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Knowledge, attitudes, and practices of food handlers regarding food safety in urban areas of Southeast Asia: a narrative review

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Abstract

This narrative review synthesizes recent evidence on knowledge, attitudes, and practices (KAP) related to food safety among food handlers in urban areas of Southeast Asia, with particular emphasis on migrant workers in Malaysia. The review aims to identify context-specific barriers and enablers that influence effective food safety practices, focusing on structural, linguistic, and institutional determinants in dense urban settings. Literature published between 2020 and 2024 was retrieved from Scopus, PubMed, Web of Science, and Google Scholar. The results of the study indicate significant variations in KAP, where the trained food handlers had a higher level of compliance (85%) than the untrained food handlers (55%). Workers with documentation had higher adherence to food safety practices (73%) than those without documentation (38%), illustrating the importance of legal status and training availability. Findings consistently demonstrate that food safety compliance is strongly associated with access to training, legal documentation, and employer support. Migrant food handlers, especially undocumented workers, face compounded challenges, including language barriers, limited formal training, and fear of regulatory engagement. Evidence indicates that multilingual, visual, and workplace-based training interventions substantially improve compliance in urban contexts. Kuala Lumpur emerges as a critical case study due to its heavy reliance on migrant labor, high food outlet density, and multicultural workforce. This review provides targeted insights to inform urban food safety policy, employer practices, and inclusive public health interventions in Southeast Asia.

Introduction

Food safety remains a critical public health concern in rapidly urbanizing regions, where high population density, complex food supply chains, and heavy reliance on food service establishments increase the risk of foodborne disease transmission (Yasin and Hassan, 2022). In Southeast Asia, urban growth has intensified dependence on food handlers, many of whom are migrants engaged in food preparation, storage, and service across formal and informal settings (Davies, 2019). While their role is essential for sustaining urban food systems, migrant food handlers often operate under structural constraints such as limited training access, linguistic diversity, and precarious employment that may compromise food safety compliance (Demiray and Sayar, 2024).

This review aims to critically synthesize recent evidence on the knowledge, attitudes, and practices (KAP) of food handlers in urban areas of Southeast Asia, with a specific focus on migrant workers. It seeks to identify key barriers and enablers influencing effective food safety practices and to examine how training, legal status, and workplace conditions interact to shape compliance. By foregrounding urban Malaysia particularly Kuala Lumpur the review addresses context-specific challenges often overlooked in generalized food safety literature.

Educational attainment is a central determinant within KAP frameworks, as it shapes risk perception, comprehension of food safety guidelines, and the ability to internalize formal training. In urban food systems characterized by linguistic diversity and informal employment, low educational levels may constrain the effectiveness of standard training approaches. Incorporating education level as an analytical lens is therefore essential for understanding variability in food safety practices among migrant and local food handlers alike.

Urban food safety challenges in Kuala Lumpur

Kuala Lumpur represents a distinctive urban food safety context within Southeast Asia due to its high concentration of food outlets, extensive reliance on migrant labor, and multicultural consumer demand (Chaudhary *et al.*, 2023). The city hosts a large population of migrant food handlers originating from South and Southeast Asia, many of whom have limited proficiency in Malay or English. This linguistic diversity complicates standard food safety training and regulatory communication (Turner, 2018; Woodhill *et al.*, 2022). Additionally, food businesses in Kuala Lumpur range from highly regulated premises to informal street-based operations, resulting in uneven enforcement and supervision (Park,

2020; Khoso, 2023). These structural and linguistic challenges create a setting where conventional food safety interventions may be insufficient, necessitating tailored, inclusive, and workplace-integrated strategies.

The influence of knowledge and attitude toward food safety practices have been well established among population (Chaudhary *et al.*, 2023), but not specifically with regard to urban migrant food handlers in Malaysia. Research on food handlers tends to treat the general population or rural contexts in general, neglecting some specificities and particularities pertaining to urban centres (Turner, 2018; Woodhill *et al.*, 2022). Adopting proper personal hygiene among migrant workers working in Selangor and Kuala Lumpur has always been a complicated road to travel down as the workers have issues with language barriers, heavy workloads, and minimal formal education, that contribute towards their failure to comply with the right food handling techniques (Park, 2020; Khoso, 2023).

In addition, few studies have looked at how knowledge and attitudes are transformed into action in the workplace, especially in work environments that are multicultural and multilingual (Park, 2020). This is a worrying gap, because there is increasing dependence on migrant food handlers as a labour force to support the urban food industry. In attempting to bring together recent work, this review seeks to address these absences by providing knowledge pertinent to both policy and practice. These insights are important for dealing not only with immediate food safety compliance challenges but also to drive proactive and sustained gains in public health.

The significance of this review is that it potentially enhances a refinement in understanding food safety problems for urban migrant workers. Through barriers including language and education, and enablers such as culturally supportive training modules and regulatory measures, the paper contributes concrete recommendations for policy makers. The implication of the findings can be used in public health interventions, policy-making, and educational interventions, especially to improve new accessible training methods, including video-based learning. Additionally, this review is in the context of the broader Sustainable Development Goal 3 which calls for healthy lives and well-being for all. The reduction of disease burden of foodborne diseases and improvement of life quality is facilitated by coping with food safety challenges, particularly in urban areas. In this way, it contributes to efforts to build Malaysia's public health capacity and the resilience of its urban food services.

