FOURTH EDITION

# Communicable Disease Control and Health Protection Handbook

Jeremy Hawker, Norman Begg, Ralf Reintjes, Karl Ekdahl, Obaghe Edeghere, Jim van Steenbergen

WILEY Blackwell

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## Fourth Edition

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# Foreword

Six years have passed since the third edition of the *Communicable Disease Control and Health Protection Handbook* was published. In many other areas of public health this may not seem a long time. However, when it comes to communicable disease control there is always an element of urgency, and each large international (or national) outbreak is an impetus for reflection on what went well and what could be done better next time. Therefore, our area of work is as much driven by the large events as it is by slow developments.

Since the last edition, the WHO has three times invoked formal declarations of public health emergencies of international concern (PHEIC) under the International Health Regulations (IHR 2005); in 2014 the polio declaration, the same year the Ebola declaration, and in 2016 the Zika virus declaration. Each of these emergencies has different characteristics and provides different lessons.

Two of the most tangible consequences of larger international outbreaks the last 10 years, are the new EU legislation on Cross-border Threats to Health (Decision 1082/2013) and the establishment of the new WHO Health Emergencies Programme. Both highlight the importance of increasing the core capacities of the countries to prepare for and respond to health threats, and the need for efficient international co-operation. These tasks cannot be performed by the health sector itself, but need an inter-sectoral and one-health approach. The new edition of the handbook, covers these areas.

However, the challenge does not only lie with the big outbreaks. We are also facing silent and slow, but no less threatening epidemics. Here I am of course referring to the growing problem of antimicrobial resistance, which can only be overcome by proper antibiotic stewardship and consequent infection prevention and control in hospitals. However, everyone needs to contribute, hence the one-health approach, to buy us the time needed for the introduction of new technologies and principles of fighting infections that may in the future save us from a situation similar to the one in the pre-antibiotic era.

The years since the previous edition of this book have also presented new challenges in the shape of increasing lack of trust in authorities, 'alternative facts', and social media filter bubbles, where rumours and myths are spreading. In the age of social media, vaccine sceptics are getting effective platforms for disseminating their messages. As public health professionals, we are, therefore, facing new tasks in debunking these myths. This is requiring new skill sets outside the traditional public health competencies, and as public health professionals, we will need to provide leadership, regardless of our specific position.

Public health professionals are facing numerous challenges. Many are working not only with communicable diseases, but in a broader public health setting, where some of the specific infectious diseases requiring public health actions are only rarely encountered. The practitioner in the field noting an infection case, or cluster of cases, therefore from time to time will need easy access to practical, authoritative and updated information to guide initial assessment and practical response.

In today's information age, we are not lacking sources of information – quite the contrary, but the format is not always relevant to the practical problem at hand. This is where the *Communicable Disease Control and Health Protection Handbook* has its niche. The format of the handbook is designed to provide the on-call public health officer with necessary information at a glance in the acute situation. It provides clear and practical guidance on what needs to be done and when to engage others. It is thus a good compliment to other sources of information, for example relevant national guidelines. At the same

time, the overview chapters are useful for setting the individual cases in a larger public health perspective.

As the Director of the European Centre for Disease Prevention and Control (ECDC), I especially appreciate the specific European dimensions of the book. The country chapters provide a useful overview of the public health systems in each of the EU countries and some more. This European dimension highlights that fighting communicable diseases is not only a national priority, but is a task requiring co-operation across the borders.

July 2018

Andrea Ammon
Director
European Centre for Disease Prevention and Control

# Abbreviations

| | |
|---|---|
| ACDP | Advisory Committee on Dangerous Pathogens |
| AIDS | Acquired immunodeficiency syndrome |
| AIH | Autoimmune hepatitis |
| AMR | Antimicrobial resistance |
| BBV | Blood-borne virus |
| BCG | Bacille Calmette–Guérin (vaccine against TB) |
| BSE | Bovine Spongiform Encephalopathy |
| CAP | Community acquired pneumonia |
| CCDC | Consultant in Communicable Disease Control (local public health doctor with executive responsibilities for CDC) |
| CCG | Clinical Commissioning Groups (health service purchaser) |
| CDC | Communicable disease control |
| CDI | *Clostridium difficile* infection |
| CFR | Case Fatality Rate |
| CHP | Consultant in Health Protection |
| CICN | Community infection control nurse |
| CJD | Creutzfeldt–Jakob Disease |
| CMV | Cytomegalovirus |
| CNS | Central nervous system |
| CRE | Carbapenem-resistant enterobacteriaceae |
| CSF | Cerebrospinal fluid |
| D | Diarrhoea |
| DEET | N,N-diethyl-*m*-toluamide |
| DNA | Deoxyribonucleic acid |
| DOT(S) | Directly observed therapy (supervised) |
| DPH | Director of Public Health |
| DTP | Diphtheria, tetanus and pertussis (whole-cell) |
| EBV | Epstein–Barr virus |
| ECDC | European Centre for Disease Prevention and Control |
| EEA | European Economic Area |
| EHO | Environmental health officer |
| EIA | Enzyme immunoassay |
| EIEC | Enteroinvasive *Escherichia coli* |
| ELISA | Enzyme-linked immunosorbent assay |
| EM | Electron microscopy |
| EU | European Union |
| FSA | Food Standards Agency |
| FWE | Food, water and environment |
| GI | Gastrointestinal |
| GP | General Practitioner (Primary Care Physician) |
| GUM | Genitourinary medicine |
| HACCP | Hazard Analysis Critical Control Point |
| HAI | Hospital acquired infection |
| HAV | Hepatitis A virus |
| HBV | Hepatitis B virus |
| HCAI | Health-care associated infection |
| HCV | Hepatitis C virus |
| HCW | Health Care Worker |
| HDV | Delta Hepatitis |
| HEPA | High-Efficiency Particulate Air (Filters) |
| HEV | Hepatitis E virus |
| Hib | *Haemophilus influenzae* type b |
| HIV | Human Immunodeficiency Virus |
| HNIG | Human normal immunoglobulin |
| HP | Health Protection |
| HPT | Health Protection Team |
| HPV | Human papillomavirus |
| HSCT | Haemopoietic Stem Cell Transplantation |
| HSV | Herpes simplex virus |
| HUS | Haemolytic uraemic syndrome |
| ICD | Infection control doctor (hospital) |
| ICN | Infection control nurse |
| ICT | Infection control team (hospital) |
| IDU | Intravenous drug user |
| IFA(T) | Indirect immunofluorescent antibody (test) |
| IgG | Immunoglobulin class G |
| IgM | Immunoglobulin class M |
| IHR | International Health Regulations |
| IID | Infectious intestinal disease |
| IPV | Inactivated poliovirus vaccine |
| IU | International unit |
| IV | Intravenous |

| | |
|---|---|
| LA | Local Authority |
| LBRF | Louse-borne relapsing fever |
| LD | Legionnaires' disease |
| LGV | Lymphogranuloma venereum |
| MDR | Multi-drug resistant (usually referring to TB) |
| MERS | Middle-East respiratory syndrome |
| MLST | Multilocus sequence typing |
| MLVA | Multiple-locus variable number tandem repeat analysis |
| MMR | Measles, mumps and rubella vaccine |
| MRSA | Met(h)icillin resistant *Staphylococcus aureus* |
| MSM | Men who have sex with men |
| NAAT | Nucleic acid amplification test |
| NCSP | National Chlamydia Screening Programme |
| NHS | National Health Service |
| NICE | National Institute for Health and Care Excellence |
| NPA | Nasopharyngeal aspirate |
| OPV | Oral poliovirus vaccine |
| Pa | Pertussis vaccine (acellular) |
| PBS | Primary biliary sclerosis |
| PCR | Polymerase Chain reaction |
| PEP | Post-exposure prophylaxis |
| PFGE | Pulsed-field gel electrophoresis |
| PHE | Public Health England |
| PPE | Personal protective equipment |
| PrEP | Pre-exposure prophylaxis |
| PSC | Primary sclerosing cholangitis |
| PT | Phage type |
| RAPD | Random amplified polymorphic DNA typing |
| RCGP | Royal College of General Practitioners |
| RNA | Ribonucleic acid |
| RSV | Respiratory syncytial virus |
| RT-PCR | Reverse transcription polymerase chain reaction |
| SARS | Severe acute respiratory syndrome |
| SCID | Severe Combined Immunodeficiency |
| SOP | Standard Operating Protocol/ Procedure |
| Sp/spp | Species |
| STEC | Shiga-toxin producing *E. coli* |
| STI | Sexually transmitted infection |
| TB | Tuberculosis. |
| TBE | Tick-borne encephalitis |
| TBRF | Tick-borne relapsing fever |
| TSE | Transmissible spongiform encephalopathy |
| TTP | Thrombotic thrombocytopaenia purpura |
| TWAR | Taiwan Acute Respiratory Agent |
| UK | United Kingdom of Great Britain and Northern Ireland |
| UTI | Urinary tract infection |
| vCJD | Variant Creutzfeldt–Jakob Disease |
| VHF | Viral haemorrhagic fever |
| VRE | Vancomycin resistant *Enterococcus* |
| VZIG | Varicella-zoster immunoglobulin |
| WGS | Whole genome sequencing |
| WHO | World Health Organization (OMS) |
| WNV | West Nile Virus |
| XDR | Extensively drug resistant (usually referring to TB) |

## Vaccine abbreviations (used in Section 5)

| | |
|---|---|
| BCG | Bacille Calmette–Guérin (vaccine against TB) |
| DTP | Diphtheria, tetanus and pertussis vaccine |
| HepA | Hepatitis A vaccine |
| HepB | Hepatitis B vaccine |
| HiB | Haemophilus influenzae type B vaccine |
| HPV | Human papilloma virus vaccine |
| IIV | Inactivated influenza vaccine |
| IPV | Inactivated polio vaccine |
| LAIV | Live attenuated influenza vaccine |
| MCV | Meningococcal conjugated vaccine (4-valent) |
| MenB | Neisseria meningitidis group B vaccine |
| MenC | Neisseria meningitidis group C vaccine |
| MMR | Measles, mumps and rubella vaccine |
| PCV | Pneumococcal conjugated vaccine |
| Rota | Rotavirus vaccine |
| RotaC | Rotavirus species C vaccine |
| TBE | Tick-borne encephalitis vaccine |
| VAR | Varicella zoster vaccine |

# Section 1
# Introduction

## 1.1 How to use this book

This book is for those working in the field of communicable disease control (CDC) and health protection. It provides practical advice for specific situations and important background knowledge that underlies communicable disease control activities; therefore, it will be of interest to all these working in this broad field, including (but not exclusively) public health physicians, epidemiologists, public health nurses, other public health practitioners, infection control nurses, environmental health officers, microbiologists, general practitioners and policy makers at all levels, as well as students in medical, public health and related fields.

