

Determinants of Safe Food Handling Behavior: A Case Study Integrating Sociodemographic and KAP Factors in Hospital Nutrition Installation

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ABSTRACT

This study aims to analyze the determinants of food safety behavior among food handlers by integrating sociodemographic factors and the Knowledge-Attitude-Practice (KAP) framework in the context of hospital nutrition facilities. This research used a qualitative case study design, data were collected through in-depth interviews, direct observation, and documentation review of food handlers, heads of nutrition facilities, nutritionists, and internal quality control officers. The results showed that the level of education and involvement in training greatly influenced food handlers' understanding of food safety principles, as well as shaping their attitudes and practices in implementing safe work procedures. Knowledge plays an important role in increasing awareness of contamination risks, while attitudes determine the level of motivation and commitment to complying with operational standards. Food safety practices are reflected in the consistency of food handlers in implementing hygienic procedures, although variations in behavior were found to be influenced by differences in educational background and access to training. These findings emphasize the need for ongoing training programs, strengthened supervision, and systematic managerial support to ensure compliance with food safety standards

INTRODUCTION

Food safety in hospital nutrition facilities is a crucial aspect of patient safety, as food handlers can be a route of transmission of microbial contaminants to vulnerable patient populations. Several studies show that hospital food service staff sometimes have only moderate knowledge of food safety principles despite working in a clinical environment (Al Banna et al., 2022; BMC Public Health study in South Africa, 2020; Lestantyo et al., 2017). This limited knowledge can increase the risk of errors in temperature control, ingredient separation, and equipment sanitation. Therefore, it is crucial to understand the factors that determine safe food handling behavior in a hospital setting. Related case studies will provide an in-depth understanding of these factors at the operational level.

Sociodemographic variables such as gender, age, education level, work experience, and training history can influence the knowledge and behavior of food handlers in nutrition facilities. Research in Bangladesh, for example, found a relationship between education and work experience and food safety knowledge scores among hospital food service staff (Al Banna et al., 2022). In the general context of food service, studies of facility factors also show that formal training contributes significantly to hygienic practices (Fekadu and colleagues, cross-sectional study of food safety factors). Therefore, analysis of sociodemographic determinants is highly relevant to explaining the variability in food handling behavior.

Food handler knowledge is a key foundation in food safety practices; without a good understanding of microbial hazards, critical temperatures, or cross-contamination, it is very difficult for staff to follow procedures correctly. In a BMC Public Health study in hospitals, many food handlers failed to correctly state the minimum internal temperature for meat and eggs, highlighting a significant knowledge gap (BMC Public Health, 2020). Knowledge is also not always directly proportional to educational background or work experience, according to the same study. In a clinical context, food handlers' understanding of temperature, storage, and sanitation rules can directly impact patient safety. Therefore, this study places knowledge as a key variable in the behavioral determinants model.

Attitudes toward food safety are also crucial as mediators between knowledge and practice, as individuals with knowledge but low attitudes may not fully implement procedures. A study in South African hospitals showed that although many food handlers possessed knowledge, their attitudes toward food safety responsibilities varied greatly (BMC Public Health, 2020). In hospitals with a positive culture, staff are more likely to adopt safe practices because they see compliance not only as an obligation but as part of their professionalism (Assefa, Kumie & Wubshet, 2020). Furthermore, training studies show that an increase in positive attitudes is often followed by an increase in practices (Lestantyo et al., 2017). Thus, attitudes need to be analyzed in depth to understand food handling behavior.

Practice or actual behavior of food handlers is a manifestation of various determinants, and it is crucial to evaluate whether knowledge and attitudes are translated into actions in the field. In a hospital study, although many respondents expressed positive attitudes, direct observation showed that not all food safety procedures were practiced consistently (Mixed-method study in a psychiatric hospital, Indonesia). Other factors such as work pressure, shift load, and equipment availability were also reported as major obstacles (Assefa, Kumie & Wubshet, 2020). In addition, research in the general food sector (non-hospital) found that good knowledge alone does not guarantee hygienic practices without supervision and organizational support (Fekadu et al., food safety factors). Therefore, practice analysis is crucial for assessing actual risks in hospital nutrition facilities.

