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Current Caregiver Awareness of Pediatric Giardiasis and Cryptosporidiosis

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Abstract

Background: We undertook an online survey to gain a greater understanding of the knowledge, attitudes, and willingness to seek care among caregivers of small children.

Methods: Caregivers were invited to participate via direct e-mail from Harris Poll, a company that specializes in on-line surveys. This was a prospective, web-based survey of a defined number of responders on a first come, first included basis. The survey focused on caregiver's awareness of the potential causes of diarrheal illnesses and of available treatment options. Caregivers were required to be US residents, have a child living in the home who was 1 -12 years old and who suffered at least one episode of diarrhea in the last year.

Results: The survey included 1,048 complete responses were accumulated. Responders were mostly female (59%) with one (51%) or two (39%) children in the home. The results of the survey showed a general lack of awareness of what constitutes clinical diarrhea and how best to care for a child who presents with persistent diarrhea.

Conclusion: The results of this survey point to the need for broad public education on the importance of recognition, treatment, and prevention of childhood diarrhea caused by parasites such as Giardia and Cryptosporidium.

Keywords: Caregiver; Survey; Awareness; Giardia; Giardiasis; Cryptosporidium; Cryptosporidiosis; Parasite

Introduction

The most frequent pathogens associated with parasite-induced diarrhea in the US are Giardia and Cryptosporidium [1-3]. Giardia is the leading cause of human intestinal parasitic infection [4] and has been associated with an estimated 1.2 million cases of foodborne illness [5]. Cryptosporidium is also a major cause of parasite-induced diarrhea [2,3] and has been associated with an estimated ~0.75 million cases of foodborne illness [5]. Cryptosporidium, furthermore, is the leading cause of waterborne outbreaks of parasite-induced diarrhea [6]. Pediatric Giardia and Cryptosporidium infections appear more frequent than commonly perceived in the US and may have therefore been understudied/underreported in the past [7]. Caregivers of children with these parasitic infections may have a low general awareness of the management and treatment of the condition. We have been unable to identify any survey results in the literature that assess the general awareness of Giardia and/or Cryptosporidium among caregivers of pediatric patients. We therefore conducted a survey of caregivers of children ages 1-12 years concerning their perceptions, attitudes, and management with respect to parasitic diarrhea in order to identify potential gaps in their knowledge that might be improved.

Methods

Study design

The study was sponsored by Lupin Pharmaceuticals Inc. (Baltimore, MD). Harris Poll Co. (New York, NY) was responsible for the conduct and completion of the online survey, its submission to potential participants, data collection, result tabulation, statistical analysis, and final reporting to the sponsor. The survey was designed by Atom Strategic Consulting, LLC (Randolph, NJ) in collaboration with academic physicians from pediatric infectious disease, pediatric gastroenterology, and epidemiology specialties (The Persistent Diarrhea Working Group) and staff from the Centers of Disease Control and Prevention (CDC) [see Acknowledgments] also provided addition input into the survey's creation. The survey was conducted by Harris Poll on behalf of Atom Strategic Consulting LLC.

Caregiver survey

The survey was conducted during July 1-14, 2014. Potential survey participants were identified from Harris Poll's general population database, and were invited to take part via direct e-mail to complete a target quota of 1000 respondents. A total of 141,300 contacts were made to achieve the survey target. Participants were randomly identified sequentially by their response to initial screening questions: they had to be US residents, have ≥ 1 child ages 1-12 years who were living at home, and be the primary caregiver who was also responsible for taking the child/children to the doctor and making medical decisions. Furthermore, children under the care of the caregiver must have had ≥ 1 episode of diarrhea. Those who completed the survey were offered a modest fee for their time.

After the screening questions, survey questions were organized in the following order: general questions about diarrhea experience, treatment approach, persistent diarrhea care, and persistent diarrhea prevention. This was followed specific questions concerning general parasite knowledge, caregiver approach to diarrhea management, and receptivity to treatment. There were a maximum of 42 survey questions that included eight screening questions, five demographic questions, five calibration questions, and 24 questions concerning pediatric

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diarrhea (causes, definition, treatment, and parasite awareness).

