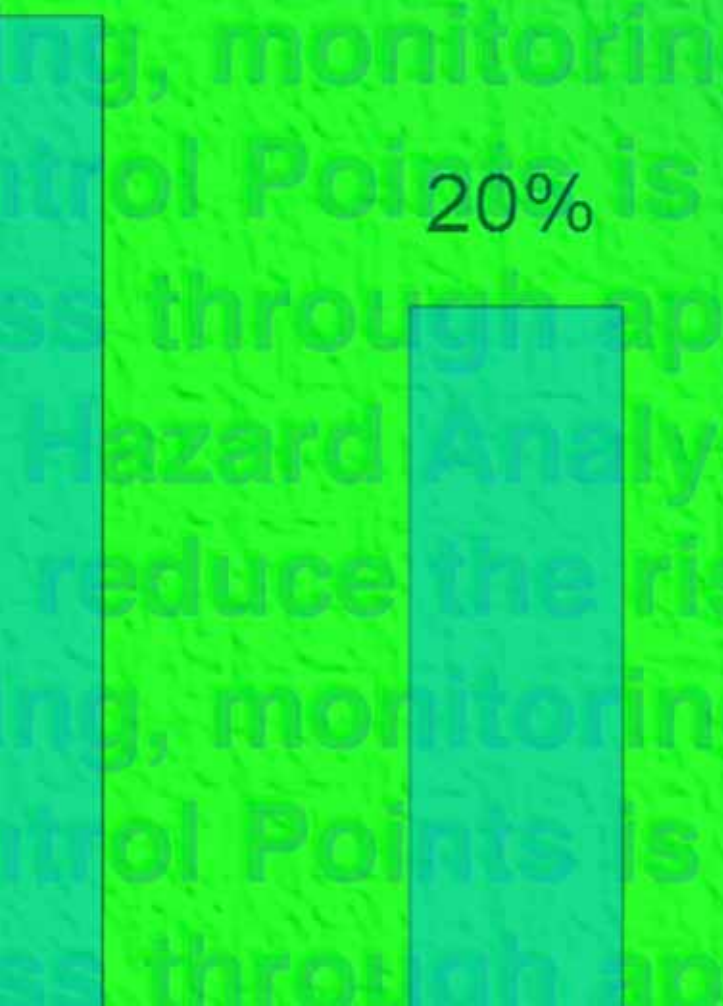
HACCP Implementation in K-12 Schools



National Food Service Management Institute
The University of Mississippi

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Building the Future Through Child Nutrition

The National Food Service Management Institute (NFSMI) was authorized by Congress in 1989 and established in 1990 at The University of Mississippi in Oxford. The Institute operates under a grant agreement with the United States Department of Agriculture, Food and Nutrition Service.

PURPOSE

The purpose of NFSMI is to improve the operation of Child Nutrition Programs through research, education and training, and information dissemination. The Administrative Offices and Divisions of Technology Transfer and Education and Training are located in Oxford. The Division of Applied Research is located at The University of Southern Mississippi in Hattiesburg.

MISSION

The mission of the NFSMI is to provide information and services that promote the continuous improvement of Child Nutrition Programs.

VISION

The vision of the NFSMI is to be the leader in providing education, research, and resources to promote excellence in Child Nutrition Programs.

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Introduction

Hazard Analysis and Critical Control Points (HACCP) is a preventative system to reduce the risk of foodborne illness through appropriate food handling, monitoring, and record keeping. HACCP is now mandated for Child Nutrition Programs (CNP) effective July 1, 2005 due to a growing concern for food safety in schools. The National Food Service Management Institute (NFSMI) contracted with the Center for Educational Research and Evaluation (CERE) to conduct a survey of the extent of HACCP implementation in schools across the United States.

A review of the literature concerning HACCP implementation indicated the rate of implementation among schools in the United States to be around 20% to 30%. Barriers to HACCP implementation within schools included lack of funds and/or time, as well as employee motivation and confidence, as reported by Giampaoli et al. (2002a). In general, however, the literature indicated that school foodservice directors recognized the benefits of HACCP, including a reduction in foodborne illness, compliance with health department regulations, and the use of HACCP as insurance against liability (Sneed and Henroid, 2003).

Research Design

The study was designed to determine the extent of HACCP implementation in schools; characteristics of the implementation process (why HACCP was implemented, source of training, length of time needed to implement, and status of implementation); benefits of HACCP implementation; and challenges associated with HACCP implementation. Frequencies and percentages were used to report the overall results of each item on the survey, and the chi-square test was used to identify significant differences in responses in relation to region or school demographic variables.

To study current HACCP implementation in schools in the United States, a printed survey was administered by mail to 2,200 school foodservice managers. The survey included questions about the school's implementation of HACCP as well as questions about school and foodservice manager demographics. Researchers surveyed 2-3% of foodservice managers in each United States Department of Agriculture (USDA) region and obtained a final response rate of approximately 18% overall. Although this rate was relatively low, comparison of responses by date received, as well as comparison with non-respondents through phone interviews, suggested that survey responses are not likely to have been substantially different with a higher response rate.

Extent of HACCP Implementation in Schools

The overwhelming majority of respondents (90%) reported having standard or formal food safety procedures in their schools. More than half of the respondents (65%) reported that their schools had begun implementing HACCP. Within all regions there

was a higher rate of HACCP implementation than lack of HACCP implementation. There was no significant relationship between region and HACCP implementation.

A significantly lower percentage of respondents from rural communities reported implementing standard food safety procedures. Schools in major cities had a significantly higher percentage of HACCP implementation (91%) than schools in other types of communities. However, a higher percentage of respondents were located in small towns, and only 67% of these respondents had implemented HACCP.

Characteristics of the Implementation Process

Of the schools that reported implementing HACCP, 30% began the program more than three years ago, and 23% began the program between one and three years ago. Only 10% began the program less than one year ago. More than half (57%) of the schools that have not implemented HACCP do not plan to begin the program, while 43% do plan to begin implementing HACCP.

In almost half of the responding schools (48%), the decision for implementing HACCP is the responsibility of the district foodservice director, and in 27% of the responding schools the decision is the responsibility of the school foodservice manager. More than half of the responding schools (56%) reported that support from their foodservice director helped to promote HACCP implementation at their facility. Further, 41% of the responding schools reported that support from the school's foodservice workers helped to promote HACCP implementation.

The majority of the responding schools reported keeping the following types of records as part of their HACCP program: 1) refrigeration and freezer temperature logs and 2) record of temperature to which food is cooked. Almost 50% of the schools keep records of preparation procedures, including the internal food temperature throughout preparation, as well as records of the temperature at which food is held on the serving line or in a holding cabinet. Between 22% and 37% of the schools keep other types of records as part of their HACCP program.

The largest number of respondents (almost 50%) reported that their role in the HACCP program included coaching food service personnel on a daily basis. More than one-third reported that their role in the HACCP program included monitoring/completing HACCP paperwork, and more than 20% of respondents reported that their role included coordinating HACCP implementation or training.

Although 39% of the total number of respondents did not state whether their school or district had a formal HACCP team, 38% reported that they did not have a formal HACCP team. Eleven percent reported having a school HACCP team, and 13% reported having a district HACCP team. The most common members of the HACCP team were reported to be the district school foodservice director, the school foodservice manager, and the school foodservice worker.

With regard to the provision of HACCP training in the school, the highest percentage of respondents (23%) reported that district personnel provided training. Next in order were the local Health Department staff, the School Nutrition Association (SNA, formerly the American School Food Service Association), and the State Department of Education staff.

Barriers to HACCP Implementation

With regard to barriers affecting HACCP implementation, the lack of resources (time and personnel) and the burden of required documentation were the most commonly reported barriers having a significant effect on HACCP implementation. The proportion of respondents from the Western region who reported that lack of available training had a significant effect on HACCP implementation was significantly higher than the combined proportion of respondents from the all other regions who reported that lack of training was a major barrier. A significantly higher proportion of respondents from the Western region also reported that high employee turnover had a moderate or significant effect on HACCP implementation. In the Midwest region, the proportion of respondents reporting that the burden of required documentation procedures had a significant effect on HACCP implementation was significantly higher than the combined proportion of respondents from all other regions who reported that documentation procedures were a significant barrier. In the Western region, the proportion of respondents reporting that the

burden of required documentation procedures had no or minimal effect on HACCP implementation was significantly higher than the combined proportion of respondents from other regions who reported that documentation was not a major barrier.

Benefits of HACCP Implementation

A majority of respondents (55%) reported that the benefits of HACCP included the fact that employees were practicing good hygiene. Almost half the respondents (48.5%) reported that HACCP promoted a routine cleaning and sanitation program. Slightly more than one-third of the respondents stated that the benefits of HACCP implementation included a facility designed to ensure that it can be kept clean and sanitary; awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety; specifications that require food safety measures; and vendors' providing safe food when delivered. Almost 25% of respondents reported reduced liability as a benefit of HACCP implementation.

Plans for Expanding HACCP Implementation

The largest number of respondents (46%) reported that their schools plan to implement practices to support all seven HACCP principles. Less than 10% of the respondents plan to expand HACCP to other sites or other programs.

Introduction

Hazard Analysis and Critical Control Points (HACCP) is a preventative system to reduce the risk of foodborne illness through appropriate food handling, monitoring, and record keeping. HACCP is now mandated for Child Nutrition Programs (CNP) effective July 1, 2005 due to a growing concern for food safety in schools. This concern for food safety in schools has intensified primarily because children, especially very young children, are at a higher risk of becoming seriously ill or dying from foodborne illnesses than adults and because large numbers of children would be impacted should foodborne illness occur in schools.

Purpose of Study

The purpose of this study was to determine the extent, challenges, and benefits of HACCP implementation in K-12 schools. Findings from this study can be used by the National Food Service Management Institute (NFSMI) to assist in developing HACCP and other food safety training materials and determining how these training materials can best be presented to school foodservice staff.

Review of Literature

For this research, a review of literature pertaining to HACCP Implementation in schools was provided by Diane Tidwell, PhD, RD, LD, and Kathy Knight, PhD, RD, LD, from the Department of Family and Consumer Sciences at The University of Mississippi.

Introduction

The Hazard Analysis and Critical Control Point (HACCP) system is a prevention-based food safety program. The National Advisory Committee on Microbiological Criteria for Foods (1998) defined HACCP as "a systematic approach to the identification, evaluation, and control of food safety hazards." Bryan (1999) stated, "HACCP is the art and science of food safety." A HACCP plan is a written document that is based on the principles of HACCP and delineates the procedures that must be followed. A HACCP system is the result of the implementation of the HACCP plan.

The objective of HACCP is to design systems that will prevent occurrences of potential food safety problems. Depending on the type of food operation, inherent risks are specifically identified in the production of foods or the preparation and serving of foods, and necessary steps are determined that will control the identified risks. The HACCP system replaces end product testing with a preventive system for producing safe food that has universal application to any type of food operation.

The HACCP system began in the 1960's with the purpose of providing safe food for astronauts. The Pillsbury Company pioneered it with participation from the National Aeronautic and Space Administration, the United States Air Force Space Laboratory Project Group, and the United States Army Natick Laboratories. Application of HACCP created food for the space program that approached 100% assurance against contamination by bacterial and viral pathogens, toxins, and physical or chemical hazards that could cause illness to astronauts. It has become widely recognized worldwide as an effective system for food safety (Hudson, 2000).

The HACCP system was first implemented by the food industry for the manufacturing and processing of foods that have a high risk for potential foodborne illnesses such as meat, poultry and milk, and canned foods if canning procedures were not followed correctly. After outbreaks of botulism were reported in the early 1970's from commercially canned foods and the isolation of *Clostridium botulinum* in canned mushrooms, the United States Food and Drug Administration (FDA) initiated a mandatory HACCP program for low-acid canned foods. More

recently, the United States Department of Agriculture (USDA) has mandated the use of HACCP systems for all meat and poultry processing plants, and the FDA has mandated the use of HACCP for seafoods, fresh fruits and vegetables, in addition to low-acid canned foods (Bryan, 1999).

A major reason for the emergence of HACCP was that emphasis on sanitary or health inspections and final product, or end product testing was ineffective in reducing the incidence of foodborne illness (Bryan, 1999). The traditional inspection process used by the USDA Food Safety and Inspection Service is a system designed to detect problems and unsafe conditions. In contrast, the HACCP system is designed to prevent problems and unsafe conditions through effective implementation of the principles of HACCP. The HACCP system has seven principles that were developed by the National Advisory Committee on Microbiological Criteria for Foods, which was formed in 1988, and has many representatives and experts from federal and state agencies, military, academia, consumer groups, and the food industry. The National Advisory Committee on Microbiological Criteria for Foods (1998) adopted the HACCP system in 1992.

HACCP Principles

The HACCP system encompasses a systematic approach to the identification, evaluation, and control of food safety hazards based on the following principles:

Principle 1. Conduct a hazard analysis.
Principle 2. Determine the critical control points (CCPs).
Principle 3. Establish critical limits to control CCPs.
Principle 4. Establish procedures to monitor CCPs.
Principle 5. Establish corrective actions when a monitoring procedure identifies the violation of a critical limit.
Principle 6. Establish procedures to verify that the HACCP system is functioning and working properly.
Principle 7. Establish effective record keeping that documents the HACCP system.

Principle 1: Conduct a hazard analysis

Potential hazards can be divided into three categories: biological (bacteria), chemical (cleaning agents, pesticides), and physical (environment, equipment). Biological hazards, or foodborne bacteria, are usually the focus of HACCP systems due to the illness that can occur if food is mishandled. More than 200 known diseases are transmitted through the ingestion of food via bacteria, viruses, parasites, and toxins. The Centers for Disease Control and Prevention (CDC) estimated that approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths occur in the United States annually due to diseases caused by contaminated food (Mead *et al*., 1999). Although CDC has reported a decrease in some bacterial foodborne illnesses, CDC has not revised its estimates of the overall incidence of foodborne illness in the United States (GAO, 2002; CDC 2003; McCabe-Sellers and Beattie, 2004).

When identifying hazards, the likelihood that the hazard will occur and the severity if it does occur is determined. Hazards that are of a low-risk nature and not likely to occur are not addressed by HACCP. There are numerous issues to consider during hazard analysis that include all processes and handling practices related to food safety in the purchasing, storing, pre-preparation, cooking, serving, and handling of leftovers. Flow diagrams that delineate all the steps in processing and handling of food are usually used to identify hazards that could possibly occur in each step.

After identifying the hazards, specific procedures or preventive measures must be determined for preventing the hazards. For example, if a hazard analysis were conducted for the preparation of hamburgers from frozen beef patties, pathogenic bacteria in the incoming raw meat would be identified as a potential hazard. Cooking the meat to an appropriate temperature that would kill the bacteria would be the preventive measure.

Principle 2: Determine the critical control points (CCPs)

A CCP is a step where a control measure can be applied and is essential to prevent or eliminate a food safety hazard, or reduce it to an acceptable level. Any step or procedure where biological, chemical, or physical factors could cause a food safety problem and can be controlled is a CCP. Using CCP flow diagrams or CCP decision trees is useful in identifying if a step or procedure is a CCP. A CCP decision tree is a sequence of questions that determines if a control point is critical or not critical (National Advisory Committee on Microbiological Criteria for Foods, 1998). There are many control points in food preparation but few are actually CCPs. Steps or procedures that do not impact food safety are not included in the HACCP plan. Different facilities preparing the same foods can differ in the risk of hazards and CCPs due to different equipment, facility layout, or the use of different processes (Hudson, 2000).

A CCP for the preparation of hamburgers from frozen beef patties that may have pathogenic bacteria in the incoming raw meat would be the final cooking step before serving. This is the last opportunity in the food preparation system to kill the bacteria.

Principle 3: Establish critical limits to control CCPs

A critical limit is the maximum and/or minimum level that a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce the food safety hazard to an acceptable level (National Advisory Committee on Microbiological Criteria for Foods, 1998). A critical limit or preventive measure criterion is established for each CCP. Critical limits are thought of as boundaries of safety for each CCP and may include temperature, time, pH, physical space, and may be derived from various sources. There are numerous regulatory standards and guidelines available to determine critical limits, in addition to scientific literature and consultation experts (Hudson, 2000).

Using the above example, if a hazard analysis is conducted for the preparation of hamburgers from frozen beef patties, pathogenic bacteria in the incoming raw meat would be identified as a potential hazard. Cooking the meat to a temperature that would kill the bacteria would be the preventive measure. The critical limit would be cooking the meat to an internal temperature of 160ºF as recommended by the USDA Food Safety and Inspection Service (2002).

Principle 4: Establish procedures to monitor CCPs

Establishing procedures to monitor CCPs is necessary to verify that the HACCP plan is being followed. Monitoring involves planned sequences of observations or measurements that determine if a CCP is under control. Monitoring is essential to food safety management in that it facilitates tracking of the foodservice operation. Monitoring is used to determine when there is loss of control or deviation of a CCP, and it provides written documentation for use in HACCP verification (National Advisory Committee on Microbiological Criteria for Foods, 1998).

Using the example above, the visual observation of the cooked hamburger patties, and noting the time and end-point temperatures to verify that the correct cooked temperature has been obtained are procedures that monitor CCPs. Recording cooking times and temperatures of a sampling of the hamburger patties are examples of establishing procedures to monitor CCPs.

Principle 5: Establish corrective actions when a monitoring procedure identifies the violation of a critical limit.

When a monitoring procedure identifies a deviation of an established critical limit, corrective actions are necessary. The violation of a critical limit has the potential of causing a health hazard. Criteria must be in place to correct the deviation and prevent foods that may be hazardous from reaching the consumer. The HACCP plan should specify the corrective action, who is responsible for implementing the corrective action, and that a record of the action is maintained.

When receiving frozen hamburger patties, the receiving procedures should indicate that frozen products must be received as frozen. If there is evidence that the hamburger patties are not frozen or are in a thawing state, the temperature should be checked and recorded. If the frozen food is not at an acceptable temperature, it should be rejected.

Principle 6: Establish procedures to verify that the HACCP system is functioning and working properly

Establishing verification procedures that the HACCP system is functioning properly includes a variety of activities. Types of activities include establishing appropriate verification inspection schedules, review of the HACCP plan, review of CCP records, review of deviations and resolutions, visual inspections of operations to observe if CCPs are under control, random sampling of foods and microbiological testing, review of critical limits to verify that they are adequate to control hazards, review of all written records, validation of the HACCP plan including on-site review and verification of flow diagrams of CCPs, and review of modifications of the HACCP plan. Verification reports should also include who is responsible for administering and managing HACCP, and training and knowledge of individuals for monitoring CCPs (Hudson, 2000).

Principle 7: Establish effective record keeping that documents the HACCP system

This principle requires the preparation and maintenance of a detailed written HACCP plan. The system used for record keeping must be organized and extensive; however, as Hudson (2000) notes, "the simplest effective record keeping system that lends itself well to integration within the existing operation is best." Traditional records such as receiving records, temperature

logs and charts, and written recipes with specific directions work well. The record keeping system in an organization ultimately makes the HACCP system work.

HACCP Prerequisites

Prerequisite programs such as current Good Manufacturing Practices that include basic food safety education and training of employees are an essential foundation for the development and implementation of every HACCP system. Prerequisite programs provide the basic environmental and operating conditions required for safe food (National Advisory Committee on Microbiological Criteria for Foods, 1998). Examples of prerequisite programs include:

1. The establishment's facilities are located, constructed, and maintained according to sanitary design principles. Traffic control and the flow of food products should be such that cross-contamination of raw and cooked items is prevented.
2. Facilities should assure that suppliers follow effective Good Manufacturing Practices and food safety principles.
3. All equipment should be constructed and installed according to sanitary design principles. Preventive maintenance and temperatures (if applicable) should be established and documented. Thermometers should be in all freezers and refrigerators, and in dry storage. Temperatures should be routinely recorded.
4. All procedures for cleaning and sanitation of equipment and the facility should be established and documented.
5. All employees and individuals entering the facilities should follow the requirements for personal hygiene.
6. All employees should receive documented training in personal hygiene and safety, cleaning and sanitation procedures, and their role in the HACCP system.
7. Documented procedures must be in place for the proper use and storage of nonfood items such as cleaning chemicals, pesticides, and any other chemicals.
8. Proper receiving, storing, and labeling procedures must be documented and followed for all raw products and materials.
9. Effective pest control programs should be documented and followed.
10. Proper employee food and ingredient handling practices should be documented and followed.
11. Recipes should be standardized and these recipes should be followed for food preparation.

Prerequisite food safety procedures provide the foundation for HACCP systems, and therefore, effective implementation of a HACCP system is dependent on HACCP prerequisites. There are many sources available for education and training in food safety and sanitation. Hwang *et al*. (2001) reported 62% of Indiana school foodservice operations had a sanitation-training program for employees. The most common source of information for developing sanitation programs was the foodservice operation itself, followed by local health departments and extension programs. Other sources included the Indiana School Food Service Association, Indiana State Department of Education, School Nutrition Association, National Restaurant Association, widely available videotapes, and private companies.

Application of HACCP to School Foodservice

More than 33 million meals are served daily to children in schools through the National School Lunch and School Breakfast programs administered by the USDA Food and Nutrition Service. In 1997 and 1998, an estimated 1,609 individuals experienced foodborne illness resulting from food served in school meal programs (GAO, 2000). In 2002, the United States General Accounting Office further discussed food safety in meals served in schools, and reported that current analysis shows an increase in the number of school-related outbreaks. However, the extent to which these outbreaks were caused by school foodservice programs could not be determined. GAO noted that another possible source of foodborne illness could be foods brought

from home (GAO, 2002). Overall, the number of foodborne illnesses resulting from school food service is a relatively small number compared to the millions of meals served daily; however, it is preventable. The HACCP system offers a preventable approach to food safety.

The HACCP system is relatively new to the foodservice arena in contrast to the food processing industry, especially the meat and poultry industry. However, the HACCP system's universal emphasis on providing safe food can be applied to any type of food operation. The FDA has recommended the implementation of HACCP in foodservice establishments because it is the most effective and efficient method of ensuring that food products are safe (Hudson, 2000). The School Nutrition Association (2003) stated in a position statement that the association supports the development and implementation of a systematic approach to food safety including HACCP into school foodservice systems. The Child Nutrition and WIC Reauthorization ACT of 2004 now mandates that, effective July 1, 2005, all districts will implement a food safety management program based on HACCP principles.

Several states have provided HACCP training to schools. The Wisconsin Department of Public Instruction through the Wisconsin School Food Safety Program offered HACCP classes to school foodservice staff during summer workshops at several locations, and at statewide conferences to help managers and directors effectively implement HACCP principles in their schools (Wisconsin Department of Public Instruction, 2003).

The New York City's school foodservice system serves more than 150,000,000 meals a year at approximately 1,400 sites with 10,000 workers, and has instituted a HACCP program. The Board of Education's Office of School Food and Nutrition Services for New York City formed a HACCP Monitoring Team consisting of ten individuals to provide oversight of HACCP implementation and serve as an extension of the training program. The HACCP Monitoring Team members were given fairly extensive training in HACCP principles and New York City's specific HACCP plan for schools. Three areas were identified "as potential bottlenecks in implementation of its HACCP program: the critical control point analysis, training, and oversight of implementation" (Gill, 2000).

