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MICHIGAN HEALTH INFORMATION PROVIDERS: KNOWLEDGE OF SAFE FOOD HANDLING

By

Kuo-Tung Li

A THESIS

Submitted to
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ABSTRACT

MICHIGAN HEALTH INFORMATION PROVIDERS: KNOWLEDGE OF SAFE FOOD HANDLING

By

Kuo-Tung Li

This study is one component of a Michigan statewide assessment of the food handling knowledge of: third-grade children and their household members, third-grade teachers, school foodservice personnel, and health information providers (HIPs). This thesis provides the results of the knowledge assessment of HIPs--foodservice sanitarians, health educators, nurses, nutritionists, physicians affiliated with local health departments and family practice physicians. Questionnaires with eight questions about food handling and 18 demographic questions were mailed to 1,541 HIPs (local health department personnel, N=891; family practice physicians, N=650) during October 1991. The response rate was 48.0% (local health departments = 68.5%, family practice physicians = 19.8%). The results support the need to provide current, accurate, and continuing education about safe food handling for all groups of HIPs. Knowledge constructs to emphasize include time-temperature relationships of food handling and the identification of potentially hazardous foods.

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1.0 INTRODUCTION

Food safety has become a major concern of consumers and governmental regulatory agencies in U.S.. Among the threats posed by potentially unsafe foods, microbiological hazards have been identified as the most common and the most serious (Wolf, 1992; Swintek, 1991; Titus and Talbot, 1991).

Foodborne disease, most often caused by bacterial pathogens, is a significant health problem in the United States. The Centers for Disease Control (CDC) stated that foodborne disease is one of the most common and significant causes of illness and death in the United States (Banwart, 1989). The CDC estimated that up to 81 million cases of foodborne disease with 9,000 related deaths occur yearly (USDA, 1989a; Bennett *et al.*, 1987; Amler and Dull, 1987; Archer and Kvenberg, 1985).

Unlike many types of disease, foodborne disease is almost totally preventable when food is handled safely. Thirty percent of all reported foodborne disease resulted from unsafe handling of food in the home (Hecht, 1991). A 1991 national consumer survey showed that the home was ranked third in a listing of sites (after food manufacturing facilities and restaurants) where food safety problems are most likely to

occur (Gravani, 1992). Many researchers have suggested that foodborne disease could be prevented if food is handled safely, especially during the final stages of preparation before service (Lawson *et al.*, 1990; Mossel, 1989; Weinstein, 1990; USDA, 1990a; Jacob, 1989; USDA FSIS July, 1989a; Holmes, 1989; Wolf and Lechowich, 1989; Hunter, 1987).

According to CDC data, the most frequently reported food preparation practices contributing to foodborne disease were improper storage or improper holding temperatures; poor personal hygiene followed (Bean and Griffin, 1990). Numerous studies have indicated that consumers in the U.S. are not always knowledgeable about safe food handling, especially in the areas of cold-storage temperatures, storage of leftovers, and methods of thawing foods (Gravani, 1992; USDA/FDA, 1991). Consumer awareness can only be accomplished through education that positively influences long-term behavioral changes.

Health information providers (HIPs), such as those who work for local health departments (foodservice sanitarians, health educators, public health nurses, public health nutritionists and public health physicians) and family practice physicians, have been recognized as a potentially influential adult population for children and their families in the area of safe food handling (Gravani, 1992; Dismuke and Miller, 1983). Previous assessments of the safe food handling knowledge of HIPs were not found in the literature. Thus, the purpose of this study was to assess the safe food handling

knowledge of HIPs and to determine their training needs in this area.

2.0 LITERATURE REVIEW

2.1 Food Safety

The food supply in the United States is one of the most abundant and nutritious on earth; it may also be one of the safest. Because of more stringent government regulation and greater knowledge about proper sanitation, foods are safer today than in the "good old days." However, a great many illnesses and deaths occur in the United States each year because of foodborne disease.

2.1.1 Foodborne Disease Outbreak Statistics

The incidence of foodborne disease is on the rise in the U.S. (USDA, 1990b). Furthermore, most cases result from the mishandling of food in foodservice establishments or in the home (Raithel, 1988). Of the 7,219 foodborne disease outbreaks occurring between 1973 and 1987 (when the site was reported), 79% of the outbreaks were attributed to foods prepared in commercial or institutional establishments, while 21% were attributed to foods prepared in the home (Bean and Griffin, 1990).

Although the exact number of people in the U.S. who contract foodborne diseases is unknown, between 6.5 and 81

million outbreaks are estimated to occur each year in U.S. (Bean and Griffin, 1990). Other researchers estimate the number of cases to be between 68.7 and 275 million (Archer and Kvenberg, 1985). The number of deaths by foodborne disease is reported annually; recent estimates for the U.S. range from 523 to 7,041 per year. These numbers indicate that even with variations in reporting procedures, foodborne disease is widespread and can have many serious health consequences, including death (Todd, 1989).

A foodborne disease outbreak has been defined as an incident in which two or more persons experience a similar illness and food is implicated (Bean *et al.*, 1990). Foodborne disease outbreaks can be economically devastating. A study of 17 foodborne disease outbreaks in the United States and Canada found that each outbreak cost an average of $200,000 (Archer and Kvenberg, 1985). The costs included medical care, lost wages, public health investigations, lost business, and legal fees. Occasionally, entire industries have been crippled (USDA, 1989a). Foodborne disease has been estimated to cost the U.S. between $3.5-17 billion per year (USDA, 1989a). Nearly everyone has an economic interest in preventing foodborne disease.

The CDC summary report of foodborne disease from 1973 to 1987, reported that reported foodborne disease outbreaks increased steadily during the first 10 years (1973 to 1982) and decreased over the past five years (1983 to 1987).

Furthermore, there is sufficient evidence to indicate that the decrease in the number of reported outbreaks during the years 1982-1987 stems from reporting changes (Bean and Griffin, 1990). The decrease in reported outbreaks since 1982 parallels the increased burdens imposed on local health departments by the Acquired Immune Deficiency Syndrome (AIDS) epidemic. The many cases of AIDS might have caused a diversion of reporting resources away from foodborne disease surveillance.

2.1.2 Foods Implicated in Outbreaks of Foodborne Disease

Foods frequently implicated in outbreaks are termed "potentially hazardous" foods. These foods are hazards because they usually provide a sufficient quantity and variety of nutrients, have a water activity above 0.85, have a pH greater than 4.6, and possess the proper oxygen requirements that are required to support the rapid growth of infectious or toxigenic microorganisms (FDA, 1986). When such foods are stored at unsafe temperatures (45-140^{o}F), disease-causing organisms can grow to dangerous levels (Banwart, 1989). In the reported outbreaks from 1973 to 1987, a specific food was implicated in 50% of the outbreaks.

However, it is important to understand that the food itself does not cause foodborne disease, but rather that it becomes contaminated with bacteria by being maintained at unsafe temperatures, by mishandling, or by improper

preparation or storage. Multiple factors are usually involved in foodborne disease outbreaks.

2.1.3 Factors Contributing to Foodborne Disease

Bryan (1988) identified 12 factors that contributed to foodborne disease outbreaks in U.S. homes from 1973-1982. These factors are shown in Table 2.1.

TABLE 2.1: Factors that contributed to the occurrence of 345 foodborne disease outbreaks that resulted from foods prepared in the home from 1973-1982.[1]

FACTOR	NUMBER	PERCENT
1. Contaminated raw food or ingredient	145	42.0
2. Inadequate cooking/heating	108	31.3
3. Obtaining food from unsafe source	99	28.7
4. Improper cooling	77	22.3
5. Lapse of 12 or more hours between preparing and eating food	44	12.8
6. Colonized person handling implicated foods	34	9.9
7. Improper fermentation	16	4.6
8. Inadequate reheating	12	3.5
9. Improper hot holding	11	3.2
10. Cross contamination	11	3.2
11. Improper use of leftovers	9	2.6
12. Improper cleaning of utensils	1	0.3

1. Bryan, 1988.

The data in Table 2.1 suggested a need to inform the public about hazardous situations unique to home food preparation (Bryan, 1988). Contaminated raw foods or

ingredients were the leading factor which contributed to foodborne disease in the home; they caused 42% of the reported foodborne disease outbreaks from 1973-1982 (Bryan, Table 2.1). This was primarily due to raw clam-, oyster- and milk-associated outbreaks.

Factors in Table 2.1 can also be associated with specific disease causing bacteria. The most important factors contributing to outbreaks of salmonellosis were improper cooling methods, (such as leaving foods on the countertop at room temperature for >4 hours) and naturally contaminated raw foods that were improperly cooked (Bryan, 1988). Factors contributing to staphylococcal intoxication were colonized persons handling foods that required no further cooking, a lapse of time between food preparation and consumption (>4 hours), and improper cooling methods. *Clostridium perfringens* outbreaks were caused by improper cooling methods, a lapse of time between food preparation and consumption (>4 hours), and inadequate reheating temperatures (<165°F). The factors contributing to botulism outbreaks included inadequate cooking temperatures (<165°F), improper fermentation process, and improper temperature during holding (<140°F)(Bryan, 1988).

2.1.4 Previous Research on Food Safety

Before public education and training programs are planned, food safety professionals must first learn what consumers know about safe food handling. Several state and

national surveys were conducted to learn about consumer food safety knowledge and home preparation practices. In 1973 the Gallup Organization conducted a survey investigating consumer knowledge about salmonella. The survey consisted of personal interviews with 816 randomly selected U.S. women 18 years of age or older. Major findings of the survey included the following high risk practices:

- 39% of respondents thought the USDA specifically inspected foods for salmonella.
- 74% could not correctly identify salmonella.
- 94% did not know that handwashing minimized the spread of harmful bacteria.

In 1974 a comprehensive food safety survey was conducted by USDA. The objectives of survey were: 1) to access homemakers' food safety knowledge and practices, 2) to identify groups of people having the greatest need for food safety information, and 3) to identify the most effective ways to disseminate food safety information (Weimer and Jones, 1977). Major topics covered in the survey included home food handling, bacterial sources of food contamination, food safety information, and government food inspection programs.

In March 1983, Oregon State University's Department of Foods and Nutrition researchers Woodburn and Van DeRiet (1985)

conducted personal interviews on food safety practices of 100 randomly selected adults from Portland and Yamhill County, Oregon. Their findings are below:

- 34% of respondents would not wash the knife, cutting board, and hands after handling raw chicken and before cutting vegetables for salad.
- 9% would not wash the work surface after cutting raw chicken on it and before removing cooked meat from bones.
- 29% would chop giblets for a sandwich without washing the board that held the raw turkey.
- 28% would only wipe or rinse the knife after cutting fresh chicken.
- 27% would thaw turkey at room temperature.
- 24% would hold sliced roast beef at room temperature for over three hours; 13% would hold chicken salad and 10% would hold beef pot pie under the same conditions.
- 58% believed that the maximum time a turkey could safely remain at room temperature was over two hours.
- 50% would cool most foods to room temperature before refrigerating.
- 22% would cool beef pot pie to room temperature before refrigerating.
- 26% would hold turkey at room temperature for over six hours; 33% would hold ham and 22% would hold beef pot pie under the same conditions.

A national survey conducted by the USDA, Food Safety Inspection Service (USDA/FDA, 1991) consisted of 3,202 telephone interviews in the U.S. of which 2,797 responded. Respondents, who prepared the main meal, were asked about food handling knowledge. Major findings of this survey concluded that:

- 71% of respondents used unsafe methods to cool a large pot of stew or soup.
- 48% of respondents used inadequate cleaning practices.
- 97% of respondents rated themselves "average" or "above average" with respect to food safety knowledge.
- 85% of respondents knew that food which looks and smells "okay" can still contain harmful bacteria.
- 84% of respondents knew that juices of raw meat and poultry are likely to contain bacteria.

In March 1990, Michigan State University's Department of Communications in cooperation with Lawler Ballard Inc. conducted 600 statewide telephone interviews (Atkins, 1990). Major findings concerning home food preparation practices were as follows:

- When asked to list their most important consideration in purchasing food, 57% of respondents said price, followed by 27% who said quality or value, and 12% who chose nutrition.

- 86% felt "very" or "somewhat" confident that the food in stores was safe.
- When asked to list their primary food safety concern, 30% said freshness/spoilage, 27% pesticides/chemicals and 15% packaging.
- 94% considered poor food handling to be a "serious" or "somewhat serious" health hazard.

The objectives of a national survey completed at Cornell University were to obtain current information on consumer food safety knowledge and home food preparation practices (Gravani, 1992). The study covered 2,005 U.S. households, of which 869 respondents were asked about their food handling knowledge. Major findings of this study are below:

- 59% of respondents did not avoid foods because they were concerned about foodborne illness.
- 24% did not understand that a food may contain pathogenic bacteria even if it does not smell, taste, or look bad.
- 17% would not wash hands after handling raw chicken and 14% would not do so after sneezing.
- 54% would store leftover stew in deep containers, and another 14% in the pot in which it was cooked.
- The source of food safety information ranked highest as

"reliable" or "very reliable" by respondents was newspapers, magazines, and health professionals (75% for each).

- Television was considered "the most convenient" way to obtain food safety information (33%), followed by newspapers (22.8%), and magazines (8.8%).

Data gathered in these state and national surveys have and will continue to help universities, government agencies, and the food industry to design appropriate and useful strategies for educating the public about food safety in the home.

2.2 Health Information Providers

Research has shown that U.S. consumers believe that health professionals provide reliable food safety information (Gravani, 1992). Health professionals have many opportunities to provide information on food safety to consumers (Valente *et al.*, 1986). Many different groups of health professionals may influence consumer knowledge of food safety: one such group is health professionals affiliated with local health departments; the other is family practice physicians.

In recent years, consumers have become increasingly aware of the role food safety plays in the maintenance of health (Adam and Sachs, 1991). The major food safety concerns identified by consumers have been food additives and pesticide

residues (Huang, 1992; Wolf and Lechowich, 1989; Albrecht, 1986). Microbiological hazards, identified by scientists as being of greater concern, received less attention by consumers (Beran, 1991; Wolf and Lechowich, 1989; Albrecht, 1986).

The regulatory sector ranks microbiological hazards as the highest food safety risk issue (Beran, 1991; USDA, 1989b; Wolf and Lechowich, 1989; Albrecht, 1986). Industry representatives also share this view. One recent survey (Swintek, 1991) asked major food processors to rank potential food hazards. The results of the survey showed that microbiological hazards topped the list, with 91% of respondents considering microbiological hazards to be of high-to-medium importance.

Consumers' two perceptions about food safety--the degree of risk from food contamination and reliable sources of information--may indirectly affect their food handling behavior. Thus, consumers need to be educated about microbiological hazards, especially those from improperly handled foods.

2.2.1 Local Health Departments

The mission of all local health departments in Michigan is to "continually and diligently endeavor to prevent disease, prolong life, and promote the public health" (Michigan Public Health Code, 1987). Local health departments provide free

resources indirectly or directly to the public and are thus an economically viable source of food safety information.

One study reported that consumers didn't avail themselves of many of the services of local health departments (Gravani, 1992). Over 40% of survey respondents never used such services. Increasing awareness about the availability of local health department services could be an important way to disseminate effective food safety information.

Many HIPs affiliated with local health departments (health educators, public health nutritionists, public health nurses, and public health physicians) pay less attention to foodborne disease than they did in the past. They tend to target the prevention of AIDS and venereal diseases, pandemics (tobacco- and alcohol-related illnesses and deaths), poverty and its attendant health problems, and issues of priority (immunization versus transplantation, rationing of care) because these are currently perceived as more critical public health issues (Houston, 1991).

Information about HIPs' knowledge of safe food handling was not found in the literature. However, various groups of HIPs have been evaluated on other general competencies specific to their specialty (Hatfield, 1991; Gantt, 1987; Williams *et al.*, 1989; Weinstein, 1989).

2.2.2 Family practice Physicians

In recent years, Americans have become increasingly aware of the role food safety--microbiological hazards, pesticide residuals, additives, etc.--plays in the maintenance of health (Adam and Sachs, 1991). However, many Americans do not correctly perceive the high risk of foodborne disease from microbiological hazards which may result from unsafe food handling (Gravani, 1992; USDA/FDA, 1991).

The public perceives physicians as a credible source of health information (Gravani, 1992; Kunkel, 1986; Dismuke and Miller, 1983). Some researchers have reported that physicians' knowledge of food and nutrition might be inadequate and/or outdated (O'Keefe, 1991; Sobal *et al.*, 1988; Winick, 1988; Sobal *et al.*, 1987; Krause, 1977).

