



CHALLENGES AND APPROACHES TO MEASURING HOSPITAL EMERGENCY PREPAREDNESS

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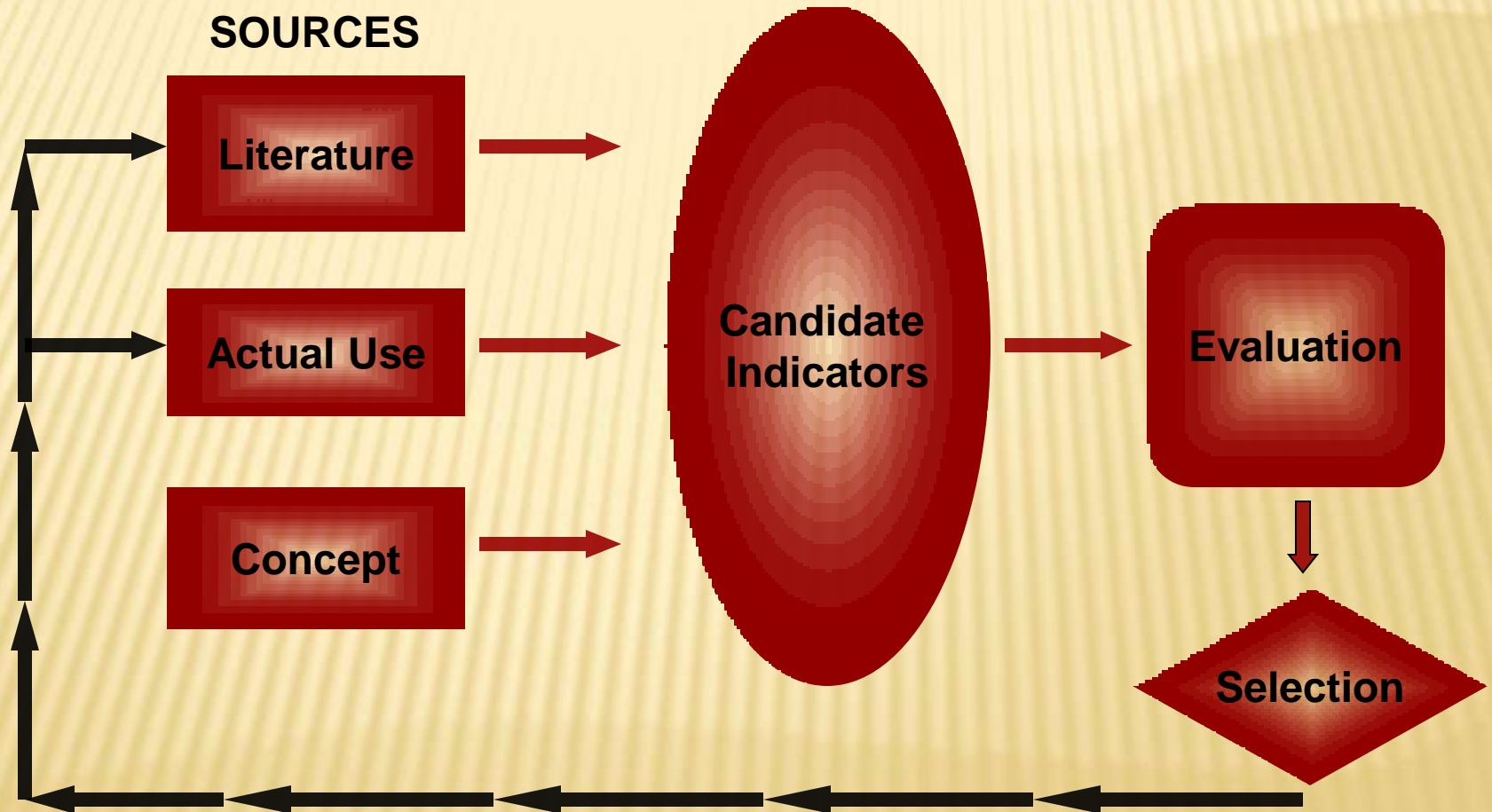
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OUTLINE

- ✘ Approach to development
- ✘ Content Domain Development
- ✘ Evaluation of existing measures
- ✘ Challenges specific to EP
- ✘ Adapting measurement approaches to EP
- ✘ Solutions to challenges
- ✘ Example measures and validation