Since the publication of the third edition, there have been many important changes in CDC and health protection. The world has faced its first large multi-country epidemic of viral haemorrhagic fever and other new or re-emerging threats, such as Middle East Respiratory Syndrome (MERS) have been identified. There have been successes, such as new vaccine programmes, improvements in knowledge, new evidence reviews, updating of consensus guidelines and new laboratory tests, particularly in relation to molecular epidemiology. The combination of these with administrative changes in the European Union (EU) and in member countries like the UK has led to major revisions in the content of this Handbook.

The structure of the book is as follows:

Section 1 contains important background material. Chapters 1.2 and 1.3 run through the basic principles of transmission and control that underlie later chapters. Chapter 1.4 provides the basics of how action resulting from that knowledge can be communicated to those who need to know and Chapter 1.5 is aimed primarily at those who undertake on-call duties: in this chapter we assume that some may not practice in mainstream communicable disease control or health protection or may be in training and are undertaking health protection response duties for the first time.

Section 2 addresses topics in the way they often present to CDC staff in the field, that is, as syndrome-related topics rather than organism based, such as an outbreak of gastroenteritis of (as yet) undetermined cause, or a needlestick injury. In these chapters, we discuss the differential diagnosis (infectious and non-infectious), including how to decide the most likely cause based on relative incidence, clinical and epidemiological differences and laboratory tests. We also give general advice on prevention and control, including how to respond to a case or cluster when the organism responsible is not yet known.

Section 3 addresses communicable disease control in a more traditional way, by disease/organism. We have continued to make these chapters suitable for a pan-European audience, using EU-wide data and policies where these exist. We have used England and Wales (or the UK if appropriate) as an example in other instances: for differences relating to surveillance and control in other countries, the relevant country specific chapter in Section 5 should be consulted (e.g. those working in Germany should consult Chapter 5.14).

The chapters in Section 3 conform to a standard pattern, which we hope will make instant reference easier. Most chapters are ordered as follows:

**1** A short introduction mentioning the syndrome(s) common synonyms and the main public health implications of the organism.

**2** A box of *suggested on-call action*. This relates only to what needs to be done if cases are reported outside normal office hours. Further action may be needed during the next working day, which will be identified in 'response to a case'.

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**3** *Epidemiology* gives the relevant points on burden of disease; important differences by age/sex/season/year/risk group are given and important differences within Europe are noted.
**4** Two sections deal with diagnosis of the infection: *clinical features* and *laboratory confirmation*. Both sections highlight the important points to practising CDC professionals. They are not meant as a substitute for clinical and microbiological textbooks.
**5** *Transmission* details the main sources, reservoirs, vehicles and routes of spread of the organism. The main aim of this section is to give the investigator clues as to how a case or outbreak may have arisen to aid identification and control.
**6** *Acquisition* deals with the incubation period, infectious period (if communicable), infective dose (if known) and any important factors affecting immunity or susceptibility.
**7** The final five sections relate to control of infection. These are based on current available guidance and evidence: where this is unclear, they are often based on practice in the UK, our assessments of the evidence base, our understanding of good public health practice and the application of first principles. These sections are:

- actions likely to be effective in the *prevention* of infection,
- *surveillance* activities relevant to the organism,
- suggested public health actions to be taken in *response to a case,*
- suggested approach to an *investigation of a cluster* of cases of that organism, and suggested actions to help in *control of an outbreak*, including a *suggested case-definition* for use in an epidemiological study.

Diseases that are generally less of a public health issue in Europe are summarised in the tables at the end of Section 3. Some infections may also be mentioned in relevant chapters in Section 2 and in chapters in Section 3 covering related organisms (e.g. information on other diarrhoeagenic *Escherichia coli* is given in a table in the chapter on Shiga-toxin producing *E. coli* (STEC)): please check the index for these.

Section 4 refers to the organisation of CDC/Health Protection services and could be titled 'how to run a CDC service'. For the authors who have worked as Consultants in CDC, this is the textbook that we wished we'd had on appointment! It deals with the services that a CDC department is expected to provide, including the non-communicable disease functions that have been attached to the health protection role in some countries. Some of those chapters are UK focused, although this has been reduced and we try to draw out the general principles underlying each approach, so that most will be of equal use to European colleagues.

Section 5 gives a brief overview of structures for infectious disease notification and public health action internationally and in each EU/European Economic Area (EEA) country. The objective of this section is to allow an orientation on public health structures relevant for infectious disease control in various European countries and to offer a starting point for further information on individual countries. Lengthy descriptions have been avoided, but internet addresses for contact points in the countries and for further information, reports and data have been given.

Finally the appendix and two lists of useful websites detail further sources of information and advice for those undertaking CDC functions routinely or on-call. Please note that the information and suggestions given in this book are not meant to override existing national or international guidelines; please also note that the information is a snapshot of the situation at the time of writing and that further data or advice will become available after writing. It is always sensible to check your national country website for up-to-date guidelines to inform public health action: if there are no national guidelines, then the European Centre for Disease Prevention and Control (ECDC) may give EU-wide guidance and other national centre (e.g. Public Health England [PHE]) or other authoritative websites may have something that can be applied to your situation. For this reason, the lists of websites have been placed inside the front and back covers for easy reference.

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most obviously Iain Blair and Julius Weinberg, who were co-authors on the first three editions and helped to prepare such excellent foundations for this edition. Others helped by commenting on specific chapters, including Orlando Cenciarelli, Eulalia Peris, Geneviève van Liere, Marga Goris, Joost van Hommerig and numerous advisors for the country-specific chapters, including Franz Allerberger and Peter Kreidl (Austria), Sophie Quoilin (Belgium), Angel Kunchev (Bulgaria), Aleksandar Šimunović (Croatia), Irene Cotter (Cyprus), Jan Kyncl (Czech Republic), Kåre Mølbak (Denmark), Tiiu Aro (Estonia), Mika Salminen (Finland), Anne-Catherine Viso (France), Sotirios Tsiodras (Greece), Ágnes Csohan (Hungary), Guðrún Sigmundsdottir (Iceland), Derval Igoe (Ireland), Silvia Declich (Italy), Irina Lucenko (Latvia), Loreta Ašoklienė (Lithuania), Jean-Claude Schmit (Luxemburg), Tanya Melillo Fenech (Malta), Frode Forland (Norway), Małgorzata Sadkowska-Todys (Poland), Paula Vasconcelos (Portugal), Florin Popovici (Romania), Dagmar Némethová and Jan Mikas (Slovak Republic), Irena Klavs (Slovenia), Isabel Noguer (Spain), Anders Tegnell and Mårten Kivi (Sweden), and Daniel Koch and Patricia Waldvogel (Switzerland). We would like to thank Annie Edwards for her administrative support, Yasmin Rehman and Shakeel Suleman for Figures 2.2.1 and 2.2.2, and Claire Bonnett, Yogalakshmi Mohanakrishnan and Bella Talbot at Wiley for their support. Finally, we are grateful to our families and work colleagues for their patience and support whilst we were preoccupied with this project.

## 1.2 Basic concepts in the epidemiology of infectious disease

### Identification

Infections can be identified by their clinical features, epidemiology and the use of appropriate laboratory procedures.

### Epidemiological triangle

The traditional model of infectious disease causation is the epidemiological triangle. It has three components: an external agent, a susceptible host and environmental factors that bring the host and the agent together.

The agent is the organism (virus, rickettsia, bacterium, fungus, prion, etc.) that produces the infection. Host factors influence an individual's exposure, susceptibility or response to a causative agent. Age, sex, socio-economic status, ethnicity and lifestyle factors such as smoking, sexual behaviour and diet are among the host factors that affect a person's likelihood of exposure, while age, genetic makeup, nutritional and immunological status, other disease states and psychological makeup influence susceptibility and response to an agent. Environmental factors are extrinsic factors that affect the agent and the opportunity for exposure. These include geology, climate, physical surroundings, biological factors (such as insect vectors), socio-economic factors such as crowding and sanitation and the availability of health services.

### Natural history of disease

This refers to the progress of a disease in an individual over time without intervention. Following exposure to an infectious agent there is a period of subclinical or inapparent pathological changes, which ends with the onset of symptoms. This period is known as the *incubation period*. For a given infectious disease, the incubation period has a range and a median and mean value. For hepatitis A, the range is two to six weeks with a mean of three weeks. During the incubation period, pathological changes may be detectable with laboratory or other tests. Most screening programs attempt to identify the disease process during this early phase of its natural history, since early intervention may be more effective than treatment at a later stage. The onset of symptoms marks the transition from the subclinical to the clinical phase. Most diagnoses are made during this stage. In some

people the disease may never progress to a clinically apparent illness. In others the disease process may result in a wide spectrum of clinical illness, ranging from mild to severe or fatal.

## Occurrence

Two rates are commonly used to describe the occurrence of infectious diseases:

$$\text{Incidence} = \frac{\text{New cases over a given time period}}{\text{Persons at risk}}$$

$$\text{Prevalence} = \frac{\text{Existing cases at a given point in time}}{\text{Persons at risk}}$$

The occurrence or amount of an infectious disease will vary with place and time. A persistent low or moderate level of disease in a specified geographic area is referred to as *endemic* and a higher persistent level is called *hyper-endemic*. A pattern with occasional cases occurring at irregular intervals is called *sporadic*. A number of cases related in time and space is referred to as a cluster. When the occurrence of an infection exceeds the expected level for a given time period, it is called *epidemic* or *outbreak*. When an epidemic spreads over a wide geographical area affecting several continents it is called *pandemic*. Epidemics vary in size and duration. An *epidemic curve,* a frequency histogram of the number of cases against time or date of onset (see Figures 4.2.1–4.2.3), should be plotted. If exposure to the infectious agent takes place over a relatively brief period, a *point source* outbreak might be suspected. Intermittent or continuous exposure broadens the peaks of the epidemic curve, and so an irregular pattern is observed. An outbreak that spreads from person to person is called a *propagated* outbreak. In theory, the epidemic curve of a propagated outbreak would have a series of peaks at intervals approximating to the incubation period. Usually, the epidemic wanes after a few generations because the number of susceptible people falls below a critical level, or effective control measures have been introduced. Some epidemic curves have both common source epidemic and propagated epidemic features because of secondary person-to-person spread. These are called *mixed epidemics*.

