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# **NCCPH Small Drinking Water Systems Project**

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Margaret Fast, Donna Ciliska, Francois Benoit, Hope  
Beanlands**

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# Outline

- **Overview of National Collaborating Centres**
- **NCCEH Retrospective Surveillance Project**
- **NCCPH project on small drinking water systems**
- **Questions**



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# National Collaborating Centres for Public Health (NCCPH)

- **Federal government is committed to strengthening public health across Canada**
- **Created 6 NCCs (collectively NCCPH)**

## **Objective:**

**Make research and evidence-based practice in public health more relevant and understandable for individuals and organizations**



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# Who are we?

## National Collaborating Centres

**Aboriginal Health** (University of Northern BC, Prince George, BC)

**Determinants of Health** (St. Francis Xavier University, Antigonish, NS)

**Environmental Health** (BC Centre for Disease Control, Vancouver, BC)

**Healthy Public Policy** (Institut national de santé publique du Québec, Montréal, QC)

**Infectious Disease** (International Centre for Infectious Diseases, Winnipeg, MB)

**Methods and Tools** (McMaster University, Hamilton, ON)



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# NCC Leads

- **NCCAHA – Margo Greenwood**
- **NCCDH – Hope Beanlands, MN, MPA, PhD(c), RN**
- **NCCEH – Tom Kosatsky, MD, MPH**
- **NCCHPP – François Benoit, MSc**
- **NCCID – Margaret Fast, MD**
- **NCCMT – Donna Ciliska, RN, PhD**



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# Goal of all NCCs

- **Synthesize, translate, and exchange evidence-based knowledge to support front-line public health practitioners and policy-makers in Canada**
- **Identify gaps** in the use of evidence in public health practice and policy making
- **Strengthen national profile** with significant contacts and networking across Canada
- **Consult with front-line public health practitioners to identify promising practices, policy options and research gaps**



<http://users.rsise.anu.edu.au/~sandun/goal.jpg>



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# Retrospective Investigation of Drinking Water-related Illnesses in Canada 1993-2008



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# Background

- **Environmental scan in 2005-6**
- **Drinking water was the highest priority for the majority of interviewees**
- **Warranted a major project in this area**



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# Background

- **Lack of systematic information on characteristics & causes of waterborne disease**
- **Outbreaks of waterborne disease (WBE) provide a window into sources, health impacts, contributing factors to waterborne illness**
- **No national surveillance system in Canada for waterborne disease outbreaks; approaches to collection of information on outbreaks are not standardized**
- **Information collected is often not published, distributed, often incomplete**



<http://www.911water.com/v/vsfiles/photos/bs-bacteria.jpg>



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# Background (cont.)

- **Investigation was undertaken in order to obtain detailed and standardized Information on past WBE's, 1993 - 2008**
- **In-depth interviews of relevant front-line environmental health professionals**
- **Collaborative user oriented project could lead to more uptake of evidence in policy and practice**



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# Objectives

- (i) Characteristics of WBE's**
- (ii) Water source characteristics pre- and post-WBE**
- (iii) Water treatment and distribution pre- and post-WBE**
- (iv) Demographic info & health outcomes for WBE's**



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# Objectives (cont.)

- (i) Contributing factors & outbreak control for WBE's**
- (ii) Prevention programs or policies stemming from the WBE**
- (iii) Programs in place to detect or prevent WBE's**
- (iv) Information needs with respect to WBE's**



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# DCI – Data Collection Instrument

- **Event date**
- **Event location**
- **Water source description**
- **Water treatment description**
- **Water system classification**
- **Watershed type and status**
- **Nature of water distribution system**
- **Microbiologic agents identified**
- **Water quality parameters**
- **Number of confirmed cases**
- **Hospitalizations**
- **Other clinical syndromes identified**
- **Deaths**
- **Age distribution**
- **Gender distribution**
- **Strength of evidence of waterborne source of outbreak**
- **Actions following event**
- **Investigation methods**
- **Resulting policy changes**
- **Gaps and needs in outbreak prevention and control identified**
- **Advocacy approaches used**
- **Nature of desired knowledge translation tools**



