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Infection Prevention and Control Education Day

London, Ontario

October 16, 2014

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Outline

- Ebola virus disease
- Enterovirus D68
- Influenza

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Ebola virus disease in West Africa

With slides prepared by:

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Ebolavirus species

- Zaire ebolavirus: 1976, Democratic Republic of Congo
- Sudan ebolavirus: 1976, Sudan
- Bundibugyo ebolavirus: 2007, Uganda
- Taï Forest ebolavirus (formerly *Côte d'Ivoire ebolavirus):* 1994, Ivory Coast
  - Single case, veterinary worker handling primate
- Reston ebolavirus: 1989, Philippines
  - Macaques, swine
  - Human laboratory workers seropositive but no clinical disease

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Ebola outbreaks prior to 2014

Year	Country	Ebola virus species	Cases	Deaths	Case fatality
2012	Democratic Republic of Congo	Bundibugyo	57	29	51%
….					
2007	Uganda	Bundibugyo	149	37	25%
2007	Democratic Republic of Congo	Zaire	264	187	71%
….					
2003 (Jan-Apr)	Congo	Zaire	143	128	90%
….					
2000	Uganda	Sudan	425	224	53%
….					
1995	Democratic Republic of Congo	Zaire	315	254	81%
….					
1976	Sudan	Sudan	284	151	53%
1976	Democratic Republic of Congo	Zaire	318	280	88%

World Health Organization. Ebola virus disease [Internet]. Geneva: World Health Organization; 2014 [cited 2014 Aug 28]. Available from: http://www.who.int/mediacentre/factsheets/fs103/en/

Reservoir and transmission to humans

- Fruit bats reservoir of virus - Drop partially eaten fruits
- Bats infect chimpanzees, gorillas, forest antelopes, porcupines
- Humans handle and eat bush meat (bats, chimpanzees, gorillas)
- Infected human passes from person to person

Centers for Disease Control and Prevention; Virus Ecology Graphic

http://www.cdc.gov/vhf/ebola/resources/virus-ecology.html

Pathogenesis - how does Ebola cause disease?

- Enters the body via infected blood/body fluid
- Strong immune response activation
- Rapid viral damage of liver cells, endothelial and epithelial tissues
- Blood vessels leaking
- Clotting disorder

Clinical manifestations

- Incubation period 8–10 days (range 2–21)
  - Mean 11 days in this outbreak
- Sudden onset of fever >38.6^{0}C
- Flu-like symptoms: chills, myalgias, malaise, sore throat
- Nausea, vomiting, abdominal pain, diarrhea
- Respiratory symptoms: chest pain, shortness of breath and cough
- Central nervous system symptoms: headache, confusion and coma
- Bleeding in about 50% of cases

Immunity and survival

- Average of 5 days from onset before hospitalization
- Average of 4 days from hospitalization to death
- Case fatality rate 50-90%
  - 70% in this outbreak
- Treatment is supportive care
- IgG response appears to be protective

Ebola Response Team. Ebola Virus Disease in East Africa – The First 9 Months of the Epidemic and Forward Projections NEJM September 2014 http://www.nejm.org/doi/full/10.1056/NEJMoa1411100

Communicability

- Only spreads once symptomatic
- As get sicker, get more infectious
- Dead bodies highly infectious

Origins of current outbreak in West Africa

- Initial (suspect) cases occurred in a family in Guéckédou, Guinea
  - December 2013 / January 2014
- Spread to a number of health care workers and then among their family members
  - January to March 2014
- Click for map

Baize S, Pannetier D, Oestereich L, Rieger T, Koivogui L, Magassouba N, et al. Emergence of Zaire Ebola virus disease in Guinea - preliminary report. N Engl J Med. 2014 Apr 16. [Epub ahead of print]. Figure 1, Map of Guinea showing initial locations of the Ebola virus disease. Available from: http://www.nejm.org/doi/full/10.1056/NEJMoa1404505#t=article

