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# Assessing food safety and hygiene practices in old age homes in Mangaung and Lejweleputswa regions, free state

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**Introduction:** Poor food handling, improper cooking, and inadequate storage practices contribute to the spread of harmful pathogens, particularly in vulnerable environments such as old age homes. Ensuring compliance with food safety regulations is essential to protect elderly residents from foodborne illnesses.

**Methods:** This study assessed food safety practices in 14 old age homes (N = 14) in the Free State, South Africa. Data were collected using questionnaires (N = 80) to evaluate food handlers' knowledge, attitudes, and behaviors. Additionally, a food safety checklist was used to assess compliance with hygiene and safety standards.

**Results:** The study identified gaps in food safety practices and regulatory compliance. Non-compliance was observed in 5 facilities (35%), with key issues including inadequate handwashing facilities, limited access to hot water, and insufficient personal protective equipment. While 9 facilities (65%) adhered to food safety regulations, stricter enforcement of measures is necessary to ensure consistent adherence. Although participants demonstrated a good understanding of personal hygiene, proper food handling, sanitation, and microbial contamination prevention, a gap remained between knowledge and practical application.

**Discussion:** The findings highlight the need for improved food safety measures in old age homes. Enhancing hygiene infrastructure, conducting frequent inspections, providing regular food safety training, and enforcing standard operating procedures (SOPs) are critical for mitigating risks. Strengthening these aspects will contribute to safeguarding the health and well-being of elderly residents.

KEYWORDS

**food handlers, food handling practices, food safety knowledge, quality assurance, hygiene compliance, legislative compliance, foodborne illnesses, elderly health**

## Introduction

Food safety in institutional settings, particularly in old age homes, is a critical public health issue. Elderly individuals are particularly vulnerable to foodborne illnesses due to age-related changes in the immune system, chronic conditions such as diabetes or hypertension, and the potential for multiple medications that weaken the body's

defence mechanisms (Elbehiry et al., 2023; Mphaga et al., 2024). According to Manafe et al. (2023) and Mphaga et al. (2024), the elderly population in care facilities faces a disproportionate risk of foodborne illnesses, which can lead to prolonged recovery periods, complications, and, in some cases, death. The World Health Organization (WHO) identifies foodborne diseases as one of the major contributors to global morbidity and mortality, with the elderly representing one of the most susceptible groups in food safety risk assessments (World Health Organization, 2024).

In South Africa, the Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972), along with the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018), provides the regulatory framework for food safety in institutional settings. These regulations are designed to establish standards for hygiene, food handling, storage, and preparation, aiming to protect consumers from foodborne illnesses. However, despite the presence of these guidelines, compliance in old age homes remains inconsistent, posing a serious public health risk. Research by Pakdel et al. (2023) has highlighted that non-compliance with food safety standards in elderly care facilities can lead to food contamination, which further exacerbates the vulnerability of elderly residents to foodborne illnesses.

Previous studies have indicated that food safety compliance in institutional settings often varies due to factors such as staff training, resource availability, and management practices (Mphasha et al., 2024; Moghnia et al., 2021; Teffo and Tabit, 2020). According to Aljasir (2023), even when food safety protocols are in place, they are sometimes poorly implemented or inconsistently monitored, leading to gaps in food safety practices. In old age homes, the role of food handlers is crucial, as their knowledge and training directly impact the implementation of safe food handling practices. Studies by Insfran-Rivarola et al. (2020) and Manafe et al. (2023) indicate that many staff members are inadequately trained, which hinders their ability to effectively adhere to food safety guidelines. This deficiency in training is particularly concerning in environments where residents are highly susceptible to contamination, highlighting the importance of providing staff with adequate training and ensuring strict compliance with hygiene protocols.

Moreover, environmental factors within old age homes, such as kitchen cleanliness, temperature control for food storage, and pest management, have been identified as key determinants of food safety (Afriyie et al., 2022). Studies by Gürsu, (2024) and Kirchner et al. (2021) show that even when food is prepared with care, improper storage and cross-contamination from unsanitary surfaces or equipment can lead to foodborne outbreaks. Refrigeration, in particular, plays a crucial role in preventing the growth of harmful bacteria such as *Salmonella* and *Escherichia coli*, which can thrive if food is not stored at the correct temperature. However, cleanliness of refrigerators and freezers often falls short in many facilities, as reported by Ehuwa et al. (2021), contributing to an increased risk of contamination.

Food handlers' personal hygiene, particularly hand hygiene, plays a role in preventing foodborne illness outbreaks. Studies by Bhagwat (2019) and Pakdel et al. (2023) highlight the importance of proper handwashing, glove use, and compliance to hygienic clothing standards. However, compliance with these practices is often insufficient, as many food handlers fail to follow recommended hygiene practices due to either a lack of awareness or insufficient enforcement of protocols.

In terms of pest and waste management, effective control measures are essential in maintaining a hygienic environment in old age homes. According to the National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health Practitioners promulgated under the National Health Act (Guidelines for Environmental Infection Control in Health-Care Facilities, 2003), pest control systems must be in place to prevent contamination from rodents, insects, and other pests. According to Bingham and Hagstrum (2023) and Kattiyapornpong et al. (2023), proper waste management systems, including safe disposal of food scraps and waste oil, are critical in controlling pests and maintaining hygiene. However, research indicates that many facilities still struggle with pest control and waste management, putting food safety at risk (Raphela et al., 2024; Viljoen et al., 2021).

