

## AN ABSTRACT OF THE DISSERTATION OF

Joan Giampaoli for the degree of Doctor of Philosophy in Nutrition and Food Management presented on April 16, 2001. Title: Challenges and Procedures Relative to Food Safety in School Foodservice.

Abstract approval: \_\_\_\_\_

Mary M. Cluskey

The purpose of this two phased study was to determine the challenges to implementing food safety and hazard analysis and critical control point (HACCP) in school foodservice and the adherence to food safety procedures in 15 schools. In phase one, food safety and HACCP procedures were studied utilizing a focus group and a national mailing of a three part survey instrument to school foodservice directors. The instrument examined the challenges and attitudes of directors toward the use of HACCP programs and food safety practices in their operations. Phase two examined the food safety procedures used in school kitchens. The researcher and two trained observers audited 15 middle school kitchens using an audit form developed by the researcher. Practices audited included temperature monitoring, personal hygiene, cold storage procedures, cleanliness of facility and other observable food safety practices. The survey yielded a response rate of 58% and the challenge and attitude statements were tested for reliability and analyzed using factor

analysis and multiple regression. The responses indicated that the school foodservice directors did not perceive the same challenges to food safety as those revealed by the focus group participants. In general, the directors were positive about the use of HACCP programs and food safety practices. However, they did perceive the time and money necessary to maintain these programs to be a challenge. Results from the food safety audits revealed that food safety practices could be improved among the audited operations. Poor food safety practices were observed in the areas of hand washing, temperature monitoring, hair restraints, and sanitizing of equipment. This study suggests that school foodservice directors need to be committed to food safety programs if they are to be effective. Directors need to continually train and monitor employees and maintain a positive attitude about the necessity of food safety in order to assure safe food handling practices.

Challenges and Procedures Relative to Food Safety  
In School Foodservice

by  
JOAN GIAMPAOLI

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of  
the requirements for the  
degree of

Doctor of Philosophy

Presented April 16, 2001  
Commencement June, 2002

Doctor of Philosophy dissertation of Joan Giampaoli presented April 16, 2001.

APPROVED:

---

Major Professor, representing Nutrition and Food Management

---

Department Head of Nutrition and Food Management

---

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

---



Joan Giampaoli, Author

## ACKNOWLEDGEMENTS

A project of this undertaking is never done alone. It takes the support of many dedicated and caring people to bring it to fruition. Without the support and guidance of these people, this project would not have reached completion. Their belief in me saw me through to the end. I am completely indebted to you all.

I am thankful to my parents, Albert and Jacqueline Giampaoli for their love and extreme courage in life. Being both challenged with handicaps, they succeeded in life against great odds. They taught me that anything is possible with dedication and hard work. I hope I have made them proud and honor their memory. To my sister, Janice Giampaoli, I owe a large dose of gratitude. She spent many hours helping me with transferring questionnaire data to scantron forms and compiling the data. I never had to ask for her support or time, she gave it willingly. Thank you for your support. I also want to thank the "children", Duke, Molly, Emily, Samuel, Maxwell, and Penelope. They have helped me through many stressful moments and are enormous source of joy for me just by being around.

I wish to thank the person whom I first presented the idea for this project, Dr. Jeannie Sneed. She took a process that had become disheartening into one that was filled with joy and possibilities. Never once was she unsupportive or critical. She gently guided me in the dynamics of

research from which I have learned and grown. She made me feel that I actually could finish this dissertation while keeping myself intact. Without her, I know I would never have accomplished what I have and would have resigned long ago. She made me stretch my limits, and in doing so, made me a better person. I hope that I may be able to impart to my students the values she taught me. Thank you!

I am grateful to Dr. Mary Cluskey, major advisor, for supporting me throughout this project. I am truly fortunate to have found a major advisor who has taken so much interest in my research and academic dealings. She did much "leg work" for me at Oregon State University and I am indebted to her for all her efforts and advice. I am also thankful to Dr. Cluskey for becoming my major advisor on short notice. Without your support, finishing this degree would not have been possible. Thank you!

A big thank you to Dr. Warren Suzuki, committee member, for his dedication to me and the completion of this project. He listened to me for hours as a friend and as a mentor. He believed in me and in my ability to complete this project and his support was fundamental to its success. There was never a time when I called that he was too busy to be bothered. He always extended himself and is a mentor in the truest sense of the word. Thank you!

Thanks to Dr. Harold Koenig, committee member, for his advice and guidance in many, many areas of my research. You worked with me on

formulating questions for the focus group and on developing my questionnaire as well. He worked with me on statistical analysis for the questionnaire and interpreting the statistical data. Without a doubt, the statistical portion of my research could not have been accomplished without his extensive support. It was a rough road, but my understanding of statistics and research methodology is far better because of him. Thank you!

To Dr. Carolyn Raab, committee member, for her extreme kindness to me during my time at Oregon State University. I am appreciative of her comments on my research proposal and her assistance with the focus group. Thank you!

I am grateful Dr. Peter Cheeke, graduate representative, for his comments on my proposal as well as his support throughout this entire project. I could not have asked for a better graduate representative. Thank you!

A big thank you to the many Santa Clara County, CA school foodservice directors who supported this project. In particular, Tish Litchfield, Carole Napolitano, Amy Lins, Susan Brooks, Arlene Yamada, Sandy Queen, Pat Ellis, Zoe Anne Briscoe, Marty Marshall, Kathleen Corrigan, Kristen Keith, and Phyllis Thivierge. Their support was invaluable during all stages of this research project. I asked for their assistance again and again through this project and they gave it willingly. They were

encouraging to me during this project and truly believed in the importance of what I was researching. They are truly dedicated to school foodservice and I could not have worked with a better group of directors.

I am very thankful to Steve Acquino, statistician, for all his hours spent analyzing my data as well as developing my questionnaire into a scantron format. It was a joy working with him and I have learned much more about research working with him on this project. I am also very grateful to Michael Hampton, lithographer, for developing my questionnaire into a professional looking booklet format and creating the postcards for this research.

A big thank you to Donna Simons and Sophia Navarro, food safety auditors. Their assistance with conducting the food safety audits was invaluable. They gladly gave their time to audit the various schools and were an encouragement to me during this process. They were truly interested in food safety and school foodservice and their enthusiasm for the topic showed.

My gratitude to Vicky Everly, Santa Clara County Department of Health Services, for assisting me with interpreting CURFFL and providing me with the county food safety inspection form. Her support was instrumental in helping me develop the food safety audit form for my project.

The first phase of this project was funded by the School Foodservice Foundation of the American School Foodservice Association. I am grateful to them for their support of this research.

Many thanks to all the participants who took the time to fill out the surveys which provided me with invaluable data.

## TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
Statement of Purpose	3
Research Questions	3
Research Objectives	4
Significance of the Research	5
Limitations	5
Definition of Terms	7
REVIEW OF LITERATURE	10
The Incidence and Causes of Foodborne Illness	10
The Incidence of Foodborne Illness in the United States	10
The Incidence of Foodborne Illness in School Foodservice	13
Causes of Foodborne Illness	15
Food Safety Practices and Research in Foodservice	18
Food Safety Practices and Research in School Foodservice	23
Food Safety Knowledge and Attitudes Among School Foodservice Employees	23
Food Safety Practices Among School Foodservice Employees	25
Strategies to Ensure Food Safety in Foodservice	29

## TABLE OF CONTENTS (CONTINUED)

	<u>Page</u>
Training/Certification of Foodservice Employees	29
Hazard Analysis and Critical Control Point (HACCP) in the Foodservice Industry	33
<b>METHODOLOGY</b>	<b>38</b>
Research Design	38
Challenges to Implementing Food Safety and HACCP Procedures	38
Development of the Questionnaire	39
Data Collection	42
Statistical Analysis	44
Food Safety Practices	45
Recruitment	45
Development of the Food Safety Audit Form	46
Training of Observers	47
Conducting the Food Safety Audits	48
Statistical Analysis	49
<b>RESULTS</b>	<b>50</b>
Challenges to Implementing Food Safety and HACCP Procedures	50
Focus Group	50
Questionnaire	52

## TABLE OF CONTENTS (CONTINUED)

	<u>Page</u>
Food Safety Practices	78
Demographics of the Sample	79
Food Safety Audits	79
DISCUSSION, CONCLUSIONS, RECOMMENDATIONS	88
Summary	88
Challenges to Implementing Food Safety and HACCP Procedures	91
Focus Group	91
Challenges to Implementing Food Safety and HACCP Procedures in School Kitchens	93
Attitudes of School Foodservice Directors Toward Food Safety Programs in School Kitchens	94
Attitudes of School Foodservice Directors Toward Utilizing a HACCP Monitoring Program in School Kitchens	99
Relationship Between Challenges and Demographic Characteristics of Respondents	100
Relationship Between Attitudes and Demographic Characteristics of Respondents	104
Food Safety Practices	107
Food Handling Practices Employed in School Kitchens	107
Conclusions	115
Recommendations for Future Research	119

## TABLE OF CONTENTS (CONTINUED)

	<u>Page</u>
Recommendations for School Foodservice	120
BIBLIOGRAPHY	122
APPENDICES	128

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Critical challenges to food safety and HACCP	52
2. Demographic characteristics of the school foodservice directors	53
3. Characteristics of the school districts represented by respondents	54
4. Responses to statements on the challenges scale	60
5. Responses to statements on the attitude scale	63
6. Summary of the analysis of variance F-test for factors on the challenges scale	69
7. Significant regression coefficients for the challenges factors	70
8. Summary of the analysis of variance F-test for factors on the attitude scale	74
9. Significant regression coefficients for the significant attitude factors	75
10. Responses to the statement "I could improve food safety in my district if..."	76
11. Food safety practices in school kitchens observed in food safety audits	81

## LIST OF APPENDICES

	<u>Page</u>
APPENDIX A SAFE FOOD HANDLING PRACTICES FOR POTENTIALLY HAZARDOUS FOODS (adopted from Reed, 1993)	129
APPENDIX B OREGON STATE UNIVERSITY, INSTITUTIONAL REVIEW BOARD, LETTERS OF APPROVAL TO CONDUCT RESEARCH	133
APPENDIX C COVER LETTERS TO RESEARCH PARTICIPANTS	137
APPENDIX D QUESTIONS DEVELOPED TO GUIDE THE FOCUS GROUP DISCUSSION	142
APPENDIX E QUESTIONNAIRE	144
APPENDIX F FOOD SAFETY AUDIT FORM	152
APPENDIX G ADDITIONAL COMMENTS FROM THE OPEN-ENDED QUESTION ON THE QUESTIONNAIRE	156

## LIST OF APPENDIX TABLES

<u>Table</u>	<u>Page</u>
1. Rotated factor matrix <sup>1</sup> for the three factors on the challenges scale	161
2. Rotated factor matrix <sup>1</sup> for the five factors on the attitude scale	163

## DEDICATION

This manuscript is dedicated to God the Father, through whom all things are possible, and to my parents, Albert Victor Giampaoli, M.D. and Jacqueline Lois Giampaoli, R.N. with all my love.

# CHALLENGES AND PROCEDURES RELATIVE TO FOOD SAFETY IN SCHOOL FOODSERVICE

## CHAPTER ONE

### INTRODUCTION

Foodborne illness in the United States (U.S.) continues to be a national concern despite the production of a relatively safe and nourishing food supply (United States Department of Agriculture {USDA} Economic Research Service, 1999; Food and Drug Administration {FDA}, 1997). The Centers for Disease Control and Prevention (CDC) estimate that foodborne illness causes “approximately 76 million illnesses, 325,000 hospitalizations, and 5000 deaths each year in the United States. Known pathogens account for 14 million illnesses, 60,000 hospitalizations, and 1800 deaths. Unknown pathogens account for approximately 62 million illnesses, 265,000 hospitalizations, and 3200 deaths” (Mead, Slutsker, Dietz, McCaig, Bresee, Shapiro, Griffin, & Tauxe, 1999).

Certain segments of the population are more susceptible to foodborne illness than others. These individuals include infants and young children, pregnant women, the elderly, people taking medications, and people with depressed immune systems. Particular attention needs to be given to these populations to prevent the spread of foodborne illness since the consequences of an outbreak are more dramatic (Educational

Foundation of the National Restaurant Association, 1999; American Dietetic Association {ADA}, 1997; International Food and Information Council {IFIC}, 1999).

School foodservice professionals feed more than 33 million children daily through the National School Lunch Program (NSLP) and School Breakfast Program (SBP) (American School Foodservice Association {ASFSA}, 1999<sup>a</sup>). These professionals are partially responsible for the health and well being of these children through the meals they serve. The goal of school foodservice programs is to serve acceptable, safe, and nutritious meals. To achieve this goal, school foodservice personnel must take responsibility for the safety of the meals they serve to school children (Neill, 1980).

In general, school foodservice meals are nutritious and safe. In a study conducted by the United States General Accounting Office (GAO, 2000) 20 outbreaks of foodborne illness occurred in schools in 1997. However, only eight of the 20 outbreaks were associated with meals prepared on the school premise. The other 12 were related to foods brought from other sources. In 1998, nine outbreaks of foodborne illness were associated with school prepared meals. Two of the nine outbreaks were associated with USDA commodity foods (GAO, 2000).

While the food served in schools is generally safe, improvements in food safety procedures are indicated. Studies have shown violations in

time-temperature procedures and hand washing practices (deWit & Kampelmacher, 1984; Richards, Rittman, Gilbert, Opal, DeBuono, Neill, & Gemski, 1993; Brown, McKinley, Aryan, & Hotzler, 1982; Kim & Shanklin, 1999). Centralized kitchens seem to be of particular concern due to the increased chance of widespread foodborne illness outbreaks from this food production system (Richards et al., 1993; Brown et al., 1982).

### Statement of Purpose

The purposes of this research were twofold: 1) determine the challenges to implementing food safety and Hazard Analysis and Critical Control Point (HACCP) procedures in school kitchens; and 2) determine the food handling practices currently employed in school kitchens.

### Research Questions

The following research questions were addressed:

1. What are the challenges to implementing food safety and HACCP procedures as perceived by school foodservice directors?
2. What are the attitudes of school foodservice directors toward food safety programs in school kitchens?
3. What are the attitudes of school foodservice directors toward utilizing a HACCP program in school kitchens?

4. How prevalent is certification in food safety or HACCP training among school foodservice directors.
5. Are food safety in-services offered to school foodservice personnel?
6. Is there a relationship between the challenges to implementing food safety procedures as perceived by school foodservice directors and demographic characteristics?
7. Is there a relationship between attitudes toward food safety among school foodservice directors and demographic characteristics?
8. What are the food handling practices currently employed in school kitchens?

### Research Objectives

The objectives of this research were:

- conduct a focus group to identify the challenges to implementing food safety and HACCP programs in school kitchens as perceived by school foodservice directors from Silicon Valley in California (CA).
- Apply the focus group results to a national survey to identify the attitudes and challenges to implementing food safety and HACCP procedures in school kitchens as perceived by school foodservice directors.
- develop a food safety audit form for evaluating food safety procedures currently used in school kitchens.

- conduct food safety audits of school kitchens in Silicon Valley, CA to identify the food safety procedures currently used and to test the food safety audit form developed.

### Significance of the Research

Despite the excellent record school foodservice professionals have for serving safe meals to children, problems do exist relative to the food handling practices used by school foodservice employees. By identifying the challenges to implementing food safety and HACCP procedures, strategies can be developed to improve the safety of school meals served to children. Further, by identifying the food safety practices currently used in school kitchens, areas of deficiency can be determined and strategies developed to improve the food handling practices among employees. The food safety audit form developed to identify the food safety practices can be used to conduct food safety self-inspections in school kitchens. The results from this research can be used as the basis for developing food safety educational programs tailored to the needs in school foodservice.

### Limitations

There are several limitations in this descriptive study. In Phase I, the nationally mailed questionnaire, the accuracy of responses to the questionnaire may have been affected by the attitude of the school

foodservice director when completing the questionnaire. Further, the responses may not be accurate depending on the openness of the school foodservice directors' responses. Further, only one focus group was conducted to generate the list of challenges to implementing and maintaining food safety procedures in school kitchens. This may have limited the completeness and accuracy of the list of challenges generated due to the fact school foodservice directors from only one region of the country participated in the focus group.

In Phase II, the food safety audits, the use of a convenience sample to conduct the food safety audits in school kitchens is a limitation. Further, the small sample size selected from Silicon Valley does not allow these results to be generalized to the total population of school foodservice operations. Also, in conducting the food safety audit, employees may have changed their actual food safety practices due to the fact that observers were monitoring their behaviors. Finally, the researcher and two trained observers conducted the food safety audits. Therefore, subjectivity in auditing food safety practices may have occurred among observers.

## Definition of Terms

American School Foodservice Association – Recognized as the authority on school nutrition programs, the association is an advocate for child nutrition programs and professionals and strives to see that all children have access to healthful school meals and nutrition education (ASFSA, 1999<sup>a</sup>).

Base Kitchen – a kitchen where food is prepared on premise and served on premise as well transported to satellite kitchens for service

Central Bakery – a kitchen where baked items are prepared on-premise but transported to satellite kitchens for service

Central Kitchen – a kitchen where food is prepared on-premise but transported to satellite kitchens for service

Challenge – a task that requires special attention or commitment to complete

Contamination – the unintended presence of potentially harmful microorganisms in food

Critical Control Points – a point at which a loss of control may result in an unacceptable health risk (FDA Food Code, 1999)

Foodborne Illness – a disease that is carried or transmitted to humans by food containing harmful substances (Partnership for Food Safety Education, 1999)

Foodborne Outbreak – an incident in which two or more people experience the same illness after eating the same food (Educational Foundation of the National Restaurant Association, 1999)

Food Safety – freedom from microbiological contaminants in quantities that are sufficient to cause foodborne illness or harm to an individual.

Foodservice/Nutrition Directors or Managers - individuals administering the foodservice program at the county or school district level; hereby referred to as a school foodservice director (ASFSA, 1999<sup>b</sup>)

Hazard – a biological, chemical, or physical property that may cause an unacceptable consumer risk (FDA Food Code, 1999)

Hazard Analysis and Critical Control Point – a prevention-based food safety monitoring program (FDA, 1998)

National School Lunch Program – A federal entitlement program that provides cash reimbursement to schools that provide nutritious meals to children. These lunches provide children with up to one-third of their Recommended Dietary Allowance (RDA) of key nutrients each day (Ohio Hunger Task Force, 1999).

On-site Kitchen – a kitchen where food is prepared on premise and served on premise

Potentially Hazardous Foods – A food that is natural or synthetic and that requires temperature control because it is in a form capable of supporting:

- the rapid and progressive growth of infectious or toxigenic microorganisms;
- the growth and toxin production of *Clostridium botulinum*; or
- in raw shell eggs, the growth of *Salmonella enteritidis* (United States Department of Health and Human Services, 1999).

School Breakfast Program – A federal program that provides states with cash assistance for non-profit breakfast programs in schools and residential childcare institutions (USDA Food and Nutrition Service, 1999).

## CHAPTER TWO

### REVIEW OF LITERATURE

The goal of school foodservice programs is to serve acceptable, safe, and nutritious meals. To achieve his goal, foods must be handled appropriately to ensure maximum quality and safety, which is the responsibility of all school foodservice employees (Neill, 1980). There is little research related to food safety in school foodservice, thus, this study will address the challenges and practices relative to food safety.

This review of literature will focus on four main areas: incidence and causes of foodborne illness, food safety practices and research in foodservice, food safety practices and research in school foodservice, and strategies to ensure food safety.

#### The Incidence and Causes of Foodborne Illness

##### The Incidence of Foodborne Illness in the United States

In general, the United States is excellent in providing a safe and nourishing food supply to the public. However, millions of Americans each year are affected by foodborne illness caused by the food they consumed (USDA Economic Research Service, 1999; FDA, 1997). The CDC

estimates that foodborne disease causes “approximately 76 million illnesses, 325,000 hospitalizations, and 5000 deaths in the United States each year. Known pathogens account for 14 million illnesses, 60,000 hospitalizations, and 1800 deaths. Three pathogens, *Salmonella*, *Listeria*, and *Toxoplasma*, are responsible for 1500 deaths each year, more than 75% of those caused by known pathogens, while unknown agents account for the remaining 62 million illnesses, 265,000 hospitalizations, and 3200 deaths” (Mead et al., 1999).

Many foodborne illness outbreaks are caused by pathogens that have not yet been identified. Many of the pathogens that are of concern today were not recognized several years ago (Mead et al., 1999). Further, an unknown proportion of foodborne illness caused by microorganisms is not recognized as such and, therefore, goes unreported (ADA, 1997). These factors complicate the surveillance of foodborne illness and impact the accuracy of reporting.

While there is concern about chemicals and other substances in food, microbiological contamination of food is the primary cause of foodborne illness (Snyder & Poland, 1990). Biological contamination presents the highest risks to the largest number of people (Reed, 1993). In a study conducted by the U.S. General Accounting Office (GAO) in which nine federal agencies were surveyed, the largest cluster of concerns by the federal agencies were foodborne microorganisms and pathogens (Wolf,

1992). Microbiological contamination of foods can include viruses, bacteria, and parasites and symptoms can range from gastrointestinal problems to renal and hepatic complications to death (Snyder & Poland, 1990; Mead et al., 1999).