The New York City's school foodservice department simplified the analysis of CCPs by grouping similar processes together, for example using the same HACCP model for preparing precooked, breaded fish fillets and precooked, breaded chicken cutlets as well as precooked, ground beef patties. Probably the biggest challenge of HACCP implementation was the training of 10,000 employees. This was accomplished by taking a two-tiered approach where one tier, or group, received extensive training and the other group received specialized, or tailored, training. The third bottleneck was the oversight of HACCP implementation, which was achieved by the forming of the HACCP Monitoring Team. The primary objectives of the team were to visit kitchens, monitor HACCP implementation using checklists, and share results with managers, supervisors, and employees who work in the kitchens to reinforce correct actions and correct inappropriate actions (Gill, 2000).

The Val Verde Unified School District in Perris, California, instituted a HACCP program. The School Foodservice Director, Michael Bazan, was reported as saying "you don't wait until you have a problem-you prevent it" (Riell, 1997). HACCP training was being phased in gradually in the school district's foodservice operation. One interesting point was the use of a strict dress code for foodservice employees. In addition to wearing protective gloves, closed-toe shoes and appropriate clothes, jewelry is kept to "an absolute minimum," as well as nail polish and artificial fingernails (Riell, 1997).

Another California school district that implemented a HACCP program was the Long Beach Unified School District's Nutrition Center in Long Beach, California. It is a large school district with a large cook-chill facility that prepares and distributes 75,000 meals a day to 85 district school sites. The food production center is located in a former warehouse. A $10 million conversion of the warehouse into a new food production center with efficient workflow space and equipment ensured the attainment of HACCP principles in all phases of the operation (Doty, 2000).

Research Investigating the Use of HACCP in School Foodservice

Youn and Sneed (2003) conducted a study to determine implementation of food safety procedures and practices related to HACCP and HACCP prerequisites in school foodservice. A questionnaire was sent to a random national sample of 600 district school foodservice directors and all 536 Iowa school foodservice directors, and 33 directors of school districts known to have centralized foodservice systems. A response rate of 35.4% was obtained and 22% of directors stated that they had implemented a comprehensive HACCP program. Factor analysis was used for identifying underlying factors for items related to HACCP procedures and practices such as measuring and recording end-point temperatures of all cooked foods, measuring and recording temperatures of foods on serving lines, and measuring and recording temperatures of milk upon receiving and in the coolers. Significant differences ($p<0.05$) were noted for centralized versus conventional foodservice systems with centralized systems scoring higher for measuring and recording safe food-handling practices. Youn and Sneed (2003) concluded, "School districts need to implement prerequisite programs so that they are ready for HACCP implementation."

Henroid and Sneed (2004) evaluated current food-handling practices, food safety prerequisite programs, and employee knowledge and food safety attitudes to provide data for implementing HACCP systems in school foodservice. A convenience sample (a sample where participants are selected, in part or in whole, at the convenience of the researcher) of 40 Iowa schools participated in the study. Results indicated that proper food-handling practices were not being followed in many schools. Inadequate hand washing practices were observed in most foodservice operations. Other problems included improper thawing and cooling of foods. Henroid and Sneed (2004) reported, "Initial results indicate that employees in school foodservice may have sufficient knowledge about food safety but need assistance in developing prerequisite programs in preparation for HACCP." Both Henroid and Sneed (2004) and Youn and Sneed (2003) concluded that emphasis on implementing prerequisite HACCP programs were needed in school foodservice.

Hwang *et al*. (2001) mailed questionnaires to all Indiana school foodservice program directors or managers (n = 447) and had a response rate of 36.2%. The majority (66.5%) of directors and managers were aware of HACCP and of those aware of HACCP, 22 (13.7%) had a HACCP program in place. Forty (26.7%) did not have a HACCP program but planned to implement HACCP in the near future. Larger school districts were more likely to implement HACCP than school districts with smaller food service operations.

Most school foodservice directors realize the benefits of HACCP in preventing foodborne illness. Sneed and Henroid (2003) questioned 17 school foodservice directors who had or were in the process of implementing a HACCP program in their school districts. These directors cited several reasons for implementing HACCP, including health department requirements, fear of making children sick, and having HACCP as an insurance policy against liability.

A survey by Giampaoli *et al*. (2002a) sent to district school foodservice directors (n = 800) with 461 responses revealed that in general, the directors had a positive attitude about food safety and the use of HACCP programs in their districts. Approximately 90% believed that checking on food safety was an important part of their job, and 82% indicated that it was important for them to learn more about food safety issues. However, the majority (70%) did not

have a HACCP program in place, and many were unsure what HACCP was or how to apply it in their operations. While it appears that school foodservice managers believe that food safety is important, HACCP is confusing to many foodservice employees. Although approximately two-thirds of school foodservice directors have food safety certification (Youn and Sneed, 2003), implementation of HAACP programs in school foodservices is still not widespread.

Barriers to Implementation of HACCP

The perception that HACCP is complicated, difficult, and time-consuming may be just a few reasons for not implementing HACCP. An organized and effective record-keeping system is at the center of every good HACCP system. Norton (2003) stated that a good record-keeping system is essential. An early barrier in developing a HACCP plan is writing out in specific detail the procedures to follow for simple food-handling and preparation techniques. Youn and Sneed (2003) reported that many school foodservice directors did not have written procedures for thawing food, taking temperatures, storing food and chemicals, cleaning and sanitizing, and handling leftovers.

Norton (2003) listed common pitfalls that must be avoided by employees such as entering data ahead of time, entering false data, failing to record process deviations or corrective actions, failing to record equipment calibrations, and failing to sign and date all records. Record keeping is the key component for managing and validating a HACCP program. However, many managers and workers in the food industry are bogged down by the regulatory requirements and dislike all the paperwork. Also, it was reported that food chain operators were plagued by problems regarding the lack of uniformity of the requirements as well as interpretation and enforcement by inspectors. Different health inspectors may interpret HACCP specifications differently depending on their knowledge base of HACCP (Anonymous, 1999).

Taylor and Taylor (2004) stated that research on barriers to HACCP implementation has been limited in terms of both amount and depth. In a qualitative study, four professionals who own and manage their own foodservice operations were questioned concerning the difficulty of HAACP implementation, the burden of HACCP implementation, the perceived necessity of HACCP implementation, and staff problems with HACCP. When they learned about HACCP for the first time, each of the interviewees found it confusing and difficult to understand. One owner stated that he tried to copy someone else's HACCP plan, not realizing that each program had to be individualized for each particular operation. Two of the owners stated that the books they read on HACCP had contradictory advice and were very "round about". One of the main complaints from the interviewees was that HACCP was a burden, especially for small businesses because they did not have the staff or the time to deal with the documentation required for the program. Other perceived burdens were time and additional money required to train employees.

As far as the perceived necessity of HACCP, most of the business owners gave the impression that they did not think that HACCP was necessary even though they could articulate the benefits of the program. They felt that they were already producing safe food and viewed HACCP as "added documentation". In terms of staff problems with HACCP, one of the owners stressed how difficult it was to get staff involved with HACCP and mentioned staff motivation as his biggest problem with HACCP implementation. All the owners believed that without proper training, the staff would continue to see HACCP as unnecessary and just "more bureaucracy" (Taylor and Taylor, 2004).

These perceived barriers to HACCP implementation, while coming from Taylor and Taylor's (2004) qualitative study, are echoed in the results from more quantitative methods. Speer and Kane (1990) conducted research with state food protection directors in 50 states. They found that challenges to certifying employees were time, limited funds, and the perceived burden of certification. These directors also stated that managers did not appear to be motivated to put food safety practices into effect, and believed certification to be unnecessary in terms of ensuring food safety.

In a study to develop and test an audit tool for assessing employee food-handling practices in school foodservice, Giampaoli *et al.* (2002b) examined time and temperature abuse, employee hygiene, and cross-contamination. The audit resulted in the identification of areas of noncompliance with safe food-handling procedures. Time and temperature abuse appeared to be the most problematic. In 10 of the 15 kitchens tested, employees were not observed taking internal temperatures of hot food at any time during pre-preparation. During preparation and service, the most frequently observed problem was the handling of food with bare hands.

In a structured interview survey of food business operators in Glasgow, Scotland, Ehiri *et al*. (1997) interviewed 70 sample food operations. Forty-five (64%) of the operations were foodservice establishments, including hotels, restaurants, hospital and nursing home kitchens, and school foodservices. The remaining 25 (36%) were food manufacturing or processing businesses. A total of 1,052 persons were employed in these operations. All 70 food business operators were asked various questions to assess their awareness and opinions about HACCP. More than half (59%) had not heard of HACCP prior to the study. However, after HACCP was explained, 41% strongly agreed and 50% agreed that HACCP was more effective than what they were currently doing to secure food hygiene. There was general consensus that HACCP had good potential to offer a good defense of due diligence with regard to an offence under the law. When asked whether HACCP would be expensive to develop and implement, the opinions varied greatly. Nineteen percent strongly disagreed and 37% disagreed that it would be expensive. However, 10% strongly agreed and 14% agreed that it would be expensive to develop and implement a HACCP program. The largest perceived barrier to HACCP implementation was time. When asked if HACCP would be a time consuming strategy, 21% strongly agreed and 37% agreed.

An independent survey on the implementation of HACCP in Ireland (Research and Evaluative Services of Ireland, 2001) questioned 710 food businesses to measure such factors as awareness of HACCP, efficiency of food safety management systems used by the businesses, and perceived barriers to HACCP implementation. Lack of understanding of HACCP was identified as one of the main barriers to HACCP implementation; 46% reported that they didn't really know what HACCP was while 14% said it was too complicated. Fifty-two percent of the respondents had not even heard of the term HACCP prior to the survey. Of those who had heard the term, 5.6 % agreed that they did not really know what HACCP was and 12% agreed that it was too complicated. A high percentage agreed with the statement that expressed a need for more food safety checks by government authorities. A smaller number of respondents agreed with the statements that food safety is not really a business priority and they saw no benefits to the HACCP system. The researchers concluded that the main barrier to implementing a HACCP system was lack of knowledge. Despite the high percentage of small businesses participating in this study, the minority of respondents highlighted the barriers that are typically associated with small businesses. The researchers felt that this reflected the lack of understanding of HACCP by the business owners.

These findings are consistent with the report of a World Health Organization (WHO) Consultation on strategies for implementing HACCP in small or less developed businesses (World Health Organization, 1999). This report identified potential barriers to HACCP implementation that included lack of government commitment, lack of customer and business demand, absence of legal requirements, financial constraints, human resource constraints, lack of knowledge and/or technical support, inadequate infrastructure and facilities, and inadequate communications.

In the study by Giampaoli *et al*. (2002a), school foodservice directors indicated that the largest barriers to HACCP implantation for them were not time and money, differentiating them from the small food business owners. These directors reported that the biggest problem for them was that their employees were nervous about taking the food safety exam. The second largest problem was employees not feeling comfortable with change. Both of these barriers to HACCP implementation seem to be more concerned with efficiency of training rather than time or money. The researchers concluded that improving employees' confidence in their food safety knowledge and their ability to make changes are two areas in which school foodservice directors should focus attention. They suggested that training, supervision, and feedback are all strategies that might improve employee confidence in their food safety knowledge and ability to implement HACCP programs.

Youn and Sneed (2002) developed a written questionnaire that measured training and perceived barriers to HACCP implementation. Nine statements related to potential barriers to implementing food safety practices were included. Barrier statements were related to time, money, HACCP plan availability, employee motivation, and knowledge about food safety practices, facility design, and having a food safety specialist. Like Giampaoli *et al*. (2002a), Youn and Sneed (2002) also found that approximately two-thirds of the directors stated that they held food safety certification. Twenty-two percent of the school foodservice directors reported that they had implemented a HACCP program in their district.

Regarding barriers to following food safety practices, two barrier factors were identified: employee barriers (6 items) and resource barriers (3 items). Employee training was rated as the greatest individual barrier item. Twenty-two percent of the foodservice directors strongly agreed and 43% agreed that employees needed more training to improve food safety practices. In addition, having an established HACCP plan, time and employee motivation were other reported barriers. Twenty percent strongly agreed and 34% agreed on the need for supervisors to have more time to follow food safety practices and 48% either strongly agreed or agreed that employees needed more time to follow food safety. Seventeen percent strongly agreed and 37% agreed that employees should be more motivated to follow food safety practices. Money was also a perceived barrier in this study. Twenty-one percent of the directors strongly agreed and 25% agreed that they needed more money to devote to food safety. The researchers suggested that school foodservice directors consider strengthening employee-training programs, including food safety certification for all employees. Also, since time and money were resource barriers, school foodservice directors need to examine how resources are allocated in their districts and may need to reallocate funds for food safety and HACCP. Another suggestion was to give one or two employees primary responsibility for HACCP implementation since this reduces barriers to improving food safety (Youn and Sneed, 2002). For small school districts, technical assistance from such groups as the USDA, state agencies responsible for child nutrition programs, or the National Food Service Management Institute could be useful.

Worsfold and Griffith (2003) surveyed 100 foodservice employees in the United Kingdom about their perceptions of hygiene training and attitudes towards risk management systems and HACCP. At a later date, the workers attended a training course on food safety and HACCP, which helped the researchers observe the workers' knowledge. The results indicated that the understanding of risk, hazards, and risk management was low, but the workers were not hostile to the idea of HACCP. Nearly 70% of the workers claimed that their business had risk

management procedures in place, but it transpired during training sessions that this was not the case, suggesting that many had misunderstood the term. Over one-third of the businesses (42%) claimed that they had a documented HACCP system in place before they attended the training course. This was also not the case. The trainees identified the keeping of records as a fully documented HACCP system. On a positive note, once HACCP was fully explained to the trainees, the requirements of the HACCP system were judged to be realistic and achievable by 82%. While 36% did not know if the benefits of HACCP would outweigh the costs, 58% of the workers were convinced of the benefits of having this system for risk management. In agreement with the World Health Organization (1999), the researchers suggested that to increase the success of HACCP implementation, evaluation should first be carried out to determine the operation's perception of barriers and attitudes towards HACCP. After implementation, the HACCP initiative should be evaluated to assess cost effectiveness, the reactions of the participants, and how improvements might be accomplished.

Hwang *et al*. (2001) investigated Indiana school foodservice managers or directors perceived obstacles to implementing HACCP. The greatest concerns were time to establish HACCP programs, and time and labor costs to operate HACCP programs on a daily basis. Other perceived barriers that Hwang *et al*. (2001) noted were lack of funding for training and union problems. However, the title of a short article by Ingram (2003), "Retailers Find HACCP Worth the Hassle," confirms what many have come to realize; if one foodborne illness can be prevented, all the time spent in implementing an effective HACCP program is worth the effort.

Advantages and Benefits of HACCP

An advantage of the HACCP system is that the principles of HACCP can be applied to virtually any type of food operation, and consumers benefit by having safer food. The HACCP system prevents problems from occurring and if problems do occur, procedures are specified for immediate corrective actions. This type of preventive system is very effective in preventing foodborne illness. Gould (2000) reported that, "HACCP is a very cost-effective program and it reduces the need for testing of finished products to ensure that the products being manufactured are safe and wholesome." Gould (2000) also listed other benefits of HACCP that included the fact that HACCP is a system of prevention versus detection; HACCP is pro-active and not reactive, and having records to support the HACCP system ensures validation of the system.

Roberts *et al*. (1996) reported on the economic benefits and costs of a HACCP system with application to the meat and poultry industry. They concluded that the benefits of complying with the principles of HACCP outweighed the costs of implementing a HACCP system. It was also reported that estimated twenty-year public health benefits were $7.13 to $26.59 billion, assuming a 90% reduction in illness and death from four pathogens (*Salmonella, Campylobacter jejuni/coli, E. coli 0157:H7, and Listeria monocytogenes*). Crutchfield *et al*. (1999) estimated benefits and costs of HACCP and reported an annual savings of $1.9 to $9.3 billion in medical costs and productivity losses, with an annual cost of $1.1 to $1.3 billion.

Successful implementation of a HACCP program requires a strong commitment from top management (National Advisory Committee on Microbiological Criteria for Foods, 1998). In addition to adequate staff to implement a HACCP system, education and training must be provided to employees. Many trade and professional associations, as well as universities and government agencies sponsor HACCP education and training programs, as well as other certification food safety and sanitation training programs. The National Restaurant Association, the Institute of Food Technologists, the National Food Processors Association, the National Food Service Management Institute, and many other agencies, associations, universities and colleges offer educational courses, seminars, and workshops on all aspects of HACCP (Henroid, Jr., 2003).

The HACCP concept has also been endorsed and/or promoted by the WHO, the International Life Science Institute, the International Association of Milk, Food and Environmental Sanitarians, the European Economic Community, the United Kingdom's Institute of Food Research, and the Codex Alimentarius Commission, in addition to the USDA, FDA, and some U.S. state and local health departments (Bryan, 1999). Hwang *et al*. (2001) stated that food sanitation certification should be encouraged and school food managers should be informed about the various sources for certification programs.

Sneed and Henroid (2003) questioned food service directors as to advantages of having a HACCP system. The directors cited that HACCP could save money and time, and improve quality. Specific ways that money and time were saved in their school districts included decreased food waste due to increased temperature monitoring, the process of standardized recipes resulted in cost savings, and data from the monitoring process could be used to document the need for equipment repairs or justify the purchase of new equipment.

The World Health Organization (1999) stated that there existed clear benefits of implementing HACCP for consumers, the food industry, and governments. Benefits to consumers included reduced risk of foodborne illness, increased awareness of basic hygiene, increased confidence in the food supply, and improved quality of life. Benefits to the food industry included increased consumer and government confidence, reduced legal and insurance costs, increased market access, reduction in food production costs due to reduced food recalls and reduced food waste, improved product consistency, improved staff and management commitment to food safety, and decreased business risks. Benefits to governments included improved public health and reduced medical costs, more efficient food control, trade facilitation, and increased confidence of the public in the food supply.

Summary

The FDA recommends the HACCP approach to food safety because it is the most effective and efficient method to ensure that food is safe (Hudson, 2000). The HACCP system is based on preventing illness from occurring by identifying and monitoring specific foodborne hazards that can adversely affect the safety of the food product. The National Advisory Committee on Microbiological Criteria for Foods (1998) identified procedures and protocols for designing, developing, implementing, and monitoring a HACCP system. All HACCP systems are based on the seven HACCP principles and tailored to individual food operations for the most effective results.

The initial application of HACCP in the United States was mandated for certain food processing industries, and most of the information and training materials have been developed primarily for these groups. Articles in scientific literature, as well as manuals and training programs developed primarily though the USDA and FDA have helped other foodservice industries develop science-based food safety practices in their operations.

Since the National Advisory Committee on Microbiological Criteria for Foods (1998) adopted the HACCP system in 1992, the theory and application of HACCP in food processing has gradually evolved to all types of food operations. However, the implementation of HACCP systems into retail foodservice operations including restaurants, hospitals, and schools, has not been as prevalent as in the food processing industry. Even though most school foodservice directors can articulate the benefits of HACCP, implementation rates seem to be consistent at around 20-30%. Primary barriers to HACCP implementation throughout the retail foodservice industry were reported as lack of understanding of HACCP and lack of training. Most school foodservice directors also cited lack of funds and/or time as important concerns. Employee motivation and confidence were also areas that should receive attention in the implementation of HACCP (Giampaoli *et al*., 2002a)

Even though barriers exist, most school foodservice directors have a positive attitude toward HACCP implementation. In general, school foodservice directors realize the benefits of HACCP, including reduction in foodborne illness, compliance with health department regulations, and having HACCP as an insurance policy against liability (Sneed and Henroid, Jr., 2003). Other benefits and advantages of HACCP cited by the World Health Organization (1999) include increased awareness of basic hygiene, increased confidence in the food supply, improved quality of life with improved public health and reduced medical costs, increased consumer and government confidence, reduction in food production costs due to reduced food recalls and reduced food waste, and improved staff and management commitment to food safety. The application of HACCP to all types of facilities that process, prepare, and/or serve food can bring a focus to food safety that traditional food inspection methods have lacked.

Research Design

To study current HACCP implementation in schools in the United States, researchers used a printed survey administered by mail to school foodservice managers. The survey included questions about the school's implementation of HACCP as well as questions about school and foodservice manager demographics. (See Appendix C, p. 66.) Through the survey, researchers proposed to measure the extent and effects of HACCP implementation and sought to determine whether significant differences existed in responses in relation to region or school demographic variables (e.g., school size, location, number of meals served daily, type of operation [self-operated or operated by a management company], or type of food production [e.g., on-site, central, satellite/receiving, vended]). Frequencies and percentages were used to report the overall results of each item on the survey, and the Pearson chi-square test was used to determine whether there was a significant difference in responses in relation to region or school demographic variables.

Research Objectives

This study was designed to determine:

- the extent of HACCP implementation in schools
- characteristics of the implementation process (why HACCP was implemented, source of training, length of time needed to implement, and status of implementation)
- benefits of HACCP implementation
- challenges associated with HACCP implementation.

Description of Survey Instrument

Researchers met with representatives from the National Food Service Management Institute (NFSMI) and from the University of Mississippi's Department of Family and Consumer Science to develop a list of questions that exemplified the types of information that should be derived from this research.

Researchers designed a draft survey instrument based on the questions listed above, then obtained feedback from NFSMI and from the representatives of the Department of Family and Consumer Science. Following revisions based on suggestions from these individuals, NFSMI submitted the draft survey instrument to the Education Information Advisory Committee (EIAC). Researchers revised the instrument based on recommendations from EIAC. This instrument was then used in a pilot study to determine whether there were any unclear items that needed to be revised prior to conducting the full survey.

Researchers developed a sample of school foodservice managers to whom the researchers would send a pilot survey, the results of which would be used in further refining the survey form. This sample was obtained from a list of foodservice directors provided by NFSMI. On January 5, 2004, researchers sent a blanket email to approximately 100 foodservice directors asking for the

names and addresses of two to four school foodservice managers who worked under their supervision. This email was sent again on January 12, 2004. Researchers received contact information for 100 school foodservice managers and 30 school foodservice directors.

Researchers mailed the pilot surveys on January 26-27, 2004. Seventeen surveys were returned and examined for feedback regarding unclear items. Respondents provided no comments suggesting changes. The survey instrument was resubmitted to EIAC and received final approval on March 26, 2004.

The final survey instrument consisted of four parts. The first part included the following 13 items that dealt with the extent and characteristics of HACCP implementation in the school:

1) Do you have standard or formal food safety procedures to follow in your school?
2) Have you begun implementing the food safety procedure known as HACCP in your school? If no, are you considering starting the HACCP program in your school?
3) How many employees do you supervise? How many employees have received formal training in HACCP?
4) Estimate the date when HACCP began to be implemented at your school.
5) Which of the following types of records are kept as part of the HACCP program at your school?
6) The decision for implementing HACCP in your school is the responsibility of whom?
7) What has helped to promote HACCP implementation at your facility?
8) What are your school's plans for continuing/expanding HACCP implementation?
9) What is your role in the HACCP program in your school?
10) Does your school or district have a formal HACCP team? If yes, who serves on it?
11) Who provides HACCP training for your school?
12) Where has corrective action been taken in your facility?
13) What have been the benefits of HACCP implementation at your facility?

The second part of the survey asked respondents to rate each of 17 HACCP practices according to whether the practice: 1) was currently in place at their school, 2) had been in place in the past but had been discontinued, or 3) had never been in place at their school. The 17 practices correlated with the seven HACCP principles.