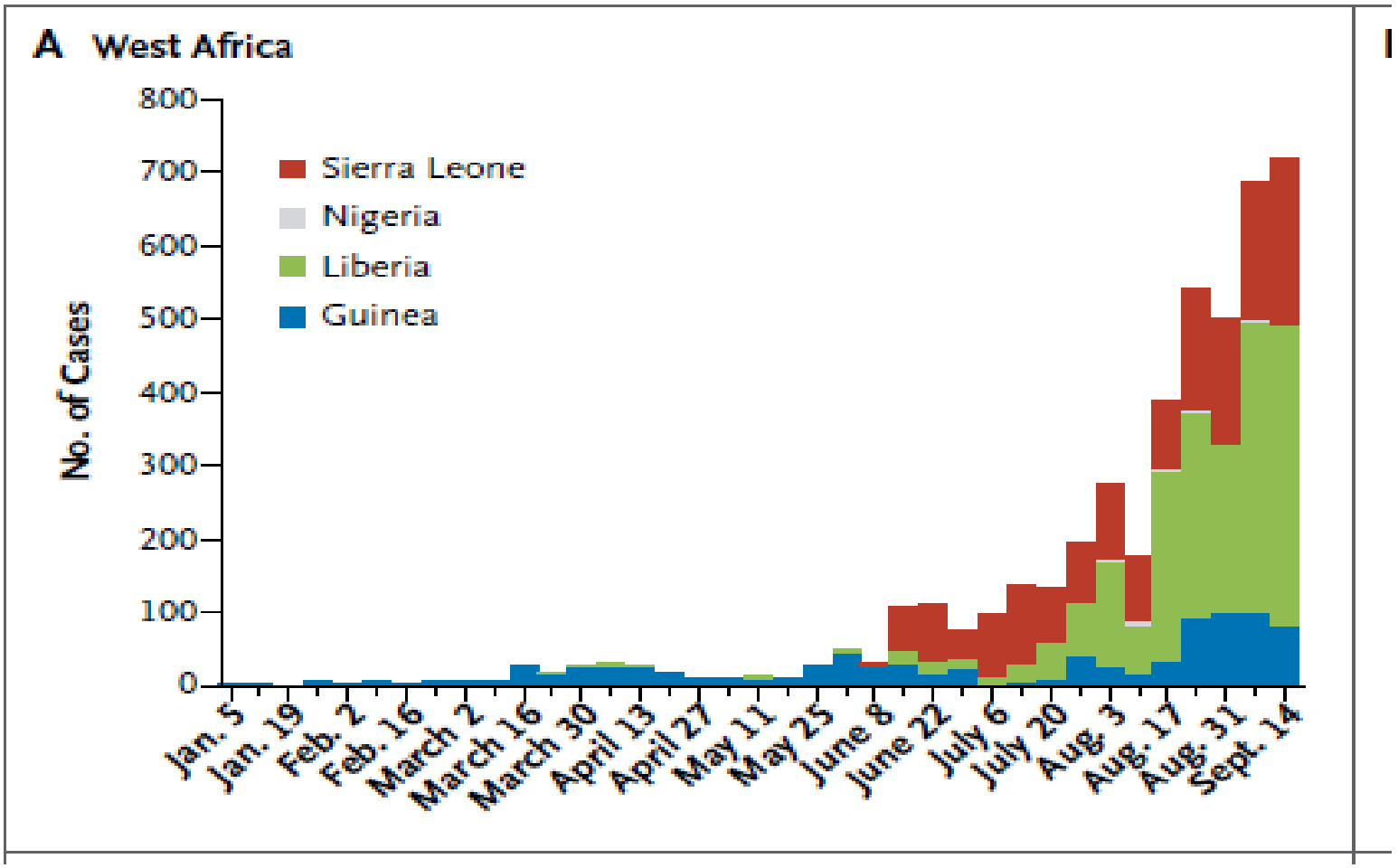
Baize S, Pannetier D, Oestereich L, Rieger T, Koivogui L, Magassouba N, et al. Emergence of Zaire Ebola virus disease in Guinea - preliminary report. N Engl J Med. 2014 Apr 16. [Epub ahead of print]. Figure 1, Map of Guinea showing initial locations of the Ebola virus disease. Available from: http://www.nejm.org/doi/full/10.1056/NEJMoa1404505#t=article

Current situation as of October 8, 2014

Country	Total cases (suspect, probable & confirmed)	Case deaths (suspect, probable & confirmed)
Guinea	1350	778
Liberia	4076	2316
Sierra Leone	2950	930
TOTAL	8376	4024

Source: World Health Organization, Ebola Response Roadmap Update on October 10, 2014

Progression of the outbreak to September 14, 2014



Ebola Response Team. Ebola Virus Disease in East Africa – The First 9 Months of the Epidemic and Forward Projections NEJM September 2014
http://www.nejm.org/doi/full/10.1056/NEJMoa1411100