Certain segments of the population are more susceptible to foodborne illness than others. Individuals at increased risk include infants and young children, pregnant women, elderly people, people taking certain medications, and people with compromised immune systems. Children are at increased risk because of immature immune systems. The elderly are at increased risk because their immune system may diminish with age (Educational Foundation of the National Restaurant Association, 1999; ADA, 1997; International Food and Information Council {IFIC}, 1999). Ensuring consumption of safe foods is particularly important for these segments of the population.

On January 25, 1997, President Clinton announced his food safety initiative in which he directed government agencies to identify ways to further improve the safety of the food supply (USDA, Department of Health and Human Services {DHHS}, Environmental Protection Agency {EPA}, & Department of Commerce, 1999). The report from these agencies was entitled *Food Safety from Farm to Table: A National Food Safety Initiative* and was presented to the President in May, 1997. The goal of this initiative was to reduce the incidence of foodborne illness as much as possible. In

August, 1998, the President's Council on Food Safety was established.

The Council will develop a strategic plan in which it will consult with interested parties to discuss short and long-term issues including emerging threats to food safety, and consider the special needs of susceptible populations such as children and the elderly (USDA, DHHS, EPA, & Department of Commerce, 1999).

The CDC stated that despite progress made in improving food safety, foodborne illness remains one of the most common causes of illness and death in the United States (Wolf, 1992). According to Alysworth (1988) the issue of food safety is not something that will disappear anytime soon.

#### The Incidence of Foodborne Illness in School Foodservice

The American School Foodservice Association (ASFSA) is the advocate for child nutrition programs. The association strives to ensure that children are served nutritious and safe meals under the school lunch and breakfast programs through the following:

- ASFSA's "Keys to Excellence" provides guidelines to develop standards of excellence for school foodservice programs. These guidelines provide standards of practice for the safe handling of food including food safety certification requirements for school foodservice employees.
- Most school districts conduct routine food safety self-inspections of their foodservice operation.

- Most school districts implement HACCP as their food safety control system (ASFSA, 1999<sup>o</sup>).

According to the United States General Accounting Office (GAO, 2000), 20 outbreaks of foodborne illness in schools were reported to the CDC in 1997. However, the health departments from the states in which these reports were recorded stated that only 8 of the 20 outbreaks were associated with foods served in the school programs. The other 12 were related to foods consumed at the schools but brought from another source. In 1998, nine outbreaks of foodborne illness were associated with school prepared meals. Two of the nine outbreaks were associated with USDA commodity ground beef and potato rounds (GAO, 2000).

School foodservice operations have a strong record of providing safe food to the children they serve. However, all school foodservice employees must continually be watchful of food safety because foodborne illness outbreaks do occur in schools (Roefs, 2000).

An increase in the number of retiring school foodservice directors may be a potential problem for school foodservice. Approximately "43% of school nutrition managers and school foodservice directors nationwide have between 11 and 20 years of foodservice experience. An additional 30% have over 20 years of experience." Further, of the nations' 50 state child nutrition directors, over half expected to see a shortage of qualified school foodservice directors by the year 2000. An average of 31 new school

foodservice directors will be needed in each state as early as next year. Given these demographics, the next group of managers and directors may have to climb the career ladder much faster than their predecessors (Lipowski, 1999). To complicate the situation, qualified potential school foodservice directors are often not interested in filling these positions. The expanding roles and responsibilities of school foodservice directors as well as tighter budgets and government regulations may deter prospective school foodservice directors from pursuing a management career in school foodservice. Also, many of the best employees are comfortable in the positions they currently hold and are not interested in further responsibilities. Also, graduates in foodservice management largely go into hotel and restaurant management (Lipowski, 1999). The shortage of qualified school foodservice directors in the future poses a challenge to maintaining the quality and efficiency of school nutrition programs.

### Causes of Foodborne Illness

The Educational Foundation of the National Restaurant Association (1999) places the greatest causes of foodborne illness into three categories: "time-temperature abuse, cross-contamination, and personal hygiene." Time-temperature abuse occurs when food has been allowed to stand for an extended period of time at temperatures favorable to bacterial growth. Cross-contamination occurs when bacteria is transferred from one

source to another that was previously uncontaminated, particularly food or food contact surfaces. Persons who exhibit poor personal hygiene such as failing to wash their hands after using the restroom, coughing, and sneezing are a potential source of contamination to food (Educational Foundation of the National Restaurant Association, 1999).

Data collected to determine the cause of foodborne illness outbreaks in foodservice establishments in the United States from 1973-1982 found that certain practices contributed to these outbreaks. The most contributory factors included “improper cooling (56%), lapse of 12 hours or more between preparation and eating (31%), infected persons handling food (24%), inadequate re-heating (20%), improper hot holding (16%), contaminated raw foods/ingredients (9%), foods from unsafe sources (6%), improper cleaning of equipment and utensils (6%), cross-contamination from raw to cooked foods (5%), and inadequate cooking (4%)” (Bryan, 1990; Neumann, 1998).

From 1983-1987, approximately two-thirds of the foodborne illness outbreaks reported to the CDC involved foodservice operations and were caused by poor food handling practices. Poor food handling practices cited include “improper holding temperatures, poor personal hygiene, inadequate cooking, contaminated equipment, and food obtained from an unsafe source” (ADA, 1997).

Further, a report by the CDC in which surveillance of foodborne illness outbreaks was conducted in the United States (1988-1992) found that bacterial contamination was the leading cause of these confirmed outbreaks. The main reasons for these outbreaks were “improper holding temperatures, poor personal hygiene, improper cooking temperatures, foods from unsafe sources, and contaminated equipment” (FDA, 1998).

Certain categories of foods present the greatest risks to foodborne illness because they promote the rapid growth of microorganisms (Bryan, 1990). These foods are termed potentially hazardous foods (PHF's) and include foods with a  $a_w$  above 0.85, high protein foods, and foods with a pH above 4.6 (FDA Food Code, 1999). According to the FDA Food Code (1999) potentially hazardous foods include “foods that consists in whole, or in part, of the following:

- milk or milk products,
- shell eggs,
- meats, poultry, and fish,
- shellfish and edible crustacea,
- baked or boiled potatoes,
- tofu or other soy-protein foods,
- garlic-and-oil mixtures,
- plant foods that have been heat treated,
- raw seeds and sprouts,

- sliced melons,
- synthetic ingredients ( such as soy protein in hamburger supplements).

Ready to eat foods also pose a potential hazard because they are intended to be eaten without re-heating or preparation” (Reed, 1993).

### Food Safety Practices and Research in Foodservice

In a study conducted by Holdt (1992) 27 university foodservice managers participated in a six-day certification program. The intent of the study was to determine the effectiveness of the certification program for improving food safety knowledge and assessing the manager’s attitudes towards food safety. Prior to the implementation of the certification exam, pre and post-tests were distributed to assess food safety knowledge. Effectiveness of the certification program was measured using a three-part questionnaire. Part one measured the attitudes of managers towards food safety. The second part of the questionnaire asked managers to rate eight job functions in order of importance. Part three related to the demographics of the managers.

Overall, managers rated food safety as an important job function and believed learning about food safety was worthwhile. Managers felt more familiar with food safety principles after training than before. The number of years in the foodservice position correlated positively with attitudes towards food safety. Managers with eleven years or more of foodservice experience

demonstrated a more positive attitude towards food safety compared to managers with less experience. An increase in food safety knowledge was demonstrated in the post-test and certification exam scores. Managers who finished their formal education at high school had significantly lower food safety knowledge scores post-test than did those with more education. No differences were found in the certification exam scores as related to education (Holdt, 1992).

In a study conducted by Custer (1989) 40 non-commercial foodservice directors were surveyed regarding their opinion as to their primary sanitation concerns. These concerns were maintenance of the foodservice facility (38%), time and temperature control (38%), pest control (26%), and food handling practices (17%).

One hundred hawkers (street food vendors) in Malaysia were interviewed to determine the impact of culture and environment on knowledge and attitudes about food safety and foodborne illness (Toh & Birchenough, 2000). Hawkers were chosen based on their willingness to participate and interviewed at their business. The results showed that hawkers with higher education had increased knowledge and attitude scores. Further, as education level increased, the attitude score increased. Hawkers in more developed sites demonstrated a better knowledge of HACCP than those situated by the roadside. Pearson bivariate correlation

demonstrated a strong relationship between knowledge and attitude scores ( $r=0.00$ ,  $p<0.01$ ) (Toh & Birchenough, 2000).

Cochran-Yantis, Belo, Giampaoli, McProud, Everly, & Gans (1996) studied the attitudes and knowledge of 300 foodservice operators of restaurants with favorable and unfavorable records of health inspections in Santa Clara, CA. The sample of restaurants for this study was selected randomly using health department criteria for determining favorable and unfavorable health code records. To classify restaurants as having favorable or unfavorable health code records, the three most critical violations attributed to a foodborne illness investigation were first identified. These violations included food storage, hand washing, and equipment condition. Restaurants with favorable health code records were identified as “those having an environmental health code status of excellent or good, less than seven total violations, no more than one minor violation and no major violations within the three established critical violations.” Restaurants with unfavorable health code records were identified as “those having a fair or poor status with the Department of Environmental Health and the Consumer Protection Division, at least two out of the three established critical violations, and no limit to the total number of violations.”

According to this study, 69% of the restaurants with unfavorable health code records reported providing food handler training to employees as opposed to 72% of the restaurants with favorable records. Upon

performing a student's *t*-test comparison, a higher level of knowledge and an increased positive attitude towards food safety were revealed among restaurants with favorable health code records (Cochran-Yantis et al., 1996).

In a survey conducted by Sawyer (1991) among convenience store employees, food safety practices related to fresh prepared take-out foods were investigated (Sawyer, 1991). Sawyer found that neither food items or delivery vehicles temperatures were taken by employees. Foods items were left unrefrigerated from 15 minutes to 2 hours until an employee found the time put them in refrigerated storage. Food thermometers were not available in any of the stores. Several violations in cross-contamination were observed such as adding fresh products to old products and using a wiping cloth for multiple purposes. Employees were observed preparing food without previously washing their hands. Items necessary for hand washing were absent in many of the convenience stores.

Hand washing is the single most important means for controlling foodborne illness. Many types of bacteria are transmitted from contaminated hands (Emery, 1990). It is estimated that unclean hands are the cause of approximately one-quarter of all foodborne illnesses (Lydecker, 1993). However, knowledge of the relationship between hand washing and foodborne illness has not shown a positive increase in hand washing practices. Supervision and the ease of using hand washing

facilities seems to have the greatest impact on hand washing compliance (Emery, 1990).

A study by deWit and Kampelmacher (1984) found that 60% of foodservice employees did not wash their hands after using the toilet. Another study conducted by Ecolab (1996) in which hand washing practices of employees at a managed care facility and two foodservice facilities were monitored found that the employees at the managed care facility had the best hand washing compliance. It was suggested that the increased compliance was due to the emphasis placed on hand washing by management as well as the training provided for employees. Further, the study found that monitoring hand washing practices increased compliance among foodservice employees.

Although hand washing is a simple task, motivating foodservice employees to properly wash their hands is challenging for several reasons. "Good personal hygiene is not learned at an early age, most hand washing is not adequately performed, and hands are easily re-contaminated." Some steps to help motivate foodservice employees to correctly wash their hands are to "teach them the how and why of hand washing, identify situations where hand washing is necessary, make hand washing easy, and monitor their hand washing practices" (Lydecker, 1993).

## Food Safety Practices and Research in School Foodservice

### Food Safety Knowledge and Attitudes Among School Foodservice Employees

The National School Lunch Program and the School Breakfast Program provides approximately 33 million meals daily to America's children (ASFSA, 1999<sup>a</sup>). School foodservice professionals are partially responsible for the well being of these children through the foods they serve, making food safety training and education an important component of the school foodservice program. The knowledge and attitudes of foodservice employees towards food safety is critical to a successful food safety program. According to Howes, McEwen, Griffith, & Harris (1996) attitudes, knowledge, and monitoring are important factors for decreasing foodborne illness outbreaks in foodservice. A positive behavior and attitude as well as training in food safety are important for maintaining safe food handling practices (Howes et al., 1996).

Green and Frame (1998) conducted a food safety study among nine elementary, middle and, high schools. The study was designed to determine existing food safety knowledge and behaviors of foodservice employees in pre and post-training sessions. The training curriculum was a 15-hour workshop adapted from the Educational Foundation of the National Restaurant Associations' *ServSafe* program. Upon completion of the training, there were improvements observed in hand washing before and

after eating, but a decline in hand washing after using the bathroom and before starting work. There also were improvements observed in product handling such as washing fruits and vegetables before processing and labeling and dating stored foods. Further, work surfaces were cleaned more frequently and dishwashing procedures improved. A decrease in compliance was demonstrated in the use of serving line temperature logs. The three critical areas where knowledge and compliance were not correlated were hand washing procedures, proper thawing procedures, and the use of thermometers. An increase in food safety knowledge did not lead to a positive change in behavior according to this study (Green & Frame, 1998).

Sneed and White (1993) conducted a study among school foodservice managers and directors/supervisors to determine their perceptions of continuing education needs of managers. A national mailing was distributed to 1200 managers and 1200 directors/supervisors. Managers and directors/supervisors rated health and safety laws, inspection, and enforcement as high continuing education needs. Perceived needs for continuing education were positively correlated with education level as well as years of foodservice experience and school foodservice experience.

In general, school foodservice employees demonstrate a positive attitude towards learning about food safety as well as a desire to receive

further knowledge in this area. However, research has shown that these factors do not always result in increased food safety compliance.

### Food Safety Practices Among School Foodservice Employees

The potential for a foodborne illness outbreak is possible in any school foodservice system. In May of 1990 in Rhode Island, a staphylococcal outbreak occurred in an elementary centralized school foodservice system. Of the 600 lunches served, 100 children reported becoming ill after consuming the school lunch. The cause of the outbreak was a foodservice employee who was infected with *S. aureus*. The employee had "removed the casings from two of nine warm ham rolls 48 hours prior to service. Because of improper refrigeration, prolonged handling, and inadequate re-heating, the ham was held at temperatures estimated at 50-120 degrees F for a minimum of 15 hours" (Richards et al., 1993).

In another study, data were collected in 10 school foodservices that prepared food in a central kitchen and transported meals to satellite kitchens. The conditions and practices that might affect the safety of the food were observed. Hand washing facilities were available in the food production areas in most of the kitchens. However, poor hand washing practices were observed among most of the employees. Picking up food

with hands to eat was observed as well as eating and drinking during food preparation (Brown et al., 1982).

Food safety abuses related to time-temperature procedures also were observed. Five entrees in four of the school systems were held over one hour between preparation and the start of transportation. The transportation time for three entrees in two large foodservice systems exceeded one hour. In seven school systems, some of the entrees were held more than one hour between the end of transportation and the start of service. Two entrees, "macaroni and cheese and charbroiled beef, were held for 4.29 and 3.85 hours respectively from end of production to end of service." However, the holding temperatures for these entrees were 140 degrees F or above. Nine of the 20 entrees showed internal temperatures between 40-140 degrees F during hot holding (Brown et al., 1982).

In a study by Connors, Bednar, Imhran, & Czajka-Narins (1999) a HACCP inspection was conducted to determine milk handling practices in 32 elementary schools in Texas. The results indicated that the milk temperatures were generally within the recommended 32 to 41 degree F range. However, inspection of individual kitchens found milk temperatures that were above 41 degrees F. Milk was ordered from an approved source for all schools. Many of the schools did not inspect the milk received or record temperatures upon delivery (Connors et al., 1999).

Gilmore, Brown, & Dana (1998) conducted a study in which data collection forms for measuring food quality were developed. Four schools with enrollments ranging from 862 to 40,265 students provided the data. Sanitation practices were evaluated in each kitchen where food was prepared. They found that hair was not fully restrained and hand washing was infrequently observed. However, when hand washing was performed it was done thoroughly. Hand washing and changing of gloves was evident in 50% of the observations. Frozen foods were thawed properly and foods were handled with utensils, clean hands, or gloves. Sanitizing of surfaces, small equipment, utensils, and thermometers tended to be performed consistently or not at all. Work surfaces were cleaned between uses and surfaces of small equipment appeared clean (Gilmore et al., 1998).

In a study by Ali and Spencer (1996) hazard analyses were conducted in six food preparation sites and 16 school canteens in the State of Bahrain. Hazards were primarily associated with the “preparation of foods too far in advance of service, bare handling of food items, and holding food items at room temperature for extended periods of time. Re-heating of foods was not observed” (Ali & Spencer, 1996).

Raccach, Morrison, & Farrier (1985) conducted an analysis of public health hazards in a centralized school foodservice operation. “Food handling, personnel, equipment, storage, preparation, holding,

distribution, serving, cleaning, and sanitation were observed.” The researchers found that foods were stored at appropriate cold storage conditions and were rotated on a “first in first out” basis. Stored foods also were covered to protect them from overhead contamination. However, employees did a large amount of handling during food preparation. Employees used bare hands to prepare foods and only two employees were observed using gloves. Further, hair restraints were not used by employees. Cooking equipment was scraped from food items and hand cleaned, but not sanitized. During service, students picked up uncovered silverware from trays and sneeze guards were not used (Raccach et al., 1985).

Kim and Shanklin (1999) conducted a study in three Midwestern elementary schools which were converting their food production system from centralized conventional to a centralized cook-chill system. Time and temperature histories were taken for three days for the two food production systems for spaghetti with meat sauce. They found that for both systems food items were re-heated several hours before service and held in a steam table or hot cart until service due to time and equipment constraints. The average temperatures for the spaghetti with meat sauce served for lunch ranged from 118F to 143F.

## Strategies to Ensure Food Safety in Foodservice

The Educational Foundation of the National Restaurant Association (1999) lists four key areas of food handling practices to ensure food safety. These four areas are: “controlling time and temperature, practicing good personal hygiene, preventing cross-contamination, and purchasing from approved suppliers.” A more comprehensive list of safe food handling practices is included in Appendix A. Further, training of foodservice employees in food safety and the application of HACCP principles can further ensure safe food handling practices are followed.

### Training/Certification of Foodservice Employees

The FDA and the Educational Testing Service (ETS) began offering a food safety certification examination in 1985 for foodservice managers. There are several reasons why the certification process was established. The incidence of foodborne illness outbreaks in foodservice establishments had been increasing and the efficiency of restaurant food safety inspections was being questioned. Further, the rapid growth of the foodservice industry did not show an increase in surveillance measures conducted by regulatory health agencies due to budget cuts. A more effective method to control food safety was needed (Speer & Kane, 1990). The certification process was established to upgrade management’s knowledge of food safety and emphasized the need for training of foodservice employees in food safety.

Specific topics in the certification courses included “basic principles of food safety and sanitation, personal hygiene, facilities construction, regulatory codes and inspection reports, motivating employees, and others” (Kneller & Bierma, 1990; Metts & Rodman, 1993). Certification training courses are intended to provide information necessary to train employees in food safety and implement a food safety system. The goal of certification is to establish minimum standards of food safety practice. Certification can also provide foodservice operations with the “reasonable care” defense in the event of a lawsuit (American Food Safety Institute {AFSI}, 2000).

Food manger certification is mandated in many states including California, Connecticut, District of Columbia, Delaware, Florida, Idaho, Illinois, Louisiana, Minnesota, North Dakota, Pennsylvania, Utah, and Wisconsin and also may be required by local county or city authorities. The requirements for certification may vary slightly among different authorities, but most require some type of formal training and the passage of a nationally recognized exam to become certified. Many authorities require a certified food manager on site to renew the foodservice establishments' license. Re-certification is required every three to five years (AFSI, 2000).

In California (CA), steps have been taken to improve the food safety within foodservice establishments. Assembly Bill (AB) 1978, which became effective January 1, 2000, mandates that “every food establishment, catering truck, and commissary that handles unpackaged food must have

an owner or employee who has been certified and is knowledgeable in food safety. New technologies, scientific advances, and emerging pathogens make recertification necessary every three years" (CA State Department of Education, Nutrition Services Division {CDOE-NSD}, 1999). The minimum level of knowledge as established by the FDA Food Code has been incorporated into the California Uniform Retail Food Facilities Law (CURFFL) as a standard for California food safety requirements. Certification is granted upon passage of a nationally recognized exam (CDOE-NSD, 1999).

However, certification is not a guarantee that safe food handling techniques will be followed. Speer and Kane (1990) conducted a study to determine the opinions of state food protection directors in 51 states toward certification. Many believed certification was not effective in improving food safety practices. While over 73% did think certification improved food safety practices in their state, many believed otherwise. The directors who responded negatively stated that many training programs had been tried in their state with little success. It was further stated that managers did not appear to be motivated to put food safety practices into effect, and certification would not change these practices. Although they felt the managers had basic food safety knowledge, they did not follow through. Motivation is the problem, and unless foodservice employees want to

practice safe food handling techniques, the current situation will show no improvement (Speer & Kane, 1990).

