CBRN risk preparedness and response: Lessons learned from Ebola outbreak

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1-Civil-Military-Interaction Command

Classification of whole presentation: ‘unclassified’
Selection of emerging diseases

- **Decreasing**
  - Polio
  - Meningococcus C (UK)
  - Pneumococcus (US)
  - HIV (US)
  - HCV (US)
  - Diphtheria
  - Cholera

- **Emerging**
  - Avian influenza
  - SARS
  - West Nile virus (US)
  - Ebola
  - vCJD
  - BSE
  - CJD
  - Antibiotic resistance (MRSA) (UK)

- **Persisting**
  - Tuberculosis
  - HIV (WW)
  - Malaria
  - Anthrax
  - Bioterrorism
Rinderpest
Foot & Mouth
African Swine Fever
Hog Cholera
PPR

Plague
Anthrax
Bird Flu
Tularemia
West Nile Virus

Salmonella
Camelpox
E. coli
BSE

Monkeypox
Hantavirus
Marburg
Ebola
SARS

Dudley & Woodford (2002)
BioScience 52, 583-592
Less than 20% of the world is prepared to respond to pandemics

- All 194 countries of the world committed to WHO International Health Regulations
- June 2012 deadline – only 16% fully prepared to detect and respond to pandemics
Interpretation of IHR Questionnaire

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<tr>
<th>Component</th>
<th>8.2</th>
<th>Laboratory biosafety and biosecurity</th>
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</table>
| Indicator | 8.2.1 | *Laboratory biosafety and laboratory biosecurity (Biorisk management)*
|           |     | practices in place and implemented |

8.2.1.1 Are biosafety guidelines accessible to laboratories?
8.2.1.2 Are regulations, policies or strategies for laboratory biosafety available?
8.2.1.3 Has a responsible entity been designated for laboratory biosafety and laboratory biosecurity?
8.2.1.4 Are relevant staff trained in laboratory biosafety and laboratory biosecurity guidelines?
8.2.1.5 Has an institution or person responsible for inspection, (could include certification of biosafety equipment) of laboratories for compliance with biosafety requirements been identified?
8.2.1.6 Has a biorisk assessment been conducted in laboratories to guide and update biosafety regulations, procedures and practice, including for decontamination and management of infectious waste?
Multiple threats to human safety & security

- Naturally-Occurring Disease Outbreaks
- Accidents
- Lack of Awareness
- Unintended Consequences of Research
- Deliberate Misuse
- Negligence
- Deliberately-Caused Outbreaks

biosafety

biosecurity
Biosecurity & Biosafety

- **Biosafety** describes the containment principles, technologies and practices that are implemented to prevent the *unintentional* exposure to biological agents and toxins, or their accidental release.

- **Biosecurity** describes the protection, control and accountability for biological agents and toxins within laboratories, in order to prevent their loss, theft, misuse, diversion of, unauthorized access or *intentional* unauthorized release.

(adapted from WHO/CDS/EPR/2006.6 and CWA 15793:2011)

Biosafety is to keep bad bugs from people,
Biosecurity is to keep bad people from bugs
The probability or chance that a particular adverse event, accidental infection or unauthorized access, loss, theft, misuse, diversion or intentional release, possibly leading to harm, will occur.

<table>
<thead>
<tr>
<th>Natural Outbreak</th>
<th>Accidental Release</th>
<th>Biocrime</th>
<th>Bioterrorism</th>
<th>Biowarfare</th>
</tr>
</thead>
</table>

Reference:
Ebola Virus Disease

Zoönotic disease
Transmission routes

Most virulent in dying patient
Only by contact
Incubation time and travel

Table 1. Model Parameters and Fitted Values for a Model of an Ebola Epidemic in Liberia and Sierra Leone, 2014.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Liberia Fitted Values</th>
<th>Sierra Leone Fitted Values</th>
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</thead>
<tbody>
<tr>
<td>Contact Rate, Community ($\beta_t$)</td>
<td>0.160</td>
<td>0.128</td>
</tr>
<tr>
<td>Contact Rate, Hospital ($\beta_H$)</td>
<td>0.062</td>
<td>0.080</td>
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<tr>
<td>Contact Rate, Funeral ($\beta_F$)</td>
<td>0.489</td>
<td>0.111</td>
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<tr>
<td>Incubation Period ($1/\alpha$)</td>
<td>12 days</td>
<td>10 days</td>
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<td>Time until Hospitalization ($1/\gamma_H$)</td>
<td>3.24 days</td>
<td>4.12 days</td>
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<tr>
<td>Time from Hospitalization to Death ($1/\gamma_{DH}$)</td>
<td>10.07 days</td>
<td>6.26 days</td>
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<tr>
<td>Duration of Traditional Funeral ($1/\gamma_F$)</td>
<td>2.01 days</td>
<td>4.50 days</td>
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<tr>
<td>Duration of Infection ($1/\gamma_I$)</td>
<td>15.00 days</td>
<td>20.00 days</td>
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<tr>
<td>Time from Infection to Death ($1/\gamma_D$)</td>
<td>13.31 days</td>
<td>10.38 days</td>
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<tr>
<td>Time from Hospitalization to Recovery ($1/\gamma_{IH}$)</td>
<td>15.88 days</td>
<td>15.88 days</td>
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<tr>
<td>Daily probability a Case is Hospitalized ($\iota$)</td>
<td>0.197</td>
<td>0.197</td>
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<tr>
<td>Case Fatality Rate, Unhospitalized ($\delta_1$)</td>
<td>0.500</td>
<td>0.750</td>
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<tr>
<td>Case Fatality Rate, Hospitalized ($\delta_2$)</td>
<td>0.500</td>
<td>0.750</td>
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</tbody>
</table>
Ebola Virus is only infective with direct body (fluid) contact.