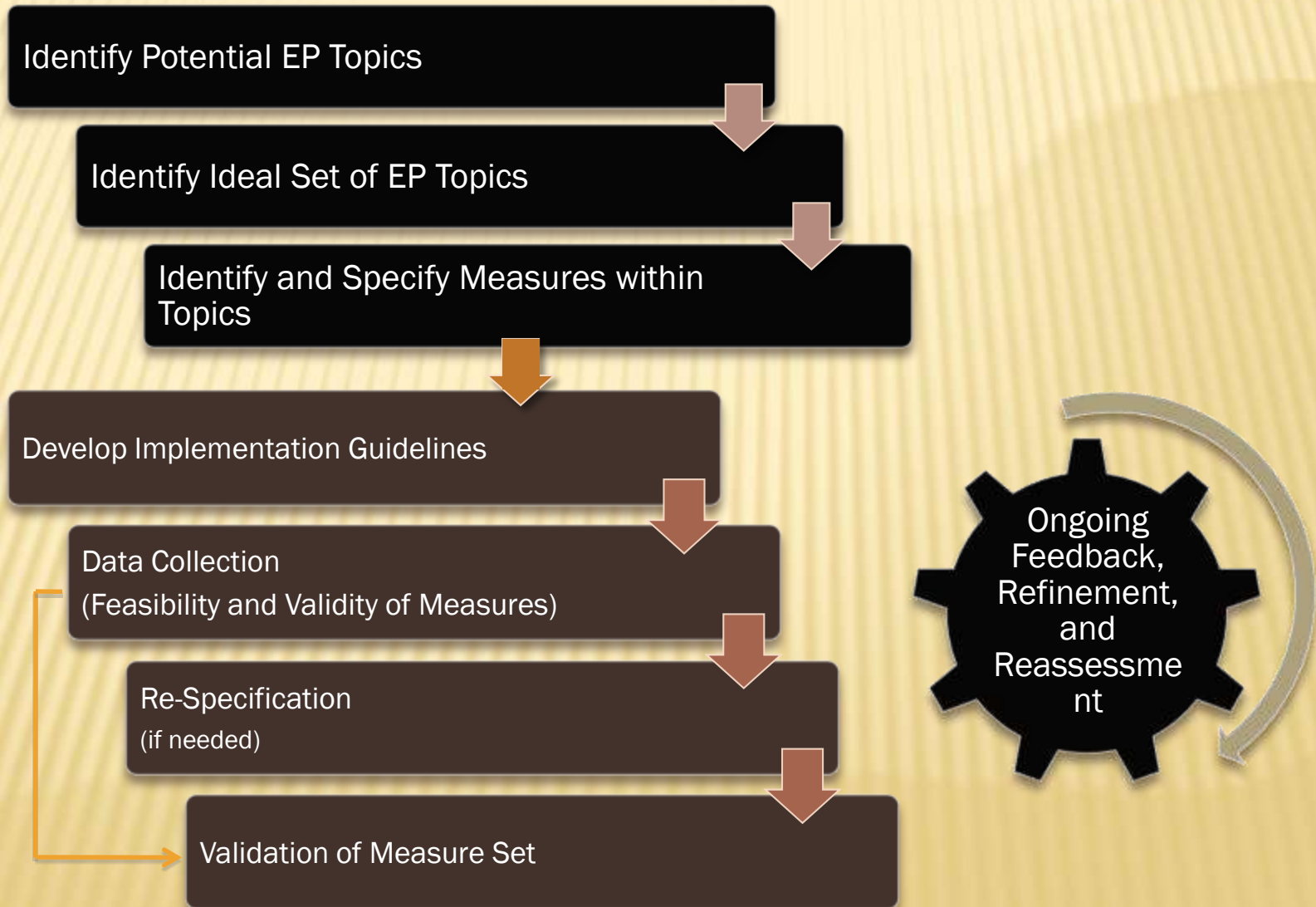
MEASURE DEVELOPMENT AND VALIDATION PROCESS



OBSTACLES TO USUAL DEVELOPMENTAL FRAMEWORK

- ✘ Broad swath of potential indicators
- ✘ Available data inconsistent
- ✘ Many standards without evidence base to guide selection
- ✘ No standardized data collection system
- ✘ Challenges specific to measuring EP

REVISED MEASURE DEVELOPMENT FRAMEWORK



OUR PROCESS: WHERE HAVE WE BEEN?

