SPECIAL MEETING
PARKS & OPEN SPACE COMMITTEE
TUESDAY, FEBRUARY 23, 2021, 4:00 PM
REMOTE WEBINAR VIA ZOOM

COVID-19 ADVISORY NOTICE

Due to Covid concerns and consistent with State Executive Orders No. 25-20 and No. 29-20, the meeting will not be physically open to the public. Members of the Committee and staff will participate in this meeting remotely. Members of the public are encouraged to participate remotely via Zoom or telephone pursuant to the information and link below. Public comment will be accepted during the meeting. The public may also submit comments in advance of the meeting by emailing Christina Cook at: ccook@cityofbelvedere.org. Please write "Public Comment" in the subject line. Comments submitted one hour prior to the commencement of the meeting will be presented to the Committee and included in the public record for the meeting. Those received after this time will be added to the record and shared with Committee members after the meeting.

The City of Belvedere is inviting you to a SPECIAL Zoom webinar.

When: February 23, 2021 @ 4:00 PM Pacific Time (US and Canada)
Topic: SPECIAL MEETING - PARKS & OPEN SPACE COMMITTEE

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Webinar ID: 870 3229 1672

The City encourages that comments be submitted in advance of the meeting. However, for members of the public using the Zoom video conference function, those who wish to comment on an agenda item should write "I wish to make a public comment" in the chat section of the remote meeting platform. At the appropriate time, City staff will allow oral public comment through the remote meeting platform. Any member of the public who needs special accommodations to access the public meeting should email ccook@cityofbelvedere.org, who will use her best efforts to provide assistance.

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TUESDAY, FEBRUARY 23, 2021, 4:00 PM
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OPEN FORUM

This is an opportunity for any citizen to briefly address the Parks and Open Space Committee on any matter that does not appear on this agenda. Upon being recognized by the Chair, please state your name, address, and limit your oral statement to no more than three minutes. Matters that appear to warrant a more lengthy presentation or Committee consideration may be agendized for further discussion at a later meeting.

SCHEDULED ITEMS

1. Discussion and possible recommendation to staff regarding the Community Park Playground surfacing material to assist city staff in proceeding with the proposed RHAA design as approved by City Council on October 12th, 2020.

Posted 02/19/2021

CITY OF BELVEDERE
Memorandum

TO: Belvedere Parks and Open Space Committee

FROM: Robert Zadnik, Public Works Director

SUBJECT: Summary of Findings for the Community Park Playground Surface Matting

DATE: February 18th, 2021

Recommended Motion/Item Description

a. Reaffirm its earlier decision regarding PIP surface matting and recommend staff proceed with next steps for the proposed design.

   OR

b. Provide additional direction and request Staff return to the Committee at a future date with alternative proposals.

Background

In October of 2020, the Parks and Open Space Committee (POSC) approved a revised playground concept plan which included a remodel of the tots play area for the Community Park Playground. This plan was developed in cooperation with the Belvedere community, POSC, the Playground Task Force, City staff, and the project architect, RHAA.

Following this meeting, it was made known to the City that certain chemicals with potential health risks were present in the rubberized poured-in-place material (PIP). RHAA, staff and the city researched this topic and provided a verbal report in January of 2021, during the regularly agenized Committee meeting. It was determined at that time that these reported health risks could be managed by the proper installation of the PIP material through a trained and certified professional contractor. In addition to this, the architect would specify a cleaner alternative rubber product, as opposed to recycled (used) crumb rubber material.

Given the importance of this decision, it was determined necessary that a special meeting should be held to discuss the topic in more detail and offer another opportunity to hear the community's comments. The following information is a brief summary of findings concerning PIP and other alternatives that were considered.

Findings

Poured-In-Place rubber surfacing consists of two components: the **surface layer** and the **base layer**. The surface layer is made up of virgin (non-recycled) rubber, coated in a urethane binder glue. The base later is designed to absorb impacts and consists of pre-consumer scrap rubber (items rejected due to wrong color, surplus, production defects, etc.). Other options for the base layer are avaible, for example, cryogenic crumb rubber (recycled vehicle tires), and recycled styrene, butadiene rubber (SBR); however, these products are becoming less common for the industry and will not be specified for this particular project.

Concerns have been raised by a member of the community that general wear and tear can break the surface layer and expose children to the recycled rubber base layer and chemicals, particularly Styrene and Butadiene. It is important to point out that Styrene and Butadiene are present in the pre-consumer postindustrial reclaimed rubber that would be used as a base layer for this project, although to a lesser degree than other SBR and recycled tire options. At the time of this report, there are no Non-Recycled rubber base layer materials available on the market that are tested and certified to meet the ASTM and ADA accessibility and impact attenuation standards. Studies by the EPA, Consumer Product Safety Commission, and Office of Environmental Health have researched the exposure risks of PIP in playgrounds and deemed it safe, given the significantly low parts-per-million concentrations found in playground matting wipe-tests throughout the Nation. Additional detail has been provided in the attached RHAA letter.

Note: the referenced reports and studies (page 3 of the attached RHAA letter) are too large for this agenda packet. The files will be available at City Hall for public review.

Alternatives

Playground matting must conform with ASTM and ADA code for fall safety and wheelchair access. Currently, there is only one alternative surface material that meets both these requirements. Sand does not meet accessibility standards.

- Engineered Wood Fiber (EWF)

  Pros:

  - Easy to install
  - Provides good impact absorption
  - Less expensive than PIP
  - Stays in place better than loose fill materials

  Cons:

  - Potential choking hazard
  - Can hide insects, pests and animal feces
  - Microbial growth can occur when material is wet
  - Expensive to refresh and maintain
  - Mold can grow on untreated wood
  - Wood chips are typically treated with Copper Chromated Arsenic (CCA), a wood preservative and insecticide that can contain up to 30% arsenic

Summary

Three are advantages and disadvantages to every product. Staff suggests that the proposed material does not present a health hazard. Based on the research conducted by the city, architect and playground task force, PIP surface matting has undergone intense review by a number of consumer and governmental agencies and has been deemed safe. It remains the preferred alternative for new playgrounds and has been used successfully in the industry for over 30 years.

Recommended Action

No specific action is necessary at this time; however, the Committee may:

a. Reaffirm its earlier decision regarding PIP surface matting and recommend staff proceed with next steps for the proposed design.

