



# Assessing Validity: Empirical Analysis

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# Agenda

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- Indicator Evaluation Criteria
- Domains of Validity
- Domains of Reliability
- Review of Available Data Sources
  - Linking available data to measures
- Validation Example
  - Number of available beds



# Evaluation Criteria

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- Measures are evaluated on four criteria:
  - Validity
    - measure captures what was intended
  - Reliability
    - measure provides consistent results over time
  - Feasibility
    - measure is user-friendly and does not impose excessive burden
  - Utility
    - supports decisions related to improvement



# Domains of Validity

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- Content (consensual)
  - established by consensus
- Criterion
  - established by comparing results from one data source to a superior data source
- Predictive
  - established through actual performance
- Construct
  - established by demonstrating associations between measures that ought to be related



# Domains of Reliability

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- Unclear operationalization
  - The indicator lacks clear, standardized definitions.
- Lack of objective standards
  - The indicator is based on subjective assessments rather than objective standards.



# Domains of Reliability

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- Lack of variation
  - The indicator yields insufficient variation to distinguish between high and low performing programs.
- Insufficient number of events
  - The indicator measures an insufficient number of events or observations for confidence in the measurements obtained.



# Validation steps

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- Data base identification and search
- Initial database quality analysis
- Indicator identification
- Cross-linking with other database indicators
- First screening of quality (correlation)
- Detailed analysis (outcome)



# Database Review

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- A search of potential Emergency Preparedness (EP) Databases
  - Web based engines
    - ISI Web of Knowledge, PubMed, Google Scholar
  - State and Federal sources
    - ASPR, DHS
  - National and regional EP expert feedback



# Database Selection

- **Databases with EP information (total 49)**
  - Price Waterhouse Cooper's Public Health Emergency Preparedness (PHEP)
  - The Joint Commission
  - Government Accountability Office
  - American Hospital Association Health Forum
    - Annual Survey, TrendWatch
  - National Hospital Ambulatory Medical Care Survey (MHAMCS) 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



# Database Selection

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- **Inclusion**
  - Sources with regional/state level Healthcare or hospital links and those with correlation to measurement indicators
- **Final database sources 13**



# Identifying Links

- **13 Databases Evaluated**
  - Characteristics
  - Quality
  - Size
  - Temporal
  - Relationship
  - Power
  
- **Total Identified Indicators with Correlations**
  - 61
    - 5 National Hospital Discharge Survey
    - 56 The Hospital Preparedness Program



# Identifying Link Example

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## ■ 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-hours

## ■ 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.



# Identifying Link Example

## ■ 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 of 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.



# Identifying Link Example

## ■ HPP SI 26 A3

- Number and level of PPE statewide to protect current and additional health care workers during an event at Level C
- When listed as MLR 2.6 : 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.



# Validation Process

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- Data must be available to describe indicators
- Association identified between existing data to defined indicators
- Data aggregated on the state level
- Spearman Rank Correlation Coefficient determined



# Validation Example

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



# Data Correlation

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- Spearman Rank Correlation Coefficient:
  - The data observations are ordered and their ranks are compared
  - Measurement range ( $-1 \leq r_s \leq 1$ )
  - Rho ( $\rho$ ) toward positive or negative 1 is highly correlated

# The Math

- Correlation Coefficient

$$\rho = \frac{n(\sum x_i y_i) - (\sum x_i)(\sum y_i)}{\sqrt{n(\sum x_i^2) - (\sum x_i)^2} \sqrt{n(\sum y_i^2) - (\sum y_i)^2}}$$

- Significance test using t-distribution

# Data Correlation

- Number of Hospital Beds Available
  - $\rho = \mathbf{0.8179}$
  - $t^* = 9.7456 \gg 3.496 = 99.95\%$  Confidence Level
  
- State population
  - $\rho = \mathbf{0.9948}$
  - $t^* = 66.96 \gg 3.496 = 99.95\%$  Confidence Level



# More Detailed steps

- After initial data quality analysis, more detailed analysis of data (regression)
  - Clarification of data
  - Aggregation of data
  - Data transfer to analysis program
  - Inter-base correlation
  - Correlation between second database
  - Outcome planning



# Example: Surge Capacity

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- Using AHA and HPP data, can determine approximate surge capacity
- Correlate between 2 datasets at aggregate level, e.g. bed capacity
- Regression performed including other HPP and AHA variables (dependent and independent)
- Need outcome: Surge capacity beds will lead to improved preparedness

# Issues

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- Data variable (quality)
- Not collected in similar manner throughout years
- Attempts to aggregate but not collected at same level (usually not a problem)
- Outcome: we have to make assumptions (e.g good surge capacity score means preparedness)
  - Drill data
  - Real time collection
  - Consistency in data



# Questions?

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