## Reservoir

The reservoir of an infectious agent is any person, animal, arthropod, plant, soil or substance (or combination of these) in which the infectious agent normally lives and multiplies. The reservoir may be different from the *source* or *vehicle* of infection. This is the person, animal, object or substance from which an infectious agent actually passes to a host. Many of the common infectious diseases have human reservoirs which include clinical cases, those who are incubating the disease and convalescent carriers. *Colonisation* is the presence of a micro-organism in or on a host, with growth and multiplication, but without evidence of infection. Shedding of an organism from a colonised host may be intermittent. Infectious diseases that are transmissible from animals to humans are called *zoonoses*. The *portal of exit* is the path by which an agent leaves the source host, which usually corresponds with the site at which the agent is localised, for example respiratory tract, genitourinary system, gastrointestinal system, skin or blood. The *portal of entry* is the route by which an agent enters a susceptible host.

For any given infection, understanding the chain of infection allows appropriate control measure to be recommended.

## Susceptibility and resistance

Various biological mechanisms present barriers to the invasion and multiplication of infectious agents and to damage by their toxic products. There may be inherent resistance in addition to immunity as a result of previous infection or immunisation.

**Box 1.2.1 Terms used to describe the outcomes of exposure to an infectious agent**

- *Infectivity*: the proportion of exposed persons who become infected, also known as the *attack rate*.
- *Pathogenicity*: the proportion of infected persons who develop clinical disease.
- *Virulence:* the proportion of persons with clinical disease who become severely ill or die (Case Fatality Rate)

Hepatitis A in children has low pathogenicity and low virulence (Box 1.2.1). Measles has high pathogenicity but low virulence, whereas rabies is both highly pathogenic and highly virulent. Nevertheless, it is difficult to draw a clear line. The case fatality rate (CFR) in measles is low in industrialised countries, but could still be several percent in children with pour nutrition and low access to health care.

The *infectious dose* is the number of organisms that are necessary to produce infection in the host. The infectious dose varies with the route of transmission and host susceptibility factors. Because of the clinical spectrum of disease, cases actually diagnosed by clinicians or in the laboratory often represent only the tip of the iceberg. Many additional cases may remain asymptomatic. People with subclinical disease may nevertheless be infectious and are called carriers.

## Infectious period

This is the time during which an infectious agent may be transmitted directly or indirectly from an infected person to another person. Some diseases are more communicable during the incubation period than during the actual illness. In others such as tuberculosis, syphilis and *Salmonella* infection the infectious period may be lengthy and intermittent. This period may be shortened by (antibiotic-) treatment (though in some infections antibiotics may prolong carriage and hence the communicable period).

## Mode of transmission

This is the mechanism by which an infectious agent is spread from a source or reservoir to a susceptible person. The mechanisms are detailed in Table 1.2.1.

**Table 1.2.1** Modes of transmission of infectious agents

| Types of transmission | Examples |
|---|---|
| **Direct transmission**<br>Transmission by direct contact such as touching, biting, kissing, sexual intercourse or by droplet spread on to the mucous membranes of the eye, nose or mouth during sneezing, coughing, spitting or talking. Droplet spread is usually limited to a distance of 1 m or less. | **Direct route**<br>Infections of the skin, mouth, and eye may be spread by touching an infected area on another person's body. Examples are scabies, head lice, ringworm, and impetigo. Sexually transmitted infections are also usually spread by the direct route.<br>**Respiratory route**<br>Sneezing, coughing, singing, and even talking may spread respiratory droplets from an infected person to someone close by. Examples are the common cold, influenza, whooping cough, and meningococcal infection.<br>**Faecal-oral route**<br>Gastrointestinal infections can spread when faeces are transferred directly to the mouth of a susceptible host. |

(*Continued*)

**Table 1.2.1** (*Continued*)

| Types of transmission | Examples |
|---|---|
| **Indirect transmission**<br>This may be *vehicle-borne* involving inanimate materials or objects (*fomites*) such as toys, soiled clothes, bedding, cooking or eating utensils, surgical instruments or dressings; or water, food, milk or biological products such as blood. The agent may or may not multiply or develop in or on the vehicle before transmission.<br>It may be *vector-borne*. This in turn may be mechanical and includes simple carriage by a crawling or flying insect as a result of soiling of its feet or proboscis or by passage of organisms through its gastrointestinal tract. This does not require multiplication or development of the organism.<br>It may be *biological* when some form of multiplication or development of the organism is required before the arthropod can transmit the infected form of the agent to human when biting. | **Faecal-oral route**<br>Faeces contaminate food or objects like toys or toilet flush handles. Animal vectors such as cockroaches, flies and other pests may transfer faeces. Environmental surfaces may be contaminated. This is particularly important in viral gastroenteritis when vomiting occurs because the vomit contains large numbers of infectious viral particles. Examples of infections spread in this way are food poisoning and hepatitis A.<br>**The blood-borne route**<br>There is transfer of blood or body fluids via a contaminated item from an infected person to another person through a break in the skin such as through inoculation, injection or transfusion.<br>**Respiratory route**<br>Droplets from the mouth and nose may also contaminate hands, cups, toys or other items and spread infection to others who may use or touch those items. |
| **Air-borne spread**<br>*Air-borne* spread is the dissemination of a microbial aerosol to a suitable port of entry, usually the respiratory tract. Microbial aerosols are suspensions of particles that may remain suspended in the air for long periods of time. Particles in the range 1–5 μm are easily drawn into the alveoli and may be retained there. Droplets and other larger particles that tend to settle out of the air are not considered air-borne. Microbial aerosols are either droplet nuclei or dust. | Examples are infection with *Legionella*, *Coxiella* and, in some circumstances, TB. |

# 1.3 Basic concepts in the prevention of infection

The information in this chapter might be appropriate for professionals/organisations to provide to the general public. The chapter deals with preventive measures, and more information on community control measures could be found in other parts of this book, for example in Chapters 2.2 and 4.3. For specific information related to immunisations see Chapter 4.7 and the travel health Chapter 4.11.

## Individual measures against infections

### Hand hygiene

Handwashing with soap is among the most effective and inexpensive ways to prevent gastrointestinal and respiratory infections. This should always be done before and after meals, after visits to the toilet and after direct contact with wounds, blood, nasal discharge and other body fluids (own and others), after direct contact with animals and after spending time in crowded conditions – especially during seasons with much respiratory tract or gastrointestinal infections. Liquid, antibacterial

soap is preferable. Rings and jewellery should be removed before handwashing. It may be more practical to carry a small bottle of alcohol disinfectant than relying on finding a place for handwashing when outdoors.

## Prevention of food-borne infection

*Food handling*

Proper hygiene knowledge is necessary to avoid food-borne infections.

- Minimise transportation time. If it is not possible to return home immediately from the store, use a cool box.
- Always check the 'best before' date to avoid buying food with high bacterial levels. It is important to note that food contaminated with pathogenic bacteria does not necessarily smell bad or look un-fresh. Many bacteria, such as *Yersinia enterocolitica*, *Listeria monocytogenes* and *Clostridium botulinum*, can grow well in low temperatures if stored in the refrigerator too long.
- When preparing large amounts of food it is important to chill the food as quickly as possible. The food could be chilled in small containers.
- Always wash your hands before, during and after preparing food to prevent contamination and cross-contamination. Never cook for others when you have diarrhoea or an infected wound on the hands.
- Rinse vegetables, fresh herbs, and fruit thoroughly before use.
- Cook meat thoroughly. This is especially important for chicken, which often contains *Campylobacter* or *Salmonella*.
- To avoid cross-contamination use different cutting boards for meat, vegetables, and prepared food. Plastic cutting boards can be washed in a dishwasher. Change dishcloths often or boil them in water. Let them dry thoroughly between use.
- When barbequing, never put the meat back on plates that were used for the raw meat.

*Risky food*

Handling food to be eaten without being heated requires proper hygiene measures to ensure that it does not contain pathogenic microbes. Some food is associated with a higher risk of infection:

- Unpasteurised milk and milk products should be avoided, especially for small children, as diarrhoeagenic *Escherichia coli*, *Salmonella* and *Campylobacter* are not uncommon, even in milk from healthy cows.
- Oysters and mussels filter large amounts of water, and micro-organisms (especially norovirus and hepatitis A virus) could be concentrated in the molluscs if they have been grown in contaminated water.
- Many large *Salmonella* outbreaks and in 2011 a large STEC outbreak in Germany have been caused by contaminated bean sprouts. The sprouts are best stored in refrigerator.
- Fresh vegetables and herbs should always be rinsed, regardless of what is stated on the package.
- Raw or soft-boiled eggs may contain *Salmonella*. Risk for infection is highest if eggs are used in products that are not heated properly (e.g. custard on cakes).
- Frozen raspberries have caused several international outbreaks of Norovirus and hepatitis A.

## Measures against respiratory tract infections

Most respiratory tract infections have an airborne mode of transmission or are spread through droplets. An alternative important mode of transmission is through a direct contact between hands and mucous membranes. Especially during the flu season it is advisable to avoid crowded settings, avoid touching the face with the hands and wash the hands regularly. Covering the mouth when coughing and sneezing prevents spread to others. During peak flu season, working from home may be an option in some workplaces.

Other effective measure to avoid respiratory tract infections include stopping smoking, immunisation against respiratory tract pathogens as appropriate (depending on age and risk group) and using a face mask when being exposed for specific pathogens such as

*Aspergillus* (renovations of cellars and attics), hantavirus infection (environment soiled by urine from the bank vole).

## Measures against sexually transmitted infections

Sexually transmitted infections (STIs) require close person-to-person contact for transmission. It should therefore be noted that most other infectious diseases (e.g. gastrointestinal and respiratory tract infections) also easily transmit during sexual contact. All forms of vaginal, oral and anal intercourse are associated with a risk of STI transmission even if condoms are used. It is therefore more appropriate to talk about 'safer sex' than 'safe sex'. Condoms should be used throughout intercourse. Even if they are generally durable, they may be torn by sharp nails or rupture during anal intercourse without lubrication. Lubrication should be water or silicon based, as oil-based lubricants such as Vaseline and skin creams may dissolve the condom.

## Measures against blood-borne infections

Hepatitis B, hepatitis C and Human Immunodeficiency Virus (HIV) are the three major viral infections transmitted via blood.

### *Intravenous drug use*

The most important risk factor for blood-borne infections outside medical care settings is intravenous drug use. The infection is mainly transmitted through the use of non-sterile needles and syringes. A lesser-known route of infection, even among drug addicts, is the transmission through the cup or saucer in which the drugs are dissolved before being drawn into the syringe. Viruses can be killed through boiling the syringes and needles (for several minutes), alternatively by cleaning them in chlorine. To affect the hepatitis B viruses, which are hardier than HIV, the needles and syringes must be in contact with chlorine for at least two minutes. Both these methods are effective, but not completely safe. The only safe way is never to share injection equipment. As a harm-reduction measure, most European countries organise needle-exchange and/or oral substitute programmes.