- Literature Review
- Review of Existing Guidelines
- Expert Panel Evaluation of Indicator Topics
- MMWG Feedback
 - Focus on Functionality and Outcomes
- Indicator Development and Justification



Panel Methods

- Review to identify guidelines, checklists, etc.
- Group together like guidelines to identify general topics
- Topics evaluated by expert panel (nominal group technique)
 - 43 panelists assigned to 3 duplicative panels
 - Rated topics on importance to include in report, participated in call, then re-rated subset of topics
 - Each call summarized and shared with other panels
 - Only highest rated topics moved to next step
 - Final rating also included set-building task
 - Ratings used to prioritize topics (priority level 1-4)

Priority One Topics

Indicator Topic	Median Rating (1-5)	Percent Including Topic in Set	Concept Area
Hospital's emergency operations plan (EOP) identifies a chain of command.	5	73.0	Emergency Management Procedures and Planning
Hospital has a plan for unsupported functioning/self sufficiency, including through the use of alternative sources of potable water and electricity, for 96 hours.	5	70.3	Continuity of Operations
Hospital has a plan for alternative means of communication or backup communication systems.	5	64.9	Communications
Hospital has a plan for coordinating all levels of communication, including both intra- and inter-organizational communication, as well as required technology.	4	75.7	Communications

Priority One Topics Continued

Indicator Topic	Median Rating (1-5)	Percent Including Topic in Set	Concept Area
Hospital has a plan specifically for protecting staff and other responders using countermeasures, supplies, and personal protective equipment (PPE).	4	64.9	Countermeasures, Supplies, and PPE
Hospital has a plan for safety and security of people, including staff, patients, and supplies, which may involve partnering with local law enforcement agencies.	4	54.0	Safety and Security
Hospital has a plan for evacuation, including transport of patients and information to alternate care sites.	4	51.4	Evacuation and Shelter in Place

Priority Two Topics

Indicator Topic	Median Rating (1-5)	Percent Including Topic in Set	Concept Area
Surge capacity is addressed at various levels in the hospital (i.e. not just in the emergency department) and with community partners.	5	78.4	Surge Capacity
Hospital's emergency operations plan (EOP) contains specific plans for communications.	5	67.6	Emergency Management Procedures and Planning
Hospital has a plan for treatment and management of contaminated persons.	4	64.9	Decontamination
Hospital has a plan for evacuation in general.	4	64.9	Evacuation and Shelter in Place
Hospital has a plan for tracking both patients and the deceased.	4	62.2	Patient Management and Care
Staff training is ongoing.	4	59.5	Staff Training

Priority Two Topics Continued

Indicator Topic	Median Rating (1-5)	Percent Including Topic in Set	Concept Area
Hospital inventory of equipment and supplies includes items such as vents, PPE, negative pressure isolation, ICU beds, decontamination showers, antidote kits, and pediatric equipment.	4	56.8	Countermeasures, Supplies, and PPE
Hospital has a plan for facility access control and staff is able to gain access to the facility when called back to duty.	4	56.8	Safety and Security
In ramping up for surge, hospital has the ability to increase physical space and resource capacity through tactics such as rapid discharge, home care, and alternate care sites.	4	56.8	Surge Capacity
Drills are executed in collaboration with other organizations.	4	54.1	Community Integration

