Public Health Preparedness As Scalable Learning

Christopher Nelson, Ph.D.

Senior Political Scientist
Professor of Public Policy, Pardee-RAND Graduate School

This presentation reflects the author’s views and not necessarily those of RAND
Many of the tools and materials I will discuss today are freely available in the public domain.
Key Themes

- What is Preparedness? What are its key components?
  - A definition and logic model

- Preparedness as scalable learning
  - Lessons from 10 years of designing improvement tools
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Several Factors Make PHEP Difficult to Characterize

• Large-scale public health emergencies are, fortunately, rare

• Community characteristics, threat profiles vary considerably across communities
Public health “system” is fragmented
- National and subnational units
  - Structure and function vary
- Non-public health partners
  - Health care, policymakers, EMS, security, media, …
  - Who’s responsible for what?

Where is “the scene”?
The Definition of Preparedness

Public health emergency preparedness (PHEP) is the \textit{capability} of the public health and health care systems, communities, and individuals, to \textit{prevent, protect against, quickly respond to, and recover from} health emergencies, particularly those whose scale, timing, or unpredictability threatens to \textit{overwhelm routine capabilities}.

Preparedness involves a \textit{coordinated and continuous process} of planning and implementation that relies on \textit{measuring performance} and taking \textit{corrective action}.

Emergencies Are Defined by **Consequences**, Not Causes

Emergency Overwhelms routine capabilities
- Scale
- Rapid onset
- Uncertainty

“All hazards” approach – avoid focusing on the “disaster du jour”
PHEP Also Involves Recovery

Response

Recovery

Emergency

Response

Recovery
Reduce the Need to Respond Through Prevention and Mitigation

Prevention
- Reduce hazards
- Reduce vulnerabilities

Response

Recovery

Capabilities vs. Capacities

- Preparedness capacities: resources to draw upon
  - infrastructure
  - policies and plans
  - knowledgeable and trained personnel

- Response capabilities: actions a public health system can take to identify, characterize, and respond to emergencies
Plans Are Usually Made by the Few, but Implemented by the Many

“You don’t have a strategy unless it is in the heads, hearts, and hands of every person in the organization” (Meyer-Looze, 2015).
Are There Common Elements of PHEP That Apply Across Situations and Contexts?
Logic Model Can Add Additional Detail

- Logic models specify how capacities and capabilities relate to goals/objectives
- Logic model seeks to provide a simplified view of the WHOLE system, not just the gaps
- Capabilities & capacities as proxies for outcomes

- Reviewed European incidents involving hazards of
  - biological origin (*E.coli*, H1N1 pandemic)
  - chemical origin (red sludge reservoir breach in Hungary, melamine in milk products imported from China)
  - environmental origin (heat wave and a volcanic ash cloud)
- Added Ebola (based on ECDC peer review visits)
- Revised based on input from National Focal Points
Earliest possible identification of event

Early and effective response
- Minimising morbidity and mortality
- Limiting spread of disease
- Minimising social disruption
- Minimising infrastructure and environmental damage

Earliest possible recovery and return to normal
From “Essential Public Health Services” (IOM, 1988)

**Capacities**

- Policy development and implementation
  - For infection control and treatment guidance
  - For population-based disease control
  - Enforcing laws and regulations

- Assessment
  - Incident recognition
  - Risk characterization
  - Epidemiological investigation
  - Surveillance and epidemiological monitoring
  - Laboratory analysis
  - Environmental monitoring

- Health care services
  - Preventive services
  - Medical surge
  - Management of medical countermeasures, supplies and equipment
  - Care for health care workers and emergency responders

- Coordination and communication (within the public health emergency preparedness system)
  - Crisis management
  - Communication with healthcare providers
  - Communication with emergency management, public safety, and other sectors
  - Communication with other public health agencies at the global, European, national, and subnational levels

- Emergency risk communication (with the public)
  - Identification of public information needs
  - Developing message content and delivering through appropriate channels

**Response Capabilities**

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**Objectives**

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- Earliest possible recovery and return to normal

- Early and effective response
  - Minimising morbidity and mortality
  - Limiting spread of disease
  - Minimising social disruption
  - Minimising infrastructure and environmental damage
Legal Measures
- Accountability
- Organisational structures
- Policy Development
- Delegation of authority
- Administrative preparedness

Economic Measures
- Financing
- Workforce development
- Facilities
- Infrastructure

Operational Measures
- Capacity assessment and planning
- Drills and exercises
- After Action reports and post-event evaluation

Social Capital: partnerships between public health and
- Health care providers
- Emergency responders
- Law enforcement
- Community organisations

Response Capabilities

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Earliest possible recovery and return to normal
Competencies Seek to Translate System-Level Attributes Into Individual-Level Attributes

• Promote consistency while recognizing variation in system structures, individual professional backgrounds

• Includes “KSAs”
  • Knowledge – body of information applied directly to the performance of a function
  • Skills – observable competence to perform a learned psychomotor act
  • Ability – competencies to perform observed behaviour or behaviours that result in an observable product

• Appropriate level of expertise needed will come with the development of training programs for particular categories of workers
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Preparedness involves a coordinated and continuous process of planning and implementation that relies on measuring performance and taking corrective action.