In line with these findings, this study aims to explore how food safety practices are implemented in old age homes in the Mangaung and Lejweleputswa regions in the Free State Province, with a specific focus on assessing food safety knowledge, hygiene practices, and compliance with national food safety regulations. The study will contribute to the growing body of research by identifying the gaps in food safety practices that need to be addressed to better protect elderly residents from foodborne illnesses. By improving food safety practices and ensuring better compliance with established regulations, these facilities can significantly enhance the quality of life and safety of their residents.

# Research design and methods

## Study design

A cross-sectional quantitative study was conducted to assess food safety practices in old age homes in the Mangaung and Lejweleputswa regions of the Free State.

## Study population and sampling strategy

The study focused on old age homes in the Mangaung and Lejweleputswa areas of the Free State. These areas were selected due to the proximity to the researchers' institution, making it easy to visit the facilities and collect data. As shown in Figure 1, all the selected old age homes had Certificates of Acceptability (CoA), which confirm compliance with South Africa's hygiene standards for food premises, as outlined in the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018). Although a list of old age homes was obtained from the Department of Social Development, only 14 were included in the study, as they were the only facilities with a valid CoA at the time. Some other homes were excluded because they were temporarily closed. Food handlers at the selected homes were given questionnaires to complete, with the researcher guiding them to ensure understanding without influencing their responses. The food handlers filled out the questionnaires independently to

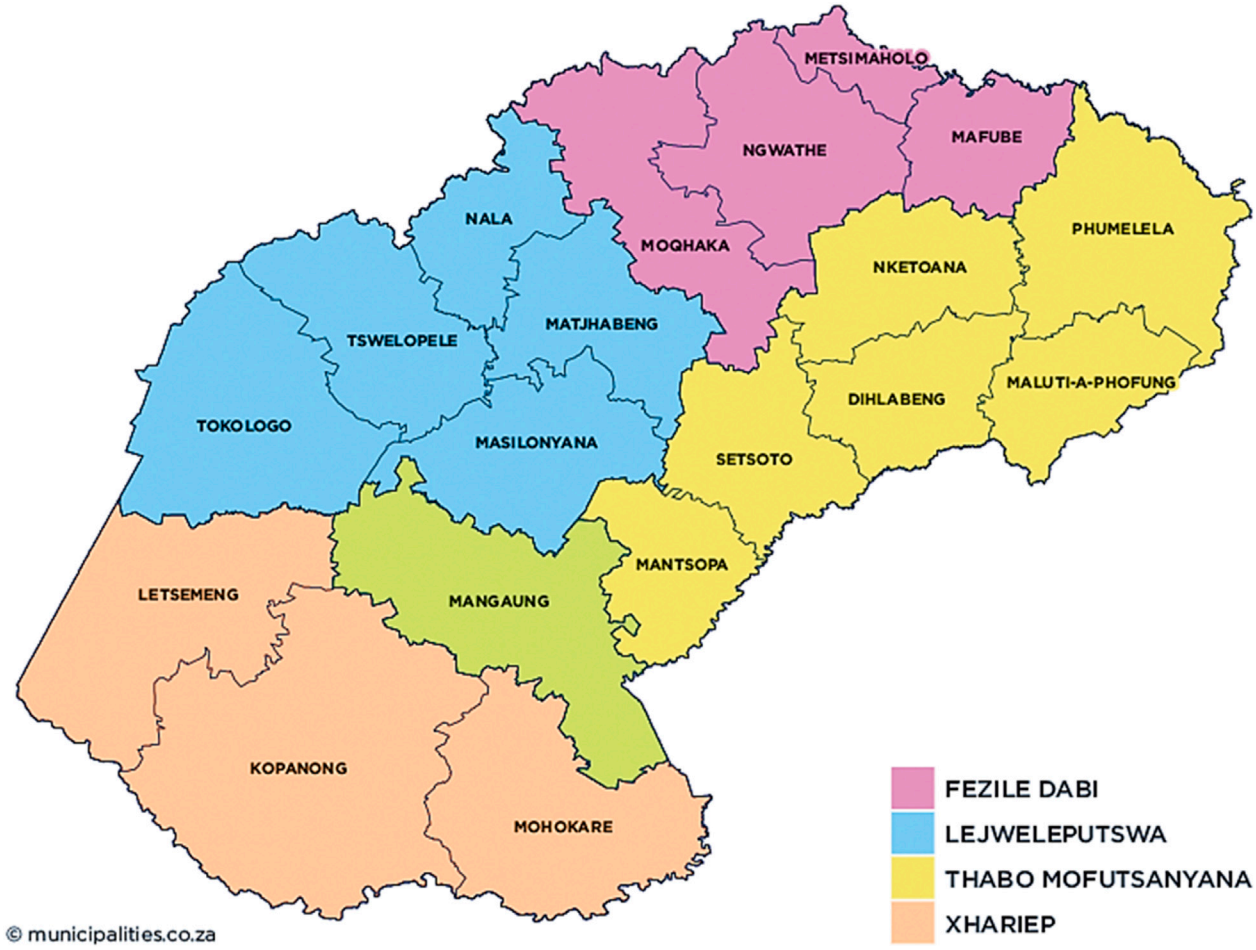


FIGURE 1
Study region.

maintain the authenticity of their answers. Additionally, a food safety checklist was used, which the researcher filled in through direct observation of food handling practices at the facilities, providing further validation of the data collected.

