A N ABSTRACT OF THE THESIS OF

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Abstract approved:

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Hospital patients are at high risk for foodborne illness; it is essential that hospital foodservice managers know food safety principles. The purpose of this research was to assess the basic food safety knowledge of hospital foodservice managers and to determine their interest in continuing education related to food safety. A survey was mailed to a random sample of 500 acute care hospital foodservice managers in the United States. Usable surveys were returned by 264 (53%) of the managers. Managers correctly answered from 5 to 16 of the 16 basic food safety knowledge question (mean 14.0±1.7). Managers correctly answered questions relating to cross-contamination and risks for foodborne illness (98%), proper procedures for thawing meat, cooling foods, and the sequence for cleaning utensils and equipment (97%). Managers knew current recommendations for storing eggs, use of a steamtable, and could identify a potentially hazardous food (94%). Managers knew the proper sequence and time for hand washing (92%).
Questions missed most frequently were end point cooking temperatures for ground beef (52% correct) and chicken (78% correct). However, when managers who chose higher temperatures than required are added, 93 and 94% of the managers would produce a safe product. Managers who chose a temperature lower than required need to review basic cooking procedures. Knowledge scores were not significantly different when the number of hospital meals served, type of hospital ownership or management, managers years in foodservice, years as a manager, education level, general certification, food safety certification, hours spent or planned learning food safety, or the managers own rating of food safety knowledge were compared to knowledge scores. Inservice training was the most used and most preferred method for learning about food safety. Time support from the hospital (66%) was most often identified as contributing to ease in learning about food safety, followed by financial support (57%). Lack of time (76%) and lack of interesting and convenient programs (39%) were most often identified as obstacles to learning. Managers (94%) were interested in learning more about food safety, especially about applying Hazard Analysis Critical Control Point principles to everyday foodservice procedures.
Food Safety Knowledge and Continuing Education Interests of Hospital Foodservice Managers

by

Jean D. Ramsay

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

Jean D. Ramsay, Author
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INTRODUCTION

Foodborne illness in the United States causes millions of persons to become ill each year (1,2,3,4,5). Food safety knowledge is basic and essential to dietetic practice and foodservice management since dietitians and other foodservice managers are employed in all areas of foodservice and often work with consumers at highest risk for foodborne illness (3,4,6,7,8,9,10,11,12). The Centers for Disease Control and Prevention has identified prevention of foodborne diseases as one of nine target areas in their strategy to prevent infectious disease in the 21st century (13). One of the new guidelines added to Dietary Guidelines for Americans is “Keep food safe to eat” (14,15). The Joint Commission on the Accreditation of Health Care Organizations (JCAHO) requires that hospitals have a procedure for ensuring the microbial safety of food (16). Members of the American School Food Service Association in major cities rated food safety as the most important of nine foodservice-related issues within the next five years (17). It is vital that foodservice managers are capable of protecting their customers by providing safe food. Yet a study of nutrition and management knowledge of foodservice managers in long-term care in Ohio determined that management knowledge questions related to food safety were the most commonly missed (18).
The purpose of this study was to determine if hospital foodservice managers also lack food safety knowledge, and if that lack of knowledge occurs throughout the United States as well as in Ohio. A survey was conducted to identify the food safety knowledge of hospital foodservice managers in the United States. The survey emphasized factors that commonly cause foodborne illness. Other questions identified the perceived continuing education interests of foodservice managers. Comparisons between the knowledge gaps and perceived education interests were made.

This assessment of the food safety knowledge of hospital foodservice managers can be used to design appropriate education programs for foodservice managers (19). The rapidly changing world of 2001 makes lifelong learning an essential activity for professionals (19,20,21,22). Preassessment of knowledge has been identified as an important first step in designing educational programs that will help managers achieve this learning (23,24,25). Results of this survey indicate areas of food safety where knowledge was adequate, missing, or out-of-date. It also indicated that foodservice managers desired more education related to food safety. Educators and foodservice managers can use results of this food safety survey to help determine what knowledge and skills are needed to increase the safety of food served to their customers.
Hypothesis and Objectives

The hypothesis of the research was that there would be no relationship between the food safety knowledge of hospital foodservice managers and their demographic characteristics such as years employed in foodservice, years as a manager, education level, general certification, food safety certification, the number of hospital meals served, or the type of hospital ownership or management. Objectives of the study were to assess the food safety knowledge of hospital foodservice managers, explore the relationships between demographic variables and the food safety knowledge, and to describe the educational interests of foodservice managers related to food safety.

Definitions

Acute care hospital: for purposes of this research, an acute care hospital was one that provided care for a short and somewhat severe illness (26). These hospitals may also provide other types of care and services.

Foodborne illness: any illness transmitted to persons through food. Examples include infections and/or intoxications caused by microorganisms such as E coli, Salmonella, Listeria monocytogenes, and Norwalk virus (3,4,9,27,28).

Foodservice manager: for purposes of this research, foodservice manager refers to the person responsible for the people and other resources used to produce food for
the patients in the hospital (27). This includes titles such as director, manager, or supervisor.
Foodborne Illness

Prevention of foodborne illness is a constant concern for foodservice professionals, particularly for those whose customers are at high risk for foodborne illness. Providing safe food to those who eat their food has become an increasing concern to foodservice managers due to the growing number of people with compromised immune systems and the identification of more microorganisms that can cause foodborne illness (4,12,29,30).

Foodborne illness refers to disease that is carried or transmitted by food. Specific causes of this illness may be microbiological, chemical, or physical (4,31,32,33). Microbiological causes include bacteria, viruses and parasites and are the cause of 80% of the foodborne illness for which a cause is known. Chemical causes include toxins such as those in some types of mushrooms or the unintentional addition of chemicals such as cleaning products. Physical causes of foodborne illness include pieces of metal or glass in the food (32,33). Each year, millions of people become ill, and thousands die from foodborne illness (4,32,33). Foodborne illness is preventable if proper food safety principles are followed (34).

Some people are more susceptible to foodborne illness than others. These people are very young, very old, pregnant, or are sick and have compromised immune systems (3,9,19,32). Thus, preventing foodborne illness is essential for
health care facilities whose customers are often young, old, and/or have compromised immune systems.

Foodservice managers need to keep bacteria that might cause foodborne illness out of food by proper purchasing, receiving, and storage procedures. Employees must use sanitary techniques to prevent the addition of harmful bacteria to food. Growth of unavoidable bacteria must be kept at minimum levels to prevent the quantities of bacteria that would cause foodborne illness (12,28,32,33). Of the six factors that affect the growth of bacteria, time and temperature are most controllable in an institutional foodservice setting such as hospitals, long term care facilities, schools, day care facilities, and correctional facilities (34).

The Hazard Analysis Critical Control Point system (HACCP) was developed in the 1960s and is an ongoing system to prevent food from becoming contaminated enough to cause foodborne illness in the persons who eat the food. It provides a positive approach to food safety and encourages persons involved in producing or serving food to think critically about the processes and procedures used (4,12,16,28,34,35). The system includes seven points: identification, critical control points, limits, monitoring, corrective action, record keeping, and verification. Hazards are assessed by identifying areas where food contamination can occur. Critical control points where contamination can be controlled or prevented are identified. Acceptable limits for these control points are established. A system to monitor the control points is implemented. Corrective action is taken when acceptable limits for the control points are not met. A record system is set up
to provide evidence of the performance of the system. Managers verify that the
system is working (4,12,16,27,28,35,36,37).

Studies of Food Safety Knowledge

Although it is widely recognized in 2001 that knowledge of food safety and
the ability to apply that knowledge to foodservice operations is an essential
competency for hospital foodservice managers (10,16,22,30,35), there is little
information about the food safety knowledge of hospital foodservice managers.
Others have surveyed the food safety knowledge of managers in long-term care
(18), restaurant operators (23,38), grocery store demonstrators (39), extension
specialists (34), and college students (40).

Knowledge of food safety research showed differences in knowledge in the
various areas of food safety. Food safety was the subject of seven of the questions
in a survey of twenty-six multiple-choice questions on foodservice management
knowledge completed by long-term care foodservice managers in Ohio (18).
Questions missed most frequently were related to proper holding times of food,
serving and cooking temperatures of food, and food contamination (41). Certified
and uncertified restaurant employees in Philadelphia answered twelve questions by
telephone. Questions missed most frequently related to cooking temperatures and
equipment cleaning (38). Volunteers who prepared and served samples of beef
products in grocery stores answered seven true-false statements related to safe
handling of beef before and after a food safety education program was
implemented. Areas where participants had the least knowledge related to food temperatures and cooling procedures (39). Students from three universities were surveyed for food safety knowledge, attitudes, and practices. Areas where the students had the least knowledge related to persons most susceptible to foodborne illness, food preservation methods, and the appearance and smell of contaminated foods. The lowest practice knowledge question score related to the final cooking temperature of meat (40). Research with foodservice workers in institutional and temporary settings included a question relating to the physical characteristics of contaminated food. More institutional workers (57%) than workers in temporary foodservices (33%) knew that contaminated food does not have identifying physical characteristics (42).

