Medical Disaster Conference
Panel Discussion on Threats and Response Plans

Joseph M. Rosen, M.D.
June 13th, 2001

Natural and Man-made Catastrophes
National Security in the 21st Century
Catastrophic Medical Disasters

CONFERENCE SPONSORS

- Thayer School of Engineering
- Dartmouth Medical School
- US Army Soldier and Biological Chemical Command (SBCCOM)
- Koop Institute
Response Plan Requirements

“A WMD incident on American Soil is likely to overwhelm local fire and rescue squads, medical facilities, and government services.”

US Commission on National Security /21st Century
Response Plan Requirements

Attacks may contaminate water, food, and air; large-scale evacuations may be necessary and casualties could be extensive.”

US Commission on National Security /21st Century
Response Plan Requirements

“Responsibilities need to be assigned and procedures put in place for these responsibilities to evolve if the situation worsens”

US Commission on National Security /21st Century
Catastrophic Medical Disasters

- Medical disaster with large number of casualties
- Ten thousand or more casualties to be cared for
- Natural or Man-made disaster
- Public healthcare system not prepared for this event
- Present healthcare system based on hospital based care
Origins of the Modern Hospital Delivery System

- Major catastrophe near Rome in the year 27 A.D.
- Collapse of amphitheater at a Gladiatorial contest
- 20,000 to 50,000 casualties
- Romans invent Modern Hospital to replace Clinics
Modern Healthcare system is based on Hospital Model

- Hospitals today are in a cost crisis
- Hospitals and their emergency departments are severely limited in their reserve capacity to deliver care
- Hospitals today are not designed to respond to catastrophic medical disasters – epidemics and bioweapons
What Threats will cause a Catastrophic Medical Disaster and change in our care model?

Natural medical catastrophes
- Earthquakes, accidents and epidemics

Terrorist (man-made) attacks

Weapons of Mass Destruction
- Nuclear, Chemical and Biological weapons
Modern Influenza
Natural Epidemic or Man-made
Medical Catastrophic Disaster

- Similar to 1918 Flu Epidemic
- Direct care causes increased casualties among responders
- Disease spreads rapidly to other major cities in Northeast region
- Response overwhelms present modern hospital based healthcare delivery system
Panel of Threats and Response Plans:

**Time Critical Operations Response Plan Requirements**

- Early detection of natural epidemic or terrorist attack
- Quarantine of infected population until agent identified
- Delivery of rapid assistance to those infected by the agent
- Timely integration of local, state and federal response plans

“The combination of unconventional weapons proliferation with the persistence of international terrorism will end the relative invulnerability of the U.S. Homeland to catastrophic attack.”
Road Map For National Security:

“A direct attack against American Citizens on American soil is likely over the next quarter century”

“In face of this threat, our nation has no coherent or integrated governmental structures.”
“This commission concludes that significant changes must be made in the structures and processes of the U.S. national security apparatus.”

Stephen Duncan will discuss in his keynote address tomorrow evening

Catastrophic Terrorism: are we prepared?
Response Plans:

- Texas state response plan
- Federal response plan and National Disaster Medical System (NDMS)
- Improved BW response templates
- Extreme Information Infrastructure
- Cybercare – a new healthcare system based on a distributed care model rather than on a centralized hospital-based delivery system
From Hospital based care to a Cybercare System

Airplane crash in Boston stimulates interest in telecare

Teleoperations from nuclear industry modified for telemedicine uses

Many pilot projects funded for NASA
Telesurgery vision from NASA 1970’s

Telesurgery to provide care to Astronauts in Space

Surgeon in Houston and patient in space

VIRTUAL INTERFACE ENVIRONMENT
TELESURGERY

TACTILE INPUT/FEEDBACK

HEAD-COUPLED STEREO CAMERA

REMOTE MANIPULATION

VIRTUAL INFORMATION WINDOWS

© J. Rosen, MD 1991
NASA 1980’s early virtual reality simulators

Shared virtual environment

Virtual Human with two or more players
Telesurgery in the Battlefield 1990’s (DARPA)

Military Medicine will lead a Revolution in Telemedicine

Telesurgery will be provided to the front lines - the surgeon will treat the soldier in the foxhole.
Telesurgery demonstrated at SRI

Telesurgery practical in Civilian applications where bandwidth is readily available
“Digital Physician” Information Revolution

Satava Concept of digital physician in the battlefield
Revolutionize practice of civilian and military medicine
Telesurgery now becomes cybersurgery
Vision of a New Health Care System

Demonstration of telemedicine, simulation virtual reality and datacube technologies

Healthcare concept 1993 with Dr Koop
Internet based Healthcare System

Availability of computers and bandwidth around the world
Store-forward approach to care
International medical electronic link (IMEL)
1996 demonstration project connecting Dartmouth to Nepal
Definition of Cyber

From the Greek – to steer or govern
Wiener – *Cybernetics* 1948 – the science of control systems – comparing human and computer

Gibson – *Neuromancer* 1984 – “Cyberspace” an environment of interlinked networks providing access to information and interactive communication systems
Convergence of Technologies

Cybercare = Telemedicine +

Cybersurgery (Satava 1998)
Tele-medicine, surgery, mentoring, and distance learning systems
Virtual Reality Simulators
Augmented Reality – datafusion
Clinical information systems
Software Intelligent Agents
Cybercare

Clinical Information System

Intelligent Agents

Telemedicine

Telesurgery

Virtual Reality

Augmented Reality
Cybercare = cyberspace + healthcare

- Creates a new environment for healthcare at a distance
- Uses present IT with expanded bandwidth and telecommunications
- Combines both physical and virtual worlds within augmented reality system
What Catastrophe or Disaster will lead to Cybercare?

**Natural catastrophes** –
- Epidemic -
- Plague, smallpox or Influenza

**Man-made disaster** -
- Terrorist Bioweapon attack or incident
Influenza Epidemic
Natural or Man-made
Contagious Disaster

- Similar to 1918 Flu Epidemic
- Direct care causes increased casualties among responders
- Disease spreads rapidly to other major cities in Northeast region
- Response requires national cybercare delivery system
Cybercare approach to epidemic

Link major medical centers across country in cyberspace

- Each affected area is supported by unaffected area in distant region
- Mobilize most of healthcare system linking through teleoperations
- Local responders supported through telementoring and telerobotics
- Complex healthcare network created
Cybercare Response System

Boston first City involved

Future Scenario

Telepresence and Telesurgery/robotic System assisting Local surgeons in Case of an Earthquake
Cybercare Response System

Boston first City attacked

Future Scenario

Telepresence and Telesurgery/robotic System assisting Local surgeons
Cybercare Response System

Spreads to New York City

Future Scenario

Cybercare system brings on Multiple additional remote Sites to provide assistance
Cybercare Response System

Future Scenario

Disease Spreads to Washington DC and Then is contained through Vaccine and quarantine
Cybercare Response System

Boston
New York
Washington D.C.

Seattle
Local Medical Responder
Washington DC

Telepresence Care System
Cybercare Response System

Tele-Robot Responders bringing supplies
Cybercare Response System

Boston
New York
Washington D.C.

Tele-Robot Responders bringing supplies
Cybercare Response System

Command
Cybercare Conclusion:

- Multiple tele-care systems with emphasis on robotics over humans
- Simulation environment (SIMNET) for healthcare (MEDNET) – virtual reality
- Cyberspace – integrates all of the IT systems within augmented reality
Thank You

Panel discussion
On threats and response plans
Joseph.Rosen@hitchcock.org