Annex B to Information Letter 10/2006

1 Conclusions and recommendations

1.1 The evidence from surveillance studies and epidemiological studies is that there has been an overall reduction in cryptosporidiosis associated with the introduction of the *Cryptosporidium* Regulations and consequential improvements in water treatment. This is especially evident in the first half of the year. This provides further evidence, on top of investigations of *Cryptosporidium* outbreaks and analytical studies of sporadic cryptosporidiosis, that drinking water has been responsible for a substantial burden of this diarrhoeal disease. It has provided an example of how new legislation can significantly impact beneficially on the burden of waterborne disease. However, there may still be some element of the burden of disease that is associated with drinking water and the epidemiological evidence is far from clear about the remaining causes of cases.

1.2 **Further investigation of the seasonal increase in cryptosporidiosis is needed to determine general and species-specific risk factors for acquisition and transmission of infection, and to enable appropriate interventions for prevention and control to be instituted. This is particularly true for the cases in the latter half of the year.**

1.3 **Spring peak**

1.4 The spring increase that was prominent nationally before 2000 has declined but is still evident, if much reduced.

1.5 **There is a need to determine whether the remaining spring cases are related to drinking water or some other source and an analytical study would be useful in determining this.**

1.6 **The late summer/autumn increase**

1.7 The drinking water regulations together with measures taken by water companies appear to have been responsible for causing the reduction in cryptosporidiosis in the first half of the year. These measures do not appear to have resulted in a similar reduction in the autumn. These results might be explained in a number of ways. It is possible that in the spring the majority of disease is drinking water related as a consequence

of raw water contamination associated with periods of lambing and the release of animals on the land. Although the Cryptosporidium Regulations have been successful in reducing this risk some further refinement may be needed. In the second half of the year the drinking water risk is unlikely to be due to highly infectious young animals or run off from land. However at this time of the year access to the countryside is at its highest and so direct contact with animals may be an important risk factor. Furthermore, in the late summer England and Wales usually experiences an influx of infections from abroad. Finally at this time the use of swimming pools is at its highest leading to local spread of cryptosporidiosis. However, the real source of *Cryptosporidium* cases in the second half of the year is unclear.

1.8 **An analytical study is required to examine the risk factors for cryptosporidiosis in the autumn.**

1.9 **Risk status, oocyst contamination of drinking water and sporadic disease**

1.10 A number of supplies produce water that occasionally contains low numbers of oocysts. The significance of these has always been questioned because the method of water testing measures oocysts which can be non-viable and of species that do not commonly infect humans. On top of this there is evidence that strains can differ in their ability to infect people (Teunis et al., 2002; Okhuysen et al., 1999). On the other hand with some strains having an ID50 of less than 10 (Okhuysen et al., 1999), and the ID50 for children possibly being lower than this (human volunteer studies cannot be conducted on children), it remains possible that low counts of oocysts represent some risk of infection. Furthermore, spatial heterogeneity of oocyst within water may mean that the mean count of oocysts in water does not adequately represent the risk (Gale et al., 2002; Gale, 1996).

1.11 The assumption from reductions in cryptosporidiosis, particularly in the first half of the year, is that reductions have been predominantly related to the identification of water supplies at significant risk and subsequent interventions such as the installation of additional treatment or abandonment of the source. The Drinking Water Inspectorate has put in place a process with the water industry for risk assessments to be reviewed to determine whether any aspects of current practice could be improved in light of investigations by DWI and the OCT in respect of two outbreaks in autumn 2005. When these findings are available there may be merit in carrying out a study of human disease associated with selected low and high risk supplies over a defined and relevant period of time.

1.12 **An analytical epidemiological study using geographic data on water supply and surveillance data on human *Cryptosporidium* cases should be conducted to compare the risks associated with supplies passing the risk assessment with those failing and whether oocysts have been detected in the treated water.**

1.13 **Swimming pools**

1.14 There is evidence that swimming pools within the UK are contributing to an increase in cryptosporidiosis within local communities in the autumn period. Appropriate ways of examining these outbreaks need to be established so that better evidence is made available. In particular, is there a link between infections in returning tourists and subsequent swimming pool outbreaks in the UK.

1.15 There is a strong suspicion that swimming pool outbreaks in other EU states are contributing to regular late summer/autumn outbreaks in the UK.

