



## GIARDIASIS OUTBREAK ASSOCIATED WITH A WOMEN'S GYM

### BACKGROUND

On October 14, 2005, ACDC received information from a confirmed giardiasis case stating that her fellow gym members were symptomatic with a similar gastrointestinal illness. ACDC contacted Public Health Nursing in the Foothill Health District (FHD) for further information about giardiasis cases in the area around the gym. A review of giardiasis cases reported since the beginning of August 2005 to October 18, 2005 in the FHD identified 10 laboratory-confirmed cases. Preliminary findings indicated that all cases resided in the same zip code and all were females between 35 and 77 years of age. Nearly all of the confirmed cases (9 of 10) reported attending a particular gym before onset of symptoms and no other common risk factors could be identified from their epidemiological case history forms. Onset of illness for these women ranged from August 30 to September 26, 2005. In comparison, no cases with the same characteristics were reported in the FHD in September of the previous year (2004). Due to the increased number of people reported with giardiasis, the temporal clustering of cases, and the association of the cases with the gym, ACDC initiated an outbreak investigation.

*Giardia* is a parasite found in soil, food, water, or surfaces that have been contaminated with the feces from infected humans or animals. One becomes infected after swallowing the parasite. Asymptomatic carriage rate is high [1]. Symptoms are often self-limiting and consist of diarrhea, gas, abdominal cramping, foul-smelling stools, and nausea. Persons at increased risk for giardiasis include: child care workers, children who attend day care centers especially those who use diapers, international travelers, hikers, campers, swimmers, and others who drink or accidentally swallow water from a contaminated source that is untreated (i.e., not purified by heat inactivation, filtration, or chemical disinfection) [2].

### METHODS

ACDC made a site visit to the gym on October 17, 2005. The site supervisor was interviewed about possible drinking water sources, food sources, plumbing problems, and cleaning procedures. A list of self-reported symptomatic members was obtained.

Via a letter to the management, ACDC requested a contact roster of all active members and a listing of members using the gym from August 1 to October 21, 2005. This list was further itemized by specific date and time of attendance. To actively identify additional cases and prevent the spread of infections, ACDC recommended that a letter be mailed notifying the gym members of the giardiasis outbreak and requesting that all ill members with diarrheal symptoms contact ACDC. The gym management mailed their letter on October 27, 2005. The letter also contained health education information regarding common symptoms, route of transmission, and instructions for ill members to consult with their medical provider.

Giardiasis cases were defined by either symptoms or laboratory results. Symptomatic cases (probable cases) were individuals with illness lasting seven days or more and a combination of two or more of six symptoms (diarrhea, flatulence, foul-smelling stools, nausea, abdominal cramps, and excessive tiredness). Culture-confirmed cases were individuals with *Giardia* species identified in their stool.

Outbreak-associated cases were gym members who attended the gym at least once during the suspected time period (from August 25 to 30, 2005) and had onset of symptoms during or after that time period. The suspected time period was chosen as the most likely window of exposure by seeing where the cases overlapped by gym attendance and applying the variable incubation period for giardiasis to the onset of the cases. Only individuals meeting the case definition for *Giardia* and outbreak-associated definition were included as cases in the subsequent case-control study. Only non-ill interviewees attending the gym during the specified time frame could be used as controls.



A case-control study was conducted using a standardized, telephone administered questionnaire of individuals attending the gym from August 25 to 30, 2005. Case-finding was accomplished via the letter distributed by gym management encouraging ill members to contact ACDC and also via the telephone interview. Controls were randomly selected from a group of supposedly non-ill members attending the gym during the implicated exposure period. Stool cultures were not obtained on controls. Only asymptomatic interviewees were included as controls.

To rule out other possible risk factors and to determine a possible common exposure at the gym, cases and controls were interviewed. The comprehensive questionnaire contained questions regarding exposure to known giardiasis cases or ill individuals with a similar type illness, diapered children, community drinking water sources, recent travel, recreational activities (e.g., camping, hiking, swimming), common food sources (e.g., restaurants, grocery stores, take out foods, diet foods), nutritional supplements, pets, group activities, and exercise activities. Questions specific to the gym were asked regarding regular workout schedules, gym towel and bathroom usage, drinking water exposure, food/drink samples received, and whether food/drink was purchased after workout.

