National Disease Surveillance Centre

Preventing Foodborne Disease:
A Focus on the Infected Food Handler

Report of the Food Handlers with Potentially Foodborne Diseases Subcommittee of the NDSC's Scientific Advisory Committee

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Foreword

To achieve the public health goal of reducing foodborne illness to the fullest extent possible, steps must be taken at each point in the food chain where hazards can occur. The food handler role on this food safety journey is a pivotal one.

Ireland has approximately 41,000 food premises, covering activities ranging from the processing, manufacturing and retailing of food through to serving to consumers. Food premises comprise such diverse entities as abattoirs, butcher shops, bakeries, supermarkets, delicatessens and the food service sector (including hotels, nursing homes, hospitals and schools). Food handlers constitute a very sizeable section of our workforce.

Assessing the risks posed by food handlers infected with potentially foodborne infectious diseases is not an easy task. While infected food handlers have been identified in a plethora of foodborne outbreaks, they have frequently been the victims themselves. Nevertheless, food handlers infected with certain pathogens – who in some instances may not even be symptomatic – can and do pose a risk to food safety. All food business operators have a responsibility to manage food safety risks, thereby protecting the consumer.

It is evident that aspects of risk reduction in relation to food handlers infected with potentially foodborne infectious diseases are not being addressed in a standardised way in this country or, indeed, internationally. There is lack of consistency, and not a little confusion, with regard to various risk reduction parameters such as food handler health screening, assessment of fitness to work and application of work exclusion criteria. Additionally, and very significantly, the crucially important areas of hand washing compliance and reporting of relevant conditions by food handlers demand ongoing, rigorous emphasis.

This document aims to inform and advise. The presented guidelines are considered to represent good practice in the light of current best scientific evidence. They are generally reflective of the advice currently cited in a number of very useful UK and US documents[1-5]. Our hope is that they will lead to greater clarity and consistency in application of risk reduction strategies throughout Ireland. It is important that all involved 'speak with one voice' about what is required to protect consumer and food handler health alike.

The Committee members devoted considerable time and energy to researching these guidelines. Several experts in the field were consulted along the way. It is emphasised that the guidelines will need to be reviewed and updated as new evidence and expert opinion continue to inform. The assistance of all involved is acknowledged with much gratitude.

Dr. Margaret B. O' Sullivan
Chairperson of the Food Handler Subcommittee
November 2003

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Terms of Reference of the Food Handler Subcommittee

1. To assess the risk posed by food handlers infected with potentially foodborne infectious diseases

2. To review current legislation regarding food handlers and work

3. To develop evidence based guidelines on:

a) Prevention of food handlers becoming infected with foodborne pathogens in their work environment

b) Prevention of food handlers infected in or outside the food business contaminating food and contributing to foodborne illness

c) Screening of food handlers routinely, with sporadic illness and in an outbreak situation

d) Exclusion from work and fitness to work

e) Treatment guidelines, if appropriate, for asymptomatic food handlers to eliminate carriage

Risk Assessment Summary

- While food handlers can be innocent victims in outbreaks of foodborne infection, there is ample epidemiological, microbiological and environmental evidence linking infected food handlers with causation in a significant number of outbreaks.

- The pathogens found to be most frequently linked to food handler transmission have been Norovirus, Salmonella and Hepatitis A virus (HAV).

- To constitute a risk, the infected food handler is generally symptomatic – most often with gastrointestinal symptoms. However, food handlers in the pre- or post-symptomatic phases of illness have also been implicated in causing foodborne outbreaks.

- The most frequently associated symptoms are vomiting and/or diarrhoea – underscoring the importance of symptom reporting and exclusion from food handling duties while symptomatic.

- By far the most common mode of pathogen transmission to food by the infected food handler is via faecally contaminated hands. Poor hand hygiene is *the* contributing factor.

- Other reported modes of transmission include infected skin lesions (usually on hands), naso-pharyngeal secretions (*Staph, Strep*), aerosolisation of vomitus (Norovirus) and fomites (Norovirus, HAV).

- There is **overwhelming evidence that food handlers whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment (HIGH-RISK FOOD HANDLERS) are those most commonly implicated** in foodborne outbreaks. The unhygienic handling of such foods constitutes a particularly grave risk.

- Infected food handlers can potentially infect food in any setting, but have been demonstrably implicated at points of the food chain near to the consumer.

Summary of Recommendations

RECOMMENDATIONS: HYGIENE

Training/Instruction/Supervision

- The key to the prevention of contamination of food by food handlers is food handler training and the ability to maintain high standards of hygiene. Food handlers should be adequately supervised.

- Food handlers should have ongoing *training and instruction* in the importance of personal hygiene and hand washing. Appropriate language translation, where necessary, is a fundamental element of training. There should be regular assessment of knowledge and practice.

Hygiene Facilities & Hand Hygiene

- Convenient, adequate and well-maintained hand washing facilities should be located in all areas of a food premises including kitchen, staff changing and toilet areas.

- The provision of convenient, adequate and properly maintained toilet facilities is essential. Sanitary facilities for staff should be separate from those provided for patrons.

- The hand washing guidelines as outlined are recommended:

HAND WASHING GUIDELINES

Hands should be washed as frequently as necessary and always.....

When?

- Before starting/recommencing work
- After using toilet
- Before handling cooked or ready-to-eat foods
- After handling or preparing raw food
- Before gloving and after glove removal
- After any non-food contact such as
  - after touching skin/ hair/ face
  - after coughing, sneezing, blowing nose
  - after cleaning duties
  - after shaking hands
  - after handling money
  - after handling refuse
  - after smoking

How?

- Wet hands under warm running water
- Use sufficient soap to form a good lather
- Systematically rub all parts of hands with soap and water
- Lather for 10-15 seconds minimum, vigorously and thoroughly rubbing all hand surfaces, including the fingertips and thumbs
- Rinse hands thoroughly with running water
- Dry hands thoroughly (using paper towel or hand dryer or cabinet roller towel)

- Ideally, taps should be non-hand operable. Non-hand operable taps should be considered when upgrading or refurbishing premises.

- The use of plain (unmedicated) soap for hand washing is effective and is recommended as adequate (while acknowledging that alternatives are specified in Vertical Directives).

- Both bar soap and liquid soap are acceptable. Use of liquid soap (with a preservative) may be more practicable. Ideally, dispensing of liquid soap should be by means of disposable cartridges (i.e. topping up of dispenser not required). Otherwise, dispensers should be readily accessible for cleaning and drying.

- The use of nailbrushes is not recommended except to remove heavy soiling which cannot be removed using soap and water alone.

- Paper towels (in a compatible dispenser) or hand dryers are recommended for hand drying. Properly maintained mechanical roller towels (cabinet roller towels or CRTs) are also acceptable.

Gloving

- It is considered that, in view of the lack of direct scientific evidence regarding the effectiveness of glove use in food handling, it is not currently possible to make a categorical recommendation regarding whether or not gloves should be used.

- The widespread use of gloving in relation to ready-to-eat foods is acknowledged. Where gloves are used, it is imperative that they are used in conjunction with an effective hand washing regime (hands washed before gloving and after glove removal), are of good quality, intact and are single use i.e. used for one task only such as working with ready-to-eat food or with raw food, used for no other purpose, and discarded when damaged or soiled, or when interruptions occur in the operation.

Infected Lesions/Cuts

- Food handlers should ensure that infected lesions and cuts on exposed areas of the skin (hands, arms, face, neck, scalp) are totally covered with a distinctively coloured waterproof dressing. Metal strip plasters should be used where appropriate.

Other

- Food handlers should wear suitable, clean and appropriate outer clothing. Hair should be kept neat and tidy. Hair restraints and beard restraints should be worn where appropriate. Jewellery wearing should be kept to a minimum.

- While no recommendation in relation to mask use is considered possible because of paucity of evidence, the legislative requirement regarding mask use in some sectors is acknowledged.

- Where vomiting occurs in a food handling area, exposed food should be disposed of. The area should be cleaned and subsequently disinfected with a freshly prepared hypochlorite-based cleaner that releases 1,000 ppm of available chlorine (according to manufacturer's instructions).

RECOMMENDATIONS: REPORTING

- Relevant conditions and infections transmissible by infected food handlers via food should be reported by food handlers to management.

CONDITIONS WHICH SHOULD BE REPORTED

- **Diarrhoea**
- **Vomiting**
- Jaundice
- Fever
- Sore throat with fever
- Infected skin lesions (e.g. boil, infected wound) or cuts on exposed body parts (hand, arm, face, neck or scalp)
- Pus-containing discharges from the eyes, ears, nose or mouth/gums

(Gastrointestinal illness while on holidays, especially overseas, should also be reported on return)

Infections of particular relevance which should be reported: Typhoid, Paratyphoid, Verocytotoxin-producing *E. coli* (VTEC), *Shigella dysenteriae* and Hepatitis A.

- The importance of reporting needs to be repeatedly emphasised at pre-employment (with handout), at refresher training and annually. The training of managers is especially crucial in this regard. Appropriate language translation for staff, where necessary, is an essential aspect.

- Illness/symptom reporting by high-risk food handlers needs concerted, ongoing focus.

- Illness/symptom reporting by food handlers should be facilitated by management without fear of penalty or financial loss.

RECOMMENDATIONS: FITNESS TO WORK

• The guidelines, as outlined, for medical assessment of employee fitness to handle food are recommended:

FITNESS TO HANDLE FOOD
- GUIDELINES FOR MEDICAL ASSESSMENT -
(in conjunction with APPENDIX D)

Personal Hygiene

- Promotion of good personal hygiene, most especially hand washing, in all circumstances

Gastrointestinal

- No symptoms of infectious gastrointestinal illness (no vomiting or diarrhoea for at least 48 hours after symptoms have abated and stools have returned to normal) – where causative organism has not been identified.
  - Routine stool screening not necessary for all sporadic cases -
- Where pathogen has been identified, c.f. APPENDIX D
- Microbiological stool clearance before return to work always applicable to high-risk* food handler in relation to confirmed or suspected infection with Typhoid, Paratyphoid, Verocytotoxin-producing *E. coli* (VTEC) and *Shigella dysenteriae*

Jaundice

- No symptoms/signs of Hepatitis A infection within previous 7 days

Skin

- No infected skin lesion or cut on an exposed body part (specifically hand, arm, face, neck or scalp) that cannot be totally covered during food handling
- Skin conditions predisposing to skin infection (e.g. eczema) on exposed parts require individual assessment

Discharges

- No purulent discharge from eye, ear, nose or mouth/gums

Throat

- No evidence of acute streptococcal sore throat in high-risk* food handler

*** High-risk food handler: work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment**

RECOMMENDATIONS: HEALTH SURVEILLANCE

Health Questionnaires

- The benefit of pre-employment health questionnaires is unproven. There is insufficient evidence to recommend them as standard practice. Their use is supported as an adjunct to appropriate training in good hygiene practice and safe food handling, and the reporting of relevant conditions by food handlers.

Medical Examinations

- There is no scientific indication for the *routine* medical examination of food handlers in the prevention of spread of food-borne pathogens, whether on recruitment or otherwise. The practice is not recommended, unless required by legislation.

- The legal requirement for medical certification of food handlers should be used as an opportunity to promote personal and food handling hygiene, and to emphasise the importance of illness reporting.

Microbiological Screening

- *Routine* stool screening of food handlers has no scientific support and is not recommended. Neither is there any indication for *routine* skin, nasal or throat swabbing.

- Stool screening may be indicated for food handlers with symptoms of gastrointestinal illness based on individual risk assessment, taking account of such factors as illness severity and hygiene practice.

- Stool screening for suspected illness due to, carriage of, or relevant contact with Typhoid/Paratyphoid/ Verocytotoxin-producing *E. coli* (VTEC) or *Shigella dysenteriae* is always indicated for high-risk food handlers.

- Screening in an outbreak situation may involve the requesting of stool specimens, nasal/throat/skin swabs or screening for the presence of skin lesions on exposed parts of the body or for symptoms/signs of jaundice (depending on the outbreak and the pathogen suspected/identified).

- Criteria for microbiological screening may be varied at the discretion of the Director of Public Health/Designated Medical Officer, in consultation with the Consultant Microbiologist and Principal Environmental Health Officer as appropriate, following an individual or outbreak risk assessment.

RECOMMENDATIONS: WORK EXCLUSION/RESTRICTION (GENERAL)

- No food handler with gastroenteritis should work while symptomatic.
- As a general rule, any food handler with symptoms of gastrointestinal infection (with diarrhoea and/or vomiting) should be advised to remain off work until 48 hours after clinical recovery and stools have returned to normal (where the causative pathogen has not been identified). Where the pathogen has been identified, specific exclusion criteria are summarised in APPENDIX D.
- For high-risk food handlers, pathogen-specific exclusion criteria with microbiological stool clearance always apply in relation to Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid and *Shigella dysenteriae.*
- Any food handler who is an asymptomatic stool carrier - other than a high-risk food handler carrier of Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid or *Shigella dysenteriae* – if practising good personal hygiene, does not generally need to be excluded.
- Any food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms.
- The decision to exclude any food handler should be based on individual risk assessment.
- The overriding prerequisite for fitness to return to food handling duties is strict adherence to personal hygiene.
- Infected skin lesions on exposed body parts (especially hands and forearms) should be adequately covered with a distinctively coloured waterproof dressing until healed. If not adequately covered, exclusion/restriction may need to be considered depending on the food handling activity.
- Those with purulent discharges (from the eye, ear, nose or mouth) should not work near open food; they may need to be excluded/restricted to non-food handling duties until recovered.

RECOMMENDATIONS: SPECIFIC PATHOGENS

(see also *APPENDIX D*)

Recommended control measures for foodborne pathogens which can be transmitted by infected food handlers via food are summarised in APPENDIX D.

ALL FOOD HANDLERS

Hepatitis A (HAV)

- A food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms
- A food handler contact of a Hepatitis A case need not be excluded provided good hygiene practice is observed
- Routine Hepatitis A vaccination of food handlers is not indicated
- When a food handler is a household contact of a confirmed case of HAV, the food handler should be considered for prophylaxis (HNIG or HAV vaccine)
- Food handler colleagues of a food handler case of Hepatitis A should be included as close contacts for prophylaxis purposes
- People who have recently been exposed to food prepared by a food handler case of Hepatitis A may benefit from prophylaxis. This should be considered by the investigating Director of Public Health/Designated Medical Officer, following risk assessment

Norovirus

- Food handlers infected with Norovirus should be excluded for at least 48 hours after resolution of illness. Evidence for longer exclusion periods remains the subject of debate, unless hygiene habits are questionable. Microbiological clearance is not indicated.

HIGH-RISK FOOD HANDLERS

Typhoid/Paratyphoid

- Case: exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals, starting 2 weeks after completion of antibiotic treatment
- Carrier: exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals
- Suspected case (history suggestive of enteric fever): consider need to obtain 6 consecutive negative stool samples at 2 week intervals
- Contact of case/outbreak: exclude until 3 consecutive negative stool samples obtained, taken at weekly intervals, starting 3 weeks after last contact with untreated case
- Household contact of carrier: consider excluding until 3 consecutive negative stool samples obtained, taken at weekly intervals, starting from date of carrier identification
- Fluoroquinolones are recommended for the elimination of carriage. Where sensitivity is a problem, cephalosporin antibiotics should be considered.

Verocytotoxin-producing *E. coli* (VTEC)

- High-risk food handlers infected with VTEC should be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued)
- High-risk food handlers who are household contacts of cases of VTEC infection should generally be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued), unless careful risk assessment suggests otherwise.

- In the absence of convincing evidence, antimicrobial treatment is currently not indicated for VTEC carriage in food handlers

Shigella

- Asymptomatic carriers of *S. sonnei* practising good personal hygiene do not require exclusion or microbiological clearance
- High-risk food handlers infected with *S. dysenteriae* should be excluded from food handling until 2 successive negative stools samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics have been discontinued)
- Antimicrobial treatment is not indicated for shigella carriage in food handlers, not least because of the problem of antibiotic resistance

Salmonella

- Asymptomatic salmonella (non-typhoidal) carriers practising good personal hygiene do not require exclusion or microbiological clearance
- On the basis of current evidence, treatment of salmonella carriage in food handlers is generally not indicated as it is of doubtful efficacy and may prolong excretion

Staphylococcus aureus

- Nasal carriers of *S. aureus* need not be excluded from food handling
- Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed
- Treatment of nasal carriage is generally not indicated; it may be considered where the food handler is implicated in an outbreak

Group A (ß-Haemolytic) Streptococci

- Exclude high-risk food handlers with streptococcal sore throat until symptom resolution
- Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed

Cholera

- High-risk food handlers infected with *V. cholerae* 01 or 0139 should be excluded for 48 hours after the first normal stool. When microbiological clearance is indicated (e.g. sanitary facilities/ personal hygiene suspect), two consecutive negative stools at intervals of at least 24 hours are required.
- Prolonged carriage is rare. If treatment of carriage is considered, sensitivities should guide the choice of antimicrobial used in view of the possibility of resistant strains.

Amoebic Dysentery

- High-risk food handlers should be excluded for 48 hours after the first normal stool. While microbiological clearance is not required for return to work, treatment of carriers of pathogenic strains is recommended.

RECOMMENDATIONS: PREVENTION OF INFECTION WITH FOODBORNE PATHOGENS AT WORK

General

- The recommendations previously made relating to the prevention of food contamination by infected food handlers - including training in safe food handling, good personal hygiene, the provision of adequate and well maintained workplace sanitation facilities, and illness reporting - are also applicable to the prevention of food handler infection with foodborne pathogens at work.

In addition, in the meat processing industry

- The education and training of food handlers in the meat processing industry should include information on:
  - the nature of relevant zoonotic diseases *and*
  - the minimisation of risk of infection to themselves by careful handling of potentially infected food-animals, carcasses and offal

- Additional protective clothing should include:
  - rubber aprons that can be frequently and easily washed down during the day (should be washed in a cabinet to contain splash), boots and gloves
  - the legal requirement for mask usage in the mince meat processing sector is acknowledged

- Hygiene facilities should include:
  - a sufficient number of boot washing facilities
  - sufficient number of facilities for cleaning tools/disinfecting equipment

- The legal requirement that taps should not be hand operable in this sector is acknowledged

- There should be appropriate ventilation systems with reduction of aerial contamination in areas where aerosols and/or dust are hazards

- Skin injuries should be treated promptly when they occur

- In relation to the primary processing of food animals there should be
  - an effective dehiding and evisceration process (in particular, the prevention of spillage of animal gut contents during evisceration)
  - an effective evisceration accident procedure
  - adequate waste disposal measures

Detailed measures relevant to the primary processing of food animals are contained in '*Guidelines for the Implementation of Food Safety Management Systems in Beef and Lamb Slaughter Plants through HACCP Principles*' (Guidelines FSAI 2002).

Chapter 1
Introduction

1.1 Foodborne Infectious Disease: Extent & Burden

Foodborne illness causes personal distress, preventable death and avoidable economic burden. For some consumers, foodborne illness results only in mild, temporary discomfort or lost time from work or other daily activity. For others, especially vulnerable groups such as children, older people and those with impaired immunity, foodborne illness may have more serious or long-term consequences and, most seriously, may be life threatening.

The true incidence of food-borne diseases is difficult to quantify. It is believed that in industrialised countries less than 10% of cases are reported, and that even fewer are investigated[5]. In a study of rates of infectious intestinal disease in England, it was established that 20% of the population suffer from infectious intestinal disease every year, while only 3.3% present to their family doctor with infectious intestinal disease[6]. Irish outbreak surveillance data in 1998/1999 indicated that over 1,900 people were ill as a result of foodborne outbreaks, with 4% requiring hospitalisation and two associated deaths[7].

1.2 The Food Handler Dimension

Food has been defined, by the Food Safety Authority of Ireland (FSAI) Act 1998:
"Food" includes –

(a) any substance used, available to be used or intended to be used for food or drink by human persons, and
(b) any substance which enters into or is used in the production, composition or preparation of these substances

The food industry has a responsibility to ensure that food provided to the consumer is safe, and that it does not become a vehicle in a disease outbreak or in the transmission of communicable disease. Risk factors identified by the US Centers for Disease Control and Prevention as contributors to foodborne outbreaks that have been investigated and confirmed are: unsafe sources, inadequate cooking, improper holding, contaminated equipment and poor personal hygiene[5]. The food handler dimension is crucially important.

Several definitions of food handler exist, both legislative and otherwise, in Ireland and internationally. The FSAI offers a clear and unambiguous definition: **'A food handler is any person involved in a food business who handles food in the course of their work, or as part of their duties, to any extent whether the food is open or pre-wrapped'** *(Guide to Food Safety Training: Level II.)*[8].

The origins of microbial contaminants in food include the food itself or its source, the environment, cross-contamination or an infected food handler. Contamination from microorganisms can be responsible for infectious disease outbreaks passed from food workers to consumers via food[9]. The focus of this document is on the food handler *infected with potentially foodborne infectious diseases.* An infected food handler can contaminate food resulting in foodborne disease as outlined (Table 1.1).

Table 1.1 Infected Food Handler & Food Contamination: Event Sequence

Pathogen shedding (e.g. stool, vomitus)

↓

Transfer via hands to food or direct contamination of food

↓

Contaminated food not treated in such a way as to destroy organism before reaching consumer

↓

Number of organisms constitutes an infective dose

or

Nature of food and its conditions of storage are such as to allow the organisms to multiply and produce an infective dose or to produce toxins in quantities sufficient to cause consumer illness

Source: WHO 1989[10]

In 2000, thirty-six outbreaks of infectious intestinal disease were reported to the FSAI; twenty-seven were reported in 2001. Contributory factors cited by the investigators included inadequately trained or supervised staff and infected food handlers (Table 1.2). An infected food handler was identified in 18% of general outbreaks of infectious intestinal disease in this country in 1998/9[7], although it was unclear whether or not the food handler was the source of the outbreak. In the UK, an infected food handler was identified in 12% of foodborne outbreaks in 1995/96[11]. It has been suggested that the cost of outbreaks due to infected food handlers can in some instances far exceed the costs associated with outbreaks due to person-to-person transmission of infectious agents[12].

Table 1.2 Factors Contributing to Outbreaks of Infectious Intestinal Disease: Ireland 2000/2001

Factors	2000/2001 (factors listed in 33/63 outbreaks reported)
Inadequate storage/refrigeration	12
Inadequately trained/supervised staff	12
Poor hygiene conditions in premises	11
Cross contamination	9
Inadequate hygiene facilities	9
Infected food handlers	6
Grossly contaminated raw ingredients	3
Inadequate cooking	1

Source: FSAI/NDSC 2002

1.3 Food Industry: Challenges

The scope of the food industry is vast, its constituent sectors diverse. It covers all activities from the processing, manufacturing and retailing of food right through to the service sector. There are approximately 41,000 food businesses in Ireland[13]. The FSAI oversees the inspection of these food premises/businesses through its service contracts with the Department of Agriculture, Food and Rural Development (DAFRD), the Health Boards, the Local Authority Veterinary Service and the Department of the Marine and Natural Resources (DMNR)[13]. The food premises under the remit of DAFRD range from large abattoirs, meat manufacturing and processing plants, through to milk plants and eggs/egg product premises. The vast majority of the premises inspected by Health Board Environmental Health Officers are retail and catering businesses, but also include many plants manufacturing foods of non-animal origin. The Local Authority Veterinary Service inspects small abattoirs and small meat manufacturing plants supplying the domestic market. DMNR officials inspect premises engaged in the processing, handling and storage of fish.

Food handlers work in these varied settings. Employers face a multitude of challenges in relation to the safe handling of food. These challenges should not be underestimated. There are skills shortages in many sectors. There is evidence of high staff turnover. Seasonal demands and high rates of casual labour are particular features in some

areas. Significant throughputs of foreign labour, with attendant language barriers and cultural differences, present their own difficulties. The increased production of ready-to-eat foods and more facilities for eating out are added factors demanding vigilance. Operators of care facilities for vulnerable groups – hospitals, nursing homes, residential and day care centres, crèches etc. - need to be particularly vigilant in minimising the risk of exposure to foodborne infection. The frail elderly, very young, those with chronic illness, the immunosuppressed and pregnant women are especially vulnerable.

The ultimate responsibility for the production of safe food rests primarily with the food industry. The industry must have appropriate systems in place to ensure this. Since 1998, it has been a legal requirement for all food businesses to have a food safety management system based on the principles of the Hazard Analysis & Critical Control Point (HACCP) system. HACCP is a systematic approach to identifying and controlling food safety hazards – it involves identifying and controlling what could go wrong and planning for prevention. An effective HACCP system should ensure the production of safe food, thereby preventing food poisoning incidents. HACCP does not replace good hygiene practices; rather, it compliments them.

1.4 Food Handler Training

The food handler does not, of course, have to be infected to contribute to the spread of foodborne pathogens. Whether infected or not, good personal hygiene and safe food handling practices are essential prerequisites for the food handler.

Food safety training and the provision of hygienic, supportive work environments are integral to ensuring a food safety culture. It is a legal requirement that staff involved in a food environment are adequately trained and/or supervised commensurate with their work activity. The responsibility for training and supervision of staff lies with the proprietor of every food business. This is the case for all staff whether they are part-time, full-time or casual, or whether they are employed in the public or private sector. The FSAI has set training standards in accordance with current legislation and in line with best practice. These are laid out in a series of FSAI training guides to support industry in the food service, retail and manufacturing sectors: '*Guide to Food Safety Training Level I - Induction Skills*'[14] and '*Guide to Food Safety Training Level II – Additional Skills*'[8].

1.5 Need for Irish Guidelines

There are no evidence based Irish guidelines which comprehensively cover the prevention of microbial contamination of food by infected food handlers. In practice, the advice contained in two 1995 UK documents: '*Food Handlers Fitness to Work*'[2] - produced by an expert working group convened by the Department of Health, and '*The prevention of human transmission of gastrointestinal infections, infestations and bacterial infections*'[1] - produced by the Public Health Laboratory Surveillance Centre, has been widely drawn upon. Other reports such as the WHO guidelines on *'Health Surveillance and Management Procedures for Food Handling Personnel'*[10] have also been extensively referred to. However, inconsistencies in application are apparent.

It is timely to review the evidence base, where such evidence exists, with regard to relevant risk reduction parameters. These parameters include personal hygiene aspects (especially hand hygiene), reporting of relevant illnesses/conditions, health screening (including the use of health questionnaires, medical examinations and stool screening), assessment of fitness to work and criteria for work exclusion, in addition to treatment of pathogen carriage where appropriate. Up-to-date evidence-based guidelines should lead to a more informed, consistent approach to risk reduction. It is cautioned, however, that reviewing and updating will be necessary as science and expert opinion continue to inform.

1.6 Target Audience

This document adopts a risk-based approach in line with best evidence. It identifies those food handlers most likely to pose a risk with regard to the potential spread of foodborne pathogens.

Its main aims are to prevent the introduction of foodborne pathogens to food by infected food handlers by (1) identifying the risks posed (2) identifying appropriate preventive measures and (3) identifying, and addressing, those circumstances relating to specific pathogens that pose particular risks.

The guidelines are intended mainly for:

I. Health Professionals (including Public Health, Occupational Health, General Practitioners, Microbiologists and Infection Control Staff)

II. Authorised Officers (including Environmental Health Officers, Veterinary Inspectors, Dairy Produce Inspectors, Technical Agricultural Officers, Sea Fisheries Officers)

III. Food business proprietors, managers and supervisors

It is pointed out that those workers involved in primary agricultural or harvesting processes are not considered as food handlers for the purposes of this guidance. Neither are those non-food handlers who can affect food safety i.e. people involved in food businesses whose duties and responsibilities can impinge on food safety (e.g. maintenance staff, cleaning staff) as they are outside of this Committee's remit.

Chapter 2
The Legislative Framework

2.1 Introduction

Current food law is complex. As set out in statute, food law has four main purposes – to protect human health, to prevent fraud, to inform the consumer and to facilitate trade[15]. In addition to core legislation, a multiplicity of Irish regulations (enacting European Union (EU) Directives) apply. Many of these regulations are specific to different subsectors of the food industry. In recent years, almost all of our food rules are based on legislation agreed by Member States of the EU[15].

Individual businesses and food handlers have legal obligations related to the need to avoid contamination of food. The relevant legislation, as it pertains to food handlers and the prevention of spread of foodborne infectious disease by food handlers, is reviewed. Specifically, those areas relating to such aspects as training/instruction/supervision, adequate facilities and clean work environment, personal hygiene, illness reporting, work exclusion and medical certification of fitness to work are examined.

2.2 Legislative Overview

The principal legislation which controls the spread of foodborne infection within the manufacturing, processing, distribution, catering and retail sectors of the Irish food industry is included in EU Directives and Irish Statutes.

I. EU Directives

A Directive is a requirement by the Council of the EU that all Member States shall adopt national measures to meet its objectives. The European Communities Act 1972 confers, on Ministers, powers for the implementation of EU Directives by the making of national regulations. European Directives have been gradually developed since 1964 in response to the needs of the internal market. The Commission of the European Communities currently has a series of proposals outlined with the intention of harmonisation of food law by 2004.

- **Horizontal Directives** (current) have universal application to all foods/food businesses
  e.g. Council Directive 93/43/EEC on the Hygiene of Foodstuffs is enabled in Ireland by the *European Communities (Hygiene of Foodstuffs) Regulations, 2000.*

- **Vertical Directives** have specific application to particular food businesses. There are 17 such Directives (Table 2.1); they apply an additional specific layer on top of the Horizontal Directive

II. Irish Statutes

- The *Food Hygiene Regulations 1950-89*, introduced under the Health Act 1947/70, set out the statutory

requirements in relation to food hygiene. They apply essentially to those sectors of the food industry to which no vertical (product specific) or sector specific rules apply[15]. They exclude distinct areas of manufacturing and processing such as meat products, fish & shellfish products and milk products – food businesses to which the Vertical Directives have application.

- The *Abattoirs Act 1988* and regulations made thereunder, have application to all abattoirs permanently derogated from Council Directive 64/433/EC as amended.

