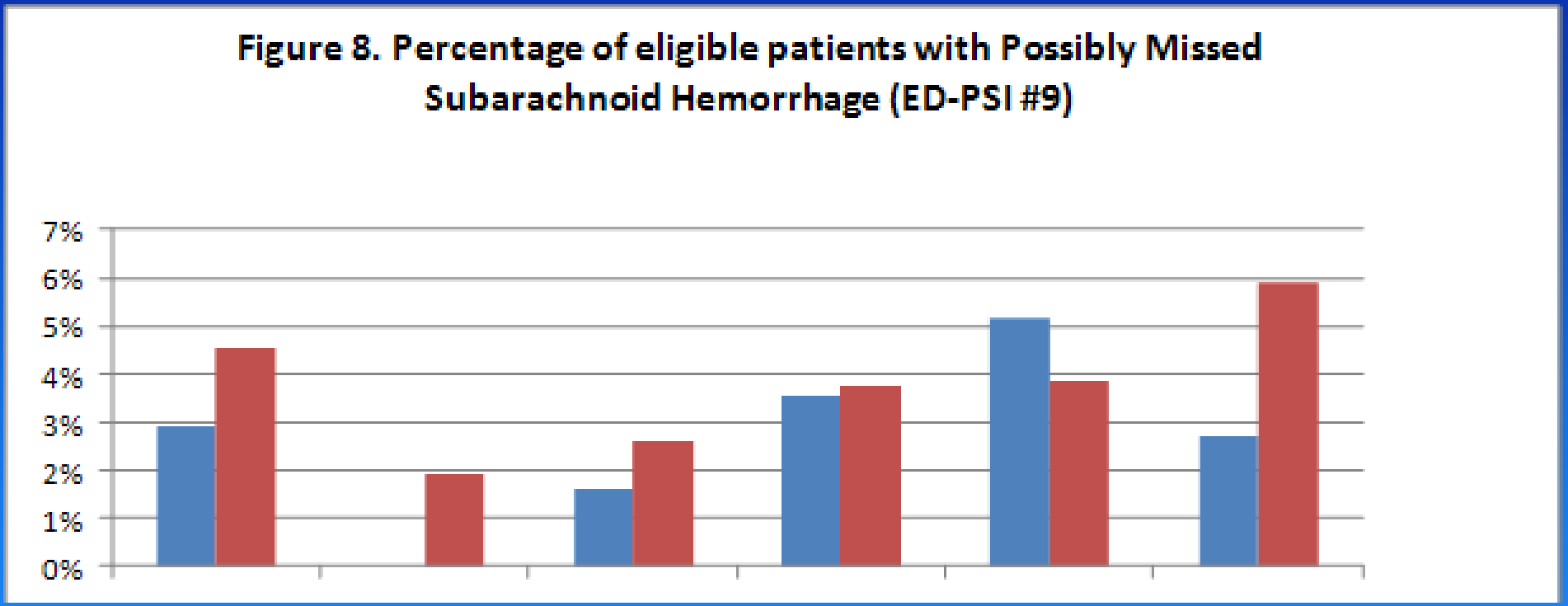
Denominator

STATE INPATIENT DATABASES: All hospital discharges, age 18 years or older, with an eligible diagnosis code of nontraumatic subarachnoid hemorrhage in the ICD-9-CM principal diagnosis field, and HCUP_ED>0.

Exclude all records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any subarachnoid hemorrhage or intracranial aneurysm (ICD-9-CM 430, 437.3, 747.81) on any linked SID record in the 12 months before this admission (if linked data are available).

Variation across states and years



Blue = 2007
Red = 2008

CV = 0.37-0.41
Year-year corr = 0.54

EDPSI #11 Chest Pain Revisit

Numerator

STATE INPATIENT DATABASES: All hospital discharges, age 18 years and older, with a qualifying diagnosis of acute coronary syndrome in the ICD-9-CM principal diagnosis field, with an admission date no more than 7 days after the index visit, and HCUP_ED>0.

