

Using Infection Prevention Resources Wisely – Examples From Ebola
Prof Shaheen Mehtar, Chair ICAN, UIPC, SUN, Cape Town S Africa
Broadcast live from IPAC Canada 2015 conference

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**Using Infection Prevention Resources Wisely –
Examples From Ebola**

Prof Shaheen Mehtar
Chair ICAN
UIPC, SUN, Cape Town S Africa

www.webbertraining.com June 16, 2015

The True Size of Africa

- It is a large continent
- The land mass covers most of the other continents except
 - Canada
 - South America
 - Australia
- Unlike the above, the population, tradition and culture is diverse and heterogenous

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Impact of poorly used resources

- Increase in mortality can be up to 15 times higher due to
- Lack of infrastructure- water, electricity
- Lack of administrative controls- no policies
- Lack of knowledge- surrounded by myth and superstition- no evidence
- Impact of HCW fear on patient care during EVD outbreak
 - Same gloves between patients
 - No drips put up on EVD cases
 - Deliveries not assisted- 100% mortality for mother and child
- Lack of preparedness!

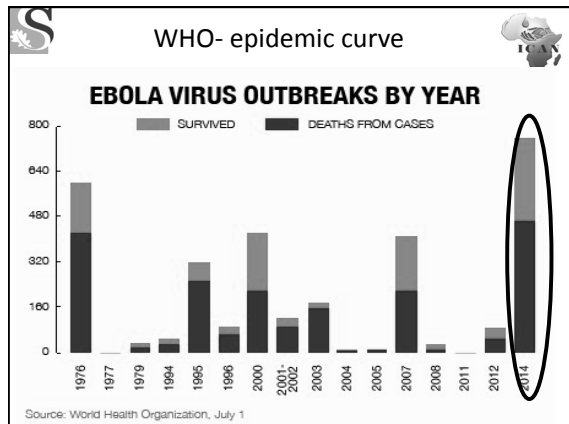
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Health profile of EVD affected countries

2012	Guinea	Liberia	Nigeria	Sierra Leone
Total population (millions)	11.45	4.19	169	6
< 5y mort / 1 000 live births	101	75	124	182
Mort 15 & 60 yr m/f (/ 1000 pop)	306/277 71% (ID)	282/246	371/346	444/426
Total expenditure on health per capita (\$) % of GDP	67 (6.3)	102 (15.5)	161 (6.1)	205 (15.1)
Doctors /10 000 pop (regional average 4.6)	0.03	0.1	4.1	0.2
Nurses- /10 000 pop (regional average 12.6)	0.04	2.7	16.1	1.7

Ebola outbreak- 2013


- Medical teams, epidemiologists, veterinary teams work in Africa
- Several NGOs work in Africa
- Most teams work in silos and communication with each other
- Why is it important to communicate with each other?



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S What happened in 2013?

- In 2012 and 2013 there was an outbreak of Ebola amongst the great apes in the DRC and surrounding areas which largely went unnoticed by the medical fraternity (over 5000 apes died)
- That was the epicentre of the current outbreak




S Ebola subspecies in humans and Non human primate outbreaks

Year	Country	Ebola sp	Cases	Deaths	Case fatality	NH primates	Subspecies	country
2008	DRC	Zaire	32	14	44%			No published report
2007	DRC	Zaire	264	187	71%			No published report
2005	DRC	Zaire	12	10	83%	Gorillas	Zaire	Congo
2003 (Nov-Dec)	DRC	Zaire	35	29	83%	Gorillas	Zaire	Congo
2003 (Jan-Apr)	DRC	Zaire	143	128	90%	Gorillas	Zaire	Congo
2001-2002	DRC	Zaire	59	44	75%	Gorillas	Zaire	Gabon
2001-2002	Gabon	Zaire	65	53	82%	Gorillas	Zaire	Gabon
1996 (Jul-Dec)	Gabon	Zaire	60	45	75%	Chimpanzees	Zaire	Gabon
1996 (Jan-Apr)	Gabon	Zaire	31	21	68%	Chimpanzees	Zaire	Gabon
1995	DRC	Zaire	315	254	81%			No published report
1994	Gabon	Zaire	52	31	60%			No published report
1997	DRC	Zaire	1	1	100%			No published report
1976	DRC	Zaire	318	280	88%			No published report