The third part of the survey asked respondents to rate the following possible barriers to HACCP implementation in terms of their effect on their school's food safety program, using the scale of: 1 = No or minimal effect, 2) Moderate effect, 3) Significant effect.

1) Lack of familiarity with HACCP
2) Lack of funding
3) Lack of resources including time and personnel
4) Inadequate support from administration
5) Lack of available training
6) High employee turnover
7) Inadequate facilities
8) Complexity of foodservice operation
9) Burden of required documentation procedures
10) Other (Please list)

The fourth part of the survey included the following demographic information:

1) What type(s) of school do you work in?
2) How many students are enrolled in the school(s) that you supervise?
3) How many lunches are served daily?
4) Which meals do you serve?
5) What type of food production is used by your school(s)?

6) What type foodservice management is used in your operation?
7) How many years have you worked in school foodservice?
8) How many years have you served in your current position?
9) What is your highest level of education?
10) What certifications do you hold?
11) In what state do you work?
12) In what type of community is your school located?

Sample Population

The primary person responsible for ensuring that HACCP is implemented in schools is the district foodservice director, who works through the foodservice manager at each school. Because the school foodservice managers have the most direct knowledge of food safety implementation at their sites, they were the primary target audience for this survey of HACCP implementation. Researchers' initial sampling plan was based on a sample size of 2,200 school foodservice site managers who would be selected at random from a list of all foodservice managers in the United States. This sample size was chosen because it was high enough to yield an acceptable level of confidence (at least 95%) and sampling precision (sampling error less than 5%) even with a relatively low return rate (as low as 16%).

The original plan for obtaining the sample population was to contact the responsible state agencies in 50 states and the District of Columbia to request the names and addresses of all school foodservice site managers. However, the individuals contacted did not have information at the school level. Therefore, the researchers obtained a list of school districts from the National Center for Education Statistics (NCES) website for 2001-2002. The subsequent plan was to randomly sort the districts and call foodservice directors in order of the randomized list and obtain names and addresses of foodservice managers who worked under them. This procedure was to be followed until the desired sample of 2,200 foodservice managers was obtained. Once again, this plan proved not to be feasible because of the length of time required to contact the appropriate individual and obtain the necessary information.

Researchers concluded that the most feasible option was to obtain a list of all schools within the United States and its territories from the NCES website. The researchers used a random number generator to assign a number to each of these 88,223 schools, then sorted the list by random number and selected the 2,300 schools with the lowest random numbers. (Although only 2,200 schools were needed for the sample, an additional 100 schools were drawn to compensate for any unusable cases.) The researchers matched the selected schools with their districts using the identifying seven-digit number assigned to each district. Approximately 20 "schools" that appeared to be special cases (i.e., that would not have food services in their facility, such as homebound programs and district offices) were deleted from the sample.

Data Collection

The final survey form was mailed to 2,200 school foodservice managers on April 21, 2004. Names of foodservice managers were not available; therefore envelopes were addressed to schools with "Foodservice Manager" as the first line. Cover letters (Appendix B, p. 64) requested that the surveys be returned by April 30, 2004. Stamped, self-addressed envelopes were included in the final survey mailings to foodservice managers. Foodservice managers were asked to complete and return the survey by mail or by fax.

NFSMI planners also stipulated that the researchers were to send a copy of the survey instrument to the foodservice director supervising each of the selected managers, along with a letter informing the supervisor that a manager from their district had been asked to participate in the survey. To comply with this request, the researchers sent the instrument and directors' letter (Appendixes C and A, respectively, p. 66 and p.62) to 1,760 school foodservice directors in the

school districts in which the targeted managers' schools were located. Return envelopes were not included in the foodservice director mailings.

Reminder postcards were mailed to all sample foodservice managers on May 4, 2004, and again on May 11, 2004. The cutoff date for accepting completed surveys was June 22, 2004. A total of 398 usable surveys were returned, yielding a response rate of 18%. Another 115 surveys from directors were returned, but could not be used because foodservice directors were not included in the sample population. The researchers believe that the foodservice directors who completed the survey did so without reading the cover letter explaining that the survey form was simply for their information and not to be completed.

Representativeness of the Sample

The response rate of 18% was lower than desired by the researchers. If a survey's response rate is low, the researcher must consider the possibility that the results would have differed if all members of the sample (in this case, 2,200 managers) had responded (Gall, Gall, & Borg, 2003). One approach to determining the extent to which the survey respondents were representative of the target population is to examine the distribution of respondents by region. For this reason, the researchers examined the extent to which responding site managers were representative of the population of site managers in the original sample and in the U. S. by comparing proportions responding by region with the geographic distribution of site managers (i.e., schools) in the U. S. (Suskie, 1996).

In addition, the researchers examined results for evidence of response bias (i.e., the possibility that responses did not accurately reflect the conditions present within the full sample and the population) using the wave analysis method (Creswell, 2003). Using this method, the researchers grouped returns by date received and examined variations in responses to key questions to identify changes from the first period of data collection to the last. Responses received during the last period were assumed to reflect conditions of non-respondents as closely as possible. This analysis was supplemented by a telephone survey of a sample of non-respondents, who were asked to respond orally to key questions selected from the survey instrument (Creswell, 2003). Answers provided by these "non-respondents" were compared with responses of site managers who completed and returned the survey to determine the extent of comparability of responses.

Representativeness by Region

In each region 2-3% of foodservice managers were surveyed. Thus, school foodservice managers from each region were included in the sample of 2,200 schools at approximately equal rates.

Figure 1, which provides additional detail on proportions by region, shows the percentage of U.S. schools in each region, the number of surveys sent to each region as a percent of all surveys sent, and the responses from each region as a percent of all responses. Ideally, the proportion of all surveys received from foodservice managers in each region would have equaled the proportion of all U.S. schools in that region. The researchers noted some differences from the ideal distribution of responses. As shown in Figure 1, the Southeast region was somewhat over-represented in the survey responses ($\_^2$=34.590, *df*=1, *p*=.000, ω=.052), as was the Midwest. Twenty-three percent of all survey responses came from the Southeast region, but only 13% of all U.S. schools were located in that region. Similarly, 25% of all survey responses came from the Midwest region, but only 20% of all U.S. schools were located in the Midwest ($\_^2$=4.070, *df*=1, *p*=.044, ω= .014). Conversely, the Southwest and Western regions were somewhat underrepresented ($\_^2$=14.303, *df*=1, *p*=.000, ω=.032; $\_^2$= 3.891, *df*=1, *p*=.049, ω=.015, respectively). Approximately 8% of the surveys received were from the Southwest, a region in which 14% of all U.S. schools were located. The Western region accounts for 17% of all U.S.

schools, but only 13% of all survey responses came from that region. These differences are statistically significant but are not substantial from a practical viewpoint. A statistically significant difference accompanied by an effect size of ω=.10 or less indicates that the difference is of little practical importance. The effect sizes associated with the regional differences in representation (ω in the statistics provided above) did not exceed .05 for any of these comparisons. The regional differences in representation noted above occurred because a somewhat larger proportion of survey recipients in the Midwest responded to the survey (a response rate of 25% compared to 18% overall). Response rates for all regions are shown in Figure 2.

Figure 1

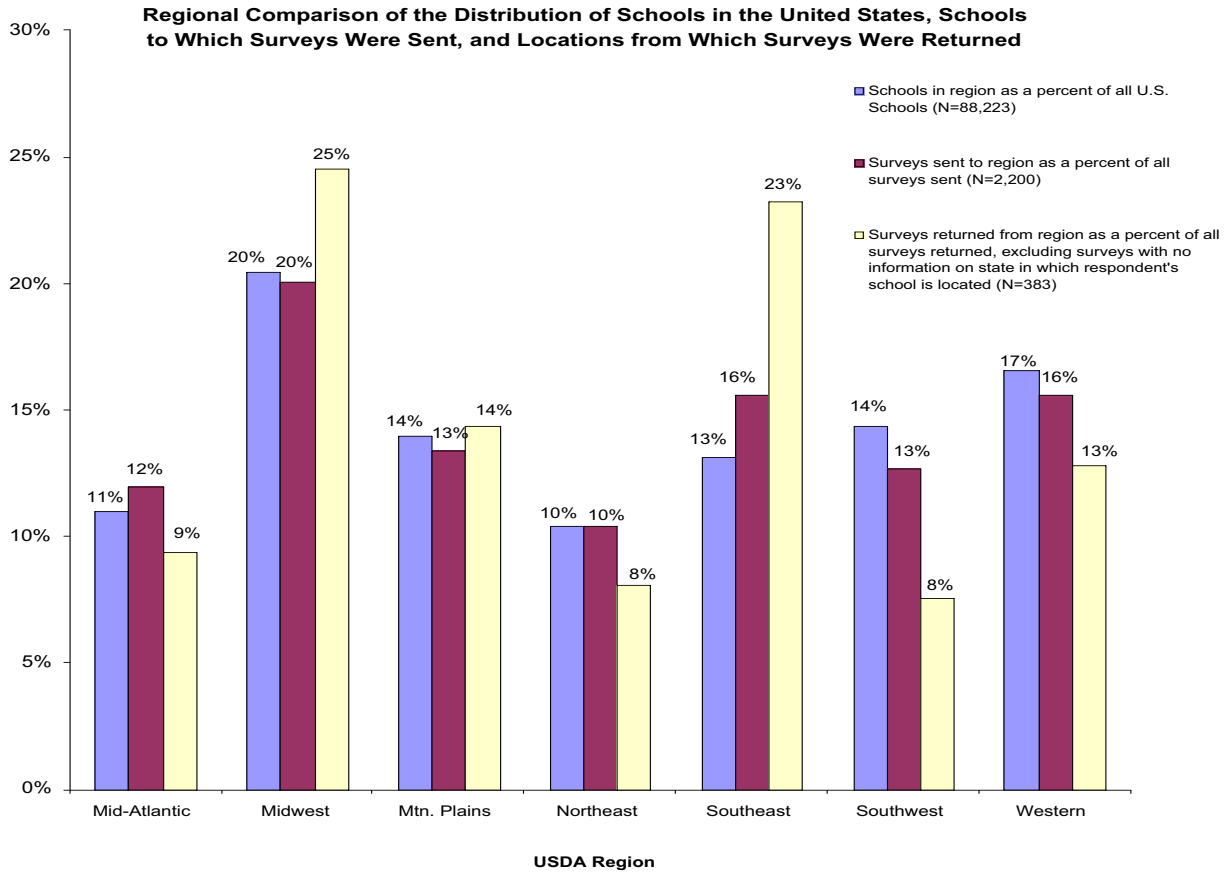
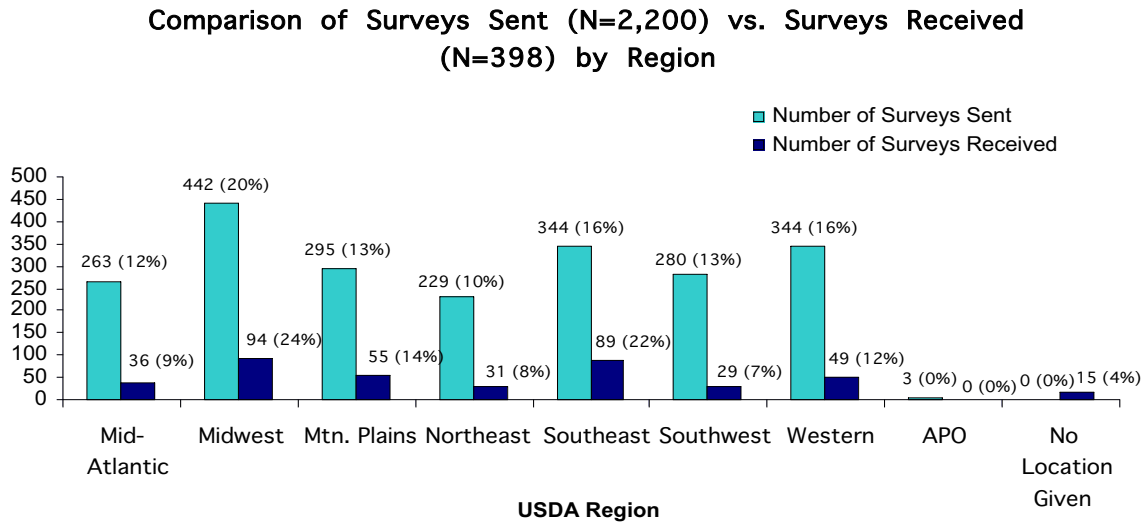


Figure 2

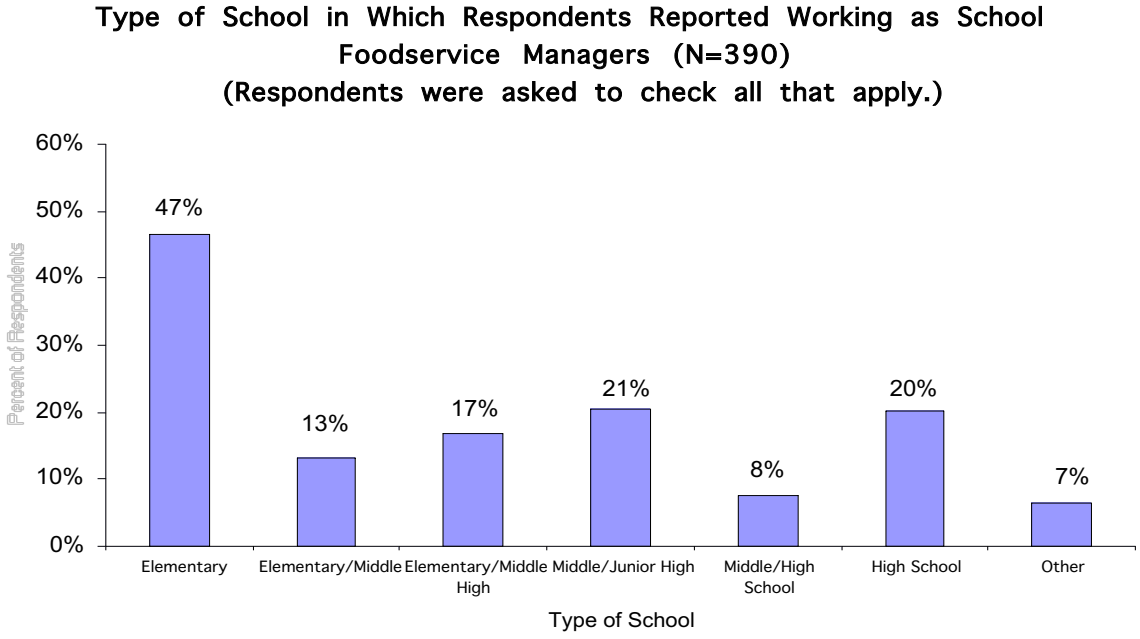


The researchers sorted completed surveys by date and compared the 155 responses received from May 11, 2004, through June 15, 2004, to the 232 responses received prior to May 11, 2004 (excluding 11 responses for which no date was available). Responses to items that may have differentiated the two groups (e.g., whether HACCP had been implemented at the school) were compared to determine whether early respondents answered differently than late respondents. No notable differences were found.

Consistent with the survey plan for the low response contingency, the researchers contacted a sample of non-respondents by phone to determine whether their responses on specific items were similar to the responses of sample members who did respond to the mailed survey. This process, which was conducted late in the school year, yielded only seven telephone interview responses. However, the proportion of respondents who reported by phone that they were implementing HACCP at their facility was comparable to the proportion who reported by survey that they were implementing HACCP. The foodservice managers who were interviewed by phone covered a wide range of school sizes, from very small (100-299 students) to 3,000 or more students, thus indicating that the phone sampling did not exclude either large or small schools. These factors, combined with the geographic distribution of respondents, suggest that the survey respondents were not substantially different than the non-respondents.

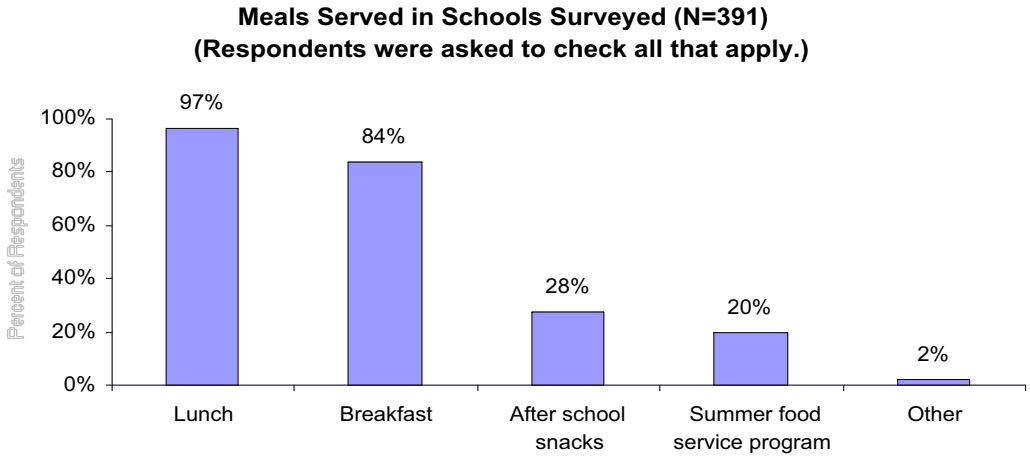
As shown in Figure 3, the largest number of respondents (47%) worked in elementary schools, followed by middle/junior high schools, then by high schools.

Figure 3



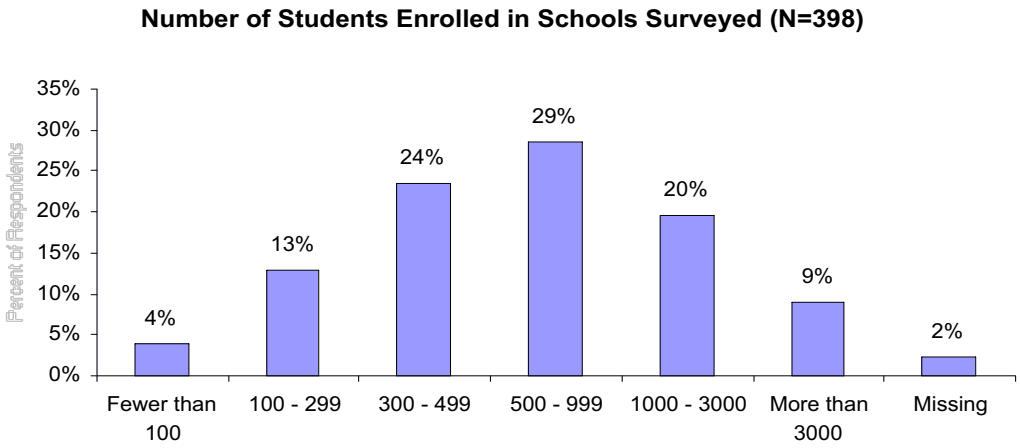
The results displayed in Figure 4 show that almost all respondents served lunch, and 84% of the respondents served breakfast.

Figure 4



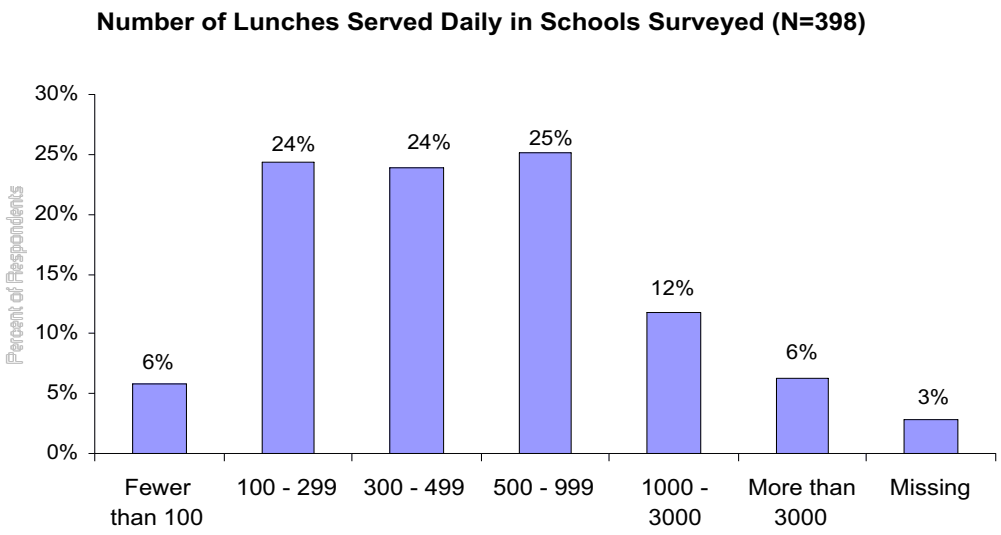
As shown in Figure 5, the largest number of respondents (29%) worked in schools with 500-999 students. The next largest number of respondents (24%) worked in schools with 300-499 students. Twenty percent of respondents worked in schools with 1000-3000 students. The remaining respondents represented a small percentage of the sample population and worked in schools that were either very small or quite large.

Figure 5



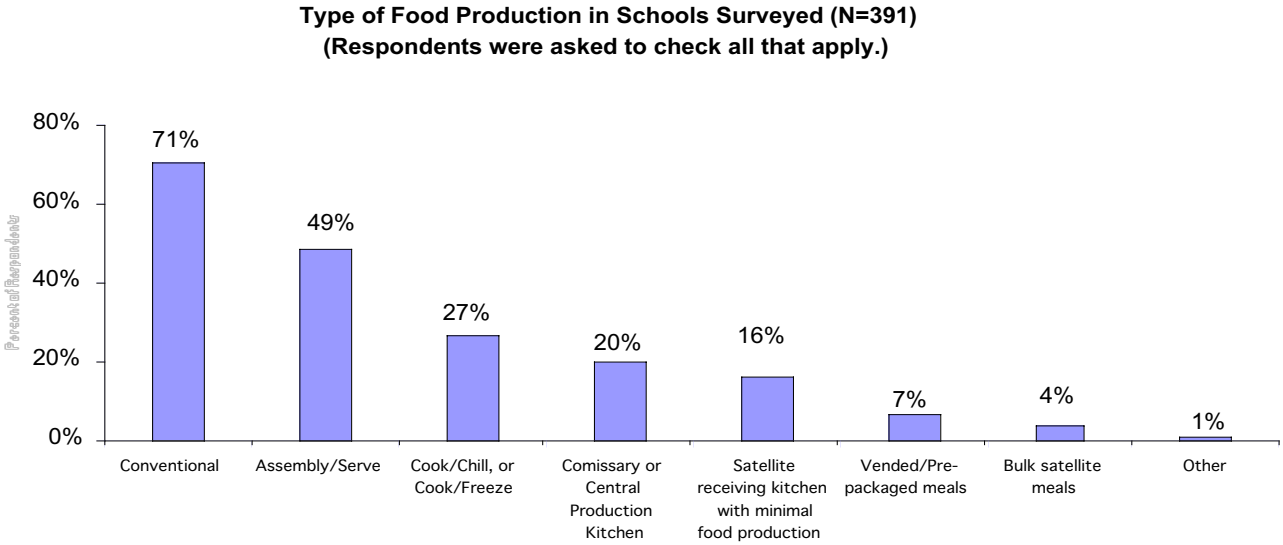
As shown in Figure 6, 73% of respondents served between 100 and 999 lunches per day. Only 6% served fewer than 100 lunches, and only 6% served more than 3,000 lunches per day.