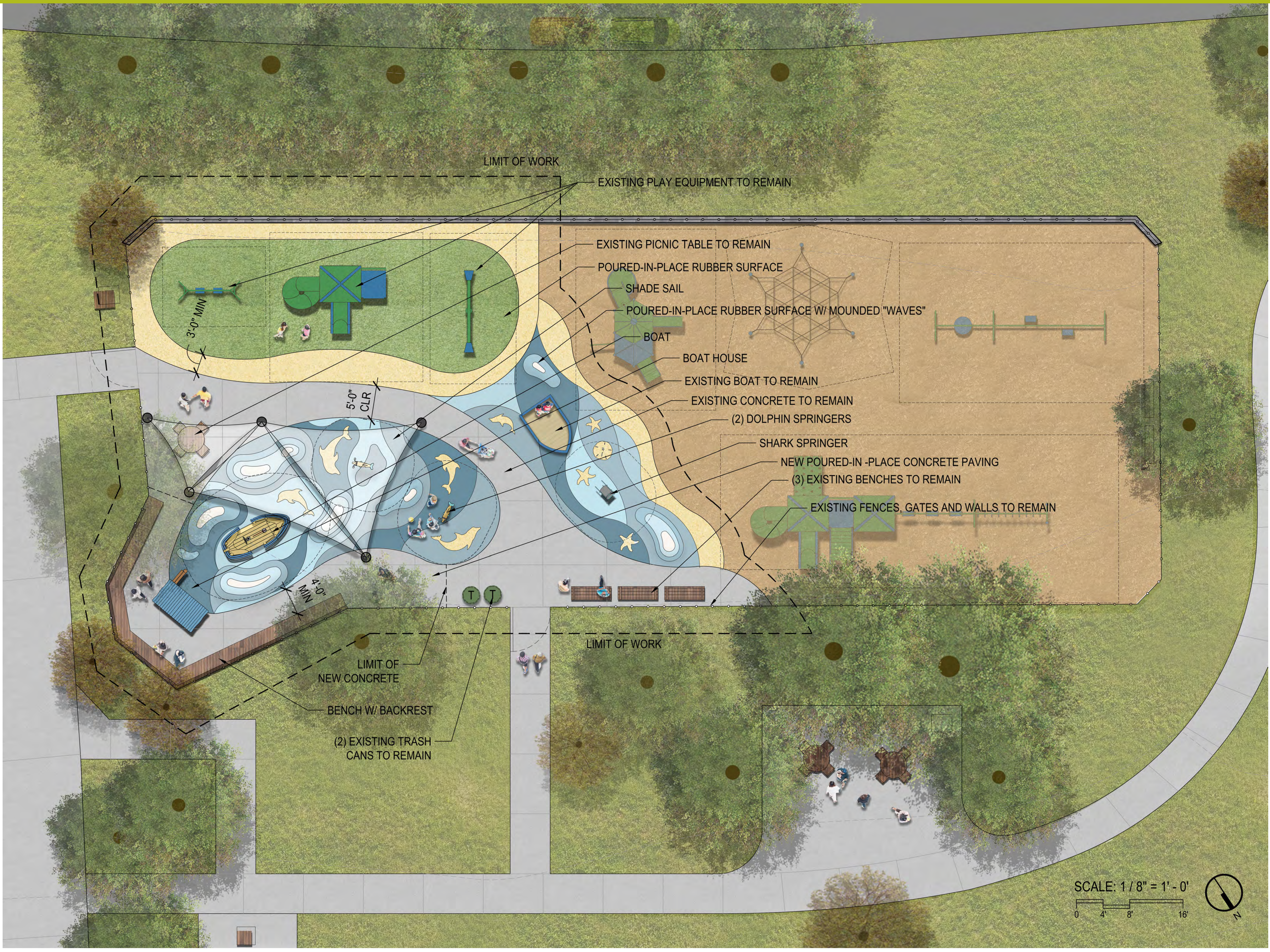
<u>or</u>

b. Provide additional direction and request Staff return to the Committee at a future date with alternative proposals.

Attachments

- Committee approved playground design by RHAA.
- Response from Architect regarding PIP surface matting.
- Committee member Valente’s summary on sand health hazards.

BELVEDERE PLAYGROUND



PLAN

Boat House
Kompan NR0414

Boat
Kompan NRO514

Dolphin Springer
Kompan NRO111

Shark Springer
Kompan PCM102

All Kompan play structures will be custom painted to match existing royal blue playground colors

PLAY ELEMENTS

Poured-in-place Rubber Surfacing

Shade Sail

Streetlife Rough & Ready Bench

SURFACING AND FURNISHINGS

Main Office
225 Miller Avenue,
Mill Valley, CA 94941

San Francisco Office
323 Geary Street, #602
San Francisco, CA 94102

rhaa.com
415.383.7900

December 18th, 2020

Robert Zadnik
Public Works Director | Emergency Preparedness Manager
City of Belvedere
450 San Rafael Ave.
Belvedere, CA 94920
Office (415) 435-4111
Fax (415) 435-0430

Project Address: Community Rd, Belvedere Tiburon, CA 94920
Scope: Renovation of Children's play area

RE: **Poured-in-place rubber surfacing.**

Rhaa understands that the industry standard for a poured-in-place rubber play surface consists of:

1. Base layer: An impact attenuation layer of cryogenic crumb rubber * or recycled styrene butadiene rubber (SBR)** or pre-consumer postindustrial reclaimed scrap rubber *** coated in a urethane binder.
2. Surface layer: A layer of virgin rubber (EPDM or TBP) coated in a urethane binder

* cryogenic crumb rubbe*r refers to untreated ground up passenger tires which will not be specified in this project.*

** Recycled Styrene, Butadiene, Rubber (SBR) will not be specified in this project.

****Most common in industry and will be specified in this project. Made of grounded, defective consumer rubber products that meet quality standards.*

Concerns have been raised by members of the community that general wear and tear can break the surface layer and expose children to the recycled rubber base layer and chemicals, particularly Styrene and Butadiene. Styrene and Butadiene are present in the pre-consumer postindustrial reclaimed rubber that would be used as a base layer for this project. There are no Non-Recycled rubber base layer materials available on the market that are tested and certified to meet the ASTM and ADA accessibility and impact attenuation standards.

If an instance occurs in which the recycled rubber content is exposed, meaning the surface layer and urethane binder is broken or worn down, a child in theory could be exposed to the recycled rubber content. In this case the Environmental Protection Agency, United States Consumer Product Safety Commission and the California Office of Environmental Health Hazard Assessment state the following:

- while chemicals are present as expected in the tire crumb rubber, human exposure appears to be limited based on what is released into air or simulated biological fluids – EPA [1] rhaa Landscape Architecture & Planning

- these surfaces would not cause skin sensitization in children, nor would they be expected to elicit skin reaction in children already sensitized to latex – California Office of Environmental Health Hazard Assessment - California Office of Environmental Health Hazard Assessment [5]
- There are 7 chemicals that could be considered carcinogens [in recycled rubber] but the concentration levels are below the level of one part per million that is generally considered an acceptable risk – California Office of Environmental Health Hazard Assessment [5]
- Zinc and four chemicals were measured [In wipe samples of in-use playground surfacing containing recycled tire rubber] that were at least three times background levels. Assuming playground use from one through 12 years of age the increased cancer risk was calculated to be 2.9 in one million which is generally considered to be an acceptable risk. – California Office of Environmental Health Hazard Assessment [5]
- no specific chemical hazards from recycled tires in playground surfacing are known by the CPSC at this time – CPSC [8]

Our understanding is that (based on their statements) federal and state health organizations have deemed poured-in-place rubber surfacing as safe for use in playground installation, provided the surfacing material is installed by a manufacturer that can prove compliance with all testing standards and any other applicable codes and it is maintained per the manufacturer's specifications.

