Observatoire pour la Recherche sur les Méga-Evènements

OLYMPIC GAMES: State of art
18th & 19th June 2018

PARIS

Round Table: Risk and environment

Microbiological risk associated with swimming in open waters

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Photo: Le Figaro

UPEC

leesu


Triathlon de Paris 2010 (https://www.nageurs.com)

Open waters: lakes, rivers, reservoirs, ocean

$\Rightarrow$ Triathlon

$\Rightarrow$ Marathon swimming

2024 Olympics: Seine River

Open waters: lakes, rivers, reservoirs, ocean

Highly diverse microbial communities
=> Could contain:

- Waterborne pathogens of fecal origin
- Opportunistic pathogens indogenous of aquatic ecosystems

Sanitary risks:

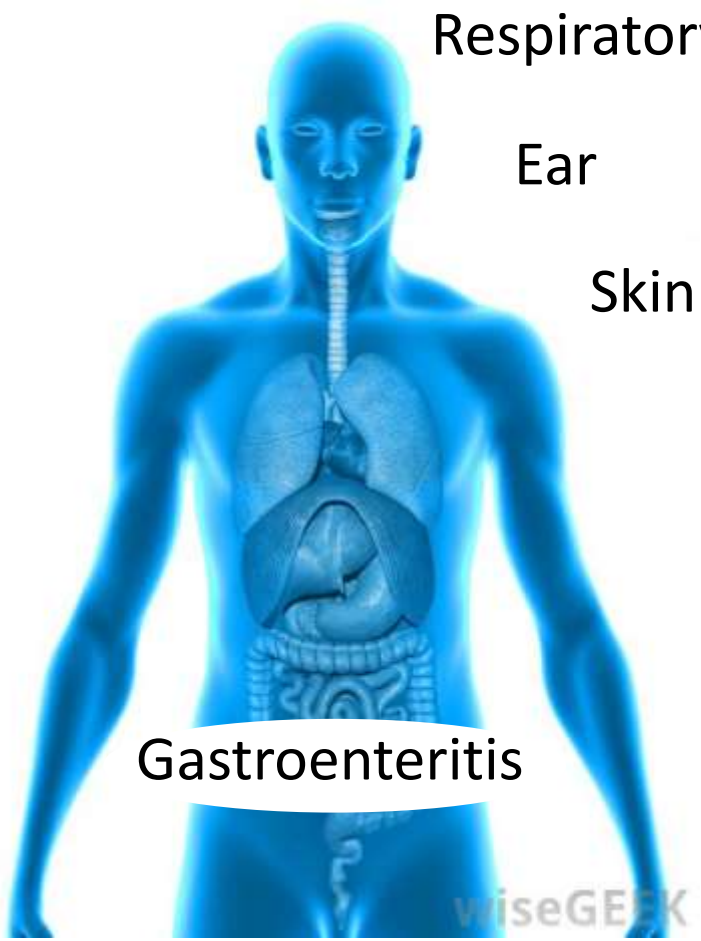
Respiratory infection: Adenovirus, *Aeromonas,* Mycobacteria…

Ear infection: *Pseudomonas aeruginosa*,…

Skin infection: *Staphylococcus aureus*, …

Gastroenteritis: enteric viruses, *Giardia, Cryptosporidium, Campylobacter, Salmonella, Shigella, Vibrio cholerae, Escherichia coli* H7:O157….

Toxine: cyanobacteria, *Dynophyceae*



Routes of infection:

Ingestion:
Submersion of the face
Water spray on the face

75% of triathletes swallow water
10-34 ml swallowed/event

(Medema et al. 1997, Dufour et al. 2006, Schets et al. 2011)

