Food Safety and HACCP in Schools

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There is rising concern for food safety as it relates to all phases of food production and preparation from "farm to fork." The growing importance of food safety in schools is evident with the recent adoption of the following food safety position statement by the American School Food Service Association (ASFSA, 2002): "ASFSA will initiate and support collaborative efforts to ensure that schools develop food safety systems so that children have safe food in schools."

This emphasis on food safety in schools is likely related to several factors, which include:

- A greater awareness of national statistics on the causes of foodborne illness;
- Changing regulations to improve the inspection system and training of foodservice managers; and
- Food safety research in school foodservice operations that highlights the need for improvements in specific food practices.

This paper reviews the research literature and presents information to support the importance of food safety and the need to develop food safety systems that support serving children safe food in schools.

Overview of the Food Safety Problem: National Food Safety Statistics

When viewed in total, the vast number of foodborne illnesses in the United States today results in tremendous financial, labor, and personal costs. Donna Shalala, former Secretary of the U.S. Department of Health and Human Services (HHS), stated that "Foodborne disease remains a substantial public health burden" (HHS, 2000). Estimates from the U.S. Department of Agriculture (USDA) suggest that the medical costs and loss of productivity that have resulted from seven of the most serious food pathogens average between $6.5 million and $34.9 billion annually (Partnership for Food Safety Education, 1997). The incidence of foodborne illness across the nation is estimated to be as high as $76 million per year (Mead et al., 1999), resulting in approximately 325,000 hospitalizations and 5,000 deaths.

In spite of a reported decline in bacterial causes of foodborne illness, recent data from the Centers for Disease Control and Prevention (CDC) suggest that foodborne diseases appear to cause more illnesses but fewer deaths than previously estimated (Mead et al., 1999). This may be due, in part, to greater knowledge of specific types of foodborne diseases, including viral sources. For example, CDC data from 1997 suggest that almost 80% of the causes of foodborne illness may be viral, 13.5% bacterial, and slightly more than 6.5% parasitic (Mead et al., 1999). The most common foodborne viruses, bacteria, and parasites are shown in **Table 1**. It also is acknowledged that the cause of foodborne illness is determined only in about 14 million of the 76 million annual cases, or about 18% of the time (Mead et al., 1999).

Printed from *The Journal of Child & Nutrition Management*, Issue 1, 2003
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Table 1. Examples of the most common viral, bacterial, and parasitic causes of foodborne illness (Mead et al., 1999)	
Microorganism	**Estimated Incidence Per Year**
Norwalk-like viruses	23,000,000
Rotavirus	3,900,000
Astrovirus	3,900,000
Campylobacter spp.	2,453,926
Giardia lamblia	2,000,000
Salmonella, nontyphoidal	1,412,498
Shigella spp.	448,240
Cryptosporidium parvum	300,000
Clostridium perfringens	248,520
Toxoplasma gondii	225,000
Staphylococcus	185,060

By contrast, when causes of death resulting from foodborne illness are determined, comparatively few incidents are the result of viral causes. Most common causes include *Salmonella, Listeria monocytogenes,* and *Toxoplasma.* These three microorganisms alone are thought to be responsible for 75% of the known causes of death due to foodborne illness (Mead et al., 1999).

As knowledge of the causes of foodborne illness grows, so has the list of foodborne pathogen concerns. Evidence of this is shown by the dramatic increase in the number of foodborne pathogens highlighted in food safety textbooks in the last 10 years. For example, the National Restaurant Association's (NRA) *ServSafe®* textbook has increased the number of pathogens discussed since 1992 from 14 to 21 (NRA, 1992; NRA, 2002). Newer pathogens discussed in the most recent edition include bacteria such as *Vibrio spp.* and *Yersinia enterocolitica*; viruses such as the rotavirus; and parasites such as *Giardia duodenalis, Toxoplasma gondii, Cryptosporidium parvum,* and *Cyclospora cayetanensis.*

Several factors impact the microbiological quality of food in today's environment. These include such factors as the global nature of the food supply, increases in the availability of organic foods, evolving pathogens, changes in modern farming practices, consumer behavior, and risk perceptions (Institute of Food Technologists [IFT], 2002). The IFT expert panel on emerging

microbiological food safety issues supports the use of Hazard Analysis Critical Control Point (HACCP) programs to improve the microbiological quality of food to improve food safety (IFT, 2002).

