

Registry-based analytics for improving emergency care in resource-limited settings

Indigenous Community Emergency Medicine ECHO Session

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I have no conflicts of interest to disclose

Objectives

- To understand what a disease registries are and how they are used clinically and epidemiologically
- To learn the roles and potential uses of an acute care registry
- To explore special considerations for registries in low-resource settings
- To understand what metadata is
- To learn the clinical and epidemiologic implications of metadata in registry development



Disease Registries: Integrated Quality Improvement Tools

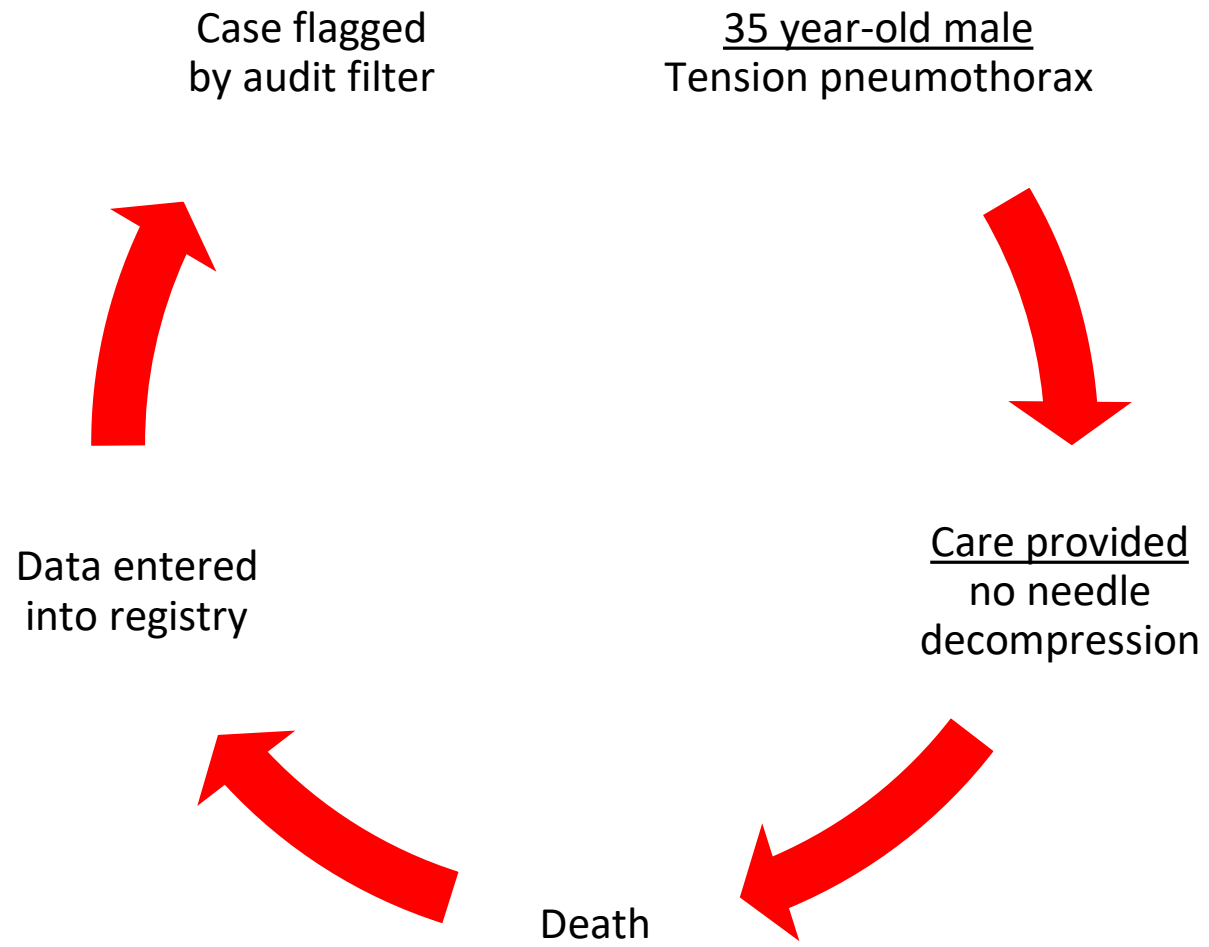
- Disease registries are data repositories with built-in analytic function that use case-level data to identify “potentially preventable outcomes”, failure to follow best practices, and/or epidemiologic trends
- They collect integrated data – from prehospital care to facility-based emergency care
- Diseases for which care is highly algorithmic respond best to such interventions (e.g. acute phases of trauma, STEMI, stroke)



Clinical applications of registries

- First, data are collected on patient presentation, care, and outcome
- Then, data are analyzed to see if poor outcomes were “potentially preventable” or if best practices were not followed
- Finally, these reports are used to inform corrective actions that are aimed at preventing repeat errors





Quality Improvement Cycles

(QI is an *iterative* process)

Corrective action
(targeted provider education)

Case flagged by
audit filter

35 year-old male
Tension pneumothorax

Case flagged by
audit filter

52 year-old female
Tension pneumothorax

Case NOT flagged
by audit filter

41 year-old male
Tension pneumothorax



Data entered
into registry

Care provided
no needle
decompression

Data entered
into registry

Care provided
no needle
decompression

Data entered
into registry

Care provided
needle
decompression



Death

Death

Survival

Trauma registries have demonstrable impact

- Khon Kaen hospital in Thailand suffered from a high trauma burden
- A trauma registry was implemented, a Trauma Audit Committee formed, and corrective actions taken based on registry analytics
- Inpatient trauma mortality decreased by nearly 30%

Charbundchachai et al, J Med Assoc Rhailand, 86(1):1-7, 2003



Explore Global Health Issues

A disease threat anywhere is a disease threat everywhere.

