FUNDAMENTALS

SECOND EDITION

Fundamentals of Infection Prevention and Control Theory and Practice

BY **DEBBIE WESTON**

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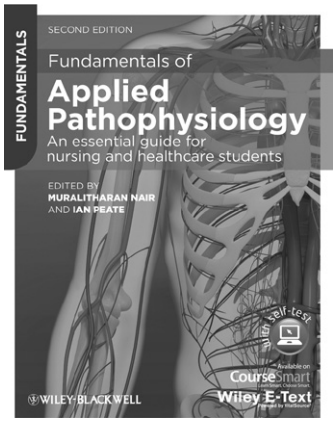

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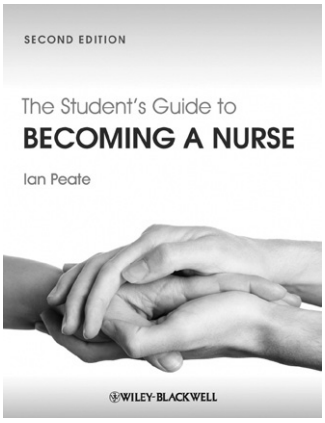

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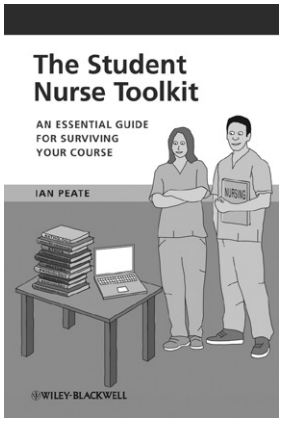

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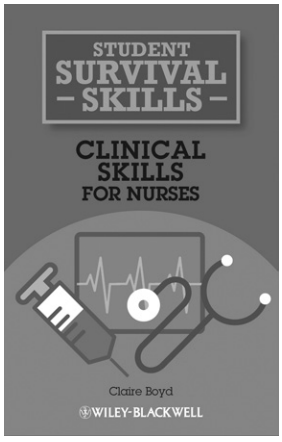

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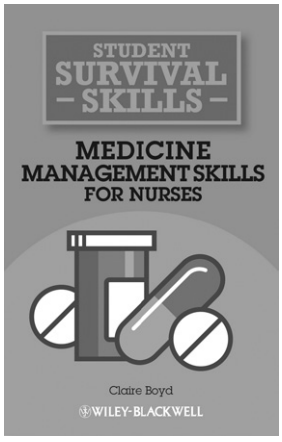

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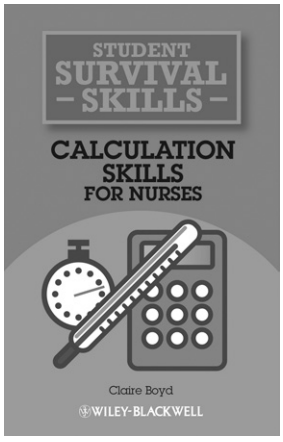

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SECOND EDITION

Fundamentals of

Infection Prevention and Control

Theory and practice

DEBBIE WESTON

Deputy Lead Nurse and Operational Lead for Infection Prevention and Control at East Kent Hospitals University NHS Foundation Trust, Kent, UK

WILEY Blackwell

This edition first published 2013 © 2013, by John Wiley & Sons, Ltd
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Registered office: John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial offices: 9600 Garsington Road, Oxford, OX4 2DQ, UK
The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK
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Library of Congress Cataloging-in-Publication Data

Weston, Debbie.
Fundamentals of infection prevention and control : theory and practice / Debbie Weston. – 2nd ed.
p. ; cm.
Rev. ed. of: Infection prevention and control / Debbie Weston. c2008.
Includes bibliographical references and index.
ISBN 978-1-118-30665-9 (pbk. : alk. paper) – ISBN 978-1-118-30769-4 – ISBN 978-1-118-30770-0 (ePub) – ISBN 978-1-118-30771-7 – ISBN 978-1-118-67383-6 – ISBN 978-1-118-67388-1
I. Weston, Debbie. Infection prevention and control. II. Title.
[DNLM: 1. Cross Infection–prevention & control. 2. Hospitals. 3. Infection Control–methods. WX 167]
RA761
362.196'9–dc23
2013012753