According to this study, barriers to certification were time and money due to tight budgets and the perceived burden of certification programs. Also, the ruralness of a state was a barrier to certification. The ability to coordinate a statewide program in these states would be difficult due to sparse populations and distances between towns.

Penninger and Rodman (1984) found certification of managers improved food safety conditions in 20 foodservice facilities surveyed. Nine had voluntary certification programs in which 28.6% of managers were certified. Eleven had mandatory certification programs in which 83.6% of managers were certified. "Ninety-one percent of the directors from the mandatory programs stated that inspection scores improved with certification of managers, as opposed to only 33.3% of directors from voluntary programs who stated this."

Failure to monitor or follow standard procedures in food safety is a principal cause of foodborne illness today. However, a shortage of qualified foodservice personnel throughout the nation makes this task even harder. The increasingly complex task of preventing foodborne illness often is encumbered upon employees who are younger than in years past, less experienced, and less motivated (Zuckerman, 1988). Regardless,

foodservice managers and employees are responsible for ensuring that safe food handling practices are followed in their facilities (ADA, 1997).

The evidence linking the training of foodservice personnel in food safety to improved sanitation scores and food safety compliance is tenuous. Through educating foodservice employees about food safety, at least a common framework of food safety protocol will be established. Training and certification, along with other food safety activities, have the potential for improving foodservice operation sanitation (Metts & Rodman, 1993). According to Custer (1989) the steps to improving food safety, such as training programs, may initially cost money but the benefits should outweigh the costs.

#### Hazard Analysis and Critical Control Point (HACCP) in the Foodservice Industry

HACCP is a management system developed to identify and monitor foodborne hazards that can affect the safety of food. The identification of hazards serves as a basis for establishing critical control points (CCP's). CCP's are those points in the process that must be controlled to assure the safety of food. CCP's include areas such as receiving, storage, preparation, and others. Further, critical limits are established that document the appropriate parameters that must be met for each CCP. Monitoring and verifying the system also are included as part of HACCP to ensure potential risks are controlled (FDA, 1999; FDA, 1998; FDA, USDA,

& National Advisory Committee on Microbiological Criteria for Foods {NACMCF}, 1997).

### Background

HACCP was developed by Pillsbury in the 1960's in conjunction with the National Aeronautic and Space Administration (NASA), Natick Laboratories of the U.S. Army, and the U.S. Air Force Space Laboratory Project Group. HACCP was used to develop foods for the space program that were virtually 100% contamination free and safe for astronauts' consumption. HACCP uses a preventative approach to food safety as opposed to a reactive approach, which was a common practice in the past, and has widespread applications for the foodservice industry (FDA, 1999).

### Prerequisite Programs

To be successful, HACCP must be based on sound prerequisite programs that provide the framework for an effective HACCP program (FDA, 1998; FDA, USDA, & NACMCF, 1997). Prerequisite programs detail the basic operating conditions that are essential for the safe production of food. Common prerequisite programs may include operating conditions for "facilities, supplier control, specifications, product equipment, cleaning and sanitation, personal hygiene, training, chemical control, receiving, storage, and shipping, traceability and recall, and pest control" (Educational

Foundation of the National Restaurant Association, 1999; FDA, USDA, & NACMCF, 1997; FDA, 1998).

### Developing a HACCP Program

The development of a HACCP program will vary from each facility and is product and process specific. Generic HACCP programs may be used as a guideline for facilities to establish control measures, but the unique needs of each facility must be considered in the development of an effective HACCP program (FDA, USDA, & NACMCF, 1997).

In the initial development of a HACCP program, five preliminary steps need to be taken before the actual HACCP principles are applied. The five steps include “assembling a HACCP team, describing the food and its distribution, describing the intended use and the consumers of the food, developing a flow diagram that describes the process, and verifying the flow diagram.”

After these five preliminary steps have been taken, the seven principles of HACCP can be applied. “These seven principles are:

- perform a hazard analysis,
- identify critical control points (CCP's),
- establish critical control limits for each CCP,
- establish monitoring procedures for the CCP's,
- establish corrective action,

- establish verification procedures, and
- establish record-keeping and documentation procedures”

(Educational Foundation of the National Restaurant Association, 1999; FDA, USDA, & NACMCF, 1997; FDA, 1998).

Although the food supply today is probably safer than it has ever been, there is still a need to implement a HACCP program. The food supply has become more global and we now import more foods into the United States today than ever before. These foods come from countries where the sanitation practices may be less stringent. Also, new and emerging pathogens are continually being identified. These pathogens were not recognized several years ago and present new challenges to food safety. Finally, a HACCP program provides documentation of the operation's sanitation practices (King, 1992).

### Education and Training

The success of a HACCP program is dependent on educating and training managers and employees on the importance of their role in maintaining food safety (King, 1992). An understanding of the HACCP plan and the prerequisite programs must be established to make HACCP effective. HACCP is applicable to all segments of the foodservice industry. To be successful, management must be committed to the implementation of HACCP. A commitment to HACCP by management

demonstrates the importance of food safety among employees.

Management in all segments of the foodservice industry must make concerted efforts to ensure the safety of the food they serve. HACCP principles, prerequisite programs, and the education and training of employees and managers can be effective in developing a successful food safety system.

Unfortunately, HACCP consultants frequently encounter foodservice personnel who do not understand what HACCP is or how to apply it to their foodservice situation. King (1992) believes this is because the spread of HACCP information from the foodservice industry has been slow. Further, misconceptions about HACCP continue to exist. Many foodservice personnel believe HACCP is equivalent to a Total Quality Management (TQM) program; if they have a TQM program they are practicing HACCP. The other misconception is that HACCP applies to only certain types of foodservice operations such as large or central kitchens. However, HACCP is applicable to any foodservice operation where there is a risk of a foodborne illness outbreak (King, 1992).

## CHAPTER THREE

### METHODOLOGY

#### Research Design

The design of this research was exploratory and descriptive in nature and intended to collect baseline data. This research was conducted in two phases. The first phase was an attempt to investigate the challenges to implementing food safety and HACCP procedures in school kitchens as perceived by school foodservice directors. The second phase was an attempt to investigate the food safety procedures currently used in school kitchens. The protocol for the conduct of this research was approved by the Institutional Review Board (IRB) for the Protection of Human Subjects at Oregon State University (Appendix B).

#### Challenges to Implementing Food Safety and HACCP Procedures

In Phase I, a focus group was conducted to identify challenges to implementing food safety and HACCP procedures in school kitchens. The responses served as the basis for developing a three-part questionnaire for data collection.

## Development of the Questionnaire

### Focus Group

Letters of invitation communicating the purpose of the focus group and the importance of their participation (Appendix C) were mailed to 12 school foodservice directors in Silicon Valley, CA who were members of the Northern California School Foodservice Association (NCSFSA). The purpose of the focus group was to develop a list of challenges to implementing food safety and HACCP procedures in school kitchens as perceived by school foodservice directors. Two weeks after the initial mailing, non-respondents were contacted by telephone to request their participation in the focus group. School foodservice directors who agreed to participate in the focus group were sent a thank you note. A set of questions was developed to guide the focus group discussion method of questions (Krueger, 1994 and Krueger, 1998) (Appendix D). During the two-hour focus group session, participants identified challenges to implementing food safety and HACCP procedures. Ideas were recorded on note pads as well as tape recorded and later transcribed for accuracy of information.

To ensure completeness and accuracy of the list of challenges, a national mailing was conducted using a random sample of 15 school foodservice directors. The sample was obtained from Market Data

Retrieval's list of school foodservice directors. The school foodservice directors were asked to evaluate the list of challenges in terms of clarity and completeness. Changes were made to the list of challenges based on participant feedback. This list was then used to develop the challenges section of the written questionnaire.

### Written Questionnaire

A three-part written questionnaire was developed following the focus group (Appendix E). Section one of the questionnaire investigated the attitudes of school foodservice directors towards food safety certification and HACCP programs. Section one was developed by reviewing the literature of the advantages and disadvantages to implementing food safety and HACCP programs in foodservices. Statements relating to these advantages and disadvantages were included. School foodservice directors were asked to respond to the statements using a five-point rating scale (1, strongly agree to 5, strongly disagree).

Section two of the questionnaire investigated the challenges to implementing food safety and HACCP procedures in school kitchens as perceived by school foodservice directors. This section utilized the list of challenges generated by the focus group. A five-point rating scale (1, never a problem to 5, always a problem) was used for respondents to rate the level of impact of each challenge.

Section three of the questionnaire gathered demographic data about the school district and the school foodservice director. These data provided a description of the sample and were used to test relationships among variables.

### Validity of the Questionnaire

To establish content validity, the questionnaire was pilot tested by 10 school foodservice directors. The random sample was chosen from school foodservice directors who were members of the Northern California School Foodservice Association and worked in Silicon Valley. The questionnaire and a cover letter explaining the purpose of the study were mailed to the school foodservice directors. They were asked to evaluate the questionnaire using a critique form. The questionnaire was evaluated for clarity, appropriateness of content, ease of completion, and appropriateness of questionnaire length. Feedback from the pilot test was used to make revisions to the questionnaire. School foodservice directors who participated in the pilot test were not included in the study.

### Factor Analysis and Reliability of the Questionnaire

A principal axis factor analysis with varimax rotation was performed to determine dimensionality among items on the challenges scale as well as the attitude scale of the questionnaire. Four of the 11 statements on the

attitude scale were stated in the negative and reversed scored. Items for each factor were examined to determine what the items had in common and each factor was named.

Upon completion of the factor analysis, a Cronbach's alpha was calculated to estimate internal consistency for each factor identified on the challenges scale as well as the attitude scale of the questionnaire. An item to total Cronbach's alpha was performed to identify how well each item fit into the total scale and verify that there were no items that would increase the alpha if they were deleted. Once the items for the scale were established, each participants score was calculated by adding responses to each item.

### Data Collection

#### Sample

A random sample of school foodservice directors was selected for the research. A membership list that provided mailing information for school foodservice directors was obtained from Market Data Retrieval, a company that maintains national databases used for marketing purposes. The total database for school foodservice directors nationally was 7012. Eight hundred school foodservice directors were selected for the study sample using simple random sampling. According to Salant and Dillman

(1994) a total of 357 usable questionnaires were needed to make estimates of the population with a sampling error of no more than 5% at the 95% confidence level using a “50/50” split. Assuming a 50% response rate, it was determined that the sample size would be 800. A total of 461 out of 800 questionnaires mailed were returned for a response rate of 58%.

### Questionnaire Distribution

A basic procedure outlined for mail surveys by Salant and Dillman (1994) was used for the research. The steps for mailing the questionnaires were as follows:

- Step 1: An advance-notice letter was sent to participants informing them that they had been selected for the study and would be receiving a questionnaire in approximately one week. The letter briefly explained the purpose of the survey and the importance of their participation.
- Step 2: Approximately one week after the first mailing, a second mailing was sent that included a personalized cover letter (Appendix C) explaining in greater detail the purpose of the survey and the importance of their participation, the questionnaire, and a business reply return envelope. An educational incentive was included to increase the response rate. Each questionnaire was coded with a three-digit code. This allowed for ease of tracking

participants who responded and those who needed additional follow-up. Respondents were assured of complete confidentiality of responses.

Step 3. Approximately one week after the questionnaire was mailed, a follow-up postcard was sent to all participants. The postcard thanked those who had responded and requested responses from those who had not completed the questionnaire.

Step 4. Three weeks after the second mailing, another cover letter, questionnaire, and business reply return envelope were sent to participants who had not responded. The cover letter indicated that their questionnaire had not been received and reiterated the importance of their response to the success of the study.

### Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 9. Frequency distributions, percentages, means, and standard deviations were calculated for the ratings scale for attitudes and challenges to food safety and HACCP implementation. For demographic data, frequency of responses and percentages were calculated. Multiple regression analysis using forward stepwise regression was used to estimate relationships among attitudes, challenges, and the demographic variables. Missing data were addressed by listwise deletion

of cases. A 95% confidence interval was selected for generalizing data findings.

### Food Safety Practices

In Phase II, practices related to food safety procedures were observed in 15 school kitchens in Silicon Valley in California. Data were collected using a food safety audit form developed for this study.

### Recruitment

School foodservice directors from Silicon Valley in CA comprised the population for this phase of the study. To be included in the audit, the school foodservice directors had to be members of Northern California School Foodservice Association (NCSFSA), participated in the NSLP, and work in Silicon Valley. A letter was sent to seven randomly selected school foodservice directors. The letter explained the purpose of the audit and the importance of their participation to its success as well as requesting their participation (Appendix C). The directors were asked to reply either by fax or mail. One week after the initial mailing, school foodservice directors who responded received a follow-up thank you and the directors who had not responded were contacted by telephone to request their participation in the audit. The five school foodservice directors who agreed to participate in the audit were asked to supply the researcher with a list of on-site kitchens.

Three on-site kitchens from each school district were randomly selected for audits totaling a convenience sample of 15 schools.

### Development of the Food Safety Audit Form

A food safety audit form for monitoring school kitchen food safety procedures was developed (Appendix F). The audit criteria were based on the Santa Clara County, Department of Environmental Health Services inspection form, the California Uniform Retail Food Facilities Law (CURFFL, 2000), and the literature (Bryan, 1990; Neumann, 1998; United States Department of Health and Human Services, 1999; & Reed, 1993 ). The following categories were evaluated:

- temperature taking practices,
- storage practices,
- hot and cold food preparation and service,
- cleaning and sanitation procedures, and
- personal practices such as hygiene and hand-washing.

Each of these major categories were divided into subcategories that detailed safe food handling practices. For example, with the category of temperature monitoring, areas for audit included observation of the presence of a thermometer in the school kitchens and use of the thermometer.

The food safety audit form was developed using a checklist format for ease of evaluation and to increase inter-rater reliability. To evaluate the performance of safe food handling practices employed by the school kitchens, **three** levels of performance were used. **Yes** meant the procedure was observed being performed correctly 100% of the time by all employees during the audit. **No** meant the procedure was observed being performed incorrectly or not consistently during the audit. **Not applied** meant the procedure was not applied or not observed during the audit.

The food safety audit form was evaluated for content validity by six school foodservice directors from Silicon Valley, CA. The school foodservice directors were asked to evaluate the form for clarity, appropriateness of content, and wording using a critique form and to provide feedback on the audit form as well. Revisions were made to the food safety audit form based on reviewer feedback.

### Training of Observers

To conduct the food safety audits in the school kitchens, the researcher trained two observers in safe food handling practices and audit procedures during a two-hour workshop. Persons selected for observer training had an educational background in nutrition and/or foodservice management. For each of the major food safety categories described in the food safety audit form, the researcher detailed the appropriate food

handling techniques and standards for potentially hazardous foods as described in CURFFL. A list of potentially hazardous foods also was used in the training session. These standards provided the framework for evaluating if safe food handling practices were observed in school kitchens.

The researcher described the procedure for filling out the food safety audit form. The terms yes, no, and not applied were defined for the observers. During the training session, the researcher provided hypothetical examples of food safety situations that may occur in the school kitchens. The observers were asked to evaluate these situations using the food safety audit form and determine if they warranted a yes, no, or a not applied score.

Prior to conducting the audits, the food safety audit form was pilot tested in two school kitchens. All three observers conducted food safety audits in the same school kitchens at the same time to verify inter-rater reliability. If the observations did not demonstrate 85% consistency among observers, the food safety audit form was evaluated and revisions made as needed or additional observer training was conducted.

### Conducting the Food Safety Audits

The researcher and the two trained observers conducted the food safety audits using the audit form developed. Each observer evaluated five school kitchens. Observations took place during the lunch meal preparation

and service periods for approximately two hours per observation. The food handling practices in the school kitchens were observed and noted on the food safety audit form.

To ensure confidentiality, all food safety audit forms were coded with a two-digit code. School foodservice directors who participated in the audit were assured complete confidentiality.

In addition to completing the food safety audit, demographic data were gathered from the school foodservice managers in order to describe the sample. Questions asked included years in current position, years of school foodservice experience, and number of meals served. A summary of findings was distributed to all school foodservice directors who participated in the audit.

### Statistical Analysis

Descriptive statistics were used to analyze the data for Phase II. The food safety audit data were analyzed using frequencies of responses and percentages to describe the food handling practices of the school foodservice employees. For demographic data, means were calculated to describe the sample.

## CHAPTER FOUR

### RESULTS

#### Challenges to Implementing Food Safety and HACCP Procedures

##### Focus Group

The purpose of the focus group was to identify the challenges to implementing food safety and HACCP procedures in school kitchens. The focus group was held on a weekday morning and lasted approximately two and one-half hours. Five school foodservice directors from Silicon Valley, CA were in attendance. The mean school district size was 17,420 students (9,100 to 34,500) students. The school foodservice directors were employed in the foodservice industry for a mean of 18 years ranging from one to 33 years. The mean length of time the school foodservice directors were employed in school foodservice was 14 years ranging from one to 23 years. The mean length of time the school foodservice directors were employed in their current position was nine years (one to 20) years.

At the conclusion of the focus group, the directors were asked to identify which challenges were the most critical to food safety and HACCP procedures from the list of challenges generated during the focus group. The critical challenges identified by the school foodservice directors are

displayed in Table 1. Employee buy-in, employee motivation, training and education of employees as well as employees being comfortable with food safety through knowledgeable and understanding were regarded as essential to implementing successful food safety and HACCP procedures. Further, finding time to address food safety issues also was considered important to implementing successful food safety and HACCP procedures. During the focus group, the directors did not rank these challenges in any order of importance. Rather, they felt all these challenges needed to be addressed in order to implement successful food safety and HACCP procedures.

**Table 1****Critical challenges to food safety and HACCP (N=5)**

---

Obtaining employee buy-in on food safety issues and practices.  
Employees having a positive attitude and being motivated about food safety.  
Training and educating employees about food safety and HACCP.  
Employees becoming comfortable with food safety issues through knowledge and understanding.  
School foodservice directors need to make time for food safety and HACCP issues in their daily operations.  
Food safety issues need to be a priority to the directors.

---

QuestionnaireDemographic Profile of the Sample

A total of 461 out of 800 questionnaires mailed were returned for a response rate of 58%. The demographic profile of the school foodservice directors is summarized in Table 2. The characteristics of the school districts of the participating school foodservice directors are summarized in Table 3.

**Table 2**  
Demographic characteristics of the school foodservice directors (N=459)

Demographic variable	n	%
<b>Age</b>		
less than 25	1	0.2
25-35	28	6.1
36-45	140	30.5
46-55	192	41.8
56-65	89	19.4
greater than 65	9	2.0
<b>Gender</b>		
male	77	16.8
female	382	83.2
<b>Education level</b>		
less than high school	2	0.4
high school	76	17.0
some college	136	30.4
bachelor's degree	103	23.0
graduate courses	41	9.2
graduate degree	89	19.9
<b>Food safety certification</b>		
no	127	28.7
yes	315	71.3
<b>Years of foodservice experience</b>		
less than 5	33	7.5
6-10	32	7.3
11-15	75	17.0
16-20	97	22.0
21-25	96	21.8
greater than 25	108	24.5
<b>Years of school foodservice experience</b>		
less than 5	82	18.5
6-10	74	16.5
11-15	97	21.9
16-20	83	18.7
21-25	61	13.8
greater than 25	46	10.4

**Table 3**  
 Characteristics of the school districts represented by respondents

Characteristic	n	%
<b>Students in district</b>		
less than 1001	61	14.0
1001-5000	257	59.1
greater than 5001	117	26.9
<b>Foodservice production system<sup>1</sup></b>		
on-site	376	81.6
base kitchen	158	34.3
central bakery	42	9.1
central kitchen	102	22.1
central kitchen using bulk	89	19.3
central kitchen using pre-plate	21	4.6
food transported hot	10	2.2
food transported cold	15	3.3
food transported hot and cold	75	16.3
<b>Use HACCP system</b>		
no	303	70.3
yes	128	29.7
<b>Participate in monitoring food safety</b>		
no	275	62.2
yes	167	37.8
<b>Employees certified for food safety</b>		
no	144	37.4
yes	241	62.6

**Table 3 (Continued)**

Characteristics of the school districts represented by respondents

Characteristic	n	%
<b>Directors have food safety certification</b>		
Servsafe	149	50.0
County Dept. of Health	28	9.0
State Certification	28	9.0
School Foodservice Organization	20	7.0
HACCP Training Certificate	17	6.0
Serving it Safe	13	4.0
Other	49	16.0
<b>Employee responsible for monitoring food safety</b>		
manager/assistant manager	72	34.0
director/assistant director	36	17.0
supervisor	27	13.0
head cook	27	13.0
cook/cooks assistant	15	7.0
nutrition services personnel	12	6.0
sanitation/safety specialist	7	3.0
lead foodservice worker	6	3.0
other	10	5.0
<b>Offer employee food safety in-service training</b>		
general food safety training	327	64.0
food temperature	34	8.0
microbiology	25	6.0
HACCP training	21	5.0
storing/receiving procedures	19	5.0
Personal Hygiene	17	4.0
cleaning facility/equipment	12	2.0
meal service preparation	10	2.0
milk sanitation	9	2.0
cross contamination	6	2.0

<sup>1</sup>directors were asked to circle all that apply

The majority (72%) of the school foodservice directors were 36-55 years of age. Twenty-one percent were 56 years and older and 6% were 35 years and under. Eighty-three percent of the directors were females and 17% were males. The majority (53%) of the school foodservice directors had some college education or a bachelor's degree. Thirty percent had taken some graduate courses or received a graduate degree. Seventeen percent of the directors had some high school education or had received a high school diploma.