Table 2.1. Vertical Directives

1.	Council Directive 64/433/EEC	(Fresh meat)
2.	Council Directive 77/99/EEC	(Meat products)
3.	Council Directive 94/65/EEC	(Minced meat & meat products)
4.	Council Directive 71/118/EEC	(Fresh poultry meat)
5.	Council Directive 92/45/EEC	(Wild game)
6.	Council Directive 91/495/EEC	(Farmed game)
7.	Council Directive 89/437/EEC	(Eggs & egg products)
8.	Council Directive 92/46/EEC	(Milk & milk products)
9.	Council Directive 89/362/EEC	(Milking hygiene)
10.	Council Directive 91/493/EEC	(Fishery products)
11.	Council Directive 91/492/EEC	(Live bivalve molluscs)
12.	Council Directive 92/48/EEC	(Hygiene on fishing vessels)
13.	Council Directive 92/118/EC	(Gelatine, frogs legs, & snails)
14.	Council Directive 77/96/EEC	(Trichina examination)
15.	Council Directive 90/667/EEC	(Animal by-products)
16.	Council Directive 93/119/EEC	(Animal welfare)
17.	Council Directive 96/93/EC	(Certification of animal & animal products)

2.3 Legislative Framework

In order to approach a review of current legislation regarding food handlers and work in a practical and meaningful way, key areas in relation to the prevention of spread of foodborne pathogens are highlighted and the pertinent legislation reviewed in this context.

The key areas highlighted include the definition of a food handler and the promotion of standards in the workplace. The legal responsibilities of food handlers are significant: they relate to personal hygiene, the reporting of certain illnesses/conditions relevant to food safety and not working if a possible source of infection relevant to food safety. The legal responsibilities of proprietors are crucial as they relate in particular to the provision of a hygienic work environment with appropriate staff facilities; the provision of staff training, instruction and supervision and the exclusion of staff from food handling duties where necessary. There is also a legislative requirement to ensure the medical certification of staff in some sectors.

The current legislative framework is broadly outlined (Table 2.2).

2.4 Food Handler Defined

There is no definition in EU Legislation of a food handler/food worker. *The Codex Alimentarius*[16], (Latin, meaning Food Law or Code), a collection of internationally adopted food standards, defines a food handler as: 'Any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements'.

In Irish legislation, a food worker is defined as follows:

'food worker' means a proprietor, employee, or any other person who works in or in connection with a food business

Table 2.2 Legislative Framework

		Relevant Legislation
1. Food handler definition		• Food Hygiene Regs 1950 (SI 205 of 1950)
2. Promotion of Standards		• European Communities (Hygiene of Foodstuffs) Regulations, 2000 • Food Safety Authority of Ireland Act 1998
3. Responsibilities of Food Handlers	a) Personal Hygiene	• European Communities (Hygiene of Foodstuffs) Regulations, 2000 (SI 165 of 2000) Second Schedule Part 8 • Food Hygiene Regs 1950 (Article 31) • Vertical Directives (Table 2.1)
	b) Reporting illness to Supervisor	• Food Hygiene Regs 1950 (Article 33(3)) • Infectious Disease Regulations 1981(and Amendments) • Abattoirs Act 1988 (Abattoir) Regs 1989-1998
	c) If a probable source of infection	• Food Hygiene Regs 1950 (Article 33(1))
4. Responsibilities of Proprietors	a) Provision of staff facilities /clean work environment	• European Communities (Hygiene of Foodstuffs) Regulations, 2000 (SI 165 of 2000) Second Schedule Parts I, II & III • Vertical Directives* (Table 2.1)
	b) Staff training/instruction/ supervision	• European Communities (Hygiene of Foodstuffs) Regulations, 2000 (SI 165 of 2000) Second Schedule Part 10 • Vertical Directives* (Table 2.1)
	c) Work Exclusion	• European Communities (Hygiene of Foodstuffs) Regulations, 2000 (SI 165 of 2000) Second Schedule Part 8 • Food Hygiene Regs 1950 (Article 33(2)) • Vertical Directives (Table 2.1)
	d) Medical Certification	• Irish Regulations Implementing EU Directives requiring Medical Certification (Table 2.4)

* part coverage

(*c.f.* Section 2.7 re Occupational Health Legislation)

but does not include a person who works only in a part of a food premises, food stall or food vehicle where –

a) food is not manufactured, prepared, stored, distributed or exposed for sale, or

b) food is imported, stored, distributed, exposed for sale or sold only in impermeable containers

(Food Hygiene Regulations 1950 (Irl))

While it is useful to have a definition of food handler, the application and interpretation of this definition raises some issues. Since the *Food Hygiene Regulations 1950* do not have universal application, the definition above does not apply to substantial sections of the food industry i.e. those sections to which Vertical Directives apply. In addition, the legislative definition does not assist in categorising food handlers with regard to potential risks of spread of foodborne disease. As will be detailed in Chapter 3, certain food handling duties pose considerably more risk than others.

2.5 Responsibilities of Food Handlers

The existing legal responsibilities of food handlers in connection with the prevention of transmission of foodborne pathogens encompass personal hygiene, illness reporting and not working if a possible source of infection relevant to food safety.

2.5.1 Personal Hygiene

Food handler obligations relating to personal hygiene are included in the *European Communities (Hygiene of Foodstuffs) Regulations, 2000* and the *Food Hygiene Regulations 1950*. They cover personal hygiene (in particular hand washing), clean clothing, hygienic maintenance of equipment and general hygiene measures. In addition, each of the Vertical Directives has an additional prescriptive layer which applies to its specific area of work.

'Every person working in a food handling area shall maintain a high degree of personal cleanliness and shall wear suitable, clean and, where appropriate, protective clothing'

(European Communities (Hygiene of Foodstuffs) Regulations, 2000
(SI 165 of 2000) Second Schedule Part 8)

'A food worker, while engaged on any work in connection with a food business

(1) shall keep himself clean and shall, in particular
  (a) wash his hands immediately after using a sanitary convenience, and
  (b) wash his hands and (if they are uncovered while engaged on his work) his forearms at other times as often as may be necessary to keep them clean;
(2) shall wear clean outer clothing;
(3) shall maintain all machinery, apparatus, utensils, tables or other equipment used in contact with food or food material for which he is responsible in a clean and hygienic condition;
(4) shall not unnecessarily handle food or food material;
(5) shall not spit or engage in any other unhygienic practice in such proximity to food as to be liable to cause contamination or infection thereof;
(6) shall not cause any contravention of these Regulations;
(7) shall, in addition to the foregoing matters, take every other reasonable precaution to prevent the contamination of food and to prevent danger to the public health arising from his work in the food business and his presence in the place where the food business is carried on'

(**Food Hygiene Regulations 1950 (Irl)** Article 31)

The *European Communities (Hygiene of Foodstuffs) Regulations 2000* - which have general application - are far less prescriptive than the *Food Hygiene Regulations 1950* in relation to the personal hygiene of the food handler. Neither set of regulations addresses risk categorisation.

2.5.2 Reporting Illness

The reporting, to their employers, of illnesses/conditions that might be relevant to the spread of foodborne disease by food handlers is addressed in the *Food Hygiene Regulations 1950* and the *Abattoirs Act 1988*. *The Food Hygiene Regulations 1950* do not apply throughout the food industry. The *Abattoirs Act* is applicable to national trade only;

other food animal sectors (i.e. export plants) are not covered with regard to such reporting. Legislation does not therefore comprehensively cover the entire food industry in this regard.

'When a person proposes to take up employment in connection with a food business, the proprietor shall require him to state (in writing if so required) whether he is suffering from or is a probable source of infection with a scheduled infectious disease or whether he has ever suffered from typhoid or paratyphoid, and such person shall to the best of his knowledge comply with such request'.

(**Food Hygiene Regulations, 1950** Article 33)

'As soon as any person engaged in or about any abattoir becomes aware that he is suffering from, or is the carrier of, any disease or condition to which paragraph (1) relates, he shall forthwith cease work in or about such abattoir and give notice of the fact to the person in charge of the abattoir whereupon that person or the occupier shall immediately notify the veterinary inspector allocated to the abattoir'.

(**Abattoirs Act, 1988** (Abattoirs) Regs, SI 152 of 1989)

Scheduled (notifiable) infectious diseases are contained in the Infectious Disease Regulations 1981 (and subsequent amendments in 1985, 1988, 1996 and 2003). These Regulations permit health authorities to take measures to prevent the spread of infectious diseases, including diseases which can be foodborne. Currently notifiable foodborne illnesses relevant to potential pathogen transmission via food/water by an infected food handler are listed (Table 2.3).

Table 2.3 Infectious Diseases Currently Notifiable in Ireland
[relevant to potential foodborne transmission by an infected food handler]

Acute Infectious Gastroenteritis	Paratyphoid
Campylobacter infection	Salmonellosis
Cholera	Shigellosis
Cryptosporidiosis	Staphylococcal food poisoning
Enterohaemorrhagic Escherichia coli	*Streptococcus* group A infection (invasive)
Giardiasis	Typhoid
Hepatitis A (acute)	Yersiniosis
Noroviral infection	

2.5.3 If a probable source of infection

The onus on a food handler not to perform work in connection with a food business if a possible source of infection relevant to food safety is covered in the *Food Hygiene Regulations 1950.*

'A person who for the time being is a probable source of infection with a scheduled infectious disease or is suffering from any boil, septic sore or other skin ailment on the hand or forearm which could contaminate or infect food shall not perform any work in connection with a food business save by and in accordance with the permission of the local chief medical officer'

(**Food Hygiene Regulations, 1950** Article 33)

It is noted that this aspect of food handler responsibility does not apply to food handlers throughout the industry since the *Food Hygiene Regulations 1950* do not apply to the meat, bacon, poultry, fishery sectors i.e. to those food businesses to which the Vertical Directives have application.

2.6 Responsibilities of Proprietors

The relevant legal responsibilities of proprietors encompass the provision of staff facilities and a clean work environment, the training/instruction/supervision of staff, work exclusion when indicated, and the ensuring of medical certification in some sectors.

2.6.1 Staff Facilities/Clean Work Environment

The mandatory requirements for the provision of staff facilities/clean work environment are outlined in the *European Communities (Hygiene of Foodstuffs) Regulations 2000, Second Schedule* (the Regulations state that the proprietor of a food business 'may derogate from the rules of hygiene as set down in the Second Schedule provided that he or she does so in accordance with Directive 96/3/EC or Directive 98/28/EC').

There are general requirements in Part I that food premises must be 'kept clean and maintained in good repair and condition'; that the layout, design, construction and size of food premises shall permit 'adequate cleaning and/or disinfection' and 'good food hygiene practices'; that an 'adequate number of washbasins' and 'flush lavatories' must be available; that 'materials for cleaning hands and for hygienic drying' must be provided; and that 'adequate changing facilities' be provided where necessary. Further specific requirements for rooms where foodstuffs are prepared, treated or processed (excluding dining areas) and for moveable, temporary and other premises are outlined in Parts II and III respectively. Hygiene requirements for transportation and equipment are also covered (Parts IV and V).

European Vertical Directives also contain specific inclusions e.g. Council Directive 64/433/EEC as enabled by S.I. 434 of 1997 requires that 'establishments shall have adequate structures and facilities' and 'absolute cleanliness shall be required of premises and equipment'.

2.6.2 Training/Instruction/Supervision

The training and supervision of food handling staff, both at commencement of employment and thereafter, is integral to food safety. These aspects are considered in the *European Communities (Hygiene of Foodstuffs) Regulations 2000,* applicable to all food businesses.

'Food business operators shall ensure that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity'

(**European Communities (Hygiene of Foodstuffs) Regulations 2000** (SI 165 of 2000) Second Schedule Part 10)

Proprietors, managers and supervisors must ensure that these requirements are met. The Vertical Directives also include reference to supervision; they refer to training where the authorised officer brings the fact to the attention of the proprietor.

2.6.3 Work Exclusion

The law requires exclusion from foodhandling areas of those workers likely to be a possible source of infections which could be transmitted via food.

'No person, known or suspected to be suffering from, or to be a carrier of, a disease likely to be transmitted through food or while afflicted, for example with infected wounds, skin infections, sores or with diarrhoea, shall be permitted to work in any food handling area in any capacity in which there is any likelihood of directly or indirectly contaminating food with pathogenic micro-organisms'.

(**European Communities (Hygiene of Foodstuffs) Regulations, 2000** (SI 165 of 2000) Second Schedule Part 8)

'A proprietor of a food business shall not allow any person who is a probable source of infection with a scheduled infectious disease or who is suffering from any boil, septic sore or other skin ailment on the hand or forearm which could contaminate or infect food to work in connection with a food business save by and in accordance with the permission of the local chief medical officer'.

(**Food Hygiene Regulations, 1950** Article 33)

Where applicable, Vertical Directives also have an inclusion referring to 'persons likely to contaminate food are prohibited from working on it and handling it'.

In practice, the area of food handler exclusion is a difficult one. Individual risk assessment may need to take account of such factors as the infecting organism, the exact nature of the food handling activity and the standard of hygiene of the food handler. Decisions with regard to certain pathogens 'likely to be transmitted through food' and food

handler *carriers* can present challenges as a variety of international guidelines are in use leading to variation in application.

2.6.4 Medical Certification

Some EU Directives demand pre-employment and/or routine (annual) medical examination of food handlers in certain sectors. Annual medical certification is a legal requirement for food workers in meat plants, plants producing meat products and minced meat production plants; workers in the dairy sector who handle raw milk have to ensure that there is no impediment to such employment; medical certification is required of food workers in the fish processing sector at the time of recruitment. Primary producers, i.e. farmers & fishermen, are excluded from this requirement. Table 2.4 below delineates the Irish Regulations implementing Directives requiring medical certification.

For these groups there is an obligation:
'to prove, by a medical certificate, that there is no impediment to such employment' and, where annual certification is a prerequisite, that 'medical certificates shall be renewed every year unless another staff medical check up scheme can offer equivalent guarantees to the satisfaction of a veterinary inspector. The owner or person in charge of an establishment shall ensure that these medical certificates are available for inspection on request by an authorised officer.'

The legal requirement for medical certification of food handlers applies to certain well defined sectors of the food industry. Although most sectors are excluded, the requirement is a source of some perplexity. There is evidence of inconsistency and confusion in practice in some of those sectors for which it is not a legal requirement. The issue of routine medical certification of food handlers is examined in Chapter 6.

Table 2.4 Irish Regs. Implementing EU Directives Requiring Medical Certification

77/99:	European Communities (Meat Products and Other Products of Animal Origin) Regulations, 1995 (S.I. No.126 of 1995)
74/65:	European Communities (Minced Meat and Meat Preparations) Regulations, 1996 (S.I. No.243 of 1996)
92/46:	European Communities (Hygienic Production and Placing on the Market of Raw Milk, Heat-Treated Milk and Milk-Based Products) Regulations, 1996 (S.I. No.9 of 1996)
64/433:	European Communities (Fresh Meat) Regulations, 1997 (S.I. No.434 of 1997)
71/118:	European Communities (Fresh Poultrymeat) Regulations, 1996 (S.I. No.3 of 1996)
89/437:	European Communities (Egg Products) Regulations, 1991 (S.I. No.293 of 1991)
92/45:	European Communities (Wild Game) Regulations, 1995 (S.I. No.298 of 1995)
91/495:	European Communities (Rabbit Meat and Farm Game Meat) Regulations, 1995 (S.I. No.278 of 1995)

2.7 Occupational Health Legislation

Employers of food handlers are obliged to look after the safety and health of their employees in accordance with the provisions of the *Safety, Health & Welfare at Work Act, 1989* and other relevant safety and health legislation particularly the *Safety, Health & Welfare (General Applications) Regulations 1993* (which cover such areas as protective clothing etc.). Section 6 of the *Safety, Health & Welfare at Work Act 1989* sets out the general duties of employers towards their employees; Section 7 covers those who are not employees. Section 12 sets out the need for assessment of risks and the production of a safety statement. Some safety and health procedures, aimed at protecting employees from zoonotic diseases, such as personal hygiene and personal protective equipment, overlap with food hygiene procedures.

Occupational health legislation also places obligations on employees. Section 9 of the *Safety, Health & Welfare at Work Act 1989* sets out the duties of employees with regard to cooperation with the safety and health arrangements at the workplace.

2.8 Codes of Practice, Guides & Standards

Various guides, standards and codes of practice have been produced for use by the food industry. A series of these

has been researched and published by the National Standards Authority of Ireland (NSAI) and, more recently, by the Food Safety Authority of Ireland (FSAI).

2.8.1 Significance

Recent years have seen a novel approach to the way in which food hygiene and safety rules are written. EU Directives have sought to harmonise food hygiene rules across the European region by moving away from detailing prescriptive food hygiene rules to the development of a framework of legislative objectives. Previously, regulations tended to be quite prescriptive. Now, a framework of objectives is set out but the law does not lay down in as much detail how to reach those objectives. Hence the importance of the production of guides to good practice and standards to fill the gap.

The *European Communities (Hygiene of Foodstuffs) Regulations 2000* provide for the FSAI to approve guides to good hygiene practice which may be used voluntarily by food businesses as a guide to compliance with the Regulations. The NSAI had been assigned the role of development of such guides under Council Directive 93/43/EEC.

The *Food Safety Authority of Ireland Act, 1998*, makes provision for the development of guidelines or codes of practice by itself, or with such representatives of particular food business groups or organisations as it deems appropriate.

2.8.2 FSAI Codes of Practice/Guidance Notes

The FSAI has produced a series of Codes of Practice and Guidance Notes to assist both regulators and the food industry in achieving a higher degree of compliance with the law and with good practice generally (Table 2.5). The Authority points out that these guidelines do not substitute for particular Regulations. However, it emphasises that adherence to the guidelines should make compliance easier by providing the basis for a high degree of consistency in the application of the relevant Regulations. Guides to Food Safety Training have been among those most recently produced.

Table 2.5 FSAI Codes of Practice & Guidance Notes*

• Code of Practice No.1	Risk Categorisation of Food Businesses to Determine Priority for Inspection
• Code of Practice No.2	Inspection of Food Operations run by Health Boards
• Code of Practice No.3	Risk Categorisation, Inspection and Sampling Frequencies of Meat Manufacturing Premises Producing Solely for the Domestic Market
• Code of Practice No.4	Production of Fresh Fruit and Vegetables
• Guidance Note No.1	Inspection of a Food Business. FSAI 2001
• Guidance Note No.4	Approval of Independent Meat Production Units under EC Meat Legislation (Meat Products, Minced Meat & Meat Preparations). FSAI 2001
• Guidance Note No.5	Approval and Operation of Independent Meat Production Units under EC Fresh Meat Legislation. FSAI 2001
• Guide to Food Safety Training – Level I. FSAI 2001	
• Guide to Food Safety Training – Level II. FSAI 2001	
• Guide to Food Safety Training – Level III. FSAI 2003	

*not exhaustive

2.8.3 NSAI Irish Standards

The NSAI has produced sector specific guides as national standards (Table 2.6), making a significant contribution to the improvement of food safety in this country.

Table 2.6 NSAI Irish Standards*

- IS 3219: 1990 *Code of Practice for Hygiene in the Food and Drink Manufacturing Industry.* NSAI
- IS 340: 1994 *Hygiene in the Catering Sector.* NSAI
- IS 342: 1997 *Guide to good hygiene for the food processing industry in accordance with the Council Directive 93/43/EEC on the Hygiene of Foodstuffs.* NSAI
- IS 341: 1998 *Hygiene in Food Retailing and Wholesaling.* NSAI
- IS 343: 2000 *Food Safety Management.* NSAI

*not exhaustive

Irish standards IS 340 and IS 341 are among a series of sector specific guides which identify general hygiene requirements including requirements relating to personal hygiene for that sector. In addition, IS 340 contains requirements relating to medical fitness.

Irish Standard IS 342 provides guidance on compliance with hygiene rules set out in Council Directive 93/43/EEC. It also includes requirements relating to personal hygiene and applies to all food processing companies with the exception of those food processing sectors which are the subject of specific European Community veterinary rules - namely the meat, fish and dairy sectors.

Irish Standard IS 343 sets out how food safety should be managed. It defines the elements of successful food safety management. It incorporates HACCP (Hazard Analysis and Critical Control Points – a systematic approach to identifying, evaluating and controlling food safety hazards – a preventive system of hazard control rather than a reactive one). However, before HACCP is addressed, the food business must put in place the pre-requisite programme covering sector specific general rules and requirements relating to food hygiene, including personal hygiene. Irish Standard IS 3219 provides for hygiene in the food and drinks manufacturing industry. It is currently being reviewed and will become a support standard for IS 343 for use in the food and drinks manufacturing sectors.

2.9 Conclusion

While our current food law is wide-ranging, there are gaps and overlaps with regard to food handler risk reduction in the spread of foodborne pathogens. There are stringent requirements in some sectors which are absent from others. The presence of a plethora of EU Directives, the intermingling of different disciplines (hygiene, animal health and official controls) and the existence of different hygiene regimes for products of animal origin and other foods result in a fairly cumbersome situation. Hardly surprisingly, there is ambiguity and not a little confusion in relation to some key preventive aspects throughout the food industry and enforcement bodies alike.

The legislative framework is in a state of flux. Our *Food Hygiene Regulations 1950-89*, which have been superseded to a significant degree by subsequent European Union and national legislation, are presently being revised. The EU plans to have all EU food law harmonised by 2004.

Measures to control potential food handler risks in the spread of foodborne infection demand a sound evidence base. Science should inform and lead the way. Guidelines should reflect current best evidence and best practice, all the while cognisant of current legislative requirements.

Chapter 3
An Assessment of Risks posed by Infected Food Handlers: *The evidence*

3.1 Introduction

Infected food handlers are not uncommonly associated with outbreaks of foodborne disease. Infected food handlers were implicated in 18% of general outbreaks of infectious intestinal disease in Ireland in the 1998/9 period[7]. However, the association between the infected food handler and the transmission of foodborne disease frequently presents an investigative challenge. Careful outbreak investigation may reveal the infected food handler to be yet another innocent outbreak victim or, on occasion, the index case.

This chapter uses an evidence-based approach to analyse the information presented in the literature and to identify the main risk factors contributing to foodborne illness caused by infected food handlers. A thorough search of published, English-language, scientific literature for the period 1980-2001 was conducted to identify articles that described outbreaks of foodborne disease that were believed to have resulted from contamination of food by infected food handlers. Stringent inclusion criteria applied - there had to be sound epidemiological evidence and microbiological evidence implicating the food handler. While not claiming to be an exhaustive list, it is considered that the articles reviewed are a relevant representation of the literature on the subject. The citation sources used were: PubMed–'Entrez', MedLine, Eurosurveillance, ProMed, FS-NET, US FDA and *local ID bulletin reports.* Key words applied in the search were: "foodhandler", "food handler", "food worker", foodborne outbreaks" and "foodborne disease".

A total of 41 outbreaks involving 12 different pathogen species were identified. Outbreaks ranged in size from less than ten cases to over 3,000 cases (Table 3.1). Aspects relating to the role of the infected food handler in causing foodborne illness are addressed – the level of evidence implicating the food handler; the most commonly reported pathogens; clinical symptoms; pathogen infectivity; mode of transmission to food; commonly implicated foods and outbreak settings.

3.2 Level of Evidence

The investigation of an outbreak of foodborne illness attempts to identify the vehicle of infection (i.e. contaminated food or water) most significantly associated with illness. If the identity of the food vehicle is established, the investigation extends to try to identify the source of contamination of that food vehicle. Outbreak investigation, conducted systematically, examines epidemiological, microbiological and environmental evidence.

EPIDEMIOLOGICAL EVIDENCE

In broad terms, there are two types of epidemiological study – descriptive and analytical. The analytical studies relevant to outbreak investigation constitute either cohort or case control studies. The level of evidence gained from a particular study design is summarised (Table 3.2). Randomised controlled trials provide the strongest type of epidemiological evidence but are not appropriate to outbreak investigation.

Table 3.1 Outbreaks Reviewed

Author	Year	Location	Pathogen	No. ill	No. exposed	Implicated food
Arness *et al*[17]	1999	Army camp, Texas, US	Norovirus	99	835	Bakery products
Daniels *et al*[18]	2000	Cafeteria, Texas University	Norovirus	125	2054	Ham sandwiches
Parashar *et al*[19]	1998	Manufacturing Co., Ohio	Norovirus	85	234	Sandwiches
DoH, Florida[20]	1997	Restaurant, Florida (2)	Norovirus	36	58	None identified
Lo *et al*[21]	1994	Hospital kitchen, Wales	Norovirus	195	N/A	Turkey salad sandwiches
Stevenson *et al*[22]	1994	Hospital, Manchester	Norovirus	164	N/A	Sandwiches
Reid *et al*[23]	1988	Hotel, England	Norovirus	164	N/A	Cold foods
Kobayashi *et al*[24]	1991	Schools, Toyota City, Japan	Norovirus	3353	8098	One type of school lunch
Patterson *et al*[25]	1993	AIDS conference	Norovirus	67	N/A	Chicken
Kassa[26]	2001	Dinner banquet	Norovirus	93	137	Tossed salad
Anderson *et al*[27]	2001	Car dealership	Norovirus	N/A	N/A	Salad
Gaulin *et al*[28]	1999	Restaurant party	Norovirus	48	82	Salad
White *et al*[29]	1989	Nursing home, Minnesota	*Giardia lamblia*	88	C	Sandwiches
Quick *et al*[30]	1992	Restaurant, US	*Giardia lamblia*	27	36	Ice
Mintz *et al*[31]	1993	Office workers, US	*Giardia lamblia*	27	N/A	Raw sliced veg
Olsen *et al*[32]	2001	School luncheon, Kansas	*C. jejuni*	27	161	Gravy & Pineapple
Maguire *et al*[33]	2000	Private hospital	*S. virchow* PT26	10	200	Turkey sandwiches
Faustini *et al*[34]	1998	Building site canteen, Italy	*S. hadar*	448	N/A	Meat salad
Saha *et al*[35]	1992	Paediatric hospital, Calcutta	*S. typhimurium*	55	347	None identified
Francis *et al*[36]	1989	Fish-and-chip shop, UK	*S. paratyphi*	6	N/A	None identified
Lee *et al*[37]	1998	Restaurant, Massachusetts	*S. javiana*	66	N/A	Chicken sandwich
Dryden *et al*[38]	1994	Hospital, UK	*S. enteritidis* PT4	29	N/A	None identified
Khuri-Bulos *et al*[39]	1994	University hospital, Jordan	*S. enteritidis*	183	619	Mashed potatoes
Hedberg *et al*[40]	1991	Fast-food restaurant	*S. enteritidis*	37	N/A	Multiple food items
Xercavins *et al*[41]	1997	Community	*S. typhi*	70	N/A	Cannelloni
Bar-Dayan *et al*[42]	1996	Airforce base, Israel	GpA ß Haem. Strep	197	N/A	White cheese
Farley *et al*[43]	1993	School banquet, US	Group A Strep.	92	190	Macaroni & cheese
Richards *et al*[44]	1993	Schools, Rhode Island	*Staph. aureus*			Ham
Pereira *et al*[45]	1994	Party, Brazil	*Staph. aureus*	12	N/A	Cream-filled cake
Lew *et al*[46]	1991	Cruise ship, Caribbean	*Shigella flexneri* 4a	84	900	German potato-salad
Dunn *et al*[47]	1995	Central kitchen	*Shigella flexneri*	46	N/A	Salad
Lee *et al*[48]	1991	Outdoor festival	*Shigella sonnei*	3175	N/A	Uncooked tofu salad
Weltman *et al*[49]	1996	Households (h/h), Michigan	Hepatitis A	11 h/h	17 h/h	Sugar-glazed bakery goods
Snydman *et al*[50]	1981	Department store, US	Hepatitis A	30	N/A	Cold sandwiches
Gustafson *et al*[51]	1983	State law firm, Tennessee	Hepatitis A			Cold meats, Cheese
Massoudi *et al*[52]	1999	Catering company	Hepatitis A	91	1318	Uncooked foods
Sundkvist *et al*[53]	2000	Public House	Hepatitis A	10	N/A	Fomites (contamination of drinking glasses)
Morse *et al*[54]	1984	Summer camp	*Yersinia enterocolitica*	225	455	Powdered milk/Chow Mein
Tangkanakul *et al*[55]	2000	Boarding school	*Vibrio parahaemolyticus*	132	N/A	Fish-balls
Quiroz *et al*[56]	2000	University campus	*Cryptosporidium parvum*	88	N/A	Not specified
Irish *et al*[57]	2000	Prison	VTEC O157	45	N/A	Not specified

Table 3.2 Level of Evidence

Level	Type of epidemiological evidence
Ia	Evidence obtained from a meta–analysis of randomised controlled trials
Ib	Evidence obtained from at least one randomised controlled trial
IIa	Evidence obtained from at least one well designed controlled study without randomisation
IIb	Evidence obtained from at least one other type of well designed experimental study
III	Evidence obtained from well designed non experimental descriptive study, such as comparative studies, correlation studies, and case studies
IV	Evidence obtained from expert committee reports or opinions and/or experience of respected authorities

Source: US Agency for Healthcare Policy and Research (NHS)

The outbreaks studied in this review each presented either cohort, case control or descriptive epidemiological evidence. The epidemiological and microbiological evidence implicating food handlers is listed (Table 3.3). Over half of the outbreaks provided analytical epidemiological evidence - case control (42%); cohort (12%). The remainder comprised well-designed descriptive epidemiological outbreak studies. All of the outbreaks demonstrated microbiological evidence implicating food handlers.

Table 3.3 Epidemiological & Microbiological Evidence Implicating Food Handlers
(41 outbreaks reviewed)

Type of Evidence	No. Outbreaks
Microbiological	41 (100%)
Epidemiological: Analytical	22 (54%)
• Case Control	17 (42%)
• Cohort	5 (12%)
Epidemiological: Descriptive	19 (46%)

When a particular food vehicle has been implicated in an outbreak, a hypothesis is generated as to the likely means by which the food was contaminated. In all of the outbreaks reviewed, a food handler was implicated to varying degrees as the source. In 71% of the outbreaks, a temporal association was demonstrated i.e. that the food handler admitted to symptoms either prior to or during the outbreak[18,19,21,23,25,32,34,38,40,53]. While such an association was not demonstrated in just over one-quarter of outbreaks, it is believed that either asymptomatic food handlers (all were culture positive) or non-reporting of symptoms were likely factors. It has been observed that a food handler will often deny symptoms because of fears related to financial sanctions and job security[46].

