Improving Return on Public Health Investments in Disasters with Evidence Synthesis

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Evidence Aid
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Effectiveness of Hospital Staff Mass-Casualty Incident Training Methods: A Systematic Literature Review
Edbert B. Hsu, Mollie W. Jenckes, Christina L. Catlett, Karen A. Robinson, Carolyn Feuerstein, Sara E. Cosgrove, Gary B. Green, Eric B. Bass
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Bioterrorism and Other Public Health Emergencies
Tools and Models for Planning and Preparedness

Evaluation of Hospital Disaster Drills: A Module-Based Approach

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Evidence Synthesis

Formal methods for summarizing evidence for a question by collecting studies addressing similar questions and evaluating the consistencies and variability in these studies
Evidence-based Medicine

“The conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.”

- Sackett et al., 1996
Evidence-Informed Decisions

The conscientious, explicit, and judicious use of current best evidence in making decisions. Evidence-based decision making means integrating individual expertise with values and preferences of the constituencies, and with the best available external evidence from systematic research.

Decisions about:
- Programmes
- Future research
-> Investment
Systematic Reviews

A review of existing evidence that uses explicit methods of identification, selection and validation of included information

• *Meta-analysis* uses statistical methods to quantitatively summarize results of similar but separate studies
## Systematic Review: Resources

### Protocol

1. **Refine Question**
2. **Searching**

### Table of Resource Requirements

<table>
<thead>
<tr>
<th>Task</th>
<th>Number</th>
<th>Time Calculations</th>
<th>Total Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search and setup of Database</td>
<td>13,875</td>
<td>Searching multiple databases 2-3 days; 1 week for deduping</td>
<td>10 working days</td>
</tr>
<tr>
<td>Title and Abstract screen</td>
<td>10,000</td>
<td>1 minute per title x 2 people</td>
<td>333 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 FTE weeks, 2 people</td>
</tr>
<tr>
<td>Full Text Retrieval</td>
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<td>15 minutes per paper (retrieve and load)</td>
<td>250 hours</td>
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<td></td>
<td></td>
<td></td>
<td>7 FTE weeks, 1 person</td>
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<tr>
<td>Full Text Screen</td>
<td>1,000</td>
<td>10 minutes per paper x 2 people</td>
<td>333 hours</td>
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<td></td>
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<td>5 FTE weeks, 2 people</td>
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<tr>
<td>Data abstraction</td>
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<td>2 hours per paper x 2 people</td>
<td>200 hours</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3 FTE weeks, 2 people</td>
</tr>
<tr>
<td>Evidence grading</td>
<td>15</td>
<td>35 hours for M-A and for 5 summary profiles</td>
<td>2 data abstractors and 1 analyst</td>
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</tbody>
</table>
What is value of evidence synthesis?

• What works
• What is missing
“Advice on some life-saving therapies has been delayed for more than a decade, while other treatments have been recommended long after controlled research has shown them to be harmful.”

- Antman et al., 1992
Examples in Disasters?

The impact of Cochrane evidence on tranexamic acid for acute traumatic injury

For more than 20 years, Cochrane has produced systematic reviews of primary research in human health care and health policy. We are internationally recognized as the highest standard in evidence-based healthcare resources. The Cochrane Making a Difference series focuses on stories of how Cochrane evidence has made an impact on real-world health decision making and outcomes.

More than four million people worldwide die of injuries every year, often because of extensive blood loss. Antifibrinolytic drugs, including tranexamic acid (TXA), promote blood clotting. The Cochrane Review ‘Antifibrinolytic drugs for acute traumatic injury’, published in May 2015 from the Cochrane Injuries Group, found evidence that using TXA safely reduces mortality in trauma patients with bleeding without increasing the risk of adverse events.

The review includes high-quality evidence gathered from more than 20,000 patients in 40 countries. As a result of these findings, TXA is now being used as an intervention for traumatic injuries by armed forces and ambulance services around the world, and has been added to the WHO Essential Medicines list.
What is missing?

![Graph showing outcomes and health impacts with missing data points.](http://gapmaps.3ieimpact.org/evidence-maps/water-sanitation-and-hygiene-evidence-gap-map)
“More research is needed”
Research Gap

A topic or area for which missing or inadequate information limits the ability of reviewers to reach a conclusion for a given question.

Research Need

A gap that limits the ability of decision makers (consumers, policy makers, etc.) from making decisions.
Continuum of Research Gaps → Research Needs

Identify gaps → Characterize gaps → Translate into needs → Prioritize needs → Disseminate needs
Development of Framework

To maximally inform researchers, policy makers, and funders - *Where* and *how* evidence falls short

Two main components of the framework

1. Characterization of gap
2. Reason(s) for existence of gap
### Characterization of Missing Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Population with gestational diabetes, adults on anti-depressive medication, African Americans with Helicobacter pylori infection</td>
</tr>
<tr>
<td>I</td>
<td>Intervention metformin, selective serotonin reuptake inhibitors (SSRIs), any oral antihistaminic drug, total thyroidectomy</td>
</tr>
<tr>
<td>C</td>
<td>Comparison any insulin, any non-steroidal anti-inflammatory drug (NSAID), hemithyroidectomy, placebo</td>
</tr>
<tr>
<td>O</td>
<td>Outcomes neonatal hypoglycemia, neonatal intensive care unit (NICU) admissions; liver outcomes (alanine transaminase [ALT], aspartate transaminase [AST]), renal outcomes (proteinuria, serum creatinine)</td>
</tr>
<tr>
<td>S</td>
<td>Setting at home, in the hospital, in the outpatient setting</td>
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</tbody>
</table>

T (timing) to be considered for I, C and O

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Reason(s) for Gap

A. Insufficient or imprecise information
B. Biased information
C. Inconsistent or unknown inconsistency
D. Not the right information
A. **Insufficient or imprecise information**

Information is insufficient or imprecise if data are sparse and thus uninformative and/or confidence intervals are wide and thus can include conflicting results or conclusions.