S The EVD spread to humans


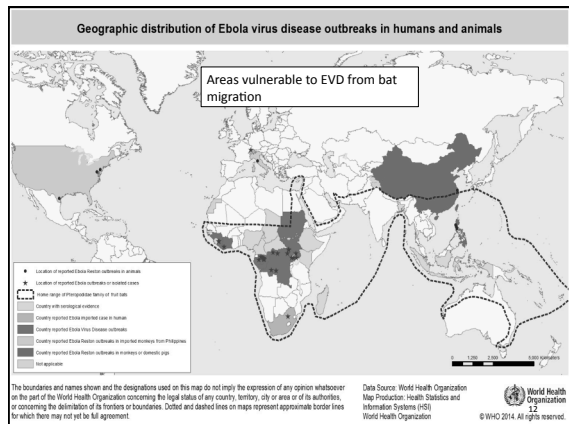
- On 13 Dec 2013, a 2 year old child was diagnosed with Ebola in Guinea - the first human case in the current outbreak.
- Why a toddler?
- Not investigated further
- From Guinea, it spread to Liberia and Sierra Leone




S Bats and humans

- Bats found to be carriers of Ebola
- The eat high hanging fruit in the forest
- Children and non human primates eat these fruit (foraging in the forest)
- Young adults hunt bats, small animals and non human primates for food
- “Bush meat” also consists of carcasses of dead animals.


S Bats and human- toddlers

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S Why was the spread amplified? 

- Deforestation in Liberia and parts of Guinea
- The non human and human primate populations moved closer together
- Foraging for food in the same area
- Humans encroaching on ape territory and their resources.
- Climate change increased bat migration and roosting to residential areas (DRC & Guinea)

S In Africa from Dec 2013 

Ebola outbreak

AFFECTED AREAS
 ● Reported cases or deaths ○ No longer active cases



DRC- separate outbreak

One case has also been confirmed in Senegal. DR Congo figures not as of 11/2014.
 Source: World Health Organization (WHO).

S 30 Sept, first case outside Africa! 



S And funding started coming! 


- NOW IS A POLITICAL ISSUE
- American lives are at stake!
 - Money- coming in!
 - Deployment of troops
 - Healthcare workers
 - Mobile laboratories
 - Mobilizing global resources
- **Contain Ebola in West Africa to stop it spreading to USA & Europe!!**




Need 5000 more HCWs!

S International Support since April 2014 

- Not very clearly documented
 - Chinese CDC = 7500 HCW- laboratories, IPC
 - Cuba = 600 approximately
 - African HCW= 8000 sent by AU
 - UK = 750 HCW, laboratory staff, plus research team
 - USA via CDC= 1000 trainers, mentors, and researchers
 - NGOs= 2000

S Use what ever is available! 


- Healthcare workers in the field since May 2014
- Support arrived after late August when the first US citizen contracted Ebola!
- Working with limited resources



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Ebola Preparedness

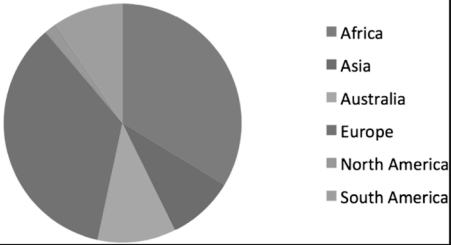
Survey conducted between October to Dec 2014
 Number of replies 192
 Number of countries 45



Preparedness of institutions around the world for managing patients with Ebola virus disease: an infection control readiness checklist
Antimicrobial Resistance and Infection Control (2015) 4:22
 doi:10.1186/s13756-015-0061-8

Participating countries

Geographic Distribution of Respondents

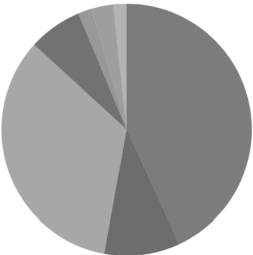


■ Africa
 ■ Asia
 ■ Australia
 ■ Europe
 ■ North America
 ■ South America

ARIC May 2015 E Tartari et al

Participating healthcare professionals

Medical Profession of Respondents



- Medical Doctor (ID, Clinical Microbiologist or Infection Control)
- Medical Doctor (other speciality)
- Infection Control Professional
- Nurse (other speciality)
- Institutional Safety Officer
- Other
- Pharmacist