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# Results

- **Contacted all RHA's in:**  
**AB ON SK NF QC**
- **Directed to select contacts**  
**BC MB**
- **Single contact covered entire province or Territory**  
**NS NB PEI YK NWT NU**



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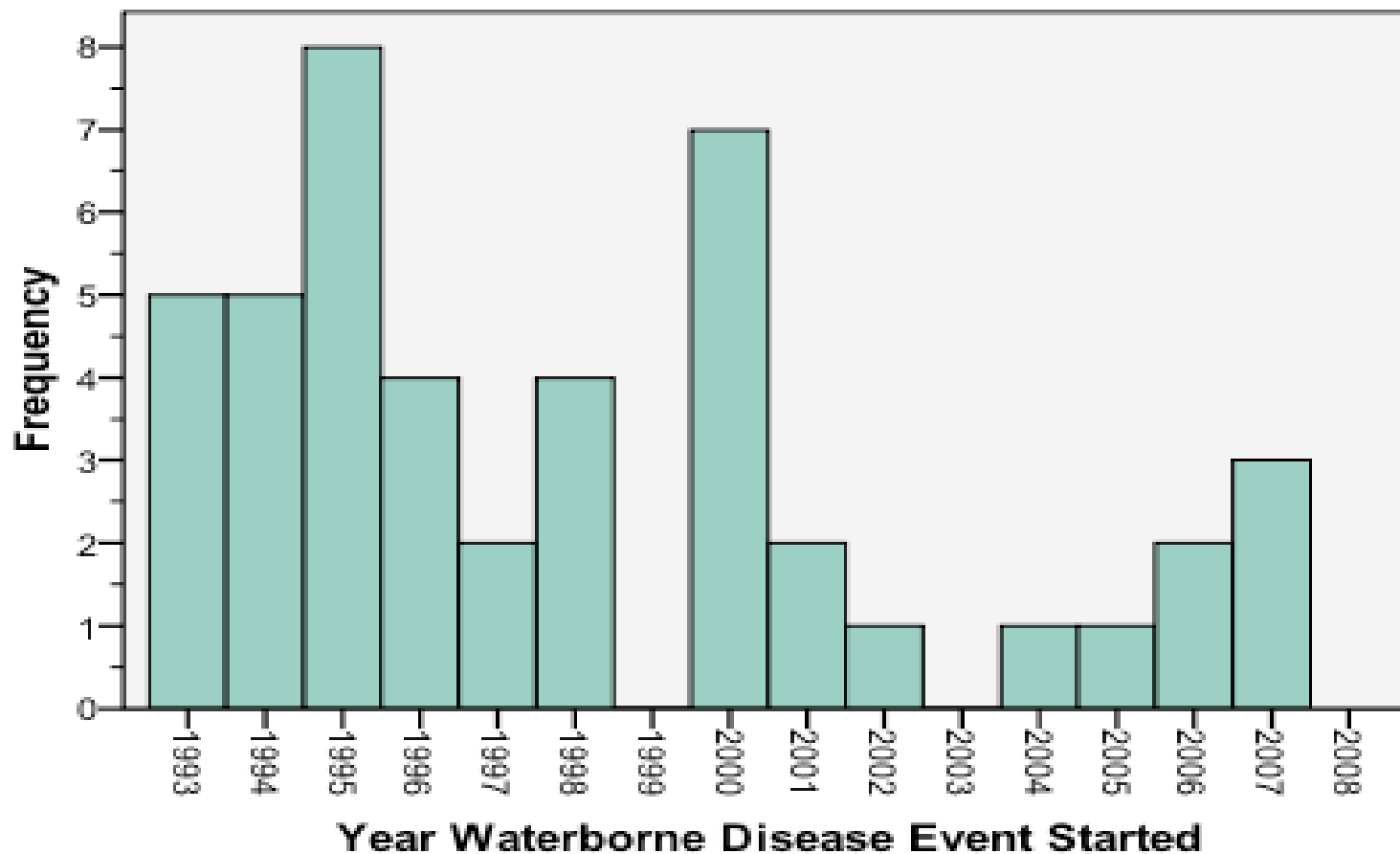
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# Compliance