Ebola Virus is the most virulent when the patient (virus host) is dying.
Liberia was declared Ebola-free in August 2015

But there is growing evidence that the virus may survive longer than previously thought in sperm has raised fears of fresh outbreaks.

The teenage girl, Kadiatu Thullah, died on Sunday September 13, 2015 at the International Medical Corps Ebola treatment unit.
US Global Health Engagement program & EU

GSHA Partner Nation Announcement by President Obama at G20 Summit in Turkey 6 November 2015:

- Bangladesh, Burkina Faso, Cambodia, Cameroon, Cote d’Ivoire, Democratic Republic of Congo, Ethiopia, Georgia, Ghana, Guinea, Haïti, India, Indonesia, Jordan, Kazakhstan, Kenia, Laos, Liberia, Mali, Mozambique, Pakistan, Peru, Rwanda, Senegal, Sierra Leone, Tanzania, Thailand, Uganda, Ukraine and Vietnam.

- US DoD has already GHE assets (laboratories, bio-surveillance emergency operations centers) active in a number of these countries and is poised to support the mission to prevent, detect and to respond to biological threats.

- DoD Cooperative threat reduction (CTR) / Cooperative Biological Engagement Plan (CBEP)
- Armed Forces Health Surveillance Center / Global Emerging Infections Surveillance and Response Systems Division (GEIS)
- PEPFAR; DAHHP; DIMO (15,000 participants in 2015); DTRA; etc

> USPHS; Military, Contractors, NGOs, IOs, GOs, Local Health Authorities
The next Epidemic – Lessons from Ebola

• “All countries could identify trained military resources that would be available for epidemics; in a severe epidemic, the military forces might have to work together”

• “The conversation should include military alliances such as NATO which should make epidemic response a priority”

Tradition of Humanity in armed forces operations

CIMIC?
Civil effects?
Nation building?
# Military in Humanitarian Aid

## Strengths

- Flexibility / Mobility
- Protection / safe haven
- Communication
- Intelligence
- Logistics
- Medical Support (Mobile hospitals; standard of care)

## Weaknesses

- Relatively short deployments
- Intercultural (in-)competence
- Cooperation / communication with civilian actors
- “Armed” forces
- No neutrality or impartiality
- Competition with NGOs
- Medical treatment standards

Ref.: LSHTM & Oxford University, Qualitative study, Refugee Studies, Programme Documentation Centre, 2001
Where do NGO’s and Military troops meet each other?

Ad hoc collaboration in deployment or training

CBRNe-incidents = Public Health effects

Civil-Military Interaction

Last resort; bridge-truck-cookie
The CIMIC “Battlespace”

Death and Destruction

Hugs and Kisses

“What do we want from our Military – a sort of Oxfam with guns?”
GBR Labour MP 1998

Competition with NGOs?
The European Mobile Lab - EMLab
Transfer of military know-how
The European Mobile Lab – EMLab
Not mobile - but rapidly deployable
### List of donor with recipient countries in Africa

<table>
<thead>
<tr>
<th>Country</th>
<th>France</th>
<th>Germany</th>
<th>G7</th>
<th>EU-IMDA</th>
<th>EU-DEVCO (Global Partnership)</th>
<th>Japan-JICA</th>
<th>Korea-ROKA</th>
<th>Netherlands</th>
<th>UK-DFID</th>
<th>USAID (GHS)</th>
<th>USAID (EPT-2)</th>
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Heterogeneity in development programs

**Anglophone countries**
- Lots of US programs present
- CBEB; DTRA; CDC; a.o.
- UK programs
- GIZ with local offices
- Structured / standard programs with standard curriculum for all countries.
- More financial support
- Private /family funds
- FDA laboratory standards

**Francophone countries**
- Institut Pasteur network
- Institut Merieux
- European support
- French ‘culture’ and presence
- Less international funding
- Different standards
- Difficulties to implement the standard CDC, WHO, US CBEB training programs due to language

Anglophone countries

Francophone countries
In trans-border outbreak incident management, a language barrier will exist.
So, where are we now with IHR Globally?

