# Patient Movement Following a Radiological Mass Casualty Incident

Sponsored by the Radiation Injury Treatment Network

and the Association of State and Territorial Health Officials

## Presenters

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# For more information on NDMS:

http://www.phe.gov/Preparedness/responders/ndms/Pages/default.aspx

*United States Department of*
**Health & Human Services**
Office of the Assistant Secretary for Preparedness and Response
*Division of Medical Countermeasure Strategy and Requirements*

# "RTR" Framework for Casualty Movement Following a Nuclear Detonation

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**Given at RITN Patient Movement Webinar**
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## Bottom line up front

An improvised nuclear detonation is one of the greatest temporal challenges to emergency operations capabilities, but advanced planning and thinking through the potential situation to leverage scarce resources in a meaningful way, related to the casualty types/needs and behaviors, and environmental factors can prepare a community to responded effectively and save many, many lives.

# Nuclear detonation response considerations

- Improvised nuclear detonation will result in
  - Infrastructure damage (response will require flexibility and adaptability)
  - Complex spectrum of injuries (treatment will require polypharmacy approaches)
    - Injury spectrum: radiation exposure, burns, mechanical trauma, combined injuries of acute radiation exposure, trauma and thermal burn
    - Spectrum of injuries changes with different scenarios
  - Resource limitations
    - Medical management will require complex coordination
    - Patient/casualty movement will require seamless connectivity among capabilities
    - Patient/casualty tracking/records will need to be seamless as well

# Potential casualties resulting from a nuclear detonation in a major city

**Distribution of casualties from nuclear detonation modeling***

| Injury type | Category | 95%ile air / ground scenarios | Pediatric population estimate (23.3 %)† |
|---|---|---|---|
| Mechanical trauma (ISS[1]) | Mild (1-9) | 80 000 | 19 000 |
| | Moderate (10-14) | 121 000 | 29 000 |
| | Severe (≥ 15) | 143 000 | 34 000 |
| Thermal burn (% TBSA[2]) | Mild | 0 | 0 |
| | Moderate | 1 000 – 3 000 | 700 |
| | Severe | 0 | 0 |
| Ionizing radiation (cGy[3]) | Mild (75-150) | 72 000 | 17 000 |
| | Moderate (150-530) | 41 000 | 10 000 |
| | Severe (530-830) | 12 000 | 3 000 |
| | Expectant (>830) | 47 000 | 11 000 |
| Combined Injury | Radiation: > 150 cGy; trauma/burn: mild-sev | 45 000 | 11 000 |

[1] injury severity score
[2] % total body surface area, partial- and full-thickness burns
[3] centigray

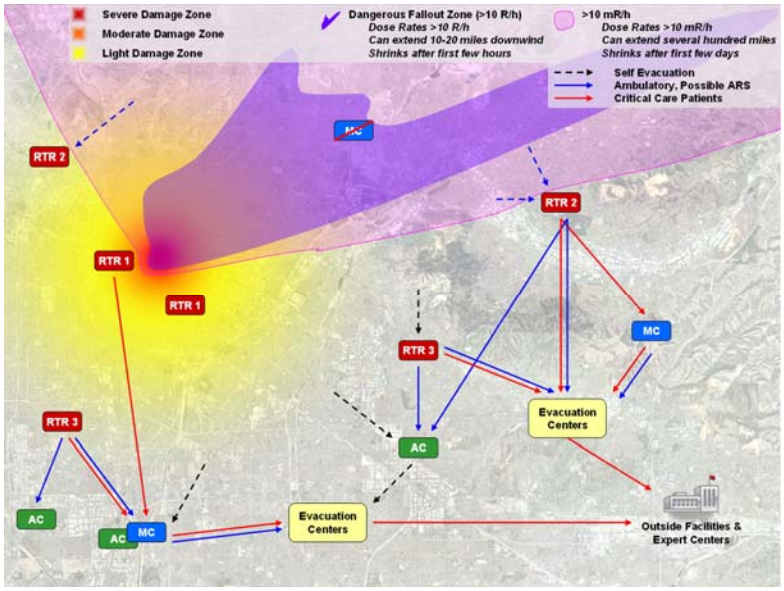
*Adapted from Knebel, et al., DMPHP (S1), March 2011: http://jnls.cup.org/pdftext.do?componentId=8848885&jid=DMP&freeFlag=OA
†http://www.childstats.gov