General Administration

Administration	EVD receiving		Non EVD receiving	
	Yes	%	Yes	%
IPC represented on Hosp Team EVD	57	69.5	46	69.3
Alert system in place	61	73.5	51	70.8
Frontline staff aware of surveillance	56	68.3	43	60
IPC policy in place	57	70.4	48	66.7
Monitoring of clusters of infection	27	33.3	19	26.8

Alert systems in place but monitoring for clusters of infection inadequate

Communication

Communication	EVD receiving		Non EVD receiving	
	Yes	%	Yes	%
Information disseminated widely to all HCW	45	59.2	33	46.5
Teaching material available	29	38.2	28	39.4
Public messaging systems in place	28	36.8	9	12.7
Draft press release ready	19	25.3	10	14
Internal communication in place	42	55.3	37	52

Information available but poorly disseminated and inadequate teaching material circulated

Supplies

Supplies and monitoring	EVD receiving		Non EVD receiving	
	Yes	%	Yes	%
Adequate amount of PPE available	55	80.9	42	68.9
Adequate stocks of essential drugs & PPE	36	52.2	22	36.7
Checking systems for supplies in place	37	53.6	33	54.1

Reasonable supplies but monitoring stores and supply chain needed improvement- responsibility for ordering!!

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Education

Item	EVD receiving		Non EVD receiving	
	Yes	%	Yes	%
Evidence of training in SP & TBP	52	71.2	37	56.1
Training teams to train others	46	63	35	53
Audit of training teams independently	24	33.8	16	25

Training given but audit of the competency of the training teams not audited

Facilities to deal with EVD

Item	EVD receiving		Non EVD receiving	
	N	%	N	%
Designated team for high risk clinical care	27	38.6	11	17.7
Completed fit testing for N95 respirator	21	30	11	17.7
Ventilation – negative pressure	38	56.7	20	34.5
Surgical masks are available and used	53	80.3	36.6	67
N95 respirators	37	55.2	24	41.3
PAPR	25	37.9	9	15.5

Contributing to mixed messages- indicating airborne rather than droplet transmission based precautions

IPC practices in place- good!


Item	EVD receiving		Non EVD receiving	
	Yes	%	Yes	%
IPC to produce evidence based GL	43	65.2	40	68.9
Isolation area for clinical evaluation	46	68.7	40	68.9
Safe movement of patients	47	70.1	32	56.1
Isolation facilities for patients	50	74.6	34	58.6
Environmental cleaning & disinfection	33	48.5	17	29.3
HCW management satisfactory	51	75	37	63.8
Trained cleaning staff	33	48.5	24	42
Safe disposal of human waste	44	65.7	27	47.4

Community involvement

- TALK TO THE TRADITIONAL LEADERS FIRST!


Pivotal for containing outbreaks

- There is
 - Fear
 - Stigma
 - Concern around witchcraft
 - Insecurity and suspicion
- If the traditional heads of tribes or communities are aware of the risks, they can become great allies!
- It enhances their power and presence in the community



Transmission- household

- EVD cases become more infectious as they move from the “dry” to the “wet” stage of the disease.
- Direct contact within families
 - Only those who were looking after a confirmed case of EVD actually developed EVD
 - Possibly due to lack of hand hygiene and contact with body fluids and excrement



