

Nebraska Ebola Experiences: Laboratory Preparedness

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No Disclosures to Reveal



Objectives

- Recognize historical perspectives of the Nebraska Biocontainment Unit (NBU) at University of Nebraska Medical Center, in relationship to NPHL
- Describe laboratory processes, tests performed, and safety considerations when testing patients under investigation (PUI) or known to have EVD
- Differentiate between transport of specimens within a facility and transport outside of a facility, across state or to CDC



The State Public Health Laboratory in Nebraska: The First Hundred Years

- 1891: State Board of Health established
- **1913: State public Health Lab established in Lincoln NE
initially called the Bacteriological Lab**
- 1918: the Great Influenza
- 1939: the State conducts major tuberculosis study
- 1943: the State first establishes local health departments
- 1952: Nebraska reports record cases of polio
- 1972: Nebraska closes state tuberculosis hospital
- **1997: Lab moves to Omaha –
established Nebraska Public Health Laboratory**
- 1999: LRN-B established
- 1999: Lied Transplant Center opened at UNMC



The State Public Health Laboratory in Nebraska: Integration into University of Nebraska Medical Center

- 2001: National anthrax outbreak
- 2002: NeDHHS commissions medical schools to join forces – forms the “Center for Preparedness Education”
- 2003: West Nile virus invades Nebraska; SARS in Asia
- 2004: Avian influenza H5N1 Asia outbreak
- 2005: NeDHHS pooled Federal BT dollars with contributions from UNMC & Nebraska Medicine to open Biocontainment Unit
- 2006: HEROES funded by CPE, Allied Health, Nursing
- 2007: NBU on alert for possible Lassa fever
- 2009: Influenza A virus H1N1 Pandemic
- 2013: Cyclosporiasis outbreak
- 2014: US State Dept visited NBU in July
- First Ebola patient Dr. Sacra arrives Sept 4
- Third Ebola patient dies 36 hours after arrival
- 2015: Multiple PUI-EVD held for observation



Why NPHL?

- NPHL was designated as the lab to test specimens for the NBU
 - BSL-3 lab
 - Contact with CDC
 - Part of LRN
- Tests initially provided
 - iSTAT, electrolytes
 - Malaria smears