### *Tattoos*

Becoming tattooed with a non-sterile needle carries the risk of blood-borne infection. It is therefore important to ensure that the tattoo is done by a reputable craftsman. In many countries there are associations of professional tattoo artists. If uncertain, it is advisable to consult the local public health/environmental health department. Tattooing abroad in countries with generally low levels of hygiene should be avoided as the prevalence of blood-infected persons may be high, and the regulation of tattoo artists is inadequate in many parts of the world.

### *Other blood exposure*

Exposure to blood occasionally happens outside healthcare environments, for example in relation to accidents. The basic rule for all contact with blood is to consider it as infected. It is especially important to avoid getting blood splashes in the eyes, mouth, or nose. Blood on the skin should be immediately washed with soap and water. Blood spill, even minimal amounts, should be dried as soon as possible. Chlorine solution (one part bleach to nine parts water) effectively destroys the virus on blood-soaked surfaces or objects, but should not be used directly on skin or on textiles. Blood-stained clothes should be washed with pre-wash and then at the highest possible temperature. Plastic or latex gloves and disposable plastic aprons should be included in car and home first aid kits. A nozzle with a check valve for mouth-to-mouth resuscitation is a valuable part of a first aid kit.

The risk of blood contamination increases with cuts and puncture wounds. If the skin is

penetrated by contaminated needles, scalpels or similar, the risk of hepatitis B infection is about 30%, hepatitis C infection about 2% and HIV about 0.3%. The injured area should be bled and the area should be washed thoroughly with soap and water. After any exposure that might have a risk of blood contamination a doctor should be immediately contacted.

## Protection against insect-borne infections

*Protection against tick bites*

The tick season usually lasts from early spring to autumn. The best protection against bites is to avoid the typical tick-infested terrains (damp and shaded terrain with half-high grass). In gardens, the number of ticks could be reduced by keeping the grass short and clearing away shady bushes and trees. Full dress, with trousers stacked in boots, is an effective protection. Furthermore, it is advisable to inspect the skin regularly, as the ticks often take some time before biting. Mosquito repellent has some effect even against ticks.

Ticks prefer to bite through thin skin. Most common areas in adults are the legs, while in children the bite is usually higher up on the body, often in the groins. Transfer of Tick-borne encephalitis (TBE) virus is instantaneous after the bite, while the risk of infection with *Borrelia* and *Ehrlichia* increases with the time the tick is attached. Ticks are best removed with tweezers (preferably special tick tweezers which can be bought in pharmacies in tick-infested regions). A gentle, twisting motion increases the chance that the entire tick is removed and reduces the risk of bacterial transmission. Margarine or cooking oil should not be used. The wound is washed with soap and water. Any remaining tick parts give rise to an inflammatory reaction and can be removed after a few days. These do not increase the risk of infection. Doctors should be contacted if an erythema occurs around the bite site.

*Protection against mosquito bites*

Personal protection against mosquito bites in risk areas include wearing covering clothes (long-sleeved shirts and long trousers) and regular application of mosquito repellents containing DEET (N,N-diethyl-*m*-toluamide), or alternatively other approved substances such as icaridin, lemon eucalyptus, or citronella in accordance with the manufacturers' instructions. This is especially important for protection against day-time bites of *Aedes* species (transmitting dengue, chikungunya, zika virus and yellow fever). The best effect against mosquito species that have a preference to bite indoors at night, as *Anopheles* species (transmitting malaria), is to sleep in screened, air-conditioned rooms, or otherwise using long-lasting insecticide treated bed nets (LLIN) impregnated with permethrin, deltamitrin or alpha-cypermethrin. Removing mosquito breeding sites in nearby outdoor or indoor premises is a more permanent measure.

*Integrated vector management*

In case of outbreaks of mosquito-borne infections (dengue, chikungunya, Zika virus) in areas with an abundance of competent vectors it is important to reduce mosquito vector density in a sustainable manner.

- Reduce outdoors and indoors breeding sites by draining or removing sources of stagnant water (e.g. flower pots, vases, used tyres, tree holes and rock pools), or, if that is not possible, treatment with larvicides. Open water containers should be well covered.
- Use physical barriers (window screens and mosquito nets) and air conditioning.
- Elimination of adult mosquitoes through aerial spraying could be considered.

## Infection control precautions in care settings

The following infection control measures are general and may need to be adapted

depending on the specific type of care setting, for example community care settings (see also Chapter 4.3) and health care settings (see also Chapter 4.4).

## Standard precautions

It is not always possible to identify persons who may spread infection to others, therefore standard precautions to prevent the spread of infection must be followed in health care settings at all times (Box 1.3.1). In addition, for persons with respiratory infections, droplet precautions may be recommended (Box 1.3.2) and in those with diarrhoea and/or vomiting enteric precautions should be followed (Box 1.3.3). These precautions are valid for any care setting.

Handwashing is the single most important part of infection control. Soiled hands should be washed with soap and water. If soap and water is not available, alcohol gel or rub can be used. Hands should be washed before contact with patients, after any activity that contaminates the hands (removal of protective clothing and gloves, using the toilet) and before handling food. Nails should be kept short, rings should not be worn, artificial nails should be avoided and cuts and abrasions should be covered with a waterproof dressing. Adequate handwashing facilities must be available in all patient areas. Liquid soap dispensers, paper hand towels and foot-operated waste bins should be provided.[1]

**Box 1.3.1 Infection control standard precautions in health care (abbreviated)[2]**

- Hand hygiene: handwashing 40–60 seconds with soap and water or use of an alcohol hand rub or gel. Cover wounds or skin lesions with waterproof dressings.
- Appropriate use of gloves, gowns, aprons and facial protection (eyes, nose and mouth).
- Prevention and management of needlestick injuries, injuries from other sharp instruments and blood splash incidents.
- Respiratory hygiene and cough etiquette.
- Safe disposal of contaminated waste.
- Managing spillages of blood and body fluids.
- Safe collection and transport of specimens.
- Decontaminating equipment including cleaning, disinfection and sterilisation.
- Maintaining a clean clinical environment.
- Safe management of used linen.
- Place patients with infections in appropriate accommodation.

**Box 1.3.2 Droplet precautions when managing respiratory infections**

- Wear a medical mask if working within approximately 1 m of the patient or upon entering the room/cubicle of a patient.
- When performing aerosol-generating procedures (chest physiotherapy, nebulisation) wear a particulate respirator, perform procedures in an adequately ventilated room and limit other persons in the room only to those required for the patient's care.

[1] World Health Organisation. Guidelines on hand hygiene in health Care. http://apps.who.int/iris/bitstream/10665/44102/1/9789241597906_eng.pdf.

[2] World Health Organisation. Infection control standard precautions in health care. http://www.who.int/csr/resources/publications/4EPR_AM2.pdf.

**Box 1.3.3 Enteric precautions when managing diarrhoea and vomiting**

- Patients should normally use a flush toilet for the disposal of excretions and soiled materials. Attendants should wear disposable plastic gloves and wash hands thoroughly.
- Faecal material on soiled clothing and bed linen should be flushed into the toilet bowl. Linen should then be washed in washing machine on a 'hot' cycle. Soaking in disinfectant before washing is not necessary.
- Use of disinfectants is important in schools, nursery schools and residential institutions. Toilet seats, flush handles, wash-hand basin taps and toilet door handles should be cleaned daily and after use with a bleach-based household cleaner, diluted according to manufacturer's instructions. Alcohol-based wipes may be used on seats and other hard surfaces. Bedpans and urinals should be emptied into the toilet bowl, washed with a disinfectant and rinsed.
- Patients and carers should be advised about personal hygiene and the hygienic preparation and serving of food. Children and adults in jobs likely to spread infection (e.g. food handlers) should stay away from work or school for 48 hours after the diarrhoea has stopped. In the NL, workers can resume work as soon as diarrhoea has stopped. Day care is not regarded as a job likely to spread infection. Most important criterium is if a worker can adequately comply to hygienic precautions.

## 1.4 Emergency risk communication

Emergency risk communication is increasingly seen as a fundamental part of preparedness and response to health threats, and is one of the eight core capacities of the International Health Regulations (IHR). When communicating during a crisis, the media should be considered as an ally in protecting the health of the public. They are one of the most powerful influences upon the public. Relationships with the media should be developed proactively; good routine relationships with the media will make dealing with them during emergency situations much easier.

Communicable disease issues arouse interest and anxiety in the public. The public have a right to be informed and the press is often the best route. Virtually all issues can be presented in a way that the public can understand. Professionals should not hide behind technical obfuscations. Do not expect to have any control over material that you provide, press releases can be selectively quoted and interviews can be edited. However, journalists are usually interested in accuracy.

### Training

Anyone who is likely to deal with the media should undergo media training. This will help in understanding what the media needs. Journalists often have a similar agenda to public health workers, they wish to inform and educate the public. If they encounter a group of professionals who understand their needs, and are trying to help, then journalists are less likely to be antagonistic. Identify people within the organisation who are particularly good with the media – they may not be the most senior people.

### Routine relationships

As for other aspects of preparedness, good emergency risk communication is best based on good relations with media cultured before the crisis. Develop regular contact with your local print and broadcast media. Be available to answer their questions, and treat your local reporters in a friendly way. If they trust you and rely on you as an authoritative source it will make things much easier if a story is breaking.

Local papers may be willing to publish a regular column; this is a powerful way of getting health advice across. Use opportunities

to publish in local papers, women's magazines, parents' magazines, and so on. This will probably have a greater influence on health than publishing in the peer-reviewed medical press. Have basic information packs available for journalists. These should describe the clinical features and importance of an infection and the salient epidemiological features and recent trends.

## Communicating during a crisis

During outbreak or emergency situations it is important to maintain good relations with the press. Journalists have a job to do, they can become intrusive, but they will understand that you also have a job to do. Let the journalists know that they will be kept informed, that there will be regular briefings, daily or even twice daily. Ensure that the briefings do happen. Appoint a media spokesperson and ensure that all media briefings are done through that person. The outbreak control team should co-ordinate the local flow of information. Sometimes, several actors (at different levels) are involved, all with their own media contacts, it is then important to have co-ordinated messages and shared lines-to-take. If not, journalists will likely focus on the differences rather than on the main messages.

WHO has developed outbreak communication guidelines that could be used as a reference by anyone involved in outbreak communication. The main principles include the following:

- build, maintain and restore trust,
- announce early,
- aim at maximum transparency (taking into account privacy issues),
- understand the public, and
- plan in advance.

