Disaster* Medicine

*serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources

- UN Disaster Management Training Program

Michael Smith, MD MPH
M.A.D.D.
Disasters

*serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources

- UN Disaster Management Training Program
Natural
Hydro/Meteorological
  Hurricanes
  Tornadoes
  Floods
  Wildfires
Geophysical
  Earthquakes / tsunamis
  Volcanoes
Biologic
  Epidemics
Man Made

Intentional

Wars / insurgencies / terrorism

Unintentional

Industrial spills / explosions / climate change (?)
Comparative Mortality

Natural disasters have killed over 4 million people, and affected over 850 million in the last 20 years, and will increase in the future, due to a variety of trends:

- coastal migration worldwide
- moving into urban centers
- marginalized populations building ramshackle communities with no resilience
- climate change disrupting established communities
Comparative Mortality

Source: CRED
The Costs of Disasters are Increasing

Source: Munich Re Touch website, www.munichre.com
Global Distribution
Tornado Incidence – US
MAJOR FIRES
since 2001, colored by units of nuclear power plant output
EARTHQUAKES
since 1898, by magnitude
Disaster Cycle

Major Aspects of Natural Disaster Management

- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Prediction & Warning
- Preparedness
- Response
- Recovery

- Logistics
- Rehabilitation & Reconstruction
- Disaster History
- Written
- Meteorologic
- Hydrologic
- Agricultural
- Environmental
- Epidemiologic
- Historical Record
- Community Experience
- Technical Evaluation
- Engineering
- Land Use Regulation
- Building Standards
- Crop/Cycle Adjustment
- Procedures
- Organization
- Awareness
- Stockpiling
- Community Planning
- Communications Planning
- Communications Planning
- Interoperability
- Interoperability
- Interpretation
- Planning
- Inventory
- Resource Inventory
- Resource Analysis
- Requirements Analysis
- Needs
- Damage
- Search & Rescue
- Sheltering/Protection
- Evacuation
- Public Response
- Communications
- Tracking & Warning
- Interpretation
- Hazard
- Distribution
- Water
- Agricultural
- Infrastructure
- Commercial
- Financial
- Geologic
- Vulnerable
- Adaptive
- Sequestration
- Mitigation
- Mitigation
- Mitigation
- Mitigation
- Mitigation
- Mitigation
Hazard / Vulnerability Analysis 1
Hazard / Vulnerability Analysis 4

DO-IT-YOURSELF SHELTER
(FALLOUT PROTECTION FOR SIX-$150 to $200)

First floor

- Joists 2x6in.
- Garbage & toilet
- Space for bunk beds
- Solid concrete 4x8x11 in.
- Inside clearance 6ft.
- Existing basement wall & floor
- Vent opening

TIME Drawing by V. Puglisi

Nuclear explosion image
Epidemiology / Public Health
Disaster Cycle

Major Aspects of Natural Disaster Management

- Recovery
  - Rehabilitation & Reconstruction
  - Commercial
  - Infrastructure
  - Agricultural
  - Water
  - Housing
  - Transport
  - Finance
  - Written
  - Oral
  - Disaster History

- Hazard Analysis
  - Scientific Analysis
  - Meteorologic
  - Geologic
  - Agricultural
  - Hydrolcologic
  - Environmental
  - Epidemiologic
  - Historical Record

- Vulnerability Analysis
  - Community Experience
  - Technical Evaluation
  - Engineering
  - Land Use Regulation
  - Building Standards
  - Crop/Cycle Adjustment

- Mitigation
  - Organization
  - Procedures
  - Stockpiling
  - Planning

- Preparedness
  - Community Planning
  - Awareness
  - Stockpiling

- Prediction & Warning
  - Forecasting
  - Logistics
  - Needs
  - Damage
  - Search & Rescue
  - Sheltering/Protection
  - Evacuation
  - Public Response
  - Communications
  - Tracking & Warning

- Response
  - Interpretation
  - Decontamination
  - Logistics
  - Resource Inventory
  - Logistics Planning
  - Recovery

- Logistics
  - Warehousing
  - Procurement
  - Resource Analysis
  - Requirements Analysis