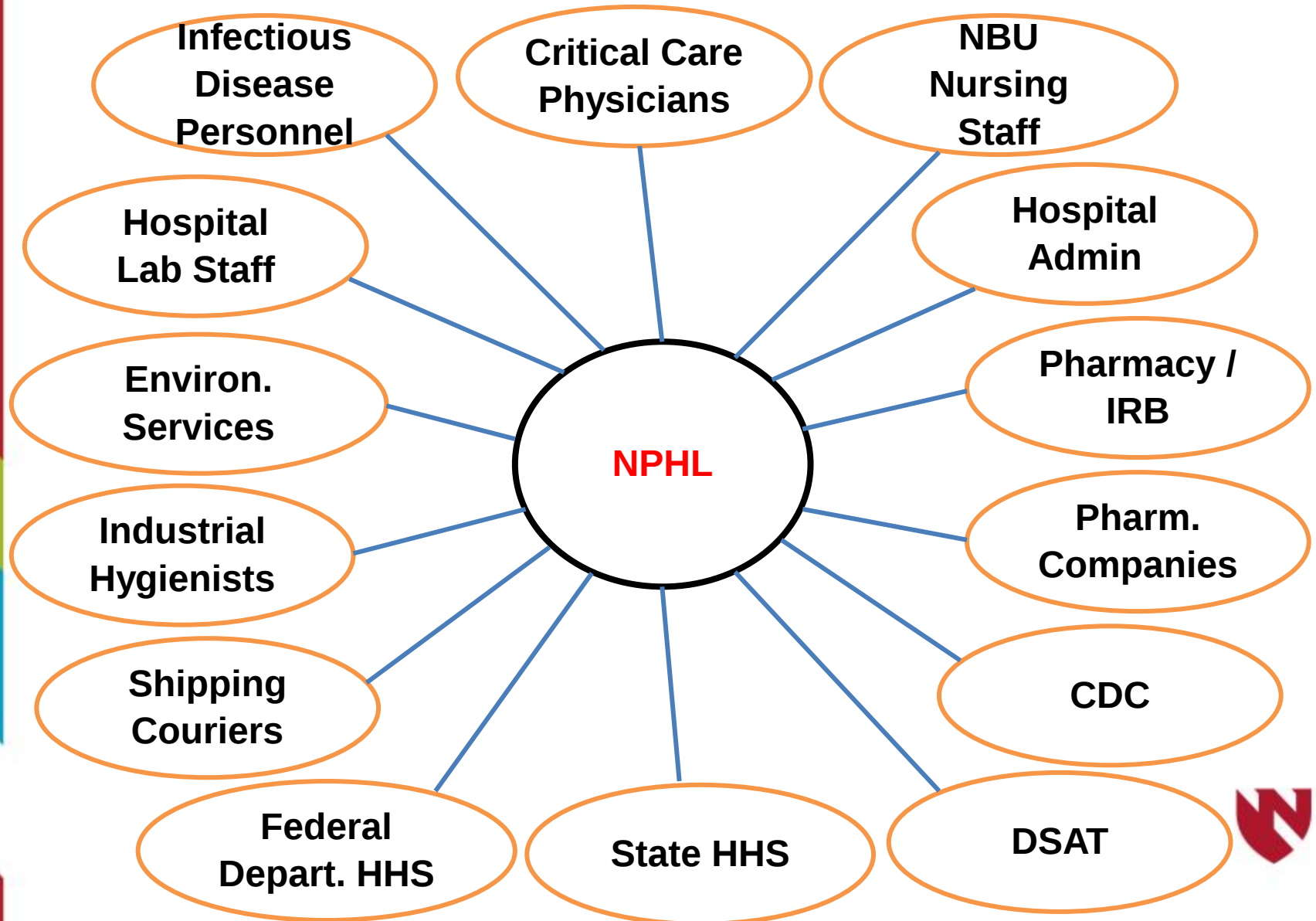


Prior to 1st Patient

- Lab test menu needed to expand!
 - Additional POC tests
 - Liver function
 - Coagulation
 - Define where testing could safely be performed



Lines of communication



Performing a Risk Assessment

- Is there a potential for aerosol generation?
 - Vortexing
 - Pipetting
 - Centrifugation
 - Opening and closing tubes
- Are sharps used?
- Are appropriate PPE available?
 - Face shields, gowns, gloves, respiratory protection, booties, bonnet
- Are staff trained in the utilization of the PPE?
 - Doffing and donning
- Is a protocol for waste disposal available?



Test menu before Risk Assessment

Test	Order Code	Tube type	performed at (Instrument)	Centrifugation (NPHL)
Blood Gas arterial	POC113	Heparinized blood gas syringe	BCU lab (iStat)	No
Blood Gas venous	POC114	4.5 ml green top PST	BCU lab (iStat)	No
Malaria	MALP	3 ml lavender top	Hospital Core lab	BCU lab will prepare smears



Results of Our Risk Assessment

- Chemistry automated analyzer
 - Initial centrifugation did not use sealed rotors
 - **NPHL would centrifuge in BSL-3 with sealed rotor**
- Coagulation automated analyzer
 - Required open tube testing
 - **POC Instrumentation (Hemochron analyzer) in BSL-3**
- Blood Bank
 - Cross matching required open tube centrifugation
 - **NPHL Staff would perform blood type by slide agglutination in BSL-3**
- Biosafety cabinets were not available in all areas



