



BC Centre for Disease Control  
An agency of the Provincial Health Services Authority

# Emerging trends in disease surveillance

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*AIHA AGM*  
*Mar 11 2016*

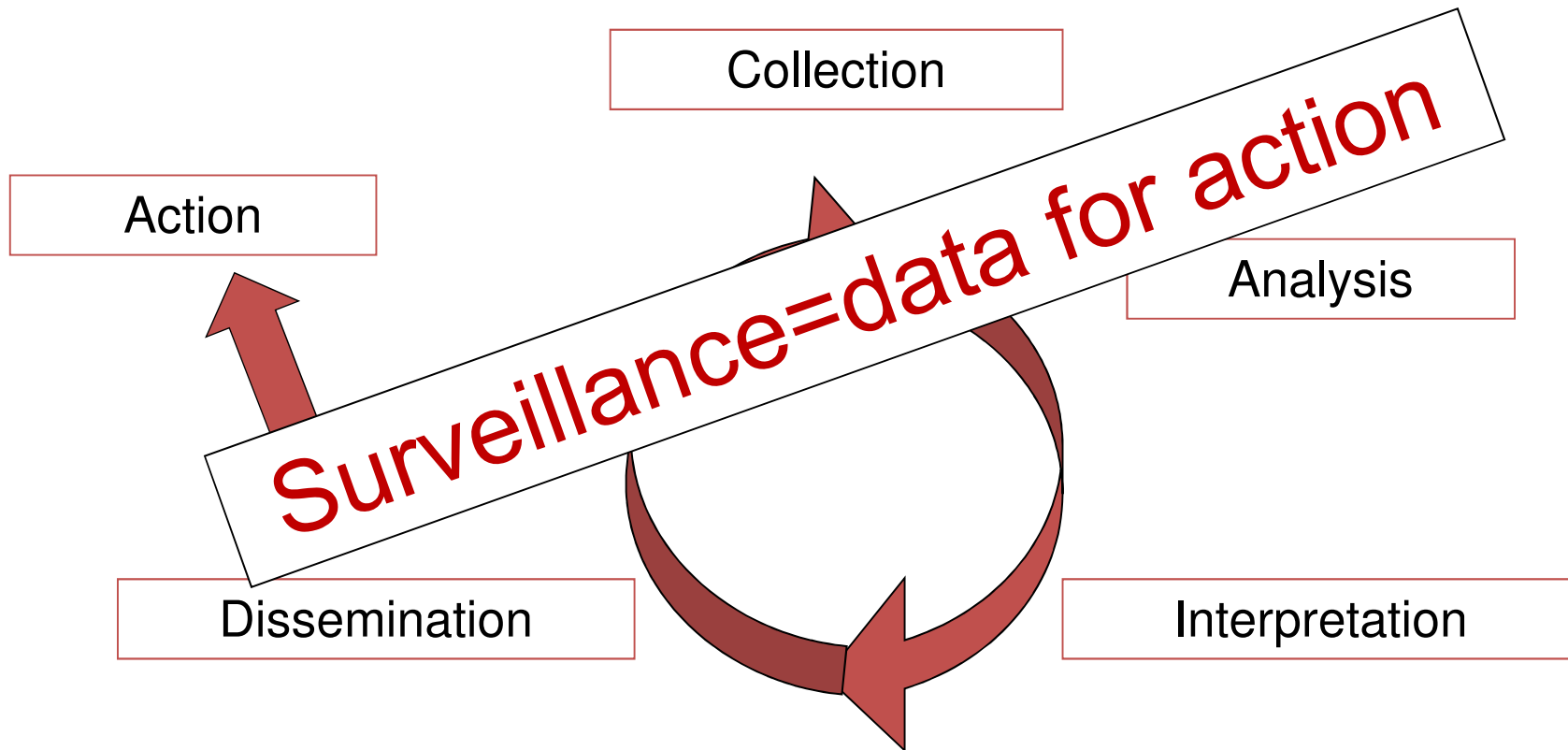
# Outline

- Definition
- History and current state
- Emerging trends
  - Data sources
  - Analysis
  - Dissemination

## Definition of surveillance

“ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control” (CDC, 1963)

# Surveillance framework



# Purpose of surveillance

1. Address a defined public health problem or question
  - Detect epidemics
  - Determine magnitude and distribution of disease
2. Guide efforts to protect and promote population health
  - Plan public health actions and allocation of resources
  - Evaluate prevention and control measures

# History of surveillance



Roman empire: organised healthcare system

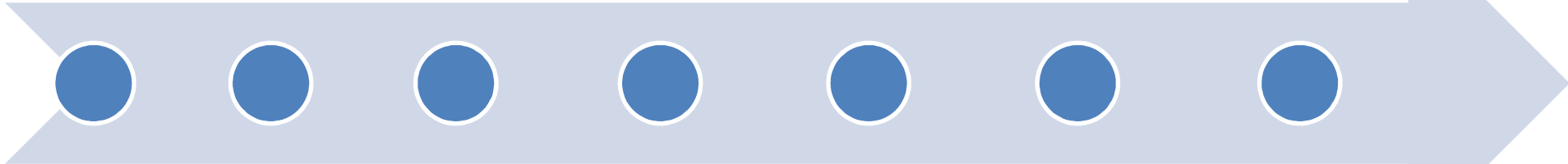
1800s: Classification system for diseases



Early 1900s: mandatory reporting of TB, STIs, cholera, smallpox, yellow fever



1968: World Health Assembly endorsed term "surveillance"