## Nuclear detonation = scarce resources situation

- Resource adequacy will vary greatly across the response areas by time and location (local and region, possibly nationally)
  - Response resources will be overwhelmed by casualty numbers and needs and concerned citizens requesting assistance
    - Limited access to interventions, (e.g., IV, transfusions, MCMs, conventional care)
  - To achieve fairness in resource allocation, a common triage approach is important
    - Possible change from "conventional" to "contingency" or "crisis" standards of care (treating those "most likely to survive" first approach)
  - Clinical reassessment and repeat triage are critical, as resource scarcity worsens or improves.
- Bottom line: Resources will be limited in the immediate aftermath of an improvised nuclear detonation, and leveraging capabilities efficiently will maximize casualty movement and access to health care and/or evacuation

## CONSIDERATIONS FOR ADDRESSING THE SCARCE RESOURCE SITUATION

# CONOPS for response
# Radiation TRiage, TRansport, TReatment

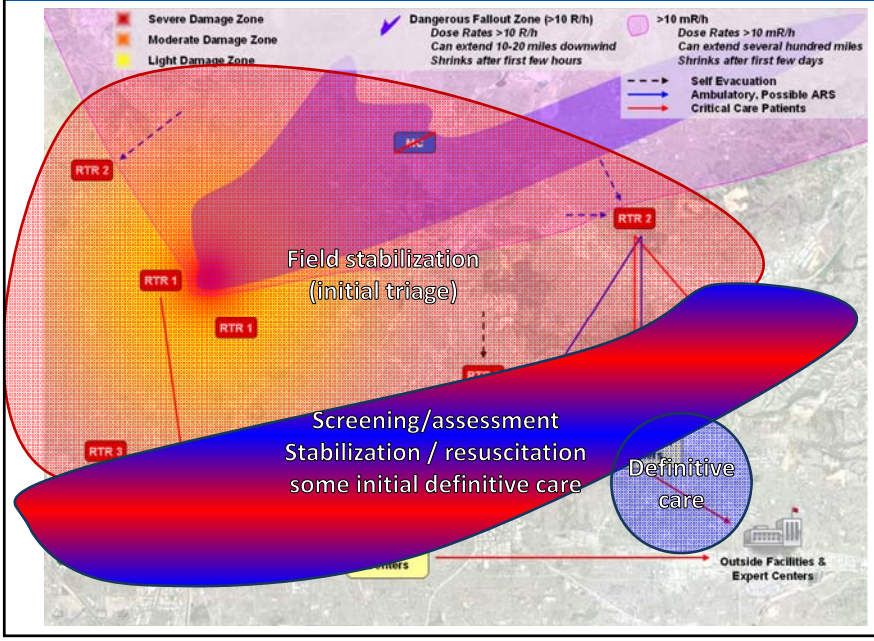



**RTR Sites (Field evacuation)**
**RTR1 – combined injuries (trauma, burn, radiation)**
**RTR2 – radiation exposure**
**RTR3 – limited injuries**

**AC – assembly centers (screening, initial intervention)**
**MC – medical centers (triage, screening, intervention)**

[1]Hrdina, et al. *Prehospital Disaster Medicine*, 2009 May-Jun; 24(3); 167-78
[2]*Planning Guidance for Response to a Nuclear Detonation* / 2nd Edition / June 2010

# CONOPS for response: activities




To maximize effectiveness of response – we must understand the limitations and constraints of each capability both independently and from a systems view to enable seamless integration of all assets and leverage every efficiency

# Response activities and MCM considerations

**Response timeline** (transition of care)

**Stabilization and Resuscitation**
field care / ER and early intervention

**Definitive Care**
inpatient/outpatient therapy

**Activities**

- Triage and radiation assessment
- Decontamination
- Biodosimetry if possible
- Stabilize mechanical trauma injuries
- Initial burn management and covering
- Initial hemodynamic compensation
- Pain control
- Initiate anti-neutropenic therapy

