Waterborne disease & Water Surveillance

Surface water swimming surveillance

24/07/2024

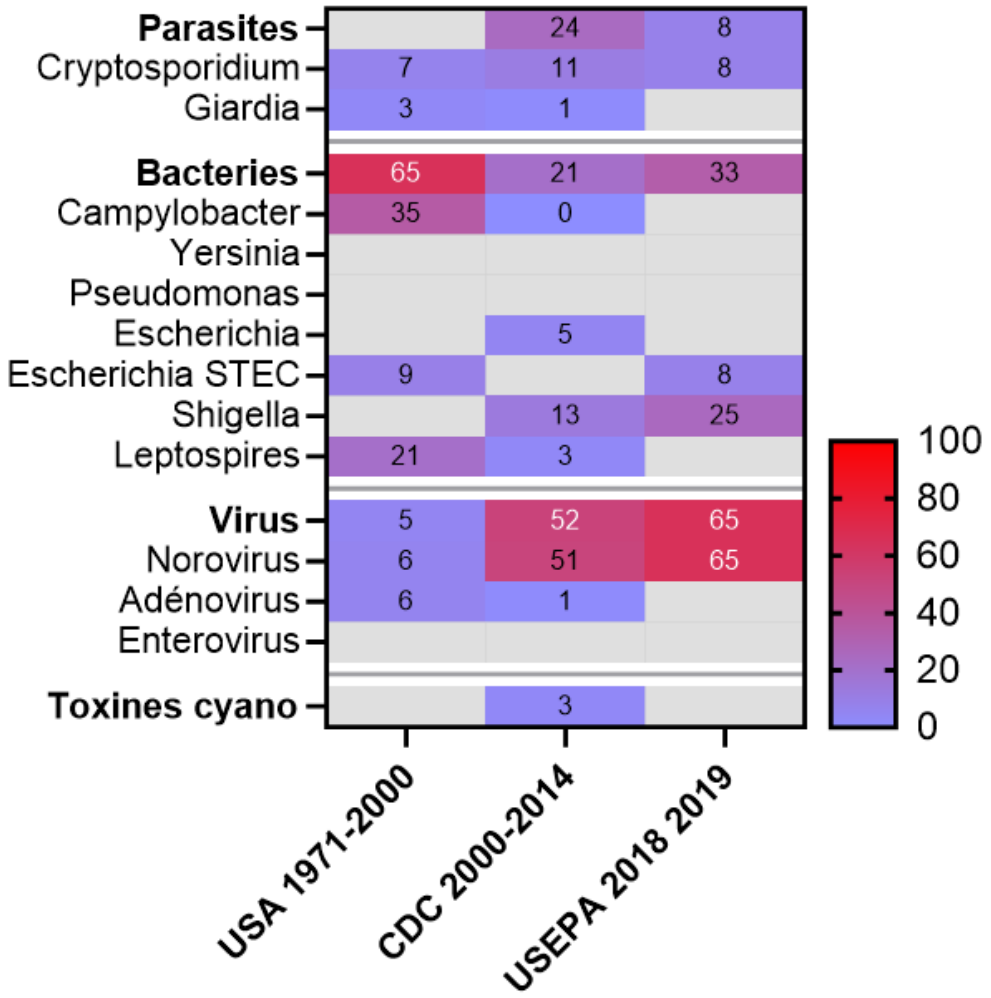
Bathing Health issues

The health risks associated with swimming are caused by many microorganisms (viruses, parasites, bacteria)

	Virus	Bactéries	Parasites
Diamètre (µm)	0.01-0.1	0.5-2	1-100
Hôtes	Homme	Homme / animal	Homme/ animal
Dose infectieuse 50%	6.6-18 particules[a]	$10\text{-}10^{6}$ cellules[b]	$10\text{-}10^{3}$ (oo)cystes[c]
Densité.g^{-1} sec de féces	$10^{5}\text{-}10^{11}$ particules	$10^{11}\text{-}5.10^{11}$ cellules	$4.10^{3}\text{-}2.10^{6}$ cystes[d]
Forme de Résistance	Virion	Spores / dormance	(oo)cystes
Décroissance k ($jours^{-1}$)	0.01-1.76[e]	0.02-133.35[f]	0.00-0.15[g]
Principaux pathogènes d'origine hydrique	Norovirus GI et GII Adénovirus F Rotavirus Entérovirus Hépatite A et E Astrovirus Sapovirus ...	*Campylobacter jejuni* *E. coli* O157:H7 *Vibrio cholerae* *Salmonella, Shigella* *Legionella pneumophila* *Pseudomonas aeruginosa* *Aeromonas hydrophila* *Leptospira ….* *+ toxines de Cyanobactéries*	*Giardia lamblia* *Cryptosporidium parvum* *Entamoeba histolitica* *Naegleria fowlieri* *Cyclospora*