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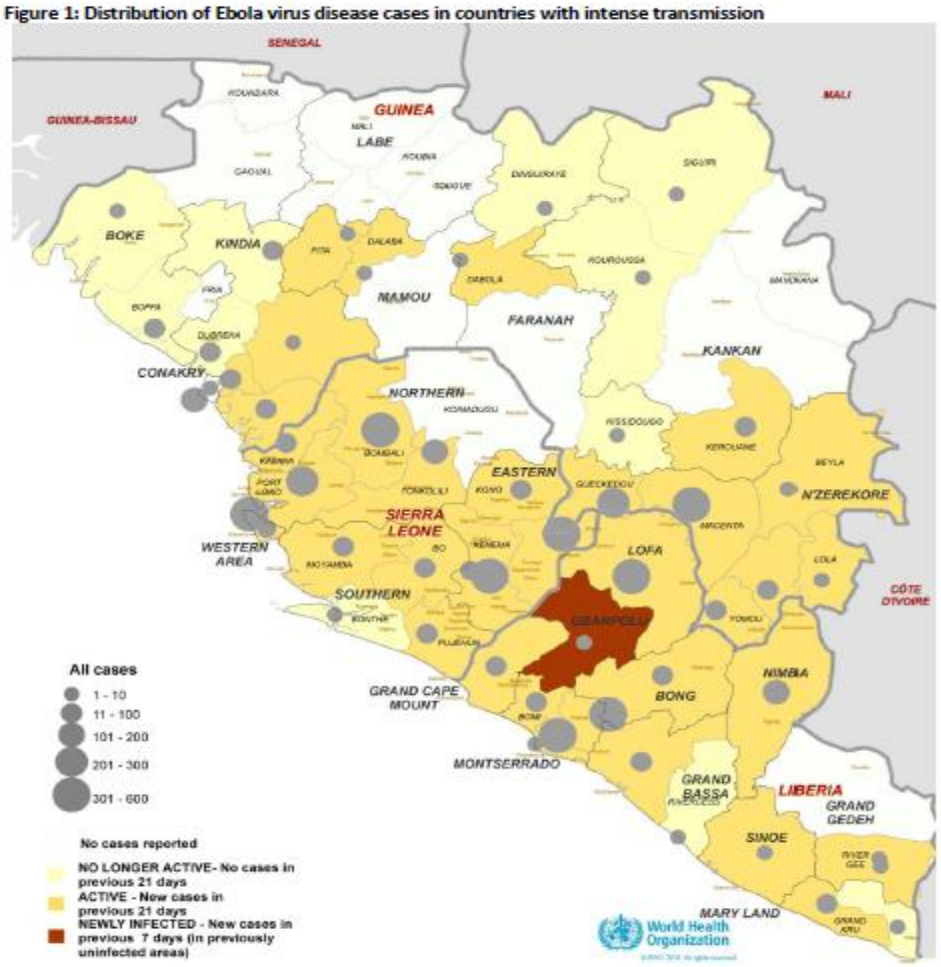
Location of cases to October 7 / 8, 2014

Figure 1: Distribution of Ebola virus disease cases in countries with intense transmission



Reproduced, from the Ebola response roadmap update, 10 October 2014 [Internet]. Geneva: World Health Organization; 2014. Available from: http://apps.who.int/iris/bitstream/10665/136161/1/roadmapupdate10Oct14_eng.pdf?ua=1 [cited 2014 October 10]. Map. p. 2.

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Context for outbreak

Country	**Population 2012** (millions)	**Median age 2012** (years)	**Literacy levels 2010 or 2012** (percent)	**Expenditures on health 2012** (per capita total expenditures at average exchange rate - US)
Guinea	11.5	18.5	25 / 41	$ 32
Liberia	4.2	18.4	61	$ 66
Sierra Leone	6	20	43	$ 96
Canada	34.8	40		$ 5741

World Health Organization. Global Health Observatory Data Repository
http://apps.who.int/gho/data/node.country.country-CAN?lang=en
Geneva: World Health Organization; 2014 [accessed 2014 Aug 31]

Context for outbreak

- Widespread on multiple fronts
- Affected large cities
- Weak and fragile infrastructure
- Lack of knowledge of the disease
- Distrust of government and foreigners
- Not seeking health care
- Social rituals / burial rituals
- Delayed response; more resources needed