**Activities**

- Provide specialized care
- Surgical interventions
- Burn debridement and management
- Long-term inpatient/outpatient care
- Pain control
- Biodosimetry
- Neutropenia therapy / bone marrow transplant
- Transfusion therapy for hemodynamic maintenance

**Medical countermeasure considerations**

- **Immediate to early access needed**
- **Ease of administration, use, application**
  Topical, intramuscular, oral, etc.
- **High therapeutic index required**
  Poor diagnostics, concerned but healthy casualties
- **Robust storage, easy deployment**
  Room temperature, lightweight, pre-formulated, etc.
- **Delayed access ok timed as patients arrive**
- **Expertise required to administer is ok**
  Surgical grafting, expert assessment, etc.
- **Low therapeutic index acceptable**
  Better diagnostics, expert assessment
- **Limiting storage requirements may be ok**
  Frozen, cryopreservation, etc.

# Casualty movement: RTR 1

**Casualty archetypes**

- Burns, fractures, lacerations, bleeding
- Possible radiation exposure
- Combination injuries
- Some with limited injuries / some with severe injuries

**Decisions**

- Initial triage level
- Send to medical center or assembly center?

**Where, when, who**

- Location: Damage zones and around blast area where people self-aggregate
- When: Immediately – 1 week
- Operator: Local EMS, volunteers

**Goals at site**

- Stabilize medical patients and route casualties to next level of care

**Activities/Interventions**

- Stabilization and triage/ disposition (decon if possible)
- Splint fractures
- Stop bleeding
- Initial coverings (e.g., burns)
- Radiation triage

**Casualty Movement Factors**

- Infrastructure damage
- Limited patient transport resources
- Volunteer transport may be available
- Casualties may have to walk
- Patient tracking

# Casualty movement: RTR 2

## Casualty archetypes
- Radiation exposure
- Possible burns, fractures, lacerations, bleeding
- Possible combined injuries
- Variety of radiation doses

## Decisions
- Initial triage level
- Send to medical center or assembly center?

## Where, when, who
- Location: Edge of the fallout zones/where people self-aggregate
- When: Immediately – 48 hours
- Operator: Local EMS, volunteers

## Goals at site
- Initial stabilization and route patients to next level of care

## Activities/Interventions
- Stabilization and triage/ disposition (decon if possible)
- Splint fractures
- Stop bleeding
- Initial coverings (e.g., burns)
- Radiation triage

## Casualty Movement Factors
- Infrastructure damage
- Limited patient transport resources
- Volunteer transport may be available
- Casualties may have to walk
- Patient tracking

# Casualty movement: RTR 3

## Casualty archetypes
- Limited/no injuries or exposure
- Possible radiation exposure
- Possible burns, fractures, lacerations, bleeding
- Possible combined injuries

## Decisions
- Initial triage level
- Send to medical center or assembly center, or shelter/evacuation center?

## Where, when, who
- Location: outside damage and fallout zones
- When: Immediately – 48 hours
- Operator: Local EMS, volunteers

## Goals at site
- Initial stabilization and route patients to next level

## Activities/Interventions
- Stabilization and triage/ disposition (decon if possible)
- Radiation triage

## Casualty Movement Factors
- Limited patient transport resources
- Volunteer transport may be available
- Casualties may have to walk
- Tracking

# Casualty movement: Medical centers

**Casualty archetypes**
- Burns, fractures, lacerations, bleeding
- Possible radiation exposure
- Combination injuries
- Some with limited injuries / some with severe injuries

**Decisions**
- Triage level
- Provide surgical interventions/transfusion?
- Definitive care disposition (level of care) or discharge
- Initiate myeloid cytokines for neutropenia?