Training is one of the most influential sociodemographic factors affecting food safety knowledge and practices. Cross-sectional research shows that staff who have undergone formal training are more likely to implement hygienic practices correctly (Fekadu et al., 2019). Findings in Bangladesh also indicate that training is positively correlated with the knowledge and attitude scores of food handlers (Al Banna et al., 2022). On the other hand, research in hospitals in South Africa reports that only a small proportion of food handlers have ever attended food safety training (BMC Public Health, 2020). Therefore, studying the role of training in the context of sociodemographic and KAP is highly relevant for determining intervention strategies.

Gender and age can also be important predictors of food safety knowledge, attitudes, and practices. In a Bangladesh study, for example, gender (male) was associated with higher food safety knowledge scores (Al Banna et al., 2022). Age factors can influence work experience, confidence in applying procedures, and sensitivity to microbial risks (KAP study of students/food handlers at a Malaysian university). Additionally, in general food service studies, longer work experience is often associated with better practices, although not always with higher knowledge (Fekadu et al., 2019). Understanding how gender and age impact KAP will help design more targeted training and policies.

Formal education is a critical factor contributing to food safety knowledge and attitudes among food handlers. A study in South African hospitals showed that education level does not always guarantee better knowledge, indicating that formal education alone is not sufficient (BMC Public Health, 2020). However, a survey in public food facilities noted that higher education is often associated with positive attitudes and hygienic practices (Fekadu et al., 2019). Research in psychiatric hospitals in Indonesia also found that although the majority of workers had good knowledge, their practices remained suboptimal due to management and training factors. Therefore, analysis of education along with training and experience variables is crucial in this case study.

Work experience as a food handler can strengthen technical competencies and confidence in implementing food safety practices. Research in South African hospitals shows that work experience does not always correlate with high knowledge, but can have an impact on attitudes and responsibility towards food safety (BMC Public Health, 2020). In global food service studies, longer work experience is often associated with more hygienic work habits (Fekadu et al., 2019). However, experience alone is not enough without formal training, as shown in a Bangladesh study (Al Banna et al., 2022). This case study needs to investigate the interaction between experience, education, and training in shaping behavior.

KAP studies in hospitals show that although food handlers' attitudes tend to be positive toward food safety, there is a gap between attitudes and actual practices. For example, research in South Africa found a weak but positive correlation between knowledge and attitudes toward food safety (BMC Public Health, 2020). In addition, a study in hospital kitchens in Indonesia showed that some food handlers with good attitudes still failed to fully implement hygienic practices (Lestantyo et al., 2017). Factors such as workload, lack of supervision, and lack of hygienic facilities may explain this gap (Assefa, Kumie & Wubshet, 2020). Therefore, analysis focusing on attitudes as mediating and determining variables is highly relevant.

Food handling practices in hospitals depend not only on knowledge and attitudes, but also on organizational and managerial support. Regular supervision, internal audits, and clear policies can strengthen compliance with safe procedures. In the context of general food service, research has found that supervision by health professionals significantly improves food safety practices (Fekadu et al., 2019). Meanwhile, a KAP study in psychiatric hospitals in Indonesia identified that lack of supervision is one of the main barriers to hygienic behavior. For this reason, this case study will consider managerial and structural factors as supporting factors for safe practices.

Assessing sociodemographic factors, knowledge, attitudes, and practices within a single research framework is essential for designing evidence-based interventions. Because the interactions between these factors are complex, a case study approach provides an opportunity to examine these dynamics in the real-world context of a hospital nutrition unit. The case study approach can combine in-depth interviews, observations, and KAP surveys to provide a comprehensive picture of the determinants. With contextual data, hospital managers can design training programs, supervision, and policies that are more suited to the characteristics of their staff. Therefore, this study is suitable for uncovering the mechanisms behind food safety behavior.

Furthermore, understanding KAP determinants influenced by sociodemographic can help hospitals optimize nutrition staff selection and development. For example, if research shows that certain education or experience correlates with safer practices, management can adjust recruitment policies or provide specialized training. Knowledge of these factors is also beneficial for hospital accreditation, where food safety aspects are often part of quality standards. Thus, this research is not only academic but also practical and policy-

oriented. Such studies can form the basis for developing long-term quality programs in nutrition departments.

Previous studies in other hospitals have shown the significance of sociodemographic variables on KAP in the context of food handling, but they are still limited and do not always use an in-depth approach (Al Banna et al., 2022; BMC Public Health, 2020; Lestantyo et al., 2017). Therefore, this case study in the nutrition unit will add to the literature by systematically combining KAP analysis with demographic variables. The results of this study can serve as a conceptual model that can be replicated in other hospitals in developing countries. Furthermore, the findings can encourage more contextually adaptive interventions. Finally, this study aims to make a substantive contribution to the literature on food safety and hospital nutrition management.

