

# The Ebola Epidemic: Lessons Learned from the Frontline Clinical Response



Dr. Sharmistha Mishra, Canadian ID physician, WHO Clinical Consultant, at the first Port Loko District Ebola Survivors Clinic, Sierra Leone, March 2015

# The 2014 Ebola epidemic was unprecedented

*Ebola deaths by outbreak, as of March 15, 2015*



2014-2015 W. Africa outbreak



All 24 previous outbreaks combined



The 10 deadliest outbreaks before 2014

# Guinea, Sierra Leone, Liberia

A. Simor, January 2015



Hospital, Koidu Town, SL

Poor access to healthcare  
and limited healthcare  
infra-structure,  
resources, and HRH

Hospital, Guéckédou, Guinea



R. Fowler, March 2015

Health Unit, Kono District, SL



A. Simor, January 2015

# **Ebola Virus Outbreak – West Africa, 2014-2015**

<b>Country</b>	<b># cases</b>	<b># confirmed</b>	<b># deaths</b>
<b>Guinea</b>	<b>3,548</b>	<b>3,117</b>	<b>2,346</b>
<b>Liberia</b>	<b>10,042</b>	<b>3,151</b>	<b>4,486</b>
<b>Sierra Leone</b>	<b>12,201</b>	<b>8,563</b>	<b>3,857</b>
<b>TOTAL</b>	<b>24,872</b>	<b>14,831</b>	<b>10,689</b>

**WHO Sit Rep April 15, 2015**



# 5 Lessons Learned



Dr. Rob Fowler,  
Canadian Critical  
Care physician, WHO  
Clinical Lead, exiting  
the red zone at AHS  
Waterloo Holding  
Centre/Treatment  
Unit, Sierra Leone,  
December 2015

