

Food handlers and foodborne diseases: grounds for safety and public and occupational health actions

Doenças transmitidas por manipuladores de alimentos em serviços de saúde: subsídios para elaboração de ações de segurança e saúde pública e ocupacional

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ABSTRACT | One of the causes of foodborne diseases is contamination during food preparation; food handlers carrying pathogens might be involved in the origin of this condition. This problem is more serious in health care facilities, since consumers of contaminated food are already ill. Therefore, operational procedures should be formulated to prevent incidents. We performed a review of scientific studies, legislation and regulations on this subject. The results indicate that the main causes of food contamination involving food handlers to be considered in strategies to reduce, or even eliminate foodborne diseases include: flaws in hand hygiene, intestinal parasites, lack of knowledge of good manufacturing practices (GMP) and of the etiologic agents of foodborne diseases, and lack of GMP monitoring. We conclude that standardized operational procedures should be developed, including clear and objective flow-charts (suggested here) to be managed by the safety and occupational medicine staff, in addition to providing training to food handlers on GMP and correct use of personal protective equipment and work clothes.

Keywords | foodborne diseases; food production; food handling; occupational health; parasitic diseases.

RESUMO | Doenças transmitidas por alimentos (DTA) têm como uma de suas causas a contaminação no processo de produção do alimento. Logo, trabalhadores portadores de doenças infectocontagiosas que manipulam alimentos podem representar a origem dessas patologias. No caso de manipulação de alimentos em serviços de saúde, essa ocorrência é ainda mais grave por causa das características do consumidor: o doente. Portanto, faz-se necessário elaborar procedimentos operacionais para prevenção desse evento. O objetivo deste trabalho foi estabelecer subsídios técnicos e legais para fundamentar a elaboração de procedimentos operacionais padrão e fluxogramas para as ações de vigilância da higiene e saúde dos manipuladores de alimentos dos serviços de alimentação de um hospital universitário de grande porte do município de São Paulo. Foi realizada revisão bibliográfica por meio de pesquisa de artigos científicos, pareceres, resoluções e normas regulamentadoras sobre o tema. As principais causas observadas na contaminação de alimentos que devem ser consideradas para subsidiar as propostas para reduzir, ou até eliminar, a possibilidade de DTA são, em relação aos manipuladores: falhas na higienização das mãos, presença de enteroparasitoses, desconhecimento das boas práticas de fabricação (BPF) e dos agentes causadores de DTA; falta de fiscalização das BPF. Concluiu-se que existe a necessidade de elaboração de procedimentos operacionais padrão com fluxogramas claros e objetivos (propostos no texto), gerenciados pela equipe de segurança e medicina do trabalho, além de capacitação e treinamento dos manipuladores acerca das BPF e da utilização correta de equipamentos de proteção individual e uniformes.

Palavras-chave | doenças transmitidas por alimentos; produção de alimentos; manipulação de alimentos; saúde do trabalhador; doenças parasitárias.

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INTRODUCTION

In the state of São Paulo, Brazil, the Health Surveillance Center, State Secretariat of Health, is responsible for the control of the quality of food¹. Within this context, one particular focus of concern for this agency — which mission is to preserve and promote the health of the population — is the prevention of foodborne diseases, i.e. those which result from the intake of contaminated foodstuffs and/or water. There are more than 250 types of foodborne diseases, most of them caused by bacteria or their toxins, viruses and parasites².

The World Health Organization rates foodborne diseases a serious global public health problem, which accounts for illness in 1 in 10 people and 33 million years of life lost. The Centers for Disease Control and Prevention reported that foodborne diseases affect 1 in 6 people in the United States (48 million people) resulting in 128,000 admissions to hospital and 3,000 deaths³.

According to the Brazilian Ministry of Health, several factors contribute to the occurrence of foodborne diseases, including: poor sanitation, poor quality drinking water, inadequate personal hygiene, and intake of contaminated foodstuffs³.

In Brazil, the Collegiate Board Resolution no. 216, from 15 September 2004⁴, defines as food handlers all the individuals who work in a food business and are in direct or indirect contact with food. For this reason, this population of workers should receive special attention from health surveillance agencies. Indeed, food handlers carrying pathogens may contaminate the products or foodstuffs they handle, and thus put the health of consumers at risk⁵.