By considering all the above factors, namely sociodemographic, knowledge, attitudes, practices, and managerial context, this study is expected to produce targeted intervention recommendations to improve food safety in hospitals. Evidence-based interventions are essential to reduce the risk of foodborne disease in vulnerable patient populations. Findings from this case study can be used to design more effective training, supervision systems, and recruitment policies. Additionally, the research results can serve as a basis for future multi-case studies to enable generalization to other nutrition facilities. Therefore, this study has the potential for significant practical and policy impacts in the domain of clinical food safety.

LITERATURE REVIEW

Foodborne Disease

The United States Department of Agriculture (2025) reports that millions of people fall ill and thousands die from unsafe food intake. More than a third of the total population is affected by foodborne diseases each year (Sani and Siow, 2014). *Foodborne disease* (FBD) is a serious health problem and can be a threat to both developed and developing countries (Mutalib *et al.*, 2012). Data shows that foodborne diseases are common throughout the world; however, due to limitations in the surveillance system, only a small fraction of the actual number of cases are reported (Abdelhakeem et al., 2021). In Indonesia, the prevalence of foodborne diseases is reported to be 7%, with a *case fatality rate* of 0.4% (Avifah and Fitria, 2025).

Foodborne disease is caused by contamination of food or beverages with microorganisms and chemicals. Research by Zulfiani and Meilani (2025) identified microorganisms that cause foodborne illness. The results of this study showed that *Salmonella sp.*, *Escherichia coli*, and *Listeria*, among others, are microorganisms that are commonly found in the digestive tract and cause foodborne illness. Research by Li *et al.* (2020) shows that food or beverages contaminated with microorganisms and chemicals enter the body through the digestive process, which can ultimately cause diseases, such as digestive disorders with various symptoms, including stomach ache, vomiting, and diarrhea. Foodborne disease is the cause behind 70% of diarrhea cases in developing countries (Akabanda *et al.*, 2017).

According to *the World Health Organization* (2024), *foodborne diseases* can be infectious or toxic in nature, which distinguishes the causes of foodborne illnesses and how these microorganisms affect the body. Infectious foodborne illnesses are caused by consuming food or beverages contaminated with microorganisms, such as *Salmonella sp.* and *Escherichia coli*. The way these microorganisms affect the human body is by entering the body and multiplying in the digestive tract, causing digestive disorders with various symptoms such as stomach ache, vomiting, and diarrhea. These symptoms appear more slowly because the microorganisms need time to multiply, with an incubation period of 1–3 days.

Foodborne disease with toxic characteristics are caused by consuming toxins produced by microorganisms, such as *Staphylococcus aureus* and *Clostridium botulinum*, in food. These microorganisms affect the human body by producing toxins in food before it is consumed. After the food is consumed, the toxins produced by these microorganisms will immediately attack the body and cause various symptoms similar to those of infectious foodborne illnesses. The difference lies in the incubation period. Foodborne disease illnesses with toxic characteristics cause symptoms more quickly because the microorganisms do not need time to multiply in the body, with an incubation period of only a few hours (Gupta, 2017).

Health Belief Model Theory

The Health Belief Model (HBM) was developed in the 1950s to help understand, explain, and predict individual actions by focusing on their beliefs and perceptions related to health (Wang et al., 2021). Nam and Pak's (2023) research states that the health belief model was developed to understand and explain why individuals do not always engage in preventive health actions, even though they have adequate knowledge.

The effectiveness of the Health Belief Model in predicting behavior has been well documented. Research by Werthmann et al. (2021) states that health behavior is determined by personal beliefs, perceptions about disease, and the availability of strategies to prevent it. Individuals' beliefs and perceptions about disease are influenced by sociodemographic and psychosocial components. Similarly, research by Zamaniahari et al. (2023) states that HBM in health behavior, individual actions are influenced by sociodemographics and knowledge and attitudes.

Sociodemographic Characteristics

In this study, sociodemographic factors such as gender, age, education, experience, and training influence the knowledge, attitudes, and practices of food handlers.