Approximately two-thirds (68%) of the directors had been employed 16 or more years in foodservice. Seventeen percent had 11-15 years of foodservice experience and 15% had 10 years or less foodservice experience. Most (57%) of the directors had 15 years or less of school foodservice experience and 43% had 16 years or more of experience.

Over one-half (59%) of the school foodservice directors responding were employed in school districts ranging in size from 1001-5000 students. Directors from school districts with greater than 5001 students accounted for 27% of the responses and directors from districts with fewer than 1001 students accounted for 14% of the responses. Eighty-two percent of these districts used on-site foodservice production systems. Base kitchen preparation (34%) was the next most common type of foodservice production system utilized. Twenty-two percent of the school districts

employed centralized foodservice production systems and 14% of the districts had a central bakery.

The majority of school foodservice directors (70%) did not have a HACCP program or a food safety monitoring system established. The remainder had or were in the process of developing a food safety monitoring system within their school district.

Seventy-one percent of the school foodservice directors had obtained a food safety certification. The majority of school foodservice directors (50%) obtained their food safety certification through the Educational Foundation of the National Restaurant Associations' *ServSafe* course. Eighteen percent of the food safety certificates were obtained through local, county, or state food safety courses. School foodservice organizations such as the American School Foodservice Association (ASFSA) as well as state and local chapters of ASFSA accounted for seven percent of the food safety certificates obtained by school foodservice directors. Six percent of the directors received a food safety certificate specific to Hazard Analysis and Critical Control Point (HACCP) training. The United States Department of Agriculture's (USDA) *Serving it Safe* course accounted for 4% of the food safety certificates obtained. The "other" category accounted for 16% of the food safety certificates obtained. This category includes food safety courses taken from a university, American Food Safety Institute, Educational Testing Service, Culinary

Institute of America, American Culinary Federation, and the International Food Safety Council.

Sixty-two percent of the school districts did not have a designated employee responsible for monitoring food safety. Thirty-eight percent of the school districts stated they had one employee specifically responsible for monitoring food safety.

Managers, assistant managers, directors, and assistant directors accounted for 52% of the employees responsible for routine food safety monitoring. Thirteen percent of the school districts stated that a supervisor was responsible for monitoring food safety. The head cook, cook, and cooks assistant comprised 20% of the employees responsible for food safety and nutrition services personnel, sanitation/safety specialists, and lead foodservice workers accounted for 12% of the employees responsible for food safety in their districts. Other employees responsible for food safety included kitchen helpers, servers, and the employee certified in food safety at each site.

When asked if employees were given an opportunity to attend an in-service training related to food safety for the academic year 1999-2000, 63% of the school foodservice directors responded yes they had provided this opportunity. The majority of in-services (64%) related to general food safety training. These in-services ranged from 15 minutes to 24 hours (three days) with the mean length of training being six hours. The other in-service topics ranged from 15 minutes to 16 hours (two days) with the mean length of training being 1.5 hours. Topics for these in-services included food temperature, microbiology, HACCP training, storing/receiving procedures, personal hygiene, cleaning the facility and equipment, meal service and preparation, milk sanitation, and cross-contamination.

#### School Foodservice Directors Responses to the Challenges Scale

The responses from the school foodservice directors to statements on the challenges scale are presented in Table 4.

**Table 4**  
Responses to statements on the challenges scale

	1	2	3	4	5 <sup>1</sup>	Mean±SD <sup>2</sup>
Employees are nervous about taking the food safety certification exam.	26 (5.8)	50 (11.1)	119 (26.4)	123 (27.3)	133 (29.5)	3.6±1.2
Employees do not feel comfortable with change.	27 (5.9)	78 (17.0)	133 (29.0)	135 (29.4)	86 (18.7)	3.4±1.1
There is not enough time available to offer sanitation/safety courses and in-services to employees.	76 (17.4)	66 (15.1)	98 (22.4)	108 (24.7)	89 (20.4)	3.2±1.4
Directors have little time to devote to food safety and HACCP monitoring system issues due to the daily operational pressures.	54 (12.0)	84 (18.7)	164 (36.4)	98 (21.8)	50 (11.1)	3.0±1.2
Employees worry about losing their jobs if they fail the food safety certification exam.	79 (17.5)	76 (16.9)	149 (33.0)	91 (20.2)	56 (12.4)	2.9±1.3
Employees need constant training and retraining in food safety issues.	77 (17.0)	106 (23.4)	104 (23.0)	106 (23.4)	60 (13.2)	2.9±1.3
There are not enough employees trained in food safety to train other employees.	76 (18.4)	83 (20.0)	117 (28.3)	88 (21.3)	50 (12.1)	2.9±1.3
The design of the facility places constraints on the extent food safety procedures can be developed.	93 (21.9)	90 (21.2)	129 (30.4)	76 (17.9)	37 (8.7)	2.7±1.2
Food safety and HACCP monitoring procedures have become routine for employees.	62 (15.5)	102 (25.4)	160 (39.9)	55 (13.7)	22 (5.5)	2.7±1.1
There is not adequate supervision to check that food safety procedures are followed.	99 (23.7)	106 (25.4)	97 (23.2)	81 (19.4)	35 (8.4)	2.6±1.3
There is a lack of support among employees to follow food safety and HACCP monitoring system procedures.	87 (19.4)	131 (29.2)	163 (36.4)	47 (10.5)	20 (4.5)	2.5±1.1
Employees are uncomfortable with food safety issues because of a lack of education in this area.	94 (20.5)	170 (37.1)	118 (25.8)	61 (13.3)	15 (3.3)	2.4±1.1

**Table 4 (Continued)**  
**Responses to statements on the challenges scale**

	1	2	3	4	5 <sup>1</sup>	Mean±SD <sup>2</sup>
Employees do not recognize the food safety risks involved in not following food safety procedures.	120 (28.7)	138 (33.0)	71 (17.0)	73 (17.5)	16 (3.8)	2.4±1.2
There is not a standardized inspection process among sanitarians and county health departments.	165 (38.4)	79 (18.4)	82 (19.1)	50 (11.6)	54 (12.6)	2.4±1.4
Employees are not motivated about food safety issues.	99 (21.5)	173 (37.6)	112 (24.3)	63 (13.7)	13 (2.8)	2.4±1.1
There is a lack of support from employees, particularly from an employee who is a respected leader to follow food safety procedures.	147 (32.5)	146 (32.2)	117 (25.8)	27 (6.0)	16 (3.5)	2.2±1.1
Employees do not care a lot about food safety issues.	155 (33.8)	169 (36.8)	86 (18.7)	40 (8.7)	9 (2.0)	2.1±1.0
There is a lack of support from the school district regarding food safety issues.	174 (43.7)	92 (23.1)	76 (19.1)	34 (8.5)	22 (5.5)	2.1±1.2
Employees may feel uncomfortable with food safety issues due to language barriers.	230 (50.0)	88 (19.1)	79 (17.2)	42 (9.1)	21 (4.6)	2.0±1.2

<sup>1</sup>For this scale, 1=never a problem; 3=neutral; 5=always a problem

<sup>2</sup>SD=standard deviation

In general, the school foodservice directors rated most of the statements as not a serious problem or were neutral on the statement as being a problem in their district. The only statement that the school foodservice directors rated as being problematic in their district was that employees are nervous about taking the food safety exam. However, this statement received a 3.6 on a five-point scale suggesting that the food safety exam is often a problem to implementing food safety and HACCP procedures in the school districts but not routinely a problem.

#### School Foodservice Directors Responses to the Attitude Scale

The responses from the school foodservice directors to statements on the attitude scale are displayed in Table 5.

**Table 5**  
**Responses to statements on the attitude scale**

	1	2	3	4	5 <sup>1</sup>	Mean±SD <sup>2</sup>
Checking on food safety is an important part of my job.	412 (89.6)	32 (7.0)	8 (1.7)	2 (0.4)	6 (1.3)	1.2±0.6
Learning more about food safety issues is worthwhile.	378 (82.2)	67 (14.6)	8 (1.7)	1 (0.2)	6 (1.3)	1.2±0.6
Employee in-service training is an important way to improve safe food handling practices among employees.	280 (61.1)	135 (29.5)	32 (7.0)	4 (0.9)	7 (1.5)	1.5±0.8
Food safety certification of employees is a good way to make sure safe food is served.	246 (53.7)	126 (27.5)	65 (14.2)	15 (3.3)	6 (1.3)	1.7±0.9
Food safety certification of employees has made the food handling practices in my facility better.	198 (44.9)	120 (27.2)	102 (23.1)	11 (2.5)	10 (2.3)	1.9±1.0
A HACCP monitoring system is important for maintaining an effective food safety system.	126 (28.6)	137 (31.1)	141 (32.0)	27 (6.1)	9 (2.0)	2.2±1.0
Creating and maintaining an effective HACCP monitoring system creates employee pride and self-esteem for a job well done.	89 (20.2)	121 (27.5)	198 (45.0)	27 (6.1)	5 (1.1)	2.4±0.9
The use of a HACCP monitoring system is too costly to implement.	43 (9.7)	84 (19.0)	191 (43.1)	78 (17.6)	47 (10.6)	3.0±1.1
The use of a HACCP monitoring system is too time consuming to implement.	38 (8.6)	93 (21.1)	188 (42.7)	79 (18.0)	42 (9.5)	3.0±1.1
The time and money required to certify employees have not increased food safety practices.	34 (7.9)	62 (14.3)	121 (27.9)	111 (25.6)	105 (24.2)	3.4±1.2
Certification has not helped put safe food handling practices into effect.	22 (5.0)	44 (10.0)	93 (21.2)	126 (28.7)	154 (35.1)	3.8±1.2

<sup>1</sup>For this scale, 1=strongly agree; 3=neutral; 5=strongly disagree

<sup>2</sup>SD=standard deviation

The school foodservice directors were in agreement with the statements "Food safety certification of employees is a good way to make sure safe food is served" and "Food safety certification of employees has made the food handling practices in my facility better." They disagreed with the statement "Certification has not helped employees put safe food handling practices into effect" which was consistent with the previous two statements. However, they were more neutral on the statement "The time and money required to certify employees have not increased food safety practices." This suggests that the directors believed food safety certification of employees has improved their food handling practices, but the time and money required to certify the employees concerns them.

Likewise, the school foodservice directors' responses varied regarding the use of HACCP as a food safety monitoring system. The directors responded positively to the statements "A HACCP monitoring system is important for maintaining an effective food safety system" and "Creating and maintaining an effective HACCP monitoring system creates employee pride and self-esteem for a job well done." However, the statements "The use of a HACCP monitoring system is too time consuming to implement" and "The use of a HACCP monitoring system is too costly to implement" received scores which suggest neutrality by the school foodservice directors. Again, this suggests that the directors have a more positive attitude towards the concept of HACCP food safety monitoring, but

the time and money required to develop and implement it may be a problem.

Finally, the school foodservice directors responses revealed agreement to the statements "Checking on food safety is an important part of my job", "Learning more about food safety issues is worthwhile", and "Employee in-service training is an important way to improve safe food handling practices among employees." According to these responses, the directors believed that food safety training is worthwhile. Further, the director's agreed that monitoring food safety practices in their district is important.

#### Factor Analysis/Cronbach's Alpha for the Challenges Scale

A principal factor analysis with a varimax rotation was performed on the 19 items that made up the challenges scale. Three primary factors were identified for this scale based on the highest factor loading. The eigenvalues calculated for each of the items were then plotted on a graph in order to visually examine where the eigenvalues "dipped" and then "leveled off" on the graph. This step was performed to verify that three primary factors did exist for the challenges scale. Upon verification of three primary factors, the items that comprised each factor were examined to identify similar themes and verify that each item did belong in the factor in which it had the highest loading.

In performing the factor analysis, some of the items did not load definitively into one factor but overlapped into two factors. A Cronbach's alpha was performed to determine internal consistency for each of the three factors. An item to total analysis was then performed and the analysis showed that there were no items that would increase the alpha if they were deleted. The three factors identified were: factor 1) resource management ( $r = 0.85$ ); factor 2) employee motivation ( $r = 0.86$ ); and factor 3) employee confidence ( $r = 0.71$ ). Resource management is defined as the directors' ability to effectively manage a variety of resources such as time, employees, and finances in order to further food safety in their district. Employee motivation is defined as the employees interest and willingness to follow food safety procedures and learn more about food safety. Employee confidence is defined as employees level of confidence in their food safety knowledge and in their ability to pass the certification examination. Appendix Table 1 shows the factor analysis data for the three factors.

#### Multiple Regression Analysis for the Challenges Scale

A forward stepwise multiple linear regression analysis was performed for each of the three factors for the challenges scale. The dependent variables were each of the three factors. The independent variables studied were district size, age, education level, years employed in

foodservice, years employed in school foodservice, and food safety certification. For each analysis, data from subjects who had three or more missing responses were excluded from the multiple regression analysis. For factor 1, resource management, the model was significant ( $p < 0.05$ ). These variables accounted for 10% of the variance in the dependent variable ( $R^2 = 0.10$ ). For factor 2, employee motivation, the model was significant ( $p < 0.05$ ). These variables accounted for 8% of the variance in the dependent variable ( $R^2 = 0.08$ ). For factor 3, employee confidence, the model was significant ( $p < 0.05$ ). These variables accounted for 12% of the variance in the dependent variable ( $R^2 = 0.12$ ). The multiple regression analysis results for the three factors are displayed in Table 6.

The independent variables that were significant for factor 1, resource management, were age, which was inversely related, and education, which was positively related. Therefore, as the age of the director decreased, the directors' perception of resource management as being a challenge to implementing food safety procedures increased. Also, as the education level of the school foodservice directors increased, the directors' perception of resource management as being a challenge to implementing food safety procedures increased.

For factor 2, employee motivation, the significant variables were age, which was inversely related, and education, which was positively related. Therefore, as the age of the directors decreased, the directors' perception

of employee motivation as being a challenge to implementing food safety procedures increased. Also, as the education level of the school foodservice directors increased, the directors' perception of employee motivation as being a challenge to implementing food safety procedures increased.

For factor 3, employee confidence, the significant independent variables were age, which was inversely related, education, which was positively related, and district size, which was positively related. Therefore, as the age of the directors decreased, the directors' perception of employee confidence as being a challenge to implementing food safety procedures increased. Also, as the education level of the school foodservice directors increased, the directors' perception of employee confidence as being a challenge to implementing food safety procedures increased. Further, as the size of the district increased, the directors' perception of employee confidence as being a challenge to implementing food safety procedures increased. The results for the significant variables for the three factors are shown in Table 7.

**Table 6**  
 Summary of the analysis of variance F-test for factors on the challenges scale

Dependent variable		Sum of squares	df	Mean square	F	$p^1$
<b>Factor 1</b> (N=365)	Regression	1916.024	6	319.337	6.692	0.000
	Residual	17083.143	358	47.718		
	Total	18999.167	364			
<b>Factor 2</b> (N=380)	Regression	581.958	6	96.993	5.612	0.000
	Residual	6447.018	373	17.284		
	Total	7028.976	379			
<b>Factor 3</b> (N=376)	Regression	754.853	6	125.809	8.497	0.000
	Residual	5463.272	369	14.806		
	Total	6218.125	375			

<sup>1</sup> $p$  value is significant at 0.05

**Table 7**  
Significant regression coefficients for the challenges factors

		B	Std. Error	Beta	t	<i>p</i> <sup>1</sup>
<b>Factor 1</b> (N=365)	Constant	25.632	2.783		9.211	0.000
	Q32(age)	-1.681	0.531	-0.205	-3.163	0.002
	Q33(educ.)	1.170	0.297	0.223	3.935	0.000
<b>Factor 2</b> (N=380)	Constant	12.013	1.642		7.315	0.000
	Q32(age)	-0.877	0.315	-0.181	-2.780	0.006
	Q33(educ.)	0.544	0.175	0.174	3.116	0.002
<b>Factor 3</b> (N=376)	Constant	13.433	1.526		8.809	0.000
	Q32(age)	-0.653	0.295	-0.141	-2.217	0.027
	Q33(educ.)	0.657	0.164	0.222	3.996	0.000
	Q38(dt. sz.)	0.916	0.356	0.141	2.571	0.011

<sup>1</sup>*p* value is significant at 0.05

### Factor Analysis/Cronbach's Alpha for the Attitude Scale

Prior to conducting a factor analysis for the attitude scale, four of the 11 items on the scale had been stated in the negative, and therefore, were reversed scored. A principal factor analysis with a varimax rotation was then performed on the 11 items that made up the attitude scale. Four primary factors were initially identified for this scale based on the highest factor loading. The eigenvalues calculated for each of the items were then plotted on a graph in order to examine where the eigenvalues "dipped" and then "leveled off" on the graph. This step revealed that the plotted eigenvalues "leveled off" significantly after the fifth item indicating that there were potentially five instead of four factors. The items were then forced into

five factors. Upon verification of five primary factors, the items that comprised each factor were examined to identify similar themes and verify that each item did belong in the factor in which it had the highest loading.

A Cronbach's alpha was performed to determine internal consistency for each of the five factors. An item to total analysis was then performed and the analysis showed that there were no items that would increase the alpha if they were deleted. The five factors were: factor 1) food safety education ( $r = 0.80$ ); factor 2) HACCP disadvantages ( $r = 0.90$ ); factor 3) certification advantages ( $r = 0.79$ ); factor 4) HACCP advantages ( $r = 0.78$ ); and factor 5) certification disadvantages ( $r = 0.65$ ). Appendix Table 2 shows the factor analysis data for the five factors.

### Multiple Linear Regression Analysis for the Attitude Scale

A forward stepwise multiple linear regression analysis was performed with the independent variables being district size, age, education level, years employed in foodservice, years employed in school foodservice, and food safety certification. The dependent variables were the five factors. For factor 1, food safety education, the model was not significant ( $p > 0.05$ ). For factor 2, HACCP disadvantages, the model was significant ( $p < 0.05$ ). These variables accounted for 21% of the variance in the dependent variable ( $R^2 = 0.21$ ). For factor 3, certification advantages, the model was significant ( $p < 0.05$ ). These variables accounted for 31% of

the variance in the dependent variable ( $R^2 = 0.31$ ). For factor 4, HACCP advantages, the model was not significant ( $p > 0.05$ ). For factor 5, certification disadvantages, the model was significant ( $p < 0.05$ ). These variables accounted for 26% of the variance in the dependent variable ( $R^2 = 0.26$ ). The multiple regression analysis for the five factors is shown in Table 8.

The significant variables for the significant attitude factors are displayed in Table 9. Factor 2, HACCP disadvantages, is defined as the items that negatively impact the success of implementing a HACCP program such as time and money. The independent variable that was significant for factor 2, HACCP disadvantages, was food safety certification which was inversely related. Therefore, as the food safety certification of the directors decreased, the more the director's agreed that time and money were disadvantages to implementing a HACCP program in their district.

Factor 3, certification advantages, is defined as the food safety benefits received from employees obtaining a food safety certification such as an improvement in safe food handling practices. For factor 3, certification advantages, the significant independent variables were age and food safety certification which were both inversely related. Therefore, as the age of the directors decreased and the certification of the directors

decreased, the more the director's agreed that improved food handling practices were an advantage of employee certification.

Factor 5, certification disadvantages, is defined as the negative outcomes obtained from certifying employees in food safety such as a lack of an improvement in safe food handling practices. For factor 5, certification disadvantages, the significant independent variable was food safety certification which was inversely related to certification disadvantages. Therefore, as the certification of the directors decreased, the more the directors agreed that the time and money required to certify employees did not improve their employees food handling practices and was a disadvantage to certifying employees. Further, as the certification of the directors decreased, the more they agreed that a lack of improvement in safe food handling practices was a disadvantage to employee certification.