**Where, when, who**
- Location: in local area and region
- When: Immediately – 1 month
- Operator: Medical personnel, EMS, volunteers (Federal support once deployed)

**Goals at site**
- Stabilize medical patients, provide necessary interventions, radiation intervention, and route casualties to next level of care

**Activities/Interventions**
- Decontamination
- Stabilization and triage
- Splint fractures
- Stop bleeding
- Initial coverings (e.g., burns)
- Radiation screening

**Casualty Movement Factors**
- Some infrastructure damage
- Limited patient transport resources
- Volunteer transport may be available
- Patient tracking

# Casualty movement: Assembly centers

**Casualty archetypes**
- Radiation exposure
- Possible burns, fractures, lacerations, bleeding
- Possible combined injuries
- Variety of radiation doses

**Decisions**
- Need medical intervention?
- Definitive care disposition? RITN center?
- Initiate myeloid cytokines for neutropenia?

**Where, when, who**
- Location: local area and region
- When: Immediately – 1 week
- Operator: Local EMS, volunteers, NGOs

**Goals at site**
- Stabilize casualties, initial radiation intervention, and route patients to next level of care

**Activities/Interventions**
- Decontamination
- Triage
- Basic care as needed for fractures, burns, lacerations
- Radiation screening

**Casualty Movement Factors**
- Infrastructure damage
- Limited patient transport resources
- Volunteer transport may be available
- Casualties may have to walk
- Patient tracking

# Casualty movement: Evacuation centers

## Casualty archetypes
- Radiation exposure
- Burns, fractures, lacerations, bleeding
- Possible combined injuries
- Variety of radiation doses
- No injuries

## Decisions
- Disposition?
- Transport level of care?
- Continue myeloid cytokines for neutropenia?

## Where, when, who
- Location: local area and region
- When: Immediately – 1-2 weeks
- Operator: Local EMS, volunteers, Federal staff, NGOs

## Goals at site
- Transport casualties to national definitive care or mass care shelters

## Activities/Interventions
- Possible decontamination
- Continuation care as needed
- Transport to final destinations

## Casualty Movement Factors
- Decontamination
- Accessing casualty transport resources
- Volunteer transport may be available
- Patient tracking

# Casualty movement: national care

RITN centers, VA hospitals, burn and trauma centers, etc.

## Casualty archetypes
- Radiation exposure
- Burns, fractures, lacerations, bleeding
- Possible combined injuries
- Variety of radiation doses

## Decisions
- Level of care: Inpatient / outpatient?
- Continue myeloid cytokines for neutropenia?

## Where, when, who
- Location: national
- When: 48 hours – months
- Operator: NGOs and Federal staff

## Goals at site
- Return healthy people home

## Activities/Interventions
- Radiation Assessment
- Possible decontamination
- Definitive care/long term care
- Specialty interventions
- “Return home”

## Casualty Movement Factors
- Decontamination
- Receiving casualties/disposition
- Patient tracking
- Return to home: how?

## Summary of considerations for patient movement

- Casualty tracking will be essential to ensure continuity of care
- Scarce resource reality
  - Seamless systems-integration of scarce capabilities and resources will ensure efficient casualty flow and maximize access to care
  - Right level of care at the right "RTR" level (appropriate effort) will ensure efficient patient flow and maximize life-saving through resource conservation
  - Effective communication and common operating picture (plan in advance and exercise) will ensure scarce resources can function seamlessly to maximize effectiveness of response
- You probably can't save everyone, but a plan, judiciously executed with transparent coordination can save the most lives

## Bottom line

An improvised nuclear detonation is one of the greatest temporal challenges to emergency operations capabilities, and requires a well-thought-out plan/operational framework that leverages situational factors through seamless coordination, thereby ensuring integration of capabilities and maximum access to care by the many casualties who will require assistance.