Data analysis

Data were described descriptively as n (%) or mean ± SD for the total respondent cohort and for pre-selected respondent subgroups. These subgroups were defined by response to survey questions: number of children in home (1/ ≥ 2); relationship to child (mother/father/other); heard of Giardia (yes/no); heard of Cryptosporidium (yes/no); children with diarrhea should be allowed to swim, attend school, etc. (yes/no); number of times children had diarrhea ≥ 3 days (0/1/ ≥ 2); receptivity to a 3-day course of treatment (very or somewhat unreceptive/neither receptive nor unreceptive/somewhat or very receptive); and education level (high school or less/college or associate's degree/college graduate/ postgraduate). Statistical testing (IBM SPSS software) across subgroups was performed using the t-test with P < .05 considered as statistically significant.

Results

Respondent demographics

A total of 1048 caregiver respondents completed the survey. Their demographics are summarized in Table 1. Caregivers were more frequently female (59%) and the mother (55%). Race/ethnicity was White (65%), Hispanic (15%), African American (13%), or other (7%). The number of children in their household was 1 (52%), 2 (34%), or ≥ 3 (15%). Mean caregiver age was 38.4 ± 9.18 years.

Characteristic	No.	%
Gender		
Male	432	41
Female	616	59
No. of children in household		
1	536	51
2	357	34
≥3	155	15
Relationship to child		
Mother	581	55
Father	401	38
Grandparent	49	5
Other	17	2
Marital status		
Married	734	70
Single, never married	145	14
Living with partner	90	9
Divorced	52	5
Separated	18	2
Widowed	9	<1
Education		
Some college/associate's degree	330	31
High school or less	323	31
College graduate	251	24
Postgraduate	144	14
Race/ethnicity		
White	681	65
Hispanic	155	15
African American	133	13
Other	76	7
Declined to answer	3	<1

Table 1: Caregiver Demographics (N = 1048).

Survey analysis

Results for selected primary survey questions are summarized in Tables 2-4. The denominator for percent calculations is for the total respondents (N = 1048) unless specified otherwise (data missing or subgroup analysis). Multiple choice responses were permissible for some survey questions so the total number of answers exceeded the number of respondents.

Responses with respect to caregiver opinion on the definition and burden of pediatric diarrhea are summarized in Table 2. Approximately two-thirds (64%) of caregivers stated that their children had ever suffered from diarrhea that had lasted > 3 days. Forty-one percent of caregivers responded that their child had experienced repeated problems with diarrhea that is difficult to treat or that lasts for several days. Approximately three-quarters (76%) of caregivers would typically seek medical care from a physician for their child experiencing diarrhea within 1-3 days of onset, infrequently right away (11%) or never (9%), and rarely > 3 days after onset (4%). Approximately three-quarters (78%) of caregivers considered that their day-to-day life was somewhat to extremely disrupted when their child had diarrhea. Fifty-nine percent considered their child was fairly to extremely distressed when they experienced persistent diarrhea and, of these, 28% were considered very/extremely distressed. With respect to care for a child with persistent diarrhea, almost two-thirds of caregivers (65%) stated they would have to stay at home with their child until they were able to return to normal activity.

Responses with respect to caregiver awareness/management of pediatric diarrhea are summarized in Table 3. The major sources or resources used by caregivers to learn about best care for children with diarrhea were the internet (69%) followed by asking a relative (54%): relatively few caregivers specified their child's physician (6%) or nurse (4%) when asked to specify any other sources or resources to learn best care. About two-thirds of respondents specified washing their own (75%) or child's (72%) hands prior to or after risk activities (e.g. food handling, diaper changing, toilet use) with respect to preventative advice or techniques when a child has persistent diarrhea; just over one-half kept their child away from child-care settings (57%) or did not let their child swim or attend a water park (55%). Most caregivers (42%) did not know whether their pediatrician tested a stool sample if their child had diarrhea, 30% said they did, and 28% said they did not.