Figure 6



With regard to food production, some facilities used more than one type. As shown in Figure 7, 71% of the respondents worked in facilities that used conventional food production. Almost half (49%) worked in facilities that used assembly/serve type of food production.

Figure 7



According to the results reported in Figure 8, the overwhelming majority of responding schools (74%) were self-managed by the school district.

Figure 8

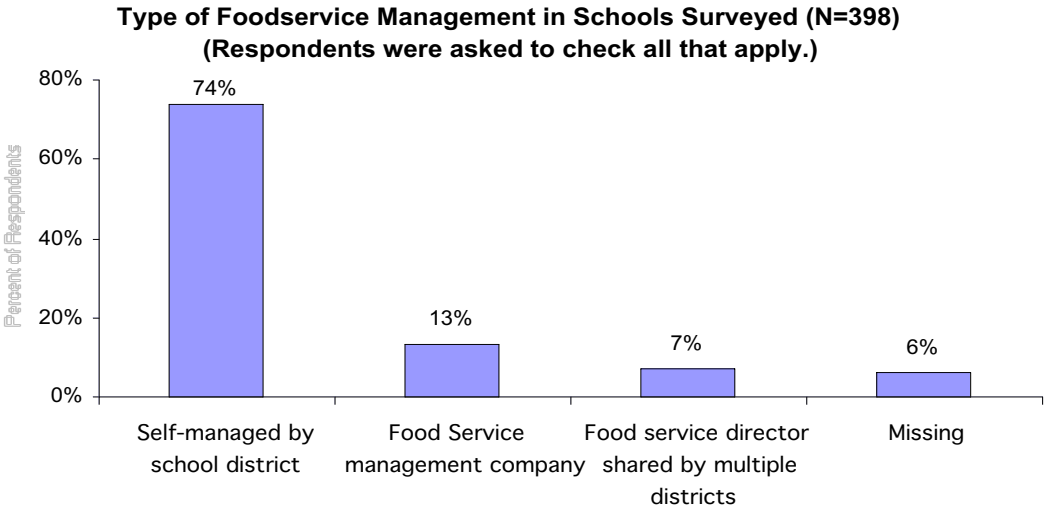
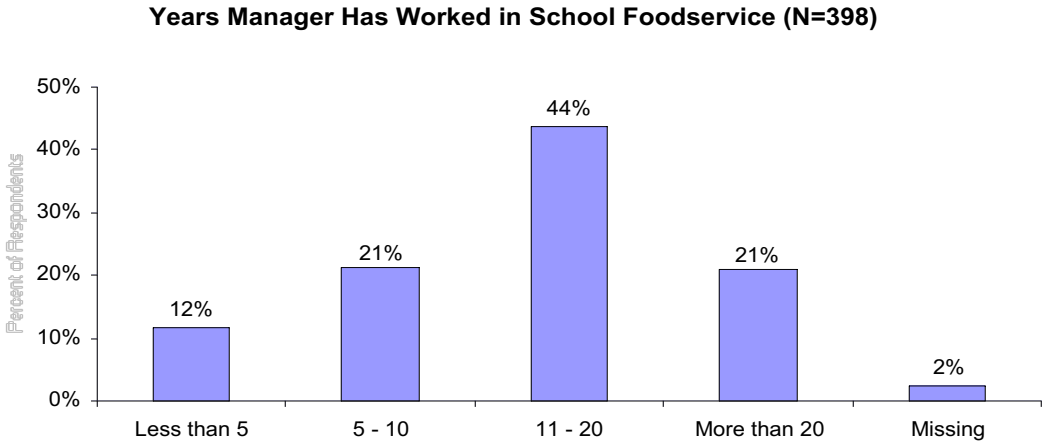


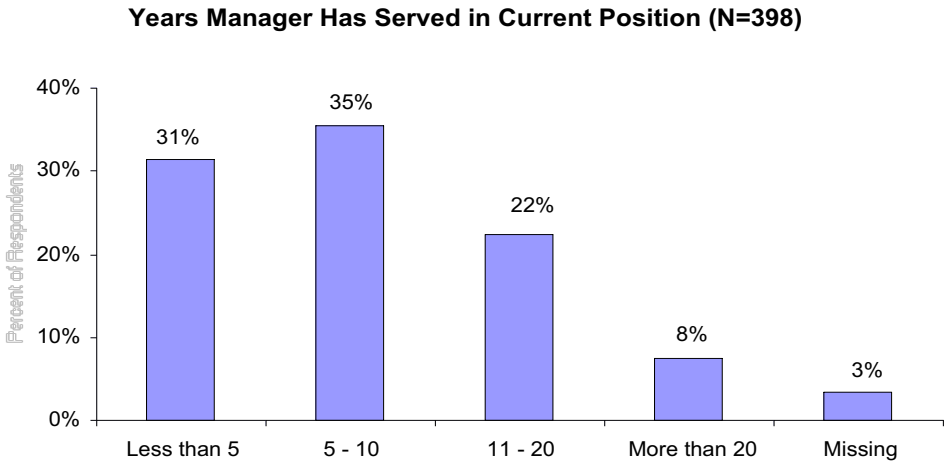
Figure 9 shows that the highest proportion of responding managers (44%) had worked in school foodservice for 11-20 years. Twenty-one percent had worked in school foodservice for 5-10 years, and the same percentage for more than 20 years' service.

Figure 9



As shown in Figure 10, most respondents had served in their current position for 5-20 years; however, 31% had served less than five years, and only 8% had served more than 20 years.

Figure 10



As shown in Figure 11, the highest percentage of respondents (47%) had completed high school. One-fourth had completed some college. A total of 24% had obtained a college degree (associate to doctorate).

Figure 11

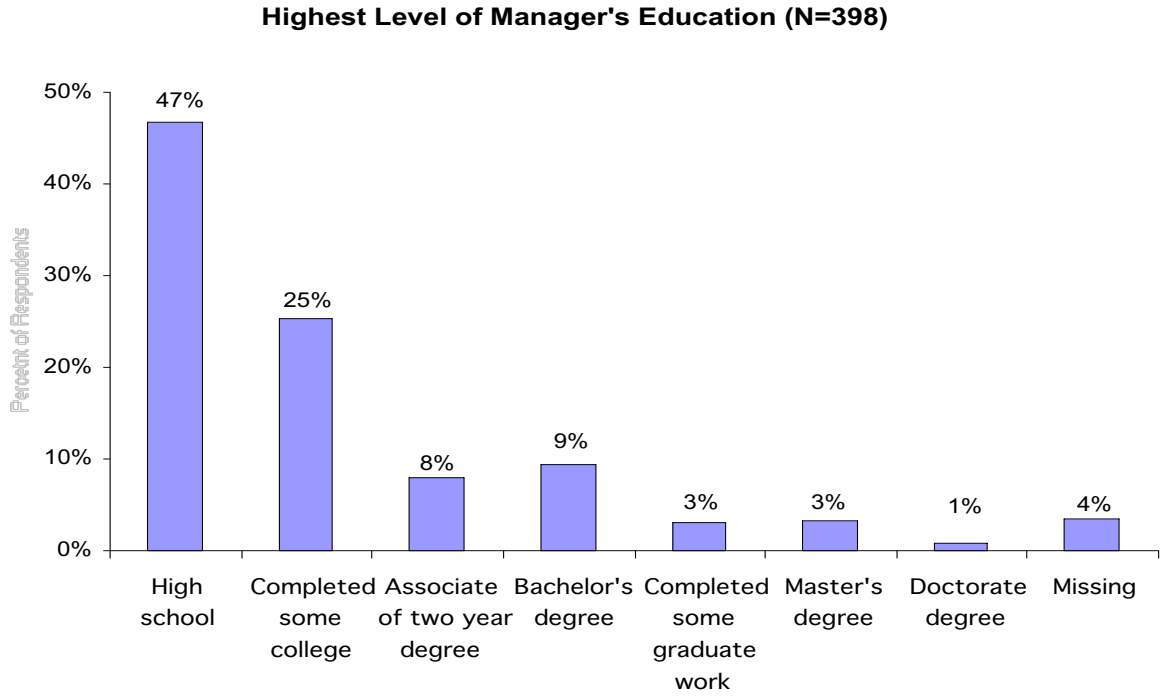


Figure 12 shows that more than half the managers reported being ServSafe certified; 35% American School Food Service Association (ASFSA) certified (the certificate title that was current when the survey was conducted); 25% certified as a Food Handler; and 16% State Agency certified. Only 11% held no certification.

Figure 12

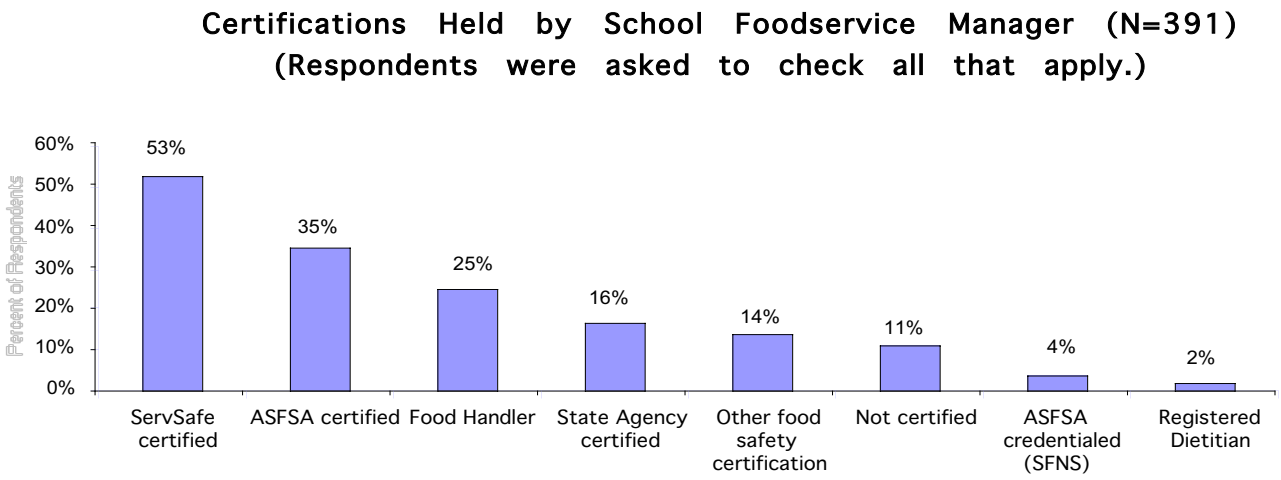
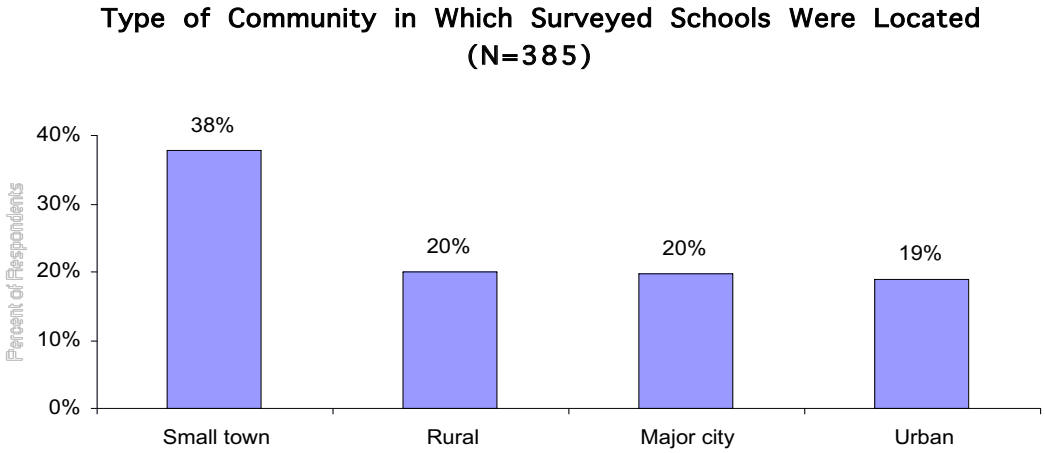


Figure 13 shows that the highest number of respondents (38%) worked in small town schools. Almost equal percentages (19-20%) worked in urban, major city, or rural schools. (For purposes of this research, the populations of a major city, urban area, small town, are considered to be: greater than 45,000, between 45,000 and 2,800, and less than 2,800 respectively. A rural area is considered to be those remote areas located outside of small towns.)

Figure 13



Data Analysis

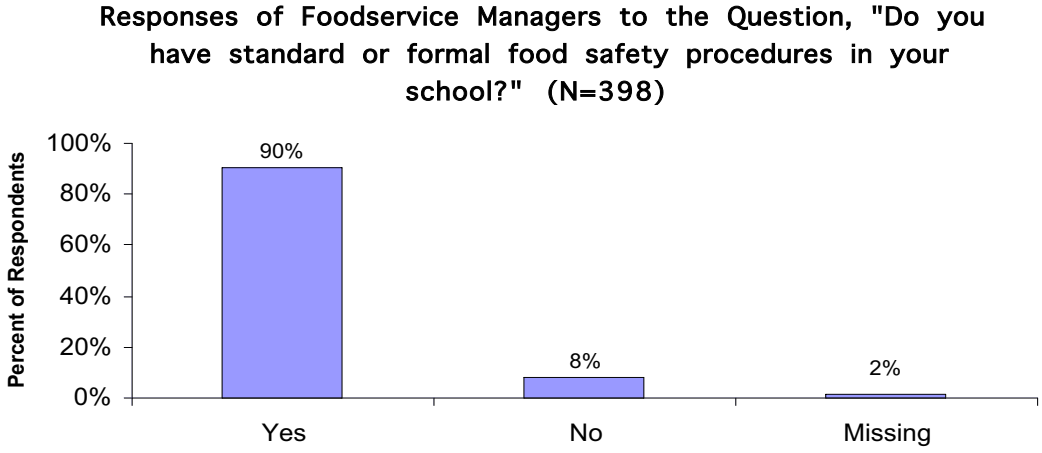
Data from survey responses were analyzed both collectively and in terms of relationship with demographic variables.

Overall Results

Survey responses were initially analyzed by calculating frequency and percentage of responses by item. Appendix D (p. 71) lists the results of this analysis.

Figure 14 indicates that 90% of the respondents reported having standard or formal food safety procedures in their schools. (Standard or formal food safety procedures refer to written procedures that are currently being used in the school.)

Figure 14



Figures 15a and 15b show that a significantly lower percentage of respondents from rural communities reported implementing standard or formal food safety procedures compared to the combined rate of implementation in other community types (χ^2=11.24, *df*=3, *p*=.011).

Figure 15a

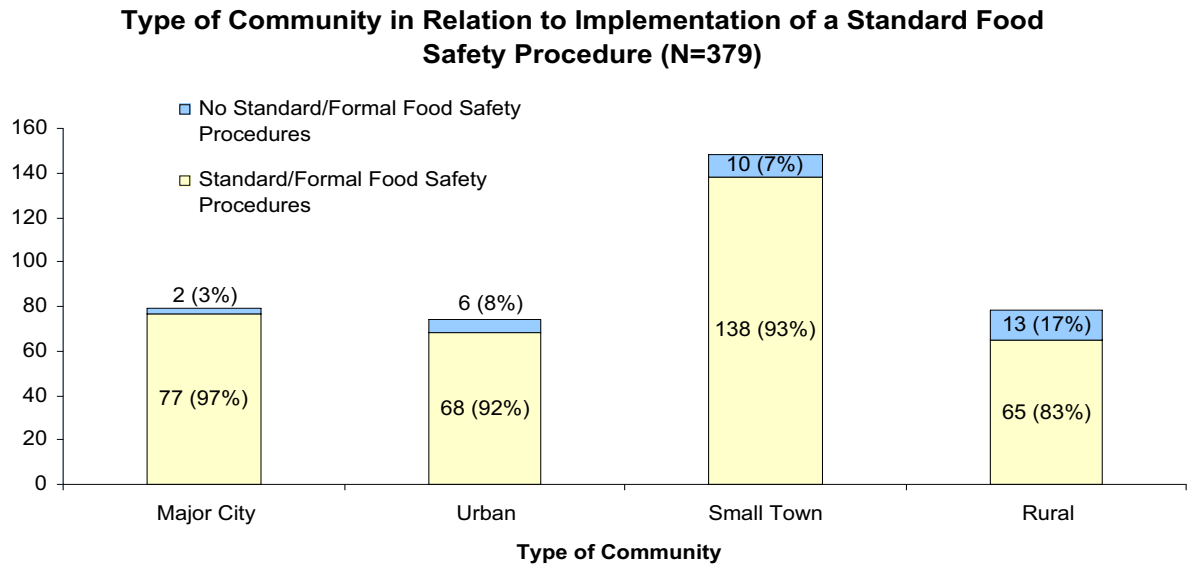


Figure 15b

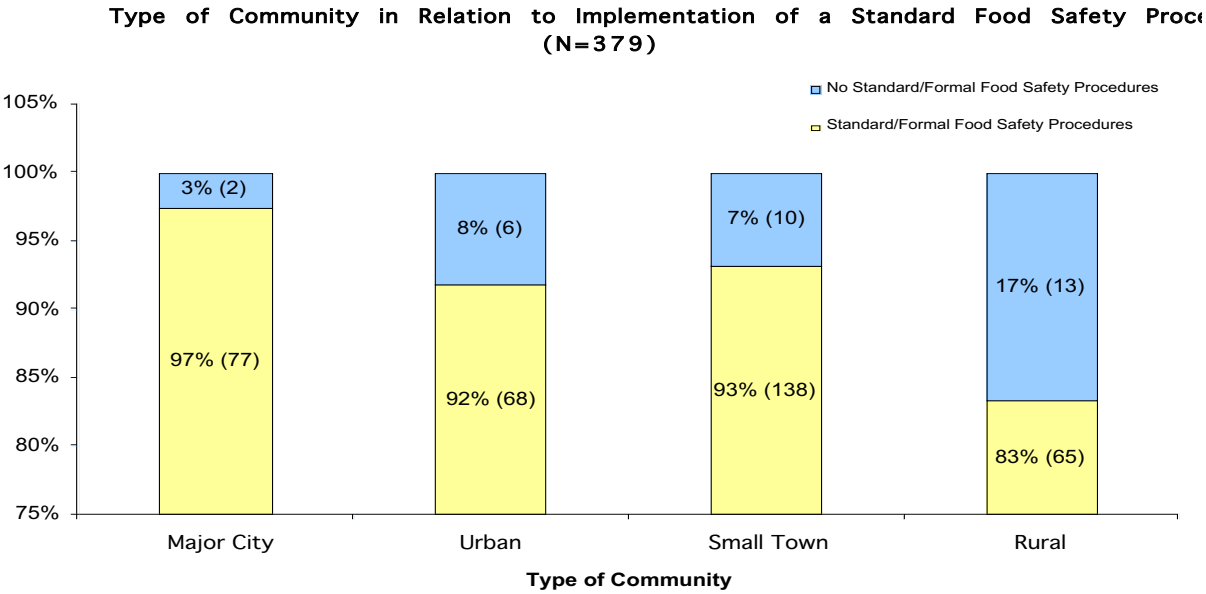
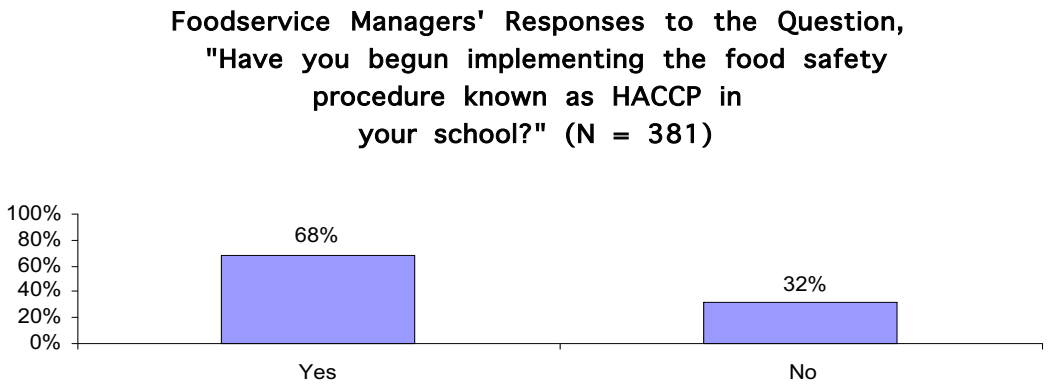


Figure 16 indicates that 68% of the 381 foodservice managers who responded to the item on HACCP implementation reported that their schools have begun implementing HACCP.

Figure 16



As shown in Figures 17a and 17b, a majority of respondents within all regions reported that their schools had implemented HACCP. Although regional differences occurred among the respondents (see Figure 17), none of these differences in HACCP implementation rates were statistically significant.

Figure 17a

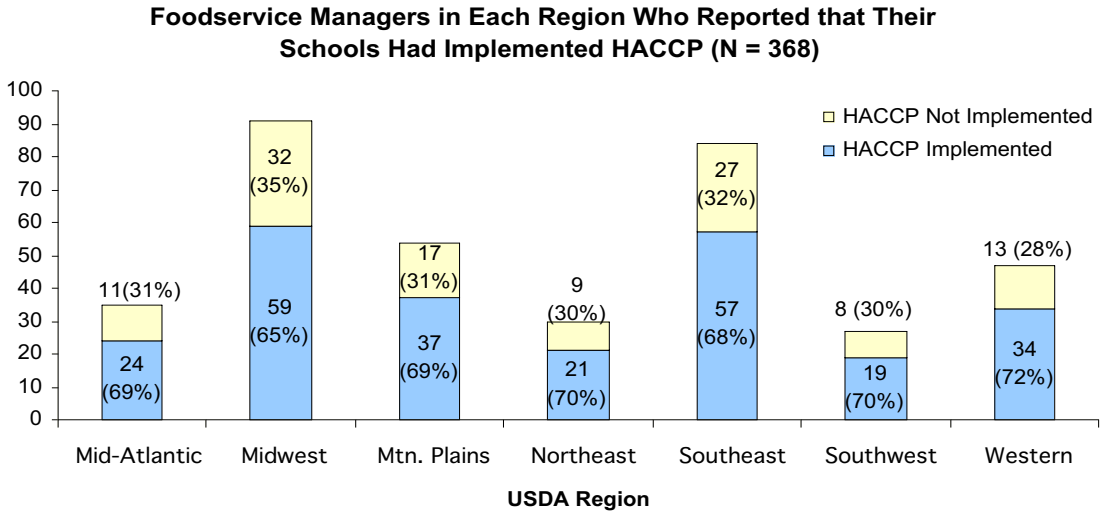
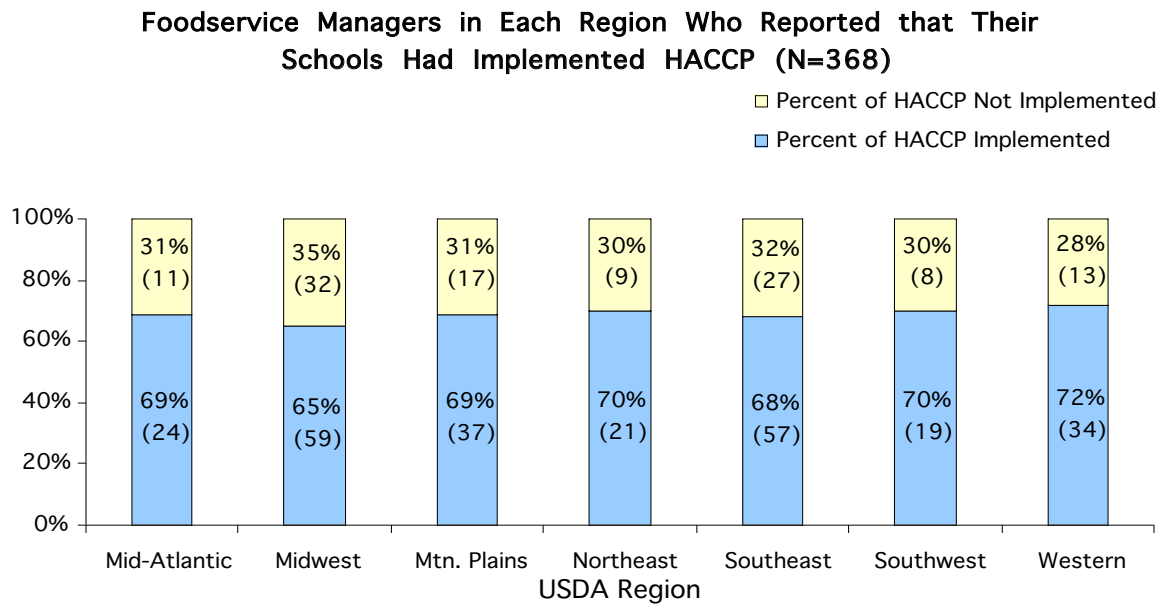


Figure 17b



As shown in Figures 18a and 18b, schools in major cities had a significantly higher percentage of HACCP implementation (91%) than schools in other types of communities, where HACCP implementation averaged 62.6% (χ^2=28.52, *df*=3, *p*=.000). The highest number of responses came from small towns, where only 67% of respondents had implemented HACCP.