Rhaa acknowledges that at the time that the referenced statements produced, the EPA, COEHHA, CPSC along with other agencies are conducting ongoing testing and research into the safety of rubber surfacing materials. Please refer to the references on the following pages. It is the responsibility of the City of Belvedere to make the final determination on material use.

We will wait for the City's direction on this matter. Please let us know how to proceed.

Sincerely,

Manuela King – President, RHAA Landscape Architects

References:

1. *https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumb-used-playing-fields* , Environmental Protection Agency Federal research summary statement.
2. *Synthetic Turf Field Recycled Tire Crumb Rubber Research Under the Federal Research Action Plan Part 1&2"* by Environmental Protection Agency (EPA), 2019
3. *"Association Releases Updated Information Regarding Use of Recycled Rubber on Playgrounds",* by International Play Equipment Manufacturers Association march 2012
4. *"Summary of Playground Surfacing Focus Groups"* by Consumer Product Safety Commission (CPSC) United States of America, January 2018
5. *"Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products*" by the Office of Environmental Health Hazard Assessment and published by the California Integrated Waste Management Board., January 2007
6. *"Are Poured in Place Playground Surfaces Safe?" by David Spease, ASLA, CPSI.*
7. *SECTION 32 18 16.13 PLAYGROUND TPV PROTECTIVE SURFACING TOTTURF by Robertson recreation.*
8. *https://www.cpsc.gov/Safety-Education/Safety-Education-Centers/Crumb-Rubber-Safety-Information-Center ,* United States Consumer Product Safety Commission

From:	Bryan Kemnitzer
To:	Robert Zadnik - Public Works Director
Subject:	Fw: Sandbox horrors
Date:	Wednesday, February 17, 2021 8:02:04 AM
Attachments:	Germiest Items in Public Places (NSF International 2008).pdf Defecation habits of animals in sandboxes (Kobe University School of Medicine 1996).pdf Parasite contamination of sand (McGill University 1991).pdf Sandboxes for children contain C. difficile (Spain 2017).pdf

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From: Mario Valente
Sent: Tuesday, February 16, 2021 10:15 PM
To: Bryan Kemnitzer
Subject: Sandbox horrors

When public health-testing organization NSF International sampled 26 different items in public places, for a 2008 study on germs, they found that sandboxes were the worst offenders of all, harboring 2000x more bacteria/mold per square inch than the door handles of public restrooms. [See attached].

McGill University tested the surface sand from 10 local day-care centers in 1991. Two of the sandboxes were contaminated with eggs of a parasite called *Toxocara*. Once a child eats them, the eggs hatch in his or her body into larvae, which can burrow into the liver or lungs, causing substantial damage. [See attached].

Another parasite kids can get from sandboxes is *Toxoplasma gondii*, which is spread by cats. In one 1996 study, Japanese researchers spied on 3 urban sandboxes at night using camcorders and found that over 150 days, cats pooped in the boxes 961 times. They calculated that one of the sandboxes contained more than 1.5 million viable Toxoplasma eggs per square foot of sand, yet children need only ingest a single egg to get sick. Although Toxoplasma infections are typically mild, individuals with compromised immune systems can fall very ill. And when women become infected during pregnancy, their babies can develop brain or vision damage. [See attached].

Finally, we are also learning that the potentially fatal *Chlostridium difficile*, generally thought of as "hospital-acquired", is becoming more common in playgrounds. Spanish researchers, in 2017, found that C. difficile was found in 9 of 20 children's sandboxes in Madrid. Toxic strains of C. difficile can range from diarrhea to life-threatening colon inflammation. Even worse, all of the samples the team analyzed were resistant to at least 2 antibiotics. Researchers wrote that the presence of C. difficile "constitutes a major health risk." [See attached].

Germiest Items in Public Places

As part of NSF International's ongoing Scrub Club® handwashing public service campaign, our microbiologists set out to find out where germs hide in schools and other public places. Teaming up with Real Simple magazine, NSF's experts swabbed key surfaces in local schools, grocery stores and other public places

Although not all germs are harmful, the existence of germs on the tested surfaces indicates that there are favorable conditions for microorganisms to grow and survive, which could create an environment for disease-causing viruses and bacteria, such as *E. coli* and *Salmonella*. In other words, the higher the level of bacteria, the higher the probability that some of those bacteria are harmful.

The Results

As part of this study, NSF microbiologists swabbed 26 different public places, testing for the level of aerobic plate count (APC), also known as the general bacterial population, at each location. Our team found that the location that harbored the highest level of bacteria was a playground sandbox, revealing a combined count of 7,440 aerobic bacteria, yeast and mold per gram. Sandboxes are an ideal setting for bacteria, as they are not only exposed to wildlife, such as cats and raccoons, but they can also hold on to bacteria that is left from human contact, such as saliva, food items and other bacteria from human hands.

Most Bacteria (Over 100 APC CFU/in2)	Relatively Clean (10-100 APC CFU/in2)	Clean (Less than 10 APC CFU/in2)
Public park sandbox	Public park swing	Dr. office checkout desk
Restaurant tray	School computer mouse	Dr. office magazine rack
School musical instrument	School desk	Dr. office toys
Theater video controller	School earphones	Dr. office waiting room chair
	School gym mat	Library kids' books
	Store basket	Restaurant restroom door handles
	Store floor	School basketball
	Theater arcade	School bus seat
	Theater restroom	Store horse ride
		Store shopping cart

Video game controllers were also found to have high numbers of germs. When NSF's microbiologists swabbed a game controller at a movie theatre that had just recently been cleaned by staff, the test results still showed an APC count of 551 bacteria per inch2. Aside from a musical instrument and a restaurant serving tray, which showed APC counts in the 200s, the rest of the 22 swabbed locations produced an APC count below 100, which by many standards is considered clean.

Three growth factors determine a surface's potential for harboring germs and bacteria: the type of surface, temperature and moisture level. Non-smooth, warm and moist areas tend to create ideal conditions for thriving bacteria to grow and hide.

In past studies, NSF found that objects such as water fountain spigots and cafeteria trays had more microorganisms than commonly cleaned areas, such as bathrooms and gym mats. Although NSF's findings are a snapshot in time at the tested sites, the results reveal that we all need to be vigilant about sanitizing those hard-to-reach areas that people may forget to clean. It also reinforces the importance of teaching proper handwashing from an early age to protect against potentially harmful bacteria, viruses and other germs.

