Serological Monitoring of Pathogen Occurrence

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Pathogen Detection in Drinking Water

- Detection of a pathogen in water (e.g. *Cryptosporidium* or *Giardia*) is commonly used by water utilities to monitor source and treated water quality.
- This was the purpose of the Information Collection Rule (ICR).

The ICR – successes and failures

- The ICR documented widespread occurrence of *Giardia* cysts and *Cryptosporidium* oocysts in raw and treated drinking water.
- The problem is ‘So what?’ How has this expensive set of data been used to improve water treatment, water quality or public health?

What went wrong?

- Pathogen detection is unreliable – even in a laboratory setting.
- Detection of something that looks like a pathogen does not mean that people are at risk of infection or disease from ingesting that organism.
- Pathogen detection is expensive

What is the alternative?

- The immune system constantly monitors even minor infections by organisms.
- An immune response will occur even when there is no illness.
- Pathogens in the body will come and go but an immune response is detectable after the infection has been cleared.

Limitations

- An assay is needed that can detect immune responses to the pathogen of interest and not general responses to large classes of organisms.
- For some viruses, general assays may be useful because there are few antigens and less of a chance of misclassification.

Limitations

- For parasites, the organism has a large number of potential antigens.
- Many of these antigens are shared with other organisms.
- Unless one selects antigens that are specific for that pathogen, misclassification can be a major problem.

Detectable NHANES Responses

Site (n)	+17-kDa	+27-kDA
SW1 (107)	50.5%	49.5%
SW2 (502)	45.2%	47.6%
SW3 (186)	72.6%	81.2%
GW1 (51)	47.1%	58.8%
GW2 (503)	26.0%	35.6%
GW3 (120)	39.2%	65.8%

Paired City Studies

Site	15/17-	27-
Albuquerque (GW)	36.3%	50.8%
Las Vegas (SW)	49.8%	55.2%
MW 1 (GW)	25.6%	36.0%
MW 2 (SW)	53.9%	38.8%
MW 3 (GW)	52.4%	72.5%
MW 4 (SW)	72.3%	82.6%

International Studies

• Site	15/17-	27-kDa
• Russia (sw)	67.6%	88.9%
• Italy (sw)	84.0%	69.3%
• Sydney (sw-au)	56.7%	60.6%
• Melbourne(sw-au)	61.5%	65.4%
• Payment (sw-ca)	81.8%	83.1%
• BC (sw-ca)	30.4%	35.6%

Riverbank Filtration

Compared to well water users, users of riverbank filtered water in Hungary more frequently had responses to *Cryptosporidium* antigens.

•But they less frequently had responses than users of surface water that was conventionally filtered.

Serological Response ≥30% of Positive Control – 15/17-kDa

• Water source	pos/N	p=
• Riverbank	16/50	0.02
• Surface filtered	25/54	--
• Deep wells	10/49	0.006

Serological Response ≥30% of Positive Control – 15/17-kDa

Source	Pos/N	p-value
Riverbank	9/50	0.02
Surface filtered	20/54	--
Deep wells	6/49	0.006

So what is next?

- We are conducting one riverbank filtration study in Nebraska under the STAR grant
- We need to replicate the riverbank filtration studies in North America
- We would like to do more international studies – e.g. Europe