Sustainable Preparedness & Response Systems

Targeting System Improvements Using Metrics & Models of Performance

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PHASYS
Public Health Adaptive System Studies

A CDC Preparedness & Emergency Response Research Center
Purpose

To generate criteria and metrics for measuring the effectiveness and efficiency of preparedness and emergency response systems

with application for evidence-based planning & investment for the public health system
To build sustainable preparedness & response systems -

Target investments to increase positive impact on outcomes
Research for “all hazards”

PHASYS starts with infectious diseases
- Outbreaks provide data, experience, and involvement among many public health system nodes

PHASYS later extends to natural disasters, accidents, and terrorism with public health consequences
- Each hazard type has response systems similar to and distinct from the others
Assumptions for sustainable system performance in response to infectious disease outbreaks

1. Optimal outcome is **fewest cases**
2. Cases are fewest when time between **critical response actions** is shortest.
3. Critical response actions are most rapid when **system characteristics** are optimal.
4. Optimal system characteristics have **measurable indicators**.
5. High-impact indicators can be identified in **computer-generated models**.
6. Model-identified indicators can be tested and validated in **field observations**.
System characteristics supporting critical actions in outbreak response:

- Clinical acuity to diagnose
- Laboratory capacity to confirm
- Information intake for reporting
- Case investigation capacity
- Authority to mitigate exposure source
- Communication authority, expertise & competence
- Management capacity for treatment & prophylaxis
In a 25-year retrospective literature review of >100 outbreak reports, 10 time-specific critical response actions were observed:


- Clinical observation
- Accurate diagnosis
- Laboratory confirmation *
- Exposure source identification
- Report to public health authority
- Risk-mitigation
- Population prophylaxis (if disease-appropriate)
- Public education
- Risk advice to healthcare workers
- Last new case documentation
System characteristics & proposed indicators for outbreak response

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>INDICATORS, SUCH AS …</th>
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<tbody>
<tr>
<td>Clinical</td>
<td>Time between observation &amp; diagnosis</td>
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<tr>
<td>Laboratory</td>
<td>Time to confirm diagnosis</td>
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<tr>
<td>Info intake</td>
<td>Time to receive &amp; act on clinical or lab report</td>
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<td>Case investigation</td>
<td>Time to deploy field staff, create case definition, find cases</td>
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<tr>
<td>Authority</td>
<td>Time to mitigate exposure source (i.e., close restaurant; impose quarantine)</td>
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<tr>
<td>Communication</td>
<td>Time to communicate inter-agency and with media &amp; public; effects of communication</td>
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<tr>
<td>Management</td>
<td>Time to deliver prophylaxis and/or treatment</td>
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Iterative approach to modeling, testing, and validation

Identify & Validate Response Indicators in Field Activity

Build Response Indicators in PHS model

Identify High-Impact Response Indicators

Challenge Model with Outbreaks
School Outbreak Movie
Limitations and caveats

- **Modeling requires practice expertise**
  - Field data
  - Professional participation & advice
- **Good models are simple, not perfect**
  - Refinement of system indicators occurs incrementally
- **Model results are not generalizable**
  - But do yield insights for field study, decision-making, and policy-making
Achieving sustainable response systems

“To improve something, we must be able to control it; to control it, we must be able to understand it; and to understand it we must be able to measure it.”

B. Turnock, Public Health – What It Is & How It Works
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