Inhalation: *Water spray on the face*

cuts, grazes, orifices, mucous membranes: *Whole body immersion*

Lower immunological defences

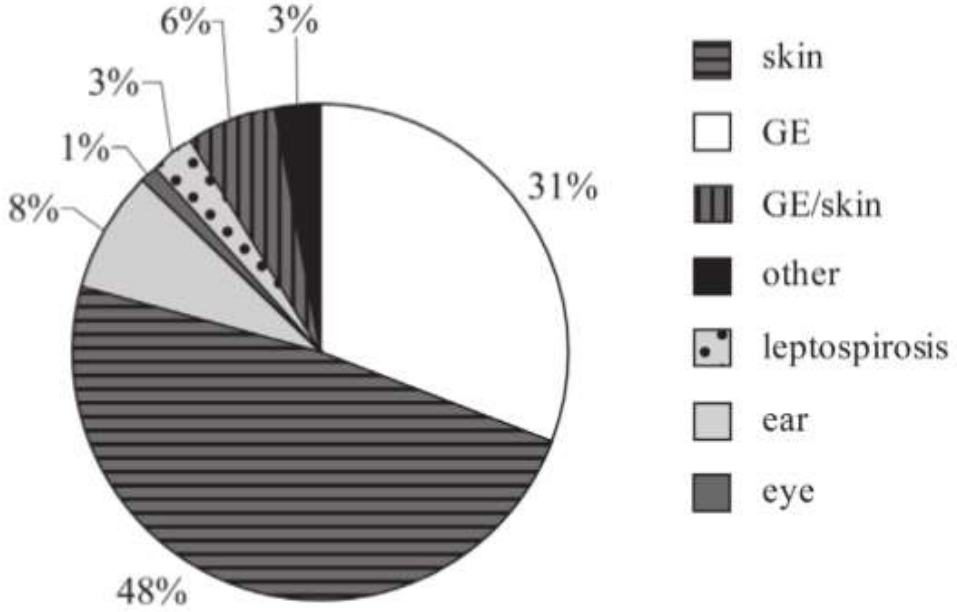
⇒ Intense & prolonged physical activity
⇒ mental stress

(Friman and Wesslen 2000)

Outbreaks associated with swimming in surface water

Netherlands (1991–2007) =>742 outbreaks *(Schets 2011)*

5623 patients



USA (1991-2006) => 138 outbreaks

36-89% gastroenteritis

5-38% neurological conditions (*Naegleria fowleri*)

5-21% skin conditions (schistosomes)