Capabilities Are Necessary, But Not Sufficient. Implications for “Going to Scale…”
“No Plan Survives First Contact With Reality”

<table>
<thead>
<tr>
<th>Issue</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited “shelf life” of capabilities</td>
<td>Staff turnover, loss of operational experience</td>
</tr>
<tr>
<td>Finding the best combination of resources that will yield the desired capability</td>
<td>MCM distribution infrastructure. Will partners and resources really be available?</td>
</tr>
<tr>
<td>Un-recognized assumptions</td>
<td>H1N1, antivirals, and cold-chain management issues due to longer-than-expected distribution timelines</td>
</tr>
</tbody>
</table>
The Preparedness Cycle

1. Identify risks
2. Prioritise top risks
3. Understand prioritised risks in detail
4. Identify preparedness options
5. Design preparedness strategies
6. Implement preparedness strategies
7. Monitoring and evaluation (past or current events)
8. Update preparedness strategies

Source: Suk et al., 2015
Backward-Looking Learning

Source: Suk et al., 2015
Critical Incident Registry (CIR) for Public Health Emergency Preparedness

- Based on successful experience in other sectors, especially aviation

- Registry concept
  - Database of incident reports filed by public health agencies that responded to a critical incident

- Objectives
  - Drive organizational improvement through careful post-event analysis of “own” events
  - Facilitate identification and sharing of “best practices”
  - Facilitate cross-case analyses to identify contexts and mechanisms that determine success

Identify root causes, preparedness actions that (could have) supported successful response. Consider “what-ifs” in order to get more learning value from cases
Increase Sample Size By Looking at Less Extreme Events That Nonetheless Leverage Key Capabilities

EXAMPLES

• Seasonal flu clinics to test elements of rapid vaccination systems, incident management

• “Routine” foodborne outbreaks to test elements of ERC (e.g., hotlines), laboratory analysis, etc.
Forward-Looking Learning

Source: Suk et al., 2015
Drills & Exercises – The Promise...

Widespread Use
Drills & Exercises – The Promise…

Widespread Use

Helps Test and Improve Capabilities

- Active, experiential learning
- Opportunity for very specific feedback at opportune moments
- Activates socio-cultural sources of learning
- Building and testing shared mental models
- Motivation of change agents on the front-lines
And the Problems

- Cost, burden, high-profile can limit frequency, willingness to “test to failure”
- Limited implementation of corrective actions
- Often scripted, with little element of surprise
- Often don’t test the “fuzzy” capabilities (e.g., crisis management)
- Lack of a “common language” for cross-jurisdictional communication about gaps, solutions
Some Possible Solutions

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Difficult to Test Entire Capabilities – Process Analysis Can Help Focus Measures on Crosscutting “Building Blocks”

BEGIN

Request SNS | CDC decision
--- | ---

CDC ships push package or MI (12 hours)

Command

Select RSS, POD

Apportion inventory

Generate pick list

Warehousing

Call down

Assemble staff

Train staff

Setup RSS

Distribution

Call down

Assemble staff

Train staff

Setup Dist’n

Dispatch

Dispensing

Call down

Assemble staff

Train staff

Setup PODs

Local plan

Local staff prophylaxis

ERP

Notify Public

PODs dispense
(48 hrs less setup or transit time)

END
Difficult to Test Entire Capabilities – Process Analysis Can Help Focus Measures on Crosscutting “Building Blocks”

BEGIN

Time = 0

48hrs

CDC ships push package or MI (12 hours)

Request SNS  |  CDC decision

Select RSS, POD  |  Apportion inventory  |  Generate pick list

Unload (1 hr)  |  Pick (1 hr)

Call down  |  Assemble staff  |  Train staff  |  Setup RSS

Call down  |  Assemble staff  |  Train staff  |  Setup Dist’n

Call down  |  Assemble staff  |  Train staff  |  Setup PODs

PODs dispense (48 hrs less setup or transit time)