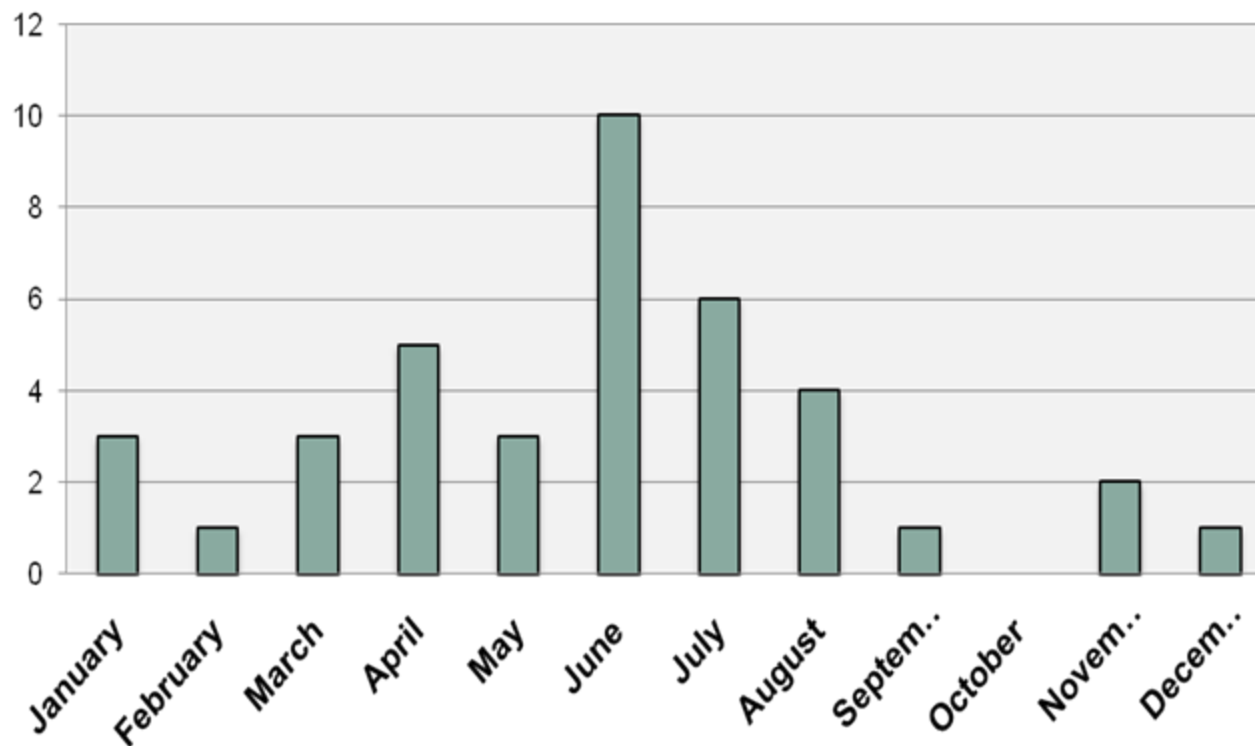
Provinces	Successful Contacts	Attempted Contacts	Success (%)
Alberta	9	9	100.0%
British Columbia	13	14	92.9%
Manitoba	2	3	66.7%
New Brunswick	0	1	0.0%
Newfoundland	4	4	100.0%
Northwest Territories	1	1	100.0%
Nova Scotia	1	1	100.0%
Nunavut	1	1	100.0%
Ontario	22	36	61.1%
Prince Edward Island	1	1	100.0%
Quebec	8	17	47.1%
Saskatchewan	8	11	72.7%
Yukon	1	1	100.0%
<b>TOTAL</b>	<b>71</b>	<b>100</b>	<b>71.0%</b>

# Temporal characteristics of WDEs





# Temporal characteristics of WDEs



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# Time to identify

- **Median onset to identification 18 days (range 2-120)**
- **Median duration 45 days (range 6-671)**



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# How were WBE identified?