Test menu after Risk Assessment

Test	Order Code	Tube type	performed at (Instrument)	Centrifugation (NPHL)
Amylase	AMY	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
B12 level	VB12	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
Blood culture	BLDCU	Plastic Aerobic Bactec bottle	NPHL lab	No
Blood Gas arterial	POC113	Heparinized blood gas syringe	BCU lab (iStat)	No
Blood Gas venous	POC114	4.5 ml green top PST	BCU lab (iStat)	No
Blood type	ABORH	3 ml (EDTA) lavender top	BCU Lab (slide forward type)	No
Basic metabolic panel	BMET	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXC)	Yes
CBC with automated diff	CBCP	3 ml lavender top	Hospital Core Lab (Sysmex)	No
CBC with manual diff	CBCM	3 ml lavender top	Hospital Core lab (DXI)	No
Comp metabolic panel	CMET	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXC)	Yes
Cortisol	CORTS	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
Creatine kinase Total	CK	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
C-Reactive protein	CRP	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core Lab	Yes
DIC screen (see note below)		3 ml lavender top	Hospital Core Lab (Sysmex)	No
NOTE: Lab will provide platelet count and examination of peripheral smear for schistocytes to be used in conjunction with coag results from BCU lab				
Drug Study experimental	No test code	5ml lavender top (Qty 1) OR 3ml lavender top (Qty 2)	BCU Lab or NPHL Lab	Yes
Fe/Ferritin/TIBC	TIBC	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
Folate level	VFOL	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core Lab	Yes
Haptoglobin	HPT	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
HIV	SUD	4ml red top (serum)	BCU Lab or NPHL Lab	No
Ionized Ca (iSTAT CHEM8+)	iSTAT CHEM8+ (Biocontainment Unit Only)	4.5 ml green top PST	BCU lab (iStat)	No
Lactic Acid	LA	5 ml grey top (fluoride) tube	Hospital Core lab (DXC)	Yes
Lipase	LIPA	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXI)	Yes
Magnesium	MG	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXC)	Yes
Malaria	MALP	3 ml lavender top	Hospital Core lab	BCU lab will prepare smears
Molecular Assay	SPPRB	3 ml or 5ml lavender top	NPHL lab	No
Phosphorus	PO4	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXC)	Yes
Prealbumin	PAB	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core Lab	Yes
PT/PTT	Coagulation Panel (For Biocontainment Unit Use Only)	1.8 ml or 2.7 ml citrate tube (blue top)	BCU lab (Hemochron)	No
Reticulocyte Count	RETCT	3 ml lavender	Hospital Core lab (DXI)	No
Sputum Culture	SPUCU	Not applicable	NPHL lab	No
Standard Ca++	CA	5 ml gold top SST tube, or 4.5 ml green top PST	Hospital Core lab (DXC)	Yes
Troponin	TROP	6 ml green top PST	Hospital Core lab (DXI)	Yes
Urine Culture	URNCU	Not applicable	NPHL lab	No
Urine electrolytes	UNA, UKS, UCLS	BD Urinalysis Plus conical tube	NPHL lab	No



Prior to 1st Patient

- Lab test menu needed to expand
 - Additional POC tests
 - Liver function
 - Coagulation
 - Define where testing could safely be performed
- Work force training
 - Not all laboratorians can work in BSL-3