Research supports the possibility that nutrition education in medical school (or the lack of it) may be a variable influencing the physician's food and nutrition knowledge (Krause, 1977). White *et al.* found that physicians obtained most of their nutrition education from residency programs and experience in practice.

According to Murphy (1990), physicians' opinions about nutrition can be influenced positively by a nutrition education intervention, such as a seminar series, during residency. Interestingly, physicians who attended continuing education programs on nutrition did not significantly differ in their knowledge about nutrition from those who did not

attend such programs. This may suggest that physicians are more likely to be influenced favorably when nutrition education occurs in a residency program before beginning office practice.

Many studies have also shown that nutrition receives insufficient attention in medical school curricula (Swanson, 1991; Weinsier *et al.*, 1989). Two surveys reported that 61% (GPEP, 1984) and 67% (McLeod, 1989) of graduating medical students believed inadequate time was devoted to nutrition education. The nutrition education provided was sporadic and poorly organized in many medical schools and residency programs (Walsh, Dappen and Gessert, 1987; Young, 1988).

Family practice physicians are most often currently trained in their specialty in formal three-year residency programs. They are trained to evaluate total health needs, to provide personal medical care within one or more fields of medicine, to refer patients when necessary, and still maintain a continuity of care (AAFP, 1991a). Family practice physicians treat 85 to 90% of patient's health care needs within their practice area. Equally important, their training teaches them to practice "preventive" medicine.

In 1986 family practice physicians represented 11.9% of the total number of physicians (569,160) in the U.S. In terms of size, family practice was ranked second among all specialties. American Medical Association (AMA) data also showed that family practice physicians conduct more patient

visits per week than do other types of physicians. Family practice physicians devoted a mean of 57.9 hours per week to professional activities, of which a mean of 48.9 were devoted to direct patient care.

Family practice physicians were sought after by managed care systems not only because they offer a broad range of services, but because they are perceived as cost-efficient users of resources. Large multihospital and multisystem organizations have a vested interest in utilizing resources efficiently, and family practice physicians might meet such interests by serving as "case managers." In addition to the economic considerations, managed-care systems place high values on disease prevention and health promotion.

Family practice physicians, because of their potential influence on the lifestyles of their patients, are involved in health and societal issues that affect the well-being of their patients. Thus, concerns about preventive health care measures have the potential to claim a larger role in the practice of family practice physicians.

The Michigan Academy of Family Physicians (MAFP) is a state association of doctors of medicine and osteopathy who are engaged in family practice (MAFP, 1992). The basic goals of the MAFP are: 1) to constantly maintain and improve high standards of family practice; 2) to promote the science and art of medicine and surgery, improve the public health, and to preserve the patients' right to free choice of physicians; and

3) to acknowledge and assume responsible public advocacy in all health-related matters.

As in the American Academy of Family Physicians there are seven types of MAFP memberships: student, resident, active, affiliated, sustaining, inactive, and life members (AAFP, 1988). Active members make up the bulk of Academy membership. To be eligible for active membership, a candidate must be a graduate of a school of medicine or osteopathy, hold a certificate of qualification recognized by the AMA, or hold a Doctor of Osteopathy degree and have completed a three-year family practice residency. The primary obligation of active membership is fulfillment of 150 hours of study acceptable to the Commission on Continuing Medical Education (CME) during the preceding three years. This guarantee of competence is met through various CME programs.

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3.0

Knowledge of Safe Food Handling of Health Information Providers at Michigan Local Health Departments

3.1 Abstract

This study was one component of a Michigan statewide assessment of the food handling knowledge of: third-grade children and their household members, third-grade teachers, school foodservice personnel and health information providers (HIPs) including sanitarians, health educators, nurses, nutritionists and physicians affiliated with local health departments. Fifty percent of Michigan local health departments participated in the study (n=24, N=48). A questionnaire was mailed to 891 HIPs. The response rate was 68.5%. Almost half (48.4%) indicated they had opportunities to provide people with information about food handling, but 66% had not received formal training in food handling during 1991. Of the five HIP groups surveyed, sanitarians had the highest mean knowledge scores (mean score=89.4%); nurses had the lowest (mean score=66.8%). Significant differences ($p \leq .01$) in knowledge were found for the average effect of training and gender as well as the interaction of training and gender. No significant differences in knowledge were found among respondents across educational level, age, or years in specialty area. Results indicated additional education about safe food handling should address: time-temperature relationships of food handling and the identification of potentially hazardous foods.

3.2 Introduction

Foodborne disease has been a significant health problem in the United States during the 1980s and continues to be a serious problem into the 1990s. Approximately 6.5 million cases of foodborne diseases are estimated to occur in the United States each year.[1]

Unlike many types of disease, foodborne disease is almost completely preventable by using safe food handling practices. Thirty percent (30%) of all reported foodborne disease resulted from unsafe handling of food in the home.[2] A 1991 national survey showed that consumers ranked the home third (after food manufacturing facilities and restaurants) among sites where food safety hazards were likely to occur.[3] Some researchers have suggested that foodborne disease can be prevented if food is handled safely, especially during the final stages of preparation before service.[4-12]

Food safety appears to be replacing nutrition as the consumer health concern of the 1990s.[13] Major food safety concerns identified by consumers have been food additives and pesticide residues.[11,14,15]

Consumers have two incorrect perceptions about food safety: the degree of risk from food contamination and reliable sources of information about food safety. These inaccuracies could affect their food handling behaviors. Studies have shown that consumers sustain minimal health risk

from the effects of pesticide residues in foods.[7] However, pesticide residues in foods are widely held to be a significant risk factor.

The regulatory sector ranks microbiological hazards as the major issue in food safety.[1,11,15,16] Industry representatives also share that view. One recent survey[17] asked major food processors to rank potential food hazards. The results of the survey showed that microbiological hazards topped the list, with 91% of respondents considering microbiological hazards to be of high-to-medium importance. Consumers need to be educated about the impact on their health of microbiological hazards from improperly handled foods.

In regard to the second perception, consumers believed that health professionals, such as physicians and nurses, can provide reliable food safety information.[3] Indeed, health professionals have many opportunities to provide information on food safety to consumers.[18] However, many HIPs affiliated with local health departments, such as health educators, public health nurses, public health nutritionists and public health physicians, pay less attention to foodborne disease in the 1990 than they did in the past.[20] Most human and financial resources of local health departments currently target the prevention of acquired immunodeficiency syndrome (AIDS) and venereal diseases, pandemics (tobacco- and alcohol-related illnesses and deaths), poverty and its attendant health problems, and issues of priority (immunization versus

transplantation, rationing of care).[20] These issues are perceived as more critical public health issues than food safety.

A research study reported consumers underutilized local health department services.[3] Over 40% of the respondents never used such services. Increasing consumer awareness about the availability of these services could be an important means to develop local health departments as a source of food safety knowledge.

Various groups of HIPs have been evaluated in the particular competencies of their specialties.[21-26] However, information about assessment of HIPs' knowledge of safe food handling was not found in the literature. Accordingly, the purpose of this study was to assess the safe food handling knowledge of HIPs and to determine their training needs in this area. HIPs working in local health departments in Michigan were used as the sample population.

3.3 Method

Mailed surveys to HIPs were used to obtain information on their knowledge of safe food handling.

3.3.1 Description of the Sampling Frame

HIPs affiliated with local health departments in Michigan made up the sampling frame for this research. HIPs were affiliated with Michigan health departments. Specific professional groups included foodservice sanitarians, health educators, public health nurses, public health nutritionists, and public health physicians.

3.3.2 Development of the Questionnaire

The objective of the questionnaire was to determine HIPs' knowledge of safe food handling. The questionnaire contained 26 questions in two areas: demographics and knowledge of safe food handling.

3.3.2.1 Demographics

The demographic questions covered three areas: (1) respondent characteristics--age, gender, years in specialty area, residential setting, race, educational level and household income; (2) types of interactions with children on safe food handling; and (3) sources of safe food handling information.

3.3.2.2 Knowledge of safe food handling

Knowledge questions were developed based on the results of earlier studies which found that consumers lacked knowledge about time and temperature effects on contamination, sources of contamination, and cooling procedures.[16] Eight questions were developed to determine the respondent's knowledge about safe food handling. The questions were developed to cover the four constructs critical to the prevention of foodborne disease: food temperatures and storage, personal hygiene, cross-contamination, and the identification of potentially hazardous foods.[2-4,6-8,12,16,27,28]

The content, construct, and face validity of the questionnaire were assessed by reviewers with expertise in these fields: food safety and surveys. Content validity in this research was assessed by determining whether the questions chosen were accurate (right answers were correct; wrong answers were incorrect).[29] Face validity was assessed by expert reviewers, which determined whether the survey was appropriate for the intended population.[29] Construct validity was assessed according to whether the items represented the concept (safe food handling) they were intended to measure.[29]

The questionnaire was pilot-tested with a subsample of the population (n=49) to determine the criterion validity and the difficulty level of the knowledge items. Criterion validity in this research referred to whether the instrument discriminated between masters and non-masters of the

information represented by the construct.[29] The discrimination index was used to assess criterion validity and was calculated for individual items and for the total survey. The index of discrimination used in this item analysis was calculated as the difference between the proportion of the high scorers (upper 27%) who selected the correct answer minus the proportion of the lower scorers (lowest 27%) who selected the right answer. An item discrimination of greater than 0.33 was the standard for acceptability in this study.

The difficulty index (proportion of the total group who selected the correct response) was also calculated. A high index indicated the item was easy and a low index indicated that the item was difficult.[29] Both the discrimination and difficulty indices for the survey were acceptable (mean difficulty=0.79; mean discrimination=0.37).

The results of the pilot test showed the Kuder-Richardson reliability coefficient for the knowledge items was 0.29. The questionnaire was also reviewed and approved by the University Committee on Research Involving Human Subjects (UCRIHS) at Michigan State University in March 1991.

3.3.3 Obtaining the Samples

In September 1991, a project statement requesting participation in the present study (Appendix 1), a reply card (Appendix 2), and a sample questionnaire (Appendix 5) were sent to the health officers of all local health departments

(N=48) in Michigan. The health officer is usually the administrative head of a local health department. The project request had the endorsement of the Michigan Association for Local Public Health (MALPH). Foodservice sanitarians, health educators, public health nurses, public health nutritionists, and public health physicians at local health departments were invited to participate in the study. Fifty percent (n=24) of the health officers of local health departments in Michigan agreed that their health departments would participate. The total number of questionnaires requested by participating local health departments was 891--252 for foodservice sanitarians, 80 for health educators, 81 for public health nutritionists, 424 for public health nurses, and 54 for public health physicians.

3.3.4 Mailing

Questionnaires for all HIPs at each public health department were sent by bulk mail. Prepaid return postage was enclosed in an attempt to increase the response rate.[30] Mailed questionnaires were coded in alphabetical order by the county in which the local health department was located.

Questionnaires (n=891) were mailed between September 20, and October 20, 1991. Each participating local health department (n=24) was mailed a box (37 cm x 27 cm x 27 cm) which included a cover letter (Appendix 3), a return sheet (Appendix 4), and the number of questionnaires requested by

the health officer on the reply postcard. The cover letter emphasized the importance of participation and its value to the HIPs. Confidentiality was ensured.

3.3.5 Statistical Analyses

Data were analyzed using the Statistical Package for the Social Sciences (SPSS/PC+, version 4.0). The following analyses were conducted: mean, standard deviation, frequency distribution, and a five-way analysis of variance to determine the differences in knowledge of food handling by respondents' gender, age, years in specialty area, formal training on safe food handling, and educational level. A probability of $p \leq .05$ was used as the level of significance for all analyses.

3.4 Results and Discussion

The purpose of this study was to assess the safe food handling knowledge of HIPs and to determine their training needs in this area. Fifty percent (n=24) of local health departments in Michigan (N=48) participated in the study. HIPs (n=891) affiliated with local health departments who received questionnaires were: foodservice sanitarians, health educators, public health nurses, public health nutritionists, and public health physicians. The questionnaires were mailed during October 1991 and returned no later than November 15, 1991.

3.4.1 Response Rate

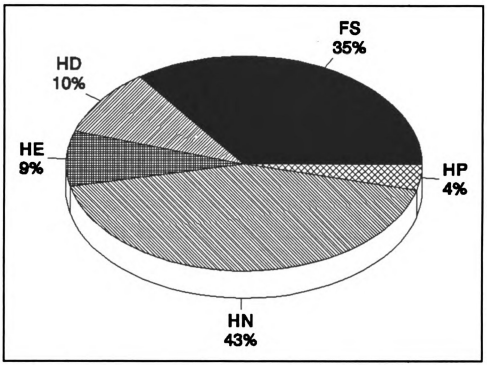
Questionnaires (n=891) were sent to the designated contact person(s) of the 24 participating local health departments in Michigan. Nearly 70% of mailed questionnaires (n=611/891; 68.5%) were completed and returned. Response rates by group of HIPs for all questionnaires (n=891) mailed are provided in Table 3.1. Of the five groups of HIPs surveyed, the highest response rate was from foodservice sanitarians (84.9%); the lowest response rate was from public health physicians (44.4%) (Table 3.1).

The percent of the total sample population by HIP group is shown in Figure 3.1. Public health nurses represented the

Table 3.1 Response rates for a questionnaire on safe food handling mailed to five groups of health information providers (n=891) affiliated with Michigan local health departments[1] (n=24)

Group of Michigan Health Information Provider	Questionnaires Sent	Questionnaires Returned	Response Rate (%)
Foodservice Sanitarians	252	214	84.9
Health Educators	80	52	65.0
Public Health Nurses	424	260	61.3
Public Health Nutritionist	81	61	75.3
Public Health Physicians	54	24	44.4
Total	891	611	68.5

1. 24 of 48 Michigan local health departments agreed to participate in this study.



Key: Health information provider groups:
FS: Foodservice sanitarians (n=214)
HD: Public health nutritionists (n=61)
HE: Health educators (n=52)
HN: Public health nurses (n=260)
HP: Public health physicians (n=24)

Figure 3.1 Percent of total respondents (n=611) represented by each of five groups of Michigan health information providers. Health information providers were affiliated with local health departments that responded to a mailed questionnaire on safe food handling in 1991.

largest sample of respondents (42.6%), followed by foodservice sanitarians (35.0%), and public health nutritionists (10.0%).

3.4.2 Demographics

Demographic characteristics of HIPs who responded to the questionnaire on safe food handling are summarized in Table 3.2 and Appendices 5-10. Respondents from local health departments were predominantly female (71.8%) and white (80.7%). The respondents ranged in age from 21 to 70 years of age, with a mean (± standard deviation) age of 39.5±9.9 years. Length of time in their specialty area ranged from less than one year to 40 years, with a mean (± standard deviation) of 9.8±8.4 years. Over half the respondents (59.2%) had at least a bachelor's degree; 18.0% had a higher degree. Only one-fifth of HIPs (20.9%) had received any formal training in safe food handling during 1991. Of the five groups of HIPs, foodservice sanitarians most frequently received formal training on safe food handling during 1991 (51.4%). Health educators received the least formal training on safe food handling (3.8%). Over half of the public health nutritionists (50.8%) were registered dietitians (R.D.), and 57.7% of public health nurses were registered nurses (R.N.). Eight percent of surveyed foodservice sanitarians were registered sanitarians (R.S.).