Health issues

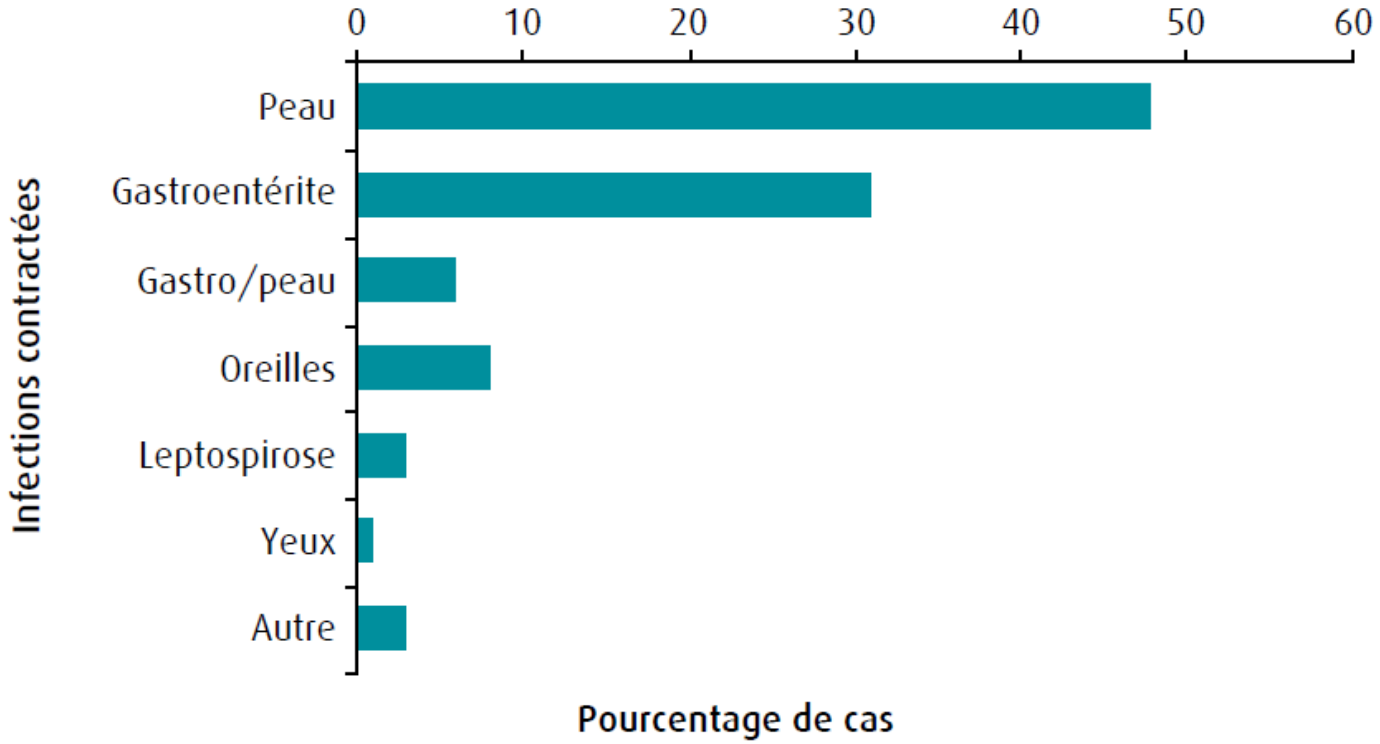
Outbreaks linked to swimming in natural water (in %, n= 2800 - 3200 cases)



A high proportion linked to viruses (norovirus)
A probable method effect.

Health issues

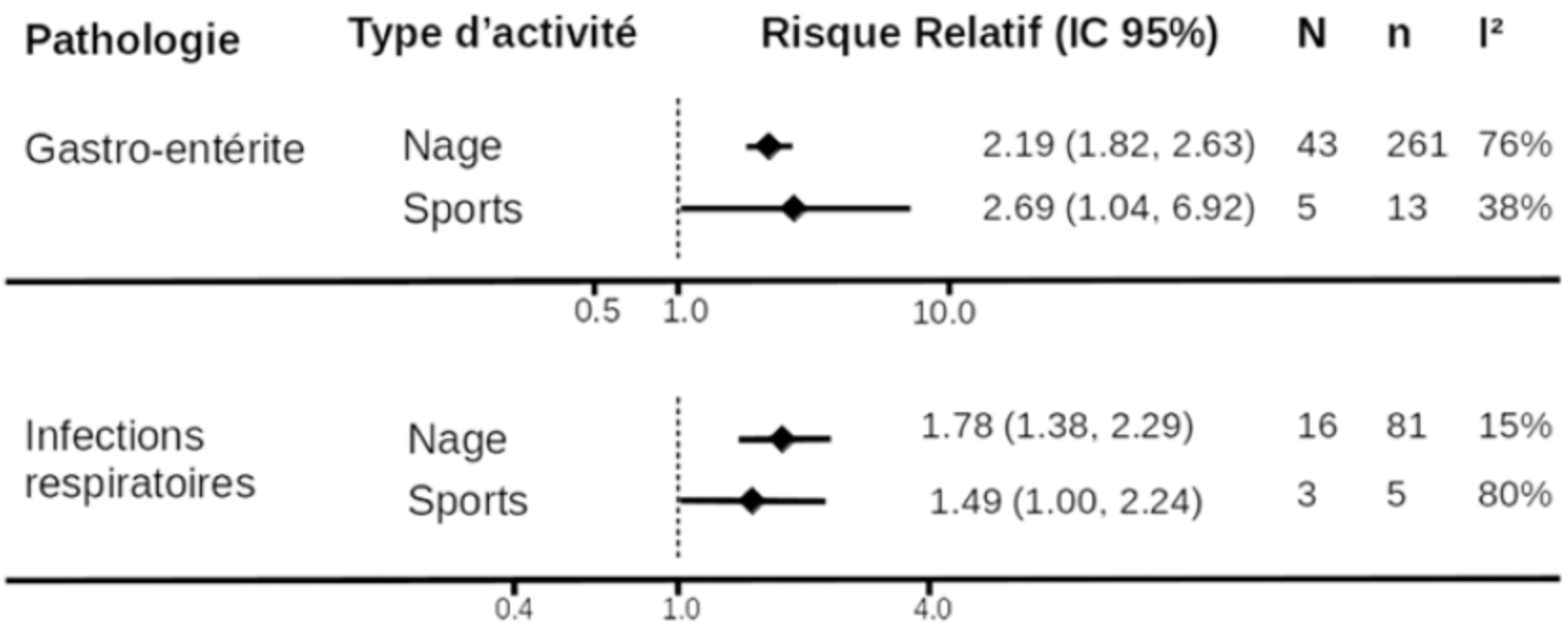
Health effects (Schets, Netherlands, 2007 and 2009, survey)



Gastroenteritis is more important in meta-analyses (Russo et al).