Just over one-half of caregivers had not heard of the parasites, Giardia (54%) or Cryptosporidium (60%). Among caregivers who had heard of Giardia and/or Cryptosporidium (n = 430), approximately one-quarter were aware that alcohol-based hand gels and sanitizers did not inactivate Giardia or Cryptosporidium (24%) and that the CDC/ American Academy of Pediatrics (AAP) recommend that children diagnosed with cryptosporidiosis should not swim until 2 weeks after their diarrhea had completely resolved (27%): about one-third of caregivers did not know the answer to either question.

About one-third (37%) of caregivers knew all the five main routes of transmission which were specified in the survey that can lead to Giardia and Cryptosporidium infection and a similar proportion (35%) did not know any of these, with small proportions knowing some of the individual routes of transmission. Subgroup analysis showed that caregivers with some college education or less were significantly (P < .05) more likely than those with a college degree or postgraduate education to not know which activities lead to infection, and those who had heard of Giardia or Cryptosporidium were significantly (P < .05) more likely than those who have not to agree that all five activities

Questions/answers	No.	%
How many times has your child/children who is/are 1-12 years old ever suffered from diarrhea that has lasted > 3 days? (N = 1048)		
Never	309	29
Once	299	29
Twice	200	19
3 times	91	9
≥ 4 times	76	7
I don't recall	73	7
Has your child ever had repeated problems with diarrhea that is difficult to treat or that lasts for several days? [N = 1048]		
Never	617	59
Once	290	28
Twice	91	9
> 2 times	50	5
When do you typically seek medical care from a physician for your child experiencing diarrhea? (N = 1048)		
Right away	110	11
After 1-2 days	327	31
After 3 days	474	45
After 7 days	46	4
After 14 days	0	0
I have never considered seeking medical care for diarrhea in my child	91	9
On a scale of 1 to 10 (1 = extremely disruptive, 10 = not at all disruptive), when your child has diarrhea how much does it disrupt your day-to-day life? (N = 1048)		
Extremely (1-3)	301	29
Somewhat (4-7)	521	49
Not at all (8-10)	226	22
How distressed was/would you say your child is when they experience persistent diarrhea? (N = 1048)		
Very/extremely distressed	291	28
Fairly distressed	329	31
Somewhat/not at all distressed	428	41
How do/would you typically arrange care for a child who has persistent diarrhea? (N = 1047*)		
I have a sitter or other that stays with my child in my home	181	17
I am able to leave my child at daycare where they are cared for	71	7
I am able to take my child to school (pre-school, elementary) where they are cared for	25	2
I have to stay at home with my child until they are able to return to normal activity	679	65
Other	91	9

*Response by one caregiver not recorded.
Note: Some percentages do not add up to 100% exactly due to rounding.

Table 2: Definition/burden of pediatric diarrhea.

can lead to infection. A high proportion of caregivers (85%) did not believe that children with diarrhea should be allowed to swim, go to a water park, or attend school. Among caregivers who had pets in their home (n = 730), 28% were concerned about the possibility of cross-infection between pets and children (or vice versa) during episodes of diarrhea in either children or pets and a similar proportion (27%) were not concerned, with most (45%) not knowing. Subgroup analysis showed that caregivers who had heard of Cryptosporidium or Giardia were significantly ($P < 0.05$) more likely than those who had not to be concerned about cross-infection between pets and children (or vice versa).

Responses to questions pertaining to treatment of pediatric diarrhea are summarized in Table 4. When asked how they would seek treatment for a child with persistent diarrhea, about one-half (49%) of caregivers would seek medical care from their physician or the doctor's office and about one-third (32%) would treat using over the counter medications. Typically, they would seek treatment from a doctor or pharmacist on the fourth or fifth day after their child had persistent diarrhea for ≥ 3 days. Most caregivers (83%) had never asked for specific medications to treat their child's diarrhea. When asked how receptive they would be to have their physician prescribe a 3-day course of medicine to treat their child's diarrhea even without knowing the diagnosis, just under one-half of caregivers (43%) would be somewhat or very receptive and one-quarter (25%) would be neither receptive nor unreceptive. A higher percentage (58%) of caregivers would be somewhat or very receptive to have their physician prescribe a 3-day course of a liquid medication to treat their child's diarrhea, 30% would be neither receptive nor unreceptive, and 12% were somewhat or very unreceptive. If there was a medication for treating persistent diarrhea available from their physician, approximately one-half (48%) of caregivers would get this medication to treat their child as soon as possible after the diarrhea starts and about one-quarter (27%) would request more information. Those requesting more information most commonly wanted to know about side effects/risks and when to start/need the medication.