Impact on social determinants of health

- Trading, industry, agriculture, tourism
- Worsening poverty
- Hunger
- Orphans
- Stigma
- School closures
- Other diseases not being treated
- Lack of preventive care: prenatal care, vaccination

Post-exposures prophylaxis / treatment

- Convalescent serum
- ZMapp – “Secret Serum” – PHAC and others
  - Three monoclonal antibodies against parts of the glycoprotein
  - Grown in tobacco plants
  - Suppress viremia and viral spread
  - Effective in non-human primates – 3 doses starting on day 3 to 5
  - Post-exposure, used in seven people – 2 of 7 died

Xiangguo Qiu et al.Reversion of advanced Ebola virus disease in nonhuman primates with Zmapp, Nature
http://www.nature.com/nature/journal/vnfv/ncurrent/pdf/nature13777.pdf

Post exposure management / treatment / prevention

- Drugs designed to inactivate viral replication
  - Tekmira
  - Favipiravir

- Vaccines
  - Several being tested for safety in humans
  - EVSV-EBOV – Public Health Agency of Canada and NewLinks Genetics donated 800 to 1,000 vials
  - Chimp Adenovirus type 3 – US National Institute of Allergy and Infectious Disease and GlaxoSmithKline

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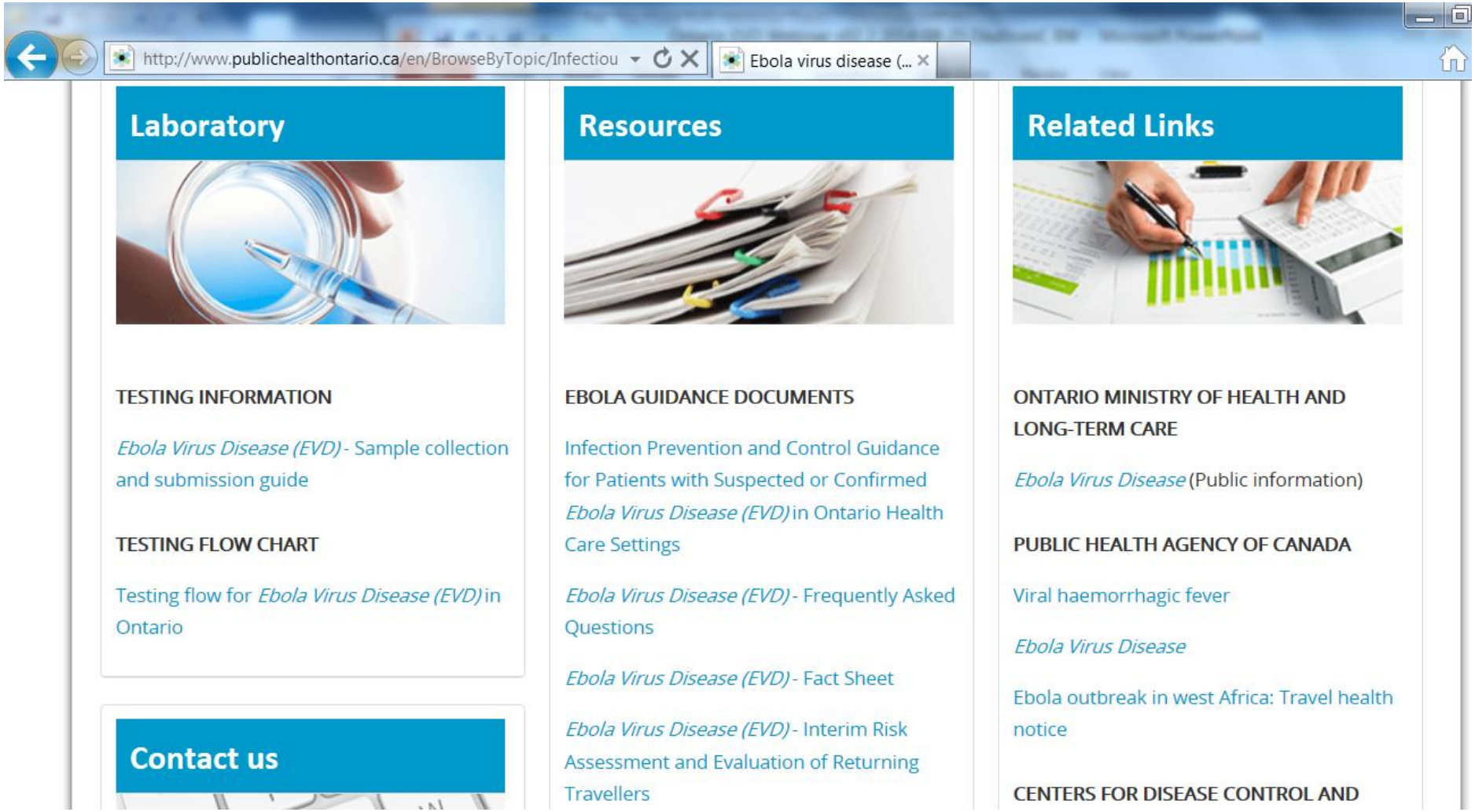
PHO EVD resource page