# 1. Why did this happen and how can we fix it?: “Staff, supplies, space and systems”

## Number of doctors per 100,000 population

LIBERIA: 1.4



SIERRA LEONE: 2.2



GUINEA: 10



UNITED STATES: 245.2



SOURCE: WHO







Conakry, Guinea, R. Fowler, March 2014





Conakry, Guinea, R. Fowler, March 2014





Conakry, Guinea, R. Fowler, March 2014





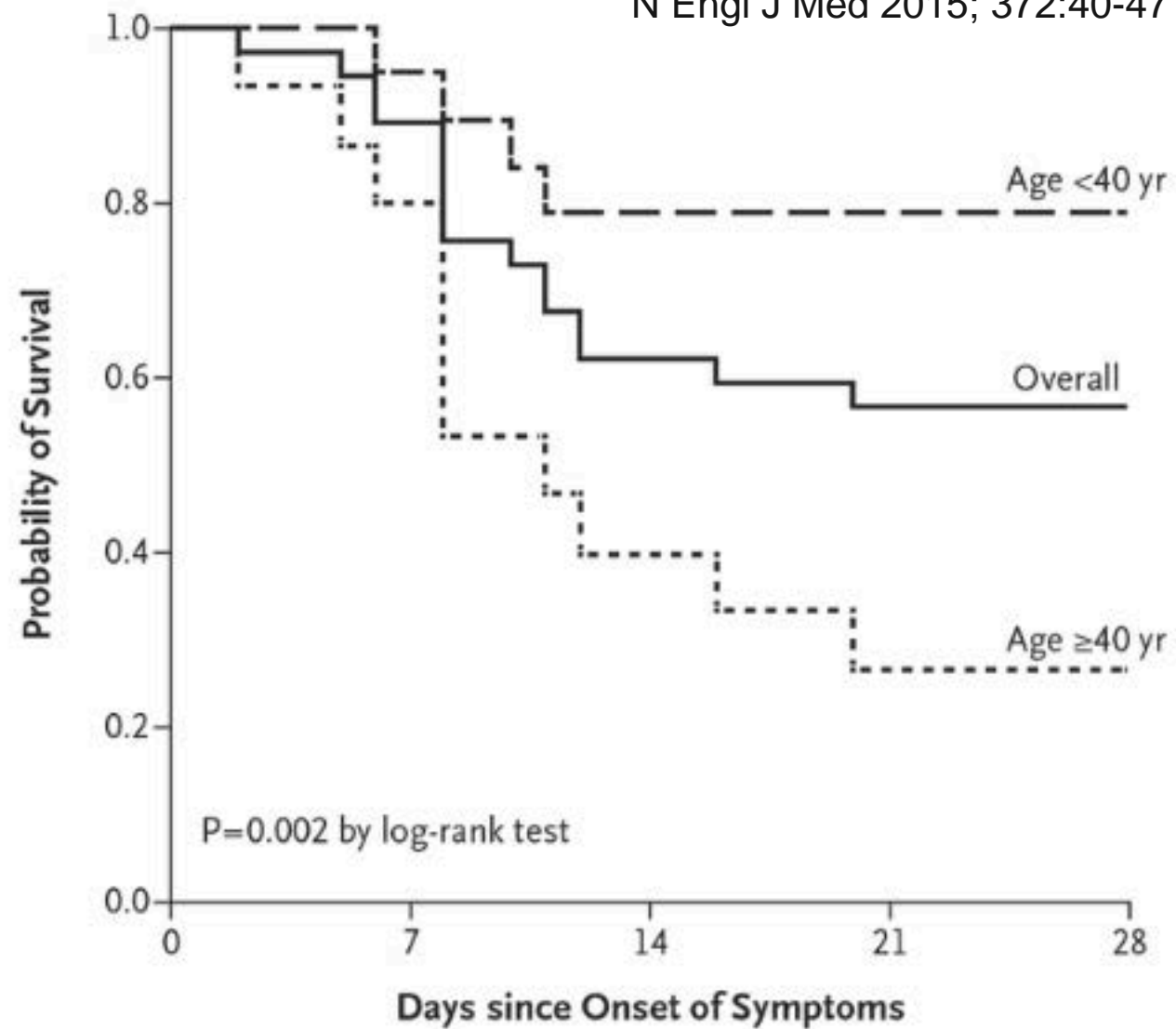


## 2. Supportive clinical care saves lives

Year	Country	Ebolavirus species	Cases	Deaths	Case fatality
2012	Democratic Republic of Congo	Bundibugyo	57	29	51%
2012	Uganda	Sudan	7	4	57%
2012	Uganda	Sudan	24	17	71%
2011	Uganda	Sudan	1	1	100%
2008	Democratic Republic of Congo	Zaire	32	14	44%
2007	Uganda	Bundibugyo	149	37	25%
2007	Democratic Republic of Congo	Zaire	264	187	71%
2005	Congo	Zaire	12	10	83%
2004	Sudan	Sudan	17	7	41%

2003 (Nov-Dec)	Congo	Zaire	35	29	83%
2003 (Jan-Apr)	Congo	Zaire	143	128	90%
2001-2002	Congo	Zaire	59	44	75%
2001-2002	Gabon	Zaire	65	53	82%
2000	Uganda	Sudan	425	224	53%
1996	South Africa (ex-Gabon)	Zaire	1	1	100%
1996 (Jul-Dec)	Gabon	Zaire	60	45	75%
1996 (Jan-Apr)	Gabon	Zaire	31	21	68%
1995	Democratic Republic of Congo	Zaire	315	254	81%
1994	Cote d'Ivoire	Taï Forest	1	0	0%
1994	Gabon	Zaire	52	31	60%
1979	Sudan	Sudan	34	22	65%
1977	Democratic Republic of Congo	Zaire	1	1	100%
1976	Sudan	Sudan	284	151	53%
1976	Democratic Republic of Congo	Zaire	318	280	88%





**No. at Risk**

Age <40 yr	19	18	15	15	15
Age ≥40 yr	15	12	6	4	4

# Clinical Management of Patients with Viral Haemorrhagic Fever:

A Pocket Guide for the Front-line Health Worker

30 MARCH 2014



Interim emergency guidance- generic draft  
for West African adaptation



World Health  
Organization



World Health  
Organization



### 3. Finding the balance between safety and patient care is challenging

Phlebotomy for  
EVD PCR,  
Suspect Area,  
IFRC Kono  
Ebola Treatment  
Centre, SL  
January 2015



# Health Care Workers at Risk

Sierra Leone, May-Oct 2014: -  
-199 cases in HCWs (5.2% of cases) -  
-incidence in HCWs 103-fold higher  
8,285/100,000 than 80/100,000 in  
general pop'n.