Since September 11, 2001, bioterrorism has become part of the American vocabulary. The food and water supply could be viable targets for bioterrorism, and these threats can be evaluated and minimized by applying HACCP principles (Bledsoe & Rasco, 2002; Bledsoe & Rasco, 2003). USDA is in the process of developing guidelines for school foodservice operations to address food security issues.

School Foodservice Statistics
According to the U.S. Government Accounting Office (GAO), outbreaks of foodborne illness in schools are rare, but appear to be increasing in incidence proportional to overall increases (GAO, 2002; GAO, 2000). For example, more than 33 million meals are served daily to children through the National School Lunch Program and School Breakfast Program, with only eight outbreaks reported nationwide in 1997 and nine in 1998 that were associated with school-provided foods (GAO, 2000). While not a large number, schools still should be vigilant as these outbreaks affected 688 children in 1997 and 921 children in 1998 (GAO, 2000).

More recent school estimates suggest that there were 292 outbreaks between the years of 1990 and 1999, causing 16,232 children to become sick with foodborne illness (GAO, 2002), and that the number of reported outbreaks actually has increased (on an average) by 10% per year (**Table 2**) (GAO, 2002). It should be noted that there was a change in surveillance methodology beginning in 1998 that might account for higher numbers of incidents. It also should be noted that these data reflect incidents caused by food brought from home as well as food served in schools. For example, of the 20 largest outbreaks reported in 1998 and 1999, seven were caused from food brought from home or sources other than the school meals program.

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Table 2. Outbreaks and illnesses in schools and non-school settings, 1990-1999*		
Year	**Outbreaks**	**Illnesses**
1990	25	1,212
1991	14	486
1992	14	991
1993	15	676
1994	31	1,807
1995	9	436
1996	32	1,772
1997	39	2,026
1998**	63	3,944
1999**	50	2,882
Total	292	16,232

Adapted from GAO, 2002 report (Original source: Centers for Disease Control and Prevention [CDC] data)

*Data includes all reported school outbreaks, including outbreaks determined to be caused by foods brought from home

**Data since 1998 reflect CDC's change from a passive to an active surveillance system in which CDC actively solicits more comprehensive information from states

Most commonly identified microorganisms for illness outbreaks connected to school foods were salmonella and Norwalk-like viruses (GAO, 2002). As a result, it has been suggested that USDA take actions to better ensure the safety of school foods (GAO, 2002). More specifically, a GAO report made the following suggestions:

- Establish a database to track all of the actions related to holding or recalling USDA-donated foods;
- Revise the school foodservice manual to include guidance for state and local school authorities on enhanced safety provisions for USDA procurement contracts;
- Provide state and local authorities with easy and routine access information on federal inspection and compliance records of potential suppliers; and
- Extend holding and recall procedures to include school-purchased foods.

Examples of foods implicated in school foodservice outbreaks include eggs and turkey, among other foods (CDC, 1985; CDC, 1987). Outbreaks may result in substantial costs to school foodservice, students, and the community. They include medical costs, attorneys fees, insurance costs, additional training or equipment to improve food safety, and lower participation rates in the school meals programs. For example, in a 1986 Oklahoma outbreak involving an estimated 202 cases of salmonellosis, medical expenses alone totaled over $40,000 for the school's insurer (CDC, 1987).

Changing Regulations
At least 17 states/jurisdictions have passed legislation, mandating certification in safe food handling for food handlers in restaurants, hospitals, schools, and other foodservice operations (Almanza & Nesmith, in review). This may be due in part to studies that have found that food safety training and certification has a positive impact on the sanitation in foodservice establishments and inspection scores, particularly those with low initial baseline inspection scores (Cotterchio, Gunn, Coffill, Tormey, & Barry, 1998). However, implementation of regulations for mandatory certification of food handlers varies greatly from state to state. Regulations differ as to who must be certified (managers vs. food handlers), whether the certified individual must be onsite at all times, recertification, approved examinations, training requirements, exemptions, allowed times for coming into compliance for new establishments, and for turnover, fees, instructor requirements, and how certification is checked (Almanza & Nesmith, in review).