Figure 18a

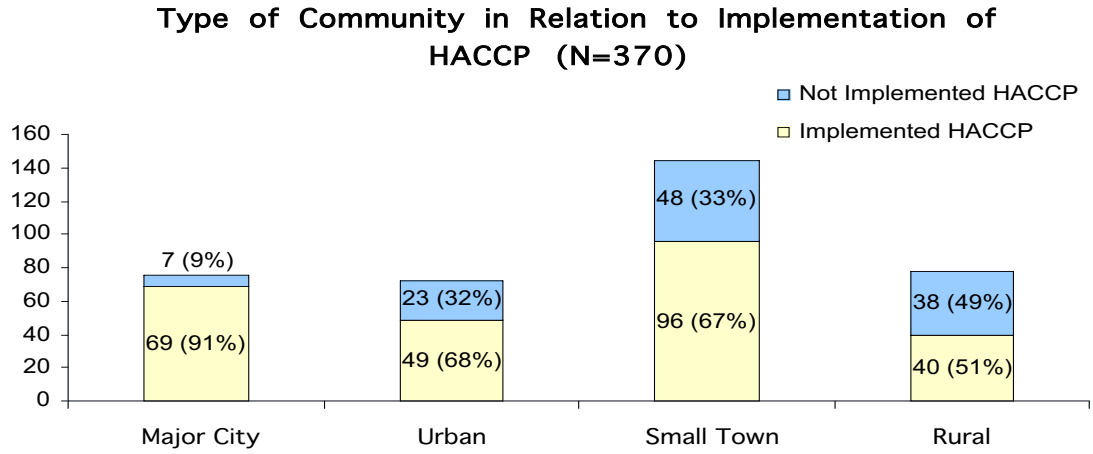
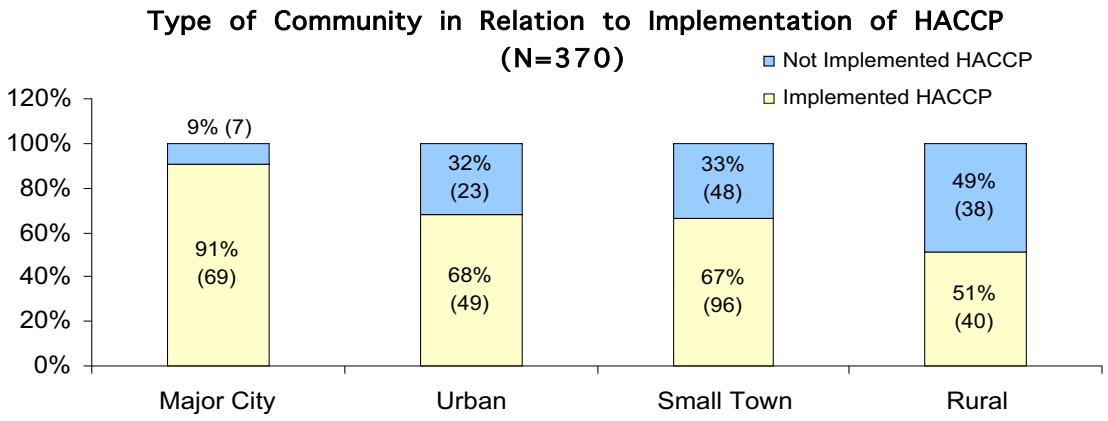
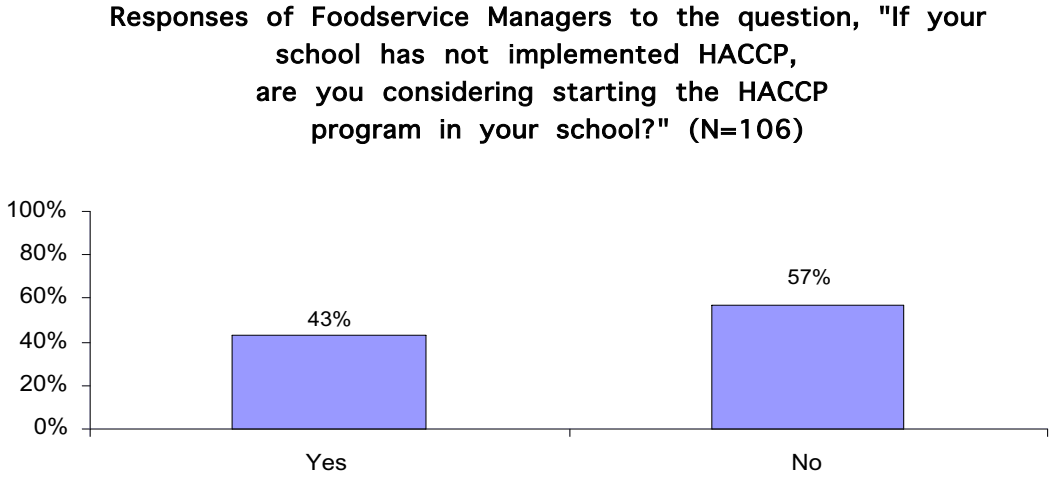


Figure 18b



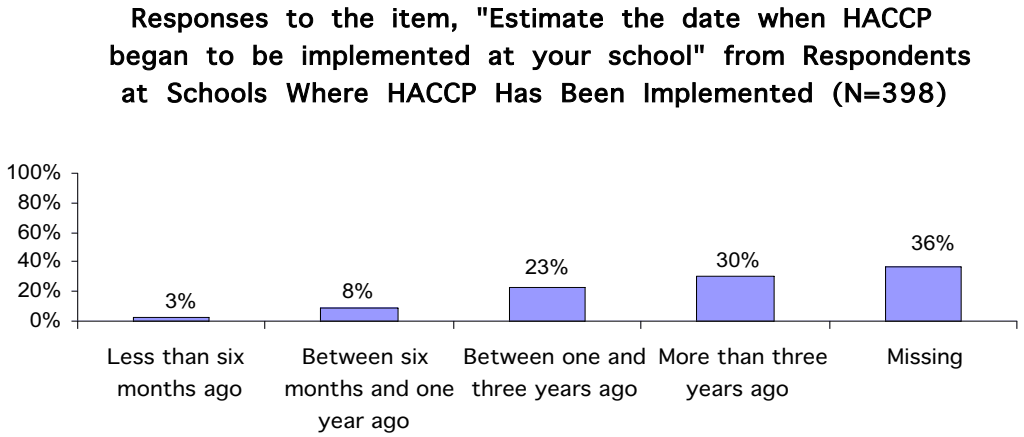
According to the results reported in Figure 19, 57% of the schools that had not implemented HACCP did not plan to begin the program, while 43% reported that they plan to begin implementing HACCP. However, the Child Nutrition and WIC Reauthorization Act of 2004 now mandates that, effective July 1, 2005, all districts will implement a food safety management program based on HACCP principles.

Figure 19



Of the schools that did report implementing HACCP, Figure 20 shows that 30% began the program more than three years ago, and 23% began the program between one and three years ago. Only 10% began the program less than one year ago. It should be noted that 36% of the schools did not respond to this item.

Figure 20



Figures 21a and 21b show that the majority of schools keep the following types of records as part of their HACCP program: 1) refrigeration and freezer temperature logs and 2) record of temperature to which food is cooked. Almost 50% of the schools keep records of preparation procedures, including the internal food temperature throughout preparation, as well as records of the temperature at which food is held on the serving line or in a holding cabinet. Between 22% and 33% of the schools keep other listed types of records as part of their HACCP program.

Figure 21a

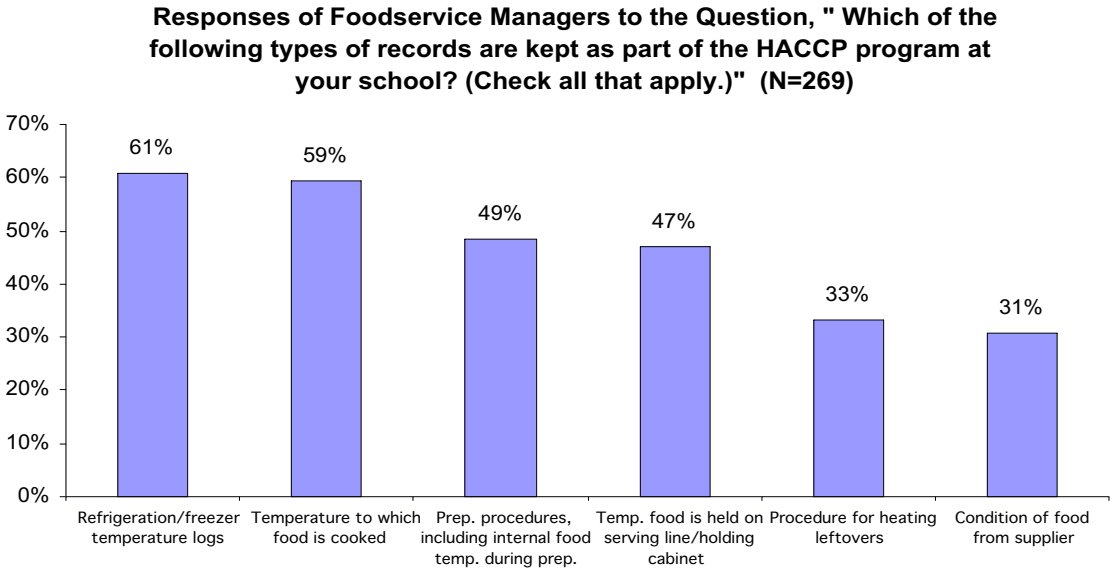


Figure 21b

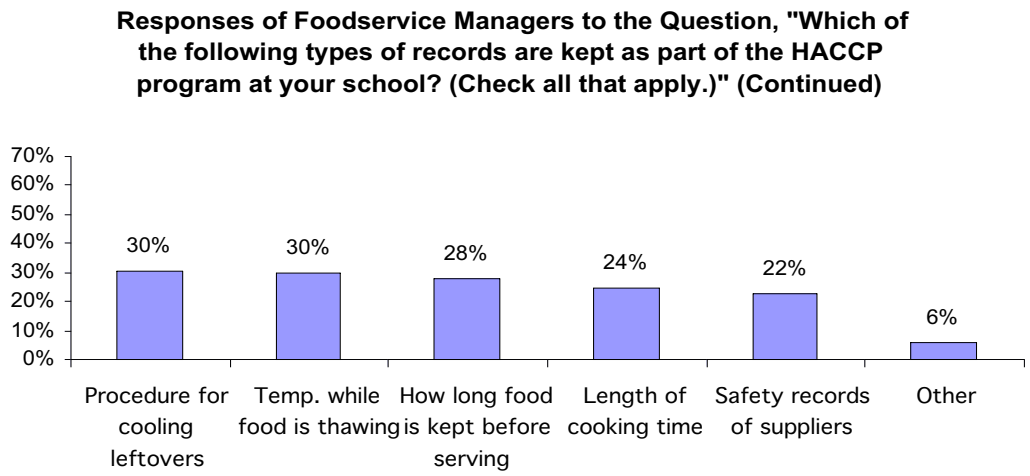
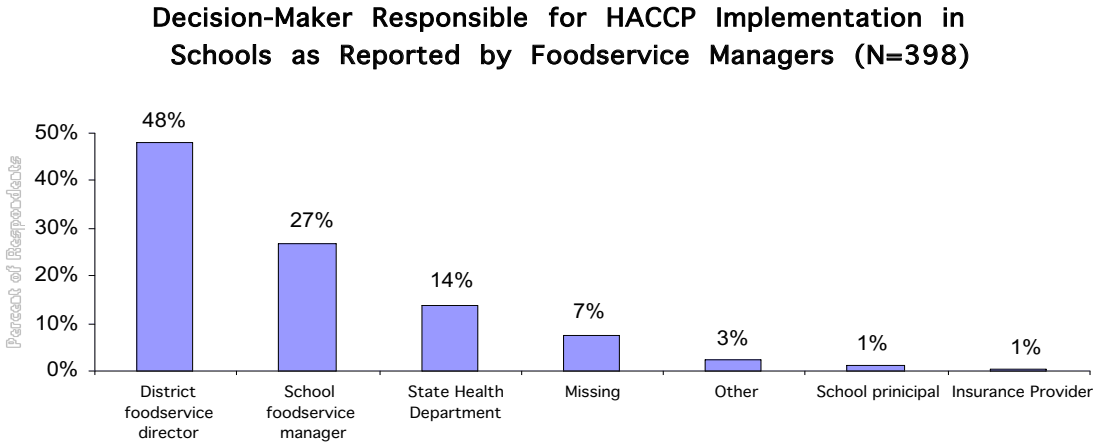


Figure 22 shows that in 48% of the responding schools, the decision for implementing HACCP is the responsibility of the district foodservice director, and in 27% of the responding schools the decision is the responsibility of the school foodservice manager. The State Health Department makes the decision for implementing HACCP in 14% of the responding schools.

Figure 22



According to the results provided in Figure 23a, 55.5 % of the responding schools reported that support from their foodservice director helped to promote HACCP implementation at their facility. Further, 41% of the responding schools reported that support from the school's foodservice workers helped to promote HACCP implementation.

Figure 23a

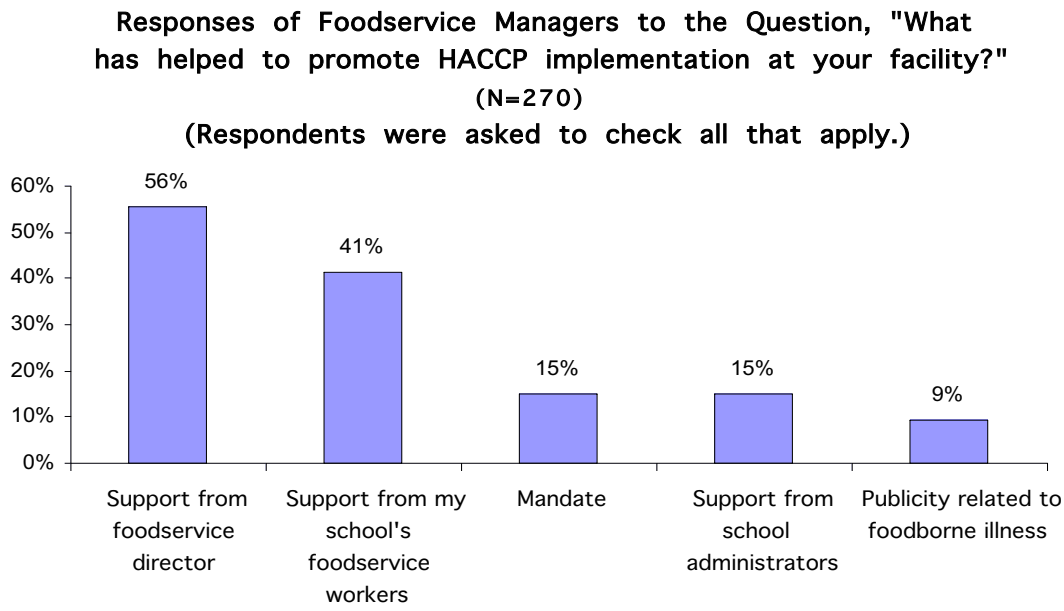
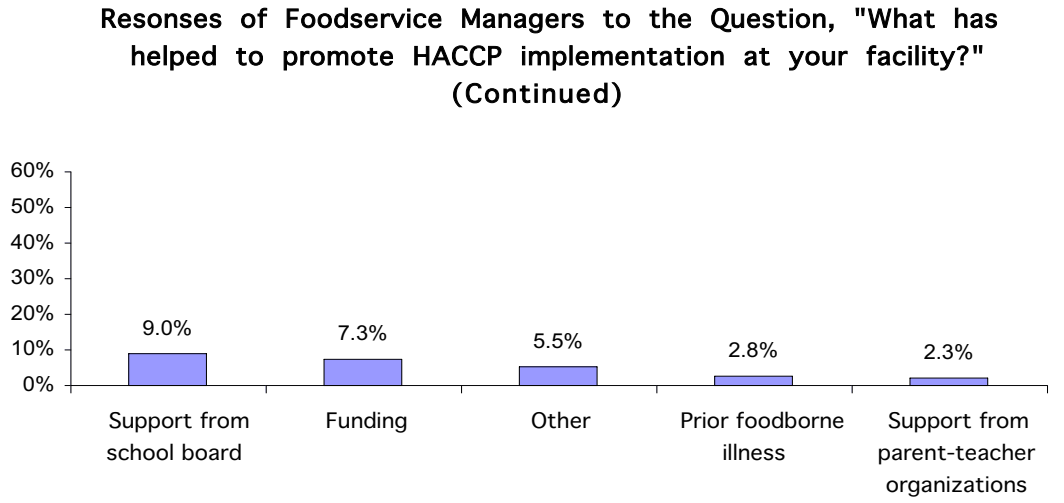
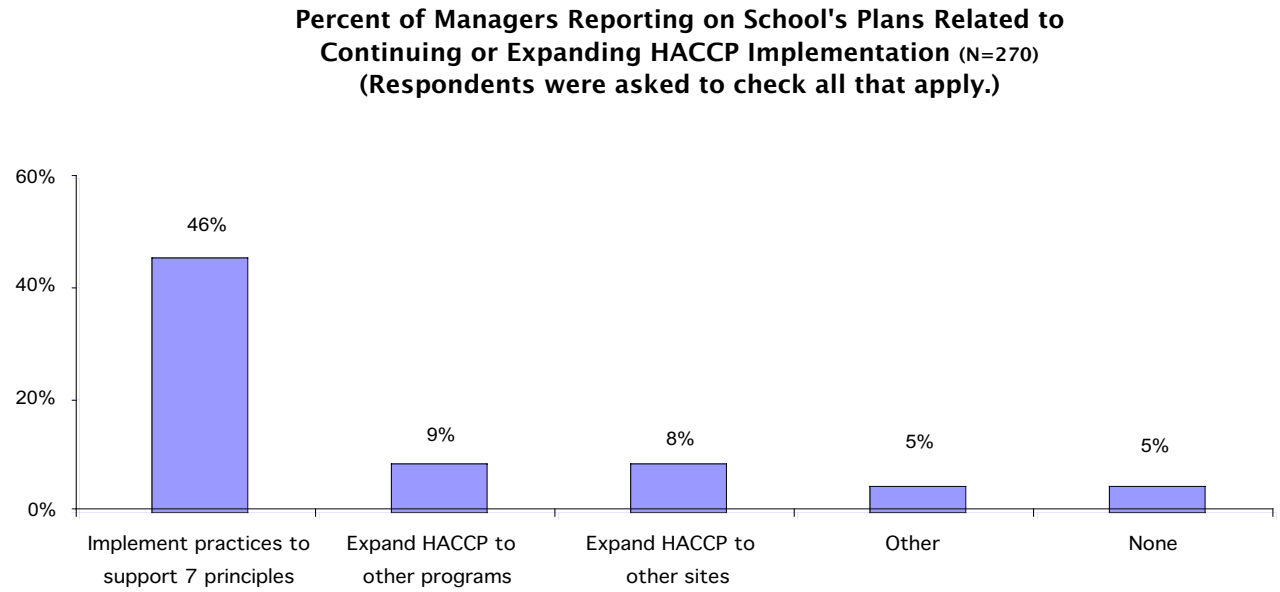


Figure 23b



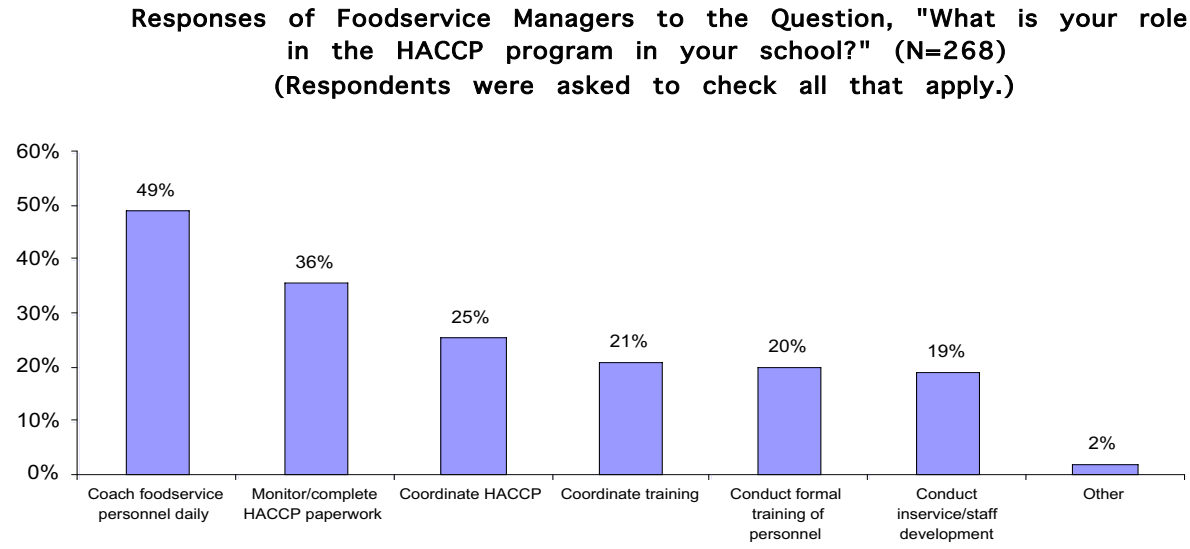
As shown in Figure 24, the largest number of respondents (46%) work in schools that plan to implement practices to support all seven HACCP principles. Less than 10% of the respondents plan to expand HACCP to other sites or other programs.

Figure 24



As shown in Figure 25, the largest number of respondents (almost 50%) reported that their role in the HACCP program included coaching food service personnel on a daily basis. More than one third reported that their role in the HACCP program included monitoring/completing HACCP paperwork, and more than 20% of respondents reported that their role included coordinating HACCP implementation or training.

