ABC News

Schools Can Be a Hotbed of Bacteria
How to Protect Children From Germs in Classrooms, Gyms and Cafeterias
By ANN PLESHETTE MURPHY and JENNIFER ALLEN

Oct. 3, 2006 —

Like millions of kids across the country, 10-year-old Nick Werner hops on a school bus each morning, bound for Oak Grove Elementary School in Lewisbug, Tenn., for a busy day of school and fun.

What he does not know is that his daily activities will expose him to something other than a fifth-grade education: potentially harmful germs.

Avoiding germs is nearly impossible, something Nick's mom, pediatrician Denise Werner, knows well.

In addition to Nick's two younger sisters, Werner comes in contact with sick kids every day at her medical practice.

She knows how easily germs can spread and how hard it is for parents to prevent sickness.

"Typically, when you have small kids, it's hard to make sure that they're getting their hands clean and that they're not touching things that have germs on them and then touching each other," she said.

Tracking Germs in School

An elementary school, where kids share practically everything, is a potential Petri dish of possibility to spread germs.

"Good Morning America" had microbiologist Robert Donofrio, director of the microbiology lab at public health and safety firm NSF International in Ann Arbor, Mich., spend a day following Nick around school.

Donofrio swabbed everything Nick touched and later analyzed it for a germ count.

For the instant germ readings, Donofrio used a hand-held germ meter, which offers a broad sense of the total number of microorganisms present.

A reading above 300 on the meter means microorganisms abound (there are lots of bacteria...).

"What we're looking for are any bacteria, yeast or mold that might be present on various surfaces or areas that the children might come into contact with during the day," Donofrio said.

In the classroom Nick touched his desktop, a pencil, a pencil sharpener and the water fountain spigot.

The germiest spot was surprising. The water fountain had the highest count: 2,335.

Then Nick's class headed to the gym for an action-packed gym class.

Nick hit the mat for push-ups, worked out with an ab roller, and dribbled a basketball. The piece of equipment with the highest germ count was a shocker.

The basketball, which dozens of students had touched, yielded the highest reading of the day: 13,987.

"[The count] was about 10 times as much as what we found on some of the other surfaces we tested in the gym and in the classroom," Donofrio said.

The next stop was lunch, and the worst culprit in the cafeteria wasn't the students' food trays, the metal counters, or even the communal tables.
The surface that harbored the most organisms was something every child and teacher touches every day: the lunch checkout keypad, which had a reading of 13,144.

"This was the last location touched before the kids started eating," Donofrio said. "If a child is ill, he could easily infect the keyboard via sneezing or coughing, then the next few children could pick up these germs and become infected themselves."

Another hot spot was the mouse Nick used in the computer lab, clocking in with a reading of 9,838.

High-traffic areas, like the lunch keypad or computer mouse, contribute significantly to the spread of germs, but another key factor is the type of material a surface or object is made of, and particularly whether it is porous.

The toilet seat, for instance, had the lowest reading of the day.

Its smooth, nonporous surface cannot retain germs like a ridged basketball or a wooden desk seat. Bathrooms, especially toilets, also are cleaned and disinfected regularly.

"Typically a smoother surface is going to have less of a film to protect that organism," Donofrio said. "A more porous or wood surface has the nooks and crannies that those organisms could reside in and maybe will shield that from any disinfectant contact."

Another germ zone lives in the music room.

Bacteria that can cause a host of medical problems, such as strep, can thrive in the body or mouthpiece of a wind instrument for weeks, according to studies conducted by Encore Etc.

To keep instruments such as recorders, flutes and trumpets free of bacteria, schools can enlist the services of Encore Etc., which created the MaestroMD Sterilization System to disinfect wind instruments.

Though the germ counts at Nick’s school may seem high, they’re likely not much different from those in any school in the United States.

NSF International and Donofrio have tested schools around the country. The findings from Oak Grove Elementary, which has no history of disease outbreaks, illness or dirty facilities, are consistent with other schools.

What Parents Can Do

The swab from Nick’s hands showed that they were relatively germ-free.

But parents should teach kids to be aware of moist environments, like the water fountain, which may harbor lots of germs.

The best bet is to send children to school with bottled water, if it’s permitted. Have children wash their hands after gym class and before eating lunch, particularly if they come in contact with a common object that everyone touches, such as a doorknob to a major entry point.

Tuck hand sanitizer or sanitizing wipes into their backpacks. On the go, they’re acceptable substitutes for proper hand washing.

To teach kids proper hand washing, check out www.scrubclub.org, an online project of NSF International that incorporates interactive games, songs, and other downloadable activities to teach kids how to wash their hands.

NSF International - The Public Health and Safety Organization

Germiest Places at Schools

According to the Centers for Disease Control and Prevention, 22 million sick days are taken each year due to the common cold alone. With even more serious concerns over influenza, the microbiologists at NSF International wanted to conduct an experiment to find out where germs were most commonly found in local schools.