In the case of health care facilities this problem should receive utmost attention, since eventually contaminated food may be served to individuals with an already impaired state of health. Therefore, besides the tests indicated in the Occupational Health Medical Control Program (OHMCP) in compliance with the Ministry of Labor Regulatory Standard 7⁶, additional tests should be performed to investigate cases of infectious or parasitic diseases among food handlers, be they symptomatic or not.

OBJECTIVE

To provide technical and legal grounds for standard operational procedures (SOP) and flowcharts to monitor the state of hygiene and health of food handlers at the food services department of a large university hospital in São Paulo, Brazil.

MATERIALS AND METHODS

We performed a review of the Brazilian and international literature to establish the state of the art in the subject of interest, and analyze and synthesize the available information.

The literature search was conducted in databases Scientific Electronic Library Online (SciELO), Latin American and Caribbean Center of Information on Life Sciences (Regional Library of Medicine–BIREME) and Virtual Health Library (VHL) among others. We also looked for rulings (Google database), resolutions and regulatory standards (legislation databases). The time frame was set to the period from 1995 to 2017, and the keywords used were food safety, food contamination and food handling, in Portuguese and English, found in Health Sciences Descriptors (DeCS).

We selected 18 studies published in Portuguese, English or Spanish, and four pieces of legislation.

The results are presented in Charts 1 and 2. The software Excel was used to plot graphics and flowcharts to systematize the data considered relevant.

RESULTS AND DISCUSSION

According to the Health Surveillance Center Regulatory Standard 5⁷, from 9 April, 2013, food handling comprises all the procedures used to transform raw materials into foodstuffs along the following steps: processing, fractioning, packaging, storage, transport, distribution, and retail display.

Food handlers are all the individuals who work in a food business and handle ingredients and raw materials, equipment and tools used in preparation and packaging, or are involved in the fractioning, distribution and transport of foodstuffs⁷.

The topics most frequently addressed in the selected studies were: pathogens among food handlers, training, and relevance of hand hygiene (Graphic 1). We also analyzed the frequency of the words used in abstracts (Graphic 2).

Some of the analyzed studies investigated intestinal parasites to call the attention to the transmission of foodborne diseases by food handlers. The parasites most frequently reported were *Entamoeba coli*, *Endolimax nana* and other commensals. Also pathogenic parasites were described, mainly *Entamoeba histolytica/Entamoeba dispar*, *Giardia lamblia*, Ancylostomidae and *Strongyloides stercoralis*, which represent a more serious situation as concerns contamination⁸⁻¹⁰.

Chart 1. Studies retrieved from databases SciELO, BIREME and HVL, 2018 (n=18).