CDC is working 24/7 to prevent, detect, and respond to many types of health threats.



GLOBAL HEALTH
SECURITY



GLOBAL HEALTH
PROTECTION



IMMUNIZATION



TRAVELERS' HEALTH



HIV & TUBERCULOSIS



MALARIA & PARASITIC
DISEASES



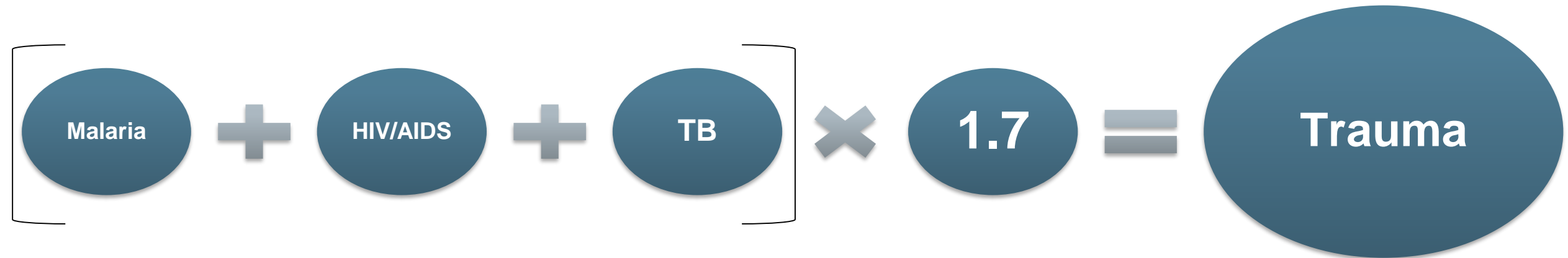
OTHER DISEASES &
THREATS



FOOD & WATER

Why focus on trauma?

- Injuries claim the lives of over **5 million people per year**
- **14,000 deaths per day**
- **9%** of global mortality
- **950,000** children killed each year



Acute Care Registry

Phoenix Area Indian Health Service

Trauma Module Selected Indicators & Metrics

Indicator	Metric	Data Elements for Calculation	Definition	Rationale	Source
Prehospital & Transport Care					
EMS Airway Protection for Altered Mental Status		Prehospital GCS Prehospital Trauma Interventions	Was airway protection given (repositioning, OPA, NPA, ETT, etc) for patients with GCS \leq 8	Will use to educate EMS on airway protection indications	WHO IRTEC
Supplemental O2 for hypoxia		Prehospital O2 Sat Prehospital Trauma Interventions	Was supplemental oxygen given for patients with prehospital hypoxia (O2<90)	Will use to educate EMS on prehospital resuscitation	CCC
Access obtained for hypotension		Prehospital SBP Prehospital Trauma Interventions	Was an IV or IO established for patients with prehospital hypotension (SBP<90)	Will use to educate EMS on prehospital resuscitation	CCC
Pelvic binder for hypotension		Prehospital SBP Prehospital Trauma Interventions	Was a pelvic binder placed for patients with prehospital hypotension (SBP <90)	Used to guide EMS practice	Australian National Trauma Research Institute
EMS Notification to Receiving Facility		Prearrival notification	Percent of patients for whom EMS called for prearrival notification	Used to guide EMS practice	CCC
Time to Hospital-Based Emergency Care	Injury to EMS Arrival Time	Symptom Onset / Injury Date Estimated Symptom Onset / Injury Time EMS Arrival at Scene Date EMS Arrival at Scene Time	The time difference between the moment the patient was injured and the moment EMS arrived on scene	Can be used to evaluate EMS response time and/or to guide care seeking behavior educational interventions	WHO IRTEC
	EMS Arrival to ED Arrival Time	EMS Arrival at Scene Date EMS Arrival at Scene Time ED Arrival Date ED Arrival Time	The time difference between the moment EMS arrived on scene and the moment EMS arrived at the facility	Can be used to evaluate duration of scene care and/or EMS transport time	WHO IRTEC
Facility Care					
ED Airway Protection for Altered Mental Status		ED Airway Interventions Initial GCS - Total	Was airway protection given (repositioning, OPA, NPA, ETT, etc) for patients with GCS <8	Will use to educate ED providers on airway protection indications	WHO IRTEC
Supplemental O2 for hypoxia		Prehospital O2 Sat Prehospital Trauma Interventions	Was supplemental oxygen given for patients with prehospital hypoxia (O2<90)	Will use to educate EMS on prehospital resuscitation	CCC
Resuscitation for hypotension		Initial SBP Medication Administration Record	Were fluids or blood given for patients with prehospital hypotension (SBP<90)	Will use to educate ED providers on trauma resuscitation	PAIHS / Australian National Trauma Research Institute
E-FAST performed if indicated		Standardised Diagnosis Initial SBP Initial O2 Saturation Was eFAST performed?	Was an E-FAST exam performed if SBP<90 or O2 Sat<90 or HR>120 for adults and ***** for kids age A-B, or ***** for kids age B-C, etc.	Will be used to educate ED providers on indications for FAST exam	PAIHS
Early Head CT for Altered Mental Status	Time to order CT	ED Arrival Date ED Arrival Time Initial GCS - Total CT Head Order Date CT Head Order Time	Average time for patients with a Glasgow Coma Scale score <13 to receive a head computerized tomography (CT) scan	Will use to evaluate and optimize patient flow from registration to CT	WHO IRTEC (list of potential audit filters) PAIHS
	Time to perform CT	CT Head Order Date CT Head Order Time CT Head Performed Date CT Head Performed Time			
	Time to read CT	CT Head Performed Date CT Head Performed Time CT Head Read Date CT Head Read Time			
ED Length of Stay	ED Arrival to Dispo Decision Time	ED Arrival Date ED Arrival Time Decision to Transfer Date Decision to Transfer Time	Time from ED Arrival until the decision to transfer a patient is made by the provider	Will be used to evaluate efficiency in throughput for major injury requiring transfer for definitive care	WHO IRTEC / PAIHS
	Dispo Decision to ED Departure time	Decision to Transfer Date Decision to Transfer Time ED Departure Date ED Departure Time	Time from the decision to transfer a patient is made by the provider until the patient physically departs from the ED	Will be used to evaluate efficiency in throughput for major injury requiring transfer for definitive care	WHO IRTEC / PAIHS
	ED Arrival to Departure (other than transfer) Time	ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time	Time from ED arrival until the patient eloped, left AMA, was discharged, was admitted, or died	Will be used to evaluate efficiency in throughput for major injury requiring transfer for definitive care	WHO IRTEC / PAIHS