## Messages

Decide beforehand what your key messages are; if possible discuss these with the journalist and discuss the questions that will be asked. Decide if there are any areas that you do not wish to be drawn into. Be honest, accurate and keep technical details to a minimum. Get the key message across first, then provide the reasoning behind it. Stress the facts and explain the context. Do not try to hide the truth or lie. If you are uncertain of the facts or some detail say so and offer to get the information. Do not be drawn into areas you feel you cannot or should not discuss, be firm and polite and say that you cannot discuss that issue. Try to avoid discussions of money and cost saving, stress public health action and your concern for safeguarding public health. Avoid being drawn into speculation or criticisms of other groups. Behave as if you were always 'on the record'. Make sure that you know if a broadcast is live or recorded. Always ask to see the article before it is published in order to correct factual mistakes – most serious journalists appreciate that. However, do not expect to be able to change the direction or angle of the article, attempts to do that will likely just upset the journalist.

## Press releases

Keep the press release short (8–10 paragraphs), make sure you have considered the message and the audience for the release and consult a press officer. Get the most important message into the first paragraph and support it with a quote from a senior official. In the introduction, describe who, what, where, when, why/how. In the middle, expand the story with supporting detail, conclude by summarising and identifying the next steps.

## Social media

As has been seen in the 2016 US election, social media is rapidly replacing traditional media when it comes to forming public opinions, and a strong presence in social media is imperative for any successful emergency risk communication. Compared

to traditional one-way communication, social media provides for monitoring debate and opinions in real time as well as engagement with key influencers. Social media also create new opportunities for interaction with users, and sensibly used messages could get through and multiplied in a very short time. However, the two-way communication inherent in social media also takes time and resources, and it is important for any organisation to have a clear social media strategy. For this purpose, ECDC has developed a toolkit on 'Social media strategy development: a guide to using social media for public health communication', available on the ECDC website.

### Problems

The press might want access to cases or locations, such as outbreak rooms for atmospheric pictures or interviews. These requests should be considered very carefully. Considerations of confidentiality and the smooth running of an investigation must come first. However, on occasion such photo opportunities might, by raising public awareness of an issue, be beneficial. If things go wrong remember that they can do so in the best of relationships. Developing good relations with the media takes time and effort. If errors of fact appear in an article, or you feel you have been misrepresented, contact the journalist and discuss them; if necessary talk to the editor.

## 1.5 Health protection on-call

During office hours, health protection activity is usually undertaken by individuals who are highly expert in their field and who have access to a full range of supporting services. Outside office hours, duties may be covered by more generalist staff and/or key support services, such as laboratories and environmental health teams, may also offer a much reduced service.

### Requirements for on-call staff

Undertaking health protection on-call should present few problems for those adequately trained in public health, as the skills applied are the same as those used in everyday public health practice, that is:

- defining the problem,
- collecting the necessary information,
- undertaking a risk assessment,
- identifying good practice,
- implementing the response,
- evaluating the outcome.

In addition to these generic public health skills, basic specialist health protection knowledge and experience is needed for safe out-of-hours health protection practice. A suggested list of the competences required is given in Box 1.5.1. These competencies need to be maintained by incorporating them into the continuous professional development plan for each individual, for example by attending an on-call updating course and participating in simulations and exercises.

Access to knowledge on-call is important and is available from

- this handbook: on-call actions and underlying theory are given for all the most common pathogens,
- a local on-call pack, detailing local policies, procedures, plans and contact details,
- national guidance documents (see Appendix),
- websites, including those of the national communicable disease control or health protection organisation (see lists inside book covers),
- local, regional and national specialist on-call, for example the local acute hospital will usually have a consultant medical microbiologist on-call and the national health protection organisation will usually provide access to a communicable disease epidemiologist.

**Box 1.5.1 Suggested competences required to undertake consultant-level health protection on-call duties**

**1** Familiarity with the principles and practice of being on-call, including
- professional obligations,
- legal issues,
- professional responsibility to ensure appropriate public health action taken in response to all incidents.

**2** Ability to perform a risk assessment of a problem, decide whether public health action is necessary and decide appropriately whether action is required out of hours.

**3** Ability to effectively exercise the local on-call procedures, including:
- Administration of urgent prophylaxis,
- Handover before and after on-call.

**4** Experience of practicalities of working with others out of hours, particularly:
- Local and national health protection agency,
- Microbiology laboratory,
- Environmental Health department.

**5** Up to date knowledge of relevant aspects of natural history, epidemiology, clinical presentation, laboratory diagnosis and methods of transmission and control of common hazards that may require public health intervention out of hours, including:
- Meningococcal disease and meningitis,
- Gastrointestinal infections, including STEC,
- Respiratory infection, including Legionella and TB,
- Blood-borne viruses (HBV, HCV, HIV),
- Infections requiring prophylaxis/advice, (e.g. pertussis, hepatitis A, measles),
- Most common chemical/environmental hazards (asbestos, CO, smoke, mercury, ammonia, chlorine),
- Other hazards with increased local/regional occurrence.

**6** Ability to interpret national guidelines and local policies for the most common scenarios that present on-call and to effectively co-ordinate public health action. Includes single cases of infections listed in item 5.

**7** Awareness of the basic principles of control and sources of advice and support (particularly out of hours) for serious, less common public health problems that may present out of hours, including:
- Imported infections (e.g. VHF, diphtheria, rabies exposure, possible MERS/avian flu),
- Exposure of particularly vulnerable groups (e.g. chickenpox in immunosuppressed/neonates; rubella in pregnancy),
- Exposure to blood-borne viruses or TB in community or health care settings (including needlestick injuries and potential lookback exercises),
- Potential public health emergencies (e.g. food-borne botulism),
- Potential deliberate release (e.g. 'White powder' exposures),
- Exposure to contaminated water,
- Acute exposure to chemical hazards,
- Urgent travel health enquiries,
- Major emergencies (e.g. floods, explosions),
- Recently emerged diseases/hazards.

**8** Understanding of the principles and practice of outbreak and incident management.

**Box 1.5.1 (*Continued*)**

**9** Ability to effectively co-ordinate the public health investigation and control of common local outbreaks and incidents out of hours, including:
- Potentially linked cases of meningococcal disease,
- Potential community outbreaks of gastrointestinal Illness,
- Chemical incidents.

**10** Ability to contribute effectively to the control of:
- Hospital outbreaks/incidents,
- Radiological incidents,
- Major emergencies,
- Deliberate release incidents.

**11** Ability to communicate effectively on public health issues, including:
- Preparing appropriate press releases out of hours,
- Giving effective media interviews,
- Communicating directly with public.

Source: UK Faculty of Public Health, 2006; accessed 2 April 2018 www.fph.org.uk/uploads/FPH%20on-call%20HP_training_generalist.pdf.

## Public health response to a case of infection

The two key questions in dealing with a case of communicable disease are:
- *Where did the case get it from?* This is important because there may be a continuing source which needs to be controlled and because there may be others who have also been exposed and need advice and/or treatment. Others exposed may be known to the case (e.g. household or fellow tourists), but this is not always the case (e.g. a *Legionella* source in the environment).
- *Is the case likely to pass it on?* This may be to close contacts (e.g. household or sexual contacts) that need to be protected by advice to the case and perhaps prophylaxis for the contacts (some of whom may be particularly vulnerable), or it may be via the patient's occupation (e.g. a food handler who has a gastrointestinal infection).

## Syndromes and diseases

At the time that health protection issues emerge, the causative agent may not yet be clear, for example an outbreak of diarrhoea and vomiting in a hospital, or an outbreak of respiratory disease at a nursing home. This may be especially true out-of-hours. Section 2 of this book looks at problems from this angle. The important issues to consider are:
- What investigations are needed to identify the agent (e.g. *Salmonella*), the cause of the incident (e.g. poor hygiene practices) and, if relevant, the vehicle of infection (e.g. a particular food served to guests)? Such investigations usually have microbiological, environmental and epidemiological components.
- What generic control measures can be applied to limit morbidity, whilst awaiting confirmation, for example enhanced handwashing, environmental cleaning and excluding ill food handlers in outbreaks of gastrointestinal illness?

## Public health action on-call

There are two key questions that define what action is taken on-call:
- Is public health action necessary?
- Does it need to be done now?

The factors in deciding whether public health action is necessary are a combination of

- Is the index case at risk of a poor outcome? A death from meningitis or any case of a viral haemorrhagic fever are examples that lead to public anxiety and media interest.
- Is the index case likely to pass infection on to others? If so, action may be required to limit onward transmission from the index case and any infected contacts.
- Is there likely to be an ongoing source that needs controlling? Some stages in investigating possible sources take considerable time, so the earlier they are started, the sooner the result.
- Do contacts or others exposed to the same source need to be traced? This will be important if their outcome can be improved by an intervention or if it will help limit onward transmission.
- Does the public need information or reassurance? This is often affected by the 'scariness' of the disease, whether particularly vulnerable groups are exposed (e.g. children) and issues of 'blame'.

If public health action is necessary, it does not automatically follow that it should take place out-of-hours. Issues that affect timing include:

- The seriousness of the disease. Some infections such as viral haemorrhagic fevers, diphtheria or Shiga-toxin producing *Escherichia coli* (STEC) may require prompt action to prevent even one more additional case in vulnerable groups, whereas others such as norovirus or mumps are less of a threat to most individuals.
- How transmissible is the infection? Not only are some infections more transmissible than others, but some cases with the same infection can transmit more easily than others (e.g. e-antigen positive hepatitis B or smear positive TB).
- How long is the incubation period? Secondary (or co-primary) cases of meningococcal infection may present very quickly, but the incubation period for TB is weeks or months.
- How vulnerable are the people that may have been exposed? Some pathogens are particularly likely to lead to infection or a poor outcome in particular groups, for example STEC in young children and the frail elderly, or chicken pox in immunosuppressed patients. This will heavily influence speed of response.
- What is the public, media or political reaction? Even if not a health protection priority to react on-call (e.g. on HIV positive healthcare worker), action may be required if information becomes public.
- What is 'expected' or good practice?
- When will normal service be resumed? The risk of delaying until 'normal' office hours is obviously proportional to the length of time until a 'normal' response can be activated. Thus, action is more likely on a Saturday morning before a national holiday Monday than on a Sunday night before a normal working Monday.

## Collection of baseline data

Collecting information and recording it in a systematic way is important in order to

- aid management of the incident: the information will be useful to you and to others who take over management later in the incident.
- be available for later scrutiny, either for professional purposes (audit, lessons learned) or legal purposes (Public Inquiries or civil actions).