Kilmarx, MMWR 2014



Different styles of  
PPE: “WHO” and  
“MSF”



Red Zone Delivery,  
MSF Gueckedou ETU,  
Guinea, October 2014





PPE Doffing Area, Arab Holding Center,  
Makeni, Sierra Leone, January 2015

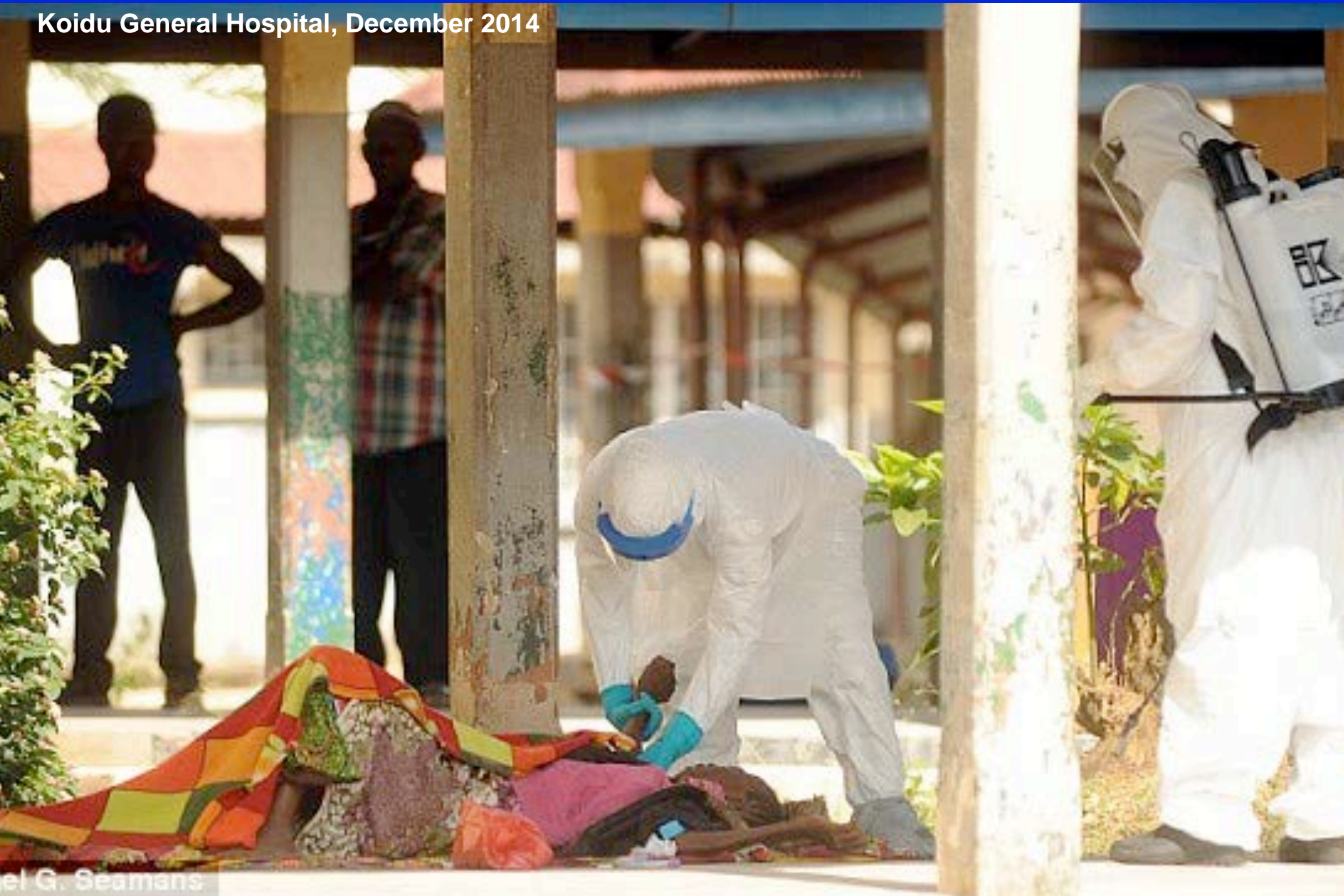




PPE Doffing Area, AHS Waterloo Holding  
Centre/Treatment Unit, Freetown, Dec 2014











Koidu General Hospital, Triage Area, IFRC  
Holding Centre, January, 2014



Green Zone, IFRC Kono District Ebola Treatment Centre,  
January, 2014





## 4. Resources from the Ebola response should be leveraged to address the collateral damage to the existing health system