# Radiation Injury Treatment Network®

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2016 Radiological Disaster
Patient Movement Webinar

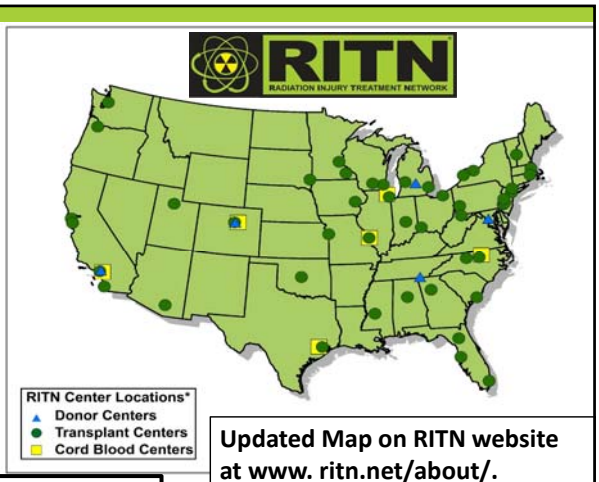
-Fortuna Favet Paratis-

est. 2006

## What is RITN?
## Concept of Operations (ConOps)
## Efforts

The Radiation Injury Treatment Network® (RITN) is preparing to provide comprehensive evaluation and treatment for victims of radiation exposure or other marrow toxic injuries from a distant incident.

**76 cancer centers /hospitals/ blood donor centers/cord blood banks**



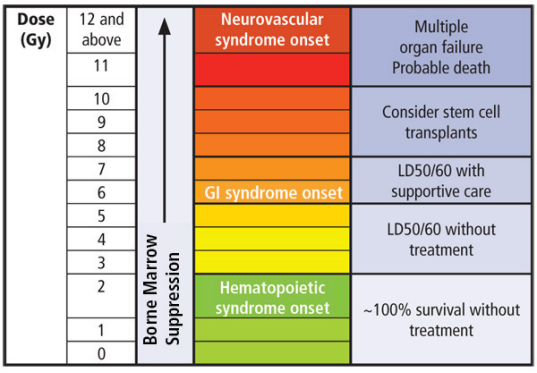

**Updated Map on RITN website at www. ritn.net/about/.**

1. **Not 1st Responders and no trauma care**
2. **Preparing to receive casualties from a distant location**
3. **Expect patient surge ~7 days after incident**
4. **Casualty distribution is through NDMS**



## Why Cancer Centers

- Through cancer treatment process patients are irradiated or given chemotherapy to destroy their immune system
- Acute Radiation Syndrome (ARS) mimics what hematology/oncology staff see daily with blood cancers
- This is what happens to a person that is exposed to ionizing radiation

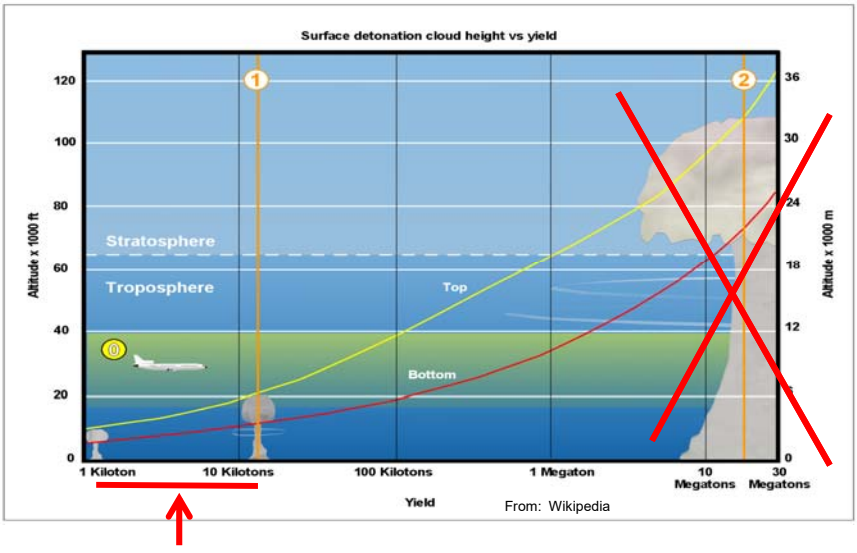



From: Medical Management of Radiological Casualties (Fourth Edition – July 2013) Military Medical Operations, Armed Forces Radiobiology Research Institute, Bethesda, Maryland 20889-5603 http://www.usuhs.edu/afrri/outreach/4thEdition.html accessed 4/3/14