Am. J. Trop. Med. Hyg., 54(2), 1996, pp. 122–126

DEFECATION HABITS OF CATS AND DOGS AND CONTAMINATION BY *TOXOCARA* EGGS IN PUBLIC PARK SANDPITS

SHOJI UGA, TOSHIKADZU MINAMI, AND KENJI NAGATA

Department of Medical Zoology, Kobe University School of Medicine, Kobe, Japan; Research and Technical Laboratories, Chemical Division, Shinto Paint Co., Ltd., Osaka, Japan

Abstract. The defecation habits of cats and dogs in three sandpits in urban public parks were observed by camcorder. Cats were the main cause of fecal contamination of these sandpits. Most (80%) feline defecations occurred at night between 6:00 PM and 6:00 AM. Each of the sandpits was used habitually as a defecation site by 4–24 cats, but these cats seemed to defecate elsewhere, as well. Fecal deposits within the sandpits were evenly distributed and did not tend to be concentrated in one area, suggesting that the cats avoided previously deposited feces when choosing a place to defecate. One sandpit was strongly contaminated and two were weakly contaminated with *Toxocara* eggs. Because sandpits are widely used as play areas for young children, effective sanitation measures should be implemented to prevent the contamination of sandpits by *Toxocara* eggs.

Toxocara canis and *T. cati* are nematodes usually found in dogs and cats, respectively. *Toxocara* eggs excreted from the host's body in feces can survive in the soil for months.[1] When these mature *Toxocara* eggs are ingested by humans, the larvae can migrate to the eye or viscera, causing severe disease. *Toxocara* has been the subject of much investigation as the cause of larvae migrans.[1]

Many reports have pointed out that our daily environment is contaminated by *Toxocara* eggs. Studies have shown degrees of contamination ranging from less than 2% to 87% in backyards and gardens in the United States,[2] public playgrounds in Ireland,[3] playgrounds of nursery schools in Nigeria,[4] a lawn adjacent to a university clinic in Australia,[5] and the soil around residences in Iraq,[6] indicating that *Toxocara* contamination is a worldwide problem. Public parks are places of recreation and relaxation for people who live in cities. The sandpits there are important as play areas for young children, and so need special management from the standpoints of safety and hygiene. However, these public parks are often contaminated by *Toxocara* eggs.[7–9] We earlier studied the sandpits of some public parks in Japan and found that the mean percentage of sandpits contaminated by *Toxocara* eggs was 13–69%, depending on the district, i.e., a mean of 69% of the sandpits were contaminated in urban districts with many factories and residences, with significantly less contamination in sandpits of suburban residential districts (18%) and rural communities (13%).[10] The reason for this pattern is probably that most of the ground in urban districts is paved and there are few suitable places for cats to defecate, and so their fecal deposits are concentrated in the sandpits of public parks.

The investigations cited above focused on existing contamination; there are few studies that have analyzed the source of contamination or identified countermeasures. Snow and others[11] suggested that the eggs they recovered from sandpits in London parks were probably those of *T. canis* "owing to the defecation habits of cats" (i.e., cats were assumed to be unlikely to defecate where contaminated soil was found). Duwel[12] suggested that because of the many local dogs, the eggs recovered from children's sandpits in Frankfurt were probably those of *T. canis*. These suggestions were not based on detailed studies. Using scanning electron microscopy for identification, we have found that the ratio of *T. canis* to *T. cati* eggs in the Japanese sandpits we examined was 1:3.[10] However, the ratio of canine to feline defecations in the sandpits was not evaluated in that study. In another investigation, 35 fecal fragments per square meter of sandpit were reported,[13] but whether the fecal deposits were those of dogs or cats was not determined.

The purposes of this study were to examine the defecation habits of cats and dogs in sandpits by detailed observation with a camcorder, and to identify the relationship between these habits and the contamination of sandpits by *Toxocara* eggs.

MATERIALS AND METHODS

Period of study and sandpits studied. The study lasted almost five months, from May 26 to October 16, 1993. Three sandpits in public parks in urban districts of Nishinomiya City, Hyogo Prefecture, Japan were examined. The environs of the parks in the study were crowded with many residences and shops, and the parks were small and equipped with only two or three kinds of play equipment, including a sandpit and a set of swings. The areas of the three sandpits studied and of the parks that contained them were as follows: sandpit A, 32 m^2 in a park area of 642 m^2; sandpit B, 23 m^2 and 499 m^2; and sandpit C, 18 m^2 and 854 m^2. Sandpit C, which was studied in more detail than the other two, was nearly rectangular and measured 3.6 × 5.0 m. On the southern side of this sandpit was an unbroken hedge of shrubs 30 cm tall, and 1 m behind that was a fence 150 cm tall.

Observations. A camcorder (CCD camcorder, 1K-53G; Toshiba, Osaka, Japan) was placed so that the entire sandpit was in view, and the species of animals that came to defecate, the time, and their behavior during defecation were recorded on videotape for 24-hr periods. All data to be observed were recorded on a 2-hr tape played very slowly. The tape was changed daily, and on playback the movements of the animals that had visited the sandpit were analyzed.

For the first 28 days of the study, all of the animals that entered each sandpit were recorded. The behavior of the cats and dogs that entered the sandpit was divided into two categories: a cat's or dog's remaining stationary for 10 sec or more in the characteristic defecation posture while in the sandpit was taken to be defecation behavior, and all other movements were taken to be transit behavior. In addition,

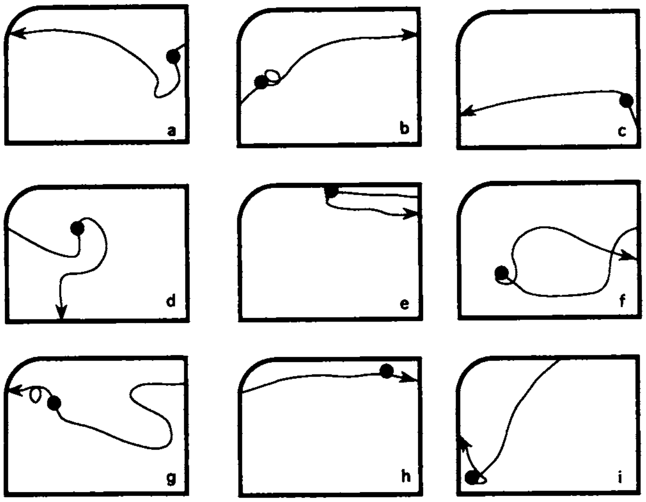

FIGURE 1. Movements and defecations of cats in sandpit C. The lines with arrows represent the movements of the cats, and the closed circles represent the defecation sites. The defecation habits of 117 visits by cats entering the sandpits were categorized into three patterns: defecation during the first third of the cat's stay in the sandpit (a–c), defecation during the middle third (d–f), and defecation during the last third (g–i). The incidence for each pattern was 10%, 27%, and 63%, respectively.

