

Peak Oil: Implications for Disaster Preparedness & Response

Daniel J. Barnett, MD, MPH
Department of Environmental Health Sciences
Johns Hopkins Center for Public Health Preparedness
Johns Hopkins Bloomberg School of Public Health
March 12, 2009

21st Century Public Health Preparedness Challenges

- Pandemic flu
- Severe weather
- Chronic disease
- Terrorism
- Disaster mental health
- **Peak Oil**

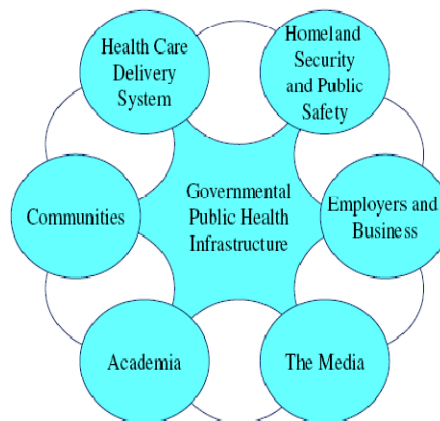


All-Hazards Model

- Current model in U.S.
 - Evolved from terrorism-focused model post-9/11
 - National Incident Management System
 - National Response Framework
 - Pandemic and All Hazards Preparedness Act
- Standardized yet flexible/scalable for broad event spectrum
 - Naturally-occurring (weather, infectious disease)
 - Terrorism (CBRNE)
 - Accidental

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Public Health Preparedness System Framework



IOM 2008

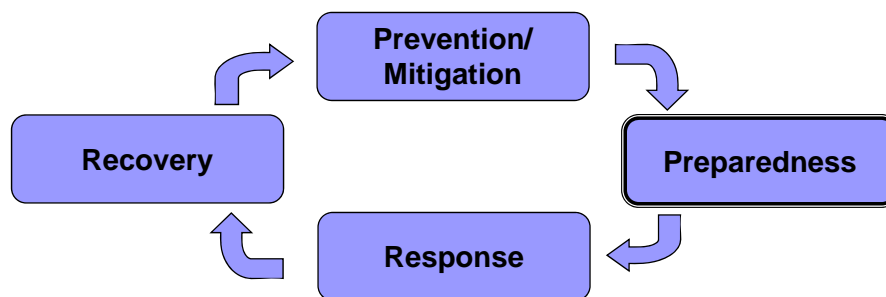
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All disasters are **local** events.

- Regardless of type or magnitude
- Necessitates *locally-driven* response
- Requires *at least* 72-hour self-sustainability at local level post-onset
 - Longer for pandemic flu scenario
 - These estimates do not factor peak oil

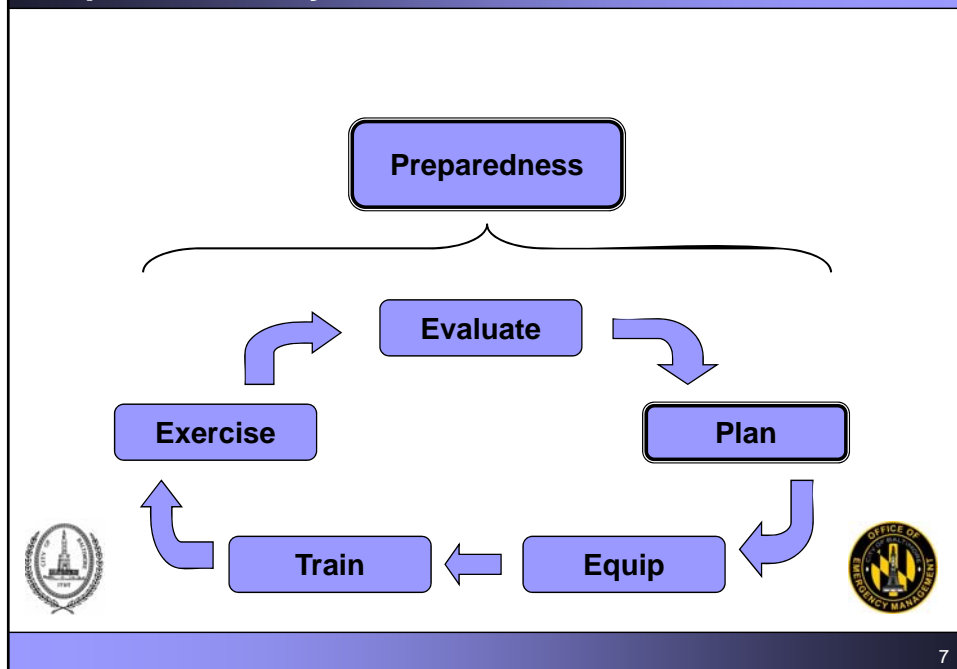
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4 Phases of Emergency Management