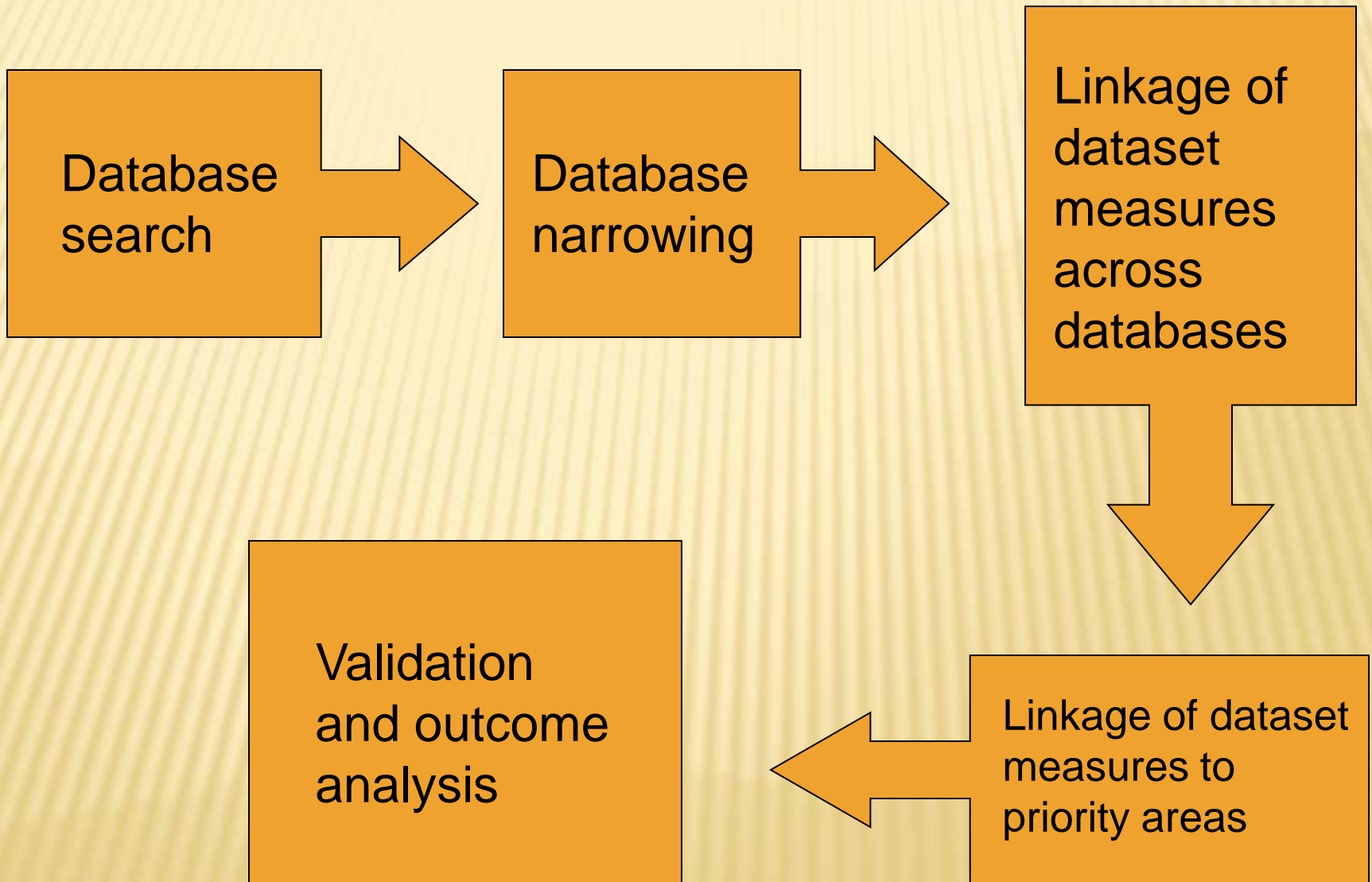
Priority Two Topics Continued

Indicator Topic	Median Rating (1-5)	Percent Including Topic in Set	Concept Area
Hospital has a plan for decontamination that is specific to chemical/biological/radiological/nuclear/high-yield explosive (CBRNE) hazards.	4	51.4	Decontamination
Hospital's emergency operations plan (EOP) is modified based on exercises or actual emergencies.	4	51.4	Emergency Management Procedures and Planning
Criteria for evacuation and shelter in place decision-making are in place.	4	51.4	Evacuation and Shelter in Place
Hospital has a plan for modification of normal clinical activities (including specialized care) or standards of care as related to disaster response.	4	51.4	Patient Management and Care
Staff training incorporates the incident command system (ICS).	4	51.4	Staff Training

Results: Concept Areas Covered by Highest Priority Topics

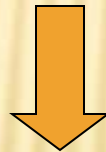
- ✘ 6 out of 15 covered in highest priority
- ✘ Priority 1 and 2 covered all except
 - + Staff and volunteer management
 - + Fatality management
 - + Disease reporting and surveillance
- ✘ Did not favor topics derived from guidelines from any single source, or from multiple sources

Database Analysis



Search for EP Data Sources

- Literature Review using web based aggregators
 - ISI Web of Knowledge, PubMed, Google Scholar
- State and federal sources
 - ASPR, DHS
- National and regional EP expert feedback