Figure 25



As shown in Figure 26, most respondents who worked in schools where HACCP was implemented and who stated whether their school or district had a formal HACCP team reported that they did not (38%). Eleven percent of the respondents reported having a school HACCP team, and 13% reported having a district HACCP team. However, 39% of the sample population did not respond to this item.

Figure 26

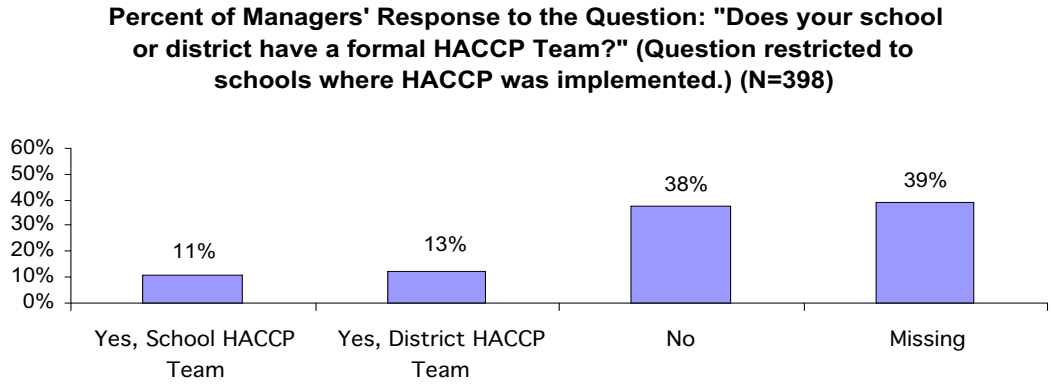
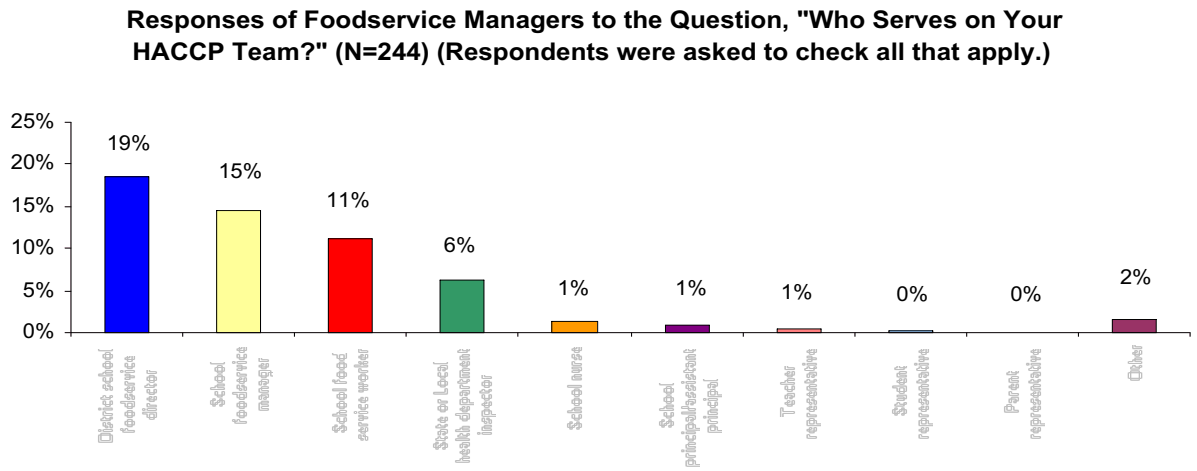


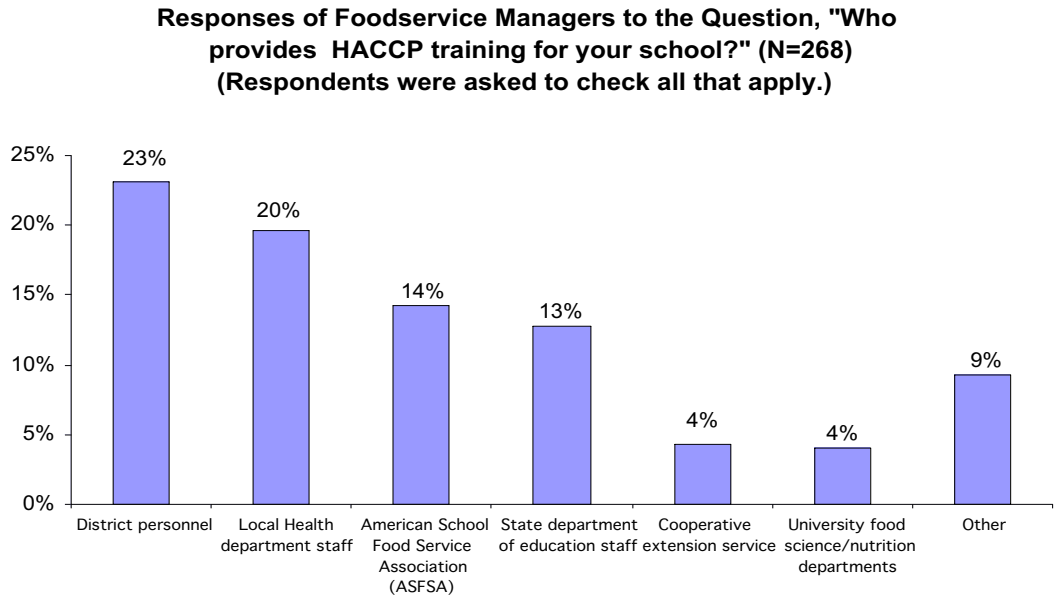
Figure 27 shows that the most common members of the HACCP team were reported to be the district school foodservice director, the school foodservice manager, and the school foodservice worker.

Figure 27



With regard to the provision of HACCP training in the school, Figure 28 shows that the highest percentage of respondents (23%) reported that district personnel provided training. Next in order were the local Health Department staff, the American School Food Service Association, and the State Department of Education staff.

Figure 28



At least 50% of all schools responding to the survey reported that they are currently implementing the following HACCP practices:

Evaluate general preparation, cooking, chilling, and holding procedures. (61%)
Identify procedures for proper thawing of frozen foods. (60%)
Establish critical limits (standards that are observable and measurable and are usually specified by using temperature and time.) (60%)
Examine records and make sure that employees are entering actual, valid data. (59%)
Perform tests such as measuring the strength of the sanitizing solution using a sanitizer test strip. (58%)
Monitor potentially hazardous foods at every step in the foodservice process. (56%)
Identify procedures to prevent, reduce, and eliminate recontamination hazards at each critical control point. (56%)
Use the routine inspection by the State public health department to provide an assessment of whether the HACCP process is working. (53%)
Establish a record keeping system to document the HACCP process and monitor results (e.g., printed internal food temperature forms, storage temperature forms). (53%)
Establish the corrective action that will be taken if the Critical Control Point does not meet the Predetermined Critical Limits. (53%)
Include the corrective action that will be taken as a part of the HACCP plan for the foodservice organization. (50%)

From 40% to 47% of all schools responding to the survey reported that they are currently implementing the following HACCP practices:

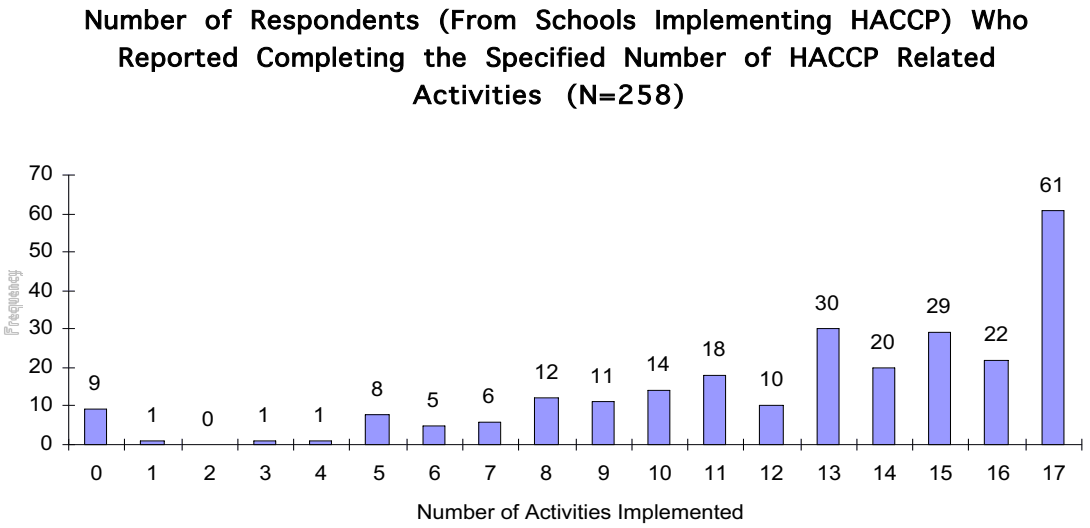
Specify exactly what should be done to meet each particular standard (Critical Limits). (47%)
Identify instances in which the Critical Control Point does not meet the predetermined Critical Limits. (45%)
Track each food from purchasing, receiving, and storing through serving and reheating, and identify hazards at each step. (44%)
Compare what actually happens during the foodservice process with the standards that have been established (Critical Limits). (40%)

Less than 35% of all schools responding to the survey reported that they are currently implementing the following HACCP practices:

Document how often corrective actions are needed. (34%)
Develop a flowchart or list the steps involved in preparing each potentially hazardous food. (29%)

As shown in Figure 29, 61 (24%) of the schools that reported implementing HACCP indicated that they were completing all 17 HACCP related activities listed on the survey. Thirty-one (12%) of the schools implementing HACCP reported completing fewer than eight HACCP related activities, with 9 of these schools (3.4%) reporting that they were completing no HACCP related activities.

Figure 29



Researchers used the *HACCP for Child Nutrition Programs: Building on the Basics* manual to categorize the 17 HACCP related activities according to the seven HACCP principles under which the activities fall. Table 1 lists the number of schools that reported implementing all activities related to each HACCP principle listed. More than half of the schools that implemented HACCP were implementing principles 2, 3, 4, 6, and 7. Nine schools did not report implementing any HACCP related activities.

Table 1
Number and Percentage of Schools Implementing HACCP and Practices Included in Each HACCP Principle

Number of Schools Implementing HACCP Principle 1: Conduct a hazard analysis	99 (38%)
Number of Schools Implementing HACCP Principle 2: Determine the critical control points (CCPs)	203 (79%)
Number of Schools Implementing HACCP Principle 3: Establish critical limits to control CCPs	177 (69%)
Number of Schools Implementing HACCP Principle 4: Establish procedures to monitor CCPs	148 (57%)
Number of Schools Implementing HACCP Principle 5: Establish corrective actions when a monitoring procedure identifies the violation of a critical limit.	106 (41%)
Number of Schools Implementing HACCP Principle 6: Establish procedures to verify that the HACCP system is functioning and working properly	218 (84%)
Number of Schools Implementing HACCP Principle 7: Establish effective record keeping that documents the HACCP system	156 (60%)
Number of Schools Implementing No HACCP Principles	9 (3%)

According to the results displayed in Figures 30a and 30b, between 30% and 41% of respondents reported that corrective action had been taken in the areas of holding and serving food, cooking, recordkeeping and documentation, reheating, storing, cooling, preparing, equipment cleaning procedures, and employee hygiene. Security and purchasing were the areas least reported to have been targets of corrective action.

Figure 30a

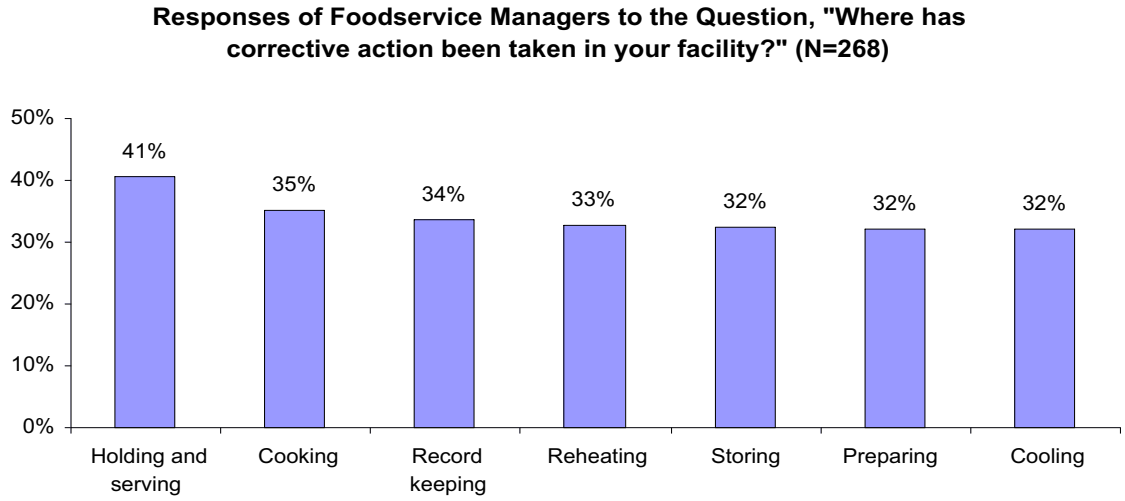
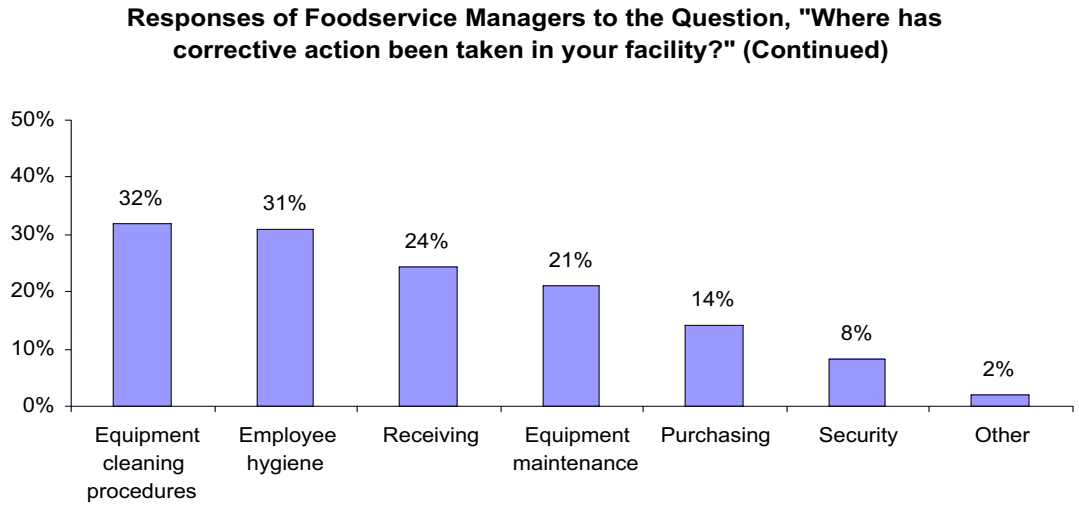


Figure 30b



Regarding the benefits of HACCP implementation as displayed in Figures 31a and 31b, the majority of respondents (55%) reported that a benefit of HACCP was employee's practice of good hygiene. Almost half the respondents (48.5%) reported that HACCP promoted a routine cleaning and sanitation program. Slightly more than one-third of the respondents stated that the benefits of HACCP implementation included a facility designed to ensure that it can be kept clean and sanitary; awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety; specifications that require food safety measures; and vendors' providing safe food when delivered. Almost 25% of respondents reported reduced liability as a benefit of HACCP implementation.

Figure 31a

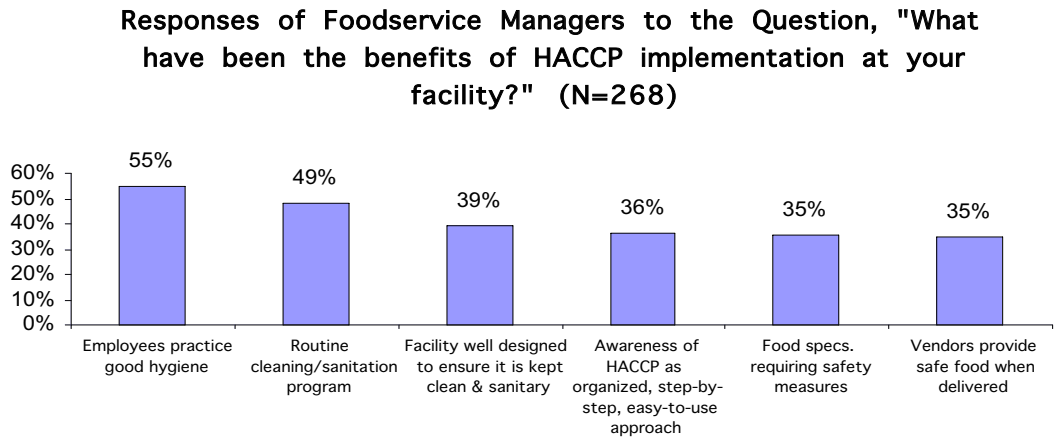
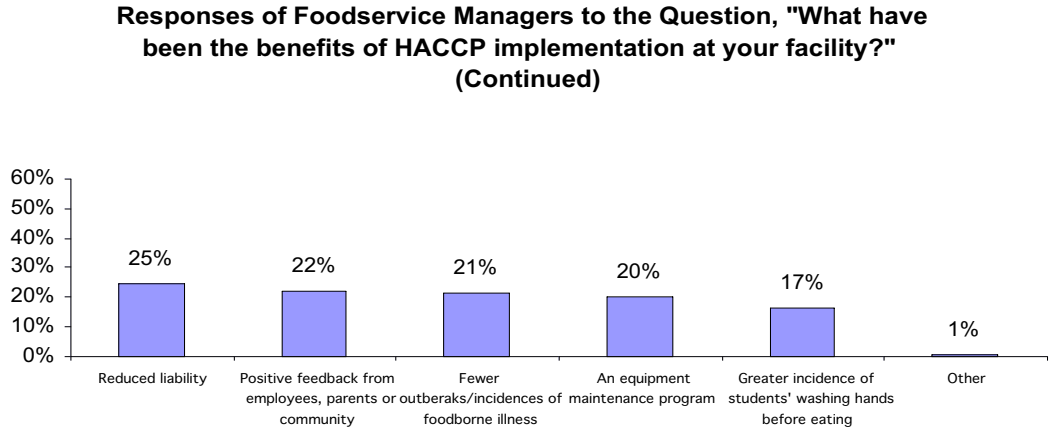


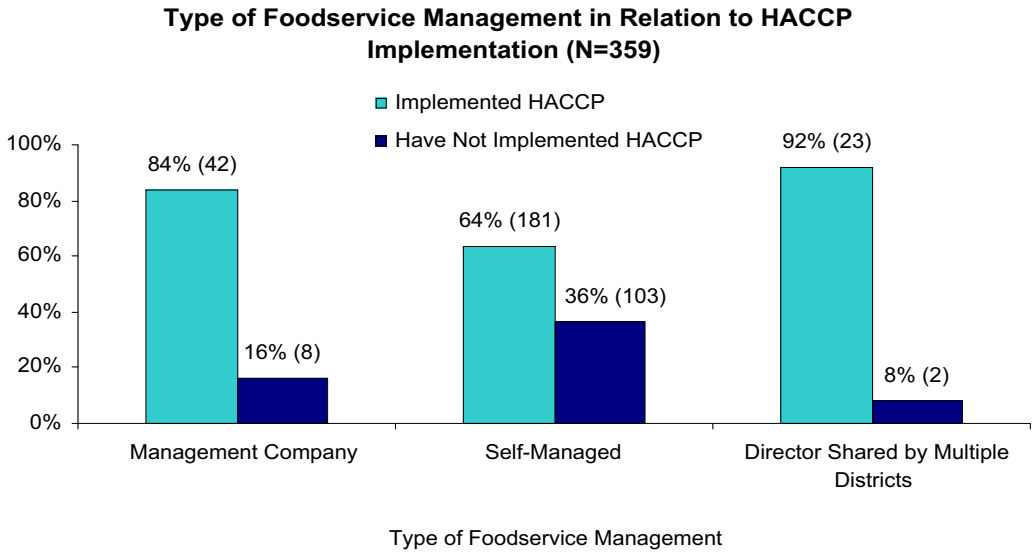
Figure 31b



Analysis of Results by Relationship with Demographic Variables

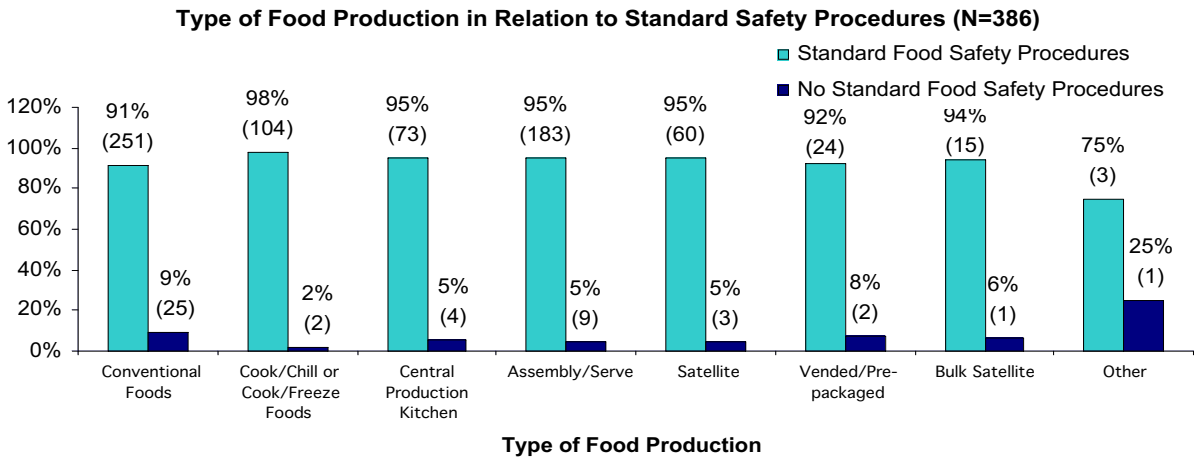
Figure 32 shows that although most schools surveyed were self-managed by the school district or used a foodservice management company, schools managed by a foodservice director shared by multiple districts had the highest rate of HACCP implementation (92%), followed by districts having a foodservice management company (84% HACCP implementation). The schools with the lowest HACCP implementation rates were self-managed by the school district (64%). The relationship between the type of foodservice management and HACCP implementation was significant at the .05 level (χ^2=14.95, *df*=2, *p*=.001).

