The Evolution of Mass Radiological Event Medical Preparedness in Israel

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On Counter-CBRN Preparedness
Disclaimer

- The opinions and ideas expressed in this presentation are strictly my own.
- Everything said and presented is strictly my personal opinion and does not necessarily represent the views of the Ministry Of Health.
Preparing for MRadI in Israel

- History of MRadI preparedness
- Scenario
- Doctrine
  - 1st hour
  - 1st day
  - 1st week
- Resources
- Training history
- Gaps
- Next steps
- History of MRadI preparedness
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Israel, is approximately the size of Maryland or Rhode Island. Its population is ~8 million people.
Israel Facts

Israel: 22,000 km²

Vermont: 25,000 km²
Background History of Preparedness for Emergencies

1948 - • Conventional WAR

1970 - • Conventional terrorism --- TRAUMA (MCI)

2005 - • Earthquakes --- TRAUMA

1973 - • Chemical Warfare

1997 - • MToxI Incidences (Hazmat, Chemical Terrorism)

2000 - • Unusual Biological Event

1970 - • Nuclear Accidents

2000 - • Mass Radiological Incidence
Israel Medical Response for Emergencies

- One (National) EMS
  - [one police force]
- Single Medical Command – MOH
- Medical Corps - fully integrated
24 Acute Care Hospitals

- All - Public Hospitals
- 6 level I trauma centers
  - 1 northern Israel
  - 3 Tel Aviv area (central)
  - 1 Jerusalem
  - 1 Negev (south)
- 11 level II trauma centers
- 7 small/regional hospitals
  - The average Emergency Department has between 30 and 60 beds

- All are prepared for MCI, MToxI, CW (War time scenario) & are being prepared for UBE
Relatively short history of MRadI preparedness
- 3rd priority in the CBRN Arena
- 4th priority in All-hazard Arena

Early era – Nuclear Reactors only scenarios
Early Era of Response

- Limited medical preparedness for Nuclear Reactors incidences only
  - 5 designated Hospitals (near Reactors and Ports)
  - Pre-hospital response = on-call military medical teams and limited EMS response
  - Regional population evacuation and evaluation centers (CRC)
  - Emergency Lugol® dispensing plan
Early Era of Response – Nuclear Reactor oriented

- Potentially exposed (No Trauma)

  Medical Corps
  PHTLS & undressing

  “MARPA” (CRC)

  Screened
  Decontamination
  Personal Risk Evaluation

TRAUMA

Designated Hospitals

X3

X5

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Early Era of Response

- No planning for non-Reactor scenarios (transport, criminal, occupational)
- No Unified Doctrine,
  - Limited (only) to hospitals
  - Planning of Acute phase response only
  - Standalone military doctrine for CRC
- Limited Interactions with non-medical bodies
- Few training programs
- Few (isolated) drills
2000 - Ministry Of Health establishes an advisory committee on Mass Radiological event preparedness

Reference scenario updated to include
1. Nuclear Reactor incidence
2. Transport incidence and other non reactor incidences
3. Radiological Terror (e.g. RDD)

Scenarios were synchronized later with MOD

2004 – a unified national Medical Doctrine is published; # of designated Rad Hospitals increased to 7 (better coverage)
History of preparedness for Radiological Incidents in Israel

- **Early era** – Nuclear Reactors only scenarios
- **Currently** - all Radiological (non-nuclear) scenarios
- History of MRadI preparedness
- **Scenario**
- Doctrine
  - 1st hour
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- Gaps
- Next steps
Risk Assessment for Disasters and Non-Conventional Events

- **Very probable** More than once a year
- **Once in 1 - 10 years**
- **Quite probable** Once per 10 to 100 years
- **Once per 100 to 1000 years**
- **Improbable**

**Probability**

- A
- B
- C
- D
- E

**Consequences**

- Unimportant
- Limited
- Serious
- Very serious
- Catastrophic

- RDD
- Nuclear reactor
Scenario for Medical Preparedness

1. Nuclear Reactor Accidents
2. Non-nuclear reactor Incidences
3. Radiological Terror (mainly RDD)

- Established by the Ministry of Defense
- Translated to “Medical Community Reference scenario”
Nuclear Reactor Accident

- Accidental or inflicted serious damage to Core / Containment

**Explosion and Fire is the immediate risk to life**
(and the main actual health risk in general)

**The radioisotopes are the main source of Public Health Hazards and of Anxiety**
Radiological Dispersion Device (RDD)

- Combining *explosives* (up to dozens of Kg’s) with *radioisotopes* (medical, industrial etc.)
  - May be dispersed otherwise