1500s: Registrations of births and deaths

BIRTHS REGISTERED		IN THE COUNTY OF York, 1800	
Name	Sex	Name	Sex
1. Richard W. 1800	M	1. Richard W. 1800	M
2. Mary 1800	F	2. Mary 1800	F
3. Thomas 1800	M	3. Thomas 1800	M
4. Elizabeth 1800	F	4. Elizabeth 1800	F
5. James 1800	M	5. James 1800	M
6. Anne 1800	F	6. Anne 1800	F
7. John 1800	M	7. John 1800	M
8. Sarah 1800	F	8. Sarah 1800	F
9. William 1800	M	9. William 1800	M
10. Margaret 1800	F	10. Margaret 1800	F
11. George 1800	M	11. George 1800	M
12. Hannah 1800	F	12. Hannah 1800	F
13. Charles 1800	M	13. Charles 1800	M
14. Elizabeth 1800	F	14. Elizabeth 1800	F
15. Thomas 1800	M	15. Thomas 1800	M
16. Mary 1800	F	16. Mary 1800	F
17. James 1800	M	17. James 1800	M
18. Anne 1800	F	18. Anne 1800	F
19. John 1800	M	19. John 1800	M
20. Sarah 1800	F	20. Sarah 1800	F
21. William 1800	M	21. William 1800	M
22. Margaret 1800	F	22. Margaret 1800	F
23. George 1800	M	23. George 1800	M
24. Hannah 1800	F	24. Hannah 1800	F
25. Charles 1800	M	25. Charles 1800	M
26. Elizabeth 1800	F	26. Elizabeth 1800	F
27. Thomas 1800	M	27. Thomas 1800	M
28. Mary 1800	F	28. Mary 1800	F
29. James 1800	M	29. James 1800	M
30. Anne 1800	F	30. Anne 1800	F
31. John 1800	M	31. John 1800	M
32. Sarah 1800	F	32. Sarah 1800	F
33. William 1800	M	33. William 1800	M
34. Margaret 1800	F	34. Margaret 1800	F
35. George 1800	M	35. George 1800	M
36. Hannah 1800	F	36. Hannah 1800	F
37. Charles 1800	M	37. Charles 1800	M
38. Elizabeth 1800	F	38. Elizabeth 1800	F
39. Thomas 1800	M	39. Thomas 1800	M
40. Mary 1800	F	40. Mary 1800	F
41. James 1800	M	41. James 1800	M
42. Anne 1800	F	42. Anne 1800	F
43. John 1800	M	43. John 1800	M
44. Sarah 1800	F	44. Sarah 1800	F
45. William 1800	M	45. William 1800	M
46. Margaret 1800	F	46. Margaret 1800	F
47. George 1800	M	47. George 1800	M
48. Hannah 1800	F	48. Hannah 1800	F
49. Charles 1800	M	49. Charles 1800	M
50. Elizabeth 1800	F	50. Elizabeth 1800	F

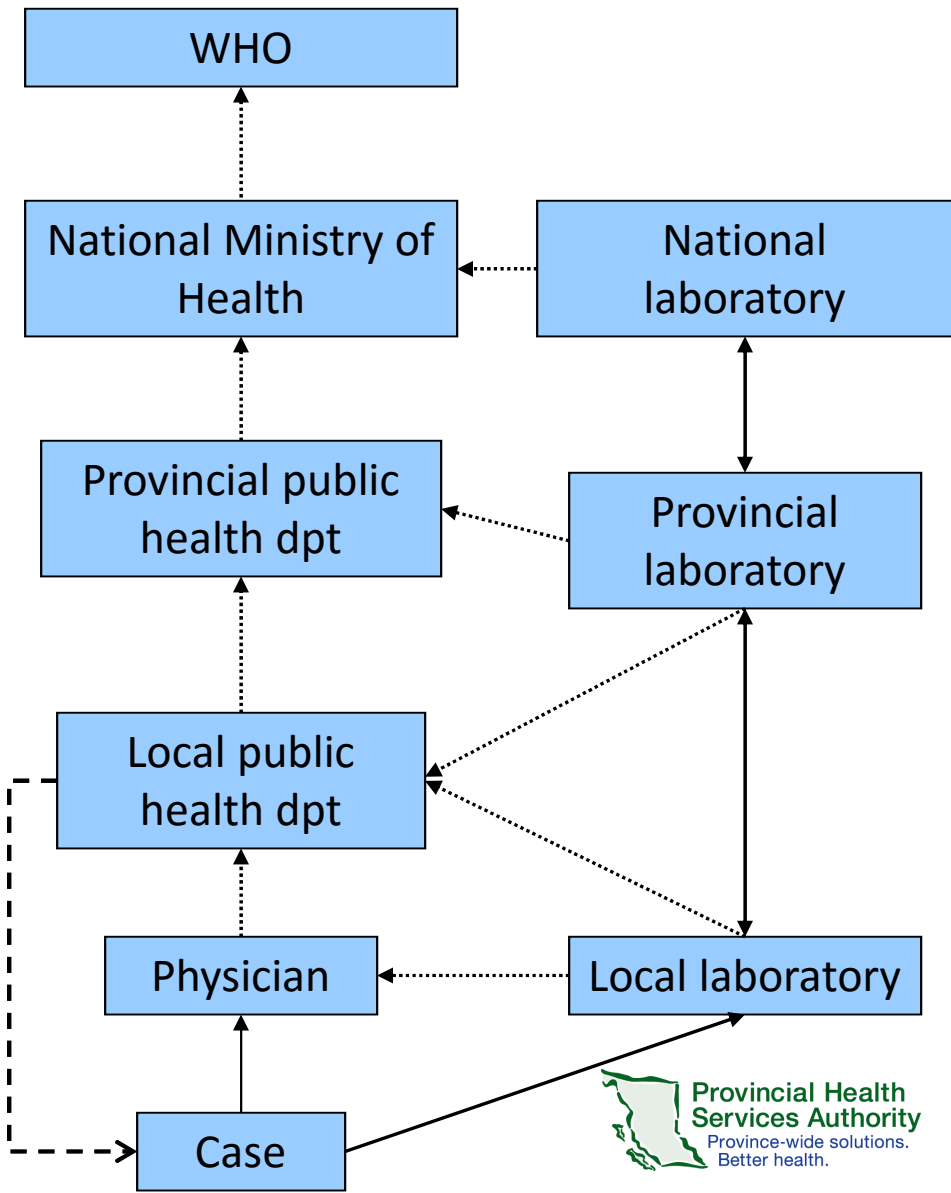
W. Farr (Registrar of England 1800s): analysed and interpreted data and produced regular reports



1963: CDC definition of surveillance

# Current surveillance: data collection

- samples
- case report
- - - - -→ interview



# Current surveillance: data collection

## Exposure Summary ? 🖨

ACTIVE

<b>Client ID:</b> <a href="#">56</a>	<b>Name(First,Middle,Last):Gender:</b> ADAIRA GREEN / female	<b>Health Card No:</b> -	<b>Date of Birth / Age:</b> 1969 Jun 20 / 39 yrs
<b>Phone Number:</b> -(-)	<b>Jurisdiction Info:</b> BC Ministry of Health	<b>Alternate ID Type / Alternate ID:</b> Provincial Health Number / -	