Houses are quarantined for 21 days but some escaped

Transmission within social circles

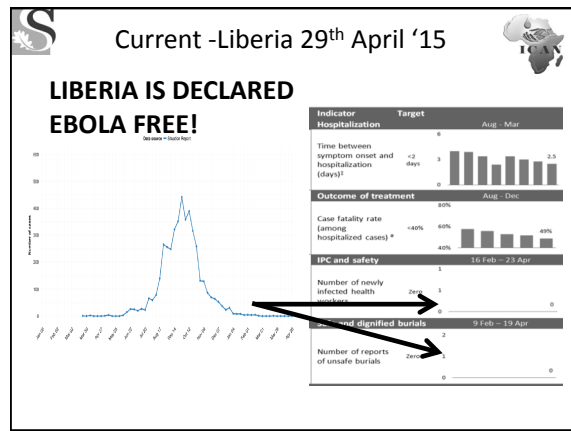
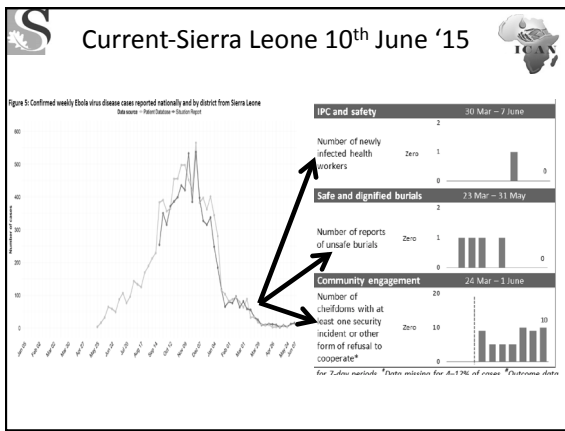
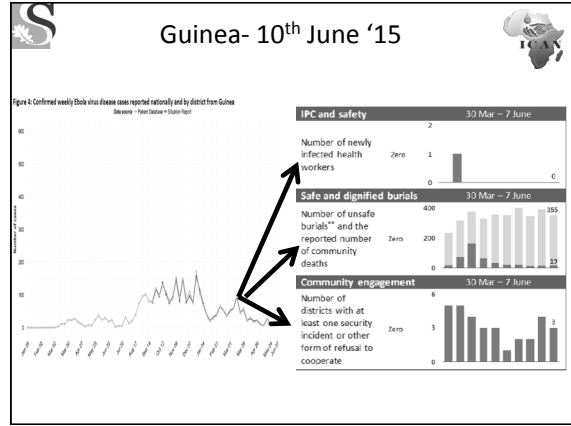
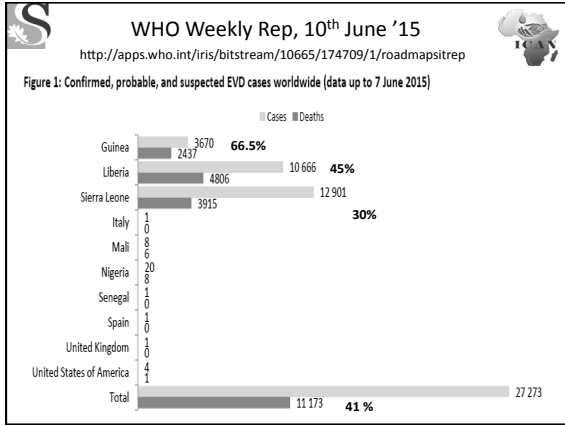
- Transmission has occurred when EVD survivors returned home and, despite warning, had unprotected sex- protection required for 3 months- 5 households; 14 cases
- Transmission also occurred from female EVD survivors- 1 household, 4 cases
- One child infected from a wet nurse (anecdotal)
- Infections from several infected traditional healer- 137 cases in SL alone! Still continues today!

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- Transmission: Clinical areas**
- Not in Ebola Treatment Centres but in general clinical areas- not aware of EVD
 - Poor IPC
 - Lack of equipment and PPE
 - Lack of segregation
 - Poor healthcare waste management
 - Most HCW working in Ebola Treatment Centres so routine HCF closed down.
 - Few untrained staff left behind to look after non EVD emergencies

EVD exposure risk in HCW

Contact areas in the workplace	Number	%
Total number interviewed	279	
In patient room	233	84
Feeding & talking	145	52
Examining patient	43	15
Lab handling blood	17	6
Taking blood	31	13
Washed patient	10	4
Washed patient clothes	7	3
Washed cadaver	20	7
Contact at home & HCF	30	
Contact at home only	3	

JID 1999;179 (Suppl 1) Ebola Serologic Survey of Health Workers

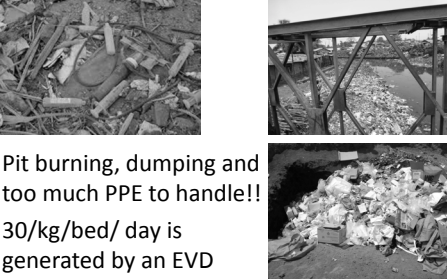
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HCW contact with EVD

Category	Number	%age
Attack rate	37/ 429	9%
Physicians	4/13	31%
Nurses	22/212	10%
Technicians	7/62	11%
Others	4/111	4%

Type of contact	Number	%age
Direct	204	73%
Indirect	3	33%
Unlikely	63	64%
Unknown	9	56%