MICROBIOLOGICAL EVIDENCE

Microbiological evidence was available in all of the outbreaks reviewed (Table 3.3), demonstrating that the food handler carried the same organism as the other people who were ill. Definitive proof that the food handler was the cause was possible where a temporal association was also established.

The development of molecular typing evidence, in combination with the demonstration of a temporal association, has aided greatly in the investigation of outbreaks and testing the hypothesis that the food handler is the cause. In a Norwalk-like virus (NLV) associated outbreak described by Daniels *et al*, 2000[18], a food handler who prepared sandwiches for a school lunch reported that her infant had been sick with watery diarrhoea since just before the outbreak (note: NLV, also previously called Small Round Structured Virus SRSV, is now termed Norovirus). A stool sample from the infant was positive for NLV by RT-PCR, and was identical to those from both the deli ham and students' stool specimens. This was the first time RT-PCR and sequence analysis successfully confirmed viral contamination of a food item likely to have been contaminated by a food handler. Molecular typing, in combination with demonstrating a temporal association, served to definitively implicate the food handler. Another recent Norovirus outbreak investigation also used this technique[27]. Molecular typing methods have now been developed for other pathogens as well and have been used in outbreaks implicating food handlers e.g. *Salmonella javiana*[37], *Salmonella virchow*[33] and *Cryptosporidium parvum*[56].

ENVIRONMENTAL EVIDENCE

Evidence gleaned from environmental investigation, used in conjunction with epidemiological and microbiological evidence, has often added weight to implicating food handlers in food handler-associated outbreaks. Poor personal hygiene - most particularly poor hand hygiene - was commonly reported as having contributed to the outbreaks reviewed. This has previously been documented as a frequently reported practice linked to foodborne outbreaks[58]. Other commonly cited environmental factors associated with the outbreaks reviewed included improper storage of food and temperature abuses. Inadequate hygiene facilities for food handlers was a notable factor in some outbreaks.

In a Hepatitis A virus outbreak described by Weltman *et al,* 1996[49], the implicated baker was observed not to have adhered to strict hand washing procedures, and was observed not to have worn gloves on occasion when he was obliged to do so. In addition, the environmental investigation revealed that a hand washing sink in the bakery had tap handles that were difficult to use and that the water took several minutes to heat.

In an outbreak of shigellosis on a cruise ship described by Lew *et al*, 1991[46], environmental inspection found that only one toilet was available in the galley area for over 100 food handlers to use while they were on duty. This toilet facility was locked (the head chef kept the key), and had no disposable towels. The authors concluded that poor personal hygiene of the food handlers contributed to the outbreak.

In an outbreak of giardiasis, raw sliced vegetables were the source of infection[31]. Poor hand hygiene of an infected food handler was identified as a cause of contamination of the raw vegetables.

3.3 Pathogens

Fifty-nine per cent of all outbreaks reviewed were found to have been attributable to bacterial pathogens; 41% were due to viral pathogens. The single most common pathogen in food handler implicated outbreaks was Norovirus (NLV/SRSV). The other reported pathogens were Hepatitis A virus, *Salmonella* spp., Verocytotoxin-producing *E. coli* (VTEC), *Staphylococcus aureus*, *Streptococcus pyogenes*, *Shigella flexneri*, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Cryptosporidium* spp*, Giardia lamblia* and *Vibrio parahaemolytica* (Table 3.4).

Table 3.4 Infected Food Handler Implicated Outbreaks of IID : Causative Pathogen

Pathogen	No. Outbreaks
Norovirus (NLV/SRSV)	12
Salmonella spp	9
Hepatitis A (HAV)	5
Giardia lamblia	3
Shigella flexneri	3
Staphylococcus aureus	2
Group A Streptococcus	2
Verocytotoxin-producing *E.coli* (VTEC)	1
Campylobacter jejuni	1
Vibrio parahaemolytica	1
Yersinia enterocolitica	1
Cryptosporidium spp	1
Total Outbreaks Reviewed	**41**

While foodborne illness may be mild and relatively short-lived for many victims, others can be more severely affected. Especially vulnerable are children, the elderly and the immunocompromised. Infection with these pathogens predominantly causes gastrointestinal symptoms, such as diarrhoea and vomiting, which can lead to severe dehydration. Some pathogens can have other serious sequelae e.g. in up to 30% of cases of VTEC infection, life-threatening complications can occur, of which Haemolytic Uraemic Syndrome (HUS) is the most common[59].

Salmonella typhi/S. paratyphi infections are particularly problematic in view of their potential seriousness and the possibility of carriage. There have been no reported outbreaks associated with these pathogens in Ireland to date. However, given the now extensive amount of foreign travel and the increasing numbers of immigrants employed in the food industry, there is potential for these pathogens to become sources of foodborne infection here. An interesting outbreak of paratyphoid fever in the UK, associated with a fish-and-chip shop, was described by Francis *et al*[36]. The source of infection for the initial cases was believed to have been a food handler who was infected overseas six years earlier. This food handler's wife (also a food handler), whose faeces and urine were originally culture negative, became culture positive on one occasion. She was considered to be the source of two further cases; secondary household spread of infection from these two cases resulted in one symptomatic and two asymptomatic infections. Another outbreak of typhoid fever highlights the potential for a prolonged outbreak caused by a casual food handler who was a carrier in a hospital setting[41]. The outbreak lasted from 1988 to 1994 and was due to intermittent low level exposure of patients to *Salmonella typhi* by the food worker.

3.4 Food Handler Symptoms

PRESENCE OF SYMPTOMS

Symptoms of gastrointestinal infection generally include nausea, malaise, abdominal pain, diarrhoea and/or vomiting. The evidence is that food handlers are more likely to contaminate food in the symptomatic phase of illness i.e. when symptoms such as diarrhoea and/or vomiting are present. Diarrhoea and/or vomiting were by far the most commonly reported symptoms involving infected food handlers implicated in the foodborne outbreaks reviewed.

Staff members involved in an outbreak of *Shigella sonnei* gastroenteritis in the week prior to an outdoor festival prepared ready-to-eat foods that led to an outbreak involving over 3,000 people. Some of the food handlers were symptomatic with diarrhoeal illness during food preparation. A salad had been thoroughly mixed by hand by these staff members and there was limited access to proper washing facilities[48].

Guzewich & Ross[60] in a review of the risks posed by food handlers found that, in outbreaks involving infected food workers, 93% were either ill prior to or at the time of the outbreak; in most of the remaining outbreaks, an asymptomatic food worker was believed to have been the source of the infection. In this current review, a lesser proportion of outbreaks (71%) were found to have been linked with food handlers who admitted to being symptomatic (i.e. having symptoms either just prior to or during the outbreak). The remainder of the outbreaks were related to food handlers who did not report symptoms but who were culture positive. Explanations could be either non-reporting of symptoms or asymptomatic food handlers; the problem of non-reporting of symptoms has been highlighted[46].

ABSENCE OF SYMPTOMS

However, the food handler may also be infectious (may be shedding the pathogen) during the pre-symptomatic and post-symptomatic phases of illness.

Pre-symptomatic Phase: In some illnesses, the food handler is particularly infectious during this phase but is unaware of his/her illness. This has been highlighted with regard to some Hepatitis A outbreaks. In 1994, an outbreak of Hepatitis A virus was reported in New York associated with an infected baker who had contaminated food while applying a sugar glaze to pastries after baking[49]. Seventy-nine people became ill prior to the outbreak being investigated. The incubation period for Hepatitis A can be as long as six weeks, and the person is infectious in the pre-symptomatic period prior to the onset of jaundice. A similar outbreak occurred in the UK in 1999[53]. Eight people who had drank in a public house in the two weeks before the barman became ill developed Hepatitis A. Fomite transmission by contamination of glasses was considered the most likely route of spread of infection.

Several outbreaks of Norovirus (NLV/SRSV) gastroenteritis also demonstrated the infectivity of the food handler in the pre-symptomatic phase of illness[28,61]. Lo *et al* 1994 describe an outbreak of NLV gastroenteritis that occurred in a hospital in Wales[21]. Descriptive evidence implicated a pre-symptomatic food handler who handled salad items as the possible source; she had become ill the day following salad preparation. This lady had a young child at home who had been ill with a gastrointestinal illness during the previous two days. The investigative team suggested that pre-symptomatic faecal shedding in the mother was a possible explanation for the contamination of the food.

Post-symptomatic Phase: Following acute illness with certain pathogens, a person may shed the pathogen for a period of time after the illness or may become an asymptomatic carrier. A number of outbreaks have been described which illustrate the role of food handlers who were asymptomatic carriers in the transmission of infection. An outbreak of *Salmonella typhi* in a public school in Madrid was considered to have originated from an asymptomatic carrier who was one of the three food handling workers in the school restaurant[62]. Another outbreak in a university hospital in Amman, Jordan implicated an asymptomatic food worker, culture positive for *S. enteritidis*, who had prepared the mashed potato which was implicated as the likely vehicle of infection[39]. In a hospital outbreak of *S. enteritidis* in the UK[38], faecal screening of asymptomatic people demonstrated a high carriage rate among catering staff. There was an association between illness and eating meals prepared by one of the food handlers.

3.5 Pathogen Infectivity

The degree of pathogen infectivity can be highly significant in determining the scale/nature of an outbreak.

High attack rates are common features of many Norovirus (NLV/SRSV) outbreaks. This is explained by characteristics of the pathogen (low infectious dose required to cause illness; pathogen survival for long periods in the environment on surfaces/fomites/possibility of multifactorial spread) and the symptoms caused (projectile vomiting that can become aerosolised). Consequently, a food handler who is symptomatic with viral gastroenteritis has the potential to infect large numbers of people. For example, Kobayashi *et al* describe a food handler associated outbreak in Japan in 1989 where 3,236 (42%) of 7,801 schoolchildren became ill following consumption of school lunches[24]. Lo *et al*, 1994 relate an outbreak of NLV gastroenteritis in a hospital where 81 patients and 114 staff were affected[21]. This type of outbreak can be extremely difficult to control, even when the infected food handler has been excluded from work, because of environmental contamination. Shigella also has a low infectious dose; a large food handler implicated outbreak resulted in over 3,000 cases[48].

For many other pathogens the infectious dose required is much higher i.e. large numbers of organisms required to cause infection. However, an infected food handler can contaminate food which, together with operational deficiencies (e.g. inadequate storage, temperature abuses), can lead to proliferation of the pathogen to sufficient numbers in the food to infect consumers. In a *Salmonella Hadar* outbreak in Italy which affected over 400 people, a meat salad was significantly associated with illness[34]. It was postulated that the meat salad was contaminated by an infected food handler and the meat was then cooled at room temperature, not by rapid refrigeration, which contributed to proliferation of the pathogen.

3.6 Mode of Transmission to Food

Pathogens can be transmitted to food by an infected food handler in a number of ways. This literature review confirms that **the hands are the most important vehicle for transfer of pathogens to food** e.g. from faeces, infected skin lesions, nose or other sites to food. Other means of pathogen transfer include naso-pharyngeal secretions, respiratory (aerosolisation of vomitus) and fomites. These factors underscore the importance of strict personal hygiene practices of food handlers and adherence to good food hygiene practices in the prevention of foodborne illness.

Hands

Faecal-oral: The overwhelming evidence from the literature is that this is the most common cause of contamination of food by an infected food handler. It involves transmission of the pathogen to food by the food worker's faecally contaminated hands - the result of breakdown in personal hygiene. Both bacterial and viral infections have been transmitted in this way e.g. *Salmonella* spp[37,40], Hepatitis A[49,53], *Shigella flexneri*[46,47], VTEC *E. coli*[57], *Yersinia enterocolitica*[54], *Campylobacter* spp[32], *Giardia lamblia*[30,31]. The question of glove use as a barrier to bare hand contact was found to have been infrequently referred to in the outbreaks reviewed; it is therefore considered inappropriate to comment on glove use in the context of these outbreaks in view of the paucity of available information. Strict personal hygiene is the only effective means of preventing faecal-oral transmission.

Assessing hygiene practices of food handlers can, however, be extremely difficult. In an outbreak caused by an infected food handler with Hepatitis A infection, a decision had been made not to administer immunoglobulin to contacts because it was felt that the personal hygiene of the food handler (who had prepared many uncooked foods served at the event) was satisfactory[52]. It transpired that ninety-one people were subsequently found to have been infected, casting doubt on the assessment of hygiene practice in this instance.

Infected skin lesions: Transmission of staphylococcal and streptococcal infection via uncovered, infected skin lesions has been reported in a number of foodborne outbreaks. An outbreak of Group A Streptococcus (GAS) pharyngitis following a school banquet was linked to a food handler who had prepared a macaroni and cheese dish[43]. The food handler had a small healing lesion on the dorsum of one hand. Culture of the lesion grew GAS. This was the first published report that found a hand lesion infected with GAS as the only identified source of food contamination. Pereira *et al*[45] relate an outbreak of *S. aureus* food poisoning caused by a food handler with a healing lesion on his neck, culture-positive for *S. aureus*. A cream filled cake at a birthday party, from which *S. aureus* was also isolated, had been inadvertently contaminated by the food handler.

Naso-pharyngeal secretions

Food can become contaminated by the food handler via infected naso-pharyngeal secretions (by coughing, sneezing or direct contact from nose to hands). Foodborne outbreaks of staphylococcus[44] and streptococcus[42] have been reported to have been transmitted in this fashion. Katzenell *et al*[63] reviewed the literature relating to streptococcal contamination of food, concluding that foodborne streptococcal pharyngitis can originate from the pharynx or hand lesions of a food handler. The authors noted that epidemics tend to occur in warm climates and in the hottest months of the year.

Aerosolisation

Aerosolisation as a mode of transmission is particularly relevant in relation to Norovirus outbreaks and has been a factor in food handler related outbreaks. Vomitus particles may become aerosolised and transmitted to food via an airborne route[23] which can result in large numbers of people becoming ill[17,26].

Fomites

The ability of viruses to survive in the environment on surfaces (fomites) has been well documented in the literature. Environmental surfaces contaminated by infected food handlers have been postulated to be sources of pathogen transmission in some outbreaks involving Norovirus and Hepatitis A. Lo *et al*[21] described an outbreak of NLV gastroenteritis where it was believed that mechanical transmission of the virus via clothes and hands was possible. Sundkvist *et al*[53] described transmission of Hepatitis A via contaminated drinking glasses.

Eye/Other Infections

Many guidance documents recommend that food handlers with eye/ear/mouth infections should refrain from food handling duties[2,10,16]. No outbreak due to such infections was identified in this literature review. Purulent eye discharges due to *S. aureus* have, however, been recognised as a source of foodborne infection[4].

3.7 Commonly Implicated Foods

Specific food items were identified as vehicles for transmission in 85% of the outbreaks (Table 3.5). No food item was pre-wrapped, canned or bottled. All of the implicated foods could be categorised as ready-to-eat foods i.e. foods which had gone through most or all of their preparation steps (c.f. Glossary). Such foods commonly comprised sandwiches, salads and cooked meats - foods that required extensive hand contact during preparation.

Table 3.5 Infected Food Handler Implicated Outbreaks of IID : Food Items

Food Item	No. of times Food Item Implicated in Outbreak
Cooked food items (e.g. ham, chicken, fish, mashed potatoes)	10 (24%)
Cold sandwiches	8 (20%)
Cold salads, incl. raw veg & cheese	8 (20%)
Other cold foods	3 (7%)
Bakery goods	3 (7%)
Beverages, incl. ice	2 (5%)
Fruit	1 (2%)
Not identified	6 (15%)
	No. Outbreaks = 41

Undoubtedly, the highest risk posed by an infected food handler whether symptomatic, pre-symptomatic or a carrier was the unhygienic handling of ready-to-eat foods. Consistent with what was stated in WHO's 1989 guidelines regarding food handling personnel[10], those food handlers who present a special risk of transmitting pathogenic organisms from themselves to food can be defined as ***'persons whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment'.*** Many current guidance documents use a similar definition[1,3,64]. Such foods constitute a high risk if contaminated because there are no further preparation steps to control the hazard.

High-risk food handler: one whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment

3.8 Outbreak Settings

The outbreaks described in the literature - where an infected food handler was implicated as a source of infection - occurred in such diverse locations as schools, universities, in the community, restaurants, pubs, hotels, hospitals, nursing homes, canteens, military training bases, a cruise-ship, prisons, summer camps, offices, a manufacturing company and conferences. Thirty-seven per cent of the outbreaks were associated with commercial catering premises (restaurants, hotels etc.), 19% with educational facilities (schools, universities, summer camps) and 17% with health care settings (hospitals, nursing homes). Most significant is contamination of ready-to-eat foods being prepared and provided to the public for consumption – the riskiest outbreak settings being at those points of the food chain near to the consumer. Some outbreak settings have been very large indeed with hundreds, and in some cases thousands, of consumers becoming ill following exposure to contaminated foods. Vulnerable populations, including the ill and the elderly, have been victims in several documented outbreaks.

3.9 Review Limitations

A caveat of this literature review is that evidence implicating food handlers has been confined to published scientific articles relating to outbreak situations. It is important to point out that these publications represent only a small fraction of foodborne disease outbreaks and an even smaller fraction of all foodborne disease. Some outbreaks, especially those causing mild illness, may not even be reported to health authorities. Of the outbreaks which are investigated, only a small proportion are written up, submitted to and ultimately published in peer-reviewed journals. Some degree of publication bias cannot therefore be outruled. In addition, many sporadic cases of foodborne illness are likely to be underreported.

As a result, it is possible that this review markedly under-represents the true number of foodborne outbreaks related to infected food handlers. However, it is unlikely that the investigation of all outbreaks and sporadic cases would produce any evidence at variance with the review's conclusions.

3.10 Conclusion

Unequivocal evidence has been presented which demonstrates that infected food handlers can serve as sources of infection in foodborne outbreaks in a wide variety of locations where food is handled.

Food handlers have been associated with the transmission of both viral and bacterial pathogens via food. In terms of symptoms, it is those food handlers who are symptomatic with gastrointestinal symptoms – diarrhoea and/or vomiting – and who continue to work through those symptoms that present the greatest risk. However, in viral outbreaks, the pre-symptomatic and post-symptomatic phases of illness are also significant in relation to risk of transmission. Less commonly, foodborne outbreaks implicating food handlers have been associated with infected skin lesions or infected discharges (e.g. nasopharyngeal).

The potential for transmitting foodborne disease is clearly greatest the nearer along the food chain the food handler is to the consumer. The review, for instance, found no evidence linking handlers of raw meat in production facilities and

abattoirs with outbreaks of consumer illness. Overwhelmingly, infected food handlers who handle unwrapped food to be consumed raw or without further cooking or other forms of treatment are the subgroup of food handlers identified as presenting the highest risk.

The hands are by far the most important vehicles for pathogen transfer from stools, nose, infected areas of skin or other sites to food. Poor personal hygiene of food handlers – in particular failure to wash hands appropriately – is a major risk factor for contamination of food. Poor hand hygiene was frequently reported in the outbreaks reviewed. In addition, lapses in safe food handling practices, including improper storage and temperature abuses, commonly exacerbated the problems posed by poor hand hygiene.

Preventing incidents of gastrointestinal illness associated with infected food handlers demands a multifaceted approach. Very clearly, this assessment of risk underscores the absolute importance of education and training in personal hygiene and safe food handling practices, as well as the reporting of relevant symptoms so that appropriate action can be taken where necessary to address any possible risks.

Risk Assessment Summary

- While food handlers can be innocent victims in outbreaks of foodborne infection, there is ample epidemiological, microbiological and environmental evidence linking infected food handlers with causation in a significant number of outbreaks.
- The pathogens found to be most frequently linked to food handler transmission have been Norovirus, Salmonella and Hepatitis A virus (HAV).
- To constitute a risk, the infected food handler is generally symptomatic – most often with gastrointestinal symptoms. However, food handlers in the pre- or post-symptomatic phases of illness have also been implicated in causing foodborne outbreaks.
- The most frequently associated symptoms are vomiting and/or diarrhoea – underscoring the importance of symptom reporting and exclusion from food handling duties while symptomatic.
- By far the most common mode of pathogen transmission to food by the infected food handler is via faecally contaminated hands. Poor hand hygiene is *the* contributing factor.
- Other reported modes of transmission include infected skin lesions (usually on hands), naso-pharyngeal secretions (*Staph*, *Strep*), aerosolisation of vomitus (Norovirus) and fomites (Norovirus, HAV).
- There is **overwhelming evidence that food handlers whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment (HIGH RISK FOOD HANDLERS) are those most commonly implicated** in foodborne outbreaks. The unhygienic handling of such foods constitutes a particularly grave risk.
- Infected food handlers can potentially infect food in any setting, but have been demonstrably implicated at points of the food chain near to the consumer.

Chapter 4
Prevention of Food Contamination by Infected Food Handlers

4.1 Introduction

There are four main facets to the prevention of food contamination by food handlers:

- A supportive work environment with the provision of clean, hygienic work premises and adequate toilet, handwashing and changing facilities
- Instructing and/or training, and supervising staff in the safe handling of food
- Good personal hygiene practice by food handlers
- The reporting by food handlers to management of relevant infectious or potentially infectious conditions so that appropriate action (including exclusion) can be considered

Legislative requirements, as earlier outlined, apply to all four areas. This chapter concentrates primarily on personal hygiene aspects (mainly hand hygiene) and the evidence base for action applicable to those aspects. Chapter 5 considers the reporting of relevant conditions by food handlers.

Good hygiene practice, a critical factor in preventing the spread of infection, is essential for all food handlers in order to protect consumer health and ensure a safe food supply. The primary concern is the avoidance of microbiological contamination of food by infected food handlers, whether by direct contact with open food, or by indirect contact (e.g. with surfaces in production and processing areas). Food handlers suffering from gastrointestinal symptoms, i.e. diarrhoea or vomiting, are especially likely to contaminate food and the environment. Management in the food industry has an important role in minimising the risk of contamination of food by ensuring that all staff understand the importance of good personal hygiene and receive training and/or instruction in the safe handling of food. All such training should be appropriately targeted, with particular emphasis on the high-risk food handler.

4.2 Hand Contamination

Contaminated hands can serve as vectors for the transmission of microorganisms. Pathogenic microorganisms responsible for outbreaks are spread from the hands of the food handler to others when the food handler contaminates his/her hands and then passes these microorganisms to consumers via hand contact with food or drinks. The consumer is exposed following the ingestion of these microorganisms, which may cause gastrointestinal illness. Hand contact with ready-to-eat foods represents a very important mechanism by which pathogens may enter the food supply. ***Food handlers whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment have been identified as a particular risk group.***

Two types of microorganism are found on the hand: resident and transient[66,67]. Resident microorganisms, buried deep within the pores, reside on the hand permanently and are normal microflora of the skin. They are not easily removed from the skin by mechanical friction[66]. Resident microorganisms do not, however, normally pose a threat of infectious disease. *Staphylococcus aureus*, a bacterium, is the only resident microorganism that is a cause of food safety concern[67]. There are situations, e.g. an infected cut, in which resident microorganisms may cause disease – but washing serves to degerm the infected area[68].

Transient microorganisms can be bacterial (e.g. *E. coli*) or viral (e.g. Norovirus) and are picked up accidentally, residing on the hand for a short period of time only. They are easily transmitted by hands unless removed by the mechanical friction of washing with soap and water or destroyed by the use of an antiseptic solution[66]. Transient organisms cause great concern to the food industry because they are loosely attached to the skin surface and can easily contaminate food if food handlers do not wash their hands adequately[69]. They include faecal microorganisms which may contaminate the hands, fingers and arms of food handlers after using the toilet.

4.3 Hand Washing

Hand washing includes the process of washing and drying hands. Hand washing removes contaminating microorganisms from the surface of the hand so that they cannot be transmitted to food. However, data from UK and American studies have found that only 50% to 60% of people wash their hands after using the toilet[70,71]. Michaels[72] reports that hand washing compliance is below 50% for almost every group studied. Compliance with hand washing among health workers is even reported to be low[73]. Cultural differences in hand washing practices have also been found in the US[74]. In general it has been found that males and those in the younger age groups tend to have poorer hand washing practices. It has been shown that particular areas of the hand are frequently missed with hand washing – notably the tips of the fingers and thumbs[75]; fingers are thought to be the most important part of the hand in terms of transfer and spread of pathogenic microorganisms[76]. These behavioural factors, along with the practical difficulties of being able to wash hands repeatedly and when needed, are important considerations in food handler training.

Experts agree that hand washing is the single most effective way to prevent the spread of microorganisms[1,77]. Much has been written in the scientific literature regarding optimum duration, water flow and temperature, types of products /soaps used and hand drying methods.

Duration: Duration of hand washing is important for mechanical action as well as exposure to the cleansing agent[66]. It is the abrasive action obtained by vigorously rubbing the surfaces being cleaned that loosens the hands' transient microorganisms[5]. Recommendations regarding the duration of hand washing range from 10-30 seconds[67,78-81,180]. Interestingly, Chamberlain *et al*[82] found a tenfold reduction in the median number of transient bacteria following both long (3 minute) and short (10 second) hand washes, suggesting that the hand washing technique used is more important than the duration of hand washing. A hand wash duration of 10-15 seconds minimum is commonly recommended[5,66].

Water Flow/Volume: Studies have found that microorganisms can be reduced to a safe number on washed hands and fingertips if hands are washed under running water with the wash hand basin stopper being removed[83]. Bidawel *et al*[84] also found that the volume of water used in hand washing to be significant. The greater volume of water used the lower the rate of transfer of viruses.

Temperature: While studies have found that no resident bacteria are removed at temperatures less than 40^{0}F, it is transient microorganisms on hands (rather than resident microorganisms) that are of greatest concern in food establishments[69]. Since transient microorganisms are more easily removed by routine hand washing (not located in deep skin layers), it has been noted that water temperature may not play a role in their removal from the skin[69]. In any event, water temperatures must be within a comfortable range to the user in order to be effective and practical[69].

Taps: The handling of taps has been associated with contamination of hands[85-87]. Lever action (elbow/wrist operated) taps have been advocated to avoid hand contamination[85-88].

Nail Brushes: The use of nailbrushes is not encouraged except to remove heavy soiling which cannot be removed

by soap and water alone[87]. It has been suggested that the frequent use of nailbrushes may damage skin and increase microbial proliferation[86]. Wet or damp brushes are likely to be heavily contaminated with microorganisms[87]. If nailbrushes are used they should be sterile and dry[87,89].

4.4 Hand Wash Products

Hand wash products include unmedicated (plain) soaps, medicated soaps (antimicrobial/antibacterial) and alcohol hand disinfectants. Soaps may either be in bar or liquid form. A number of studies have been carried out to evaluate the effectiveness of a variety of such hand wash products. However, there has been no standardised approach to evaluation, making comparisons between studies difficult[69]. In the UK, existing food handler guidelines have not specified the use of particular hand wash products[1,2].

4.4.1 Plain (Unmedicated) Soap

Plain or non-antimicrobial, non-antiseptic soaps are detergent-based cleansers that have no bactericidal activity and, by mechanical action, are used for the physical removal of dirt[66]. Washing with plain soap and water has been shown to be effective in mechanically removing transient microorganisms from the hands[66,78,90]. Plain soaps are considered to be sufficient to remove transient microflora from the hands of food employees[78]. They have been recommended as adequate for the removal of microorganisms and, thereby, the prevention of the spread of gastrointestinal infections[1,83,86]. In addition plain soaps are gentle on skin, are non-allergenic and are cosmetically acceptable – important factors in promoting hand washing compliance.

4.4.2 Medicated Soap

Medicated soaps are variously termed as antimicrobial, antibacterial or antiseptic soaps. They contain ingredients active against microorganisms on the skin[66]; they are used for the mechanical removal and killing or inhibition of both transient and resident flora[66]. Fendler *et al*[65] note that the literature clearly demonstrates that antimicrobial hand washing agents can be highly effective in killing pathogens and can provide residual antimicrobial activity over a period of several hours. The antimicrobial effectiveness of medicated soap is increased with multiple applications over a number of days[91], of particular relevance when a long-term reduction in colonising microflora is needed[81]. It is to be noted that the use of medicated soaps is specified in Vertical Directives and therefore applies to some sectors of the food industry.

The impact of repeated washing with harsh substances and the sustainability of these products if they are irritant to food workers hands require consideration. In a recent review on the effects of hygiene skin products, Larson found that the integrity of the skin could be damaged by excessive washing with antiseptic preparations and this was related to more frequent colonisation by *S. hominis* and *S. aureus*[92]. Common chemicals used in medicated soaps include[66] (a) ***Chlorhexidine gluconate*** which has a broad spectrum of activity and a relatively low skin-irritation potential; several clinical studies report good reductions in skin flora after 15-second hand wash[93] (b) ***Iodine solutions*** which have a wide range of activity but have a propensity towards skin irritation and allergic effects in sensitive persons and (c) ***Triclosan*** which has good antimicrobial activity against most bacteria, is only minimally affected by organic matter and appears to be non-allergic with short term use.

Any advantages of using medicated soaps need to be balanced with possible irritant effects, possible damage to skin integrity and the potential of resistant strain emergence. The use of plain soap by food handlers for hand washing should be adequate for removing transient microorganisms; it also avoids the risks of excessive drying and irritation leading to dermatitis.

4.4.3 Alcohol Hand Disinfectants

Alcohol hand disinfectants are only effective when used on physically clean hands; they are completely inactivated by any organic matter[66,90]. They provide a rapid reduction in skin microflora and are a very effective method of hand asepsis[66,90]. Alcohol based formulations have been recommended in preference to detergent based products for health care workers[92]. Alcohol solutions have been shown to have a very drying effect on the skin causing skin irritation, although many commercially produced products now contain emollients. While alcohol formulations

containing 70% alcohols have been found to be effective in reducing the numbers of *E. coli* and rotavirus[94], alcohol products are not effective against viruses such as Hepatitis A[95]. Recent research has shown that washing hands with a mild soap was more effective than applying a 70% alcohol hand sanitizer[96].

4.4.4 Bar Soaps or Liquid Soaps?

Bar soaps have been found to have higher bacterial cultures after use compared to liquid soaps[97]. Very significantly, however, studies have found that bacteria were not transferred to hands on subsequent use[98,99]. Proponents of bar soap recommend that small bars be used and changed frequently; in addition, soap should be kept on soap racks to allow for drainage, because if soaps are left lying in a pool of water contamination is likely to result[66,89,100]. A practical issue relating to bar soaps is that they may go missing leaving no soap available.