<b>Investigation ID:</b> <a href="#">43</a>	<b>Status:</b> OPEN	<b>Disposition:</b> Pending	<b>OB No:</b> <a href="#">4</a>
<b>Disease:</b> Tuberculosis	<b>PHAC Date/Type:</b> 2008 Oct 31 / Report Received	<b>Causative Agent:</b> -	<b>Authority/Classification:</b> National / Case - Person Under Investigation / 2008 Nov 2

[Investigation](#)

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### Transmission Event Summary ⤴ Hide Transmission Event Summary

1 Transmission Events Found. 0 Contacts Found.

<b>Row Actions:</b>	<input type="button" value="Copy"/> <input type="button" value="View/Update"/> <input type="button" value="Delete"/>	<input type="button" value="Quick Entry"/>	<input type="button" value="Add Transmission Event"/>
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	Transmission Event ID	Start Date	End Date	Location Name	Setting Type	Responsible Organizational Unit
○ ⊕	<a href="#">22</a>	2009 Jan 5	2009 Jan 12	Vancouver	Private Function,	BC Ministry of Health

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### Acquisition Event Summary ⤴ Hide Acquisition Event Summary

0 Acquisition Events Found.

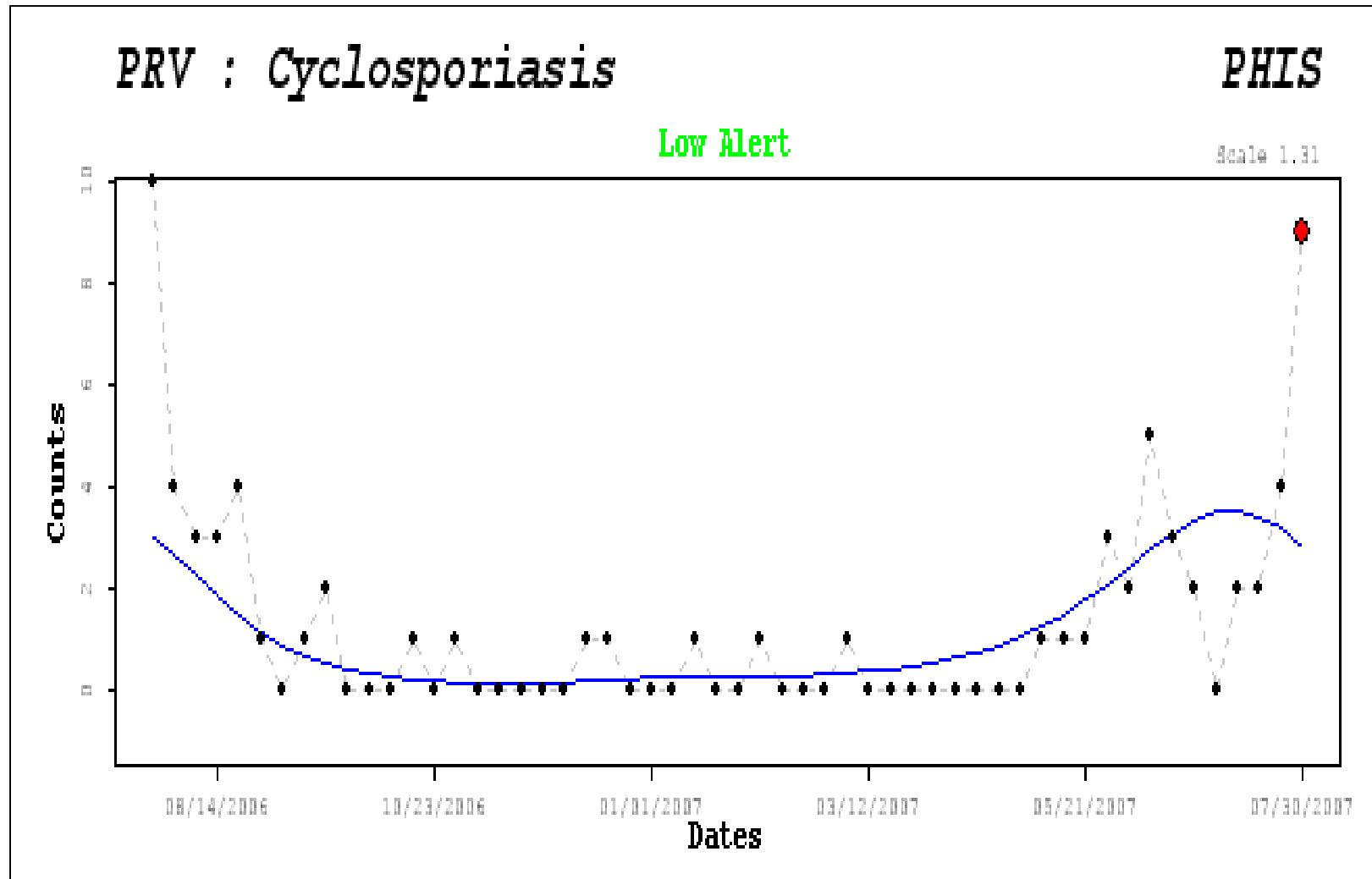
<b>Row Actions:</b>	<input type="button" value="Search and Link TE"/> <input type="button" value="Copy"/> <input type="button" value="View/Update"/> <input type="button" value="Delete"/>	<input type="button" value="Quick Entry"/>	<input type="button" value="Add Acquisition Event"/>
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Acquisition Event ID	Transmission Event ID	Source Name	Start Date	End Date	Location Name	Setting Type	Responsible Organizational Unit	Exposed	Likely Source
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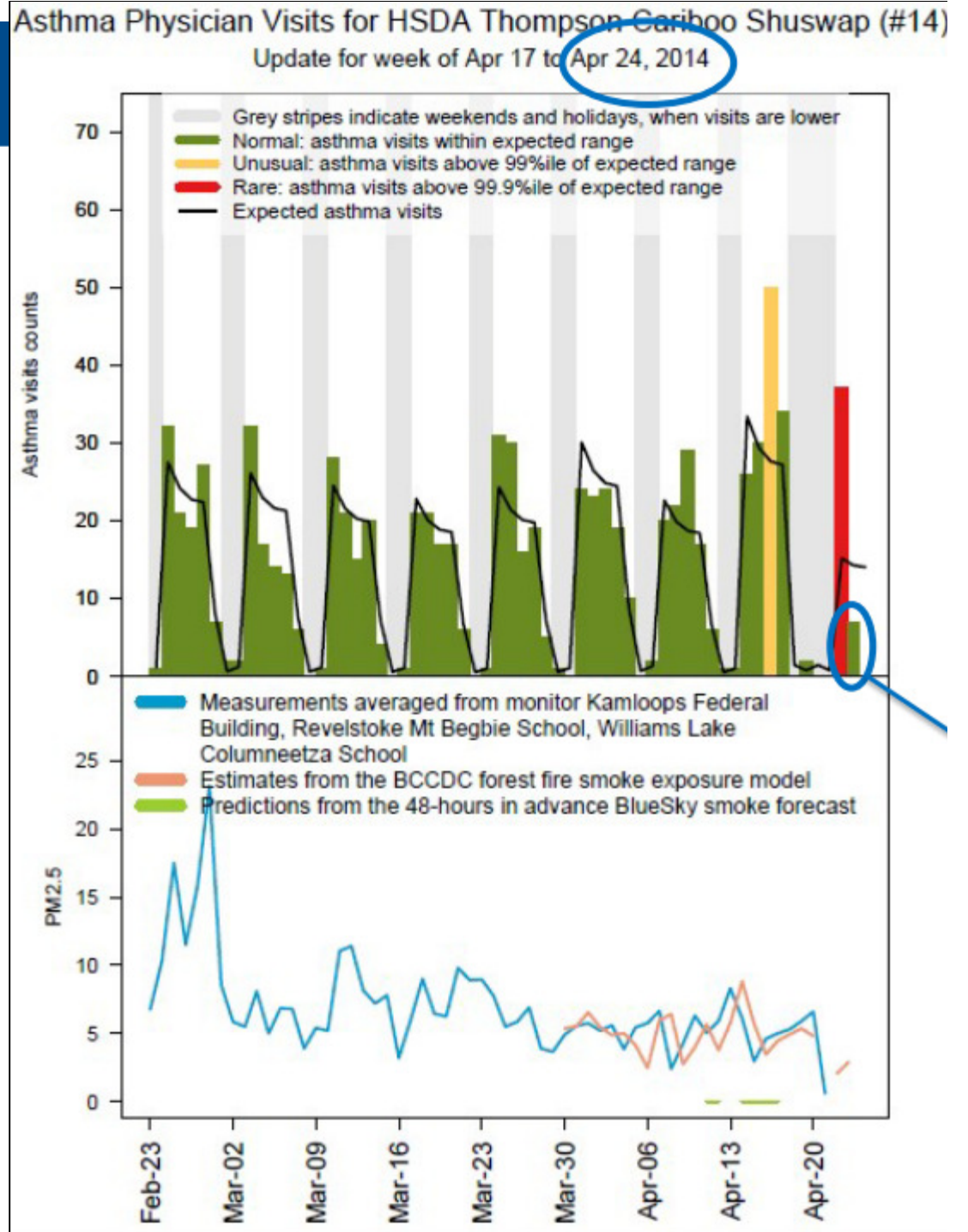