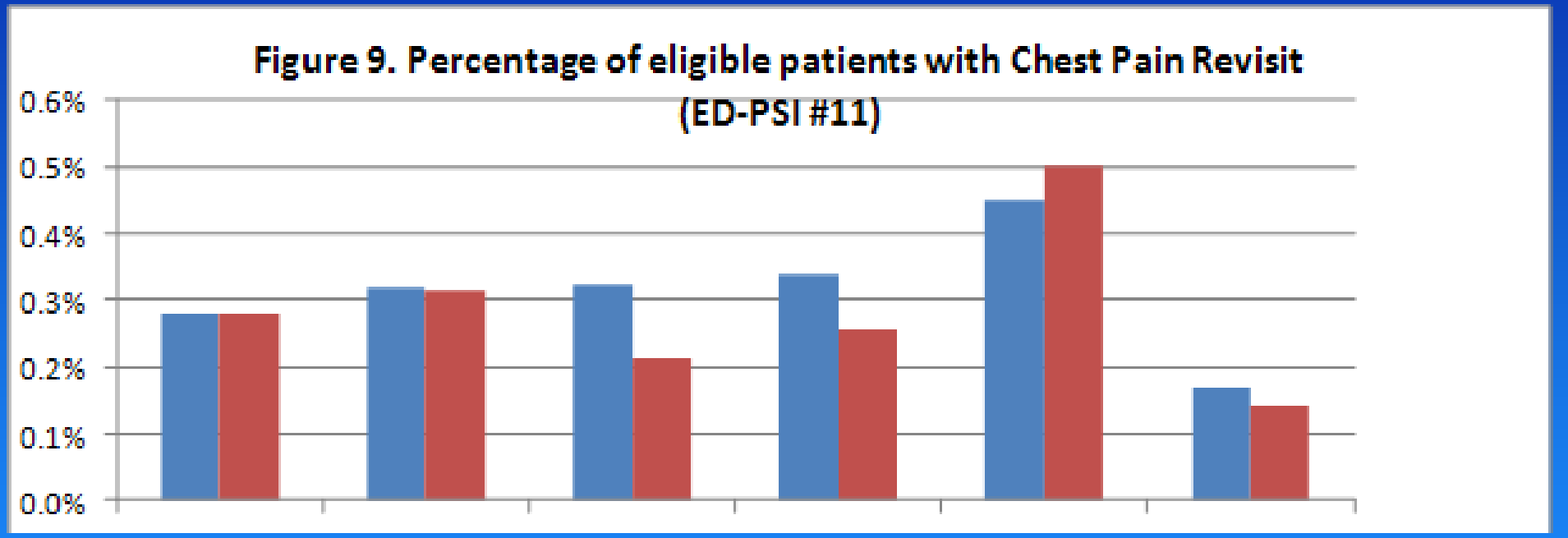
Denominator

STATE EMERGENCY DEPARTMENT DATABASES: All "treat and release" emergency department (ED) discharges, age 18 years or older, with an eligible diagnosis code related to chest pain in any ICD-9-CM diagnosis field and HCUP_ED>0.

Exclude all records with:

- Any diagnosis code assignable to MDC 14 (Complications of Pregnancy, Childbirth & Puerperium), including ICD-9-CM 630-677.
- Any documentation indicating death in the ED (DISPUNIFORM=20)

Variation across states and years



Blue = 2007
Red = 2008

CV = 0.29-0.43
Year-year corr = 0.89

Expert work group

- General interest in quality and safety-related concepts that can theoretically be captured using HCUP data
  - Utilization of indicated services to optimize patient safety
  - Revisits for related conditions after a high-risk index ED visit
  - Prior ED visits for symptoms or signs of a potentially missed dx
- Limited ongoing quality improvement efforts in EDs, typically based on EMR or manual record review
- Some skepticism about whether gaps in care actually exist for ECG utilization
- Questions re face validity of observed variation in the rates of some proposed ED-PSIs across states
- Great interest in preliminary results
- Strong support for further testing and refinement, with a focus on bringing states up to a common standard

Recommendations and next steps

- More states should be included in the next round of empirical analyses, to better understand patterns of variation and the potential scope of use of ED-PSIs.
- Timeliness indicators are not promising, due to the easier availability of "time stamp" data from other sources.
- Utilization-related and revisit-related indicators appear to be most promising for further development and testing.
- Validation work should be undertaken to confirm that administrative data sets consistently capture:
  - relevant service utilization, such as electro-cardiography
  - relevant revisits
- Complications based on current PSIs represent important concepts, but there are severe limitations due to confusion and inconsistency in reporting of POA status
  - Collaboration with HCUP partners needed

Acknowledgments

- UC Davis team
  - Banafsheh Sadeghi (epidemiologist)
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  - Jesse Pines (GWU), Michael Phelan (Cleveland Clinic), Emily Carrier (HSC), Evaline Alessandrini (CCHMC), Astrid Guttmann and Michael Schull (ICES), Jeremiah Schuur (Brigham & Women's), Drew Dawson, MD (Federal Inter-agency Committee on Emergency Medical Services), Rollin Fairbanks (National Center for Human Factors Engineering in Healthcare, MedStar), Andrew Garrett (ASPR), Charlotte Yeh (AARP)
- AHRQ CDOM staff
  - Pamela Owens and Ryan Mutter (ED task)
  - Jenny Schnaier and Carol Stocks (HCUP)
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