- **Patient 35%**
- **Lab reports 33%**
- **Physician 22%**
- **Complaint line 7%**



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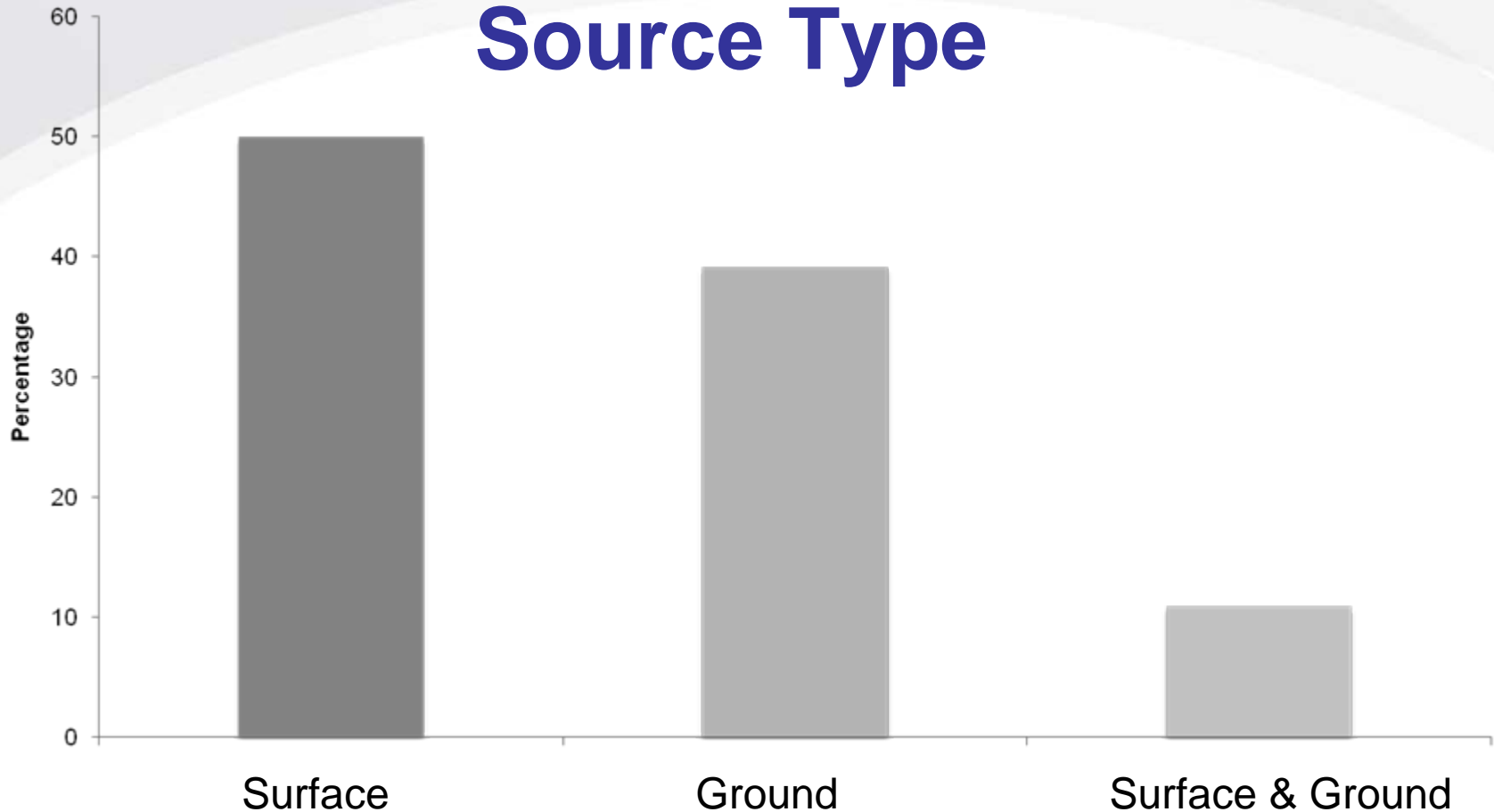
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# Etiologic Agent