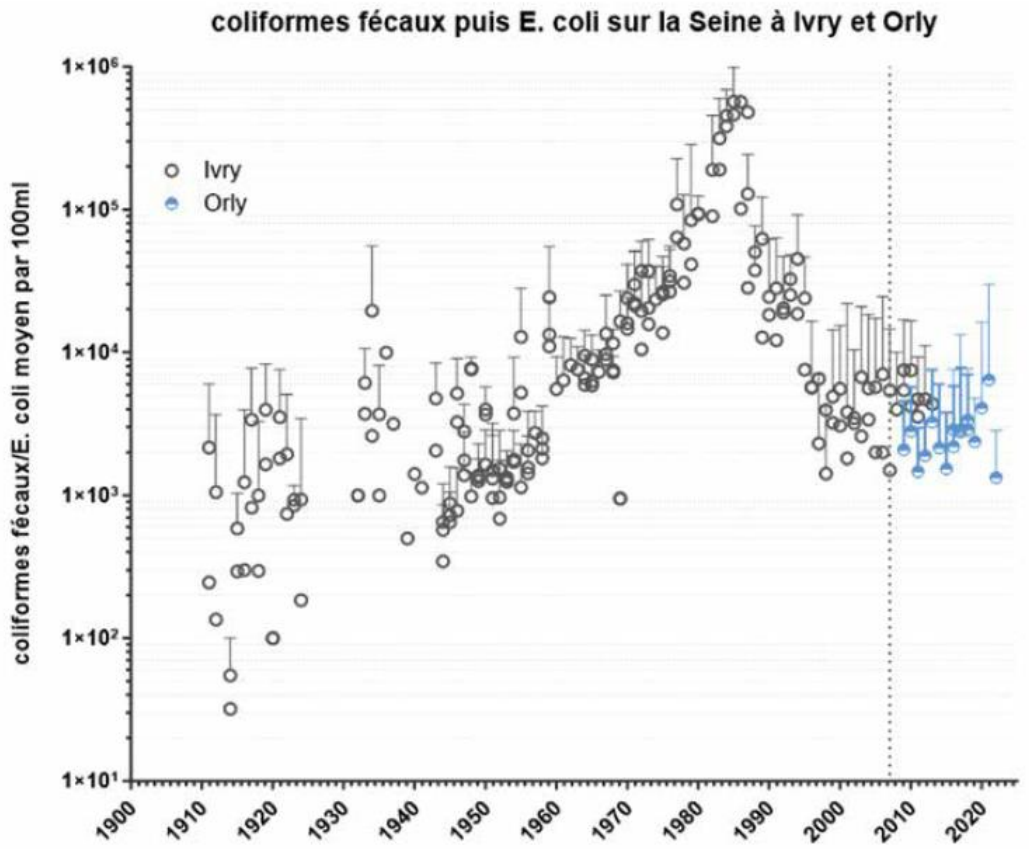
Health issues

Risk Factors (meta-analysis by Russo *et al*)