Overview of food safety in urban settings

Food safety is an important issue concerning public health, especially for urban areas with high population density, various food cultures, and quick urbanization. The World Health Organization (WHO) highlights that unwholesome food is responsible for over 600 million cases of food-related diseases worldwide every year, with a higher associated burden observed in urban areas, due to elevated consumption and more complex food supply chains (WHO, 2022). The diseases these pathogens cause are a major public health and economic burden; hence, successful food safety measures are critical to preserve public health.

Urbanization has also led to growth of the food service industry, particularly in certain urban areas such as Selangor, Kuala Lumpur and Putrajaya. These urban centres experienced an increase in various food service outlets, due to demand and a new migrant workforce, which gained employment in the food sector. Within this growth, the key role played by migrant food handlers, who come from diverse cultural and linguistic backgrounds, means that the maintenance of standardised safety practices is challenging (Yusoff *et al.*, 2022). International cuisine is also on the rise with different food handling and preparation methods that necessitate a broad range of safety protocols.

Urban choking due to high population density also increases food safety risks. Problems due to lack of sanitation, food hygiene and poor waste management are compounded in crowded urban environments. Street food vendors are also challenging to monitor as many of them do not adhere to the regulatory conditions (Nawawi *et al.*, 2022), contributing to the complexity of urban food safety (ibid). These traders, important livelihood networks, can also be unintended food safety hotspots as a result of hygiene

lapses (Grace, 2023). With rapid urbanization, and the role of the informal sector, tailored interventions are required to manage the specific challenges of food safety in cities (Tacoli, 2020). Meeting these challenges will depend on coordinated action, good policy-making, and specific training, enabling safe food management within the urban context.

Role of food handlers in foodborne disease prevention

Food workers are the foundation of protection against foodborne diseases as they are the first line in food safety. Their actions have implications for public health, as poor handling practices can contaminate food and contribute to disease transmission. It is well documented that food handlers play a critical role in preventing foodborne illnesses through adherence to hygiene and food safety requirements (WHO, 2022). As guardians of hygiene throughout food preparation, storage, and service, they contribute directly to consumer safety. The multifaceted responsibilities of food handlers and their contribution to food safety are summarized in (*Supplementary Figure 1*).

Such knowledge and attitude gaps among food handlers may lead to unsafe practices though. Research have singled out several practices that could pose risks of contamination, such as not washing hands after touching raw products, or not cleaning devices, among others (Watson and Gong, 2018; Kamboj *et al.*, 2020). Attitude and perception also have a significant effect; for example, a food handler that does not consider food safety policies to be important is less likely to adhere to them. Ignorance or apathy related to hygiene necessities are often the result of inadequate training with migrant workers adding the dimension of cultural difference or language barriers (Moyce and Schenker, 2018).

Common hygiene lapses are frequently reported in urban food establishments. Inadequate hand washing, cross-contamination during food preparation, and improper storage conditions are among the most cited issues in recent studies (Kinyua, 2024; Thelwell-Reid and Elliott, 2025). For example, improper temperature control during storage can facilitate the growth of pathogens, posing significant health risks. Research from Malaysia highlights recurrent non-compliance with basic hygiene practices, particularly in small and informal food businesses, where regulatory enforcement is often limited (Aziz *et al.*, 2023). Addressing these lapses requires targeted training and continuous monitoring to equip food handlers with the knowledge and tools to implement effective food safety practices consistently.

Knowledge, attitudes, and practices framework

Definitions and theoretical background

The KAP model is a commonly used model in the field of public health, especially in relation to food safety. It aims to explain and predict human behaviour by investigating KAP of people. In the area of food safety, the KAP model can help to reveal how an understanding of hygienic standards, perceptions of foodborne disease risk, and everyday practices impact public health (Boyce *et al.*, 2019). The model is founded on the theoretical assumption that greater knowledge results in improved attitudes that should translate into better practices. For example, food handlers who understand the risk of cross contamination are also more likely to adopt this approach to hygiene and seek to minimize it. However, a linear connection between knowledge and practice cannot always be drawn. According to Social Cognitive Theory (Bandura, 1986), environmental, personal, and social factors frequently mediate this relationship. In urban environments, language barriers, cultural and workplace practices can interfere with this pathway, particularly mobile food (Moyce and Schenker, 2018). It is important to understand these dynamics in order to develop interventions that effectively translate awareness into action.

Figure 1 shows a model depicting the relationships between KAP and their impact on health outcomes. Ignorance, whether from lack of knowledge, awareness or motivation, underlines attitudes, leading to ignorance of self-care and misbeliefs about the behavior. These in themselves are drivers of suboptimal behavior like non-compliance and unedited time management that will eventually lead to bad health outcomes, including a higher rate of complications, a less successful forecast and a shorter life expectancy (Shafizi *et al.*, 2024).

Relevance to food safety behavior

Food safety training is an important determinant of food hygiene practices of food handlers. Researches have unequivocally proved that the trained food handlers have a significantly greater level of knowledge about food microbiology and safety as compared to their untrained counterparts (Faour-Klingbeil *et al.*, 2025). Training, particularly when designed to meet particular cultural and linguistic needs, was found to enhance knowledge retention and attitude. For example, multimedia learning modules performed in different languages had been proven effectively in a positive way to improve food safety compliance in urban areas such as Kuala Lumpur and Selangor (Abd Lataf Dora-Liyana *et al.*, 2018). Further still, perception of food safety frequently integrates with predictions about the probability of converting awareness into behavioural pattern. Food handlers who care about public health are more inclined to follow hygiene practices. On the other hand, complacent types may not even realize the importance of simple measures, such as washing your hands after using the bathroom and keeping food stored properly throughout its life cycle. Uneducated workers, particularly migrant ones, have little or no idea about the knowledge and positive attitude that would support the way of handling food safety; thus, the risk of contamination and foodborne outbreaks is high (Omar and Mohd Shahril, 2019). Filling these gaps would involve a mix of education, attitude-building and work environment support.