WBE Agent	Frequency (%)	
<i>Giardia</i>	10	(21.3)
<i>Cryptosporidium</i>	7	(14.9)
<i>Cryptosporidium &amp; Giardia</i>	2	(4.3)
Toxoplasma	1	(2.1)
<i>Campylobacter</i>	3	(6.4)
<i>E. coli</i>	3	(6.4)
<i>E. coli &amp; Campylobacter</i>	1	(2.1)
<i>Legionella</i>	1	(2.1)
<i>Salmonella</i>	1	(2.1)
<i>S. aureus</i>	1	(2.1)
Total coliform	1	(2.1)
Norovirus	4	(8.5)
Hepatitis A	3	(6.4)
Chemical	2	(4.3)
Not identified	7	(14.9)
<b>Total</b>	<b>47</b>	<b>(100.0)</b>

# Distribution of WBDEs by Water Source Type



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# WBE Agent by Water Source Type

- **Protozoal outbreaks occurred most frequently in association with surface water sources**
- **Bacterial and viral more commonly with ground water**



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# Surface Water Protection

- **84% of surface watersheds were unprotected at the time of the outbreak**



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# Nature of Ground Water Source

- **53% of WBE's involving ground water reported to be under the direct influence of surface water**
- **66.6% of WBE's involving ground water reported a protected well-head**
- **37.5% of WBE's reported a change in integrity of the well or aquifer**



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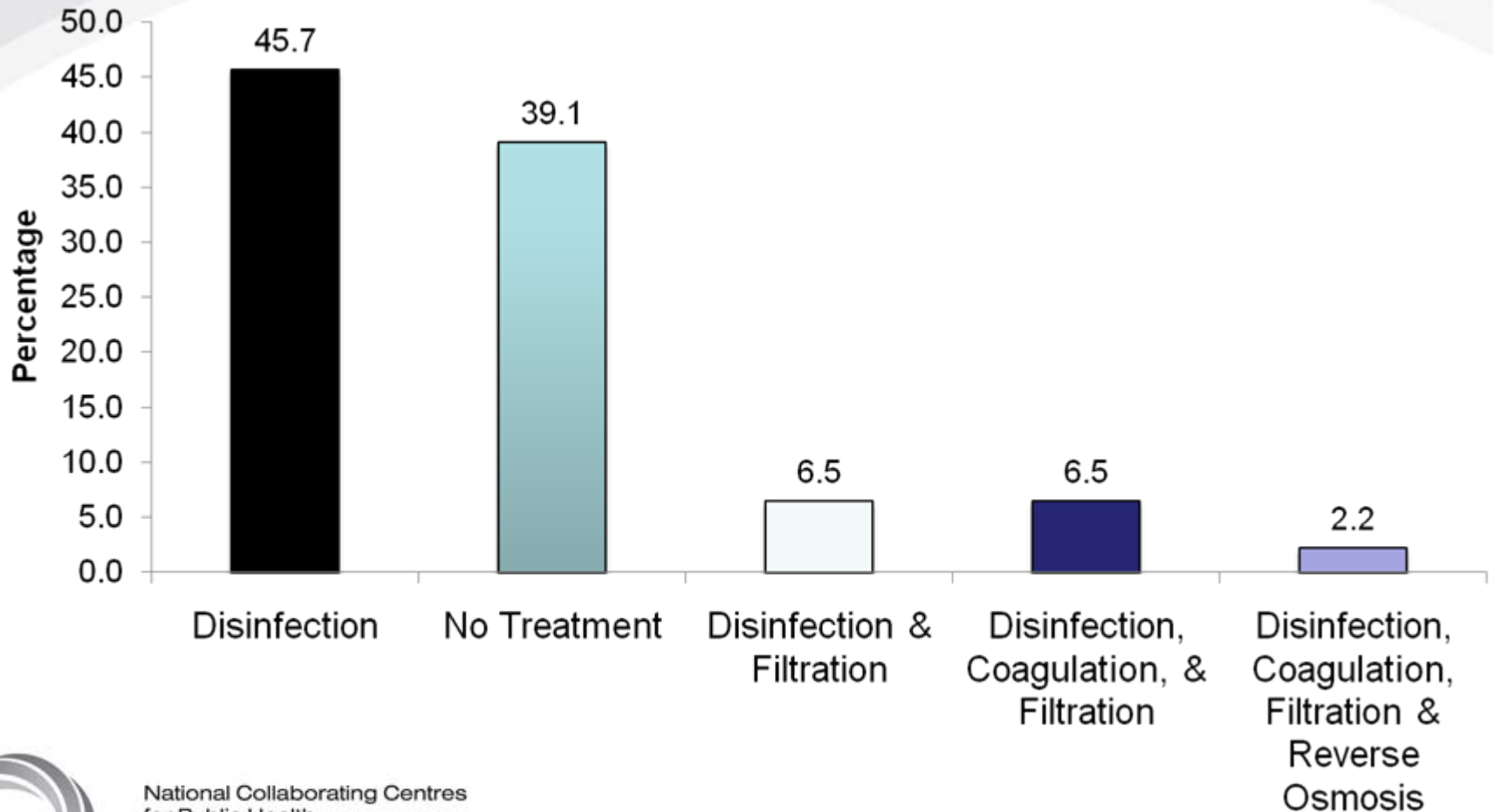
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# Comparison of Water Source During WBE and at Time of Interview