**Explosive is the immediate risk to life**
(and the main actual health risk in general)

**The radioisotope is the main reason of Terror**
MRadI Consequences

- **Scene, Medical & Health:**
  - Medical – combined injury and exposure
  - Radiation Safety of first responders

- **Outer perimeters, Health:**
  - Health impact (mainly long term)
  - Psychological impact (= Terror)

- **General, non-medical impact:**
  - Economical (direct, indirect)
  - Security and Military
  - International
Health Effects and Response Perimeters

- Low level External & Internal Contamination
- Moderate level External & Internal Contamination
- High level External & Internal Contamination

First responders & Hospitals

Risk Communication & Population Screening

Mainly Risk Communication

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## Estimated numbers for Planning

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Combined Injury</th>
<th>Radiation Exposure (Radiation Field, External contamination, Internal contamination)</th>
<th>Anxiety &amp; “Worried well”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear facility Incidence</td>
<td>10’</td>
<td>High level – 10’; Low-level: 1,000’</td>
<td>1,000’-10,000’</td>
</tr>
<tr>
<td>Transportation Incidence</td>
<td>Few up to 10’ (plane crash)</td>
<td></td>
<td>100’</td>
</tr>
<tr>
<td>RDD – Overt or early detection</td>
<td>Few up to few 10’</td>
<td>High level – few; Low-level: 1,000’</td>
<td>1,000’-10,000’</td>
</tr>
<tr>
<td>RDD – Dispersion w/out explosion or fire</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- History of MRadI preparedness
- Scenario
- **Doctrine**
  - 1st hour
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Principles of Pre-Hospital Medical Response
1. Treat Trauma First
2. Disrobe Patients and Cover
3. Notify Hospitals about the nature of the Event
4. Evacuate Patients
5. Decontaminate Personnel in Exit Points at hospital
Hospital Response

A modification of the already implemented MToxI response (!!!)
• 2 Nuclear facility Centers
• 7 Designated Hospitals for Mass Radiological Event
- **Detection** is currently a mission of the police force.

- Nevertheless, in any **Mass Casualty Event (Trauma)**, an hand-held Geiger Meter is used to screen **trauma** victims at the gates of all MRadI designated hospitals.
  - Alternative Detection of a possible covert RDD event.
MToxI (HAZMAT) Hospital Deployment Scheme

“Warm” zone

Decon. Facility

Ambulatory Casualties
Decontamination

Non-Ambulatory Casualties
Decontamination

“Cold” zone

Primary Evaluation and Treatment sites

Mildly Injured Site
(Inc. Stress Reaction)

Combined Injury
Moderately Injured
Severely Injured

Main Triage point

Resuscitation Site (optional)

Hospitalization

1. Discharge
2. Relocation

Functional Triage point
Hospital MRE Deployment Scheme

"Warm" zone
Decon. Facility

Ambulatory Casualties
Decontamination

Non-Ambulatory Casualties
Decontamination

Functional Triage point

Main Triage point

Primary Evaluation and Treatment sites

"Cold" zone

Mildly Injured Site
(Inc. Stress Reaction)

High exposure
Moderately Injured

1. Discharge
2. Relocation

Severely Injured
OR

Hospitalization

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Initial Patient Management

- Treat life-threatening conditions FIRST
- Remove Clothing
- Assess base-line Contamination level
- Decontaminate
- Re-asses Contamination level (Residual)
- Move pt. to the “Clean” area
1. Treat life-threatening conditions FIRST
2. Remove Clothing
3. Assess base-line Contamination level
4. Decontaminate
5. Re-asses Contamination level (Residual)
6. Move pt. to the “Clean” area
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Mass Radiological event VS Single patient event

1. Changes in Standards of Care
   (mainly standards of decontamination)

2. Change of Pace

3. Less attention for environmental contamination
Mass Radiological event VS Single patient event

1. Changes in Standards of Care
   (mainly standards of decontamination)
2. Change of Pace
3. Less attention for environmental contamination
Exit Point Control