Title	Authors	Journal (vol., no., p., year)
[Intestinal parasites among food handlers in Ribeirão Preto, São Paulo, Brazil, 2000]	Capuano et al. ⁸	<i>Revista Brasileira de Epidemiologia</i> , vol. 11, no. 4, p. 687-695, Dec 2008
About 33.1% of food handlers in Ribeirão Preto, São Paulo, Brazil, were infected with intestinal parasites, 20% with more than one species. The highest prevalence rates corresponded to workers who handled foodstuffs directly (68%). The authors concluded that sanitary education and training are needed, as well as implementing the APPCC method in all the stages of food preparation to ensure the safety of foodstuffs made available to consumers.		
[Prevalence of intestinal parasites among food handlers, Florianópolis, Santa Catarina, Brazil]	Nolla and Cantos ⁹	<i>Revista da Sociedade Brasileira de Medicina Tropical</i> , vol. 38, no. 6, p. 524-525, 2005
The results for 238 stool samples from 2 populations of food handlers in Florianópolis, Santa Catarina, Brazil (employees of a food business and workers in market fairs) evidenced high incidence of intestinal parasites.		
[Intestinal parasites and onychomycosis among food handlers in Ribeirão Preto, São Paulo, Brazil]	Silva et al. ¹⁰	<i>Revista Brasileira de Epidemiologia</i> , vol. 8, no. 4, p. 385-392, 2005
69 stool and 23 nail samples from 23 food handlers in Ribeirão Preto were analyzed from July through November 2000. Four samples (17.4%) tested positive for intestinal parasites, mycosis was identified in 8 samples (34.8%) and 1 worker (4.3%) exhibited both conditions. The authors concluded that several simultaneous actions are needed to prevent foodborne diseases, including identification of contaminated food handlers.		
[Presence and characterization of <i>Staphylococcus aureus</i> among food handlers]	Jordá et al. ¹¹	<i>Revista Argentina de Microbiología</i> , vol. 44, no. 2, p. 101-104, Jun 2012
37.5% of nasal samples from 88 food handlers tested positive for <i>Staphylococcus aureus</i> likely to cause foodborne disease.		
[Socioeconomic and occupational profile of food handlers and positive impact of a good manufacturing practice training course]	Devides et al. ¹²	<i>Brazilian Journal of Food Technology</i> , Campinas, vol. 17, no. 2, p. 166-176, Apr/Jun 2014
The authors analyzed the socioeconomic and occupational profile and level of knowledge of 192 food handlers and the impact of a good manufacturing practice (GMP) training course in Araraquara, São Paulo, Brazil, through 2 questionnaires administered before (baseline) and after (final evaluation) the training course. The results showed that the training course had positive impact on the participants' level of knowledge. The proportion of right answers increased for all the considered GMP topics in the final compared to the baseline evaluation.		
[Actions for food sanitary quality and safety management in a self-service restaurant]	González-Muñoz and Palomino-Camargo ¹³	<i>Revista Gerencia y Políticas de Salud</i> , vol. 11, no. 22, p. 123-140, Jun 2012
Compliance with good food manufacturing practices was assessed in a self-service restaurant in Havana, Cuba, using several instruments, including the Tourist Accommodation Sanitary Evaluation Guideline and Sanitary Profile. 55% of flaws were fixed through orientation to workers.		
[Knowledge of good manufacturing practices in food handling among workers in public markets in Teresina, Piauí, Brazil]	Morais et al. ¹⁴	<i>Higiene Alimentar</i> , vol. 30, no. 254/255, p. 42-45, 2016
In this study performed in 5 public markets in Teresina, Piauí, Brazil, in September and October 2014, the authors interviewed 60 food handlers to evaluate their knowledge of basic notions on food contamination. The largest proportion of answers were partially correct (68.34±4.40%), followed by wrong answers (25.48±9.68%). The authors concluded that the interviewed food handlers had basic notions about contamination and good manufacturing practices, but had not receive training and inspection was unsatisfactory.		

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Chart 1. Continuation.