Table 3.2 (P.1 of 3) Demographic characteristics of health information providers affiliated with Michigan local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Characteristics	Total (n=611)	Group of health information providers[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<---------- % of response ---------->					
Gender						
Male	26.8	68.2	0.0	5.8	1.5	45.8
Female	71.8	29.4	100.0	94.2	97.3	54.2
Total	98.6[2]	97.6	100.0	100.0	98.8	100.0
Age (years)						
21-30	20.6	28.5	29.5	42.3	9.6	0.0
31-40	30.1	29.0	19.7	32.7	32.3	37.5
41-50	24.7	23.4	16.4	17.3	30.0	16.7
51-60	12.1	6.5	18.0	1.9	16.2	25.0
over 60	1.5	0.5	1.6	1.9	0.8	16.7
Total	89.0	87.9	85.2	96.2	88.8	95.8
Mean	39.5±9.9[3]	37.1±9.2	39.6±11.5	34.0±8.8	41.7±9.0	48.0±11.5
Ethnic (optional)						
African-American	7.9	8.4	19.7	1.9	5.8	8.3
Arab/Chaldean	0.3	0.5	0.0	0.0	0.4	0.0
Asian/Pacific Islander	2.9	0.9	3.2	1.9	2.0	33.3
Hispanic	1.2	1.9	1.6	0.0	0.4	4.2
Native Indian	0.3	0.9	0.0	0.0	0.0	0.0
White	80.7	77.6	72.1	92.3	85.4	54.2
Total	93.3	90.2	96.7	96.1	93.8	100.0

1. Group of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HP: Public health physicians
   HN: Public health nurses
2. Total percent response varies among demographic characteristics because some respondents did not answer all questions.
3. Age: mean ± standard deviation

Table 3.2 (Continued, P.2 of 3)

Characteristics	Total (n=611)	Group of health information providers[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<——— % of response ———>					
Training						
Received	20.9	51.4	6.6	3.8	4.2	4.2
Not received	66.9	39.3	83.6	86.5	81.2	75.0
Total	87.8[2]	90.7	90.2	90.3	85.4	79.2
Residential Setting						
Farm	5.7	5.1	0.0	9.6	6.9	4.2
Less than 10,000 people	24.9	29.0	14.8	28.8	23.1	25.0
10,000-50,000 people	28.0	22.0	18.0	36.5	35.0	12.5
Suburb, more than 50,000	16.5	15.0	21.3	11.5	17.3	20.8
City, more than 50,000	22.7	26.0	42.6	11.5	16.2	33.3
Total	97.9	97.7	96.7	98.1	98.5	95.8
Household Income (optional)						
Less than $10,000	0.5	0.0	1.6	1.9	0.4	0.0
$10,001-20,000	1.1	1.4	0.0	1.9	1.2	0.0
$20,001-30,000	15.2	20.1	19.7	26.9	9.2	0.0
$30,001-40,000	16.7	22.0	16.4	17.3	13.8	0.0
$40,001-50,000	11.5	13.6	13.1	9.6	10.8	0.0
$50,001-60,000	9.0	7.5	4.9	13.5	10.8	4.2
$60,001-70,000	7.2	6.1	9.8	5.8	7.3	12.5
$70,001-80,000	4.4	2.3	6.6	3.8	5.4	8.3
$80,001-90,000	3.1	2.3	3.3	0.0	4.6	0.0
$90,001-100,000	2.1	0.0	0.0	0.0	3.1	20.8
$100,000 - more	2.0	1.0	0.0	3.8	1.6	16.7
Did not answer	20.0	15.4	16.4	9.6	26.5	20.8
Total	92.8	91.6	91.8	94.2	94.6	83.3

1. Group of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HP: Public health physicians
   HN: Public health nurses
2. Total percent response varies among demographic characteristics because some respondents did not answer all questions.

Table 3.2 (Continued, P.3 of 3)

Characteristics	Total (n=611)	Group of health information providers[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<——— % of response ———>					
Years in specialty area (years)						
1-10	54.2	47.2	65.6	57.7	58.8	29.2
11-20	21.4	22.9	13.1	11.5	22.7	37.5
21-30	8.8	11.2	11.5	1.9	7.7	8.3
31-40	1.3	0.5	0.0	0.0	0.8	20.8
Total	85.8[2]	81.8	90.2	71.2	90.0	95.8
Mean	9.8±8.4	10.3±8.1	9.1±8.8	6.3±6.0	9.3±7.9	18.4±11.8
Education						
Vocational	0.8	0.0	0.0	0.0	2.0	0.0
Associate Degree	2.6	2.3	0.0	5.8	3.1	0.0
B.S.	59.2	66.8	59.0	51.9	52.7	79.1
M.S.	17.7	20.1	26.3	32.8	10.4	20.9
Ph.D.	0.3	0.5	1.6	0.0	0.0	0.0
Total	80.8	89.7	86.9	90.5	68.2	100.0
Compared to most of the things you do to maintain your health, how important is safe food handling?						
1. Most important	12.3	21.0	9.8	3.8	7.7	8.3
2. Important	81.2	75.2	88.5	78.8	84.6	83.3
3. Less important	4.9	2.8	0.0	11.5	6.2	8.3
4. Not important	0.0	0.0	0.0	0.0	0.0	0.0
5. Not familiar with safe food handling	1.0	0.5	1.6	3.8	0.8	0.0

1. Group of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HP: Public health physicians
   HN: Public health nurses
2. Total percent response varies among demographic characteristics because some respondents did not answer all questions.

One question requested respondents to identify the importance of safe food handling relative to other things they do to maintain their health (Appendix 5, Question 1). Almost ninety percent (89.6%) of all HIPs considered safe food handling to be the "most important" or "as important as most" other things they do to maintain their health (Table 3.2). Only 1.0% of respondents replied that they were not familiar with safe food handling methods. Compared to the other groups of HIPs, 11.5% of health educators considered safe food handling to be less important than other things they do to maintain their health.

Types of interaction with children about food handling noted by HIPs are listed in Table 3.3. Almost half (48.4%) indicated that they had opportunities to provide children with information about safe food handling, especially public health nutritionists (59.0%) (Table 3.3; Appendix 5, Question 5). The most frequent type of interaction reported was talking to parents or guardians during office visits for their child (26.4%).

Sources of information on safe food handling received by HIPs are shown in Table 3.4. Based on results shown in Table 3.4, over half the HIPs (62.2%) responded that newspapers and consumer magazines were the information sources used most frequently for information about safe food handling. Professional or job-related meetings followed with 50.9%, professional journals (50.4%), and government pamphlets

Table 3.3 Types of safe food handling interaction with children reported by Michigan health information providers (n=611) of local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Type of interaction with children about safe food handling	Total (n=611)	Group of health information provider[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<——— % of responses ———>					
Safe food handling interaction with children or families						
1. Request by co-workers talk to children and/or their parents	8.3	7.4	1.6	7.7	8.8	29.2
2. Talk to a child during office visits	7.4	2.8	1.6	3.8	12.3	16.7
3. Talk to groups of children in community settings	12.6	17.7	3.2	7.7	11.9	8.3
4. Talk to parents (guardians) during office visits for their children	26.4	5.1	49.1	5.7	40.7	45.8
5. Talk to educational personnel	9.0	12.1	4.9	9.6	7.3	8.3
6. Prepare written materials	9.3	14.0	14.8	5.4	2.3	16.7
7. Other[2]	8.3	8.4	9.8	19.2	6.5	0.0
Total	48.4	37.3	59.0	36.5	56.5	58.3

1. Groups of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HN: Public health nurses
   HP: Public health physicians
2. Other= teaching parents in elementary school, home visit and classroom speaking event

Table 3.4 Sources of safe food handling information identified by Michigan health information providers (n=611) affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Source of information on safe food handling	Total (n=611)		Group of health information providers[1]									
			FS (n=214)		HD (n=61)		HE (n=52)		HN (n=260)		HP (n=24)	
	S[2]	A[3]	S	A	S	A	S	A	S	A	S	A
	% of responses											
1. Cooperative Extension Service	27.2	11.8	19.2	2.3	44.2	19.7	36.5	15.4	29.6	18.1	8.3	0.0
2. Family and friends	24.4	0.5	14.0	0.0	6.5	0.0	46.1	0.0	32.3	0.8	29.2	4.2
3. Government pamphlets	43.7	10.0	66.3	9.3	45.9	13.1	40.4	19.2	26.1	8.1	33.3	8.2
4. Local school district	3.6	0.0	3.7	0.0	0.0	0.0	3.8	0.0	3.8	0.0	8.3	0.0
5. Newspaper/consumer magazines	62.2	6.5	53.7	1.9	55.7	4.9	69.2	15.4	68.8	8.5	66.7	12.5
6. National/ Michigan Dairy Council	17.8	2.1	14.4	1.4	31.1	4.9	36.5	7.7	13.1	1.2	25.0	0.0
7. Professional journals	50.4	21.3	75.7	27.1	52.4	19.7	30.7	17.3	32.7	16.9	54.2	29.2
8. Professional or job related meetings	50.9	24.9	83.6	44.6	40.9	9.8	23.1	3.8	34.2	17.7	25.0	8.3
9. Other[4]	13.1	5.4	15.8	6.1	11.4	6.6	21.1	7.7	0.1	4.6	8.3	0.0
10. No response	8.2	17.5	1.8	7.0	6.5	21.3	11.5	13.5	12.7	24.2	12.5	37.5

1. Groups of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HN: Public health nurses
   HP: Public health physicians
2. S: Sources of information on safe food handling identified by Michigan health information providers
3. A: The most accurate source of information on safe food handling identified by Michigan health information providers
4. Other: radio, college courses, television, books and video tapes

(43.7%) (Appendix 5, Question 2). Sources of information about safe food handling noted by HIPs were similar to those described by Gravani[3] in a national consumer survey. Results of both studies indicated that newspapers and consumer magazines were the most frequent sources of information on safe food handling.

Sources of information on safe food handling rated as the most accurate by the respondents are shown in Table 3.4. Almost one-fourth of HIPs (24.9%) believed that professional or job-related meetings provided the most accurate information about safe food handling, followed by professional journals (21.3%), and Cooperative Extension Service materials (11.8%) (Table 3.4, Appendix 5, Question 3). Almost 20% of health educators responded that government pamphlets provided the most accurate information on safe food handling. Both public health nurses (18.1%) and public health nutritionists (19.7%) identified Cooperative Extension Service materials as the most accurate source of information on safe food handling.

The HIPs' perception of the most accurate source of information on safe food handling was different from Gravani's findings on consumers' expectations of accuracy.[3] Gravani found that 75% of the consumers he surveyed ranked newspapers, magazines, and health professionals as "reliable" or "very reliable" sources of food safety.

3.4.3 Knowledge of Safe Food Handling

Content of knowledge questions on safe food handling and percent of correct responses by five groups of HIPs are shown in Table 3.5. Ninety-nine percent (99.7%) of respondents across all groups of HIPs correctly identified the refrigerator as the location for proper storage of ground beef (Table 3.5). Among all groups of HIPs surveyed, foodservice sanitarians had a significantly higher mean score (89.4%) on the eight knowledge questions about safe food handling than any other group (Table 3.5). Public health nutritionists had a statistically significantly higher mean score (79.9%) on safe food handling than did public health nurses (66.8%). The scores of health educators (73.6%), public health nurses (66.8%), and public health physicians (73.4%) did not differ significantly.

3.4.3.1 Food temperature and storage

Nearly 98% of respondents correctly answered the first two questions about methods of storing and thawing ground beef (Table 3.5, Appendix 5, Question 7 and 8). Although almost all HIPs knew that the refrigerator is the safest place to store ground beef and to thaw frozen ground beef, only three-fifths of HIPs (60.9%) knew that 45°F was the maximum safe temperature for the operation of refrigerators.[31] The temperature, 45°F, was chosen as the correct answer to the question on refrigerator temperature because 45°F is still

Table 3.5 (P.1 of 2) Percent correct response to knowledge items on safe food handling (n=8) from Michigan health information providers (n=611) affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Knowledge Item (Content)	Total (n=611)	Group of health information providers[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<——— % correct response ———>					
A. Food temperature and storage						
1. Best location for storage meat	99.7	100.0	100.0	100.0	99.2	100.0
2. Best location for thawing meat	97.9	99.1	98.4	94.2	97.7	95.8
3. Recommended maximum temperature of an operating refrigerator	60.9	95.8	70.5	51.8	32.0	58.4
4. Chilling of leftover foods in a shallow container	56.0	91.1	75.4	38.5	27.3	41.7
B. Personal hygiene (Method of handwashing)	83.0	81.8	83.6	88.5	82.7	83.3
C. Cross contamination (Transfer of *Staphylococcus aureus* from foodhandlers to potato salad)	76.8	88.3	73.8	76.9	66.9	87.5

1. Groups of health information provider:
FS: Foodservice sanitarians
HD: Public health nutritionists
HE: Health educators
HN: Public health nurses
HP: Public health physicians

Table 3.5 (Continued, P.2 of 2)

Knowledge Item (Content)	Total (n=611)	Group of health information providers[1] FS (n=214)	HD (n=61)	HE (n=52)	HN (n=260)	HP (n=24)
	<——— % correct response ———>					
D. Identification of potentially hazardous foods						
1. Foods on which bacteria can grow	50.6	65.9	50.8	48.1	39.6	37.5
a. Baked potato	89.0	93.0	83.6	84.6	87.7	91.7
b. Broiled chicken breast	97.5	98.6	100.0	100.0	96.2	91.7
c. Glass of skim milk	96.4	96.7	96.7	98.1	95.4	100.0
d. Refried beans	91.7	93.0	93.4	88.5	90.8	91.7
2. Identification of unsafe food by sight, smell and/or taste	90.2	93.5	86.9	90.4	88.8	83.3
Mean	76.9	89.4[2a]	79.9[b]	73.6[bc]	66.8[c]	73.4[bc]

1. Groups of health information provider:
   FS: Foodservice sanitarians
   HD: Public health nutritionists
   HE: Health educators
   HN: Public health nurses
   HP: Public health physicians
2. Means sharing the same superscript (a, b, c) did not differ significantly ($p \leq .05$)

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used as the maximum operating temperature for refrigerators in the publichealth codes of Michigan.[31]

In a 1974 USDA study[32], 49% of respondents indicated that they kept their refrigerators warmer than 40°F. The USDA has indicated that 40°F was the maximum safe temperature for the operation of refrigerators.[16] Similarly, a recent national consumer survey found that 42% of respondents did not know 45°F was the maximum safe temperature for the operation of refrigerators.[3]

Half of all respondents (56.0%) knew that a shallow container should be used to chill food rapidly (Table 3.5, Appendix 5, Question 14). However, 23.7% thought the depth of the container was not important. This result is similar to that of a national consumer survey that reported 68% of respondents did not cool stew in a shallow container.[3] Results of a 1988 USDA/FDA study indicated that 71% of the respondents used unsafe methods to cool a large pot of stew or soup.[33] Improper storage and holding temperatures were the most common causes of foodborne disease.[34] Information on the proper procedures to cool foods rapidly should be incorporated into a safe food handling education program.

3.4.3.2 Personal hygiene

More than three-fourths of HIPs (83.0%) knew that handwashing was important after handling raw chicken (Table 3.5, Appendix 5, Question 10). This finding is similar to that of a 1991 national consumer survey where 83% of

respondents reported washing their hands with soap and water after handling chicken.[3] Handwashing can effectively remove transient foodborne pathogens to prevent the contamination of food.[35] According to Feachem,[36] the incidence of diarrhea can be reduced by 14 to 48% by simply washing contaminated hands with soap and water for 20 seconds.

3.4.3.3 Cross-contamination

Data in Table 3.5 showed that 76.8% of the respondents knew that *Staphylococcus aureus* is most often introduced into potato salad from food handlers (Appendix 5, Question 12). Food handlers are also an important cause of cross-contamination.[7,8,37]

3.4.3.4 Identification of potentially hazardous foods

Data in Table 3.5 shows that 50.6% of the respondents correctly selected the four foods out of six that are potentially hazardous (Appendix 5, Question 9). "Potentially hazardous food" has been defined as any perishable food that consists in whole or in part of milk or milk products, egg, meat, poultry, fish and shellfish, or other ingredients capable of supporting rapid and progressive growth of infectious or toxigenic microorganisms.[38]

In the present study, 94.6% of the respondents correctly selected two potentially hazardous foods of animal origin--broiled chicken breast and skim milk. However, only 50.6% of the respondents identified the other two foods--baked potatoes and refried beans--which also support bacterial growth.

Nevertheless, plant foods, such as baked potatoes and rice, have been implicated in outbreaks of foodborne disease.[39] However, the question was not worded in such a way as to determine whether the respondents knew that plant sources could be a source of bacteria. This supports the need to inform HIPs that any food, whether of plant or animal origin, is a potential vehicle for foodborne disease.

In the present study, over 90% of the respondents knew that food such as ham could not necessarily be determined to be spoiled by looking, smelling, and tasting it (Table 3.5, Appendix 5, Question 13).