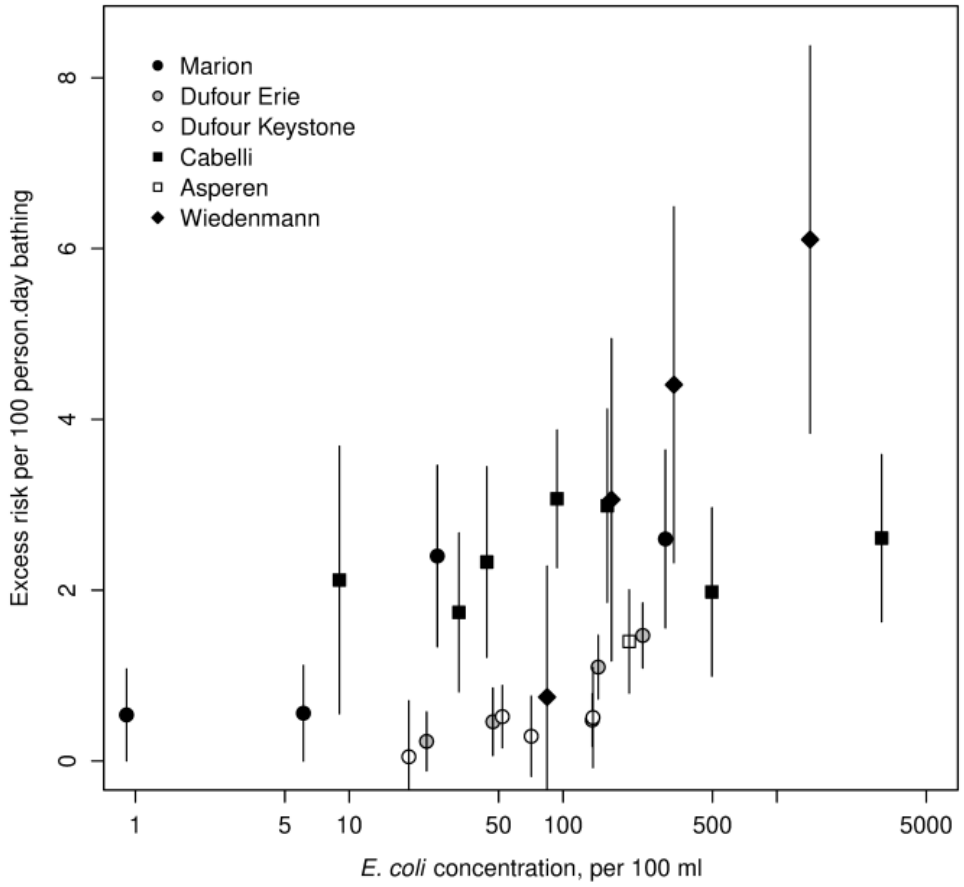
Health issues

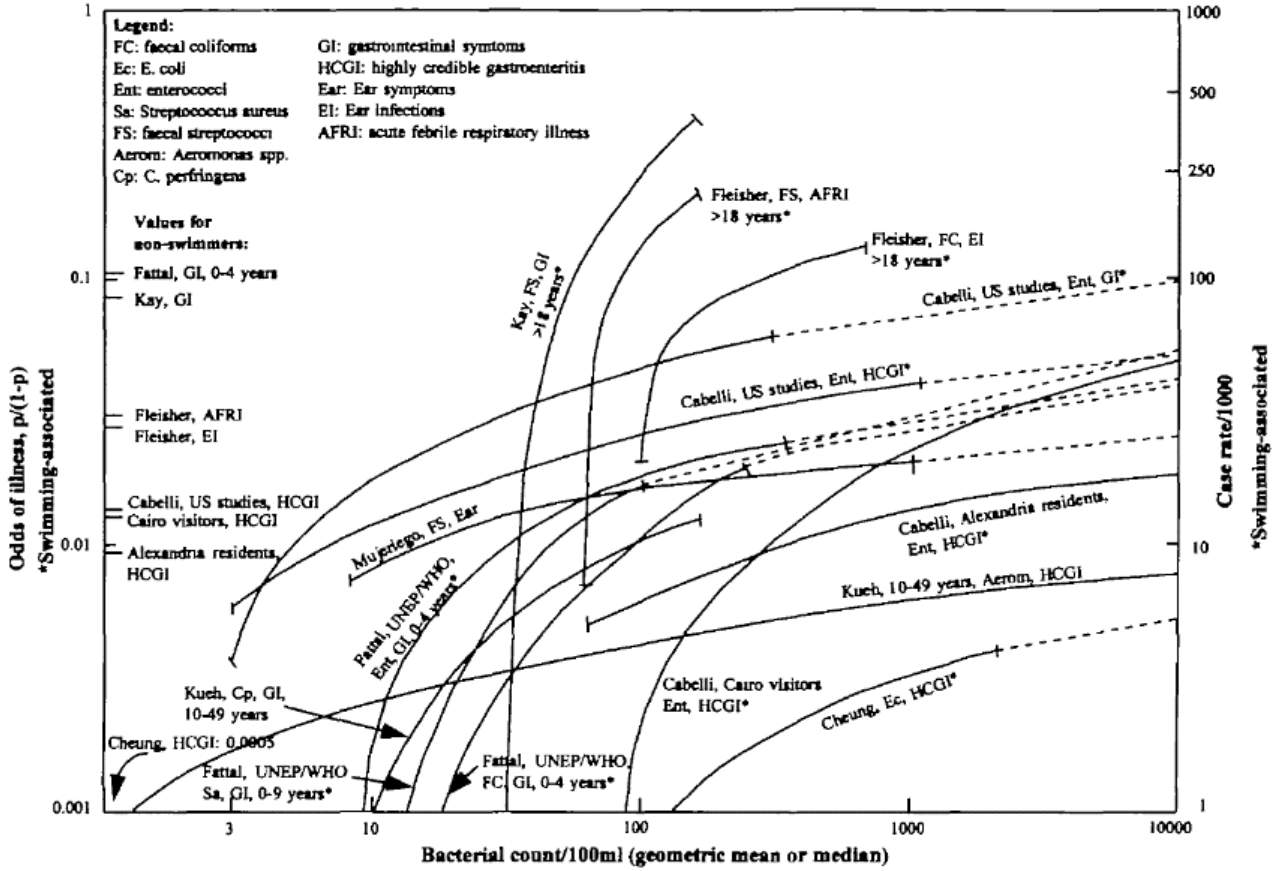
Monitoring of faecal contamination via indicators (*E. coli* and *enterococci*)



How to define limits ?

> Monitoring of swimming, based on an "exposure" study





Health issues

How can this risk be managed?