Despite the positive evidence relating to the use of bar soaps, a number of reports have stated a preference for liquid soap for routine hand washing[87,100,101]. Overall, practical advantages in using liquid soap have been cited - including ease of access through dispensers, avoidance of contact with contaminated hands, and speed and ease of lathering. Liquid soap dispensers with disposable cartridges reduce the risks of contamination compared with refillable containers[102]. Where only refillable containers are available, it has been recommended that these need to be thoroughly cleaned before replenishing. Liquid soap dispensers should preferably be wall-mounted and operated by elbow, wrist or foot[102].

It is noted that the use of liquid soaps is standard practice in certain meat processing sectors. However, this committee considers that there is insufficient evidence to recommend the practice of liquid soap use in food premises as a standard. Both bar soap and liquid soap are considered acceptable. Use of liquid soap (with a preservative) may be more practicable.

4.5 Hand Drying

The importance of adequate hand drying cannot be underestimated. Hands must be dried adequately[103]. Wet hands facilitate the transfer of bacteria and viruses; residual moisture on hands is significantly associated with the increased transfer of microorganisms[66,104-106].

Authors differ regarding their preference for paper towels or hand dryers[107,108]. Significant reductions in bacterial counts have been demonstrated when hands are dried with paper towels, since the friction effect physically removes bacteria from hands[109]. In addition, paper towels dry hands rapidly and a dispenser can be used by several people at once[110]. While there are advantages offered by paper towels, it has been pointed out that there are also issues of hand contamination with pathogens from paper towel exit areas[69]. Hand dryers are in common use. A disadvantage of using hand dryers is that warm air currents dry the hands slowly and that each hand dryer can only be used by one person at any one time. Some authors have suggested that hand dryers may accumulate microorganisms from toilet aerosols and contaminate hands as they are dried; they have in turn recommended that paper towels are the most hygienic hand drying method[83].

While significant reductions in bacterial counts have been noted when hands are dried with cloth towels[109], they are a potential source of cross-contamination. Single cloth towels are inferior to paper towels or hand dryers in terms of bacteriologic quality[110,111]. The bacteriologic quality of *continuous* cloth towels is reported to be less than that of paper towels[109]. Proposed causes include the laundering process as well as the possibility of bacteria transfer from one user to the next as the towel is rotated and pulled in order to obtain a clean area[69]. There is a paucity of evidence relating to the use of cabinet dispensed roller towels. Despite this, it is the considered view of this subcommittee that, if properly maintained and used, their use is acceptable.

Recommended hand washing - *including hand drying* - guidelines are outlined (Table 4.1).

Table 4.1 Hand Washing Guidelines

Hands should be washed as frequently as necessary and always…

When?

- Before starting/recommencing work
- After using toilet
- Before handling cooked or ready-to-eat foods
- After handling or preparing raw food
- Before gloving and after glove removal
- After any non-food contact such as
  - after touching skin/ hair/ face
  - after coughing, sneezing, blowing nose
  - after cleaning duties
  - after shaking hands
  - after handling money
  - after handling refuse
  - after smoking

How?

- Wet hands under warm running water
- Use sufficient soap to form a good lather
- Systematically rub all parts of hands with soap and water
- Lather for 10-15 seconds minimum, vigorously and thoroughly rubbing all hand surfaces, including the fingertips and thumbs
- Rinse hands thoroughly with running water
- Dry hands thoroughly (using paper towel *or* hand dryer *or* cabinet roller towel)

4.6 Barriers to Bare Hand Contact

4.6.1 Gloves

Gloves provide a physical barrier between food and hands[87]. The use of gloves has been advocated by some as a means of eliminating bare hand contact with ready-to-eat foods and thereby preventing the transfer of pathogenic microorganisms from hands to food[86]. **However, it has been emphasised that no direct scientific evidence has been published to support the premise that use of a physical barrier (gloves) on the hands of food handling personnel prevents transfer of pathogens to food and consequently to support a requirement for no hand contact with ready-to-eat food**[68]. In the US, it has been reported that regulations prohibiting bare hand contact are viewed by the food industry as unnecessary, expensive and potentially dangerous to workers and patrons alike[72].

Gloves alone are not sufficient to prevent the transmission of pathogenic microorganisms from food employees to consumers[68]. The use of gloves may provide a false sense of security and may discourage frequent hand washing[87]. Hand washing has been strongly encouraged prior to gloving[9, 65] and after glove removal[66]. The exterior and interior of the glove can become contaminated with microorganisms if hands are not washed prior to gloving. Microorganisms may grow more rapidly on a gloved hand due to the increased levels of moisture and nutrients[5].

Glove use is only effective and acceptable when used in association with an effective handwashing regime[65,73,81,87]. If used, it has been recommended that disposable gloves should be 'single use'; food handlers should dispose of and replace gloves after handling potentially contaminated materials (e.g. money, raw food) or after putting gloved hands to their mouth or nose[65,68]. Hardly surprisingly, doubts regarding glove-changing compliance have been expressed, given that handwashing compliance is below about 50% for almost every group studied[72]. Glove use can cause users to engage in risky food handling practices or activities resulting in cross-contamination[72]. Gloves do not prevent cross-contamination as food handlers may continue to touch raw food or contaminated surfaces[65].

Many types of glove materials, with a variety of specific characteristics pertinent to overall functionality, are now available. The food industry lacks glove quality standards; studies indicate that gloves used in food service are generally poor quality and have higher leakage rates than gloves used in healthcare[65]. An additional complication of gloving is the high potential in food handlers for allergic reactions (contact dermatitis[112] and urticaria) to latex[65,113] and plastic gloves[65].

A great deal of information is available on the negative aspects of glove usage. The value of gloving in food handling settings is assumed, but has not been proven[65]. There are difficulties in proving the effectiveness of gloving. More research is needed to assess the positive effects of glove use in reducing disease transmission in the food industry. Until such evidence is available, it has been emphasised that there must be a reliance on conscientiously employed handwashing practices[72].

4.6.2 Other Barriers

Other physical barriers to bare hand contact include such items as deli tissues, spatulas, tongs and other dispensing equipment. Their use has been encouraged[114]. However, there is currently a lack of available evidence regarding the use of such barrier methods[69]. Instrument mishandling could result in indirect food contamination.

4.7 Other Personal Hygiene Aspects

Personal behaviour: Food handlers should refrain from behaviour which could result in contamination of food such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food[16].

Clothing: Recommendations with regard to appropriate clothing, general tidiness and other hygiene aspects are based on common sense and best practice. Best practice guidelines promote the wearing of suitable, clean and appropriate outer clothing by food handlers[8,14]. The use of protective clothing is recommended for certain categories of food handler; where used, protective clothing should be clean, durable and light-coloured.

Hair: Hair can be a source of microbacterial contamination. Food handlers should keep their hair neat and tidy; hair restraints (e.g. hats, hair coverings, nets) and beard restraints should be worn where appropriate to effectively keep hair from contacting exposed food. The use of hair restraints also discourages the touching of hair.

Jewellery: Jewellery can be a source of microbacterial contamination. Higher bacterial counts have been found on the hands of people with rings compared to those without[115]. Wrist jewellery may also prevent adequate hand washing[116,117]. A greater reduction in microbial counts has been shown after hand washing among those not wearing rings[118].

Face Masks: There is a legislative requirement for the wearing of face masks in the minced meat sector. It is to be noted that a number of studies currently challenge the efficacy of routine face mask use in the hospital setting by surgical staff; it has been advocated that more well designed studies are required before changes in practice can be implemented[119]. Any recommendation with regard to face mask use in the food sector is therefore beyond the scope of this document at the present time.

4.8 Infected Skin Lesions & Purulent Discharges

There is potential for food handlers with infected lesions on exposed body parts to contaminate food with *Staphylococcus aureus* or streptococci. Hence the importance of ensuring that infected lesions on exposed areas of the skin (hands, arms, face, neck, scalp) are adequately covered with a clean waterproof dressing. Waterproof dressings are necessary to ensure that microorganisms from an infected lesion do not contaminate the food being handled. Cuts on exposed parts should be similarly covered as such dressings also prevent bacteria from food, especially raw meat or fish, infecting cuts[117]. Coloured dressings (e.g. blue or green) are preferred, and are commonly used, as their colour makes them more visible in food should they become detached. Where metal detection is part of the food production process, it is recommended that metal strip plasters be used to facilitate their detection in the product. Fingernails should be kept short and clean.

Purulent (pus containing) discharges of the eye, ear, nose or mouth/gums are also a potential source of food contamination. The reporting of these infections by food handlers, and of skin lesions as above, is further considered in Chapter 5.

4.9 Vomitus in Food Preparation Areas

It is the responsibility of management to ensure that toilets, hand washing facilities and food contact surfaces in food premises are maintained to the highest standard. This is especially critical after contact by anyone reporting diarrhoea or vomiting.

Specific mention is here given to the risks of food contamination with Norovirus from an infected food handler. Norovirus has been shown in Chapter 3 to be a frequent cause of outbreaks involving infected food handlers. Within the general community, circulation of Norovirus is common, causing sporadic cases and small clusters of gastroenteritis. It has been reported in the UK that over 1500 times more cases occur in the community than are recorded[120]. Vomiting is a prominent symptom in Norovirus-associated gastroenteritis. Onset of vomiting can occur with little or no warning. Norovirus can be detected in vomitus, and in some incidents, staff have vomited in kitchens. Minimisation of the risk of transmission of infection by vomiting is problematic. Besides direct gross contamination of food, aerosols produced by vomiting could contaminate food or alternatively lead to contamination of work surfaces with the potential for subsequent transfer to foods[121].

Recent recommendations have been made by the PHLS Viral Gastroenteritis Working Group in relation to hospital outbreaks of gastroenteritis due to Norovirus[122]. Where vomiting has occurred in a food preparation area, it has been recommended that the vomit should be carefully removed (wearing disposable gloves and apron), the area cleaned (with detergent, hot water and disposable cloth), the food preparation area disinfected (with a freshly prepared hypochlorite-based cleaner that releases 1,000 ppm of available chlorine) and any exposed food/food that may have been contaminated destroyed. The Centers for Disease Control and Prevention, in a recent review of the public health consequences of Norovirus, makes similar disinfection recommendations. It notes that, because environmental surfaces have been implicated in the transmission of enteric viruses, surfaces that have been soiled should be cleaned with an appropriate germicidal product (e.g. 10% solution of household bleach) according to the manufacturer's instructions[123].

4.10 Conclusion

The training of food handlers in good hygiene practices is a most critical element in reducing contamination risks to food. *Good hand hygiene is the key risk reduction measure* in the prevention of transfer of potentially harmful microorganisms on hands to food and ultimately to consumers of that food.

The hands of food handlers can be readily contaminated with microorganisms, usually from the gastrointestinal tract. Effective hand washing is crucial. Hand washing with soap and water, followed by thorough hand drying, is effective in removing transient microrganisms from hands. Thorough hand washing, at the right times and with a cosmetically acceptable formulation, is more important than the type of soap used. There is a low general awareness of the importance of hand hygiene regimens by food handlers[65]. Education and training programmes as well as measures to promote compliance are needed throughout the food industry.

It is stressed that glove use is only effective and acceptable when used in association with an effective hand washing regime. The complete covering of skin lesions and cuts on exposed areas of skin with distinctive waterproof dressings is important. Other personal hygiene measures include keeping fingernails short and clean, wearing suitable clean outer clothing, keeping hair neat and covered, and minimising the wearing of jewellery.

A supportive work environment is essential to ensuring that staff understand, are trained, are supervised, are encouraged and are provided with adequate and well-maintained facilities to allow for the practice and maintenance of good personal hygiene standards at all times.

Recommendations

Training/Instruction/Supervision

- The key to the prevention of contamination of food by food handlers is food handler training and the ability to maintain high standards of hygiene. Food handlers should be adequately supervised.

- Food handlers should have ongoing *training and instruction* in the importance of personal hygiene and hand washing. Appropriate language translation, where necessary, is a fundamental element of training. There should be regular assessment of knowledge and practice.

Hygiene Facilities

- Convenient, adequate and well-maintained hand washing facilities should be located in all areas of a food premises including kitchen, staff changing and toilet areas.

- The provision of convenient, adequate and properly maintained toilet facilities is essential. Sanitary facilities for staff should be separate from those provided for patrons.

Hand Hygiene

- The hand washing guidelines as outlined in Table 4.1 are recommended.

- Ideally, taps should be non-hand operable. Non-hand operable taps should be considered when upgrading or refurbishing premises.

- The use of plain (unmedicated) soap for hand washing is effective and is recommended as adequate (while acknowledging that alternatives are specified in Vertical Directives).

- Both bar soap and liquid soap are acceptable. Use of liquid soap (with a preservative) may be more practicable. Ideally, dispensing of liquid soap should be by means of disposable cartridges (i.e. topping up of dispenser not required). Otherwise, dispensers should be readily accessible for cleaning and drying.

- The use of nailbrushes is not recommended except to remove heavy soiling which cannot be removed using soap and water alone.

- Paper towels (in a compatible dispenser) or hand dryers are recommended for hand drying. Properly maintained mechanical roller towels (cabinet roller towels or CRTs) are also acceptable.

Gloving

- It is considered that, in view of the lack of direct scientific evidence regarding the effectiveness of glove use in food handling, it is not currently possible to make a categorical recommendation regarding whether or not gloves should be used.

- The widespread use of gloving in relation to ready-to-eat foods is acknowledged. Where gloves are used, it is imperative that they are used in conjunction with an effective hand washing regime (hands washed before gloving and after glove removal), are of good quality, intact and are single use i.e. used for one task only such as working with ready-to-eat food or with raw food, used for no other purpose, and discarded when damaged or soiled, or when interruptions occur in the operation.

Infected Lesions/Cuts

- Food handlers should ensure that infected lesions and cuts on exposed areas of the skin (hands, arms, face, neck, scalp) are totally covered with a distinctively coloured waterproof dressing. Metal strip plasters should be used where appropriate.

Other

- Food handlers should wear suitable, clean and appropriate outer clothing. Hair should be kept neat and tidy. Hair restraints and beard restraints should be worn where appropriate. Jewellery wearing should be kept to a minimum.

- While no recommendation in relation to mask use is considered possible because of paucity of evidence, the legislative requirement regarding mask use in some sectors is acknowledged.

- Where vomiting occurs in a food handling area, exposed food should be disposed of. The area should be cleaned and subsequently disinfected with a freshly prepared hypochlorite-based cleaner that releases 1,000 ppm of available chlorine (according to manufacturer's instructions).

Chapter 5
Illness Reporting

5.1 Introduction

The reporting by food handlers to management of illnesses or symptoms that might be relevant to the spread of foodborne disease is integral to prevention – most especially in the case of the high-risk food handler. Such conditions should be reported so that any need for possible temporary restriction in food handling duties, exclusion from food handling, or for medical advice can be considered. In addition, it affords management the opportunity to reinforce personal hygiene advice. As previously outlined in Section 2.5.2, there is also a legislative basis to reporting. The *Codex Alimentarius* states that 'any food handler known or suspected to be suffering from, or to be a carrier of, a disease or illness likely to be transmitted through food …… should immediately report illness or symptoms of illness to management'[16]. The standards, guidelines and other recommendations of the Codex Alimentarius Commission are considered to reflect international consensus regarding the scientific requirements for protecting human health from foodborne risks.

5.2 What should be Reported?

Food handlers should be aware of the need to report to management immediately if they are ill. The pathogens responsible for diseases/illnesses which can be transmitted from infected food handlers via food are listed (Table 5.1). Confirmed illness due to, or carriage of, such pathogens as Typhoid, Paratyphoid, Verocytotoxin-producing *E. coli* (VTEC) and *Shigella dysenteriae* are of particular relevance as exclusion of high-risk food handlers is always applicable in such instances until microbiological clearance criteria for work resumption are met (Chapter 7).

Table 5.1 Pathogens/Conditions Transmissible by Infected Food Handlers via Food

Aeromonas	Salmonellosis (*Salmonella* spp)
Amoebic Dysentery *(Entamoeba Histolytica)*	*Salmonella typhi/paratyphi* (Enteric Fever)
Campylobacter spp	*Shigella* spp
Cholera	*Staphylococcus aureus*
Cryptosporidium spp	Streptococcal disease
E. coli (other than VTEC)	Vibrios (non-cholera)
E. coli (VTEC)	Viral gastroenteritis (Rotavirus)
Giardiasis (*Giardia lamblia*)	Viral gastroenteritis (Norovirus)
Hepatitis A	*Yersinia* spp

The relevant symptoms which should be reported have been listed by the Centers for Disease Control and Prevention (CDC) as commonly experienced by people suffering from pathogens transmissible through food by infected food handlers: diarrhoea, vomiting, jaundice, fever and sore throat with fever[5]. A food handler suffering from any of these

symptoms presents an increased risk of transmitting foodborne illness[5]. Visibly infected skin lesions e.g boils, cuts[2,16] and discharges from the eye, ear[2,16], nose[16] and mouth/gums[2] are also relevant as there is the potential to contaminate food with *Staphylococcus aureus* or streptococci.

The symptoms/conditions listed (Table 5.2) may therefore be indicative of a disease that could potentially be transmitted through the food supply by infected food handlers and should be reported. **Gastrointestinal symptoms of diarrhoea and/or vomiting are highly significant; these symptoms have been most frequently associated with outbreaks involving infected food handlers.** A liquid stool in particular is liable to contaminate the hands and the environment, facilitating the spread of gastrointestinal pathogens. While certain pathogens causing gastroenteritis may be passed in the stools for varying periods after recovery from illness, transmission at that stage is generally unlikely provided that good hygiene is practised by the food handler.

Table 5.2 Conditions which should be Reported

- **Diarrhoea**
- **Vomiting**
- Jaundice
- Fever
- Sore throat with fever
- Infected skin lesions (e.g. boil, infected wound) or cuts on exposed body parts (hand, arm, face, neck or scalp)
- Pus-containing discharges from the eyes, ears, nose or mouth/gums

(Gastrointestinal illness while on holidays, especially overseas, should also be reported on return)

5.3 Subsequent Action

Supervisors should use their discretion as to whether or not those who report relevant illnesses/conditions need to be temporarily subjected to certain restrictions or exclusion from food handling duties. Medical advice will at times be necessary in the decision making process. General exclusion criteria and fitness to work are examined in Chapter 6; actions with regard to food handler infection with specific pathogens are detailed in Chapter 7.

Diarrhoea/Vomiting: Any food handler with diarrhoea and/or vomiting should immediately cease food handling and report the condition to their line manager[2]. No food handler with gastroenteritis should work while symptomatic. While it is initially very difficult to be certain whether one bout of vomiting or diarrhoea is infectious, if there is only one bout in a 24-hour period, and it is not associated with fever, it is reasonable to assume that it is not infectious and the person may resume food handling duties[2]. Otherwise, as a general rule, any food handler with diarrhoea and/ or vomiting should be excluded from work until 48 hours after symptoms have abated and stools have returned to normal (where the causative pathogen has not been identified) – c.f. Section 6.7. Where the pathogen has been identified, specific exclusion criteria are addressed in Chapter 7 & APPENDIX D.

Jaundice: c.f. Chapters 6/7.

Sore throat with fever: Streptococcal sore throat is only of significance in the context of the high-risk food handler and is considered in Chapter 7.

Infected skin lesions/purulent discharges: Infected lesions containing pus on the hands/wrists/arms represent a direct threat for introducing *S. aureus* into food[5]. Consequently, an impermeable bandage/waterproof dressing should completely cover such lesions. Lesions on other exposed parts of the body (face, neck, scalp) should also be covered. Food handlers should be aware that hands and fingers that contact pustular lesions on other parts of the body or with the mucous membranes of the nose also pose a direct threat for introducing *S. aureus* into food[5]. Cuts can become sites of infection; cuts on exposed body sites should be similarly covered. Those with purulent discharges from the eye, ear, nose or mouth/gums should not work near open food and may need to be restricted to non-food handling activities until recovered.

Hygiene Advice: Reporting always presents an opportunity to management to ensure that personal hygiene advice is vigorously reinforced.

5.4 Reporting Challenge

The challenge of illness/symptom reporting by food handlers, a most critical aspect of food safety, should not be underestimated. Many fail to report[124]; *anecdotal evidence suggests that it is an all too rare occurrence, even among high-risk food handlers*. The importance of reporting needs repeated emphasis: at pre-employment (with handout), at refresher training and annually. Appropriate translation for non-nationals should be an indispensable component. Reporting by high-risk food handlers merits concerted, ongoing focus. The training of managers is especially significant.

Food handlers should neither suffer financially nor be penalised on foot of health surveillance demands. The use of casual labour in the food industry – especially the catering sector – and the financial penalties which can be incurred by staff if absent due to illness, does not encourage the reporting of illness. Food handlers need reassurance that they will not suffer loss of pay if they report illness, or symptoms such as diarrhoea/vomiting, or any other circumstance that could post a risk to hygienic food production. Disincentives to the honest disclosure of symptoms should be tackled. An important consideration in relation to food handler exclusion centres around loss of pay. The adoption of a work policy that includes paid leave for ill employees with gastroenteritis would probably increase compliance with illness related work exclusion policies[18].

Recommendations

Reporting

- Relevant infections, and those conditions outlined in Table 5.2, should be reported by food handlers to management. Infections of particular relevance which should be reported: Typhoid, Paratyphoid, Verocytotoxin-producing *E. coli* (VTEC), *Shigella dysenteriae* and Hepatitis A.
- The importance of reporting needs to be repeatedly emphasised at pre-employment (with handout), at refresher training and annually. The training of managers is especially crucial in this regard. Appropriate language translation for staff, where necessary, is an essential aspect.
- Illness/symptom reporting by high-risk food handlers needs concerted, ongoing focus
- Ilness/symptom reporting by food handlers should be facilitated by management without fear of penalty or financial loss

Chapter 6
Health Surveillance & Fitness to Work

6.1 Introduction

The relative merits, costs and benefits of the health screening of food handlers remains the subject of debate. This, despite past conclusions of expert committees and working groups which have questioned the relevance of routine medical examination of food handlers and which have recommended education in hygienic practices as a much more effective preventive measure in the control of foodborne diseases[10].

The questions posed on the topic of food handler health screening in relation to fitness to work with food are multi-fold. These relate to the use of health questionnaires, whether pre-employment or otherwise; the undertaking of medical examinations; the requirements for medical certification; the conducting of microbiological screening whether routinely, during sporadic illness or in an outbreak situation; and the criteria for exclusion from food handling duties.

6.2 Health Surveillance: Lack of Standardisation

Lack of uniformity is evident in the procedures adopted by countries in undertaking health surveillance of food handlers. Routine medical examinations or microbiological screening tests are variously undertaken in assessing fitness to work as a food handler.

6.2.1 European Dimension

In the course of researching this report, sixteen European countries were surveyed to ascertain the health surveillance procedures currently in place in those jurisdictions. Eight countries responded – France, Italy, Denmark, Sweden, Germany, Austria, Finland and Greece.

The term food handler or food worker is used in most countries to define workers who work with food, with the terms being used interchangeably by some. A legal definition of food handler/food worker is in operation in four countries. A regulatory framework relating to food handler fitness to work is in place in all responding countries; two utilise additional guidance documents. Pre-employment screening of workers is undertaken in seven of the eight responding countries. There is wide variation in approach. The systems reported to be in place are outlined (Table 6.1).

In all countries, food handler exclusion from work following illness is dependent on the particular circumstances of the illness. Most countries (7) place restrictions on food workers following illness. Where there is no microbiological diagnosis, two countries do not exclude workers, while four countries exclude while symptomatic; two countries did not respond.

Table 6.1 Pre-employment Screening
(Survey of 8 European Countries)

Country	Pre-employment Screening
France	Stool culture for salmonella, shigella, stool microscopy for amoeba, nasopharyngeal swab for staphylococcus, pharyngeal swab for Streptococcus Group A.
Italy	A medical visit and questionnaire on knowledge of food.
Denmark	Food workers working with milk, fish, meat and eggs at wholesale level (according to EU Directives) must undergo a medical examination. There is no requirement for stool sampling unless there is an indication for same.
Sweden	Pre-employment medical examination for those working with milk, fish, meat and eggs.
Germany	All food handlers must have certified education by local health authorities before starting work and afterwards, annual repetitions by employer. In some specific factories, according to EU directives (eggs and fresh meat) stool samples have to be tested before a person starts working.
Austria	Before starting work, food handlers examined for infectious diseases, including chest x-ray and stool examination. Stool exams repeated every year; chest x-rays at 2 yr intervals.
Finland	Pre-employment stool salmonella investigation.
Greece	Food workers must have Health Booklet issued by District Public Health Authority.

Surveyed by: Food Handler Subcommittee NDSC

Six of the responding countries have organism-specific exclusion criteria. The criteria vary substantially between countries. They range from a requirement of three negative samples before allowing return to work, to not allowing a healthy carrier of shigella to work with unpacked foods, to allowing return to food handling when asymptomatic.

The circumstances where food handlers are required to provide stool samples are diverse and reveal little consistency between countries. Circumstances include employment commencement, routine annual examinations, where infection or carriage is suspected, following sick leave for gastrointestinal illness, outbreak situations and following travel abroad in some instances (Table 6.2).

Table 6.2 Stool Sample Requirements
(Survey of 8 European Countries)

Country	Circumstances where food handlers are required to provide stool samples
France	*At start of employment and after interruption of employment of greater than six months *If foodstuffs contaminated and transmission by food handler suspected *After sick leave for gastrointestinal or respiratory illness
Italy	In 'old' regulations, food handlers were required to provide stool samples for testing each year for enteropathogenic bacteria before licence renewal. This practice now abandoned in most regions because of huge resources required and lack of efficacy. *Samples can be requested if disease or carriage suspected.
Denmark	Yes; if well founded evidence that an outbreak source is contamination from staff
Sweden	Yes; food workers always sampled when circumstances indicate that it is meaningful
Germany	Yes; on request of local health authorities in case of investigation of Infectious Disease
Austria	Yes; annual routine examination
Finland	Yes; employer can request stool sample if employee has traveled abroad
Greece	Yes; when responsible physician requires it

Surveyed by: Food Handler Subcommittee NDSC

6.2.2 Ireland

Lack of standardisation is evident in this country also - in terms of different food premises management demands, varying approaches of individual health professionals to health surveillance in practice and the specific legislative requirements applicable to some sectors. However, two sets of guidelines produced in the UK in 1995 have served as very useful reference sources: '*Food Handlers Fitness to Work*'[2] prepared by an expert working group convened by the Department of Health and '*The prevention of human transmission of gastrointestinal infections, infestations and bacterial infestations*' produced by a Working Party of the PHLS Salmonella Committee (PHLS 1995)[1] . The latter is currently under review.

A more standardised approach to food handler health surveillance, based on best evidence where such is available, would provide greater clarity and would better inform local professional judgement. **It is emphasised, however, that the key to the prevention of contamination of food by infected food handlers is food handler training and the ability to maintain high standards of hygiene**. A food handler does not have to suffer from overt infection to pose a threat to food safety[10]; there is ample evidence that pathogens can be transmitted in the pre-symptomatic[28] and post-symptomatic phases of illness.

6.3 What constitutes fitness to work as a food handler?

Irish and EU Legislation place an onus on employers to satisfy themselves that no food handler poses a hygiene risk to the product.

Employers therefore need to satisfy themselves that their food handling employees:
- undergo appropriate induction and training
- understand the principles of hygiene (the absence of which is the single most important impediment to work as a food handler)
- are fit to handle food and to establish, if indicated, confirmation of the absence of specific foodborne pathogens
- undertake to report any illness that could pose a risk to food safety

Based on the assessment of risks posed by food handlers infected with potentially foodborne pathogens in Chapter 3, it is reiterated that the most pertinent risk factors are:
- poor hand hygiene - the most common mode of pathogen transmission to food by an infected food handler being via faecally contaminated hands
- the unhygienic handling of unwrapped foods to be consumed raw or without further cooking or other forms of treatment
- gastrointestinal symptoms of diarrhoea and/or vomiting, with the pre- and especially the post-symptomatic phases also being of relevance (notably in relation to norovirus)
- Infection with Hepatitis A

In conjunction with relevant guidance documents[1,2,4,5,10,16], the general principles of fitness to work are outlined (Table 6.3)

Table 6.3
FITNESS TO HANDLE FOOD - GUIDELINES FOR MEDICAL ASSESSMENT
(in conjunction with APPENDIX D)

Personal Hygiene
- Promotion of good personal hygiene, most especially hand washing, in all circumstances

Gastrointestinal
- No symptoms of infectious gastrointestinal illness (no vomiting or diarrhoea for at least 48 hours after symptoms have abated and stools have returned to normal) – where causative organism has not been identified.
  - Routine stool screening not necessary for all sporadic cases -
- Where pathogen has been identified, c.f. APPENDIX D

- Microbiological stool clearance before return to work always applicable to high-risk* food handler in relation to confirmed or suspected infection with Typhoid, Paratyphoid, Verocytotoxin-producing *E.coli* (VTEC) and *Shigella dysenteriae* (c.f. Chap 7)

Jaundice
- No symptoms/signs of Hepatitis A infection within previous 7 days (c.f. Chap 7)

Skin
- No infected skin lesion or cut on an exposed body part (specifically hand, arm, face, neck or scalp) that cannot be totally covered during food handling

- Skin conditions predisposing to skin infection (e.g. eczema) on exposed parts require individual assessment

Discharges
- No purulent discharge from eye, ear, nose or mouth/gums

Throat
- No evidence of acute streptococcal sore throat in high-risk* food handler (c.f. Chap 7)

***High-risk food handler: work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment**

The issues which arise in relation to assessment of fitness to work include:
- the use of health questionnaires
- the role of medical examination
- the question of microbiological screening
- the grounds for exclusion from food handling duties

6.4 Health Questionnaires

In practice, the most effective methods of reducing contamination risks to food will remain training individuals in good hygiene practices and the reporting of illness[125]. There is no evidence that routine use of health questionnaires prevents the spread of infection from an infected food handler. Only 'snapshot' information about health status at a particular point in time is provided. Additionally, the accuracy of the completed questionnaire is dependent on the understanding of the questions by, and the honesty of, the employee. The process may foster a false sense of security.