**Demographic Factors Related to Knowledge**

Several demographic factors such as education, general certification, and food safety certification were related to food safety knowledge in other research studies. Long-term care managers with more education, higher levels of certification, and those employed in larger facilities scored significantly higher on management knowledge than did other managers (18,41). Restaurant managers in California with more food safety knowledge and appropriate attitudes toward food safety had more favorable environmental health food safety inspections (23). College students who had completed a college course that included food safety
information had higher mean scores for food safety attitudes, food safety knowledge, and food safety practices (40).

Several organizations provide certification in food safety for managers and employees of foodservice facilities. These include Dietary Managers Association (43), Educational Foundation of the National Restaurant Association (44), the National Registry of Food Safety Professionals (33,45), and NSF International (46). States such as Illinois (47,48) and some counties and cities (28,38,48) also have certification programs. Support of certification is an important step a manager can make to keep food safe that is served to patients (28). In Philadelphia, restaurant employees who were certified in food safety answered more questions correctly than did uncertified employees. Therefore, certification training increased the knowledge of food safety of certified restaurant employees (38).

Methods
Written mailed surveys have been used to gather most of the data on food safety knowledge (18,23,39). Medeiros, et.al (34) also used a written survey, but administered it as a pre-test prior to an educational session. Unklesbay et al used a written survey administered during a college class meeting (40). Salant and Dillman (49) point out that mailed written surveys protect the manager’s sense of privacy and are less prone to interviewer error. Subjects are able to fill out the survey at a time convenient for them. However, it is more difficult to cover the entire population if the mailing list’s database is outdated. Raval-Nelson and Smith
(38) used a telephone survey to gather data on food safety knowledge of certified and other foodservice employees in the city of Philadelphia. Telephone surveys have the advantage of producing an immediate response and of allowing more details to be obtained (49,50). Also, according to Salant and Dillman (49), participation in telephone surveys is seldom refused. This may not be true of hospital foodservices since it is difficult to predict convenient times for phone calls. Use of a written survey seemed the most appropriate method for to survey hospital foodservice managers.

**Attitudes**

Foodservice organizations need to have a culture that considers food safety an essential component of the job to effectively implement prevention programs such as HACCP (37). Dietitians employed in hospitals or extended care facilities (69%) were very concerned about foodborne bacteria at their facility (51). Attitudes regarding the importance of food safety were part of research conducted with staff of community-based homes for people with developmental disabilities in Massachusetts. All of the dietitians (100%) employed in or consulting with these homes agreed that safe food handling is important. None of the dietitians felt that the direct care staff in these homes understood the importance of food safety in the Massachusetts study (11).

Attitudes regarding food safety were included in research with college students. Mean scores on the 15 item attitude scale indicated high agreement that
food safety was important. Students who had taken dietetics or science courses had significantly higher attitude mean scores than other students. Attitude questions contained a knowledge of food processing component combined with the attitude regarding the importance of food safety component (40). Attitudes toward food safety were investigated with vendors of potentially hazardous foods at the Delaware State Fair. The attitude questions used combined an attitude such as it is important to with a food safety principle such as hot foods should be kept above 140°F. (52). Most of the attitude questions reported in research with workers in temporary and institutional operations also combined knowledge and attitudes. Three of the four institutions included were hospitals (42). It is difficult to determine from these research studies if the employees felt food safety was or was not important or if they did not know the food safety principle involved.

**Food Safety Knowledge Needed in Operational Foodservice**

The United States Food and Drug Administration (FDA) developed a model food code in 1993 that is updated approximately every two years (4,53). This model food code sets recommended standards for food safety practices to prevent foodborne illness (4,54,55). In 1971, the FDA and the American Public Health Association sponsored a Conference for Food Protection (CFP). In 1984, the CFP became a not-for-profit organization (56). The CFP includes members from all segments of the retail food industry, regulatory agencies, and academic professionals (33). This group evaluates issues related to food safety and makes
recommendations for changes in the model food code. The Conference for Food Protection group identified 5 knowledge areas and 20 critical component tasks to ensure safe food handling in retail foodservices. The components related to day to day foodservice operations include knowledge of foodborne illness, storage of food, use of thermometers, cooking procedures, minimizing food contamination, cleaning and sanitizing procedures, and handwashing (53).

Thorough cleaning of kitchen equipment may eliminate many of the microorganisms that can cause foodborne illness (9,12,53). Improper temperatures related to thawing, cooking, cooling, reheating, and holding foods are the most often identified causes of foodborne illness (53). Food production and service practices that will prevent these time and temperature problems that allow the growth of harmful bacteria include using a thermometer to determine internal temperature to avoid undercooking of meat products, rapidly cooling foods, reheating foods to 165°F, and avoiding cross-contamination. Poor personal hygiene is also an important cause of foodborne illness (3,9,53,57).

Food safety recommendations for use by consumers from the U.S. Food Safety and Inspection Service have been incorporated into the Fight BAC!™ campaign. These recommendations are similar to the US Model Food Code but differ in some details such as recommending higher cooking temperatures for ground beef and poultry (54,55,57,58).
Continuing Education

Foodservice managers need to develop a program of lifelong learning to keep pace with the increasingly rapid changes occurring in foodservice (20,21,22,39). In research conducted by Digh and Dowdy, hospital clinical dietitians identified continuing education as important to their skill development (59). Among the management tasks performed by 37% of the hospital dietitians participating in the research was checking food temperatures, an important monitoring point to protect the safety of the food (32,33,36). Foodservice managers who earned a Masters Degree in foodservice management between 1980 and 1988 identified food production sanitation as very relevant to their current employment, and the most relevant of the 12 food production factors surveyed. Hospitals were the place of employment for 29% of the managers. Although the quality of their educational preparation was more than satisfactory, they gained more of their competence from other sources. Although the “other sources” were not identified, continuing education beyond formal education programs is clearly important to the professional responsibilities of foodservice managers (10).

Foodservice procedures in purchasing, production, storage, and service must be continually reviewed and revised as information on and methods to keep food safe to eat are developed (28,29). Principles of HACCP apply not only to recipe construction but also to the entire system of food production and service (3,27,28,35,37). Staff must be properly trained (3,28,48). Training needs of long-
term care foodservice managers in Ohio included computer skills and staff management skills (41).

Better methods of identifying and tracking sources of foodborne illness present opportunities to connect the cause of the illness to the foodservice processes that allowed the food to become contaminated and the microorganisms to grow (5,12). Knowledge of microorganisms that cause foodborne illness is important to food safety (53).

Evidence based decision making has become increasingly important. Research provides objective evidence and evaluation of procedures. Quality research is needed to provide the evidence needed to develop practical methods of protecting food from contamination. Clinical dietitians (50%) surveyed in Memphis, TN chose a lack of research skills as a reason for not doing outcomes research (5,40,60,61,62).

The American Dietetic Association surveyed continuing education needs of Registered Dietitians (RDs) and Dietetic Technicians Registered (DTRs) prior to 1991 Management was chosen as the primary area of practice for 19% of the RDs and 20% of the DTRs of the 2827 persons responding the survey. Food supply safety was one of the ten most frequently selected topics for advanced level education by 31% of the DTRs, but was not chosen frequently by RDs or as a basic level topic by either group. Of the RDs in management practice, 87% were interested in computer applications, 70% were interested in food supply safety, and
30% were interested in learning to conduct research. Information on interests of DTRs in management practice is not given (63).

Adult learners are a diverse group of people, and foodservice managers are no exception. For optimum learning, it is important that topics and methods of continuing education offered match the learning styles and interests of the managers. Factors outside the learning environment also affect the learning that occurs. Consideration needs to be given to minimizing the effect of these outside factors when designing learning experiences for managers (64).

Several resources are useful for learning about food safety. The internet is an increasingly popular resource for education. The Foodborne Illness Education Information Center of the United States Department of Agriculture lists links to distance learning programs and on-line courses that provide education on food safety (65). Professional journals present research faster than books and are readily available to health care professionals (66). Research of media coverage of newspapers, newspapers and magazines during 1995 showed that foodborne bacteria was among the top 10 nutrition related topics covered (67).