In addition, regulation of foodservice through state and local inspection systems also has been changing (Almanza, Ismail, & Mills, in press). The traditional scoring system relied on the use of a demerit system and deducted points for each violation from a possible score of 100 points (Educational Foundation of the National Restaurant Association, 2002). Critical violations were valued at four to five points and non-critical violations were worth one to two points.

Many health departments have been moving to newer inspection scoring systems that include the use of HACCP or a system that monitors the number of critical and non-critical violations (Almanza, Ismail, & Mills, in press). The HACCP-based inspection is different in that it focuses on the flow of potentially hazardous foods and observes food items from receiving until the time meals are served rather than simply doing a "walk-through" to observe the establishment at a given point in time (Food and Drug Administration [FDA], 1999). During a HACCP-based inspection, times and temperatures of potentially hazardous foods are evaluated and compared against critical limits established for those food products. Handling of food and the facility/equipment also are evaluated with a focus on critical time periods when risk of contamination is greatest.

A third type of inspection is the criticals/non-criticals monitoring system. This system also places violations into categories of being critical or non-critical, but it is different from the traditional system in that it notes whether these violations are first time or repeat incidents (FDA, 1999). Multiple violations of the same type (for example, more than one employee without a hair restraint) also may be tracked under this system. This system is thought to provide more

information and better communication between foodservice employees and health inspectors, but overall results are more difficult to interpret because there is no single summary result or number compared to the traditional system.

As a result of changing food regulations, school foodservice managers in certain geographic areas may now be required to obtain added training and/or certification in food handling. In addition, widely evolving inspection systems may require a more proactive approach to potential sanitation problems and changes in how foodservice managers view their approach to food safety.

Food Safety Issues in Schools

These national statistics, as cited above, emphasize the need to focus on food safety in schools. In addition, there have been changes in food production systems in schools that necessitate more emphasis on food safety. For example, there has been an increase in the number of school districts using centralized production systems. In the 1999 *Operations Survey*, 23% of directors surveyed indicated that their district had a central production facility and 13% had a central bakery. Centralized, or commissary, foodservice systems have more critical control points than conventional systems (Unklesbay et al., 1977). Due to budget constraints, an increasing number of small school districts are centralizing production with existing equipment. As a result, facilities and equipment sometimes are not adequate to ensure food temperature control. When properly planned and implemented, these systems can provide good food safety controls.

Food-Handling Practices in School Foodservice

Food quality is multidimensional, and is defined by nutritional, aesthetic, and microbiological aspects of the food. For food quality, all three aspects must be present and maintained through excellent food handling practices. A high level of food safety results from appropriate food handling practices by foodservice employees. Several studies of food-handling practices in school foodservice indicate that there are areas of concern that need to be addressed (Blakeslee & Penner, 1999; FDA, 2000; Giampaoli, Cluskey, & Sneed, 2002; Gilmore, Brown, & Dana, 1998; Henroid & Sneed, in press; Kim & Shanklin, 1999).

Gilmore, Brown, and Dana (1998) developed and tested a food quality model for school foodservice operations. In this process, these researchers conducted observations in eight school kitchens in Iowa and Minnesota, reviewing receiving practices, food production sanitation steps, and food-handling techniques during food production. Many sanitation practices were good, including clean uniforms, short and unpolished fingernails, appropriate use of utensils/gloves for handling food, sanitizing of work surfaces, and the thawing of foods. Researchers did observe that handwashing was infrequent, hair restraints were not used, and jewelry was not limited to a watch and wedding band. They also observed the use of reusable towels to dry dishes/utensils in some kitchens.

These findings are consistent with observations of food-handling practices in subsequent research studies. An FDA study (2000) was conducted to develop baseline data on the risk factors for foodborne illness in retail foodservice operations, including schools, hospitals, nursing homes, restaurants, and retail food stores. Overall, elementary schools were in 80% compliance for the items observed. Improper holding and time/temperature relationships were the area with the lowest compliance (60.5%) and personal hygiene was next at 74.2% compliance. For cold foods, 45% of schools did not hold them at a cold enough temperature. Improper or inadequate handwashing was seen at 36% of those schools that were out of compliance for personal hygiene, while 27% of the sites did not take steps to prevent hand contamination.