1.16 Swimming pools appear to play an important part in the epidemiology of cryptosporidiosis in the second half of the year. While failures in filtration are likely to be important it is difficult to pinpoint the management practices and infrastructural limitations that are responsible in these outbreaks. This makes it difficult to identify interventions that may be useful in preventing further cases in an outbreak and in reducing the risks of outbreaks in subsequent years.

1.17 Outbreaks related to drinking water have declined in recent years but there are still outbreaks linked to swimming pools and farm visits.

1.18 **A protocol for the examination of swimming pool and farm related outbreaks needs to be produced so that risk related factors can be better identified.**

1.19 **Travel**

1.20 Travel related cryptosporidiosis have been recognised for years. The occurrence of two large outbreaks in the UK in different years associated with hotel pools in Majorca suggests that outbreaks linked to overseas resorts may be contributing significantly to the national burden of cases.

1.21 **A study into the risk factors for individuals travelling to other countries is needed to provide appropriate advice to travellers as well as to guide the government on where efforts to reduce the risk to travellers should be targeted.**

1.22 Improving laboratory detection

1.23 Evidence from a number of sources indicates that the staining methods currently used for screening human faecal samples for *Cryptosporidium* oocysts may be missing about a half of all the cases. In addition a number of laboratories adopt selection criteria for testing faecal samples that result in further cases being undiagnosed.

1.24 **Additional research needs to be conducted to develop practical but sensitive methods that can be used to screen faecal samples more reliably than the currently used staining methods.**

1.25 **All laboratories should be encouraged to use standard methods and testing criteria for examining faecal samples for *Cryptosporidium* oocysts.**

1.26 **The variation in local practice in the application of the national standard method for *Cryptosporidium* should be addressed as presently this is resulting in a non-systematic bias in detection and under-ascertainment of cases**

1.27 Speciation of isolates

1.28 The genotyping of isolates of *Cryptosporidium* has provided clear information on the changing distribution of the two main species within the human population. Because the epidemiology of the two main species (*C. hominis* and *C. parvum*) differs both in reservoirs, transmission, age distribution and seasonality it would be useful and informative to type all isolates. It has been useful in identifying species-specific risk factors. There is a strong rationale for typing all isolates and feeding the results back into routine surveillance and analytical studies.

1.29 ***Cryptosporidium* genotyping should be extended to all human isolates to enable the identified epidemiological studies to be conducted and to assist in the assessment of need for additional**

interventions for prevention and control. Funding needs to be found for this.

1.30 Identifying the value of sub-typing

1.31 Sub-typing *Cryptosporidium* oocysts has generated much new information and has the potential to provide new insights into the transmission of disease.

1.32 **Research needs to be undertaken to improve the methods for genetic sub-typing of material extracted from faeces that could be used on all samples.**

1.33 **Although research is currently underway into the investigation of *C. hominis* subtypes using a variety of typing methods, further studies of the population genetics of *C. hominis* are required to allow greater differentiation between isolates.**

1.34 **Sub-typing methods for *C. parvum* and *C. hominis* should be subjected to systematic evaluation in an inter-laboratory trial.**

1.35 **The ways in which sub-typing might be useful in further elucidating the epidemiology of cryptosporidiosis need to be examined.**

1.36 Surveillance data

1.37 The usefulness of the routine cryptosporidiosis surveillance data in providing powerful insights into its epidemiology and prevention is limited by the lack of timeliness, completeness and dissemination of its findings. The surveillance data needs to include typing of all samples to main species level and incorporation of this data into national records.

1.38 The remaining differences in practice between laboratories are measured through occasional surveys of reporting practice.

1.39 The improvements in the timeliness and completeness of reporting to national surveillance have increased the ability to detect national increases in cases in a timely manner. The increase in the capture of the post-code of patients in a way that does not compromise patient confidentiality allows the ability to conduct geographic analytical studies that have not previously been possible. A recent Wellcome study

organised as a collaboration between HPA and UEA has identified useful geographic approaches to the analysis of data on cryptosporidiosis cases, including case-control studies.

1.40 **Existing procedures for notification, surveillance and alerting of cases of cryptosporidiosis should be reviewed.**

1.41 **Data from *Cryptosporidium* genotyping should be fed into national surveillance in a timely way through interaction between the Cryptosporidium Reference Unit and the HPA Centre for Infections.**

1.42 **The timeliness and completeness of surveillance data needs to be further improved through the HPA Centre for Infections and HPA Local and Regional Services focussing attention on areas with poor rates of reporting.**