Meetings of various types were used most frequently as a method for continuing education by 46 to 51% of the RDs and by 21 to 33% of the DTRs in the survey conducted by the American Dietetic Association. Academic course work was used as a learning method by 11% of the RDs and 11% of the DTRs. Articles from the Journal of The American Dietetic Association were used by only 9% of the RDs and 8% of the DTRs. When asked about preferred methods of learning,
64% of the RDs and 54% of the DTRs preferred lectures. Workshops, the second most preferred method, were chosen by 60% of the RDs and 44% of the DTRs. Academic course work was chosen as a preferred method by 15% of the RDs but by 20% of the DTRs. Articles in publications were also preferred by more DTRs (29%) than by RDs (14%). Computer assisted instruction was chosen by only 7% of the RDs and 8% of the DTRs (63).

The greatest deterrents to continuing education participation among dietitians in Delaware were scheduling and lack to time (68). Dietitians who were members of the American Association of Diabetes Educators identified lack of financial support followed by lack of time as major barriers to continuing education. Lack of time off from work was not a major barrier. Geographic location and lack of high-quality programs available locally were considered minor barriers. Preferred styles of learning were ranked into groups. Most preferred were meetings, symposia and workshops, followed by reading journal articles and watching videotapes. Books and programmed instruction were less popular learning resources. Audiotapes were the least preferred resource (69).
METHODS

Food safety knowledge and continuing education interests of hospital foodservice managers were collected by using a custom designed mailed survey sent to a random sample of foodservice managers in acute care hospitals in the United States. The survey instrument was based on guidelines recommended by Salant and Dillman for format, delivery and follow-up format (49).

Sample

A random sample of 500 was selected from a list of foodservice managers employed in the 5334 United States acute care hospitals of any size by American Medical Information, Omaha, NB using a computer program (Oracle Corporation, Redwood Shores, CA). The computer program used the 5334 available records from the acute care hospital list with the title of Foodservice Director and the number of hospital locations within each state. The computer randomly selected names of foodservice managers to reach the total of 500 with at least one hospital selected from each state. Surveys were addressed to the individual currently listed as “Foodservice Director” of each hospital and were mailed directly to them at the hospital. The foodservice director will be referred to as the manager in this study.

Surveys were numerically coded to enable foodservice managers to be identified for follow-up purposes and to provide confidentiality. The list of manager names and code numbers was kept separate from the surveys. Approval
was obtained from the Oregon State University Institutional Review Board for the Protection of Human Subjects (Appendix A).

**Instrument**

A custom designed survey instrument was written to assess the food safety knowledge, demographic variables, and continuing education interests of hospital foodservice managers using guidelines suggested by Salant and Dillman (49). Knowledge questions focused on microbiological causes of foodborne illness and critical food safety areas identified by an advisory committee of food scientists, food safety professionals, and psychometricians (53). Areas included in the survey instrument were related to routine daily kitchen operations likely to be under the direction of the foodservice manager. Sixteen multiple-choice food safety knowledge questions focusing on temperatures, cooling, heating, reheating, and personal habits were included. Areas noted as the most frequently missed by other studies were included (18,34,38,39,40). Correct answers were based on the 1999 US Model Food Code (54,55). Options for answers included correct, once correct but now out of date, and incorrect answers. Number used in answer choices for temperatures, etc. were numbers relevant to food service operations to lessen the chance of guessing the correct answer.

Demographic questions to assess the foodservice managers' foodservice and managerial experience were included with the food safety knowledge survey. Educational level and general certification level of the manager were also included.
Research with long-term care managers found education and certification level significantly related to foodservice management knowledge (18). Average number of meals produced per day measured the size of the foodservice operation. Number of hospital beds was no longer an accurate measure of hospital foodservice operations given the current occupancy rate of acute care hospitals, the move from inpatient to outpatient care, and the trend toward providing meals to clients other than acute care hospital patients (70). Managers were asked to rate their level of expertise in food safety using a 7 point scale with ratings from expert =7 to novice=1.

Other knowledge questions were designed to assess the manager’s opinions of factors that promoted or were obstacles to learning about food safety. Areas of knowledge investigated in a study with dietitian participants in Delaware (68) were included as were items suggested by members of the pilot study panel. The manager’s use of resources to learn about food safety and their preferred resources were topics of two survey questions. Items included as resources were professional journals, professional meetings, inservice training, formal education classes, the internet, and newspapers. These resources were those used by the author and those suggested by members of the pilot study panel. The managers were asked to indicate their interest in continuing education topics in various food safety areas. Areas of suggested education topics were consistent with the areas of the knowledge questions. Topics included computer programs, which were an area of interest in the research with long-term care managers (18,41). Topics on major
areas of foodservice operations - recipes, food production, food service, cleaning and sanitizing - were related to Hazard Analysis Critical Control Points (HACCP) principles as this approach forms the current basis for protecting food (27,36). Research with hospital clinical nutrition managers indicated an interest in conducting research but a lack of knowledge on how to do research (71,72). A topic related to research was included. Microbiological sources of foodborne illness were a topic suggested by one of the survey content reviewers. Space was allowed at the end of the survey for comments.

A pilot study of the survey was conducted with a convenience panel of foodservice managers and educators in northern Illinois similar to the population to be surveyed and to those who might use the results of the survey. Each individual manager completed the written survey. Time required to complete the survey, ease of completion, and clarity of the questions and answers were evaluated. After each manager completed the survey and evaluation, problems and suggestions for possible solutions were discussed. In addition, four professors from four different universities with expert knowledge in food safety reviewed face validity of the content of knowledge questions and answers and the survey format.

The survey and research proposal were submitted for approval to the Oregon State University Institutional Review Board for the Protection of Human Subjects prior to data collection. The project was approved for exemption under the guidelines of Oregon State University’s Institutional Review Board and the U.S. Department of Health and Human Services on January 9, 2001 (Appendix A).
Data Collection

The cover letter and survey were mailed to the random sample of acute care hospital foodservice managers in the United States. Surveys were coded with a number to enable managers to be identified for follow-up purposes and to provide confidentiality. The list of manager names and code numbers was kept separate from the surveys. Data from the surveys was entered into the statistical program (JMP version 3.2.1, 1997, SAS Institute, Inc. Cary, NC) using code numbers only as identification.

The random sample of 500 foodservice managers from the list of foodservice managers in 5334 United States acute care hospitals was obtained from American Medical Information, Omaha, NB on February 20, 2001. This list is continually updated to ensure names and addresses used were as current as possible. A computer program (Oracle Corporation, Redwood Shores, CA) was used by American Medical to select a random sample of 500 names. Surveys were addressed to the individual currently listed as “Foodservice Director” of each hospital and were mailed directly to them at the hospital.

A mailing process modified from recommendations of Salant and Dillman (49) was used to increase the response rate. A personalized cover letter (Appendix B), survey (Appendix C), and addressed stamped envelope were sent to the managers. The cover letter informed them of the random selection process to select them to participate in the research study and urged them to participate. They were
told results of the survey would provide information useful to them through publications. Use of coding to protect confidentiality was explained. This cover letter served as the informed consent document, and return of the survey indicated that the manager understood the benefits and risks of the research and voluntarily consented to participate in the research.

Ten days after the first mailing (March 15, 2001), reminder postcards were mailed to foodservice managers who had not responded (Appendix D). This procedure increased the number of surveys returned. Eighteen days later (April 6, 2001), a new cover letter (Appendix E), the original cover letter, a replacement survey and addressed stamped return envelope were sent to those who still had not responded.

Data Analysis

The JMP computer program for Windows (version 3.2.1, 1997, SAS Institute, Inc. Cary, NC) was used for statistical analyses. For purposes of statistical analysis, alpha was set at the conventional probability level of .05 (73).

Surveys were identified by the assigned code number and entered into the statistical program. Data entries were double-checked for accuracy. Data outliers that were greater than 1.5 quartiles from the median were rechecked for accurate data entry (74). A back-up copy of the data was maintained on an electronic disc.

Demographic variables were analyzed by counting frequency of response for each of the possible answers listed on the survey. Percentage of the total for
each survey question was calculated using the total number of managers answering each question. Comments written by managers on the food safety certification question indicated confusion as to which food safety certification title the manager held. Responses for this survey question were recategorized to certified in food safety or not certified in food safety.