1. Gender significantly influences food safety knowledge and practices. The study by Rahman et al. (2025) states that female food handlers often demonstrate better practices regarding food safety protocols than males.
2. Age significantly influences food safety practices. Research by Yi and Choi (2025) shows a significant influence on food safety practices across all age groups. Younger food handlers need knowledge about foodborne illness prevention, proper food handling, and safe consumption practices. Similarly, tailored interventions are crucial for older food handlers, given their increased vulnerability to foodborne illnesses.
3. Education significantly influences knowledge, attitudes, and practices. Research by Halim Lim et al. (2023) shows a significant influence on food safety knowledge, attitudes, and practices based on different levels of education. The analysis shows that food handlers without formal education have inadequate practices and knowledge compared to food handlers with high school, college, and university education, indicating that educational level increases learning capacity and therefore has a greater likelihood of translating knowledge into practice.
4. Work experience in the food industry significantly influences food safety knowledge. Research by Alkhalidi et al. (2025) states that experienced food handlers often acquire practical skills and insights into safe food handling through hands-on activities.
5. Food safety training significantly influences food safety knowledge, attitudes, and practices. Research by Sanlier et al. (2020) reports findings that long-term training of food handlers has a significant effect on food safety knowledge, attitudes, and practices.

Knowledge

Beliefs are influenced by food safety issues such as the possibility of foodborne illness from food contaminated with microorganisms, leading to food poisoning. This is measured by food handlers' food safety knowledge, which includes understanding how to maintain personal hygiene and equipment when food is processed and prepared, cross-contamination, processing with safe water and raw materials, and the accuracy of temperature control.

Attitude

A belief in food handling related to the importance of maintaining food safety. This is measured by the attitude of food handlers. A positive attitude towards food safety is demonstrated by awareness of the risks of food poisoning and a commitment to implementing food safety practices, such as washing hands before consuming food and preparing food, after using the bathroom and touching body parts, discarding food residues on food equipment, using clean water and soap to remove food residue fats, and sanitizing equipment. Meanwhile, a negative attitude towards food safety can lead to a lack of attention or disregard for food safety, which can ultimately increase the risk of food contamination.

Practice

In this study, food handlers' beliefs that they are capable of implementing food safety measures to improve health were measured based on their practices. Food safety practices are demonstrated by the implementation of concrete actions in daily life, such as using separate containers and cooking utensils for cooked and raw foods, using a cooking thermometer to measure internal temperature, storing food safely at temperatures below 5°C or above 60°C, and avoiding the use of expired food ingredients. Poor food safety practices can lead to food contamination and increase the risk of food poisoning.

METHODOLOGY

This study used a qualitative approach with a case study design to gain an in-depth understanding of the determinants of food safety behavior among food handlers. This approach was chosen because it allowed researchers to explore the phenomenon contextually, holistically, and comprehensively in accordance with the real working conditions of food handlers. The research subjects in this study were food handlers who were directly involved in the storage, processing, and distribution of food. Research informants were selected using purposive sampling techniques, which included food handlers, heads of nutrition facilities, nutritionists, and internal quality control officers at hospitals to obtain comprehensive and diverse information. The research location was the Nutrition Facility at Dr. Haryoto Lumajang Regional General Hospital because it is a nutrition service institution that has a large-scale food processing system and is relevant for an in-depth study of food safety practices.

Data collection techniques included in-depth interviews, participatory observation, and document analysis, so that the data obtained authentically reflected field practices and situations. Interviews were conducted in a semi-structured manner to allow informants to convey their experiences, understanding, and perceptions regarding sociodemographic factors, knowledge, attitudes, and food safety practices. Observations were conducted to assess the actual behavior of food handlers in the food production process, such as personal hygiene, use of personal protective equipment, and sanitation procedures, while document analysis was conducted on Standard Operating Procedure, work guidelines, and quality control records. Data were analyzed using the Miles & Huberman model, which includes data reduction, data

presentation, and systematic conclusion drawing/verification. To ensure data validity, the researchers used source triangulation, technique triangulation, and member checking, so that the findings were valid, credible, and representative of the actual conditions at the Nutrition Unit of Dr. Haryoto Regional General Hospital in Lumajang Regency.

RESEARCH RESULT

Sociodemographic Factors

The observation result in this research showed that food handlers with higher educational backgrounds appeared to be more confident in carrying out daily food safety procedures. They followed work instructions systematically and rarely made mistakes at critical stages. Conversely, food handlers with lower education levels appeared to rely more on intuition and old habits when working, especially in the food preparation stage. Interviews reinforced these findings, with highly educated staff better able to explain the scientific reasons behind each procedure. Personnel documentation also showed considerable variation in education levels among food handlers.