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Preparedness Cycle



Strategic vs. Operational Plans

■ Strategic Plans

- Greatest risks?
- Capability gaps?
- How to invest scarce resources to bridge those gaps and reduce risk?

■ Operational Plans

- What functions must be performed in emergencies?
- Who will do what?
- What strategies will be used to respond and recover?
 - Emergency Operations Plan (EOP)
 - Continuity of Operations Plan (COOP)



Peak Oil and Disaster Response Challenges

Peak Oil and All-Hazards

Peak Oil Challenges:

- Cut across all hazards
- Intensify known hazards
- Create “new” hazards
- Impact entire PH preparedness system

Peak Oil and Local Disaster Impacts

- Impact on emergency response system capacity at all jurisdictional levels
- A Local “Perfect Storm”
 - Local self-sustainability requirements and duration will **increase**
 - Local infrastructure resources will **decrease**
 - Physical and psychological vulnerabilities will **increase**

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Peak Oil and Preparedness Phase

- Preparedness phase (“pre-event”)
- Peak Oil disaster preparedness: inadequate to nonexistent
 - Minimal general public awareness
 - Extremely limited local planning/education
 - Inadequately addressed by National Planning Scenarios

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Peak Oil and Response Phase

- Response (crisis phase – “event”)
 - Increased duration
 - Increased severity
- Example: pandemic flu and transportation



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Peak Oil and Recovery Phase

- Recovery (consequence phase – “post-event”)
 - Increased duration
 - Increased severity
- Example: weather-related events and infrastructure restoration



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The Haddon Matrix

	HOST	AGENT	PHYSICAL ENVIRONMENT	SOCIO-CULTURAL ENVIRONMENT
PRE-EVENT				
EVENT				
POST-EVENT				

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The Haddon Matrix: Example

Haddon's Matrix, Pedestrian Injury Example

		Epidemiological Dimension			
		Human Factors	Agent or Vehicle	Physical Environment	Sociocultural Environment
Event Dimension	Pre-Event	Intoxicated pedestrian	Speeding vehicle	Intersection with poor lighting	Low rate of enforcement of yield laws
	Event	Osteoporosis in elderly pedestrians	Car front-end profile	Road surface characteristics	Speed limits
	Post-Event	Elderly pedestrian	Crash investigation with vehicle inspection	Distance to trauma care facility	Regionalized trauma care

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The Haddon Matrix: Event (Response Phase)

	HOST	AGENT	PHYSICAL ENVIRONMENT	SOCIO-CULTURAL ENVIRONMENT
PRE-EVENT				
EVENT				
POST-EVENT				

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Host/Event : Peak Oil Considerations

- Heightened morbidity and mortality
- Pronounced psychological impacts
- Diminished “human” response infrastructure

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Host/Event: (Pan Flu – *Current* Estimates: US)

Characteristic	Moderate (1957/68-like)	Severe (1918-like)
Illness	90 million	90 million
Outpatient med care	45 million	45 million
Hospitalization	865,000	9,900,000
ICU care	128,750	1,485,000
Mechanical ventilation	64,875	745,500
Deaths	209,000	1,903,000