STEMI Module Selected Indicators & Metrics

Health System, Epidemiology, and Prevention					
Aspirin Administration	Prehospital Aspirin Administration	Prehospital Aspirin Administration	Did EMS give Aspirin, or note a contraindication	To evaluate the efficacy of the system in delivering aspirin	PAIHS
	Aspirin Administered (if no prehospital)	ED Aspirin Administration (contingent upon above)	Was aspirin administered in the ED if no contraindication and if EMS did not already give aspirin	To evaluate the efficacy of the system in delivering aspirin	PAIHS GWTG Coronary Artery Disease
Time from symptom onset to Thrombolytics		Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time Thrombolytics Date Thrombolytics Time	Median value of Thrombolytics Date & Time - Symptom Onset or Estimated Date & Time	To evaluate the rapidity with which the system can give a patient thrombolytics	PAIHS
Time from symptom onset to transfer for definitive care		Symptom Onset / Injury Date Estimated Symptom Onset / Injury Time ED Departure Date ED Departure Time	Median value of ED Departure Date & Time - Symptom Onset or Estimated Date & Time	To evaluate the rapidity with which the system can send a patient for definitive care from when they feel symptoms	PAIHS
Demographics Descriptive table	Date of Birth	Date of Birth	Descriptive analysis of STEMI patients	For epidemiologic analysis	PAIHS
	Sex	Sex	Descriptive analysis of STEMI patients	For epidemiologic analysis	PAIHS
	Mode of Arrival	Mode of Arrival	Descriptive analysis of STEMI patients	To target care seeking behavior interventions	PAIHS
	BMI	Height Weight	Descriptive analysis of STEMI patients	To target lifestyle modification interventions	PAIHS
	Smoking	Smoking	Descriptive analysis of STEMI patients	To target lifestyle modification interventions	PAIHS
Primary Prevention	Already on aspirin	Home Medications	Was patient already taking home aspirin	To guide primary care practice	CCC
	Already on statin	Home Medications	Was patient already taking home statin	To guide primary care practice	CCC
Audit Filters					
Failure to perform ECG in ED		ED ECG Performed	List of all patients for whom an ECG was NOT ordered in ED, regardless of whether or not there was a prehospital ECG	Ensure that repeat ECG's to confirm are performed in ED	CCC GWTG Coronary Artery Disease
Failure to administer aspirin	Prehospital Failure to Administer Aspirin	Prehospital Aspirin Administration	List of all patients for whom EMS did not give aspirin	Used to guide EMS practice	PAIHS
	ED Failure to Administer Aspirin (if no prehospital)	ED Aspirin Administration (contingent upon above)	List of all patients for whom ED provider did not give aspirin (without contraindication)	Ensure that aspirin is administered if no contraindication and no EMS administration	GWTG Coronary Artery Disease
Time to Lytics >30 min		ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Median value of Thrombolytics Date & Time - Arrival Date & Time	Optimize time to lytics	See ACCF/AHA Guidelines, Para 3.41, Class I, 7. Standard: 30 minutes.
Failure to give adjunct therapy	No antithrombotics with Thrombolytics	Antithrombotic Administration Thrombolytics Date	List of all patients NOT receiving antithrombotic adjuncts with lytics	Ensure adjuncts are given	CCC
	No antiplatelets with Thrombolytics	Antiplatelet Administration Thrombolytics Date	List of all patients NOT receiving antiplatelet adjuncts with lytics	Ensure adjuncts are given	CCC
Failure to achieve time from arrival to transfer ≤45 min		ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time	List of all patients who took longer than 45minutes from arrival to ED departure	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	GWTG Coronary Artery Disease