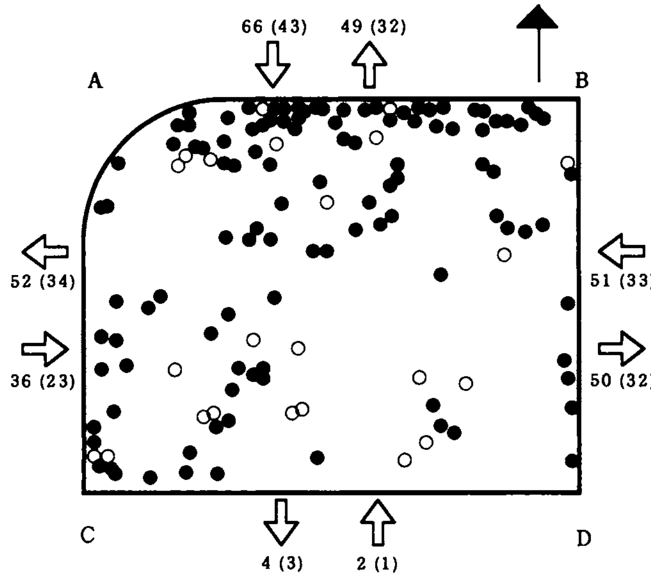

FIGURE 2. Defecation sites in sandpit C. Closed circles represent 110 defecation sites of 16 cats. Open circles represent 23 defecation sites of one cat (cat C-5). Arrows indicate the number (%) of times that cats entered or exited from that side of the sandpit. The dark arrow at the top right indicates north. Percentages do not necessarily add up to 100 because of rounding off.

each animal's place of entry into and exit from the sandpit, movements within the sandpit, and site of defecation were recorded. After day 28, only the defecation behavior of cats and dogs was analyzed.

Test for *Toxocara* eggs and survey for cats and dogs kept as pets. We used the centrifugal flotation technique with a sucrose solution (specific gravity = 1.200) to recover eggs of the genus *Toxocara* from sand as described elsewhere.[14] Fecal deposits recovered from the sandpits were examined to identify *T. cati* infection of cats (see Results for the reasons why dog fecal deposits were not examined). Specimens were recovered from the sites of defecation located by review of the videotape, and tested for the presence of *T. cati* eggs.

In the week beginning September 18, we visited residences within a 200-meter radius of sandpits A and C and asked the residents how many cats or dogs they kept as pets.

RESULTS

Only two species of mammals were observed during the first 28 days of the study, cats and dogs (a total of 249 visits by cats and 22 visits by dogs in the three sandpits).

Only transit behavior was observed in 86% (19) of the visits by dogs, which were all accompanied by their owners, and defecation behavior was observed in 14% (three). In contrast, defecation behavior was observed in 71% (176) of the visits by cats. The relationship between defecation behavior and actual defecation could not be ascertained by observation with the camcorder. Therefore, at times during the five-month observation period, we reviewed the videotape of the previous day and searched the sand in the areas seen on the videotape as probable defecation sites. We found the fecal deposits of 20 (91%) of 22 cats in this way, so there was good agreement between filmed defecation behavior and actual defecation.

The behavior of cats after entering the sandpit and the timing of defecation were examined in a random sampling of 117 defecations in sandpit C. Figure 1 shows nine typical examples. The lines indicated by the arrows show the movements of the cats from entry to exit, and the closed circles represent defecation sites. Three patterns of defecation could be identified: defecation immediately after entry (during the first third of the cat's stay in the sandpit; a to c), defecation during the middle third of the stay (d to f), and defecation during the last third of the stay (g to i). The frequency of each of these patterns was 12 times (10%), 32 times (27%), and 73 times (63%), respectively. The mean ± SD time that a cat spent in a sandpit when defecation behavior was observed was 137 ± 71 sec (minimum = 47 sec; maximum = 330 sec), and the mean ± SD time a cat remained in the defecation posture was 42 ± 20 sec (minimum = 12 sec; maximum = 116 sec).

Figure 2 shows the defecation sites of cats in sandpit C. We examined 110 sites of 16 cats and 23 sites of cat C-5. Many of the sites were near edge A-B, but not all were concentrated at the periphery of the sandpit or in any other area (Figure 2). In the 155 times these cats entered and left the sandpit, only two (1%) times was the south side (edge C-D, Figure 2) used for entry, and only four (3%) times was this side used for an exit. This edge was next to shrubbery and a fence, as mentioned above.

Table 1 lists the numbers of cats and dogs observed in each sandpit during the study. Excluding the days when a sandpit could not be observed continuously for 24 hr because of camcorder malfunction or the park being used by nearby residents for summer festivals and the like, each sandpit was observed for 140 or 144 days (total = 424 park-

TABLE 1
Number of dogs and cats observed in three sandpits

Sandpit	Observation period (days)	Dogs		Cats		Mean no. of cats observed/day (range)
		Max.*	Total	Max.*	Total	
A	144	0	0	5	96	1 (0–5)
B	140	1	11	6	201	1 (0–6)
C	140	0	0	14	664	5 (0–14)
Total	424	–	11	–	961	–

* Maximum number of dogs and cats observed per day. – = not applicable.

TABLE 2
Numbers of cats observed in sandpits, numbers of cats infected with *Toxocara*, degree of contamination of sandpits, and numbers of pets nearby

Sandpit	Cats			Eggs/200 g of sand	Pets‡	
	No.*	Tested	Infected (%)†		Cats	Dogs
A	4	4	1 (25)	8	4	23
B	10	4	1 (25)	8	ND	ND
C	24	12	8 (67)	21	4	7

* Number of different cats observed in each sandpit.
† Number and percent infected by *Toxocara cati*.
‡ Number of dogs and cats kept within 200 meters of the sandpit. ND = not done.

days). During this time, a total of 11 canine defecations and 961 feline defecations were observed; almost all of the fecal contamination of the sandpits was caused by the cats. Therefore, the remainder of our analysis was limited to the data on cats. The total number of feline defecations observed during the observation period was 96 in sandpit A, 201 in sandpit B, and 664 in sandpit C. The mean number of cats observed to defecate in one of the sandpits was 1–5 per day. In sandpit C, 14 cats were observed to defecate during one day on three of the observation days.

We analyzed the time of day of the 961 feline defecations observed. There were peaks at 4:00 AM–6:00 AM and at 6:00 PM–8:00 PM. Eighty percent (772 defecations) of the defecations were between 6:00 PM and 6:00 AM.

Because observations were videotaped, we were able to differentiate among the animals that came to defecate. The number of cats that habitually used the sandpit for defecation was four for sandpit A, 10 for sandpit B, and 24 for sandpit C (Table 2). Of the cats whose fecal deposits were examined for *T. cati*, 25% (1 of 4) of the cats frequenting sandpits A and B and 67% (8 of 12) of the cats frequenting sandpit C were infected. Next, we attempted to recover *Toxocara* eggs (mean of 30 tests) from soil samples from these three sandpits. The mean number of eggs found in 200 g of soil was eight for both sandpits A and B and 21 for sandpit C. These results show that in the three sandpits, the percentage of cats infected by *T. cati* was low when few *Toxocara* eggs were recovered and high when many eggs were recovered. Only four cats were kept by residents in the vicinity of sandpit C, so almost all of the cats coming to defecate in that sandpit were stray cats. There were 23 dogs kept as pets in the vicinity of sandpit A, but no dog was seen to defecate in that sandpit during the 144 days of observation.