Key findings from recent knowledge, attitude and practice studies in urban contexts

Several studies in Malaysia demonstrated differences in KAP towards food handlers between urban areas. Research by Wahab *et al.* (2023) in Kuala Lumpur found that 78% of food handlers had a basic knowledge of foodborne pathogens, but only 52% practised recommended hygiene. Migrant workers largely comprised of the urban food service population and reported lower than average score compared to the local workers due to difference in the language and access to the training.

In Selangor, Arifen *et al.* (2021) found that food handlers who operate in small size and unregulated premises demonstrated lower level of positive attitude towards food safety as compared to legitimate establishment. In Putrajaya, an unequitable use between different types of employment was found where trained workers in a formal setting also had higher compliance compared to untrained (Rahman *et al.*, 2022). These results emphasize that that institutional backing and formal training have a significant impact on food safety behaviors.

Comparative perspectives on other Southeast Asian nations can also shed light on these patterns. For instance, in Indonesia, up to 68% of food handlers did not have sufficient knowledge of hygiene standards, and their practices were greatly influenced by cultural norms as well as workplace factors (Li *et al.*, 2024). In Thailand and the Philippines, food handlers in urban settings improved overall knowledge and compliance from government-led training interventions (Kwoba *et al.*, 2023). These results indicate additional intervention programs to translate knowledge and shape attitudes, which include exploring and applying strategic prevention programs with migrant workers in cities. This conglomeration of studies suggests that the KAP concept does form a background, albeit a conservative one, for a framework used to explain food safety behavior, but must be used in a context, dependent on the influence of urbanization, diversity of the workforce, and support of the establishment. Addressing these conditions is of utmost importance to promote safe food preparation and reduce burden of disease among rapidly expanding urban populations.

Migrant food handlers: vulnerabilities and gaps

Socioeconomic and linguistic barriers

Migrant food handlers in urban areas often face significant socioeconomic and linguistic barriers that compromise their ability to adhere to food safety standards (Figure 2). Low income, unstable employment, and substandard living conditions directly influence their capacity to maintain personal and workplace hygiene.

According to a study by Manap (2023), many migrant workers in Kuala Lumpur live in overcrowded accommodations with limited access to clean water and sanitation facilities, which exacerbates hygiene challenges. These conditions are particularly problematic for those employed in informal food sectors, where hygiene oversight is minimal, and resources for sanitation are scarce.

Language barriers further exacerbate these challenges by hindering comprehension of training materials and communication of hygiene protocols. Many migrant workers in Malaysia, particularly those from Nepal, Bangladesh, and Myanmar, struggle to understand food safety training conducted in Malay or English (Simkhada *et al.*, 2018). This lack of linguistic accessibility often results in incomplete or incorrect implementation of safety practices. For example, a case study conducted in Selangor highlighted a compliance gap in handwashing protocols among Nepali food handlers due to their limited understanding of instructional posters and verbal guidelines (Abd Latiff, 2020). Such gaps emphasize the critical need for culturally and linguistically tailored training programs.

The broader implications of these barriers extend to public health, as unsafe practices by migrant workers in densely populated urban areas contribute to the risk of foodborne illness outbreaks. Addressing these socioeconomic and linguistic hurdles is vital for achieving Sustainable Development Goal 3, which emphasizes ensuring healthy lives and promoting well-being for all (United Nations, 2020).

Training access and legal/institutional challenges

Migrant and food handlers frequently face barriers in their ability to access formal food safety training, due to legal, financial, and institutional constraints. Some do not have the necessary paperwork, which means they are not able to participate in government-sanctioned training programs (Farah *et al.*, 2017). Documented workers also have high training expenses and inadequate employer support, especially in small and informal food companies. A study among migrant food handlers in Putrajaya demonstrated that 45% of them have received some formal food safety training, whereas 80% of local food handlers had attended such training (Siau *et al.*, 2025).

Laws and practice in countries like Malaysia do not always adopt migrants into formal food safety mechanisms. For example, the Employment of Foreign Manpower Act of Singapore requires training in food safety but access is forbidden to undocumented workers (Hengst *et al.*, 2023). Access to training is widespread in the UAE, but high costs of trainings, and linguistic homogeneity in English or Arabic presents challenges to non-native speakers (Osaili *et al.*, 2021). Not only are the migrant workers repressed by all these legal bans, but the efficiency of food safety policy is also weakened. There are also institutional weaknesses in surveillance and enforcement that exacerbate these difficulties.

Regulations are rarely enforceable among informal food operations or noncompliant migrant labor. A study by Aziz *et al.* (2023) reported that less than a quarter of Selangor informal eating outlets were routinely inspected for hygiene, resulting in the majority of migrant-run food outlets operating unchecked. The improvement of food safety performance and the reduction of public health risks associated with migration primarily depends on the development of regulatory policies that include and support migrants.