1. In-Hospital
2. For Hospital & EMS personnel
Main Management “Blocks”

**Pr. TRIAGE & DECO**
- Pr. Trauma survey
- Pr. External radiation survey
- Decontamination

**Urgent Trauma procedures**

**Extended TRIAGE & Evaluation**
- Dose (Risk) assessment
  - Physical
  - Clinical
  - Laboratory (CBC)

**1st Day**
- High dose exposure cohort
- Low dose exposure cohort
- Burns
- Internal Incorporation burden

**Treatment Phase**
- Intensive care
- Bone Marrow Unit
- De-corporation “Unit”
- Burn Unit

**1st Week**
- Ambulatory follow-up
Laboratory Analysis

- **Methodology** (for population screening)
  - 1-50 ml “spot” sample
  - 4-36 hours turnaround time

- **Prioritization**
  1. Samples prioritizing & collection
  2. Criteria for lab processing
Population Monitoring
MABAT: Community Reception Center
(Opens gates 6 hours following the incident)

- **Services include:**
  1. Screening for radioactive contamination
  2. Assistance with decontamination
  3. Initial Evaluation of Internal Burden

- **Prioritize people for further care**
  - Divert burden from hospitals
  - Manage scarce medical resources

- **Comparable with already implemented models**
  1. War-time Decontamination & Treatment Centers for CW ambulatory victims
  2. Unusual Biological Event Point of Dispensing (POD) Center
<table>
<thead>
<tr>
<th>Evaluate potentially-affected population for:</th>
<th>Relevant modalities in MABAT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Needed medical treatment (non-rad related)</td>
<td>• Mental aspects Rx</td>
</tr>
<tr>
<td>• Presence of contamination on body or clothing</td>
<td>• Monitoring</td>
</tr>
<tr>
<td>• Removal of external contamination</td>
<td>• Decontamination *</td>
</tr>
<tr>
<td>• Radiation dose received and the resulting health risk</td>
<td>• Assessment</td>
</tr>
<tr>
<td>• Internal Intake of radioactive materials</td>
<td>• Radio-toxicological Samples collection</td>
</tr>
<tr>
<td>• Long-term health effects</td>
<td>• Registry</td>
</tr>
</tbody>
</table>

* Internal decontamination is begun at Hospitals only
Six Main Process Areas

1. Initial Sorting
2. Emergency Medical Care or Transfer (limited)
3. Survey and Monitoring
4. Wash Station
5. Registration and Exposure Assessment
6. Discharge
MABAT’s Screening and Monitoring

1. **Hand-held radiation survey instruments powered by Israeli AEC professionals**
   - The future use of Portal monitors (for beta/gamma monitoring) is under planning

2. **Urine sampling for radio-toxicological internal burden assessment of selected members of the screened population**
1. **Hand-held radiation survey instruments powered by Israeli AEC professionals**
   - The future use of Portal monitors (for beta/gamma monitoring) is under planning

2. **Urine sampling** for radio-toxicological internal burden assessment of selected members of the screened population
Current Principles of Response

Spatial Components

WIND

Hot Zone

Potentially exposed (No Trauma)

EMS PHTLS & cloths removal

TRAUMA

Sec. Medevac

Non-designated Hospital

Designated Hospitals

Risk

Communication

• Screening
• Decontamination
• Personal Risk Evaluation

“MABAT” (CRC)
History of MRadI preparedness

Scenario

Doctrine
- 1st hour
- 1st day
- 1st week

Resources

Training history

Gaps

Next steps
Resources 1st hour

- Human
  - Responders in nuclear facilities
  - EMS (single national organization) and medical corps personnel
  - National police force (Incidence commander for non-nuclear facility events)

- Equipment
  - PPE
  - Hand held and Personal Dosimeters
Resources 1st Day

- Hospitals (7)
  - Trauma 1st, Decontamination, specific Rx
- CRC (3)
  - POPULATION Monitoring by the Israeli atomic energy agency personnel
  - Decontamination
  - Health risk assessment
- National radio-toxicological Laboratory

- Infrastructure and Equipment
  - Decon Facilities
  - PPE
  - Hand held and Personal Dosimeters
  - Pharmaceuticals
MToxI and MRadI
Pre-hosp PPE

- Powered Air Purifying Respirator (PAPR) = Level C+
- Industrial + Chemical Warfare agents resistant: garment, gloves, booties
- ABEK$_2$P$_3$ filters

Personal electronic dosimeter
Personal Protective Equipment Outside the Scene

- Modified Airborne Precaution (in UBE)
- En Route, In hospitals, in CRC entrance
Resources 1st Week