A good basic minimum dataset is usually required, preferably by completion of a standard form/dataset, covering:

- Administrative details for those providing information (name, organisation/position, contact details) and cases and contacts (name, address, phone, GP, hospital).
- Epidemiological information on cases in relation to person (age, sex, occupation), place (residence, travel, institution) and time (onset and exposures).
- Diagnosis, consisting of clinical and laboratory information.
- Record of advice given.

## Risk assessment

The next stage is usually to undertake a risk assessment, which includes the principles identified earlier (see 'public health on-call'), but may involve the use of a standard framework for assessing the need for action (ranging from gathering more information to implementing an immediate intervention), such as one using the following four criteria:

- *Uncertainty/Confidence* – how confident are you in the diagnosis of the suspected/confirmed illness or in the identification of the hazard? Are there other areas of uncertainty in assessing the situation?
- *Severity* – How severe is the illness in the individual(s) and/or how severe (and likely) is the potential range of illnesses caused by the suspected/confirmed pathogen?
- *Spread* – how likely are others to be exposed to the same source or to people/objects infected or contaminated by it?
- *Intervention* – what interventions are available, how effective are they, when do they need to be implemented for maximum effectiveness and how feasible is it to intervene?

It is often necessary to assess how likely contacts are to have been put at significant risk. The three general questions that are asked in assessing the likelihood of transmission are:

- How infectious is the source (or case)?
- How close is the contact?
- How susceptible are those exposed?

An example of how this is applied for a particular disease is given in Box 3.78.2.

## Possible interventions

If it is decided that action is required, possible interventions include:

- Action to improve the outcome for cases by ensuring appropriate care is provided: this may include provision of immunoglobulins (rabies), antitoxins (diphtheria), antidotes (chemicals) or different antibiotics to usual (e.g. *Legionella*).
- Action to trace others exposed to source or cases in order to provide advice, antibiotics or vaccines (e.g. in contacts of meningococcal disease, all three may be provided).
- Action to prevent others being exposed to cases or contacts, for example by: rendering them non-infectious by use of antibiotics and/or isolation (e.g. diphtheria or TB); by provision of hygiene advice and/or exclusion from work or school (e.g. gastrointestinal illness); or by closure of premises associated with incident (e.g. cooling tower or food premises).
- Action to identify a possible source so that control measures can be implemented and monitored.

## Communications

Communication is vital in public health incidents. Communication needs can be considered from a number of perspectives:

- Who needs to know for public health purposes? Some may need to be contacted on-call (may include the case [or parents], contacts or clinicians) and some can wait until the next working day (e.g. school).
- Who needs to know for information purposes (e.g. who needs to know before the press/public/politicians become aware)? This may include officers of local public health organisations (press officer, chief executive, Director of Public Health) and regional or national organisations (e.g. the national public health or health protection agency and the Department of Health may sometimes need to be told).
- Who can offer advice or help in management of the incident? Such individuals may be able to contribute from a microbiological, epidemiological or environmental health aspect. Occasionally an Incident Management Team meeting by teleconference may need to be set up out of hours.

Is there any advantage in wider dissemination of information or advice? This may be to primary or secondary health care services (e.g. identification and treatment of cases) or the public and press (e.g. to allay anxiety).

## Governance issues

Ensuring an appropriate quality of response on-call can be considered as a mixture of preparation and follow up.

Preparation for on-call includes:

- access to an up-to-date on-call pack,
- access to up-to-date local policies and contingency plans,
- undertaking appropriate training and updating,
- exercising contingency plans and multi-agency response,
- ensuring effective authorisation for use of legal powers,
- ensuring access to required support, including surge capacity and access to additional resources (e.g. an Incident Room), if needed.

Follow-up issue include:

- debrief to review individual cases with local health protection team as learning exercise,
- systematic audit,
- adverse incident reporting,
- written reports, including any lessons learnt,
- review of policies and plans.

# Section 2
# Common topics

# 2.1 Meningitis and meningism

Meningitis is inflammation of the meninges. Meningism is the group of signs and symptoms that accompanies the inflammation. The symptoms of meningism are headache, neck stiffness, nausea or vomiting and photophobia. The classical physical sign of meningism is a positive Kernig's test; however this may be negative in mild cases. Typical features of meningism are uncommon in infants and young children, who are usually simply floppy and pale, with fever and vomiting. A bulging fontanelle may be present in a young infant.

Meningitis is a notifiable disease in most countries in Europe. This is however a rather unhelpful term for communicable disease control purposes, as bacterial meningitis (particularly due to *Neisseria meningitidis*), can present as septicaemia without any features of meningitis, and many types of meningitis require no public health action. Meningococcal septicaemia presents with a typical haemorrhagic rash, which may be accompanied by shock, circulatory collapse, and confusion or coma. Many patients with meningococcal disease will have features of both meningitis and septicaemia (see Chapter 3.47).

## Infectious and other causes

Meningitis is the most common cause of meningism; however, meningism can occur in the absence of meningitis (Table 2.1.1). It may accompany upper lobe pneumonia, urinary tract infection and other febrile conditions. Cerebrospinal Fluid (CSF) examination is normal in these conditions. Meningism without fever can also occur in non-infectious conditions, the most important of which is subarachnoid haemorrhage; malignancy affecting the meninges can also present as meningism.

## Clinical and epidemiological differences

Many infectious agents can cause meningitis. Acute meningitis is nearly always viral or bacterial; fungal and protozoal infections occasionally occur, mainly in the immunosuppressed patient.

The overall incidence is relatively stable across Europe, having declined since 2000 due to both the introduction of meningococcal group C vaccine and a general reduction in serogroup B infections. The recent introduction of serogroup B vaccine in the UK has further contributed to the decline. Hib meningitis is well controlled as all countries in Europe routinely vaccinate in infancy; vaccination with pneumococcal conjugate vaccination has also had an impact.

## Viral meningitis

Viral meningitis (Table 2.1.2) is common. However, most cases are mild or inapparent. Notifications are an unreliable estimate of incidence as only the more severe cases are investigated.

The most common cause is an enterovirus infection (either an echovirus or coxsackie virus). In enterovirus meningitis there is sometimes a history of a sore throat or diarrhoea for a few days before the onset of headache, fever and nausea or vomiting. The headache is severe; however, there is no alteration of neurological function. Meningism is usually present to a greater or lesser degree. Recovery is usually complete and rapid (within a week). The CSF is clear, with 40–250 cells, all lymphocytes, elevated protein and normal glucose. An enterovirus infection can be confirmed

*Communicable Disease Control and Health Protection Handbook*, Fourth Edition. Jeremy Hawker, Norman Begg, Ralf Reintjes, Karl Ekdahl, Obaghe Edeghere and Jim van Steenbergen.

**Table 2.1.1** Differential diagnosis of meningism

| Cause | Distinguishing features |
|---|---|
| Viral meningitis | Fever. Clear CSF with a lymphocytosis and raised protein |
| Bacterial meningitis | Fever. Purulent CSF with a neutrophil pleiocytosis, raised protein and lowered glucose |
| Other febrile conditions | Fever; Normal CSF |
| Subarachnoid haemorrhage | No fever. Abrupt onset, rapid deterioration. Bloodstained CSF |
| Meningeal malignancies | No fever. Insidious onset. Variable CSF features |

**Table 2.1.2** Causes of viral meningitis

| |
|---|
| *Common* |
| Echovirus |
| Coxsackievirus |
| *Rare* |
| Poliovirus |
| Mumps virus |
| Herpes simplex type 2 |
| Herpes zoster |
| Influenza types A or B |
| Arbovirus |
| Rubella |
| Epstein–Barr virus |

by detection of virus in a faecal sample or by serology. Enterovirus meningitis occurs mainly in later summer. It affects all age groups, although it is commonest in preschool children.

Mumps can cause meningitis, although it is now rare due to widespread use of the MMR vaccine. It is easily recognised by the accompanying parotitis. The diagnosis can be confirmed by detection of specific IgM in blood or saliva, or by serology.

In herpes simplex meningitis the illness is more severe and may persist for weeks. It is usually associated with primary genital herpes.

Non-paralytic poliomyelitis can present as meningitis, indistinguishable clinically from other causes of enteroviral meningitis. Poliovirus is detectable in faeces or CSF.

## Bacterial meningitis

Bacterial meningitis (Table 2.1.3) is a medical emergency. The clinical presentation depends on the age of the patient, and the infecting organism. In the neonate, the presentation is non-specific, with features of bacteraemia. The infant is febrile, listless, floppy and does not feed. There may also be vomiting, drowsiness, convulsions, or an abnormal high-pitched cry. In this age group, the commonest causes are *Escherichia coli* and group B streptococci.

Signs and symptoms in older infants and young children are also non-specific. Meningococcal infection is the commonest cause at this age and is often accompanied by a haemorrhagic rash (see Chapter 3.47).

**Table 2.1.3** Causes of bacterial meningitis

| Neonate | Infant/preschool child | Older child/adult |
|---|---|---|
| *Common* | | |
| *Escherichia coli* | *Neisseria meningitidis* | *N. meningitidis* |
| Group B streptococci | | *Streptococcus pneumoniae* |
| *Uncommon* | | |
| *Listeria monocytogenes* | *Haemophilus influenzae* | *L. monocytogenes* |
| *N. meningitidis* | *S. pneumoniae* | Staphylococci |
| Staphylococci | | *H. influenzae* |
| | | *Mycobacterium tuberculosis* |

In older children and adults, the symptoms are more specific. Fever, malaise and increasing headache are accompanied by nausea and often vomiting. Photophobia may be extreme. Meningism is usually present. Meningococcal infection is also the commonest cause in this group and the typical rash of meningococcal septicaemia may be present. Patients with rapidly advancing meningococcal disease may, over the course of a few hours, develop hypotension, circulatory collapse, pulmonary oedema, confusion and coma.

Other causes of acute bacterial meningitis in older children and adults are uncommon. *Haemophilus influenzae* meningitis occasionally occurs in unvaccinated children or adults; it has a slower onset than meningococcal meningitis and a rash is rare. Pneumococcal meningitis also has a more insidious onset and the symptoms are less specific than meningococcal meningitis. It usually occurs in adults with an underlying risk factor, such as dura mater defect due to trauma or surgery, chronic intracranial infection, asplenia, terminal complement deficiency or alcoholism.

*Listeria* meningitis presents either as a neonatal infection following intrapartum exposure or as a food-borne illness in older children and young adults, often in the immunosuppressed.

Tuberculous meningitis is a manifestation of primary tuberculosis, which occurs mainly in children and young adults. It has an insidious onset; meningism is usually mild and other features (except fever) are often absent.