Title	Authors	Journal (vol., no., p., year)
Microbiological evaluation of sugarcane juice sold at street stands and juice handling conditions in São Carlos, São Paulo, Brazil	Oliveira et al. ¹⁵	<i>Cadernos de Saúde Pública</i> , vol. 22, no. 5, p. 1111-1114, May 2006
24 samples of sugarcane juice for consumption were tested by means of conventional methods for heterotrophic bacteria, total and thermotolerant coliforms, <i>Salmonella</i> spp. and parasites. 25% of the samples were rated unsatisfactory, since the levels of thermotolerant coliforms were above the maximum permissible in the Brazilian legislation. Thermotolerant coliforms were detected on the hands of 37% of food handlers, and the heterotrophic bacteria count was 2.0x10 ³ CFU/hand. As per the responses given on questionnaires, 62% of participants admitted to ignore/not to implement any food hygiene/sanitation practice.		
[Hygiene and sanitary conditions of kitchens in public and philanthropic daycare centers]	Oliveira et al. ¹⁶	<i>Ciência e Saúde Coletiva</i> , vol. 13, no. 3, p. 1051-1060, Jun 2008
The authors assessed the hygiene and sanitary conditions of kitchens in public and philanthropic daycare centers in São Paulo, Brazil, through a food contamination risk score. The results showed that the risk of food contamination was high, being food handlers behaviors one of the main risk factors. The authors concluded that investing in training and continuous monitoring of food handlers is the best and easiest means to ensure the hygiene, sanitation and quality of food.		
[Relevance of food handlers in the transmission of foodborne diseases]	Souza and Diniz ¹⁷	<i>Higiene Alimentar</i> , vol. 27, no. 224/225, p. 18-21, Sept/Oct 2013
The authors observe that food handlers play a crucial role in food production, and may be determinant for the occurrence of foodborne diseases as a function of the epidemiological hygiene and sanitary conditions. Special attention should be paid to the formulation and implementation of good manufacturing practice training to prevent foodborne diseases.		
[Good practices among food handlers in ice cream kiosks]	Souza et al. ¹⁸	<i>Higiene Alimentar</i> , vol. 31, no. 268/269, p. 56-61, 2017
18 ice cream kiosks—divided into the following categories: hard- and soft-serve and popsicles—were analyzed in a cross-sectional study. The authors used a 17-item checklist with the following 6 sections: personnel clothing, personal hygiene, hygiene habits, state of health, location, and waste disposal, as per the criteria described in the Collegiate Board Resolutions no. 216/2004 and no. 275/2002 (classification). Hard-serve ice cream was rated class 2 (58.4%), and soft-serve ice cream (46.3%) and popsicles (47%) class 3. Food handlers did not comply with the recommended good practices, thus they increased the risk of contamination. The authors emphasize the relevance of training and monitoring.		
[Food handlers' knowledge, attitudes and practices relative to food safety: systematic review]	Soares et al. ¹⁹	<i>Higiene Alimentar</i> , vol. 30, no. 256/257, p. 71-76, 2016.
A review of observational, descriptive or analytical studies published from 1986 through 2014 concluded that food handler training programs might contribute to ensure the safety of food, with long-term benefits for the food and nutrition industry. Systematic assessment of food handlers' competence enables strategies to develop training models to achieve the desired behavioral changes.		
[Presence of microorganisms indicative of food hygiene and sanitation in public schools in Porto Alegre, Brazil]	Oliveira et al. ²⁰	<i>Ciência e Saúde Coletiva</i> , vol. 18, no. 4, p. 955-962, Apr 2013
Microorganisms indicative of food hygiene and sanitation— <i>Escherichia coli</i> , coagulase-positive <i>Staphylococcus</i> , <i>Salmonella</i> sp. and <i>Shigella</i> sp.—were investigated in food samples collected in schools in Porto Alegre, Brazil. The food in most schools exhibited adequate hygiene and sanitary conditions, but 60% of the schools had never been visited by nutritionists, and some procedures did not comply with the legislation in force.		
[Food handlers' perception of hygiene and microbiological profile of a university restaurant]	Medeiros et al. ²²	<i>Ciência e Saúde Coletiva</i> , vol. 22, no. 2, p. 383-392, 2017
The authors investigated food handlers' perception of hygiene practices in the workplace and its correlation with the results of bacteriological analysis of hand samples. 61.36% of hand and 25% of tool samples tested positive for the investigated pathogens (coliforms at 45°C, sulfite-reducing <i>Clostridia</i> , coagulase-positive <i>Staphylococcus</i> and aerobic mesophilic heterotrophic bacteria). These findings were significantly associated with low self-perceived personal, environmental and food handling hygiene.		

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Chart 1. Continuation.