http://www.publichealthontario.ca/ebola



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Public Health Ontario response

Infection prevention and control

Laboratory testing

Public health

Key Ebola Virus Disease Facts

- Only spread by direct contact with blood and body fluids; not airborne
- Incubation 2-21 days; usually 8-10 days
- Only infectious when symptomatic
- Increasingly infectious as get sicker

General Infection Prevention and Control Guidance

- Personal protective equipment
  - Fluid-resistant, long-sleeved, cuffed gown
  - Gloves
  - Full face protection (face shield)
  - Surgical or procedure mask
- If lots of blood or body fluids, add
  - Fluid impermeable gown
  - Head covering
  - Leg / foot covering
- Aerosol generating procedures – N95
- Cleaning and laundry

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Interim risk assessment of returning travellers

EVD risk level	Criteria	Action for asymptomatic patient
No risk	Not in affected country/ area	No action
Very low risk	No known exposures	Self-monitoring No public health action
Low risk	In a health care facility OR Near a person with EVD but no direct contact	Self-monitoring Intermittent public health follow-up
Intermediate risk	Direct contact WITH full PPE	Self-monitoring Daily public health follow-up
High risk	Direct contact WITHOUT full PPE	Self-monitoring Daily public health follow-up Review daily activities Stay in town

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Monitor twice daily for fever and other symptoms

Lists other symptoms

Contact public health if:

- Exposed to someone with Ebola
- Touched dead body
- In a health care facility
- Virus in lab
- Ate bush meat

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Ebola virus disease (EVD): Advice for returning travellers from countries/areas affected by EVD

August 29, 2014

Visit the PHO website at www.publichealthontario.ca/ebola for an updated list of countries/areas affected by Ebola. If you have traveled to Guinea, Sierra Leone, Liberia, Nigeria (Lagos and Port Harcourt), or Democratic Republic of Congo (Equateur Province) in the past 21 days, you should:

1. MONITOR YOUR TEMPERATURE FOR 21 DAYS FROM YOUR RETURN

a) Check your temperature twice daily with a thermometer in your mouth and record the results. You can use the Temperature Recording Form provided below to record your temperature. Do not share your thermometer.

b) If possible, do not take medications that may reduce fever. Consult a health care provider or pharmacist if you are not sure whether a medication will reduce a fever.

c) If you develop a fever of 38°C (101°F) or greater, or any symptoms that may suggest Ebola virus disease:

- Avoid physical contact with others
- Call a health care provider or go to a hospital
- If going to the hospital, call ahead to the emergency department and advise them of your travel history and symptoms
- Do not take public transportation. Take a private vehicle, or if very ill, call an ambulance and advise them of your travel history and symptoms
- If you are already being monitored by public health, call them to tell them of your symptoms

Symptoms that may suggest Ebola virus disease:

- Fever equal to or greater than 38°C (101°F)
- Feeling feverish
- Diarrhea
- Severe headache
- Vomiting
- Muscle pain
- Sore throat
- Stomach pain

2. IF YOU DID ANY OF THE FOLLOWING WHILE IN THE AFFECTED COUNTRY/AREA, CALL YOUR LOCAL PUBLIC HEALTH UNIT:

- Came into contact with or were near a person who had or likely had Ebola virus disease
- Touched the body fluid of person who had or likely had Ebola virus disease
- Touched a dead body
- Visited, worked or was a patient in a hospital or other health care facility
- Worked with Ebola virus in a laboratory
- Touched or ate bush meat or a bat

For additional information, contact your local public health unit.
To find your public health unit, call Service Ontario at 1-866-532-3161 or visit the Ministry of Health and Long-Term Care's public health unit locator at www.phdapps.health.gov.on.ca/PHULocator

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TEMPERATURE RECORDING FORM

This form is intended for travellers returning from countries / areas affected by Ebola virus disease to record their temperature readings and other symptoms for 21 days after their return date.