A1 – This reason should be selected if no studies are identified.

A2 – This reason should be selected if a limited number of studies are identified.

A3 – This reason should be selected if the sample sizes or event rates in the available studies are too small to allow conclusions.

A4 – This reason should be selected if the estimate of the effect (usually achieved from a meta-analysis) is imprecise. That is, if the width of the confidence interval is such that the conclusion could be for benefit or harm.

Correspondence to grading systems:

- **EPC SOE**: **Precision** is a required domain.

- **GRADE**: The GRADE Working Group advises decreasing the grade of the quality of the evidence if the data are “imprecise or sparse”.

- **USPSTF**: The following questions are considered while grading the evidence:
  - “How many studies have been conducted that address the key question(s)?”
  - “How large are the studies? (Influence on the precision of the evidence?)”
Worksheet

Systematically identify gaps from systematic reviews

- Prospectively
- Retrospectively

**Framework for Determining Research Gaps During Systematic Review: Evaluation**

*Methods Research Reports*

Investigators: Karen A. Robinson, PhD, Oluwaseun Akinyede, MPH, Tania Dutta, MS, MPP, Veronica Ivey Sawin, BA, Tianjing Li, MD, PhD, Merianne Rose Spencer, BS, Charles M. Turkelson, PhD, and Christine Weston, PhD.

Johns Hopkins University Evidence-based Practice Center

Rockville (MD): Agency for Healthcare Research and Quality (US); 2013 Feb.
JHU EPC Frameworks Project: Research Gaps Worksheet

Systematic Review ID: ________________

Completed by – ________________
Date – ________________
Page ____ of ____

Key Question Number (Enter “99” if outside scope) – ________________

<table>
<thead>
<tr>
<th>Gap No.</th>
<th>Reason(s) for Gap*</th>
<th>Other Reason(s) for Gap</th>
<th>POPULATION (P)</th>
<th>INTERVENTION (I)</th>
<th>COMPARISON (C)</th>
<th>OUTCOMES (O)</th>
<th>SETTING (S)</th>
<th>Free Text Gap</th>
<th>Notes</th>
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</table>

* Reasons for Gap

**Insufficient or Imprecise Information** → A1=No studies, A2=Limited number of studies, A3=Sample sizes too small, A4=Estimate of effect is imprecise

**Information at Risk of Bias** → B1=Inappropriate study design, B2=Major methodological limitations in studies

**Inconsistency or Unknown Consistency** → C1=Consistency unknown (only 1 study), C2=Inconsistent results across studies

**Not the right information** → D1=Results not applicable to population of interest, D2=Inadequate duration of interventions/comparisons, D3=Inadequate duration of follow-up, D4=Optimal/most important outcomes not addressed, D5=Results not applicable to setting of interest
Application of framework to 50 systematic reviews:

• 144 review questions:
  • in 19 EPC reports average of 5.5 questions
  • in 31 Cochrane reviews average of 1.3 questions

• Number of gaps per question:
  • 12.75 gaps per question for EPC reports (95% CI 9.31 to 16.19)
  • 8.5 gaps per question for Cochrane reviews (95% CI 6.23 to 10.32)

• A total of approximately 600 unique research gaps were identified and characterized

• Insufficient information (Reason A) was most frequent reason for the gaps, followed by inconsistency (C), not the right information (D), and biased information (B)
Process to Identify Research Needs

Multi-step continuum for setting research agendas

1. Identify research gaps
2. Characterize research gaps
3. Translate research gaps into research needs
4. Prioritize research needs
5. Disseminate research needs

Step I: Identification and abstraction of research gaps

Step II: Feedback from authors of systematic review

Step III: Translation of research gaps into researchable questions

Step IV: Feedback from local stakeholders

Step V: Feedback from external stakeholders

Step VI: Prioritization of outcomes

Step VII: Refinement of final research questions and development of conceptual models to display research questions

Step VIII: Evaluation of entire process

Avoidable waste in research:

- More than 50% studies designed without reference to systematic reviews of existing evidence

Biomedical research: increasing value, reducing waste. Macleod et al., The Lancet - 11 January 2014 (Vol. 383, Issue 9912, Pages 101-104)
• About 80% of prior studies about the same question were NOT cited in reports of RCTs
  • About half of the RCTs cited zero or one prior trial

• Information from 76% of participants enrolled in prior trials not acknowledged
“While the use of research synthesis to make evidence-informed decisions is now expected in health care, there is also a need for clinical trials to be conducted in a way that is evidence-based.

Evidence-based research is one way to reduce waste in the production and reporting of trials, through the initiation of trials that are needed to address outstanding questions and through the design of new trials in a way that maximizes the information gained.”
What should happen?

Use synthesis of existing evidence to:
  • Identify worthwhile questions (gaps + needs)
  • Design valid and informative studies
  • Report results within context of what is known
Evidence-Based Research

Using evidence to inform research so that it is addressing questions that matter in a valid, efficient and accessible manner.
The Evidence-Based Research Network

ebrnetwork.org

Launched
1-2 December 2014
in Bergen, Norway
Reduce waste in research by promoting:

1. No new studies without prior systematic review of existing evidence
2. Efficient production, updating and dissemination of systematic reviews
Value of Evidence Synthesis?

Evidence-informed decisions:

• What works -> prioritise
• What is missing -> evidence-based research
• Investments
Questions

• Examples of evidence synthesis findings about what works (or doesn’t) that changed practice?
• What metrics are most helpful for comparison and to prioritise interventions/efforts?
• How can evidence-based research be implemented in this field?