Local staff prophylaxis

Notify Public

END
Small-Scale Drills With Metrics Provide Opportunity to Test “Building Block” Capabilities

Focus on and develop metrics for key individual processes first

- Call down staff
- Assemble staff
- Train staff
- Operate warehouse
- Dispense medication
Small-Scale Drills With Metrics Provide Opportunity to Test “Building Block” Capabilities

Focus on and develop metrics for key individual processes first

Call down staff
Assemble staff
Train staff
Operate warehouse
Dispense medication

Then test capabilities together

“Select, combine, adapt”

Call down  Assemble  Train  Operate warehouse  Dispense
Some Possible Solutions

- Costly, labor intensive, often high-profile
  - Limits frequency of testing, willingness to “test to failure”
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Example: Hospital Surge Drill Focuses on Bed-Clearing During First 90 Minutes of an Incident

90 minutes total

Emergency Department (ED)

Hospital Command Center

Peer assessors

Peer assessors
Exercise Injects Occur at Emergency Department

- Evaluators provide periodic patient “arrivals”
- Hospital must triage patients and find space for them
  - No actual patient movement
Hospital Command Center (CC) Activities Driven By Action in the ED

- ED communicates with Command Centre regarding need for beds
- Command Centre provides ED with locations of (specific!) available beds
Tool Provides Detailed Instructions for Controllers/Evaluators, Minimizing Prep Time

**Review Instructions**

*Evaluation team & trusted insider should assemble at a pre-designated place, approximately 30 minutes prior to the exercise start.*

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**T=0 to T=15 Time Interval**

- **Start Time**: 12:29 PM
- **Exercise Time**: 0:26:00 (10 sec intervals)
- **End Time**: 1:44 PM

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**Read Script Aloud**

*For the next 75 minutes, we will be running a mass casualty exercise. We will need at least two ED staff to participate. Since the drill must not interfere with patient care, participants must be relieved of all clinical duties.*
... And Convenient Places to Enter Data, Minimizing Analysis Time
Hot-wash: Auto-Generated Graphs For Hot Wash Provide *Immediate* Feedback To Players

- **Patient Arrivals vs. Time**
  - Red
  - Yellow
  - Green

- **ED Immediate Bed Availability (IBA) vs. Time**

- **Patient Transfers out of the ED vs. Time**
  - Red
  - Yellow
### Arrival List T=15

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Leg deformity; bleeding controlled with pressure dressing</td>
</tr>
<tr>
<td>2.</td>
<td>Chest wound; walking around; no respiratory distress</td>
</tr>
<tr>
<td>3.</td>
<td>Covered in soot, ambulatory</td>
</tr>
<tr>
<td>4.</td>
<td>C/o thumb deformity</td>
</tr>
<tr>
<td>5.</td>
<td>Coughing, intermittently gagging; able to speak in full sentences, ambulatory</td>
</tr>
<tr>
<td>6.</td>
<td>Thigh laceration; no hematoma, no active bleeding</td>
</tr>
<tr>
<td>7.</td>
<td>Covered in soot, ambulatory</td>
</tr>
<tr>
<td>8.</td>
<td>4cm leg laceration no active bleeding</td>
</tr>
<tr>
<td>9.</td>
<td>Scalp laceration with pressure dressing; GCS 15</td>
</tr>
<tr>
<td>10.</td>
<td>Eye pain, tearing, debris in eyes</td>
</tr>
</tbody>
</table>
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Adding the Element of Surprise

• Hospital Surge Test is no-notice, but within a pre-announced 2-week window
  – Hospital chooses time window, peer assessors

• Countermeasure dispensing “call-down” drills
  – Staff
  – Facilities
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Collective Decision-making During Crises: Some Challenges

- Different mental models and assumptions
- Different terminology
- Different views on dealing with uncertainty and political sensitivities

Yet, drills and exercises often don’t test this, or don’t provide structured feedback on it
Simple Computer Simulations Can Provide Meaningful Practice and Feedback on Crisis Decision-making