# Current surveillance: analysis



# Current surveillance: collection and analysis



# Current surveillance: dissemination

**British Columbia Annual Summary of Reportable...**

**British Columbia Influenza Surveillance Bulletin**  
Infection Season 2015-16, Number 9, Week 4  
January 24 to 30, 2016

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**Increasing Influenza Activity: Influenza B Still Predominant**

In week 4 (January 24 to 30, 2016), influenza continued to increase in BC, with influenza B predominating.

At the BCCDC Public Health Laboratory, influenza B positivity has increased steadily in recent weeks, ranging from 32% in week 2 to 35% in week 4. Influenza B detections continued to outnumber influenza A detections, comprising about 60% of all influenza positive specimens. In week 4, influenza B (H3N2) viruses slightly outnumbered influenza A (H3N2) viruses that predominated earlier this season.

Since our last bulletin one week ago, one confirmed influenza B outbreak was reported from a long-term care facility (LTCF) in FHA in week 4, and two new influenza B outbreaks were reported in IHA.

With increased influenza B activity, the BCCDC was notified this week of a cluster in FHA with myositis (i.e. inflammation of muscle tissue) associated with respiratory symptoms. Myositis is a recognized complication of influenza B, and is generally self-limited. In this cluster, at least four children in hospital, and influenza B was detected.

**Prepared by BCCDC Influenza & Emerging Respiratory Pathogens**  
Contributors: Lisan Kwindt, Catharine Chambers, Danuta Skowron  
Report Disseminated: February 4, 2016

**Provincial Health Services Authority**  
Province-wide solutions. Better health.

**Update on multi-provincial outbreak of Salmonella Infantis with BC Cases**

Dear Colleagues,

This is an update on the multi-provincial outbreak of *Salmonella* Infantis with BC cases. As of February 4, 2016, 10 cases have been identified in BC (including 9 in BC). Onset dates range from March 15, 2015 to January 15, 2016. Epicenter of this outbreak. There was insufficient product information available to initiate tracking. Further food safety investigation was being conducted, the Federal/Provincial Outbreak Investigation in Canada posted their final Public Health Notice about this outbreak on March 4, 2016 ([http://www.hc-sc.gc.ca/lcdc/0000/2016/20160304\\_salmonella\\_infantis\\_ebc.php](http://www.hc-sc.gc.ca/lcdc/0000/2016/20160304_salmonella_infantis_ebc.php)); however, national enhanced outbreak investigation methods have been discontinued.

Since the OICC was declared over, another BC case was identified. BC now has 10 cases match 2016. Sixty percent are female. The age range is 11 months to 73 years (median=59); 70% of cases were VCH (2). For the cases with exposure information available, 7/9 (78%) reported eating any chicken.