United Kingdom (1992-2003) => 5 outbreaks

Cryptosporidium

Giardia

norovirus

Infective dose : 50% of the exposed population exhibit symptoms

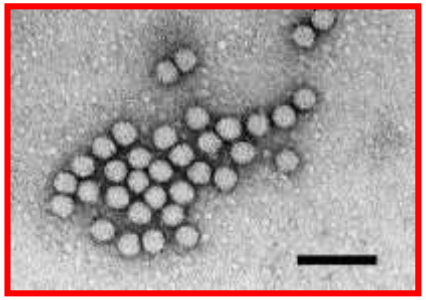
+ exposure : quantity swallowed

=> Calculation of the risk of infection

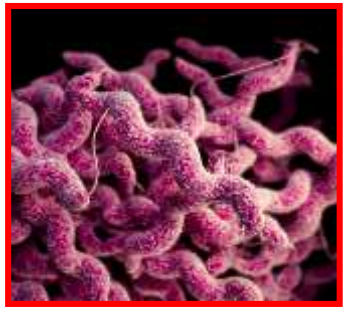
Giardia lamblia: ID_{50}= 34,8

Not available for all the pathogens

Cryptosporidium parvum: ID_{50} = 173,1

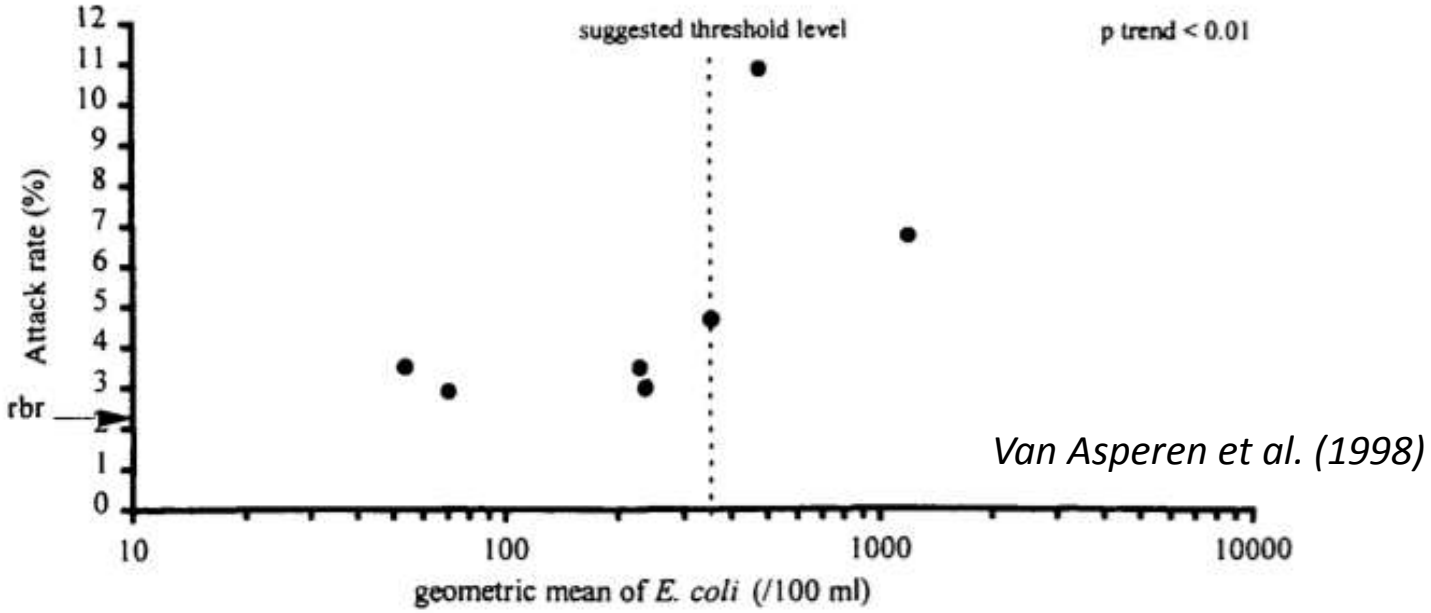


Rotavirus: ID_{50}=6,11



Campylobacter jejuni : ID_{50}= 890

Risk for triathletes to contract gastroenteritis



Van Asperen et al. (1998)

Epidemiological studies *(Pruessen, 1996; Wiedmann et al. 2006)*

=> threshold values for water regulations

=> Fecal indicator bacteria (*Escherichia coli*, intestinal enterococci)

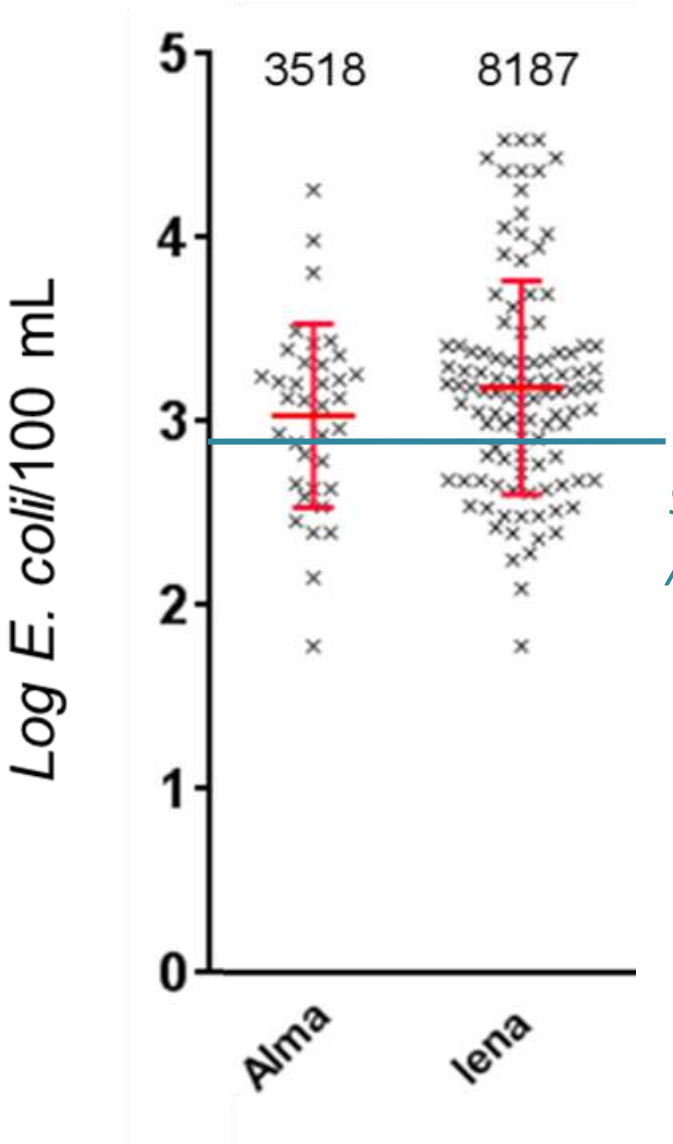
European bathing guidelines for inland waters (2006/7/CE)

