COMMUNICABLE DISEASES AND EMERGING INFECTIONS AT THE LOCAL PUBLIC HEALTH LEVEL

Arlene Seña, MD, MPH
Medical and Laboratory Director, Durham County Department of Public Health
Associate Professor, University of North Carolina-Chapel Hill Division of Infectious Diseases

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OVERVIEW

1) Provide an overview of communicable programs in public health

2) Discuss current communicable disease threats, including vectorborne infections, HIV, syphilis, foodborne infections, and Ebola virus disease.

3) Review local communicable disease prevention and control strategies: HIV pre-exposure prophylaxis (PrEP), partner notification, foodborne outbreak investigations, and public health preparedness.

AUTHORITY OF LOCAL HEALTH DEPARTMENT

N.C. General Statutes 130A- 41:

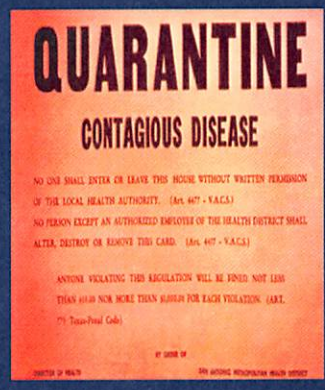
1) To investigate causes of infectious, communicable and other diseases;
2) To enforce immunization requirements;
3) To disseminate public health information and to promote the benefits of good health;
4) To advise local officials concerning public health matters;

COMMUNICABLE DISEASE LAWS

- "An illness due to an infectious agent or its toxic products which are transmitted directly or indirectly to a person from an infected person or animal…"

  APHA, *Control of Communicable Disease Manual*, 2004.

- G.S 130A-144 - 145: Investigation and control measures
  - **Isolation** – limitation of freedom of movement or action for confirmed or suspected cases; ex: HIV, tuberculosis
  - **Quarantine** – limitation of freedom of movement for exposed persons at risk for disease, ex: SARS



REPORTABLE COMMUNICABLE DISEASES

7 days:

- Ehrlichiosis
- Dengue
- Lyme disease
- Malaria
- ***Rocky Mountain Spotted Fever***

24 hours:

- Foodborne illnesses
- Hepatitis A
- ***HIV/AIDS***
- Influenza deaths, adult and pediatric
- Meningococcal disease
- Pertussis
- ***Salmonellosis***
- **Shigellosis**
- ***Syphilis***
- Tuberculosis

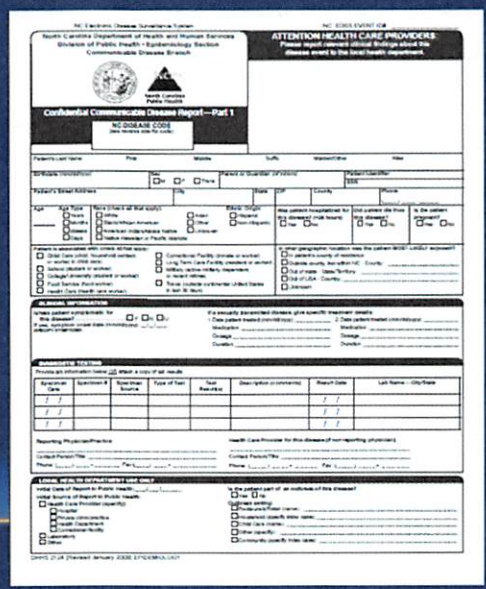
Immediately:

- Anthrax
- Botulism
- ***Hemorrhagic fever virus infection***
- Novel influenza virus infection
- Plague

* List not all inclusive.

NC COMMUNICABLE DISEASE REPORTING

- Local clinicians and laboratories report by mailing or faxing forms to local health departments.
- Public health nurses (PHN) contact providers to gather more data as needed to determine if case definitions are met.
- PHNs enter data electronically in the NC Electronic Disease Surveillance System.


North Carolina Department of Health and Human Services
Division of Public Health • Epidemiology Section
Communicable Disease Branch

ATTENTION HEALTH CARE PROVIDERS

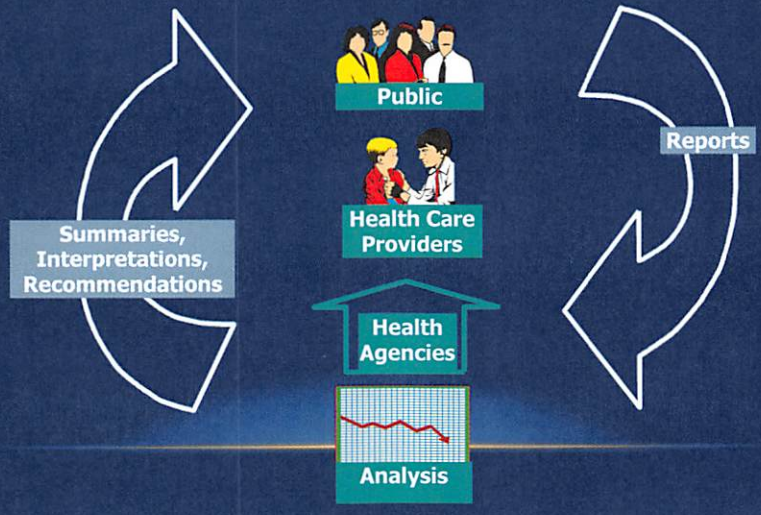
Confidential Communicable Disease Report—Part 1