Nevertheless, the routine use of health questionnaires for prospective food handling employees is common practice among Irish food industry exemplars. Expert opinion also seems to generally favour their use for pre-employment screening[2,5,10,124,125] . The US Food Code takes the view that proper management of a food establishment operation begins with employing healthy people and instituting a system of identifying employees who present a risk of transmitting foodborne pathogens to food or to other employees[5]. The WHO has pointed out that short questionnaires can focus on the few conditions of relevance to food safety[10].

A recent survey of the Food Industry Medical Association (FIMA), comprising mainly occupational physicians representing food manufacturers, retailers and distributors in the UK, supported the use of pre-employment questionnaires, irrespective of employment type[125]. It suggested that the format of the questionnaire would enable the applicant to complete the questionnaire without including medical details. Forms with no positive answer could be 'passed fit' by non-medical/nursing personnel; those indicating a possible health problem should be assessed by a health professional. However, others have expressed concern regarding medical confidentiality aspects of such questionnaires, insisting that they should be inspected and interpreted only by health professionals[124].

This committee considers that, if used, pre-employment health questionnaires play a subsidiary role to the absolute importance of (a) training and instructing employees in good hygiene practice and the safe handling of food and (b)

reporting of relevant conditions by the food handling employee. The committee acknowledges that health questionnaires, although merely a 'snapshot' of health status, present an opportunity to underscore the absolute importance of reporting any relevant illness or circumstance that could pose a risk to food safety. It is therefore considered that the incorporation of relevant issues into a health questionnaire is appropriate (APPENDIX A). Cognisant of best practice within the industry, the use of such questionnaires is supported as an adjunct to – but not as a substitute for – the absolute requirement of reporting. The use of health questionnaires may not be an issue for companies who have access to occupational health services, but many medium and smaller companies involved in food production, preparation, service and retail may not have access to occupational health services. Ideally, those practitioners giving medical advice should have relevant occupational health training.

The routine use of health questionnaires, other than at recruitment or in conjunction with the legislative requirement for medical certification (Section 6.6), is considered to be unnecessary if 'on-the-job' reporting of relevant conditions by food handlers is actively encouraged and facilitated by management. The latter is the more effective approach, alerting management to relevant food handler illnesses/circumstances on an ongoing and timely basis.

The benefit of pre-employment health questionnaires is unproven. There is insufficient evidence to recommend them as standard practice. Their use is supported as an adjunct to appropriate training in good hygiene practice and safe food handling, and the reporting of relevant conditions by food handlers.

6.5 Medical Examination

Medical examination of a food handler should be carried out if clinically or epidemiologically indicated. The question of *routine* medical examination is a separate issue.

6.5.1 Is Routine Medical Examination necessary?

The information obtained from a health examination is valid only for the time at which it is carried out. Routine medical certification of a food handler's fitness to work can only declare that the individual is not, *at that point in time,* suffering from any impediment to employment as a food handler on public health grounds[10]. Medical certification cannot declare an individual free of medical considerations for the future. Physical examination will not detect carriers of gastrointestinal disease. There is no evidence that pre-employment or routine examinations are of value in the prevention of foodborne disease[2,10,124]. Routine medical examinations of food handlers are viewed as costly - in time and money, ineffective and unnecessary[10].

While some employers in this country choose to have routine medical examinations for their food handling employees (e.g. pre-employment), there is no requirement for medical certification of food handlers under Ireland's general food hygiene legislation i.e. under the *Food Hygiene Regs*, 1950 (S.I. 205 of 1950) or *the European Communities (Hygiene of Foodstuffs) Regs, 2000* (S.I. 165 of 2000). Rather, these Regulations require that staff report illness and that proprietors question staff, excluding them from work if necessary.

There is no scientific indication for *routine* medical examination of food handlers in the prevention of spread of foodborne pathogens, whether on recruitment or otherwise. The practice is not recommended, unless required by legislation.

6.5.2 EU Directives Requiring Certification

Some EU Directives, however, demand pre-employment and/or routine (annual) medical examination of food handlers in some sectors (c.f. Section 2.6.4). Annual medical certification is a legal requirement for food workers in meat plants, plants producing meat products and minced meat production plants; workers in the dairy sector who handle raw milk have to ensure that there is no impediment to such employment; medical certification is required of food workers in the fish processing sector at the time of recruitment. For these groups there is an obligation "to prove, by

a medical certificate, that there is no impediment to such employment" and, where annual certification is a prerequisite, that "medical certificates shall be renewed every year unless another staff medical check up scheme can offer equivalent guarantees to the satisfaction of a veterinary inspector".

Doctors working in the UK food industry consider the routine certification of meat workers to be of doubtful value[124], there being no epidemiological evidence that routine certification will reduce the incidence of food poisoning. Hardly surprisingly, this inconsistency is a source of some confusion within the general food sector in that, for instance, food handlers working in the meat processing sector need routine medical clearance while those working with ready-to-eat foods do not.

The single most important impediment to working as a food handler is a lack of understanding and awareness of the principles of hygiene[2]. The legal requirement for certification presents an opportunity to reinforce good hygiene practice and to emphasise the reporting of relevant illnesses/conditions that could pose a risk through food handling.

The legal requirement for medical certification of food handlers should be used as an opportunity to promote personal and food handling hygiene, and to emphasise the importance of illness reporting.

6.5.3 Medical Consultation and Fitness to Work

In addition to the legislative requirement for medical certification in some sectors, medical examination of a food handler should be carried out if clinically or epidemiologically indicated – this may be appropriate at various times following certain instances of illness reporting or sick leave, following assessment of a completed health questionnaire, or in an outbreak situation.

The UK Food Industry Medical Association (FIMA) has suggested that guidelines for health practitioners could be developed to ensure competence in making decisions on fitness to work[125]. The general principles outlined in Table 6.3 are applicable, covering the key issues in relation to fitness to work as a food handler. A template for medical certification, which could be used by the medical practitioner, is appended (APPENDIX B). A food handler advice sheet on 'Good Hygiene Practices and Reporting Requirements' is also appended (APPENDIX C) which could be given to, and discussed with, the food handler as part of the health consultation process – serving to reinforce the ongoing importance of personal hygiene and reporting.

Specific Health Considerations:

- **Stool screening:** The requesting of stool samples will depend on individual assessment; stool sampling does not need to be routinely done in all sporadic cases of gastroenteritis. Negative stool samples from an employee recovering from a diarrhoeal illness are not necessary conditions of returning to work, with the exception of certain specific infections[2]. However, stool microbiological clearance will always be necessary before declaration of fitness to work for the high-risk food handler who has had Verocytotoxin-producing *E. coli* (VTEC), *S. typhi, S. paratyphi* or *Shigella dysenteriae* infection. Consultation with the Director of Public Health/Designated Medical Officer or Consultant Microbiologist is advised. Details on pathogen-specific microbiological clearance requirements are discussed in Chapter 7. It is recommended that all laboratory request forms should specify 'food handler'.

- **Bowel Disorders:** There is no reason why a person with inflammatory bowel disease should not work as a food handler, provided that the normal standards of personal hygiene expected of such a worker are satisfied. Although these patients may always have loose stools, they are usually able to recognise any changes from their normal pattern which would indicate a superimposed gastroenteritis[124]; they should be aware of the need to notify their managers in such instances.

  Decisions relating to fitness to work as a food handler in the case of someone with an ileostomy or colostomy should depend on the individual's level of personal hygiene[124]. The bacterial content of ileostomy effluent is one-twentieth that of normal faeces; colostomy effluent has a bacterial content more akin to normal faeces[124].

- **Skin Diseases:** Skin problems such as eczema and psoriasis are common. Lesions of eczema are very frequently colonised or infected by *S. aureus* and sometimes by *S. pyogenes*. Such organisms are dispersed into the environment on naturally shed skin scales[126], with catering industry implications[124]. The hazard presented by active eczema is real and requires individual assessment of risk[124]. Colonisation of psoriatic lesions with potentially pathogenic bacteria is less of a problem than in atopic eczema[124]. However, lesions involving the hands and forearms or the scalp (common) and face (rare) present a potential hazard[124]. It is not possible to be prescriptive about such skin diseases; small scaly lesions on exposed parts should be covered; larger lesions, especially on hands/forearms/face/neck/scalp should be subject to individual medical assessment and advice. It has been recommended that skin conditions require thorough dermatological investigation in order to diagnose them sufficiently accurately to give reliable medical advice about employment[124].

- **Chest/Respiratory Diseases:** There is no evidence that chest and upper respiratory tract infections pose a risk of food contamination. A history of tuberculosis does not pose a risk to food. However, the infection may affect an individual's health in such a way as to make them unfit for work or they may pose a risk of infection to others in the workplace.

- **Blood-borne Infections:** Blood-borne infections (notably Hepatitis B, Hepatitis C and HIV) do not present a risk as far as microbiological contamination of food is concerned. Provided those affected are well, there is no contraindication to their employment as food handlers.

6.6 Microbiological Screening

6.6.1 Pathogen Excretion (Stools)

Gastrointestinal pathogens are excreted, often in very large numbers, in the acute phase of disease when stools are characteristically loose and frequent. There is, however, a significant difference between those who are acutely ill from a gastrointestinal infection and those who continue to excrete the organism after the clinical illness is over. The latter have recovered clinically, have normally formed stools and excrete diminishing numbers of organisms as time passes. Those with diarrhoea present a far greater risk of spreading infection than do known symptom-free excreters, but even symptom-free excreters with poor or doubtful standards of personal hygiene pose a potential risk. Clinically well excreters with normal formed stools and good personal hygiene standards pose minimal risk[3]. Several studies support the conclusion that asymptomatic excreters play a minor role in initiating outbreaks of infectious intestinal disease[127].

6.6.2 Routine Microbiological Screening

Periodic testing of asymptomatic food handlers for the presence of diseases transmissible through food is not cost effective or reliable[5] – whether routine microbiological screening of stools or routine swabbing of the skin, nose or throat.

As with routine health examination, the information obtained from microbiological examination of stools for pathogens is valid only for the time at which it is carried out. This lack of support for routine stool screening of food handlers is consistent with the view of the WHO[10]. Importantly, the risk of pathogen transmission by a person with normally formed stools (if practising good hygiene) is minimal. Also, a negative result does not necessarily mean there are no pathogenic organisms in the specimen, only that none were detected by the test at that particular time. Other findings support the lack of necessity for routine stool screening of food handlers. Following a food handler associated salmonella outbreak that occurred despite routine surveillance cultures of kitchen employees, it was concluded that routine screening of food handlers was not cost-effective and should not be used as a substitute for education and proper hygienic practices[39]. A study which looked at the prevalence of pathogenic microorganisms in over 1,000 asymptomatic individuals in Australia noted that pathogens were rarely found in asymptomatic individuals in the community[128].

Additionally, in outbreaks traced to food handlers (Chap. 3), contamination of food has been noted to have typically occurred either during (most usual) or shortly before/after an acute illness – routine screening would not have

detected or prevented these acute illnesses. Contamination is infrequently traced back to an asymptomatic carrier. Carriers of *S. typhi*, who may cause foodborne outbreaks while asymptomatic, are a probable exception to this rule. Routine screening might detect some chronic *S.typhi* carriers, but a great deal of effort would be needed to find even one carrier; it is hard to justify such enormous resources in terms of expense and time[10].

Routine stool screening of food handlers has no scientific support and is not recommended. Neither is there any indication for _routine_ skin, nasal or throat swabbing.

6.6.3 Sporadic Illness

Sporadic gastrointestinal illness is common. In England, it has been established that 20% of the general population suffer from infectious intestinal disease every year[6]. Some experts have recommended that, in the general population, stool specimens should be taken from all sporadic cases[1]. However, it has been pointed out that because of its low yield in unselected specimens, stool culture is often cost ineffective[129]. Extrapolating from this, the value of stool sampling in all sporadic food handler cases of gastrointestinal illness is questionable. Additionally, negative stool samples from a food handler are not necessary conditions of return to work following recovery from diarrhoeal illness, with the exception of certain specific pathogens[2].

Stool screening may be indicated for food handlers with symptoms of gastrointestinal illness based on individual risk assessment, taking account of such factors as illness severity and personal hygiene practice. It is always recommended where there is suspicion of infection (either case or carrier) with Verocytoxin-producing *E. coli* (VTEC), *Typhoid*, *Paratyphoid* or *S. dysenteriae* in a high-risk food handler, or where a relevant contact history in relation to these pathogens exists (c.f. Chap 7).

Stool screening may be indicated for food handlers with symptoms of gastrointestinal illness based on individual risk assessment, taking account of such factors as illness severity and hygiene practice.

Stool screening for suspected illness due to, carriage of, or relevant contact with Typhoid/Paratyphoid/ VTEC/_Shigella dysenteriae_ is always indicated for high-risk food handlers.

6.6.4 Outbreak Situation

Following a suspected food poisoning incident, standard investigative procedures are adopted in an effort to identify factors which may have led to the outbreak and to implement control measures. The investigation includes epidemiological, environmental and microbiological elements. Screening of food handlers may be indicated in the course of the investigation. Depending on the outbreak and the pathogen suspected or identified, such screening may involve the requesting of stool specimens, nasal/throat/skin swabs or screening for the presence of skin lesions on exposed parts of the body or for symptoms/signs of jaundice. Decisions relating to microbiological screening are generally agreed by the investigating Director of Public Health/Designated Medical Officer in consultation with the local Consultant Microbiologist, and with the Principal Environmental Health Officer as appropriate.

It is not possible to be prescriptive but, broadly speaking, such screening may be indicated where:
- there is evidence of current or recent illness among staff or
- a food handler carrier is suspected or
- the pathogen has not been identified or
- to confirm a food handler link

The basis for the above is evidenced from the literature review in Chapter 3, where there are numerous instances of outbreak causation being solved, the pathogen identified, exclusion criteria applied to prevent the possibility of further spread, and where proven links have been established on the basis of food handler screening in outbreak situations.

It has been pointed out in relation to Norovirus that outbreaks are often reported too late for obtaining satisfactory stool specimens from initial cases and it may be easier to obtain samples from secondary cases[121] - who may be food

handlers. In the case of possible implication of food handlers, it is often worth examining stool samples from them, even if they deny illness, since positive results can help to confirm the link with the kitchen where the food was prepared[121].

Screening in an outbreak situation may involve the requesting of stool specimens, nasal/throat/skin swabs or screening for the presence of skin lesions on exposed parts of the body or for symptoms /signs of jaundice (depending on the outbreak and the pathogen suspected/identified).

Criteria for microbiological screening may be varied at the discretion of the Director of Public Health/ Designated Medical Officer, in consultation with the Consultant Microbiologist and Principal Environmental Health Officer as appropriate, following an individual or outbreak risk assessment.

6.7 Work Exclusion/Restriction

In certain circumstances, food handlers will need to be temporarily excluded from work or restricted to non-food handling duties to reduce the risk of spreading infection via food. The decision to exclude or restrict any food handler should be based on individual risk assessment.

The degree of risk posed may be influenced by several factors:
- the infecting organism (if known) and its infectivity
- the clinical state of the food handler
- the exact nature of the food handling activity
- the standard of hygiene of the food handler
- the availability of adequate hygiene facilities at work
- the susceptibility of the population being served

Gastrointestinal Infection:

The evidence implicating infected food handlers with foodborne pathogen transmission clearly indicates that the risk is greatest for those who are clinically ill with gastrointestinal symptoms. All cases of gastroenteritis should be regarded as potentially infectious, although diarrhoea and vomiting are caused by many infective and non-infective agents[1]. Agents causing gastroenteritis may infect without causing symptoms or be excreted for long periods after recovery from illness. Under these circumstances transmission is unlikely, provided that good personal hygiene is practised[1].

Published expert opinion varies with regard to how long food handlers suffering from common causes of gastrointestinal infection should be excluded (i.e. whether until clinical recovery or longer) *and* with regard to who exactly should be excluded beyond clinical recovery.

- Apart from high-risk food handlers, the UK Public Health Laboratory Service generally advises return to work for food handlers after clinical recovery when stools have returned to normal[1]. PHLS 1995[1] states that all cases of gastroenteritis should be regarded as potentially infectious and should normally be excluded from work until the person is free from diarrhoea and vomiting. It recommends referral to *Food handlers: fitness to work*[2] for detailed guidance on food handlers. It stresses the importance of assessing infected people in risk groups (including high-risk food handlers), for whom special action should be considered depending on individual circumstances (and delineates such action in relation to individual pathogens depending on whether the individual is a case, excreter, carrier or contact). It recommends that *people not in risk groups present a minimal risk of spreading gastrointestinal illness and may return to any form of work after they have recovered clinically and their stools have returned to normal*, with microbiological follow up being unnecessary except after enteric fevers and infections caused by Verocytotoxin-producing *E. coli* (VTEC).

- UK food handler guidelines recommend *exclusion for 48 hours after clinical recovery* (i.e. no vomiting for 48 hours and bowel habit has returned to normal for 48 hours) for all common causes of gastrointestinal infection[2].

It is to be noted that these guidelines apply to food handlers who handle open food only – the document stating that: 'workers who handle only pre-wrapped, canned or bottled food, or those involved in primary agricultural or harvesting processes are not considered as food handlers for the purposes of this guidance'.

- Recent Scottish guidelines on the investigation and control of outbreaks of foodborne disease[3] make the general recommendation that *all* persons with diarrhoea should be advised *to remain off work until 48 hours after clinical recovery.* With regard to identified pathogens, however, the guidelines only advise exclusion beyond clinical recovery for serious pathogens (e.g. VTEC, *S. typhi, S. paratyphi,* etc) involving certain risk groups.

The overriding principle of food handlers not working when they are suffering from diarrhoea and/or vomiting due to common causes of infectious gastrointestinal illness is firmly established. Cognisant of varying expert opinion on the subject of exclusion periods this committee considers that, as a general rule, all food handlers should be advised to remain off work until 48 hours after clinical recovery where the causative pathogen has not been identified. Adopting a risk-based approach, this is most crucially important in the case of high-risk food handlers. Where the pathogen has been identified, specific exclusion criteria are addressed in Chapter 7 & APPENDIX D. In all instances of work exclusion, the prerequisite for fitness to return to food handling duties is strict adherence to personal hygiene.

Food handlers whose work involves *handling unwrapped food to be consumed raw or without further cooking or other forms of treatment* have been identified as constituting *the* high-risk food handler group. Stringent pathogen-specific exclusion criteria, with microbiological stool clearance, are always indicated for this group in relation to VTEC, Typhoid, Paratyphoid and *S. dysenteriae* - the evidence for which is detailed in Chapter 7. For other pathogens, in instances where it is not certain that the food handler will maintain good hygiene, exclusion may be required until microbiological clearance of infection has been demonstrated. Careful individual consideration should be given to all handlers of open foods.

Infected skin lesions and purulent discharges have been considered previously. General food handler exclusion/restriction guidelines are summarised (Table 6.4). Pathogen-specific criteria, and microbiological clearance criteria where applicable, are examined in Chapter 7.

Table 6.4 GENERAL EXCLUSION/RESTRICTION GUIDELINES

- No food handler with gastroenteritis should work while symptomatic.
- As a general rule, any food handler with symptoms of gastrointestinal infection (with diarrhoea and/or vomiting) should be advised to remain off work until 48 hours after clinical recovery and stools have returned to normal (where the causative pathogen has not been identified). Where the pathogen has been identified, specific exclusion criteria are summarised in APPENDIX D.
- For high-risk food handlers, pathogen-specific exclusion criteria with microbiological stool clearance always apply in relation to Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid and *Shigella dysenteriae* (c.f. Chap 7).
- Any food handler who is an asymptomatic stool carrier - other than a high-risk food handler carrier of Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid, or *Shigella dysenteriae* – if practising good personal hygiene, does not generally need to be excluded.
- Any food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms (c.f .Chap 7).
- The decision to exclude any food handler should be based on individual risk assessment.
- The overriding prerequisite for fitness to return to food handling duties is strict adherence to personal hygiene.
- Infected skin lesions on exposed body parts (especially hands and forearms) should be adequately covered with a waterproof dressing until healed. If not adequately covered, exclusion may need to be considered depending on the food handling activity.
- Those with purulent discharges (from the eye, ear, nose or mouth) should generally not work near open food; they may need to be restricted to non-food handling duties until recovered.

Recommendations

- FITNESS TO WORK -

Fitness to Handle Food

- The recommended guidelines for medical assessment of employee fitness to handle food are tabulated (Table 6.3).

- HEALTH SURVEILLANCE -

Health Questionnaires

- The benefit of pre-employment health questionnaires is unproven. There is insufficient evidence to recommend them as standard practice. Their use is supported as an adjunct to appropriate training in good hygiene practice and safe food handling, and the reporting of relevant conditions by food handlers.

Medical Examinations

- There is no scientific indication for the *routine* medical examination of food handlers in the prevention of spread of food-borne pathogens, whether on recruitment or otherwise. The practice is not recommended, unless required by legislation.

- The legal requirement for medical certification of food handlers should be used as an opportunity to promote personal and food handling hygiene, and to emphasise the importance of illness reporting.

Microbiological Screening

- *Routine* stool screening of food handlers has no scientific support and is not recommended. Neither is there any indication for *routine* skin, nasal or throat swabbing.

- Stool screening may be indicated for food handlers with symptoms of gastrointestinal illness based on individual risk assessment, taking account of such factors as illness severity and hygiene practice.

- Stool screening for suspected illness due to, carriage of, or relevant contact with Typhoid/Paratyphoid/ Verocytotoxin-producing *E. coli* (VTEC) or *Shigella dysenteriae* is always indicated for high-risk food handlers.

- Screening in an outbreak situation may involve the requesting of stool specimens, nasal/throat/skin swabs or screening for the presence of skin lesions on exposed parts of the body or for symptoms/signs of jaundice (depending on the outbreak and the pathogen suspected/identified).

- Criteria for microbiological screening may be varied at the discretion of the Director of Public Health/Designated Medical Officer, in consultation with the Consultant Microbiologist and Principal Environmental Health Officer as appropriate, following an individual or outbreak risk assessment.

- WORK EXCLUSION/RESTRICTION (GENERAL) -

- No food handler with gastroenteritis should work while symptomatic.

- As a general rule, any food handler with symptoms of gastrointestinal infection (with diarrhoea and/or vomiting) should be advised to remain off work until 48 hours after clinical recovery and stools have returned to normal (where the causative pathogen has not been identified). Where the pathogen has been identified, specific exclusion criteria are summarised in APPENDIX D.

- For high-risk food handlers, pathogen-specific exclusion criteria with microbiological stool clearance always apply in relation to Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid and *Shigella dysenteriae* (c.f. Chap.7).

- Any food handler who is an asymptomatic stool carrier - other than a high-risk food handler carrier of Verocytotoxin-producing *E. coli* (VTEC), Typhoid, Paratyphoid or *Shigella dysenteriae* – if practising good personal hygiene, does not generally need to be excluded.

- Any food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms (c.f. Chap.7).
- The decision to exclude any food handler should be based on individual risk assessment.
- The overriding prerequisite for fitness to return to food handling duties is strict adherence to personal hygiene.
- Infected skin lesions on exposed body parts (especially hands and forearms) should be adequately covered with a distinctively coloured waterproof dressing until healed. If not adequately covered, exclusion/restriction may need to be considered depending on the food handling activity.
- Those with purulent discharges (from the eye, ear, nose or mouth) should not work near open food; they may need to be excluded/restricted to non-food handling duties until recovered.

Chapter 7
Pathogen-Specific Control Measures

7.1 Introduction

Foodborne pathogens transmissible by infected food handlers vary in their capacity to infect and in the potential seriousness of the illnesses they can cause. Pathogens such as *Shigella*, Verocytoxin-producing *E.coli* (VTEC) and Norovirus are highly infectious, with only a small number of organisms needed to produce infection. VTEC and *S.typhi* are notable in view of the potential severity of the medical consequences to those who become infected.

The application of stringent control measures - such as a requirement for microbiological clearance prior to returning to food handling duties – is appropriate in relation to food handlers (usually high-risk) infected with certain pathogens. Examining individual pathogens, this chapter looks at the circumstances where such control measures are indicated, and where they are specific to high-risk food handlers or are more generally applicable. Consideration is also given to the question of whether or not treatment of asymptomatic food handlers to eliminate carriage is necessary.

However, it is cautioned that while pathogen-specific guidelines are here presented on the basis of current best evidence and expert opinion, they cannot take account of every eventuality. The guidelines are intended to aid the decision making process; they are not intended to advise on the clinical management of individual cases. In practice, decision making on pathogen-specific control measures is an area that may require the exercise of considerable professional judgement.

The circumstance of each food handler case, carrier or contact needs to be considered individually. Factors such as type of food handling activity, standards of personal hygiene, provision of sanitation facilities at work and the vulnerability of the population served (i.e. very young, frail elderly, ill or immunocompromised) should be taken into account. If microbiological clearance is indicated, once an individual meets the criteria for clearance he/she should no longer be considered a risk and should be allowed to return to normal working. Pathogen-specific control measures are summarised in APPENDIX D.

7.2 Typhoid Fever/Paratyphoid Fever

Typhoid and Paratyphoid Fever (both also known as Enteric Fever) are caused by *Salmonella typhi* and *S. paratyphi* A, B, C respectively. Although rarely notified in this country, these infections are endemic in parts of the developing world. It has recently been reported that the risk of travellers contracting typhoid while abroad is rare except for areas in north and west Africa, Peru and South Asia[130].

Symptoms[4]

Typhoid and Paratyphoid Fever are characterised by insidious onset of sustained fever, severe headache, malaise and nausea. Constipation tends to occur more commonly than diarrhoea. Typhoid Fever, if untreated, can have a case-fatality rate as high as 10-20%. This has been reduced to less than 1% with prompt antibiotic treatment. Paratyphoid

Fever tends to be a milder illness, with a much lower case-fatality rate. The relapse rate for Typhoid Fever can be as high as 15-20%, while relapses of Paratyphoid Fever may occur in about 3-4% of cases.

Excretion

The carrier state may follow acute illness or mild or even subclinical infections. About 10% of untreated typhoid fever patients will discharge bacilli for 3 months after onset of symptoms, and 2-5% become permanent carriers. Considerably fewer persons infected with paratyphoid organisms may become permanent gallbladder carriers[4].

Exclusion/Microbiological Clearance

Expert opinion agrees on the need for exclusion and microbiological clearance of cases, carriers and contacts of cases from food handling. However, the guidelines of the American Public Health Association (APHA)[4] appear somewhat less restrictive than those of the UK Public Health Laboratory Service (PHLS 95)[1]. In a comparison of published guidelines on length of follow up of *S. typhi* and *S. paratyphi* patients in Birmingham over a decade ago, it was considered that for those who might pose a special risk to others (vis food handlers), it would be worth having at least five consecutive negative sets of cultures before discharge from surveillance[131]. In the absence of any new published evidence and, in particular, in the absence of prospective evaluation of any new policies, it seems reasonable that Ireland should remain in line with current PHLS (PHLS 95)[1] and UK Food Handler guidelines[2] in terms of microbiological stool clearance requirements prior to returning to food handling. However, it is again pointed out that the former guidelines relate to high-risk food handlers; the latter to all handlers of unwrapped, uncanned and unbottled foods. This committee's recommendations on Typhoid/Paratyphoid exclusion and microbiological clearance criteria are made in relation to the high-risk food handler.

High-risk Food Handler:

Case – exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals, starting 2 weeks after completion of antibiotic treatment[1,2]

Carrier – exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals[2]

Suspected Case (history suggestive of enteric fever) - consider need to obtain 6 consecutive negative stool samples at 2 week intervals[2]

Contact of a Case/Carrier

Because of the potential seriousness of Typhoid and Paratyphoid Fevers, strict exclusion and microbiological clearance criteria also apply to a food handler who is either a household contact of an acute case, or who has a history of contact with a known outbreak or a known case at home or abroad.

High-risk Food Handler:

Contact of case/outbreak – exclude until 3 consecutive negative stool samples are obtained, taken at weekly intervals, starting 3 weeks after last contact with an untreated case[1,2]

Food handlers who are household contacts of carriers also merit consideration. In the household situation, as there may be continuing exposure to a potential source of infection (i.e. contact with continuing asymptomatic carrier), a food handler who is negative on screening should return to food handling duties only if they fully understand and adhere to good hygiene practice.

High-risk Food Handler:

Household contact of carrier – consider excluding until 3 consecutive negative stool samples are obtained, taken at weekly intervals, starting from the date of carrier identification[2]

Treatment of Carriage

There is universal agreement regarding the necessity to treat the carrier state in Enteric Fever. In recent studies, the new oral quinolones are reported to have produced excellent results in the treatment of the carrier[4]. Fluoroquinolones are recommended when attempting to eliminate carriage of *S. typhi*[132,133]. Studies on Ciprofloxacin, Norfloxacin or Ofloxacin treatment resulted in a cure in 80-90% of chronic enteric carriers of *S. typhi*[134] (Two studies: Ciprofloxacin

750mg twice daily for 28 days; Norfloxacin 400mg every 12 hours for 28 days). Ciprofloxacin has recently been recommended as the drug of choice for chronic adult carriers of *S. typhi*[135].

However, the appearance of strains of *S. typhi* with decreased sensitivity to Ciprofloxacin may pose a problem. In 1998 in the UK, 21% of investigated infections of *S. typhi* had decreased sensitivity to Ciprofloxacin[136]. The majority were linked with the Indian sub-continent. All strains with decreased sensitivity to Ciprofloxacin were fully sensitive to Cephalosporin antibiotics such as Ceftriaxone or Cefotaxime. Reference to antibiotic sensitivity patterns is crucial.

The treatment of chronic carriers may depend on whether anatomic abnormalities such as biliary or kidney stones are present[137]. If gallstones are present, antibiotics alone have a high failure rate for eradication of the carrier state in some, but not all, studies. Those carriers who do not respond to an initial course of treatment should be referred for specialist opinion to rule out biliary or renal disease.

Fluoroquinolones are recommended for the elimination of carriage. Where sensitivity is a problem, cephalosporin antibiotics should be considered.