A catalogue record for this book is available from the British Library.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Cover image: iStockphoto File #22313218 © Mark Bowden
Cover design by Fortiori Design

Set in 10/12 pt Calibri by Toppan Best-set Premedia Limited

1 2013

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Wiley's *Fundamentals* series are a wide-ranging selection of textbooks written to support pre-registration nursing and other healthcare students throughout their course. Packed full of useful features such as learning objectives, activities to test knowledge and understanding and clinical scenarios, the titles are also highly illustrated and fully supported by interactive MCQs, and each one includes access to a Wiley E-Text powered by VitalSource – an interactive digital version of the book including downloadable text and images and highlighting and note-taking facilities. Accessible on your laptop, mobile phone or tablet device, the *Fundamentals* series is *the* most flexible, supportive textbook series available for nursing and healthcare students today.

Preface

Since I wrote the first edition in 2007, which was published in February 2008, much has changed. The threat of an influenza pandemic became a reality in 2009 with the H1N1 'swine flu' pandemic, antibiotic resistance remains an ever-increasing concern, particularly with the emergence of carbapenemase resistance and NDM-1, and although the overall prevalence of healthcare-associated infections (HCAIs) has decreased (and infections caused by meticillin-resistant *Staphylococcus aureus*, or MRSA, and *Clostridium difficile* have decreased significantly), the prevalence of some specific HCAIs has increased. The NHS is experiencing a period of turmoil with the NHS reforms and there are huge concerns in the media not so much around HCAIs but around patient care.

Infection prevention and control are integral parts of patient care and they are everyone's responsibility. HCAIs are harm events, and the principles of infection prevention and control have to be embedded into everyday clinical practice and not be viewed as something separate. The focus now is very much on preventing avoidable HCAIs, with a culture of zero tolerance for avoidable infections and poor practice, and holding staff to account, and it is becoming even more essential that healthcare professionals have a firm grasp of both the principles of infection control that they can relate to clinical practice, and the current issues.

'Infection control' as a speciality is fascinating, complex (although the basic principles are simple), challenging, sometimes very frustrating and extremely diverse, and it is my passion. I hope that this revised and updated second edition will provide the reader with an insight into the work of the Infection Prevention and Control Team and that it will be a valuable resource, not only enhancing their knowledge and understanding of infection control but also encouraging them to look at their own clinical practice and that of others. I also hope that it fosters a real interest in, and enthusiasm for, the subject.

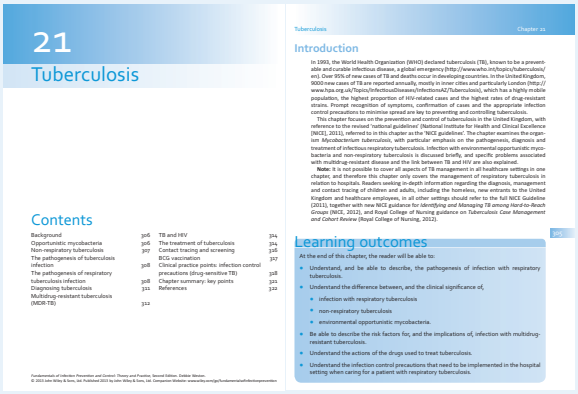
Debbie Weston
Deputy Lead Nurse / Operational Lead, Infection Prevention and Control
East Kent Hospitals University NHS Foundation Trust, Kent, UK

How to get the best out of your textbook

Welcome to the new edition of *Fundamentals of Infection Prevention and Control*. Over the next few pages you will be shown how to make the most of the learning features included in the textbook.

Features contained within your textbook

Every chapter begins with a contents list, an introduction to the topic, and the learning outcomes you should have achieved by the end of the chapter.