3.4.4 Statistical Analyses of Knowledge Scores by Demographics

Table 3.6 summarizes the effect of the demographic variables of HIPs on their knowledge of safe food handling. Significant differences were determined by analysis of variance ($p \leq .05$). For some analyses, age was categorized into two groups: less than and 40 years or greater than 40 years. This value was selected as the dividing point because it was a median value resulting in development of two groups of equal size. Years in specialty area was categorized into two groups: less than ten years or ten years and more than ten years. This value was selected as the dividing point because it was median value resulting in development of two groups of equal size. Also, educational level was categorized into two

Table 3.6 Analysis of variance of demographic factors on total score of eight knowledge questions for health information providers affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Demographic Characteristics	DF	Mean Square	F	P
Training (T) during 1991	1	72.183	62.385	<.01[1**]
Years in specialty area (Y)	1	1.628	1.407	0.24
Gender (G)	1	27.378	23.661	<.01**
Education (E)	1	1.426	1.232	0.27
Age (A)	1	2.085	1.802	0.18
T Y	1	.783	.676	0.41
T G	1	17.818	15.400	<.01**
T E	1	.849	.734	0.39
T A	1	2.869	2.480	0.12
Y G	1	.150	.130	0.72
Y E	1	1.117	.966	0.33
Y A	1	6.434	5.561	0.02*
G E	1	.233	.201	0.65
G A	1	.124	.107	0.74
E A^2	1	1.778	1.537	0.21
Residual Error	318	1.157		
Total	343	1.688		

1. *: p <.05
   **: p <.01
2. Higher interactions among more than two factors were not statistically significant.

groups: a bachelor's degree or less or higher than a bachelor's degree.

A significant difference in knowledge of safe food handling was found between HIPs who had received training in safe food handling and those who had no formal training during 1991 ($p \leq .01$) (Table 3.6). Respondents who had received formal training in 1991 were more knowledgeable (mean score=92.7%) about safe food handling than were respondents who had not received formal training during 1991 (mean score=76.0%).

A significant difference was found between the gender of the respondents and their knowledge of safe food handling ($p \leq .01$) (Table 3.6). Based on the eight knowledge questions, male respondents (n=110) were significantly more knowledgeable (mean score=89.6%) about safe food handling than female respondents (n=234) (mean score=76.3%).

The difference in knowledge of safe food handling when respondents received formal training on safe food handling in 1991 was more pronounced with respect to female HIPS than male HIPs ($p \leq .01$) (Table 3.6). As shown in Figure 3.2, knowledge of safe food handling was higher for trained (mean score=93.6%) versus untrained females (mean score=72.6%), whereas knowledge scores of trained (mean score=92.1%) versus untrained males (mean score=87.2%) were not significantly different.

Although there were no prominent differences in the age and years in specialty areas, the difference in knowledge

between the respondents of different age groups differed significantly according to the number of years in their respective specialty areas (p=.02) (Table 3.6). Respondents who were ≤40 years and had ≥10 years work experience were the most knowledgeable about safe food handling (mean score=88.7%) (Figure 3.3). For respondents over 40 years, there was no significant difference in knowledge scores based on the number of years in their specialty area.

The primary effect of years in specialty area, educational level, and age was not significant, nor were other interactions examined.

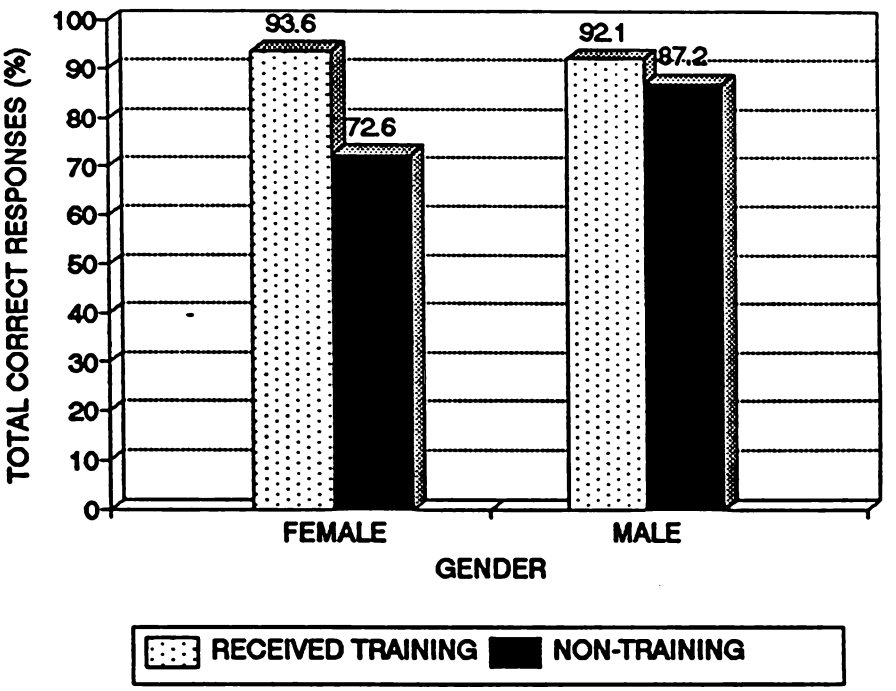

Figure 3.2 Histogram of mean knowledge scores of health information providers affiliated with local health departments, by gender and training

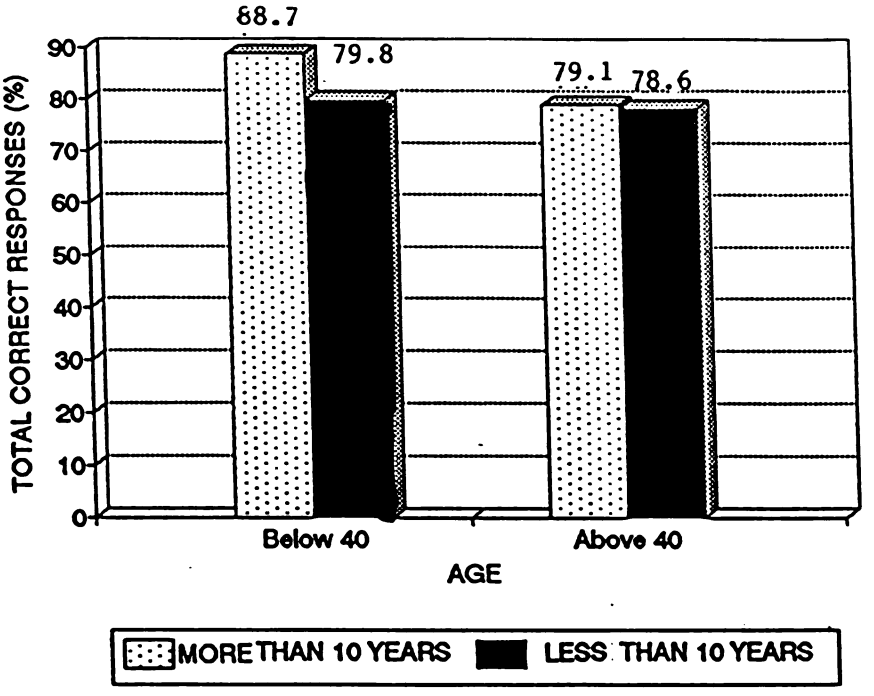

Figure 3.3 Histogram of mean knowledge scores of health information providers affiliated with local health departments, by age and years in specialty area.

3.5 Conclusions and Recommendations

Research has shown that U.S. consumers believe that health professionals provide reliable food safety information.[3] The results of the present study showed that almost half the HIP respondents (296/611) indicated that they had opportunities to provide people with information about safe food handling. These results, however, also demonstrated that some HIPs were unable to correctly answer questions on safe food handling. They were also unable to identify some potentially hazardous foods.

In the present study, HIPs who said they had received training during the previous year had significantly higher scores than those who said they had not. Professional societies to which HIPs belong should increase their emphasis on educational opportunities that focus on safe food handling. Important concepts to include in training are time-temperature relationships as they affect proper food handling and the identification of potentially hazardous foods (Tables 3.7 to 3.11).

Recommendations based on the results of this study of five groups of Michigan HIPs affiliated with local health departments are shown in Tables 3.7 to 3.11.

Table 3.7 Safe food handling objectives for further training of foodservice sanitarians affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Personal hygiene** Foodservice sanitarians will be able to recognize recommended handwashing procedures which can decrease the risk of foodborne disease.	1. Because 18.2% (39/214) of foodservice sanitarians were unable to correctly answer the question on handwashing procedure (Table 3.5; Appendix 6, Question 10).
2. **Identification of potentially hazardous foods** Foodservice sanitarians will be able to identify potentially hazardous foods.	2. Because 34.1% (73/214) of foodservice sanitarians were unable to identify potentially hazardous foods (Table 3.5; Appendix 6, Question 9).

Table 3.8 Safe food handling objectives for further training of health educators affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Food temperature and storage** Health educators will be able to identify recommended refrigerator temperatures and identify appropriate methods to cool leftovers.	1. Because 48.2% (25/52) of health educators did not know the highest safe temperature of an operating refrigerator (Table 3.5; Appendix 7, Question 11). Because 61.5% (32/52) of health educators were unable to correctly answer the question on refrigerating leftovers (Table 3.5; Appendix 7, Question 14).
2. **Identification of potentially hazardous foods** Health educators will be able to identify potentially hazardous foods.	2. Because 51.9% (27/52) of health educators were unable to identify potentially hazardous foods (Table 3.5; Appendix 7, Question 9).

Table 3.9 Safe food handling objectives for further training of public health nurses affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Food temperature and storage** Public health nurses will be able to identify recommended refrigerator temperatures and identify appropriate methods to cool leftovers.	1. Because 68.0% (177/260) of public health nurses did not know the highest safe temperature of an operating refrigerator (Table 3.5; Appendix 8, Question 11). Because 72.7% (189/260) of public health nurses were unable to correctly answer the question on refrigerating leftovers (Table 3.5; Appendix 8, Question 14).
2. **Identification of potentially hazardous foods** Public health nurses will be able to identify potentially hazardous foods.	2. Because 60.4% (157/260) of public health nurses were unable to identify potentially hazardous foods (Table 3.5; Appendix 8, Question 9).

Table 3.10 Safe food handling objectives for further training of public health nutritionists affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Food temperature and storage** Public health nutritionists will be able to identify recommended refrigerator temperatures.	1. Because 29.5% (18/61) of public health nutritionists did not know the highest safe temperature of an operating refrigerator (Table 3.5; Appendix 9, Question 11).
2. **Cross-contamination** Public health nutritionists will be able to recognize situations which involve cross-contamination.	2. Because 26.2% (16/61) of public health nutritionists were unable to correctly answer the question on handwashing procedure (Table 3.5; Appendix 9, Question 10).
3. **Identification of potentially hazardous foods** Public health nutritionists will be able to identify potentially hazardous foods.	3. Because 49.2% (30/61) of public health nutritionists were unable to identify potentially hazardous foods (Table 3.5; Appendix 9, Question 9).

Table 3.11 Safe food handling objectives for further training of public health physicians affiliated with local health departments who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Food temperature and storage** Public health physicians will be able to identify recommended refrigerator temperatures and identify appropriate methods to cool leftovers.	1. Because 41.6% (10/24) of public health physicians did not know the highest safe temperature of an operating refrigerator (Table 3.5; Appendix 10, Question 11). Because 58.3% (14/24) of public health physicians were unable to correctly answer the question on refrigerating leftovers (Table 3.5; Appendix 10, Question 14).
2. **Identification of potentially hazardous foods** Public health physicians will be able to identify potentially hazardous foods.	2. Because 62.5% (15/24) of public health physicians were unable to identify potentially hazardous foods (Table 3.5; Appendix 10, Question 9).

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4.0

Michigan Family Practice Physicians: Knowledge of Safe Food Handling

4.1 ABSTRACT

Background. This study was one component of a Michigan statewide assessment that evaluated food handling knowledge of the following populations: third-grade children and their household members, third-grade teachers, school foodservice personnel, and health information providers including family practice physicians.

Method. Fifty percent (n=650) of the names on the active membership list of the Michigan Academy of Family Physicians (MAFP) were randomly selected to participate in the study. Questionnaires with eight knowledge items on safe food handling and 18 demographic items were mailed to the family practice physicians during October, 1991.

Results. The response rate was 19.8%. Most respondents were male (70.5%) and white (86.8%), with a mean age of 41 years. Although only 1.6% of the respondents had received any formal training in safe food handling during 1991, almost 40% indicated that they had had opportunities, such as office visits, to provide people with information about safe food handling. A significant difference (p=.02) in safe food handling knowledge was found between men and women.

Conclusions. The results indicated that additional education on safe food handling is needed which focuses on time-temperature relationships on food handling and the identification of potentially hazardous foods.

4.2 INTRODUCTION

Foodborne disease has been a significant health concern in the United States for many decades and continues to be a problem into the 1990s. In 1961, the Communicable Disease Center (since renamed the Centers for Disease Control or CDC) became responsible for maintaining records and reporting foodborne diseases in the United States.[1] Currently, approximately 24-81 million cases of foodborne diseases are estimated to occur in the United States each year.[2]

Unlike many types of disease, foodborne disease is almost 100% preventable through safe food handling. Thirty percent of all reported foodborne diseases resulted from unsafe handling of food in the home.[3] A 1991 national survey showed that consumers ranked the home third (after food manufacturing facilities and restaurants) as the site where food safety hazards were most likely to occur.[4] Some researchers have suggested that foodborne disease can be prevented if food is handled safely, especially during the final stages of preparation before service.[5-13]

In recent years, Americans have become increasingly concerned about the effect of pesticide residues, and additives in foods.[14] However, this perception is not correct. American consumers have not yet become aware of the high risk from microbiological hazards of food that was not handled safely.[3,15]

Although the public perceives physicians as credible sources of health information,[3,16,17] results of other studies have indicated that their knowledge of food and nutrition might be inadequate or outdated.[18-22] Research in this area supports the possibility that nutrition education in medical school may be a variable influencing the physician's food and nutrition knowledge.[22] White *et al.*[23] found that physicians obtained most of their nutrition education from postgraduate study and experience in practice.

According to Murphy,[24] physicians' opinions about nutrition can be influenced positively by some type of nutrition education intervention, such as a seminar series during postgraduate training. This may suggest that physicians are more likely to be influenced favorably when nutrition education occurs in a residency or fellowship program than they are after beginning practice.

Many studies have indicated that nutrition receives insufficient attention in medical school curricula.[25,26] Two surveys reported that 61%[27] and 67%,[28] respectively, of graduating medical students believed inadequate time was devoted to nutrition education. The nutrition education provided was sporadic and poorly organized in many medical schools and residency programs.[29,30]

Family practice physicians are trained in their specialty in formal three-year residency programs. They are expected to learn how to evaluate total health needs, to provide personal

medical care within one or more fields of medicine, to refer patients when necessary and, at the same time, maintain a continuity of care.[31] Also, family practice physicians treat 85 to 90% of a patient's health care needs within their clinics.[31] Equally important, their training teaches them to practice "preventive" medicine.

Physicians practicing in various specialties have been shown to have inadequate knowledge in food-related areas, such as nutrition.[18-22] However, specific information on family practice physicians' knowledge of safe food handling was not found in the literature. Thus, the purpose of the present study is to assess the safe food handling knowledge of family practice physicians and to determine their training needs in this area. Family practice physicians were selected for this study because they are an adult population whose knowledge could have an impact on people.

4.3 METHODS

Mailed surveys to Michigan family practice physicians were used to obtain information on their knowledge of safe food handling.

4.3.1 Description of the Sampling Frame

In 1986 family practice physicians represented 11.9% of the total number of 569,160 physicians in the United States.[32] In terms of size, family practice ranked second among all physician specialties. According to a 1987 American Academy of Family Physicians (AAFP) Practice Profile Survey,[33] 93.5% of family practice physicians were engaged in direct patient care.

The Michigan Academy of Family Physicians (MAFP) is the association of doctors of medicine and osteopathy who are engaged in family practice in the state of Michigan.[34] The goals of the MAFP are (1) to work constantly to maintain and improve high standards of family practice; (2) to promote the science and art of medicine and surgery and the betterment of public health and to preserve the patients' right to free choice of physicians; and 3) to acknowledge and assume responsible public advocacy in all health-related matters.

As in the AAFP there are seven types of MAFP memberships: student, resident, active, affiliated, sustaining, inactive, and life members.[35] Active members make up the bulk of

Academy membership. To be eligible for active membership, a candidate must be a graduate of a school of medicine or osteopathy, hold a certificate of qualification recognized by the American Medical Association, or hold the degree of doctor of osteopathy and have completed a three-year family practice residency. The primary obligation of active membership is fulfillment of 150 hours of continuing study acceptable to the Commission on Continuing Medical Education (CME) during the preceding three years. This guarantee of competence is met through various CME programs.

Active members of the MAFP made up the sampling frame. Family practice physicians treat 85 to 90% of a patient's health care needs within their unique environment. Equally important, their training teaches them to practice "preventive" medicine. This study hypothesized that family practice physicians were in a position to provide primary care and information about safe food handling to children and adult family members during office visits for the treatment of foodborne disease.