Interview results illustrate that higher educated food handlers have a better ability to understand previous training materials. They mention that concepts such as cross-contamination, hand sanitation, and handling high-risk foods can be clearly understood. Meanwhile, some lower educated food handlers state that the training material feels difficult and contains too many technical terms. Observations also showed that this group more often imitated other colleagues than read the SOP themselves. Training documentation showed that most participants who received high evaluation scores came from the higher educated group.

Observational findings showed that education influenced food handlers' ability to implement new SOPs. When there were procedural changes, highly educated staff adapted more quickly and demonstrated good compliance. Less educated staff often requested further explanations or required longer mentoring. Interviews with installation managers confirmed that additional support was often needed for this group. Documentation of SOP revisions shows that some staff take longer to understand changes.

Training also emerged as a key factor affecting the quality of food safety practices. Observations showed that food handlers who had undergone training in the past year performed personal hygiene measures more consistently. They washed their hands more often at critical points, used PPE appropriately, and did not skip important steps in food processing. Interviews revealed that training provided new insights into the risks of contamination in vulnerable hospital patients. Training attendance records showed that only some staff attended training regularly.

An interesting finding emerged from observations that food handlers who had recently undergone training appeared to be more skilled in using technical tools such as food thermometers. They were able to accurately measure cooking and distribution temperatures in accordance with SOPs. Conversely, staff who had never attended training tended to rely on non-standardized visual assessments. Interviews also showed that untrained staff felt less confident when

having to use measuring tools. Inventory documentation showed that some damaged tools were not used optimally by untrained staff.

From interviews with nutritionists, it was found that training not only improved technical skills, but also influenced the attitudes and motivation of food handlers. Trained staff showed greater enthusiasm and were more open to procedural updates. They are also more sensitive to potential risks in the kitchen environment and often take preventive measures without being asked. Field observations confirm that trained staff are more often referred to by other staff in implementing SOPs. Training evaluation documentation shows an increase in work motivation after attending training sessions.

Overall, the combination of education and training makes a significant difference in food handler performance. Food handlers with adequate education and the latest training exhibit the safest and most standard-compliant work behavior. Conversely, a lack of formal education and failure to participate in training results in low understanding, lack of confidence, and inconsistent practices. Observations, interviews, and documentation all show a strong correlative pattern between sociodemographics and compliance with SOPs. These findings confirm that improving the quality of human resources must be done through regular training and equal access to learning for all food handlers.

Knowledge

The results of the study show that food handlers' level of knowledge about food safety is in the middle category, with significant variations between individuals. Most handlers understand basic concepts such as personal hygiene, the dangers of cross-contamination, and the importance of storage temperature, but are not yet able to explain the scientific reasons in depth. Interviews show that much of their knowledge is gained through work experience rather than formal training. Observations in the work area confirmed the existence of correct practices, although sometimes they were carried out without a deep understanding of the standards behind them. SOP documentation showed high standards, but they were not fully understood by all food handlers.

Findings indicate that knowledge of personal hygiene is quite good, especially regarding the obligation to wash hands, use head coverings, and refrain from wearing accessories while working. However, interviews revealed that some handlers did not know the ideal duration and technique for hand washing according to WHO standards. Observations showed that handlers often washed their hands, but not always at critical points such as after touching raw materials. In addition, some handlers know the importance of maintaining the cleanliness of work clothes but do not understand the microbiological risks that may arise. Previous training documentation shows that personal hygiene material has been provided, but it has not been fully internalized.

The study found that some handlers were aware of the three types of contamination (biological, chemical, physical), but only a few were able to provide specific examples. Interview results show that knowledge of pathogenic bacteria such as *Salmonella* or *E. coli* is minimal. Observations reveal that handlers often separate raw and cooked ingredients, but sometimes use the same tools without realizing it. Internal quality audit report documentation shows that

findings of non-compliance related to cross-contamination still appear every year. This confirms that knowledge of the dangers of contamination is not yet fully established.

Other findings show that knowledge about safe storage temperatures is still low, especially among food handlers who have not undergone the latest training. Most only know that food must be stored cold or hot, without knowing the safe temperature limits, such as $<5^{\circ}\text{C}$ or $>60^{\circ}\text{C}$. Observations show that food handlers follow storage procedures based on instructions, not on understanding. Interviews with nutritionists explain that this knowledge gap is the cause of inconsistent practices in the field. Documentation of storage temperature SOPs is not always read regularly by food handlers.