Distribution Network Map

<table>
<thead>
<tr>
<th>POD Number</th>
<th>Inventory at POD</th>
<th>Served in Period</th>
<th>Backlog</th>
<th>Amount Ordered</th>
<th>Amount to Ship</th>
</tr>
</thead>
<tbody>
<tr>
<td>POD 1</td>
<td>1000</td>
<td>0</td>
<td>0</td>
<td>1100</td>
<td>0</td>
</tr>
<tr>
<td>POD 2</td>
<td>1500</td>
<td>0</td>
<td>0</td>
<td>1500</td>
<td>0</td>
</tr>
<tr>
<td>POD 3</td>
<td>2000</td>
<td>0</td>
<td>0</td>
<td>2000</td>
<td>0</td>
</tr>
<tr>
<td>POD 4</td>
<td>2500</td>
<td>0</td>
<td>0</td>
<td>2500</td>
<td>0</td>
</tr>
<tr>
<td>POD 5</td>
<td>3000</td>
<td>0</td>
<td>0</td>
<td>3000</td>
<td>0</td>
</tr>
<tr>
<td>POD 6</td>
<td>3500</td>
<td>0</td>
<td>0</td>
<td>3500</td>
<td>0</td>
</tr>
<tr>
<td>POD 7</td>
<td>4000</td>
<td>0</td>
<td>0</td>
<td>4000</td>
<td>0</td>
</tr>
<tr>
<td>POD 8</td>
<td>4500</td>
<td>0</td>
<td>0</td>
<td>4500</td>
<td>0</td>
</tr>
<tr>
<td>POD 9</td>
<td>5000</td>
<td>0</td>
<td>0</td>
<td>5000</td>
<td>0</td>
</tr>
<tr>
<td>POD 10</td>
<td>5500</td>
<td>0</td>
<td>0</td>
<td>5500</td>
<td>0</td>
</tr>
</tbody>
</table>

Instructions:
1. Enter the amount of inventory you plan to ship to each POD in the yellow input boxes.
2. To ship exactly what was ordered, use the "Ship As Ordered" button.
3. Make sure that your shipment amounts do not exceed the inventory at the RSS.
4. Click "Simulate Period" to run the simulation until it is time to make more shipping decisions.
5. Repeat steps 1 and 2 until the simulation is complete.

Module 1: Visibility of POD Orders Only

Warnings:
At least one POD has a queue of people waiting outside right now.
A Simple, Literature-Based Tool for Evaluating Crisis Decision-making

• Checklist used by expert practitioners in evaluating decision-making component of exercises
  – **Situational awareness.** Incident and resource awareness, etc.
  – **Action planning.** Generating and selecting among alternatives, initiating execution
  – **Process control.** Information processing, leadership, use of expertise, managing conflicts
• Recognize documented biases in group decision-making and use “countermeasures”

**Example**

**Common-knowledge bias:** Decision-making groups often do not adequately draw out information known only to select individuals, limiting situational-awareness and action-planning efforts.

**Countermeasure:** Explicit acknowledgment of expertise can help to counter this tendency.
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Use of Stakeholder-SME Advisory Groups Helps Create Conditions for Uptake

• Groups represented variation in jurisdiction risk profile, governance structure, “level” of system

• Supplements weak evidence base and promotes buy-in
  – Overall Evaluation Workgroup to ensure coherence, integration
  – Subject-specific subgroups provide SME perspectives in specific areas

• Stakeholders often enlisted in developing process maps to identify measures, and reached out to other constituencies
Additional Lessons Learned About Tool-Building

• Pilot test the tools!!!!
  – Use the same “build-measure-learn” logic as in the preparedness cycle.

• Assess validity and reliability, but also utility and feasibility
  – Perceived burden and perceived usefulness affect uptake
  – Assess whether tools lead to actionable insights

• Be very clear up-front about intended uses
  – Accountability, improvement, knowledge-building, etc.

• Tools can be incorporated into policy guidance.
SUMMARY

1. Preparedness definition and logic model identify core components of PHEP system relevant across Member States, contexts, and scenarios

2. Draft competencies translate these system-level properties into individual-level knowledge, skills, and abilities

3. Nevertheless, a robust process of continuous learning is needed to maintain and adapt these general capabilities to specific settings

4. Regular exercises and drills provide one mechanism for supporting such learning
5. User-friendly drill-based tools, built on “drillable chunks” of capabilities, can provide common points of reference EU-wide, without unduly burdening users.

6. Drills and exercises should test the “hard things,” such as dealing with surprise, collective decision-making under conditions of uncertainty, etc.

7. Robust participation and co-design by key stakeholders can help increase the likelihood of update and impact.
Selected References (Freely Available Online)

• Hospital Surge Evaluation Tool: A software-based tool designed to help hospitals evaluate their level of preparedness for mass casualty incidents. http://www.phe.gov/Preparedness/planning/hpp/surge/Pages/default.aspx
• The RSS-POD Supply Chain Management Game: An Exercise for Improving the Inventory Management and Distribution of Medical Countermeasures. http://www.rand.org/pubs/working_papers/WR661.html