The 24 cats that habitually visited sandpit C were numbered C-1 to C-24 in the order of the number of times they appeared in the sandpit. Cat C-1, the cat most frequently seen in sandpit C, was observed on 84 of the 140 observation days and defecated a total of 160 times (mean = 1.1 times per day). The total number of times each of the 21 cats C-4 to C-24 defecated was less than 50 (mean = 0.3 times per day or less). None of the 24 cats that frequented sandpit C was observed in sandpits A or B (2 and 0.3 km distant in a straight line, respectively).

DISCUSSION

On the basis of its behavior in human hosts, *T. canis* has been assumed to be more important as the etiologic parasite in toxocariasis than *T. cati*. It is necessary to differentiate between the eggs of these two *Toxocara* species if this assumption is to be examined, but that is difficult because the eggs are similar in appearance. Therefore, previous studies have not strictly differentiated between the eggs of these species, and in some reports, the term *Toxocara* egg is used to mean *T. canis* egg, although no method is described for discrimination between the species.[4,8] The eggs of *T. canis* are slightly larger than those of *T. cati*, but when we tried to distinguish between *T. canis* eggs and *T. cati* eggs on the basis of size alone, about 75% of the eggs could not be classified.[10] Scanning electron microscopy can be used to identify individual eggs reliably.

No canine fecal deposits were found in two of the three sandpits observed in this investigation. At least 30 dogs were kept as pets by residents in the neighborhoods around these sandpits, so the reason canine feces were not found in the sandpits was probably that the dog owners in these neighborhoods kept their dogs from defecating there. Dogs are to be kept on a leash, according to local regulations, and the regulations are almost universally observed. In sandpit B, 11 canine defecations were seen during the 140 days of observation, and all of these dogs were accompanied by their owners. The degree of contamination by *T. canis* eggs was greatly influenced by the behavior of dog owners with regard to where they allow their pets to defecate. Many canine fecal deposits were found along the paths where dogs were walked in residential areas, and we found *T. canis* eggs in 100% of the 10 soil samples from these paths. These findings suggest that contamination by *T. canis* eggs tends to increase with time since eggs are viable for months and are being added daily with few systematic measures taken to remove them. Such contamination would be particularly severe in areas where dog walkers do not follow the custom of collecting fecal deposits for proper disposal.

Almost all of the fecal contamination of sandpits in public parks was caused by cats. The mean time a cat was in a sandpit was 137 sec. During the 95 sec left after subtraction of the time taken for defecation, the cats wandered around the sandpit, but we did not observe behavior such as resting, grooming, or playing. These results suggest that the only reason the cats came to the sandpit was to defecate. In 117 visits, defecation was during the last third of the visit 73 (63%) times. Because entry into sandpit C along edge C-D was obstructed by shrubbery, a slight lack of uniformity was found in the cats' defecation sites, but those of cat C-5 (open circles in Figure 2) were fairly evenly distributed within the sandpit. These findings suggest that although cats like the properties of sand and enter the sandpits to defecate, they do not defecate in a single site that they are attracted to by smell, but instead seem to avoid the sites that carry the odor of their own previous defecations. This disposition of cats to defecate where they have not defecated before seemed to be the cause of the wide distribution of *Toxocara* eggs in the sandpits. Macdonald and others[15] reported that both urine and feces are invariably left unburied when barn-dwelling cats are away from the barn. All of the cats we observed buried their feces after defecating, and one reason may be that they lived near the sandpit. The cats' sphere of action was limited by the traffic conditions of the area around the parks. Thus, we decided that a radius of 200 meter from the sandpit was sufficient in our survey of dogs and cats kept by residents.

Sandpit C, which was the most contaminated of the three sandpits studied, was used by 24 cats as a defecation site. The cats defecated a total of 664 times during the 140-day observation period. Yet even cat C-1, the cat that came most often to sandpit C and defecated 160 times, did not come to this sandpit for a whole week several times. The mean number of defecations per day exceeded one only for cat C-1. These results show that all of the cats that defecated in sandpit C must have had other defecation sites besides this sandpit. These results suggest that the cats' attachment to sandpits is not particularly strong, and that they will defecate elsewhere if some physical or chemical obstacle prevents them from defecating in a particular location. The results of these observations were the basis for measures taken in one study to control fecal contamination by the use of a repellent, with the result that the number of cats defecating in the sandpits of three parks was reduced by two-thirds.[16]

Eighty percent of the defecations occurred at night, which suggests that when measures to prevent the fecal contamination of sandpits are being planned, methods that focus on nighttime defecations would be most effective.

The results of our previous studies[13,14] showed that some sandpits are strongly contaminated and some are weakly contaminated by *Toxocara* eggs. There was no difference between strongly and weakly contaminated sandpits we studied in terms of size, the surroundings, the daily hours of sunlight, the size of the grains of sand, the pH of the sand, or whether trees had been planted nearby, and it is unclear why the sandpits have different degrees of contamination. The percentage of cats (25%) infected with *T. cati* that used the weakly contaminated sandpits A and B was about the same as the mean percentage of parasitic infection for that region (22%),[17] but 67% (eight of 12) of the cats that used the strongly contaminated sandpit C were infected with *T. cati*. These results probably showed that sandpit C was strongly contaminated by *Toxocara* eggs not simply because more cats came there to defecate, but also because more of the cats that came there were infected with *T. cati*.

Infection of cats and dogs in this district by 15 or 16 types of helminths has been reported.[17] The fecal deposits of cats and dogs result in contamination of sandpits by parasites other than *T. cati* and *T. canis*, and from the standpoint of public health, other such contamination (e.g., *Cryptosporidium, Acanthamoeba, Toxoplasma*, and *Trichuris vulpis*) is a problem that should not be ignored. The results of a survey by questionnaire of 300 mothers with children 1–9 years of age living in Tokyo or Osaka showed that playing with sand was the seventh best-liked recreation of 40 choices (Proctor and Gamble Far East, Inc., Kobe, Japan, unpublished data). These results suggest that sandpits are a popular and important play area for young children. Knowledge of the defecation habits of cats and dogs will help in the planning of effective measures to prevent the fecal contamination of sandpits in public parks.

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Parasite contamination of sand and soil from daycare sandboxes and play areas

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TW GYORKOS, E KOKOSKIN-NELSON, JD MACLEAN, JC SOTO. Parasite contamination of sand and soil from daycare sandboxes and play areas. Can J Infect Dis 1994;5(1):17-20.

