Transmission of *Giardia lamblia* from a Day Care Center to the Community

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Abstract: An outbreak of giardiasis was investigated in one urban day care center; another day care center was selected as a control. In the study day care center, 35 per cent of the children were infected. Infection was spread to at least one household contact of 47 per cent of the infected children. The data suggest person-to-person transmission of giardiasis and the need for measures to prevent its dissemination. Early recognition and treatment of *Giardia lamblia* infections in children may be indicated. (*Am J Public Health* 1986; 76:1142–1144.)

Introduction

Giardia lamblia, once considered a harmless commensal organism, has become the most common pathogenic intestinal parasite in the United States.[1,2] Person-to-person transmission of *G. lamblia* to families of children from day centers has been reported.[3] Keystone, *et al,* further document moderately severe illness associated with *G. lamblia* in children attending day care centers and their infected household contacts.[4]

In March 1982, several cases of giardiasis were reported from a day care center in an affluent area in northwest Washington, DC. An epidemiologic investigation was undertaken to determine the prevalence and spread of giardiasis and also to establish the relation of *G. lamblia* infection to symptomatic disease.

Methods

Stool specimens were obtained from all children at the day care center, their household contacts, and staff of the center. A questionnaire regarding possible exposure to *G. lamblia,* symptoms or lack thereof, and of previous treatment was submitted to parents and household contacts of the children and to staff of the day care center. Stool specimens were also obtained from a control group, an age-matched group of children in a similar day care center which had not previously reported any cases of giardiasis.

Fresh stool specimens were collected without urine or water and mixed in Merthiolate iodine formaline solution (Marion Scientific). A Ritchie formalin-ether concentration was performed on all specimens that did not reveal *G. lamblia* on direct smear examination. At least one stool specimen from each child in the study center was examined; children or adults who had two negative stool examinations were considered negative for the purposes of this investigation. Single stool specimens were obtained from some members of the control group, with additional specimens obtained from some toddlers at that center who became symptomatic after the initial specimens were examined.

Relative frequencies were compared using the Fisher exact test;[5] presence of the trend was tested using the Yates mean score statistic.[6]

Results

The study day care center (SC) and the control center (CC) consist of 49 and 41 children, respectively, ages 10 months to 5 years, from affluent families. Each center segregated children into groups based on level of development: infants, toddlers, and preschoolers. The proportion of children in the three groups who were toilet trained was: infants, 0 per cent, toddlers, 35–50 per cent, preschool, 100 per cent.

The prevalence of *G. lamblia* in each center by age is seen in Table 1. Six of 10 infants were positive for *G. lamblia* in the SC as compared with none in the 13 infants in the CC. Among the toddlers, there was a greater prevalence of *G. lamblia* found in the CC than in the SC. At the beginning of the study, none of the children from the CC had signs or symptoms of giardiasis. On initial sampling, four toddlers in the CC were found to harbor *G. lamblia.* Subsequently, several children became symptomatic and further sampling identified four more toddlers with *G. lamblia.* The prevalence of giardiasis among the preschoolers in the SC was higher than that among those in the CC. Among the children attending the SC, there was a downward trend in the prevalence of *Giardia lamblia* with increasing age.

As seen in Table 2, of the 17 children in the SC found to harbor *G. lamblia,* six of nine children (67 per cent) with completed epidemiologic data forms were symptomatic. Symptomatic cases were defined as those presenting with diarrhea of more than seven days duration accompanied by abdominal pain and/or flatulence. Of the 32 not found to have the parasite, three of 21 (16 per cent) with completed forms were symptomatic. Similarly, of the 14 adults found to have *G. lamblia* ten of 11 (91 per cent) with complete forms were symptomatic whereas only four of 18 (22 per cent) with completed forms who were not found to have *G. lamblia* were symptomatic. The duration of symptoms in children ranged from three days of diarrhea to more than a year of episodic bouts of flatulence with abdominal pain and diarrhea. In the adults, symptoms ranged from one week of diarrhea to intermittent episodes of fullness and diarrhea for several months. Thus there was an association between the presence of *G. lamblia* in the stools and clinical symptoms, at least among the subjects who returned the questionnaire. Since the frequency of response was 30 per cent for adults and 61 per cent for children, it is possible that the respondents may not have been representative of the entire study group.

In the SC group, 14 of 17 children (82 per cent) were found positive for *G. lamblia* on the first stool specimen with an additional three (18 per cent) found positive only on the second stool specimen. All 14 adults with *G. lamblia* had positive stools on the first sample examined. In the CC, four of eight (50 per cent) were positive on the first stool specimen, two of eight (25 per cent) not until the second

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TABLE 1—Prevalence of *Giardia lamblia* in Day Care Centers

Study Groups	Study Center	Control Center	P Value	Estimated Odds Ratio (95% CI)
Infants	<18 mos (%)	<18 mos (%)		
	6/10 (60)	0/13 (0)	.002	∞ (2.36,∞)
Toddlers	18–36 mos	18–26 mos		
	6/15 (40)	8/15 (53)	>.20	0.58 (0.11,3.08)
Preschoolers	3–5 years	>26 mos		
	5/24 (21)	0/13 (0)	.10	∞ (0.52,∞)
Adults, Household Contacts	>5 years			
	14/56 (25)			

Among the children attending the study center, there is a downward trend in the prevalence of *Giardia lamblia* with increasing age. (Yates mean score test; $x^2 = 5.05$, $p = .025$).

sample, and two of eight (25 per cent) not until the third. The latter results may be due to spread of infection among the toddlers after the initial sampling as noted earlier.