No running H<sub>2</sub>O Maternity Ward  
Makeni General Hospital, SL



Piped in 0.5%, 0.05% and bore hole  
H<sub>2</sub>O MSF Kissey ETU, SL



**Labour and Delivery, Koidu General Hospital, January 2015**





Port Loko, Sierra Leone, DERC Ebola Ambulance Fleet, January 2015

## 5. Capacity Building: Training must be linked to on-site mentorship and supportive supervision

**Systems:**

**Triage, IPC, inpatient surveillance**

**Overcoming fear →  
providing appropriate  
care for non-EVD  
conditions in the  
context of ongoing  
EVD transmission**



Screening and  
Triage area,  
PHU, Port Loko  
District, SL  
February 2015





**WHO Phase 2 “Mock ETU” Training, IOM Ebola Training Academy,  
Freetown, December 2014**







**Dr. Ronald Marsh,  
Hospital  
Superintendant,  
General Medical  
Officer, and Kono  
DERC Case  
Management Pillar  
Lead teaching IPC  
to staff**



**Student nurses  
deployed to help staff  
a CCC in Kono District  
are taught how to do  
phlebotomy by PIH/  
WHO**

**Dr. Michael Kamara,  
IOM Facilitator,  
Sierra Leone,  
teaching the WHO  
Phase 1 Training**







**1 YEAR LATER:  
WHERE ARE WE NOW?**


# Ebola survivors

- >14,000 known survivors
- Uveitis
- Arthralgias
- Tinnitus
- Psychosocial / mental health
- Viral shedding



Survivors Tree, Maforki ETU, Port Loko, January 2015





Port Loko  
District  
Ebola  
Survivors  
Clinic, March  
2015

# **Ebola specific therapies:**

## **It's important to find the magic bullet....**

- **Monoclonal antibodies (Zmapp/Zmab)**<sup>4,6,7</sup>
- **Convalescent Plasma/ Whole Blood – Antibodies**<sup>2,3,5</sup>
- **Anti-Ebola Specific Equine Polyclonal Immune Globulin (FabEntech)**
- **Small Antiviral Molecules – Favipiravir,<sup>14</sup> T-705, jk-05**
- **Small inhibitory RNA molecules**
  - **TMK 100802 Tekmira**<sup>8,9</sup>
  - **Sarepta AVI-7537**
- **Brincidofovir\* (BMC, CMX001), BCX4430**
- **Tissue Factor Inhibitors and Anticoagulants - APC (!)**
- **Interferons**
- **Vaccination (Prevention and Therapy)**<sup>10,11,12,13</sup>

<sup>1</sup>Huggins, JW et al. *Rev Infect Dis* 1989; <sup>2</sup>Jarhling, P et al. *JID* 2007; <sup>3</sup>Mupapa, K et al. *JID* 1999 S18; <sup>4</sup>Olinger, GG et al. *PNAS* 2012; <sup>5</sup>Dye, JM et al. *PNAS* 2012; <sup>6</sup>Qiu, X et al. *Sci Transl Med* 2013; <sup>7</sup>Qiu, X et al. *Nature* 2014; <sup>8</sup>Geisbert, TW et al. *JID* 2007; <sup>9</sup>Geisbert, TW et al. *Lancet* 2010; <sup>10</sup>Kobinger, GP et al. *Virology* 2006; <sup>11</sup>Wang, D et al. *J Virol* 2006; <sup>12</sup>Geisbert, TW et al. *JID* 2011; <sup>13</sup>Gunther et al. *JID* 2011; <sup>14</sup>Oestereich, L et al. *Antiviral Res.* 2014.



...but it's also important to figure out  
how to deliver it to where it's needed





# IT COSTS MORE TO STOP OUTBREAKS THAN TO PREVENT THEM.

COST OF EBOLA RESPONSE (SO FAR)

\$4.3B



COST TO BUILD UP HEALTH SYSTEMS  
IN GUINEA, LIBERIA AND  
SIERRA LEONE

\$1.58B



 = US\$100M





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WHO Ebola Response Clinical Team