OBJECTIVES: To determine if there was parasite contamination in the sand and soil in daycare sandboxes and play areas, with the goal of developing practice guidelines for their management.

METHODS: One hundred samples of sand and soil from 10 daycare centres in different regions of the province of Quebec, collected between April 22 and May 6, 1991, were examined.

RESULTS: Toxocara eggs were found in both surface and subsurface sand from two Montreal centres and co-occurred with *Ascaris* species (surface sand) in one centre and with hookworm (surface soil) in the second. Hookworm eggs were also recovered from one centre in the Quebec City region.

CONCLUSIONS: These results document the presence of potentially pathogenic helminth parasites in the daycare environment. Evidence from the literature regarding the health risk to children is insufficient and highlights the need for further research into the assessment of the risk of human infection and morbidity, the viability of these parasites under different environmental conditions and practical issues related to the management of sand and soil.

Key Words: *Child daycare centres, Environmental microbiology, Parasites, Toxocara*

Contamination parasitaire du sable et de la terre dans les carrés de sable et les terrains de jeux des garderies

OBJECTIF : Développer des directives pour la protection du sable et de la terre des carrés de sable et des terrains de jeux des garderies contre une possible contamination parasitaire.

MÉTHODE : Cent échantillons de sable et de terre obtenus auprès de 10 garderies dans différentes régions du Québec ont été recueillis entre le 22 avril et le 6 mai 1991 pour fin d'étude.

RÉSULTATS : Des oeufs de Toxocara ont été trouvés tant à la surface que sous la surface des carrés de sable de deux garderies de Montréal, avec l'espèce *Ascaris* (sable de surface) dans une garderie, et l'ankylostome (terre de surface) dans le second établissement. Des oeufs d'ankylostome ont également été identifiés dans un centre de la région de Québec.

CONCLUSIONS : Ces résultats attestent de la présence de parasites helminthiques potentiellement pathogènes dans l'environnement des garderies. Les résultats présentés dans la littérature au sujet du risque que courent les enfants sont incomplets et rappellent la nécessité de pousser la recherche pour évaluer le risque d'infection et de morbidité chez l'humain, la viabilité de ces parasites selon différentes conditions environnementales, ainsi que les aspects pratiques liés à la prévention des infections transmises par le sable et la terre.

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IT IS WIDELY RECOGNIZED THAT SAND AND SOIL FROM AREAS accessible to dogs and cats are likely to be contaminated by parasites (1,2). In fact, the geographic distribution of geohelminths such as the dog or cat roundworm (*Toxocara* species) can be thought of as being as widespread as that of their hosts. Public parks, playgrounds, beaches, backyards, gardens, kennels and kindergarten sandpits in localities around the world have all been documented as sites of toxocara contamination (Table 1) (3-12). Daycare centres differ in most, if not all, of these environmental sites in that the external environment is completely enclosed (there is usually legislation to this effect), thereby restricting or completely eliminating access by animals, especially dogs, the principal transmitters of *Toxocara canis*. One important exception relates to cats, which transmit *Toxocara cati*; however, this parasite is generally considered to be less important than *T canis* in causing human infection (1). To date, environmental contamination of parasite origin within the daycare setting has focused on the internal, and not the external, physical environment (13). However, as new opportunities for contamination become recognized (for example, sand play areas are no longer restricted to the traditional sandbox, which could be covered, but include large areas with all types of recreational structures, which cannot be practically covered), and as awareness of environmental and public health concerns increases, an evaluation of the nature and risks associated with this type of potential contamination is warranted.

Humans acquire toxocariasis by ingesting infective eggs from matter contaminated with dog or cat feces. The toxocara infection rate in human populations is known to vary considerably (seroprevalence estimates range from 3 to 30%) according to geographic and demographic factors (1,14). Children attending daycare centres are under the age of five, the peak age of first infection and the age of high risk behaviours such as geophagia and lack of personal hygiene skills. While most infections with these parasites remain asymptomatic, there exists some (as yet unquantified) risk of disease (visceral larva migrans, ocular toxocariasis) following exposure. Fatal outcomes have been reported, but these are extremely rare (15).

Because of the importance of sand in the daycare environment, questions have arisen concerning its proper maintenance and management. However, in reviewing the evidence with the intent of developing practice guidelines, it was unclear whether these should take into consideration possible contamination from microorganisms. Therefore, a study was undertaken to investigate the occurrence of contamination in sand or soil play areas of daycare centres, using geohelminths as indicators of this contamination.

METHODS

Specimen collection: Ten daycare centres in different geographical regions in the province of Quebec (Montreal, six; Quebec City, two; Shawinigan, two) were selected for collection of sand and soil specimens between April 22 and May 6, 1991. The daycare centres were selected in an arbitrary manner. Two daycare centres located within the Département de santé communautaire territory of five members of the Comité provincial des maladies infectieuses en service de garde (an advisory committee to the Director of Public Health) were invited to participate in the study. All agreed. Five sand specimens from sandboxes and play areas and five soil specimens from grass or around fences were obtained in 100 mL collecting bottles containing 50 mL fixative (sodium-acetate-formalin). Each specimen consisted of approximately 75 g of surface (less than 2 cm deep) or subsurface (2 to 10 cm deep) sand or soil.

Laboratory examination: Both zinc sulphate flotation and ethyl acetate concentration methods were performed on each specimen. Approximately 20 microscope slides per specimen were examined by two experienced parasitology laboratory technologists. Only

TABLE 1
Studies illustrating diversity of environmental parasite contamination by toxocara

Reference	Locality (Year)*	Type of environment†	Number tested	Number positive (%)
3	Britain (1973)	Public parks	10	10 (100)
4	Frankfurt (1984)	Sandpits (playgrounds)	31	27 (87)
5	Southwest Michigan (1989)	Public parks	3	2 (67)
6	Montreal (1976)	Public parks	10	6 (60)
7	Illinois (1988)	Public parks	23	11 (48)
8	Dublin (1991)	Household gardens	26	10 (38)
		Public parks	17	2 (12)
9	Baton Rouge (1984)	Public parks	20	4 (20)
10	Baltimore (1985)	Backyards and gardens	146	16 (11)
11	Perth (1984)	Sand (dog 'beach')	200	0 (0)
		Public parks	6	0 (0)
12	Brisbane (1990)	Kindergartens (sandpits)	30	0 (0)

*Date of publication; †Unit of observation (descriptor indicating origin of type of specimen examined) qualitative determinations (presence/absence) of parasites were made. Parasites observed were mounted and photographed. Photographic slides of parasites were sent to Centers for Disease Control and Prevention for confirmation.

Questionnaire: Questions concerning the maintenance and replacement of the sand and the presence of animals within the enclosed exterior of the daycare were asked of each centre coordinator. Specifically, maintenance questions determined whether there was general maintenance (removal of debris, raking) or cleaning with solvents (chlorine, javel water, etc) of sandboxes and other sand and soil areas. The frequency with which new sand and/or soil was added was also obtained. Reports on the presence of animals concerned day- or night-time observation of dogs and cats specifically, with an option for the reporting of other types of animals. In addition, a sketch of the external environment depicted the location of physical structures, sandboxes and play areas, as well as the sites of specimen collection.