Stroke Module Selected Indicators & Metrics

Indicator	Metric	Data Elements for Calculation	Definition	Rationale	Source
Prehospital & Transport Care					
Time to Hospital-Based Emergency Care	Last Known Well to EMS Arrival Time	Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time EMS Arrival at Scene Date EMS Arrival at Scene Time	The time difference between the moment the patient was injured and the moment EMS arrived on scene	Can be used to evaluate EMS response time and/or to guide care seeking behavior educational interventions	GWTG Stroke Reporting Measures
	EMS Arrival to ED Arrival Time	EMS Arrival at Scene Date EMS Arrival at Scene Time ED Arrival Date ED Arrival Time	The time difference between the moment EMS arrived on scene and the moment EMS arrived at the facility	Used to guide EMS practice	GWTG Stroke Reporting Measures
Pre-notification		Prearrival notification	Percent of cases of advanced notification by EMS for patients transported by EMS from scene.	Used to guide EMS practice	GWTG Stroke Reporting Measures
Prehospital Blood Glucose Check		Prehospital Blood Glucose Check	Percent of patients for whom EMS checked a blood glucose	Used to guide EMS practice	PAIHS
Facility Care					
% Door to CT <25minutes		Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time ED Arrival Date ED Arrival Time CT Head Order Date CT Head Order Time	% of acute ischemic stroke patients who arrive < 4.5 hours from time last known well who receive brain imaging within 25 minutes of arrival.	Optimizing flow from ED to Radiology	GWTG Stroke Reporting Measures
CT Process Timing	Time to order CT	ED Arrival Date ED Arrival Time Initial GCS - Total CT Head Order Date CT Head Order Time	Disaggregation of CT process timing	Will use to evaluate and optimize patient flow from registration to the final read of the CT	PAIHS
	Time to perform CT	CT Head Order Date CT Head Order Time CT Head Performed Date CT Head Performed Time			
	Time to read CT	CT Head Performed Date CT Head Performed Time CT Head Read Date CT Head Read Time			
Time to intravenous thrombolytic therapy	Time Histogram w/ minute deciles	ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Histogram of timing for acute ischemic stroke patients to receive intravenous tissue plasminogen activator (tPA) therapy during the hospital stay who have a time from hospital arrival to initiation of thrombolytic therapy administration (door-to-needle time) of 60 minutes or less.	Optimizing time to thrombolytic therapy	GWTG Stroke Reporting Measures
	% Meeting 60 minute target	ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Percent of acute ischemic stroke patients receiving intravenous tissue plasminogen activator (tPA) therapy during the hospital stay who have a time from hospital arrival to initiation of thrombolytic therapy administration (door-to-needle time) of 60 minutes or less.	Optimizing time to thrombolytic therapy	GWTG Stroke Quality Measures Target Stroke
Thrombolytic administration table	Reasons for delay, IV rt-PA initiation bey	Reason for Thrombolytic delay	Reasons why IV t-PA was initiated greater than 60 minutes after hospital arrival in ischemic stroke patients treated with IV t-PA greater than 60 minutes after hospital arrival.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures
	Reasons for no IV rt-PA (Contra/Warning	Thrombolytics Contraindications	Reasons why eligible acute ischemic stroke patients were not treated with IV t-PA at my hospital.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures
	Reasons for no IV rt-PA (Hospital-Relate	Thrombolytics Contraindications	Reasons why eligible acute ischemic stroke patients were not treated with IV t-PA at my hospital.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures

What is metadata?

- Information that describes the data you are trying to collect

or more simply but less useful...

- Data about other data



Examples of metadata - Date

- In the United States this is most commonly coded as

Month / Day / Year

- But other countries have very different “Date” metadata...



Examples of metadata - Date

- There are over 40 different calendars used to represent day and year.
- Some countries (e.g. Ethiopia) use different calendars in different parts of the country.
- Europe and the United States of America reverse DD-MM-YYYY and MM-DD-YYYY
 - Ex. What date is this: 03/05/2022
 - In the USA this is March 5th, 2022
 - In France this is May 3rd, 2022



Examples of metadata - Disposition

- Our EHR uses many different options for ED Disposition
- Options include:
 - Admit
 - Admit to Observation
 - AMA
 - Deceased
 - Discharge
 - Elope
 - Left After MSE
 - LWBS
 - Transfer



Examples of metadata - Disposition

- Because facilities use different options, it is not possible to aggregate raw data on ED Disposition across facilities
 - One could not write the code “SUMIF(ED Dispo = ELOPED)” if some facilities use Left Before Completing Treatment instead of Eloped
- It is also not possible to benchmark our performance against reference registries such as the Arizona State Trauma Registry because we do not have the most granular option set

(the importance of granularity is discussed in more detail later)



Examples of metadata – Mechanism of Injury

- Facilities that wish to become a “leveled trauma center” need to collect data on the Mechanism of Injury – how a patient was injured
- These data must be reported to the applicable state trauma registry
- It may also be useful to compare data to national registries such as the WHO’s International Registry for Trauma and Emergency Care

Examples of metadata – Mechanism of Injury

- Example mechanisms of injury are: Road Traffic Incident, Assault, Fall, etc.
- How might you code “falls” in your EHR?
 - Arizona State Trauma Registry uses one option:
 - Fall
 - WHO’s International Registry for Trauma and Emergency Care uses:
 - Fall (from ≥ 1.5 times patient height)
 - Fall (from < 1.5 times patient height)
 - Fall (unspecified height)



Levels of data usage

There are many levels of data usage, in this talk we will discuss three in particular:

1. Case-level
2. Facility-level
3. Area-level (Referring to the IHS proper noun Area)



Clinical implications of metadata: Case-level

- Severity scores are a crucial element of risk stratification
- Finding patients who required a certain intervention based off of their level of severity, or who had an incongruent outcome with their predicted risk are key functions of data for case-level review
- Example: The ED Director asks you for help gathering data on trauma patients' mental status on arrival
- How would you gather that data?



Clinical implications of metadata: Case-level

- Multiple scoring systems exist for mental status, most notably:
 - Glasgow Coma Score (GCS)
 - Alert Verbal Pain Unresponsive (AVPU)
- If the requesting ED Director wishes to calculate injury severity, most scoring systems use GCS. Using AVPU would make it impossible to perform the previously mentioned functions.