Discussion

Until the present survey, there would appear to be no published information in the literature concerning awareness of giardiasis and cryptosporidiosis among caregivers of children. Admittedly, the assessment of general awareness about causes of diarrhea in general in

Questions/answers	No.	%
What sources or resources do you use for information to learn how best to care for your child with diarrhea? (N = 1048)*		
I look up information on the internet (world-wide-web)	721	69
I ask a relative (mother, father, aunt, others) for advice on how to care for my child	566	54
I ask a friend or neighbor for advice on how to care for my child	229	22
I use information and articles from health magazines	193	18
I don't use other sources or resources	100	10
All other answers specified verbally by respondents combined	116	11
What prevention advice or techniques have you used when your child has had persistent diarrhea? (N = 1048)*		
Wash my hands with soap and water (e.g., before handling food)	790	75
Wash my child's hands with soap and water (e.g., after they have diaper changed or use toilet)	755	72
Keep my child away from child-care settings (e.g., day care) until diarrhea has resolved	602	57
Do not let my child swim or attend a water park while they still have diarrhea	578	55
I have not used any prevention advice or techniques	12	1
My child has never had persistent diarrhea	180	17
All other answers specified verbally by respondents combined	24	2.3
Do you think that children with diarrhea should be allowed to swim, go to a water park, or attend school? (N = 1048)		
Yes	60	6
No	888	85
I don't know	100	10
If you have pets in your home, are you concerned about the possibility of your child being infected by a family pet with diarrhea and/or infecting your pet when you child has diarrhea? (N = 730)		
Yes	204	28
No	199	27
I don't know	327	45
To the best of your knowledge, does your pediatrician test a stool sample if your child has diarrhea? [N = 1048]		
Yes	313	30
No	296	28
I don't know	439	42
Have you ever heard of the parasite, Giardia? [N = 1048]		
Yes	379	36
No	571	54
Not sure	98	9
Have you ever heard of the parasite, Cryptosporidium? [N = 1048]		
Yes	290	28
No	626	60
Not sure	133	13
If you have heard of Giardia and/or Cryptosporidium, do you believe that alcohol-based hand gels and sanitizers effectively inactivate Cryptosporidium and/or Giardia? (N = 430)		
Yes	176	41
No	103	24
I don't know	151	35
If you have heard of Giardia and/or Cryptosporidium, the CDC and AAP recommend that patients diagnosed with cryptosporidiosis should not swim until when? (N = 430)		
Until they complete a 3-day treatment course of nitazoxanide (Alinia)	72	17
Until their diarrhea has completely resolved	110	26
Until 2 weeks after their diarrhea has completely resolved	116	27
I don't know	132	31
Which of the following activities can lead to Cryptosporidium or Giardia infection? (N = 1048)*		
Drinking unfiltered, untreated water from a lake, river, or stream	182	17
Swallowing recreational water while swimming or playing in a pool, water park, spray ground/splash park, river, lake, ocean	154	15
Having contact with persons ill with diarrhea, particularly those in diapers	141	13
By putting something in your mouth or accidentally swallowing something that has come into contact with stool of a person or animal infected with Cryptosporidium or Giardia	187	18
By eating uncooked food contaminated with Cryptosporidium or Giardia	174	17
All of the above	392	37
None of the above	11	1
I don't know	372	35

*Multiple choice response.
Note: Some percentages do not add up to 100% exactly due to rounding.
AAP, American Academy of Pediatrics; CDC, Centers for Disease Control and Prevention.