If possible, do not take medications that may reduce fever. Do not share your thermometer.

Should you develop a fever of 38°C (101°F) or greater, or develop any of the symptoms listed below:

- Call your health care provider or go to the hospital. If going to the hospital, call ahead to the emergency department and advise them of your symptoms and travel history
- Avoid physical contact with others
- Do not take public transportation. Take a private vehicle, or if very ill, call an ambulance and advise them of your travel history and symptoms
- If you are already being monitored by public health, call them to tell them of your symptoms

Date	Temperature reading				Other symptoms
	Time	AM Temperature	Time	PM Temperature	severe headache, muscle pain, sore throat, diarrhea, vomiting, stomach pain

To find your public health unit, call Service Ontario at 1-866-532-3161 or visit the Ministry of Health and Long-Term Care's public health unit locator at www.phdapps.health.gov.on.ca/PHULocator

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Enterovirus D68

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Enterovirus

- Summer / fall viruses
- Range of symptoms
  - Nothing, colds, fever and rashes, neurologic complications
- Enterovirus D68
  - Uncommon type
  - Cause cold like symptoms and wheezing
  - 2011 –6 clusters of cases, 95 cases (3 US States, Philippines, Japan, Netherlands)
  - Mostly children, although some adults
  - Worsened asthma, 3 deaths

Centers for Disease Control and Prevention (CDC). Clusters of Acute Respiratory Illness Associated with Human Enterovirus 68 -Asia, Europe, and United States, 2008—2010 Morbidity and Mortality Weekly Report, September 30, 2011 / 60(38);1301-1304

Current outbreak of Enterovirus D68

- September 12, 2014 MMWR article
  - 19 children in Kansas City
  - 11 patients in Chicago
- Ages 6 weeks to 16 years (median 4-5 years)
- ~ 70% with a history of asthma
- Went viral; identified across US and Canada

Centers for Disease Control and Prevention. Severe Respiratory Illness Associated with Enterovirus D68 — Missouri and Illinois, 2014 Morbidity and Mortality Weekly Report, September 12, 2014 / 63(36);798-799

780 cases as of October 15, 2014

CDC Enterovirus D68 web site http://www.cdc.gov/non-polio-enterovirus/outbreaks/EV-D68-states.html Accessed October 15, 2014

Acute Flaccid Paralysis

- Children's Hospital Colorado
- 9 children with acute flaccid paralysis
- August 8 to September 15, 2014
- Median age 8 years (1 to 18 years)
- All had preceding respiratory illness (3-16 days before)
- 4 positive for EV-D68

Centers for Disease Control and Prevention. Acute Neurologic Illness of Unknown Etiology in Children — Colorado, August–September 2014 Morbidity and Mortality Weekly Report, October 10, 2014 / 63(40)901-902

Acute Flaccid Paralysis

- Reported in other US States and in Canada, including Ontario
- Uncertain if coincidental or causal
- Prognosis uncertain

Monitoring

- Enhanced surveillance for acute flaccid paralysis
  - Previously just to determine polio elimination