Two of the 14 adults with *G. lamblia* were employees at the SC. The remaining 12 were from only six families, including one family in which the father, mother, and two siblings of a SC child all harbored *G. lamblia*. Additionally, the parents of another SC child with *G. lamblia* were found by their private physician to have giardiasis (not included in our data). The 17 SC children with *G. lamblia* came from 15 families (there were two pairs of sibs). Of these 15 families, seven (47 per cent) were found to include either an older sib and/or a parent with *G. lamblia*. All seven families had a child in either the infant or toddler group at the SC.

Discussion

Transmission of *G. lamblia* has been reported to occur after drinking from mountain streams,[7,8] from contaminated cisterns,[9] and from contaminated municipal water supplies in the Soviet Union.[10,11] Outbreaks have been reported in a ski resort in Aspen, Colorado,[12] in New Hampshire,[13] and in Camas, Washington with beavers implicated as a possible host.[14] There is an increased incidence of *G. lamblia* in institutions for the mentally retarded,[15,16] among homosexual men,[17,18] and in day care centers.[3,4,19,20] A fecal-oral method of transmission has been implicated in some outbreaks, and foodborne giardiasis[21] has also been described. The ingestion of as few as 10 cysts has been shown to cause giardiasis.[1]

TABLE 2—Relative Frequency of Symptoms Reported in Subjects in the Study Center with and without Giardiasis

	Symptomatic subjects			
	No. (%) with Giardiasis	No. (%) without Giardiasis	P-Value	Estimated Odds Ratio (95% CI)
Children*	6/9 (67)	3/21 (16)	<.01	10.7 (1.42,112)
Adults**	10/11 (91)	4/18 (22)	<.01	29.6 (2.88,1623)

*30/49 children with completed questionnaires.
**29/90 adults with completed questionnaires.

The prevalence of giardiasis may have been underestimated in our study. The Entero-test and duodenal aspiration have been shown to demonstrate the presence of *G. lamblia* even when stool specimens are repeatedly negative.[22] Some reports of low yields on stool examination are based on only a single stool examination using concentration techniques or direct smears without concentration. In one series, three stool specimens from patients with giardiasis were examined and *G. lamblia* was identified in 76 per cent of the first samples, in 90 per cent of at least one of the first two samples, and in 97 per cent of at least one of the three samples.[23] Similar results have been reported by other workers,[3,19] and the present investigation yielded similar results.

Due to the poor response to the questionnaire, the present study is somewhat limited in drawing conclusions about the relationship between *G. lamblia* infection and symptomatic disease. From our limited data, the presence of *G. lamblia* in the stool appeared to correlate positively with symptomatic disease.

The present investigation demonstrated a 35 per cent overall prevalence of giardiasis in children in the SC, with 53 per cent of the toddlers positive in the CC. The finding of giardiasis within the individual groups highlights the epidemic nature of the disease. It is noteworthy that the data suggest that 47 per cent of the children in the SC transmitted the disease to at least one household contact, indicating person-to-person spread of *G. lamblia*.[20] One study reports a secondary attack rate of 17 per cent in families with gastro enteritis due to *G. lamblia*.[20] Transmission from child to adult appears to be more likely than adult to child due to the generally better hygiene of the adult. The greatest incidence of giardiasis was found among the children who were not toilet trained; this group also had the greatest number of household contacts with *G. lamblia*. Several of the adult contacts had a history of diarrhea and abdominal pain previously undiagnosed by their family physician.

G. lamblia can no longer be regarded as occurring solely in areas with overcrowding, poor sanitation, or an impure water supply. The family physician and pediatrician need to be aware that giardiasis occurs in both developed and under developed countries, and that person-to-person spread is common. The unexpectedly high prevalence of giardiasis in the CC emphasizes the need for increased surveillance for *G.*

lamblia as a cause of diarrhea in children, especially among a day care population. A recent study indicates that thorough handwashing in day care centers may help prevent its dissemination.[24] Early recognition and treatment may be necessary to prevent its spread in the community.

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Affirmative Action at Work: A Survey of Graduates of the University of California, San Diego, Medical School

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Abstract: Reported here are the results of a mail survey of 113 graduates from the University of California, San Diego, School of Medicine. Fifty-seven had been admitted with assistance of the Special Admissions Subcommittee (SAS) and 56 had been admitted through the traditional Recruitment and Admissions Committee mechanisms. SAS graduates see more patients daily, and practice more often in primary care specialties in rural and inner-city areas, providing medical care for ethnic minorities from lower socioeconomic strata. (*Am J Public Health* 1986; 76:1144–1146.)

Introduction

In 1969, the faculty of the University of California, San Diego, School of Medicine (UCSD-SOM) approved a policy recommending that a serious effort be made to find and admit students from a broad range of cultural and socioeconomic (SES) backgrounds. This policy was implemented by setting 30 per cent of the entering class as a target and by establishing a Special Admissions Subcommittee (SAS) of the Recruitment and Admissions Committee (RAC) charged with recruiting and admitting these students. The "admission-variance" (SAS) target group includes socioeconomically disadvantaged White-American, Asian-American, Black-American, Mexican-American, and American-Indian students.

We present here the results of a self-report questionnaire survey of SAS and RAC graduates from UCSD-SOM. Other surveys of ethnic minority physicians have been published.[1–11] However, at the initiation of our study, none had addressed the diverse aspects of the educational and career patterns of minority physicians.

Method

Questionnaires, developed by the authors, consisted of multiple choice items. These were mailed to all 92 UCSD-SOM graduates who entered via the admission variance mechanism and graduated between 1973 and 1981, and to 92 randomly selected, traditionally admitted, White graduates matched by year of graduation. In each question, graduates were asked to choose the alternative that best characterized their perceptions of their practice styles and locations.

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