7.3 Verocytotoxin-producing *E. coli* (VTEC)

Verocytotoxin-producing *E. coli* (VTEC) is a serious, global, public health concern. The most common strain causing illness in humans in Ireland is *E. coli* O157: H7. VTEC serogroups other than O157 may also cause illness. There is no evidence that the sources and routes of transmission differ from VTEC O157[64]. The measures outlined below are therefore recommended for the control of all VTEC infections, irrespective of serogroup.

Symptoms

VTEC poses a serious risk to humans as the number of organisms required to cause illness is very low. VTEC infections cause a spectrum of illnesses, from mild non-bloody diarrhoea to haemorrhagic colitis (comprising abdominal pain, diarrhoea and frank red blood). Bloody diarrhoea is seen in about 50% of VTEC O157 cases[64]. In up to 30% of cases, life-threatening complications can occur, of which Haemolytic Uraemic Syndrome (HUS) is the most common[59]. The reported case fatality rate of HUS is from 3-17%, and a substantial number of survivors suffer long-term residual impairment[64].

Excretion

The duration of excretion of the pathogen is typically one week or less in adults. Prolonged carriage is uncommon[4] but can occur, notably in young children[64]. Isolation from faeces is routinely successful usually only if specimens are obtained within four days of the onset of symptoms[64].

Exclusion/Microbiological Clearance

Because of the extremely small number of organisms needed to produce infection, and because of the potential severity of this disease, experts agree on the necessity for stringent precautions to prevent any possible spread of infection. Experts have stressed the importance of exclusion of high-risk food handlers until stool microbiological clearance has been obtained[64]. After providing two negative stool specimens it is considered unlikely that an individual will still be excreting the organism.

High-risk food handlers infected with VTEC should be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued).

Contact of a Case

In view of the potential seriousness of this infection and its ease of spread in households, action regarding a high-risk food handler who is a household contact of a case of VTEC infection requires the exercise of considerable judgement. Recent PHLS guidelines recommend that, if the food handler is a household contact of a case of VTEC, the exclusion criteria above should also apply[64]. However, the report also points out that the contact may (on occasions), if passing normal stools, be allowed to go to work without obtaining the additional reassurance of two consecutive negative stool specimens taken at an interval of not less than 48 hours. All such decisions need to be justified, however, and should be made only after a careful assessment of the risk of further spread.

Additionally, the report states that it is wise to ensure that the household case is passing normal stools and no longer excreting the organism after clinical recovery. In the event of persistent excretion of VTEC O157, particularly in young children, both the case and the household contacts may need to be kept under longer-term review by the public health authority[64].

Food handlers should be advised to report household contact with a VTEC case. High-risk food handlers who are household contacts of cases of VTEC infection should generally be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued), unless careful risk assessment suggests otherwise.

Treatment of Carriage

The role of antibacterial treatment of infections with *E. coli* O157:H7 is uncertain[4]. Some researchers have stated that antimicrobial agents have no proven value in the treatment of *E. coli* O157:H7 infections[138]. There is evidence to suggest that treatment with fluorquinolones and certain other antimicrobials may actually precipitate complications such as HUS[4,139], a progression which may be influenced by several factors[140]. A further concern about the use of antimicrobial agents in VTEC infections reflects the ability of sub-inhibitory concentrations of antimicrobial agents in vitro to cause lysis or sub-lethal damage to VTEC with subsequent liberation of verocytotoxins[64].

Overall, no convincing data currently indicate that antimicrobial agents alter the natural history of VTEC infection or the duration of faecal excretion of the organism[64]. It should be pointed out, however, that most studies have been retrospective, lacked adequate controls, been of small size, and have recorded dosage and duration of treatment inconsistently. Furthermore, most studies have been of co-trimoxazole, aminoglycosides, or beta-lactam antibiotics rather than fluoroquinolones that are effective in other forms of infective enteritis[64].

In the absence of convincing evidence, antimicrobial treatment is currently not indicated for VTEC carriage in food handlers.

7.4 Hepatitis A

Recognised foodborne outbreaks caused by Hepatitis A virus (HAV) are usually associated with contamination of uncooked food during preparation by a food handler who is infected with HAV[135]. The virus is transmitted by the faecal-oral route. Immunity following infection protects against re-infection and appears to persist for life[141]. Personal hygiene remains the cornerstone of measures for preventing HAV infection and its spread[141].

Symptoms[141]

HAV infection causes a prodromal illness of fever, nausea, loss of appetite, abdominal pain and mild gastrointestinal upset, followed by jaundice. Asymptomatic and mild disease is common in children; the severity of infections increases with age.

Excretion

The virus is present in the stools, reaching peak levels the week or two before symptom onset and diminishes rapidly after symptoms appear[4]. Most cases are probably non-infectious after the first week of jaundice[4].

Exclusion

As most cases of Hepatitis A infection are probably non-infectious within a week of jaundice/symptom onset, there is consistency within current international guidelines regarding food handler case exclusion – with exclusion advised for the week after the onset of jaundice and/or symptoms[1,2,3,5]. The US Food Code 2001[5] also gives the option of returning to work if at least two blood tests show falling liver enzymes.

A food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms.

Contact of a Case

The US Food Code 2001[5] makes the point that because Hepatitis A virus infection can occur without clinical illness (i.e. without symptoms) or because a person may shed Hepatitis A virus in the stool for up to a week before becoming symptomatic, it is possible that a person unknowingly may have been exposed to an asymptomatic Hepatitis A virus shedder or to an infected person who is in the incubation stage. No restriction/exclusion routinely occurs in these - presumably much more common - circumstances. It follows therefore that there is no reason to exclude food handlers from work who may be contacts of a case of Hepatitis A providing good hygiene practice is observed.

A food handler contact of a Hepatitis A case need not be excluded provided good hygiene practice is observed.

Microbiological Clearance

None required

Treatment of Carriage

None required

Immunisation

Outbreaks of Hepatitis A associated with food handlers are not frequent enough to justify routine vaccination of all catering staff[135,141]. In a recent study on the economics of vaccinating restaurant workers against Hepatitis A, it was concluded that vaccination was unlikely to be economical from either the restaurant owner or the societal perspective[142].

Routine Hepatitis A vaccination of food handlers is not indicated.

PHLS recommends that prophylaxis should be considered for close contacts of a confirmed case of HAV infection[141]. The choices for prophylaxis are between human normal immunoglobulin (HNIG), HAV vaccine or using both together. HAV vaccine is increasingly being used for contacts in place of HNIG because of concerns about use of human blood products. The vaccine should be given as close to the time of exposure as possible and the latest time that the vaccine is likely to be effective in preventing disease is probably 7 days from onset of disease in the primary case[141]. HNIG offers protection to close contacts who are identified too late to be protected by vaccine (8 days or more from exposure). The window of opportunity for HNIG to prevent a secondary case is 14 days post-exposure, but HNIG may modify disease severity if given after 14 days[141].

Since food handlers often work long hours, eat together and share toilet facilities, it is considered that their workplace colleagues should be included as close contacts for prophylaxis, as well as telling them not to work if they develop any symptoms (Personal Communication: Natasha Crowcroft, PHLS)[143].

Where a food handler is a household contact of a confirmed case of HAV, the food handler should be considered for prophylaxis (HNIG or HAV vaccine).

Food handler colleagues of a food handler case of Hepatitis A should be included as close contacts for prophylaxis purposes.

Where there has been widespread exposure from an infected food handler preparing food while symptomatic, PHLS has advised that HAV vaccine or immunoglobulin should be offered to patrons if feasible, depending on the delay to knowing about the case (Personal Communication: Natasha Crowcroft, PHLS)[143]. A local assessment of risk by the Outbreak Control Team (symptomatic food handler? high-risk food? deficiencies in personal hygiene? etc.) should inform the decision making process.

People who have recently been exposed to food prepared by a food handler case of Hepatitis A may benefit from prophylaxis. This should be considered by the investigating Director of Public Health/Designated Medical Officer, following risk assessment.

7.5 Shigellosis

There are four serogroups of Shigella[4]: *S. sonnei, S. boydii, S. dysenteriae* and *S. flexneri. S. sonnei* is the most common species of shigella in Ireland. Shigellosis is highly infectious, with a low infectious dose of 10-100 organisms. The principal route of transmission is faecal-oral from cases with diarrhoea. Spread may be facilitated by a contaminated environment, particularly toilets or fomites[144]. Food and water vehicles are uncommon but important when they occur.

Symptoms[4]

Shigella infection is characterised by diarrhoea accompanied by fever, nausea, vomiting and cramps. *S.sonnei* usually causes a mild illness with a short clinical course and almost negligible case-fatality rate except in the immunocompromised host. *S. boydii*, *S. dysenteriae* and *S. flexneri* infections present clinically as dysentery (diarrhoea with blood, mucus and pus). *S.dysenteriae* is often associated with serious disease and severe complications that include toxic megacolon and the haemolytic uraemic syndrome[4].

Excretion

The excretion of shigella following apparent recovery from illness may be both intermittent and prolonged[145]. The duration of excretion of the organism is usually up to 4 weeks after illness[4]; rarely the carrier state may persist for months or longer.

Exclusion/Microbiological Clearance

Guidance on exclusion and microbiological clearance varies internationally. That from the American Public Health Association[4] differs significantly from that issued by PHLS[1]. The former advises that microbiological clearance prior to return to work should be determined by two consecutive negative stool specimens, advice which is adopted by the US Food Code 2001[5]. PHLS advises that microbiological stool clearance should only be considered for infections with *S. dysenteriae* in high-risk food handlers[1]. Scottish guidelines[3] advise microbiological clearance for *S. flexneri, boydii* and *dysenteriae*. The 1995 UK food handler guidelines[2] do not recommend microbiological clearance, pointing out that - in the case of *Shigella sonnei* - it has been shown that there is a 10% chance of the next sample being positive after three negative samples[146] i.e. three negative stools do not equate to clearance, and do not preclude the excretion of small numbers of organisms, possibly intermittently. In addition, it has been observed that, on those occasions where exclusion was considered appropriate, the use of negative faecal samples to determine clearance of *S.sonnei* appears to have conferred no additional benefit[144].

The weight of evidence suggests that, although the infectious dose is small, asymptomatic shigella carriers practising good personal hygiene pose minimal risk of spread of the infection. In addition, *S. sonnei*, the most common shigella species in Ireland, generally causes a mild illness. It is considered, however, that because of the potential severity of *S. dysenteriae*, it is prudent that stringent precautions are taken to prevent any possible spread of that serogroup.

Asymptomatic carriers of *S. sonnei* practising good personal hygiene do not require exclusion or microbiological clearance.

High-risk food handlers infected with *S. dysenteriae* should be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued).

Treatment of Carriage

Little information exists relating to antimicrobial treatment of shigella carriage. While appropriate antimicrobial treatment may reduce duration of carriage to a few days[4], the literature suggests that antimicrobial treatment of cases of *S. sonnei* is seldom indicated. Routine use of antimicrobial agents is not recommended solely to speed return to work, not least because of the possible development of antibiotic resistance[144].

Multidrug resistance is common[147]. Since 1983, the incidence of resistance to ampicillin in *S. dysenteriae, S.flexneri* and *S. boydii* infection in England and Wales has increased from 42% to 64% and the incidence of resistance to trimethoprim from 6% to 64%. For *S. sonnei*, almost 50% of isolates were resistant to ampicillin or trimethoprim and 15% were resistant to both[147].

Antimicrobial treatment is not indicated for shigella carriage in food handlers, not least because of the problem of antibiotic resistance.

7.6 Salmonellosis (non-typhoidal)

There are over 2,000 known serotypes of salmonella. Numerous serotypes are pathogenic for humans. *S. typhimurium* and *S. enteritidis* are the most commonly reported in Ireland. Most cases occur sporadically. Outbreaks can arise from food contaminated at its source or, less often, during handling by an ill person or carrier. Person-to-person spread can also occur.

Symptoms[4]
Salmonellosis is characterised by sudden onset of headache, abdominal pain, diarrhoea, nausea and sometimes vomiting. Vomiting may be severe. Fever is almost always present. Anorexia and diarrhoea often persist for several days. Infection may develop into septicaemia or focal infection. Deaths are uncommon except in the very young, very old, debilitated and immunocompromised.

Excretion[4]
A temporary carrier state occasionally continues for months. Depending on the serotypes, approximately 1% of infected adults and 5% of children aged less than five years may excrete the organism for over one year.

Exclusion/Microbiological Clearance
Human carriage of non-typhoidal salmonella plays a negligible role in transmission[137]. Only 2% of 566 outbreaks in the United Kingdom were related to a specific food handler. Prolonged carriage in food handlers after gastroenteritis is rare and the amount of organisms is small. It therefore seems reasonable to allow individuals to return to work after diarrhoea has fully resolved.

Current guidelines in the UK[1,2], Scotland[3] and the US[45], do not require the elimination of salmonella carriage before return to food handling duties. Farthing[148] has recommended that if good personal hygiene can be assured then carriers may return to work. The American Public Health Association does, however, stipulate that exclusion of asymptomatic infected individuals is indicated for those with questionable hygiene habits[4] - two negative stool cultures not less than 24 hours apart; if antibiotics are used, initial culture should be taken at least 48 hours after the last dose.

Asymptomatic salmonella (non-typhoidal) carriers practising good personal hygiene do not require exclusion or microbiological clearance.

Treatment of Carriage
The general consensus on literature review concurs that antibiotic treatment of salmonella carriage may not eliminate the carrier state but may indeed prolong excretion[4]. However, most of the evidence seems to be extrapolated from the treatment of cases of salmonellosis, with little direct evidence available on treatment of the carrier state. Quinolones, in common with other antibiotics, have produced unimpressive microbiological results in adults with uncomplicated non-typhoid salmonella enteritis[149,150]. Not only have they had doubtful efficacy in the treatment of uncomplicated infections caused by salmonella, they may also prolong the carrier state and promote antibiotic resistance[149]. A controlled, randomised, double blind study concluded that norfloxacin treatment for 10 days decreased the excretion of salmonella bacteria during the first week, but there was no difference in excretion rates 1-6 months after treatment initiation in the treatment versus placebo group[151]. While some success in the elimination of carriage has been achieved with quinolones, the minimum dosage and duration of treatment has not yet been established[148]. Overall, it has been advised that antibiotics, including 5-fluoroquinolones, are not useful for intestinal salmonella eradication and should not be recommended[150].

Interestingly, it has been proposed that this non-intervention policy is unlikely to find favour with employers of food handlers[148], and that there will be some instances where quinolone therapy of asymptomatic salmonella excretion might be considered. Oral ciprofloxacin has been advocated for the treatment of convalescent excreters of salmonellae as part of infection control measures in hospital outbreaks[148]. It has been argued that this approach has

its limitations: while stool cultures may be negative soon after stopping quinolone therapy, bacteriological relapse may nevertheless follow two or more weeks later. Further clinical trial evidence is needed before quinolones can be recommended as a routine measure to control salmonella excretion during outbreaks. In situations where a quinolone is used, it has been stressed that stool cultures should be taken after at least 3 weeks to detect relapse rates[148].

On the basis of current evidence, treatment of salmonella carriage in food handlers is generally not indicated as it is of doubtful efficacy and may prolong organism excretion.

7.7 Norovirus

Formerly known as Norwalk-like virus (NLV) or Small Round Structured Virus (SRSV), Noroviruses are an antigenically diverse group of caliciviruses which have similar morphology under the electron microscope and appear to cause an identical clinical picture of projectile vomiting and diarrhoea[152]. They have been commonly implicated in food handler associated outbreaks.

The low infectious dose of Norovirus (i.e. less than 100 viral particles) readily allows spread by droplets, fomites, person-to-person transmission and environmental contamination. A clear understanding of how food handlers contaminate food is crucial[121]. It was initially assumed that transmission was solely by faecal contamination due to poor hygiene. Alternative methods of contamination are now apparent. Direct contamination of food by vomitus can obviously occur. In addition, aerosols produced by vomitus can directly contaminate food or alternatively lead to contamination of work surfaces with the potential for subsequent transfer to food.

Symptoms
Illness is characterised by acute onset of nausea, vomiting, abdominal pain and diarrhoea. Vomiting is relatively more prevalent among children, whereas a greater proportion of adults experience diarrhoea. Constitutional symptoms (e.g. headache, fever, chills and myalgia) are common.

Excretion
Both pre and post-symptomatic contamination of foods has been documented in outbreaks traced to food handlers. Anecdotal evidence from outbreak investigations has also shown that viral shedding can occur for a prolonged period and in the absence of clinical illness[152]. Excretion of virus in faeces begins a few hours before the onset of symptoms and can continue for up to 7-10 days, with maximum shedding occurring 24-72 hours after exposure[122]. One volunteer study has shown that viral antigen can be detected in stools seven days after exposure in both symptomatic and asymptomatic persons[153]; in another, viral antigen was detected up to two weeks after exposure[154]. The epidemiologic significance of these findings remains unclear. Further research is needed to determine whether the viral antigen that is detectable for prolonged periods after recovery from illness is evidence of infectious virus or not. Additional research is also necessary to assess the time of maximal viral shedding.

Prolonged duration of viral shedding that can occur among asymptomatic individuals increases the risk for secondary spread and is of concern in food handler-related transmission. Infected food handlers might contaminate food items during preparation. The risk is increased when the food item is consumed without further cooking. Because of the low infectious dose of Norovirus, even a limited contamination can result in substantial outbreaks.

Exclusion/Microbiological Clearance
The exclusion of food handlers for 48-72 hours after resolution of illness is generally recommended to prevent outbreaks caused by food handlers; the evidence for lengthier periods of exclusion is not conclusive. Although data are limited regarding whether detectable viral antigen in the post symptomatic phase of illness represents infectious virus, food handlers should be required to maintain strict personal hygiene at all times. Clearance stool specimens are of no value and should not be requested[121].

Food handlers infected with Norovirus should be excluded for at least 48 hours after resolution of illness. Evidence for longer exclusion periods remains the subject of debate, unless hygiene habits are questionable. Microbiological clearance is not indicated.

7.8 *Staphylococcus aureus*

S. aureus is a common cause of bacterial skin lesions (including impetigo, folliculitis, carbuncles, abscesses and infected lacerations). About 20-30% of the general population are nasal carriers[4]. Transmission is through contact with a person who either has a purulent lesion or is an asymptomatic carrier of a pathogenic strain. The pathogen can also inhabit apparently normal skin. The hands are the most important instruments for transmitting infection.

Foodborne transmission occurs by ingestion of a food product containing staphylococcal enterotoxin. Foods involved are particularly those that come in contact with food handlers' hands, either without subsequent cooking or with inadequate heating or refrigeration. When these foods remain at room temperature for several hours before being eaten, toxin-producing staphylococci multiply and elaborate the heat stable toxin.

Symptoms (of food poisoning)
Symptoms are abrupt and sometimes violent in onset, with severe nausea, cramps, vomiting and prostration, often accompanied by diarrhoea and sometimes with subnormal temperature and lowered blood pressure. Deaths are rare; duration of illness is commonly not more than a day or two, but the intensity of symptoms may require hospitalisation.

Exclusion/Microbiological Clearance
Treatment of skin infections may be clinically indicated. In staphlococcal outbreak situations, it is recommended to search for food handlers with skin infections, particularly of the hands, and to collect nasal swabs from food handlers[4]. Nasal carriers need not be excluded from food handling[1]. Treatment of nasal carriage is generally not indicated; it may be considered where the food handler is implicated in an outbreak (Director of Public Health/ Designated Medical Officer in consultation with Consultant Microbiologist).

Nasal carriers of *S. aureus* need not be excluded from food handling.

Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed.

Treatment of nasal carriage is generally not indicated; it may be considered where the food handler is implicated in an outbreak.

7.9 Group A (ß-Haemolytic) Streptococci

Group A Streptococci (*Strep. pyogenes*) cause a variety of diseases. The most common are streptococcal sore throat and streptococcal skin infections (pyoderma or impetigo)[4]. The distinguishing characteristics of foodborne streptococcal pharyngitis have recently been reviewed[63]. The evidence suggests that *S. pyogenes* originates from the pharynx or hand lesions of a food handler. It has been shown that nasal carriers of streptococci may contaminate food by sneezing, or by handling food with hands contaminated by respiratory secretions. Outbreaks may be traced to an individual with an acute or persistent streptococcal infection or carrier state (nose, throat, skin).

Symptoms
In comparison to airborne transmission, foodborne disease is more frequently characterised by symptoms such as sore throat, pharyngeal erythema, enlarged tonsils and submandibular lymphadenopathy than by coughing and coryza[63].

Exclusion/Microbiological Clearance
With adequate penicillin therapy of streptococcal pharyngitis cases, transmissibility is generally terminated within 24 hours[4]. If untreated, cases may continue to carry the organism in the pharynx and remain infectious for weeks or even months. However, the contagiousness of these carriers decreases sharply in 2-3 weeks after onset of infection[4]. Identification of pharyngeal/skin carriers can involve intensive epidemiological and microbiological investigation.

Exclude high-risk food handlers with acute Streptococcal sore throat until symptom resolution.

Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed.

7.10 Cholera

Cholera is caused by infection of the small intestine by *Vibrio cholerae* 01 or 0139. Transmission is by ingestion of food or water contaminated directly or indirectly with faeces or vomitus of infected persons[4]. Its occurrence in this country has been confined to imported cases. Foreign travel and contaminated seafood account for most cases of cholera in the US, and antimicrobial resistance is increasing among *V. cholerae* 01 strains isolated from ill travellers[155]. Travel is now more frequent and more rapid. Dramatic epidemics have occurred in Latin America, the Indian subcontinent, Southeast Asia, parts of Africa and Eastern Europe. Person-to-person spread by the faecal oral route contributes to its epidemic spread in underdeveloped countries where sanitary facilities and personal hygiene are poor.

Symptoms
The infection is characterised by massive acute diarrhoea, vomiting and dehydration; death occurs in severe, untreated cases[156]; with proper treatment, the mortality rate is less than 1%[4]. Asymptomatic infection is much more frequent than clinical illness[4].

Excretion
Stools usually remain positive for only a few days after recovery; occasionally the carrier state may persist for several months[4].

Exclusion/Microbiological Clearance
Information regarding food handler exclusion is sparse. Secondary spread is rare where sanitary facilities are available and good personal hygiene is practised[1]. The guidelines of the PHLS 1995[1] recommend that food handlers (high-risk group) should be excluded for 48 hours after the first normal stool; when indicated, two consecutive negative stools taken at intervals of at least 24 hours are required.

Treatment of Carriage
Antibiotics known to be effective against the infecting strains (e.g. tetracycline against the 0139 strain and most 01 strains) shorten the period of communicability[4]. Since individual strains of 01 and 0139 may be resistant to a number of antimicrobials, sensitivities should guide the choice of antimicrobial used. Very rarely, chronic biliary infection that lasts for several years has been observed in adults associated with intermittent shedding of vibrios in the stool[4].

High-risk food handlers infected with *V. cholerae* 01 or 0139 should be excluded for 48 hours after the first normal stool. When microbiological clearance is indicated (e.g. sanitary facilities/personal hygiene suspect), two consecutive negative stools at intervals of at least 24 hours are required.

Prolonged carriage is rare. If treatment of carriage is considered, sensitivities should guide the choice of antimicrobial used in view of the possibility of resistant strains.

7.11 Amoebic Dysentery

Amoebic dysentery is an infection with a protozoan parasite – *Entamoeba histolytica*. Differentiation of pathogenic *E. histolytica* from the morphologically identical non-pathogenic *E. dispar* is based on immunologic differences and on isoenzyme patterns. Most asymptomatic cyst passers carry strains of *E. dispar*. Geographically, rates are higher in areas with poor sanitation (such as parts of the tropics). Transmission occurs mainly by ingestion of faecally contaminated food or water containing amoebic cysts. Infection is rarely transmitted from acute cases; most cases arise through faecal-oral spread from those excreting cysts[1].

Symptoms
Most infections are asymptomatic. Intestinal disease can be relatively mild or, alternatively, severe with fever, chills and bloody or mucoid diarrhoea (amoebic dysentery).

Excretion
Cysts may continue to be passed in the stools for years.

Exclusion/Microbiological Clearance
Microbiological clearance before return to work is not required[1].

Treatment of Carriage
All asymptomatic pathogenic infections of *Entamoeba histolytica* should be treated because of the potential or real risk of invasive disease and of transmission to others[157]. Treatment of asymptomatic carriers with iodoquinol, paromomycin or diloxanide furoate is recommended by the American Public Health Association[4].

High-risk food handlers should be excluded for 48 hours after the first normal stool.

While microbiological clearance is not required for return to work, treatment of carriers of pathogenic strains is recommended.

7.12 Other Pathogens

Control measures with regard to other foodborne pathogens which can be transmitted by infected food handlers via food are outlined in APPENDIX D. These pathogens include *Aeromonas* spp*, Campylobacter* spp*, Cryptosporidium* spp*, E. coli* (other than VTEC), *Giardia lamblia,* Vibrios (non-cholera), Rotavirus and *Yersinia spp*. The recommended guidelines for those pathogens are in line with current published UK Public Health Laboratory Service advice[1]. As a general rule, none requires microbiological clearance prior to returning to food handling duties, after symptom resolution, unless personal hygiene practices are questionable.

Recommendations

Overall

- Recommended control measures for foodborne pathogens which can be transmitted by infected food handlers via food are summarised in APPENDIX D

- ALL FOOD HANDLERS -

Hepatitis A (HAV)

- A food handler infected with Hepatitis A should be excluded from food handling duties for seven days after the onset of jaundice and/or symptoms
- A food handler contact of a Hepatitis A case need not be excluded provided good hygiene practice is observed
- Routine Hepatitis A vaccination of food handlers is not indicated
- When a food handler is a household contact of a confirmed case of HAV, the food handler should be considered for prophylaxis (HNIG or HAV vaccine)
- Food handler colleagues of a food handler case of Hepatitis A should be included as close contacts for prophylaxis purposes
- People who have recently been exposed to food prepared by a food handler case of Hepatitis A may benefit from prophylaxis. This should be considered by the investigating Director of Public Health/Designated Medical Officer, following risk assessment

Norovirus

- Food handlers infected with Norovirus should be excluded for at least 48 hours after resolution of illness. Evidence for longer exclusion periods remains the subject of debate, unless hygiene habits are questionable. Microbiological clearance is not indicated.

- HIGH-RISK FOOD HANDLERS -

Typhoid/Paratyphoid

- Case: exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals, starting 2 weeks after completion of antibiotic treatment
- Carrier: exclude until 6 consecutive negative stool samples obtained, taken at 2 week intervals
- Suspected case (history suggestive of enteric fever): consider need to obtain 6 consecutive negative stool samples at 2 week intervals
- Contact of case/outbreak: exclude until 3 consecutive negative stool samples obtained, taken at weekly intervals, starting 3 weeks after last contact with untreated case
- Household contact of carrier: consider excluding until 3 consecutive negative stool samples obtained, taken at weekly intervals, starting from date of carrier identification
- Fluoroquinolones are recommended for the elimination of carriage. Where sensitivity is a problem, cephalosporin antibiotics should be considered.

Verocytotoxin-producing *E. coli* (VTEC)

- High-risk food handlers infected with VTEC should be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued)
- High-risk food handlers who are household contacts of cases of VTEC infection should generally be excluded from food handling until 2 successive negative stool samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics are discontinued), unless careful risk assessment suggests otherwise.
- In the absence of convincing evidence, antimicrobial treatment is currently not indicated for VTEC carriage in food handlers

Shigella

- Asymptomatic carriers of *S. sonnei* practising good personal hygiene do not require exclusion or

microbiological clearance

- High-risk food handlers infected with *S. dysenteriae* should be excluded from food handling until 2 successive negative stools samples are obtained (collected at least 48 hours apart and no earlier than 48 hours after antibiotics have been discontinued)
- Antimicrobial treatment is not indicated for shigella carriage in food handlers, not least because of the problem of antibiotic resistance

Salmonella

- Asymptomatic salmonella (non-typhoidal) carriers practising good personal hygiene do not require exclusion or microbiological clearance

- On the basis of current evidence, treatment of salmonella carriage in food handlers is generally not indicated as it is of doubtful efficacy and may prolong excretion

Staphylococcus aureus

- Nasal carriers of *S. aureus* need not be excluded from food handling.
- Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed
- Treatment of nasal carriage is generally not indicated; it may be considered where the food handler is implicated in an outbreak

Group A (ß-Haemolytic) Streptococci

- Exclude high-risk food handlers with streptococcal sore throat until symptom resolution
- Exclude high-risk food handlers with infected skin lesions on exposed body parts that cannot be adequately covered (with waterproof dressing) until healed

Cholera

- High-risk food handlers infected with *V. cholerae* 01 or 0139 should be excluded for 48 hours after the first normal stool. When microbiological clearance is indicated (e.g. sanitary facilities/personal hygiene suspect), two consecutive negative stools at intervals of at least 24 hours are required.
- Prolonged carriage is rare. If treatment of carriage is considered, sensitivities should guide the choice of antimicrobial used in view of the possibility of resistant strains.

Amoebic Dysentery

- High-risk food handlers should be excluded for 48 hours after the first normal stool. While microbiological clearance is not required for return to work, treatment of carriers of pathogenic strains is recommended.

Chapter 8
Prevention of Food Handler Infection with Foodborne Pathogens at Work

8.1 Introduction

The outbreaks delineated in Chapter 3 are those in which infected food handlers were found to have been causally linked. However, in many outbreaks where food handlers are affected, the food handler is not uncommonly a victim of the outbreak - secondary to eating contaminated food, drinking contaminated water, being exposed to a contaminated environment or through contact with another infected person in the workplace. The route of exposure in the course of such outbreaks is dependent on the circumstances of each particular outbreak and the pathogen involved. Control measures implemented during the course of the outbreak investigation by the outbreak control team act to prevent further spread of infection.

Apart from outbreak situations, there is a paucity of published information relating to transmission of foodborne pathogens to food handlers in the course of their work (i.e. occupational exposure). Any evidence that does exist relating to non-outbreak situations indicates that such occupationally related infections are largely confined to those whose work involves handling animal carcasses and raw meat. While such pathogens are relevant to the health of the food handler, no evidence has been found in this review that food handlers in the meat processing industry pose a risk of passing the infection through to the consumer via the food they handle. The handled product will undergo further preparation steps before consumption – preparation steps which, if adequate, will control any potential hazard.