NC DISEASE CODE

COMMUNICABLE DISEASE ACTIVITIES

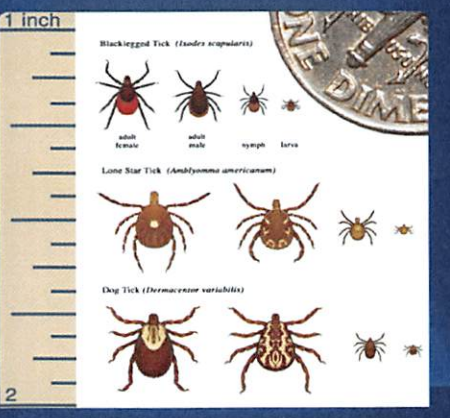
- **Surveillance** – Monitor and report suspected or confirmed cases of communicable diseases, communicate with the State Division of Public Health
- **Investigation** – Immediately investigate case reports and disease outbreaks using standard procedures for disease investigation.
- **Control measures** – Promptly institute measures to minimize the spread of communicable diseases and prevent new cases in the community.

Information Loop of Public Health Surveillance



COMMUNICABLE DISEASE CONTROL AND PREVENTION

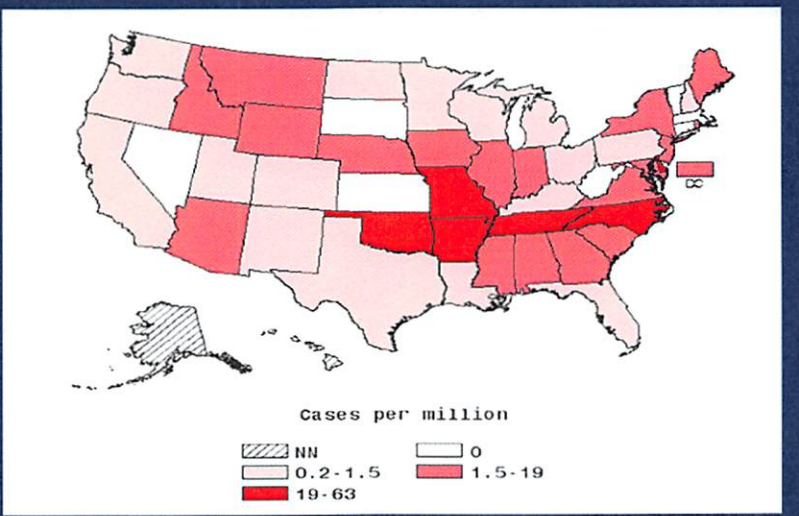
VECTORBORNE INFECTIONS



ROCKY MOUNTAIN SPOTTED FEVER

- Caused by obligate intracellular bacterium *Rickettsia rickettsii*
- Multiple vectors - main vector is American dog tick (Dermacentor variabilis) in eastern US; new vector in Arizona
- Incubation 2-14 days (average 7 days)
- From 2008-2012, NC has an average of 417 cases reported annually.
- Surveillance is limited for confirmed cases, requires testing of paired acute and convalescent (2-3 weeks later) sera for IgG IFA testing.

ROCKY MOUNTAIN SPOTTED FEVER - US INCIDENCE, 2010

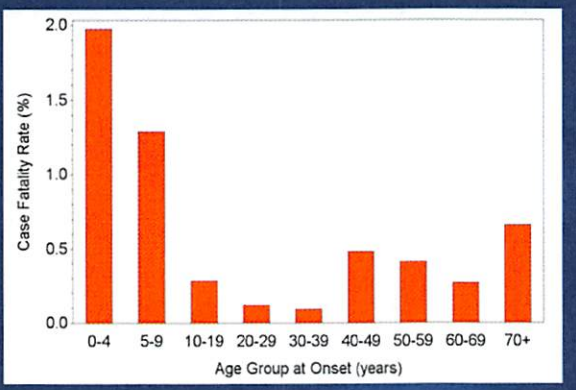


RMSF SIGNS AND SYMPTOMS

Fever	99%
Headache	91%
Rash	88%
Myalgia	83%
Nausea/vomiting	60%
Abdominal pain	52%
Conjunctivitis	30%
Stupor	26%
Edema	18%
Meningismus	18%
Coma	9%

Adapted from Heinick CG, et al. J Infect Dis 150; 480, 1984

CASE FATALITY RATE OF SPOTTED FEVER RICKETTSIOSIS 2008-2013



TREATMENT OF RMSF

- ***Doxycycline is the first line treatment for adults and children of all ages and should be initiated immediately whenever RMSF is suspected.***
- Use of antibiotics other than doxycycline is associated with a higher risk of fatal outcome.
- Recommended Dosage