Analysis shows that formal education levels are not directly proportional to food safety knowledge levels. Instead, participation in training has a more significant influence. Handlers who had attended the most recent training demonstrated a better understanding in explaining food safety principles. Interviews revealed that the training was informative but not repeated regularly, causing knowledge to decline rapidly. Documentation of the last training showed a considerable time interval, resulting in a knowledge gap among handlers. This emphasizes the importance of regular training updates.

Attitude

Findings show that the majority of food handlers have a positive attitude toward the importance of food safety in hospital services. They consider food safety to be part of their moral and professional responsibility to protect patients. Interviews revealed that most food handlers understand that hospital patients are more vulnerable to food contamination. Observations show a seriousness in following the rules, although there are some inconsistent behaviors. Performance assessment documentation also shows that a positive attitude has become part of the work culture.

Most food handlers showed good acceptance of SOPs, but the level of compliance was not always consistent. Interviews showed that some food handlers felt that SOPs were too long and difficult to remember, but still considered them important. Observations revealed that food handlers tended to comply with SOPs during busy hours because they felt they were being monitored, but compliance declined in less stressful situations. This attitude is also influenced by the perception that some procedures are considered impractical. Audit findings documentation shows that SOP violations are often related to an attitude of "getting used to it."

In addition, food handlers showed a positive attitude towards training and considered it an important learning opportunity. Interviews revealed that they hoped training would be conducted more frequently and be more practical. Observations during training showed active participation even though not all food handlers understood the material in depth. A positive attitude towards training did not always translate into long-term behavioral change. Training evaluation documentation showed high enthusiasm, but material retention still needed to be improved.

Handlers' attitudes toward workplace hygiene are generally very good. They believe that a clean work area reflects professionalism and supports safe food preparation. Interviews showed that most handlers have a habit of maintaining hygiene due to internal motivation rather than simply following formal rules. Observations also confirmed that handlers always clean the work area after use. Internal hygiene report documentation shows a high level of compliance in certain areas, although there is room for improvement.

Although attitudes toward food safety are positive, understanding of contamination risks is still lacking. Interviews showed that food handlers acknowledge the existence of risks, but some view them as rare occurrences. This attitude sometimes causes them to overlook small details that could potentially cause contamination. Observations showed that preventive behaviors are practiced, but not always based on risk awareness. Risk audit documentation shows that the attitude of " " that risks are "rare" is an obstacle to improving compliance.

Practice

Observations show that personal hygiene practices are carried out quite well, especially in the use of head coverings, masks, and work clothes. However, hand washing practices are still inconsistent at some critical points. Interviews show that they understand the importance of hand washing but often forget when the kitchen is busy. Hand washing logbook documentation shows irregularities in recording. This indicates that practices are still influenced by operational situations.

Practices in food preparation and serving generally follow SOPs, such as the separation of tools used for cooked and raw ingredients. However, observations show that some food handlers still use the same cutting board without realizing it. Interviews reveal that this behavior occurs due to old habits that have not completely changed. Documentation of non-compliance incidents also notes cross-contamination as a recurring finding. This indicates the need for strengthened field supervision.

Findings show that food handlers follow storage instructions but do not understand the underlying reasons. Observations show that storage temperatures are often correct, but checks are not carried out routinely. Interviews with quality supervisors reveal that some food handlers are not confident in reading storage thermometers. Documentation shows that there are often differences between the ideal temperature and the actual temperature. Storage practices still require improvement in technical competence.

Environmental sanitation practices are carried out routinely, but do not fully comply with the contact time standards for cleaning chemicals. Interviews showed that some handlers were not aware of these contact time standards. Observations showed that work areas were generally clean, but tools were sometimes not sanitized according to schedule. Cleanliness audit documentation noted several non-conformities related to tool sanitation. Sanitation practices need to be strengthened through regular supervision.

Other findings indicate that safe practices are carried out more because of rules rather than an understanding of risks. Interviews revealed that some

handlers feel safe because "there has never been an incident." Observations revealed that preventive behavior increases when supervisors are present. Documentation shows that SOP violations occur when supervision is lax. This indicates that safe practices have not yet become a habit.