Current Pandemic Flu Estimates: US

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Host/Event: **Psychological Impacts**

- Patients
 - Mental health surge
 - Psychological : Physical Casualties = **10:1 to 100:1**
 - Based on **current (“non-Peak Oil”)** scenarios
- Response personnel
 - Psychosocial vulnerabilities
 - **Willingness** to respond

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Hospital Workers' Willingness to Respond – Pan Flu

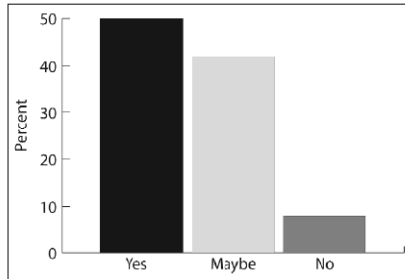


Figure 3—Overall responses to question: "Would you come to work?"

	Yes	Maybe	No, even if I might lose my job
Doctor	42/57 (74%)	14/57 (25%)	1 (2%)
Nurse	24/55 (44%)	23/55 (42%)	8/55 (15%)
Other	19/56 (34%)	34/56 (61%)	4/56 (7%)

Table 2—Results for question: "In the event of an avian influenza pandemic, and patients were being treated at St. John, would you come to work as usual?"

Irvin CB, Cindrich L, Patterson W, Southall A. *Prehosp Disast Med* 2008; 23(4):328-335.

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LHD Workers' Willingness to Respond – Pan Flu

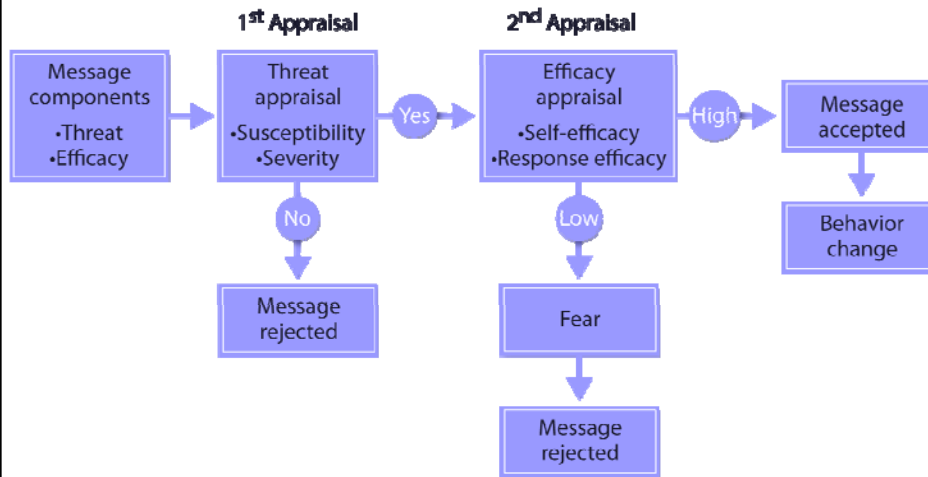
- JH~PHIRST
- N = 2264 (84% survey response)
- 63 LHDs in 3 states (MN, OH, WV)

Reporting to Duty	Weather	Pandemic Influenza	Dirty Bomb	Anthrax
If Required by agency	89%	87%	72%	80%
If Asked, but not required by agency	83%	79%	61%	70%

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The Extended Parallel Process Model (Kim Witte)

- How do you frame messages to get people to take care of themselves?