## Data collection

A structured questionnaire was used to collect data, and it was divided into four sections: Personal Hygiene, Food Safety Management, Cleaning Practices, and Pest Control. The questions were carefully designed to be clear and consistent, ensuring they aligned with food safety regulations to assess whether the required standards were being met. This format allowed food handlers to answer the questions independently, ensuring their responses were not influenced by the researcher. In addition to the questionnaire responses, food safety management documentation in these facilities was also consulted, particularly when using the food safety checklist, to provide a comprehensive assessment of compliance with food safety standards. Throughout the data collection process, the researcher worked closely with a registered EHP to ensure that all food handlers were interviewed. After the interviews, the researcher then reviewed the completed questionnaires to confirm that all responses were accurate and complete.

## Reliability

The questionnaire was reviewed by an EHP who specializes in food premises and food handling inspections. The EHP ensured that the questions were clear, relevant, aligned with the study's goals, accurately captured key aspects of food safety practices, and complied with food safety regulations. To further ensure the data's consistency and reliability, the researcher took steps to guarantee that the responses provided by food handlers were uniform across all participants. While food handlers were encouraged to answer independently, the researcher remained present during the data collection process to provide clarification if needed and to make sure the responses were unbiased.

Additionally, the researcher used a food safety checklist during direct observations of food handling practices and the overall condition of the facilities, which allowed for an objective assessment to determine whether the practices observed were

consistent with the responses provided in the questionnaire. This two-step approach, combining the questionnaire and the observational checklist, ensured that the information collected was consistent and aligned with the study's objectives.

## Validity

To assess knowledge that supports compliance with legislation, the tool was shared with a practicing EHP who regularly uses similar tools and is familiar with the requirements of the Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972), with particular emphasis on the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018) stipulated under it. These regulations provide detailed guidelines for food handling, hygiene practices, sanitation protocols, and waste control measures to ensure public health safety. The tool was designed to align closely with these regulatory standards to ensure that the questions it contained were both relevant and in compliance with established food safety practices.

## Data analysis

The questionnaire data were coded and entered into an Excel spreadsheet, then imported into the Statistical Package for the Social Sciences (SPSS) version 29. Responses were coded as "1.00" for "Yes" and "2.00" for "No" to make analysis easier. Descriptive statistics were used to summarize the data and assess hygiene practice compliance. This coding helped organize the data, allowing comparisons and identifying common trends related to hygiene practices, food safety management, and infrastructure in old age homes. SPSS outputs also showed summarized results for key areas, like handwashing facilities, temperature checks, and cleaning protocols, highlighting the percentage of respondents following each practice.

# Results

## Data analysis methodology

### Questionnaire

The data for this study were analyzed using SPSS software, focusing on means and frequencies to assess food safety and hygiene practices in old age homes. The results were grouped into themes that emerged from the data, including hygiene and sanitation practices, food safety practices, cleaning and maintenance, pest and waste management, and notable gaps in practices. These themes helped identify key areas of compliance and non-compliance across the study participants.

Since no formal statistical tests for significance (such as chi-square or t-tests) were performed, the results presented here are based on descriptive statistics, providing an overview of the compliance rates for different food safety practices. Frequencies and percentages are used to describe the extent to which food safety standards are being followed.

## Food safety checklist

In addition to the questionnaire, a detailed food safety checklist was used to assess how well the 14 old age homes followed the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018). The checklist looked at important areas like personal hygiene, food storage, food preparation, equipment maintenance, and waste management. The results from the checklist gave additional insights into the food safety practices in the homes, working alongside the data from the questionnaire and observations.

Compliance was scored from 1% to 100%, with higher scores indicating better adherence to the prescribed standards. A score below 50% indicated areas requiring improvement. The checklist was supplemented with observational data and interview findings, providing a reliable analysis of actual food safety practices in the homes. This also helped address potential discrepancies between self-reported practices and observed behaviors.

## Compliance overview

Table 1 summarizes the compliance rates for various food safety and hygiene practices across different themes in old age homes from the study participants. These rates are specifically compared to the standards set under the Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972), particularly the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018). These standards outline the requirements for maintaining hygiene in food handling, storage, and preparation, which are critical to preventing foodborne illnesses.

The results presented in Tables 1, 2 highlight both areas where facilities are performing well and areas that require improvement. The following sections will provide a detailed discussion of these findings.

## Non-compliance overview

Table 2 summarizes the areas of non-compliance observed across the study participants, grouped by key themes. It highlights the percentage of facilities that did not fully meet important food safety and hygiene practices, emphasizes areas that require improvement to ensure the safety and well-being of residents in old age homes.