Water Source During WBE	Number (%)	
Surface Water	23	(50.0)
Ground Water	18	(39.1)
Mix of Surface & Ground	5	(10.9)
Total	46	(100)
Water Source at Time of Interview	Number (%)	
Surface Water	16	(34.8)
Ground Water	23	(50.0)
Mix of Surface & Ground	5	(10.9)
Closed Facility	2	(4.3)
Total	46	(100.0)

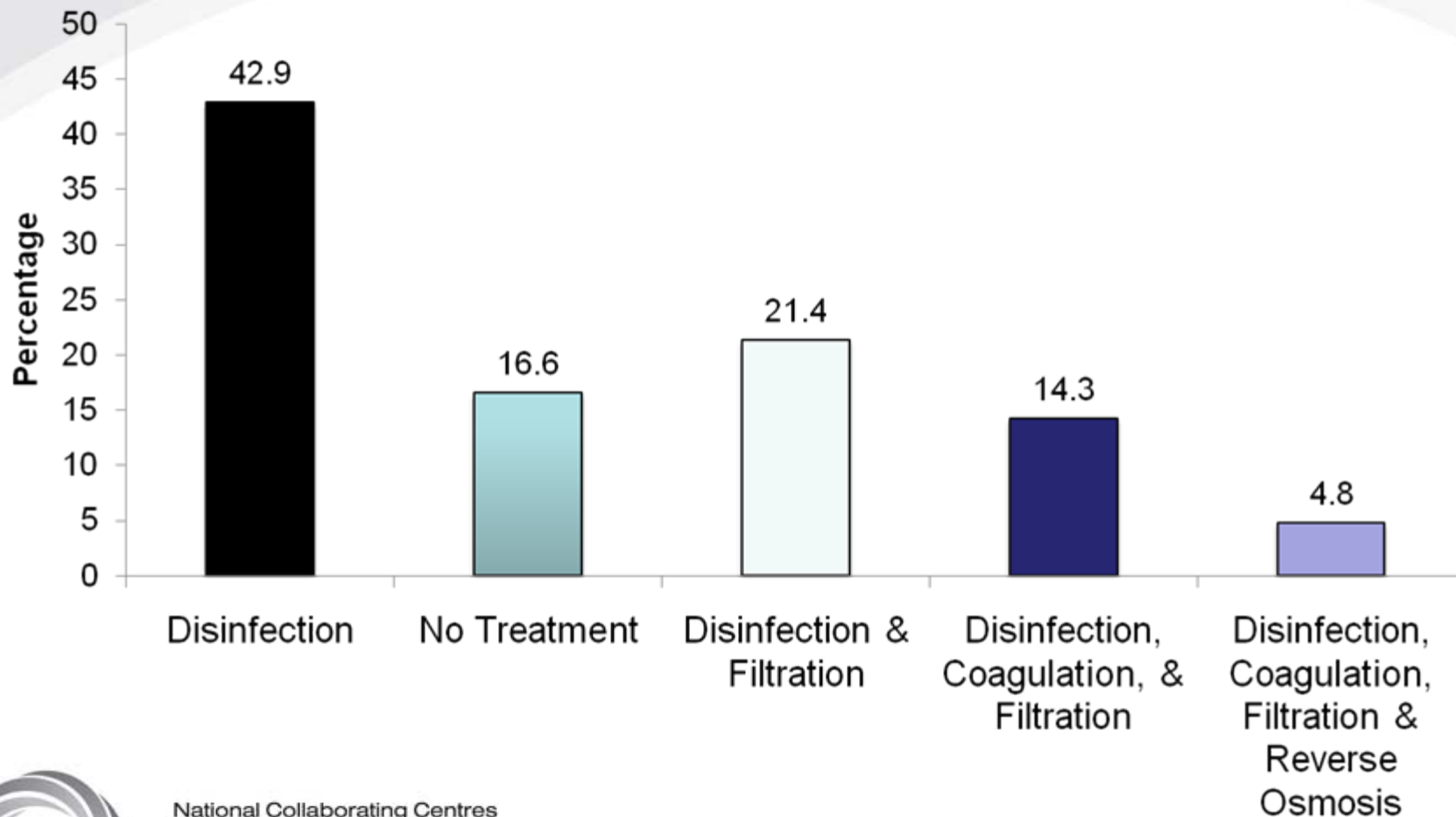
# Water Treatment at Time of WBE



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# Water Treatment at Time of Interview



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# Demographic characteristics of WDEs

	Number of People Served by Water Supply	Number of People Who Became ill	Number of Lab-Confirmed Cases
Mean	26,970	654	41
Median	438	20	13
Minimum	4	0	0
Maximum	390,000	15,000	283
Number of WBE	42	39	37



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# Demographic Information

- ***Giardia* outbreaks**
  - **Affected smaller populated communities (mean 2,213)**
  - **Fewer clinical cases (mean 21)**
- ***Cryptosporidium* outbreaks**
  - **Tended to affect larger communities (mean 138,643)**
  - **Caused more cases (mean 3,173)**






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# Contributing factors in WBE