Chi-square and Fisher's exact tests were used to calculate odds ratios (OR) and 95% confidence intervals (95%CI), and the *t*-test was used to test the differences of the means in the two groups. To decrease potential misclassification, symptomatic members not fitting the case definition were excluded from the study.

## RESULTS

**Gym Inspection:** An inspection by ACDC revealed no obvious problem areas. The overall appearance of the gym was clean and well maintained. There was one main room containing the circuit of 14 exercise machines with exercise mats between each machine. In this 30-minute workout gym, members advance through all stations (machines and mats) at timed intervals set to music. There was also a bathroom, changing room, back storage room, and small conference room. Per the onsite manager, the exercise machines are cleaned at least twice daily (at 12:30 pm and 8:00 pm) using a common bleach-based spray cleaner and antibacterial wash. Gym towels are cleaned on the premises—usually twice a day. The bathroom is cleaned twice a day; the only plumbing problems reported was the occasional toilet clog, which occurs about once or twice a month. According to the supervisor, no overflow of the toilet was reported during the end of August 2005.

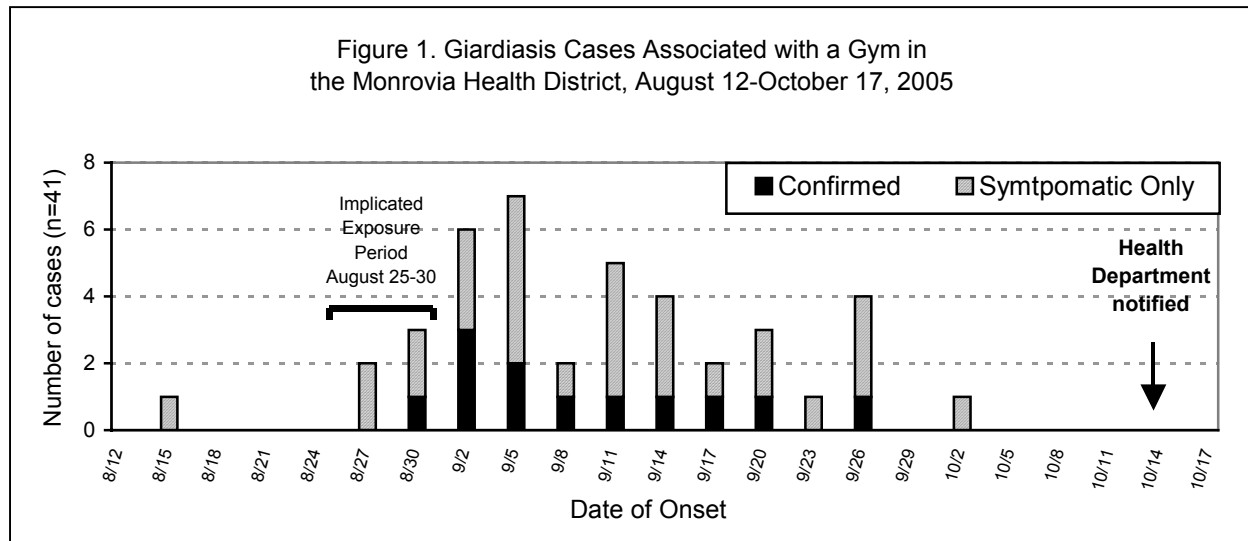
The gym does not serve food but there were two common drinking water sources: individual-sized bottled water for purchase and a common 5-gallon drinking water ceramic crock dispenser. The water in the crock dispenser was usually replenished once a day by the supervisor. During questioning it was discovered that the crock dispenser was not regularly cleaned during the implicated exposure period. Because management suspected that the dispenser might be the source of infection, it had been washed and then totally replaced as of October 16. There was a report of liquid leaking from the ceiling, but not in the vicinity of the water dispenser. Construction was occurring above the gym and there was an incident of water with paint leaking from the ceiling.

**Descriptive Epidemiology:** A total of 41 cases were identified meeting the *Giardia* case definition. There were 12 culture-confirmed cases and 29 symptomatic only persons (probable cases). The median age for cases was 57 years (range 30–77). All but five cases resided in the 91001 ZIP-code area, and those five resided in adjacent ZIP-codes. The first case had onset of symptoms in mid-August and the last on October 3. The peak of the onset curve occurred on September 6 (Figure 1). Also, no countywide increase in giardiasis for 2005 was observed in the Visual Confidential Morbidity Report surveillance system.