> Classification of bathing areas

> *E. coli* and *enterococci* indicators

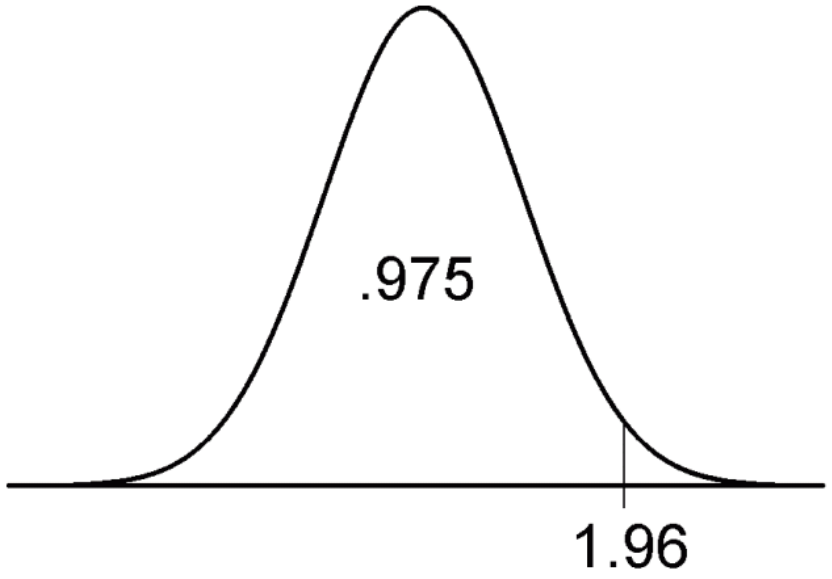
Based on an estimate of the distribution (Log, then Mean + x.standard) deviation):

	Excellent quality	Good quality	Sufficient quality
Enterococcus	200*	400*	330**
E. Coli	500*	1000*	900**

* 95th percentile
** 90th percentile

Health issues

Since sampling is not continuous, and represent a mockup of the real exposures of bathers, classification is based on a estimation of the distribution. More precisely on the confidence interval.



Calculation :

- Log transformation
- Averaging
- Standard deviation calculation
- 90/95 percentile estimate

	Excellent quality	Good quality	Sufficient quality
Enterococcus	200*	400*	330**
E. Coli	500*	1000*	900**

* 95th percentile
** 90th percentile

Exemple of bathing area monitoring

valeur	log(valeur)
248	2,39
321	2,51
363	2,56
387	2,59
411	2,61
413	2,62
437	2,64
471	2,67
493	2,69
524	2,72
555	2,74
589	2,77
589	2,77
589	2,77
607	2,78
625	2,80
639	2,81
663	2,82
703	2,85
703	2,85
774	2,89
842	2,93
842	2,93
860	2,93
897	2,95
1096	3,04
1390	3,14
1390	3,14
1529	3,18
1709	3,23
1709	3,23
1776	3,25

$10^{(2,84+1,282\times0,22)}$ → 1330,7 → P90

Average	2,84
SD	0,22

$10^{(2,84+1,65\times0,22)}$ → 1607,3 → P95

Value that should be compared with the classification table

For inland waters

	A	B	C	D	E
	Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
1	Intestinal enterococci (cfu/100 ml)	200 (*)	400 (*)	330 (**)	ISO 7899-1 or ISO 7899-2
2	Escherichia coli (cfu/100 ml)	500 (*)	1 000 (*)	900 (**)	ISO 9308-3 or ISO 9308-1

(*) Based upon a 95-percentile evaluation. See Annex II.
(**) Based upon a 90-percentile evaluation. See Annex II.

Exemple of bathing area monitoring

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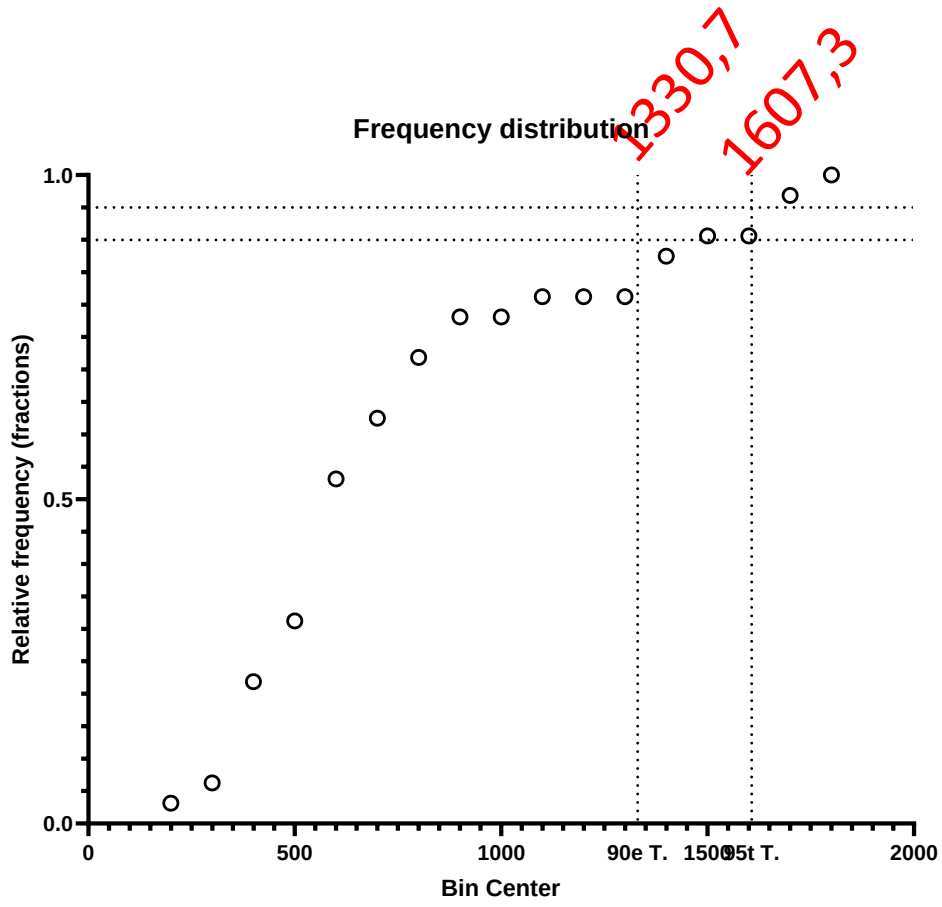
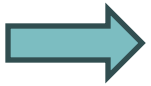