- Enhanced surveillance for Enterovirus D68
  - Not reportable

Public Health Surveillance and Laboratory Testing for AFP and EV-D68

	AFP in children less than 15 years of age	AFP in those 15 years of age and over	Possible EV-D68 associated respiratory symptoms
Reporting to public health	Reportable on an ongoing basis to assist with documenting polio elimination in Canada	Currently reportable to assist with understanding if there is an association between AFP and EV-D68	Not reportable
Laboratory testing (see "How to order acute flaccid paralysis testing" section of web site for additional details)	1) **Stools:** Two sets of stool samples - each stool sample is divided into a sterile container for viral testing (including polio testing) and a bacterial (Cary-Blair) transport media container for *Campylobacter* testing 2) **Throat swab:** Throat swab in universal transport medium (UTM) for both EV-D68 and polio testing 3) **CSF**: CSF as appropriate for the investigation 4) **Neurologic investigations:** Neurologic tests, such as electromyography, nerve conduction studies, MRI, CT, should be conducted as appropriate	1) **Respiratory specimens:** A nasopharyngeal swab (NP) or throat swab (NP swab preferred) in universal transport media (UTM), or bronchoalveolar lavage in a sterile dry container for EV-D68 testing 2) **CSF**: CSF as appropriate for the investigation 3) **Neurologic investigations:** Neurologic tests, such as electromyography, nerve conduction studies, MRI, CT, should be conducted as appropriate	1) **Respiratory specimens:** A nasopharyngeal (NP) swab or throat swab (NP swab preferred) in universal transport media (UTM), or bronchoalveolar lavage in a sterile dry container for EV-D68 testing
Forms to complete	1) Acute Flaccid Paralysis Case Report Form sent to local public health unit 1) Enterovirus D68 (EV-D68) Patient Clinical Summary Form requested to be sent to laboratory with specimen and requisition, or faxed to 416-649-4512	1) Acute Flaccid Paralysis Case Report Form sent to local public health unit 1) Enterovirus D68 (EV-D68) Patient Clinical Summary Form requested to be sent to laboratory with specimen and requisition, or faxed to 416-649-4512	1) Enterovirus D68 (EV-D68) Patient Clinical Summary Form requested to be sent to laboratory with specimen and requisition, or faxed to 416-649-4512

www.publichealthontario.ca/EV-D68

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Influenza

With slides prepared by:

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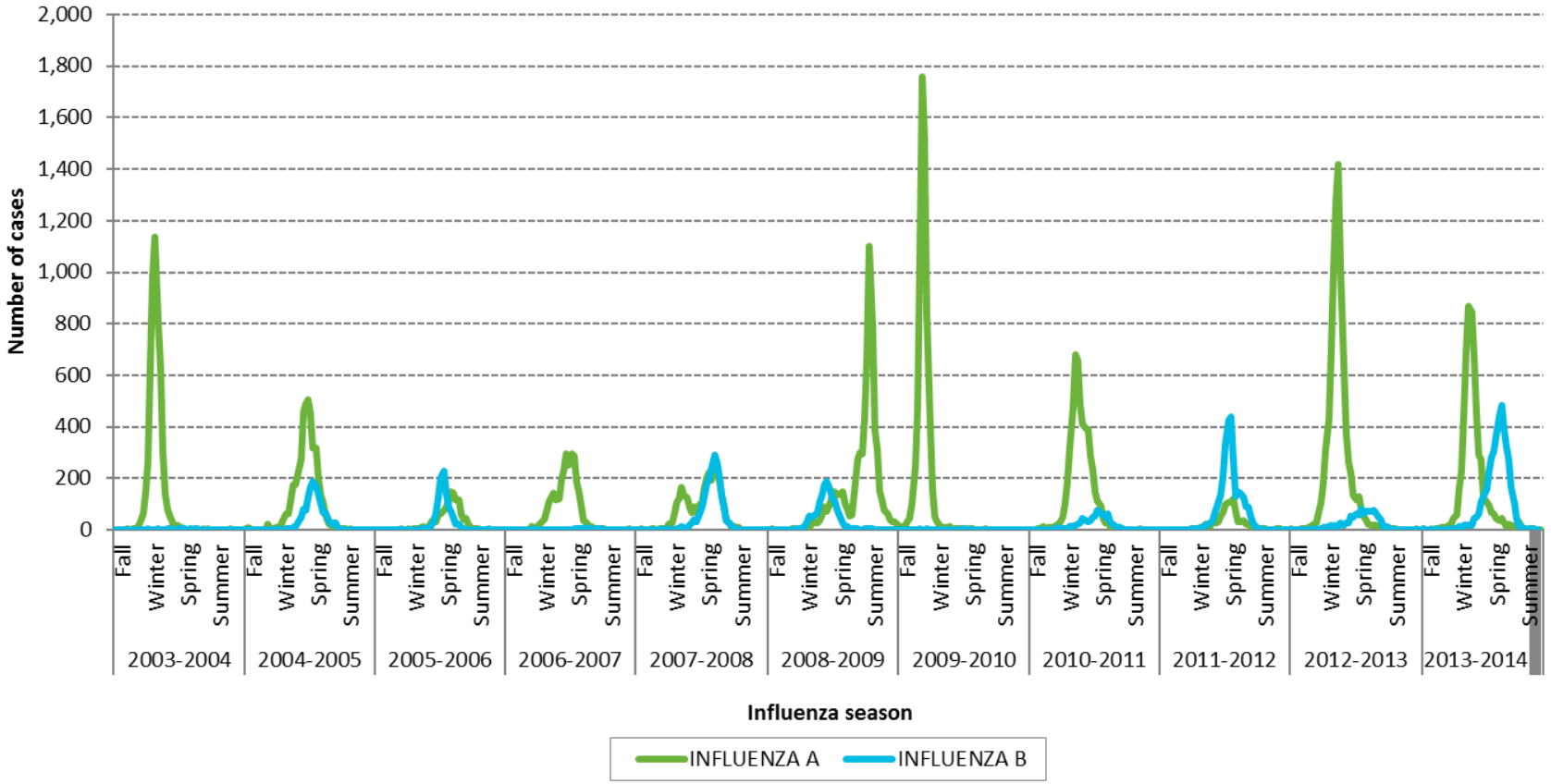
Confirmed cases of influenza by type and season: Ontario, 2003-2004 to 2013-2014*