Table 3: Awareness/management pediatric parasite-induced diarrhea.

Questions/answers	No.	%
How do/would you treat diarrhea that persists for more than 3 days: do/would you treat this on your own or seek medical care? [N = 1047*]		
Treat on my own using over the counter medications	338	32
Treat on my own but without medications	144	14
Seek medical care from my physician or the doctor's office	516	49
Seek medical care from a pharmacist	24	2
Seek care through alternative means and resources	15	1
Other	10	<1
If you indicated you sought/would seek care from your child's doctor or pharmacist after your child had diarrhea for 3 or more days: how many days after this did you/would you seek care from the physician or pharmacist? [N = 539*]		
On the 4th or 5th day	475	88
On the 6th or 7th day	18	3
After 7 days	5	<1
Other	41	8
Have you ever asked for specific medications to treat your child's diarrhea? (N = 1048)		
Yes	182	17
No	866	83
How receptive would you be to have your physician prescribe a 3-day course of medicine to treat your child's diarrhea even without knowing the diagnosis? [N = 1048]		
Very receptive	167	16
Somewhat receptive	285	27
Neither receptive nor unreceptive	266	25
Somewhat unreceptive	213	20
Very unreceptive	117	11
How receptive would you be to have your physician prescribe a 3-day course of a liquid medication to treat your child's diarrhea? [N = 1048]		
Very receptive	230	22
Somewhat receptive	382	36
Neither receptive nor unreceptive	311	30
Somewhat unreceptive	83	8
Very unreceptive	42	4
If there was a medication for treating persistent diarrhea available from your physician, would you…? [N = 1048]		
Get this medication to treat your child as soon as possible after diarrhea starts	504	48
Get this medication for your child only if the diarrhea lasts for more than a week	220	21
Not ask for this medication as all diarrhea is self-limited and will go away	43	4
Request more information from my child's doctor	281	27
If you would request more information from your child's doctor on medication for treating persistent diarrhea, what information would that be? [N = 281]†		
Side effects/risks	101	36
Information on when to start/need the medication	56	20
Information about other/alternative treatments	37	13
Prefer to have doctor's opinion	29	10
Information about causes of diarrhea/symptoms	26	9
Information about efficacy	25	9
Prefer to have any/all available information	24	9
Safety	23	8
Information about specific medication	20	7
Duration of treatment	16	6

*Response by one caregiver not recorded.
†Multiple choice response.
Note: Some percentages do not add up to 100% exactly due to rounding.

Table 4: Treatment of pediatric diarrhea.

children among caregivers of those same children is not well studied. A study published in 2002 assessed parental knowledge of the causes and signs of diarrhea and dehydration [8]. The study also examines parental-care practices during an episode of diarrhea. A wide variation in the level of awareness of signs, causes, and treatment of diarrhea was detected. General knowledge of diarrhea was related positively to accessibility of health information, level of education, ethnicity, and experience with dehydration. The authors concluded that in children, dehydration from diarrhea may be prevented by increasing parents'/caregivers' general knowledge of diarrhea and dehydration and the appropriate usage of oral rehydration solutions. Two older studies also assessed parenteral awareness and practices in acute diarrhea but again without focus on parasite induced diarrhea [9,10]. The results of these studies revealed general poor awareness of symptoms or "danger signs" of diarrhea regardless of background and incomplete awareness of solutions available to address diarrhea.

The authors conclude that more aggressive education should be

undertaken via emerging mass media and other agencies on recognition and treatment of diarrhea in infants [9].

The current survey results reflect responses from caregivers based in the United States. The consistent finding across all studies, regardless of the decade in which they were conducted, was that awareness of causes, route of transmission, and treatment options of diarrhea were generally not well known by caregivers or parents.

Of particular interest to us was the burden of care to the caregiver who was responsible for the child. The majority of caregivers found their child's diarrhea to be at least somewhat disruptive (78%). More than half (59%) think the condition is at least fairly distressing for their child. This was markedly different from similar data derived from pediatricians who did not recognize the distress to the child or the burden of care to the caregiver at nearly the same rate as the caregiver noted.