Recent findings from Malaysia and comparable countries

Recent studies have highlighted critical gaps in KAP among migrant food handlers in Malaysia's urban areas. For example, Abdullah *et al.* (2020) found that while 65% of migrant workers in Kuala Lumpur displayed basic knowledge of food safety, only 40% adhered to recommended hygiene practices, compared to 75% compliance among local workers. Similar disparities were observed in Selangor and Putrajaya, with migrant workers citing language barriers and lack of training as primary obstacles. A comparative study between Malaysia and Thailand revealed that while Thai authorities provide multilingual training materials, Malaysia lacks such inclusivity, resulting in lower compliance rates among its migrant workforce (Srichampa *et al.* 2018). *Supplementary Table 1* summarizes these findings,

illustrating differences in knowledge and compliance between migrant and local food handlers in selected countries.

Supplementary Table 2 highlights common barriers faced by migrant food handlers in urbanized nations with high migrant workforces.

Malaysia can draw valuable lessons from these international cases. Thailand's emphasis on multilingual training materials and subsidized programs for migrants could serve as a model for Malaysian policymakers. Similarly, Singapore's structured monitoring of food businesses, despite its limitations, underscores the need for better regulatory enforcement in Malaysia. To align with broader public health goals, Malaysia must adopt a more inclusive approach to food safety, incorporating tailored training programs, accessible resources, and robust legal frameworks. These measures are critical to bridging the gaps in KAP among migrant food handlers and ensuring safer food systems in urban areas.

Barriers to effective food safety practices

Effective food safety practices are vital for ensuring public health, especially in urban areas with high population density and diverse food systems. However, numerous barriers impede the consistent implementation of these practices among food handlers. This section discusses four critical barriers: knowledge and skill deficits, cultural practices and beliefs, workplace conditions and supervision, and policy enforcement and compliance gaps.

Knowledge and skill deficits

Lack of knowledge and skills among food handlers are the dominant barriers for proper food safety practice. Most food providers, mainly migrants, are improperly trained in food safety that hinders them from following procedures and necessary practices in hygiene and handling. The gaps are especially common in casual food service, where workers learn on the job instead of in training programs. Standard skill deficiencies are storage temperatures, personal habits and cross-contamination. For example, research carried out in Kuala Lumpur showed that the rate of knowledge on the proper refrigeration temperature for food items was 42% among the food handlers interviewed, while always washing their hands with soap were practised by less than half of the participants (Rahman *et al.*, 2023). Similarly, Ebert *et al.* (2022) noted high rates of between-restaurant cross-contamination during urban food preparation, typically facilitated by ignorance regarding the separation of raw and cooked foods.

Supplementary Table 3 highlights the disparities in knowledge and skills between various food handler groups, emphasizing the critical role of training and education.

The table illustrates significant disparities, particularly between trained and untrained workers, highlighting the necessity of mandatory training programs for all food handlers. Migrant workers consistently exhibit the lowest levels of knowledge and skill, underscoring the need for targeted interventions in this group.

Cultural practices and beliefs

Cultural practices and beliefs play a crucial role in shaping food safety behaviors. While these traditions provide a sense of identity and continuity, they can conflict with modern food safety guidelines, leading to unsafe practices. In Malaysia and other Southeast Asian countries, food preparation methods rooted in cultural traditions often prioritize taste and aesthetics over hygiene and safety (Harmayani *et al.*, 2019). For example, the use of communal cooking utensils without proper sanitation is common in some cultural settings, increasing the risk of cross-contamination. Additionally, beliefs such as "natural foods don't require refrigeration" persist among some food handlers, leading to improper storage of perishable items. *Supplementary Table 4* compares cultural beliefs and their implications for food safety in Malaysia and neighboring countries.

While Malaysia shares common cultural challenges with neighboring countries, its multicultural food system adds complexity, requiring tailored strategies to address these diverse practices. Thailand's focus

on raw seafood highlights the need for specific safety measures, contrasting with Malaysia's broader storage-related challenges.

Workplace conditions and supervision

Adverse workplace conditions, such as high workloads, extended working hours, low wages, and inadequate supervision, significantly impact food handlers' ability to maintain safety standards. Workers in urban areas, especially in small eateries and hawker stalls, often operate under immense pressure, leaving little time to focus on hygiene and proper food handling (Haque, 2025). A survey conducted in Selangor found that 65% of food handlers cited high workload as the primary reason for neglecting hygiene practices (Rahman *et al.*, 2023). Poor supervision further compounds this issue, as managers and supervisors often fail to enforce compliance with safety standards. For instance, Appling *et al.* (2018) observed that establishments with proactive managerial oversight reported 30% fewer hygiene violations than those without. *Supplementary Table 5* below summarizes the impact of workplace conditions on food safety compliance.

Workplace supervision emerges as a critical enabler, with significant potential to mitigate the negative effects of workload and wage challenges. Establishments with structured oversight consistently outperform those without.

Policy enforcement and compliance gaps

The enforcement of food safety policies in Malaysia faces numerous challenges, particularly in urban areas with high concentrations of small food businesses. Insufficient inspections, limited resources, and a lack of standardized training programs hinder effective policy implementation.