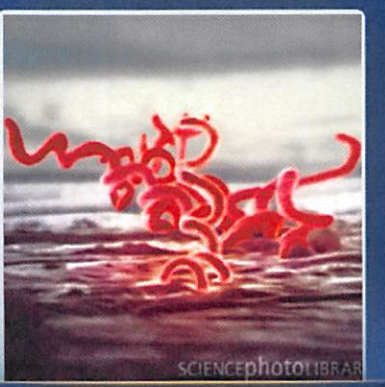
Adults: 100 mg every 12 hours

Children under 45 kg (100 lbs): 2.2 mg/kg body weight given twice a day

RMSF PREVENTION AND CONTROL EFFORTS

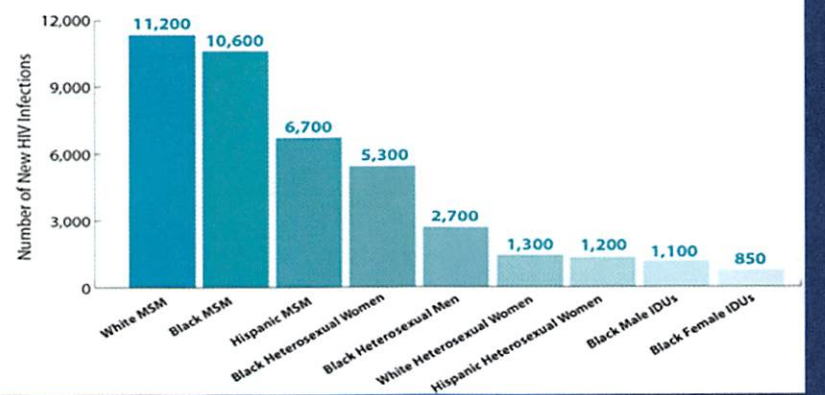
- Education on avoidance of tick exposures
- Promotion of tick repellants with DEET or Permethrin
- Information for special groups; e.g. parents regarding children in summer camps
- Early recognition of symptoms and empiric treatment

HIV INFECTIONS AND SYPHILIS

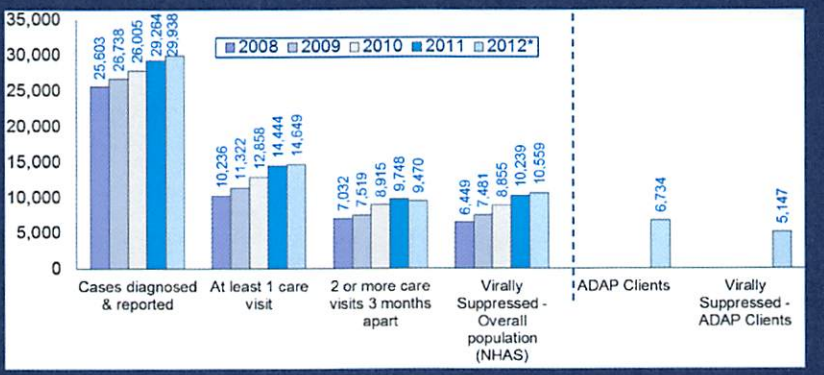


HIV – US SURVEILLANCE DATA

Figure 1: Estimated New HIV Infections in the United States, 2010, for the Most Affected Subpopulations



NC HIV CARE CASCADE AND CONTROL



- In December 31, 2013, there was an estimated 28,101 persons living with HIV in North Carolina.

HIV PREVENTION - PRE-EXPOSURE PROPHYLAXIS (PREP)

Use of antiretroviral medications **before** an exposure, to reduce the risk of becoming infected

Tenofovir is the most studied agent for PrEP

- Properties of drug allow infrequent dosing
- Few drug-drug interactions
- Safe and well tolerated

FDA approved in 2012

HIV PRE-EXPOSURE PROPHYLAXIS

- Effectiveness of tenofovir 300 mg and emtricitabine 200 mg in reducing risk of sexual HIV acquisition in adults:

Table 2: Evidence Summary—Overall Evidence Quality (per GRADE Criteria[23])

Study	Design[a]	Participants: Agent	Participants: Control	Limitations	Quality of Evidence (See Table 14, Appendix 2)
Among Men Who have Sex with Men					
iPrEx Trial	Phase 3	TDF/FTC (n = 1251)	Placebo (n = 1248)	Adherence	High
US MSM Safety Trial	Phase 2	TDF (n = 201)	Placebo (n = 199)	Minimal	High
Among Heterosexual Men and Women					
Partners PrEP	Phase 3	TDF (n = 1589) TDF/FTC (n = 1583)	Placebo (n = 1586)	Minimal	High
TDF2	Phase 2	TDF/FTC (n = 611)	Placebo (n = 608)	High loss to follow-up, modest sample size	Moderate
Among Heterosexual Women					
FEM-PrEP	Phase 3	TDF/FTC (n = 1062)	Placebo (n = 1058)	Stopped at interim analysis, limited follow-up time, very low adherence to drug regimen	Low
West African Trial	Phase 2	TDF (n = 469)	Placebo (n = 467)	Stopped early for operational concerns, small sample size, limited follow-up time on assigned drug	Low
VOICE	Phase 2B	TDF (n = 1007) TDF/FTC (n = 1003)	Placebo (n = 1009)	TDF arm stopped at interim analysis (futility), very low adherence to drug regimen in both TDF and TDF/FTC arms	Low
Among Injection Drug Users					
BTS	Phase 3	TDF (n = 1204)	Placebo (n = 1207)	Minimal	High

Note: GRADE quality ratings:
high = further research is very unlikely to change our confidence in the estimate of effect.
moderate = further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
low = further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
very low = any estimate of effect is very uncertain.