## Laboratory diagnosis

With the exception of tuberculosis, bacterial meningitis causes neutrophil pleiocytosis in the CSF, with raised protein and lowered glucose. A Gram stain will often demonstrate the typical appearance of the infecting organism, allowing a definitive diagnosis to be made.

Conventional culture of CSF and blood should always be carried out; however, these may be negative, particularly if the patient has been given antibiotics before hospital admission. In addition, a CSF specimen may not be available, as clinicians are often reluctant to undertake a lumbar puncture.

Polymerase Chain Reaction (PCR) diagnosis for meningococcal disease (see Box 3.47.1) for suggested investigations) and serology are available. Other useful investigations include throat swab and microscopic examination of a rash aspirate if present.

## General prevention and control measures

*Hygiene*. Enteroviral meningitis usually spreads as result of environmental contamination, particularly under conditions of crowding and poor hygiene. General hygiene measures such as hand washing will help prevent spread. This is particularly important in hospitals.

*Pregnancy*. Group B streptococcal meningitis in neonates may be prevented by intrapartum antibiotic treatment of colonised women (see Chapter 3.76).

*Immunisation*. Childhood immunisation schedules in Europe ensure protection against meningitis caused by mumps, polio, and *H. influenzae* type b (Hib). In many countries, *N. meningitidis* group C and tuberculosis are also in the schedule. Quadrivalent vaccines *N. meningitidis* serogroups A, C, Y and W135 are increasingly replacing serogroup C vaccines, and a serogroup B vaccine is now available and has been introduced into the UK infant immunisation programme. 7, 10 and 13 valent conjugate pneumococcal vaccines are licensed in Europe and have been implemented in most countries (mainly 13 valent).

*Chemoprophylaxis* is indicated for close contacts of meningococcal and Hib disease (see Chapters 3.36 and 3.47) and investigation for close contacts of TB (Chapter 3.78). It is not necessary for contacts of pneumococcal or viral meningitis.

*Food safety*. *Listeria* meningitis is preventable by avoiding high-risk foods such as soft cheese, pate and cook-chill foods, particularly for the immunosuppressed and in pregnancy.

*Optimising case management*. In cases of suspected meningococcal disease, a parenteral antibiotic should be given urgently (see Chapter 3.47).

### Response to a case or cluster

The first priority when a case is notified is to establish the diagnosis. This requires close liaison with clinicians and microbiologists to ensure that appropriate investigations are carried out. If the initial diagnosis is viral meningitis, then no further action is needed at this stage, although it may be necessary to provide information to GPs and parents if the case appears to be linked with others.

If bacterial meningitis is suspected, then further measures will depend on the cause. Again, optimum investigation is essential as the nature of the public health response differs for each organism. Typing of the organism is needed to determine whether cases are linked. Chemoprophylaxis, and sometimes also vaccination, is indicated for cases due to *N. meningitidis* or *H. influenzae* (see Chapters 3.36 and 3.47). With the widespread introduction of Hib and group C meningococcal vaccines, meningococcal group B infection is the most likely diagnosis in a patient with acute bacterial meningitis and it may sometimes be appropriate to initiate control measures before laboratory confirmation.

## 2.2 Gastrointestinal infection

Every year in the UK, approximately 1 in 30 people attend their general practitioner with an acute gastroenteritis (usually diarrhoea and/or vomiting) and many more suffer such an illness without contacting the health service. Although an infectious cause is not always demonstrated, there is strong epidemiological evidence to suggest that most of these illnesses are caused by infections. A wide variety of bacteria, viruses and parasites may cause gastrointestinal infection: commonly identified ones in the EU are listed in Table 2.2.1. Less common but highly pathogenic infections may be imported from abroad including amoebic dysentery, cholera, typhoid and paratyphoid fevers, as well as milder causes of travellers' diarrhoea, such as *Plesiomonas* and various *Escherichia coli*. Other infectious causes of gastroenteritis include other *E. coli*, *Bacillus subtilis*, *Clostridium difficile, Listeria monocytogenes*, *Vibrio parahaemolyticus*, *Yersinia enterocolitica* and viruses, such as sapovirus, adenovirus, astrovirus, and coronavirus. Non-infectious causes of acute gastroenteritis include toxins from shellfish (see Chapter 3.89.8), vegetables (e.g. red kidney beans) and fungi (such as wild mushrooms), and chemical contamination of food and water.

### Laboratory investigation

Identification of the causative organism is dependent upon laboratory investigation, usually of faecal samples. As well as microscopy and culture, testing may also be undertaken using a PCR panel, which tests for numerous pathogens: PCR can give rapid results, although follow up culture should also be undertaken It is important that such samples are taken as soon after the onset of illness as possible, as the likelihood of isolating some pathogens (e.g. viruses) decreases substantially within a few days of onset. Collecting at least 2 ml of faeces and including the liquid part of the stool will increase the chances of a positive result. Delay in transport to the laboratory, particularly in warm weather should be minimised: if delay is likely, samples should be refrigerated and/or stored in a suitable transport medium. A local policy on sampling and transport should be agreed with the local microbiology laboratory. Samples of vomit may sometimes be helpful. In both cases, the patient should receive instructions on the collection and storage or transport of the specimen. Serum samples may occasionally be helpful, particularly if some cases become jaundiced. It is often difficult to distinguish between bacterial and chemical food-borne gastroenteritis on clinical grounds, although some toxins cause an unpleasant taste and/or burning in the mouth or throat. If a chemical cause is

**Table 2.2.1** Differential diagnosis of common gastrointestinal infection

| | Laboratory Confirmed Cases from EU/EEA in 2014[a] | | Incubation Period (Approx.) | | Clinical clues in outbreaks | | |
|---|---|---|---|---|---|---|---|
| **Organism** | **Cases (No.)** | **Notification rate per 100000 population** | **Usual** | **Range** | **Symptoms[b]** | **Severity** | **Other features** |
| *Campylobacter* | 240379 | 59.8 | 1–7 days | 1–10 days | D often with blood. Abdominal pain ± fever. | Usually lasts 2–7 days. | Peaks in early summer. |
| *Salmonella* | 91408 | 25.4 | 12–48 hours | 4 hours–10 days | D often with fever. May be myalgia, abdominal pain, headache. | Can be severe. Lasts several days to 3 weeks. | Peaks in late summer. |
| Norovirus | n/a | (10.0) | 15–50 hours | 6–72 hours | Nausea/vomiting, cramps, mild D common. Malaise, headache, fever may occur. | Usually mild lasts 1–2 days. | Secondary spread common. More common in winter. |
| Rotavirus | n/a | (7.5) | 2–4 days | 1–4 days | Watery D, fever, vomiting ± respiratory symptoms. | Usually lasts a few days, but occasionally severe. | Usually children, common in winter. |
| *Giardia* | 17278 | 5.4 | 5–16 days | 1–28 days | D, malaise, flatulence, smelly stools, cramps, bloating. | Often prolonged. May be malabsorption and weight loss. | Often travel associated. Possibility of water-borne outbreak. |
| Hepatitis A | 13724 | 3.0 | mean = 28 days | 15–50 days | Fever, nausea, malaise, possibly diarrhoea in children. Jaundice fairly specific but not sensitive. | Worse in adults Lasts up to 4 weeks. | Children may be asymptomatic. |
| *Cryptosporidium* | 7285 | 2.4 | 5–30 days | 1–28 days | D, bloating and abdominal pain common. | Usually self-limiting in 5–14 days, but can lasts much longer. | Severe in immunocompromised. Increase in spring and autumn. |

(*Continued*)

**Table 2.2.1** (*Continued*)

| Organism | Laboratory Confirmed Cases from EU/EEA in 2014[a] | | Incubation Period (Approx.) | | Clinical clues in outbreaks | | |
|---|---|---|---|---|---|---|---|
| | Cases (No.) | Notification rate per 100 000 population | Usual | Range | Symptoms[b] | Severity | Other features |
| STEC | 6167 | 1.4 | 2–4 days | 6 hours – 10 days | D.[b] Often abdominal pain, fever and/or vomiting; blood not uncommon | Variable, may be very severe e.g. HUS, TTP. | Consider in all cases of bloody diarrhoea. |
| *Shigella* | 6125 | 1.4 | 24–72 hours | 12–96 hours | *S. sonnei*: Often watery D. May be mucus. | *S. sonnei*: Self-limiting in 3–5 days. | *S. sonnei:* Often children or institutions: secondary spread common |
| | | | | possibly up to 1 week for *S. dysenteriae* | Other shigellae: D, mucus, blood, fever and colic common. | Other shigellae: Lasts average of 7 days, often severe. | Other shigellae: Often imported, secondary spread common. |
| *Clostridium perfringens* | n/a | n/a | 8–18 hours | 5–24 hours | D, abdominal pain common (vomiting and fever are rare). | Usually mild and short-lived lasts approx. 1 day. | Usually failure of temperature control post cooking. |
| *Bacillus cereus* | n/a | n/a | 0.5–6 hours (Vomiting); 6–24 hours (diarrhoea) | | Syndrome of nausea, vomiting + abdominal pain. *or* Syndrome of diarrhoea + abdominal pain. | Usually mild and short-lived lasts approx. 1 day. | Often from rice or pasta. High attack rate. |
| *Staphylococcus aureus* | n/a | n/a | 2–4 hours | 0.5–8 hours | Nausea, vomiting, abdominal pain and often diarrhoea. Often abrupt onset. | May be very acute. | Food handler may have skin infection. |

[a] ECDC, Annual Epidemiological Report on communicable diseases in Europe; note number of reporting states may vary by organism, so rates more comparable than numbers. Case ascertainment also varies markedly by organism. Rates in (brackets) are for England and Wales only (source PHE).
[b] D = Diarrhoea, which can be defined as three or more loose stools in 24 hours.

suspected, advice on sampling should be obtained from a toxicologist (e.g. public analyst).

A suitable list of organisms to test for in all community outbreaks of gastroenteritis is:

- *Salmonella* species
- *Campylobacter* species
- *Shigella* species
- Shiga-toxin Producing *E. coli* (STEC)
- Norovirus
- Protozoa (*Cryptosporidium* and *Giardia*)

Plus, if food poisoning is suspected or if clinical features suggest (see Table 2.2.1):

- *Bacillus* species
- *Clostridium perfringens*
- *Staphylococcus aureus*

Also consider if clinical or epidemiological features suggest or if the first list above negative.