Chicken samples from two BC cases tested positive for *Salmonella* Infantis with PFGE patterns matching grocery store chains. The ten BC cases reported shopping at a variety of grocery stores, including:

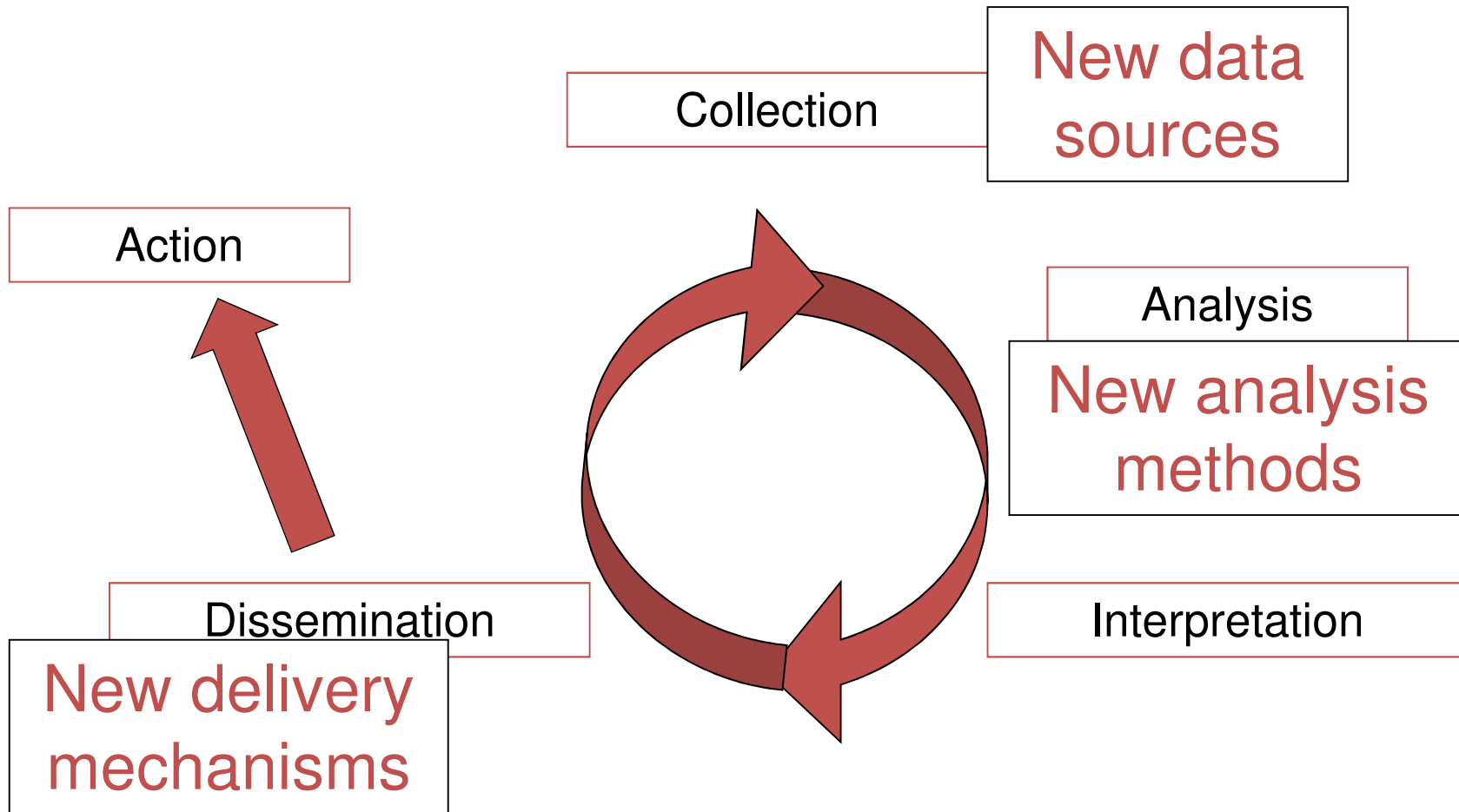
If you have any *Salmonella* Infantis cases, please interview them using our standard *Salmonella* Infantis form and enter the details into Panorama (FHA, IHA, VIHA, NHA) or fax the form (VCH) to BCCDC at 604-707-2525.

If further cases with the PFGE patterns are identified as related to this outbreak, we will let them know.

Thank you.

Better health.

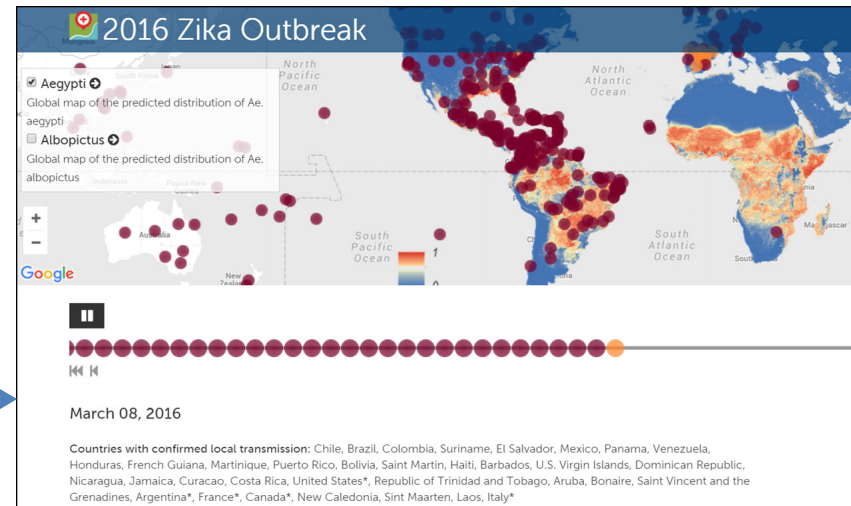
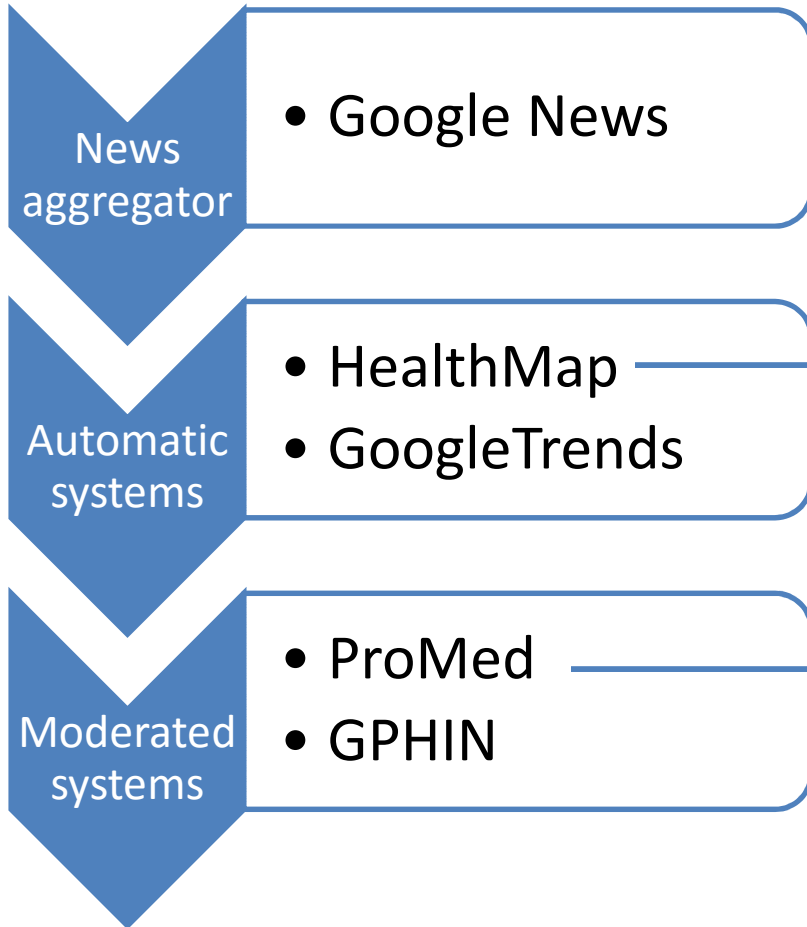
# Emerging trends in surveillance