**Table 8**  
Summary of the analysis of variance F-test for factors on the attitude scale

Dependent variable		Sum of squares	df	Mean square	F	<i>p</i> <sup>1</sup>
<b>Factor 1</b> (N=380)	Regression	33.660	6	5.610	1.790	0.100
	Residual	1169.287	373	3.315		
	Total	1202.947	379			
<b>Factor 2</b> (N=363)	Regression	63.737	6	10.623	2.681	0.015
	Residual	1410.401	356	3.962		
	Total	1474.138	362			
<b>Factor 3</b> (N=366)	Regression	105.905	6	17.651	6.280	0.000
	Residual	1008.970	359	2.811		
	Total	1114.874	365			
<b>Factor 4</b> (N=363)	Regression	29.863	6	4.977	1.748	0.109
	Residual	1013.415	356	2.847		
	Total	1043.278	362			
<b>Factor 5</b> (N=358)	Regression	97.281	6	16.213	4.064	0.001
	Residual	1400.496	351	3.990		
	Total	1497.777	357			

<sup>1</sup>*p* value is significant at 0.05

**Table 9**  
Significant regression coefficients for the significant attitude factors

		B	Std. Error	Beta	t	$p^1$
<b>Factor 2</b> (N=363)	Constant	7.473	0.801		9.328	0.000
	Q40(cert.)	-0.731	0.241	-0.163	-3.034	0.003
<b>Factor 3</b> (N=366)	Constant	7.045	0.677		10.413	0.000
	Q32(age)	-0.498	0.130	-0.249	-3.863	0.000
	Q40(cert.)	-1.054	0.204	-0.268	-5.165	0.000
<b>Factor 5</b> (N=358)	Constant	7.458	0.813		9.177	0.000
	Q40(cert.)	-1.165	0.245	-0.252	-4.755	0.000

<sup>1</sup> $p$  value is significant at 0.05

## Comments

When asked to complete the statement "I could improve food safety in my district if..." the school foodservice directors provided a variety of responses. Some of the school foodservice directors gave more than one response to this statement, providing a total of 239 responses. The responses given by the school foodservice directors are represented in Table 10.

**Table 10**

Responses to the statement "I could improve food safety in my district if..."

---

	<u>n</u>	<u>%</u>
Directors had more time	70	29
There were more money for training	53	22
Employees had a better attitude towards food safety/more employee incentives for following food safety	17	8
District had better facilities/equipment	16	7
District had more staff	13	6
More time for employees to attend training and follow food safety procedures	12	5
Shorter, more available courses were offered	12	5
Directors had more help	11	5
Employee turnover were lower	7	3
We had a HACCP program in place	5	2
Other	11	5

---

Time and money were the greatest obstacles to improving food safety, accounting for 51% of the responses given by school foodservice directors. Directors believed they did not have adequate time to monitor food safety themselves due to the daily operational responsibilities. Lack of district funds to send employees to food safety training programs or have a trainer come to the district also were considered obstacles to improving food safety. Lack of funding also impacted employee attitudes towards food safety. Directors stated that because employees are not rewarded for following food safety procedures, and are not compensated for attending food safety training, they are not motivated to do so. Eleven percent of the school foodservice directors responded that a lack of staff and a lack of time for employees to attend food safety training and follow food safety procedures posed a challenge to improving food safety in their district. School foodservice directors reported that employees do not want to attend food safety training because they are generally offered after work hours and the employees are not compensated for their time. Also, because of high turnover and a lack of staff, employees are too overwhelmed to devote attention to food safety. Five percent of the directors responded that they wished shorter, more frequent training courses were available and that these were offered closer to their district so employees could attend them. Five percent of the directors responded that they are doing a great job in their district with food safety and no improvements were needed in this

area. Finally, the directors responded that they could improve food safety in their district if they had more help (5%), if employee turnover were lower (3%), and they had more time and support to develop a HACCP program (2%).

### Additional Comments

An open-ended section for school foodservice directors to submit additional comments was included at the end of the questionnaire. There were trends in responses and the majority of the comments were categorized as time and money, food safety training issues, and developing HACCP programs. The list of comments is found in Appendix G.

### Food Safety Practices

Upon completion of phase 1 of this research, the challenges to implementing food safety and HACCP procedures in school foodservice, food safety audits of 15 school kitchens were conducted. The food safety audits were conducted to determine what food handling practices are used among school foodservice employees. The following presents the results from these audits.

### Demographics of the Sample

School food safety audits were conducted at 15 middle school kitchens that used on-site foodservice production by the researcher and two trained observers. The researcher and the two observers each audited five school kitchens. During the audits, the kitchen managers were asked about their employment history in school foodservice. The mean length of time the managers were employed in their current position was nine years, ranging from three months to 24 years. The mean length of time the managers had been employed in school foodservice was 16 years, ranging from five to 24 years. The average number of lunch meals served daily was 430, ranging from 80 to 1800 meals being served daily.

### Food Safety Audits

Food safety procedures were audited in the school kitchens using a food safety audit form with three response categories; yes, no, or not applied. **Yes** meant the procedure was correctly performed during the audit 100% of the time by all employees. **No** meant the procedure was observed being performed incorrectly or inconsistently during the audit. **Not applied** meant the procedure was not applied or not observed during the audit. The researcher and observers audited each school kitchen for approximately two hours. The audits were conducted in the mornings during a time when

food preparation and meal service could be observed. The results from the food safety audits are presented in Table 11.

**Table 11**  
**Food safety practices in school kitchens observed in food safety audits**  
**(N=15)**

	Y F(%)	N F(%)	NA F(%)
<b>TIME/TEMPERATURE CONTROL</b>			
Probe-type thermometers to monitor food temperatures are provided.	8(53)	7(47)	
Employees take temperatures of re-heated foods.	5(33)		10(67)
Employees take internal temperatures of hot and cold foods prepared from scratch.		5(33)	10(67)
Temperatures were observed being taken:			
On the line	1(7)		
During the cooking process	6(40)		
During pre-preparation			
Employees refrigerate potentially hazardous foods (PHF's) between preparation steps.	2(14)	8(53)	5(33)
Employees keep food temperature logs.	6(40)	9(60)	
Approved methods are used for rapidly cooling PHFs such as size reduction, shallow pans, or ice bath.	2(14)		13(86)
Thermometers provided in or on refrigerator/freezer units.	13(86)	2(14)	
<b>FOOD PREPARATION/SERVICE</b>			
Appropriate utensils are used (tongs, scoops, plastic gloves) whenever possible to minimize hand contact with foods.	5(33)	10(67)	
Gloves are changed after soiling.	3(20)	5(33)	7(47)

**Table 11 (Continued)**

Food safety practices in school kitchens observed in food safety audits  
(N=15)

	Y F(%)	N F(%)	NA F(%)
Separate boards (ie. color coded boards) are used for PHF's and ready-to-eat food items.		2(14)	13(86)
Sneeze guards are used in foodservice areas.	6(40)	9(60)	
<b>STORAGE</b>			
Raw meats, poultry, and seafood are stored below ready-to-eat foods in refrigeration units.	4(26)	1(7)	10(67)
Food is covered to protect from overhead contamination.	9(60)	6(40)	
Food and beverages are stored at least 6" off the floor.	9(60)	6(40)	
Food is properly labeled and dated.	1(7)	14(93)	
Storage facilities are kept clean and in good order.	14(93)	1(7)	
Toxic materials are stored in an area separate from food utensils, food equipment, or food contact surfaces.	13(86)	2(14)	
<b>EMPLOYEES</b>			
Employees wash hands after contaminating them.		13(86)	2(14)

**Table 11 (Continued)**

Food safety practices in school kitchens observed in food safety audits  
(N=15)

	Y F(%)	N F(%)	NA F(%)
Hand-wash facilities are operable, accessible, and provided with approved soap and towels in dispensers.	13(86)	2(14)	
Employees are wearing clean clothes.	15(100)		
Employees use hair restraints.	2(14)	13(86)	
Employees do not use tobacco in food preparation/storage/dishwashing areas.	14(93)	1(7)	
Employees do not eat or drink in food preparation/storage/dishwashing areas.	7(47)	8(53)	
<b>UTENSILS/EQUIPMENT/FACILITY</b>			
Food contact surfaces and utensils are cleaned and sanitized after each use.		10(67)	5(33)
Employees use test strips to check sanitizer concentration.		15(100)	
Employees use proper hand dishwashing technique (wash, rinse, sanitize, and air dry).	3(20)	9(60)	3(20)
Equipment is kept clean, operable, and in good repair.	14(93)	1(7)	
All utensils and containers are kept clean.	14(93)	1(7)	
Floors are kept clean and in good repair.	13(86)	2(14)	
Walls are kept clean and in good repair.	15(100)		
Ceilings are kept clean and in good repair.	13(86)	2(14)	

### Time/Temperature Control

A probe type thermometer for taking food temperatures was present in eight of the 15 kitchens. These included metal probe type thermometers or temperature sticks that changed color when the food item reached the correct temperature. In 10 of the kitchens, employees were not observed taking internal temperatures of prepared foods, the predominant type of foods served. Further, internal temperatures of cold foods were never observed being taken by employees. When food temperatures were taken, they were generally taken during the cooking process. Cold and frozen foods were observed being left out during the entire time of the audit in eight of the 15 kitchens. Frozen foods were often observed thawing at room temperature during the audit. Six of the 15 kitchens maintained temperature logs of food items that were later sent to the district office for review. Due to the high use of prepared foods in the kitchens, cooling methods used for foods were not routinely observed. However, when the cooling of food items was observed, it was performed correctly. The majority of kitchens had thermometers provided in or on all of the refrigerator and freezer units.

### Food Preparation/Service

In handling food during preparation or service, employees frequently were observed using their hands to handle foods as opposed to using a utensil or gloved hands. When gloves were used, they were not changed between tasks in five of the 15 schools observed. Cutting boards were frequently not observed being used in the kitchens. When cutting boards were used, they were not color coded because only one cutting board was available in the kitchen. In nine of the 15 kitchens, sneeze guards were not used to protect food items during service.

### Storage

The majority of foods served were prepared food items. Therefore, the storage of raw meats, seafood, and poultry below other refrigerated food items was not observed in many kitchens. When raw meat products were stored in the refrigerator, they were generally stored below other refrigerated food items to prevent cross-contamination. In nine of the 15 kitchens, refrigerated food items were covered to protect them from contamination. However, the greatest majority of refrigerated food items frequently were not labeled and/or dated. Further, in six of the 15 kitchens, food was not stored at least 6" off the floor in dry storage but placed directly on the floor. In almost all of the kitchens, the storage facilities were found

to be clean and in good order and toxic chemicals were kept separate from food and food preparation items.

### Employees

In two of the 15 schools, the procedure for hand washing among employees was not observed. However, in 13 of the 15 schools where employees were observed washing their hands, the technique used to wash their hands was of concern. In these instances, hand washing consisted of rinsing hands under water quickly, with no soap. When soap was used, the proper hand washing technique was not performed. In most of the kitchens, hand wash facilities were accessible, operable, and supplied with the items necessary for proper hand washing. Many of the employees were observed washing their hands in food preparation sinks. This may be due to the fact that many of the sinks for hand washing were not located directly in the kitchen, but were located in a bathroom away from the kitchen. In all the school kitchens, employees were wearing clean clothes. However, in 13 of the 15 kitchens, one or more of the employees were not wearing hair restraints. In the majority of the kitchens, tobacco was not used in food preparation areas, but in nearly half of the kitchens, food or drink was consumed in food preparation areas.

### Utensils/Equipment /Facility

In five of the kitchens, cleaning and sanitizing of food contact surfaces was not observed. Further, in 10 of the kitchens, cleaning or wiping of food contact surfaces was observed, but sanitation of these surfaces with an approved sanitizer was not noted. Test strips to check that the proper sanitizer concentration was not observed in any of the kitchens. As with sanitizing food contact surfaces, sanitizing of manually washed dishes was infrequently performed and observed in only three of the 15 kitchens. Dishes were cleaned, rinsed, and air dried, but frequently not sanitized. In three of the kitchens, cleaning and sanitizing of dishes was not observed. In general, equipment, utensils, floors, walls, and ceilings were clean and in good order in all of the school kitchens.

## CHAPTER FIVE

### DISCUSSION, CONCLUSIONS, RECOMMENDATIONS

The purposes of this research were: 1) determine the challenges to implementing food safety and Hazard Analysis and Critical Control Point (HACCP) procedures in school kitchens, and 2) determine the food safety practices currently used in school kitchens. A summary of the research project will precede the discussion of results. The food safety and HACCP implementation challenges will then be discussed, followed by a discussion on the attitudes of school foodservice directors toward food safety and HACCP programs. The analysis for both the challenges and attitudes will then be discussed. Finally, the food safety procedures currently used in school kitchens will complete this discussion section.

#### Summary

A two-phase study was conducted to determine the challenges to implementing food safety and HACCP procedures in school kitchens and to audit current food safety procedures used in school kitchens. For Phase I, a national questionnaire was mailed to 800 school foodservice directors to gather data regarding the attitudes of school foodservice directors toward certification and HACCP programs and to identify the challenges they

perceive to the implementation of food safety and HACCP procedures in school kitchens. A focus group of Silicon Valley school foodservice directors was used to develop the list of the challenges to implementing food safety and HACCP procedures. This list was used in the development of the challenges section of the questionnaire. Four hundred sixty one out of the 800 questionnaires mailed were returned providing a response rate of 58%.

Results from the questionnaire suggested that responding school foodservice directors perceived the challenges as either minor or were neutral in impact within their districts. Further, the directors appeared to be in positive agreement about the effectiveness of implementing food safety certification and HACCP programs toward improving food safety procedures.

The multiple regression analysis for the challenges section revealed that younger directors and more educated directors perceived the challenges to implementing food safety and HACCP procedures in their district as more problematic. Further, the larger the district size, the less confident the directors perceived the employees to be about food safety.

The multiple regression analysis for the attitude section revealed that the less often the school foodservice directors were certified, the more they agreed that time and money were disadvantages to employee certification and implementing HACCP programs in their district. Further, the less often

the directors were certified, the more they agreed that certification does not improve employee food handling practices. Also, the younger the directors and the less frequently they were certified, the more often the directors agreed that improved employee food handling practices was an advantage to certification.

For Phase II, food safety audits were conducted at 15 middle schools that used an on-site foodservice production system. Three observers audited five kitchens each. Audit areas included time/temperature control, storage procedures, food preparation and service procedures, employee hygiene, and the cleaning procedures for utensils, equipment, and the facility.

Results from the food safety audits revealed that employees did not routinely take food temperatures, wear hair restraints, use proper hand washing, or use gloves when handling food items. Further, employees often ate in the food preparation area and did not routinely sanitize dishes and counter surfaces. Also, refrigerated food items frequently were not labeled and/or dated and many dry storage items often were placed directly on the floor. In general, the facility, equipment, and storage areas were clean and in good order.

## Challenges to Implementing Food Safety and HACCP Procedures

### Focus Group

A focus group of five Silicon Valley school foodservice directors developed a list of challenges to implementing food safety and HACCP procedures that they perceived to be problematic in school foodservice. These were later included in the challenges section of the questionnaire (Appendix E). At the end of the focus group, the directors were asked to identify the challenges that they perceived as being critical to the success of implementing food safety and HACCP procedures (Table 1).

The results from the focus group contradicted the results from the challenges section of the questionnaire. This could be due to the fact that the focus group participants were from one region of the United States and identified challenges indicative to that particular region. Perhaps, the school foodservice directors who participated in the focus group were interested in food safety as indicated by their willingness to participate in the session. Consequently, these directors may have been overly enthusiastic about identifying food safety challenges and issues that were perhaps not considered challenges to the respondents. Finally, it is possible that the responding directors may not have been completely honest in their responses due to social acceptability concerns.

However, the focus group results were in greater agreement with the open-ended responses provided to the questionnaire statement "I could improve food safety in my district if..." (Table 10). Areas of agreement about the challenges to implementing food safety and HACCP procedures included employees having a better attitude about food safety, more time for employees to attend food safety training, and directors having more help and time to address food safety issues. Again, this may be due to the fact that the responding directors were not completely honest in their responses or were answering the questions half-heartedly. These results may also be due to the fact that the directors choosing to respond to the open-ended comment items were perhaps more interested in food safety and HACCP issues or perhaps they simply took more time and care in completing the questionnaire.

## Challenges to Implementing Food Safety and HACCP Procedures in School Kitchens

School foodservice directors perceived the challenges to implementing food safety and HACCP procedures as either of minor impact or they were neutral regarding the impact of these in their district. This contradicts the focus group participants viewpoints suggesting that these issues, such as employee motivation and lack of resources, are problematic to school foodservice. This contradiction could be due to the fact that the responding directors are unaware or not cognizant of these problems as challenging in their district. Further, the directors may believe that their districts do not have food safety challenges and are doing well in this area. This could occur since they may not be involved in the day to day operations. Finally, the focus group may not have addressed the food safety issues that are real challenges in other areas of the country. The focus group was conducted once and consisted of five participants who were from one region of the country. This may have hindered the development a complete list of challenges by the focus group.

The issue that emerged as a challenge to implementing food safety to responding directors was "Employees are nervous about taking the food safety certification exam." This issue may pose a challenge to directors who want to require certification for employees as a means of increasing their food safety knowledge. By educating employees in food safety, it is anticipated that their site food handling practices will improve. Employees

who take the certification exam and fail may experience a loss of confidence and self-esteem, which creates even more anxiety about repeating the exam. This may lead to a “snowball effect” in that the more the employees don’t succeed, the more anxious the employees become about succeeding, and the harder it is for them to pass the certification exam. This could be especially difficult if other employees in a school kitchen have passed the exam and one or two employees have not succeeded.

#### Attitudes of School Foodservice Directors Toward Food Safety Programs in School Kitchens

In general, the school foodservice directors responded positively to the statement “Checking on food safety is an important part of my job.” These directors may perceive monitoring food safety procedures as essential to having a quality foodservice program. Since they are ultimately responsible for ensuring the quality of these programs, they may believe it is their job to oversee the food safety in their district. Also, by being directly involved, the director may feel they can serve as an example for the importance of food safety to their employees. This response also could be due to the fear of a foodborne illness outbreak in their district and the publicity and costs resulting from such outbreaks.

School foodservice directors also responded that learning more about food safety issues was worthwhile. According to this research, 71%

had a food safety certification. This result may be due to the fact that the directors believe learning more about food safety will provide them with more knowledge to train their employees. Also, educating themselves further on food safety keeps them updated on current food safety issues that may be relevant to their district. Further, the American School Foodservice Association (ASFSA) certification requires a food safety course.

Literature on the attitudes of school foodservice directors regarding food safety issues is limited. However, Sneed and White (1993) found that both the directors and managers rated health and safety laws, inspection, and enforcement as high continuing education needs. Holdt (1992) also found that university foodservice managers rated ensuring food safety and continuing education in food safety as important job functions.

The school foodservice director is the person who ultimately creates the atmosphere in their district regarding the importance of food safety. Determining their attitude regarding the degree of involvement they should have in food safety is beneficial to discovering the atmosphere they may be setting in their district. If they do not view food safety as an issue worth their time and effort, it could send a message to the employees that food safety is unimportant.

Finally, school foodservice directors responded that food safety certification has improved the food handling practices in their district. They

also agreed that food safety certification and employee in-service training are good ways to ensure that safe food is served in their district. The initial goal of food safety certification was to establish food safety standards and to educate management in food safety (Speer & Kane, 1990; American Food Safety Institute {AFSI}, 2000). According to this research, school foodservice directors agree that educating employees in food safety through certification and in-service training is beneficial for improving food safety in their district.

These results are also consistent with a study conducted by Penninger and Rodman (1984) which found that certification of managers improved the food safety conditions in the 20 foodservice facilities surveyed. However, these results are not consistent with a study conducted by Speer and Kane (1990). In that study, it was found that many of the 51 state food protection directors surveyed felt that managers were not motivated to put food safety practices into effect and certification would not change this. Further, Green and Frame (1998) found that an increase in food safety knowledge did not lead to a positive change in behavior among school foodservice employees.

Although school foodservice directors are ultimately responsible for food safety in their districts, it is the managers and employees who actually perform the food handling functions. By educating and certifying employees in food safety, the director may believe that "knowledge is

power” and this knowledge will translate into better food handling practices. According to this research, 63% of the school foodservice directors had provided in-service training through general food safety courses, or topic specific food safety courses, to their employees during the 1999-2000 academic year. However, this response also could be due to the fact that it is mandated in some states that at least one employee be certified in food safety at each site. In this case, directors may have employees certified in food safety because it is required in their locality.

The agreement rate was lower for the statement “Food safety certification of employees has made the food handling practices in my facility better.” This may be due to the fact that the directors who did not respond, and even some of those who did, may not be sure food safety certification has improved the food handling practices in their district. They realize the intent of food safety certification is to improve the food safety practices in school kitchens, but are not clear how, and if, food safety certification has benefited their district. Also, these directors may feel that the current food handling practices in their district are excellent, regardless of certification, and chose not to respond to this statement.

The school foodservice directors were neutral about the benefits of food safety certification in relation to the time and money required for certification. Again, the agreement rate for this statement was lower than for other statements. The directors responding to this statement may

perceive food safety certification positively, but are frustrated by the lack of resources and employee motivation required for certifying employees.

Further, if certification is mandated in the directors' state, this could add to their frustration. This result may be reflective of the findings of Speer and Kane (1990). They found that the barriers to certification included time and money due to tight budgets and the perceived burden of the certification program. As one director from this research commented "You can have a food safety program without having a certification or a HACCP program." Another director commented "Mandatory certification seems to be another way for someone to fill their pockets."

The school foodservice directors also may have been neutral about this statement due to the fact that some of the directors may not require a food safety certification in their district and are unable to respond to this statement. Also, some of the directors may not have evaluated the benefits of food safety certification in relation to the time and money required for certifying employees and, therefore, are uncertain if it has increased the food safety practices in their district. Further, if employee turnover is high in a particular district, the director may be unsure if the constant certification of short-term employees is beneficial.