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Tuberculosis

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Introduction

In 1993, the World Health Organization (WHO) declared tuberculosis (TB), known to be a preventable and curable infectious disease, a global emergency (http://www.who.int/topics/tuberculosis/en). Over 95% of new cases of TB and deaths occur in developing countries. In the United Kingdom, 9000 new cases of TB are reported annually, mostly in inner cities and particularly London (http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Tuberculosis), which has a highly mobile population, the highest proportion of HIV-related cases and the highest rates of drug-resistant strains. Prompt recognition of symptoms, confirmation of cases and the appropriate infection control precautions to minimise spread are key to preventing and controlling tuberculosis.

This chapter focuses on the prevention and control of tuberculosis in the United Kingdom, with reference to the revised 'national guidelines' (National Institute for Health and Clinical Excellence [NICE], 2011), referred to in this chapter as the 'NICE guidelines'. The chapter examines the organism *Mycobacterium tuberculosis*, with particular emphasis on the pathogenesis, diagnosis and treatment of infectious respiratory tuberculosis. Infection with environmental opportunistic mycobacteria and non-respiratory tuberculosis is discussed briefly, and specific problems associated with multidrug-resistant disease and the link between TB and HIV are also explained.

Note: It is not possible to cover all aspects of TB management in all healthcare settings in one chapter, and therefore this chapter only covers the management of respiratory tuberculosis in relation to hospitals. Readers seeking in-depth information regarding the diagnosis, management and contact tracing of children and adults, including the homeless, new entrants to the United Kingdom and healthcare employees, in all other settings should refer to the full NICE Guideline (2011), together with new NICE guidance for *Identifying and Managing TB among Hard-to-Reach Groups* (NICE, 2012), and Royal College of Nursing guidance on *Tuberculosis Case Management and Cohort Review* (Royal College of Nursing, 2012).

Learning outcomes

At the end of this chapter, the reader will be able to:

- Understand, and be able to describe, the pathogenesis of infection with respiratory tuberculosis.
- Understand the difference between, and the clinical significance of,
  - infection with respiratory tuberculosis
  - non-respiratory tuberculosis
  - environmental opportunistic mycobacteria.
- Be able to describe the risk factors for, and the implications of, infection with multidrug-resistant tuberculosis.
- Understand the actions of the drugs used to treat tuberculosis.
- Understand the infection control precautions that need to be implemented in the hospital setting when caring for a patient with respiratory tuberculosis.

Fact boxes highlight need-to-know information.

Fact Box 5.4 Biofilm activity

Biofilm have been defined as 'a community of micro-organisms irreversibly attached to a surface' (Lindsay and von Holy, 2006) and 'a complex, highly multi-cultural community with a level of activity within the biofilm that resembles a city' (Watnick and Koiter, 2000).

Reflection boxes help you consider the wider implications of the topic or how it relates to your practice.

Reflection point

What other examples can you think of where failure to demonstrate compliance with infection control practice may be viewed as negligent or as a breach of duty of care?

The glossary at the back of the book explains the meaning of the words in **bold coloured** text.

re based on antigenic differences and
ility, epidemiology and clinic
ans, also circulate among
ies barrier that makes
a viruses with **pandemic** potential, as
ch originated in Mexico and spread glo
th Organization in 2010). While influen
nza C causes mild disease throughout th
vious pandemics, although that does n

Global outbreak of infection or disease.

Every chapter ends with a summary listing the key points of the topic.

Chapter summary: key points

- *Clostridium difficile* is the most important cause of hospital-acquired diarrhoea in adults and is a significant cause of patient morbidity and mortality.
- It causes a spectrum of illness which ranges from asymptomatic colonisation of the bowel, to trivial diarrhoea to life-threatening pseudomembranous colitis and toxic megacolon.
- Although antibiotics are the main cause of *C. difficile* infection, there are numerous other factors that can increase the risk of *C. difficile* acquisition.
- *C. difficile* produces two potent toxins that cause extensive damage to the bowel mucosa.
- Symptomatic *C. difficile* infection must be regarded as a separate diagnosis in its own right and not simply as an 'add on' to the patient's other illness.
- Recurrent *C. difficile* infection is not uncommon, and more than one course of metronidazole or vancomycin may be required.
- *C. difficile* infection can be prevented.