Small food establishments and hawker stalls often operate outside formal regulatory frameworks, escaping routine inspections and enforcement actions. According to Taib *et al.* (2025), only 30% of hawker stalls in Kuala Lumpur undergo regular health inspections, compared to 75% of larger establishments. This disparity leaves significant gaps in the food safety landscape, increasing the risk of foodborne illnesses. *Supplementary Table 6* outlines key policy implementation gaps and enforcement challenges in Malaysia. The table highlights critical weaknesses in policy enforcement, emphasizing the need for more inclusive and adequately funded regulatory measures. Targeting informal food businesses, particularly hawker stalls, is essential for improving urban food safety outcomes.

Enablers and best practices

Addressing the barriers to effective food safety practices requires strategic enablers and the adoption of best practices. This section explores three pivotal enablers: training programs and behavior-based interventions, visual and video-based learning methods, and the role of monitoring, audits, and supportive management. Each is analyzed with evidence-based examples and recommendations for fostering sustainable improvements in food safety compliance.

Training programs and behavior-based interventions

Training programs play an important role in providing the knowledge and skills required for the food handlers to practice food safety. Customised training interventions have shown to mean improvement in the rate of adherence and in hygiene in an environment in which different cultural and linguistic contexts coexist.

A noteworthy study was conducted among the taxi drivers in Kuala Lumpur that demonstrated the impact of a cognitive intervention program which integrated various theoretical concepts with real practice. The program achieved a 45% reduction in the number of food safety violations recorded over the six-month period, thereby highlighting the value of incorporating behavior-based approaches to training (Young *et al.* 2019). In the same vein, a study in Singapore identified cultural and linguistic considerations as a

factor for enhancing participant engagement and retention in food safety training programmes (Berglund *et al.*, 2024).

Ongoing education and refresher classes also help food safety practices stay fresh, so food handlers can keep up with changing opportunities and methods. Data collected during the Selangor Food Safety Audit (2021) demonstrated that premises with biannual refresher training had 25% fewer hygiene infractions than those who did not have refresher training (McFarland *et al.*, 2021).

Supplementary Table 7 summarizes key findings from studies on training effectiveness. The findings underscore the importance of integrating continuous education and behavior-focused interventions to enhance the effectiveness of training programs.

Visual and video-based learning methods

Visual and video learning have been recognized as being transformative for food safety training, especially for multilingual and low-literate audiences. During training, the inclusion of video clips, infographics, and other visual aids has been found to aid in breaking down difficult food safety concepts and promoting better comprehension.

For instance, in Malaysia, an urban program showed hygiene demonstration videos and how to store food hygienically. The programme led to a 40% improvement in compliance with storage temperature standards among participants (Hussain *et al.*, 2023). An experiment done in Thailand also proved that food handlers who were trained by visual aids had better handwashing and cross-contamination practices than those trained in conventional way (Suryani *et al.*, 2022). *Supplementary Table 8* presents the performance of visual and video-based learning methodologies with traditional training methodologies. These methods also enhance retention and application of safety practices, especially when combined with practical demonstrations and follow-up assessments. Additionally, video-based learning enables scalability, allowing content to be easily distributed across diverse urban areas.

Role of monitoring, audits, and supportive management

Regular monitoring, audits, and supportive management practices are essential enablers of food safety compliance. These mechanisms ensure consistent adherence to safety standards and provide opportunities for continuous improvement. Studies have consistently highlighted the positive correlation between regular inspections and compliance rates. A report by the Malaysian Food Safety Authority (2022) indicated that urban food establishments subjected to quarterly audits exhibited a 35% higher compliance rate compared to those audited annually. Furthermore, establishments with robust managerial support demonstrated better adherence to hygiene protocols, suggesting the importance of leadership in fostering a culture of safety (Rahman *et al.*, 2022).

Supportive management practices, such as positive reinforcement and structured feedback, play a pivotal role in motivating food handlers to adopt safer practices. For instance, a program in Singapore utilized reward-based incentives to encourage compliance, resulting in a 20% improvement in hygiene standards within participating establishments (Jevšnik Podlesnik and Raspor, 2026).

Supplementary Table 9 outlines the impact of monitoring and managerial support on food safety compliance.

The findings emphasize the need for regular audits and supportive leadership as integral components of food safety programs. Establishments that prioritize these practices not only improve compliance rates but also contribute to a safer food environment.

Methodology

This study adopts a narrative review design informed by systematic search and content analysis principles. The review focuses on identifying recurring patterns, barriers, and enabling factors related to food safety KAP among food handlers in urban contexts, particularly migrant workers. Three guiding questions structured the review: (1) What common KAP-related challenges affect urban food handlers?

(2) What barriers and enablers influence compliance with food safety practices? and (3) Which training approaches demonstrate effectiveness in urban, multicultural settings?

Justification of narrative review approach

A narrative review approach was adopted to allow for conceptual synthesis of heterogeneous evidence on food safety KAP across diverse urban contexts. Unlike systematic reviews, which prioritize narrowly defined interventions or outcomes, narrative reviews are particularly suited for examining complex public health phenomena influenced by social, educational, legal, and institutional determinants. Given the variation in study designs, outcome measures, and contextual focus across Southeast Asian countries, a narrative review enabled integrative interpretation and critical comparison rather than statistical aggregation. While this approach limits formal risk-of-bias assessment, it provides flexibility to explore structural and contextual dimensions central to KAP research.

To ensure comprehensive coverage, a systematic approach was adopted to gather relevant literature. Four primary databases were used to identify articles and reports that align with the study objectives. Each database contributed specific insights into food safety practices, public health, and urban food handlers (Table 1). The data collection process is summarized below:

Scopus: A total of 15 articles were retrieved, focusing on KAP on food safety in urban settings. These studies provided insights into the challenges and enablers for food handlers in high-density areas.

