Medical Response Planning for Radiological and Nuclear Events: the Overview

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Disclaimers

• Not speaking officially for HHS, just me
• No financial conflicts to disclose
• No endorsement of drugs or devices
Objectives of This Lecture

• Identify the framework for federal response planning for disasters, including radiological and nuclear disasters: NRF, NIMS, ICS

• Identify the framework for hospital response planning: HICS

• Locate key resources about radiation event response planning: REMM
Technical Issues

• Upon request, ASTRO will provide a CD containing all the lectures in this symposium in pdf format.

• CD will contain all the active hyperlinks in this lecture
  • Optimize Adobe acrobat settings: Edit>Preferences>Categories> Web capture>Open web links> In web browser

• Documents and URLs may change
Assumptions

- Few other medical professionals know as much as Radiation Oncologists do about the clinical effects of ionizing radiation.
- With some additional training in **content** and **process**, Radiation Oncologists can play a leadership role in responding to mass casualty radiological and nuclear (Rad/Nuc) events by
  - Helping to plan responses for your department, institution, or local, regional, state government
  - Participating in Response Teams as educators and SMEs during exercises and actual events
• All responses begin **locally**.
• Larger events require more assets.
• The larger the event, the more coordination required.
• Preparedness is a **shared responsibility**:
  • Government: federal, state, local, tribal
  • Private sector
  • Citizens individually and families
• **You can’t just make up an effective plan in isolation!**
Response Planning (2)

- Plans and responses must be
  - Consistent with existing laws/regulations, which evolve
  - Collaborative and coordinated with all partners
  - Considerate of all potential victims
  - Cognizant of initial, intermediate and long term activities
  - Cognizant of issues related to scale
  - Consistent with budget
  - Combined with regular job training and formal exercises of all partners together
USG Medical Response Planning

- Effect of 9/11, SARS, Pandemic Influenza
  - Recognized new, urgent threats
  - Developed detailed plans (short, intermediate, and long term)
  - Enhanced surveillance, deterrence, R and D for countermeasures
- Effect of Katrina: 8/2005, responses must be more…
  - Effective
  - Rapid
  - Flexible
  - Scalable
  - Coordinated at every level, inside and outside of government
  - Evidence-based
  - Pre-scripted
  - Exercised regularly with all partners
  - Iteratively improved
Rad/Nuc Response Planning (1)

• Problems are very complex.
• Potential impact could be huge, on population and infrastructure.
• Responses must be planned anyway, and they have been.
  • In detail, at the federal level
  • Less detail, at state and local level
• There are effective medical things to do.
Rad/Nuc Response Planning (2)

- US Government approach
  - All hazards, with additional specific actions for each type of incident, including rad/nuc
- Planning evolves, based on
  - Intelligence about likelihood of specific threats
  - Magnitude of the potential resulting problem
  - Efficacy of deterrence
  - Availability and efficacy of new response assets, including countermeasures
- Realistic cost-benefit analysis of the response

Nihilism
What You Need to Know about Response Planning

- “Clinical” things
- “Organizational” things
“Clinical” things (1)

- What types of mass casualty radiological and nuclear events might occur
- Difference between radiation exposure and contamination
- Exposure
  - Acute radiation syndrome (ARS): dx and rx
  - Delayed effects of acute radiation exposure (DEARE): dx and rx
- Contamination
  - External decontamination: dx and rx
  - Internal contamination: dx and rx
“Clinical” things (2)

• How a very large mass casualty event (surge) could affect typical standards of care

• Population monitoring during and after the event
  • Acute effects in victims and responders
  • Longer term effects: stochastic and deterministic
  • Psychosocial effects: short and long term

• Safety issues
  • Personal protective equipment (PPE) appropriate for incident
  • Procedure guidelines: using survey equipment and personal dosimeters, minimizing dose, documentation

• Protective Action Guidelines: PAGs

- Source of information
  - Clinical
  - Organizational
- Created and maintained by
  - HHS/NLM/NCI/CDC collaboration
- Dozens of US and international reviewers
- Evidence-based recommendations
- Just-in-time information
- Whole site downloadable in advance
Radiological Dispersal Devices
- Dirty Bomb, Other Dispersal Methods
- Radiological Exposure Devices: Hidden Sealed Sources
- Nuclear Explosions: Weapons, Improvised Nuclear Devices
- Nuclear Reactor Accidents
- Transportation Accidents
- Disseminating an Event

Patient Management
- Choose Appropriate Algorithm:
  - Evaluate for Contamination/Exposure
  - Contamination
  - Exposure (Acute Radiation Syndrome)
  - Exposure + Contamination

Management Modifiers
- Radiation + Trauma
- Burn Triage and Treatment
- Mass Casualty
- Psychological Issues
- Specific Populations