US PHS CLINICAL PRACTICE GUIDELINES 2014

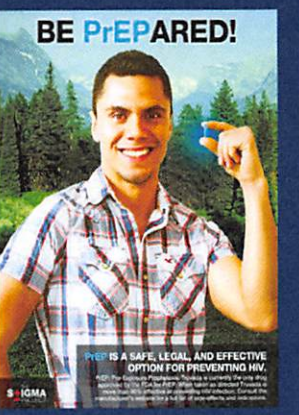
Summary of Guidance for PrEP Use

	Men Who Have Sex With Men	Heterosexual Women and Men	Injection Drug Users
Detecting substantial risk of acquiring HIV infection:	• Sexual partner with HIV • Recent bacterial STD • High number of sex partners • History of inconsistent or no condom use • Commercial sex work	• Sexual partner with HIV • Recent bacterial STD • High number of sex partners • History of inconsistent or no condom use • Commercial sex work • Lives in high-prevalence area or network	• HIV-positive injecting partner • Sharing injection equipment • Recent drug treatment (but currently injecting)
Clinically eligible:	• Documented negative HIV test before prescribing PrEP • No signs/symptoms of acute HIV infection • Normal renal function, no contraindicated medications • Documented hepatitis B virus infection and vaccination status		
Prescription	**Daily, continuing, oral doeses of TDF/FTC (Truvada), ≤90 day supply**		
Other services:	• Follow-up visits at least every 3 months to provide: • HIV test, medication adherence counseling, behavioral risk reduction support, side effect assessment, STD symptom assessment • At 3 months and every 6 months after, assess renal function • Every 6 months test for bacterial STDs		
	• Do oral/rectal STD testing	• Assess pregnancy intent • Pregnancy test every 3 months	• Access to clean needles/ syringes and drug treatment services

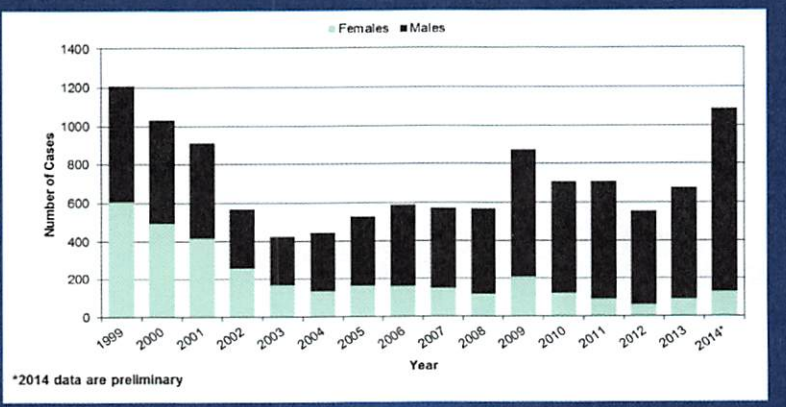
Source: US Public Health Service. Preexposure prophylaxis for the prevention of HIV infection in the United States —2014: a clinical practice guideline.

HIV PREP IMPLEMENTATION

- Blended implementation model – health deoartment provides STI/HIV testing, refer to community health providers for PrEP
- PrEP education, behavioral risk reduction and adherence counseling
- Challenges: patient navigation, expansion, funding



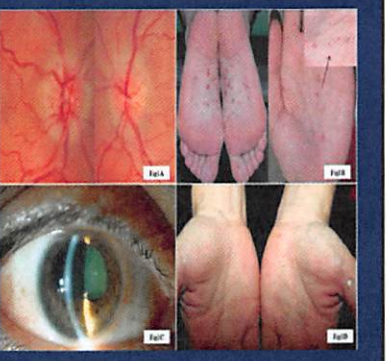
EARLY SYPHILIS AND CO-INFECTION WITH HIV IN NC, 2007-2013



In 2013, 45% of men with early syphilis were co-infected with HIV.

SYPHILIS IN HIV-INFECTED PERSONS

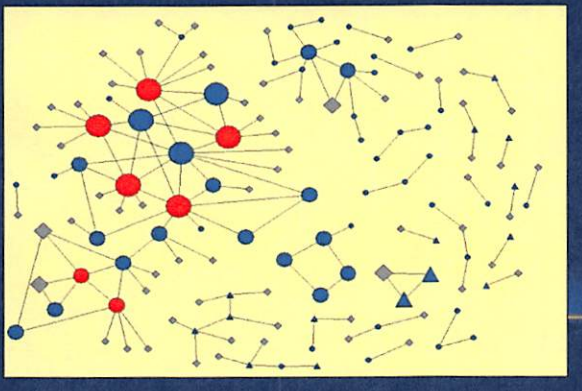
- Primary: Larger and numerous chancres
- Secondary:
  - Aggressive ulceronodular skin rashes (lues maligna) in advanced AIDS
  - Syphilitic hepatitis
- Ocular syphilis (anterior or posterior uveitis)
- Early symptomatic and asymptomatic neurosyphilis



TRANSMISSION FACTORS - SEXUAL NETWORKS

- Sexual network analysis demonstrate that men co-infected with HIV and syphilis are centrally located in dense sexual networks during syphilis outbreaks in the U.S.