Title	Authors	Journal (vol., no., p., year)
[Hand hygiene among food handlers in Ji-Paraná, Rondônia, Brazil]	Ponath et al. ²³	<i>Revista Pan-Amazônica de Saúde</i> , Ananindeua, vol. 7, no. 1, p. 63-69, Mar 2016
To investigate microorganisms indicative of poor hand hygiene among food handlers, the authors collected 3 samples in each of 5 businesses on alternate days. None of the 15 samples met the Pan American Health Organization standards (maximum permissible count: 10 ² CFU/hand). The authors concluded that lack of information on correct hand washing might favor pathogen transmission to food, with serious consequences for the health of consumers.		
[Knowledge, practices and intestinal parasites among food handlers in hospitals in Fortaleza, Ceará, Brazil]	Santos and Oliveira ²⁴	<i>Nutrivisa Revista de Nutrição e Vigilância em Saúde</i> , vol. 1, no. 2, p. 30-36, 2014
The aim of this study was to analyze the knowledge and attitudes of food handlers in the food and nutrition department of 2 private hospitals in Fortaleza, Ceará, Brazil. 20 food handlers were subjected to interviews and subungual examination in August 2012. The results showed that some aspects relative to personal and food hygiene still needed to be reinforced, even among the participants with adequate technical training to perform their work correctly, hand washing in particular, since 35% of the subungual samples tested positive for intestinal parasites (ameba, <i>Ascaris lumbricoides</i>) and Enterobacteriaceae (<i>Escherichia coli</i>).		
[Fungal species isolated from workers' hands and nails]	Ferreira and Martins ²⁵	<i>Revista Brasileira de Medicina do Trabalho</i> , vol. 14, no. 1, p. 60-70, 2016
The prevalence of fungi varied among the various occupational groups: food handlers, 26.3% to 63.4%; health care workers, 6.7% to 93%, with predominance of <i>Candida</i> spp. The prevalence rates were lower for other groups, with predominance of dermatophytes.		

Chart 2. Legislation retrieved from Google database, 2018 (n=4).

Name	Agency	Publication
Collegiate Board Resolution (CBR) no. 216, 15 September 2004 ⁴	Brazilian Health Regulatory Agency (ANVISA), Ministry of Health	<i>Diário Oficial da União</i> (DOU), Executive Branch, 16 September 2004
Technical regulations for good manufacturing practices in food services		
Administrative Ruling no. 5, 9 April 2013 ⁷	Disease Control Coordination Division of Health-related Products, State Secretariat of Health, São Paulo	<i>Diário Oficial do Estado</i> , São Paulo, Executive Branch, no. 73, section 1, p. 32-35, 19 April 2013
Administrative Ruling no. 2,619, 6 December 2011 ²⁶	Municipal Secretariat of Health, São Paulo	<i>Diário Oficial da Cidade de São Paulo</i> , p. 23, 6 December 2011
Good practices and sanitary and technical control regulations for activities related to food imports, exports, extraction, production, handling, improvement, conditioning, transport, storage, distribution, packaging, repackaging, fractioning, sale and use—including mineral waters, spring waters and beverages, additives and packing.		
CBR no. 275, 21 October 2002 ²⁷	ANVISA, Ministry of Health	DOU, no. 206, 23 October 2002, and no. 215, 6 November 2002
Technical regulations for standardized operational procedures and good manufacturing practice checklist for food manufacturing companies.		

In the study by Capuano et al.⁸, most individuals infected with parasites were asymptomatic at the time of medical visits, while only 14.7% reported complaints. Workers carrying commensals were not allowed any contact with food for the duration of treatment.

Yeasts were found during investigation of onychomycosis, sometimes associated with nail infection by

*Staphylococcus*¹⁰. In a study¹¹, 33 of 88 of nasal mucosa samples tested positive for *Staphylococcus aureus*, being 13 potentially enterotoxigenic. These findings point to the role of food handlers in the transmission of foodborne diseases, since the odds of transmitting *Staphylococcus* are high for workers with respiratory symptoms.

Pathogens were found on the hands of workers even when they had received adequate technical training. This finding points to the need to insist on stressing the relevance of personal and food hygiene²⁴.

Chart 3 describes the main reasons for food contamination pointed out in the analyzed studies and possible solutions.

The unfavorable findings reported in the analyzed studies occur against the good practice legislation for the food industry and services in the state of São Paulo. According to such legislation, food handlers cannot be carriers of any evident or non-evident infectious or parasitic disease, and their state of health should be duly documented in medical and laboratory reports as per the regulations in force^{6,7}.

Workers with lesions or diseases involving the skin, mucous membranes or nails, wounds or cuts on the hands or arms, or acute or chronic eye, lung, pharyngeal or gastrointestinal infection cannot be allowed to handle foodstuffs. Workers with any of these conditions should be referred for medical examination and treatment and not permitted to handle foodstuffs as long as these conditions persist⁷.