TABLE 1 Summary of food safety and hygiene practices compliance[1].

| Theme | Compliance overview | Compliance rate (%) |
|---|---|---|
| Hygiene and Sanitation | - Handwash basins with essentials (water, soap, drying) | 83.8 |
| | - Hygienic drying method | 83.8 |
| | - Changing and storage facilities | 83.8 |
| | - Designated restroom with wash basin | 83.8 |
| Food Safety Practices | - Correct stock rotation | 100 |
| | - Separation of raw and cooked foods | 100 |
| | - Defrosting, preparation, and cooking on-site | 100 |
| | - Cooling methods and reheating on-site | 100 |
| Temperature and Monitoring | - Temperature checks on chillers/freezers | 60.0 |
| | - Monitoring temperature of reheated food | 71.3 |
| | - Temperature checks on food delivery | 60.0 |
| Cleaning and Maintenance | - Easy-to-clean surfaces | 75.0 |
| | - Cleaning schedules | 78.8 |
| | - Maintenance staff available | 75.0 |
| Pest and Waste Management | - Pest control systems | 78.8 |
| | - Waste and refuse disposal facilities | 83.8 |
| Employee Health and Safety | - Sick employee records | 81.3 |
| | - Preventing contamination | 81.3 |
| General Infrastructure | - Lighting and ventilation | 100 |
| | - Safe reheating of food | 100 |

## Overall compliance

Figure 2 shows the distribution of compliance status among participants. The "Yes" section reflects the total percentage of compliance across all questions, while the "No" section highlights areas of non-compliance among the participants from the old age homes study.

# Discussion

## Hygiene and sanitation practices

The researchers found that, while most old age homes in Mangaung and Lejweleputswa meet basic hygiene standards, certain gaps exist that could potentially affect food safety for elderly residents. Most study participants (83.8%, N = 67) reported having essential handwashing facilities, including basins with hot and cold water, soap, and hygienic hand-drying methods, which are important for preventing the spread of microbes. However, 16.3% (N = 13) lacked these facilities, making it harder to maintain proper hand hygiene and increasing the risk of foodborne illnesses. The food safety checklist also highlighted concerns in personal hygiene, with 60% compliance observed in handwashing practices, and only 20% of food handlers demonstrating proper handwashing. This suggests that, despite the presence of handwashing facilities, there may be gaps in the training and reinforcement of proper hand hygiene practices. The findings from the systematic review by Insfran-Rivarola et al. (2020) indicate that while training interventions have positive effects on knowledge and practices, specific aspects such as handwashing might require more focused or practical training to ensure consistent application, as seen in the low compliance rates here. This highlights the need for targeted interventions to improve hand hygiene behaviors across the facilities. In line with the findings of Johnstone et al. (2022), who identified gaps in hand hygiene practices in a community survey in Soweto, targeted interventions should focus on specific groups, like food handlers. Their study showed that only 42% of respondents practiced proper hand hygiene, highlighting the need for focused educational efforts.

1 Compliance Overview refers to the key practices and standards assessed within each theme to ensure adherence to food safety and hygiene regulations. Compliance Percentage indicates the proportion of facilities that fully meet the specified standards for each practice, expressed as a percentage of the total number of facilities surveyed. A higher percentage reflects greater adherence to the required practices within that area.

TABLE 2 Summary of non-compliance ("no" responses)[2].

| Theme | Key practice | Number of study participants responses on non-compliant facilities (N) | Percentage non-compliant (%) |
|---|---|---|---|
| Hygiene and Sanitation | Handwash basins with essentials | 13 | 16.3 |
| | Hygienic drying method | 13 | 16.3 |
| | Changing and storage facilities | 14 | 17.5 |
| | Designated restroom with wash basin | 14 | 17.5 |
| Food Safety Practices | Temperature checks upon food delivery | 32 | 40.0 |
| | Temperature checks on chillers/ freezers | 23 | 28.7 |
| Food Handling and Contamination Prevention | Reheating of food undertaken on-site | 14 | 17.5 |
| | Monitoring temperature of reheated food | 14 | 17.5 |
| | Risk of contamination of foods on display | 44 | 55.0 |
| Employee Health and Safety | Sick employee records | 15 | 18.8 |
| Cleaning and Maintenance | Food surfaces well-constructed and easy to clean | 20 | 25.0 |
| | Cleaning schedule | 17 | 21.3 |
| Waste and Pest Management | Adequate facilities for refuse disposal | 17 | 21.3 |
| | Adequate facilities for waste oil disposal | 17 | 21.3 |
| | Pest control and formal contracts | 13 | 16.3 |

Similarly, emphasizing the importance of soap for hand hygiene and considering the social context could help improve hand hygiene practices in food safety. The checklist findings are consistent with the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638 of 2018), which require facilities to have hot and cold water, soap, and hygienic drying methods for effective hygiene practices.

Resource limitations and gaps in monitoring are factors that may contribute to these challenges (Mphaga et al., 2024). For instance, although most study participants reported having proper handwashing facilities, those without these facilities often faced budget constraints, limited time, or a shortage of EHPs to provide the necessary training and consistent monitoring. This lack of resources and capacity made it difficult for some of these facilities to meet the required standards. Similarly, Aljasir (2023) found that inadequate food handling practices, due to insufficient training and resources, lead to foodborne illnesses in Gulf countries. Similarly, Pakdel et al. (2023) highlighted how inadequate food safety management, including improper design of food processing facilities and lack of hygienic monitoring, can lead to food contamination risks, especially in settings that use open food processing equipment. Their findings emphasize the importance of proper monitoring and intervention strategies, which align with the challenges faced by old age homes in ensuring food safety. Additionally, since EHPs are mandated to inspect the premises only twice a year, as outlined in the National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health Practitioners in terms of the National Health Act (61 of 2003), Section 4: 2 (2.1), the findings of the study indicate this as a gap due to insufficient opportunities for ongoing support and follow-up inspections, which has hindered compliance at some facilities.