Clinical implications of metadata: Facility-level

- Scenario: Strokes can either be due to blockage of blood flow (ischemic) or rupture of a vessel/aneurysm (hemorrhagic). The treatments are completely different for these two conditions. To differentiate, doctors need to get a CT scan as soon as possible after a patient arrives in the ED. You are asked to help gather data to help discover the reason for prolonged times to CT.
- How would you calculate this time?
- What would your start and end points be?



Clinical implications of metadata: Facility-level

- Start would be ED Arrival Time
- End could be:
 - CT Head Order Time
 - CT Head Performed Time
 - CT Head Read Time

What are the implications of using these different times?



Epidemiologic implications of metadata: Area-level

- Observations of epidemiologic trends
 - Requires all facilities in the same region to use interoperable data
- Alignment to state, regional, and/or national datasets to allow:
 - Benchmarking against these datasets
 - Submission to / participation in registries for oversight
 - Demonstrating performance for reimbursement



Data Interoperability

- The PAIHS ACR is completely interoperable with the following registries:
 - Trauma
 - Arizona State Trauma Registry (local)
 - CDC Web-based Injury Statistics Query and Reporting System (WISQARS) (national)
 - WHO International Registry for Trauma and Emergency Care (IRTEC) (international)
 - STEMI
 - National Cardiovascular Data Registry (NCDR) /
Get With The Guidelines (GWTG) STEMI
 - Stroke
 - Get With The Guidelines Stroke (GWTG) Stroke



Data Interoperability: Creating a “Rosetta Stone”

ED Disposition										
Definition and Patient Applicability										
Contextual definition: The disposition of the patient at the time of discharge from the emergency unit of the current facility										
Patient Applicability All										
Facility Applicability All										
Data representation and notes										
Data source: EHR										
Data type: Integer, add String if Other										
Format: Numeric, add alphanumeric if Other										
Suggested values:	Value	Meaning	WHO IRTEC	CDC WISQARS	ASTR - Admission Status data element Option Set	ASTR - Admission Status data element Description	ASTR - ED Discharge Disposition data element Option Set	ASTR - ED Discharge Disposition data element Description	NCDR / GTWG STEMI	GTTG Stroke - Not Admitted / Reason Not Admitted
	1	Admit - Floor	Ward	N/A	ED_ADMIT	Admitted through ED at your hospital	FLOOR	Floor bed (general admission, non	N/A	No, patient admitted as inpatient
		Admit - ICU	Intensive Care Unit				ICU	Intensive Care Unit (ICU)		
	2	Admit to Observation	Ward				OTHER	Other (jail, institutional care, ment		
	3	AMA	Left without being seen or before cc				LEFT AMA	Left against medical advice		Left from ED AMA
	4	Deceased	Mortuary or died		ED_DEATH	DOA or Died in ED	ED DEATH	Deceased/expired		Died in ED
	5	Discharge	Discharged home		ED_RELEASE	Seen in your ED and released (or refer pri	HOME NO SE	Home without services		Discharged directly from ED to home
	6	Elope	Left without being seen or before cc							
	7	Left After MSE	Left without being seen or before cc							
	8	LWBS	Left without being seen or before cc							
	9	Transfer	Transferred to another hospital		ED_TRANSFER	Seen in your ED then transferred out by E	TRANSFER	Transferred to another hospital		Transferred from your ED to another
	777	Other: _____	Other: _____				OTHER	Other (jail, institutional care, ment		

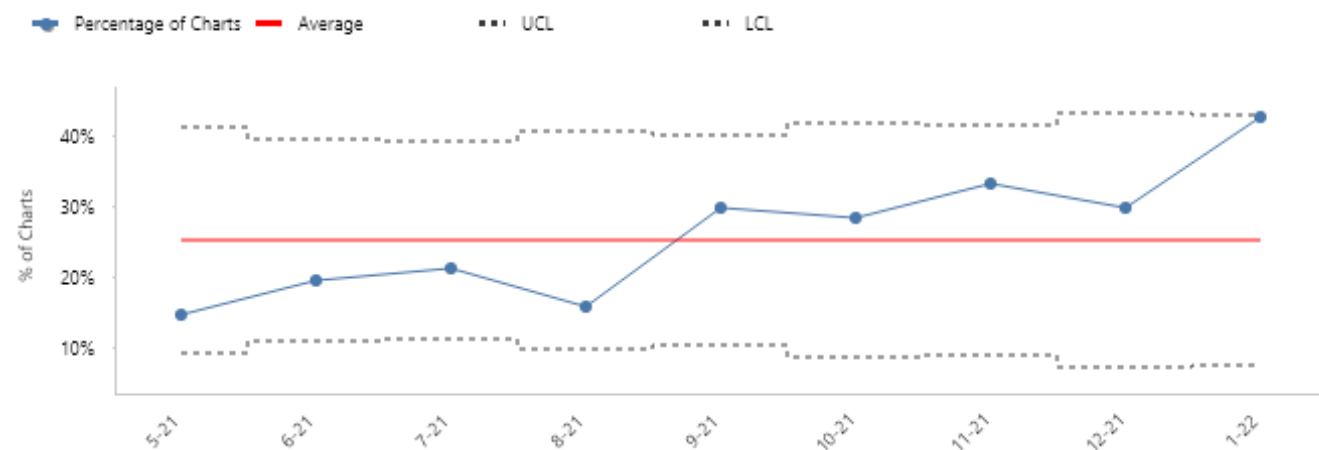
Operationalizing these concepts

- Consider harmonizing your metadata with existing metadata when developing:
 - New data elements
 - Template notes
 - Non-EHR-based data collection efforts