Staff Training Requirements

Trained in BSL-3 practices



Trained in PPE



PPE



N95 Mask
Double Glove
Impermeable Gown

Hair Bonnet
Shoe Covers
Face Shield



Lab Safety

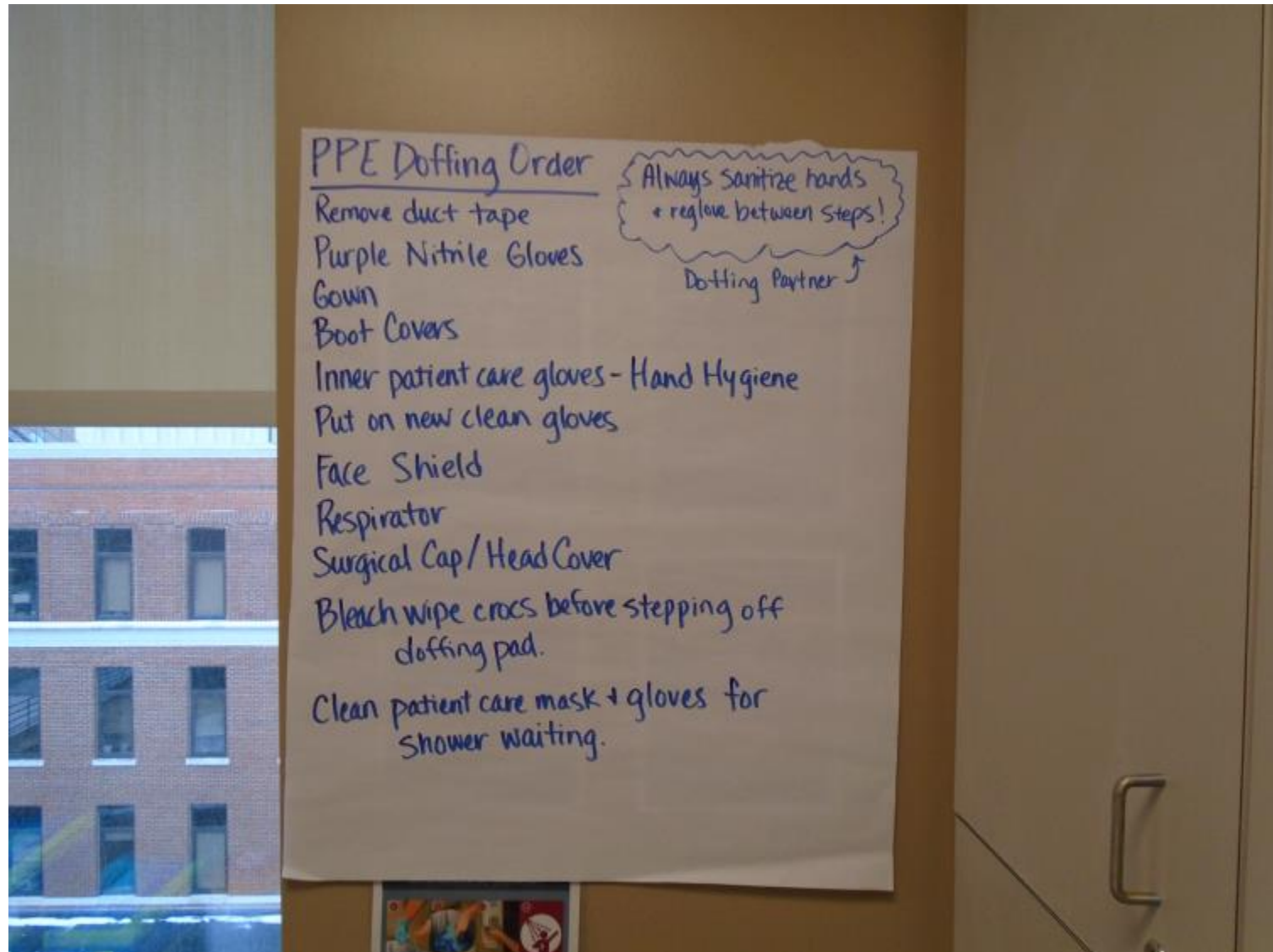


Buddy System

PRACTICE, PRACTICE, PRACTICE!