Figure 3: Sexual network and centrality for HIV and syphilis co-infection outbreak, Cumberland County NC, 2000 – Mar 2006



DISEASE PREVENTION - PARTNER NOTIFICATION

- Partner services - a core component of HIV and syphilis prevention and control programs in the U.S.
- Disease intervention specialists - trained to follow-up with infected persons reported to health departments, conduct interviews with patients and locate sexual partners.
- Sexual partners to patients with HIV – evaluated with 4th generation HIV testing with p24 antigen and antibody detection
-
- Sexual partners to patients with early syphilis are evaluated and treated empirically regardless of test results.

TREATMENT OF SYPHILIS – CDC GUIDELINES

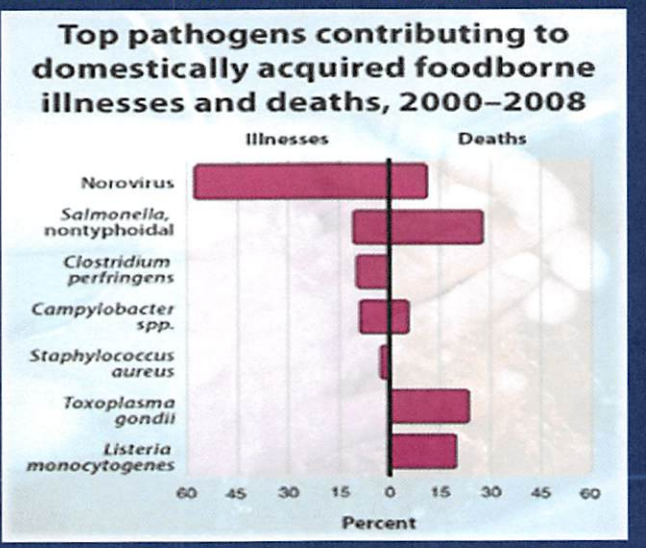
- Primary, secondary, early latent syphilis
  - Benzathine penicillin G 2.4 mu IM x 1 dose
  - For PCN –allergic:
    - Doxycycline 100mg PO BID x 14 days
    - Ceftriaxone 1-2 g daily either IM or IV for 10–14 days
    - Azithromycin 2gm PO x 1 dose
- Late latent syphilis, tertiary syphilis
  - Benzathine penicillin G 2.4 mu IM q week x 3 weeks
  - For PCN-allergic: Doxycycline 100mg PO BID x 28 days

AZITHROMYCIN RESISTANCE

- Azithromycin resistance in *Treponema pallidum* due to mutation at A2058 position in the 23s rRNA gene.
- Studies showed higher proportion of resistant isolates among persons with prior macrolide use in the past 1-12 months vs. no macrolide history
  - Mitchell SJ, et.al (14% vs. 1%, p , 0.01)
  - Marra CM, et al. (56% vs. 25%, p=0.02)
- Due to potential for azithro resistance, 2 gm dose in early syphilis is not a routinely recommended alternative regimen (not for MSM, HIV+, or pregnant women).

FOODBORNE INFECTIONS

FOODBORNE ILLNESSES – US CDC ESTIMATES

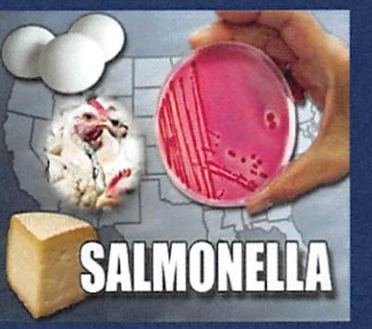


OUTBREAK INVESTIGATION AND RESPONSE

- Case definition and assess epidemiologic risk factors
- Facilitate laboratory testing for confirmation
- Determine infectiousness and risk of transmission
- Identify contacts (close, casual) and risk of exposure
- Determine eligibility of contacts for post-exposure prophylaxis or vaccination

SALMONELLA INFECTIONS

- There are numerous *Salmonella* subtypes; *S. typhimurium* and *S. enteritides* are most common in US
- Salmonellosis has short incubation period of 6-72 hours.
- Many modes of transmission: raw or undercooked eggs, milk, and meat; contact with reptiles; contamination of unchlorinated public water.
- Presentations: gastroenteritis; enteric fever; septicemia.