Class of quality	Excellent	Good	Sufficient
Intestinal enterococci (N/100 mL)	200[a]	400[a]	330[b]
Escherichia coli (N/100 mL)	500[a]	1000[a]	900[b]

a: based on 95th percentile evaluation

b: based on 90th percentile evaluation

Risk at the potential olympic site:



Monitoring in summers 2016 & 2017

90th Percentiles

Alma : 3518 *E. coli*/100 mL
Iena : 8187 *E. coli*/100 mL

Water quality in the Seine River => insufficient for bathing according to the EU legislation

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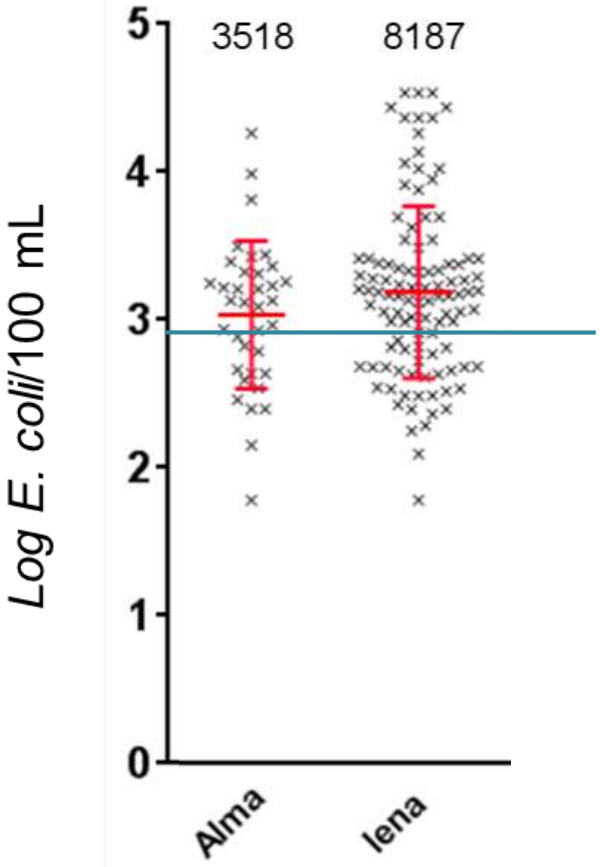
Risk at the potential olympic venue:



Fecal indicator bacteria at the Olympic venue:

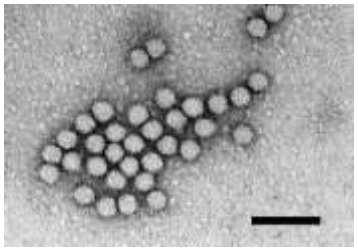
90th Percentiles > 900 *E. coli*/100 mL

>10% of risk to contract a gastroenteritis

>3,8% of risk to contract a respiratory infection

(WHO 2013)

Pathogens upstream the Olympic venue:



Rotavirus

~1000 genome unit/L

~34 ingested> ID_{50}= 6

Giardia sp.