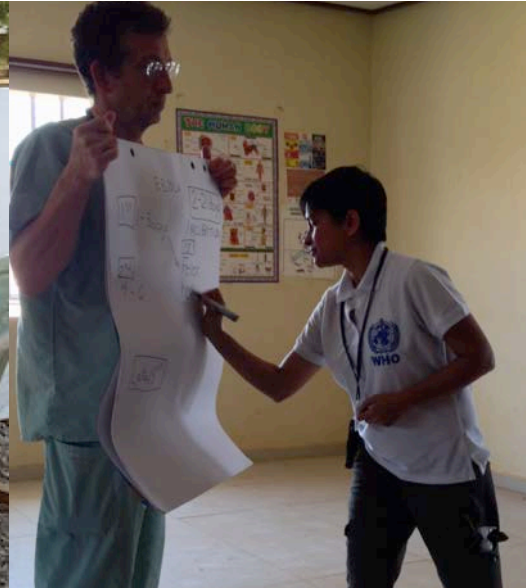
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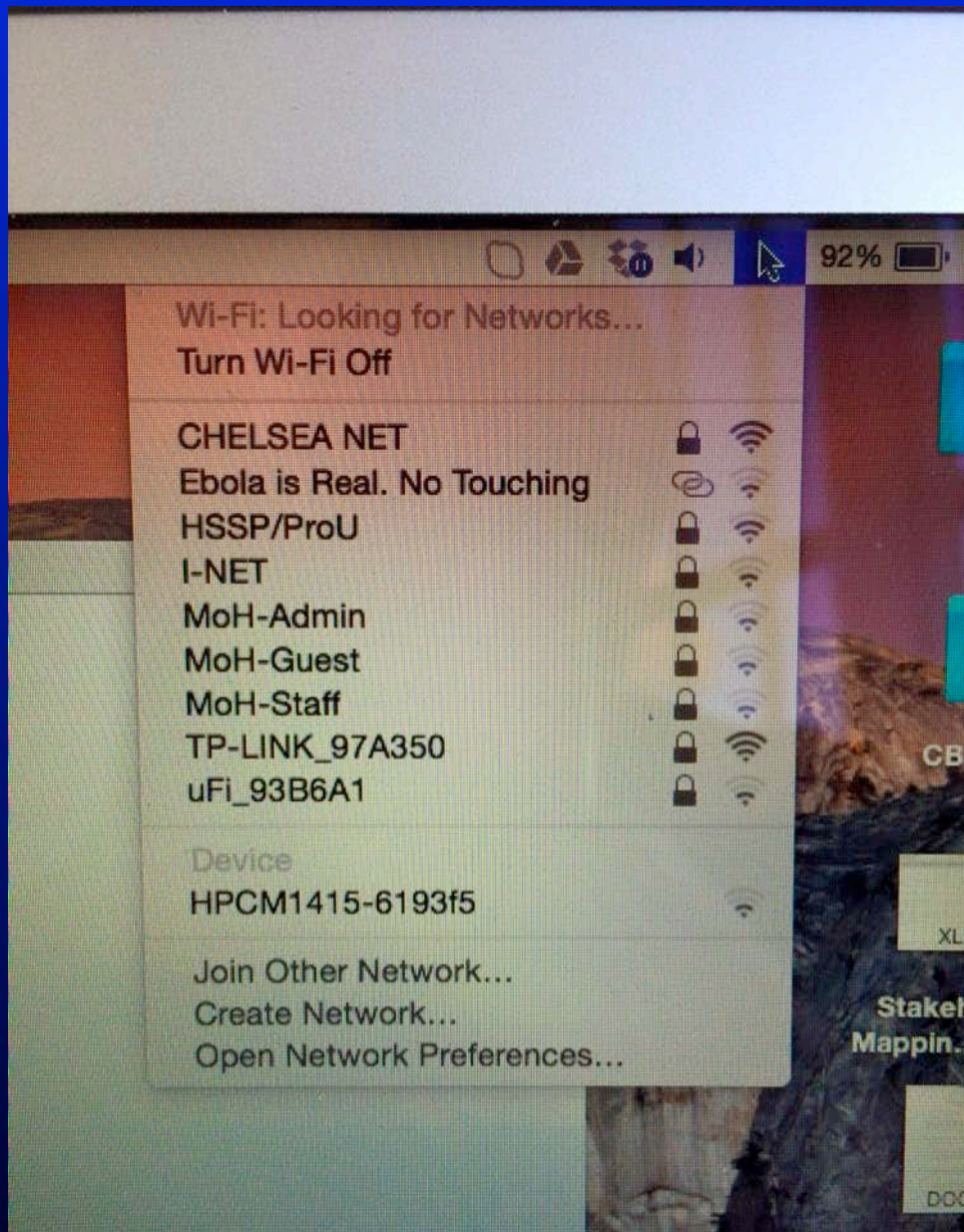
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World Health  
Organization







Trying to get internet hot spot at Liberia MOH in Monrovia



0.05% chlorine at canteen of UK Military HQ, Freetown, Sierra Leone