# RITN ConOps

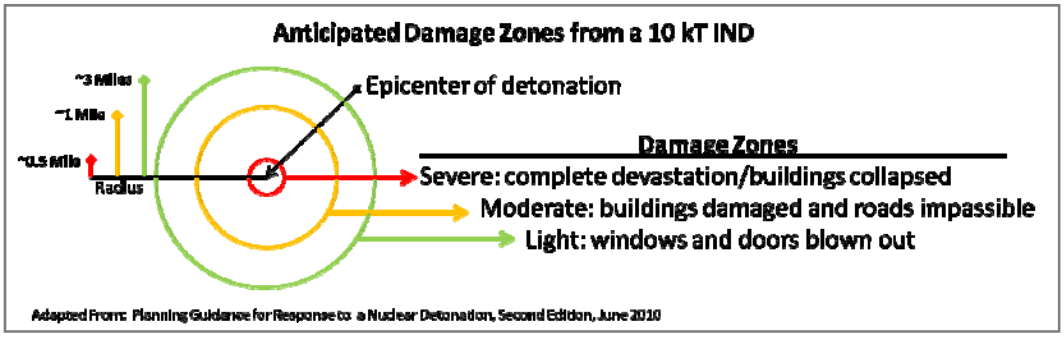


## 10 KT IND per US Planning Scenarios




From: Wikipedia

# 10 KT IND per US Planning Scenarios






# 10 KT IND per US Planning Scenarios

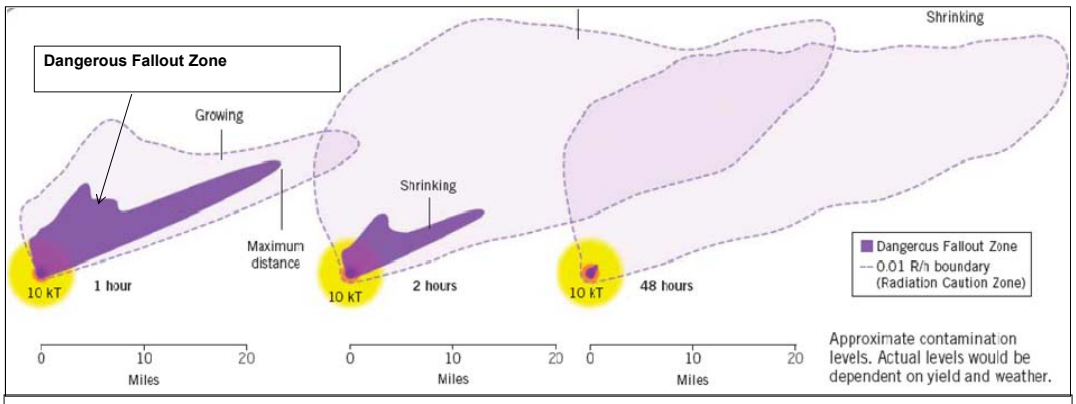
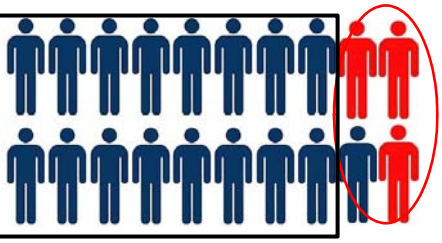



Illustration from: Knebel AR, Coleman CN, Cliffer KD; et al. Allocation of scarce resources after a nuclear detonation: setting the context. Disaster Med Public Health Prep. 2011;5 (Suppl 1):S20-S31