60 cysts/10L

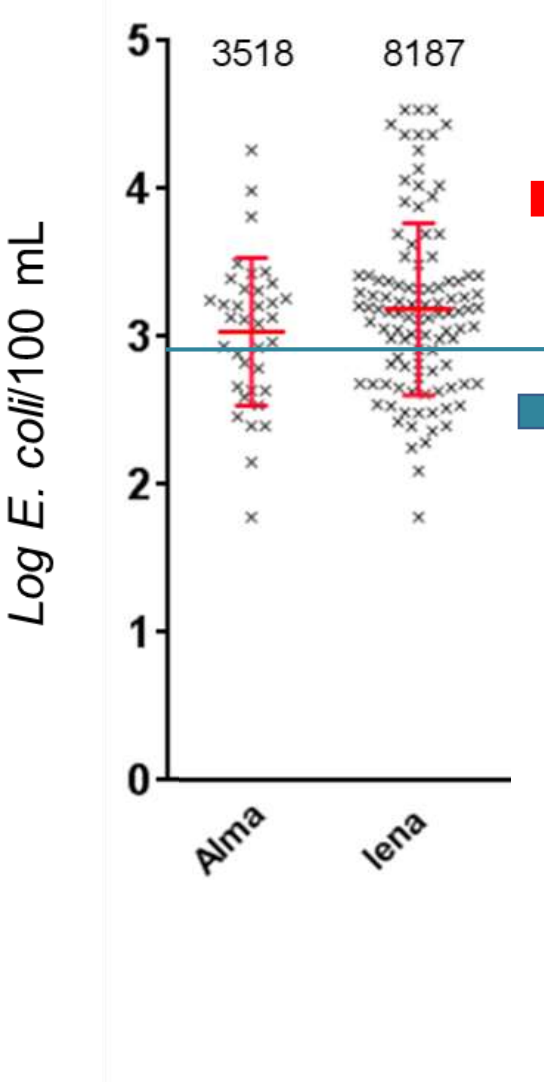
<ID_{50}=35

Cryptosoridium sp.

5 oocysts/10L

< Infective dose

Risk at the potential olympic site:



High concentrations of Fecal indicators

34-44% of the samples < 900 E.coli/100mL

Mitigation strategies to improve the quality
=> Coordinated actions of stakeholders and local authorities in Ile de France

=> Which level of mitigation is enough ?
- modeling
- monitoring

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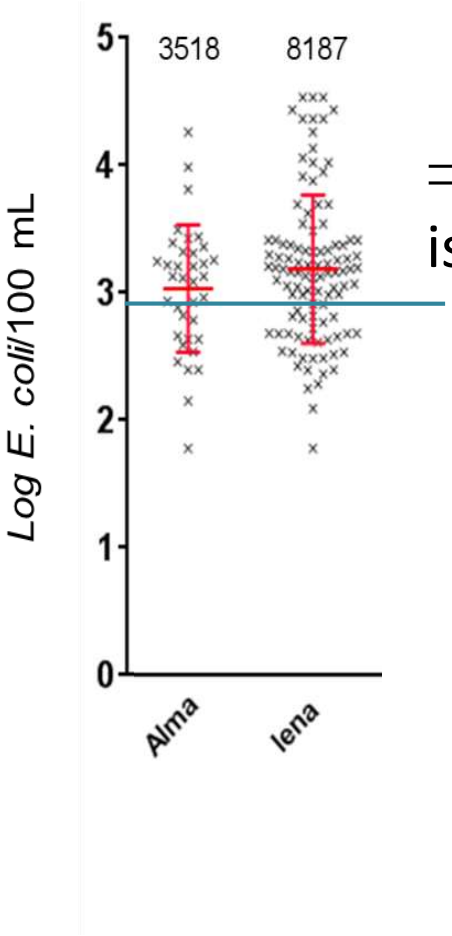
Risk at the potential olympic site:



⇒**Temporal variation**
is it predictible?

