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# *Cryptosporidium* in Water

## *Report of the consensus conference on Cryptosporidium in Water, Melbourne, October 1998*

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### *Introduction*

The *Cryptosporidium* in Water conference, held in Melbourne in October 1998, provided an overview of the current scientific knowledge on *Cryptosporidium*, and an opportunity to discuss the needs for future research, public health strategy, and risk assessment and management for water supplies.

More than 290 delegates from diverse backgrounds in water supply and management, parasitology, general microbiology, epidemiology and public health attended the conference.

The conference was divided into three themes, each with its own objective:

- Parasitology and genetic typing, to introduce genetic typing to assist in locating the source of the parasite;
- Epidemiology, to improve epidemiological surveillance, outbreak management and public health response; and
- Risk assessment and management, to understand and manage the health risks implied by *Cryptosporidium* monitoring results.

During the opening session, five speakers presented an overview of the latest *Cryptosporidium* research. The conference was then divided into the three parallel workshops for more specialised presentations on each of the themes. The conference closed with a plenary session in which the discussions on each theme were summarised by expert reporters, and questions were invited from the audience.

On the day following the general conference, small groups of experts continued discussions on each theme, with the aim of arriving at consensus positions on parasitology research needs, public health strategy and risk management principles. The deliberations and conclusions

of the Epidemiology workshop group are summarised in the following Consensus Statement.

### **Consensus Statement: Epidemiology workshop group**

Discussions led to the identification of a number of areas of research priority as well as the need to develop rational public health policies despite the current limitations in our understanding. The group agreed that the primary aims of public health in relation to *Cryptosporidium* in water supplies are to:

- control disease;
- only intervene when needed; and
- use public funds as efficiently as possible.

### *Research priorities*

The research priorities agreed by the group highlighted the current inadequate understanding of the natural history of the disease in humans, the nature and role of the immune response and the determinants of disease.

It was agreed that in this current state of uncertainty, there is a need to invest in well-targeted research that:

- will help us to understand the natural history of the disease and its immunology;
- explores the factors which enhance transmission of the infection in humans and the risk factors which predispose to that infection; and
- explores the effect of prior serological experience on infection outcomes.

### *Phenotyping or genotyping of strains*

It was agreed that considerable effort should go into developing methods for routine phenotyping or genotyping of strains isolated from humans and from water. Such techniques would represent a significant advance in epidemiology by allowing us to trace the origins of

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individual strains, and determine the importance of drinking water relative to other routes of transmission.

#### *Viability and pathogenicity*

There is also a great need for improved tests to determine the viability and pathogenicity of oocysts isolated from the environment so that we can better assess the degree of health risk posed by oocysts detected in drinking water.

#### **Methods of treatment**

There is also a need for continuing efforts to develop effective methods of treatment of people with known infection. The availability of such treatment would markedly reduce the risks associated with infection in immunocompromised individuals, and would significantly change the public health perspective on this organism.

#### **Community education**

There is clearly a need for better community education to improve the understanding of the disease, and to permit the effective protection of the community without promoting panic. It is important that we make efforts to explain our current limited knowledge of these issues, and the difficulties in predicting health risks from water testing results. We must also endeavour to use scarce public health resources as efficiently as possible.

#### **Protocol for surveillance**

It is believed there is a need to develop a national best practice protocol for surveillance that is based on standard advice to laboratories regarding which stool specimens to examine, which methods to use, and the minimum notification data that should be passed on to public health agencies when the organism is identified. General practitioners around Australia should be advised by public health agencies on which cases to request stools for, and the most common risk factors, as they are currently understood, in this condition. At present there are considerable variations in testing practices and reporting procedures between different States and Territories which makes it difficult to establish a comprehensive picture. There is also a need for a validated system of multiplier values to relate the number of laboratory defined cases to the number of cases in the community.

Surveillance will only work effectively if improved partnerships are developed between public health units and water authorities, and if there are agreed triggers for enhanced surveillance. It is believed that increased water turbidity events and the presence of contamination with other pathogens may be appropriate triggers for enhanced surveillance for *Cryptosporidial* infection. Enhanced surveillance should include a systematic approach to elevated rates of diarrhoeal illness in nursing homes and other institutions, a follow-up of individual cases of cryptosporidiosis, active contact with laboratories, and possible activation of other sentinel systems, including school absenteeism, general practice systems and oncology units. Geographic Information Systems mapping of such data may be useful as an adjunct to identify and track outbreaks. The National Communicable Diseases Network is seen as the appropriate forum to progress these improvements in surveillance mechanisms for *Cryptosporidium*.

#### *Outbreak investigations*

On the issue of investigation of suspected waterborne outbreaks, the group was not convinced that case control methodology is always the best approach to conducting investigations. A clear specification of the relevant investigative questions requires input from both public health as well as water authorities, and this may require brainstorming and application of cutting-edge technology. It is emphasised that while outbreaks of illness are undesirable, they nevertheless represent opportunities to improve our knowledge. The opportunity should be taken to store faecal and blood specimens, and it should be expected that each outbreak will help us further to understand the natural history of the disease. Finally, there is a need for national and international collaboration in outbreak investigations, including the standardisation of questionnaires used.