PubMed: From this database, 10 articles were identified, emphasizing public health interventions aimed at improving food safety practices among food handlers.

Google Scholar: This source contributed 8 articles, including grey literature and policy documents that provided contextual depth and highlighted practical implications in real-world settings.

Web of Science: Seven articles were sourced, concentrating on Southeast Asia, with particular attention to Malaysia. These studies addressed regional trends and practices in food safety.

The regional scope was retained to enable cross-country comparison of structural determinants, recognizing that Malaysia represents a data-rich but not isolated case within Southeast Asia.

Search strategy

A structured literature search was conducted between January and March 2024 using Scopus, PubMed, Web of Science, and Google Scholar. Search terms were developed based on the KAP framework and urban food safety literature. Core keywords included combinations of: “food safety”, “food handlers”, “knowledge”, “attitude”, “practice”, “KAP”, “urban”, “migrant workers”, and “Southeast Asia”. An example search string used in Scopus was: (“food safety” AND “food handlers” AND (knowledge OR attitude OR practice OR KAP) AND urban AND (“migrant” OR “foreign worker”).

These databases were selected to balance biomedical indexing (PubMed), interdisciplinary coverage (Scopus and Web of Science), and regional or grey literature inclusion (Google Scholar). Regional databases were not included due to limited indexing consistency for KAP-related studies

Results

Food safety knowledge and attitudes

Across urban Southeast Asian settings, food handlers demonstrate uneven food safety knowledge and attitudes, with consistent disparities linked to training access, educational attainment, and institutional support. Rather than absolute knowledge deficits, studies report selective understanding particularly regarding cross-contamination and temperature control suggesting fragmented rather than absent food safety literacy. Attitudinal compliance is generally higher among workers exposed to structured training environments, indicating that workplace context moderates individual knowledge in shaping safe practices.

Recent research shows that migrant food handlers in general have many knowledge gaps particularly related to food safety, and that these gaps differ depending on training and documentation status. For

example, Rahimain *et al.* (2023), who carried out a survey in Selangor and Kuala Lumpur with 250 migrant food preparers, showed that 42% of them had the misconception of cross-contamination prevention, and 58% had the correct knowledge on temperature of storage of food. Likewise, perceptions on the importance of food safety were mixed; 70% of the trained food handlers agreed with the statement that food safety is essential for preventing foodborne illnesses and ensuring customer health, as compared to 38% of the untrained handlers.

A similar report from Chaudhary *et al.* (2023) in Malaysia and Vietnam found that documented migrants had significantly higher knowledge scores (76%) than undocumented migrants (47%) because of more frequent access to official training. Moreover, across multiple studies, lower formal education consistently corresponded with weaker conceptual understanding of hygiene principles, even among trained workers, indicating that education moderates the depth and durability of food safety knowledge Nguyen (2022).

Compliance behaviors among trained vs. untrained food handlers

Training has been identified as a cornerstone in improving food safety compliance among handlers, particularly in urban settings. Woh *et al.* (2023) conducted a detailed study involving 300 food handlers in urban areas of Malaysia, revealing a stark contrast between trained and untrained workers. Trained food handlers adhered to hygiene practices, such as proper handwashing and utensil sanitation, in 85% of cases, compared to a significantly lower 55% compliance rate among their untrained counterparts.

In another research conducted by Lee *et al.* (2022) among food handlers in Putrajaya, implementation of a video-based training module led to a 20% increase in their compliance at 6 months, increasing from 65% to 85%. In addition, staff who were taught via scenario role-playing had better comprehension and retention of emergency food safety guidelines when compared with traditionally trained employees.

The importance of monthly audits conducted by the local health department also play a significant role in encouraging adherence. Earnhart and Harrington (2021) revealed that regular inspection carried an additional increased compliance rate of 15%, with a number of firms facing frequent auditing being 90% compliant, while only 75% did on those that were audited annually or less.

Differences between documented and undocumented migrants

Documented migrant workers have higher food safety performance than undocumented workers because they have more opportunities for professional education and were more likely to be supported by the employer. Woh *et al.* (2026) found in Selangor that 73% of documented workers complied with personal hygiene protocol as compared to only 38% by undocumented workers based on 400 migrants working as food handlers. This difference was explained by the low access of the undocumented workforce to formal courses and the fear associated with contacting the authorities as undocumented. In addition, a comparative study by Harkins and Lindgren (2023) in Malaysia and Thailand revealed that informal sector workers in Thailand had a similar underlying pattern with participation rates of 41% and 70% for undocumented and documented, respectively. This indicates that the problems encountered by migrant workers are similar in all countries of Southeast Asia. The problem is compounded by language barriers, precarious working conditions and the absence of legal protection making it difficult for undocumented workers to gain and then implement food hygiene knowledge effectively.

Employer involvement plays a pivotal role in bridging the gap for undocumented workers. Fintland *et al.* (2022) noted that in establishments where employers provided on-the-job training and supplied personal protective equipment (PPE), undocumented workers' compliance rates improved by 25%, rising from 38% to 63%. This improvement underscores the potential for workplace-based interventions to mitigate barriers posed by legal and institutional constraints. The findings on compliance behaviors among documented and undocumented workers can be summarized in Table 2.