Lab Safety



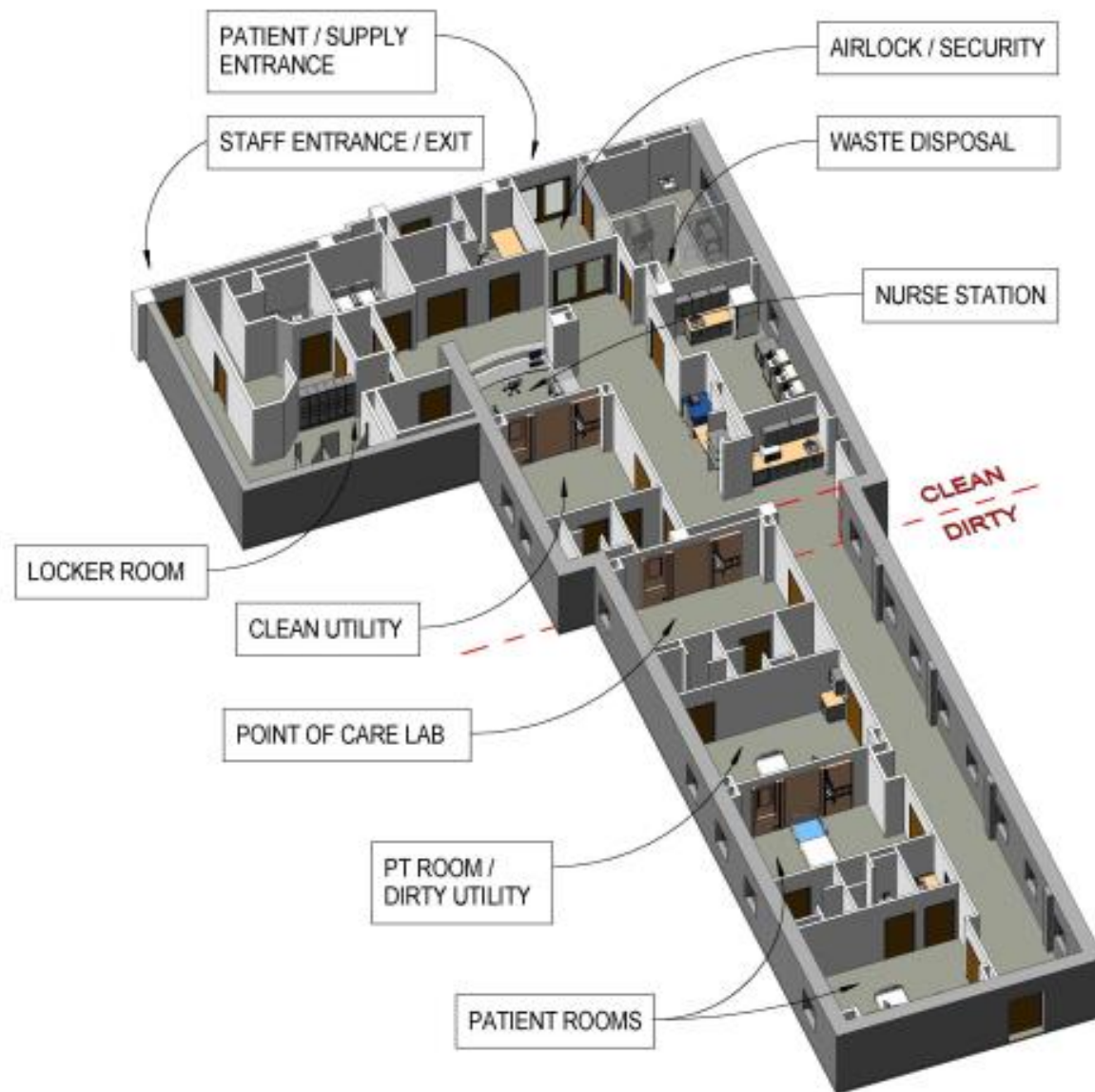
Lab Safety



Lessons Learned

- Needed more trained staff
- Needed a laboratory within the NBU
- Communications is a key
- **Practice, Practice, Practice!!**
- Shipping of specimens is not easy!





3D Illustration

Bio Containment Unit

LEO A DALY



Specimen Disposal

- On-site disposal
 - Decontamination (treat as Medical Waste)
 - Autoclaving
 - Monitoring essential
 - Chemical disinfection
- Off-site disposal
 - Known Ebola virus positive specimens
 - Classified as Category A infectious substances
 - Not all waste management companies will accept

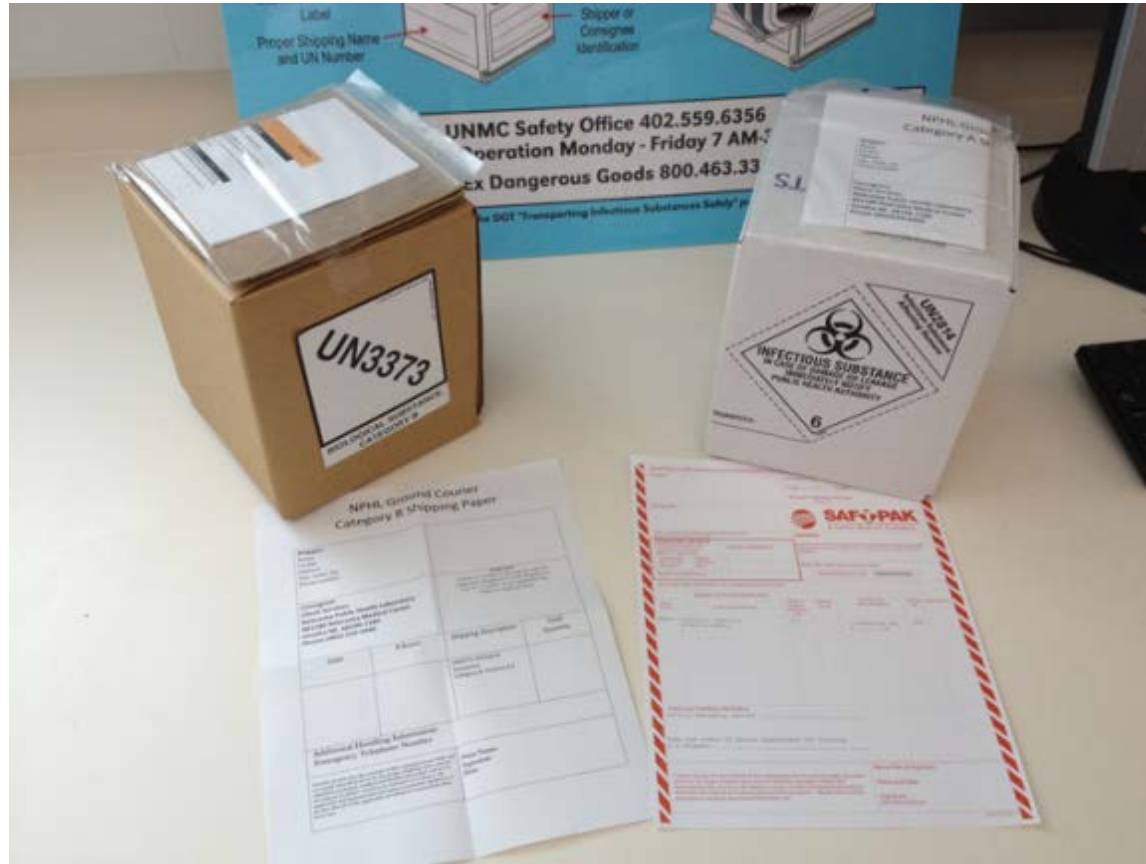


Final Comments

- Defined an essential list of tests,
- Performed risk assessments to determine which tests can be done safely,
- Determined alternatives for tests that cannot be done safely,
- Identified where laboratory testing will be done,
- Weighed safety and optimal management of the patient
- Established multiple lines of communication
- Be flexible!