This chapter focuses on the occupational health risk of foodborne pathogen infection to those who handle carcasses, offals and meats from potentially infected food animals - where such evidence is available. The preventive aspects examined are therefore specific to food handlers in the meat processing industry.

8.2 Meat Processing Industry

The exposure to biological agents in the meat processing industry concerns a wide variety of bacteria, viruses, parasites and fungi. Zoonotic diseases (infectious diseases which are naturally transmissible between vertebrate animals and man) can be transmitted from infected animals or their hair, feathers, fleece, hides, blood, digestive tracts or excrements to food handlers in the occupational setting by such means as hand/skin contact, inhalation of aerosols, ingestion of dust, or by splashes in eyes. Some of the causative zoonotic agents are potential foodborne pathogens.

The primary meat processing sector comprises those businesses which slaughter, dress and cut-up animals for the production of food. Food handlers in the meat industry, especially in the slaughtering industry, are at particular risk of acquiring certain zoonoses which are foodborne pathogens. A vitiated atmosphere contaminated with micro organisms, inadequate ventilation if present, and frequent skin injuries contribute to the risk of exposure.

Advances in the control of zoonotic diseases in animals have reduced the hazards posed to workers in the meat industry and to consumers of meat. A limited number of zoonoses is relevant to the safety of workers slaughtering and/or processing red and white meat in Europe[158]. Published reports on the subject are relatively scarce, and most relate to studies of pathogen carriage rates. They mainly concern VTEC, *Salmonella* spp. and *Campylobacter* sp. Other potential foodborne pathogens of relevance include *Yersinia* sp., *Staph aureus, ß-Haemolytic Strep* and *Cryptosporidium* spp.

8.3 Relevant Zoonotic Pathogens

VTEC: Cattle are the primary reservoir of *E. coli* 0157:H7. The organism persists in the rumen and colon of cattle and is passed in the faeces. In an Irish study, *E. coli* 0157:H7 was detected in 0.8% of rumen samples, 2.8% of faecal samples, and on 2.8% of beef carcases[159,160]. However, an incidence of up to 15.7% has been reported[161]. The organism has also been found in sheep[162]. Other types (e.g. 026 and 0111) are found in a wide variety of food animals, particularly in sheep, goats and cattle, and to a lesser extent in pigs[158].

It has been pointed out that VTEC poses an occupational risk to food handlers because of its low infective dose[64]. A study on the prevalence of VTEC in stool samples from asymptomatic human carriers working in the meat processing industry in Switzerland has been reported[163]. A carrier rate of 3.5% was detected among staff members from three large meat processing plants.

A predisposition for VTEC in slaughterhouse employees, where the prevalence of carriers may increase up to 9%, has been proposed[164]. It is assumed that slaughterhouse work, where individuals presumably encounter VTEC more frequently (especially during the dehiding and evisceration process) and in higher numbers, may put these individuals at higher risk. In addition, the role of asymptomatic human carriers as a source of contamination and thus, the importance of personal hygiene measures in the meat processing industry, should not be underestimated.

SALMONELLA: Food animals are an important reservoir of salmonella[165]. An Irish study conducted by the National Food Centre in 2000 indicated that:

- 2% of cattle carry salmonella and 0.16% of bovine carcasses are contaminated
- 24% of pigs carry salmonella in their caecum and 2.4% of porcine carcasses are contaminated
- 3.6 % of broilers carry salmonella and 14.9% of poultry carcasses are contaminated

Cutaneous salmonellosis has been reported in food handlers in the porcine sector[166-168]. The lesions take the form of pustular dermatitis or folliculitis as small, red, patchy spots on arms and hands apparent within three days of contact. Infection with salmonella is reported to be much rarer among workers in the poultry/broiler industries than campylobacteriosis[158].

CAMPYLOBACTER: Campylobacter is endemic in Irish poultry flocks. Detection rates of 90-100% have been recorded from dressed carcasses at slaughterhouses[169]. Poultry carcass sampling by DAFRD in conjunction with FSAI, commenced in 1999, has reported isolation rates of between 50-70% to date. A number of reports have documented evidence that foodworkers in poultry abattoirs and processing units are at risk of infection from campylobacter. One study noted that new members of staff were found to have contracted campylobacteriosis within a few weeks of starting work in poultry processing plants[170]. Another study found, on testing abattoir workers and clerical workers in the same workplace, that workers in direct contact with freshly cut animal parts had significantly higher antibody levels[171]. In a study of the incidence of occupationally acquired infectious disease in the UK 1996-7, rates were highest among meat production workers and among farmers; the higher rates among those who work with poultry than with other meats, and the predominance of campylobacter among them was noted[172].

YERSINIA: *Yersinia entercolitica* is a component of the intestinal flora of red meat animals, especially pigs. It is also found on the tonsils and the nasopharynx of pigs. Some serotypes of *Y. enterocolitica* cause gastroenteritis in humans. Severe infections with *Y. entercolitica* among newly employed foodhandlers in Danish pig abattoirs have been reported[173]. It has also been found that a significantly higher prevalence of antibodies occur in food handlers working on pig killing lines, compared with those working in offices in the same premises[174].

STREPTOCOCCAL & STAPHYLOCOCCAL INFECTIONS: Outbreaks of skin infection due to *Streptococcus pyogenes* have been recorded among food handlers in meat processing plants. In Yorkshire, in 1978, an attack rate as high as 44% occurred in the meat packaging section[175]. Outbreaks associated with Staphylococcus aureus and ß-haemolytic streptococci have been recorded in Scottish abattoirs[176].

CRYPTOSPORIDIUM: Crytosporidia are commonly shed by cattle, sometimes sheep, and more often by calves and young lambs[177]. Humans may become infected following either direct or indirect contact with food-animals, particularly cattle[178]. The level of risk posed by cryptosporidium in the meat industry is unknown.

OTHER INFECTIONS: Other zoonotic agents do pose a potential risk to food handlers in the meat processing industry. However, these zoonoses are not subsequently transmissible via food handled by an infected food handler. They are therefore not considered further in the context of prevention of food handler infection with foodborne pathogens at work. Such zoonoses include include Brucellosis, Tuberculosis, Leptospirosis, Listeriosis, Orf (contagious pustular dermatitis), Q Fever, Chlamydiosis, Newcastle Disease, Ringworm and Toxoplasmosis. This committee found no reported evidence that occupational exposure to animals infected with Bovine Spongiform Encephalopathy (BSE), and in particular to Specified Risk Material (SRM), poses a health risk to abattoir workers.

8.4 Susceptible Food Handlers

People working on slaughter lines are likely to be exposed to more hazards than those on meat cutting operations. It has been suggested that consideration should to be given to the question of whether susceptible groups of food handlers should work on slaughter lines where exposure to these zoonoses constitutes a higher risk[158]. Susceptible groups would include those who are immunosuppressed (e.g. on immunosuppressive drugs, HIV infection) or those who are pregnant.

8.5 Preventive Aspects in the Meat Industry[158]

The reduction in the prevalence of various diseases in farm livestock arriving at abattoirs and slaughterhouses will lead to the reduction of hazards to food handlers becoming infected with foodborne pathogens in their work environment. Some pathogens, however, such as VTEC, campylobacters and salmonellas frequently cause no clinical disease in farm animals, and will therefore remain a potential hazard to meat workers. Further advances in making meat safer are likely to result from the introduction of various Quality Assurance schemes. These involve the identifying, monitoring and keeping records of the disease status and treatment of each animal (or poultry flock) so that its history is known when it reaches the abattoir. The Dept. of Agriculture Food & Rural Development's clean livestock policy offers an additional protective measure.

The principal pathogens responsible for food-borne illness and attributable to meat originate from the digestive tracts of animals, either directly via spillage of gut contents, or indirectly from an animal's hide or fleece. Hygienic slaughter and dressing operations, in conjunction with veterinary ante-mortem and post mortem inspection, are essential in minimising the risk of contaminating meat with pathogenic organisms. Any risks to the worker will thereby be minimised also.

Precautions to prevent infection of workers in the meat processing industry are mostly those that should already be in use to prevent the contamination of meat. Those recommendations outlined earlier in the report relating to the prevention of food contamination by food handlers should apply. The protection of meat workers from infection depends upon taking normal hygienic precautions which also protect the meat from inadvertent contamination by the workers. Additionally, further specific measures are applicable in reducing the risk of meat workers becoming infected with foodborne pathogens in their work environment – including the provision of protective clothing, sector-specific environmental and hygiene facilities and, most significantly, the prevention of gut spillage on the slaughterline.

Recommendations

General

- The recommendations previously made relating to the prevention of food contamination by infected food handlers - including training in safe food handling, good personal hygiene, the provision of adequate and well maintained workplace sanitation facilities, and illness reporting - are also applicable to the prevention of food handler infection with foodborne pathogens at work.

In addition, in the meat processing industry

- The education and training of food handlers in the meat processing industry should include information on:
    - the nature of relevant zoonotic diseases and
    - the minimisation of risk of infection to themselves by careful handling of potentially infected food-animals, carcasses and offal

- Additional protective clothing should include:
    - rubber aprons that can be frequently and easily washed down during the day (should be washed in a cabinet to contain splash), boots and gloves
    - the legal requirement for mask usage in the mince meat processing sector is acknowledged

- Hygiene facilities should include:
    - a sufficient number of boot washing facilities
    - sufficient number of facilities for cleaning tools/disinfecting equipment

- The legal requirement that taps should not be hand operable in this sector is acknowledged

- There should be appropriate ventilation systems with reduction of aerial contamination in areas where aerosols and/or dust are hazards

- Skin injuries should be treated promptly when they occur

- In relation to the primary processing of food animals there should be
    - an effective dehiding and evisceration process (in particular, the prevention of spillage of animal gut contents during evisceration)
    - an effective evisceration accident procedure
    - adequate waste disposal measures

Detailed measures relevant to the primary processing of food animals are contained in *'Guidelines for the Implementation of Food Safety Management Systems in Beef and Lamb Slaughter Plants through HACCP Principles'* (Guidelines FSAI 2002)[179].

Glossary

Abattoir: A slaughterhouse where the killing of livestock and the preparation of the meat takes place

Antibiotic: a substance produced by, or derived from, a microorganism that inhibits or destroys other microorganisms

Antimicrobial or antiseptic soaps: Soaps containing ingredients with activity against microorganisms on the skin

Antimicrobial resistance: see resistance

Asymptomatic: not showing any symptoms of a disease, although it is present

Case: A person with symptoms identified as having a particular disease

Carrier: A person that harbours a specific infectious agent without discernible clinical disease and serves as a potential source of infection

Communicable disease: An illness due to a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal or inanimate reservoir to a susceptible host

Contact: a person who has been exposed to a source of infection

Contamination: the presence of disease-causing microorganisms or their by-products, chemicals and/or foreign bodies, at a level sufficient to cause a potential health hazard

Cross-contamination: the transfer of harmful or potentially harmful microorganisms from contaminated surfaces or foods to other foods either by hand, physical contact, air or contact with food preparation surfaces or food utensils

Disinfectant: a chemical that destroys or removes bacteria and other microorganisms

Disinfection: the killing of infectious agents outside the body by direct exposure to chemical or physical agents

Epidemiology: the study of the factors affecting health and disease in populations and the application of this study to the control and prevention of disease

Evisceration: the removal of the abdominal organs, including intestines

Excreter: A person without symptoms but excreting pathogenic organisms in their faeces or urine for fewer than twelve months.

Food: Includes (a) any substance used, available to be used or intended to be used, for food or drink by human

persons and (b) any substance which enters into it or is used in the production, composition or preparation of these substances

Foodborne disease: any disease of microbial origin caused by, or thought to be caused by, the consumption of food or water

Food handler: any person involved in a food business who handles food in the course of their work, or as part of their duties, to any extent whether the food is open or pre-wrapped

Food hygiene: all measures necessary to ensure the safety and wholesomeness of food during preparation, processing, manufacture, storage, transportation, distribution, handling and offering for sale or supply to the consumer

Fomite: an object, such as a book, wooden object, or an article of clothing, that is not in itself harmful, but is able to harbour pathogenic microorganisms and thus may serve as an agent of transmission of infection

HACCP (Hazard Analysis Critical Control Point): a system which identifies, evaluates and controls hazards which are significant for food safety

Hand antisepsis: the removal or destruction of transient microorganisms from the hands

High-risk food: food which supports the growth of harmful and potentially harmful microorganisms and which will not be subjected to any further heat treatment or processing which would remove or destroy such microorganisms, prior to consumption. Ready-to-eat foods are high-risk foods.

High-risk food handler: a food handler who handles unwrapped food to be consumed raw or without further cooking or other forms of treatment

Immunocompromised/Immunosuppressed: a person who has impaired immunity due to disease (e.g. cancer) or treatment (e.g. corticosteroid drugs or radiotherapy)

Incidence: the number of episodes of a disease that occur in a specified period of time in a specified group of people

Microbiological clearance: the reduction of the number of pathogenic organisms in a specimen below that detectable by conventional means

Microorganism: any organism that is too small to be visible to the naked eye (e.g. bacteria, fungi, viruses and protozoa)

Non-food handler: a person involved in a food business whose duties and responsibilities can impinge on food safety (e.g. managers, maintenance staff, cleaning staff).

Outbreak: two or more cases of disease linked to a common source

Pathogen: a microorganism capable of causing disease

Plain or non-antimicrobial, non-antiseptic soaps: detergent based cleansers that have no bactericidal activity and, by mechanical action, are used for physical removal of dirt

Prevalence: the number of instances of a particular disease or other condition at a particular time

Ready-to-eat foods: Foods that have gone through most or all of their preparation steps. There will be a ‘high-risk’ if these are contaminated or allowed to deteriorate because there are no further preparation steps to control the hazard, e.g. cooked meat and poultry, pates, meat pies, cooked meat products (e.g. gravy and stock), milk, cream,

custards and dairy produce, shellfish and other seafood (cooked or intended to be eaten raw), cooked rice, cooked eggs and products made with eggs, prepared salads, fruit and vegetables, soft cheeses, etc.

Resistance: the ability of a microorganism to withstand an antimicrobial agent

Screening: the process by which unrecognised diseases or defects are identified by tests that can be applied rapidly on a large scale; screening tests sort out apparently healthy people from those who may have a disease

Specified Risk Material (SRM): those tissues of cattle, sheep and goats which are known to, or might potentially, harbour detectable BSE infectivity in infected animals

Sporadic Case: a single case which has not apparently been associated with other cases, excreters or carriers in the same period of time.

Surveillance: the systematic collection and evaluation of data on all aspects of a disease that are relevant to its prevention and control

Susceptible/Sensitive: organisms that are unable to replicate or are killed by an antimicrobial agent

Transmission: passing infectious disease from one person to another

Virus: a very small microorganism that can only survive and multiply within a living cell

Zoonoses: infectious diseases which can be transmitted naturally from vertebrate animals to humans

References

1. Public Health Laboratory Service. Working Party of the PHLS Salmonella Committee. The prevention of human transmission of gastrointestinal infections, infestations and bacterial intoxications. *Communicable Disease Report CDR Review* 1995; **5**: (11).

2. Department of Health Expert Working Party. Food handlers: fitness to work. London: Department of Health, 1995.

3. Food Standards Agency/Scottish Executive Health Department. Guidance on the investigation and control of outbreaks of foodborne disease in Scotland. Guidance 2002.

4. Chin J (Editor). *Control of Communicable Diseases Manual.* 17th Edition. Washington 2000. American Public Health Association.

5. Food Code 2001. US Dept of Health and Human Services; Public Health Service; Food and Drug Administration. Washington DC 20204.

6. Wheeler JG, Sethi D, Cowden J *et al*. Study of infectious intestinal disease in England: rates in the community, presenting to general practice, and reported to national surveillance. *BMJ* 1999; **318**:1046-50.

7. Bonner C, Foley B, Wall P, Fitzgerald M. Analysis of outbreaks of infectious intestinal disease in Ireland: 1998 and 1999. *Ir Med J*. 2001 May; **94**(5): 140, 142-4.

8. Guide to Food Safety Training LEVEL II – Additional Skills. Food Service, Retail and Manufacturing Sectors. FSAI 2001.

9. Paulson DS. Get a handle on contamination. *Food Quality*. April 1996: 42-6.

10. World Health Organisation. Health Surveillance and management procedures for food handling personnel. *Report of a WHO consultation*. Geneva: WHO 1989; Technical Report Series 785.

11. Evans HS, Madden P, Douglas C, Adak GK, O' Brien SJ, Djuretic T, Wall PG, Stanwell-Smith R. General outbreaks of infectious intestinal disease in England and Wales: 1995 and 1996. *Commun Dis Public Health* 1998 Sep; **1**(3): 165-71.

12. Dalton CB, Haddix A, Hoffman RE, Mast EE. The cost of a food-borne outbreak of hepatitis A in Denver, Colo. *Arch Intern Med* 1996; **156**: 1013-16.

13. Food Safety Authority of Ireland. Annual Report 2001.

14. Guide to Food Safety Training LEVEL I – Induction Skills. Food Service, Retail and Manufacturing Sectors. FSAI 2001.

15. A Compendium of Food Law in Ireland. Food Safety Authority of Ireland 1998.

16. Codex Alimentarius. Joint FAO/WHO Food Standards Programme – Codex Alimentarius. Volume 1B – General Requirements (Food Hygiene). FAO, Rome. ISBN 103766. Website: http://www.fao.org/WAICENT/faoinfo/economic/ESN/codex/Default.htm

17. Arness *et al*. Norwalk-like viral gastroenteritis in US army trainees – Texas, 1998. *MMWR Weekly* 1999; **48**:225-227.

18. Daniels NA, Bergmire-Sweat DA, Schwab KJ, Hendricks KA, Reddy S, Rowe SM, Fankhauser RL, Monroe SS, Atmar RL, Glass RI, Mead P. A foodborne outbreak of gastroenteritis associated with Norwalk-like viruses: first molecular traceback to deli sandwiches contaminated during preparation. *J. Infect Dis* 2000; ***181***(4): 1467-70.

19. Parashar UD, Dow L, Fankhauser RL, Humphrey CD, Miller J, Ando T, Williams KS, Eddy CR, Noel JS, Ingram TI, Bresee JS, Monroe SS & Glass RI. An outbreak of viral gastroenteritis associated with consumption of sandwiches: implications for the control of transmission by food handlers. *Epidemiol. Infect* 1998; **121**:615-621.

20. www.doh.state.fl.us/environment/hsee/foodsurveillance/norwalk.htm

21. Lo SV, Connolly AM, Palmer SR, Wright D, Thomas PD, & Joynson D. The role of the pre-symptomatic food handler in a common source outbreak of food-borne SRSV gastroenteritis in a group of hospitals. *Epidemiol Infect* 1994; **113**:513-521.

22. Stevenson P, McCann R, Duthie R, Glew E, Ganguli L. A hospital outbreak due to Norwalk virus. *J Hosp Infect* 1994; **26**(4): 261-72.

23. Reid JA, Caul EO, White DG & Palmer SR. Role of infected food handler in hotel outbreak of norwalk-like viral gastroenteritis: Implications for control. *Lancet* 1988; **6**: 321-3.

24. Kobayashi S, Morishita T, Yamashita T, Sakae K, Nishio O, Miyake Y, Ishihara Y & Isomura S. A large outbreak of gastroenteritis associated with a small round structured virus among schoolchildren and teachers in Japan. *Epidemiol Infect* 1991; **107**:81-86.

25. Patterson T, Hutchings P & Palmer S. Outbreak of SRSV gastroenteritis at an international conference traced to food handled by a post-symptomatic caterer. *Epidemiol Infect* 1993; **111**:157-162.

26. Kassa H. An outbreak of Norwalk-like viral gastroenteritis in a frequently penalised food service operation: a case for mandatory training of food handlers in safety and hygiene. *J Environ Health* 2001; **64**: 9-12.

27. Anderson AD, Garrett VD, Sobel J, Monroe SS, Fankhauser RL, Schwab KJ, Bresee JS, Mead PS, Higgins C, Campana J, Glass RI. Multistate outbreak of Norwalk-like virus gastroenteritis associated with a common caterer. *American Journal of Epidemiology* 2001; **154**: 1013-1019.

28. Gaulin C, Frigon M, Poirier D, Fournier C. Transmission of calicivirus by a foodhandler in the pre-symptomatic phase of illness. *Epidemiol Infect* 1999; **123**(3); 475-8.

29. White KE, Hedberg CW, Edmonson LM, Jones DB, Osterholm MT, MacDonald KL. An outbreak of giardiasis in a nursing home with evidence for multiple modes of transmission. *J Infect Dis* 1989; **160**: 298-304.

30. Quick R, Paugh K, Addiss D, Kobayahi J & Baron R. Restaurant-associated outbreak of Giardiasis. JID 1992; **166**:673-676.

31. Mintz ED, Hudson –Wragg M, Mshar P, Cartter ML & Hadler JL. Foodborne Giardiasis in corporate office setting. *JID* 1993; **167**:250-253.

32. Olsen SJ, Hansen GR, Bartlett L, Fitzgerald C, Sonder A, Manjrekar R, Riggs T, Kim J, Flahart R, Pezzino G, Swerlow DL. An outbreak of *Campylobacter jejuni* infection associated with food handler contamination: The use of pulsed field gel electrophoresis. *The Journal of Infectious Diseases* 2001; **183**(1): 164-7.

33. Maguire H, Pharaoh P, Walsh B, Davison C, Barrie D, Threlfall EJ & Chambers S. Hospital outbreak of Salmonella virchow possibly associated with a food handler. *J Hosp Infect* 2000; **44**: 261-266.

34. Faustini A, Sangalli M, Fantasia M, Manganello R, Mattaccini E, Trippanera R, Spera D, LaRosa U, Topi MT, Forastiere F & Perucci CA. An Outbreak of *Salmonella hadar* associated with food consumption at a building site canteen. *Eur J Epidemiol* 1998; **14**:99-106.

35. Saha MR, Sircar BK, Dutta P, Pal SC. Occurrence of nulti-resistant Salmonella typhimurium infection in a pediatric hospital at Calcutta. *Indian Pediatr*.1992; **29**: 307-11.

36. Francis S, Rowland J, Rattenbury K, Powell D, Rogers WN, Ward L, Palmer SR. An outbreak of paratyphoid fever in the UK associated with a fish-and-chip shop. *Epidemiol Infect*. 1989; **103**: 445-8.

37. Lee R, Peppe J, & George H. Pulsed-field gel electrophoresis of genomic digests, demonstrates linkages among food, food handlers, and patrons in a food borne Salmonella Javiana outbreak in Massachusetts. *J Clin Microbiol* 1998; **36**:284-285.

38. Dryden MS, Keyworth N, Gabb R, Stein S. Asymptomatic foodhandlers as the source of nosocomial salmonellosis. *Journal of Hospital Infection* 1994; **28**: 195-208.

39. Khuri-Bulos NA, Abu Khalaf M, Shehabi A, Shami K. Foodhandler associated Salmonella outbreak in a University hospital despite routine surveillance cultures of kitchen employees. *Infect Control Hosp Epidemiol* 1994; **15**(5): 311-4.

40. Hedberg CW, White KE, Johnson JA, Edmonson LM, Soler JT, Korlath JA, Theurer LS, MacDonald KL, Osterholm MT. An outbreak of Salmonella enteritidis infection at a fast-food restaurant: implications for foodhandler-associated transmission. *J Infect Dis* 1991; **164**:1135-1140.

41. Xercavins M, Llovet T, Navarro F, Morera MA, More J, Bella F, Freixas N, Simo M, Echeita A, Coll P, Garau J, Prats G. Epidemiology of an unusually long outbreak of typhoid fever in Terrassa, Spain. *Clin Infect Dis*. 1997; **24**(3): 506-10.

42. Bar-Dayan Y, Bar-Dayan Y, Klainbaum Y, Shemer J. Foodborne outbreak of streptococcal pharyngitis in an Israeli airforce base. *Scand J Infect Dis* 1996; **28**:563-566.

43. Farley TA, Wilson SA, Mahoney F, Kelso KY, Johnson DR & Kaplan EL. Direct inoculation of food as the cause of an outbreak of group A streptococcal pharyngitis. *JID* 1993; **167**:1232-1235.

44. Richards MS, Rittman M, Gilbert TT, Opal SM, DeBuono BA, Neill RJ & Gemski P. Investigation of Staphylococcal food poisoning outbreak in centralized school lunch program. *Pub Health Reports* 1993; **108**(6):765-771.

45. Pereira ML, do Carmo LS, dos Santos EJ & Bergdoll MS. Staphylococcal food poisoning from cream filled cakes in metropolitan area of southeastern Brazil. Rev. *Saúde Pública* 1994; **28** (6):406-409.

46. Lew JF, Swerdlow DL, Dance ME, Griffin PM, Bopp CA, Gillenwater MJ, Mercatante T & Glass RI. An outbreak of Shigellosis aboard a cruise ship caused by a multiple-antibiotic-restraint of *Shigella flexneri*. *Am J Epidemiol* 1991; **134**:413-420.

47. Dunn RA, Hall WN, Altamirano JV, Dietrich SE, Robinson-Dunn B & Johnson DR. Outbreak of Shigella flexneri linked to salad prepared at a central commissary in Michigan. *Public Health Rep* 1995; **110**: 580-586.

48. Lee LA, Ostroff SM, McGee HB, Johnson DR, Downes FP, Cameron DN. An outbreak of shigellosis at an outdoor music festival. *Am J Epidemiol* 1991; **133**: 608-15.

49. Weltman AC, Bennett NM, Ackman DA, Misage JH, Campana JJ, Fine LS, Doniger AS, Balzano GJ & Birkhead GS. An outbreak of hepatitis A associated with a bakery, New York, 1994: The 1968 'West Branch, Michigan' outbreak repeated. *Epidemiol Infect* 1996; **117**:333-341.

50. Snydman DR, Dienstag JL, Stedt B, Brink EW, Ryan DM, Fawaz KA. Use of IgM - hepatitis A antibody testing. *JAMA* 1981; **245** (8): 827-30.

51. Gustafson TL, Hutcheson RH Jr, Fricker RS, Schaffner W. An outbreak of foodborne hepatitis A: the value of serologic testing and matched case-control analysis. *Am J Public Health* 1983; **73**(10): 1199-201.

52. Massoudi MS, Bell BP, Paredes V, Insko J, Evans K, Shapiro CN. An outbreak of hepatitis A associated with an infected foodhandler. *Public Health Rep* 1999; **114**: 157-164.

53. Sundkvist T, Hamilton GR, Hourihan BM., Hart IJ. Outbreak of hepatitis A spread by contaminated drinking glasses in a public house. *Comm Dis Pub Health* 2000; **3**:60-62.

54. Morse DL, Shayegani M, Gallo RJ.: Epidemiologic investigation of a Yersinia camp outbreak linked to a food handler. *Am J Pub Health* 1984; **74**:589-592.

55. Tangkanakul W, Tharmaphornpilas P, Datapon D & Sutantayawalee S. Food poisoning outbreak from contaminated fish-balls. *J Med Assoc Thai* 2000; **83**: 1289-1295.

56. Quiroz ES, Bern C, MacArthur JR, Xiao L, Fletcher M, Arrowood MJ, Shay DK, Levy ME, Glass RI, & Lal A. An outbreak of Cryptosporidiosis linked to a foodhandler. *J Infect Dis* 2000; **181**: 695-700.

57. Irish C & Mason B. Outbreaks of VTEC O157 infection in inmates of two prisons in the United Kingdom. *Commun Dis Rep CDR Weekly* 2000; **10**: 375.

58. Bean NH, Griffin PM, Goulding JS & Ivey CB. Foodborne Disease Outbreaks, 5-year summary, 1983-1987. *Mor Mortal Wkly Rep CDC Surveill Summ.* 1990 Mar; **39**(1): 15-57.

59. FSAI. The prevention of E.coli O157:H7 infection. A shared responsibility. Food Safety Authority of Ireland, 1999.

60. Guzewick J, Ross MP. *(Evaluation of risks related to microbiological contamination of ready-to-eat foods by preparation workers and the effectiveness of intervention to minimise those risks. White Paper, Section 1: A Literature Review Pertaining to Foodborne Disease. Outbreaks Caused by Food Workers, 1975-1998*.) Food and Drug Administration. Center for Food Safety and Applied Nutrition. Sept 1999.

61. Connolly AM, Palmer SR, Wright D, Thomas PD & Joynson D. The role of the pre-symptomatic food handler in a common source outbreak of food-borne SRSV gastroenteritis in a group of hospitals. *Epidemiol Infect* 1994; **113**:513-521.

62. Usera MA, Aladueña A, Echeita A, Amor E, Gomez-Garcés JL, Ibañez C, Mendez I, Sanz JC & Lopez-Brea M. Investigation of an Outbreak of *Salmonella Typhi* in a public school in Madrid. *Eur J Epidemiol* 1993; **9**:251-254.

63. Katzenell U, Shemer J and Bar-Dayan Y. Streptococcal contamination of food: an unusual cause of epidemic pharyngitis. *Epidemiol Infect* 2001;**127**: 179-184.

64. Guidelines for the control of infection with Verocytotoxin producing Escherichia coli (VTEC). Subcommittee of the PHLS Advisory Committee on Gastrointestinal Infections. *Communicable Disease and Public Health* 2000; **3**:14-23.

65. Fendler EJ, Dolan MJ & Williams RA. Handwashing and gloving for food protection. Part I. Examination of the evidence. *Dairy Food Environmental Sanitation* 1998(a); **18**:814-23.

66. Larson EL. APIC guidelines for handwashing and hand antisepsis in health care settings. *American Journal of Infection Control* 1995; **23**(4): 251-69.

67. Miller ML. A field study evaluating the effectiveness of different hand soaps and sanitizers. *Dairy Food Environmental Sanitation* 1994; **14**:155-60.

68. Fendler EJ, Dolan MJ, Williams RA & Paulson DS. Handwashing and gloving for food protection. Part II. Effectiveness. *Dairy Food Environmental Sanitation* 1998(b); **18**:824-9.

69. Guzewick J, Ross MP. *(Evaluation of risks related to microbiological contamination of ready-to-eat foods by preparation workers and the effectiveness of intervention to minimise those risks. White Paper, Section II: Interventions to prevent or minimise risks associated with bare-hand contact with ready-to-eat foods.)* Food and Drug Administration. Center for Food Safety and Applied Nutrition. Sept 1999.