#### **Monitoring *Cryptosporidium* in finished water**

In the review of Sydney events, it became evident that the workshop group and others have been puzzled by the huge oocyst counts reported in finished water, with no detectable evidence of increased disease despite substantial enhancement of surveillance. It is noted that the availability of the technical capacity to detect *Cryptosporidium* in finished water makes it difficult for water authorities to avoid monitoring, but it is emphasised that the Sydney episode underlines our inability to interpret such findings. This is perhaps due to technology being ahead of medical science.

Multiple 'boil water' alerts can have hazardous results both in terms of injury risks to the community, loss of credibility for water and health authorities, and community outrage. The workshop group emphasised the view that, at present, public health is not a reason for monitoring *Cryptosporidium* numbers in finished water. Given the current state of testing technology, the viability or infectivity of oocysts cannot be determined, and therefore such counts cannot be used as a basis for public health action. However, it is recognised that such monitoring may serve a purpose for the water industry in assessing the effectiveness of water treatment processes for the removal of *Cryptosporidium* oocysts, and in identifying environmental factors which lead to elevations in oocyst numbers.

The group believed that a better approach to the monitoring of treated water would be careful investigation of all turbidity events. Changes in turbidity of treated water requires collaborative discussions with health personnel, review of water treatment procedures, and possibly introduction of enhanced surveillance when raw water *Cryptosporidium* counts are raised. When *Cryptosporidium* counts on treated water are elevated, it cannot be assumed that they necessarily constitute a significant public health hazard without extensive accompanying data and advice from a range of experts. Thus the detection of such events should not automatically trigger a 'boil water' alert, but instead trigger investigations by water and health officials to determine the causes and consider the need for such an alert to be issued.

The available evidence on natural history indicates that several oocysts are needed to infect people with normal immune function, but it is not clear whether people with significantly impaired immune function might be infected

with lower numbers, perhaps even with one oocyst. Few (if any) water authorities can guarantee complete freedom from such a risk from using finished water, given the current state of technology.

*Swimming pools*

Finally, it was agreed that *Cryptosporidium* constitutes a substantial public health hazard in swimming pools, and that this risk will continue while parents take young children to pools in the summer. The only approaches identified as being available were public education to minimise contamination of pools, improved engineering of pool filters, and overnight hyperchlorination of affected filters and pools. Pool closures are as undesirable for the recreational water industry as 'boil water' alerts are for the drinking water industry, and may create similar public responses. While there is some scope for reducing the problem by better design and operation of pools, it is clear that the major need is for better public understanding of the issue.

**Public health strategy for drinking water**

There was further discussion of the consensus public health strategy for drinking water in the final plenary session, with the following points being agreed:

- Relevant health and water industry personnel should have frequent routine contact so that rapid and effective consultation can take place whenever unusual water quality events occur.
- A stepwise response protocol should be established depending on the degree of health concern associated with different circumstances.
- It is important that the response protocol agreed between health and water authorities is subject to public comment during its development.
- The final response protocol must be made available to the public and the media. The protocol should set out the circumstances that would trigger a response, the investigative and corrective measures to be implemented for various levels of response, and the time period required to carry them out. Placing this information in the public domain in advance of any water quality events helps to address industry concerns over 'duty of care' with respect to the time taken for confirmatory testing and investigations.

It is preferable that one person in each State or Territory is responsible for dealing with the media during the investigation of water quality events. The media should be kept informed on the progress of investigations being undertaken to ascertain the degree of health risk to the community.

*Errata*

Amin, J. Heath, T. and Morrell, S. Hepatitis A in Australia in the 1990s: future directions in surveillance and control. *Commun Dis Intell* 1999; 23:113-120.

The organisation with which the first author is affiliated is the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS).

A sentence towards the end of the Methods section (paragraph 1, page 115) should read 'The outbreak level is defined as the number of notifications occurring in a month for which the probability of that number occurring is less than 0.05, based on the expected number of notifications per month being the average number of notifications per month'.

**Typhoid fever - urgent health alert**

A health warning has been issued to all passengers who travelled on the *P&OFair Princess*, cruise No.76 that departed Cairns, Australia on 12 May 1999 and travelled to Port Moresby, Samarai Island, Milne Bay, Honiara, Champagne Bay and Vila to see a doctor immediately if they are feeling unwell or have been recently sick.

The Communicable Diseases Network of Australia New Zealand (CDNANZ) advises that at least three passengers on this cruise have been infected with typhoid fever and there may be more passengers who are affected.

There are two confirmed cases of typhoid fever in Victoria and one in NSW. All of the cases notified so far appear to have taken a Kokoda Trail tour on 14 May.

Typhoid is an infection caused by bacteria of the *Salmonella* group. It occurs world-wide but is more common in developing countries such as Asia, including

the Pacific Islands, the Middle East, Africa and Latin America.

Typhoid is transmitted by contaminated food, water or ice. The symptoms of typhoid are fever, diarrhoea or constipation, abdominal pain or tenderness, nausea, vomiting and headache, malaise and cough. Diagnosis is usually made by blood test or faeces examination. Symptoms can occur within three days and up to three months after consumption of contaminated food or water, but usually in one to three weeks. Antibiotic treatment is extremely effective and results in complete recovery.

Passengers who travelled on this cruise and who have the above symptoms are advised to seek medical attention urgently.

P&O Cruises are cooperating fully with the investigation now under way and they point out that the evidence so far points to the Kokoda tour as the source of the problem.