- Hospitals (7)
  - Internal Decontamination, specific Rx
  - Burns
  - Acute Radiation Syndrome
- CRC (3)
  - POPULATION Monitoring by the Israeli atomic energy agency personnel
  - Decontamination
  - Health risk assessment
- National Radio-toxicological Laboratory
- BMT Units (5)
- Infrastructure and Equipment
  - Positive pressure Isolation Units
  - Pharmaceuticals (Chelators, Growth Factors)
Allogeneic BM Transplantation (A-BMT) in Israel

- Five medical centers
- ~350 A-BMT per year
- Estimated simultaneous BMT capability in RAD emergency – dozens
History of MRadI preparedness

Scenario

Doctrine
- 1st hour
- 1st day
- 1st week

Resources

Training history

Gaps

Next steps
1. Building Capabilities for an Integrated, comprehensive Response

2. Creating “Organizational Memory”

3. Maintaining Readiness
1. Five (now 7) Designated Hospital since 1994 – **isolated drills** of Combined Injury scenario (**triennial**)

2. Community Screening and Decontamination Centers operated by the Home Front Command - **isolated drills**

3. Very limited 1\textsuperscript{st} responders training in pre-hospital settings

4. Very limited Command Centers training
Training Hospitals

Hospitals

Year

2007 2008 2009 2010 2011 2012 2013

Scenario

- MRadI
- Orange Flame
- MToxI
- CW
- Earthquake
- MCI

Israeli Preparedness for MRadI - POLES, 2014 ©
1. 70s – 90s: Building capacity & training for Nuclear Reactor incidences
   - 1st responders in the nuclear facilities
   - CRCs
   - Designated 5 “Rad” Hospitals

2. 2000- : expanding Readiness for non-nuclear facilities related scenarios
   - 1st responders
   - CRCs
   - Designated 7 “Rad” Hospitals

“Black Cloud”
Unusual Biological Event – “Orange Flame” Project

- Since 2005; a perennial program led by the MOH
- A Model of inter-disciplinary and inter-agency preparedness for a Generic Biological Threat
- Six months building capabilities effort in Regional and (National) Command Centers levels
  - Doctrines, Standing Orders, Check-lists, Procurement, Hands-on training, constructing Interfaces and interagency cooperation,
- A 36h large scale drill of all components
Main Results of “Orange Flame”

1. Feasibility of the National Unified Doctrine for UBE (“Initial Steps of Response for an Unknown Agent”)

2. Across the board, proper assimilation of UBE Terminology, Processes, Skills and Integrative Response

3. Much Enthusiasm & Cooperation of the all participants
   1. “Culture of Emergency”
   2. Perceived by participants: Potential expansion of the model to other scenarios and projects!
# Main Progress Made since “Orange Flame 1”

<table>
<thead>
<tr>
<th>Subject</th>
<th>Content</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Unified Generic Doctrine</td>
<td>Setting Common language, Principles of Response, Missions, Standards, Expectations &amp; Roles at all levels</td>
<td>Written &amp; Implemented</td>
</tr>
<tr>
<td>Derived Institutional Doctrine</td>
<td>Institution-based response plan, expectations &amp; roles</td>
<td>Written and Trained</td>
</tr>
<tr>
<td>Local SOPs</td>
<td>Tactic-level Standards</td>
<td>Written and Trained</td>
</tr>
<tr>
<td>Expansion of preparedness</td>
<td>Integration of Additional Medical organizations</td>
<td>Achieved</td>
</tr>
<tr>
<td>National and Regional Levels</td>
<td></td>
<td>Achieved</td>
</tr>
</tbody>
</table>
Ministry of Defense* and Ministry of Health

Translate the success of “Orange Flame” model of preparedness, to the Radiological Scenario using a similar process

* Currently the Ministry of Defense holds responsibility for Rad events Response
“Black Cloud 1” Goals

1. Increased preparedness across agencies & jurisdictions
2. Hands-on training for hundreds of participants
3. A unified & integrated Response system
A hypothetical but plausible scenario:

A suicide bomber explodes a car bomb laced with Cs-137 in Haifa Harbor
STATISTICAL AREAS OF HAIFA
The necessary components of Response ("Drilled in Black Cloud")

1. Immediate Pre-hospital response
2. Immediate Hospital Response
3. Delayed Population Screening
4. Public health Risk assessment
5. Risk communication
6. Command & Control
“Black Cloud 1” Participants