547 initially selected, however 44 unique EP data sources identified

Database Identification and Narrowing

- Inclusion Criteria
 - + Must focus on hospital or healthcare system in part or whole
 - + Must be state, regional data, (or aggregate of data above state level if available)
 - + Data must be available and accessible (some EP data lost or “secure”)
 - + Must have available data dictionary
- Identified: 44
- Data sources which met criteria: 11

Database Selection: The final 11

- Databases with EP information
 - + Price Waterhouse Cooper's Public Health Emergency Preparedness (PHEP)
 - + The Joint Commission
 - + Government Accountability Office 2003
 - + Government Accountability Office 2008
 - + American Hospital Association Health Forum
 - Annual Survey, TrendWatch
 - + National Hospital Ambulatory Medical Care Survey (NHAMCS) Pandemic & Emergency Response Preparedness Supplement 08
 - + National Hospital Discharge Survey
 - + South Bay Disaster Resource Center at Harbor-UCLA Medical CTR
 - + Veteran's Health Administration Data
 - + Hospital Preparedness Program, ASPR
 - + The Pediatric Preparedness of Emergency Departments: A 2003 Survey

Identifying Links

- 11 databases evaluated in detail
 - + characteristics
 - + quality
 - + size
 - + temporal
 - + relationship

- Indicators identified with relevance to MMWG
 - + ONLY 16
 - National Hospital Discharge Survey
 - The Hospital Preparedness Program
 - American Hospital Association
 - The Joint Commission

Example of Identified Link

✘ HPP SI 25

- + Number of participating hospitals statewide that have access to pharmaceutical caches sufficient to cover hospital personnel (medical and ancillary), hospital based emergency first responders and family members associated with their facilities for a 72-hour period.

✘ Links TJC EC.4.14.3

- + The organization plans for replenishing medical supplies that will be required throughout response and recovery, including access to and distribution of caches (stockpiled by the hospital or its affiliates, local, state, or federal sources) to which the hospital has access.

Example of Identified Link

✘ HPP SI6 Drills

- + Number of drills conducted during the FY 2005 budget period that included hospital personnel, equipment or facilities.

✘ Links to TJC EM.03.01.03, EP 3

- + For each site of the hospital that offers emergency services is a community-designated disaster receiving station, at least one of the hospital's two emergency response exercises includes an escalating event in which the local community is unable to support the hospital.

Example of Identified Link

✘ HPP SI 26 A3

- + Number and level of PPE statewide to protect current and additional health care workers during an event
- + Possess sufficient numbers of PPE to protect both the current and additional health care personnel deployed in support of an event.

✘ Links to TJC EC.4.11.9

- + The organization keeps a documented inventory of the assets and resources it has on site that would be needed during an emergency (at a minimum, personal protective equipment, water, fuel, staffing, medical, surgical etc.

Links to priority areas 1 and 2

- ✘ Only 7 represented in the linkages between databases to the major topic areas in Priority 1 and 2 (n = 16)
- ✘ None of the major function areas were represented (surge capacity)
- ✘ None of the patient care areas were represented
- ✘ Unable to provide any link between databases and the priority areas determined by group

Issues with Linkages Between Databases

- ✘ Lack of clear definitions
- ✘ Lack of similarity
- ✘ Extensive assumptions required
- ✘ From an EP perspective, indicators from databases do NOT accurately reflect EP function

Additional Database Problems

- ✘ Most linkages between only 2 datasets: HPP and TJC
- ✘ Data for measures collected and recorded differently
 - + HPP: mixed (continuous, categorical, rank)
 - + TJC: binary (compliant, non-compliant)
- ✘ Do not measure EP function or outcome during a clinical or simulated situation
- ✘ Thus, data are inconsistent within and between datasets

Data Quality Example

Correlation

- + American Hospital Association Survey 2008
 - × AHA: Total licensed beds - the total number of beds authorized by the state licensing (certification agency)
- + Hospital Preparedness Program Survey 2006
 - × HPP: Number of beds statewide, above the current daily staffed bed capacity that awardee is capable of surging beyond within 24-hours post event

Note: These variables differ from an EP perspective but collected from same agency (L & C) in state

Data Correlation

- ✗ Number of hospital beds available

- + $\rho = 0.8179$

- + $t^* = 9.7456 \gg 3.496$ (95% Confidence)

- ✗ State population

- + $\rho = 0.9948$

- + $t^* = 66.96 \gg 3.496$ (95% Confidence)