- Rotavirus
- *Vibrio* species
- *Yersinia* species
- *C. difficile*
- Other *E. coli* (see Chapter 3.69)
- Other viruses
- Toxins or poisons

In hospitals, the most common causes of outbreaks are:

- Norovirus
- *C. difficile*
- *Salmonella*
- Rotavirus

## Prevention and control

Vaccines are not yet available against most of the major causes of gastrointestinal infection and so public health efforts concentrate on reducing exposure to the organisms responsible. Most gastrointestinal infections are either food-borne or spread person to person. The role of the consumer in demanding safe food via pressure on government and food retailers is under-developed in many countries:

At the local level, prevention of gastrointestinal or food-borne infection is achieved by:

- Working with food businesses and staff to reduce the likelihood of contamination of food (from the environment, food handlers or cross-contamination) and avoid inadequate cooking and storage at inadequate temperatures. The Hazard Analysis Critical Control Point (HACCP) system is used by the food industry in identifying and assessing hazards in food, and establishing the control measures needed to maintain a cost-effective food-safety programme. Important features are that HACCP is predictive, cheap, on-site and involves local staff in the control of risk. In the UK, this approach is reinforced by inspection of premises by the Environmental Health Department of the Local Authority and other enforcement agencies.
- Use of statutory powers: For example, UK Local Authorities can exclude cases or carriers of infection from work or school and compensate them for any loss of earnings. Other powers include seizure of food and closure of premises that present an 'imminent risk to Public Health'. Officers of the Environmental Health Department usually exercise these powers. The Food Standards Agency (FSA) is the enforcing authority for licensed fresh meat/poultry premises in Great Britain.
- Advising the public on safe food handling and the reduction of faeco-oral spread. This includes the importance of handwashing immediately after going to the toilet and before handling or eating food. This is of vital importance, as approximately 80% of people with gastrointestinal infection do not consult the health service when ill.
- Adequate infection control policies in all institutions, such as hospitals, nursing and residential homes, schools and nurseries, including use of enteric precautions (see Box 1.3.3) for cases of diarrhoea or vomiting.
- Regular surveillance to detect outbreaks and respond to individual cases. Food poisoning (proven or suspected and including water-borne infection), dysentery and viral hepatitis are all statutorily notifiable, as are cholera, paratyphoid and typhoid fever in almost all European countries. However, there may often be no laboratory confirmation

of the organism responsible and it is often necessary to initiate action before the causative organism is known. Arrangements should also be in place for reporting of isolates of gastrointestinal pathogens from local microbiology laboratories (see Table 4.1.2). However, around 90% of cases seen by general practitioners are not identified by either of these systems: obtaining surveillance data from computerised primary care providers may help address this.

## Response to individual case

It is not usually possible to identify the organism causing gastroenteritis on clinical grounds in individual cases. The public health priorities in such cases are:

- To limit secondary spread from identified cases by provision of general hygiene advice to all and by specific exclusion from work/school/nursery of those at increased risk of transmitting the infection (see Box 2.2.1),
- To collect a minimum dataset to compare to other cases to detect common exposures or potential outbreaks. It is best to collect such data on standardised forms and a subset should be entered on a computerised database for both weekly and annual analysis. A possible dataset is given in Box 2.2.2,
- Ideally, a faecal sample would be collected from all clinical notifications of food poisoning or dysentery to detect clusters by organism/type, to detect potentially serious pathogens requiring increased intervention, and to monitor trends.

A local policy to address these priorities should be agreed with local Environmental Health Officers, microbiologists and clinicians. The role of the primary care practitioners in public health surveillance and in preventing secondary spread is of particular importance and needs to be emphasised regularly (e.g. via a GP newsletter).

## Response to cluster

The most common setting for a cluster of clinical cases of gastroenteritis is in an already defined cohort, for example a nursing home or amongst attendees at a function. Such a situation is slightly different to investigating a laboratory identified cluster:

- It is important to discover the microbiological agent. Following discussion with the relevant microbiologist stool specimens should be obtained without delay from 6 to 10 of the patients with the most recent onset of illness and submitted to the laboratory for testing for all relevant organisms, (see list above: the laboratory may not test for all

**Box 2.2.1 Groups that pose an increased risk of spreading gastrointestinal infection**

**(a)** Any person who is unable to perform adequate personal hygiene due to lack of capacity or ability to comply OR has lack of access to hygiene facilities.

**(b)** All children aged five years old or under (up to the sixth birthday*) who attend school, pre-school, nursery or other similar child care or minding groups.

**(c)** People whose work involves preparing or serving unwrapped ready to eat food (including drink).

**(d)** Clinical, social care or nursery staff who work with young children, the elderly, or any other particularly vulnerable people, and whose activities increase the risk of transferring infection via the faecal-oral route.

* *Guidelines in some countries may specify 'under-5' only.*

Source: *Principles and Practice Recommendations for the Public Health Management of Gastrointestinal Infections. A joint guideline from Public Health England and the Chartered Institute of Environmental Health.*

**Box 2.2.2 Possible local dataset for investigation of cases of gastrointestinal infection**

Administrative details (Name, address, telephone, Date of birth, GP, unique number)
Formally notified? Yes/No
Descriptive variables (Age, sex, postcode)
Date and time of onset

| | | |
|---|---|---|
| Symptoms: | Diarrhoea | Yes/No |
| | Nausea | Yes/No |
| | Vomiting | Yes/No |
| | Fever | Yes/No |
| | Abdominal pain | Yes/No |
| | Blood in stool | Yes/No |
| | Malaise | Yes/No |
| | Headache | Yes/No |
| | Jaundice | Yes/No |
| | Others (specify):_____ | |

Duration of illness
Stool sample taken? (Source, date, laboratory)
Microbiological result (Organism details, laboratory, specimen date)

Food history: Functions, restaurants, takeaways;
Food consumed in five days before onset (if microbial cause known, use organism incubation period);
Raw water consumed outside the home in previous 14 days.

Travel abroad?
Animal contact?
Occupation, place of work/school/nursery
Advised not to work?
Formally excluded?
Part of outbreak?

Organism specific questions may be added if microbiological investigation reveals an organism of particular public health importance (e.g. STEC, *Cryptosporidium*, *Salmonella* Typhi, *Salmonella* Paratyphi).

these unless requested). The identity of the agent will dictate the urgency of the investigation (e.g. to prevent further exposure to a source of STEC), the control measures to be introduced (e.g. to limit person to person spread of norovirus in institutions) and provide valuable clues as to how the outbreak may have happened (e.g. inadequate temperature control in a *Bacillus cereus* outbreak).

- As microbiological results will not be available for a number of days, clinical details should be collected from all reported cases so that the incubation period, symptom profile, severity and duration of illness can be used to predict which organism(s) are most likely to be the cause (Table 2.2.1). The likelihood of different microbiological causes also varies by season (Figures 2.2.1 and 2.2.2). There may also be clues as to whether the illness is likely to be food-borne or spread person to person (Box 2.2.3). In many such outbreaks a formal hypothesis-generating study is not necessary, and it is often possible to progress to an analytical study to investigate possible food vehicles early in the investigation (see Chapter 4.2).

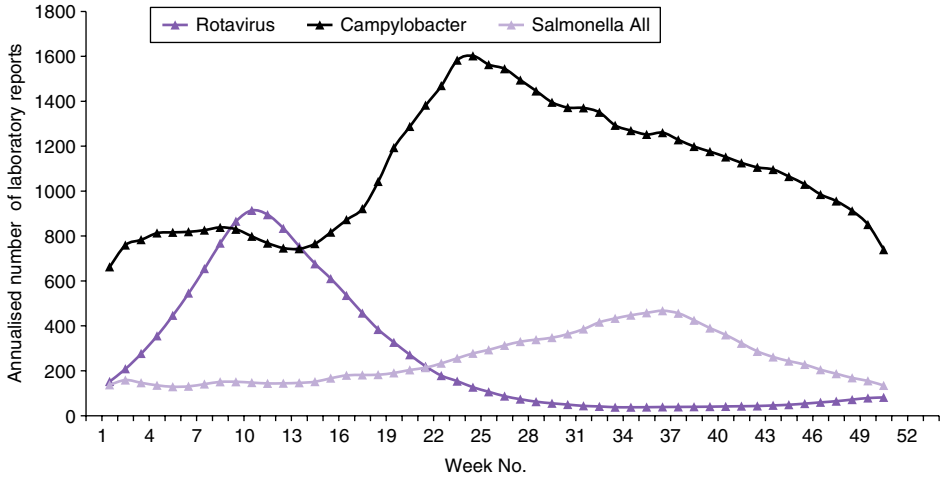


**Fig 2.2.1** Seasonal distribution of gastrointestinal pathogens (Rotavirus, Campylobacter, Salmonella All) 1998–2017, England, Wales & Northern Ireland (3-week moving average).

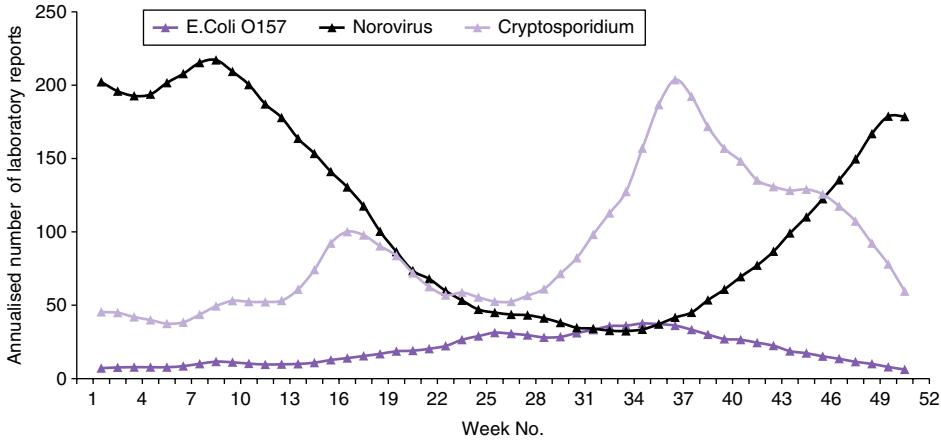


**Fig 2.2.2** Seasonal distribution of gastrointestinal pathogens (*E. Coli* O157, Norovirus, Cryptosporidium) 1998–2017, England, Wales & Northern Ireland (3-week moving average).

- The environmental component of the investigation is often illuminating as to why the outbreak happened, in other words, how did an infectious dose of the organism occur in the identified food vehicle? This investigation will look at:
  - food sources, storage, food preparation, cooking procedures, temperature control after cooking and reheating,
  - symptoms of gastrointestinal or skin disease, or testing for faecal carriage in food handlers,
  - general state of knowledge of the staff and condition of the premises,
  - examination of records of key controls, such as temperatures and pest controls,
  - whether samples of food are available for examination/analysis and whether environmental swabbing or water sampling is appropriate.
- General control measures to prevent spread from those affected can be instituted early, as can addressing important problems identified in the environmental investigation.