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 CDC activities; therefore it will be of interest to all these working in this broad field, including (but not exclusively) public health physicians, epidemiologists, general practitioners, public health nurses, infection control nurses, environmental health officers, microbiologists and policy makers at all levels, as well as students in medical, public health and related fields.

Since the publication of the second edition, there have been many important changes in CDC and health protection. The world has faced its first pandemic of influenza for many decades and other new or re-emerging threats 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, the accession of new member states, the increasing role and outputs of the European Centre for Disease Prevention and Control (ECDC) and new administrative changes in 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. Chapter1.2 runs through the basic principles of transmission and control, which underlie later chapters. **Chapter 1.3** is aimed primarily at those who undertake on-call duties but do not practice in mainstream CDC or health protection and those 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, i.e. 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. A new chapter in this section addresses measures that can be taken by individuals to reduce the risk of infection. When the organism becomes known, Section 3 should be consulted.

Section 3 addresses CDC in a more traditional way, by disease/organism. We have continued to make these chapters more European, 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 5.13).

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 of normal office hours. Further action may be needed during the next working day, which will be identified in 'response to a case'.

Communicable Disease Control and Health Protection Handbook, Third Edition. Jeremy Hawker, Norman Begg, Iain Blair, Ralf Reintjes, Julius Weinberg and Karl Ekdahl.

3 *Epidemiology* will give 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 based on practice in the UK (supplemented by our own views) although the principles will be equally relevant to European readers. 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;* and
- suggested approach to an *investigation of a cluster* of cases of that organism, and suggested actions to help *control of an outbreak*, including a *suggested case-definition* for use in an epidemiological study.

New chapters have been added on *Burkholderia* and chickungunya. Diseases that are generally less of a public health issue in Europe are summarised in the tables that follow Section 3.

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 most (e.g. surveillance, outbreak management, hospital infection, clinical governance) will be of equal use to European colleagues. New chapters on antimicrobial resistance, pandemic preparedness and global health have been added to this section.

Section 5 gives a brief overview of structures for infectious disease notification and Public Health action internationally (consisting of two new chapters) and in the 27 EU Member States (including new chapters on the new members states), plus Norway, Switzerland and a new chapter on Iceland. 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 two appendices and two lists of useful websites detail further sources of information and advice for those undertaking CDC functions routinely or on-call.

In updating the evidence base for this edition, we have often referred to the systematic review of 57 infections that was undertaken on behalf of ECDC by a combined team from the Health Protection Agency and the Royal College of Paediatrics and Child Health (which was led by JH) and we gratefully acknowledge this help. We are indebted to a number of individuals who have helped us in commenting on parts of the book, including Andrew Kibble, Amal Rushdy and numerous advisors for the country-specific chapters, including Reinhild Strauss and Franz Allerberger (Austria), René Snacken, Carl Suetens and Emmanuel Robesyn (Belgium), Angel Kunchev (Bulgaria), Chrystalla Chadjianastassiou (Cyprus), Jozef Dlhý (Czech Republic), Kåre Mølbak (Denmark), Kuulo

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1.2 Basic concepts in the epidemiology and control of infectious disease

The epidemiological framework

Identification

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

Infectious agent

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, 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.

Occurrence

The occurrence or amount of an infectious disease will vary with place and time. A persistent low or moderate level of disease is referred to as *endemic* and a higher persistent level is called *hyper-endemic*. An irregular pattern with occasional cases occurring at irregular intervals is called *sporadic*. When the occurrence of an infection exceeds the expected level for a given time period, it is called *epidemic*. The term outbreak or cluster is also used. When an epidemic spreads over a wide geographical area, such as a continent or continents, it is called *pandemic*. Epidemics vary in size and duration. An *epidemic curve,* a frequency histogram of 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 occurs. 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. Some epidemic

curves have both common source epidemic and propagated epidemic features because of secondary person-to-person spread. These are called *mixed epidemics*.

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 chain of infection

Transmission occurs when the agent leaves its *reservoir* or host through a *portal of exit* and is conveyed by a mode of *transmission* and enters through an appropriate *portal of entry* to infect a susceptible host. This is the *chain of infection*.