ρ : Spearman Rank Correlation Coefficient

Summary For Databases

- ✘ Unable to identify existing measures
 - + No outcome or function analysis
 - + hypothetical, not real patient care events
 - + Limited in scope of EP
 - + Few measures in major priority areas
- ✘ Unable to perform validation of existing measures
 - + Lack of adequate linkages across datasets with similar data
 - + Inconsistently defined data
 - + Absence of patient outcome data

CHALLENGES IN MEASURING PREPAREDNESS

Challenge	Clinical Measurement	EP Measurement
1: INFREQUENT EVENTS	Observe patient outcomes on daily basis	Few small scale responses, very rare large scale responses
2: MEASUREMENT REQUIRES ADDITIONAL EFFORT	Can observe daily patient care	Requires proxy events to regularly observe
3: HOSPITALS CONTROL SIMULATED EVENTS	Limited ability to “cherry pick” patients	Parameters of proxy events often controlled by the measured entity
4: LINK BETWEEN PERFORMANCE IN PROXY EVENTS AND ACTUAL EVENTS NOT FULLY ESTABLISHED	Limited need to rely on proxy measures. Proxy measures based on evidence.	Proxy measures not yet linked to outcomes, and limited ability to establish link given frequency of actual events.

CHALLENGES IN MEASURING PREPAREDNESS

Challenge	Clinical Measurement	EP Measurement
5: RESPONSE SYSTEM COMPLEXITY	Outside entities have limited impact on care; Can isolate care for clinical groups	Outside entities (e.g. public health system) integral to response; Difficult to isolate response activities
6: LIMITED EVIDENCE BASE FOR BEST PRACTICES	Extensive literature based on RCTs and scientific evaluation of interventions	Limited knowledge about best “preparation” to improve outcomes, limited ability to establish.
7: VARIATIONS IN SCALE AND TYPES OF DISASTERS	Daily care somewhat homogeneous, can isolate clinical groups	Small scale to large scale events; different types require different response

CHALLENGES IN MEASURING PREPAREDNESS

Challenge	Clinical Measurement	EP Measurement
8: POTENTIAL VARIATION IN NEED FOR PREPAREDNESS	Most hospitals will care for commons diseases	Major differences in scale and type of disasters likely to occur.
9: EXACT NATURE OF POTENTIAL EVENTS UNCERTAIN	Day to day clinical care predictable	When, what, where, how big? - all uncertain.
10: IMPACT OF RESOURCE DEDICATION TO EP	Improving performance on QIs theoretically improves day to day care.	Resources dedicated to EP and EP measurement may draw resources away from day to day clinical care.

CONCEPTUAL MODELS RELATED TO MEASUREMENT

✘ Donabedian Model of Clinical Measurement

+ Structure

- ✘ Material, human resources, hospital characteristics
- ✘ Lack evidence linking structure with outcome

+ Process

- ✘ What you do: includes planning and response
- ✘ Doing the right thing well
- ✘ Includes functional measures
- ✘ Assumed to be associated with outcomes

+ Outcomes

- ✘ True outcomes are difficult to measure
- ✘ Approaches to estimating outcomes during exercise not established
- ✘ Risk adjustment required

GUIDING PRINCIPALS TO ADDRESS CHALLENGES

- ✘ AIM TO MEASURE FUNCTIONALITY
- ✘ IDENTIFY A GOAL OUTCOME
- ✘ SEEK CONTINUOUS OUTCOMES
- ✘ CONSTRAIN THE FOCUS TO HOSPITAL
- ✘ CONSIDER THE POTENTIAL DATA AND DISTRIBUTIONS

POTENTIAL APPROACHES TO MEASUREMENT

- + SURVEY OF PREPAREDNESS ACTIVITIES

Example: Elements included in Emergency Operation Plan

- + EXERCISE BASED MEASURES OF FUNCTIONALITY

Example: Time to establish a functional security checkpoint.

- + EXERCISE + MODELING BASED MEASURES

Example: Time to evacuate a hospital, based on small demonstration evacuation and modeling to extrapolate time to evacuate the entire hospital.

STEPS UNDERTAKEN TO DEVELOP MEASURES

- ✘ Identify potential ways to measure topics
 - + Review existing metrics and concepts
 - + Identify most salient functionality reflected in topic
 - + Consider how well metric fits topic area
 - + Consider potential performance
- ✘ Draft specifications
 - + Consider feasibility of implementation
 - + Consider how well the metric reflects actual functionality

STEPS UNDERTAKEN TO DEVELOP MEASURES, CONT.