Template note proof of concept: Acute Coronary Syndrome Risk Stratification

- HEART Score for risk stratification for Acute Coronary Syndrome
 - Computer algorithm searches for the words “HEART Score” in juxtaposition to determine if it was documented
 - Serves as data for the “S” in PDSA cycles to improve risk stratification for ACS



Questions/Comments

For offline or follow-up questions

Email: vijay.kannan@ihs.gov



Indicator	Metric	Data Elements for Calculation	Definition	Rationale	Source	
Health System, Epidemiology, and Prevention						
Time from injury to transfer for definitive care	By severity	Facility	Total time from the moment of injury until the moment patient leaves ED for transfer, stratified by injury severity score (GAP and RTS), facility, age, and gender	A combined measure of our EMS and ED rapidity for whole trauma system evaluation, with subgroup analyses for vulnerable populations	PAIHS / Australian National Trauma Research Institute	
	By facility	Age				
	By age	Gender				
	By gender	Symptom Onset / Injury Date Estimated Symptom Onset / Injury Time ED Departure Date ED Departure Time RTS: Initial GCS - Total, Initial SBP, Initial Spontaneous RR GAP: Initial GCS - Total, Age (calculated from DOB and ED Arrival Date), Initial SBP				
Epidemiology and Prevention Descriptive Table	Setting of Injury		Whether the injury incident occurred at home, work, school, or other setting (Location for MVC)	Will be used to identify settings that confer a higher risk of injury	WHO IRTEC	
	Mechanism of Injury		Mechanism of Injury recoded to broader External Cause of Injury Categories, ie MVC, Fall, Fire/Burn, Drowning, Poisoning, Violence, Bites (dogs), Suffocation, Natural/Environmental	Will be used to identify the most frequent mechanisms of injury to target preventive efforts	WHO IRTEC	
	Activity at Time of Injury		What was the patient doing at the time of the injury	Will be used to identify the most frequent activities during time of injury to target preventive efforts	WHO IRTEC	
	Road Traffic Incidents	Modes of transport		What was the patient's mode of transport in the RTI	Will be used to describe the most frequent factors involved with road traffic incidents	WHO IRTEC
		Patient roles in incident		What was the patient's role (driver, passenger, pedestrian, etc.)		
		Counterpart in incident		Did the patient collide with anything, if so what?		
	Protective Devices		Whether or not the injured person (during an MVC, adult or child) was restrained or not	Will be used to target public education campaigns and policy changes	WHO IRTEC	
	Details of Drownings or Submersions		Did the patient intend to be in the water or not? What are the drowning-specific details of the incident?	Will be used to target public education campaigns and policy changes	WHO IRTEC	
	Details of Poisonings or Toxic Exposures		What was the exact type of poisoning or toxic exposure?	Will be used for descriptive analysis of the different types of poisonings or exposures	WHO IRTEC	
	Intent		Assault, self-directed violence, unintentional ("accidental"), or unable to determine	Will be used to describe the incidence and manners of assault	PAIHS, WHO IRTEC	
	Relationship to Assailant		What was the relationship between the patient and their assailant?			
	Weapon Involvement & Type		Whether or not a weapon caused the injury, and if so what type			
	Alcohol Use		Whether alcohol intoxication was involved based on Alcohol Use field (observation) or BAC >0.08.	Will be used to describe the incidence and agents involved in injuries associated with alcohol and substance-induced impairment	WHO IRTEC	
	Substance abuse or misuse		Whether substance abuse, illicit or Rx, were a contributor to the injury incident		WHO IRTEC	
	Prehospital Care Provision	Provider Types		Descriptive analysis of who is providing prehospital care (layperson, healthcare worker, etc.)	Used to target Community First Aid initiatives and to educate EMS	WHO IRTEC
		Care Provided		Descriptive analysis of what care is being provided in prehospital setting	Used to target Community First Aid initiatives and to educate EMS	WHO IRTEC
	ED Disposition		Outcome Index is a combination of Death in Current Facility, Transfer to Higher Level of Care from EU, Functional Status at Following Disposition at Current Facility, Discharge from EU without admission or transfer. (May need to add LOS if functional status is too simple like ADLs.)	Will be used for epidemiologic survey of injury across the area	WHO IRTEC	
Record Completion Rate	<<PRESENCE OR ABSENCE OF TEMPLATE NOTE>>	Whether or not the template note was used if Diagnosis = Injury	Evaluating uptake of template note for data collection	PAIHS / Australian National Trauma Research Institute		