SALMONELLA OUTBREAK

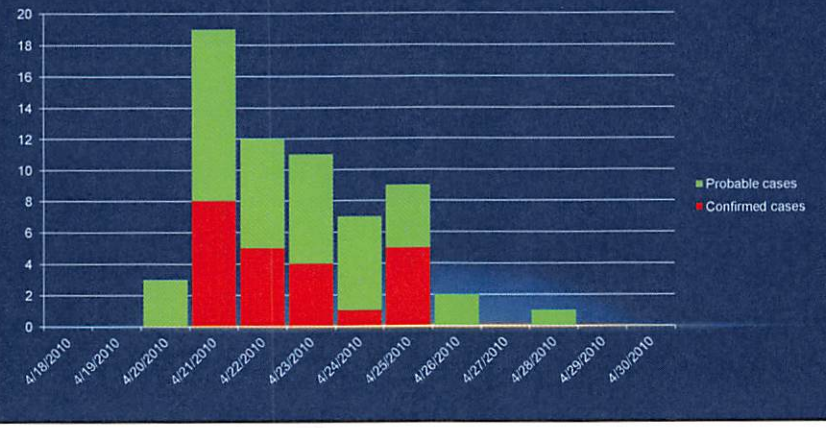
- In 2010, local company reported gastrointestinal illness among staff who ate catered for employee appreciation luncheon. Over the weekend, persons from second group hospitalized after eating food from same barbecue restaurant.
- Initial outbreak investigation activities:
  1. **Identify investigation team and resources**
     - Notified NC GCDC, convened Epi-team
  2. **Establish existence of outbreak**
     - Identified number of ill persons with exposure
  3. **Verify the diagnosis**
     - Obtained preliminary results + Salmonella;
     - Facilitated transport of patient specimens to State Lab

SALMONELLA OUTBREAK

- 4. Construct case definition
  - Person (s) who had vomiting or diarrhea with 7 days of eating food prepared from the restaurant between 4/20-4/24/10
    - Confirmed case – State lab confirmed;
    - Probable - Clinically compatible case with exposure
- 5. Find cases systematically and develop line listing
  - Administered questionnaires to ill persons and restaurant employees for recent illnesses
  - Issued a blastfax for physicians, HAN alert, and press release for public notification
  - Established a "hot-line," considering that over 2000 persons had eaten at the restaurant over 4 day period
  - Collected stool specimens for additional laboratory testing

SALMONELLA OUTBREAK

- 6. Perform descriptive epidemiology/ develop hypotheses
  - Generated Epi-curve to assess type and time of exposure 21 confirmed and 41 probable cases



CASE-CONTROL STUDY

Final analysis of data from 65 cases, 41 controls

	Odds Ratio	Lower Limit	Upper Limit	p-value (Fisher's Exact)
Brunswick Stew	1.24	0.56	2.72	0.69
Barbeque Pork	0.75	0.34	1.65	0.55
Fried Chicken	1.28	0.53	3.12	0.66
Fried Shrimp	1.60	0.56	4.57	0.45
Coleslaw	1.02	0.47	2.23	1.00
Macaroni and Cheese	1.59	0.59	4.27	0.47
Breen Beans	0.58	0.20	1.69	0.40
Hushpuppies	0.78	0.35	1.71	0.55
Banana Pudding	1.82	0.74	4.48	0.27
Chocolate Pie	3.89	0.80	18.90	0.11
Dessert	3.01	1.27	7.12	0.01
Tea	1.08	0.48	2.46	1.00
Sweet Tea	0.73	0.16	3.38	1.00
Unsweetened Tea	0.52	0.07	3.70	0.64
Ice	2.13	0.64	7.14	0.27
Dinner Rolls	0.63	0.04	10.28	1.00
Other	2.10	0.90	4.89	0.09

FINDINGS – MULTISTATE OUTBREAK

- PulseNet - other restaurant outbreaks reported in Arkansas, Louisiana, Minnesota, West Virginia, Ohio
- Molecular Analysis – indistinguishable pulse field gel electrophoresis (PFGE) patterns from cases in NC
- Probable source – commercially distributed pasteurized egg whites from same manufacturer, ?eggs from Iowa supplier involved in nationwide recall

EMERGING INFECTIONS

EMERGING INFECTIOUS DISEASES SINCE 1990

- 1993 (US) - Hantavirus pulmonary syndrome (Sin nombre virus)
- 1994 (US) – Human granulocyte ehrlichiosis
- 1994 (Australia) – Hendra virus
- 1995 (Worldwide) - Kaposi sarcoma (HHV-8)
- 1995 (US) – Cyclosporiasis from raspberries
- 1996 (England) – Variant Creutzfeld-Jakob disease (vCJD)
- 1997-present (Asia) – Avian influenza (H5N1)
- 1998 (Malaysia) – Nipah virus
- 1999 (US) - West Nile encephalitis (West Nile virus)
- 2001 (US) - Anthrax attack via letters
- 2001 (Netherlands) – Human metapneumovirus
- 2002 (US) – Vancomycin-resistant *S. aureus*
- 2003 (China→worldwide) - Severe acute respiratory syndrome (coronavirus)
- 2003 (US) – Monkeypox
- 2009 (Mexico→ worldwide) – Novel H1N1 influenza (triple reassortment; human, avian, swine)

EMERGING DISEASES IN THE US

DISEASE (source)	CASES	OUTCOME	YEAR
West Nile virus (Israel)	Thousands	Endemic (US)	1999
SARS (China)	8096 (8 US)	Controlled	2003
Monkeypox (Africa)	71	Controlled	2003
Novel flu, H1N1 (Mexico)	Thousands	Endemic (Worldwide)	2009
MERS-CoV (Arabian Peninsula)	Hundreds	Epidemic	2014
Enterovirus D68	Hundreds	Epidemic (US)	2014

LOCAL PUBLIC HEALTH PREPAREDNESS

- Training and response for potential public health threats involving emerging pathogens and bioterrorism.
- Coordination with Emergency Management, local hospitals, health care providers, law enforcement, and other community partners.
- Past activities include smallpox vaccination exercises, pandemic influenza vaccinations.