How to monitor the bathing area ?

valeur	log(valeur)
78	1,89
85	1,93
100	2,00
125	2,10
15	1,18
78	1,89
15	1,18
15	1,18
800	2,90
800	2,90
800	2,90
75	1,88
55	1,74
82	1,91
34	1,53
15	1,18



Average	1,89
SD	0,59

slido

Please download and install the Slido app on all computers you use

How is this water quality for bathing activity (inland water) ?

ⓘ Start presenting to display the poll results on this slide.

How to monitor the bathing area ?

valeur	log(valeur)
78	1,89
85	1,93
100	2,00
125	2,10
15	1,18
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800	2,90
800	2,90
800	2,90
75	1,88
55	1,74
82	1,91
34	1,53
15	1,18

$$10^{(2,84+1,282\times0,22)}$$ → **700,2 < 900** **Sufficient quality**

→

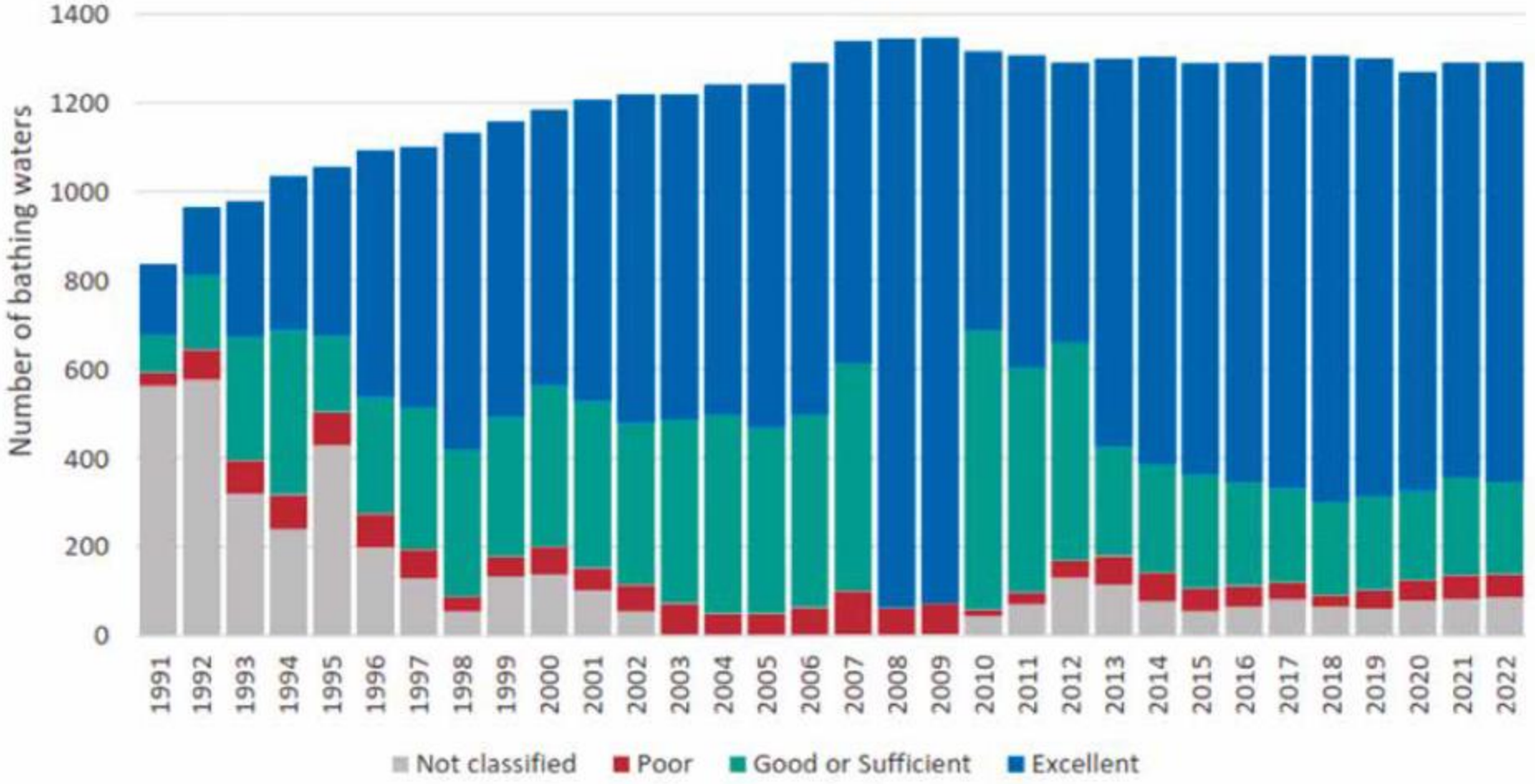
Average	1,89
SD	0,59

$$10^{(2,84+1,65\times0,22)}$$ → **1274,9**

	Excellent quality	Good quality	Sufficient quality
Enterococcus	200*	400*	330**
E. Coli	500*	1000*	**900****