The results show that 82.5% (N = 66) of the study participants reported that their old age homes have changing and storage areas, as well as restrooms with wash basins. However, 17.5% (N = 14) indicated a lack at their facilities. Changing and storage areas are essential for ensuring food handlers can change into clean clothing, reducing the risk of contaminating food with external dirt or bacteria. These areas also help maintain cleanliness and prevent

2 Data derived from the study on food safety practices in old age homes, specifically focusing on non-compliant responses from participants. The number of non-compliant facilities (N) and the corresponding percentages (%), as indicated for each theme and key practice, reflect the observed gaps in adherence to established food safety standards within the study's scope.

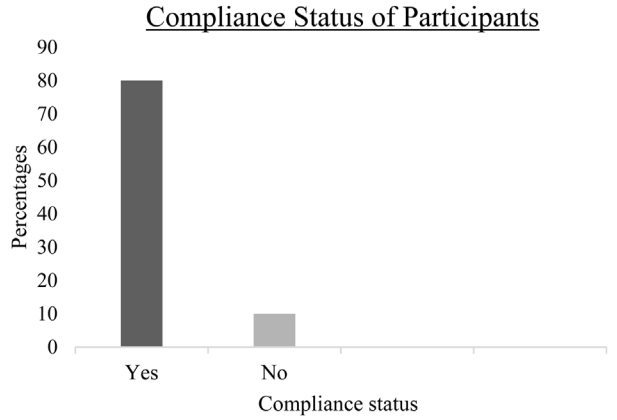


FIGURE 2
Overall compliance of food safety and hygiene practices[3].

cross-contamination, which is critical for food safety, as emphasized by Pakdel et al. (2023). Proper hygiene facilities, such as restrooms with wash basins, are fundamental to preventing contamination, as their absence puts both food handlers and elderly residents at risk. According to Putri and Susanna, (2021), the availability of wash basins plays a role in promoting regular handwashing among food handlers, a practice that is particularly important after activities such as using the restroom or handling raw food. Therefore, regular handwashing reduces the risk of transferring harmful microorganisms to food, thereby enhancing food safety.

The food safety checklist revealed gaps in cleanliness and adherence to hygiene standards in food storage and preparation areas, with 60% compliance in areas like food storage and refrigeration cleanliness. As noted by Lorenzo et al. (2018) and Ehuwa et al. (2021), maintaining cleanliness in food storage and refrigeration areas is vital, as it prevents the growth of harmful microorganisms and helps ensure food is stored at safe temperatures. Improving these facilities is vital to protect the health and safety of everyone involved.

## Food safety practices

The researchers' study results show that while most food safety practices are being followed, there is room for improvement in some areas. The control of food temperature in the facilities is generally managed using food thermometers, which allow food handlers to regularly check and maintain proper cooking and holding temperatures. However, non-compliance is evident in areas such as the failure to check temperatures upon food delivery (40%, N = 32) and in chillers/freezers (28.7%, N = 23), which can jeopardize food safety if not addressed, as reported by study participants. Hot holding units, such as warming ovens or food warmers, are commonly used in most facilities to keep food above 65°C, ensuring it remains safe for consumption until served. All participants (100%, N = 80) reported practicing key measures such as stock rotation, keeping raw and cooked foods separate, and cooking food to temperatures above 65°C. They also reported adhering to the minimum time-temperature requirements for food safety, which include ensuring that food is not kept at room temperature for longer than 2 h. This practice is crucial to prevent the rapid growth and multiplication of pathogenic bacteria, which can compromise food safety. Furthermore, maintaining a minimum temperature of 65°C complies with the standards set out in the Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972), specifically the standards and requirements for food on display, storage, and temperature under regulation 8 (4) (a) (i) [Annexure E: Food Temperatures]. According to column 1 under the category "Heated Products" and column 3 of this section, the Act specifies the required core temperatures for food to ensure safety.

Food safety practices extend beyond temperature control. Bhagwat (2019) emphasizes that the quality of water used in various food production processes, such as processing, cleaning, and storage, is crucial in ensuring food safety. Contaminated water can introduce harmful microorganisms that jeopardize food safety, highlighting the importance of effective water quality management as a critical component of food safety practices within facilities. Therefore, ensuring that water used in food preparation meets safe drinking standards and is properly treated is as critical as maintaining proper food temperatures. This is especially important for cleaning processes, where water is often used for sanitizing surfaces, utensils, and equipment. The quality of water, free from pathogens and contaminants, directly affects the effectiveness of cleaning procedures, which are vital to preventing cross-contamination and the spread of foodborne illnesses.

For hot drinks, temperature control is also important to prevent foodborne illness. Beverages like tea or coffee are typically heated to temperatures above 65°C; however, the duration for which they are maintained at this temperature is not always monitored as closely as it is for cooked food. To ensure safety and quality, it would be beneficial for food handlers to serve hot beverages at a consistent and safe temperature and to serve them immediately after preparation.