- ✘ Define each component
 - + Consider alternative interpretations of specification
- ✘ Justify choices based on literature and case studies
- ✘ Define how to move from hospital based data collection to aggregate measures at state-level
- ✘ Iterative process

EXAMPLE INDICATOR FUNCTIONAL MEASURES

Topics

- (1) Hospital has a plan for alternative means of communication or backup communication systems.*
- (2) Hospital has a plan for coordinating all levels of communication, including both intra- and inter-organizational communication, as well as required technology*

Proposed Measure 1: The time to relay a field asset request or critical field information to a non-hospital-based emergency operations center (EOC) during an exercise. (Repeated for secondary and tertiary communication modalities.) [Preliminary recommendation for state level reporting: Mean time for all hospitals.]

EXAMPLE INDICATOR

MODELING + MEASURE BASED INDICATORS

Proposed Measure: The time to evacuate the hospital. [This time is to be based on the time to evacuate a sample of X patients, the time for planning evacuation, and the subsequent extrapolation to the entire hospital.]

Preliminary recommendation for state level reporting: Mean time for all hospitals.

- ✘ Modeling helps to reduce measurement burden
- ✘ Potential to reduce measurement bias
- ✘ Requires extensive development and validation

EXAMPLE INDICATORS USING MULTIPLE APPROACHES

Topic

- ✘ *Hospital has a plan for safety and security of people, including staff and patients, and supplies, which may involve partnering with local law enforcement agencies.*

Proposed Measure 1: The time to establish a functioning security screen checkpoint during an exercise, according to the hospitals EOP.

Proposed Measure 2: Does the hospital have an MOU or MOA with a security agency for security support?

EVALUATION CRITERIA BASED ON NATIONAL QUALITY FORUM

Importance	<ul style="list-style-type: none">• Is the concept important to measure?• Is there opportunity for improvement?
Usability	<ul style="list-style-type: none">• Does the measure foster true quality improvement instead of gaming or adverse consequences?• Is the measure harmonized with similar measures?• Is the measure meaningful, understandable and useful?
Feasibility	<ul style="list-style-type: none">• Does the measure minimize burden?• Is the data collection and implementation feasible?
Scientific Acceptability	<ul style="list-style-type: none">• Is the measure precisely defined?• Is it reliable (test-retest and inter-rater)?• Does the measure demonstrate face validity, construct validity and predictive validity?• Is there systematic bias and can that bias be address with adjustment?• Does it detect meaningful differences in performance?

PROPOSED INDICATORS KNOWN EVIDENCE BASE

Axis	Criterion	Known evidence base
Importance	Concept is important	Panel/MMWG
	Opportunity for improvement	Actual performance
Usability	Fosters true improvement	Theoretical
	Harmonization	Theoretical
	Meaningfulness	Theoretical
Feasibility	Minimizes burden	Theoretical
	Implementation	Unknown
Scientific acceptability	Precise definition	Specifications
	Reliability	Unknown
	Face/Consensual validity	Panel/MMWG, literature
	Construct validity	Unknown
	Criterion validity	Unknown
	Bias and risk adjustment	Theoretical issues
	Power	Theoretical issues

VALIDATION RECOMMENDATIONS

- ✘ STEP 1: ESTABLISH CONSENSUAL VALIDITY THROUGH STRUCTURED PANEL REVIEW PROCESS
- ✘ STEP 2: DEVELOP DATA COLLECTION PROCESSES
- ✘ STEP 3: DEVELOP METHODS TO ASSESS FEASIBILITY
- ✘ STEP 4: DEVELOP METHODS FOR ASSESSING PROXY OUTCOMES IN AN EXERCISE (optional)
- ✘ STEP 5: IDENTIFY A REPRESENTATIVE SAMPLE OF HOSPITALS TO PILOT TEST MEASURES
- ✘ STEP 6: COLLECT PILOT DATA, INCLUDING TEST-RETEST RELIABILITY, INTER-RATER RELIABILITY, AND MEASURE PERFORMANCE
- ✘ STEP 7: ASSESS THE DISTRIBUTION OF PERFORMANCE AND RELATIONSHIP BETWEEN MEASURES