Audit Filters

ESI 4/5 and dispo not = transfer, death, admit		Emergency Severity Index (ESI)	A list of all patients with ESI 4 or 5 who were not transferred, admitted, or deceased	Will be used for triage and case review	PAIHS
All ED Deaths		ED Disposition	A list of all trauma deaths occurring in the ED	Will be used for case review	Australian National Trauma Research Institute
EMS Access obtained for hypotension		Prehospital SBP Prehospital Trauma Interventions	A list of patient ID's for all patients meeting the criteria : No IV or IO established for patients with prehospital hypotension (SBP<90)	Will use to educate EMS on prehospital resuscitation	CCC
EMS Airway Protection for Altered Mental Status		Prehospital GCS Prehospital Trauma Interventions	A list of patient ID's for all patients meeting the criteria : No airway protection given by EMS for patients with GCS <8	Will be used to target cases for review	PAIHS
ED Airway Protection for Altered Mental Status		ED Airway Interventions Initial GCS - Total	A list of patient ID's for all patients meeting the criteria : No airway protection given by ED provider for patients with GCS <8	Will be used to target cases for review	WHO IRTEC
Early Head CT for Altered Mental Status		ED Arrival Date ED Arrival Time Initial GCS - Total CT Head Order Date CT Head Order Time	A list of patient ID's for all patients with a Glasgow Coma Scale score <13 and no head computerized tomography (CT) scan within 2 hours of arrival at hospital (if CT available in hospital)	Will be used to target cases for review	WHO IRTEC (list of potential audit filters)
Deaths with Low/Mod Inj Severity (List of record numbers)	Death with RTS <X Death with GAP <X	RTS: GCS, SBP, RR GAP: GCS, Age, SBP	A list of patient ID's for all patients meeting the criteria : Death with RTS <11 or GAP <19 (moderate/severe thresholds for each)	Will be used to target cases for review	WHO IRTEC

Indicator	Metric	Data Elements for Calculation	Definition	Rationale	Source
Prehospital & Transport Care					
Time to Hospital-Based Emergency Care	Symptom Onset to EMS Arrival Time	Symptom Onset / Injury Date Estimated Symptom Onset / Injury Time EMS Arrival at Scene Date EMS Arrival at Scene Time	The time difference between the moment the patient was injured and the moment EMS arrived on scene	Can be used to evaluate EMS response time and/or to guide care seeking behavior educational interventions	GWTG
	EMS Arrival to ED Arrival Time	EMS Arrival at Scene Date EMS Arrival at Scene Time ED Arrival Date ED Arrival Time	The time difference between the moment EMS arrived on scene and the moment EMS arrived at the facility	Used to guide EMS practice	GWTG
Prehospital 12-lead ECG		Prehospital 12-lead ECG	Percent of patients receiving a 12-lead ECG by EMS	Used to guide EMS practice	ACTION-GWTG Registry Codebook, seq 4010
EMS Notification to Receiving Facility		Prearrival notification	Percent of patients for whom EMS called for prearrival notification	Used to guide EMS practice	CCC
Prehospital Aspirin Administration		Prehospital Aspirin Administration	Percent of patients to whom EMS gave Aspirin, or noted a contraindication	Used to guide EMS practice	ACTION-GWTG Registry Codebook & Joint Commision AMI-1
Facility Care					
ECG performed in ED		ED ECG Performed	Was an ECG ordered at ED, regardless of whether or not there was a prehospital ECG	Ensure that repeat ECG's to confirm are performed in ED	CCC
Aspirin Administered (if no prehospital)		ED Aspirin Administration (contingent upon above)	Was aspirin administered in the ED if no contraindication and if EMS did not already give aspirin	Ensure that aspirin is administered if no contraindication and no EMS administration	GWTG Coronary Artery Disease
Time to Lytics (from ED arrival)		ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Median value of Thrombolytics Date & Time - Arrival Date & Time	Optimize time to lytics	See ACCF/AHA Guidelines, Para 3.41, Class I, 7. Standard: 30 minutes.
Thrombolytic adjuncts given	Antithrombotic Adjunct	Antithrombotic Administration Thrombolytics Date	If Thrombolytics were given, was antithrombotic also given	Ensure adjuncts are given	CCC
	Antiplatelet Adjunct	Antiplatelet Administration Thrombolytics Date	If Thrombolytics were given, was antiplatelet also given	Ensure adjuncts are given	CCC
Thrombolytic administration table		Thrombolytics Date Thrombolytics Contraindications	Descriptive table showing the % of STEMI patients who received lytics, as well as the % who did not and what the contraindication was	Ensure best practices in lytic administration	ACCF/AHA Guidelines para 5.1
ED Length of Stay	ED Arrival to Dispo Decision Time	ED Arrival Date ED Arrival Time Decision to Transfer Date Decision to Transfer Time	Time from ED Arrival until the decision to transfer a patient is made by the provider	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS / ACCF/AHA Guideline, ref 129.
	Dispo Decision to ED Departure time	Decision to Transfer Date Decision to Transfer Time ED Departure Date ED Departure Time	Time from the decision to transfer a patient is made by the provider until the patient physically departs from the ED	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS / ACCF/AHA Guideline, ref 129.
	ED Arrival to Departure (other than transfer) Time	ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time	Time from ED arrival until the patient eloped, left AMA, was discharged, was admitted, or died	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS / ACCF/AHA Guideline, ref 129.
Record Completion Rate		<<PRESENCE OR ABSENCE OF TEMPLATE NOTE>>	Whether or not the template note was used if Diagnosis = STEMI	Evaluating uptake of template note for data collection	PAIHS