Attitudes of School Foodservice Directors Toward Utilizing a HACCP  
Monitoring Program in School Kitchens

According to this research, responding school foodservice directors were in positive agreement about the use of HACCP as a monitoring system for food safety in their district. Further, approximately 50% of the responding directors were in positive agreement that creating and maintaining a HACCP monitoring system increased employee morale. By implementing a HACCP monitoring system, the directors have indicated that food safety is a priority, possibly increasing employee motivation about food safety. This result is consistent with King (1992) who states that employees need to understand the importance of their role in creating a successful food safety program. Further, to be successful, management needs to be committed to establishing an effective HACCP program.

School foodservice directors were neutral on the subject of HACCP being too time consuming or too costly to implement. This may be due to the fact that 70% of the directors responding to this statement did not have a HACCP monitoring system in place. Therefore, these directors may be uncertain if implementing a HACCP monitoring system is too time consuming or costly. In the comment section of the questionnaire, some of the school foodservice directors responded that they would like to implement a HACCP program, but they needed additional resources to accomplish this task. Others commented that they were not familiar with

HACCP. The majority of phone calls the researcher received from participants were about HACCP; what did it stand for and what was it?

These results appear to be consistent with the analysis of King (1992). According to several food safety and HACCP consultants, many foodservice operators are unfamiliar with HACCP or are unclear how to apply HACCP principles to their operation. This problem is compounded by the slow dissemination of HACCP information throughout the foodservice industry. Although the directors generally had a positive attitude toward the concept of HACCP, they appear to be unfamiliar with the actual implementation and use of HACCP. This could also account for the lower response rate for all of the HACCP statements.

#### Relationship Between Challenges and Demographic Characteristics of Respondents

The multiple regression analysis for factor 1, resource management, revealed that the younger the school foodservice directors were, the greater they perceived resource management to be a challenge to implementing food safety and HACCP procedures. This could be due to the fact that younger directors may be less adept at time management, personnel management, and financial management strategies, especially if they are first time directors. The tasks of monitoring food safety, training employees in food safety through in-services or certification courses, as well as keeping up with the daily tasks of the foodservice operation may be

demanding to them. Further, younger school foodservice directors may be more ambitious and enthusiastic about food safety but feel limited in what they can achieve due the resources available. Older school foodservice directors may be very dedicated to food safety, but have become more realistic about what is feasible, making resource management less of a frustration, and therefore, less of an issue for them.

The multiple regression analysis for factor 1 also found that the more education the school foodservice directors had, the more resource management was a challenge. This could be due to the fact that school foodservice directors with more education probably have received an education in dietetics or foodservice management in which food safety would be part of the curriculum. Therefore, more educated directors would probably regard food safety issues, such a training, as important to their foodservice operation. Further, more educated school foodservice directors may place more emphasis on or know more about implementing food safety procedures and monitoring food safety practices. These tasks would require additional resources that may be unavailable, such as district funds or time to conduct food safety training.

The multiple regression analysis factor 2, employee motivation, revealed that the younger school foodservice directors were, the more employee motivation was a challenge. Younger school foodservice directors may be less skilled at managing and leading employees,

therefore, motivating employees to follow food safety procedures may be more challenging. Further, these directors are probably younger than many of the employees they are supervising, which may be intimidating to them. This age difference may pose a challenge for the director in earning the employees' respect and confidence, especially among senior employees.

The multiple regression analysis for factor 2 also found that the more education the school foodservice directors had, the more employee motivation was a challenge to them. As with resource management, school foodservice directors who are more educated have probably received this education in dietetics or foodservice management. These directors may place more emphasis on or know more about food safety procedures in their districts and, therefore, place greater emphasis on motivating employees to follow these procedures.

The multiple regression analysis for factor 3, employee confidence, revealed that the younger the school foodservice directors were, the more creating a sense of confidence among employees about food safety was a challenge. Further, the more educated the directors were, the more challenging employee confidence with food safety became to them. This may be due to the fact that younger school foodservice directors as well as more educated directors probably place a greater importance on food safety. These directors most likely are the ones who will want their employees to take the food safety certification exam and work toward

implementing food safety and HACCP programs. Therefore, the level of confidence their employees have with food safety will be critical to the success of their food safety programs.

The multiple regression analysis for factor 3 also found that the larger the size of the district the responding directors were from, the less the employees felt confident about food safety. This may be due to the fact that school foodservice directors in larger districts have a greater pool of employees to choose from for their foodservice positions. Therefore, employees in the larger districts may feel they have less job security and can be readily replaced if they do not pass the food safety certification exam or follow food safety procedures. Further, employees from larger districts may be less confident about taking the food safety certification exam because these school foodservice directors place greater importance on passing it. Directors from the larger districts may place more emphasis on the certification exam because the consequence of a foodborne illness in their district has greater implications.

The fact that younger school foodservice directors' face more challenges with implementing food safety procedures is consistent with the literature. According to Zuckerman (1988) a shortage of qualified foodservice employees makes following and monitoring food safety practices more difficult today. Further, the responsibility for ensuring food

safety is now falling into the hands of employees who are younger, less experienced, and less motivated than past employees.

Lipowski (1999) also reported similar findings. With the increase of retiring school foodservice directors, it was estimated that 31 new directors were needed in each state by the year 2000. However, qualified potential directors who are willing to fill these positions are not readily available. Given this situation, future directors will have to fill these positions much sooner than they may be prepared for or expect.

#### Relationship Between Attitudes and Demographic Characteristics of Respondents

The multiple regression analysis for factor 2, HACCP disadvantages, revealed that as the food safety certification of the directors decreased, the more the directors agreed that time and money were disadvantages to implementing a HACCP program in their district. This may be due to the fact that the responding directors who have not bought into the certification program will probably also have not bought into a HACCP program. These directors may believe that spending additional time and money on a HACCP program will not improve food safety in their district. Further, they may believe that their district is doing well in terms of food safety and spending additional time and money on a structured food safety program will be a waste of resources. Also, claiming that HACCP is too time

consuming and too costly to implement may be an excuse for directors who simply do not want to take the time to develop a HACCP program. Finally, the district may not have the funds needed to support developing and implementing a HACCP program.

The multiple regression analysis for factor 3, certification advantages, revealed that as the age of the directors decreased, the more the director's agreed that improved food handling practices were an advantage of employee certification. This may be due to the fact that younger directors may have received an education in food safety through a dietetics or foodservice curriculum and place greater emphasis on food safety. Also, they may have been taught through this curriculum that the goal of certification is to improve safe food handling practices, therefore, these directors are more likely to have bought into the certification process. Further, this response may not be from personal experience in their district but from secondary sources.

The multiple regression analysis for factor 3 also found that as the certification of the directors decreased, the more the directors agreed that improved food handling practices were an advantage of employee certification. The directors responding to this statement may be purely speculating about the advantages of certification since they may not have a food safety certification themselves and, therefore, may be unfamiliar with the certification process. They may or may not be responding to this

statement based on personal experience in their district. These directors may have heard about the certification process and its advantages from peers or organizations such as the National Restaurant Association and are responding to the statement based on secondary sources. If the directors themselves are not certified in food safety, this suggests that they may not have truly bought into the certification process.

The multiple regression analysis for factor 5, certification disadvantages, revealed that as the certification of the directors decreased, the more the directors agreed that time and money were disadvantages to employee certification. As with the HACCP disadvantages, this may be due to the fact that the less the school foodservice directors are certified, the less they value the certification of employees. Further, they may believe that certification of employees in the past has not improved their food safety practices. Therefore, the directors may be using the excuse of time and money as a means to not re-certify employees.

The multiple regression analysis for factor 5 also found that as the certification of the directors decreased, the more they agreed that a lack of improved employee food handling practices was a disadvantage to employee certification. This is contradictory to what the school foodservice directors responded in factor 3 in which they agreed that certification of employees had improved food handling practices. This contradiction may be due to the fact that although the school foodservice directors know that

food safety certification is supposed to improve employee food handling practices, they do not want to take the time or incur the expense of certifying employees. Therefore, claiming that certification of employees has not improved food safety in their district gives the directors an excuse not to re-certify employees.

For factor 5, the correlation coefficient was weak ( $r = 0.65$ ). Further, question six on the attitude scale did not load strongly onto factor 5 (Appendix Table 2). Due to the descriptive nature of this research and that it was intended to collect baseline data only, the statistical analysis presented is appropriate for this research study. However, care must be taken in the interpretation of factor 5 due to the moderate correlation between the items that comprised this factor.

## Food Safety Practices

### Food Handling Practices Employed in School Kitchens

Although many of the food handling practices observed during the food safety audit were performed correctly, areas needing additional attention were observed. Food handling abuses were observed with time and temperature control in terms of lack of available thermometers, inadequate temperature taking procedures, improper hand washing procedures, and lack of refrigerating food items between preparation steps.

Sawyer (1991) found similar food safety abuses. Foods were left without being refrigerated for extended amounts of time and food thermometers were not supplied in the foodservice facilities. Richards et al. (1993) found abuses related to improper re-heating and refrigeration of ham rolls in elementary schools with a centralized foodservice system. One hundred of the 600 children who consumed the school lunch became ill due to the ham rolls being contaminated with *S. aureus*. Brown et al. (1982) and Kim and Shanklin (1999) found foods were left out for extended periods of time between preparation and transportation. Also, many of the entrees showed inadequate hot holding temperatures. Further, Ali et al. (1996) and Kim and Shanklin (1999) found food safety abuses with holding foods at room temperature and preparing foods long before they were consumed.

Abuses also were observed with food preparation and service in terms of touching food items with unclean hands, inadequate changing of gloves, and lack of the use of sneeze guards during service. Brown et al. (1982), Richards et al. (1993), and Ali et al. (1996) found abuses with food preparation in terms of prolonged handling of food items and physical touching of food items with unclean hands. Gilmore et al. (1998) found that gloves were changed as needed only 50% of the time in their study. Raccach et al. (1985) found that sneeze guards were not used on the service line during their observation of a school foodservice kitchen.

As far as storage, foods were generally not labeled and dated. Also, food items were frequently not covered to protect them from contamination and they were often found stored on the floor. Raccach et al. (1985) found differing results during their school kitchen observation. Foods were stored under appropriate refrigeration and freezer storage conditions and were rotated on a "first in first out" basis. Stored foods also were covered to protect from overhead contamination.

In terms of employee hygiene practices, employees were observed either not washing their hands or using the incorrect procedure to wash their hands. Also, employees consistently did not use hair restraints and frequently ate or drank in the food production area.

Brown et al. (1982) found similar food safety abuses in that eating and drinking during food preparation was observed among employees as well as improper hand washing. However, hand washing facilities were available in most of the school kitchens. Gilmore et al. (1998) found food safety abuses in four school districts audited. Hair restraints were not properly worn and hand washing was not routinely performed. Sawyer (1991) observed employees preparing foods without washing their hand and hand washing articles were absent in many of the convenience stores studied. Further, Raccach et al. (1985) found that employees did a large amount of handling during food preparation. Employees used bare hands

to prepare foods and only two employees used gloves; no hair restraints were used.

In regard to cleaning utensils, equipment, and the facility, abuses were observed in the lack of sanitizing food contact surfaces after they were cleaned. Further, employees never used test strips to check the sanitizer concentration. Also, employees often used improper hand dishwashing techniques. This could be due to the fact that the dishes cleaned consisted of the sheet pans used to re-heat food items and the employees may have felt that these dishes did not require sanitizing because raw foods were not cooked on them. Gilmore et al. (1998) found similar results in that sanitizing of small equipment and surfaces was performed inconsistently. Raccach et al. (1985) found that employees cleaned cooking equipment but did not sanitize the equipment.

Motivation may explain why many safe food handling procedures were not followed. The employees may feel that a foodborne illness outbreak has not occurred in their district, so why do the current food handling practices need to change. Further, no one may be monitoring their foods handling practices, including the manager certified in food safety, so food safety procedures may not be perceived as important. Unless someone is continually emphasizing the importance of food safety procedures to the employees, food safety will simply become a concept to them.

This idea of food safety as a concept may be the other issue as to why employees do not follow many of the appropriate food handling practices. Although the employees appear to be aware of these procedures, they may not understand how they directly apply to their foodservice situation. Many of the prepared foods they work with are wrapped. This may give the employees the impression that because these foods are pre-cooked and wrapped they are safe. Therefore, taking food temperatures is not necessary. This theory may also apply to hand washing procedures; because the foods are wrapped, hand washing may be perceived as unnecessary. This belief may then invade food preparation where unwrapped or raw foods are prepared. Finally, this thought process may impact other safe food handling practices such as sanitizing counters and dishes. However, this thought process can prove dangerous since many of the foods used in school kitchens are considered potentially hazardous such as chicken nuggets, cheese and bean burritos, pepperoni pizza and others.

In observing the food handling practices within the school kitchens, a lack of knowledge did not appear to contribute to poor food handling practices. When the researcher visited the kitchens to conduct the audits, the employees could tell the researcher the correct temperature pre-prepared foods needed to be re-heated to and why. Also, on the walls of the kitchens were displayed the certificates of completion for the food safety

certification courses taken by the managers. Further, charts displaying the correct procedures for hand washing and food safety temperatures were posted in the kitchens. Further, time to follow food safety procedures did not appear to be an issue. All three observers noted that although the employees were busy, they were not so busy that time could not have been taken to monitor temperatures or wash their hands correctly.

Certain discrepancies between the results from the questionnaire and the food safety audit results emerged. School foodservice directors responding to the questionnaire were neutral on the statement that food safety procedures have become routine for employees. They were not sure if this issue was a problem in their district. However, according to the food safety audits, food safety procedures have not become routine for employees. Many food safety procedures were not observed being practiced by the school foodservice employees in several or all of the school kitchens. This discrepancy could be due to the fact that school foodservice directors may not know if improper food handling practices are occurring in their school kitchens because they are not monitoring their kitchens routinely. However, when the researcher contacted the school foodservice directors about auditing the food handling practices in their school kitchens, the directors who agreed knew there were problems in their district and wanted the audits conducted to identify problem areas so they could address them. Finally, this contradiction may be because the

directors responding to the questionnaire are not acknowledging there are food safety problems in their district or they are responding honestly and their employees do follow food safety procedures routinely.

The directors also responded that employees are motivated about food safety and care about food safety issues; these challenges were not a problem in their districts. During the food safety audits, however, employees did not follow many food safety procedures even though it appeared they had enough time to do so. Further, lack of food safety knowledge did not appear to be an explanation for employees not following food safety procedures. This discrepancy could be due to the fact that employees are not motivated about food safety and do not care a lot about these issues. This contradiction may also be because employees do not fully understand the risks of not following food safety procedures routinely, although the directors responding to the questionnaire stated this also was not a problem in their district. Finally, this contradiction may be due to the fact that the directors did not respond to the questionnaire accurately or they did answer the questionnaire accurately and their employees truly are motivated about and interested in food safety.

The directors also agreed that food safety certification of employees had improved the food handling practices in their kitchens. It was noted during the audits that the managers in each of the kitchens was certified in food safety. However, this certification did not lead to improved food

handling practices among employees. Again, the directors may not know that there are food safety problems in their district because they are not monitoring the school kitchens. Although the directors also agreed that monitoring food safety was an important part of their job, they may not have the time or help to monitor food safety. Further, the directors may believe they do not need to monitor food safety because they have employees certified in food safety. Therefore, they may believe they have done their part to ensure food safety in their district and their responsibility is complete. This contradiction may also be due to the fact that the directors are not responding accurately to the questionnaire or they may be responding accurately and certification of employees has improved the food handling practices in their district.

Finally, the directors responding to the questionnaire agreed that a HACCP monitoring system is important for maintaining an effective food safety system. However, HACCP did not appear to be established in any of the kitchens audited and monitoring procedures were often not followed such as taking temperatures of food items and keeping temperature logs. Although the directors may believe HACCP is a good concept, they may not have the resources to implement a HACCP program or an understanding of what HACCP is and how to implement a HACCP program.

## Conclusions

The results from the questionnaire suggest that school foodservice directors do not perceive the challenges to implementing food safety and HACCP programs as real problems in their district as identified by the focus group. The responding directors believed the challenges were not a problem in their district or were unsure if these challenges presented food safety problems. However, younger school foodservice directors as well as more educated school foodservice directors did perceive these challenges as more of a problem than older and less educated directors.

The results from the questionnaire also suggest that school foodservice directors who were less often certified in food safety were in more agreement with the disadvantages to implementing HACCP procedures as well as the disadvantages to certifying employees in food safety. Further, directors who were less often certified in food safety as well as younger school foodservice directors were in more agreement with the advantages of employee certification.

Caution must be taken in interpreting the results from the questionnaire data due to several limitations in this phase of the research. First, the school foodservice directors were unclear about many challenges as being problems in their district and, generally, indicated their districts did not have any major food safety challenges. The honesty and knowledge of the directors regarding the food safety challenges in their district may be

questionable. Second, the attitude of the school foodservice director while completing the questionnaire may have affected the responses. If the director felt inconvenienced by filling out the questionnaire or intimidated by completing it, their responses may not accurately reflect their perceptions of food safety issues. Third, the challenges section of the questionnaire was based on five participants from one region of the country, Silicon Valley, during one focus group. Fourth, the respondents to the questionnaire were largely older school foodservice directors which may have biased the results of the questionnaire. Finally, the low correlation between the two items that comprise factor 5 on the attitude scale limits the reliability of interpreting this factor.

The results from the food safety audits suggest that, although some food safety procedures were followed correctly, improvements in food handling practices among foodservice employees are needed. The lack of routinely following food safety procedures appears to be due to a lack of employee motivation to follow food safety procedures or a lack of understanding among employees the significance of following these procedures or how they apply to their foodservice situation.

In conducting the food safety audits, some limitations exist. The results from the audits can only be generalized to the 15 schools in Silicon Valley, CA because the sample selected for conducting the audits was a convenience sample. Further, employee food safety behavior may have

changed while conducting the audits due to the fact that someone was observing their behavior. Also, the researcher and two trained observers conducted the audits. Therefore, subjectivity in interpreting food safety practices among employees may have occurred.

In terms of the research objectives, not all of the objectives were fulfilled. For the focus group, the objectives were partially met. A focus group was conducted with school foodservice directors from Silicon Valley and a list of challenges to implementing food safety and HACCP procedures in school kitchens was developed. Further, this list was incorporated into the challenges section of the questionnaire. However, the focus group was conducted one time with school foodservice directors from one region of the country. Therefore, the relevance of the challenges list to the directors in the rest of the country is questionable.

For the challenges section of the questionnaire, the objectives were partially fulfilled. The responding directors did not identify any of these challenges as a relevant problem in their district. Therefore, the challenges section of the questionnaire did not fulfill the intended objective of identifying the challenges to implementing food safety and HACCP procedures in school kitchens. However, the comments section of the questionnaire, "I could improve food safety in my district if..." did identify challenges to implementing food safety and HACCP procedures on a

national level. Therefore, through these comments, the objectives were partially fulfilled.

For the attitude section of the questionnaire, the objective of determining the attitude of school foodservice directors toward food safety and HACCP programs may not have been fulfilled. The directors responding to the questionnaire positively agreed that food safety certification and HACCP programs were beneficial to improving employee food safety practices in their district. However, it is possible that the directors were responding based on social acceptability and not their true attitude.

For the food safety audits, the objective of determining what food handling practices are employed in school kitchens was met. The researcher and two observers were able to audit the school kitchens without the employees appearing to change their food safety practices. Also, the researcher and the two observers found similar food safety abuses in all 15 school kitchens. Further, the audit form was based on food safety code specific to California, the state in which the food safety audits were conducted. Therefore, the objectives of the food safety audits were met, but the results are only applicable to the 15 school kitchens audited.

## Recommendations for Future Research

This research project was descriptive in nature and intended to collect baseline data. The results from the questionnaire found that school foodservice directors who were younger and more educated encountered more challenges within the school foodservice operation. Also, directors from larger school districts perceived their employees to be less confident with their food safety knowledge and with taking the certification examination. Additionally, directors who were less often certified were in more agreement with the disadvantages to implementing a HACCP program and certifying employees. Further, directors who were less often certified and who were younger were in more agreement with the advantages to certifying employees in food safety. Based on the results from this research, hypotheses can be developed and tested to determine the impact of challenges on school foodservice directors at various age and educational stages as well as district sizes. Also, hypotheses can be developed and tested to determine the impact of HACCP disadvantages as well as certification advantages and disadvantages on school foodservice directors at various age and certification levels. Further, additional focus groups in other regions of the country should be conducted to determine if additional challenges to implementing food safety and HACCP procedures are identified.

For factor 5 on the attitude scale, additional questions could be included in the factor to increase the correlation coefficient. Also, the two items that comprised factor 5 could be separated into two factors and questions added to increase the correlation coefficient of each factor.

For the food safety audits, further audits need to be conducted to refine the food safety audit from for potential use by school foodservice professionals. In addition, further research should be conducted to determine the attitudes and knowledge of school foodservice professionals towards food safety practices.