4.3.2 Development of the Questionnaire

The objective of the questionnaire was to determine family practice physicians' knowledge of safe food handling. The questionnaire contained 26 questions concentrated in two areas: demographics and knowledge of safe food handling.

4.3.2.1 Demographics

Demographic questions focused on two areas: personal and professional. Personal demographics were defined as age, gender, race (optional), residential setting, and household income (optional). The personal demographic information was linked (below) to their personal knowledge of and attitudes about safe food handling practices.

Professional demographics were defined as length of time in family practice, educational level, and professional registration (M.D. or D.O.). These demographics were linked (below) with their opinions about current, accurate sources of safe food handling information, training on safe food handing received during 1991, and type(s) of interaction(s) with children on safe food handling.

4.3.2.2 Knowledge of safe food handling

Knowledge questions were developed based on the results of earlier studies which found that consumers lacked knowledge about time and temperature relationships to food safety, sources of contamination, and proper cooling procedures.[36] Eight (8) questions were developed to determine the respondent's knowledge about safe food handling. The questions were developed to cover the four constructs critical to the prevention of foodborne disease: food temperatures and storage, personal hygiene, cross-contamination, and the identification of potentially hazardous foods.[3-8,13,36-38]

The content, construct, and face validity of the questionnaire was assessed by reviewers with expertise in these fields: food safety and surveys. Content validity in this research was assessed by determining whether the questions chosen were accurate (right answers were correct; wrong answers were incorrect).[39] Face validity was assessed by expert review which determined whether the survey was appropriate for the intended population.[39] Construct validity was assessed by determining if the questions represented the concept (safe food handling) they were intended to measure.[39]

The questionnaire was pilot-tested with a subsample of the population (n=30) to determine criterion validity and difficulty level. Criterion validity in this research referred to whether the instrument discriminates between masters and non-masters of the information represented by the construct.[39] The discrimination index was used to assess criterion validity and was calculated for both individual items and the total survey. The index of discrimination used in this item analysis was calculated as the difference between the proportion of the high scorers (upper 27%) who selected the correct answer minus the proportion of the lower scorers (lowest 27%) who selected the right answer. An item discrimination index of greater than 0.33 was the standard for acceptability in this research.

The difficulty index (proportion of the total group who select the correct response) was also calculated.[39] A high

index indicated the item was easy and a low index indicated that the item was difficult. Both the discrimination and difficulty indices for the survey were acceptable (mean difficulty=0.72; mean discrimination=0.38). Results of the pilot test showed the Kuder-Richardson reliability coefficient for the knowledge items was 0.42. The questionnaire was approved for use with the specified population by the University Committee on Research Involving Human Subjects (UCRIHS) at Michigan State University (MSU) in March 1991.

4.3.3 Obtaining the Samples

After approval of the questionnaire use and content by MAFP in August 1991, a list of addresses of all MAFP active members (n=1,300) was received by MSU during October 1991. Fifty percent (50%) of family practice physicians were randomly selected (every other name from the MAFP active member lists) to participate in the study (n=650 of 1,300 physicians).

4.3.4 Mailing

Questionnaires (n=650) to MAFP members were coded numerically by zip codes and mailed in bulk (October 12 and November 14, 1991). Returned mail was collected, addresses were corrected, and a second mailing was sent to those individuals. A cover letter requesting participation in the study (Appendix 11) and one questionnaire (Appendix 5) were

sent to each family practice physician (n=650) with a return envelope (33 cm x 26 cm). Return postage was not included. The cover letter emphasized the importance of the data and its value to family practice physicians. Confidentiality was guaranteed.

4.3.5 Statistical Analyses

Data was analyzed using the Statistical Package for the Social Sciences (SPSS/PC+, version 4.0). To evaluate the study purpose, the following analyses were conducted: mean, standard deviation, frequency distribution, and a three-way analysis of variance to determine the differences in knowledge of food handling by the respondents' gender, age, and years in family practice. A probability of $p \leq .05$ was used as the level of significance for all analyses.

4.4 RESULTS and DISCUSSION

Fifty percent (n=650) of MAFP active members (n=1,300) were randomly selected to participate in the study. The questionnaires (n=650) were mailed during October 1991 and returned by December 14, 1991.

4.4.1 Response Rate

Of 650 questionnaires sent to family practice physicians, 129 physicians filled out and returned the questionnaires. The response rate was 19.8%. The response rate of <20% may indicate that only physicians who were interested in safe food handling responded. Researchers suggested that a higher survey response rates are usually obtained if project resources and the project timeline permit use of: return postage for questionnaires, reminder cards for nonrespondents, and repeated survey mailings.[40,41]

4.4.2 Demographics

Information on the personal and professional demographics of family practice physicians in Michigan is described below.

4.4.2.1 Personal demographics

Personal demographic characteristics are summarized in Table 4.1 and Appendix 12. They were predominantly male (70.5%), and white (86.8%). The respondents ranged in age from 21 to 70 years, with a mean ± standard deviation age of

Table 4.1 Personal demographic characteristics of Michigan family practice physicians (n=129) who responded to a mailed questionnaire on safe food handling in 1991.

Characteristics	No. of responses[1]	% of responses
Gender		
Male	91	70.5
Female	36	27.9
Total	127	98.4[2]
Age[3] (years)		
21-30	8	6.2
31-40	64	49.6
41-50	24	18.6
51-60	19	14.7
over 60	11	8.5
Total	126	97.7
Ethnic (optional)		
African-American	1	0.8
Asian/Pacific Islander	3	2.4
Hispanic	3	2.4
White	121	86.8
Total	128	99.2
Residential Setting		
Farm	7	5.4
Less than 10,000 people	41	31.8
10,000-50,000 people	22	17.1
Suburb, more than 50,000	26	20.2
City, more than 50,000	32	24.8
Total	128	99.2
Household Income (optional)		
$30,001-40,000	3	2.3
$40,001-50,000	2	1.6
$50,001-60,000	5	3.9
$60,001-70,000	3	2.3
$70,001-80,000	13	10.1
$80,001-90,000	10	7.8
$90,001-100,000	20	15.5
$100,001 -110,000	8	6.2
$110,001-120,000	10	7.8
$120,001-130,000	6	4.7
$130,001-140,000	1	0.8
$140,001-150,000	6	4.7
$150,001 - more	13	10.1
Did not answer	26	20.2
Total	126	97.7
Compared to most of the things you do to maintain your health, how important is safe food handling?		
Most important	3	2.3
Important	89	69.0
Less important	33	25.6
Not important	0	0.0
Not familiar with methods of safe food handling	4	3.1
Total	125	96.9

1. (129/650)*100%=19.8% response rate
2. Total percent response varies among demographic characteristics because some respondents did not answer all questions.
3. Mean age = 42.8 ± 10.6 years (Mean ± Standard Deviation)

40.5±10.0 years. Over one-third of the respondents (37.2%) lived in a town of less than 10,000 people. One third of the respondent's (33.4%) had an annual household income between $70,001 and $100,000. Over 70% of the respondents considered safe food handling to be the "most important" or "as important as most other" things they do to maintain their personal health. Approximately one-fourth of the respondents (25.6%) considered safe food handling to be "less important" than other things they do to maintain their personal health.

4.4.2.2 Professional demographics

Professional demographic characteristics are summarized in Table 4.2. The length of time in family practice ranged from less than one year to 46 years, with a mean ± standard deviation of 12.4±10.9 years. Only 1.6% of all respondents received any formal training in safe food handling during 1991. Over 95% of the respondents had at least a bachelor's degree. The majority of the respondents (82.9%) were Doctors of Medicine; and 16.3% of the respondents were Doctors of Osteopathy.

Types of interaction on safe food handling with children noted by family practice physicians are listed in Table 4.2. Almost 40% indicated that they had had opportunities to provide people with information about safe food handling (Table 4.2, Appendix 12, Question 5). The most frequent type of interaction reported was talking to parents or guardians during office visits for their child (30.2%).

Table 4.2 Professional demographic characteristics of Michigan family practice physicians (n=129) who responded to a mailed questionnaire on safe food handling in 1991.

Characteristics	No. of responses[1]	% of responses
Length of time in family practice[2]		
1-10	76	58.9
11-20	23	17.8
21-30	15	11.6
over 30	13	10.1
Total	127	98.4[3]
Training		
Received	2	1.6
Not received	86	66.7
Total	88	68.3
Educational level		
B.S.	123	95.3
M.S.	4	3.1
Ph.D.	1	0.8
Total	128	99.2
Professional Registration		
Doctor of Osteopathy (D.O)	21	16.3
Doctor of Medicine (M.D)	107	82.9
Total	128	99.2
Type of interaction with children about safe food handling		
1. Request by co-workers talk to children and/or their parents	5	3.9
2. Talk to a child during office visits	24	18.6
3. Talk to groups of children in community settings	5	3.9
4. Talk to parents (guardians) during office visits for their children	39	30.2
5. Talk to educational personnel	2	1.6
6. Other[4]	1	0.8
Total	50	38.8
Source of information on safe food handling		
1. Cooperative Extension Service	14 (9)	10.9 (7.0)[5]
2. Family and friends	43 (3)	33.3 (2.3)
3. Government pamphlets	21 (5)	16.3 (3.9)
4. Local school district	6 (1)	4.7 (0.8)
5. Newspaper/consumer magazines	65 (9)	50.4 (7.0)
6. National/ Michigan Dairy Council	16 (3)	12.4 (2.3)
7. Professional journals	56 (41)	43.4 (31.8)
8. Professional or job related meetings	16 (1)	12.4 (0.8)
9. Other[6]	6 (2)	4.7 (1.6)
10. No response	41 (55)	31.8 (42.6)

1. (129/650)*100%=19.8% response rate
2. Number of years in practice = 12.4 ± 10.9 years (Mean ± Standard Deviation)
3. Total percent response varies among demographic characteristics because some respondents did not answer all questions.
4. Other= Question at time of history asking information gastroenteritis symptoms
5. Number in parentheses was represented the percent of Michigan family practice physicians rated the most accurate source of information on safe food handling
6. Other: television, books and public health departments

Sources of information on safe food handling received by family practice physicians are listed in Table 4.2. As shown in Table 4.2, 50.4% responded that newspapers and consumer magazines were their most frequent information source about safe food handling, followed by professional journals (43.4%), and family and friends (33.3%) (Appendix 12, Question 2). Sources of information about safe food handling were similar to those of U.S. consumers in 1991.[4] Results of both studies indicated that newspapers and consumer magazines were the most frequent source of information on safe food handling. However, one-third of family practice physicians also received information on safe food handling from their family and friends. Ely[42] and Covell[43] observed physicians accessing information sources to solve patient problems. Their results showed that physicians were most likely to consult a human source (such as another physician, or other type of health professional) rather than a printed source because of the time required to read.

Sources of information on safe food handling rated as "the most accurate" by family practice physicians are listed in Table 4.2. Approximately one-third of the respondents (31.8%) believed that professional journals provided the most accurate information on safe food handling, followed by newspaper and consumer magazines (7.0%), and Cooperative Extension Service materials (7.0%) (Table 4.2, Appendix 12, Question 3). However, over 40% of the respondents did not

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identify a "most accurate source of information on safe food handling." The respondents' perception of the most accurate source of information on safe food handling was different from consumers' perception.[4] Gravani found that 75% of consumers ranked newspapers, magazines, and health professionals as "reliable" or "very reliable" sources of food safety.[4] In the present study, nearly one-third of the respondents (31.8%) believed that professional journals provided the most accurate information on safe food handling.

4.4.3 Knowledge of Safe Food handling

Table 4.3 lists the eight knowledge questions by construct: food temperature and storage, personal hygiene, cross-contamination, and the identification of potentially hazardous foods.

4.4.3.1 Food temperature and storage

Almost 90% of the respondents knew that ground beef should be stored and thawed in the refrigerator (Table 4.3, Appendix 12, Questions 7 and 8). Although the respondents knew that the refrigerator is the safest place in which to store food and to thaw frozen food, only half the respondents (51.2%) knew that 45°F was the maximum safe operating temperature for refrigerators.[44] The temperature, 45°F, was chosen as the correct answer to the question on refrigerator temperature because 45°F is still used as the maximum operating

Table 4.3 Percent correct response to knowledge items on safe food handling (n=8) from Michigan family practice physicians (n=129) who responded to a mailed questionnaire on safe food handling in 1991.

Construct/Knowledge Item	% correct responses
A. Food temperature and storage	
1. Best location to store fresh, raw ground beef overnight	98.4
2. Best location to safely thaw frozen, raw ground beef	89.9
3. Recommended maximum temperature of an operating refrigerator	51.2
4. Chilling of leftover foods in a shallow container	24.0
B. Personal hygiene (Method of handwashing)	81.4
C. Cross-contamination (Transfer of *Staphylococcus aureus* from foodhandlers to potato salad)	73.6
D. Identification of potentially hazardous foods	
1. Foods on which bacteria can grow	38.0
a. Baked potato	89.9
b. Broiled chicken breast	99.2
c. Glass of skim milk	97.7
d. Refried beans	97.7
2. Identification of unsafe food by sight, smell and/or taste	93.0
Mean knowledge score	73.5

temperature for refrigerators in the public health code of Michigan.[44]

In a 1974 USDA study, 49% of the respondents indicated that they kept their refrigerators warmer than 40°F.[45] The USDA has indicated that 40°F was the maximum safe operating temperature for refrigerators.[36] Similarly, a recent national consumer survey found that 42% of the respondents did not know that 45°F was the maximum safe operating temperature for refrigerators.[4]

As shown in Table 4.3, only 24% of the respondents knew that a shallow container (2-inch depth) should be used to chill food rapidly (Appendix 12, Question 14). This result is similar to a national consumer survey that reported 68% of the respondents did not cool stew in a shallow container.[4] Results of a 1988 USDA/FDA study indicated that 71% of the respondents used unsafe methods to cool a large pot of stew or soup.[15] Improper storage and holding temperatures were the most commonly reported causes of foodborne disease.[46] Information on the proper procedures to cool foods rapidly should be incorporated into a safe food handling education program.

4.4.3.2 Personal hygiene

As shown in Table 4.3, 81.4% of the respondents knew the importance of handwashing (Appendix 12, Question 10). This finding is similar to that found by a national consumer survey which reported that 83% of the respondents washed their hands

with soap and water after handling raw chicken.[4] Handwashing can effectively remove transient foodborne pathogens to prevent contamination of food.[47] According to Feachem,[48] the incidence of diarrhea can be reduced by 14 to 48% by simply washing contaminated hands with soap and water for 20 seconds.

4.4.3.3 Cross-contamination

Data in Table 4.3 showed that 73.6% of the respondents knew that *Staphylococcus aureus* is most often introduced into potato salad by food handlers (Appendix 12, Question 12). Food handlers are significant carriers of cross-contamination.[7,8,49]

4.4.3.4 Identification of potentially hazardous foods

Data in Table 4.3 showed that 38.0% of the respondents correctly selected the four foods out of six that are potentially hazardous (Appendix 12, Question 9). "Potentially hazardous food" is defined as any perishable food which consists in whole or in part of milk or milk products, egg, meat, poultry, fish and shellfish, or other ingredients that can support the rapid and progressive growth of infectious or toxigenic microorganisms.[50]

In the present study, 97.7% of the respondents correctly selected the two potentially hazardous foods of animal origin--broiled chicken breast and skim milk. However, only 38% of the respondents identified the other two foods of plant origin--baked potatoes and refried beans--that can support bacterial growth. This finding might indicate that most

respondents think that only animal foods and their products can support the growth of pathogenic bacteria. However, plant foods, such as baked potatoes and rice, have been implicated in outbreaks of foodborne disease.[51] The question (Appendix 12, Question 9) was not worded in such a way as to determine whether the respondents knew that plant sources could be a source of bacteria. This supports the need to teach family practice physicians that all foods--whether of plant or animal origin--can be vehicles for foodborne disease.

In the present study, over 90% of the respondents knew that food such as ham could not be determined to be spoiled by looking at, smelling, or tasting it (Table 4.3, Appendix 12, Question 13).

4.4.4 Statistical Analyses of Knowledge Scores by Demographics

Table 4.4 summarizes the effect of the demographic variables of family practice physicians on their knowledge of safe food handling. Significant differences were determined by analysis of variance ($p \leq .05$). For some analyses, age was categorized into two groups: less than 40 years or 40 or more years. This value was selected as the dividing point, because it was median value resulting in development of two groups of equal size. Length of time in family practice was categorized into two groups: less than eight years or eight or more years. This value was selected as the dividing point, because

Table 4.4 Analysis of variance of demographic factors on total score of eight knowledge questions for Michigan family practice physicians who responded to a mailed questionnaire on safe food handling in 1991.