Willingness to Report *by Scenario/EPPM* (if required)

	Extended Parallel Processing Model Category							
	Low threat, Low Efficacy		Low threat, High Efficacy		High threat, Low Efficacy		High threat, High Efficacy	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Weather	1.00	Ref.	12.47	6.51 23.91	2.15	1.52 3.04	18.86	9.87 36.07
Pan Flu	1.00	Ref.	9.80	5.38 17.83	2.23	1.58 3.16	20.61	11.63 36.53
Dirty Bomb	1.00	Ref.	7.37	5.29 10.26	1.71	1.32 2.21	11.22	7.96 15.83
Anthrax	1.00	Ref.	24.06	12.59 45.96	1.54	1.17 2.03	31.50	18.14 54.69

Frequencies of Attitudes/Beliefs by Scenario - LHDs

Attitude/Belief Construct	Weather	Pan flu	Dirty bomb	Anthrax
Knowledgeable about PH impact	77%	82%	45%	63%
Awareness of role-specific responsibilities	54%	64%	36%	52%
Psychologically prepared	77%	76%	45%	62%
Ability to safely get to work	65%	76%	39%	60%
Confidence in safety at work	71%	66%	35%	54%
Family prepared	70%	69%	46%	57%
Health Department's perceived ability to provide timely information	74%	81%	58%	71%
Ability to address public questions	66%	69%	35%	52%
Importance of one's role in the agency's overall response	71%	76%	53%	67%

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The Haddon Matrix: Agent

	HOST	AGENT	PHYSICAL ENVIRONMENT	SOCIO-CULTURAL ENVIRONMENT
PRE-EVENT				
EVENT				
POST-EVENT				

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Agent/Event: Peak Oil Considerations

- New/emerging pathogens
- Increased virulence in face of weakened immunity
- Increased frequency/intensity of weather-related disasters
- “Psychological contagion”

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The Haddon Matrix: Physical Environment

	HOST	AGENT	PHYSICAL ENVIRONMENT	SOCIO-CULTURAL ENVIRONMENT
PRE-EVENT				
EVENT				
POST-EVENT				

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Physical Environment/Event: Peak Oil Considerations

- Fossil fuel-dependency of PH preparedness infrastructure
 - Supplies/Equipment
 - Transportation
 - Hospitals / EDs

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Physical Environment/Event: Supplies & Equipment

- **Petrochemical** applications in disasters: a selected list
 - Anesthetics
 - Antihistamines
 - Bandages
 - Heating and Cooling
 - Pharmaceuticals
 - Refrigerators
 - Synthetic rubber
 - Splints
 - Transportation
 - X-ray dyes

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Physical Environment/Event: **Stockpiles**

- Strategic National Stockpile
 - 12-Hour Push Packs (less than 5% of the SNS inventory)
 - Broad-spectrum oral and intravenous antibiotics
 - Other medicines for emergency conditions
 - IV fluids and fluid administration kits
 - Airway equipment, such as ET tubes, stylettes, oropharyngeal airways, Ambu-Bags, and CO2 detectors
 - Bandages
 - Vendor Managed Inventories
 - Vaccines
 - Antitoxins (e.g., Botulinum)
 - Ventilators
 - Additional quantities of 12-Hour Push Pack items

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Physical Environment/Event: **Transportation**

- Access to supplies/equipment
 - SNS transport issues
- Ambulance – EMS services
- Access to healthcare settings by patients and **providers**
 - Rural areas especially (but not exclusively) challenged

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Transportation Issues – SNS 12-Hour Push Pack

- The SNS program is committed to having ***12-Hour Push Packs delivered anywhere in the United States or its territories within 12 hours of a federal decision to deploy.***
- The 12-Hour Push Packs have been configured to be ***immediately loaded onto either trucks or commercial cargo aircraft for the most rapid transportation.***
- At the same time assets from the SNS are deployed, the SNS program will deploy its Technical Advisory Response Unit (TARU) to ***coordinate with state and local officials so the SNS assets can be efficiently received and distributed on arrival at the site.***

HHS

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Physical Environment/Event: Case Example

- 1973 Oil Crisis
 - Plastic syringe manufacturers
 - Shortages in ethylene and benzene
 - Increased price
 - Delayed delivery to end-users

Clark GB, Kline B. *Public Health Rep.* 1981;96(2):111-115.