Quick Links
- How Users/Where Do I Start?
- Use REMM, Learn OME
- Patient Management Algorithms
- Print Algorithms & Tables
- Exposes of Interest
- Countermeasures
- Decontamination Procedures
- Dose Estimator for Exposure
- Manage ARS Subsyndromes
- Hematologic Subsyndrome
- Cutaneous Radiation Syndrome
- Time/Dose Effects in ARS
- Time Phase of ARS
- Strategic National Stockpile
- Animations, Illustrations, Photos
- Dictionary
- Understanding Radiation
- Sources of Radiological/Nuclear Information

Features
- HHS Public Health Emergencies Medical Countermeasures Plan for Chemical, Biological, Radiological and Nuclear (CBRN) Threats, 4/2007 (HHS)
- Medical Countermeasures Against Radiological and Nuclear Threats (HHS/NIH/NNED)

Other Web Resources
- APHIS
- ARIC
- CDC
- CDC
- CBER
- CMS
- DLA
- EPA
- FDA
- HHS
- HHS

Other Audiences
- First Responders in the Field
- Mental Health Professionals
- Hospitals
- Public Information Officers
- Radiation Safety and Protection
- Preplanning
- Practices and Drills
Goals of the REMM web site

• Provide guidance for health care providers, *primarily physicians*, about clinical diagnosis and treatment during mass casualty radiological/nuclear (rad/nuc) events
• Provide just-in-time, evidence-based, usable information with sufficient background and context to make complex issues understandable to those *without* formal radiation medicine expertise
• Provide web-based information that is also downloadable in advance, so that it would be available during an event if the internet is not accessible

http://remm.nlm.gov/Aboutthissite.htm#forwho
Choose Appropriate Algorithm: Evaluate for Contamination and/or Exposure

Difference between exposure and contamination

http://remm.nlm.gov/newptinteract.htm#skip
Contamination

- **External Contamination**
  - Full Body
  - Partial Body
  - Wound Contamination with Radioactive Shrapnel
- **Internal Contamination**
  - Via Respiratory Tract
  - Via Digestive Tract
  - Via Radioactive Dust in Open Wounds
- **Incorporation**

Patient Management:

- Contamination Only Management Algorithm

**Contamination**

- Contamination results when a radioisotope (as gas, liquid, or solid) is released into the environment and then ingested, inhaled, or deposited on the body surface.
- **How to diagnose:**
  - Scan with appropriate radiation survey meter
  - As appropriate: swab orifices, obtain spot and/or 24 hour urine/stool sample for radioactivity
  - Whole-body scanner or hospital nuclear medicine equipment

[http://remm.nlm.gov/contamimage_top1.htm](http://remm.nlm.gov/contamimage_top1.htm)
Exposure - Animations

Exposure:
- Whole Body
- Partial Body

Patient Management:
- Exposure Only
- Management Algorithm

Exposure:
- Radiation exposure occurs when all or part of the body absorbs penetrating ionizing radiation from an external radiation source, as shown in the illustration above.
  - Exposure from an external source stops when a person leaves the area of the source, the source is completely shielded, or the process causing exposure ceases.
- Radiation exposure also occurs after internal contamination, i.e., when a radionuclide is ingested, inhaled, or absorbed into the bloodstream.
  - This kind of exposure stops only if the radionuclide is totally eliminated from the body, with or without treatment.
- An individual exposed only to an external source of radiation, as shown above, is NOT radioactive or contaminated and may be approached without risk, just like after a chest x-ray or CT scan.
- Radiation from external exposure alone is either absorbed without the body becoming radioactive, or it can pass through the body completely.
  - Therefore, if a person is scanned with a radiation survey meter after external exposure alone, the device will not register radiation above the background level.
- Acute Radiation Syndrome (ARS) may result if the dose from whole or partial body exposure is high enough.
  - Diagnosis of ARS usually requires specific blood tests and clinical findings.

http://remm.nlm.gov/exposureimage_top1.htm
Choose Appropriate Algorithm: Evaluate for Contamination and/or Exposure

Radiological/Nuclear Event

How do you know a radiation event has occurred?

Initial Onsite Activities
- Ensure safety of responders
- Establish patient handling flow
- Perform life-saving tasks before managing radiation problems

Has your patient been contaminated by radiation?
- What Is Contamination?

Has your patient been exposed to radiation?
- What Is Exposure?

Both

Neither

No Contamination or Exposure

Contamination Only

Exposure and Contamination

Exposure Only

Management Algorithm

Management Algorithm

Management Algorithm

http://remm.nlm.gov/newptinteract.htm
Contamination algorithm

http://remm.nlm.gov/contamonly.htm
Exposure algorithm

http://remm.nlm.gov/exposureonly.htm
Exposure + Contamination

http://remm.nlm.gov/exposurecontam.htm
http://remm.nlm.gov
Biosdosimetry

Dose Estimator (Biosdosimetry Tools)  (What Is Biosdosimetry?)