Figure 32



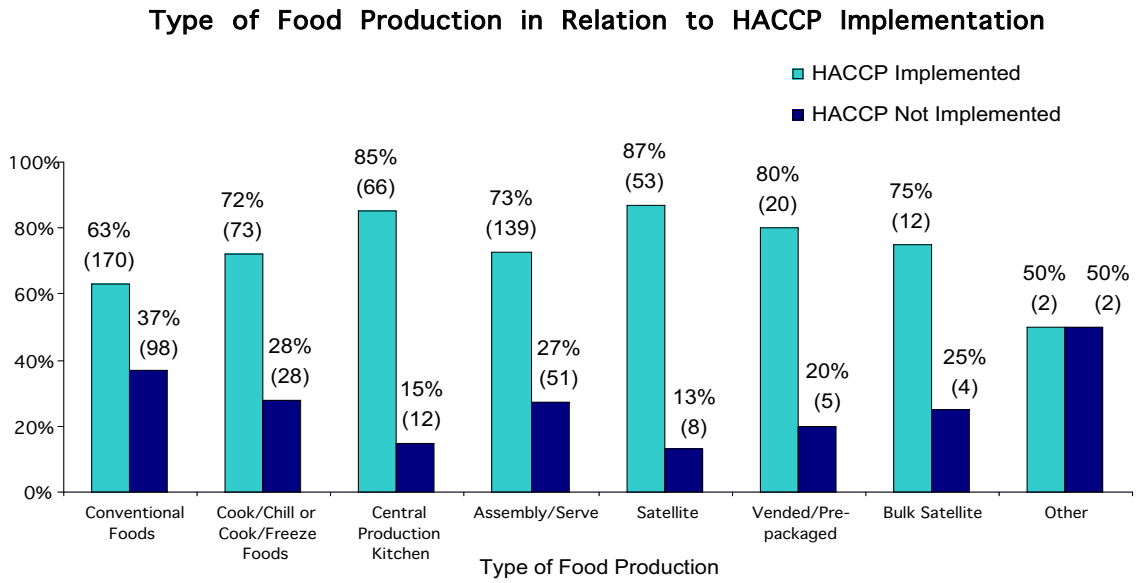
A majority of schools using all categories of food production reported that they had standard or formal food safety procedures to follow at their facility. (See Figure 33.)

Figure 33



Although a majority of schools using all categories of food production reported that they had implemented HACCP, significant differences were found in HACCP implementation rates among schools in the various categories of food production. Schools using conventional methods of food production had implemented HACCP at a rate that was significantly lower than the combined rate for schools using all other food production categories (χ^2=11.65, *df*=1, *p*=.001). However, schools using a satellite receiving kitchen had implemented HACCP at a rate that was significantly higher than the combined rate for schools using all other types of food production (χ^2=11.25, *df*=1, *p*=.001). Schools using commissary or central production kitchen methods of food production also had implemented HACCP at a rate that was significantly higher than the combined rate for schools using all other food production categories (χ^2=11.70, *df*=1, *p*=.001). (See Figure 34.)

Figure 34



With regard to barriers affecting HACCP implementation, the lack of resources (time and personnel) and the burden of required documentation were the most commonly reported barriers having a significant effect on HACCP implementation. (See Figure 35.)

A higher proportion of respondents from the Western region reported that lack of available training had a significant effect on HACCP implementation than did respondents from the other regions combined (χ^2=11.21, *df*=2, *p*=.004). A higher proportion of respondents from the Western region also reported that high employee turnover had a moderate or significant effect on HACCP implementation than did respondents from all other regions combined (χ^2=16.32, *df*=7, *p*=.022). In the Midwest region, a significantly higher proportion of respondents reported that the burden of required documentation procedures had a significant effect on HACCP implementation than did respondents from all other regions combined (χ^2=8.61, *df*=2, *p*=.014). In the Western region, a significantly higher proportion of respondents reported that the burden of required documentation procedures had no or minimal effect on HACCP implementation than did respondents from all other regions combined (χ^2 =8.69, *df*=2, *p*=.013). (See Figures 35-37.)

Figure 35

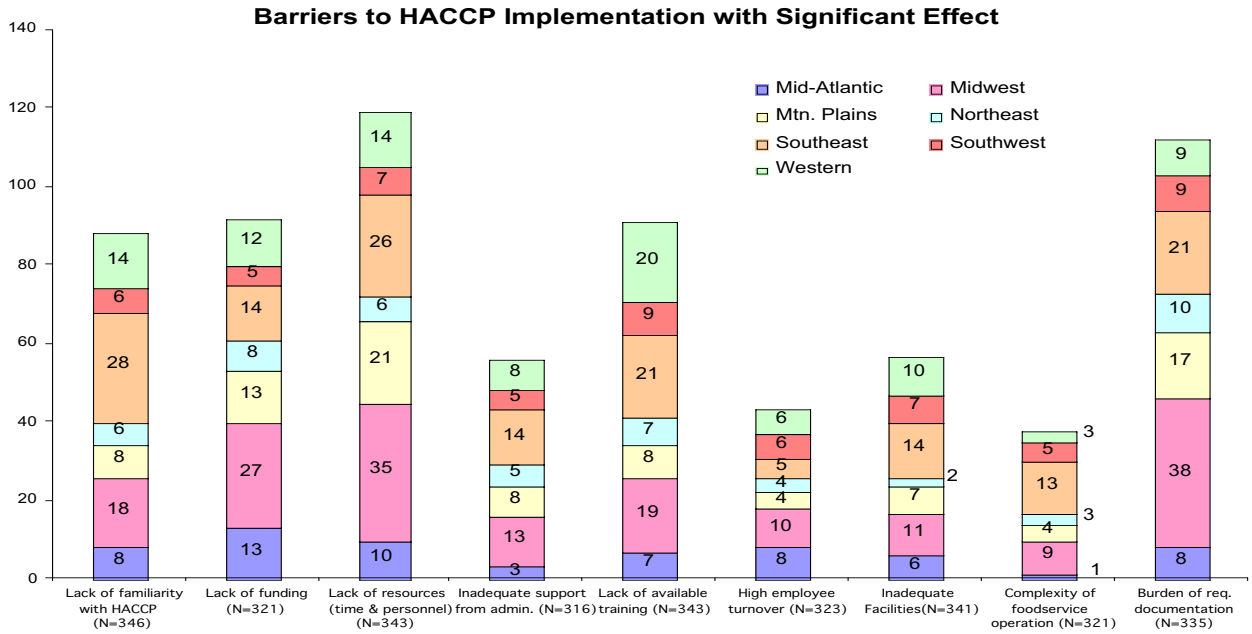


Figure 36

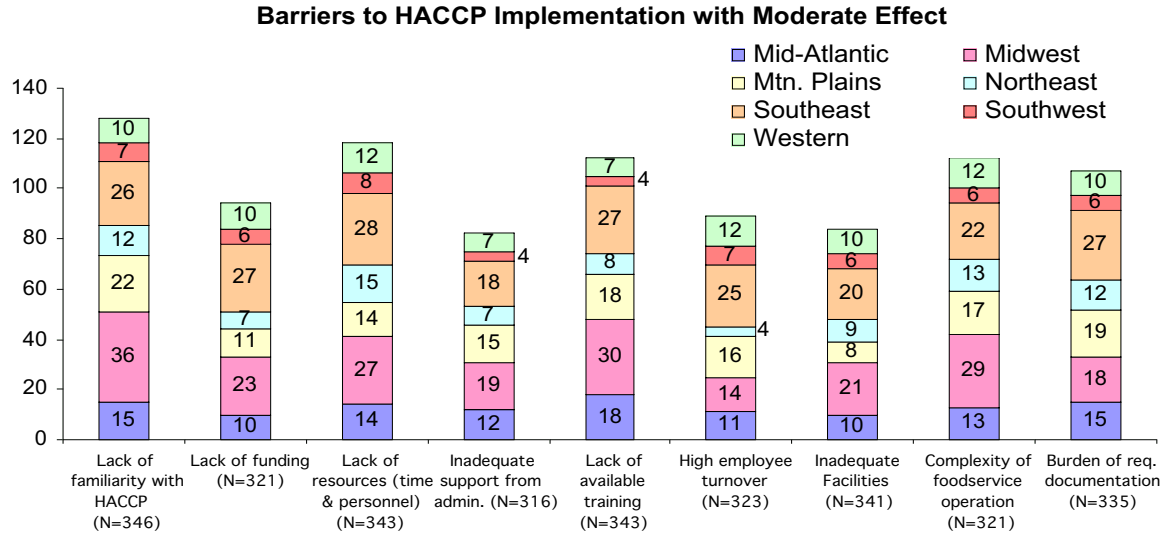
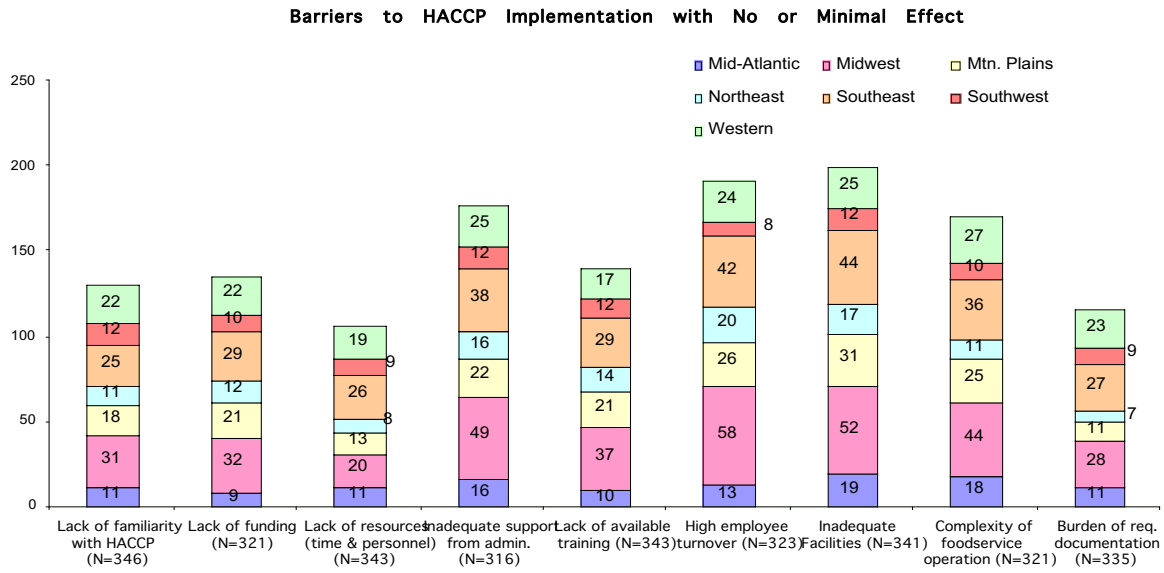


Figure 37



Conclusions

In conducting this study, researchers surveyed 2-3% of foodservice managers in each USDA region and obtained a response rate of approximately 18% overall. The Southeast region returned a significantly higher proportion of the surveys than did the other regions combined. The Southwest region returned a significantly lower proportion of the surveys than did the other regions combined.

Demographic Characteristics of Respondents

The largest number of respondents (47%) worked in elementary schools, followed by middle/junior high schools, then by high schools. More respondents (29%) worked in schools with 500-999 students than in schools of any other size. The highest number of respondents (38%) worked in small town schools. Almost equal percentages (19-20%) worked in urban, major city, or rural schools.

Almost all respondents served lunch, and 84% of the respondents served breakfast. Seventy-three percent of respondents served between 100 and 999 lunches per day. Only 6% served fewer than 100 lunches, and only 6% served more than 3,000 lunches per day.

With regard to food production, some facilities used more than one type. Most of the respondents (71%) worked in facilities that used conventional food production. Almost half (49%) worked in facilities that used assembly/serve type of food production. The overwhelming majority of responding schools (74%) were self-managed by the school district.

The highest proportion of responding managers (44%) had worked in school foodservice for 11-20 years. Twenty-one percent had worked in school foodservice for 5-10 years, and the same percentage for more than 20 years. Most respondents had served in their current position for 5-20 years; however, 31% had served less than five years, and only 8% had served more than 20 years. The highest percentage of respondents (47%) had completed high school. One-fourth had completed some college. A combined total of 24% had obtained a college degree (associate to doctorate). More than half the managers reported being ServSafe certified; 35% ASFSA

certified; 25% certified as a Food Handler; and 16% State Agency certified. Only 11% held no certification.

Overall Results

The overwhelming majority of respondents (90%) reported having standard or formal food safety procedures in their schools. More than half of the respondents (65%) reported that their schools had begun implementing HACCP. Within all regions there was a higher rate of HACCP implementation than lack of HACCP implementation. Rates of HACCP implementation ranged from 65% to 72% over all regions. There was no significant relationship between region and HACCP implementation.

A significantly lower percentage of respondents from rural communities reported implementing standard food safety procedures. Schools in major cities had a significantly higher percentage of HACCP implementation (91%) than schools in other types of communities. However, a higher percentage of respondents were located in small towns, and only 67% of these respondents had implemented HACCP.

Of the schools that did report implementing HACCP, 30% began the program more than three years ago, and 23% began the program between one and three years ago. Only 10% began the program less than one year ago. More than half (57%) of the schools that had not implemented HACCP did not plan to begin the program, while 43% do plan to begin implementing HACCP. However, the Child Nutrition and WIC Reauthorization Act of 2004 now mandates that, effective July 1, 2005, all districts will implement a food safety management program based on HACCP principles.

In almost half of the responding schools (48%), the decision for implementing HACCP is the responsibility of the district foodservice director, and in 27% of the responding schools the decision is the responsibility of the school foodservice manager. More than half of the responding schools (55.5%) reported that support from their foodservice director helped to promote HACCP implementation at their facility. Further, 41% of the responding schools reported that support from the school's foodservice workers helped to promote HACCP implementation.

The majority of the responding schools reported keeping the following types of records as part of their HACCP program: 1) refrigeration and freezer temperature logs and 2) record of temperature to which food is cooked. Almost 50% of the schools keep records of preparation procedures, including the internal food temperature throughout preparation, as well as records of the temperature at which food is held on the serving line or in a holding cabinet. Between 22% and 37% of the schools keep other types of records as part of their HACCP program.

The largest number of respondents (almost 50%) reported that their role in the HACCP program was to coach food service personnel on a daily basis. More than one-third reported that their role in the HACCP program was to monitor/complete HACCP paperwork, and more than 20% of respondents reported that their role was to coordinate HACCP implementation or training.

Most respondents who stated whether their school or district had a formal HACCP team reported that they did not (38%). Eleven percent of the respondents reported having a school HACCP team, and 13% reported having a district HACCP team. The most common members of the HACCP team were reported to be the district school foodservice director, the school foodservice manager, and the school foodservice workers.

With regard to the provision of HACCP training in the school, the highest percentage of respondents (23%) reported that district personnel provided training. Next in order were the local

Health Department staff, the American School Food Service Association, and the State Department of Education staff.

At least 50% of all schools surveyed reported that they are currently implementing the following HACCP practices:

Evaluate general preparation, cooking, chilling, and holding procedures.
Identify procedures for proper thawing of frozen foods.
Establish critical limits (standards that are observable and measurable and are usually specified by using temperature and time.)
Examine records and make sure that employees are entering actual, valid data.
Perform tests such as measuring the strength of the sanitizing solution using a sanitizer test strip.
Monitor potentially hazardous foods at every step in the foodservice process.
Identify procedures to prevent, reduce, and eliminate recontamination hazards at each critical control point.
Use the routine inspection by the State public health department to provide an assessment of whether the HACCP process is working.
Establish a record keeping system to document the HACCP process and monitor results (e.g., printed internal food temperature forms, storage temperature forms).
Establish the corrective action that will be taken if the Critical Control Point does not meet the Predetermined Critical Limits.
Include the corrective action that will be taken as a part of the HACCP plan for the foodservice organization.

Between 30% and 41% of respondents reported that corrective action had been taken in the areas of holding and serving food, cooking, recordkeeping and documentation, reheating, storing, cooling, preparing, equipment cleaning procedures, and employee hygiene. Security and purchasing were the areas least reported to have been targets of corrective action.

The largest number of respondents (46%) reported that their schools plan to implement practices to support all seven HACCP principles. Less than 10% of the respondents plan to expand HACCP to other sites or other programs.

Although most schools surveyed were self-managed by the school district or used a foodservice management company, the highest proportion of those implementing HACCP were managed by a foodservice director shared by multiple districts (92%), followed by districts having a foodservice management company (84%). The smallest percentage of schools implementing HACCP reported that they were self-managed by the school district (64%). The relationship between the type of foodservice management and HACCP implementation was significant at the .05 level.

A majority of schools using all categories of food production reported that they had implemented HACCP. However, significant differences were found in HACCP implementation rates among schools in the various categories of food production. Schools using conventional methods of food production had implemented HACCP at a significantly lower rate than had schools in all other food production categories. However, schools using a satellite receiving kitchen had implemented HACCP at a significantly higher rate than had schools using all other types of food production. Also, schools using commissary or central production kitchen methods of food production had implemented HACCP at a significantly higher rate than had schools in all other food production categories.

With regard to barriers affecting HACCP implementation, the lack of resources (time and personnel) and the burden of required documentation were the most commonly reported barriers having a significant effect on HACCP implementation. A higher proportion of respondents from the Western region reported that lack of available training had a significant effect on HACCP

implementation than did respondents from the other regions combined. A higher proportion of respondents from the Western region also reported that high employee turnover had a moderate or significant effect on HACCP implementation than did respondents from all other regions combined. In the Midwest region, a significantly higher proportion of respondents reported that the burden of required documentation procedures had a significant effect on HACCP implementation than did respondents from all other regions combined. In the Western region, a significantly higher proportion of respondents reported that the burden of required documentation procedures had no or minimal effect on HACCP implementation than did respondents from all other regions combined.

Regarding the benefits of HACCP implementation, the majority of respondents (55%) reported that employees practice good hygiene. Almost half the respondents (48.5%) reported that HACCP promoted a routine cleaning and sanitation program. Slightly more than one-third of the respondents stated that the benefits of HACCP implementation included a facility designed to ensure that it can be kept clean and sanitary; awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety; specifications that require food safety measures; and vendors' providing safe food when delivered. Almost 25% of respondents reported reduced liability as a benefit of HACCP implementation.

Discussion

One of the most important findings of this study was that more than half of the responding schools had begun implementing HACCP. This was a higher percentage than that reported by either Giampaoli et al. (2002a) or Hwang et al. (2001). In the study reported by Hwang et al. (2001), 26.7% of the responding schools in Indiana indicated they did not have a HACCP program said they planned to implement HACCP in the near future. Researchers found that 43% of the responding schools that did not implement HACCP were planning to begin implementation. Among the schools reporting that they were implementing HACCP, the largest percentage (84%) indicated that they had established procedures to verify that the HACCP system was functioning and working properly. However, only 38% of the schools implementing HACCP reported that they conduct a hazard analysis.

Another finding of the research study was that schools in major cities had a significantly higher percentage of HACCP implementation than other types of communities. This finding is consistent with the study by Hwang et al. (2001), which revealed that larger school districts were more likely to implement HACCP than were school districts with smaller foodservice operations.

With regard to food production, researchers found that most respondents (71%) worked in facilities that used conventional food production. Almost half (49%) worked in facilities that used the assembly/serve type of food production. The overwhelming majority of responding schools (74%) were self-managed by the school district. Although a majority of schools using all categories of food production reported that they had implemented HACCP, schools using conventional methods of food production had implemented HACCP at a significantly lower rate than had schools in all other food production categories. However, schools using a satellite receiving kitchen, as well as schools using commissary or central production kitchen methods, had implemented HACCP at a significantly higher rate. The finding of lower implementation of HACCP among schools using conventional methods of food production is consistent with the results of the study conducted by Youn and Sneed (2003), which reported significant differences for centralized versus conventional foodservice systems, with centralized systems achieving higher scores for measuring and recording safe food-handling practices.

Regarding HACCP records kept by schools, researchers found that the majority of responding schools reported keeping refrigeration and freezer temperature logs and records of the temperature to which food is cooked. This finding is important in light of the audit reported by Giampaoli et al. (2002b), which stated that in identifying areas of noncompliance with safe food-handling procedures, time and temperature abuse appeared to be the most problematic.

Henroid and Sneed (2004) also reported problems with improper thawing and cooling of foods.

With regard to barriers affecting HACCP implementation, researchers found that the lack of resources (time and personnel) and the burden of required documentation were the most commonly reported barriers having a significant effect on HACCP implementation. This finding is similar to that of Giampaoli et al. (2002a), who reported that primary barriers to HACCP implementation in the retail foodservice industry included lack of understanding of HACCP and lack of training, with most school foodservice directors also citing lack of funds and/or time as important concerns. Giampaoli et al. (2002a) also reported that employee motivation and confidence were areas needing attention in the implementation of HACCP. Further, Norton (2003) reported that although record keeping is the key component for managing and validating a HACCP program, many foodservice managers and workers are bogged down by the regulatory requirements and are displeased with all the paperwork.

With regard to the benefits of HACCP, researchers found that the majority of responding schools reported that employees' practice of good hygiene was a benefit of HACCP. Almost half the respondents reported that HACCP promoted a routine cleaning and sanitation program. Slightly more than one-third of the respondents stated that the benefits of HACCP implementation included a facility designed to ensure that it can be kept clean and sanitary; awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety; specifications that require food safety measures; and vendors' providing safe food when delivered. Almost 25% of respondents reported reduced liability as a benefit of HACCP implementation. Findings by Sneed and Henroid (2003) indicated that foodservice directors thought HACCP could save time and money and could improve food quality. These authors also cited additional reasons given by foodservice directors for implementing HACCP, including health department requirements, prevention of sickness in children, and having HACCP as insurance against liability.

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Appendix A
Cover Letter to Foodservice Directors

April 19, 2004

Dear Food Service Director:

The National Food Service Management Institute (NFSMI), in collaboration with the Center for Educational Research and Evaluation at The University of Mississippi, is conducting a survey of food service managers across the United States to determine the level of Hazard Analysis and Critical Control Points (HACCP) implementation in schools. The enclosed survey and cover letter will be sent to a food service manager in your district.

NFSMI has permission from the Food and Nutrition Subcommittee of the Education Information Advisory Committee, Council of Chief State School Officers to conduct this study.

The findings of this survey will provide information on the scope of food safety activities and will help NFSMI to determine what training services and materials may be beneficial to schools that want to implement HACCP as part of their food safety practices. Results of the survey will be compiled and reported by USDA region and will not be used to critique any individual school. The purpose of this survey is to find out what needs currently exist within the schools with regard to food safety implementation.

The University of Mississippi's Institutional Review Board (IRB) has reviewed this study. The IRB has determined that this study meets the ethical obligations required by Federal law and University policies. If you have any questions, concerns or reports regarding your rights as a research subject, please contact the IRB at (662) 915-7482.

We encourage the participation of all recipients of this survey. Thank you for your assistance.

Sincerely,

Charlotte Oakley, PhD, RD, FADA
Executive Director

Enclosures

Appendix B
Cover Letter to Foodservice Managers

April 19, 2004

Dear Food Service Manager:

The National Food Service Management Institute (NFSMI) is conducting a survey to determine the extent of Hazard Analysis and Critical Control Points (HACCP) implementation in schools. You have been selected to participate in this survey, which will help NFSMI determine what training services and materials would be helpful to you in your school. Please do not be afraid to answer truthfully. There are no right or wrong answers. Your school's name will not be used in any reports. The purpose of this survey is simply to find out what food safety training needs exist within the schools.

Dr. Kathleen Sullivan and Dr. Maxine Harper, from the Center for Educational Research and Evaluation, School of Education, The University of Mississippi, are conducting this survey for NFSMI. Ensley Howell, with NFSMI, is working with Drs. Sullivan and Harper in this research effort. If you have questions regarding the survey, please contact Mrs. Howell (800-321-3061), Dr. Harper (662-915-6729), or Dr. Sullivan (662-915-5017).