There is room for improvement in monitoring food storage and temperature control. While 71.3% (N = 57) of study participants reported regularly checking the temperatures of chillers and freezers, 28.7% (N = 23) do not. This lack of monitoring is concerning, as improper storage temperatures can allow bacteria like *Salmonella* and *E. coli* (*E. coli*) to grow, increasing the risk of foodborne illnesses, especially among elderly residents (Adhikari et al., 2018). Moghnia et al. (2021) emphasize that improper storage conditions are a significant risk factor in healthcare settings, and this issue remains pertinent in old age homes as well. Facilities typically rely on their suppliers to ensure that food is free from harmful bacteria before it is received. According to Mphaga et al. (2024), to further mitigate risks, it is crucial for facilities to adopt measures to test for the presence of harmful bacteria in food before its reception. This can be done by implementing random sampling, which should be carried out by a staff member who has been trained by an EHP in food safety practices. The samples would then be sent to accredited

3 The majority (84.6%) reported compliance, while 15.4% indicated non-compliance. This suggests that most participants adhered to the required protocols, though a smaller proportion did not. This data is important for assessing overall adherence to the study guidelines.

laboratories for microbial testing to detect common pathogens like *Salmonella*, *E. coli*, and *Listeria*. This practice aligns with the guidelines set out in the Codex Alimentarius Commission (2003), which advises that food facilities should take necessary steps to ensure that the food they receive meets microbiological safety standards. In addition, facilities should verify that their suppliers comply with food safety standards, including those outlined in the Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972), and maintain proper documentation of regular bacterial testing for food products. Regular audits and tests are also consistent with the Hazard Analysis and Critical Control Points (HACCP) system, which requires that food safety hazards be identified and controlled at critical points in the supply chain, including the receipt of food products (HACCP, 2018). These proactive steps play a role in ensuring that all food entering the facility is thoroughly inspected and deemed safe for consumption. By reducing the risk of contamination, these measures contribute to protecting the health and wellbeing of vulnerable residents.

The food safety checklist found that 60%–100% compliance in refrigeration practices was common, however only 60% of facilities adhered to cleanliness and contamination prevention standards in refrigerators, raising concerns about cross-contamination despite proper temperature control. Additionally, 40.0% (N = 32) of study participants do not check the temperatures of food deliveries, exposing food to potential temperature abuse during transportation, which poses another critical food safety risk. The food safety checklist also revealed that all participants in the study (100%, N = 80) strictly follow proper cooking and food preparation practices. However, 80% compliance was observed in temperature documentation and utensil cleaning for food preparation, indicating room for improvement in monitoring practices. This is important because proper documentation and temperature monitoring are crucial for food safety, especially in high-risk environments like old age homes.

## Cleaning and maintenance

The researchers found that 75% (N = 60) of study participants noted that their homes had food preparation surfaces that were easy to clean. The surfaces were made of non-porous, smooth materials such as stainless steel, which resists the absorption of liquids and is free of cracks, crevices, or joints that could harbor bacteria, ensuring proper hygiene is maintained. These surfaces are in compliance with the Foodstuffs, Cosmetics and Disinfectants Act (54 of 1972), under the Standards and Requirements for Facilities on Food Premises, Section 6(1) regulations. However, 25% (N = 20) of the study participants reported that their homes had surfaces that were harder to clean, such as wooden countertops, tiles with unsealed grout, or damaged stainless steel with scratches or dents. These types of surfaces often have cracks or porous areas that can absorb moisture and trap bacteria, making cleaning and disinfecting difficult. As a result, harmful bacteria can build up, as pointed out in the Guidelines for Environmental Infection Control in Healthcare Facilities (2003). The importance of clean surfaces in preventing contamination is also highlighted in studies by Little and Sirsat (2024); Ehuwa et al (2021) and Kirchner et al. (2021), who found that surfaces in food preparation areas that are not properly maintained are more likely to harbor bacteria. The study also found that food safety practices in the facilities showed 50%–80% compliance, especially in keeping thermometers clean. However, it was concerning that only 50% of the facilities cleaned thermometers between uses, which raises the risk of contamination during temperature checks.

In the study, 78.8% (N = 63) of study participants followed a cleaning schedule, which helps ensure important areas are cleaned regularly. However, 21.3% (N = 17) did not follow a cleaning schedule, which may lead to areas being missed and a higher risk of contamination. The food safety checklist confirmed that 60%–90% compliance was observed in dishwashing and waste management, with some gaps noted in waste storage and pest control, especially in facilities with only 60% compliance in maintaining clean waste bins. Regular cleaning and sanitization, especially of surfaces that come into contact with food, are essential to minimize the risk of foodborne illnesses (Little and Sirsat, 2024; Kirchner et al., 2021; Codex Alimentarius Commission, 2003).