## Casualty Profile

**85% of casualties will have trauma or combined injuries and receive treatment elsewhere**

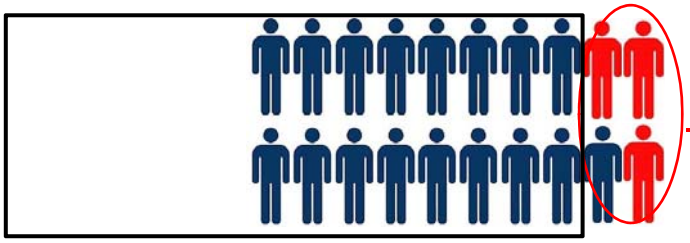


**15% will have "radiation only" injuries and be sent to RITN centers for definitive medical care**

Casualty Estimates adapted from: Knebel AR, Coleman CN, Cliffer KD; et al. Allocation of scarce resources after a nuclear detonation: setting the context. Disaster Med Public Health Prep. 2011;5 (Suppl 1):S20-S31

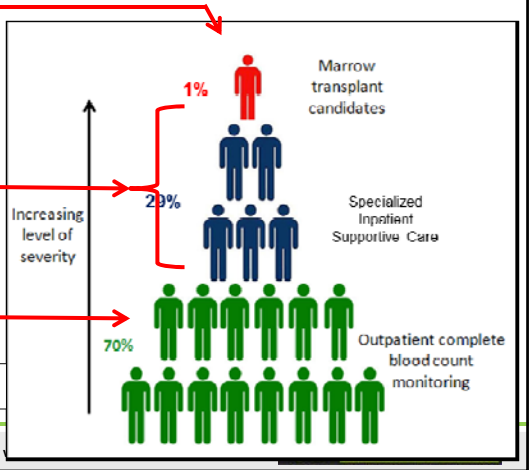


## Casualty Profile



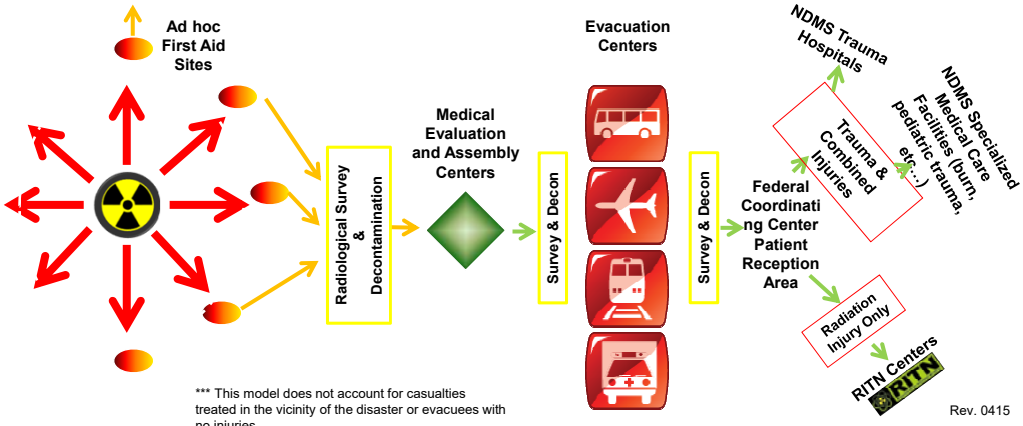
RITN will need to have inpatient care for 30% of the radiation only casualties

70% of the radiation only casualties will require outpatient monitoring




Casualty Estimates adapted from: Knebel AR, Coleman CN, Cliffer KD; et al. Allocation of scarce resources after a nuclear detonation: setting the context. Disaster Med Public Health Prep. 2011;5 (Suppl 1):S20-S31

## Flow of Casualties to a RITN Center






# RITN Efforts

## RITN Efforts

- Training (over 13,000 trained since 2006)
  - Medical Grand Rounds PPT on RITN.net
  - Free web based training on RITN.net
    - Basic Radiation Training
    - Non-medical Radiation Awareness
    - Radiation Safety Communication
- Exercises (582 since 2006)
  - All exercise materials and AARs are available on RITN.net
- Medical Order Sets (adult and ped) on RITN.net & REMM.NLM.gov
- Referral guidelines on RITN.net
- ARS Treatment Guidelines on RITN.net



*"the specter of nuclear terrorism still threaten us all."*

-President Barack Obama

June 2, 2016 address to the US Air Force Academy

**Partners**

# Questions + Discussion

## Contact Information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