mSOS
Mobile SMS-based disease outbreak alert system

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Yellow Fever

1912 Zaire
1917 Zaire
1927–1928 Zaire
1936 Sudan, Uganda, Kenya
1940 Sudan
1958 Zaire
1959 Sudan
1960–1962 Ethiopia
1966 Ethiopia, Sudan
1971 Angola
1972 Zaire
1988 Angola
2003 Sudan
2005 Sudan
2010–2011 Uganda
2012–2013 Sudan

2000 Guinea, Liberia, Nigeria
2001 Senegal, Cote d’Ivoire, Burkina Faso, Liberia
2002 Senegal, Cote d’Ivoire
2003 Cote d’Ivoire, Burkina Faso, Sierra Leone, Guinea, Cameroon
2004 Burkina Faso, Liberia
2005 Mali, Guinea, Ghana, Cameroon, Senegal
2006 Cote d’Ivoire, Togo
2007 Togo, Cote d’Ivoire, Cameroon
2008 Sierra Leone, Burkina Faso, Guinea, Cote d’Ivoire, Liberia
2009 Cote d’Ivoire, Cameroon, Guinea
2010 Senegal, Gambia, Cameroon, Guinea, Cote d’Ivoire
2011 Ghana, Sierra Leone, Cote d’Ivoire
2012 Cameroon.

(Annu. Rev. Entomol. (2007) 52: pp209-229, Fig 4)
(Advances in Virus Research (2003) Vol.61, pp291-315, Table. 1)
Rift Valley fever

In November 2006, RVF outbreak occurred in Kenya and spread into bordering countries such as Tanzania and Somalia in 2007. According to WHO, 684 RVF cases had been reported in Kenya with 155 fatality. However, only 234 cases (34%) were laboratory diagnosed.


<table>
<thead>
<tr>
<th>Country</th>
<th>Duration</th>
<th>No of cases</th>
<th>No of death</th>
<th>CFR</th>
<th>No of laboratory confirmed cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>30/Nov/2006–12/Mar/2007</td>
<td>684</td>
<td>155</td>
<td>23%</td>
<td>234 (34%)</td>
</tr>
<tr>
<td>Tanzania</td>
<td>13/Jan/2007–3/May/2007</td>
<td>264</td>
<td>109</td>
<td>41%</td>
<td>154 (60%)</td>
</tr>
<tr>
<td>Somalia</td>
<td>19/Dec/2006–20/Feb/2007</td>
<td>114</td>
<td>51</td>
<td>45%</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>
Case Study–1: Outbreak of Yellow fever in Sudan, 2005

Patients: 605
Fatal case: 163
Case Fatality Rate: 27%

Confirmation of YFV (ELISA)
NAMRU–US (Cairo, Egypt)

WHO declared outbreak of YFV
Mosquito control started.
Vaccination campaign started.

First fatal cases (7)

Figure 1  Cases of outbreak-related illness reported to the Sudan Federal Ministry of Health by date of estimated disease onset, 2005. Epidemic curves were derived using reported dates of symptom onset. For cases with no onset date reported, the data of symptom onset was estimated by subtracting a set number of days from the date of hospital admission or death as follows: 3 days for cases with fever, 5 days for jaundice, 7 days for hemorrhage and 10 days for death.

Five weeks from first fatal case to declaration of YFV outbreak.
We started off with questions

• What are the systems already in place to address rapid disease notification and response?
  – IDSR (WHO-AFRO)

• What are the challenges in disease surveillance, response, containment, and information sharing?
  – Rare outbreaks
  – Difficult diagnosis
  – Access to peripheral health facilities
  – Mobilization of resources
  – Media reporting

• Could innovative technology bridge some of the gaps?
- Strengthen disease surveillance
- Compliment IDSR (Integrated Disease Surveillance & Response)
- Emphasize sustainability & local ownership
Mobile SMS-based disease outbreak alert system
MOH collaborations with local university
- Local capacity building
Diseases to be reported

- Adverse events following immunization (AEFI)
- Anthrax (ATX)
- Cholera (CL)
- Dengue Fever (DF)
- Dysentery (DYS)
- Guinea worm disease (GW)
- Measles (MLS)
- Neonatal Tetanus (NT)
- Plague (PLG)
- Rift Valley Fever (RVF)
- Severe respiratory illness (SARI)
- Viral Hemorrhagic Fever (VHF)
- Yellow Fever (YF)
- Any public health event of international concern (OTH)
Health facility workers

District Disease Surveillance Coordinators

County/Provincial Surveillance Focal Persons

National Surveillance Focal Persons

National Response Focal Persons

Reference laboratories
Functions of mSOS

• SMS information management tool
  – Health facility workers send information
  – Server sorts messages according to threshold levels
  – Suspected outbreak information received by MOH

• Web portal to view and analyze information
  – MOH
  – Provincial/county surveillance focal persons
  – District surveillance focal persons
  – Laboratories
  – Health facility workers
Nairobi test training

mSOS System Workflow

1. Request SMS Format
2. Format Reply
3. Send Alert
4. Receive confirmation SMS

Format Alert
Send Clear

alert at 30 f a
Send Clear

Message received. Action will be taken promptly the incident ID is S6621A7620
Multifaceted intervention

• IDSR (disease case base definition) training to all health facilities
• Training on mSOS and functions of the system
Evaluation plans

Assess eligibility
(Facilities with curative services that are operational)

Enrollment
(n=153 facilities in 12 districts)

Randomize

Allocate to intervention
(n=76 or 77 facilities in 12 districts)

Baseline data collection

Endline data collection

Allocate to control
(n=76 or 77 facilities in 12 districts)

Baseline data collection

Endline data collection
Null hypothesis

- Implementation of mSOS will not change the timeliness of notification and response of disease outbreaks in selected health facilities in Kenya
Primary indicators

• % of health facilities that **reported** suspected outbreak cases within 24 hours to the next level

• % of health facilities that **responded** to suspected outbreak cases within 24 hours of notification
Analysis plan

• Intervention arm
  – Notifications are made to the next level using mSOS and normal IDSR reporting system
  – Response actions are made based on notifications received using mSOS and the normal IDSR reporting system

• Control arm
  – Notifications are made to the next level using the normal IDSR reporting system
  – Response actions are made based on notifications received using the normal IDSR reporting system
Potentials

• Early warning system
  – Weather and livestock information
• Digital reporting of routine data
• Cross-sector collaborations
• Regional collaborations
Conclusion

• First cluster randomized control trial of an outbreak alert system using innovative mobile phone technology
• Evidence based policy for enhancing disease surveillance mechanisms
• Local capacity building
• Good will and political buy-in
• Sustainable
Partners

Division of Disease Surveillance and Response (DDSR), Ministry of Health (MOH)

Kenya Medical Research Institute (KEMRI)
Nagasaki University Institute of Tropical Medicine
Japan International Cooperation Agency (JICA)
Japan Science and Technology Agency (JST)

System developers

Strathmore University, Faculty of IT
Thank you

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