## Pest control and waste management

Pest control is an important part of food safety, as discussed in previous studies. In this study, 83.8% (N = 67) of study participants reported that their facilities had pest control measures in place, including contracts with pest control companies, bait stations, routine inspections, and waste management systems. These facilities also sealed potential entry points, such as cracks in walls and floors, to prevent pests. Similarly, Bingham and Hagstrum (2023) highlighted that sanitation is a key element in pest management, removing insects and food residues that may serve as shelter for pests. Inadequate sanitation can reduce the efficacy of pest control measures, highlighting the need for comprehensive pest management strategies, a point also emphasized by Morrison et al. (2019), who found that decreased sanitation negatively affected the efficacy of pest control tactics, highlighting the importance of proper sanitation in maintaining effective pest management. However, 16.3% (N = 13) of the study participants indicated that their facilities in this study lacked pest control systems, which increases the risk of food contamination from pests like rodents and insects. According to Donkor (2020), pests such as rodents, flies, cockroaches, and stored-product insects can carry and spread diseases. For instance, rodents are known to carry diseases like *Salmonella* and can contaminate food and surfaces through their droppings, urine, or saliva. Cockroaches are also known to spread pathogens, such as *Salmonella* and *E. coli* by crawling on food surfaces and transferring bacteria. Flies, another common vector for foodborne diseases, can land on decaying matter and then transfer harmful bacteria to food (Yin et al., 2022). Similarly, stored-product insects, like beetles and moths, can contaminate food by feeding on it, leaving behind faeces, shed skin, and other waste products. The food safety checklist showed 60%–90% compliance with pest control and waste management practices, but only 60% of facilities were fully compliant with waste storage cleanliness and pest prevention. This indicates that pest control measures need to be more rigorously enforced in all facilities, as the presence of pests can compromise food safety and the health of residents.

In terms of waste management, 78.8% (N = 63) of the study participants stated they had proper systems for storing and disposing of waste, including waste oil. However, 21.3% (N = 17) of the study participants stated that their homes did not have proper waste disposal systems, which raises concerns about hygiene and the risk of pests.

## Non-compliance and areas for improvement

The researchers identified several key issues related to food safety, focusing on food handling and temperature control. It was found that 55.0% (N = 44) of the study participants did not have enough measures to protect food on display from contamination. This means some of the food was left exposed to dust, airborne germs, and pests, which could easily make the food unsafe. The lack of protective coverings, such as plastic wraps, increased the risk of contamination from improper handling by staff. Byrd-Bredbenner et al. (2013) discuss a similar problem in their study, pointing out that many consumers do not recognize the risks of foodborne illness at home, which leads to unsafe food handling practices. Their research suggests that food safety programs aimed at changing consumer attitudes and behaviors are necessary to reduce the risk of foodborne illness. Both studies highlight the need to raise awareness about food contamination risks and take proper steps to prevent it, whether in food facilities or at home. This is further supported by the findings of Siddiky et al. (2024), who emphasize that food handlers in institutional settings would benefit from enhanced exposure to food safety interventions, active participation in training sessions, and strict adherence to food hygiene regulations to improve their knowledge and practices. Their study indicates that food handlers who were more knowledgeable about food safety had better food safety practices, especially regarding hand hygiene and food separation, which aligns with the need for better food safety education in various environments.

In addition, the food safety checklist showed that 60%–80% of facilities followed proper food storage and contamination prevention practices. However, some facilities did not fully comply with food safety rules for storage. This means that many food items were not kept in the right containers or at the correct temperatures, which can lead to spoilage or bacterial growth, as explained by Nkosi and Tabit (2021). To improve this, it is essential to ensure food on display is properly covered, stored in suitable containers, and regularly checked to maintain safe temperatures.

The current study findings also revealed that 17.5% (N = 14) of the study participants stated that they did not check the temperature of reheated food, which creates a serious health risk. Reheated food that is not brought to the correct temperature can allow harmful bacteria, such as *Salmonella* or *E. coli*, to grow, as discussed by Ehuwa et al. (2021). This highlights how important it is to monitor food temperatures during reheating to prevent foodborne illnesses. Additionally, the food safety checklist showed that only 50% of facilities cleaned their thermometers between uses. Since thermometers are crucial for ensuring food is reheated safely, poor cleaning practices increase the risk of contamination.

Furthermore, 81.3% (N = 65) of study participants stated that their facilities kept records of sick employees, but 18.8% (N = 15) did not. The checklist findings suggest that keeping these records is important for stopping the spread of foodborne illnesses caused by sick food handlers. These results show the need for stronger monitoring and cleaning processes, as well as consistent record-keeping, to improve food safety and protect public health.

## Resource limitations and systemic challenges in food safety practices

While the discussion effectively highlights gaps and compliance, resource limitations likely play a key role in non-compliance with food safety standards. From the observations made, financial constraints prevent some facilities from investing in essential infrastructure, such as proper handwashing stations or maintenance of food safety equipment, which contributes to gaps in hygiene and food safety practices. Moreover, systemic challenges in enforcement and monitoring may exacerbate these issues. The study revealed that some facilities experienced delays in follow-up inspections after discrepancies were noted. According to Section 4 of the National Norms and Standards Relating to Environmental Health in Terms of the National Health Act (61 of 2003), under the heading "Homes for the Aged," Section 2 (2.1), EHPs are required to inspect food-handling facilities, including those in old age homes, at least twice a year to ensure compliance with food safety standards. However, delays in conducting follow-up inspections may lead to gaps in maintaining consistent compliance.