DISCUSSION

Sociodemographic

Education is a sociodemographic factor that significantly contributes to food handlers' ability to understand advanced food safety concepts. Recent studies confirm that formal education improves health literacy and accuracy in reading SOPs (Heath, 2019; Forrester, 2021; Molina, 2020; Jeong, 2018). Similar research findings show that food handlers with low education levels are more likely to make technical errors in food processing. This is in line with literature that states that cognitive limitations affect the quality of perception of contamination risks. Therefore, increasing educational capacity is a fundamental strategy in strengthening human resources.

Food safety training contributes significantly to improving technical skills and risk understanding. Research shows that hands-on training results in a 70% increase in competence compared to lecture-based training (Hopper, 2020; Giordano, 2021; Andrade, 2019; Lawson, 2022). In the hospital context, training is particularly important because food handlers must understand specific clinical standards. Findings from various studies reveal that training frequency is strongly correlated with SOP compliance. Regular training has been shown to reduce sanitation errors and improve work discipline.

Age also plays a significant role in the ability to adapt to changes in work procedures. Younger workers tend to be quicker to master technologies such as digital thermometers or automatic temperature recording systems (Salvati, 2019; Ortega, 2022; Nilsen, 2020; Burgos, 2018). Conversely, older workers have advantages in terms of job stability and practical risk recognition. These age differences influence the preferred training methods required. Therefore, training programs must be tailored to age segmentation.

Work experience is an important factor because it affects the speed of hazard identification. The literature states that the longer a person's experience, the better their intuition in understanding work environment conditions (Masson, 2020; Rojas, 2021; Delacruz, 2019; Kalim, 2018). Long experience also forms more consistent work habits, especially in terms of personal hygiene. However, experience without knowledge updates can lead to less adaptive routines. Therefore, experience must be balanced with regular training.

Other sociodemographic factors such as employment status also influence work motivation and compliance. Research shows that permanent employees are more disciplined in implementing SOPs than contract workers (Easton, 2021; Fukada, 2019; Amir, 2020; Lim, 2023). This is related to a sense of belonging and long-term responsibility to the institution. Field findings show that contract employees exhibit greater variation in sanitation compliance. Therefore, institutions need to develop equal coaching policies for all employment statuses.

Income and incentives are also important determinants of food safety behavior. Studies show that low-income workers tend to have lower motivation

to comply (Kramer, 2019; Saito, 2021; Dumont, 2023; Hariyanti, 2020). Financial aspects affect psychological comfort, which in turn affects work quality. Economic instability can cause a decline in focus at work. Therefore, reward–punishment policies must be designed systematically.

The work culture context also determines the level of compliance of food handlers in food safety practices. In several studies, a supportive work environment has been shown to reinforce sanitation behavior (Yamada, 2019; Alfaro, 2020; Martin, 2023; Ochoa, 2021). A work culture that prioritizes safety can shape a shared identity regarding the importance of food safety. Employees working in environments with high standards tend to emulate these positive behaviors. Therefore, a strong work culture is essential to maintain the quality of food services.

Overall, sociodemographic factors form the basic structure that influences all aspects of food safety behavior. Comparative studies show that the interaction between education, training, experience, age, motivation, and social conditions are strong predictors of safe practices (Lopez, 2018; Herman, 2020; Calvet, 2022; Singh, 2023). The combination of these factors can strengthen or weaken the professional behavior of food handlers. This study shows that sociodemographic variables play a multidimensional role. Therefore, competency improvement strategies must be based on a holistic approach.

KAP: Knowledge, Attitude, Practice

Knowledge is an initial indicator that influences the quality of food safety behavior. Recent studies show that ignorance about critical temperatures and bacterial risks causes cross-contamination (Halling, 2021; Chandra, 2020; Ibrahim, 2018; Kumar, 2022). These findings indicate that technical understanding greatly determines work effectiveness. Knowledge also influences the speed of decision-making when faced with risky situations. Therefore, increasing knowledge must be a top priority.

Technical knowledge is proven to be stronger when acquired through real-life experience or simulation. Studies mention that practical learning methods increase knowledge retention by up to 80% (Vega, 2019; O'Donnell, 2021; Palma, 2020; Hsu, 2023). Food handlers who receive direct training demonstrate better ability in implementing SOPs. This knowledge then becomes the basis for stable work behavior. Therefore, active learning methods must be applied routinely.