Table 3 provides a comparative summary of knowledge and attitude scores among migrant food handlers across studies, highlighting variations by training status, documentation, and key influencing factors.

Comparative perspectives across Southeast Asia

Although Malaysia dominates the evidence base, comparative findings from Thailand, Indonesia, and Vietnam reveal parallel structural challenges, particularly in informal urban food sectors. Thailand demonstrates stronger institutional investment in multilingual training, while Indonesia and Vietnam report similar education-related knowledge gaps among food handlers Nguyen (2021). These patterns suggest that Malaysia's challenges are regionally shared rather than exceptional, supporting the relevance of a Southeast Asian analytical lens despite unequal research volume.

Cross-study analytical synthesis

When synthesized across studies, three recurring patterns emerge. First, training alone does not guarantee compliance unless reinforced by supportive workplace environments and supervision. Second, individual-level factors such as education and language proficiency interact with institutional constraints, shaping how knowledge is translated into practice. Third, urban food safety challenges are amplified in informal and small-scale establishments, where regulatory oversight is limited. These patterns suggest that food safety behaviour is not solely an individual responsibility but a structurally mediated outcome.

Discussion

While legal documentation status influences access to formal training and regulatory protection, it should be understood as one of several interacting structural determinants rather than the primary explanatory variable. Evidence across studies suggests that education level, language proficiency, and workplace organization frequently mediate the impact of legal status on food safety practices (Al Banna *et al.*, 2021). In several cases, documented workers with limited education exhibited comparable compliance challenges to undocumented workers, highlighting that legal status alone does not ensure effective practice (Moyce and Schenker, 2022).

Education level emerges as a critical but under-addressed determinant in urban food safety KAP. Food handlers with limited formal education often rely on procedural imitation rather than conceptual understanding, reducing their ability to adapt practices to unfamiliar situations. This finding aligns with broader KAP literature, which emphasizes education as a prerequisite for sustained behavioural change rather than short-term compliance.

To argue, the gap is related to the prevailing opportunities: the documented workers have limited access to formal training, and the undocumented ones are afraid of possible legal outcomes. Such differences are related to systemic barriers. For example, the access of undocumented employees to training resources is restricted by the reluctance of employers to invest in the education of non-documented staff and the fear of people to engage with systems that increase the risk of deportation.

The outcomes of the study also prove the effectiveness of a person-centered approach, such as multilingual training and demonstrations: the situational compliance level of the undocumented workers increased from 38% to 63%. In terms of behavior-based theories, such an outcome correlates with Zhang *et al.* (2022) that suggests the contributions of approachable and culture-adaptive training to the modification of workplace practices. Furthermore, the propositions of the study are consistent with global findings concerning the issue of migrant food safety. Research in Southeast Asia and other regions constantly emphasizes the significance of training in enhancing the levels of compliance. For example, Pham (2019) conducted a study in Malaysia and Vietnam and found out that only 47% of the undocumented workers have sufficient knowledge compared to 76% of documented workers. Additionally, the attitude disparity demonstrated by this study has deep roots and is consistent with the results of cultural and socio-economic research in the field.

The results are also consistent with the Health Belief Model, which posits that perceived barriers such as fear of legal consequences or financial insecurity hinder positive health behaviors (Rosenstock *et al.*, 1988). This theoretical framework offers an explanatory lens for understanding why undocumented

workers exhibit lower compliance despite exposure to similar workplace environments as their documented peers.

Practical implications

Training programs and multilingual education

The findings underscore the necessity of multilingual, behavior-based training programs tailored to the diverse literacy levels of migrant workers. Training initiatives incorporating visual aids and practical demonstrations should be scaled, as these approaches have proven effective in enhancing knowledge retention and compliance. Employers should prioritize regular refresher courses, as ongoing education reinforces learned behaviors and adapts to evolving food safety standards.

Legal frameworks and policy recommendations

The significant gap between documented and undocumented workers highlights the need for inclusive policies that facilitate training access regardless of legal status. Policymakers should consider creating safe avenues for undocumented workers to participate in food safety education without fear of reprisal. Additionally, implementing legal mandates that require employers to provide training for all staff, coupled with subsidized programs for smaller businesses, could address current inequities.

Workplace policies and managerial practices

Supportive management practices, including regular audits and positive reinforcement, were identified as critical enablers of compliance. Employers should adopt a proactive stance by integrating food safety compliance into daily operations through structured supervision and incentivized adherence programs. Moreover, the provision of PPE and sanitary facilities should be standardized across all food service establishments.

Recommendations for stakeholders

To address the challenges identified in enhancing food safety practices among migrant food handlers, several recommendations are proposed. Policymakers should prioritize the development of inclusive policies that guarantee universal access to food safety training for all migrant workers, regardless of their legal status. Public-private partnerships can be instrumental in funding and delivering multilingual training programs to bridge language and literacy gaps. Furthermore, strengthening regulatory frameworks to enforce employer compliance with food safety education and workplace safety standards is essential for systemic improvement.

Employers play a crucial role in fostering compliance. Investing in regular, on-site training sessions tailored to the cultural and linguistic needs of their workforce is a practical step toward improving knowledge and practices. Additionally, establishing incentive structures, such as recognition programs or monetary rewards, can motivate workers to adhere to food safety guidelines. Enhancing workplace conditions by addressing workload disparities and ensuring the provision of adequate resources, such as PPE and sanitation facilities, will further support compliance efforts.