1. Estimate Exposure Dose -
   - Dose Estimator  
   - Onset of Vomiting  
   - Lymphocyte Depletion Kinetics  
   - Chromatographic Analysis
2. Suggest Hematopoietic Subsyndrome Treatment, Based on Exposure Dose and Event Size
3. Biosdosimetry Based on Acute Radiation: Equivalent Exposures (PDF - 58 KB)
4. See also: Explaining Biosdosimetry

http://remm.nlm.gov/explainbiodosimetry.htm

Dose Estimator - Onset of Vomiting

1. Time to vomiting after exposure: Select Onset Time  Time to Onset of Vomiting and Dose (Illustration)
2. Estimated Whole-body Radiation Dose: \( \text{(Dose shown in units of gray)} \)  (Read-only field)
3. Percent victims with vomiting at this dose:  (Read-only field)
4. Get Suggested Treatment  for hematopoietic subsyndrome based on this dose.

Notes:
- Remember that in a mass casualty incident, vomiting may be related to many conditions other than radiation exposure, including psychological factors.

Dose Estimator - Lymphocyte Depletion Kinetics
Surge and “standards of care appropriate to the event”

• What to do clinically in a very large event when resources become scarce: mass casualty triage and care
  • Scaling up and trying to do the “right” thing
    • Based on scientific evidence
    • Doing the most good for the greatest number
• “Surge/standards of care” references on REMM
• *Chest, May 2008, supplement* (PanFlu paradigm)
Population Monitoring

- Population monitoring during radiation emergencies: a guide for state and local public health planners
  CDC, draft 2007
  - Measurement of radiation, initially and later
  - Registries for all responders, victims and concerned citizens
  - Evaluation of short and long term effects
  - Stochastic and deterministic endpoints
  - Importance of public messaging, communications
  - Psychosocial issues

What You Need to Know about Response Planning

- “Clinical” things
- “Organizational” things
“Organizational” things

- **National Planning Scenarios**: \( N = 15 \)
- Organization of the federal response
  - National Response Framework (NRF)
  - National Incident Management System (NIMS)
    - Incident Command System
- Organization of the hospital response
  - Hospital Incident Command System (HICS)
- Organization of the HHS PH/Medical Response
  - Complexity of the federal medical response
  - Playbooks: scripting the federal/HHS response in detail
National Planning Scenarios

- 15 very detailed, specific hazards that government must plan for
- Focal points for homeland security preparedness activities and exercises for federal, state, and local participants
- DHS, Version 20.1 Draft, April, 2005

National Planning Scenarios


Introduction ............................................................................................................... ii

Scenario 1: Nuclear Detonation – 10-Kiloton Improvised Nuclear Device .................. 1-1
Scenario 2: Biological Attack – Aerosol Anthrax .................................................... 2-1
Scenario 3: Biological Disease Outbreak – Pandemic Influenza ............................... 3-1
Scenario 4: Biological Attack – Plague ................................................................. 4-1
Scenario 5: Chemical Attack – Blister Agent ....................................................... 5-1
Scenario 6: Chemical Attack – Toxic Industrial Chemicals ..................................... 6-1
Scenario 7: Chemical Attack – Nerve Agent ....................................................... 7-1
Scenario 8: Chemical Attack – Chlorine Tank Explosion ...................................... 8-1
Scenario 9: Natural Disaster – Major Earthquake .................................................. 9-1

Scenario 10: Natural Disaster – Major Hurricane .................................................. 10-1
Scenario 11: Radiological Attack – Radiological Dispersal Devices ..................... 11-1
Scenario 12: Explosives Attack – Bombing Using Improvised Explosive Devices .... 12-1
Scenario 13: Biological Attack – Food Contamination ........................................... 13-1
Scenario 14: Biological Attack – Foreign Animal Disease (Foot and Mouth Disease) .. 14-1
Scenario 15: Cyber Attack .................................................................................. 15-1
The National Response Framework presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies—from the smallest incident to the largest catastrophe. The Framework establishes a comprehensive, national, all-hazards approach to domestic incident response.

More information is available in the following documents:

- Brochure
- Fact Sheet
- Frequently Asked Questions

http://www.fema.gov/emergency/nrf/aboutNRF.htm
National Response Framework Resource Center

Information and Documents
- About the National Response Framework
- National Response Framework Document
- Overview Document
- National Incident Management System (NIMS)
- Response Partner Guides

Annexes
- Emergency Support Function Annexes
- Support Annexes
- Incident Annexes
- Printable Version of All Annexes

References
- Authorities
- Overview of Stafford Act Support to States
- Overview of Federal-to-Federal Support
- IFO Task Books
- Glossary/Acronyms
- Additional Resources

Briefings and Training
- Briefings
- Training Courses
- Job Aids/SOPs

What's New? Collaborate Site Help Site Index

http://www.fema.gov/emergency/nrf/
http://www.fema.gov/emergency/nrf/


• Define the **roles and responsibilities of Federal agencies** in responding to the unique characteristics of different categories of nuclear/radiological incidents.