Answers for each of the four possible responses to the food safety knowledge questions were counted and scored 1 for the correct answer and 0 for any of the other options. Skipped questions were also scored as 0. Total knowledge score for each manager was calculated by adding all of the correct answers. To compare the effect of each of the demographic variables on the knowledge scores, mean and standard deviations for the knowledge score for each variable group were calculated and compared using ANOVA (JMP version 3.2.1, 1997, SAS Institute, Inc. Cary, NC). Mean and standard deviation for the manager’s own estimate of their expertise in food safety were also calculated for each score from 7 to 1. Comparison of mean knowledge scores to each category of expertise was compared using ANOVA.

Frequency of responses to the continuing education survey questions relating to factors that promoted or were obstacles to learning and to resources used and preferred for learning were counted for each of the possible answers listed on the survey. Percentage of the total for each survey question was calculated using the total number of managers answering each question.
Mean knowledge score and standard deviation were calculated for managers indicating an interest in learning more about food safety and managers not interested in learning more about food safety. Mean food safety knowledge scores of each group of managers were compared using ANOVA (JMP version 3.2.1, 1997, SAS Institute, Inc. Cary, NC). Frequencies of very interested and slightly interested responses for each of the suggested food safety continuing education topics were calculated.
RESULTS

A survey to determine food safety knowledge and continuing education interests of hospital foodservice managers was mailed to a random sample of 500 acute care hospital foodservice managers in the United States. The data represents three major areas: demographics, food safety knowledge, and continuing education.

Surveys were returned by 264 managers from acute care hospitals in every state in the United States except Delaware, Idaho, and Vermont. This represents a 53% return rate. Twenty percent of the managers chose not to answer 1 to 3 questions. One manager chose not to answer 5 questions and another did not finish the survey, resulting in 12 unanswered questions. Questions they did answer are included in the analysis. For demographic variables, percents are calculated as a percent of the total of managers answering the question (N=259 to 263). For food safety knowledge questions, percents are calculated as a percent of the total usable surveys returned (n=263). One hospital returned an uncompleted survey with the comment that the hospital had no kitchen, and foodservice is contracted with another facility. This response is not included in calculations.

Demographic Characteristics

Selected demographic characteristics of the managers as well as the hospitals where the managers are employed are presented in Table 1. These include years as a foodservice manager, educational level, and general certification level. Hours spent learning about food safety in 2000, the hours managers planned to
spend learning about food safety in 2001, and the number of meals served in hospitals where the managers were employed are also presented in Table 1. Years the manager has been employed in foodservice, the manager’s food safety certification, and whether the hours planned to learn about food safety in 2001 were more or less than those spent learning in 2000 are presented in Appendix F. The profit status and department management characteristics of the hospital where the managers were employed are also presented in Appendix F.

Table 1
Selected demographic variables of hospital foodservice managers (n=263)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years as manager</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5</td>
<td>51</td>
<td>19</td>
</tr>
<tr>
<td>5 to 9</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>10 to 14</td>
<td>51</td>
<td>19</td>
</tr>
<tr>
<td>15 to 19</td>
<td>47</td>
<td>18</td>
</tr>
<tr>
<td>20 to 24</td>
<td>44</td>
<td>17</td>
</tr>
<tr>
<td>25 or more</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td><strong>Hours spent learning about food safety last year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>1 to 4</td>
<td>75</td>
<td>29</td>
</tr>
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<td>5 to 9</td>
<td>83</td>
<td>32</td>
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<td>10 to 14</td>
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</tr>
<tr>
<td>15 to 19</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>20 or more</td>
<td>36</td>
<td>14</td>
</tr>
<tr>
<td><strong>Hours planned to spend learning next year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>1 to 4</td>
<td>72</td>
<td>28</td>
</tr>
<tr>
<td>5 to 9</td>
<td>87</td>
<td>34</td>
</tr>
<tr>
<td>10 to 14</td>
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<td>16</td>
</tr>
<tr>
<td>15 to 19</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>20 or more</td>
<td>36</td>
<td>14</td>
</tr>
</tbody>
</table>
Table 1 (Continued)

**Educational level**

<table>
<thead>
<tr>
<th>Level</th>
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<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school</td>
<td>37</td>
<td>14</td>
</tr>
<tr>
<td>Some college work</td>
<td>34</td>
<td>13</td>
</tr>
<tr>
<td>Associates degree</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>69</td>
<td>27</td>
</tr>
<tr>
<td>Some graduate work</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>64</td>
<td>25</td>
</tr>
</tbody>
</table>

**General certification status**

<table>
<thead>
<tr>
<th>Status</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not certified</td>
<td>56</td>
<td>21</td>
</tr>
<tr>
<td>Certified dietary manager</td>
<td>63</td>
<td>24</td>
</tr>
<tr>
<td>Restaurant/hospitality manager</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Dietetic technician registered</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Registered dietitian</td>
<td>110</td>
<td>42</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

**Average meals served per day in hospital where manager is employed**

<table>
<thead>
<tr>
<th>Meals/served</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>100 to 499</td>
<td>92</td>
<td>35</td>
</tr>
<tr>
<td>500 to 999</td>
<td>44</td>
<td>16</td>
</tr>
<tr>
<td>1000 to 1499</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>1500 to 1999</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>2000 or more</td>
<td>39</td>
<td>15</td>
</tr>
</tbody>
</table>

The majority of the hospital foodservice managers (57%) had 20 or more years of experience in foodservice. Years of experience as a manager was more distributed with 12 to 19% of the managers in each group.

Hours spent learning about food safety last year were estimated at 1 to 9 hours by 61% of the managers. However, 14% of the managers spent more than 20 hours learning about food safety. The same percentage of managers planned to spend from 1 to 9 hours or more than 20 hours learning about food safety next year.

When plans of individuals were compared, 61% of the managers planned to spend
the same time learning about food safety next year, and the remainder were equally divided between more and less time.

Educational level of the managers was widely distributed. Of those who chose to answer the question, the largest group had earned a bachelors degree (27%) followed by a graduate degree (25%). The largest group of managers were registered dietitians (42%) or certified dietary managers (24%) or held no general certification (21%). Just under two-thirds of the managers (62%) had some type of certification in food safety.

The average number of meals served each day was used as an indication of the size of the foodservice operation. Just over one-third of the hospitals (35%) served from 100 to 499 meals per day and 16% served from 500 to 999 meals per day. Another group of hospitals (15%) served an average of 2000 or more meals each day.

Most of the facilities responding (85%) were not-for-profit hospitals, with the remainder investor owned. Foodservices in most of the facilities (81%) were self-operated with the remainder contracted to another organization.

**Knowledge of Food Safety**

Managers of acute care hospitals were asked to describe their expertise in food safety on a continuous seven point scale from expert (7) to novice (1). The mean rating describing managers opinion of their expertise was 5.2 ± 1.0 (Table 2).
Table 2
Managers description of their expertise in food safety (n=263); Mean rating 5.2±1.0

<table>
<thead>
<tr>
<th>Rating</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 (Expert)</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>91</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>96</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1 (Novice)</td>
<td>1</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

Hospital foodservice managers have knowledge of basic food safety principles. Managers correctly answered from 5 to 16 questions of a 16 question multiple choice survey of basic food safety knowledge (Table 3).

Table 3
Total number of 16 food safety knowledge questions answered correctly; mean 14.0 ±1.7

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>45</td>
<td>17</td>
</tr>
<tr>
<td>15</td>
<td>73</td>
<td>28</td>
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<td>12</td>
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<tr>
<td>11</td>
<td>17</td>
<td>6</td>
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<tr>
<td>10</td>
<td>4</td>
<td>2</td>
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<tr>
<td>7</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>
Managers correctly identified an example of cross-contamination and that risks for foodborne illness occur at each step in the flow of food (98%), proper procedures for thawing meat, cooling foods, and the proper sequence for cleaning utensils and equipment (97%). Managers knew current recommendations for storing eggs, could identify the proper use of a steamtable, and could identify an example of a potentially hazardous food (94%). They also knew the proper sequence and time for hand washing (92%).

Managers could identify the group of people most susceptible to foodborne illness (89%), knew that bacteriologically contaminated food has no distinctive physical characteristics and that leftovers should be reheated to 165°F (82%). Managers could also identify the temperature zone (41°F to 140°F) of rapid bacterial growth (79%). The correct answer for this question was based on United States Food and Drug Administration (FDA) 1999 Food Code recommendations that have not been adopted in all states. Managers (13%) who chose the older recommendation of 45°F to 140°F may be correct in the state where the hospital is located.