Contributing Factors		Frequency (%) of response	
Contamination at Water Sources	 <b>Precipitation</b>	14	<b>(31.8)</b>
	Spring thaw / run-off	7	(15.9)
	Flooding	3	(6.8)
	 <b>Lack of source water protection</b>	17	<b>(38.6)</b>
	Animals in the watershed	16	(36.4)
	Other	7	(15.9)
Water Treatment Deficiencies	Treatment failure	7	(15.9)
	 <b>Inadequate treatment</b>	28	<b>(63.6)</b>
	Other	5	(11.4)
Cross Contamination in Water Distribution	Broken pipe(s)	3	(6.8)
	Post-treatment contamination	5	(11.4)
	Cross connection	0	(0.0)
Other	Turbidity	10	(22.7)

# Evidence Implicating Outbreak Waterborne

Type of Evidence	Frequency (%)	
Pathogen Identified in Cases and Water	26	(63.4)
Water Quality Failure	17	(41.5)
Descriptive Epidemiology	17	(41.5)
Water Treatment Problem But No Pathogen Found	4	(9.8)
Analytical Epidemiologic Study	2	(4.9)



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# Prevention of future WDEs

	Actions	Frequency (%)	
→	Upgrade/change treatment system	24	(55.8%)
	Education/study/assessment	12	(27.9%)
→	Changed water source	28	(65.1%)
	Changed/improved policy, reporting, monitoring	13	(30.2%)