• Discuss the **specific authorities, capabilities, and assets** the Federal Government has for responding to nuclear/radiological incidents that are not otherwise described in the NRF.

• Discuss the **integration of the concept of operations** with other elements of the NRF, including the unique organization, notification, and activation processes and specialized incident-related actions.

• Provide **guidelines for notification, coordination, and leadership** of Federal activities.

National Incident Management System

- How to coordinate planning and responses
- Enables responders from different jurisdictions and disciplines to work together better to respond to natural disasters and emergencies, including acts of terrorism.
- Based on the Incident Command System
  - Unified approach to incident management
  - Emphasizes preparedness, mutual aid and resource management
- Currently undergoing review and update

http://www.fema.gov/emergency/nims/index.shtm
National Incident Management System

• Where to find FEMA’s key NIMS documents

http://www.fema.gov/emergency/nims/rm/guide.shtm
Basic Structure of the Incident Command System

Many more pre-specified functions (boxes) can be added if needed.

Excellent ICS teaching tool


Click on individual components of the ICS/UC organizational chart below for specific information on the various positions. (As you roll your mouse over the components of the chart, related sub-components/positions will appear.)
Features of the Incident Command System

- Unified command structure
  - Integrate responder disciplines and jurisdictions
- Modular organization: flexible, scalable
- Manageable span of control
- Common terminology: space, staff, stuff, SOPs…
- Integrated communications
- Consolidated incident action plans
- Comprehensive resource management
- Pre-designed incident facilities
Hospital Incident Command System (HICS)

• Helps hospitals and communities improve emergency management planning, response, and recovery activities for unplanned and planned events of any size, both emergent and non-emergent conditions
  • Includes specific job actions sheets
  • Provides for hazard-specific planning
  • Provides forms for documentation
• Represents an overarching structure but not a template for hospital emergency management plan or a hospital emergency operations plan. (See documents)
• Maintains consistency with the National Incident Management System (NIMS)
• Provides a way to use the Incident Command System (ICS) in the hospital/healthcare setting
HICS

Organizational things on REMM

- Federal planning
- Hospital planning
- Develop a radiation response plan
HHS: Preparedness, Planning, Responding

- **Office of the Assistant Secretary for Preparedness and Response**
  - Partnerships and community outreach, work force development, countermeasures R and D, policy development, strategic planning, exercise planning, actual responses, management of the SOC

- Plans for responding to all scenarios, including the most complex: radiological/nuclear
  - All hazards approach
  - Detailed playbooks (scripts) for each of the 15 national planning scenarios, hundreds of pages each
HHS medical resources and partners (+ DOD, VA, DHS)

Source: CAPT Ann Knebel, USPHS
Key federal medical resources: + DOD, VA, DHS

- **Metropolitan Medical Response System** (FEMA)
- **Medical Reserve Corps** (HHS)
- **American Red Cross** (Federally chartered)
- **Emergency System for the Advanced Registration of Volunteer Health Professionals (ESAR-VHP)** (HHS)
- **National Disaster Medical System** (HHS)
- **USPHS OFRD**: deployable active duty teams
- **USPHS deployable inactive reserves**
Complexity of the Rad/Nuc Medical Response: conceptual, not official (Dr. Norm Coleman)

1. Event
2. Event detection and initial description
3. Emergency responders to scene- initial description
4. Initial dose information, field dosimeters/ surveys
5. Federal government contacted
6. Agency response
7. Local medical response
8. Public communications
9. Surge capacity: loco-regional
10. Additional dose information
11. Chemical-physical analysis
12. Medical expertise- DOD (in parallel HHS)
13. Medical expertise- HHS (including PHS)
14. Countermeasures- from forward deployment or SNS
15. Referral to centers of excellence/ research protocols
16. Patient tracking
17. Long term epidemiology/ followup
HHS/ASPR Preparedness Funding

- **Hospital Preparedness Planning** (HPP)
- **Health Care Facilities Partnership Program Grants** (awarded 9/27/07)
  - Develop innovative and creative projects that can be replicated across the country
  - Require close coordination among health officials from state, local and private sectors
Rad/Nuc Learning Aids for Radiation Oncologists

- REMM
  - Radiation Event Medical Management
  - [http://remm.nlm.gov](http://remm.nlm.gov)
  - REMM Rad/Nuc Bibliography

- Participate in formal radiological and nuclear response planning and exercises: hospital, local, tribal, state, federal
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- Identify the framework for hospital response planning: **HICS**
- Locate key resources about radiation event response planning: **REMM**
Thank you

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