Giampaoli, Cluskey, and Sneed (2002) observed employees in 15 school districts in the Silicon Valley, Calif. They found that proper handwashing techniques often were not used, that the majority of employees did not wear hair restraints, and that employees were observed eating and drinking in the kitchens. Some food storage practices were inappropriate, such as boxes being stored on the floor, raw meats stored above other food items, and inadequate labeling and dating of food in storage. Sanitizing issues, such as not checking temperature/sanitizer concentrations and not using sanitizing agents on food contact surfaces, also were identified.

In a study of 40 Iowa school districts, Henroid and Sneed (in press) identified several food-handling issues. About one-third of the observed employees either did not wash their hands frequently enough or use appropriate handwashing techniques. Temperatures (food, refrigeration, freezer, and dishwashing machine) frequently were not taken and even less frequently were recorded. Calibrated thermometers often were not used (and employees often were not aware of calibration procedures). Researchers checked temperatures of both hot and cold food items at the time of service and found more problems with appropriate cold food temperatures than hot food temperatures, which is consistent with the FDA study (2000). There were few written standard operating procedures in any of the school districts in the Iowa study.

In a study of time and temperature control in a Kansas school district that was in transition from a centralized conventional system to a centralized cook-chill system, Kim and Shanklin (1999) identified a number of food safety concerns. Researchers found inconsistencies in reheating methods and observed extended periods of holding for hot foods, especially in the cook-chill foodservice system. Time and equipment constraints caused much of the temperature problems, and demonstrated the need for standard operating procedures and continual training and supervision. Blakeslee and Penner (1999) worked with the same Kansas school district to establish a HACCP program. These researchers found that inconsistencies in sanitation steps emphasized the need to establish standard sanitation practices.

There were many similarities in the findings of these research studies. Consistently, researchers have concluded that there is a need for more employee training, supervision, and standard operating procedures to guide food-handling procedures to ensure the safety of food served to children.

HACCP and Prerequisite Program Implementation in School Foodservice
HACCP has been defined as "a systematic approach to the identification, evaluation, and control of food safety hazards" (National Advisory Committee on Microbiological Criteria for Foods, 1998). The Committee also identified prerequisite programs that are necessary for developing and implementing an effective HACCP plan. Examples of prerequisite programs are written sanitation standard operating procedures, employee training, personal hygiene, and supplier control.

Prerequisite Programs
There is little research about the status of prerequisite programs in school foodservice. Youn and Sneed (2003) conducted a study of prerequisite programs using a national and an Iowa sample of school foodservice directors. Less than half of the respondents indicated that they had written standard operating procedures for cleaning and sanitizing equipment and facilities. For foodservice directors using centralized systems, 73% reported that they take and record temperatures throughout the food flow, compared with 67% of directors using conventional systems. Only about 25% of directors surveyed determined if suppliers had a HACCP plan or checked the condition of suppliers' delivery trucks.

According to the study, emphasis on prerequisite programs is needed to prepare schools for HACCP implementation. The larger the school district, the higher the number of good food safety practices and procedures implemented. Researchers also have found that operations that employed a person with the primary responsibility for food safety implemented more practices and procedures than did those schools that did not assign that specific responsibility. Districts with centralized foodservice systems also implemented more food safety procedures and practices than did districts with conventional foodservice systems.

HACCP Implementation
Extent of HACCP implementation in schools. Research indicates that a small percentage of school districts have a HACCP program in place. A study in Indiana (Hwang, Almanza, & Nelson, 2001) found that 66.5% of school foodservice managers were aware of HACCP, but only 22 of the 85 managers who were aware of HACCP indicated that they had a HACCP program in place. Plans to implement HACCP were not related to concerns about an outbreak of a foodborne illness, but were related to the availability of sanitation training programs, the managers' knowledge of sanitation, and current sanitation practices.

In a later national study, 30% of school foodservice directors indicated that they either had a HACCP program or were in the process of implementing one (Giampaoli, Sneed, & Cluskey, 2002). Another national study found that 22% of foodservice directors indicated that they had implemented a comprehensive HACCP plan, while only 11% indicated that they had a HACCP team in place (Youn & Sneed, 2002). One caveat should be considered in interpreting these results: Self-assessed levels of comprehensive HACCP implementation may be misleading because of varying definitions and understanding of what it means to implement HACCP in foodservice.