*2013-2014 season only includes cases reported up to the end of Week 28 (July 12, 2014).

Note: Counts from the end of 2008-2009 and 2009-2010 are underreported and should be interpreted with caution due to modified reporting during the pandemic.

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/07/15].

Influenza vaccine for this year

- Same strains as last year
  - an A/California/7/2009 (H1N1)pdm09-like virus;
  - an A/Texas/50/2012 (H3N2)-like virus;
  - a B/Massachusetts/2/2012-like virus (Yamagata)

  - Quadrivalent vaccine: a B/Brisbane/60/2008-like virus (Victoria)

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Available Influenza Vaccines

Influenza Supply - Trivalent Inactivated Vaccine (TIV)

Vaccine	Manufacturer	Package Description and Additional Information
Agriflu®	Novartis	Single dose syringe
Fluviral®	GlaxoSmithKline	Multi-dose vial
Vaxigrip®	Sanofi Pasteur	Multi-dose vial
Fluzone®	Sanofi Pasteur	Multi-dose vial
Fluad®	Novartis	Single dose syringe TIV with adjuvant Targeted to seniors aged ≥65 years in long-term care homes (LTCHs)

Agriflu®, Vaxigrip®, Fluzone® and Fluviral® are considered to be equivalent vaccines.

http://www.health.gov.on.ca/en/pro/programs/publichealth/flu/uiip/
Accessed October 15, 2014

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Potential issues

- Already seeing some drift; May 18 to Sept 20
  - 70 / 70 (100%) pH1N1 - matches vaccine strain
  - Of 141 influenza AH3N2 (78 international and 63 US)
    - 49% similar to A/Texas/50/2012 (vaccine strain)
  - Of 180 influenza B (69 international and 111 US)
    - 78% similar to the B/Massachusetts/2/2012 virus (vaccine strain)
    - 22% similar to the B/Brisbane/60/2008 virus

Centers for Disease Control and Prevention Update: Influenza Activity — United States and Worldwide, May 18–September 20, 2014 Morbidity and Mortality Weekly Report, October 10, 2014 / 63(39)861-864

Southern Hemisphere Vaccine for 2015

- A/California/7/2009 (H1N1)-like virus;
- A/Switzerland/9715293/2013 (H3N2)-like virus;
- B/Phuket/3073/2013-like (B/Yamagata lineage) virus

- Quadrivalent vaccine: a B/Brisbane/60/2008-like virus (Victoria)

Potential Issues

- Not offering the quadrivalent vaccine
- Not offering the live attenuated intranasal vaccine for young children
- Not offering high dose Fluzone vaccine for seniors
  - 24.2% better efficacy than standard dose vaccine; (95% confidence interval 9.7 to 36.5) in those 65 years of age and over

DiazGranados CA. et al. Efficacy of High-Dose versus Standard-Dose Influenza Vaccine in Older Adults New England Journal of Medicine
http://www.nejm.org/doi/full/10.1056/NEJMoa1315727?query=featured_home

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Staff immunization

Median influenza immunization coverage among health care workers, 2013-2014 season:

- **Hospitals: 55.4% (16.3 - 97.5%)**
- **Long-term care homes: 78% (7.0 - 100%)**

Data Source for the presentation: Ontario Ministry of Health and Long-Term Care (MOHLTC), Ontario Influenza Immunization Database, [2014/02/28]
Note: Among 227 hospitals in Ontario as of 2014/02/28, 205 (90%) hospital sites were included in the analysis
Note: Among 632 Long-Term Care Homes in Ontario as of 2014/02/28, 586 (93%) homes were included in the analysis