Poorly managed HC Waste



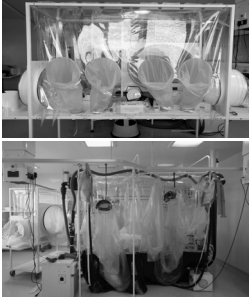
- Pit burning, dumping and too much PPE to handle!!
- 30/kg/bed/ day is generated by an EVD case

Difference in isolation facilities- 2014

Rudimentary: Plastic buckets for disinfectant or even possibly vomit from patients stand in front of simple partitions put up to make cubicles for the ever-increasing number of patients




Isolator used to treat VHF at the RFH




Differences in PPE –both effective?

First, protect yourself.




Dressing up for Ebola




Confusion about taking off PPE

- **“First-on-last off” principle ?**
- Do the outer gloves come off first? (CDC)
- Does the apron come off first? (WHO)
- Evidence for exposure occurs while removing PPE?



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S Has the training been effective? 

- Now extensive training, mentorship programmes and support in the field has been provided
- **173 healthcare workers trained in IPC**
- Fewer cases of transmission amongst the national HCW
- Only cases occurred in international groups
- NGO mentors found to be less knowledgeable than the nationals
- Many African HCW have been dealing with VHF in Africa for years- and have survived


S WHO report on HCW infection 

Table 5: Ebola virus disease infections in health workers in the three countries with intense transmission

Country	Cases	Deaths
Guinea	187	94
Liberia	375*	189*
Sierra Leone	303	221**
Total	865	504

Data are confirmed cases and deaths only, apart from deaths in Sierra Leone, which include confirmed, probable, and suspected deaths.
*Data missing for 24 to 26 April. **Data as of 17 February


26th April, '15

Table 5: Ebola virus disease infections in health workers in Guinea, Liberia, and Sierra Leone


Country	Cases	Deaths
Guinea	187	94
Liberia*	378	192
Sierra Leone	304	221 [†]
Total	869	507

Data are confirmed cases and deaths only, apart from deaths in Sierra Leone, which include confirmed, probable, and suspected deaths.
*The outbreak in Liberia was declared over on 9 May. [†]Data as of 17 February.


10th June '15


S Structures SL- UIPC at national level 

- A national IPC coordinator appointed
- An IPC training coordinator appointed
- National offices being set up
- Massive IPC training programmes funded by the WHO & CDC and delivered by ICAN
- Getting there– slowly!


S Hand washing stations everywhere! 

- Hand hygiene stations with 0.05% chlorine where everyone has to rub ones hands and allow to air dry
- Many HCW have had skin reactions




S 

The indiscriminate use of chlorine!

S Fears and Healthcare 

- Many people will not go to ordinary HCF because of fear of exposure to EVD but mainly to chlorine.
- Several people died because of a lack of healthcare
- Not much staff available outside ETUs
- No protection for the person being sprayed




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S **Community triage**

When a case is identified in the community

- A team of investigators and sprayers are dispatched
- The household is interrogated and the suspected case or cases are taken to the nearest ETU



S **About chlorine**

- Highly toxic and dangerous!
- Usually accidental exposure
 - Train derailment
 - Wrong dilutions of concentrated chlorine powder or liquid
- WHO proposes ambient level of chlorine is
 - 0.034 ppm (0.1mg/m³) to protect the general population from sensory irritation and significant reduction in ventilatory capacity.
- Fatality- 400 ppm in 30 min and 1000 ppm in few minutes.
- Spraying has been in higher concentrations than the recommended dose

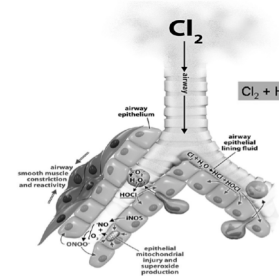
S **Workplace exposure**

Workplace exposure limits include

- **Short-term** exposure of up to 15 min not to exceed 1 ppm (2.9 mg/⁻³)
- **Long term** exposure not to exceed 0.5 ppm (1.5 mg/⁻³)

World Health organization. WHO Task Group on Environmental Health Criteria for Chlorine and Hydrogen Chloride. [Accessed December 3, 2009.] Mercier M, convenor. Geneva: WHO; 1982. Available from: <http://www.inchem.org/documents/ehc/ehc/ehc21.htm#SubSection-Number:1.2.4>

S **Injury to the respiratory tract**



$Cl_2 + H_2O \rightleftharpoons HCl + HOCl$
 $2HOCl \rightleftharpoons 2HCl + O_2$

Converts from chlorine to hydrochloric acid and other toxic substances which destroy the lining of the respiratory tract and cause wheezing!