### Recommendations for School Foodservice

Based on the results from the questionnaire, younger school foodservice directors need assistance in handling the challenges encountered in the school foodservice industry. Courses specifically geared for new directors' need to be developed to provide these directors with information on managing and leading employees, how to manage their foodservice operation, and provide information on resources available to assist these directors with their daily operations. Food safety in relation to the previous issues would be included in these courses. In addition, mentoring of younger school foodservice directors by more experienced directors through networking at conferences, telephone calls, and other means would serve as a reference and support system for these directors.

Further, information about HACCP needs to be better disseminated to school foodservice directors. The majority of directors did not have a HACCP program in place and many were unsure of what it was or how to apply HACCP principles to their operation. Information could be provided from an agency such as the state department or the National Food Service Management Institute (NFSMI) and courses provided about HACCP specifically tailored to the school foodservice industry.

For the food safety audits, school foodservice directors need to ensure that monitoring of food handling procedures in school kitchens is conducted. Further, the directors must emphasize the importance and rationale for following these procedures to their employees. In addition, food safety courses specific to the needs of school foodservice could be developed. A food safety regimen of consistent monitoring and training is needed to help motivate employees to follow food safety procedures and to improve the food handling practices in their districts.

## BIBLIOGRAPHY

- Ali, A.A., & Spencer, N.J. (1996). Hazard analysis and critical control point evaluation of school food programs in Bahrain. *Journal of Food Protection*, 59, (3) 282-286.
- Alysworth, J. (1988). Tackling food safety concerns. *Western Fruit Grower*, 108, (10) 12-14.
- American Dietetic Association. 1997. Position of the American Dietetic Association: Food and water safety. *Journal of the American Dietetic Association*, 97, 184-189.
- American Food Safety Institute. Facts about food management certification (FMC). Retrieved May 7, 2000 from the World Wide Web: <http://www.americanfoodsafety.com/facts.html>.
- American School Foodservice Association. (1999<sup>a</sup>). About ASFSA. Retrieved March 27, 2000 from the World Wide Web: <http://www.asfsa.org/about/>.
- American School Foodservice Association. (1999<sup>b</sup>). Membership categories. Retrieved March 10, 2000 from the World Wide Web: <http://www.asfsa.org/member/categories.html>.
- American School Foodservice Association. (1999<sup>c</sup>). How safe is school food? Retrieved February 16, 2000 from the World Wide Web: <http://asfsa.org/nutrition/foodsafety/schoolfood.html>.
- Brown, N.E., McKinley, M.M., Aryan, K.L., & Hotzler, B.L. (1982). Conditions, procedures, and practices affecting safety of food in 10 school foodservice systems with satellites. *School Food Service Research Review*, 6, 36-41.
- Bryan F.L. (1990). Hazard Analysis Critical Control Point (HACCP) systems for retail and restaurant operations. *Journal of Food Protection*, 53, 978-983.
- Byran, F.L. (1982). Diseases transmitted by foods. Atlanta, GA: Centers for Disease Control and Prevention.

- California Association of Environmental Health Administrators. (2000). *California Uniform Retail Food Facilities Law (CURFFL)*. Sacramento, CA: California Association of Environmental Health Administrators.
- California Department of Education, Nutrition Services Division. (1999). *Nutrition Services Division Management Bulletin. No. 99-813*. Sacramento, CA: California Department of Education.
- Cochran-Yantis, D., Belo, P., Giampaoli, J., McProud, L., Everly, V., & Gans, J. (1996). Attitudes and knowledge of food safety among Santa Clara County, California restaurant operators. *Journal of Foodservice Systems, 9*, (2) 117-128.
- Connors, P., Bednar, C., Imhran, V., & Czajka-Narins, D. (1999). Evaluation of milk handling practices in public elementary schools results in HACCP model development. *Journal of Child Nutrition and Management, 23*, 101-105.
- Custer, M.J. (1989). The challenge of sanitation. *Food Management, 24* (4), 56.
- deWit, J.C., & Kapelmacher, E.H. (1984). Some aspects of bacterial contamination of hands of workers in foodservice establishments. *Journal of Bacteriology and Hygiene, 186*, (1) 9-12.
- Ecolab. (1996). Personal Communication to Peter Snyder. Ecolab: St. Paul, MN.
- Educational Foundation of the National Restaurant Association. (1999). *ServSafe Coursebook*. Chicago, IL., National Restaurant Association.
- Emery, H.C. (1990). Changing poor hand washing habits-A continuing challenge for sanitarians. *Dairy, Food, and Environmental Sanitation, 10*, (1) 8-9.
- Food and Drug Administration, United States Department of Agriculture, Environmental Protection Agency, & Centers for Disease Control and Prevention. (1997, May). Food safety from farm to table: A national food safety initiative. Report to the President, May, 1997. Retrieved March 5, 2000 from the World Wide Web: <http://vm.cfsan.fda.gov/~dms/fsreport.html>.

- Food and Drug Administration, United States Department of Agriculture, & National Advisory Committee on Microbiological Criteria for Foods. (1997, August). Hazard Analysis and Critical Control Point principles and application guidelines. Retrieved March 5, 2000 from the World Wide Web: <http://vm.cfsan.fda.gov/~comm/nacmcfp.html>.
- Food and Drug Administration. (1998). Managing food safety: A HACCP principles guide for operators of food establishments at the retail level. Retrieved April 24, 2000 from the World Wide Web: <http://vm.cfsan.fda.gov/~dms/hret-1.html>.
- Food and Drug Administration. (1999). Annex 5: HACCP guidelines. *Food Code*. Retrieved March 6, 2000 from the World Wide Web: <http://vm.cfsan.fda.gov/~dms/fc99-a5.html>
- Food and Drug Administration. (1999, February). Critical steps toward safer seafood. *FDA Consumer*. Publication No. (FDA) 99-23-2317. Retrieved March 5, 2000 from the World Wide Web: <http://vm.cfsan.fda.gov/~dms/fdsafe3.html>.
- General Accounting Office. (2000, February). School meal programs. Few outbreaks of foodborne illness reported. Retrieved April 25, 2000 from the World Wide Web: <http://schoolmeals.nal.usda.gov:8001/safety/GAO-RC053.pdf>.
- Gilmore, S.A., Brown, N.E., & Dana, J.T. (1998). A food quality model for school foodservices. *Journal of Child Nutrition and Management*, 22, 33-39. Green, C.G., & Frame, C.J. (1998). Testing training. *School Foodservice & Nutrition*, 52 (9), 77-82.
- Holdt, C.S. (1992). Attitudes and knowledge of university foodservice managers toward sanitation. *NACUFS Journal*, 16, 17-24.
- Howes, M., McEwen, S., Griffith, M., & Harris, L. (1996). Food handler certification by home study: Measuring changes in knowledge and behavior. *Dairy, Food, and Environmental Sanitation*, 16, 737-744.
- International Food and Information Council. (1999). Hazards at the plate. Children and food safety risk. Retrieved March 14, 2000 from the World Wide Web: <http://ifinfo.health.org/insight/childfsr.htm>.

- Kim, T., & Shanklin, C.W. (1999). Time and temperature analysis of a school lunch meal prepared in a commissary with conventional versus cook-chill systems. *Foodservice Research International*, 11, 237-249.
- King, P. (1992). Implementing a HACCP Program. *Food Management*, 27 (5), 58.
- Kneller, P., & Bierma, T. (1990). Food service certification: Measuring the effectiveness of a state program. *Journal of Environmental Health*, 52, (5) 292-294.
- Krueger, R.A. (1994). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage Publications.
- Krueger, R.A. (1998). *Developing questions for focus groups*. Thousand Oaks, CA: Sage Publications.
- Lipowski, M. (1999). The age of wave—who will replace today's retiring food service directors. *Food Management*, 34 (2), 34-38.
- Lydecker, T. (1993). Motivating f/s workers to wash their hands. *Food Service Director*, 6 (1), 148.
- Mead, P.S., Slutsker, L., Dietz, V., McCaig, L.F., Bresee, J.S., Shapiro, C., Griffin, P.M., & Tauxe, R.V. (1999, September). Food-related illness and death in the United States. Center for Disease Control and Prevention *Emerging Infectious Diseases*, 5, (5), 1-38. Retrieved March 5, 2000 from the World Wide Web: <http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm>.
- Metts, A. & Rodman, V. (1993). Improving inspection scores through training/certification of foodservice workers. *Dairy, Food, and Environmental Sanitation*, 13, 450-453.
- Neill, C. (1980). Safe-n-sensible food safety. *School Foodservice Journal*, 34 (7), 44-46.
- Neumann, R. (1998). The eight most frequent causes of foodborne illness. *Food Management*, 33 (6), 28.

- Ohio Hunger Task Force. (1999). National School Lunch Program (NSLP). Retrieved March 23, 2000 from the World Wide Web: <http://ww.ohtf.org/NSLP.htm>.
- Partnership for Food Safety Education. (1999). Foodborne illness: A constant challenge. Food safety glossary. Retrieved March 5, 2000 from the World Wide Web: <http://www.fightbac.org/fbi/glossary.htm>.
- Penninger, H.K., & Rodman, V.A. (1984). Foodservice managerial certification: How effective has it been? *Dairy and Food Sanitation*, 4 (7), 260-264.
- Raccach, M., Morrison, M.R., & Farrier, C.E. (1985). The school food service operation: An analysis of health hazards. *Dairy and Food Sanitation*, 5 (11), 420-426.
- Reed, G.H. (1993). Safe food handling of potentially hazardous foods (PHF)-A check list. *Dairy, Food, and Environmental Sanitation*, 13, 208-209.
- Richards, M.S., Rittman, M., Gilbert, T.T., Opal, S.M., DeBuono, B.A., Neill, R.J., & Gemski, P. (1993). Investigation of a staphylococcal food poisoning outbreak in a centralized school lunch program. *Public Health Reports*, 108, 765-771.
- Roefs, V.I. (2000). Catching up on food safety. *Poppyseeds*, 44 (2), 12-14.
- Salant, P., & Dillman, D.A. (1994). *How to conduct your own survey*. New York, NY: John Wiley & Sons, Inc.
- Sawyer, C.A. (1991). Safety issues related to use of take-out food. *Journal of Foodservice Systems*, 6, 41-59.
- Sneed, J., & White, K.T. (1993). Continuing education needs of school level managers in child nutrition programs. *School Food Service Research Review*, 17, 103-108.
- Snyder, O.P., & Poland, D.M. (1990). America's safe food. *Dairy, Food, and Environmental Sanitation*, 10, (12) 719-724.
- Speer, S.C., & Kane, B.E. (1990). Certification for foodservice managers: A survey of current opinion. *Journal of Food Protection*, 53, 269-274.

Toh, P.S., & Birchenough, A. (2000). Food safety knowledge and attitudes: culture and environment impact on hawkers in Malaysia. Knowledge and attitudes are key attributes of concern in hawker food handling practices and outbreaks of food poisoning and their prevention. *Food Control*, 11, (6) 447-452.

United States Department of Agriculture, Department of Health and Human Services, Environmental Protection Agency, & Department of Commerce. (1999). President's Council on Food Safety. Retrieved March 10, 2000 from the World Wide Web:  
<http://www.foodsafety.gov/~fsg/cwelcome.html/>.

United States Department of Agriculture, Economic Research Service. (1999, September). Promoting Food Safety: An Economic Appraisal. Retrieved March 16, 2000 from the World Wide Web:  
<http://www.econ.ag.gov/epubs/pdf/foodrevw/may99/contents.html>.

United States Department of Agriculture Food and Nutrition Service. (1999). School Breakfast Program-Frequently asked questions. Retrieved March 23, 2000 from the World Wide Web:  
<http://www.fns.usda.gov/cnd/Breakfast/AboutBFast/faqs.htm>.

United States Department of Health and Human Services. (1999). *Food Code*. Springfield, VA: Department of Commerce.

Wolf, I.D. (1992). Critical issues in food safety, 1991-2000. *Food Technology*, 46 (1), 64-70.

Wright, J., & Feun, L. (1986). Certification: An evaluation of its impact. *Journal of Environmental Health*, 49, 1.

Zuckerman, D. (1988). Food safety: the cutting edge. *Food Management*, 23, (12) 91-101.

## APPENDICES

APPENDIX A

SAFE FOOD HANDLING PRACTICES FOR POTENTIALLY HAZARDOUS  
FOODS  
(adopted from Reed, 1993)

## SAFE FOOD HANDLING PRACTICES FOR POTENTIALLY HAZARDOUS FOODS

- Verify that the PHF is from safe and approved sources.
- Check incoming PHF for proper temperature, signs of spoilage, sound condition, expiration dates, proper labeling.
- Do not accept products of questionable integrity (example: swelled or damaged cans).
- Maintain a regular stock rotation program to ensure use before expiration.
- Refrigerate PHF at or below 41 degrees F until ready to use; store in chillable quantities (shallow pans with food no more than 2" in depth); loosely cover PHF until it cools below 41 degrees F to allow sufficient air flow to the surface of the food; avoid double stacking of storage containers.
- Store frozen PHF at or below 0 degrees F.
- Thaw frozen PHF properly to prevent a rise in surface temperature above 41 degrees F; DO NOT thaw at room temperature.
- Exclude from work food handlers with illnesses transmissible by food, carriers of such illnesses, and those with boils, cuts, and infected wounds. Persons with diarrhea, sore throat, and sneezing/coughing should stay at home or go home.

- Verify that workers practice good personal hygiene habits; handling of food minimized; hands washed as frequently (and effectively) as necessary; careless hand habits controlled.
- Minimize potential for cross-contamination of PHF by reviewing work practices to eliminate problems via workers' hands, food-contact surfaces (counters), cutting boards, utensils, cleaning cloths (DO NOT use sponges), or equipment.
- Insure proper cleaning and sanitizing of surfaces and equipment.
- Prepare PHF as close to serving time as possible.
- Cook PHF to internal temperatures required to kill pathogenic agents; give special attention in cooking eggs and egg-containing items until firm (not runny) or use a commercially pasteurized egg product.
- DO NOT hold PHF at room temperature more than 2 hours, cumulatively (during preparation time).
- Cool hot PHF to 41 degrees F within four hours of cooking.  
(Alternatively, cool cooked foods to 70 degrees F within two hours, and then chill to 41 degrees F within four hours).
- When using PHF as ingredients, be sure to keep PHF refrigerated (chilled) until ready to use; especially pertinent when preparing meat, poultry, egg, or seafood salad.
- Rapidly reheat refrigerated pre-prepared or leftover PHF to at least 165 degrees F throughout before transferring to hot holding equipment.

- Hold hot PHF at 140 degrees F or above until served.
- Protect PHF from contamination by poisonous or toxic substances as a result of carelessness, improper storage, mistaking these chemicals for food ingredients, or accidents.
- Protect PHF from contamination by pests.
- Thermometers in place or available to verify holding temperatures (hot, cold) of food products.
- DO NOT re-serve unwrapped foods, especially PHF.
- SALAD BAR: PHF displayed, protected properly and temperature monitored; PHF discarded after operation ceases, not returned to storage for later re-use.

**APPENDIX B**

**OREGON STATE UNIVERSITY,  
INSTITUTIONAL REVIEW BOARD,  
LETTERS OF APPROVAL TO CONDUCT RESEARCH**

RESEARCH OFFICE



OREGON  
STATE  
UNIVERSITY

Administration Building  
Corvallis, Oregon  
97331-2140

Telephone  
541-737-8008  
Fax  
541-737-3093  
INTERNET  
laura.lincoln@orst.edu

July 17, 2000

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Committee for the Protection of Human Subjects and the U.S. Department of Health and Human Services.

Principal Investigator(s): Mary Cluskey

Student's Name (if any): Joan Giampaoli

Department: Nutrition and Food Management

Source of Funding: ASFSA

Project Title: Food Safety and HACCP in School Foodservice  
(Focus Group)

Comments:

**This approval is valid for one year from the date of this letter.** A copy of this information will be provided to the Committee for the Protection of Human Subjects. If questions arise, you may be contacted further.

Sincerely,

Laura K. Lincoln  
IRB Coordinator

cc: CPHS Chair

RESEARCH OFFICE

October 23, 2000

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Institutional Review Board (IRB) and the U.S. Department of Health and Human Services.



OREGON  
STATE  
UNIVERSITY

Administration Building  
Corvallis, Oregon  
97331-2140

Principal Investigator(s): Mary Cluskey

Student's Name (if any): Joan Giampaoli

Department: Nutrition and Food Management

Source of Funding: ASFSA

Project Title: Food Safety and Hazard Analysis and Critical Control Point (HACCP) in School Foodservice (Questionnaire)

Comments:

**This approval is valid for one year from the date of this letter. A copy of this information will be provided to the Institutional Review Board. If questions arise, you may be contacted further.**

Sincerely,

A handwritten signature in cursive script that reads "Laura K. Lincoln".

Laura K. Lincoln  
IRB Coordinator

cc: IRB Chair

Telephone  
541-737-3437  
Fax  
541-737-3093  
IRB@orst.edu

SEARCH OFFICE

December 8, 2000



**OREGON  
STATE  
UNIVERSITY**

Administration Building  
Corvallis, Oregon  
97331-2140

Telephone  
541-737-3437  
Fax  
541-737-3093  
IRB@orst.edu

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Institutional Review Board (IRB) and the U.S. Department of Health and Human Services.

Principal Investigator(s): Mary Cluskey

Student's Name (if any): Joan Giampaoli

Department: Nutrition and Food Management

Source of Funding: American School Foodservice Association

Project Title: Food Safety and Hazard Analysis and Critical Point (HACCP) in School Food Service (Food Safety Audit Survey)

Comments:

**This approval is valid for one year from the date of this letter.** A copy of this information will be provided to the Institutional Review Board. If questions arise, you may be contacted further.

Sincerely,

A handwritten signature in cursive script that reads "Laura K. Lincoln".

Laura K. Lincoln  
IRB Coordinator

cc: IRB Chair

**APPENDIX C**  
**COVER LETTERS TO RESEARCH PARTICIPANTS**

(ON OSU LETTERHEAD)

**Phase I Focus Group**

Date

Dear School Foodservice Director:

I am a doctoral student at Oregon State University. My doctoral research involves examining the barriers to implementing and maintaining food safety and HACCP procedures in school kitchens. As a school foodservice director in the Santa Clara County, CA area, you have been selected to participate in a focus group.

The purpose of this focus group is to determine the barriers to implementing food safety and HACCP procedures in school kitchens as perceived by school foodservice directors. The results from this study will provide beneficial information for developing a nationally mailed questionnaire to identify the knowledge and attitudes of school foodservice directors regarding food safety and HACCP.

As a school foodservice director, I am asking you to participate in this focus group to help in identifying the barriers mentioned above. I would appreciate if you would take approximately two hours of your time to participate in the focus group. Only a small group of school foodservice directors have been selected for this focus group, so your participation is vital to its' success. **The focus group will be held at my home which is 1294 Hanchett Avenue, San Jose (between Park Avenue and The Alameda). The time of the focus group will be July 26 from 8:30 am to 10:30 am.**

All data related to you obtained from this focus group will be strictly confidential. Data from this focus group will be collected through tape recording and will be used only for the purposes of this study. Upon transcription of the focus group data, the focus group tape will be erased of all information. Data reported from this focus group will contain no information that will allow identification of individual participants. Names of participants as well as school foodservice directors who choose not to participate in the focus group will not be revealed.

Your participation in this focus group is voluntary. You are free to refuse to take part in this focus group and you may withdraw from it at any time.

Again, let me emphasize that your participation in this focus group is critical to the success of my doctoral work. As a gesture of my appreciation, I will provide the focus group participants with a full breakfast and a summary of the focus group discussion results.

If you have any questions, please contact Joan Giampaoli at (408) 297-3576 or e-mail her at [jgiam@pacbell.net](mailto:jgiam@pacbell.net).

Enclosed, please find two letters of the focus group consent form. If you wish to participate in this focus group, please return a signed copy of this form to Joan Giampaoli at 1294 Hanchett Avenue, San Jose, CA 95126 or FAX the form to Joan Giampaoli at (408) 295-9485. The other copy is for you to keep for your records.

\*\*\*\*\*  
\*\*\*\*\*

I have read the above information and agree to take part in this focus group.

Participants' signature: \_\_\_\_\_

Date: \_\_\_\_\_

Thank you for your help. I appreciate you cooperation!

Sincerely,

Joan Giampaoli, MS, RD  
Doctoral Student  
Oregon State University

Mary M. Cluskey, PhD, RD  
Assistant Professor  
Oregon State University

**(ON OSU LETTERHEAD)****Phase I Questionnaire**

Date:

Dear School Foodservice Director:

You have been randomly selected to participate in a study to determine the challenges to implementing food safety and Hazard Analysis and Critical Control Point (HACCP) monitoring procedures in school kitchens. I would appreciate if you would take approximately 20 minutes to respond to the enclosed questionnaire. Only a small group of school foodservice directors have been selected to participate, so your response is vital to the success of this study.

All information obtained in this study will be strictly confidential. The information will be used only for the purposes of this study and will not allow identification of individual participants.

Your participation in this study is voluntary. You are free to refuse to take part or answer any questions. You may withdraw from this study at any time.