Managers had the most difficulty with end point temperatures of 155°F for cooking ground beef (52% correct) and 165°F for cooking chicken (78% correct). However, when combined with managers who chose temperatures higher than necessary, 93 and 94% of the managers would produce a safe product. Another area of difficulty was the temperature goals when cooling foods. Although managers (97%) could identify procedures to promote rapid cooling, fewer (62%)
could identify the temperatures recommended. Current recommendations are to cool foods to 70°F within 2 hours and to 41°F within an additional 4 hours. This recommendation from the FDA 1999 Food Code had also undergone change. Managers who chose the older recommended temperatures and time of cooling to 45°F within 4 hours (19%) may be accurate in the state where the hospital is located.

Mean knowledge scores were not significantly different when the number of hospital meals served, type of ownership or management, the managers years in foodservice, years as a manager, education level, general certification, food safety certification, hours spent or planned to spend learning food safety, the managers own rating of food safety knowledge, or the manager's interest in continuing education were compared to knowledge scores.

**Continuing Education**

Several resources were used by managers to learn about food safety, and managers often used more than one resource. The most common resources used were participating in inservice training (65%), reading professional journals (57%) and attending professional meetings (54%). Inservice training was also the preferred resource for learning about food safety (70%). Attending professional meetings (61%), reading professional journals (43%) and attending formal education classes (41%) were also popular methods. The Internet was used as a learning resource in the past year by 20% of the managers, but was a chosen as a
preferred resource by slightly more managers (23%). Other resources used to obtain continuing education in food safety were state and local health departments, inspections by various agencies such as health departments and the Joint Commission on the Accreditation of Health Care Organizations, textbooks, consultation with a Dietitian, and preparing training for others.

Managers were asked to identify factors that made learning about food safety easier or that presented obstacles. Time was the most important factor. Time support from the institution was the most mentioned factor that made learning easier (66%) followed by having convenient information available (62%). Lack of time was the greatest obstacle to learning about food safety for many managers (76%). Financial support from the institution was also important to making learning easier (57%). Fewer managers (33%) mentioned lack of money as an obstacle. A lack of interesting programs in food safety that were readily available was also an important obstacle to learning (39%).

Other factors that made learning about food safety easier were a suitable learning environment, materials used to train others, and exhibits of new foodservice equipment. Other obstacles to learning about food safety were the geographical distance from learning opportunities and a lack of frequent opportunities to learn.

Most managers (94%) were interested in learning more about food safety (See Figure). Topics of greatest interest were developing cleaning and sanitizing procedures to incorporate Hazard Analysis Critical Control Points (HACCP)
principles, followed by developing procedures for food preparation and for serving food to incorporate HACCP principles. Computer programs for increasing the manager's personal knowledge of food safety and for educating staff about food safety were also of interest, as was writing recipes to incorporate HACCP principles. Of less interest were learning to conduct research on food safety and learning about microbiological causes of foodborne illness.

Other topics suggested for continuing education were food storage procedures that incorporate Hazard Analysis Critical Control (HACCP) procedures, more usable HACCP procedures and recipes, and educational materials such as handouts and videos usable for education foodservice and other hospital staff.
Figure
Continuing education interests of hospital foodservice managers (n=247)
Comments

Over half of the managers (55%) volunteered comments related to the survey and/or food safety in general. Comments supporting the importance of food safety and the need for research in this area were the most common types of comments. Other areas of comment related to actions being taken by the managers to ensure safe food in the hospital where the manager is employed, the need for staff training and the need for effective training materials for use with staff.
DISCUSSION

For this research on hospital food safety knowledge and continuing education interests of hospital foodservice managers, a randomly chosen sample of 500 foodservice managers employed in acute care hospitals in the United States was surveyed. The custom designed survey of food safety knowledge and continuing education interests were returned by 53% of the managers.

Demographics

Foodservice managers in United States acute care hospitals participating in this research had more years of experience in foodservice than years of experience as managers. Hospital managers in this research had been employed in foodservice for 10 to 19 years (26%) or for 20 years or more (57%). More managers (37%) had been managing foodservice for 10 to 19 years and fewer of the managers (29%) had been managers for 20 or more years. Most of the hospitals (85%) where managers in this research were employed were not-for-profit hospitals and most of the foodservices (81%) were self-operated foodservice operations.

Hospital foodservice managers participating in this research were well-educated. Nearly three-fourths (73%) of the hospital foodservice managers had an associates degree or higher, and one-quarter of them had a graduate degree. Managers were registered dietitians (42%) or certified dietary managers (24%).
Knowledge

Hospital foodservice managers knew basic food safety principles. All sixteen food safety knowledge questions on the survey were answered correctly by 45 (17%) of the managers, and 73 managers (28%) answered all but one question correctly. Overall, most managers (91%) were able to answer 75% or more of the food safety knowledge questions correctly. Although there are many differences in research methods, foodservice managers in this research answered a greater percentage of food safety knowledge questions correctly than did restaurant operators, grocery store demonstrators, extension specialists, or college students (23, 34, 38, 39, 40).

Managers who did not correctly answer 75% or more of the food safety knowledge questions (n=24) are a concern. Since managers were asked to answer questions from memory, they might not have remembered precise details such as cooking temperatures. It is likely that more answers would have been correct if references were checked before answering the surveys. Surveys were sent to heads of the foodservice department. These managers may not be directly responsible for the details of food safety. As one manager commented: “this survey causes one to stop and think and realize how much knowledge one loses when not utilizing frequently.” It is probable that these managers would check the details before monitoring department food safety procedures or educating other staff members. All managers with scores below 75% correct for the food safety knowledge
questions were interested in learning more about food safety, which is an indication they are concerned about food safety and will increase their knowledge. The manager with the lowest food safety knowledge score on a completed survey recognized limitations in food safety by rating expertise at 1=novice, and commented that they were currently enrolled in food safety training.

Hospital foodservice managers in this research knew a broad range of food safety principles well. Hospital foodservice managers in this research most often correctly identified an example of cross-contamination (98%). Managers in this research (97%) also correctly identified proper procedures for thawing meat. They could identify an example of potentially hazardous food and knew how to use a steamtable properly (94%). Most managers (92%) also knew the proper sequence and time for hand washing to prevent foodborne illness.

Three food safety questions in this research were designed to measure how current the food safety knowledge of hospital foodservice managers was, and most of the managers in this research did have up to date knowledge of food safety. Hospital foodservice managers (94%) correctly identified the need to refrigerate fresh whole eggs to prevent growth of Salmonella that may be present in the eggs. This recommendation in the US Model Food Code (54,55) was changed in 1995 after foodborne illness was caused by Salmonella enteriditis found in uncracked whole eggs. A more recent change in 1997 in the definition of the “danger zone” of most rapid bacterial growth from a range of 45°F to 140°F to a range of 41°F to 140°F was known to fewer (79%) of the managers. Even fewer managers (62%)
also knew that recommendations for cooling foods had changed from to 45°F in 4 hours to 70°F in 2 hours and to 41°F in an additional 4 hours. Managers (13%) who chose the earlier range for the danger zone or managers (19%) who chose the older guideline of cooling food might be correct in state or county where they are employed as not all jurisdictions have adopted the US Model Food Code (54,55).

Hospital foodservice managers in this research were least likely to correctly answer questions about the proper end point temperatures of 155°F for cooking ground beef (62% correct) and 165°F for chicken (78% correct). However, when combined with managers who chose temperatures higher than necessary, most of the hospital foodservice managers (93 and 94%) would have produced a safe product. Managers who chose lower temperatures than recommended need to review proper cooking temperatures. Hospital foodservice managers participating in this research were more knowledgeable about proper cooking temperatures for ground beef and poultry than were long term care managers and restaurant workers (18, 38). Cooking meat or poultry to a higher temperature than necessary produces a safe product but may result in less tender and flavorful meat and poultry. Higher temperatures also increase moisture loss resulting in less edible product to serve and increased energy costs (27).

More hospital foodservice managers in this research could identify the proper temperature for reheating leftovers (83%) than could identify proper cooking temperatures for ground beef (62%) and poultry (78%). At least two reasons may contribute to this difference in knowledge. Meat and poultry cooking
temperatures have been the subject of much discussion in the last few years, and various increases in the recommended temperatures have been discussed. In addition, the Partnership for Food Safety Education began a campaign in 1997 to educate the public about food safety and foodborne illness. The name for the campaign is FightBAC!™. Temperatures recommended for consumer use in the Fight BAC!™ campaign (58) for ground beef (160°F.) and poultry (180°F) are 5 to 15° higher than the temperatures recommended for professionals (155°F for ground beef, and 165°F for poultry) in the United States Food and Drug Administration's Model Food Code (54,55). Recommendations for reheating leftovers have not been changed, and the Fight BAC!™ and Food Code recommendations (165°F) are the same.