# New data sources

- Internet
- Social media
- Mobile devices (mHealth)
- Electronic medical records
- Participatory surveillance

# Internet-based surveillance




# Social media

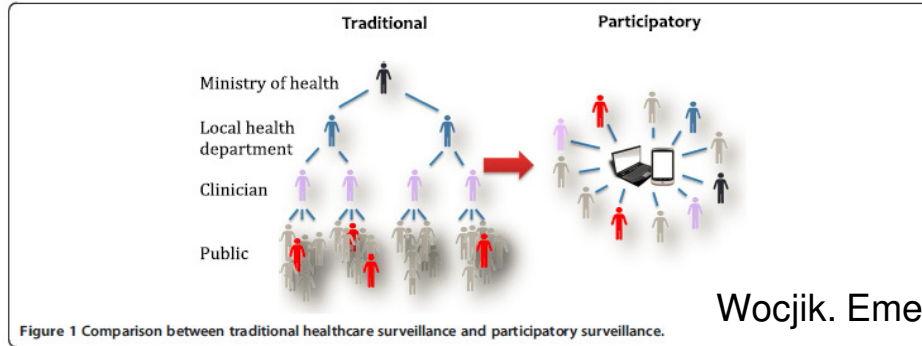


- Twitter feeds can identify influenza season accurately and earlier
- Twitter identified Haiti cholera outbreak 2wks earlier and German *E. coli* outbreak 1d earlier
- Twitter shows potential for pharmacovigilance
- Facebook showed self-reported alcohol use and sexual references correlated with official data





# Participatory surveillance



Wocjik. Emerg Them Epi. 2014

www.flunearyou.org

## How it works

Thousands of individuals submit weekly health reports to benefit their community. It's the power of the crowd!

**Did you know?**

- CDC estimates of flu-associated yearly deaths in the United States range from a low of about 3,000 to a high of about 49,000 people.
- If you have the flu, you can infect others 1 day before showing symptoms and up to 7 days after becoming sick.
- The single best way to prevent the flu is to get a flu vaccine each season.

Take just a few seconds to report how you've been feeling. It's free and anonymous

Thousands of reporters across the country also contribute weekly

## Who we are

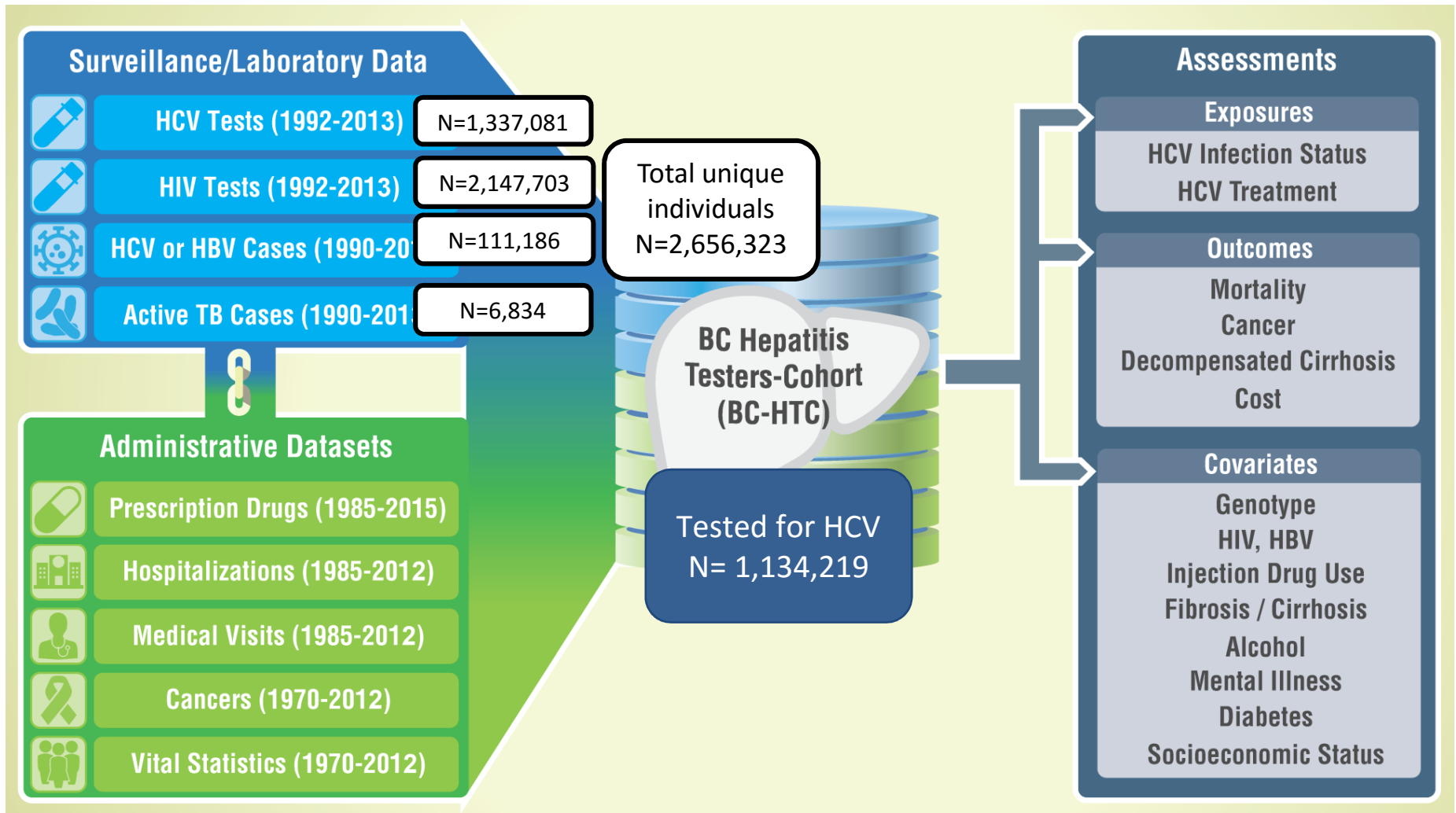
Category	Count	Percentage
Flu-Like Symptoms	9	8%
Any symptoms	33	29%
No Symptoms	81	71%