70. Foodlink. 2001. Dirty hands put millions at risk of food poisoning. www.foodlink.org.uk.

71. Guinan ME, McGuckin-Guinan M & Sevareid A. Who washes hands after using the bathroom? *Am J Infect Control* 1997; **25**(5): 424-5.

72. Michaels BS. *Are gloves the answer? Dairy, Food and Environmental Sanitation* 2001; **21**(6): 489-492.

73. Pittet D. Boyce JM. Hand hygiene and patient care: pursuing the Semmelweis legacy. *The Lancet* 2001; April:9-20.

74. Shiferaw B, Yang S, Cieslak P, Vugia D, Marcus R, Koehler J, Deneen V, Angulo F and the Foodnet working group. Prevalence of high-risk food consumption and food-handling Practices among adults: A multistate survey, 1996 to 1997. *Journal of Food Protection 2000*; **63**(11):1538-1543

75. Taylor LJ. An evaluation of handwashing techniques. *Nursing Times* 1978; **74**:108

76. Ansari SA, Springthorpe VS, Sattar SA, Rivard S, Rahman M. Potential role of hands in the spread of respiratory viral infections: studies with human Parainfluenza virus 3 and Rhinovirus 14. *J Clin Microbiol* 1991; **29**(10):2115-9.

77. LeBaron CW. Furatan NP, Lew JF. Allen JR. Gouvea V. Moe C et al. Viral agents of gastroenteritis. *MMWR* 1990; **39**:1-24.

78. Paulson DS. A comparative evaluation of different hand cleansers. *Dairy Food Environ Sanit* 1994; **14**: 524-28.

79. Nicoletti G, Boghossian V, Borland R. Hygienic hand disinfection: a comparative study with chlorhexidine detergents and soap. *Journal of Hospital Infection* 1990; **15**:323-37.

80. Larson EL. Quantity of soap as a variable in handwashing. *Infection Control* 1987; **8**:371-5.

81. Larson EL, Mayur K, Laughon BA. Influence of two hand washing antisepsis in health care settings. *American Journal of Infection Control* 1989; **17**:83-8.

82. Chamberlain AN, Halablab MA, Gould DJ, Miles RJ. Distribution of bacteria on hands and the effectiveness of brief and thorough decontamination procedures using non-medicated soap. *Zentralbl Bakteriol*. 1997; **285**:565-75.

83. Snyder OP. *Hand washing for retail food operations – A review. Dairy Food Environ Sanitation* 1998; **18**(3): 149-162.

84. Bidawid S, Farber JM, Sattar, SA. Contamination of foods by food handlers: Experiments on hepatitis A virus transfer to food and its interruption. *Applied and Environmental Microbiology* 2000; **66**(7):2759-2763

85. Gould. Making sense of hand hygiene. *Journal of Infection Control Nursing* 1994.

86. Ayliffe GAJ, Babb JR, Taylor LJ (1998) Hospital Acquired Infection: Principles and Prevention. 3rd ED. Butterworth-Heinemann.

87. Babb J. 1998. Hand Hygiene (taken from a presentation to the food industry)

88. Bushell (2000) Chapter 5. Design of New and Refurbished Buildings. In: [Infection Control, Science, Management and Practice].

89. Ayliffe et al. 2000. Control of Hospital Infection - A Practical Handbook. Ed Ayliffe GAJ, Fraise AP, Geddes AM, Mitchell K. 4th ED. Pub Arnold, London.

90. Paulson DS, Riccardi C, Beausoleil CM, Fendler EJ, Dolan MJ, Dunkerton LV, Williams RA. Efficacy evaluation of four hand cleansing regimens for food handlers. *Dairy Food Environmental Sanitation* 1999; **19**:680-4.

91. Namura S, Nishijima S, Mitsuya K, Asada Y. Study of the efficacy of antiseptic handrub lotions with hand washing machines. *Journal of Dermatology* 1994; **21**:405-10.

92. Larson E. Hygiene of the skin: when is clean too clean? *Emerging Infectious Diseases* 2001; **7**(2): 225-30.

93. Larson E, McGinley K, Grove G, Leyden J, Talbot G. Physiological, microbiological and seasonal effects of handwashing on the skin of health care personnel. *American Journal of Infection Contro*l 1986; **14**: 51-9.

94. Ansari SA, Sattar SA, Springthorpe VS, Wells GA, Tostowaryk W. In vivo protocol for testing efficacy of hand-washing agents against viruses and bacteria: experiments with rotavirus and Escherichia coli. *Applied Environmental Microbiology* 1989; **55**: 3113-8.

95. Mbithi JN, Springthorpe VS, Sattar SA. Comparative in vivo efficiencies of hand-washing agents against hepatitis A virus (HM-175) and poliovirus type 1 (Sabin). *Applied Environmental Microbiology* 1993; **59**: 3463-9.

96. Charbonneau DL, Ponte JM & Kochanowsi BA. A method of assessing the efficacy of hand sanitizers: use of real soil encountered in the food service industry. *Journal of Food Protection* 2000; **63**(4): 495-501.

97. McBride ME. Microbial flora of in-use soap products. *Applied Environmental Microbiology* 1984; **48**:338-41.

98. Heinze JE. Bar soap and liquid soap. *Journal of the American Medical Association* 1985; **253**:1561.

99. Heinze JE, Yackovich FY. Washing with contaminated bar soap is unlikely to transfer bacteria. *Epidemiology of Infection* 1988; **101**:135-142.

100. Infection Control Nurses Association. 1998. Guidelines for Hand Hygiene

101. Gould. Hand Care – Maintaining Standards. *Journal of Wound Care* 1997.

102. Ayliffe GAJ, Lowbury EJL, Geddes AM & Williams JD (1992). Control of Hospital Infection – A Practical Handbook. 3rd Edition. Chapman & Hall Medical, London.

103. Coates D, Hutchinson DN, Bolton FJ. Survival of thermophilic Campylobacters on fingertips and their elimination by washing and disinfection. *Epidemiol Infec*t 1987; **99**: 265-74.

104. Ansari SA, Sattar SA, Springthorpe VS, Wells GA, Tostowaryk W. Rotavirus survival on human hands and transfer of infectious virus to animate and nonporous inanimate surfaces. *Journal of Clinical Microbiology* 1988; **26**:1513-8.

105. Patrick DR, FindonG, Miller TE. Residual moisture determines the level of touch-contact-associated bacterial transfer following hand washing. *Epidemiological Infection* 1997; **119**:319-25.

106. Springthorpe S, Sattar S. Handwashing: what can we learn from recent research? *Infection Control Today* 1998; **2**:20-8.

107. Ansari SA, Springthorpe VS, Sattar SA, Tostowaryk W, Wells GA. Comparison of cloth, paper, and warm air drying in eliminating viruses and bacteria from washed hands. *America Journal of Infection Control* 1991a; **19**:243-9.

108. Taylor JH, Brown KL, Toivenen J, Holah JT. 2000. A microbiological evaluation of warm air hand driers with respect to hand hygiene and the washroom environment. *Journal of Applied Microbiology* 2000; **89**(6): 910-9.

109. Blackmore MA. A comparison of hand drying methods. *Catering and Health* 1989; **1**: 189-198.

110. Blackmore MA. Hand drying methods. *Nursing Times – Journal of Infection Control Nursing* 1987; **83** (37): 71-4.

111. Redway K, Knights B, Bozoky Z. 1994. Hand drying: A study of bacterial types associated with different hand drying methods and with hot-air dryers. London University of Westminster.

112. Kumar A. Freeman S. Protein contact dermatitis in food workers. Case report of a meat sorter and summary of seven other cases. *Australian Journal of Dermatology*.1999; **40**:138-40.

113. Schwartz HJ. Latex: a potential hidden “food” allergen in fast food restaurants. *J Aller Clin Immunol* 1995; **95**: 139-140.

114. US Department of Health and Science

115. Jacobson G. Thiele JE. McCune JH. Farrell LD. Handwashing: Ring wearing and number of microorganisms. *Nursing Research* 1985; **34**:186-88.

116. Aston G. Tiffney J. 1997. The essential guide to food hygiene and safety. Eaton Publications. Surrey, England.

117. Sprenger RA. 1997. Hygiene for management – A text for food hygiene courses. Highfield publications. Doncaster.

118. Salisbury DM, Hufliz P, Treen LM, Bollin GE, Gautam S. The effect of rings on microbial load of health care workers’ hands. *Am J Infect Control* 1998; **25**: 24-7.

119. Romney MC. Surgical face masks in the operating theatre: re-examining the evidence. *The Journal of Hospital Infection* 2001; **47**: 251-6.

120. Cowden JM. Winter vomiting. *BMJ* 2002; **324**: 249-50.

121. Viral Gastroenteritis Sub-Committee of the PHLS Virology Committee. Outbreaks of gastroenteritis associated with SRSVs. *PHLS Microbiology Digest* 1993; **10**(1): 2-8.

122. Chadwick PR et al. Management of hospital outbreaks of gastro-enteritis due to small round structured viruses. Report of the Public Health Laboratory Service Viral Gastro Enteritis Working Group. *Journal of Hospital Infection* 2000; **45**: 1-10.

123. Centers for Disease Control and Prevention. 'Norwalk-Like Viruses': Public Health Consequences and Outbreak Management. *MMWR Weekly Report* 2001; Vol. 50/No. RR-9: 1-17.

124. Cox RAF, Edwards FC and McCallum RI. *Fitness for Work - The Medical Aspects.* Second Edition : Oxford University Press. New York 1995.

125. Harker C. Pre-employment health assessments for food handlers: a survey of occupational physicians in the food industry. *Occup Med* 2001; **51**: 332-5.

126. Noble WC. Dispersal of skin microorganisms. *British Journal of Dermatology* 1975; **93**: 477-85.

127. Ryan MJ, Wall PG, Gilbert RJ, Griffin M, Rowe B. Risk factors for outbreaks of infectious intestinal disease linked to domestic catering. *Commun Dis Rep CDR Rev* 1996; **6**: R179-183.

128. Hellard ME, Sinclair I, Hogg GG, Fairley CK. Prevalence of enteric pathogens among community based asymptomatic individuals. *J Gastroenterol Hepatol* 2000; **15**(3): 290-3.

129. Choi SW, Park CH, Silvia TMJ, Zaenker EI, Guerrant RL. To culture or not to culture: fecal lactoferrin screening for inflammatory bacterial diarrhea. *J Clin Microbiol* 1996; **34**(4): 928-32.

130. PHLS. Food and waterborne diseases associated with travel. *Commun Dis Rep CDR Wkly* [serial online] 2002 [cited 4 July] ; **12** (27): travel health.

131. Braddick MR, Crump BJ, Lian Yee M. How long should patients with Salmonella typhi or Salmonella paratyphi be followed up? A comparison of published guidelines. *Journal of Public Health Medicine* 1991; **13**: 101-7.

132. Trujillo Z, Quiroz C, Gutierrez MA, Arias J, Renteria M: Fluoroquinolones in the treatment of typhoid fever and the carrier state. *Eur J Clin Microbiol Infect Dis* 1991;**10**: 334-341.

133. Hendershot EF. Fluoroquinolones. *Infectious Disease Clinics of North America* 1995; **9**(3): 715-30.

134. Graninger W, Zedtwitz-Liebenstein, Laferl H, Burgmann H. Quinolones in Gastrointestinal Infections. *Chemotherapy* 1996; **42** (suppl 1): 43-53.

135. Red Book 2000. Report of the Committee on Infectious Diseases. American Academy of Paediatrics. 25th Ed.

136. Threlfall EJ, Ward LR, Skinner JA, Smith HR, Lacey S. Ciprofloxacin-resistant Salmonella typhi and treatment failure. *The Lancet* 1999; **353**: 1590-1.

137. Mandell GL, Bennet JE, Dolin G. Principles and Practice of Infectious Diseases. Churchill Livingstone. 4th Ed. Vol 2, 1995.

138. Besser RE, Griffin PM, Slutsker L. Escherichia coli 0157:H7 Gastroenteritis and the Haemolytic Uraemic Syndrome: An Emerging Infectious Disease. *Ann Rev Med* 1999; **50**: 355-67.

139. Wong et al. The Risk of the Haemolytic–Uraemic Syndrome after Antibiotic Treatment of Escherichia Coli 0157:H7 Infections. *The New England Journal of Medicine* 2000; **342**: 1930-1936.

140. Zimmerhackl LB. (Editorial). E.coli, Antibiotics and the Hemolytic-Uremic Syndrome. *The New England Journal of Medicine* 2000; **342**: 1990-1991.

141. Crowcroft NS, Walsh B, Davison KL & Gungabissoon U on behalf of the PHLS Advisory Committee on Vaccination and Immunisation. Guidelines for the control of hepatitis A virus infection. *Commun Dis Public Health* 2001; **4**: 213-27.

142. Meltzer MI, Shapiro CN, Mast EE, Arcari C. The economics of vaccinating restaurant workers against hepatitis A. *Vaccine* 2001; **19**(15-16): 2138-45.

143. Personal Communication: Dr. Natasha S. Crowcroft, Immunisation Division, PHLS Communicable Disease Surveillance Centre, Colindale. 2001.

144. PHLS Working Group. Revised guidelines for the control of *Shigella sonnei* infection and other infective diarrhoeas. *CDR Review* 1993; **3**: R69-70.

145. Newman CPS. Surveillance and control of *Shigella sonnei* infection. *CDR Review* 1993; **3**: R63-68.

146. Mawer SL. *Shigella sonnei* – a review of its microbiology. *PHLS Microbiology Digest* 1994; **11**(1): 45-48.

147. Cheasty T, Skinner JA, Rowe B, Threlfall EJ. Increasing Incidence of Antibiotic Resistance in Shigellas from Humans in England and Wales: Recommendations for Therapy. *Microbial Drug Resistance* 1998; **4**: 57-60.

148. Farthing M et al. The Management of Infective Gastroenteritis in Adults. A consensus statement by an expert panel convened by the British Society for the Study of Infection. *Journal of Infection* 1996; **33**: 1433-152.

149. Wistrom J, Ragnar Norrby S. Fluoroquinolones and bacterial enteritis, when and for whom? Journal of *Antimicrobial Chemotherapy* 1995; **36**: 23-39.

150. Sirinavin S, Garner P. Antibiotics for treating salmonella gut infections (Cochrane Review). In: The Cochrane Library, Issue 4, 2000. Oxford: Update Software.

151. Pitkajarvi T, Kufanne E, Sillantaka T, Lumio J. Norfloxacin and Salmonella excretion in acute gastroenteritis – a 6-month follow-up study. *Scandinavian Journal of Infectious Disease* 1996; **28**(2): 177-80.

152. 'Norwalk-like viruses'. Public Health Consequences and Outbreak Management. US Dept of Health and Human Services. *MMWR* 2001; **50**: No. RR-9.

153. Graham DY, Jiang X, Tanaka T, Opekun AR, Madore HP, Estes MK. Norwalk virus infection of volunteers: new insights based on improved assays. *J Infect Dis* 1994; **170**: 34-43.

154. Okhuysen PC, Jiang Xi, Ye L, Johnson PC, Estes MK. Viral shedding and fecal IgA response after Norwalk virus infection. *J Infect Dis* 1995; **171**:566-9.

155. Steinberg EB, Greene KD, Bopp CA, Cameron DN, Wells JG & Mintz ED. Cholera in the United States, 1995-2000: trends at the end of the millennium. *J Infect Dis* 2001; **184**: 799-802.

156. Rabbani GH, Greenough WB. Food as a vehicle of transmission of cholera. *J Diarrhoeal Dis Res* 1999; **17**(1): 1-9.

157. Jackson TFHG. Entamoeba histolytica cyst passers – to treat or not to treat? (Editorial). *S Afr Med J* 1987; **72**: 657-8.

158. Corry JEL, Hinton MH. Zoonoses in the Meat Industry: A Review. *Acta Veterinaria Hungarica* 1997: **45**(4), 457-479.

159. McEvoy JM, Doherty AM & Sheridan JJ (1999a). *The incidence of Escherichia coli O157:H7 and Salmonella in faeces, rumen contents and on carcasses in a commercial Irish beef abattoir*. Abstract: Handbook of the Society for Applied Microbiology Summer Conference, University of York, July 1999.

160. McEvoy JM, Doherty AM, Sheridan JJ, Maguire L & McNally AM. *The incidence of E.coli O157:H7 in faeces, rumen contents and on carcasses in a commercial Irish beef abattoir.* Proceedings of Concerted Action Meeting 'Verocytotoxigenic *E.coli* in Europe; Pathogenicity and Virulence of *E. coli*. Liege, Belgium 1999.

161. Chapman PA, Siddons CA, Cedan Malo AT & Harkin MA. A 1 year study of *Escherichia coli* O157 in cattle, sheep, pigs and poultry. *Epidemiol Infect* 1997; **119**: 245-50.

162. Kuduva IT, Hatfield PG & Hovde CJ. Escherichia coli O157: H7 in microbial flora of sheep. *J Clin. Microbiol* 1996; **34**: 431-3.

163. Stephan R, Ragettli S. & Untermann. Prevalence and characteristics of verotoxin-producing *Escherichia coli* (VTEC) in stool samples from asymptomatic human carriers working in the meat processing in Switzerland. *Journal of Applied Microbiology* 2000; **88**: 335-341.

164. Stephan R and Untermann F. Virulence factors and phenotypical traits of verotoxin-producing Escherichia coli strains isolated from asymptomatic human carriers. *Journal of Clinical Microbiology* 1999; **37**: 1570-72.

165. Frost AJ, O'Boyle D & Samuel JL. The isolation of Salmonella spp. from feed lot cattle managed under different conditions before slaughter. *Australian Veterinary Journal* 1988; **65**: 224-5.

166. Cameron IRD. Salmonella infection in a vet. *Vet Rec* 1988; **123**(20): 528.

167. Collyer JH. Salmonella infection in a vet. *Vet Rec* 1988; **123**(18): 476.

168. Visser IJ. Cutaneous salmonellosis in veterinarians. *Vet Rec* 1991; **129**(16): 364.

169. Whyte P. 'Hazard Analysis Critical Control Point (HACCP) Systems – a basis for food safety management in commercial poultry processing'. PhD submission to Veterinary College UCD, 2000.

170. Berndtson E, Danielsson-Tham ML & Engvall A. *Campylobacter* incidence on a chicken farm and the spread of *Campylobacter* during the slaughter process. *Int J Food Microbiol* 1996; **32**: 35-47.

171. Vaira D, D'Anastasio C, Holton J, Dowsett JF, Londei M, Bertoni F, Beltrandi E, Grauenfels P, Salmon PR, Gandolfi L. Campylobacter pylori in abattoir workers: is it a zoonosis? *Lancet* 1998 Sep 24; **2**(8613): 725-6.

172. Ross DJ, Cherry NM & McDonald JC. Occupationally acquired infectious disease in the United Kingdom: 1996 to 1997. *Communicable Disease and Public Health* 1998; **1**: 98-102.

173. Skovgaard N & Morgen CA. Detection of Listeria spp in faeces from animals, in feeds and in raw foods of animal origin. *International Journal of Food Microbiology* 1996; **6**: 229-42.

174. Nesbakken T, Kapperud G, Lassen J & Skjerve E. Yersinia enterocolitica 0:3 antibodies in slaughterhouse employees, veterinarians and military recruits. Occupational exposure to pigs as a risk factor for yersiniosis. *Contrib Microbiol Immunol* 1991; **12**: 32-9.

175. Barnham M, Kirby J & Skillin J. An outbreak of Streptococcal infection in a chicken factory. *J Hyg* (Lond) 1980; **84** (1): 71-5.

176. Barnham M & Nielson DJ. Group L beta-haemolytic streptococcal infection in meat handlers: another streptococcal zoonosis. *Epidemiol Infect* 1987; **99** (2): 257-64.

177. Robertson IJ & Smith HV. Cryptosporidium and cryptosporidiosis. Part I: Current perspective and present technologies. *Eur Micro* 1992: Nov/Dec pp. 20-29.

178. Casemore DP. Epidemiological aspects of human cryptosporidiosis. *Epidemiol* 1990; **104**: 1-28.

179. *Guidelines for the Implementation of Food Safety Management Systems in Beef and Lamb Slaughter Plants through HACCP Principles.* FSAI Red Meat Working Group 2002.

180. Pratt RJ, Pellowe C, Loveday HP, Robinson N, Smith GW, and the epic guideline team. The epic project: Developing national guidelines for preventing healthcare associated infections. *Journal of Hospital Infection*. 2001; **47**(Suppl):S3-S4.

181. Paulson DS. Handwashing, gloving and disease transmission by the food preparer. *Dairy Food Environ Sanit* 2000; **20** (11): 838-45.

APPENDIX A
FOOD HANDLER QUESTIONNAIRE: NEW EMPLOYEES

PREVENTING THE SPREAD OF DISEASES THROUGH FOOD

The purpose of this questionnaire is to ensure that new employees advise the person-in-charge of relevant conditions so that appropriate steps can be taken, if necessary, to prevent the spread of diseases through food

Applicant/Employee Name: _____

Address: _____

_____

_____

CURRENTLY

1. Are you suffering now, or within the last seven days, from any of the following:
   - (a) Diarrhoea? Yes/No
   - (b) Vomiting? Yes/No
   - (c) Jaundice? Yes/No

2. Are you suffering from:
   - (a) A skin infection or sore affecting the hands, arms, face, neck or scalp? Yes/No
   - (b) Skin trouble (such as eczema) affecting the hands, arms, face, neck or scalp? Yes/No
   - (c) Discharge from the eye, ear, nose, mouth or gums? Yes/No
   - (d) Sore throat with fever? Yes/No

ONGOING

3. Do you suffer from

   - (a) A recurring bowel problem? Yes/No
   - (b) Recurring skin trouble (such as eczema or psoriasis)? Yes/No

PAST

4. Have you ever been diagnosed as being ill with, or to be a carrier of, Typhoid or Paratyphoid? Yes/No

5. In the last 21 days have you been in contact with anyone, at home or abroad, who may have been suffering from Typhoid or Paratyphoid? Yes/No

6. In the last 10 days have you been in contact with anyone in your household who may have been suffering from E. coli (VTEC) infection? Yes/No

Signature of Applicant/Employee: _____

Date: _____

APPENDIX B
MEDICAL CERTIFICATION

Food Handler: Fitness to Work

Preventing Transmission of Diseases Through Food By Infected Food Employees

This is to certify that:

Name: _____

Address: _____

_____

_____

Date of Birth: _____

1. Is not today suffering from any impediment to employment as a food handler on public health grounds
2. Has been informed of the need for good hygiene practice to prevent the transmission of foodborne disease
3. Has been informed of the need to report conditions that might pose a risk to public health through food handling

Signed: _____ **Date:** _____

Name/Stamp of
Certifying Health Care Professional: _____

I understand the advice given to me during this consultation and have received a written summary of that advice.

Signed: _____ **Date:** _____

APPENDIX C
FOOD HANDLER: GOOD HYGIENE PRACTICES AND REPORTING REQUIREMENTS

Preventing Transmission of Diseases through Food by Infected Food Handlers

Contamination of food by an infected food handler can lead to food poisoning in the consumer.

Infections in the food handler which could result in consumer food poisoning are almost always those which cause the food handler to have a tummy upset (i.e. diarrhoea and/or vomiting). Other possibilities include jaundice or skin infections or, very rarely, infections of the eye/ear/nose/mouth/gums or streptococcal sore throat. Occasionally, the food handler may have no symptoms all.

Strict attention to good personal hygiene (especially handwashing) at all times is the most important means of preventing the spread of infection from the food handler through food.

ALWAYS OBSERVE THE FOLLOWING

1. **Wash your hands thoroughly**
   - after using the toilet
     and
   - before and after handling food

(This means thorough washing with soap & water and thorough drying afterwards)

2. **Report immediately any of the following conditions to your supervisor:**

   - DIARRHOEA OR VOMITING
   - Any infection, sore or cut on exposed skin (i.e. on hands, arms, face, neck or scalp)
   - Any discharge from the eyes, ears, nose, mouth or gums
   - Jaundice
   - Sore throat with fever

3. **Do not handle food if you are suffering from diarrhoea or vomiting**

4. **Do not handle food if you have an infection, a sore or a scaly area on exposed skin which cannot be totally covered during food handling**

5. **Ensure that cuts and abrasions on exposed skin are totally covered with a distinctively coloured waterproof plaster**

APPENDIX D:

Organism/Condition: Recommended Control Measures for Food Handlers

[High-Risk Food Handler - Handles unwrapped food to be consumed raw or without further cooking of other forms of treatment]

Causative Agent /Illness	Incubation Period	Main Clinical Features	Exclusion beyond clinical recovery required?	Microbiological Clearance Required?	If Food Handler is a Household Contact of a Case
Aeromonas spp[1]		Vomiting, diarrhoea	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Amoebic Dysentery (*Entamoeba histolytica*)	Variable Commonly 2-4 weeks	Fever, chills, bloody or mucoid diarrhoea	**High-risk F/H:** 48 hours after first normal stool	No (Late follow-up to detect chronic carriage advisable)[1]	Screen to detect if cyst excreter (careful assessment needed (to evaluate significance as many cysts non-pathogenic)[1]
Bacillus spp	1-5 hrs (emetic) 8-16 hrs (diarrhoeal)	Nausea, vomiting Diarrhoea, abdominal pain	Exclusion after clinical recovery not appropriate	No	(Person-to-person spread does not occur)
Campylobacter spp	1-10 days (usually 2-5 days)	Abdominal pain, profuse diarrhoea, headache, fever (vomiting uncommon)	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Cholera (*Vibrio cholerae 01 or 0139*)	Hrs – 5 days *(usually 2-3 days)*	Sudden onset profuse, painless,watery stools, nausea and vomiting; rapid dehydration	**High-risk F/H:** 48 hours after first normal stool	When indicated (suspect hygiene/ poor sanitation), 2 consecutive negative stools taken at intervals of at least 24 hours[1]	Reinforce hygiene advice
Clostridium botulinum (Botulism)	8 hrs-8 days (commonly 12-18 hrs)	Visual disturbance, dry mouth, swallowing difficulty, paralysis, respiratory failure	Exclusion after clinical recovery not appropriate	No	(Person-to-person spread does not occur)
Clostridium perfringens[1]	8-22 hrs (usually 12-18 hrs)	Diarrhoea and abdominal pain	Exclusion after clinical recovery not appropriate	No	(Person-to-person spread does not occur)

Cryptosporidium spp[1]	2-5 days	Watery or mucoid diarrhoea	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Escherichia coli (other than VTEC)[1]	9-12 hr (EPEC) 10-72 hr (ETEC)	Diarrhoea	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Escherichia coli (VTEC)	1-8 days (usually 3-4 days)	Abdominal pain, diarrhoea, haemorrhagic colitis (bloody diarrhoea). Haemolytic Uraemic syndrome 2-7%	**High-risk F/H:** Until microbiological clearance obtained	**High-risk F/H:** Yes (2 negative stool samples not less than 48 hours apart)	**High-risk F/H**: Exclude until micro. clearance obtained unless careful risk assessment suggests otherwise
Giardia lamblia[1] (Giardiasis)	5-25 days	Diarrhoea, abdominal cramps	**High-risk F/H:** 48 hours after first normal stool	No	Screening may identify those who need treatment
Hepatitis A	2-6 weeks	Fever, nausea, loss of appetite, abdominal pain, jaundice	**All:** 7 days from onset of jaundice and/or symptoms	Not relevant	Consider for prophylaxis (HNIG or HAV vaccine)
Salmonella spp (Salmonellosis)	6-72 hours (Usually 12-36 hrs)	Headache, abdominal pain, fever, diarrhoea, nausea +/- vomiting	**High-risk F/H:** 48 hours after first normal stool	No (provided hygiene practise adequate)	Reinforce hygiene advice
Salmonella typhi/ paratyphi (Enteric Fever)	Typhoid: 3 days-1 month (usually 8-14 days) Paratyphoid: 1-10 days	Fever, rigors, rash, variable gastro-intestinal symptoms: constipation (early); diarrhoea (late)	**High-risk F/H:** Until microbiological clearance obtained	**High-risk F/H:** Yes (6 consecutive negative stool samples taken at 2-weekly intervals, starting 2 weeks after completion of antibiotic treatment)	**High-risk F/H**: Exclude until 3 consecutive negative stool samples taken at weekly intervals starting 3 weeks after last contact with untreated case (consider also for contact with household carrier)
Shigella spp.	12 hrs-7 days (usually 1-3 days)	Bloody diarrhoea, fever, abdominal pain. *S.sonnei* generally mild	**High-risk F/H:** 48 hours after first normal stool	**High-risk F/H**: *S. dysenteriae* (2 negative stool samples not less than 48 hours apart)	Reinforce hygiene advice
Staphylococcus aureus	1-7 hours (usually 2-4 hours)	Vomiting, abdominal cramps, often with diarrhoea	Nasal carriers – do not need to be excluded Skin – exclude high-risk food handler if infected skin lesion on exposed part that cannot be adequately covered until healed	No	–
Streptococcal Disease (Group A ß-Haemolytic Strep)	1-3 days	Variety of diseases: e.g. Sore throat - with fever, exudative tonsillitis/pharyngitis and lymphadenopathy	**High-risk F/H:** Exclude those with streptococcal sore throat until treated	No	–

Vibrios (non-cholera) [1]	2-48 hrs (usually 12-18 hrs)	e.g. Skin – Impetigo/pyoderma Diarrhoea, fever	Skin – asfor *S. aureus* above **High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Viral gastroenteritis (Rotavirus) [1]	24-72 hrs	Diarrhoea, vomiting	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice
Viral gastroenteritis (Norovirus`)	12-48 hours (av)	Nausea, vomiting (often projectile),abdominal cramps, diarrhoea, fever, chills	**All**: At least 48 hours after first normal stool	No	Reinforce hygiene advice
Yersinia spp[1]	3-7 days	Watery diarrhoea, abdominal pain, fever, arthritis	**High-risk F/H:** 48 hours after first normal stool	No	Reinforce hygiene advice

NOTE:

- These recommended control measures are guidelines only and do not purport to address every eventuality
- Criteria may be varied at the discretion of the Director of Public Health/Designated Medical Officer, in consultation with a Consultant Microbiologist, following an individual or outbreak risk assessment

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