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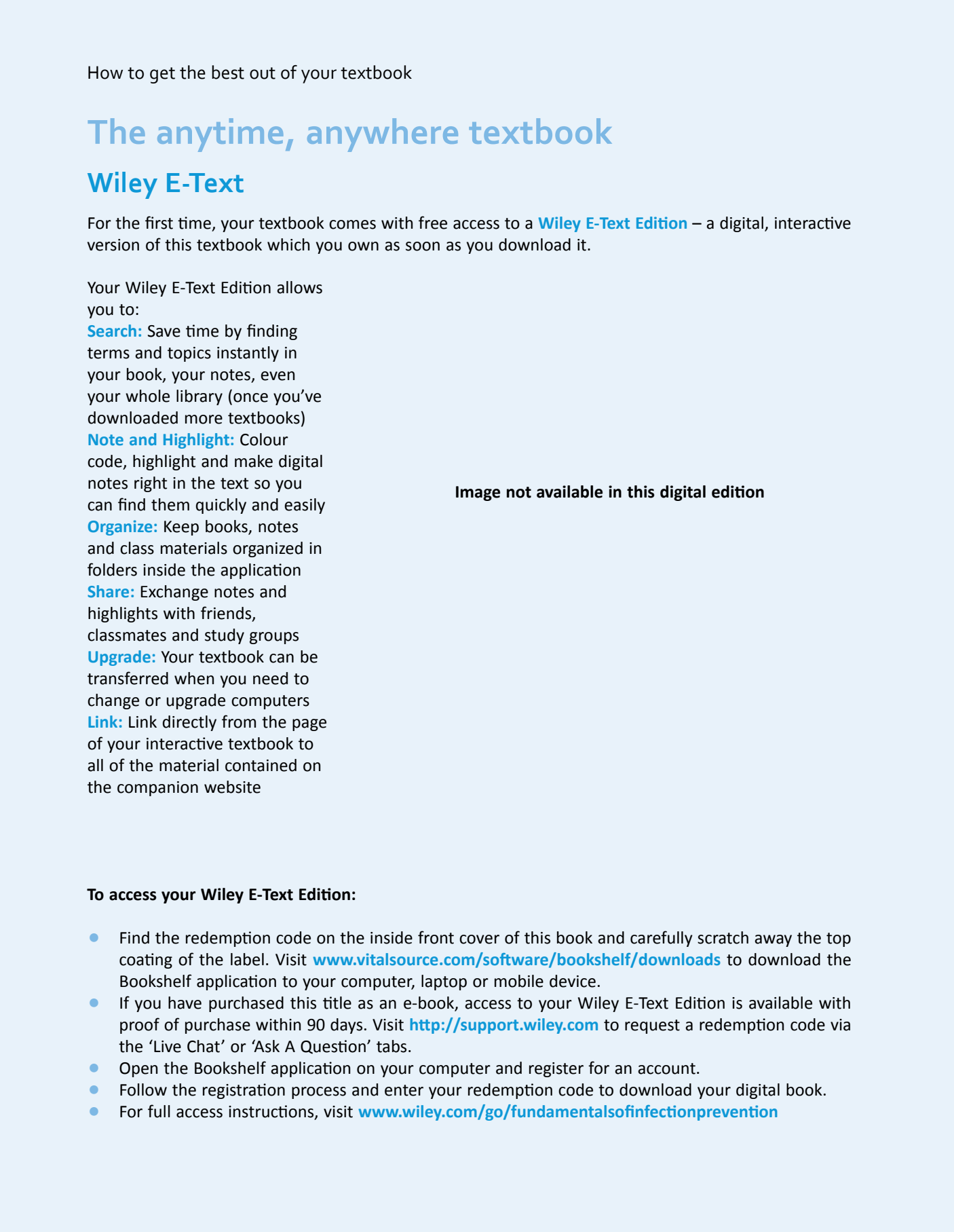

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How to use the companion website

Don't forget to visit the companion website for this book:

www.wiley.com/go/fundamentalsofinfectionprevention

There you will find valuable instructor and student material designed to enhance your learning, including:

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- scenarios
- fact sheets
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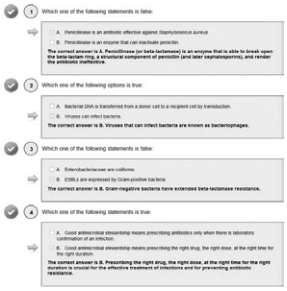