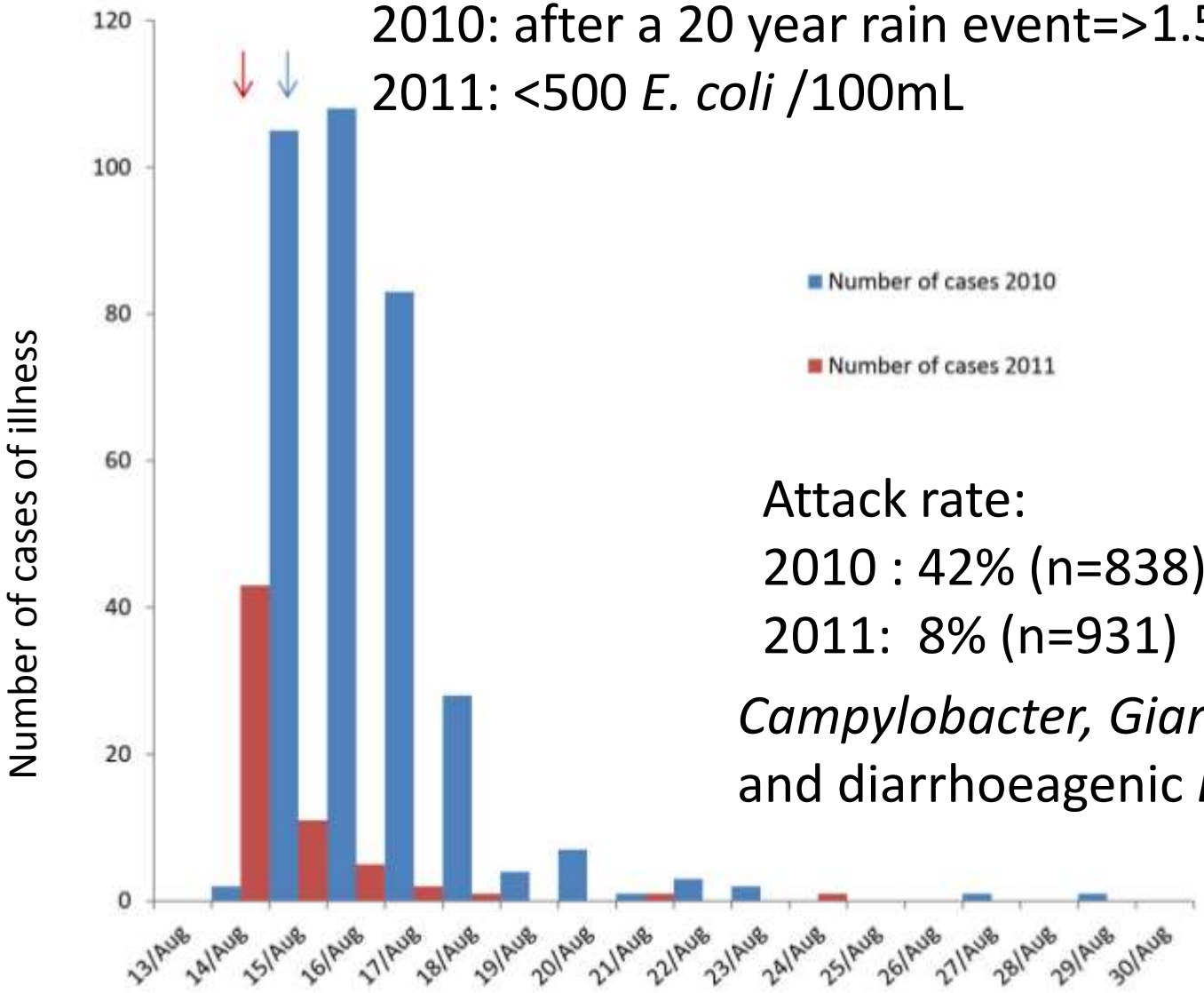
- Rainfalls
- Accidental pollutions

Impact of rain event on the water quality

Triathlon in Copenhagen harbour

2010: after a 20 year rain event=>1.5x10 ^{4} *E. coli*/100 ml

2011: <500 *E. coli* /100mL



Attack rate:

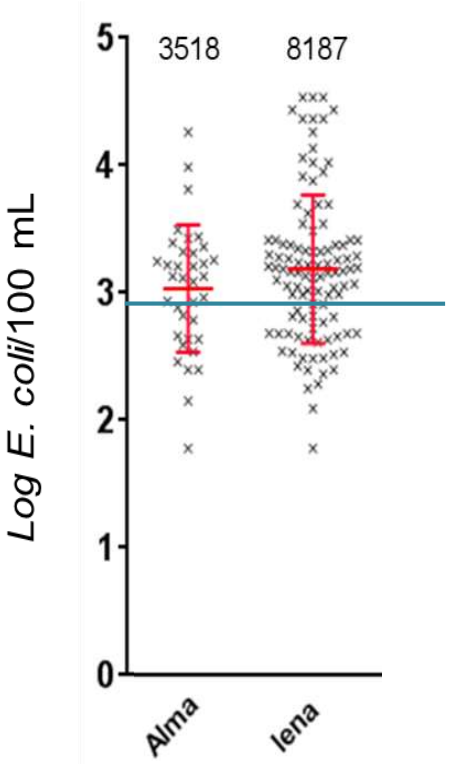
2010 : 42% (n=838)

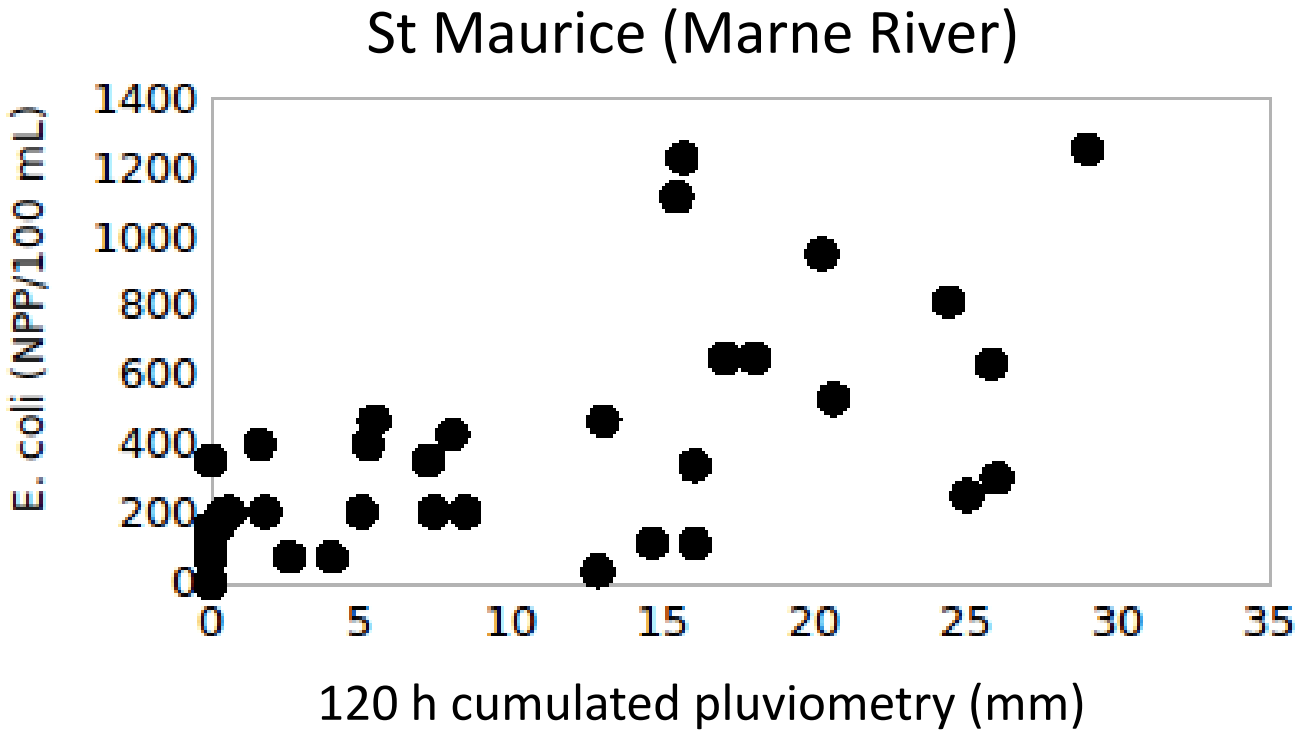
2011: 8% (n=931)

Campylobacter, Giardia lamblia and diarrhoeagenic *E. coli.*

(Harder-Lauridsen et al. 2013)

Risk at the potential olympic site: Rainfalls





How to manage?