Two Michigan elementary schools were selected to take part in this experiment. A range of bacterial samples was taken from a variety of surfaces that kids come in contact with every day at school. The goal of this experiment was to determine what educators and school cleaning crews need to be on the lookout for when protecting kids from germs. The following table summarizes the surfaces on which the most germs were found:

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>(Colony Forming Units / in sq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Fountain Spigot (classroom)</td>
<td>2,700,000 CFU/in sq</td>
</tr>
<tr>
<td>Water Fountain Spigot (cafeteria)</td>
<td>62,000 CFU/in sq</td>
</tr>
<tr>
<td>Plastic Reusable Cafeteria Tray</td>
<td>33,800 CFU/in sq</td>
</tr>
<tr>
<td>Faucet (cold water handle)</td>
<td>32,000 CFU/in sq</td>
</tr>
<tr>
<td>Faucet (hot water handle)</td>
<td>18,000 CFU/in sq</td>
</tr>
<tr>
<td>Cafeteria Plate</td>
<td>15,800 CFU/in sq</td>
</tr>
<tr>
<td>Keyboard (classroom)</td>
<td>3,300 CFU/in sq</td>
</tr>
<tr>
<td>Toilet Seat</td>
<td>3,200 CFU/in sq</td>
</tr>
<tr>
<td>Student's Hand</td>
<td>1,200 CFU/in sq</td>
</tr>
<tr>
<td>Animal Cage</td>
<td>1,200 CFU/in sq</td>
</tr>
</tbody>
</table>
Surprisingly, the study revealed that there were actually more germs found on an average classroom water fountain spigot than there were on a toilet seat. Although these findings are a snapshot in time at these particular schools, the results reveal that we need to be vigilant about sanitizing hard-to-reach areas in schools as well as those surfaces that people may forget to regularly clean and sanitize.

**Importance of Handwashing**

Since bacteria and viruses can live for more than two days on many surfaces, it's important to protect yourself. And the best way is through proper and frequent handwashing. Proper handwashing involves thorough scrubbing of hands under warm water with soap for a full 20 seconds before rinsing and drying with a clean towel. To learn more about proper handwashing, visit the NSF Scrub Club website.
Study Reveals Common Bacteria Linger on Surfaces, May Spread

Published January 9, 2014

University at Buffalo experiments from a day care center have revealed that two common bacteria persist on various surfaces for extended periods of time.

This research, published in *Infection and Immunity*, "is the first to directly investigate that these bacteria can survive well outside a human host, and potentially spread between individuals," says the study’s senior author Anders Hakansson, PhD, assistant professor of microbiology and immunology.

**Biofilm Found on Toys, Books, Cribs, Hands**

The researchers found that biofilms of *Streptococcus pneumoniae* and *Streptococcus pyogenes* survived for hours on human hands and could be isolated from books, soft and hard toys and other surfaces.

Four out of five stuffed toys tested positive for *S. pneumoniae*, and cribs and other items tested positive for *S. pyogenes*.

Tests were conducted before the day care center opened, several hours after the last human contact.

**Month-Old Surface Biofilms Colonize Mice**

The researchers also found that month-old biofilms of *S. pneumoniae* and *S. pyogenes* from contaminated surfaces readily colonize mice.

"Although bacterial colonization doesn't by itself cause infection, it's a necessary first step if an infection is going to become established in a human host," he explains.

Hakansson's team previously demonstrated that bacteria form hardy, highly structured biofilms when colonizing human tissues.

**Research May Lead to Better Prevention**

"Our findings change our ideas about how these bacteria may spread between individuals and, if this spread is shown to be substantial, it should make us more cautious about bacteria in the environment," says Hakansson.

The scientific literature maintains that one can only become infected by *S. pneumoniae* and *S. pyogenes* by breathing in droplets expelled as infected individuals cough or sneeze.

Hakansson concludes that "commonly handled objects contaminated with these biofilm bacteria could act as reservoirs of bacteria for hours, weeks or months, being vehicles of spread upon contact."

"If this type of spread is substantial, then prevention protocols similar to those now used for intestinal bacteria and viruses—which do persist on surfaces—will need to be implemented," he says.

"Hand washing, which is well implemented in most day care centers, is very effective in preventing spread and should be encouraged as one measure."

**Bacteria Studied Cause Numerous Infections**

Any resulting anti-infection precautions would be especially important for people who work with children or in health care settings.

"Our findings change our ideas about how these bacteria may spread between individuals and, if this spread is shown to be substantial, it should make us more cautious about bacteria in the environment."

Anders Hakansson, PhD
Assistant professor of microbiology and immunology

Related Profile
Anders Hakansson, PhD

Related Article
Biofilm Formation Enhances Fomite Survival of *S. pneumoniae* and *S. pyogenes* (Infection and Immunity, Dec. 26, 2013)

Related Links
Hakansson Lab
Children, the elderly and others with compromised immune systems are especially vulnerable to infections caused by the bacteria studied.