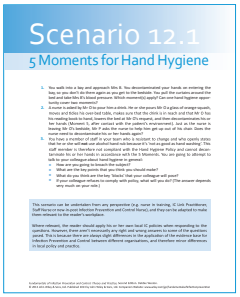

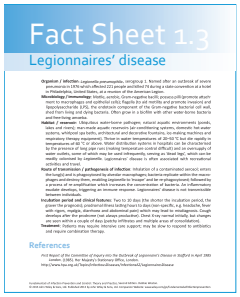

The website contains a number of clinical practice scenarios to work through that are relevant to Chapters 2–5, 9–14 and 20–24.

They can be undertaken from any perspective (e.g. that of a nurse in training, infection control (IC) link practitioner, staff nurse or new-in-post infection prevention and control nurse) and they can be adapted to make them relevant to the reader's workplace.

The reader should apply his or her own local IC policies when responding to the questions where relevant. However, there aren't necessarily any right and wrong answers to some of the questions posed. This is because there are always slight differences in the application of the evidence base for infection prevention and control between different organisations, and therefore minor differences in local policy and practice.

Acknowledgements

I would like to thank:

My family and friends for their patience with me over the last 12 months or so.

The Infection Prevention and Control Specialist Nursing Team at East Kent Hospitals University NHS Foundation Trust for being so supportive – Sue Roberts, Alison Burgess, Zoe Nixon, Kathrin Penticost-Turnbull, Esther Taborn and Catherine Maskell.

I would particularly like to thank Zoe for her assistance with the Scenarios for Chapters 12 and 13 on the companion website.

Dr Angela Kearns at the Staphylococcus Reference Laboratory, HPA Colindale, London for the information regarding the evolution of MRSA and clones.

My very grateful thanks to those at Wiley in particular Magenta Styles, Executive Editor; Madeleine Hurd, Associate Commissioning Editor; Catriona Cooper, Project Editor; Angela Cohen, Production Manager; Cheryl Adam, Copy Editor and Kathy Syplywczak, Project Manager.

Introduction

This book is written with the intention of providing healthcare staff working within acute and primary care with a valuable and comprehensive text that will enable them to understand the theory behind the practice of infection prevention and control, and apply the principles in their day-to-day work. It is envisaged that this book will be a particularly useful resource for student nurses, nurses undertaking postgraduate education, staff nurses, ward or department managers, infection prevention and control link practitioners, and new-in-post infection prevention and control nurses. I hope that it will also be a resource for medical students and foundation year 1 junior doctors.

The book is in four parts. **Part** 1 consists of Chapters 1–10. **Chapter 1** introduces the reader to the problem of healthcare-associated infections (HCAIs), looking at the national and global burden of HCAIs, the risk factors for their development and the threat that infectious diseases pose to public health. It also briefly discusses the challenges of infection prevention and control in acute trust and primary care settings. **Chapter 2** describes the role of the infection prevention and control team and discusses the responsibility, accountability and duty of care that healthcare staff have regarding the prevention and control of infection. **Chapter 3** introduces audit and surveillance, and explains their value in HCAI prevention and reduction, and **Chapter 4** describes aspects of the investigation and management of clusters and outbreaks of infection. In **Chapter 5**, the reader is introduced to the classification, structure and properties of bacteria and viruses, and is also introduced to some of the medically important viruses. **Chapters 6 and 7** aim to give the reader an insight into the importance of obtaining good-quality clinical specimens and the workings of the clinical microbiology laboratory, so that they will understand some of the processes that occur in order to identify the cause of the patient's infection, which in turn influences the patient's treatment. **Chapter 8** describes the basic components and functions of the immune system and how an immune response is generated in patients with an infection, giving rise to systemic signs and symptoms of illness. **Chapter 9** looks at sepsis and neutropenia. Part 1 concludes with **Chapter 10**, which examines the problem of antimicrobial resistance and the implications for patient care and public health, and discusses specific antibiotic-resistant bacteria and associated infections.