Demographic Characteristics	DF	Mean Square	F	P
Gender (G)	1	8.425	5.229	0.02[1*]
Age (A)	1	2.716	1.686	0.20
Number of years in practice (Y)	1	.303	.188	0.67
G A	1	.312	1.911	0.13
G Y	1	5.462	.194	0.07
A Y^2	1	.173	.107	0.74
Residual Error	104	1.611		
Total	111	1.727		

1. * p <.05
1. Higher interactions among more than two factors were not statistically significant.

it was median value resulting in development of two groups of equal size.

The gender of respondents showed a statistically significant effect on their knowledge about safe food handling (Table 4.4, p=.02). Female respondents (n=32) correctly answered more knowledge questions (mean score=77.0%) on safe food handling than did male respondents (n=80) (mean score=68.0%).

The primary effects of age and length time in family practice were not significant, nor were other interactions examined (Table 4.4).

4.5 CONCLUSIONS and RECOMMENDATIONS

Consumers believe that health professionals can provide reliable food safety information.[4] The present study showed that over one-third of physician respondents (38.8%) indicated that they had opportunities to provide people with information about safe food handling. However, results of the present study showed that some family practice physicians were unable to correctly answer questions on safe refrigerator temperature, on proper cooling methods, and on the identification of potentially hazardous foods (Table 4.3).

Family practice physicians should be given opportunities to improve their knowledge about safe food handling. Education programs for family practice physicians should include reinforcement of time-temperature relationships to food handling and the identification of potentially hazardous foods.

Family practice physicians should become more aware of people and organizations knowledgeable in the area of safe food handling. Nutritionists and dietitians are an important resource regarding food preparation and handling, but many physicians still do not fully use their expertise. Although the registered dietitian is recognized as the professional most qualified to teach nutrition, only 1% of residency programs employ a full-time dietitian for this purpose.[52] A

need for a greater awareness of and use by physicians of the dietitian's potential as a consultant is indicated.

According to one study[24], physicians were more likely to be influenced favorably when food safety and nutrition education occurred before starting office practice. If this is true, dietetic professionals should aggressively seek to collaborate with medical faculties to create medical school and medical residency/internship food safety and nutrition education curricula.

Recommendations for continued education related to safe food handling for Michigan family practice physicians based on these results are provided in Table 4.5.

Table 4.5 Safe food handling objectives for further training of Michigan family practice physicians (n=129) who responded to a mailed questionnaire on safe food handling in 1991.

Objectives	Rationale
1. **Food temperature and storage** Family practice physicians will be able to identify recommended refrigerator temperatures and appropriate methods to cool leftovers.	1. Because 48.8% (63/129) of family practice physicians did not know the maximum safe temperature for an operating refrigerator (Table 4.3; Appendix 12, Question 11). Because 76.0% (98/129) of family practice physicians were unable to correctly answer the question on refrigerating leftovers (Table 4.3; Appendix 12, Question 14).
2. **Identification of potentially hazardous foods** Family practice physicians will be able to identify potentially hazardous foods.	2. Because 62.0% (80/129) of family practice physicians were unable to identify potentially hazardous foods (Table 4.3; Appendix 12, Question 9).
Residency programs	Physicians were more likely to be influenced favorably when food and nutrition education occurred before starting office practice.[24]
Food safety professionals such as Registered Dietitians	Although the registered dietitian is recognized as the professional most qualified to teach nutrition, only 1% of residency programs employ a full-time dietitian for this purpose.[52]

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5.0 CONCLUSIONS

Research has shown that consumers believe that health professionals can provide reliable food safety information (Gravani, 1992). Data from the current study indicated that 48.4% of HIP respondents (Table 3.4, p.45) and 38.8% of Michigan family practice physician respondents (Table 4.2, p.80) are providing information on safe food handling to people.

Information provided by HIPs and family practice physicians may not be always current or accurate. Educational opportunities for learning about safe food handling should be offered to HIPs and family practice physicians on at least a yearly basis. HIPs who reported receiving training during 1991 had significantly higher scores than those who did not report receiving training. Important topics to stress include time-temperature relationships to safe food handling and the identification of potentially hazardous foods (Tables 3.7-3.11 and Table 4.5).

Future educational programming should include wider use of the mass media, including newspaper and consumer magazines, because these sources were identified by the respondents as their most frequently used information source. Furthermore,

the mass media reach many sectors of the population and would thus be an excellent information resource, if the information presented was accurate.

6.0 RECOMMENDATIONS FOR FUTURE RESEARCH

Limitations of this study include: (1) lack of the ability to generalize family practice physician data because of the low response rate (19.8%); (2) a limited number of knowledge questions (n=8) on safe food handling; and (3) specific foods were listed on knowledge items, thus limiting the ability to generalize the results (Appendix 5, Questions 7, 8, 9, 10, 12 and 13).

In the course of conducting this research, both in the field and in reviewing the literature, ideas for future study were developed. A safe food handling knowledge test which includes more items for health information providers (HIPs) should be developed. Types of and places to conduct safe food handling training that are acceptable to HIPs need to be investigated. Furthermore, the impact of various educational interventions on safe food handling needs to be evaluated by scores from pre- and post-test data.

7.0 APPENDICES

Appendix 1.

A project statement requesting Michigan local health departments to participate in the study

Appendix 1. A project statement requesting Michigan local health departments to participate in the study

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John Plowman
Vice-President

John Petrasky, M.D.
Treasurer

Lois Bracey
Secretary

September 5, 1991

David L. Ohmart, M.D.
Health Officer
Allegan County Health Department
Service Building, 2233 Thirty-Third Street
Allegan, MI 49010

Dear Dr. Ohmart:

Your assistance is requested with an MSU study. The study is intended to determine the knowledge of safe food handling of health information providers in Michigan.

MSU researchers are interested in the food handling knowledge of health information providers and how this knowledge may affect the public, specifically, families with young children. Targeted professionals to be included in this study are health educators, nurses, physicians, and sanitarians. The study would benefit especially from the input of sanitarians whose work concentration is foodservice. One possible outcome of this study is the creation of recommendations for curriculum revision in allied health professions.

This MSU safe food handling project has received the assistance and endorsement of your state association, the Michigan Association for Local Public Health.

Would you allow the health educators, nurses, physicians and sanitarians working in your local health department to participate in this study? Participation in the MSU safe food handling study involves completing a questionnaire on food handling. A copy of the questionnaire is enclosed for your review. The pretest for the project indicated that the questionnaire required approximately 15 minutes for completion. Responses are confidential; respondent names are not requested on the questionnaire; completed questionnaires will be identified only by county.

If you have questions regarding this study at any time, contact Carol Sawyer at MSU (517/353-9663) or Anita Turner, R.N., at the Ingham County Health Department (517/887-4311). Anita Turner and her nursing staff piloted this questionnaire in Ingham County earlier this summer.

Executive Director
Mark J. Bertler

Facsimile Machine
(517) 485-6412

recycled paper

Please return the addressed, prepaid postcard before October 1, 1991 with your reply. The individual you designate as Contact Person will receive the appropriate number of the surveys.

Thank you in advance for your support and assistance.

Sincerely,

Carol A. Sawyer, Ph.D., R.D.*
Associate Professor
Dept. Food Science & Human Nutrition
517/353-9663

Sandra Andrews, Ph.D., R.D.
Assistant Professor
Dept. Food Science & Human Nutrition

June Youatt, Ph.D.
Associate Professor
Dept. of Family and Child Ecology

Mark J. Bertler
Executive Director
Mich. Assoc. for Local Public Health
P.O. Box 14065
Lansing, MI 48901
517/485-0660

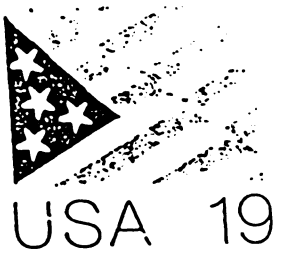
*Contact person

Enclosures: reply postcard
questionnaire

Appendix 2.

A reply card for Michigan local health department use

Appendix 2. A reply card for Michigan local health department use



Michigan State University
Carol Sawyer, Ph.D.
Department of Food Science
and Human Nutrition
East Lansing, Michigan 48824

© USPS 1991

Contact Person _____ **Title** _____

Local Health Department _____

Address _____

Phone Number ( ) - _____

Please Check All That Apply:

___ **Our health educators are willing to assist. Send _____ copies of the questionnaires.**

___ **Our nurses are willing to assist. Send _____ copies of the questionnaires.**

___ **Our physicians are willing to assist. Send _____ copies of the questionnaires.**

___ **Our sanitarians are willing to assist. Send _____ copies of the questionnaires.**

___ **Our local health department is unable to assist you.**

Thank you.

Please return this card no later than October 1, 1991.

Appendix 3.

A cover letter for each participating local health department

Appendix 3. A cover letter for each participating local health department

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION — EAST LANSING • MICHIGAN • 48824-1224

September 20, 1991

Bowwie Willings
Health Ed.
Grand-Traverse-Leelanau-Beniz District Health Department
P.O. box 905
Traverse City, MI 49684-0905

Dear Ms Willings:

This packet contains questionnaires from the Michigan State University Food Handling Study. These were requested by Mr. Gordon Rady, the Health Officer of your local health department. The purpose of this Study is to determine attitude and knowledge of food handling of health information providers.

The return sheet attached to this cover letter indicates the number of questionnaires enclosed. Please check the contents of your packet against the return sheet to make sure you have received all of the materials your local health department requested.

If not enough questionnaires were provided, please feel free to duplicate additional questionnaires.

Please return the completed questionnaires to MSU by November 15, 1991 using the enclosed, self-addressed, stamped envelope.

If you have any questions about the contents of your packet, or about the procedure for distributing and collecting questionnaires, please call Carol Sawyer at (517)353-9663.

The return address for all questionnaires is:

Carol Sawyer
Department of Food Science and Human Nutrition
139 Food Science Building
Michigan State University
East Lansing, MI 48824-1224

Thank you very much for your assistance.

Sincerely,

Carol A. Sawyer

Carol A. Sawyer, Ph.D., R.D.
Associate Professor

Enclosure: questionnaires
return sheet
self-addressed stamped envelope

MSU is an Affirmative Action/Equal Opportunity Institution

Appendix 4.

A return sheet for each participating local health department

Appendix 4. A return sheet for each participating local health department

MSU FOOD HANDLING STUDY

to improve the health of our Michigan children

RETURN SHEET

DIRECTIONS:

Complete and return this sheet with your questionnaires.

1. Fill in information for the contact person who distributed and collected the questionnaires.
2. Write in the table below the quantity of questionnaires returned.

CONTACT PERSON _____

TITLE _____

LOCAL HEALTH DEPARTMENT _____

ADDRESS _____

_____ **ZIP CODE** _____

COUNTY _____ **DATE RETURNED** _____

PHONE NUMBER (DAY) ( ) _____

TYPE	QUANTITY OF QUESTIONNAIRES		NUMBERS ON THE QUESTIONNAIRES* SENT TO LOCAL HEALTH DEPARTMENT	
	SENT	RETURNED	BEGIN	END
1. Health Educator Questionnaire (HE)	_____	_____	HE_____	HE_____
2. Nurse Questionnaire(HN)	_____	_____	HN_____	HN_____
3. Physician Questionnaire (HP)	_____	_____	HP_____	HP_____
4. Sanitarian Questionnaire (HS)	_____	_____	HS_____	HS_____

*HE=Health Educator Questionnaire HN=Nurse Questionnaire
HP=Physician Questionnaire HS=Sanitarian Questionnaire
Please return all available questionnaires by November 15, 1991.

The return address for all questionnaires is:
Carol Sawyer
Department of Food Science and Human Nutrition
139 Food Science Building
Michigan State University
East Lansing, MI 48824-1224

THANK YOU

Appendix 5.

Response frequencies of health information providers (n=611) affiliated with local health departments

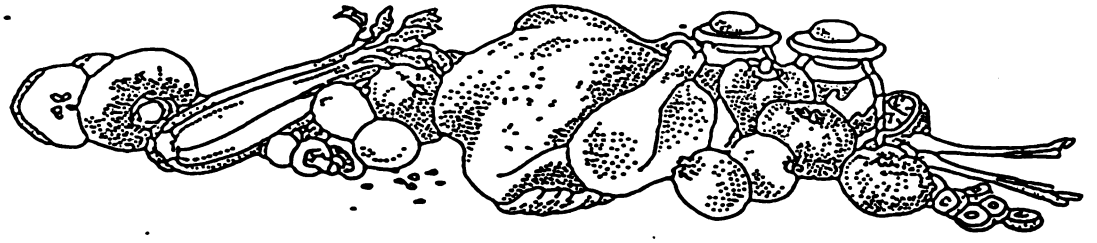
Appendix 5. Response frequencies of health information providers (n=611) affiliated with local health departments

MICHIGAN STATE UNIVERSITY

FOOD HANDLING STUDY

to improve the health of our Michigan children

QUESTIONS FOR HEALTH INFORMATION PROVIDERS



Dear Health Information Provider:

This study is designed to learn about your beliefs, knowledge and practices related to food handling. Food handling refers to the things typically done when storing, preparing, cooking, and/or serving food. Information learned from this study will be used to educate Michigan children about safe food handling.

Please note:

1. **The questionnaire will take about fifteen minutes to complete.**
2. **Answers are confidential.**
3. **Your name is <u>not</u> required.**

You indicate your voluntary agreement to participate by completing and returning this questionnaire. You may decline to answer any of the questions.

Thank you in advance for your participation.

Department of Food Science and Human Nutrition
Michigan State University
East Lansing, MI 48824
517/353-9663

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is **safe food handling**? (Check one)

   12.3% Safe food handling is the most important thing I do.

   81.2% Safe food handling is as important as most things I do.

   4.9% Safe food handling is less important than most things I do.

   0.0% Safe food handling is not important.

   1.0% I am not familiar with methods of safe food handling.

2. During the past year, from what **sources** have you received information on food handling? (Check all that apply)

27.2% (11.8%)	Cooperative Extension Service (CES)
24.4% (0.5%)	Family and friends
43.7% (10.0%)	Government pamphlets
3.6% (0.0%)	Local school district
62.5% (6.5%)	Newspapers, consumer magazines
17.8% (2.1%)	National/Michigan Dairy Council
50.4% (21.3%)	Professional journals
50.9% (24.9%)	Professional or job related meeting
13.1% (5.4%)	Other. Please specify: radio, college courses, television, books and video tapes
8.2% (17.5%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most **accurate** information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal **training** in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

   20.9% A. Topic/Name of Training Session_____

   Length_____

   Location_____

   Presenter (Sponsoring agency)_____

   Date_____

   66.9% B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

 8.3% Request that your co-workers talk to children and/or their parents.

 7.4% Talk to a child about food handling during office visits.

 12.6% Talk to groups of children about food handling in community settings.

 26.4% Talk to parents (guardians) during office visits for their child.

 9.0% Talk to educational personnel such as third grade teachers.

 9.3% Prepare written materials on safe food handling.

 8.3% Other. Please specify: teaching parents in elementary school, home visit and classroom speaking event

 25.2% I do not see children professionally.

 38.3% No interaction with children on safe food handling.

 7.5% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

 9.5% Yes 76.3% No materials available.

 If yes, please write the necessary information on how to obtain the material here:

 _____

 _____

 Price $ _____

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

 0.0% in a cupboard.

 0.2% in a kitchen sink.

 99.7% in a refrigerator.

 0.0% on the top of a kitchen counter.

 0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   1.5% in a kitchen sink (without water).

   97.9% in a refrigerator.

   0.5% on the top of a kitchen counter.

   0.0% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   89.0% baked potato

   97.5% broiled chicken breast

   35.7% corn oil

   96.4% glass of skim milk

   91.7% refried beans

   14.6% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

    0.5% rinsing hands under very hot water before handling raw chicken

    83.0% washing hands with soap and clean water before handling raw chicken

    0.8% wiping hands on a clean towel before handling raw chicken

    13.6% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

    60.9% The temperature should be 45 °F (or 7.2 °C)

    37.5% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

    76.8% people who handle the potatoes.

    0.5% from diseased potatoes.

    0.8% soil and dust on the potatoes.

    9.2% all of these choices.