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Transportation Issues – Ambulance Services

- Ambulances frequently diverted from overcrowded EDs to more distant hospitals (which may have fewer resources)
 - Ambulances diverted 501,000 times in 2003
 - 1 ambulance diverted per minute

IOM: *Hospital-Based Emergency Care: At the Breaking Point* (2007)

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Transportation Issues – Ambulance Services

“[Ambulance] diversion may provide a brief respite for a beleaguered staff, but it prolongs ambulance transport times and disrupts established patterns of care. It also creates ripple effects that can compromise care throughout the community. Because crowding is rarely limited to a single hospital, decisions to divert ambulances can prompt others to do the same. When this happens, a community may experience the health care equivalent of a “rolling blackout”. Everyone’s access to care is affected - insured and uninsured alike.”

Congressional Testimony: Ronald D. Bass, MD, FACEP
(July 26, 2006)

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Transportation Issues – LHD Workers

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Transportation Issues – NYC HCWs

- Qureshi et al (2005) study of 6,428 workers [GNYHA]
 - Most frequently cited barriers to **ability** to respond in disasters
 - **Transportation (33.4%)**
 - Child care (29.1%)
 - Personal health concerns (14.9%)
 - Elder care (10.7%)
 - Pet care (7.8%)
 - Second job obligations (2.5%)

Qureshi K, Gershon RR, Sherman MF et al. *J. Urban Health* 2005; 82(3): 378-88.

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Physical Environment/Event: Hospitals / EDs

- Fast-growing demand for emergency care
 - From 1993 – 2003:
 - 26% increase in ED visits
 - # of EDs declined by 425
 - # of hospital beds declined by 198,000
 - A hospital-wide problem
 - Back-up of patients in ED because cannot get admitted to hospital bed
 - Results in patient “boarding” in EDs (can be 48+ hours)
 - **Translation: minimal surge capacity in EDs *currently***

IOM: *Hospital-Based Emergency Care: At the Breaking Point* (2007)

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The Haddon Matrix: Socio-Cultural Environment

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EVENT				
POST-EVENT				

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Socio-cultural Environment: Peak Oil Considerations

- Societal expectations toward PH preparedness systems
- Scarce resource allocation: policy and ethics

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PH Response Resource Scarcity: Ethics

- Justice
 - Requires equitable distribution of benefits and burdens
 - Example: Allocation of finite petroleum-based healthcare supplies

Beauchamp and Childress. Principles of Biomedical Ethics, 5th Edition (Oxford University Press: New York) 1991.

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PH Response Resource Scarcity: Ethics

- How should we allocate?
 - Prevention/public health
 - Scientific/medical functioning
 - Social functioning/critical infrastructure
 - Medical need/vulnerability
 - Intergenerational equity

Gostin LO. *JAMA* 2006, 295(5): 554-556.

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PH Response Resource Scarcity: Ethics

- How should we allocate?
 - "Save the most lives."
 - "Women and children first."
 - "First come, first serve."
 - "Save the most quality life years."
 - "Save the worst off."

Emanuel EJ, Wertheimer A. *Science* 2006; 312: 854-855.

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PH Response Resource Scarcity: Ethics

- How should we allocate?
 - “Reciprocity.”
 - “Save the most likely to survive.”
 - Save those “instrumental in making society flourish.”
 - Save those “who contribute to the well-being of others.”

Emanuel EJ, Wertheimer A. *Science* 2006; 312: 854-855.

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Principles, Problems, Prioritization

- Why is prioritization crucial?
 - Massive loss of life
 - Advanced planning should mean that bioethical principles may be considered
 - Peak oil could mean massive political destabilization
 - Failure to plan could lessen trust and adherence to additional governmental policies (e.g. quarantine)

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Conclusions

- Impact of peak oil is on entire PH preparedness system
- Haddon matrix can be used to parcel out phases and factors
- Local planning must be a priority
- Must consider psychosocial impacts for general public and responders
 - Resistance, Resilience, Recovery
- Need to explicitly incorporate Peak Oil into current disaster planning scenarios and exercises
- Must address ethical issues as an urgent priority for healthcare system preparedness

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Questions?

dbarnett@jhsph.edu
410-502-0591
www.jhsph.edu/preparedness



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