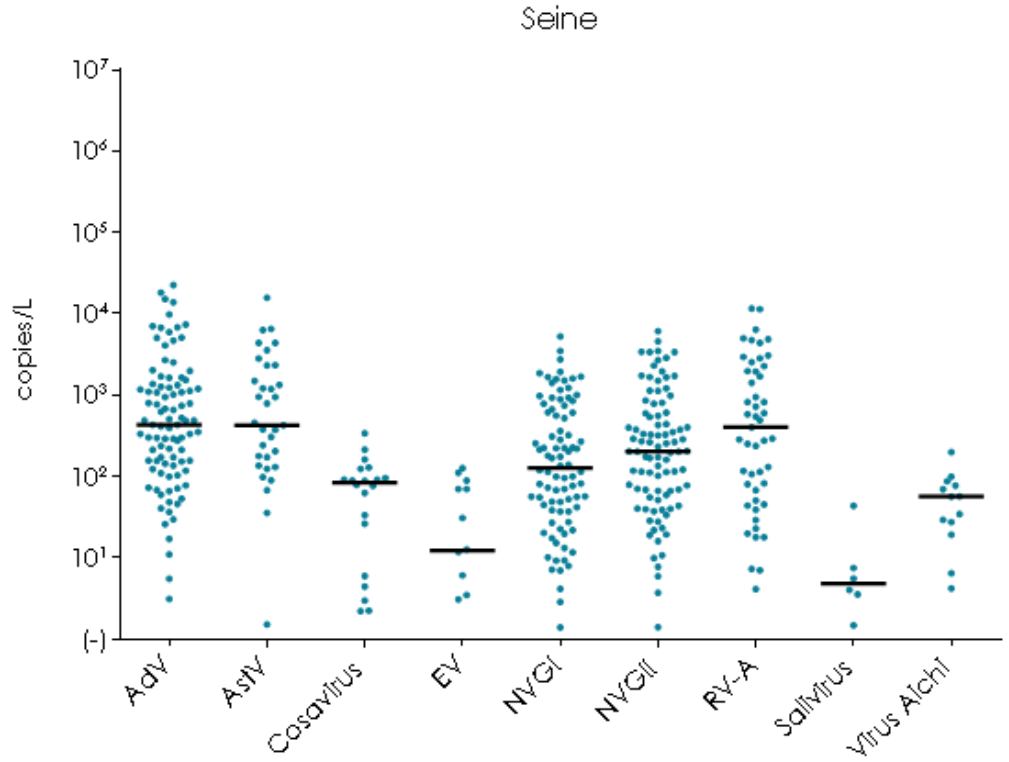
Health issues

Classification of bathing areas in France.
Freshwater Quality< Coastal Waters Quality



Health issues

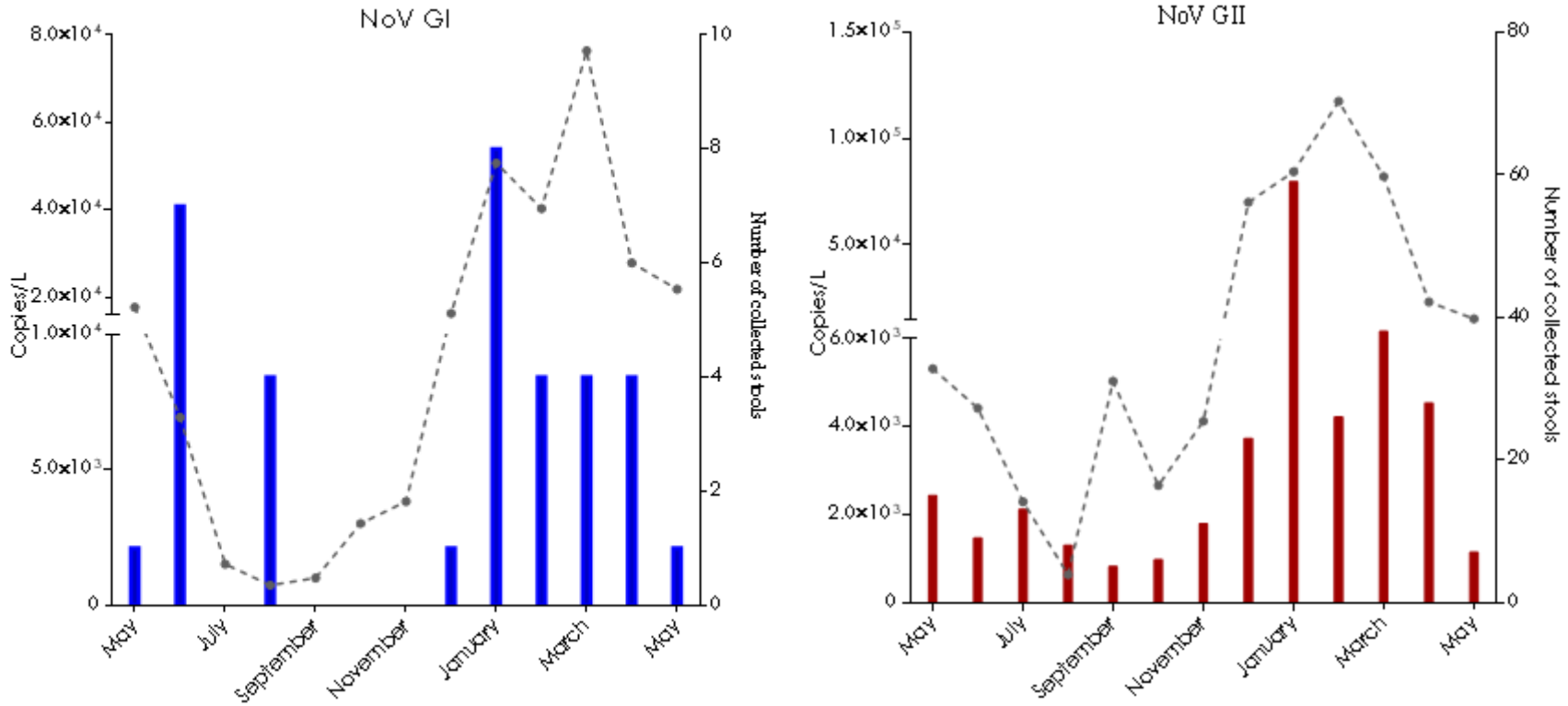
Beyond the indicators, is there data about pathogens ?
Example of Work on virus contamination (PIREN, B. Prévost)