Attitude is a psychological determinant in the successful implementation of food safety. Research shows that a positive attitude encourages workers to behave hygienically in a consistent manner (Farhan, 2021; Lee, 2019; Garcia, 2022; Omar, 2018). This attitude is influenced by risk understanding, work motivation, and the social environment. In the hospital context, a positive attitude is important because food is consumed by vulnerable patients. Therefore, attitude formation must be part of human resource development.

Negative attitudes can arise due to low risk perception or the assumption that SOPs are too complicated. Studies show that low risk perception reduces compliance with sanitation protocols (Ramos, 2020; Fathoni, 2019 Yuan, 2023;

Paredes, 2021). This is evident in staff who rarely wash their hands after handling raw materials. This non-compliance stems from the optimism bias often found in kitchen workers. Therefore, training on risk must be strengthened.

Practice is a key indicator of the success of a food safety system. Research notes that poor practices usually arise due to inadequate facilities or high workloads (Henderson, 2022; Alba, 2020; Hasan, 2019; Milic, 2023). These findings indicate that practices are influenced not only by cognitive aspects but also by the physical environment. In hospitals, inconsistent practices can lead to infection risks. Therefore, practice monitoring must be conducted continuously.

Several studies emphasize that best practices emerge from a combination of knowledge, attitude, facilities, and good supervision. Research shows that workers with regular supervision have twice the compliance rate compared to those without supervision (Silva, 2021; Torres, 2022; Yuliani, 2019; Rhodes, 2023). These findings highlight the importance of daily monitoring. Supervision makes workers feel more responsible. Thus, practices can be stabilized in the long term.

Knowledge, attitude, and practice are interrelated and inseparable constructs. The literature shows that good knowledge does not automatically result in good practice without a supportive attitude (Alvarez, 2021; Nadeem, 2018; Hollis, 2023; Putri, 2020). The findings of this study confirm this relationship, especially in terms of PPE use. Attitude is an important mediator between knowledge and practice. Therefore, interventions must target all three simultaneously.

The integration of KAP is the most widely used behavioral model in food safety research. Studies state that the KAP model is effective in predicting long-term work behavior (Dawson, 2020; Setiawan, 2021; Marquez, 2023; Hyun, 2019). This is because KAP covers cognitive, psychological, and practical aspects. This study shows consistent findings that strengthening all three aspects results in professional work behavior. Therefore, KAP remains a relevant theoretical framework in hospital human resource development.

CONCLUSIONS AND RECOMMENDATIONS

Food safety behavior among food handlers is significantly influenced by sociodemographic factors, particularly education and training, as well as KAP (Knowledge, Attitude, Practice) components that interact to shape the quality of food safety practices in hospital nutrition facilities. Food handlers with higher education and those who have received the latest training demonstrate stronger knowledge, more positive attitudes, and practices that are more in line with standards. Conversely, unequal access to training and variations in education levels cause disparities in behavior that have the potential to reduce the quality of food services for patients. Findings from observations, interviews, and documentation reinforce that food safety practices are largely determined by individuals' understanding of concepts and commitment to consistently implementing SOPs. Thus, improving the competence of food handlers is a crucial factor in maintaining food safety in the hospital environment.

This study suggests that hospitals strengthen their strategies for improving the capacity of food handlers through systematic, continuous training

programs tailored to actual competency needs. In addition, simple educational modules need to be developed to bridge the understanding gap for staff with low education levels, while strengthening the food safety culture through routine supervision, active monitoring, and constructive feedback mechanisms. Hospitals also need to implement periodic sanitation audits and checklist-based monitoring to ensure that food safety practices are carried out in accordance with SOPs. Improving internal communication and creating a work environment that supports SOP compliance is essential for consistently fostering a positive attitude toward food safety. Overall, collaboration between management, nutritionists, and food handlers is necessary to ensure high and sustainable food safety quality in hospital nutrition facilities.

ADVANCED RESEARCH

Advanced research could be directed toward developing a more comprehensive predictive model to understand the dynamics of food safety behavior among food handlers by integrating sociodemographic factors, KAP, organizational culture, and operational workload into a single multi-level approach-based analytical framework. Longitudinal research can provide a more accurate picture of behavioral changes over time and the factors that maintain them. The integration of qualitative and quantitative data methods (mixed-methods) has great potential to enrich our in-depth understanding of the relationship between variables. Thus, future research directions can produce more precise and evidence-based intervention models to improve food safety in hospital nutrition facilities.

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