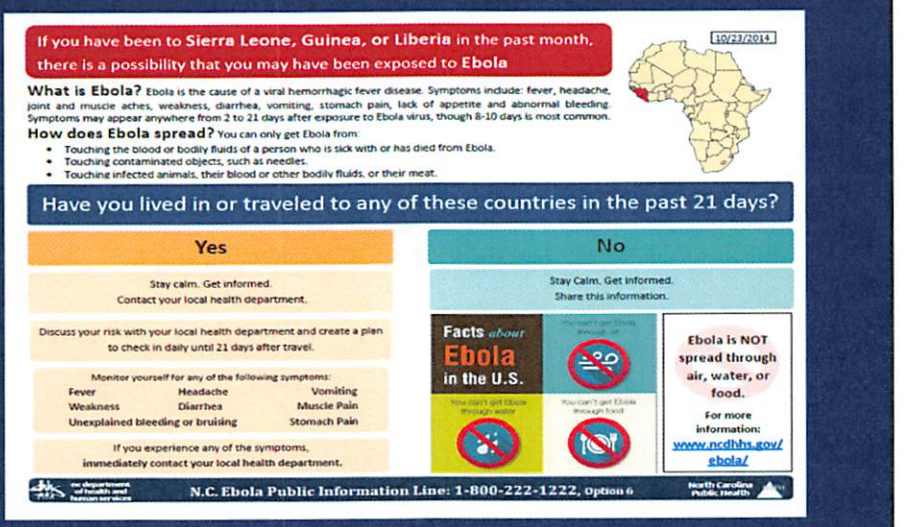
EBOLA

- Ebola virus disease (EVD), formerly known as Ebola haemorrhagic fever.
- Prior EVD outbreaks had case fatality rate of up to 90%.
- Fruit bats of the *Pteropodidae* family are considered to be the natural host of the Ebola virus.

- 2014-2015 *Zaire ebolavirus* outbreak:
  - 27,898 cases with 11,296 deaths
- Guinea and Sierra Leone with declining cases

http://www.who.int/mediacentre/factsheets/fs103/en/

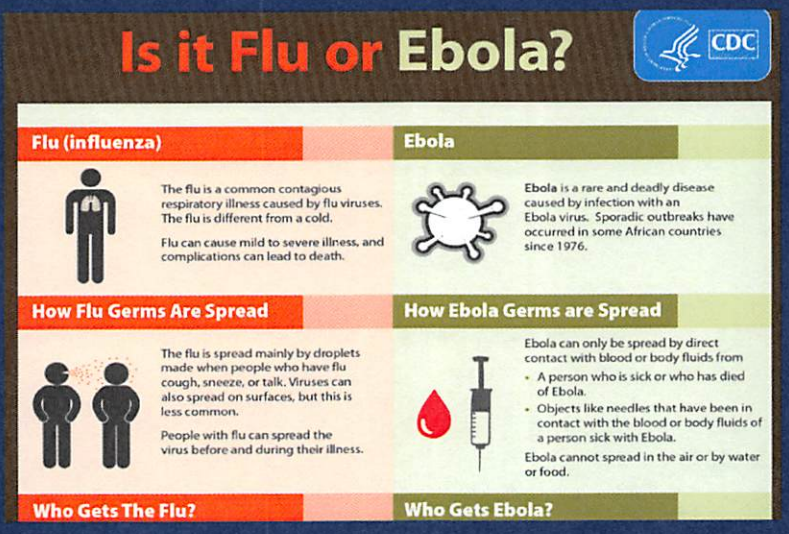
EBOLA VIRUS THREAT IN US



EBOLA VIRUS DISEASE (EVD) PREPAREDNESS

- Outreach and education, public information
- Surveillance and early recognition
- Risk assessment for travelers
- Active monitoring of travelers
- Coordination with local EMS and hospitals for immediate evaluation
- Facilitating EVD testing at the State Lab
- Contact tracing for probable and confirmed cases
- Control measures – isolation, quarantine
- Environmental health issues (i.e. decontamination and waste management)