For researchers, there is a pressing need to investigate the long-term effectiveness of multilingual training programs and their impact on sustained food safety compliance. Comparative studies across various industries can shed light on sector-specific barriers and enablers, providing nuanced insights. Moreover, exploring the psychosocial dimensions of food safety practices, particularly the influence of cultural attitudes and socioeconomic pressures, can inform more targeted interventions.

Conclusions

This review demonstrates that effective food safety practices among urban food handlers are strongly shaped by access to training, legal status, and workplace support. Migrant food handlers, particularly those in undocumented or informal employment, experience persistent structural and linguistic barriers

that limit their ability to comply with food safety standards. Evidence from urban Southeast Asia, and notably Kuala Lumpur, highlights the effectiveness of multilingual, visual, and employer-supported training interventions in improving compliance. The findings underscore the need for inclusive food safety policies that accommodate workforce diversity and urban complexity. Through centering urban migrant food handlers, this review contributes a context-sensitive perspective that can inform public health strategies, employer practices, and future research on sustainable urban food safety systems.

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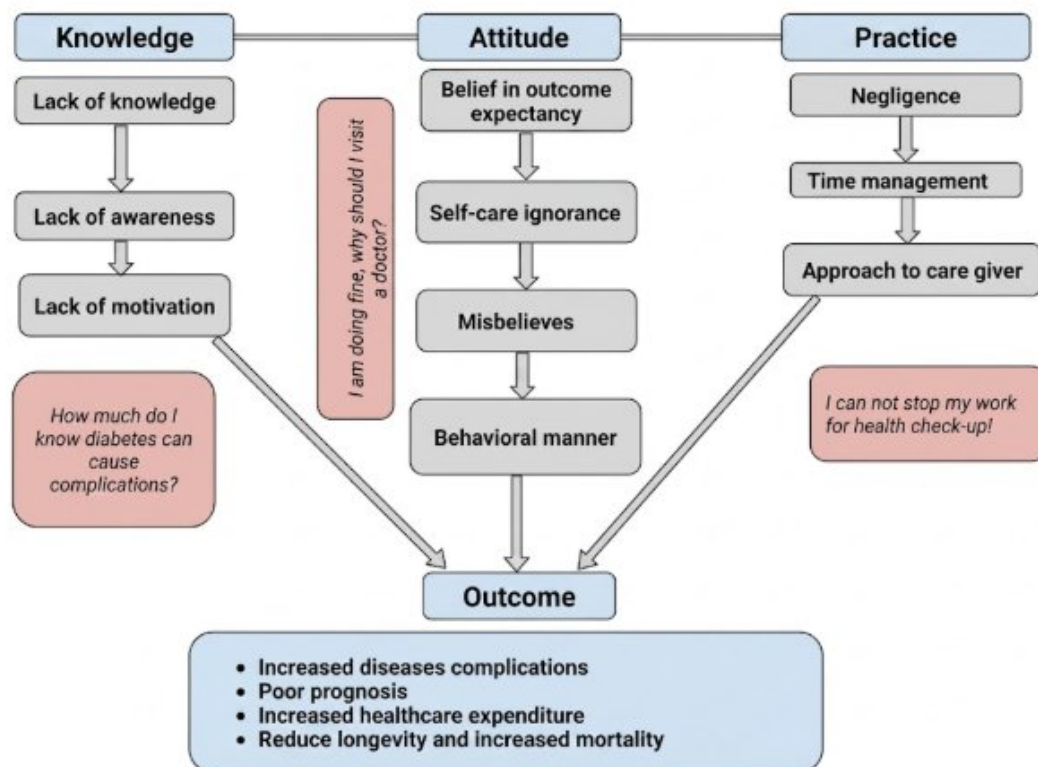


Figure 1. Framework linking knowledge, attitude, and practice to health outcomes.



Figure 2. Overcoming barriers for migrant food handlers.

Table 1. Overview of data sources and contributions.

Database/source	Number of articles/reports	Focus
Scopus	15	Food safety knowledge and practices in urban contexts
PubMed	10	Public health interventions targeting food handlers
Google Scholar	8	Grey literature and policy documents providing real-world implications
Web of Science	7	Studies focusing on Southeast Asia, particularly Malaysia

Table 2. Compliance rates and key enablers among documented and undocumented food handlers.

Category	Compliance rate	Key enabler
Documented workers	73%	Access to formal training, employer support
Undocumented workers (baseline)	38%	Limited training, fear of legal repercussions
Undocumented workers (intervention)	63%	Employer-provided on-the-job training and PPE

Table 3. Summary of knowledge and attitude scores among migrant food handlers.

Study	Country	Population sample	Knowledge levels (%)	Attitude levels (%)	Outcomes
Rahimain <i>et al.</i> (2023)	Malaysia (Selangor and KL)	250 migrant food handlers	58%	42%	Highlighted misconceptions about cross-contamination and improper storage
Nguyen <i>et al.</i> (2022)	Malaysia and Vietnam	300 migrants	76% (documented), 47% (undocumented)	63% (documented), 38% (undocumented)	Emphasized the role of documentation in accessing training
Lim <i>et al.</i> (2023)	Malaysia	300 food handlers	85% (trained), 55% (untrained)	70% (trained), 45% (untrained)	Showed significant improvements in compliance with training interventions
Noor <i>et al.</i> (2022)	Malaysia	200 undocumented workers	38%	35%	Revealed the impact of legal status on food safety practices