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.

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.

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 mean value. For hepatitis A the range is 2–6 weeks with a mean of 3 weeks. During the incubation period, pathological changes may be detectable with laboratory or other tests. Most screening programmes 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.

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 communicable period may be lengthy and intermittent. The communicable period may be shortened by antibiotic treatment (though in some

Table 1.2.1 Modes of transmission of infectious agents

Types of transmission	Examples
Direct transmission 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 one metre or less.	**Direct route** Infections of the skin, mouth and eye may be spread by touching an infected area on another person's body or indirectly through a contaminated object. Examples are scabies, head lice, ringworm and impetigo. Sexually transmitted infections are also spread by the direct route. **Respiratory route** 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. **Faecal-oral route** Gastrointestinal infections can spread when faeces are transferred directly to the mouth of a susceptible host.
Indirect transmission 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. 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. 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** 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. **The blood-borne route** There is transfer of blood or body fluids from an infected person to another person through a break in the skin such as a bite wound or open cut or through inoculation, injection or transfusion. Blood-borne infections include infection with HIV, and hepatitis B and C infections. Spread can also occur during sexual intercourse **Respiratory route** 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 *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.

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*).

infections antibiotics may prolong carriage and hence the communicable period).

Susceptibility and resistance

This describes the various biological mechanisms that 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.

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. 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 are nevertheless infectious and are called carriers.

Preventing spread of infection

Standard precautions

It is not always possible to identify people who may spread infection to others, therefore standard precautions to prevent the spread of infection must be followed at all times (Box 1.2.2). In addition, for patients with respiratory infections, droplet precautions may be recommended (Box 1.2.3) and in those

Box 1.2.2 Standard precautions to prevent the spread of infection

- Hand hygiene: handwashing 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 and 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.

World Health Organization (2007). Standard precautions in health care. Geneva: World Health Organization. http://www.who.int/csr/resources/publications/EPR_AM2_E7.pdf [Accessed March 2010].

Box 1.2.3 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.

with diarrhoea and/or vomiting enteric precautions should be followed (Box 1.2.4).

Handwashing

Handwashing is the single most important part of infection control. The technique illustrated in Figure 1.2.1 should be used when washing soiled hands with soap and water. At other times an 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.

Box 1.2.4 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 should stay away from work or school for 48 h after the diarrhoea has stopped.