PUBLIC INFORMATION AND EDUCATION



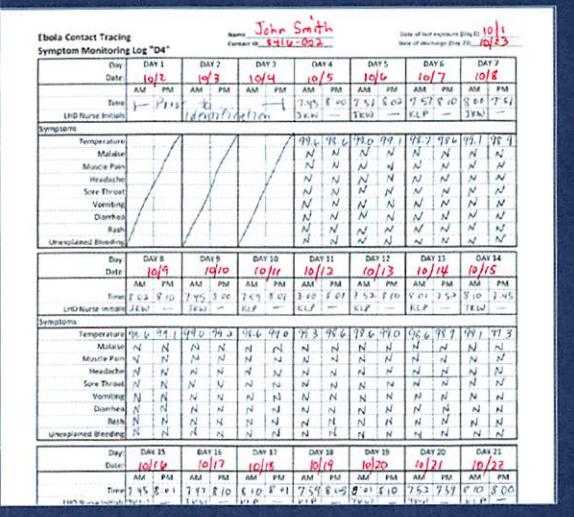
RISK ASSESSMENT

- In October 2014, Department of Homeland Security began requiring all persons from countries designated by CDC as posing a risk of Ebola exposure to fly into one of five major US airports.
- Contact information for asymptomatic travelers are shared with State and local health departments.
- Risk assessment of travelers involve symptom review, with the initial assessment conducted in person.
- All individuals in the high risk, some risk, or low (but not zero) risk classifications undergo either active or *direct* active monitoring for 21 days following the last date of exposure.

NC SYMPTOM MONITORING TOOLS

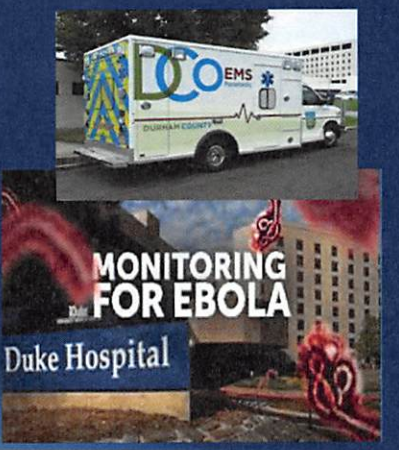
2. Active monitoring

Monitor contacts with high- or low-risk exposures for 21 days following last exposure


Ebola Contact Tracing
Symptom Monitoring Log "D4"
Name: John Smith

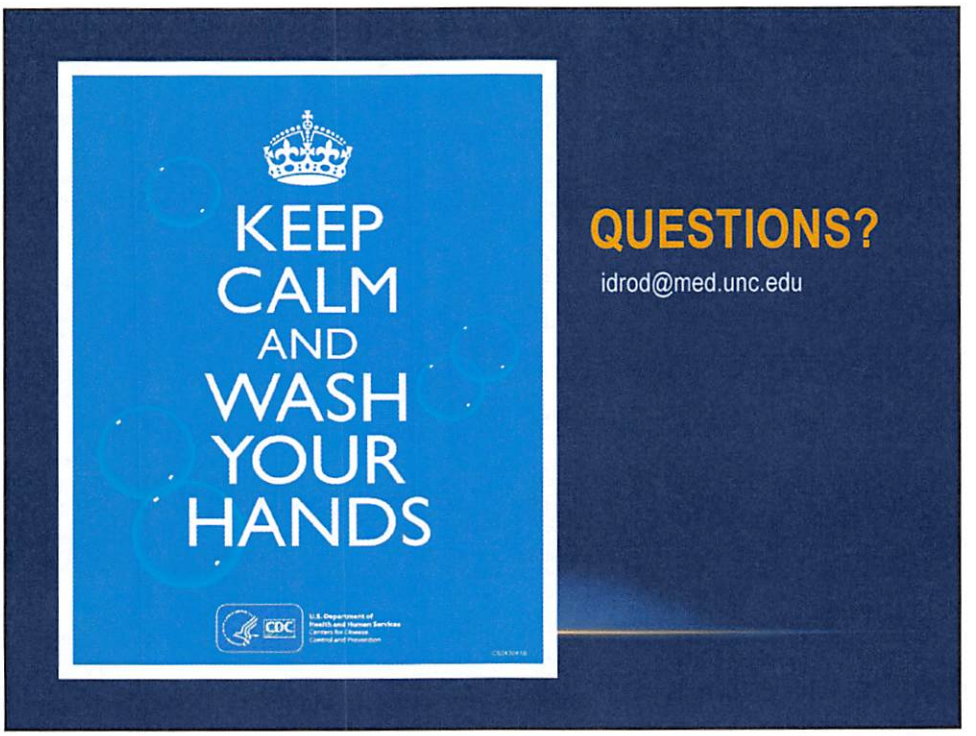
EBOLA EXPERIENCE IN DURHAM COUNTY, NC

- In October 2014, meetings were initiated with local public health preparedness partners regarding:
  - EVD screening
  - Communication and notification
  - Personal protective equipment
  - Referral to EMS and local hospitals for suspected EVD cases
- On October 31, a probable case of EVD in a traveler prompted a test of the system in Durham and Person counties.



TAKE HOME MESSAGES

- Health departments have the authority for monitoring, investigation, control and prevention of communicable diseases.
- Timely and complete communicable disease reporting is critical for prevention and control efforts.
- In our state, prominent communicable disease issues include RMSF, HIV, syphilis, foodborne infections (e.g. norovirus, Salmonella), and emerging infections (e.g. Ebola).
- Key communicable disease activities include:
  - Provider and public education
  - PrEP and partner notification for HIV/syphilis
  - Foodborne outbreak investigations
  - Public health preparedness


KEEP
CALM
AND
WASH
YOUR
HANDS
CDC
QUESTIONS?
idrod@med.unc.edu