Giardia and Cryptosporidium Infection in Childcare Centres in Western Australia

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I declare that this thesis is my own account of my research and contains no material which has been previously submitted for a degree at any other educational institution and contains no material previously published or written by any other person, except where due reference is made in the text of this thesis.

Jennifer Ann Walters Lymbery
To my father,

James Alan Walters

and my sons,

Hamish, Rowan and Samuel.
ABSTRACT

*Giardia* and *Cryptosporidium* are both recognised as important causes of infectious diarrhoea in children worldwide, and childcare centres have been shown to be a major site of infection. The incidence of infectious diarrhoea in children attending childcare centres has been estimated at between two to five times greater than in children cared for at home. Both *Giardia* and *Cryptosporidium* have a faecal-oral route of transmission that facilitates their spread in childcare environments, but can also be interrupted through the use of efficient hygiene protocols such as handwashing. Despite their importance as causes of infectious diarrhoea, there are no data on the prevalence or transmission dynamics of these parasites in Australian childcare centres.

The present study was designed to determine the prevalence and incidence of both *Giardia* and *Cryptosporidium* in children attending childcare centres in Perth, Western Australia. Data were collected on asymptomatic infection, seasonal trends, the transmission dynamics of the parasites and risk factors for infection. The second part of the study involved the development, implementation and evaluation of a health intervention package designed to interrupt the transmission of causative organisms of infectious diarrhoea in childcare centres. This intervention was based on appropriate and effective handwashing.

Over a period of 23 months, 1172 faecal samples were collected from non-toilet-trained children (n=306) attending 14 childcare centres in Perth, Western Australia. Where possible, family and contacts of infected children were also sampled to determine the
dynamics of infection in the community. Information on symptomology of infections and risk factors for infection was obtained by the administration of a questionnaire to parents of all the children in the study.

Over all the childcare centres in the study, 7.8% of children were positive for Giardia and 10.8% were positive for Cryptosporidium. Of these, 37.5% of the Giardia-positive children returned positive samples on two to four occasions, but not always consecutively, suggesting either continuous or repeated infection with the parasite. Only 12% of children who were Cryptosporidium-positive were infected for two consecutive months.

The major findings of this study included a significant seasonal peak in the prevalence of both Giardia and Cryptosporidium, with 50% of Giardia and 73% of Cryptosporidium infections occurring during the autumn months of March, April and May, and a high proportion of asymptomatic Giardia infections (45%), compared with only 13.5% of asymptomatic Cryptosporidium infections.

There was evidence for the transmission of both Giardia and Cryptosporidium infections to household contacts of infected children. Of the children who were found to be positive, faecal samples were also collected from 28 family members of those children with Giardia and from 14 family members of those with Cryptosporidium. Of these, 17.9% family members of the children with Giardia and 28.6% of family members of the Cryptosporidium children returned positive faecal samples. The only significant risk factor for Giardia infection was the number of adults living in the household, with infection more likely to occur in children who had a greater number
of adults in the household. Significant risk factors for *Cryptosporidium* infection included the age of the child: the mean age of the positive children (20.6 months) was higher than in the negative children (16.6 months), and the length of time enrolled at the centre. Children who were positive had attended for a longer time than those who were negative (11.2 and 7.8 months respectively).

These results have important implications for the control of infection with these organisms, both within and beyond childcare centres. Since these parasites can be readily transmitted by an asymptomatic carrier, the high percentage of asymptomatic cases in this study, particularly of *Giardia*, strengthens the argument for health interventions which are directed at interrupting the transmission of the parasite.

A health intervention programme was developed that focused on handwashing procedures and was targeted at the carers, the children and the parents of the children in the centres. It was designed to be a low-cost programme both financially, and in the time and effort required to implement the programme within the childcare centre, to enhance compliance with the intervention. The success of the programme in changing the knowledge, attitudes and practices of carers was evaluated through a pre- and post-test questionnaire. This showed that the programme successfully improved the knowledge of the carers in the test centres in several important areas of infection control. These included knowledge about specific organisms causing infectious diarrhoea in childcare centres, transmission of these by asymptomatic individuals and increased knowledge about effective handwashing technique. Because it has been repeatedly shown that increased knowledge does not always translate into improved practices, and that interventions are not always successful in
maintaining an improvement in the desired practices, a subjective evaluation was also performed. This was designed to determine how effective the intervention was perceived to be by the carers themselves, and whether they would continue to use the intervention over time. The results showed that the majority of the carers (>88%) found the intervention appropriate and useful in teaching both the carers and the children within the centres, the importance of handwashing. Twelve months after the intervention had first been implemented, 57% of the centres in the study were still using the intervention at least once per month and a further 29%, while using it less than this, still continued to use it occasionally. This is important information, since an intervention can only be useful if it is actually being used.
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