Food safety knowledge mean scores of managers in this research were not significantly different when mean scores for managers with differing years of experience in foodservice, years of experience as a food service manager, or size of foodservice operation were compared. Although it seems logical that these factors might affect food safety knowledge scores, the hypothesis that these factors would have no affect on food safety knowledge scores was not rejected.

Food safety knowledge mean scores of managers in this research were also not significantly different when mean scores for managers with differing education levels, general certification levels, or certification in food safety were compared. The hospital foodservice managers in this research had a higher level of education and were more likely to have a general certification status that requires a higher
level of education than did foodservice professionals involved in other research (18,23,34,38,39,41). Food safety knowledge is part of the hospital foodservice manager’s education and training for this general certification. Hospital foodservice managers had learned, implemented, and used basic food safety procedures as a part of everyday hospital foodservice operations. The lack of effect of certification in food safety was likely due to the fact that food safety was part of the basic training of hospital foodservice managers. Hospital foodservice managers without certification in food safety were educated in food safety even if they had not passed a specific food safety certification exam. Hospital foodservice managers in this research have also kept learning about food safety. Managers (69%) spent 5 or more hours learning about food safety in 2000 and plan to spend that amount of time (61%) or more (19%) learning about food safety in 2001.

Hospital foodservice managers in this research were asked to rate their own expertise in food safety using a scale from 7(expert) to 1 (novice). The managers’ ratings ranged from 7 (6%) to 1 (1 manager), with a mean rating of expertise of 5.2 ± 1.0. Most managers (71%) rated their expertise as 5 or 6. Food safety knowledge mean scores were not significantly different when the manager’s rating of their own expertise was compared to their total food safety knowledge score. It is possible that managers are not skilled at evaluating their own expertise. It seems more likely that these managers recognized that knowledge of basic food safety principles is only the beginning of providing safe food. Comments written on the survey by 15 (6%) of the managers noted that application of the food safety principles not just by
the dietary department but by all persons involved in providing food is essential to

safe food.

An attitude that food safety is important makes it more likely that food

safety knowledge will be obtained and used. Although this research did not

specifically assess attitudes toward food safety, comments added by 18 managers

(7%) included a statement that food safety was important and that food safety is an

essential competency for a foodservice manager.

**Continuing Education Resources**

Hospital foodservice managers in this research (76%) identified time as the

major obstacle to learning about food safety. This was reflected not only in the

listing of time as the most often chosen obstacle, but also in the listing of time

support from the institution (66%) as the most often chosen factor that made

learning easier. Time was also likely a factor in the choice of inservice training

(65%) as the most used and most preferred (70%) resource for learning about food

safety. Lack of interesting programs in a convenient location (39%) was the

second most commonly identified obstacle to learning about food safety; this

obstacle also reflects a time component.

Hospital foodservice managers in this research chose lack of money (33%)
as an obstacle and financial support from the institution (57%) as a factor that made

learning about food safety easier. This difference in the importance of time versus

money may be due to the nature of the work. Services provided by hospital
foodservice managers focus on the inflexible provision of providing three or meals a day at specific times every day of the year. Time is likely to be a scarcer resource than is money.

Several resources were used to learn about food safety. Hospital foodservice managers in this research read professional journals (57%) and attended professional meetings (54%) to learn about food safety. Attending professional meetings (61%) and reading professional journals (43%) were also preferred resources for learning about food safety. Formal education classes were used to learn about food safety by hospital foodservice managers (30%) in this research, and more of the managers (40%) chose formal education classes as a preferred resource for learning about food safety.

Hospital foodservice managers in this research used the internet (20%) less than other resources to learn about food safety. More managers (23%) chose the internet as a preferred using the internet than had actually used it. This may be due to a lack of available computers with internet connections or lack of skill in using the internet as a resource for learning about food safety. In general, hospital foodservice managers chose traditional, familiar, and convenient methods to learn about food safety.

**Continuing Education Interests**

Hospital foodservice managers in this research knew the basics of food safety, but most (94%) of the managers also were interested in learning more about
food safety. Managers of hospital foodservices were most interested in learning more about applying Hazard Analysis Critical Control Points (HACCP) principles to foodservice operations. More managers were interested in learning more about applying HACCP principles to cleaning equipment and surfaces (92%), to food preparation and to serving of food (91%) than were interested in learning more about HACCP recipes (83%). This may reflect the availability of several resources for applying HACCP to recipes (32,33,75,76,77).

When asked about interest in computer programs to learn about food safety, managers (89%) were slightly to very interested in using computer programs to increase their own knowledge of food safety. Fewer managers (84%) were interested in using computer programs to teach their staff about food safety.

The least often chosen topics for continuing education in food safety were microbiological causes of foodborne illness (80%) and learning to conduct research about food safety (62%). However, over half of the managers were interested in learning more about these topics. It is likely that the topics relating to microbiological causes of foodborne illness and research were chosen less often because they are not as directly related to everyday foodservice operations.

Limitations

Although 53% of the hospital foodservice managers in the random sample of 500 managers returned the survey, these managers may differ from those who
chose not to return the survey. Therefore, caution should be used in extending results to the general population of hospital foodservice managers.

**Further Research Needs**

Hospital foodservice managers know basic food safety principles. Further research is needed to assess the food safety knowledge of other hospital employees responsible for providing nutrition to hospital customers.

Knowing how to prepare and serve food safely is essential to keeping food safe to eat. Knowing what to do does not guarantee that this knowledge will be applied to the work situation. Several managers in this research expressed their frustration with ensuring that other staff in foodservice and throughout the hospital apply food safety principles. Leadership and supervisory methods to ensure that all hospital staff keep food safe are also topics for further research.

Inservice training was the most used and most preferred method for managers to learn about food safety. This research did not address the content, type, or source of this inservice training. Research into effective and efficient methods of providing inservice training would increase the availability and usefulness of food safety information for hospital foodservice managers.
SUMMARY

Foodborne illness causes millions of persons to become ill each year. Hospital patients, who have compromised immune systems and are often older or very young, are a high-risk population for foodborne illness. A thorough knowledge of food safety is a necessary requirement for hospital foodservice managers. While others have studied the food safety knowledge of restaurant owners, foodservice managers in long-term care facilities, and college students, no information about the food safety knowledge of hospital foodservice managers has been found.

The purpose of this research was to assess the basic food safety knowledge of hospital foodservice managers and to determine their interest in continuing education related to food safety. A custom designed mailed survey was sent to a random sample of 500 hospital foodservice managers employed in acute care hospitals in the United States. This survey collected information about the manager’s years in foodservice, education level, general certification status, food safety certification status, years as a foodservice manager, hours spent learning about food safety last year, and hours planned to spend learning about food safety next year. The managers were asked to estimate their own expertise in food safety on a seven point scale from expert to novice. Information about the hospital’s meals served per month, ownership and management of the foodservice department was also collected. Managers completed a 16 question survey of basic food safety knowledge that covered areas of daily foodservice operations. Managers also listed
resources used to learn about food safety, preferred resources, and factors that made learning easier or that provided obstacles to learning. Managers indicated their interest in learning more about food safety topics such as computer programs to learn about food safety, applying Hazard Analysis Critical Control Point (HACCP) procedures to recipes, food preparation, serving or cleaning and sanitizing. Microbiological causes of foodborne illness and learning to do research about food safety were other suggested topics. The manager’s food safety knowledge score was calculated by adding all correct answers.

Mean and standard deviations for the knowledge score for each variable group and for the manager’s estimate of their food safety expertise were calculated. Mean and standard deviations for knowledge scores of managers interested and not interested in learning more about food safety were also calculated. Knowledge score means for demographic variables, manager’s estimate of expertise, and manager’s interest in continued education in food safety were compared using ANOVA.

Surveys were returned by 264 of the 500 managers (53%) in the random sample. Most managers (57%) had 20 or more years experience in foodservice, but represented more variation in years as a manager. Bachelor’s degree had been earned by 27% of the managers and 25% of the managers had a graduate degree. Most managers were registered dietitians (42%), or certified dietary managers (24%). Just under two thirds of the managers (62%) had some type of certification in food safety. The hospitals where the managers were employed were primarily
(85%) not for profit hospitals and were self-operated (81%). The largest group of hospitals served from 100 to 499 meals per day (35%) followed by hospitals that served from 500 to 999 meals per day (16%).