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# Effectiveness of actions taken

Effectiveness	Frequency (%)	
Yes	29	(90.6)
No - had BWA since	2	(6.3)
No - had outbreak since	1	(3.1)
Total	32	(100)



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# Policies and Procedures to Prevent WBE

Developed Policies and Procedures	Frequency (%)	
Yes	30	88.2
No	4	11.8
Total	34	100.0



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# Policies and Procedures to Prevent WBE

Policies & procedures developed	Frequency (%)	
Water source	5	(18.5)
Boil water advisory/notice	2	(7.4)
Surveillance	2	(7.4)
→ Inspection/water quality monitoring	7	(25.9)
→ Treatment	11	(40.7)
Response to outbreak	2	(7.4)
Other initiative	5	(18.5)



# Summary

- **About 1/2 of interviews reported WBEs**
- **Trend is a decrease in WBEs over time**
- **Most WBEs began in summer**
- **About 1/2 of WBEs were caused by protozoa**
- **More than 1/2 of WBEs were from areas that used surface water (or mix of surface and ground, or under direct influence of surface)**
- **Viral and bacterial WBEs were more often associated with ground water**



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# Summary Cont'd

- **46% used disinfection only and 39% had no treatment at all**
- **Largest contributing factor was contamination of source water (i.e., precipitation, lack of surface water protection, animals)**
- **Majority of local units took action to prevent WBEs in future**
- **Most indicate the actions were effective**



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# NCCCPH Small Drinking Water Systems Project



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# NCCCPH Collaborative Effort

- **All 6 NCCs are collaborating on a small drinking water systems project this year**
- **Consulted policymakers & practitioners from agencies responsible for small drinking water systems**
  - CIPHI conference (May 2009)**
  - CPHA conference (June 2009)**
  - Toronto forum (June 2009)**
  - Montreal forum (September 2009)**
  - CIPHI conference (November 2009)**



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# Priorities Identified in Consultations

- **Gaps were prioritized within each of these six areas:**
  - **Testing**
  - **Treatment**
  - **Surveillance**
  - **Interventions**
  - **Policy**
  - **Education**



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# Results

- **Coverage testing, technology, and surveillance topics was extensive**
- **Lacking in other areas such as social determinants, Aboriginal health, and policy**



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# Results (pending)

- **Web survey - rank order of priority in each of 6 categories identified by previous consultations (Testing, Treatment, Surveillance, Interventions, Policy, Education)**



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# NCCEH

- **Coordinate project and consultations**
- **Analyze results from our drinking water project for small systems only**
- **Identify who does what in small drinking water systems across Canada**
- **Put together repository of information on small systems**
- **Review on treatment technologies & impact on public health**



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# NCCID

- **Surveillance**

**Examine surveillance data connecting illness to water from the Center for Disease Control and other organizations**

**Compile a list of organisms that cause water-borne illness**

**Investigate the evidence available surrounding informal surveillance (may survey public health actors re their experiences with informal surveillance)**



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# NCCMT

- **Systematic review on effective strategies around communicating boil-water advisories**
- **Effectiveness of home water tests**  
**User's guide to home water testing**



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# NCCAH

- **Identify useful examples of solutions in specific First Nations, Inuit, and Métis communities to improve other systems**



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# NCCHPP

- **Identify how to assess safety of water systems, identify tools such as ethical analysis, deliberative process or governance models**



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# NCCDH

- **Conducting a literature review on safe drinking water and pregnancy, newborns, and children's health**
- **Conducting an analysis of the tools in terms of whether or not they assess access to safe drinking water for infants and children and what information is gathered**



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# Questions for you

- 1. What is currently available on small drinking water systems (i.e., tools, programs, projects)?**
- 2. What are the gaps in policy or practice in small drinking water systems?**
- 3. How should the NCCs proceed with assisting practitioners and policymakers fill the gaps in small drinking water systems?**



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# Contact us

- **E-mail: [contact@ncceh.ca](mailto:contact@ncceh.ca)**
- **Website: [www.nccph.ca](http://www.nccph.ca)**



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