Barriers/Obstacles to HACCP implementation. Several studies have examined barriers to HACCP implementation in school foodservice. Hwang et al. (2001) found that Indiana school foodservice managers identified time to establish a HACCP program, time to run the program, and labor costs as being the three biggest obstacles. In addition, "lack of training funds, time to get used to running the HACCP program, and union problems" were other identified obstacles. Giampaoli, Sneed, Cluskey, and Koenig (2002) conducted a national study and found three types of barriers: resource management, employee motivation, and employee confidence. Employees are nervous about taking food safety certification examinations and often are not comfortable with the change needed for implementation of a program like HACCP. Youn and Sneed (2002) identified employee and resource barriers in a national study of school foodservice directors. Lack of employee training was the biggest employee barrier and lack of financial resources to devote to food safety was the biggest resource barrier. Time was the barrier cited in a centralized cook-chill foodservice system (Blakeslee & Penner, 1999).

A group of school foodservice directors who have implemented or are in the process of implementing HACCP in their districts identified the challenges that they faced (Sneed & Henroid, 2003). Consistent with other research, the responding directors indicated that time and cost issues were challenges. Other challenges related to state/local health departments, employee issues, school culture, and foodservice system structure. The main issue in regard to health departments is the inconsistency in the understanding and application of HACCP. Employee issues related to such areas as employee attitude, self esteem, time constraints, a viewpoint that HACCP is an added responsibility, the ability to make good decisions, and employee turnover. Issues related to school culture included perceptions of teachers and staff and the impact of other departments on foodservice. The directors noted that sometimes the organizational structure did not support employees' ability and willingness to make decisions.

Support needed for HACCP implementation. In a focus group discussion, foodservice directors who have implemented or are in the process of implementing HACCP identified several areas of support that are needed (Sneed & Henroid, 2003). One very important need was for school districts to establish a food safety policy, which should address issues such as who has keys to the kitchen, use of the kitchen by outside groups, food-handling certification requirements for those who use the kitchen, and guidelines for foods served in the classroom. Sneed and Henroid (personal communication) visited schools that did not lock kitchens, placed the time clock for all the school's hourly employees in the kitchen, and allowed students to walk through the kitchen to store personal food in kitchen refrigerators. These practices do not support food safety, yet are permitted in many schools.

Other areas of support that have been identified (Sneed & Henroid, 2003) include resources (such as model HACCP programs and educational materials), new equipment (both large and small), and time. Support to eliminate or minimize the barriers to HACCP implementation also must be considered.

Advantages to HACCP implementation. While there are barriers to HACCP, there also are many potential advantages that should be recognized. Several advantages to implementing HACCP in school districts have been identified by school foodservice directors (Sneed & Henroid, 2003). HACCP programs can save money and time and improve quality. The HACCP

process necessitates a thorough review of every aspect of procurement, production, and service-- and this process helps identify areas of improvement. In addition, some school foodservice directors view HACCP as an insurance policy.

RECOMMENDATIONS

Statistics related to food safety and research on food safety practices in schools indicate several areas that need change. Several recommendations are offered to school district administrators and foodservice directors.

Recommendations for school administrators. Food safety is an important issue throughout the entire school district and must be addressed in a coordinated manner for the entire school district. It is recommended that school districts:

1. Develop a food safety and food security policy for the school district. The policy should address the following areas:

- School foodservice program
- Food brought from home or other sources
- Food in the classroom
- Vending
- Concessions
- Use of facilities by outside groups
- Access to the school kitchen

2. Involve key constituents on a team to develop the food safety and security policy, including such representatives as the foodservice director, a teacher, school nurse, and custodian.

3. Support food safety and food security training for school foodservice staff.

4. Support food safety education for students.

Recommendations for school foodservice directors. The school foodservice director is key to ensuring that food served to children is safe. It is recommended that directors:

- Work with school administrators to develop a strong school district food safety and security policy.
- Develop food safety standard operating procedures to support the department's food safety and food security programs.
- Require food safety certification for all management/supervisory staff members.
- Provide substantive food safety training for all employees before they begin working.
- Provide continuing food safety education.
- Evaluate the school foodservice program to determine that all prerequisite programs are in place to support food safety and security programs.

- Purchase the tools required to support food safety, such as thermometers, test strips, etc. Make sure these tools are readily available and that staff members are trained on their proper usage.
- Develop self-inspection programs in food safety, such as HACCP.
- Stay informed about current food safety regulations and inspection processes.

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