The cases complained of an average of eight symptoms (Table 1). Diarrhea was the most common complaint (98%) followed by fatigue (93%), gas (85%), weight loss (80%), abdominal cramps (80%), foul smelling stool (71%), and nausea (68%). The mean duration of illness was 19 days (range 1–56 days). Most of the cases (59%) continued to go to the gym after illness onset. Of the 30 individuals who sought



medical care and reported a date of medical care, it took an average of 17 days after onset of symptoms before they sought treatment. Of these, three cases (8%) were hospitalized, (hospitalization ranging from 2 to 4 days).



**Case-Control Study:** The purpose of the case-control study was to determine which exposures were associated with giardiasis illness. The study compared responses from 36 cases and 31 controls. Five individuals were excluded from analysis for not meeting the outbreak-associated case definition—four for not attending the gym during the suspected time period and one symptomatic only individual for having an onset date (8/15/05, first case) before the suspected time period. Controls were obtained from 85 randomly selected participants and qualified by responding to the survey and were asymptomatic or not diagnosed with giardiasis during the study period. No significant difference in the mean age was identified between the cases and controls ( $t=0.54$ ,  $p\text{-value}=0.59$ ).

Symptoms	Cases (n=41)	
	no.	%
Diarrhea	40	98%
Fatigue	38	93%
Gas	35	85%
Weight Loss	33	80%
Abdominal Cramps	33	80%
Foul Smelling Stool	29	71%
Nausea	28	68%
Vomiting	15	37%
Headache	15	37%
Body Ache	13	32%
Fever	11	27%

Only two of the assessed exposure items were significantly associated with illness (Table 2). One, knowing a non-household contact who was diagnosed with giardiasis or had diarrheal illness—although this item was substantially skewed because 40% (6/15) of the reported ill non-household contacts were fellow gym members. The second significantly associated factor, and the most likely cause of exposure, was drinking water from the gym’s dispenser—*all* of the assessed cases (those both diagnosed and with symptoms only) reported drinking from the dispenser, compared to only 61% of the controls. However, there was no significant difference between cases and controls in the mean number of cups consumed per visit or the mean number of times attending the gym during the implicated exposure period.

**Laboratory:** ACDC did not collect specimens for testing or confirmation of illness in this study. Instead, test reports were obtained through our standard passive reporting system by the cases’ respective private physicians. A total of 12 cases with stool samples positive for *Giardia* were reported through our surveillance system; of these, six were further identified as *G. lamblia*.

**Additional Findings:** From extensive case-finding, the first case, although she was not clear about her exact onset date, reported an onset at about August 15. Also, her duration of illness was seven days



**Table 2. Case-Control Study Results—Selected Exposure Risk Factors for Illness**

Exposure	Cases (n=36)*		Controls (n=31)		Odds Ratio(95%CI) t-test, p-value
	n	(%)	n	(%)	
<u>Gym exposure†</u>					
– Drank from water dispenser	36	(100)	19	(61)	Undefined <sup>+</sup>
– Avg. number of cups consumed from dispenser	2.6		2.7		t=0.17, p=0.86
– Received food/drink samples	9	(25)	7	(23)	1.14 (0.32–4.09)
– Used gym bathroom (n=35)*	22	(63)	20	(65)	0.93 (0.30-2.86)
– Used gym towels	13	(36)	14	(45)	0.69 (0.23-2.05)
– Brought own water (n=35)*	3	(9)	8	(26)	0.27 (0.04-1.30)
– Avg. number of times attended gym between August 25 and 30	1.9		1.9		t=0.08, p=0.93
<u>Other Select Risk Factors‡¶</u>					
– Outside household contact ill	15	(42)	4	(13)	4.82 (1.39-16.69) <sup>+</sup>
– Consumed “unusual” foods (n=35)*	7	(20)	2	(6)	3.63 (0.61-38.01)
– Ate diet meals	10	(28)	3	(10)	3.59 (0.79-22.13)
– Diapered children (n=35)*	12	(34)	4	(13)	3.52 (0.89-16.76)
– Recent travel (n=25)*	15	(60)	12	(39)	2.38 (0.71-8.10)
– Consumed community drinking water (n=35)*	26	(74)	16	(52)	2.71 (0.86-8.73)
– Participated in recreational activities with public water sources	16	(44)	8	(26)	2.30 (0.73-7.43)
– Avg. number of times eat out per week (n=35)*	2.6		2.3		t=0.83, p=0.41
* Cases did not respond to all of the questions; when the number of case responses is fewer than the overall total, the number is listed next to its respective question.					
+ Significant finding, p<0.05.					
† Risk factors are specific to the period of potential giardiasis exposure, August 25 to 30, 2005.					
¶ Only includes select risk factors where the Odds Ratio was 2.0 or above.					