- Needs
  - Damage

- Damage
Bioterrorism Agent Categories
A - C

Category A agents
Ease of dissemination / Transmission
High mortality rates
Cause public panic
Require special action to contain

http://emergency.cdc.gov/agent/agentlist-category.asp
Disaster Cycle

Major Aspects of Natural Disaster Management

- Prediction & Warning
- Preparedness
- Response
- Recovery
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Prevention
- Hazard Analysis
- Vulnerability Analysis
- Mitigation & Preve
Additional Items to Consider Adding to an Emergency Supply Kit:

- Prescription medications and glasses
- Infant formula and diapers
- Pet food and extra water for your pet
- Important family documents such as copies of insurance policies, identification and bank account records in a waterproof, portable container
- Cash or traveler's checks and change
- Emergency reference material such as a first aid book or information from www.ready.gov
- Sleeping bag or warm blanket for each person. Consider additional bedding if you live in a cold-weather climate.
- Complete change of clothing including a long sleeved shirt, long pants and sturdy shoes. Consider additional clothing if you live in a cold-weather climate.
- Household chlorine bleach and medicine dropper – When diluted nine parts water to one part bleach per gallon of water. Do not

Ready

Family Emergency Plan

Ready

Emergency Supply List

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
www.ready.gov

Ready

FEMA
Never Be Without Water!

waterBOB
emergency drinking water storage

Store up to 100 Gallons of Fresh Drinking Water

Almaceno hasta 100 galones de agua potable en cualquier bañera de tamaño estándar
PATENT PENDING
Disaster Cycle

Major Aspects of Natural Disaster Management

- Recovery
  - Rehabilitation & Reconstruction
  - Agricultural Infrastructure
  - Commercial Development
  - Community Planning

- Hazard Analysis
  - Historical Record
  - Community Experience
  - Technical Evaluation
  - Engineering
  - Land Use Regulation
  - Building Standards
  - Crop/Cycle Adjustment

- Vulnerability Analysis
  - Suicide Prevention
  - Mental Health Support
  - Social Services

- Mitigation & Prevention
  - Stockpiling
  - Procedures
  - Organization
  - Community Planning

- Prediction & Warning
  - Logistics Planning
  - Communications Planning
  - Technology

- Preparedness
  - Resource Inventory
  - Awareness
  - Stockpiling

- Response
  - Search & Rescue
  - Evacuation
  - Public Response
  - Communications

- Logistics
  - Distribution
  - Transport
  - Warehousing

- Resource Analysis
  - Needs
  - Damage

- Requirements Analysis
  - Financial
  - Human
  - Physical
Incident Command System
Algorithmic approach imposed over clinical judgement

START triage system, 4 categories are provided

120 systems are in existence worldwide

Problems are that its focused almost entirely on trauma, under treats medical problems
People are hesitant to use expectant category
Excludes the crowd as helpers
Isn't what happens in large disasters
Excludes many hospitals / urgent care centers
Causes of Mortality and Morbidity ...

Varies by type of disaster ..... and how long into the disaster “time to rescue” similar to golden hour.
Earthquake Mortality and Morbidity

0-2 days
Severe crush / trauma
Asphyxia
Drowning
2-14 days
Dehydration
Environmental Exposure
Rhabdomyolysis /
Renal failure
1 week – ongoing

Wound infections / sepsis
Tetanus
URIs
Communicable diseases
Mental Health Issues
<table>
<thead>
<tr>
<th>Hurricanes/ Typhoons / Cyclones</th>
</tr>
</thead>
<tbody>
<tr>
<td>all the same, &gt; 74 mph winds</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drowning</td>
<td>MVAs</td>
</tr>
<tr>
<td>Lacerations</td>
<td>Dehydration</td>
</tr>
<tr>
<td>Blunt injuries</td>
<td>malnutrition</td>
</tr>
<tr>
<td>Electrocution</td>
<td>Infectious</td>
</tr>
<tr>
<td></td>
<td>diseases</td>
</tr>
<tr>
<td></td>
<td>Cardiac Events</td>
</tr>
<tr>
<td></td>
<td>Chain saw injuries</td>
</tr>
</tbody>
</table>
Tornadoes

Trauma - flying debris, head trauma especially
Severe crush trauma / multiple injuries
Lacerations
Electrocutations
Floods

Drowning
Trauma
Vector breeding
Infectious diseases
Malnutrition
Toxic contamination
Chronic Illnesses
Questions ?