Managers rated their expertise in food safety from 7 (expert) to 1 (novice), with the mean score 5.2 ± 1.0. Most managers (91%) had good actual knowledge of basic food safety principles, correctly answering at least 12 of the 16 food safety knowledge questions correctly (mean 14.0± 1.7). The questions most often answered correctly identified an example of cross-contamination and that risks occur at every step in the flow of food (98%), proper procedures for thawing meat, cooling foods, and the proper sequence for cleaning utensils and equipment (97%). Managers know current recommendations for storing eggs, can identify proper use of a steamtable, and can identify an example of a potentially hazardous food (92%). The proper sequence and time for hand washing was identified by 92% of the managers.

Managers had the most difficulty identifying end point temperatures of 155°F. for cooking ground beef (52% correct) and 165 °F. for chicken (78%). However, when combined with managers who chose temperatures higher than necessary, 93 and 94% of the managers would have prepared a safe product. These temperatures have been the subject of much discussion. Government recommendations for consumer use are higher than recommendations for professional use. Managers had less confusion about the endpoint temperature of
165 °F for reheating leftovers (83% correct). This temperature recommendation is consistent for professionals and for consumers, and has not been changed.

Mean food safety knowledge scores were not significantly different when the number of hospital meals served, type of hospital ownership or management, the managers years in foodservice, years as a manager, education level, general certification, food safety certification hours spent or planned to spend learning about food safety, interest in continuing education or the managers own rating of food safety knowledge were compared to knowledge scores. The hospital foodservice managers in this research had more education than did participants in other research studies that showed a significant difference according to level of education, general certification, and food safety certification. Hospital foodservice managers also include food safety as part of their education and general certification even though they may not have passed a certification examination.

Even though the hospital foodservice managers in this research knew basic food safety principles, most (94%) wanted to know more. Managers (69%) spent 5 or more hours learning about food safety in 2000. Managers plan to spend as much or more time (81%) learning about food safety in 2001. Time was identified as the major obstacle to learning about food safety by 75% of the managers, and time support from the institution was the most often chosen (66%) factor that made learning easier. Inservice training was the most used resource (65%) for learning about food safety, followed by reading professional journals (57%) and attending professional meetings (54%). Preferred resources for learning differed from those
managers had used in the last year. Inservice training was the most preferred resource for learning about food safety (70%). However, more hospital foodservice managers preferred attending professional meetings (61%) than preferred reading professional journals (43%). When food safety topic choices were investigated, managers were most interested in learning more about applying Hazard Analysis Critical Control Points (HACCP) to foodservice operations. They were most interested in applying HACCP to procedures for cleaning and sanitizing equipment and surfaces (92%), food preparation (91%) and serving food (91%).

This research documented hospital foodservice managers’ knowledge of food safety, compared that knowledge to the manager’s assessment of their knowledge, and gathered information about preferred methods and topics for further education in food safety. Hospital foodservice managers in this research knew basic food safety principles and are interested in learning more about applying their knowledge of food safety to daily foodservice operations.
A bibliography of 12 sources is presented, covering various topics related to food safety and management. The sources include studies on the incidence of foodborne illnesses, food safety in retail establishments, long-term care facilities, and healthcare food and nutrition services. There are also articles on food safety in infant and preschool day care, and the relevance of competencies to graduate education in foodservice management. The bibliography concludes with discussions on food safety training needs for staff and consumers, and the integration of hazard analysis and critical control points (HACCP) and sanitation for verifiable food safety.


70. Richards, LM. *Measure It, Manage It.* Chicago: The American Dietetic Association; 1997.


APPENDICES
APPENDIX A   Approval from Institutional Review Board

RESEARCH OFFICE

January 9, 2001

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): Ann Messersmith

Student’s Name (if any): Jean Ramsay

Department: Nutrition and Food Management

Source of Funding:

Project Title: Food Safety Knowledge of Hospital Foodservice Managers

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,

Laura K. Lincoln
IRB Coordinator

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

cc: IRB Chair
Dear Hospital Foodservice Director:

Food safety is in the news, but very little has been written about the food safety knowledge of hospital foodservice directors. Would you please take 10 to 15 minutes of your time to help increase knowledge in this area by completing the enclosed survey? The survey will help you assess your personal knowledge of food safety and the combined results of the survey will document the food safety knowledge of hospital foodservice managers. The survey has 40 questions in three sections—some general demographic information, a short assessment on food safety, and questions relating to your continuing education interests. Results will help meeting planners and educators provide future continuing education activities of interest to you.

Your input into this research survey will be kept confidential. Your responses, together with other responses, will be combined and used for statistical summaries only. Results will be reported as group results only. Return of this survey indicates you have been informed of the risks and benefits of this research and consent to participating in the research project.

If you’re willing to participate, please turn the page and circle the response that best indicates your answer. The research will be more complete if you answer all the questions, but if you find one you’d rather not answer, just skip it. To ensure the integrity of the results, please complete the survey without checking references. Additional comments relating to food safety are welcome.

When you’re finished, put the completed survey in the enclosed addressed stamped envelope and mail the survey to Jean D. Ramsay, R.D., 16810 Ramsay Road, Caledonia, IL, 61011. If you have any questions or concerns, please contact Ann Messersmith, PhD.R.D., Dept. of Food and Nutrition Management, Oregon State University, phone: (541) 737-0958 or e-mail at messersa@orst.edu.

Thanks for helping.

Jean D. Ramsay, R.D.
Principal Investigator

Ann Messersmith Ph.D., RD
Professor, Dept of Food & Nutrition Management
APPENDIX C  Survey

Food Safety Knowledge and Continuing Education Interests of Hospital Foodservice Managers

Questions about you and your facility
Please circle the letter of your response.

1. How many years have you worked in any type of foodservice?
   A. less than 5 years
   B. 5 to 9
   C. 10 to 14
   D. 15 to 19
   E. 20 to 24
   F. 25 years or more

2. How many years have you worked as a manager in any type of foodservice?
   A. less than 5 years
   B. 5 to 9
   C. 10 to 14
   D. 15 to 19
   E. 20 to 24
   F. 25 years or more

3. The average number of meals served per day by your department last month was:
   A. less than 100 meals per day
   B. 100 to 499
   C. 500 to 999
   D. 1000 to 1499
   E. 1500 to 1999
   F. 2000 or more meals per day

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
APPENDIX C   Survey (Continued)

Please circle the letter of your response.

4. About how many hours did you spend learning about food safety last year?
   A. less than 1 hour
   B. 1 to 4
   C. 5 to 9
   D. 10 to 14
   E. 15 to 19
   F. 20 or more hours

5. About how many hours do you plan to spend learning about food safety this year?
   A. less than 1 hour
   B. 1 to 4
   C. 5 to 9
   D. 10 to 14
   E. 15 to 19
   F. 20 or more hours

6. Your educational level (Circle the highest earned)
   A. High school diploma
   B. Some undergraduate college work
   C. Associates degree
   D. Bachelor's degree
   E. Some graduate work
   F. Graduate degree

Jean D. Ramsay, R.D.          Oregon State University          February 15, 2001
APPENDIX C  Survey (Continued)

Please circle the letter of your response.

7. Your current general certification status is:
   A. Not certified
   B. Certified Dietary Manager
   C. Restaurant/Hospitality Manager
   D. Dietetic Technician Registered
   E. Registered Dietitian
   F. Other certification __________________________

8. Your current certification status related to food safety:
   A. Not certified in food safety
   B. Certified Foodservice Professional
   C. Certified Foodservice Manager
   D. Certified Food Safety Professional
   E. Other __________________________

9. The facility where you work is:
   A. Not for profit
   B. Investor owned

10. The foodservice management of the facility where you work is:
    A. Self operation
    B. Contract

11. How would you describe your expertise in the area of food safety:
    (place an X between the two ends of the spectrum where you think your level of expertise is)
    Novice _____! ______! ______! ______! ______! ______! ______! ______! ______! ____! Expert

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
Questions to assess your food safety knowledge

Please circle the letter of the most correct answer.

12. Risks for food contamination exist:
   A. at each step in the flow of food.
   B. only during preparation and service of food.
   C. only with potentially hazardous foods.
   D. only when leftover foods are used.

13. Which of the following foods would be most likely to cause foodborne illness?
   A. paprika
   B. cornflakes
   C. fresh apple
   D. tuna salad

14. Persons most likely to get sick from contaminated food are:
   A. older adults who are already sick.
   B. middle-age adults who are already sick.
   C. healthy teen-agers.
   D. healthy older adults.