> Mainly adenovirus and norovirus.
> Rotavirus episodes
> High seasonality
More in Winter, less in summer

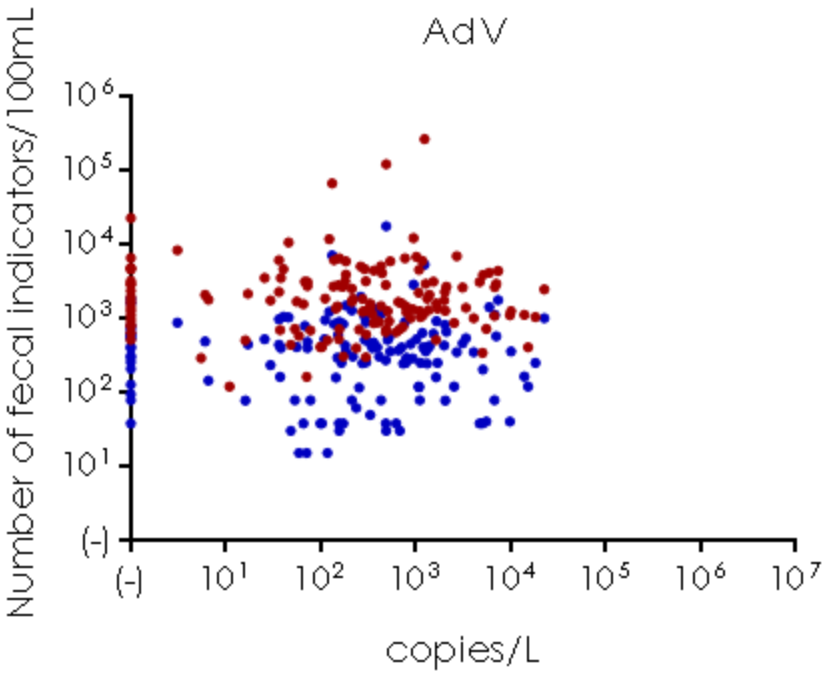
Health issues

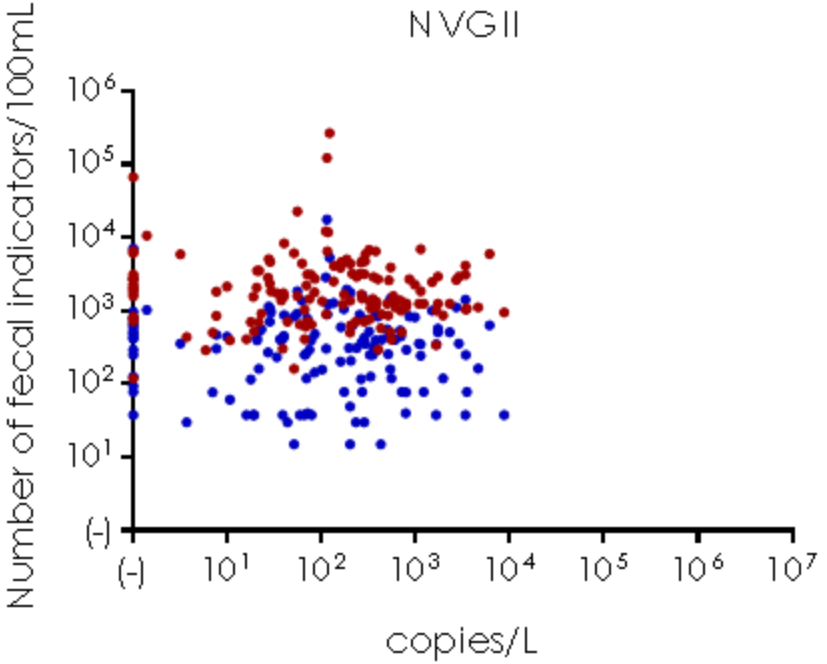
Validated tools (good correlation between epidemic and viral load)
A consistent assessment of contaminations



Health issues

- Are the indicators correlated?
- Limitations of traditional indicators
- Low settling of viral particles (on the path studied...)





To conclude

> Contamination of bathing areas by contaminated water could poses a risk to users
> Risks are linked to the presence of pathogens, mainly viral and parasitic
> The use of indicators makes it possible **to limit these risks of exposure**.

> Limitations exist for these indicators
> The search for new indicators is necessary

Acknowledgements

The creation of this training material was commissioned by ECDC to Institut Pasteur with the direct involvement of Laurent Moulin