Please return the completed survey by **April 30, 2004**, by faxing to 800-321-3061, Attention Dr. Maxine Harper, or by mailing it in the enclosed self-addressed postage-paid envelope to Dr. Maxine Harper, School of Education, University, MS 38677.

This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by Federal law and University policies. If you have any questions, concerns or reports regarding your rights as a research subject, please contact the IRB at (662) 915-7482.

Your participation in this study is very important. Thank you for taking time out of your busy schedule to complete this survey.

Sincerely,

Charlotte Oakley, PhD, RD, FADA
Executive Director

Enclosures

Appendix C
HACCP Survey

SURVEY OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS
(HACCP) IMPLEMENTATION IN SCHOOLS
Completed by School Foodservice Managers

Part I. Instructions: Please respond to each item by checking the appropriate box.

1. Do you have standard or formal food safety procedures to follow in your school?

   ❑ Yes ❑ No

2. Have you begun implementing the food safety procedure known as HACCP in your school?
   ❑ Yes—*Please continue to Item 3*
   ❑ No

   If no, are you considering starting the HACCP program in your school?
   ❑ Yes—*Please skip to Part III, page 3* ❑ No—*Please skip to Part III, page 3*

3. How many employees:
   a. do you supervise? _____ b. have received formal training in HACCP? _____

4. Estimate the date when HACCP began to be implemented at your school.
   ❑ Less than six months ago
   ❑ Between six months and one year ago
   ❑ Between one and three years ago
   ❑ More than three years ago

5. Which of the following types of records are kept as part of the HACCP program at your school? (Check all that apply.)
   ❑ Safety records of suppliers
   ❑ Record of condition of food upon arrival from supplier
   ❑ Record of temperature while food is thawing
   ❑ Record of preparation procedures, including the internal food temperature throughout preparation
   ❑ Record of temperature to which food is cooked
   ❑ Record of length of cooking time
   ❑ Record of how long food is kept on a service line or in a holding cabinet
   ❑ Record of temperature at which food is held on serving line or in a holding cabinet
   ❑ Record of procedure for cooling leftovers
   ❑ Record of procedure for heating leftovers
   ❑ Refrigeration and freezer temperature logs
   ❑ Other (Please list)_____ _____

6. The decision for implementing HACCP in your school is the responsibility of:
   ❑ District foodservice director
   ❑ School foodservice manager
   ❑ School principal
   ❑ Insurance provider
   ❑ State health department
   ❑ Other (Please list) _____

7. What has helped to promote HACCP implementation at your facility? (Check all that apply.)
   ❑ Support from school board
   ❑ Support from school administrators (such as superintendent, principal)
   ❑ Support from foodservice director
   ❑ Support from parent-teacher organizations
   ❑ Support from my school's foodservice workers
   ❑ Mandate
   ❑ Funding (e.g., for training)
   ❑ Prior food borne illness outbreak in operation
   ❑ Publicity related to food borne illness
   ❑ Other (Please list)_____

8. What are your school's plans for continuing/expanding HACCP implementation?
   ❑ Implement practices to support all seven HACCP principles
   ❑ Expand HACCP to other sites (if responsible for more than one site)
   ❑ Expand HACCP to other programs
   ❑ Other (Please list)_____
   ❑ None

9. What is your role in the HACCP program in your school? (Check all that apply.)
   ❑ Monitor/complete HACCP paperwork
   ❑ Coordinate training
   ❑ Coordinate HACCP implementation
   ❑ Coach foodservice personnel on a daily basis
   ❑ Conduct formal training of foodservice personnel
   ❑ Conduct inservice/staff development
   ❑ Other (Please list)_____

10. Does your school or district have a formal HACCP team?
    - ❑ Yes: school HACCP team
    - ❑ Yes: district HACCP team
    - ❑ No

    If yes, who serves on it? (Check all that apply.)
    - ❑ District school foodservice director
    - ❑ School foodservice manager
    - ❑ School principal / assistant principal
    - ❑ School nurse
    - ❑ Teacher representative
    - ❑ Parent representative
    - ❑ Student representative
    - ❑ State or Local health department inspector
    - ❑ School foodservice worker
    - ❑ Other (Please list)_____

11. Who provides HACCP training for your school?
    - ❑ District personnel
    - ❑ State department of education staff
    - ❑ American School Food Service Association (ASFSA)
    - ❑ Cooperative extension service
    - ❑ University food science/nutrition departments
    - ❑ Local health department staff
    - ❑ Other (Please list)_____

12. Where has corrective action been taken in your facility? (Check all that apply.)
    - ❑ Purchasing
    - ❑ Employee hygiene
    - ❑ Receiving
    - ❑ Equipment cleaning procedures
    - ❑ Storing
    - ❑ Equipment maintenance
    - ❑ Preparing
    - ❑ Reheating
    - ❑ Cooking
    - ❑ Holding and serving
    - ❑ Cooling
    - ❑ Security
    - ❑ Record keeping/documentation
    - ❑ Other (Please list)_____ _____

13. What have been the benefits of HACCP implementation at your facility? (Check all that apply.)
    - ❑ Employees practice good hygiene
    - ❑ A facility that is well designed to ensure that it can be kept clean and sanitary
    - ❑ Vendors provide safe food when delivered
    - ❑ Food specifications that require food safety measures
    - ❑ A routine cleaning and sanitation program
    - ❑ Reduced liability
    - ❑ An equipment maintenance program
    - ❑ Fewer outbreaks/incidences of food-borne illness
    - ❑ Greater incidence of students' washing their hands before coming to the cafeteria
    - ❑ Positive feedback from employees, parents or community
    - ❑ Awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety
    - ❑ Other (Please list)_____ _____

Part II. Please rate the following HACCP practices, using the scale provided below:

1 = Is currently in place at your school
2 = Has been in place in the past but has been discontinued
3 = Has never been in place at your school

		1	2	3
1.	Track each food from purchasing, receiving, and storing through serving and reheating, and identify hazards at each step.	_	_	_
2.	Evaluate general preparation, cooking, chilling, and holding procedures.	_	_	_
3.	Develop a flowchart or list the steps involved in preparing each potentially hazardous food.	_	_	_
4.	Identify procedures for proper thawing of frozen foods.	_	_	_
5.	Identify procedures to prevent, reduce, and eliminate recontamination hazards at each critical control point.	_	_	_
6.	Establish critical limits (standards that are observable and measurable and are usually specified by using temperature and time).	_	_	_
7.	Specify exactly what should be done to meet each particular standard (Critical Limits).	_	_	_
8.	Monitor potentially hazardous foods at every step in the foodservice process.	_	_	_
9.	Compare what actually happens during the foodservice process with the standards that have been established (Critical Limits).	_	_	_
11.	Identify instances in which the Critical Control Point does not meet the predetermined Critical Limits.	_	_	_
10.	Establish the corrective action that will be taken if the Critical Control Point does not meet the predetermined Critical Limits.	_	_	_
12.	Include the corrective action as part of the HACCP plan for the foodservice organization.	_	_	_
13.	Document how often corrective actions are needed.	_	_	_
14.	Perform tests such as measuring the strength of the sanitizing solution using a sanitizer test strip.	_	_	_
15.	Examine records and make sure that employees are entering actual, valid data.	_	_	_
16.	Use the routine inspection by the State public health department to provide an assessment of whether the HACCP process is working.	_	_	_
17.	Establish a record keeping system to document the HACCP process and monitor results (e.g., printed internal food temperature forms, storage temperature forms).	_	_	_

Part III. Rate the following possible barriers to HACCP implementation in terms of their effect on your school's food safety program. Use the following scale:

1 – No or minimal effect
2 – Moderate effect
3 – Significant effect

Lack of familiarity with HACCP	_	_	_
Lack of funding			
Lack of resources including time and personnel	_	_	_
Inadequate support from administration	_	_	_
Lack of available training	_	_	_
High employee turnover	_	_	_
Inadequate facilities	_	_	_
Complexity of foodservice operation	_	_	_
Burden of required documentation procedures	_	_	_
Other (Please list)	_	_	_

18. Additional comments_____

_____

(Please use additional sheets if necessary.)

Part IV. In this section, please select the appropriate responses or provide the requested information.

1. What type(s) of school do you work in? (Check all that apply.)
   - ❑ Elementary
   - ❑ Elementary/Middle
   - ❑ Elementary/Middle/High
   - ❑ Middle/Junior High
   - ❑ Middle/High School
   - ❑ High School
   - ❑ Other (Please list)_____ _____

2. How many students are enrolled in the school(s) that you supervise?
   - ❑ Fewer than 100
   - ❑ 100-299
   - ❑ 300-499
   - ❑ 500-999
   - ❑ 1,000-3,000
   - ❑ More than 3,000

3. How many lunches are served daily?
   - ❑ Fewer than 100
   - ❑ 100-299
   - ❑ 300-499
   - ❑ 500-999
   - ❑ 1,000-3,000
   - ❑ More than 3,000

4. Which meals do you serve? (Check all that apply.)
   - ❑ Lunch
   - ❑ Breakfast
   - ❑ After school snacks
   - ❑ Summer food service program
   - ❑ Other (Please list) _____

5. What type of food production is used by your school(s)? (Check all that apply.)
   - ❑ Conventional (raw foods are purchased, prepared on site, and served soon after preparation)
   - ❑ Cook/Chill, or Cook/Freeze (Foods are Prepared on site, then chilled or frozen, and stored for reheating at a later time)
   - ❑ Commissary or Central Production Kitchen (A central production kitchen with centralized food purchasing and delivery to off-site facilities for final preparation)
   - ❑ Assembly/Serve (Fully prepared foods are purchased, stored, assembled, heated, and served)
   - ❑ Satellite receiving kitchen with minimal food production
   - ❑ Vended/Pre-packaged meals
   - ❑ Bulk satellite meals
   - ❑ Other (Please list)_____ _____

6. What type foodservice management is used in your operation?
   - ❑ Foodservice management company
   - ❑ Self-managed by school district
   - ❑ Foodservice director shared by multiple districts

7. How many years have you worked in school foodservice?
   - ❑ Less than 5
   - ❑ 5-10
   - ❑ 11-20
   - ❑ More than 20

8. How many years have you served in your current position?
   - ❑ Less than 5
   - ❑ 5-10
   - ❑ 11-20
   - ❑ More than 20

9. What is your highest level of education?
   - ❑ High school
   - ❑ Completed some college
   - ❑ Associate or two year degree
   - ❑ Bachelor's degree
   - ❑ Completed some graduate work
   - ❑ Master's degree
   - ❑ Doctorate degree

10. What certifications do you hold? (Check all that apply.)
    - ❑ Not certified
    - ❑ State Agency certified
    - ❑ ASFSA certified
    - ❑ ASFSA credentialed (SFNS)
    - ❑ Registered Dietitian
    - ❑ ServSafe certified
    - ❑ Food handler
    - ❑ Other food safety certification (Please list)_____

11. In what state do you work? _____

12. In what type of community is your school located?
    - ❑ Major city
    - ❑ Urban
    - ❑ Small town
    - ❑ Rural

Appendix D
HACCP Survey Results by Item

School Foodservice HACCP Implementation Survey

Responses by Item

1. Do you have standard or formal food safety procedures to follow in your school?

	Number	Percent
Yes	359	90.2%
No	32	8.0%
Missing	7	1.8%

2. Have you begun implementing the food safety procedure known as HACCP in your school?

	Number	Percent
Yes	259	65.1%
No	122	30.7%
Missing	17	4.3%

If no, are you considering starting the HACCP program in your school?

	Number	Percent
Yes	46	43.40%
No	60	56.60%

3. a. How many employees do you supervise?

	Number	Percent
1-10	188	47.2%
11-20	33	8.3%
21-100	33	8.3%
101-250	7	1.8%
Missing	137	34.4%

b. How many employees have received formal training in HACCP?

	Number	Percent
0	14	3.5%
1-10	117	29.4%
11-40	19	4.8%
41-160	6	1.5%
Missing	242	60.8%

4. Estimate the date when HACCP began to be implemented at your school?

	Number	Percent
Less than six months ago	10	2.5%
Between six months and one year ago	33	8.3%
Between one and three years ago	91	22.9%
More than three years ago	120	30.2%
Missing	144	36.2%

5. Which of the following types of records are kept as part of the HACCP program at your school?

	Number	Percent
Refrigeration and freezer temperature logs	242	60.8%
Record of temperature to which food is cooked	236	59.3%
Record of preparation procedures, including the internal food temperature throughout preparation	193	48.5%
Record of temperature at which food is held on serving line or in a holding cabinet	187	47.0%
Record of procedure for heating leftovers	132	33.2%
Record of condition of food upon arrival from supplier	122	30.7%
Record of procedure for cooling leftovers	120	30.2%
Record of temperature while food is thawing	118	29.6%
Record of how long food is kept on a service line or in a holding cabinet	112	28.1%
Record of length of cooking time	97	24.4%
Safety records of suppliers	89	22.4%
Other	23	5.8%

6. The decision for implementing HACCP in your school is the responsibility of:

	Number	Percent
District foodservice director	192	48.2%
School foodservice manager	106	26.6%
State Health Department	54	13.6%
School principal	5	1.3%
Insurance Provider	2	0.5%
Other	10	2.5%
Missing	29	7.3%

7. What has helped to promote HACCP implementation at your facility? (check all that apply.)

	Number	Percent
Support from foodservice director	221	55.5%
Support from my school's foodservice workers	164	41.2%
Mandate	60	15.1%
Support from school administrators	59	14.8%
Publicity related to foodborne illness	37	9.3%
Support from school board	36	9.0%
Funding	29	7.3%
Prior foodborne illness	11	2.8%
Support from parent-teacher organizations	9	2.3%
Other	22	5.5%

8. What are your school's plans for continuing/expanding HACCP implementation? (Check all that apply.)

	Number	Percent
Implement practices to support all seven HACCP principles	183	46.0%
Expand HACCP to other programs	35	8.8%
Expand HACCP to other sites	33	8.3%
Other	19	4.8%
None	19	4.8%

9. What is your role in the HACCP program in your school? (Check all that apply)

	Number	Percent
Coach foodservice personnel on a daily basis	196	49.2%
Monitor/complete HACCP paperwork	143	35.9%
Coordinate HACCP implementation	101	25.4%
Coordinate training	83	20.9%
Conduct formal training of foodservice personnel	80	20.1%
Conduct in-service/staff development	77	19.3%
Other	8	2.0%

10a. Does your school or district have a formal HACCP Team?

	Number	Percent
Yes, School HACCP Team	43	10.8%
Yes, District HACCP Team	50	12.6%
No	151	37.9%
Missing	154	38.7%

10b.Who serves on the HACCP Team? (check all that apply)

	Number	Percent
District school foodservice director	74	18.6%
School foodservice manager	58	14.6%
School food service worker	44	11.1%
State or Local health department inspector	25	6.3%
School nurse	5	1.3%
School principal/assistant principal	3	0.8%
Teacher representative	2	0.5%
Parent representative		
Student representative	1	0.3%
Other	6	1.5%

11. Who provides HACCP training for your school?

	Number	Percent
District personnel	92	23.1%
Local Health Department staff	78	19.6%
American School Food Service Association	57	14.3%
State department of education staff	51	12.8%
Cooperative extension service	17	4.3%
University food science/nutrition departments	16	4.0%
Other	37	9.3%

12. Where has corrective action been taken in your facility? (Check all that apply.)

	Number	Percent
Holding and serving	162	40.7%
Cooking	140	35.2%
Record keeping/documentation	134	33.7%
Reheating	130	32.7%
Storing	129	32.4%
Preparing	128	32.2%
Cooling	128	32.2%
Equipment cleaning procedures	127	31.9%
Employee hygiene	123	30.9%
Receiving	97	24.4%
Equipment maintenance	83	20.9%
Purchasing	56	14.1%
Security	33	8.3%
Other	8	2.0%

13. What have been the benefits of HACCP implementation at your facility? (Check all that apply)

	Number	Percent
Employees practice good hygiene	218	54.8%
A routine cleaning and sanitation program	193	48.5%
A facility that is well designed to ensure that it can be kept clean and sanitary	157	39.4%
Awareness of HACCP as an organized, step-by-step, easy-to-use approach to food safety	144	36.2%
Food specifications that require food safety measures	141	35.4%
Vendors provide safe food when delivered	139	34.9%
Reduced liability	99	24.9%
Positive feedback from employees, parents or community	87	21.9%
Fewer outbreaks/incidences of food-borne illness	85	21.4%
An equipment maintenance program	81	20.4%
Greater incidence of students' washing their hands before coming to the cafeteria	66	16.6%
Other	3	0.8%

Part II. Please rate the following HACCP practices, using the Scale provided below:

	Is currently in place at your school (Percent)	Has been in place in the past but has been discontinued (Percent)	Has never been in place at your school (Percent)	Missing (Percent)
1. Track each food from purchasing, receiving, and storing through serving and reheating, and identify hazards at each step.	44.0%	2.8%	16.3%	36.9%
2. Evaluate general preparation, cooking, chilling, and holding procedures.	61.1%	2.3%	1.5%	35.2%
3. Develop a flowchart or list the steps involved in preparing each potentially hazardous food.	29.4%	4.0%	24.6%	42.0%
4. Identify procedures for proper thawing of frozen foods.	60.1%	1.0%	3.3%	35.7%
5. Identify procedures to prevent, reduce, and eliminate recontamination hazards at each critical control point.	55.8%	1.3%	4.3%	38.7%
6. Establish critical limits (standards that are observable and measurable and are usually specified by using temperature and time.)	59.8%	1.5%	3.3%	35.4%
7. Specify exactly what should be done to meet each particular standard (Critical Limits).	46.5%	3.0%	9.5%	41.0%
8. Monitor potentially hazardous foods at every step in the foodservice process.	56.0%	1.5%	6.3%	36.2%
9. Compare what actually happens during the foodservice process with the standards that have been established (Critical Limits).	39.9%	4.0%	14.3%	41.7%

10. Identify instances in which the Critical Control Point does not meet the predetermined Critical Limits.	45.0%	2.5%	15.1%	37.4%
11. Establish the corrective action that will be taken if the Critical Control Point does not meet the Predetermined Critical Limits.	52.5%	2.5%	8.8%	36.2%
12. Include the corrective action that will be taken as a part of the HACCP plan for the foodservice organization.	50.3%	2.8%	9.8%	37.2%
13. Document how often corrective actions are needed.	33.7%	4.5%	19.6%	42.2%
14. Perform tests such as measuring the strength of the sanitizing solution using a sanitizer test strip.	57.8%	3.5%	4.0%	34.7%
15. Examine records and make sure that employees are entering actual, valid data.	48.7%	3.3%	8.0%	39.9%
16. Use the routine inspection by the State public health department to provide an assessment of whether the HACCP process is working.	58.5%	2.0%	4.3%	35.2%
17. Establish a record keeping system to document the HACCP process and monitor results (e.g., printed internal food temperature forms, storage temperature forms).	52.8%	2.0%	9.8%	35.4%

Part III. Rate the following possible barriers to HACCP implementation in terms of their effect on your school's food safety program. Use the following scale:

	Significant effect (Percent)	Moderate effect (Percent)	No or minimal effect (Percent)	Missing (Percent)
Lack of resources including time and personnel	30.7%	30.7%	27.6%	11.1%
Burden of required documentation procedures	28.4%	28.1%	30.7%	12.8%
Lack of funding	24.6%	23.6%	34.7%	17.1%
Lack of available training	23.1%	29.1%	36.7%	11.1%
Lack of familiarity with HACCP	22.1%	33.4%	34.2%	10.3%
Inadequate facilities	14.8%	22.1%	51.8%	11.3%
Inadequate support from administration	14.1%	21.9%	46.5%	17.6%
High employee turnover	10.8%	23.9%	49.0%	16.3%
Complexity of foodservice operation	9.5%	29.4%	44.2%	16.6%
Other	2.0%	1.5%	1.8%	94.7%

Part IV. Demographics

1. What type of school do you work in? (Check all that apply.)

	Number	Percent
Elementary	205	46.5%
Elementary/Middle	53	13.3%
Elementary/Middle High	67	16.8%
Middle/Junior High	82	20.6%
Middle/High School	30	7.5%
High School	80	20.1%
Other	26	6.5%

2. How many students are enrolled in the school(s) that you supervise?

	Number	Percent
Fewer than 100	16	4.0%
100 - 299	51	12.8%
300 - 499	94	23.6%
500 - 999	114	28.6%
1000 - 3000	78	19.6%
More than 3000	36	9.0%
Missing	9	2.3%

3. How many lunches are served daily?

	Number	Percent
Fewer than 100	23	5.8%
100 - 299	97	24.4%
300 - 499	95	23.9%
500 - 999	100	25.1%
1000 - 3000	47	11.8%
More than 3000	25	6.3%
Missing	11	2.8%

4. Which meals do you serve? (Check all that apply)

	Number	Percent
Lunch	385	96.7%
Breakfast	333	83.7%
After school snacks	110	27.6%
Summer food service program	79	19.8%
Other	7	1.8%

5. What type of food production is used by your school(s)? (Check all that apply.)

	Number	Percent
Conventional (raw foods are purchased, prepared on site, and served soon after preparation)	281	70.6%
Assembly/Serve (Fully prepared foods are purchased, stored, assembled, heated, and served)	196	49.2%
Cook/Chill, or Cook/Freeze (Foods are prepared on site, then chilled or frozen, and stored for reheating at a later time)	106	26.6%
Commissary or Central Production Kitchen (A central production kitchen with centralized food purchasing and delivery to off-site facilities for final preparation)	79	19.8%
Satellite receiving kitchen with minimal food production	64	16.1%
Vended/Pre-packaged meals	26	6.5%
Bulk satellite meals	17	4.3%
Other	4	1.0%

6. What type of food service management is used in your operation?

	Number	Percent
Self-managed by school district	294	73.9%
Food Service management company	52	13.1%
Food service director shared by multiple districts	28	7.0%
Missing	24	6.0%

7. How many years have you worked in school foodservice?

	Number	Percent
Less than 5	46	11.6%
5 - 10	85	21.4%
11 - 20	174	43.7%
More than 20	84	21.1%
Missing	9	2.3%

8. How many years have you served in your current position?

	Number	Percent
Less than 5	125	31.4%
5 - 10	141	35.4%
11 - 20	89	22.4%
More than 20	30	7.5%
Missing	13	3.3%

9. What is your highest level of education?

	Number	Percent
High school	186	46.7%
Completed some college	101	25.4%
Associate of two year degree	32	8.0%
Bachelor's degree	37	9.3%
Completed some graduate work	12	3.0%
Master's degree	13	3.3%
Doctorate degree	3	0.8%
Missing	11	2.8%

10. What certifications do you hold? (Check all that apply.)

	Number	Percent
ServSafe certified	210	52.8%
ASFSA certified	138	34.7%
Food Handler	100	25.1%
State Agency certified	65	16.3%
Other food safety certification	55	13.8%
Not certified	44	11.1%
ASFSA credentialed (SFNS)	16	4.0%
Registered Dietitian	7	1.8%

11. In what region do you work?

	Number	Percent
Mid-Atlantic	36	9.1%
Midwest	95	23.6%
Mountain Plains	55	13.8%
Northeast	31	7.8%
Southeast	89	22.4%
Southwest	29	7.3%
Western	49	12.3%
No Region	15	3.8%

12. In what type of community is your school located?

	Number	Percent
Small town	151	37.9%
Rural	80	20.1%
Major city	79	19.8%
Urban	75	18.8%
Missing	13	3.3%

Notes

Notes

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