The National Environmental Health Strategy (2016–2020) states that there should be one EHP for every 10,000 individuals within a population. Despite this guideline, many municipalities face challenges in meeting the recommended staffing levels due to resource constraints. As a result, the current status reveals a shortage of EHPs, which further exacerbates delays in inspections and follow-up actions. These challenges are compounded by the lack of records for second inspections after initial violations, raising concerns about the enforcement of regulations. Insufficient staffing levels contribute to the delays, as fewer EHPs mean a reduced capacity to inspect all facilities on time and thoroughly. This highlights the need to address staffing shortages within regulatory bodies to ensure that food safety standards are consistently upheld. The combination of resource constraints and enforcement challenges underscores the importance of improving monitoring systems and implementing measures that ensure timely follow-up actions to correct identified issues, as outlined by the existing legislative framework.

## Legislative and regulatory recommendations

To address the gaps in food safety and hygiene practices observed in the study, several legislative and regulatory measures could be introduced.

### Stricter enforcement of hygiene standards

More frequent and unannounced inspections would help ensure that facilities consistently follow food safety rules. A system of penalties for not following the rules, particularly for issues like

not having proper handwashing stations or pest control, could encourage better compliance with regulations.

### Infrastructure requirements and resource allocation

Legislation should require that all facilities have basic infrastructure, like handwashing stations, temperature monitoring systems, and pest control measures, in place before they can receive a CoA after their first inspection. These measures are essential to prevent contamination and protect the health of both food handlers and residents. For facilities struggling to meet these requirements, financial assistance or subsidies should be available. Government grants could help support food safety improvements in underfunded facilities, especially in rural or low-income areas. Private companies may also offer financial support, equipment, or training programs. Additionally, non-governmental organizations (NGOs) that focus on health or food security could assist with funding or expertise. These forms of support will help ensure that all facilities, regardless of their financial situation, can maintain a safe and hygienic environment, ensuring the health and safety of vulnerable populations, such as the elderly.

### Mandatory food safety management systems (FSMS)

All old age homes should have a complete Food Safety Management System (FSMS) in place, which includes mandatory health checks for food handlers, regular training on proper food safety practices, and accurate record-keeping of food safety activities. These measures help ensure that food is safe and that the risk of foodborne illnesses is minimized. The Foodstuffs, Cosmetics, and Disinfectants Act (54 of 1972) mandates these practices to protect public health, particularly in environments like old age homes, where residents are more vulnerable to foodborne illnesses. Additionally, the Occupational Health and Safety Act (85 of 1993) supports these measures by requiring employers to protect the health and safety of their workers, including ensuring that food handlers are healthy and trained in proper food safety practices.

### Training and continuous education

Mandatory training programs for food handlers, along with regular refresher courses, are important to ensure food safety knowledge is consistently applied. According to the National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health Practitioners in terms of the National Health Act (61 of 2003), ongoing food safety training must be provided to all staff working in food service settings in old age homes, and this training should be carried out EHPs. However, the regulations only require inspections of old age homes to be conducted twice a year. While this sets a minimum standard, the findings suggest that this frequency is not enough to address recurring food safety and hygiene issues. Therefore, more training sessions should be held, and the frequency of inspections should be increased.

## Limitations of the study

This study has several limitations. First, the sample size of 14 old age homes and the geographic focus on Mangaung and Lejweleputswa may limit the generalizability of the findings to other regions or a broader population of old age homes. Additionally, the reliance on self-reported data from food handlers and staff introduces the potential for bias, despite efforts to complement this with observational data. The study's cross-sectional design only provides a snapshot of food safety practices at a single point in time, and no formal statistical tests for significance were performed, limiting the ability to draw conclusions about causal relationships. Finally, while the study assessed compliance, it did not measure the actual outcomes, such as foodborne illness rates, which would provide a more comprehensive evaluation of the effectiveness of these practices.

## Conclusion

This study highlights gaps in food safety practices and compliance with food safety regulations in old age homes in the Free State, South Africa. Among the fourteen facilities assessed, nine demonstrated compliance with most food safety regulations, while five did not meet these standards; three located in the Mangaung Metropolitan area and two in the Lejweleputswa District Municipality. While food handlers demonstrated a high level of knowledge about food safety, inconsistencies in practice, particularly related to hand hygiene and the provision of personal protective equipment, were observed. Additionally, non-compliance with basic hygiene standards in these five homes stresses the need for stricter enforcement of regulations. These gaps contravene the main act that governs all food safety regulations, the National Health Act (61 of 2003), particularly the Foodstuffs, Cosmetics and Disinfectants Act (54 of 1972) and the Regulations Governing General Hygiene Requirements for Food Premises, the Transport of Food and Related Matters (R638) stipulated under it, as well as the National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health Practitioners. The study recommends improving hygiene facilities, such as providing designated handwashing stations and access to necessary personal protective equipment (e.g., aprons, gloves, hairnets), more frequent inspections to ensure ongoing compliance, enhanced food safety training for all food handlers, and stricter adherence to standard operating procedures (SOPs) to ensure the protection of elderly residents and reduce the risk of foodborne illnesses.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by the University of the Free State's Research Ethics Committees (UFS-HSD2023/0476 and UFS-ESD2023/0104). The studies were conducted in accordance with the local legislation and institutional

requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

TN: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing–original draft, Writing–review and editing. NM: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing–review and editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

## Publisher's note



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