114 reports this week

# New analysis methods

- Ability to manage big data
- Linkage of longitudinal data
- Integration of disparate data

# BC Hepatitis Testers Cohort



Source: N Janjua, BCCDC, 2016

# New dissemination mechanisms

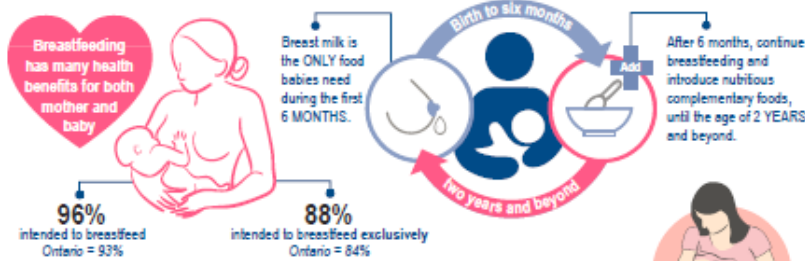
- Visuals
  - Visualisations
  - Infographics
- Personalised
  - Interactive
  - Self-serve
  - Social media and mobile friendly

# Infographics

## Facts on Infant Feeding in Ottawa

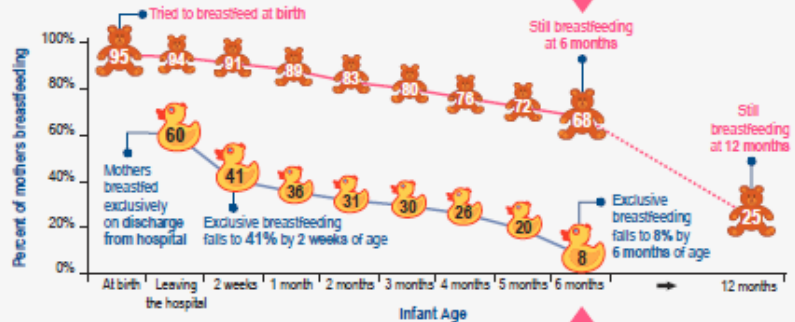


Facts on Infant Feeding in Ottawa outlines what Ottawa mothers report on how they feed their infant from birth to one year. It also provides information about Ottawa Public Health (OPH) services and community resources for parents.



### Breastfeeding by infant age, Ottawa 2014

Higher household income = More likely to TRY to breastfeed (first-time mothers)	• Breastfed another child • Full-term birth • Born outside Canada • Younger (20-29 years) • Income (>\$30K)	More likely to TRY to breastfeed (multiparous mothers)	• Not feeding formula in-hospital • Waiting until 6 months to introduce solids • Higher education • English or other mother tongue language	More likely to breastfeed at 6 months (first-time mothers)
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ANY breastfeeding (represented by a bear icon)

EXCLUSIVE breastfeeding (represented by a duck icon)

• Higher education = More likely to breastfeed exclusively at 6 months (first-time mothers)

• Vaginal birth

Ottawa Public Health.ca  
Santé Publique Ottawa.ca

613-580-6744  
TTY/ATS : 613-580-9656



# MEASURING POSITIVE MENTAL HEALTH IN CANADA

POSITIVE MENTAL HEALTH IN ADULTS CAN BE MEASURED THROUGH THESE FIVE INDICATORS

High self-rated mental health <b>65%</b>	Happy <b>82%</b>	Satisfied with life <b>82%</b>	High psychological well-being <b>70%</b>	High social well-being Coming soon (summer 2015)
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Source: CCHS Mental Health, 2012, based on Canadian self-reported data

MANY FACTORS CONTRIBUTE TO POSITIVE MENTAL HEALTH, FROM THE INDIVIDUAL TO SOCIETY

**WHAT IS POSITIVE MENTAL HEALTH?**

It is a state of well-being that allows us to "feel, think, and act in ways that enhance our ability to enjoy life and deal with the challenges we face."

Source: Public Health Agency of Canada

**INDIVIDUAL**

Individual behaviours and experiences are associated with positive mental health.

**54%** of Canadian adults are physically active (CCHS, 2012)

**85%** adults drink according to the low risk alcohol drinking guidelines (CCHS, 2012)

**FAMILY**

Healthy family relationships provide an important foundation for positive mental health.

**40%** of adults have a family member with drug, alcohol, emotional, or mental health problems (CCHS Mental Health, 2012)

**70%** of adults live with a spouse or partner (CCHS Mental Health, 2012)

**COMMUNITY**

Positive mental health is supported by strong ties to the community.

**64%** of adults are a member of at least one community organization (CCHS, 2012)

**87%** of adults believe their neighbourhood is a place where neighbours help each other (CCHS, 2012)

**SOCIETY**

At the societal level, factors such as discrimination and stigma are related to lower positive mental health.

This infographic is the first in a series of knowledge products responding to the need for better data on positive mental health, as identified in Canada's first national mental health strategy, "Changing Directions, Changing Lives" developed by the Mental Health Commission of Canada.

The Public Health Agency of Canada is working with the Mental Health Commission of Canada and other key experts to identify, organize, and present data on positive mental health outcomes, and protective and risk factors. This infographic provides some examples of these data.