Transport of High Consequence Pathogens



Transport of Highly Infectious Specimens

1. Within Facility – transport from isolation room to hospital laboratory
2. Outside of Facility
 - Transport to Public Health Laboratory
 - Transport to Commercial Reference lab ?
3. Transport from Public Health Laboratory to CDC



Within Facility – transport from isolation to hospital laboratory

- Transport to Laboratory
 - Double bag
 - Rigid container
 - Biohazard symbol
- Utilize a buddy system for transport
- Potential Ebola virus positive specimens
 - Consider using plastic collection devices
 - Try not to use containers that have the potential to leak
 - Urine cups
 - Bleach wipe containers and the outside of each bag





Nebraska Department of Health and Human Services
HEALTH ALERT NETWORK
Advisory



TO: Laboratories and Public Health

FROM: Joseph Acierno, M.D. J.D.
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State of Nebraska
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RE: **Laboratory Guidelines for Handling Specimens from Patients Under Investigation (PUI) for Ebola Virus Disease (EVD) in Nebraska**

DATE: October 24, 2014

Inquiries regarding suspect EVD should immediately be directed to the State or Local Public Health Department:

- **DHHS Office of Epidemiology (402) 471-2937 (after hrs 402-471-1983)**
- **Douglas County (402) 444-7214 (after hrs 402-444-7000)**
- **Lancaster County (402) 441-8053 (after hrs 402-440-1817)**
- **All Other Counties please refer to the DHHS website for contact information at www.dhhs.ne.gov/lhd.**



Within Facility – transport to hospital laboratory

- Encouraged each facility to have a protocol on how to collect specimens!
- **And to exercise their plan!!**
- Wipe down specimen tube/biohazard bag with bleach wipes
- Hand off to clean area
- Package in clean area
 - Transport to lab
 - Transport to NPHL



Outside Facility Transport

- Sentinel & Basics Laboratories protocol to transport to the PHL for testing
 - ❖ **Contact state/local authorities for approval!**
- Specimens with the potential to have Ebola virus
 - DOT classified as suspicious **Category A** infectious substances
- Shipper required to be trained and certified in DOT Division 6.2 Hazard Materials
- Courier must meet certain requirements to ship Category A packages
 - **Most private shippers are not trained to transport Category A**



Commercial Courier Requirements to handle Ebola

- Comply with all applicable federal and state laws and regulations that apply to service offered
- Must be willing to accept Category A(suspect)and/or Risk Group 4 (confirmed)
 - FedEx accepts only specimens with suspected Ebola
 - Only one Ground courier accepts suspected Ebola
- Must show proof of:
 - Vehicle liability insurance & General liability
 - CDL Hazardous Materials endorsed driver
- Trained in regulations governing dangerous goods/hazardous materials (HMR-232 & CFR172.704)
 - General awareness/Function specific training
 - Safety training & emergency response
 - Security Awareness



Specimen Transport in Nebraska

Transport will be based on distance & shipper capability:

Sentinel Laboratories - trained in Division 6.2

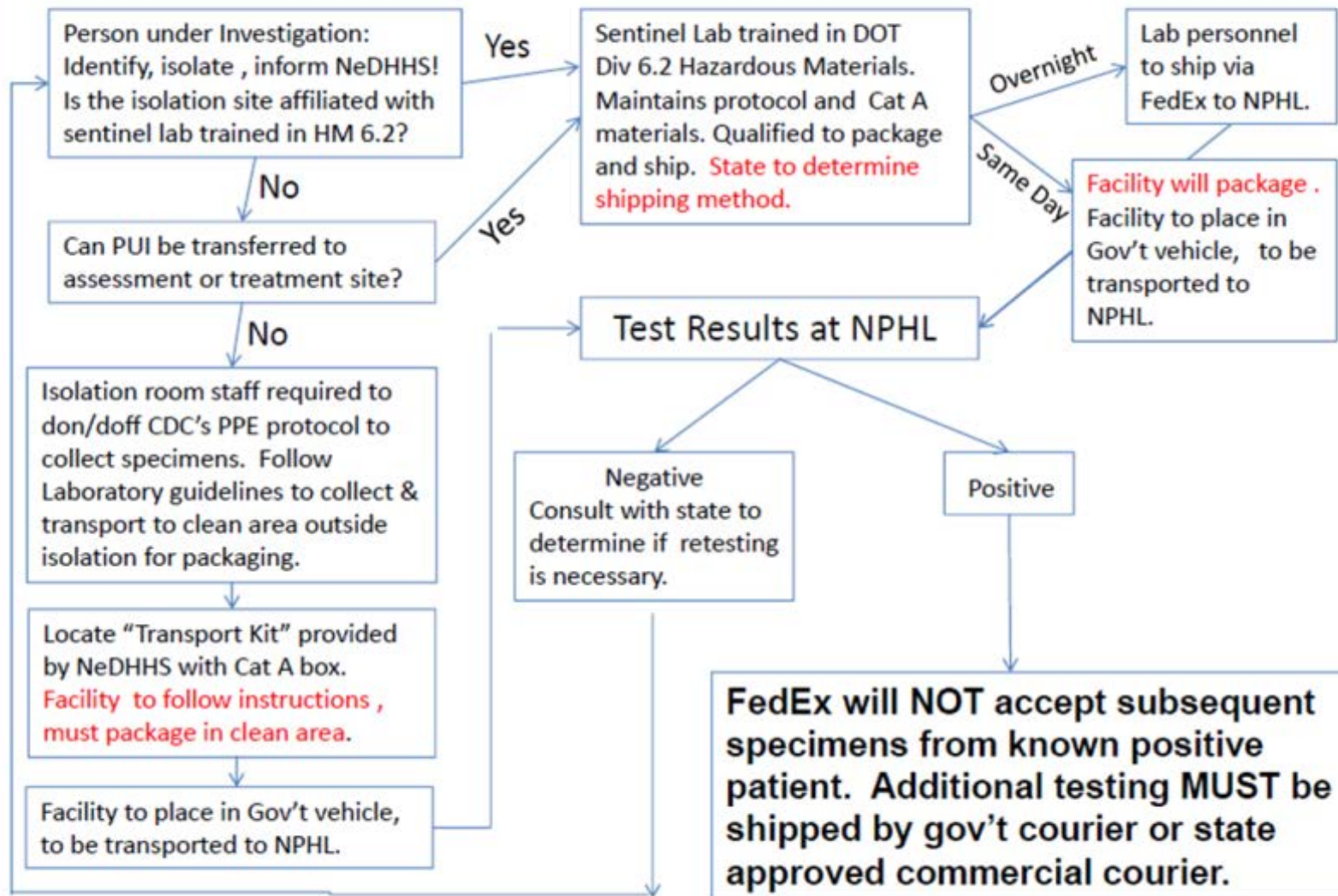
- Next day TAT – FedEx
- Same day TAT – Gov't courier arranged by NPHL

Basic Laboratories - not trained in Division 6.2

- NPHL will arrange government courier (non-commercial)
- Not subject to HMR (CFR 171.1 D5),
BUT still required to triple package according to CFR173.196
 - Leakproof primary container
 - Leakproof secondary container, to withstand pressure ≥ 95 kPa and including absorbent material
 - Itemized list of contents
 - Rigid outer packaging of adequate strength



Algorithm for Transport of Specimens of High-Consequence



NeDHHS to provide:

“Transport Kit”

- Category A shipper
- Transport cooler - Rigid
- Bleach wipes
- Gel Packs to be pre-frozen
- Instructions/check lists
 - o Specimen Collection & Shipping Protocol
 - o Contact Info
 - o Map & Directions
 - o Chain of Custody Form
 - o DOT Emergency Response Information
- Government Courier to transport
 - o State & Local Health Dept
 - o State Patrol



State Patrol Training

Transport of Highly Infectious Pathogens by Government Couriers

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Transport from NPHL to CDC

Confirmed Positive by DoD EUA RT-PCR for the
Ebola virus = Risk Group 4

CDC testing required - viral load

FedEx does NOT accept known positive specimens due to the FX variations:

- FX-09 Division 6.2, items classed as Risk Group 4 by the World Health Organization (WHO) will not be accepted for carriage.

Couriers accepting Risk Group 4 (Non-Select Agent) :

- USA Courier
- World Courier
 - Can ship from any part of the USA or international
 - Provide shipping containers ahead of time,
 - Confirmed shipping declaration (must be completed prior to even scheduling pickup)
 - Walked through every step of the checklist to confirm packaged correctly
 - Refilled with Dry Ice when one shipment was delayed
 - Guaranteed security every step of the way.
 - Only catch, not every airport is a World Courier “Hub” for Category A. Specimens had to be securely driven from Omaha to Chicago by CDL & DG certified drivers to reach their hub @ \$2.50/mi!!