S. pyogenes commonly causes strep throat in children and can cause skin infections and other serious infection in both children and adults.

S. pneumoniae is widespread in day care centers and a common cause of hospital infections. It is a leading cause of childhood ear infections as well as illness and death from respiratory tract infections in children and the elderly. In developing countries, where fresh water, good nutrition and common antibiotics may be scarce, the bacterium often leads to pneumonia and sepsis, killing 1 million children each year.

Refuting Previous Studies: Lab vs. Real-World Findings

Much prior research has found that these bacteria cannot live long outside the human body, and therefore do not linger on inanimate objects.

These studies, however, have used broth-grown planktonic bacteria, or lab cultures, to show that bacteria die rapidly.

Based on his team's previous research, "we knew this lab-produced form of bacteria may not represent how these pathogens actually grow in the host," says Hakansson.

UB Medical School Funds Research

Co-authors on the study, "Biofilm Formation Enhances Fomite Survival of S. pneumoniae and S. pyogenes," are both advanced student researchers at UB: MD/PhD candidate Laura R. Marks is first author and PhD candidate Ryan M. Reddinger is second author.

The research was funded by UB's School of Medicine and Biomedical Sciences and its Department of Microbiology and Immunology.

Hakansson conducts research through two collaborative UB centers: the Witebsky Center for Microbial Pathogenesis and Immunology and the New York State Center of Excellence in Bioinformatics and Life Sciences.
Food Poisoning Resources

Food Poison JOURNAL

FOOD POISONING OUTBREAKS AND LITIGATION: SURVEILLANCE AND ANALYSIS

Presented by
MARLER CLARK

The nation’s foremost law firm with a practice dedicated to representing victims of foodborne illness

Millions of Germs and Bacteria Await Kids at School

Posted By Food Poisoning Lawyer on September 16, 2005

NSF International reports that American children are back in school, but homework isn't all they're bringing home — they're likely bringing home thousands of microscopic germs. NSF International (NSF), an independent, not-for-profit organization, recently collected and tested samples and found as many as 2.7 million bacterial cells per square inch on common school surfaces such as water fountains, desks, computer keyboards, bus seats and cafeteria trays.

NSF's startling findings include:

* Drinking water fountain spigots had the highest amount of bacteria on the tested surfaces — 2.7 million bacterial cells per square inch.
* A cafeteria tray had more than ten times as many germs as a toilet seat (33,800 bacterial cells per square inch vs. 3,200 bacterial cells per square inch).
* A student's hand had 1,500 bacterial cells per square inch.

* Commonly cleaned areas, such as desks and doorknobs had fewer germs (19 bacterial cells per square inch and 5 bacterial cells per square inch respectively), while computer keyboards and ear phones had significantly more at 260 bacterial cells per square inch and 740 bacterial cells per square inch respectively.

While not all germs are harmful, their existence suggests the presence of viruses and bacteria that can lead to the common cold and flu, or even serious foodborne illnesses such as E. coli and Salmonella. The Centers for Disease Control and Prevention (CDC) estimates that 164 million days of school are lost each year due to illness — up to half of which could be eliminated with proper handwashing.

**Handwashing Help from the Scrub Club**

Developed by NSF International, The Scrub Club(TM) (http://www.scrubclub.org) provides a fun way for kids to learn the importance of handwashing to fight infectious and foodborne diseases. Each of the Scrub Club kids represents one of the six steps in the handwashing process — "Hot Shot" and "Chill" combine to make the warm water essential for proper handwashing; "Squeaks" turns into various forms of soap; "Taki" becomes a clock that counts down the required 20 seconds for proper handwashing; "Scruff" reminds kids to clean around their nails; "Tank" turns into a sink to rinse away the germs and "P.T." transforms into paper towels.
Directions: For each article you read, pull out important facts about bacteria and where they grow. This will guide you when you and your group design your experiment.

Important facts you should take notes on:

- Where/what surfaces do bacteria grow on
- How bacteria grow
- Possible ways to eliminate bacteria
- Any other important facts about bacteria

Article title: “Schools can be a Hotbed of Bacteria” by Ann Pleshette and Jennifer Allen

Source: http://abcnews.go.com/GMA/OnCall/story?id=2455073
Article title: “Germiest Places at School”

Source: http://www.nsf.org/consumer-resources/studies-articles/germ-studies/germiest-places-schools/

Article title: “Study Reveals Common Bacteria Linger on Surfaces, May Spread”

Source:
http://medicine.buffalo.edu/news_and_events/news.host.html/content/shared/smbs/news/2014/01/bacteria-surface-3541_detail.html
Article title: "Millions of Germs and Bacteria Await Kids at School"