Indicator	Metric	Data Elements for Calculation	Definition	Rationale	Source
Complications	Complication types	Standardized Diagnosis	Types of bleeding complications seen with thrombolytic therapies received by ischemic stroke patients at my hospital.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures
	Thrombolytic complications	Standardized Diagnosis	Percent of ischemic stroke patients with bleeding complications to thrombolytic therapy received at my hospital.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures
Severity scoring reported		Stroke Severity Scale Stroke Level of Severity	Percent of ischemic stroke and stroke not otherwise specified patients with a score reported for NIH Stroke Scale (Initial), or VAN, or LAMS.	Ensuring proper severity stratification for initial management and disposition planning	GWTG Stroke Quality Measures
ED Length of Stay	ED Arrival to Dispo Decision Time	ED Arrival Date ED Arrival Time Decision to Transfer Date Decision to Transfer Time	Time from ED Arrival until the decision to transfer a patient is made by the provider	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS GWTG Stroke Descriptive Measures
	Dispo Decision to ED Departure time	Decision to Transfer Date Decision to Transfer Time ED Departure Date ED Departure Time	Time from the decision to transfer a patient is made by the provider until the patient physically departs from the ED	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS GWTG Stroke Descriptive Measures
	ED Arrival to Departure (other than transfer) Time	ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time	Time from ED arrival until the patient eloped, left AMA, was discharged, was admitted, or died	Will be used to evaluate efficiency in throughput for STEMI requiring transfer for definitive care	PAIHS GWTG Stroke Descriptive Measures
Record Completion Rate		<<PRESENCE OR ABSENCE OF TEMPLATE NOTE>>	Whether or not the template note was used if Diagnosis = Stroke	Evaluating uptake of template note for data collection	GWTG Stroke Data Quality Measures
Missing time data		<<ONLY TIME VARIABLES REQUIRING MANUAL ENTRY>> Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time EMS Arrival at Scene Time Decision to Transfer Time	Missing, incomplete, or invalid date/time data for ischemic stroke patients.	GWTG measure to ensure times are collected	GWTG Stroke Reporting Measures
Health System, Epidemiology, and Prevention					
Thrombolytic Timing Targets	IV rt-PA arrive by 4.5 hour, treat by 4.5 hour	Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Percent of acute ischemic stroke patients who arrive at the hospital within 270 minutes (4.5 hours) of time last known well and for whom IV t-PA was initiated at this hospital within 270 minutes (4.5 hours) of time last known well.	Evaluating combined EMS + ED performance on early thrombolytic therapy	GWTG Stroke Reporting Measures
	% No IV tPA 4.5 hour (Contra/Warning):	Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	Percent of eligible acute ischemic stroke patients not treated with IV t-PA at my hospital who had reasons for not receiving IV t-PA.	Evaluating combined EMS + ED performance on early thrombolytic therapy	GWTG Stroke Reporting Measures
Last known well to IV rt-PA times		Symptom Onset / Injury Date Estimated Symptom Onset / Injury Time ED Departure Date ED Departure Time	Time from symptom onset to administration of IV t-PA for ischemic stroke patients treated at my hospital.	Evaluating combined EMS + ED performance on early thrombolytic therapy	GWTG Stroke Reporting Measures

GWTG Descriptive Measures Table	Age	Date of Birth	Patients grouped by age.	Epidemiology and Prevention targets	GWTG Stroke Descriptive Measures
	Diagnosis	Standardized Diagnosis	Patients grouped by final clinical diagnosis related to stroke.	Epidemiology and Prevention targets	GWTG Stroke Descriptive Measures Target Stroke
	Mode of Arrival	Mode of Arrival	Patients grouped by how they arrived at your hospital.	Epidemiology and Prevention targets	GWTG Stroke Reporting Measures
	Gender	Gender Stroke Severity Scale Stroke Level of Severity	Percent of female, male, and unknown patients. Initial exam findings: Patients grouped by initial exam findings. (Stroke Scale Severity)	Epidemiology and Prevention targets	GWTG Stroke Descriptive Measures
	Length of Stay	ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time Standardized Diagnosis	Length of Stay, grouped by diagnosis.	Epidemiology and Prevention targets	GWTG Stroke Descriptive Measures
	Medical History	Diabetes Hypertension Hyperlipidemia Coronary Artery Disease Peripheral Artery Disease Atrial Fibrillation Prior Stroke TIA Smoking BMI (Height & Weight)	A histogram of previously known medical history.	Epidemiology and Prevention targets	GWTG Stroke Descriptive Measures
Audit Filters					
Failure to achieve door to CT <25minutes		Symptom Onset / Injury Date Symptom Onset / Injury Time Estimated Symptom Onset / Injury Time ED Arrival Date ED Arrival Time CT Head Order Date CT Head Order Time	List of acute ischemic stroke patients who arrive < 4.5 hours from time last known well who did not have a CT scan within 25 minutes of arrival.	Optimizing flow from ED to Radiology	GWTG Stroke Reporting Measures
Failure to achieve IV rt-PA arrive by 4.5 hour, treat by 4.5 hour		ED Arrival Date ED Arrival Time Thrombolytics Date Thrombolytics Time	List of acute ischemic stroke patients who arrived at the hospital within 270 minutes (4.5 hours) of time last known well and for whom IV t-PA was NOT initiated at this hospital within 270 minutes (4.5 hours) of time last known well.	Evaluating combined EMS + ED performance on early thrombolytic therapy	GWTG Stroke Achievement Measures
Failure to administer IV rt-PA to eligible patients on time or at all	Reasons for delay, IV rt-PA initiation beyond 60 minutes	Reason for Thrombolytic delay	List of patients (and reasons why) for whom IV t-PA was initiated greater than 60 minutes after hospital arrival in ischemic stroke patients treated with IV t-PA greater than 60 minutes after hospital arrival.	Optimizing time to thrombolytic therapy	GWTG Stroke Reporting Measures
	Reasons for no IV rt-PA (Hospital-Related)	Thrombolytics Contraindications	List of patients (and reasons why) who were not treated with IV t-PA at my hospital due to hospital-related reasons, not patient contraindication.	Ensuring proper use of thrombolytic therapy	GWTG Stroke Reporting Measures
Time from arrival to transfer >60 min		ED Arrival Date ED Arrival Time ED Departure Date ED Departure Time	List of patients with extended time from arrival to departure for definitive management	Optimizing ED flow	GWTG Stroke Quality Measures Target Stroke