The State Secretariat of Health Administrative Ruling no. 2,619²⁶, from 2011, items 15.34.1 and 15.34.2, establishes that in addition to the tests described in the OHMCP, food handlers and all those involved in the distribution and

serving of meals should be subjected to stool culture and the ova and parasite (O&P) exam at the time of hiring and on 6-month medical examinations; those who exclusively handle packaged foods should be tested once a year.

ANVISA established additional regulations for food handlers, further reinforced in later administrative rulings. Such regulations stress the need for adequate personal hygiene, wearing clothes appropriate for the job, in good state, clean and changed at least once daily. They further call the attention to the relevance of hand hygiene since the time of arriving in the workplace, after handling foodstuffs, and after any interruption of tasks. These rulings also state that employers/technical managers must mandatorily place posters in visible places providing orientation on appropriate hand washing and antiseptics, and other hygiene habits⁴.

Additional hygiene rules for food handlers include: not smoking, not singing, not whistling, not sneezing, not coughing, not eating, not spitting, not handling money, and avoid talking unnecessarily while handling food. In regard to personal hygiene: wearing hairnets or caps, keeping the nails short and without enamel, avoiding wearing jewelry and makeup, and beards in the case of men⁴.

Many of these requirements should be included in local SOPs for food handlers' hygiene and health, including the need for training programs and records of the employees who effectively attend sessions to be presented when requested by inspectors²⁷.

None of these documents attribute food contamination and possible transmission of foodborne diseases to food handlers alone, but address in general terms structural aspects and work processes in food services facilities.

Chart 3. Causes of contamination and suggested solutions in studies retrieved from databases ScieELO, BIREME and VHL, 2018 (n=18).

Causes of food contamination	Suggested solutions
Poor hand hygiene	Washing hands with tap water and neutral liquid soap, followed by iodophor-based antiseptics ²¹ as per the legislation in force ^{7,23,24}
Intestinal parasites	Pathogen investigation ^{9,10} —stool culture and ova and parasite exam ²⁵
Ignorance of good manufacturing practices (GMP)	Training ^{8,12-19,24} centered on personal, environmental and food handling hygiene ²²
Ignorance of pathogens involved in foodborne diseases and contamination routes	Raising the workers' awareness in regard to respiratory ¹¹ and gastrointestinal symptoms, skin lesions, other signs and symptoms ⁷
Non-monitoring of GMP	Systematic monitoring ^{8,14,20}

CONCLUSION

The results of the present study evidence the relevance of formulating SOPs for food handlers' hygiene and health, including personal hygiene and hand washing. Instructions should be given on appropriate hand washing, step by step, and describing the necessary products.

Employers should ensure adequate conditions for appropriate hand washing (number and distribution of washbasins, soap, paper towels, etc.) and place posters illustrating the procedure and its relevance.

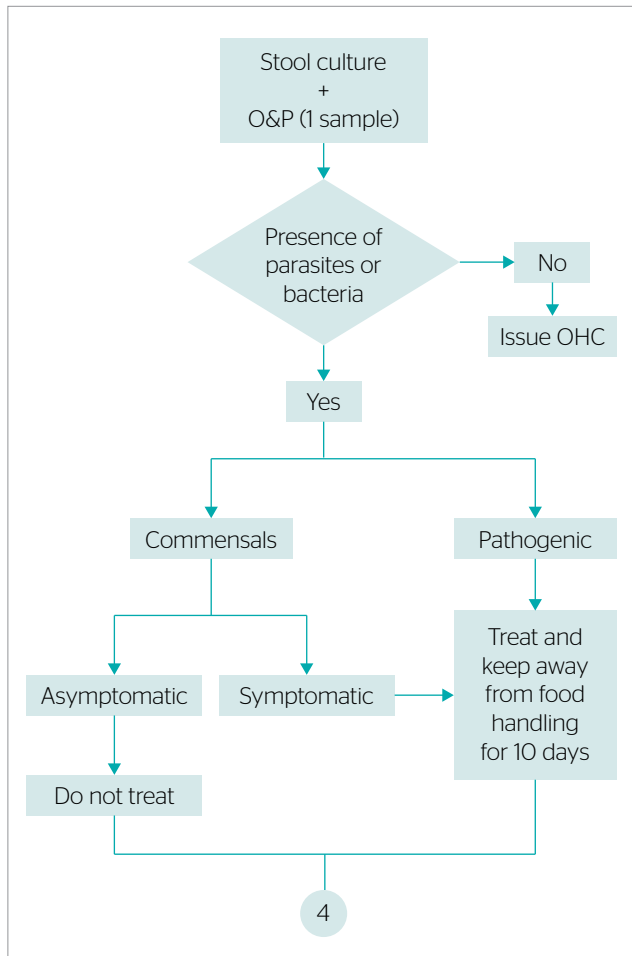
SOPs should clearly describe the procedures to be implemented whenever food handlers exhibit respiratory