It was encouraging that a larger than anticipated percent of caregivers recognized the need to isolate their affected child from other to prevent the potential for spread. Most caregivers reported that they kept their child at home until the diarrhea resolved either under supervision of the caregiver (65%) or a sitter/other person (17%).

Of concern was the caregiver's knowledge about transmission prevention. With respect to preventative measures when their child had persistent diarrhea, about three-quarters of caregivers had performed hand washing with soap and water when performing risk activities such as food handing (75%) or toileting (72%). Rigorous hand washing with soap and hot water is a pivotal measure in the control of infectious diarrhea, specifically with respect to parasitic infections such as Giardia and Cryptosporidium among contacts of children with diarrhea [11,12], and this message should receive further emphasis among caregivers. Further with respect to preventative measures, just over half of the caregivers would keep their child away from child-care settings (57%) or stop allowing them to swim or attend a water park (55%) while they still had diarrhea. However, when asked directly whether children with diarrhea should be allowed to swim, go to a water park, or attend school, 85% of caregivers said no. There would therefore appear to be a gap between caregiver knowledge with respect to what they should do and their actual practice.

With respect to questions specifically applying to Giardia and Cryptosporidium, relatively low proportions of caregivers had heard of Giardia (36%) and, less so, Cryptosporidium (28%). Among caregivers who had heard of Giardia and/or Cryptosporidium, there was appeared to be a significant gap in their knowledge concerning awareness that alcohol-based hand gels and sanitizers do not effectively inactivate both Cryptosporidium and possibly Giardia [13]: 41% were unaware of the ineffectiveness of alcohol-based hand gels and sanitizers and 35% did not know whether this infectious disease control method was ineffective towards these parasites.

Giardia infection results from ingestion of fecally contaminated food or water or contact with infected persons or less so with infected animals [14]. Fecal-oral transmission can occur in child-care centers and within households [14]. Child-care center outbreaks have been associated with toddler wading pools where diapered children share the same water. Similar transmission can potentially occur at any water park where contact with contaminated water occurs [15]. Like other enteric infections, rates of giardiasis increase during warmer months [7], likely because of more frequent exposure to contaminated water through swimming or camping. Similarly, Cryptosporidium infection also results following ingestion of fecally contaminated food or water or contact with infected persons or animals [16]. Cryptosporidium is extremely chlorine tolerant and so can survive in a properly chlorinated pool or other treated recreational water venues for more than 10 days [17-19]. This creates a special challenge for outbreaks linked to recreational water such as swimming pools. Like Giardia, Cryptosporidium transmission can also occur at any water park where contact with contaminated water occurs [15,20]. The CDC/AAP recommendation that patients with cryptosporidiosis should abstain from swimming until 2 weeks after their diarrhea had completely resolved [15,21]. The 2-week restriction on swimming also applies to children who have been treated with a 3-day course of nitazoxanide for diarrhea induced by either Giardia or Cryptosporidium [22]. In our survey, even among caregivers who had heard of Giardia and Cryptosporidium, only 25% correctly identified that children with cryptosporidiosis should not swim until 2 weeks after their diarrhea has completely resolved. A more detailed discussion on transmission of Giardia and Cryptosporidium and recommendations on prevention and control of these parasitic infections was recently provided by Painter et al. [14,23].

In conclusion, awareness by caregivers of pediatric diarrhea, and more specifically persistent diarrhea induced by Giardia and Cryptosporidium, appears low, particularly with respect to some important considerations such as ineffectiveness of alcohol-based hand gels and sanitizers, modes of transmission, and restrictions on swimming. A key to minimizing the burden and impact of parasitic infection in the community may lie in the improvement of awareness among caregivers. In particular, education should be directed at appropriate management and treatment of giardiasis and cryptosporidiosis in children with persistent diarrhea. Improved caregiver education with respect to the management and treatment of diarrhea induced by either Giardia or Cryptosporidium in children should be made available using various and appropriate media, particularly via the internet, with reinforcement by all healthcare professionals with whom they come in contact.

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