Enclosed, please find a small gift as a token of my appreciation for your participation in this study. Please return this questionnaire in the enclosed return envelope no later than December 11, 2000.

If you have any questions, please call Joan Giampaoli at (408) 297-3576 or e-mail me at [jgiam@pacbell.net](mailto:jgiam@pacbell.net).

Thank you for your assistance!

Sincerely,

Joan Giampaoli, MS, RD  
Doctoral Student  
Oregon State University

Mary M. Cluskey, PhD, RD  
Assistant Professor  
Oregon State University

**(ON OSU LETTERHEAD)****Phase II HACCP Audit**

Date:

Dear (Name):

You have been randomly selected to participate in an audit of food safety practices. The purpose of this study is to develop and test an audit form that can be used to identify the food safety procedures used in school kitchens. Once developed, this form can be used by school employees to ensure that food safety practices are followed.

All information obtained in this audit will be strictly confidential. The information gathered during this audit will be used only for the purposes of this study and will contain no information that will allow identification of individual participants. Further, all data collected will be reported as group data.

Your participation in this audit is voluntary. You are free to refuse to take part in this audit and you may withdraw from it at any time. We will choose three randomly selected schools from your district for the audits. The schools chosen need to have on-site kitchens. At the conclusion of the audit, a summary of results will be provided to the directors who agreed to participate.

If you have any questions, please contact Joan Giampaoli at (408) 297-3576 or e-mail me at [jgiam@pacbell.net](mailto:jgiam@pacbell.net).

If you wish to participate in this audit, please return a signed copy of this form to Joan Giampaoli at 1294 Hanchett Avenue, San Jose, CA 95126 or fax the form to me at (408) 295-9485 by December 15, 2000. The additional copy of this consent form is for you records.

.....  
I have read the above information and agree to take part in this food safety audit.

Participants' signature: \_\_\_\_\_

Date: \_\_\_\_\_

Thank you for your assistance!

Sincerely

Joan Giampaoli, MS, RD  
Doctoral Student  
Oregon State University

Mary M. Cluskey, PhD, RD  
Assistant Professor  
Oregon State University

APPENDIX D  
QUESTIONS DEVELOPED TO GUIDE  
THE FOCUS GROUP DISCUSSION

## FOCUS GROUP DISCUSSION QUESTIONS

### OPENING QUESTION

Tell us your name, place of employment, and one unique piece of information about yourself you would like the group to know.

### INTRODUCTORY QUESTIONS

When you hear the term food safety, what comes to mind?  
When you hear the term Hazard Analysis and Critical Control Point (HACCP), what comes to mind?

### TRANSITION QUESTIONS

Think about a time when you were implementing (a) food safety procedure(s) or (a) HACCP procedure(s). What were some of the challenges you faced? Take a few minutes to think about this situation and discuss it with the person next to you.

### KEY QUESTIONS

Tell me about the food safety procedures you tried to implement but discontinued; the changes you tried to make but were not successful.

What were some of the challenges or obstacles present that prevented successful implementation of these procedures or changes?

Why do you believe these factors posed a challenge?

What additional resources would potentially eliminate these challenges?

### ENDING QUESTION

Of all the challenges we discussed, which have the most impact on the success of your food safety and HACCP programs?

APPENDIX E  
QUESTIONNAIRE

**FOOD SAFETY AND HAZARD ANALYSIS AND CRITICAL CONTROL  
POINT  
PROGRAMS IN SCHOOL FOODSERVICE**



*Remember, all information provided is confidential!*

Department of Nutrition and Food Management  
Oregon State University  
Corvallis, Oregon

ID Number: \_\_\_\_\_

A variety of opinions exist among school foodservice directors about the effectiveness of food safety and Hazard Analysis and Critical Control Point (HACCP) programs. Please indicate the extent to which you agree or disagree with each of the following statements using the scale below:

1 = STRONGLY AGREE  
 3 = NEUTRAL  
 5 = STRONGLY DISAGREE

**Please circle your answer to each statement!**

		Strongly Agree			Strongly Disagree	
1.	Checking on food safety is an important part of my job.	1	2	3	4	5
2.	Learning more about food safety issues is worthwhile.	1	2	3	4	5
3.	Food safety certification of employees is a good way to make sure safe food is served.	1	2	3	4	5
4.	Food safety certification of employees has made the food handling practices in my facility better.	1	2	3	4	5
5.	The time and money required to certify employees have not increased food safety practices.	1	2	3	4	5
6.	Certification has not helped employees put safe food handling practices into effect.	1	2	3	4	5
7.	Employee in-service training is an important way to improve safe food handling practices among employees.	1	2	3	4	5
8.	The use of a HACCP monitoring system is too costly to implement.	1	2	3	4	5
9.	The use of a HACCP monitoring system is too time consuming to implement.	1	2	3	4	5

		Strongly Agree			Strongly Disagree	
10.	Creating and maintaining an effective HACCP monitoring system creates employee pride and self-esteem for a job well done.	1	2	3	4	5
11.	A HACCP monitoring system is important for maintaining an effective food safety system.	1	2	3	4	5

There are a variety of reasons why food safety procedures and HACCP monitoring systems may not be implemented and/or followed in a school district. Please indicate the degree to which each of the following is a problem in your school district using the scale below:

1 = NEVER A PROBLEM  
 3 = NEUTRAL  
 5 = ALWAYS A PROBLEM

**Please circle your answer to each statement!**

		Never a Problem			Always a Problem	
12.	Directors have little time to devote to food safety and HACCP monitoring system.	1	2	3	4	5
13.	Employees do not feel comfortable with change.	1	2	3	4	5
14.	Employees are not motivated about food safety issues.	1	2	3	4	5
15.	Employees do not care a lot about food safety issues.	1	2	3	4	5
16.	Employees are uncomfortable with food safety issues because of a lack of education in this area.	1	2	3	4	5
17.	Employees may feel uncomfortable with food safety issues due to language barriers.	1	2	3	4	5

		Never a Problem					Always a Problem				
		1	2	3	4	5	1	2	3	4	5
18.	Employees are nervous about taking the food safety certification exam.	1	2	3	4	5					
19.	Employees worry about losing their jobs if they fail the food safety certification exam.	1	2	3	4	5					
20.	There is a lack of support among employees to follow food safety and HACCP monitoring system procedures.	1	2	3	4	5					
21.	There is a lack of support from employees, particularly from an employee who is a respected leader to follow food safety procedures.	1	2	3	4	5					
22.	Employees need constant training and retraining in food safety issues.	1	2	3	4	5					
23.	There is a lack of support from the school district regarding food safety issues.	1	2	3	4	5					
24.	Employees do not recognize the food safety risks involved in not following food safety procedures.	1	2	3	4	5					
25.	Food safety and HACCP monitoring procedures have become routine for employees.	1	2	3	4	5					
26.	There are not enough employees trained in food safety to train other employees.	1	2	3	4	5					
27.	There is not adequate supervision to check that food safety procedures are followed.	1	2	3	4	5					
28.	The design of the facility places constraints on the extent food safety procedures can be developed.	1	2	3	4	5					
29.	There is not a standardized inspection process among sanitarians and county health departments.	1	2	3	4	5					
30.	There is not enough time available to offer sanitation/safety courses and in-services to employees.	1	2	3	4	5					

31. I could improve food safety in my school district if:

---

The following questions are for demographic purposes only. Please circle the appropriate response for each question.

32. What is your age?

- A. Under 25 years
- B. 25-35 years
- C. 36-45 years
- D. 46-55 years
- E. 56-65 years
- F. Over 65 years of age

33. What is your gender?

- A. Male
- B. Female

34. Which of the following best describes your education level?

- A. Less than high school
- B. High school
- C. Some college
- D. Bachelor's degree
- E. Graduate courses
- F. Graduate degree

35. How many years have you been employed in foodservice?

- A. 5 years or less
- B. 6-10 years
- C. 11-15 years
- D. 16-20 years
- E. 21-25 years
- F. Over 25 years

36. How many years have you been employed in school foodservice?

- A. 5 years or less
- B. 6-10 years
- C. 11-15 years
- D. 16-20 years
- E. 21-25 years
- F. Over 25 years

37. How many students are in your district? \_\_\_\_\_
38. What type of food production system is used in your school district?  
(circle all that apply)
- A. On-site
  - B. Base kitchen serving more than one school
  - C. Central bakery
  - D. Central kitchen
- If central kitchen, do you use:
- A. Bulk
  - B. Pre-plate
- Do you transport food:
- A. Hot
  - B. Chilled
  - C. Both
39. Do you have a food safety certification?
- A. NO
  - B. YES
- If yes, which one: \_\_\_\_\_
40. Are you currently utilizing a HACCP program/monitoring system in your district?
- A. NO
  - B. YES
41. Does your district have one or more employee(s) whose primary responsibility is implementing and monitoring food safety in foodservice production?
- A. NO
  - B. YES
- If yes, what is that (these) person(s)' title(s)? \_\_\_\_\_
42. During the past school year (1999-2000) did you provide employees an opportunity to attend a food safety certification program such as **ServSafe** or **Serving It Safe**?
- A. NO
  - B. YES

43. During the past school year (1999-2000) what in-service training related to food safety did you provide? **(Please list)**

<u>Topic</u>	<u>Length of Time</u>
_____	_____
_____	_____
_____	_____
_____	_____

Your comments will be appreciated, either here or in a separate envelope!

**THANK YOU FOR YOUR HELP!**

**Please return you completed questionnaire in the enclosed envelope to:  
JOAN GIAMPAOLI, MS, RD  
1294 Hanchett Avenue  
San Jose, CA 95126**

*If you would like a copy of the results of this study, please enclose a separate card or a business card with your address.*

APPENDIX F  
FOOD SAFTY AUDIT FORM

FOOD SAFETY AUDIT FORM

ID # \_\_\_\_\_

Evaluate the food safety procedures used in the school kitchen by checking one of the following criteria. **YES** means the procedure was correctly performed during the audit. **NO** means the procedure was incorrectly performed during the audit. **NOT APPLIED** means the procedure was not applied/applicable or not observed during the audit. The following statements provide the correct food safety procedures. Check each practice using the following scale:

Y = YES  
 N = NO  
 NA = NOT APPLIED

TIME/TEMPERATURE CONTROL

	Y	N	NA
1. Probe-type thermometers to monitor food temperatures are provided.	___	___	___
2. Employees take temperatures of re-heated foods.	___	___	___
3. Employees take internal temperatures of foods.	___	___	___
Temperatures were observed being taken:			
On the line		___	
During the cooking process		___	
During the pre-preparation process		___	
4. Employees refrigerate potentially hazardous foods (PHF's) between preparation steps.	___	___	___
5. Employees keep food temperature logs.	___	___	___
6. Approved methods are used for rapidly cooling PHFs such as size reduction, shallow pans, or ice bath.	___	___	___
7. Thermometers provided in or on refrigerator/freezer units.	___	___	___

FOOD PREPARATION/SERVICE

8. Appropriate utensils are used (tongs, scoops, plastic gloves) whenever possible to minimize hand contact with foods.	___	___	___
---	-----	-----	-----

		Y	N	NA
9.	Gloves are changed after soiling.	___	___	___
10.	Separate boards (ie. color coded boards) are used for PHF's and ready-to-eat foods items.	___	___	___
11.	Sneeze guards are used in food service areas.	___	___	___

### STORAGE

12.	Raw meats, poultry, and seafood are stored below ready-to-eat foods in refrigeration units.	___	___	___
13.	Food is covered to protect from overhead contamination.	___	___	___
14.	Food and beverages are stored at least 6" off the floor.	___	___	___
15.	Food is properly labeled and dated.	___	___	___
16.	Storage facilities are kept clean and in good order.	___	___	___
17.	Toxic materials are stored in an area separate from food, utensils, food equipment, or food contact surfaces.	___	___	___

### EMPLOYEES

18.	Employees wash hands after contaminating them.	___	___	___
19.	Hand-wash facilities are operable, accessible, and provided with approved soap and towels in dispensers.	___	___	___
20.	Employees are wearing clean clothes.	___	___	___
21.	Employees use hair restraints.	___	___	___
22.	Employees do not use tobacco in food preparation/storage/dishwashing areas.	___	___	___
23.	Employees do not eat or drink in food preparation/storage/dishwashing areas.	___	___	___

## UTENSILS/EQUIPMENT/FACILITY

	Y	N	NA
24. Food contact surfaces and utensils are cleaned and sanitized after each use.	___	___	___
25. Employees use test strips to check sanitizer concentration.	___	___	___
26. Employees use proper hand dishwashing technique (wash, rinse, sanitize, and air dry).	___	___	___
27. Equipment is kept clean, operable, and in good repair.	___	___	___
28. All utensils and containers are kept clean.	___	___	___
29. Floors are kept clean and in good repair.	___	___	___
30. Walls are kept clean and in good repair.	___	___	___
31. Ceilings are kept clean and in good repair.	___	___	___

**Remember to contact the manager of the school kitchen to ask these questions before or after conducting the food safety audit!**

32. How many years have you been employed in your current position? \_\_\_\_\_
33. How many years have you been employed in school foodservice? \_\_\_\_\_
34. How many lunch meals do you serve? \_\_\_\_\_

COMMENTS:

## APPENDIX G

### ADDITIONAL COMMENTS FROM THE OPEN-ENDED QUESTION ON THE QUESTIONNAIRE

### **Time/Money Issues**

I was not at the district at the time to know which employees received training (5 responses).

Time is the big issue for food safety training, but we do cover it on an ongoing basis.

There is no time for training.

Our district does not have in-service days.

Food safety is important, but money for training is not a priority. Food safety is a great concern, but implementing it depends on economics; a high turnover is financially draining for training employees. Also, employees are asked to do more in the same time and things get missed.

There are no district funds for training or purchasing of new equipment. However, all employees receive training.

Our biggest obstacle is time. Our staff is predominately stay at home moms who realize the importance of food safety because they are feeding their own children. However, they do not want to stay longer for additional training.

Time is the important part of which we do not have enough. It takes time and money to stay up with every new idea.

### **Food Safety Training Issues**

I didn't even know courses were available.

Provided hand-outs and discussed sanitation and food safety with others.

Staff does not go to seminars, only the director does.

Managers had the chance to attend the new Food Code and NRA course each year as well as having access to videos and workshops for self-training. This could then become part of the performance appraisal process.

Food safety has been, and is, a priority in our district.

You can have a food safety program without using HACCP or a certification program.

We plan to certify all cooks within the next two years.

We now have a new trainer position and will offer NRA yearly. All new employees will receive a sanitation course within the first month.

NRA will be taught to all employees in 2001.

All district employees are sent to state conference every three years, most go yearly.

Our workshops are quite costly to attend and there is little extra district money, so there is not much interest in keeping up food safety certification.

Assistant managers are responsible for giving food safety lessons to employees monthly.

We feel that our clients are important and we should use skill in food preparation.

We have a problem with checking cooling temperatures of leftovers since the employees leave immediately after lunch.

Mandatory certification seems to be another way for someone to fill their pockets. Mandatory self-reviewers would be less costly and as effective. Videos are also an excellent source for education.

I know we need to do a better job. We have little documentation and training; we need help.

We attend with our chapter as many workshops as we can and encourage our employees to attend.

We take temperatures at each site daily and documents are sent to the director monthly.

We try to attend as many classes as we can.

We need more press regarding food safety initiatives. We are viewed as the enemy when we try to make a policy change to the school.

It would be nice to have one standardized inspection for our state. Thanks for your help in this critical area.

All the foodservice employees take food safety and sanitation very seriously.

Most of our food safety and sanitation procedures are in the process of re-evaluation.

As a foodservice director, I know the importance of food safety. However, time, money, conflicts in scheduling, and a lack of staff development days present overwhelming obstacles.

Because of budget cuts, there are only two foodservice employees. It makes it hard for either of us to attend training. Also, there are no qualified substitutes as a replacement.

I give my staff release time to attend conferences and classes in the local area.

I feel the *ServSafe* and *Serving it Safe* programs are very beneficial to school foodservice.

Director should never be too busy to be concerned about food safety.

Time and making certification mandatory would help the employee make the connection better.

We need more help from the state and the school system on training the employees; the director can't do it all.

The employees take the temperatures at receiving, cooking, and serving. However, I don't require paperwork for this because I am afraid of a mutiny.

Each month, school foodservice PAC representatives visit each school, train new employees, and evaluate the kitchens. They address any problems seen and the director gets the reports monthly for follow-up.

### **HACCP Issues**

I don't know what HACCP is (6 responses).

We are moving towards implementing a HACCP plan. We have implemented a sanitation system which includes lab tests.

Prepared HACCP manuals are too costly and I do not have the time to do my own.

I am not familiar with HACCP. I strongly acknowledge the need for food safety monitoring and evaluation.

HACCP is an excellent concept, but time and money limit training for staff. We need a condensed version in video form to send home with the staff.

We need a short HACCP course for people already trained in food safety.

I believe HACCP principles are vital to school foodservice when working with potentially hazardous foods.

We take temperatures on all foods and keep records, but we do not have the money to support the hours it would take to train employees on a HACCP plan.

Sanitation is very important and comes first always, but HACCP is paperwork and that is what is hurting my job performance. With the daily pressures of the job, I can't keep up.

We have no HACCP procedures yet, but we are in the process of gathering data to develop guidelines.

We do not follow HACCP per se, but we are very concerned about proper sanitation.

**Appendix Table 1**Rotated factor matrix<sup>1</sup> for the three factors on the challenges scale

	Factor		
	1	2	3
Directors have little time to devote to food safety and HACCP monitoring systems issues due to the daily operational pressures.	0.518	0.150	0.239
Employees do not feel comfortable with change.	0.418	0.338	0.337
Employees are not motivated about food safety issues.	0.346	0.716	0.192
Employees do not care a lot about food safety issues.	0.159	0.846	9.966E-02
Employees are uncomfortable with food safety issues because of a lack of education in this area.	0.245	0.462	0.340
Employees may feel uncomfortable with food safety issues due to language barriers.	0.125	0.284	0.349
Employees are nervous about taking the food safety certification exam.	0.284	0.156	0.790
Employees worry about losing their jobs if they fail the food safety certification exam.	0.153	0.101	0.651
There is a lack of support from employees, particularly from an employee who is a respected leader to follow food safety procedures.	0.360	0.561	0.175
Employees need constant training and retraining in food safety issues.	0.524	0.295	0.286

**Appendix Table 1 ( Continued)**Rotated factor matrix<sup>1</sup> for the three factors on the challenges scale

	Factor		
	1	2	3
There is a lack of support from the school district regarding food safety issues.	0.395	0.280	9.966E-04
Employees do not recognize the food safety risks involved in not following food safety procedures.	0.489	0.517	0.201
Food safety and HACCP monitoring procedures have become routine for employees.	0.537	0.290	0.219
There are not enough employees trained in food safety to train other employees.	0.523	0.279	0.281
There is not adequate supervision to check that food safety procedures are followed.	0.711	0.344	0.136
The design of the facility places constraints on the extent food safety procedures can be developed.	0.574	0.183	0.104
There is not a standardized inspection process among sanitarians and county health departments.	0.495	0.136	0.162
There is not enough time available to offer sanitation-safety courses and in-services to employees.	0.571	0.121	0.353

<sup>1</sup>extraction method: principal axis factoring;  
rotation method: varimax with Kaiser Normalization

**Appendix Table 2**Rotated factor matrix<sup>1</sup> for the five factors on the attitude scale

	<b>Factor</b>				
	1	2	3	4	5
Checking on food safety is an important part of my job.	0.918	2.783E-02	0.164	2.662E-02	4.273E-02
Learning more about food safety issues is worthwhile.	0.904	8.648E-02	0.160	4.594E-02	3.752E-02
Food safety certification of employees is a good way to make sure safe food is served.	0.254	3.764E-02	0.826	0.208	6.313E-02
Food safety certification of employees has made the food handling practices in my facility better.	0.188	0.108	0.847	0.146	0.181
The time and money required to certify employees have not increased food safety practices.	0.110	0.104	2.477E-02	1.373E-02	0.921
Certification has not helped employees put safe food handling practices into effect.	4.942E-02	0.190	0.464	-2.873E-02	0.683

**Appendix Table 2 ( Continued)**Rotated factor matrix<sup>1</sup> for the five factors on the attitude scale

	Factor				
	1	2	3	4	5
Employee in-service training is an important way to improve safe food handling practices among employees.	0.661	-6.125E-02	0.178	0.389	0.163
The use of a HACCP monitoring system is too costly to implement.	4.743E-02	0.926	9.441E-02	0.162	0.115
The use of a HACCP monitoring system is too time consuming to implement.	1.115E-02	0.901	6.497E-02	0.233	0.132
Creating and maintaining an effective HACCP monitoring system creates employee pride and self-esteem for a job well done.	8.434E-02	0.179	0.107	0.883	-2.687E-02
A HACCP monitoring system is important for maintaining an effective food safety system.	0.144	0.249	0.205	0.803	1.087E-02

<sup>1</sup>extraction method: principal axis factoring;  
rotation method: varimax with Kaiser Normalization