1. Police forces and District Commander
2. MADA (EMS) of Haifa region
3. Designated MRadI Hospitals: RAMBAM & CARMEL
4. Non-MRadI Designated Hospital: BNEI-ZION

5. The Municipality of Haifa
6. Home Front Command District
4. Israeli Atomic Energy Committee
5. Radio-toxicological Reference Laboratory
6. Command Center in MOH
7. National Crisis Control Center
Principles of Response

Spatial Components

- Screening
- Decontamination
- Personal Risk Evaluation

Potentially exposed (No Trauma)

Hot Zone

EMS PHTLS & cloths removal

TRAUMA

Sec. Medevac

TRÁMÁ

“MABAT” (CRC)

Non-designated Hospital

Non-designated Hospitals

Risk Communication
Main Drill’s Assets

- Mock Patients
- Mannequins containing sealed Rad sources of ultra-low level (below notification and marking level)
- Actors posing as Journalists and as “Worried well”
Main Drill’s Challenges

1. Transforming 1\textsuperscript{st} Responders and Hospitals Modus Operandi from a MCI of Trauma to a MRadI
2. Caring for “Immediate” Category Patients while minimizing long–term risks to personnel & others
3. Establishing a functional Population Monitoring System
4. Publishing Reasonable Risk Communication messages
Lessons learned
Model of Preparedness

1) “Orange Flame” model is optimal for planning, training and evaluating a complex response to a non-Nuclear incidence like RDD

2) Three year cycle of “Black Cloud” capability-building project - Recommended
   1) Regional + National levels
   2) Medical and Non medical Integrated response
Pre-hospital

Rescue
1. Medical Response needs enhancement – mainly SOP, Training and integration of response with other medical and non-medical bodies

2. Non-medical Response needs enhancement – training on Detection, Radiation safety, Rescue priorities, Command and Control, Contamination monitoring, Risk assessment and Risk communication
Hospital

Deployment
Hospital

Monitoring
1. Non Rad-designated Hospital will have very limited efficient response to MRadI mainly due to Staff hesitancy and lack of awareness by basic training

- Should not be a destination for planned Medical evacuation in MRadI
- Immediate on-site consulting deemed necessary
Population Evaluation Center (~CRC)

Monitoring
Population Evaluation Center (~CRC)

Monitoring

Risk Assessment
Lessons – Population Evaluation Center (~CRC)

1. An Emergency-Only facility, operated by many organizations
   = more training needed for all CRCs planned
2. CRC Command should be under Public Health (not Military)
3. More professionals needed for rapid & efficient population screening and consulting
4. Screening Gates definitely needed
5. Risk Communication should be established and Trained
   - Critical to assure a desirable public reaction related to CRC
1. Training of Incident commanding officers is needed on issues like MRadI consequences, priorities, radiation safety and integrative response
   - Tactic level basic Training, Table-tops and Drills
2. Leadership needs to be briefed pre-event or ASAP, on consequences of MRadI incidences
   - Best alternative – participating in large scale or C³ Drills
3. Risk communication should be improved
   - Dedicated drills recommended
History of MRadI preparedness
Scenario
Doctrine
  - 1st hour
  - 1st day
  - 1st week
Resources
Training history
Gaps
Next steps
Gaps

- Lack of Basic and Advanced level training
  - Medical & Non-medical responders
  - Low level attention
- Heterogeneous level of preparedness among 1st responder
- Command and control issues
  - Lack / minimal of Training of decision makers
  - Non terror Extra reactor incidence – orphan
- Pre & Post “black cloud” - Segregated Training is the rule
  - Mainly “Rad” hospitals
  - CRCs (Home Front Command)
- Risk communication is not well prepared
History of MRadI preparedness
Scenario
Doctrine
  - 1st hour
  - 1st day
  - 1st week
Resources
Training history
Gaps
Next steps
Components of Preparedness

Scenario ✔
Doctrine ✔
Standing Orders ✔
Command and Control ✔
Infrastructure ✔
Pharmaceuticals ✔
Equipment [PPE, Monitoring, Decon] ✔
Training ✔
Integration ✔
Next Steps

- Anticipated Increased attention to MRadI scenario
  - Changing face of the middle east – traditional war replaced by modern terrorism and rockets
  - Diverting now-available resources and attention to MRadI
- Effort to increase integrated system response to MRadI
  - “Orange Flame” - “Black Cloud” model
Thank you