compared to an average of 19 days for cases. She did not seek medical care, and she had three symptoms compared to an average of eight symptoms reported among all cases. She attended the gym 3 or 4 times per week and drank three cups from the water dispenser per visit. No outside source of infection for her *Giardia*-like illness could be identified via her standardized case-control study questionnaire. While an exact mechanism for transmission could not be identified, if her onset date was indeed August 15, her onset would predate the outbreak and she could possibly have been the source of infection.

In addition to the cases used in this report, one secondary confirmed case was identified in a household contact to a confirmed case. Plus, another confirmed case was reported—the boyfriend of a non-ill employee. The boyfriend reported onset of symptoms on August 15, although he was noted to have poor recollection. The boyfriend also drank water from the gym crock dispenser that was brought home by his girlfriend. No other risk factors were noted in his epidemiology case history form. The non-ill employee could have been a potential source of contamination for the outbreak. *Giardia* can be shed from an asymptomatic infected person and this employee had routine contact with the implicated water dispenser during the daily water bottle replacement.



## INTERVENTIONS

The implicated gym was not closed by DHS because no on-going high-risk conditions could be identified. In addition, there was no indication that the outbreak was continuing. The last case occurred 12 before the health department was notified. The most likely source of infection, the water dispenser, was replaced before the investigation began. The letter notifying the members of the cluster of cases, describing the disease, and encouraging ill members to contact ACDC was beneficial. As noted by the results, it usually took more than two weeks before cases sought medical attention and many cases continued to work out after symptom onset. By encouraging ill individuals to get medical care and educating them about transmission, it decreased the likelihood that they could potentially spread the infection to their close contacts and other gym members.

## CONCLUSION

Although a definitive source of infection could not be determined by this study, our investigation indicates the most likely source was the gym water dispenser. An ill employee may have contaminated the dispenser—the person who usually changes the water bottle did not have symptoms, although her boyfriend was a laboratory-confirmed case. For giardiasis, asymptomatic infections are common and the infecting dose is very low. Alternatively, an infectious member could have contaminated the spigot of the dispenser. The spigot required substantial hand manipulation to use—contaminated hands could easily come in contact with the spout, which would be a viable environment for the *Giardia* organisms to live. There was one symptomatic case with an onset date as early as mid-August and she did report drinking from the water dispenser although she was not clear on her exact onset date, her duration of illness was shorter, and her symptoms seem to be less severe than other cases. She did attend the gym two days during the suspected period of exposure. Also other ill members may have been a continuing source because many continued to workout at the gym despite illness.

An important limitation to this study was our inability to adequately test the implicated water dispenser because it had been washed and then replaced with a new ceramic crock when the staff suspected it might be the source of infection—which was before ACDC was involved. It is also of interest to note that the potential quantity of exposure (i.e., the reported amount of water consumed from the dispenser and the number of times a member came to the gym) were not decisive factors. Instead, illness appeared to be associated with having contact with the contaminated dispenser at a specific time when infection was most likely—at sometime between August 25 through 30. Another limitation is that due to the high rate of asymptomatic cases in giardiasis, controls may not have been true non-cases. Additional limitations include potential self-selection bias among the controls and also recall bias among the cases—since the management and many of the cases already presumed the water dispenser was the source of infection long before the health department was involved.

## REFERENCES

1. Heymann, DL (Editor). Control of Communicable Diseases Manual 18<sup>th</sup> Edition. United Book Press, Inc., 2004, 230.
2. CDC. Parasitic Disease Information: Giardiasis Fact Sheet. Available at: [www.cdc.gov/ncidod/dpd/parasites/giardiasis/factsht\\_giardia.htm](http://www.cdc.gov/ncidod/dpd/parasites/giardiasis/factsht_giardia.htm)