- 3, 2% Fully Implemented
- 48, 24% 2-year extension requested
- 64, 33% no communications
- 81, 41% Member State agreed to IHR at a later date

"...We must come together to prevent, and detect and fight every kind of biological danger – whether it’s a pandemic like H1N1, a terrorist threat, or a treatable disease."

President Barack Obama, 2011

Global health security agenda

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President Barack Obama, 2011
Joint External Evaluation of the Republic of Liberia
Mission Report
September 2016

Press releases in English and Arab, not in French

It looks like a copy of:
Some local leaders spread rumors that "the white people" were conducting experiments, infecting Sierra Leonians or cutting off people's limbs.

Doctors Without Borders warned that widespread belief that Ebola does not exist threatened to spread the disease regionally.

Today the word "Ebola" carries so much stigma that few ailing individuals even seek diagnosis.
Public awareness

SYMPTOMS
Fever, weakness, muscle pain, headache and sore throat, followed by vomiting, diarrhea, and bleeding

HOW IT SPREADS
Direct contact with body fluids of an infected person (incl. dead bodies) – most infectious: blood, faeces, vomit

EBOLA IS NOT AIRBORNE
Unlike influenza or tuberculosis, Ebola does not spread through the air

HOW TO PREVENT
Isolate yourself and get medical care

Who?
If you have been in an affected country + have had contact with a sick person + you begin to have symptoms

Wash your hands with soap and water frequently
Handrub with alcohol-based hand sanitizer

PEOPLE CAN SURVIVE EBOLA
Although Ebola is a severe, often fatal illness, getting medical care early can increase the chance of survival
Better control
A total of 30 confirmed cases of Ebola virus disease (EVD) were reported in the week to 5 April. This is the lowest weekly total since the third week of May 2014. Case incidence in Guinea decreased to 21, compared with 57 confirmed cases the previous week. Liberia reported no confirmed cases. Sierra Leone reported a fifth consecutive weekly decrease from 25 confirmed cases in the week to 29 March to 9 in the week to 5 April.
# Lost Gross Domestic Product

## Executive Summary Table: Lost GDP due to Ebola in dollars and as a percentage of 2013 GDP

<table>
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<tbody>
<tr>
<td>Guinea</td>
<td>130 million (2.1%)</td>
<td>-43 million (0.7%)</td>
<td>142 million (2.3%)</td>
</tr>
<tr>
<td>Liberia</td>
<td>66 million (3.4%)</td>
<td>113 million (5.8%)</td>
<td>234 million (12.0%)</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>163 million (3.3%)</td>
<td>59 million (1.2%)</td>
<td>439 million (8.9%)</td>
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<tr>
<td>Core Three Countries</td>
<td>359 million</td>
<td>129 million</td>
<td>815 million</td>
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<tr>
<td>West Africa</td>
<td>2.2 – 7.4 billion</td>
<td>1.6 billion</td>
<td>25.2 billion</td>
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</table>

Note: All values are expressed in 2013 US dollars.

Malaria has been estimated to cost Africa more than **US $ 12 billion** every year in lost GDP.
World Bank investment in Public Health

The World Bank’s World Development Report 1993

- Evidence-based health expenditures are an investment not only in health, but in economic prosperity
- Additional resources should be spent on cost-effective interventions to address high-burden diseases
Between 2000 and 2011, about a quarter of the growth in full income in low-income and middle-income countries resulted from VLYs gained.
Any questions?

Civil-Military-Interaction Command

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Ebola shortlist

- Ebola virus disease (EVD), formerly known as Ebola hemorrhagic fever, is a severe, often fatal illness in humans.
- EVD outbreaks have a case fatality rate of up to 90%.
- EVD outbreaks occur primarily in remote villages in Central and West Africa, near tropical rainforests.
- The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.
- Fruit bats of the Pteropodidae family are considered to be the natural host of the Ebola virus.
- Severely ill patients require intensive supportive care. No licensed specific treatment or vaccine is available for use in people or animals.
History of outbreaks

Ebola cases and deaths by year, and countries affected

- **1976**: Sudan, Democratic Republic of Congo
  - 602 cases
  - 431 deaths
  - Source: World Health Organization

- **1995**: Democratic Republic of Congo
  - 315 cases
  - 254 deaths

- **2000**: Uganda
  - 425 cases
  - 224 deaths

- **2007**: Uganda, Democratic Republic of Congo
  - 413 cases
  - 224 deaths

- **2014**: Guinea, Liberia, Nigeria, Senegal and Sierra Leone
  - 6,553 cases
  - 3,083 deaths as of Sept. 26
Ebola virus strain evaluation

Long chain of virus particles is essential for infection

Novel Ebola species caused 2007 outbreak in Uganda