In **Part** 2, **Chapters 11–15** focus on the basic principles of infection prevention and control and the underpinning evidence base for hand hygiene, the principles of isolation and cohort nursing, the use of personal protective equipment, the safe use and disposal of sharps, and cleaning.

In **Part** 3, **Chapters 16–19** focus on clinical practice in relation to the management of vascular devices and the prevention of bloodstream infections caused by them, the prevention and management of catheter-associated urinary tract infections, the prevention and management of surgical site infections, and the prevention and management of hospital and community-acquired

Fundamentals of Infection Prevention and Control: Theory and Practice, Second Edition. Debbie Weston.

pneumonia. In **Part** 4, **Chapters 20–24** are concerned with specific organisms and examine in detail *Staphylococcus aureus* (particularly meticillin-resistant *S. aureus*, or MRSA), tuberculosis, *Clostridium difficile*, norovirus and blood-borne viruses (HIV, hepatitis B and hepatitis C). Each organism is described along with the pathogenesis of infection, the clinical features of infection, laboratory testing and diagnosis, and the infection control management of infected or colonised patients, along with clinical practice points.

The book can be read as a whole from cover to cover, or dipped in and out of. All chapters are cross-referenced and contain learning outcomes, fact boxes, and reflection and clinical practice points. Throughout the book, reference is made to the evidence base arising from national and international guidance and Department of Health policies, drives and initiatives, and there is an emphasis on best practice.

The glossary at the back of the book explains words and terms used (in **bold coloured print**) in the text. It also directs the reader to the **companion website** at www.wiley.com/go/fundamentalsofinfectionprevention, where there are numerous fact sheets relating to specific organisms and infections (e.g. *Neisseria meningitidis*, the causative agent of meningococcal disease, and invasive group A streptococcal disease) and clinical practice points (such as aseptic non-touch technique), which are referred to within the chapters but not covered within the text in detail. The website also contains multiple choice questions (MCQs) and clinical practice scenarios for each chapter.

Note: Readers should always refer to the policies in the 'Infection Prevention and Control Manual' within their own place of work. There are often slightly different approaches and variations in local policies, although the basic principles are the same.

Part One

Introduction to infection prevention and control

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1

The burden of healthcare-associated infections, and disease threats old and new

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Introduction

This introductory chapter is in two parts. The first part looks at the burden and impact of healthcare-associated infections on the NHS as an organisation and on patients, including risk factors for, and risk factors contributing to, the development of these infections, and the threats to public health posed by old and new infectious diseases. The second part briefly reflects on the changing face of healthcare and summarises some of the key differences and challenges regarding infection control in acute and community care settings.

Learning outcomes

After reading this chapter, the reader will be able to:

- Define healthcare-associated infections (HCAIs).
- List six patient risk factors for the development of HCAIs.
- List 10 general factors that can increase the risk of HCAIs.
- List six ways in which HCAIs can affect patients and healthcare providers.
- Understand the continuing threat to public health from old and new diseases.

Background

The problem of healthcare-associated infections (HCAIs) is not a new one. In 1941, seven years before the creation of the NHS, the British Medical Council recommended that 'control of infection officers' be appointed in hospitals to oversee the control of infection. This was followed in 1944 by the setting up of control of infection committees consisting of clinical and laboratory staff, nurses and administrators.

Fact Box 1.1 The first Infection Control Nurse

The first Infection Control Nurse was appointed in the United Kingdom in 1959 (Gardner *et al.*, 1962). The appointment of Miss E.M. Cottrell, formerly an Operating Theatre Superintendent, as Infection Control Sister at Torbay Hospital, Devon, was in response to a large outbreak of staphylococcal infections affecting both patients and staff. Staphylococci (see Chapters 5 and 20) had been causing problems in UK hospitals since 1955, and staphylococcal surveillance at Torbay Hospital revealed that the carriage rate amongst nursing staff on two of the major hospital wards was 100%, with high staff absentee levels due to staphylococcal skin sepsis, and evidence of post-operative wound infections and skin sepsis amongst the patients.

Miss Cottrell was appointed for an experimental period to assist in the collection of surveillance data and advise healthcare staff on the prevention of cross-infection through rigorous adherence to the principles of **asepsis**.