15. Foods with enough bacterial contamination to cause foodborne illness in susceptible persons:
   A. have a color that is not characteristic of the food.
   B. have a distinctive smell.
   C. cannot be identified by sight or smell.
   D. can be identified by sight or smell if contamination levels are high enough.

16. The temperature danger zone for foods according to the 1999 USDA Food Code is between:
   A. 32°F and 180°F
   B. 41°F and 140°F
   C. 45°F and 140°F
   D. 41°F and 145°F

Jean D. Ramsay, R.D.
Oregon State University
February 15, 2001
APPENDIX C  Survey (Continued)

Please circle the letter of the most correct answer.

17. Clean uncracked fresh eggs should be:
   A. stored at room temperature for 24 hours or less, then refrigerated until used.
   B. refrigerated immediately upon delivery, and kept refrigerated until use.
   C. refrigerated immediately upon delivery, and held at room temperature for one hour before use.
   D. any of the above methods is safe, but quality is better if refrigerated.

18. Thawing raw meat should be stored:
   A. on the top shelf of the refrigerator or walk-in.
   B. on the middle shelf of the refrigerator or walk-in.
   C. on the bottom shelf of the refrigerator or walk-in.
   D. any shelf is acceptable as long as it is not on the floor.

19. To safely roast poultry, the internal temperature thermometer reading should be:
   A. 140 °F
   B. 155 °F
   C. 165 °F
   D. 180 °F

20. A preheated steam table can be safely used to:
   A. heat 2 opened (#10) cans of peas.
   B. serve lasagna which has been previously heated to the proper temperature.
   C. keep properly cooked roast beef warm between 11 AM lunch and 7 PM supper.
   D. reheat leftover chicken noodle soup prior to serving.

21. Ground beef must be cooked to a minimum temperature of:
   A. 140 °F
   B. 155 °F
   C. 165 °F
   D. 180 °F

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
APPENDIX C  Survey (Continued)

Please circle the letter of the most correct answer

22. Cooked foods to be cooled must be refrigerated and (according to the 1999 USDA Food Code) must reach
   A. 70°F within 2 hours, and 41 °F within the next 4 hours.
   B. 70°F within 4 hours, and 41 °F within the next 2 hours.
   C. 45 °F within 4 hours.
   D. 41°F within 6 hours.

23. Previously cooked foods must be rapidly reheated to:
   A. 140°F
   B. 145°F
   C. 155°F
   D. 165°F

24. Foods that need to be cooled should be:
   A. put in 2-inch deep pans, covered loosely and refrigerated to cool quickly.
   B. put in as few containers as possible to save space, then covered tightly and refrigerated.
   C. put in 2-inch deep pans and covered tightly, then left on the counter for 1 hour before refrigerating to decrease energy usage.
   D. put in 6-inch deep pans, covered loosely and refrigerated to cool quickly.

25. When contaminated, hands should be washed by:
   A. rinsing under warm running water with soap for at least 10 seconds.
   B. washing with soap and cool water for at least 10 seconds.
   C. rinsing under warm running water for at least 20 seconds.
   D. washing with soap and warm water for at least 20 seconds.

26. The basic procedure for cleaning utensils and equipment in the kitchen is to:
   A. wash, rinse, and sanitize.
   B. wash, sanitize, and rinse.
   C. soak, wash, and rinse.
   D. scrape, wash, and rinse.
APPENDIX C  Survey (Continued)

Please circle the letter of the most correct answer.

27. Practices most likely to produce foodborne illness are:
   A. cleaning and sanitizing cutting boards before and after cutting raw poultry.
   B. serving cooked chicken with a clean pair of tongs.
   C. breading raw chicken using clean disposable gloves, then refrigerating the chicken until the chicken is cooked.
   D. using a cutting board to cut chicken strips for grilling, then to shred lettuce for a salad.

Questions about your continuing education interests

28. I learned about food safety this past year using the following resources:
   (circle all that apply)
   A. Professional journals
   B. Professional meetings
   C. Inservice training
   D. Formal education classes
   E. Internet
   F. Newspapers
   G. Other _______________________

29. My preferred methods of learning about food safety are: (circle all that apply)
   A. Professional journals
   B. Professional meetings
   C. Inservice training
   D. Formal education classes
   E. Internet
   F. Newspaper
   G. Other _______________________

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
APPENDIX C  Survey (Continued)

Please circle the letter of your response.

30. Which of the following make it easier to learn about food safety? (circle all that apply)
   A. Financial support from institution
   B. Time support from institution
   C. Convenient information available
   D. Educational resources matched my learning style
   E. Educational resources were interesting
   F. Educational resources were useful
   G. Other ____________________________

31. Which of the following are obstacles to learning about food safety? (circle all that apply)
   A. Lack of time
   B. Lack of money
   C. Institution does not support
   D. Little use for food safety information
   E. Lack of interest in food safety
   F. Interesting programs in food safety are not readily available
   G. Other ____________________________

32. Would you be interested in learning more about food safety in 2001?
   A. Yes – please continue with question 33 on the next page and consider the topic suggestions.
   B. No – please go to question 42 on page 10.

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
APPENDIX C  Survey (Continued)

Please circle the phrase which best indicates your level of interest:

<table>
<thead>
<tr>
<th></th>
<th>Not Interested</th>
<th>Somewhat Interested</th>
<th>Very Interested</th>
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<tr>
<td>33. Computer programs to increase your personal knowledge of food safety</td>
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<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>34. Computer programs to help you educate your foodservice staff about food safety</td>
<td>Not Int</td>
<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>35. Microbiological causes of foodborne illness</td>
<td>Not Int</td>
<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>36. Writing recipes to incorporate Hazard Analysis Critical Control Points (HACCP)</td>
<td>Not Int</td>
<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>37. Developing food preparation procedures to incorporate HACCP principles</td>
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<td>S Int</td>
<td>V Int</td>
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<tr>
<td>38. Developing food serving procedures to incorporate HACCP principles</td>
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<td>V Int</td>
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<tr>
<td>39. Developing cleaning and sanitizing procedures to incorporate HACCP principles</td>
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<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>40. How to conduct research related to food safety</td>
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<td>S Int</td>
<td>V Int</td>
</tr>
<tr>
<td>41. Other topic suggestions</td>
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</tr>
</tbody>
</table>

Please continue on the next page

Jean D. Ramsay, R.D.  
Oregon State University  
February 15, 2001
APPENDIX C  Survey (Continued)

42. Comments about the survey and/or food safety issues:

Thank you for helping document food safety knowledge of hospital foodservice directors. Please place the completed survey in the envelope provided and mail it back. (If you've lost the envelope, return the survey to Jean D. Ramsay, R.D., 16810 Ramsay Road, Caledonia, IL 61011)

Jean D. Ramsay, R.D.  Oregon State University  February 15, 2001
Remember the survey you received in the mail last week?

If you haven't yet returned it, please take a few minutes to complete the survey. You were selected as part of a representative sample of hospital foodservice directors, and your response is important to describing the food safety knowledge of foodservice directors.

If you already returned the survey and we just haven't received it yet, thanks very much for helping with this important project.

Jean D. Ramsay, R.D.
Oregon State University
Dear Hospital Foodservice Director:

Do you remember the survey you received about a month ago? Your response to the survey is really important to help determine the food safety knowledge of hospital foodservice directors.

If you’ve already returned the survey and we just haven’t received it yet, thanks for helping to provide a nationwide picture of food safety knowledge.

If you haven’t returned the survey, please take 10 to 15 minutes now to complete the survey. People who have completed the survey have commented they found it easy and quick to do, and felt the topic was important. To make it easier, I’ve enclosed a duplicate survey and return envelope.

Your response is important. You were selected as part of a representative sample of hospital foodservice directors, and the research will be not be complete without your participation. Please help complete this important research.

If you have any questions or concerns, please contact Ann Messersmith, PhD.D.R., Dept. of Food and Nutrition Management, Oregon State University, phone: (541) 737-0958 or e-mail at messersa@orst.edu.

Thanks for your help,

Jean D. Ramsay, R.D
Principal Investigator
Table 4
Other demographic variables of hospital foodservice managers (n=263)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
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<td>10 to 14</td>
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<td>15 to 19</td>
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<td>20 to 24</td>
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<td>25 or more</td>
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<td><strong>Hours spent compared to hours planned to spend learning about food safety</strong></td>
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