EU directive =>No swimming for 3 days after a rain event

Alert system => fine tuning the management of accidental pollution and rainfall?

In situ monitoring of the pollution upstream the Olympic venue?:

- Alert (Fluidion)
- ColiMinder (VWM)

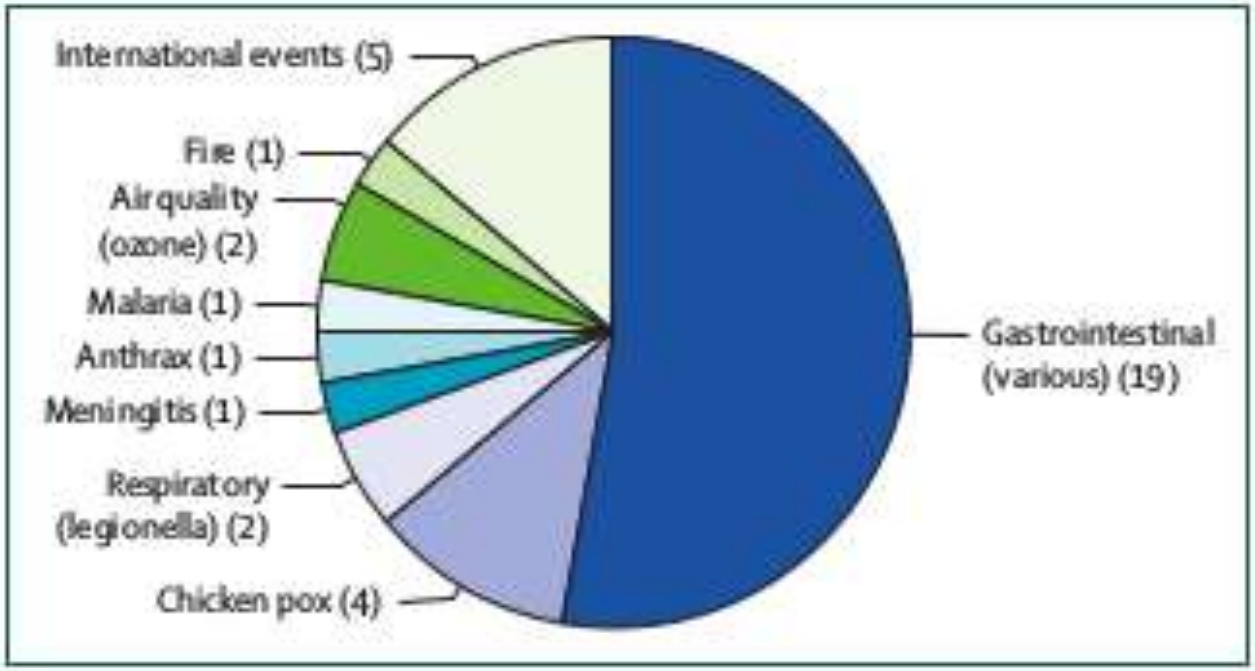
Conclusions :

- today not suitable for swimming according to the EU regulation

  > 10 % of risk to declare gastroenteritis due to enteric viruses

- Strategies to lower the risk:
  - Improvement of the water quality
  - Management of storm events
  - Advices for athletes
    - vaccinations,
    - avoid swallowing water,
    - shower after the competition
    - Clean swimming suits and equipment after the competition

Mass gathering => risk for transmission of infectious diseasis



Infectious diseasis reported to the daily Health Protection Agency during London 2012 Olympics/paralympics

(McCloskey et al. 2014)

Atlanta 1996, Sydney 2000, Beijing 2008:
<1% of health care visits were for infectious diseasis

Athens 2004
6-7% respiratory infections
3-7% gastroenteritis
Salmonellosis, tuberculosis, hepatitis B, meningitis

THANKS FOR YOUR ATTENTION

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“Qualité de l’eau et baignade”