# Interactive platforms

The screenshot shows the NYC Environment & Health Data Portal. The header includes the NYC Health logo and navigation links. The main content area features a title 'Environment & Health Data Portal' with a subtitle 'A tool for exploring environmental and health data from New York City'. Below this are three icons: 'Epi Query', 'Asthma Infographic', and 'Resources for Teachers'. A section titled 'click one of the following options' contains four large buttons: 'Explore Environment Data', 'Explore Health, Behavior & Population Data', 'Customize a Dataset & Download Data', and 'Download Neighborhood Report'. At the bottom, there are 'LINKS' and 'MORE LINKS' sections with dropdown menus.

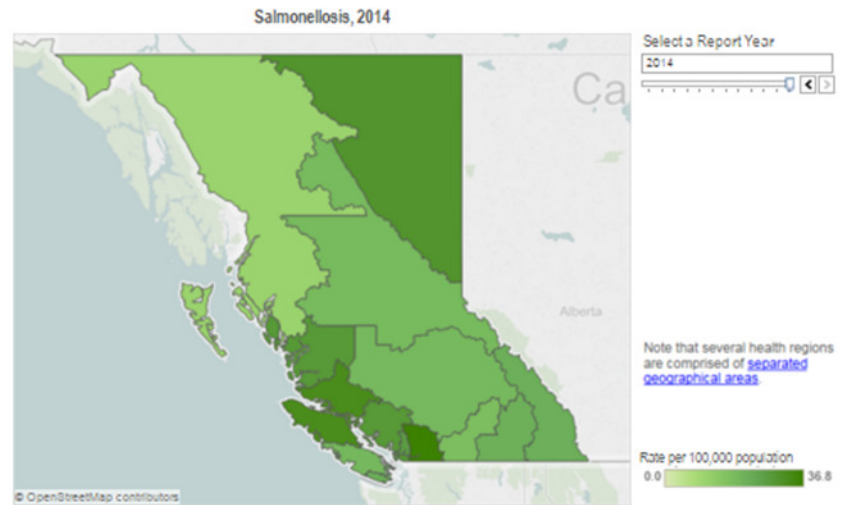
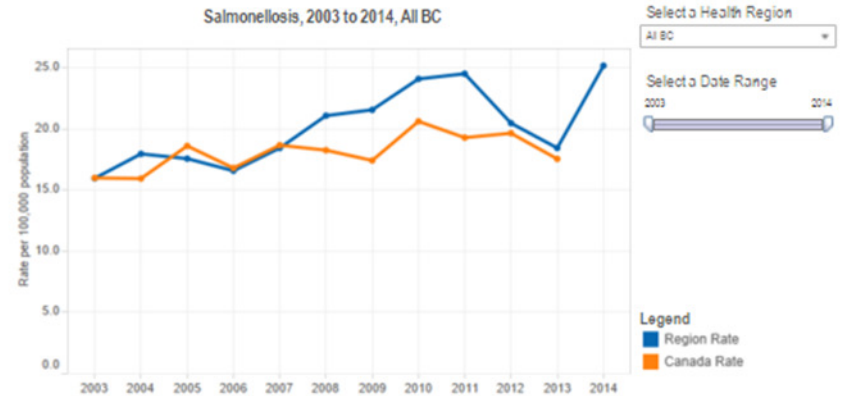
## Reportable Disease Dashboard

This interactive tool provides summary statistics on a variety of reportable diseases and conditions in BC.

Select from the drop down menus on the right to change diseases and display options. Click on the tabs to view different arrangements of the data.

Geography Age/Sex Tables Summary Download Data

The charts below show an overview of the selected disease and its geographic distribution. Choose a different disease, health region, or years from the menus on the right.



### Quick links

Annual reports

How to save charts

Send us Feedback

# Self-serve data

The image shows two overlapping web interfaces. The background interface is the 'Environment & Health Data Portal' from NYC Health, featuring a map of New York City neighborhoods and a 'Choose Report' dropdown menu with options like 'Community Health Profiles', 'Housing and Health', 'Outdoor Air and Health', 'Climate and Health', and 'Asthma and the Environment'. The foreground interface is a CDC 'Email Updates' form, which includes a 'Subscription Type' dropdown menu with 'Email' selected, a text field for '\*Email Address', and 'Submit' and 'Cancel' buttons. A small note at the bottom of the CDC form states: 'Your contact information is used to deliver requested' with a link to 'Privacy Policy'.

# Social-media and mobile friendly

The screenshot shows the CDC's Facebook profile page. At the top, there is a blue header with the Facebook logo and a 'Sign Up' button. Below this, there are several images: a scientist in a lab coat, a family in winter gear, and a group of people with a snowman. A text box says 'CDC is on Facebook. To connect with CDC, sign up for Facebook today.' with 'Sign Up' and 'Log In' buttons. The CDC logo is prominently displayed with the tagline 'CDC 24/7. Saving Lives. Protecting People.™'. Below the logo is a navigation menu with 'Timeline', 'About', 'Comment Policy', 'Vital Signs', and 'More'. The main content area features the 'Vital Signs' logo and a silhouette of a human body. Text reads: 'Highlighting important public health issues by focusing on recent data and calls to action for a variety of audiences.' Below this is a list of topics: Adult Smoking, Prescription Painkiller Overdose, Asthma, HIV Testing, Teen Pregnancy Prevention, Food Safety, and Drinking and Driving. At the bottom right, there is a 'Vital Signs' logo and the text 'Learn about the latest public health data.'

The screenshot shows a mobile phone displaying the ELUVIEW CDC website. The phone's status bar at the top shows 'Carrier', signal strength, '10:54 PM', and battery level. The website header includes 'ELUVIEW' and the CDC logo. Below the header is a color-coded legend for 'Age' categories: 'Age', 'Middle', 'You', 'Older', and 'Influenza-like illness'. A map of the United States is shown with green shading. Text below the map reads: 'Influenza-Like Illness Activity Levels 2010-11 Influenza Season Week 19 Ending May 14, 2011'. At the bottom, there are navigation options: 'Week: Current Last Before last', 'Details: ON', 'Disclaimer', and 'Download'.





## Discussion

- Internet and social media generate alerts which still require human assessment, interpretation and validation
- EMRs show promise for non-infectious diseases but require better data quality
- Accessible, big, integrated data allow surveillance and discovery to co-occur
- Outputs determined by users rather than producers of data

# Conclusion

*Our greatest hopes could become reality in the future with the technology at our disposal. The possibilities are unbounded. All we need to do is make sure we keep talking.*

*—Stephen Hawking*



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An agency of the Provincial Health Services Authority

# Questions?