    9.0% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

    9.2% true

    90.2% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

    56.0% a shallow container such as uncovered cake pan (2 inches deep)

    3.3% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

    38.8% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

    R.D., R.N., R.S., M.D., D.O., Nutritionists, Health Educators

16. Medical practice specialty area (e.g. pediatrics, family medicine)

    Public Health

17. How many years have you been in this specialty area? 9.8±8.4 yrs.

18. What is your gender (sex)? 71.8% female 26.8% male

19. What is your age? (Fill in blank) 39.5±9.9 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    12.7±5.4 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 9.0±5.5 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

- 4.1% newly immigrated (you were born outside of the US)
- 5.2% one generation (your mother was born outside of the US)
- 21.6% two generations (your mother's mother was born outside of the US)
- 63.3% more than two generations
- 3.9% I am not sure.
- 0.3% a visitor to the US (for example, a ex-change student)

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

- 7.9% African-American (Black)
- 0.3% Arab/Chaldean
- 2.9% Asian/Pacific Islander
  - 0.7% Asian Indian
  - 0.2% Chinese
  - 1.3% Filipino
  - 0.3% Japanese
  - 0.0% Hmong
  - 0.0% Laotian
  - 0.2% Vietnamese
  - 0.3% Korean
- 1.2% Hispanic (Latino)
  - 0.2% Central American
  - 0.0% Cuban
  - 0.5% Mexican
  - 0.2% Puerto Rican
  - 0.3% South American
- 0.3% Native Indian (American Indian) or Alaskan Native
- 80.7% White, non-hispanic

If none of the above adequately describes your ethnic heritage, please write it in here.

_____

24. Please describe your **residential setting**. (Check one)

5.7%	farm
24.9%	town under 10,000 people or rural non-farm
28.0%	town or city of 10,000 to 50,000 people
16.5%	suburb of city of over 50,000 people
22.7%	city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

59.2%	B.S.	3.3%	M.D.
0.0%	D.D.S.	17.7%	M.S.
0.3%	Dental hygienist	0.0%	P.A.
0.0%	Dentist	0.3%	Ph.D.
0.5%	D.O.	5.1%	R.D.
0.8%	L.P.N.	24.7%	R.N.

_____ Other professional degree. Please specify: 2.6% R.S.

0.8% Vocational 2.6% Associate Degree

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

0.5%	less than $10,000	3.1%	$80,001 to $90,000
1.1%	$10,000 to $20,000	2.1%	$90,001 to $100,000
15.2%	$20,001 to $30,000	0.8%	$100,001 to $110,000
16.7%	$30,001 to $40,000	0.0%	$110,001 to $120,000
11.5%	$40,001 to $50,000	0.7%	$120,001 to $130,000
9.0%	$50,001 to $60,000	0.2%	$130,001 to $140,000
7.2%	$60,001 to $70,000	0.0%	$140,001 to $150,000
4.4%	$70,001 to $80,000	0.3%	$150,001 or greater

20.0% I do not wish to say or I do not know.

Please continue onto the next page.

We would like to hear from you. Please write any additional comments in the space provided below.

THANK YOU FOR YOUR PARTICIPATION IN THE MSU FOOD HANDLING STUDY.

Please return questionnaires to
Carol A. Sawyer, Ph.D., R.D.
Dept. of Food Science and Human Nutrition
Michigan State University
East Lansing, MI 48824

If you have any questions about this study, please call Dr. Sawyer at 517/353-9663.

Appendix 6.

Response frequencies of foodservice sanitarians (n=214) affiliated with local health departments

Appendix 6. Response frequencies of foodservice sanitarians (n=214) affiliated with local health departments

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is safe food handling? (Check one)

21.0%	Safe food handling is the most important thing I do.
75.2%	Safe food handling is as important as most things I do.
2.8%	Safe food handling is less important than most things I do.
0.0%	Safe food handling is not important.
0.0%	I am not familiar with methods of safe food handling.

2. During the past year, from what sources have you received information on food handling? (Check all that apply)

19.2% (2.3%)	Cooperative Extension Service (CES)
14.0% (0.0%)	Family and friends
66.3% (9.3%)	Government pamphlets
3.7% (0.0%)	Local school district
53.7% (1.9%)	Newspapers, consumer magazines
14.4% (1.4%)	National/Michigan Dairy Council
75.7% (27.1%)	Professional journals
83.6% (44.6%)	Professional or job related meeting
15.8% (6.1%)	Other. Please specify: State law, Job training, Books FDA Bulletin, Certified food manager course, Video
1.8% (7.0%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most accurate information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal training in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

51.4%	A. I have received formal training.
39.3%	B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

   7.4% Request that your co-workers talk to children and/or their parents.

   2.8% Talk to a child about food handling during office visits.

   17.7% Talk to groups of children about food handling in community settings.

   5.1% Talk to parents (guardians) during office visits for their child.

   12.1% Talk to educational personnel such as third grade teachers.

   14.0% Prepare written materials on safe food handling.

   8.4% Other. Please specify: Home visit on foodborne outbreak

   31.7% I do not see children professionally.

   25.7% No interaction with children on safe food handling.

   12.6% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

   12.6% Yes 72.9% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

   0.0% in a cupboard.

   0.0% in a kitchen sink.

   100% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   0.0% in a kitchen sink (without water).

   99.1% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.9% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   93.0% baked potato

   98.6% broiled chicken breast

   23.8% corn oil

   96.7% glass of skim milk

   93.0% refried beans

   6.1% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

    0.9% rinsing hands under very hot water before handling raw chicken

    81.8% washing hands with soap and clean water before handling raw chicken

    0.0% wiping hands on a clean towel before handling raw chicken

    15.9% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

    95.8% The temperature should be 45 °F (or 7.2 °C)

    3.3% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

    88.3% people who handle the potatoes.

    0.0% from diseased potatoes.

    0.9% soil and dust on the potatoes.

    4.2% all of these choices.

    2.8% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

    6.5% true

    93.5% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

    91.1% a shallow container such as uncovered cake pan (2 inches deep)

    1.4% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

    6.1% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

    Foodservice sanitarians

16. Medical practice specialty area (e.g. pediatrics, family medicine)

    Public Health

17. How many years have you been in this specialty area? 10.3±8.1 yrs.

18. What is your gender (sex)? 29.4% female 68.2% male

19. What is your age? (Fill in blank) 37.1±9.2 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    12.3±5.3 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 6.9±5.1 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    2.3% newly immigrated (you were born outside of the US)

    2.8% one generation (your mother was born outside of the US)

    22.4% two generations (your mother's mother was born outside of the US)

    63.1% more than two generations

    7.5% I am not sure.

    0.5% a visitor to the US (for example, a ex-change student)

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    8.4% African-American (Black)

    0.5% Arab/Chaldean

    0.9% Asian/Pacific Islander
    - 0.9% Asian Indian

    1.9% Hispanic (Latino)
    - 0.0% Central American
    - 0.0% Cuban
    - 0.9% Mexican
    - 0.5% Puerto Rican
    - 0.5% South American

    0.9% Native Indian (American Indian) or Alaskan Native

    77.6% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    5.1% farm

    29.0% town under 10,000 people or rural non-farm

    22.0% town or city of 10,000 to 50,000 people

    15.0% suburb of city of over 50,000 people

    26.0% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

2.3%	Associate Degree	66.8%	B.S.
20.1%	M.S.	0.5%	Ph.D.
8.0%	R.S.		

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

0.0%	less than $10,000	2.3%	$80,001 to $90,000
1.4%	$10,000 to $20,000	0.0%	$90,001 to $100,000
20.1%	$20,001 to $30,000	0.5%	$100,001 to $110,000
22.0%	$30,001 to $40,000	0.0%	$110,001 to $120,000
13.6%	$40,001 to $50,000	0.5%	$120,001 to $130,000
7.5%	$50,001 to $60,000	0.0%	$130,001 to $140,000
6.1%	$60,001 to $70,000	0.0%	$140,001 to $150,000
2.3%	$70,001 to $80,000	0.0%	$150,001 or greater

15.4% I do not wish to say or I do not know.

Appendix 7.

Response frequencies of health educators (n=52) affiliated with local health departments

Appendix 7. Response frequencies of health educators (n=52) affiliated with local health departments

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is **safe food handling**? (Check one)

   3.8% Safe food handling is the most important thing I do.

   78.8% Safe food handling is as important as most things I do.

   11.5% Safe food handling is less important than most things I do.

   0.0% Safe food handling is not important.

   3.8% I am not familiar with methods of safe food handling.

2. During the past year, from what **sources** have you received information on food handling? (Check all that apply)

36.5% (15.4%)	Cooperative Extension Service (CES)
46.1% (0.0%)	Family and friends
40.4% (19.2%)	Government pamphlets
3.8% (0.0%)	Local school district
69.2% (15.4%)	Newspapers, consumer magazines
36.5% (7.7%)	National/Michigan Dairy Council
30.7% (17.3%)	Professional journals
23.1% (3.8%)	Professional or job related meeting
21.1% (7.7%)	Other. Please specify: State law, Books, TV
11.5 (13.5%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most **accurate** information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal **training** in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

   3.8% A. I have received formal training.

   86.5% B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

   7.7% Request that your co-workers talk to children and/or their parents.

   3.8% Talk to a child about food handling during office visits.

   7.7% Talk to groups of children about food handling in community settings.

   5.7% Talk to parents (guardians) during office visits for their child.

   9.6% Talk to educational personnel such as third grade teachers.

   5.4% Prepare written materials on safe food handling.

   19.2% Other. Please specify: Health care/day care

   19.2% I do not see children professionally.

   51.9% No interaction with children on safe food handling.

   17.3% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

   11.5% Yes 76.9% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

   0.0% in a cupboard.

   0.0% in a kitchen sink.

   100% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   3.8% in a kitchen sink (without water).

   94.2% in a refrigerator.

   0.0% on the top of a kitchen counter.

   1.9% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   84.6% baked potato

   100% broiled chicken breast

   38.5% corn oil

   98.1% glass of skim milk

   88.5% refried beans

   13.5% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

 0.0% rinsing hands under very hot water before handling raw chicken

 88.5% washing hands with soap and clean water before handling raw chicken

 0.0% wiping hands on a clean towel before handling raw chicken

 9.6% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

 51.8% The temperature should be 45 °F (or 7.2 °C)

 46.3% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

 76.9% people who handle the potatoes.

 1.9% from diseased potatoes.

 1.9% soil and dust on the potatoes.

 5.8% all of these choices.

 11.5% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

 5.8% true

 90.4% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

 38.5% a shallow container such as uncovered cake pan (2 inches deep)

 7.7% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

 51.9% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

 Health educators

16. Medical practice specialty area (e.g. pediatrics, family medicine)

 Public Health

17. How many years have you been in this specialty area? 6.3±6.0 yrs.

18. What is your gender (sex)? 94.2% female 5.8% male

19. What is your age? (Fill in blank) 34.0±8.8 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    12.4±5.4 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 9.1±5.6 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    3.8% newly immigrated (you were born outside of the US)

    1.9% one generation (your mother was born outside of the US)

    15.4% two generations (your mother's mother was born outside of the US)

    76.9% more than two generations

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    1.9% African-American (Black)

    1.9% Asian/Pacific Islander
    1.9% Filipino

    92.3% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    9.6% farm

    28.8% town under 10,000 people or rural non-farm

    36.5% town or city of 10,000 to 50,000 people

    11.5% suburb of city of over 50,000 people

    11.5% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

    5.8% Associate Degree 51.9% B.S. 32.8% M.S.

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

1.9%	less than $10,000	13.5%	$50,001 to $60,000
1.9%	$10,000 to $20,000	5.8%	$60,001 to $70,000
26.9%	$20,001 to $30,000	3.8%	$70,001 to $80,000
17.3%	$30,001 to $40,000	1.9%	$130,001 to $140,000
9.6%	$40,001 to $50,000	1.9%	$140,001 to $150,000
9.6%	I do not wish to say or I do not know.		

Appendix 8.

Response frequencies of public health nurses (n=260) affiliated with local health departments

Appendix 8. Response frequencies of public health nurses (n=260) affiliated with local health departments

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is safe food handling? (Check one)

7.7%	Safe food handling is the most important thing I do.
84.6%	Safe food handling is as important as most things I do.
6.2%	Safe food handling is less important than most things I do.
0.0%	Safe food handling is not important.
0.8%	I am not familiar with methods of safe food handling.

2. During the past year, from what sources have you received information on food handling? (Check all that apply)

29.6% (18.1%)	Cooperative Extension Service (CES)
32.3% (0.8%)	Family and friends
26.1% (8.1%)	Government pamphlets
3.8% (0.0%)	Local school district
68.5% (8.5%)	Newspapers, consumer magazines
13.1% (1.2%)	National/Michigan Dairy Council
32.4% (16.9%)	Professional journals
34.2% (17.7%)	Professional or job related meeting
0.1% (4.6%)	Other. Please specify: Nutritionists, TV, Radio Environmental health Department
12.7% (24.2%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most accurate information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal training in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

4.2%	A. I have received formal training.
81.2%	B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

 8.8% Request that your co-workers talk to children and/or their parents.

 12.3% Talk to a child about food handling during office visits.

 11.9% Talk to groups of children about food handling in community settings.

 40.7% Talk to parents (guardians) during office visits for their child.

 7.3% Talk to educational personnel such as third grade teachers.

 2.3% Prepare written materials on safe food handling.

 6.5% Other. Please specify: teaching parents in elementary school, home visit and classroom speaking event

 13.8% I do not see children professionally.

 34.6% No interaction with children on safe food handling.

 1.9% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

 6.2% Yes 78.5% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

 0.0% in a cupboard.

 0.4% in a kitchen sink.

 99.2% in a refrigerator.

 0.0% on the top of a kitchen counter.

 0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

 0.0% in a cupboard.

 1.9% in a kitchen sink (without water).

 97.7% in a refrigerator.

 0.0% on the top of a kitchen counter.

 0.0% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

 87.7% baked potato

 96.2% broiled chicken breast

 45.0% corn oil

 95.4% glass of skim milk

 90.8% refried beans

 21.1% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

    0.4% rinsing hands under very hot water before handling raw chicken

    82.7% washing hands with soap and clean water before handling raw chicken

    1.5% wiping hands on a clean towel before handling raw chicken

    12.3% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

    32.0% The temperature should be 45 °F (or 7.2 °C)

    66.1% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

    66.9% people who handle the potatoes.

    0.8% from diseased potatoes.

    0.0% soil and dust on the potatoes.

    13.1% all of these choices.

    14.6% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

    10.8% true

    88.8% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

    27.3% a shallow container such as uncovered cake pan (2 inches deep)

    3.8% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

    66.9% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

    R.N., L.P.N., Public health nurses

16. Medical practice specialty area (e.g. pediatrics, family medicine)

    Public Health

17. How many years have you been in this specialty area? 9.3±7.9 yrs.

18. What is your gender (sex)? 97.3% female 1.5% male

19. What is your age? (Fill in blank) 41.7±9.0 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    12.8±5.6 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 10.4±5.3 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    3.8% newly immigrated (you were born outside of the US)

    6.5% one generation (your mother was born outside of the US)

    23.1% two generations (your mother's mother was born outside of the US)

    62.7% more than two generations

    2.3% I am not sure.

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    5.8% African-American (Black)

    0.4% Arab/Chaldean

    2.0% Asian/Pacific Islander
    - 0.4% Chinese
    - 0.8% Filipino
    - 0.4% Japanese

    0.4% Hispanic (Latino)
    - 0.4% South American

    85.4% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    6.9% farm

    23.1% town under 10,000 people or rural non-farm

    35.0% town or city of 10,000 to 50,000 people

    17.3% suburb of city of over 50,000 people

    16.2% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

2.0%	Vocational	3.1%	Associate Degree
52.7%	B.S.	10.4%	M.S.
1.9%	L.P.N.	57.7%	R.N.

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

0.4%	less than $10,000	4.6%	$80,001 to $90,000
1.2%	$10,000 to $20,000	3.1%	$90,001 to $100,000
9.2%	$20,001 to $30,000	1.2%	$100,001 to $110,000
13.8%	$30,001 to $40,000	0.0%	$110,001 to $120,000
10.8%	$40,001 to $50,000	0.4%	$120,001 to $130,000
10.8%	$50,001 to $60,000	0.0%	$130,001 to $140,000
7.3%	$60,001 to $70,000	0.0%	$140,001 to $150,000
5.4%	$70,001 to $80,000	0.0%	$150,001 or greater

26.5% I do not wish to say or I do not know.

Appendix 9.