Couriers accepting Risk Group 4 (Select Agent) :

- Custom Critical – arranged by DOD



Is it a Select Agent?

Monday, September 08, 2014

CDC Guidance: Compliance with Select Agent Regulations For Labs Handling Specimens Containing Ebola Virus



9052

'Select agents' are those pathogens that have been deemed to pose a significant biological hazard, and among those, **Tier 1 select agents are considered** 'biological agents and toxins present the greatest risk of deliberate misuse with significant potential for mass casualties or devastating effect to the economy, critical infrastructure, or public confidence, and pose a severe threat to public health and safety.'

Tier 1 Select Agents and Toxins		
HHS Agents and Toxins	Overlap Agents	USDA Agents
Botulinum neurotoxins Botulinum neurotoxin producing species of Clostridium Ebola virus Francisella tularensis Marburg virus Variola major virus (Smallpox virus) Variola minor virus (Alastrim) Yersinia pestis	Bacillus anthracis Burkholderia mallei Burkholderia pseudomallei	Foot And Mouth Disease virus Rinderpest virus

As you might have already guessed, the various species of Ebolavirus are Tier 1 select agents, which makes everything contaminated (by blood, sweat, feces, urine, etc.) by an Ebola infected patient potentially a select agent – and subject to rigorous safety regulations – as well.

Are specimens collected from a patient suspected to have Ebola infection covered by the select agent regulations?

No, specimens would not be subject to the Federal select agent regulation until identified as containing Ebola virus by viral isolation.

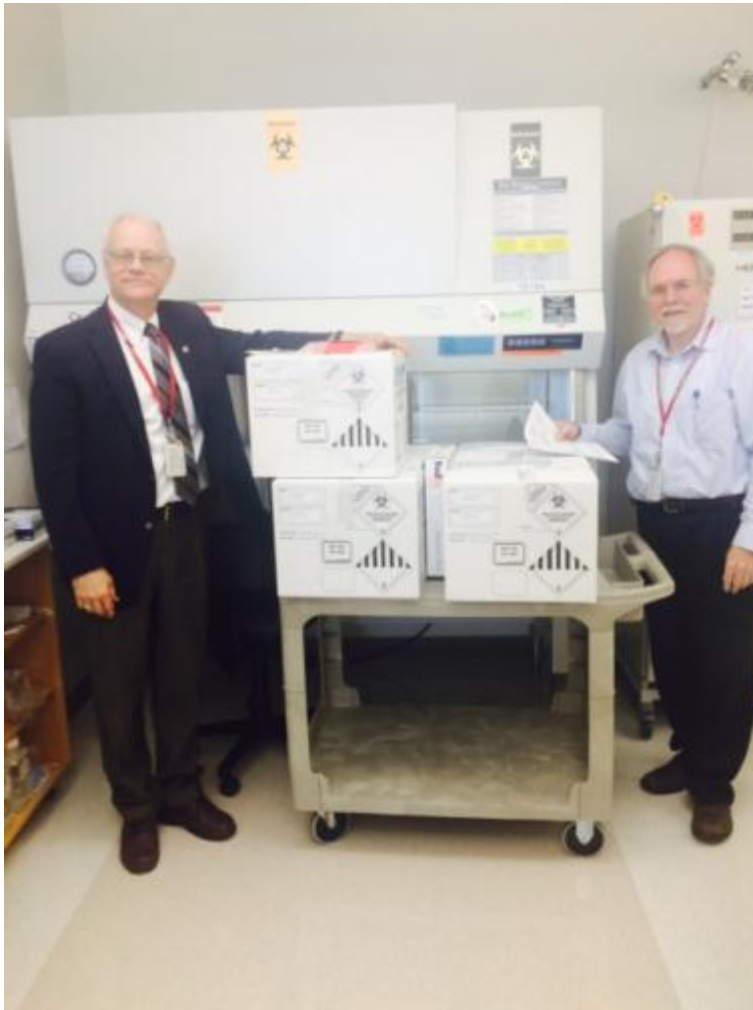
How do select agent regulations apply to specimens that have tested positive by molecular methods?

The select agent regulations would not apply until the specimen that has tested presumptively positive using molecular methods has been proven to contain live-infectious Ebola virus by virus isolation.

Any specimens that are confirmed by virus isolation to contain live-infectious Ebola virus must be reported to DSAT immediately by telephone (404-718-2000), Email (Irsat@cdc.gov), or FAX (404-718-2096) and be followed up with APHIS/CDC Form 4 within seven days of the initial report.



Ebola as a Select Agent



Questions?



Bloomberg New On-line, 10/14