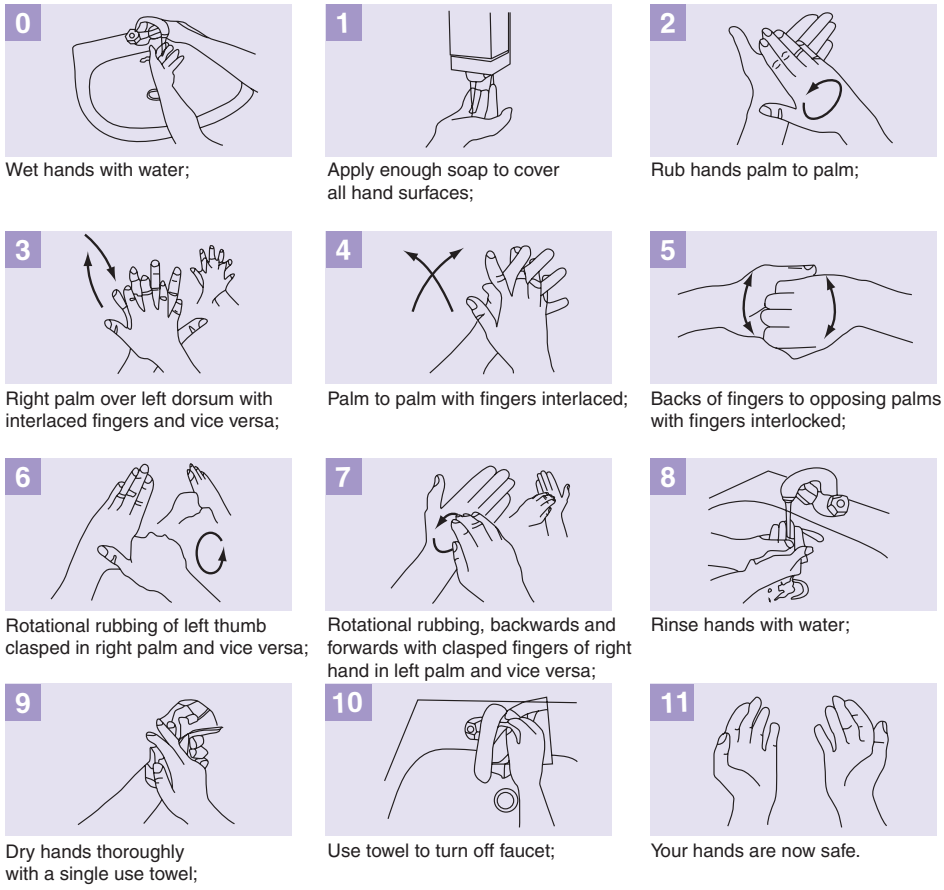

Fig. 1.2.1 How to wash hands correctly and reduce infection. (From World Health Organization (2009). WHO Guidelines on Hand Hygiene in Health Care. Geneva: World Health Organization. http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf [Accessed March 2011].)

1.3 Health protection on-call

During office hours health protection activity is usually undertaken by individuals who are expert in their field and have access to a full range of supporting services. Outside of office hours, this is not always the case, for example in the UK health protection on-call at a local level may be integrated with general public health rotas and laboratories 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, i.e.

- defining the problem;
- collecting the necessary information;
- undertaking a risk assessment;
- identifying good practice;
- implementing the response; and
- 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 1.3.1. 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 2);
- websites, including those of the national communicable disease control or health protection organisation (see inside covers); and
- 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.

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 (e.g. hepatitis B), 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 as follows:

- 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

Box 1.3.1 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; and
- 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; and
- 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; and
- 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 *E. coli* O157;
- respiratory infection, including *Legionella* and TB;
- blood-borne viruses (hepatitis B, hepatitis C, HIV);
- infections requiring prophylaxis/advice (e.g. pertussis, hepatitis A, measles);
- most common chemical/environmental hazards (asbestos, CO, smoke, mercury, ammonia, chlorine); and
- 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 coordinate public health action effectively. Includes single cases of infections listed in Section 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. viral haemorrhagic fever, diphtheria, rabies exposure, possible SARS/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 healthcare 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); and
- recently emerged diseases/hazards.

8 Understanding of the principles and practice of management of outbreaks and incidents.

Box 1.3.1 (*Continued*)

9 Ability to effectively coordinate 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; and
- chemical incidents.

10 Ability to contribute effectively to the control of:
- hospital outbreaks/incidents;
- radiological incidents;
- major emergencies; and
- deliberate release incidents.

11 Ability to communicate effectively on public health issues, including:
- preparing appropriate press releases out of hours;
- giving effective media interviews; and
- communicating directly with public.

Source: UK Faculty of Public Health, 2006.

usually have microbiological, environmental and epidemiological components.
- What generic control measures can be applied to limit morbidity, whilst awaiting confirmation (e.g. 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 the following:
- 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.
- Do 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 occur out-of-hours. Issues that affect timing include the following:
- The seriousness of the disease. Some infections such as viral haemorrhagic fevers, diphtheria or *Escherichia coli* O157 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 of 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 e.g. *E. coli* O157 in young children and the frail elderly or chickenpox 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. an 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 learnt) 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 the following:
• 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).
• 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 above (see 'Public health action on-call'), but often also includes an assessment of whether contacts 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 3.80.2.

Possible interventions

If it is decided that action is required, possible interventions include the following:
• Action to improve outcome for cases by ensuring appropriate care is provided. This may include provision of immunoglobulins (rabies), antitoxins (diphtheria), antidotes (chemicals) or different antibiotics from 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 before the press? 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 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.
- Is there any advantage in wider dissemination of information or advice? This may be to primary or secondary healthcare 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 the following:

- 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 multiagency response.
- Ensuring effective authorisation for use of legal powers.
- Ensuring access to required support, including surge capacity.

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; and
- review of policies and plans.