Response frequencies of public health nutritionists (n=61) affiliated with local health departments

Appendix 9. Response frequencies of public health nutritionists (n=61) affiliated with local health departments

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is **safe food handling**? (Check one)

9.8%	Safe food handling is the most important thing I do.
88.5%	Safe food handling is as important as most things I do.
0.0%	Safe food handling is less important than most things I do.
0.0%	Safe food handling is not important.
1.6%	I am not familiar with methods of safe food handling.

2. During the past year, from what **sources** have you received information on food handling? (Check all that apply)

44.2% (19.7%)	Cooperative Extension Service (CES)
6.5% (0.0%)	Family and friends
45.9% (13.1%)	Government pamphlets
0.0% (0.0%)	Local school district
55.7% (4.9%)	Newspapers, consumer magazines
31.1% (4.9%)	National/Michigan Dairy Council
52.4% (19.7%)	Professional journals
40.9% (9.8%)	Professional or job related meeting
11.4% (6.6%)	Other. Please specify: College course, Egg Board
6.5% (21.3%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most **accurate** information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal **training** in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

6.6%	A. I have received formal training.
83.6%	B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

   1.6% Request that your co-workers talk to children and/or their parents.

   1.6% Talk to a child about food handling during office visits.

   3.2% Talk to groups of children about food handling in community settings.

   49.1% Talk to parents (guardians) during office visits for their child.

   4.9% Talk to educational personnel such as third grade teachers.

   14.8% Prepare written materials on safe food handling.

   9.8% Other. Please specify: Talk about food safety in WIC education session and home visit

   11.5% I do not see children professionally.

   40.9% No interaction with children on safe food handling.

   4.9% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

   8.2% Yes 78.7% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

   0.0% in a cupboard.

   0.0% in a kitchen sink.

   100% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   1.6% in a kitchen sink (without water).

   98.4% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   83.6% baked potato

   100% broiled chicken breast

   29.5% corn oil

   96.7% glass of skim milk

   93.4% refried beans

   13.1% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

    0.0% rinsing hands under very hot water before handling raw chicken

    83.6% washing hands with soap and clean water before handling raw chicken

    1.6% wiping hands on a clean towel before handling raw chicken

    13.1% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

    70.5% The temperature should be 45 °F (or 7.2 °C)

    27.9% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

    73.8% people who handle the potatoes.

    0.0% from diseased potatoes.

    3.3% soil and dust on the potatoes.

    11.5% all of these choices.

    8.2% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

    11.5% true

    86.9% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

    75.4% a shallow container such as uncovered cake pan (2 inches deep)

    3.3% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

    16.4% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

    R.D., Nutritionists

16. Medical practice specialty area (e.g. pediatrics, family medicine)

    Public Health

17. How many years have you been in this specialty area? 9.1±8.8 yrs.

18. What is your gender (sex)? 100% female 0.0% male

19. What is your age? (Fill in blank) 39.6±11.5 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    14.1±5.4 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 11.3±5.3 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    1.6% newly immigrated (you were born outside of the US)
    6.6% one generation (your mother was born outside of the US)
    21.3% two generations (your mother's mother was born outside of the US)
    65.6% more than two generations
    1.6% I am not sure.
    1.6% a visitor to the US (for example, a ex-change student)

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    19.7% African-American (Black)
    3.2% Asian/Pacific Islander
        1.6% Vietnamese
        1.6% Korean
    1.6% Hispanic (Latino)
        1.6% Mexican
    72.1% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    0.0% farm
    14.8% town under 10,000 people or rural non-farm
    18.0% town or city of 10,000 to 50,000 people
    21.3% suburb of city of over 50,000 people
    42.6% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

    59.0% B.S. 26.3% M.S.
    1.6% Ph.D. 50.8% R.D.

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

1.6%	less than $10,000	13.1%	$40,001 to $50,000
0.0%	$10,000 to $20,000	4.9%	$50,001 to $60,000
19.7%	$20,001 to $30,000	9.8%	$60,001 to $70,000
16.4%	$30,001 to $40,000	3.3%	$80,001 to $90,000
6.6%	$70,001 to $80,000		

16.4% I do not wish to say or I do not know.

Appendix 10.

Response frequencies of public health physicians (n=24) affiliated with local health departments

Appendix 10. Response frequencies of public health physicians (n=24) affiliated with local health departments

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is **safe food handling**? (Check one)

8.3%	Safe food handling is the most important thing I do.
83.3%	Safe food handling is as important as most things I do.
8.3%	Safe food handling is less important than most things I do.
0.0%	Safe food handling is not important.
0.0%	I am not familiar with methods of safe food handling.

2. During the past year, from what **sources** have you received information on food handling? (Check all that apply)

8.3% (0.0%)	Cooperative Extension Service (CES)
29.2% (4.2%)	Family and friends
33.3% (8.2%)	Government pamphlets
8.3% (0.0%)	Local school district
66.7% (12.5%)	Newspapers, consumer magazines
25.0% (0.0%)	National/Michigan Dairy Council
54.2% (29.2%)	Professional journals
25.0% (8.3%)	Professional or job related meeting
8.3% (0.0%)	Other. Please specify: Television
12.5% (37.5%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most **accurate** information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal **training** in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

4.2%	A. I have received formal training.
75.0%	B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

   29.2% Request that your co-workers talk to children and/or their parents.

   16.7% Talk to a child about food handling during office visits.

   8.3% Talk to groups of children about food handling in community settings.

   45.8% Talk to parents (guardians) during office visits for their child.

   8.3% Talk to educational personnel such as third grade teachers.

   16.7% Prepare written materials on safe food handling.

   0.0% Other. Please specify: _____

   37.5% I do not see children professionally.

   29.2% No interaction with children on safe food handling.

   8.3% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

   16.7% Yes 70.8% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

   0.0% in a cupboard.

   0.0% in a kitchen sink.

   100% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   4.2% in a kitchen sink (without water).

   95.8% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   91.7% baked potato

   91.7% broiled chicken breast

   41.7% corn oil

   100% glass of skim milk

   91.7% refried beans

   20.8% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

    0.0% rinsing hands under very hot water before handling raw chicken

    83.3% washing hands with soap and clean water before handling raw chicken

    0.0% wiping hands on a clean towel before handling raw chicken

    16.7% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

    58.4% The temperature should be 45 °F (or 7.2 °C)

    37.4% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

    87.5% people who handle the potatoes.

    0.0% from diseased potatoes.

    0.0% soil and dust on the potatoes.

    12.5% all of these choices.

    0.0% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

    16.7% true

    83.3% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

    41.7% a shallow container such as uncovered cake pan (2 inches deep)

    4.2% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

    54.2% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

    M.D., D.O.

16. Medical practice specialty area (e.g. pediatrics, family medicine)

    Public Health

17. How many years have you been in this specialty area? 18.4±11.8 yrs.

18. What is your gender (sex)? 54.2% female 45.8% male

19. What is your age? (Fill in blank) 48.0±11.5 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    12.5±4.9 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 7.3±5.0 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    29.2% newly immigrated (you were born outside of the US)

    16.7% one generation (your mother was born outside of the US)

    12.5% two generations (your mother's mother was born outside of the US)

    37.5% more than two generations

    4.2% I am not sure.

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    8.3% African-American (Black)

    33.3% Asian/Pacific Islander
    - 8.3% Asian Indian
    - 20.8% Filipino
    - 4.2% Korean

    4.2% Hispanic (Latino)
    - 4.2% Central American

    54.2% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    4.2% farm

    25.0% town under 10,000 people or rural non-farm

    12.5% town or city of 10,000 to 50,000 people

    20.8% suburb of city of over 50,000 people

    33.3% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

79.1%	B.S.	20.9%	M.S.
12.5%	D.O.	83.3%	M.D.

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

4.2%	$50,001 to $60,000	4.2%	$100,001 to $110,000
12.5%	$60,001 to $70,000	4.2%	$120,001 to $130,000
8.3%	$70,001 to $80,000	8.3%	$150,001 or greater
20.8%	$90,001 to $100,000		

20.8% I do not wish to say or I do not know.

Appendix 11.

A cover letter requesting Michigan family practice physicians to participate in the study

Appendix 11. A cover letter requesting Michigan family practice physicians to participate in the study

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION

EAST LANSING • MICHIGAN • 48824-1224

November 6, 1991

John Ockenfels
924 Swinton
Sault St. Marie, MI 49783

Dear Dr. Ockenfels:

Your assistance is requested with a Michigan State University study. The study is intended to determine the attitude and beliefs toward safe food handling of family practitioners in Michigan.

MSU researchers are interested in the food handling knowledge of family practitioners and how this knowledge may affect the public, specifically, families with young children. One possible outcome of this study is designing hypermedia to educate children on safe food handling. In the future, you might choose to use such a software program as ours in the waiting room of your clinic to educate children on how to handle food properly. The other possible outcome is the creation of recommendations for curriculum revision in medical schools.

This MSU safe food handling project has received the assistance of your state association, the Michigan Academy of Family Practice Association.

This packet contains two questionnaires, one for you and one for the nurse or physician's assistant in your office. Would you please take approximately 15 minutes to complete one of the questionnaires? At the same time, researchers would like to encourage the participation of your office nurse (R.N. or L.P.N.) or assistant (P.A.) by having the nurse or assistant complete one of the enclosed questionnaires. Completed questionnaires may be mailed back to MSU in the enclosed self-addressed office before November 27, 1991. Responses are confidential; respondent names are not requested on the questionnaire; completed questionnaires will be identified only by county.

If you have any questions regarding this study at any time, please call Carol Sawyer at MSU (517/353-9663).

Thank you very much in advance for your support and assistance.

Sincerely,

Carol A. Sawyer

Carol A. Sawyer, Ph.D., R.D.
Associate Professor

Enclosures: two questionnaires
self-addressed envelope

MSU is an Affirmative Action/Equal Opportunity Institution

Appendix 12.

Response frequencies of family practice physicians (n=129)

Appendix 12. Response frequencies of family practice physicians (n=129)

QUESTIONS FOR HEALTH INFORMATION PROVIDERS

1. You do many important things to keep yourself healthy. Compared to most of the things you do to maintain your health, how important is **safe food handling**? (Check one)

2.3%	Safe food handling is the most important thing I do.
69.0%	Safe food handling is as important as most things I do.
25.6%	Safe food handling is less important than most things I do.
0.0%	Safe food handling is not important.
3.1%	I am not familiar with methods of safe food handling.

2. During the past year, from what **sources** have you received information on food handling? (Check all that apply)

10.9% (7.0%)	Cooperative Extension Service (CES)
33.3% (2.3%)	Family and friends
16.3% (3.9%)	Government pamphlets
4.7% (0.8%)	Local school district
50.4% (7.0%)	Newspapers, consumer magazines
12.4% (2.3%)	National/Michigan Dairy Council
43.4% (31.8%)	Professional journals
12.4% (0.8%)	Professional or job related meeting
4.7% (1.6%)	Other. Please specify: Television
31.8% (42.6%)	I have not received information on food handling. (Go to question 5)

3. Of the choices you checked in question number 2 above, please circle the source of information that you believe provides the most **accurate** information on safe food handling. (Circle one choice in question 2 above).

4. Describe the most important formal **training** in safe food handling that you received during the past 12 months (April 1, 1990 to March 31, 1991). (Check A or B below and fill in the blank lines below if required)

1.6%	A. I have received formal training.
66.7%	B. I have not received any formal training.

5. Please indicate below any **interaction** related to food handling you may have had with children in your professional area. (Check all that apply)

   3.9% Request that your co-workers talk to children and/or their parents.

   18.6% Talk to a child about food handling during office visits.

   3.9% Talk to groups of children about food handling in community settings.

   30.2% Talk to parents (guardians) during office visits for their child.

   0.0% Talk to educational personnel such as third grade teachers.

   1.6% Prepare written materials on safe food handling.

   0.8% Other. Please specify: Question at time of history asking information of gastroenteritis symptoms

   5.4% I do not see children professionally.

   55.0% No interaction with children on safe food handling.

   7.7% I would like an opportunity to work in this area.

6. Would you be willing to provide us with a copy of any **effective teaching materials** on safe food handling (or tell us how to obtain a copy) that you have used with children?

   0.0% Yes 91.5% No materials available.

7. To keep fresh, raw ground beef safe to eat, the best place to **store** it overnight is (Check one)

   0.0% in a cupboard.

   0.8% in a kitchen sink.

   98.4% in a refrigerator.

   0.0% on the top of a kitchen counter.

   0.0% all of these choices are OK.

8. The best place to safely **thaw** frozen, raw ground beef is (Check one)

   0.0% in a cupboard.

   3.9% in a kitchen sink (without water).

   89.9% in a refrigerator.

   3.1% on the top of a kitchen counter.

   1.6% all of these choices are OK.

9. On which of the following foods are bacteria able to grow? (Check all that apply)

   89.9% baked potato

   99.2% broiled chicken breast

   49.6% corn oil

   97.7% glass of skim milk

   97.7% refried beans

   31.0% white vinegar

10. Which of the following activities is the best way to **prevent** getting sick from bacteria and viruses in food? (Check one)

 0.0% rinsing hands under very hot water before handling raw chicken

 81.4% washing hands with soap and clean water before handling raw chicken

 0.0% wiping hands on a clean towel before handling raw chicken

 15.5% none of these are important

11. A unopened carton of milk is stored in a refrigerator overnight. The **highest safe temperature** of the refrigerator would be (Check one and fill in the temperature if required)

 51.2% The temperature should be 45 °F (or 7.2 °C)

 46.5% I do not know the temperature.

12. *Staphylococcus aureus*, a potentially harmful bacteria, is most often introduced into potato salad from (Check one)

 73.6% people who handle the potatoes.

 0.0% from diseased potatoes.

 2.3% soil and dust on the potatoes.

 11.6% all of these choices.

 9.3% none of these choices.

13. You always can tell when a food such as ham has bacteria (germs) that could make you sick by how it looks, smells or tastes. (Check one)

 6.2% true

 93.0% false

14. When refrigerating leftover stew, which container will best limit the growth of harmful bacteria ?(Check one)

 24.0% a shallow container such as uncovered cake pan (2 inches deep)

 14.7% a deep container such as an uncovered eight-quart soup pot (12 inches deep)

 58.1% the depth of container is not important

15. Professional title (e.g. M.D., D.O., R.D., L.P.N., physician, dentist, nurse practitioner)

 M.D., D.O.

16. Medical practice specialty area (e.g. pediatrics, family medicine)

 Family practice

17. How many years have you been in this specialty area? 12.4±10.9 yrs.

18. What is your gender (sex)? 27.9% female 70.5% male

19. What is your age? (Fill in blank) 42.8±10.6 yrs.

20. During a typical week, how many meals are made in your household? (Write in number of meals)

    13.0±5.2 meals per week are made in my household
    (number)

21. Of the meals made in your household during a typical week, how many do you personally prepare? (Write in number of meals)

    I typically make 5.0±4.9 meals per week.
    (number)

22. For how many **generations** have your mother's ancestors been in the US? (Check one)

    5.4% newly immigrated (you were born outside of the US)

    10.1% one generation (your mother was born outside of the US)

    20.9% two generations (your mother's mother was born outside of the US)

    62.8% more than two generations

    0.8% I am not sure.

23. The following question is **optional**. What is your main family **background**? The reason for this question is that we would like to learn about the special food handling knowledge and practices of the various ethnic groups in Michigan. (Check all that apply)

    0.8% African-American (Black)

    2.4% Asian/Pacific Islander
    - 1.6% Asian Indian
    - 0.8% Filipino

    2.4% Hispanic (Latino)
    - 2.4% South American

    86.8% White, non-hispanic

24. Please describe your **residential setting**. (Check one)

    5.4% farm

    31.8% town under 10,000 people or rural non-farm

    17.1% town or city of 10,000 to 50,000 people

    20.2% suburb of city of over 50,000 people

    24.8% city of over 50,000 people or more

25. What is the **highest** professional and/or academic degree you have received (check as many as are applicable or highest degree obtained)

    95.3% B.S.

    0.8% Ph.D.

    83.3% M.D.

    3.1% M.S.

    12.5% D.O.

26. The following question is **optional**. In what range is your annual household **income**? (Check one)

2.3%	$30,001 to $40,000	6.2%	$100,001 to $110,000
1.6%	$40,001 to $50,000	7.8%	$110,001 to $120,000
3.9%	$50,001 to $60,000	4.7%	$120,001 to $130,000
2.3%	$60,001 to $70,000	0.8%	$130,001 to $140,000
10.1%	$70,001 to $80,000	4.7%	$140,001 to $150,000
7.8%	$80,001 to $90,001	10.1%	$150,001 or greater
15.5%	$90,001 to $100,000		

20.2% I do not wish to say or I do not know.

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