or gastrointestinal symptoms, lesions on the skin, or any other health condition that might threaten the safety of food. The medical staff should formulate standardized measures, for instance, whether asymptomatic workers infected with commensals should or not receive treatment.

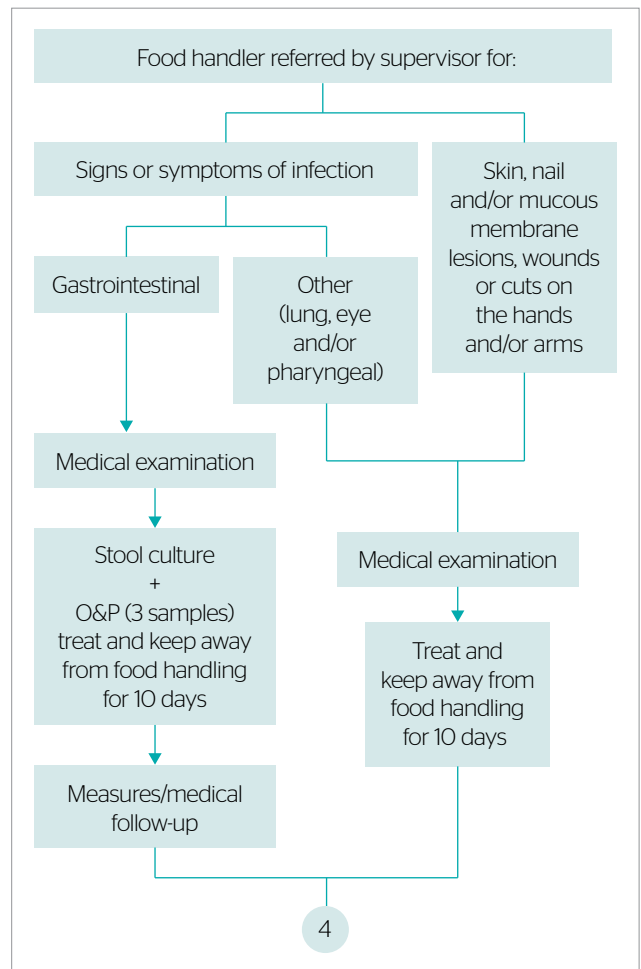
Training has paramount importance (including duration, content and frequency) and attendance should be mandatorily recorded as per the legislation in force. Also appropriate PPE and daily changes of clothes are highly significant aspects.

OHMCP should indicate what tests will be required from food handlers and their periodicity, since the legislation affords some flexibility to the physicians in charge and as function of the geographical location of organizations.

To conclude, we developed two flowcharts with measures to monitor the state of health of food handlers (Flowcharts 1 and 2, Chart 4).



Flowchart 1. 6-month periodic examination.



Flowchart 2. Active search at general medical services or emergency departments linked to occupational health departments.

Chart 4. Prophylactic measures.

Measures to prevent food contamination	
Centered on food handlers	Hand washing
	Notions of personal and environmental hygiene
	Training and continued education on good manufacturing practices
Centered on medical control	Testing (stool culture + P&O) on periodical examinations and for symptomatic workers
	Instruct workers to seek medical care in case of symptoms or lesions which might threaten the safety of food
Centered on quality control	Systematic monitoring

P&O= parasite and ova test.

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