S **Chlorine effect on Eyes**


- 10 volunteers' eyes were irrigated with
 - 250 mL (50 seconds) of physiological salt solution (PSS), pH 6.4
 - distilled water (DW), pH 6.8
 - tap water, pH 6.8
 - or PSS with chlorine (0.5 mg/L) pH 6.4.
- Vital staining, fluorophotometric assessment, and confocal microscopy were performed before and after irrigation with each fluid
- **Chlorine showed corneal irritation, ulceration and increase uptake of fluorescein**

Cornea 2008; 27 (1) 40-3


S **Chlorine study- SL preliminary data**

S Mehtar, A Bulabula- SUN
 H Nyandemoh, S Jambawai- SL


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S **Methodology** 


- Data on chlorine exposure collected retrospectively between March – May 2015
- HCW and Ebola survivors were interviewed using a questionnaire
- The number of exposure to chlorine spraying
- Adverse effects of chlorine recorded
 - Eyes
 - Respiratory
 - Skin

S **HCW exposure to Chlorine** 


Item	N = 400	%	95 % CI
Males	213	53	48.2 - 58.2
19-35 y of age	301	75	70.7 - 79.3
Working in ETU 4-6 months	278	69.5	64.7 - 73.9
Hygienist	188	47	42.0 – 52.0
Nurses	184	46	41.1 – 51.0
Dr	5	1.3	0.5 - 3.1
Chlorine Exposure	391	97.8	95.6 - 98.9
Wearing eye protection	325	81.5	77.2 - 85.1
Wearing skin protection	358	89.7	86.3 - 92.5

S **Exposure to chlorine amongst HCW** 


Item	n=400	n	%	95% CI
Previous eye problems		39	9.8	7.1- 13.2
Eye problems after exposure to chlorine		179	44.8	39.8- 49.8
Overall eye problems		192	48.0	43- 53
Overall respiratory symptoms		253	63.3	58.3-67.9
Skin irritation		152	38.0	33.3- 43

S **Multiple chlorine exposure** 

Condition	Multiple Chlorine Exposure	Single Chlorine Exposure	P value	OR (95% CI)
Eye	56.8% (109/192)	43.2% (83/192)	<0.001	3.3 (2.18 – 5.02)
Chest	51.8% (131/253)	48.2% (122/253)	<0.001	3.2 (2.04 – 4.99)
Skin	55.3% (84/152)	44.7% (68/152)	<0.001	2.4 (1.59 -3.64)


S **Comparison between HCW and Ebola Survivors** 

Condition	HCW	Ebola Survivors	P value
Eye	45.0%	55.0%	<0.01
Chest	66.4%	33.6%	<0.01

S **Chlorine** 

- There is no published evidence that chlorine spraying will reduce transmission of EVD.
- It is a HCW ritual based on fear of healthcare workers.
- It is messy and drips and spreads the virus!
- It is toxic particularly when burning used PPE soaked in chlorine!

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S Summary 

- Do not forget the basic IPC principles
- Good IPC is of the essence- safe, and sensible!
- Keep the environment clean and dry!
- Vaccines are coming!

IMPORTANT PUBLIC HEALTH GUIDELINES FOR THE U.S. REGARDING EBOLA VIRUS DISEASE

- 1) Stay home if you are sick
- 2) Wash your hands regularly
- 3) Do not eat fruit bats
- 4) Do not fondle the dead
- 5) Do not kill healthcare workers

Save The Date
23 – 28 September, 2016




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www.icanetwork.co.za



The screenshot shows the IPAC Canada website homepage. At the top, it features the IPAC logo and the URL www.ipac-canada.org. Below the navigation bar, there is a 'Media Kit' section with buttons for 'EBOLA VIRUS' and 'MERS-CoV'. The main content area includes a 'Welcome to IPAC Canada' message, a 'Knowledge Resources' sidebar with links to various documents and courses, a 'Professional Resources' sidebar, and a 'News Headlines' section with a featured article about the 2015 IPAC Canada Conference.

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