RESULTS

Parasites were recovered from three of 10 daycare centres, two from Montreal area centres and one from the Quebec City area (Table 2). Toxocara eggs were found in both surface and subsurface sand from the two Montreal centres and co-occurred with *Ascaris* species (surface sand) in one centre and with hookworm (surface soil) in the second. Hookworm eggs from surface soil were recovered from one centre in the Quebec City region.

Of the three centres where contamination was found, all but one had more than one sand play area. Sand from all three centres was reported to be treated with cleaning solvents, but only one specified the solvent (javel water) and the frequency with which it was used (annually). New sand was brought in at least every two years. No animals had been observed either during the day or the night in two centres, but in the third, dogs had been seen on centre property during the day. The location of the sand specimens from the two centres from which toxocara eggs were recovered included a large sand play area and sand from around a swing set.

Of the seven centres in which parasite contamination was not found, all had more than one sand play area. Two centres did not use any cleaning solvents, three used javel water, one used chlorine water and one did not specify the cleaning agent. Javel water was reported to be used once or twice per year. New sand was brought in in two centres every year, in one centre after the fifth year and in the remaining centres, every two or three years. Two reports of animals seen during the day included a raccoon and birds. During the night, either by direct observation or by inference (presence of fecal material), the following animals were reported

TABLE 2
Parasite recovery from sand and soil of daycare centres in three different regions in Quebec – Spring 1991

Daycare centre		Parasite	Sand or soil	Surface or subsurface
Montreal	A	None found		
	B	Toxocara ?*Ascaris* species	Sand Sand	Surface Surface
	C	None found		
	D	None found		
	E	None found		
	F	Toxocara ?Hookworm	Sand Soil	Subsurface Surface
Quebec	A	?Hookworm	Soil	Surface
	B	None found		
Shawinigan	A	None found		
	B	None found		

In all cases, 10 specimens were evaluated

from three centres: cats, dogs, squirrels, raccoons, pigeons and mice.

DISCUSSION

The presence of parasite contamination in the external daycare environment found in this study was not completely unexpected. Toxocara contamination had previously been reported from the Montreal area (6), and the type of temperate climatic conditions prevalent in this region would not prevent completion of the parasite's life cycle (16). However, because the external environment of daycares in the province of Quebec must be enclosed by a security fence at least 1.2 m in height (17), fecal contamination by dogs was considered unlikely.

Our findings differ from studies that have examined sand from kindergartens, an environment most similar to that of daycares (4,12). No toxocara parasites had been recovered from sand taken from two kindergartens in Frankfurt (4), nor from 41 sandpits obtained from 30 kindergartens in Brisbane (12). Although the efficacy of the laboratory method had been verified in the latter study, a review of the methods of sand collection, processing and laboratory examination used in the studies reported here indicate an extreme lack of standardization and the possibility that low densities of parasites would be missed.

Other enclosed types of environment examined were household backyards and gardens (8,10). Toxocara contamination was reported at levels of 38 and 11%, respectively.

While no attempt was made to quantify the amount of sand contamination or to determine the viability of eggs in our study, it is clear that these two issues will need to be examined to provide an estimate of the risk of human infection. An assessment of the determinants of risk (eg, age specificity, type of play area) will assist in the development of targeted preventive actions. However, the mere presence of these parasites indicates that measures need to be taken to eliminate animal fecal contamination from the daycare environment. There are published Canadian and American standards for the management of sand in sandboxes (18,19); however, these have been formulated in the absence of any demonstrated effectiveness of, for example, cleaning solvents or turning over of sand, on geohelminth contamination (personal communication). It should also be noted that these standards refer exclusively to sandboxes or sand play areas that can be covered and do not include larger (uncoverable) sand play areas, where toxocara contamination was shown to occur in our study.

Minimal preventive measures for the external daycare environment include: first, maintenance of all fences and gates, and second, immediate removal of any fecal material. The need for covering, replacing or turning over sand and the frequency with which this should be done in the different types of sand play areas requires further study. Sand can be decontaminated using methods such as sterilization (20), but this is probably too impractical for application in daycares. Cleaning sand with chemical cleaning solvents like javel water has not been effective in destroying toxocara eggs; however, exposure of eggs to direct sunlight is effective (2). Practical and cost-effective recommendations based on these observations in terms of preventive actions at the disposal of daycare personnel requires rigorous examination.

In addition to the above two preventive measures, daycare personnel and children should understand the importance of adequate hand-washing practices and the avoidance of ingestion of nonfood matter (eg, sand, soil).

These measures must ideally coincide with municipal control of stray animal populations and the mutual collaboration of pet owners and veterinarians in the adequate de-worming of domestic dogs and cats.

Parasite contamination in this report has focused on geohelminths. However, extension of these proposed investigations to include other pathogenic microorganisms should also be considered to ensure that practice recommendations regarding the maintenance and management of sand and soil are comprehensive.

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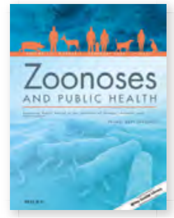

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ORIGINAL ARTICLE

Recreational sandboxes for children and dogs can be a source of epidemic ribotypes of *Clostridium difficile*

Cristina Orden, Carlos Neila, José L. Blanco, Sergio Álvarez-Pérez
... See all authors

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Related Information

Summary

Different studies have suggested that the sand of public playgrounds could have a role in the transmission of infections, particularly in children. Furthermore, free access of pets and other animals to the playgrounds might increase such a risk. We studied the presence of *Clostridium difficile* in 20 pairs of sandboxes for children and dogs located in different playgrounds within the Madrid region (Spain). *Clostridium difficile* isolation was performed by enrichment and selective culture procedures. The genetic (ribotype and amplified fragment length polymorphism [AFLP]) diversity and antibiotic susceptibility of isolates was also studied. Overall, 52.5% (21/40) of samples were positive for the presence of *C. difficile*. Eight of the 20 available isolates belonged to the toxigenic ribotypes 014 (*n* = 5) and 106

Details

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belonged to the toxigenic ribotypes 014 (n = 5) and 106 (n = 2), both regarded as epidemic, and CD047 (n = 1). The other 12 isolates were non-toxigenic, and belonged to ribotypes 009 (n = 5), 039 (n = 4), and 067, 151 and CD048 (one isolate each). Nevertheless, all isolates (even those of a same ribotype) were classified into different AFLP genotypes indicating non-relatedness. In conclusion, our results revealed the presence of epidemic ribotypes of *C. difficile* in children's and dog's sandboxes located nearby, which constitutes a major health risk.

Clostridium difficile

dog

epidemic strains

sandboxes

Publication History

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Citing Literature

Supporting Information

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