MANUAL OF INFECTION CONTROL PROCEDURES

2nd Edition

To my wife Laila, and my children Numair and Namiz for their abiding love, understanding and encouragement

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What, will these hands ne'er be clean?

WILLIAM SHAKESPEARE
Macbeth

Foreword to the Second Edition

When Professor Graham Ayliffe wrote the foreword to the first edition of this manual in 1997, he said '*this manual contains a wealth of practical advice, a number of useful tables, diagrams, definitions and essential references.*' He also said that the policies were detailed enough and provided enough instruction to allow health care workers (HCWs) to carry out individual procedures. In this respect, the second edition of this manual fulfils these requirements and will appeal to both medical and nursing practitioners in infection control and to nurse educators whose job it is to provide first-hand practical advice to those responsible for the provision of a safe environment for patients and staff alike.

This second edition has been revised and updated and the reader eager to find out what is new and different from the first edition will be pleasantly surprised. New sections include the *Principles of Infection Control, Design and Management of Health Care Facilities, Surveillance and Outbreak Control, Epidemiology and Biostatistics* and not least a section on *Infection Control Information Resources*. This latter section, together with the updated and easily accessible reading lists which are highlighted at strategic points in the text and at the end of each section provides a wealth of information for the inquisitive reader. In this respect, as much evidence-based information as there is available has been presented.

Infection control is a quality improvement activity that focuses on improving the care of patients and protecting the health of staff, and yet, despite advances in modern medicine and surgery, 5–10% of patients admitted to hospital subsequently acquire an infection of varying degrees of severity. Because of the need to discharge patients to the community with the shortest possible length of stay in hospital, some patients may not manifest their hospital-acquired infection (HAI) until some time later. Post-discharge surveillance is still in its infancy but some record of its occurrence will need to be taken into account before the true cost of HAIs can be measured. Unfortunately, the incidence of HAI is as high today as it has been for many years, but there are many reasons for this. Improvements in supportive care have led to more aggressive medical and surgical therapy and seriously ill patients with several underlying risk factors are often highly susceptible to infection.

This manual addresses the need for patient care and recognises that the factors involved in HAI are complex and that cost-effective measures to combat them are needed which are based on evidence-based guidelines. Reliable comparisons of infection rates between units, hospitals and countries are difficult without ongoing monitoring with risk factor adjustment and benchmarking. The new section on *Epidemiology and Biostatistics* will facilitate worthwhile comparison and make benchmarking a challenge, not a threat.

The control of infection in hospitals has greatly improved in recent years; we have many more professional staff, who are better trained, and more resources are being set aside for infection control since the acknowledgement by management that infection control is part of the quality improvement process required of health care services. However, the free movement of patients between hospitals and the community, by breaking down invisible barriers, will always remain a challenge for HCWs. We still lack sufficient isolation facilities to contain the major problems of patients with antibiotic-resistant strains of bacteria such as multi-drug resistant tuberculosis (MDR-TB), methicillin-resistant *Staphylococcus aureus* (MRSA) and gylcopeptide resistant enterococci (GRE). A combined approach of prudent antibiotic prescribing, effective surveillance and good infection control practices is essential if antibiotic resistance is to be contained. This is a worldwide problem, and the spread of infection is a major problem in the developed world, but the principles of effective control are the same throughout the world.

In the developed world, people are having longer and more 'adventurous' surgery and transplantation is being carried out in hospitals in the face of emerging new diseases and newly-identified micro-organisms which are difficult to treat. There is a sharp increase in the use of minimally invasive surgery, with the widespread use of expensive, heat-labile equipment like endoscopes, which require a high quality system for decontamination. This manual contains most of the procedures necessary to carry out such a service, but the author has not forgotten that basic hand washing is generally considered to be the most important single measure in the control of hospital infection and is dealt with in detail in this manual.

I have enjoyed reading this manual and commend it to all health care workers involved in the prevention and control of infection.

M. Emmerson
London
November, 2002

Foreword to the First Edition

Hospital-acquired (nosocomial) infection is a major problem in the hospitals of most countries and despite improvements in control methods, the prevalence of infection remains at 5–10%. Infections are mainly of surgical wounds, the respiratory and urinary tracts, and the skin. The important risk factors for the acquisition of infection are invasive procedures which include operative surgery, intravascular and urinary catheterization and mechanical ventilation of the respiratory tract. Other risk factors include traumatic injuries, burns, age (elderly and neonates), immunosuppression and existing disease.

Many infections are endogenous (i.e. acquired from the patient's own microbial flora) and are not necessarily preventable, although infection can be kept to a minimum by good aseptic techniques. The spread of infection from patient to patient is often difficult to prevent, particularly in overcrowded hospitals with staff shortages and limited facilities. The prevention of cross-infection with highly antibiotic-resistant organisms, such as epidemic methicillin-resistant *Staphylococcus aureus* (MRSA) can be difficult and often requires considerable resources. Vancomycin-resistant enterococcal infections may be untreatable with currently available antibiotics and Gram-negative bacilli resistant to the quinolones and the third generation cephalosporins frequently cause therapeutic problems. Cross-infection can be considerably reduced by a few basic measures, for example handwashing or disinfection correctly performed at the right time. Handwashing is generally considered to be the most important single measure in infection control and is dealt with in detail in this manual. Although prevention of transmission is of major importance, the rational use of antibiotics and restriction of certain agents is necessary to achieve a long-term effect. Other organisms which have emerged in hospitals in recent years include *Clostridium difficile*, causing outbreaks in the elderly, and legionella associated with cooling towers and contaminated water supplies. Food poisoning is mainly a problem in the community, but epidemics occur in hospitals. *Escherichia coli* 0157:H7 has recently been responsible for large outbreaks of severe gastroenteritis and occasional deaths from renal failure.

The potential hazards of blood-borne viruses (hepatitis B (HBV) and C (HCV) and human immunodeficiency virus (HIV)), particularly from injuries due to sharp instruments, cause considerable anxiety to staff. Policies for the safe disposal of clinical waste, especially needles, must be correctly implemented. Spread of these blood-borne infections to patients from contaminated medical equipment is also a potential hazard and the production of safe decontamination policies is a major responsibility of infection control teams. Although decontamination of equipment by heat is the optimal method, many items are heat-labile and chemical disinfection is required. Flexible endoscopes fall into this category and are difficult to clean and disinfect. The nature of surgery is also changing and minimal access surgery is often replacing conventional surgery, but the equipment is often heat-labile and difficult to clean. All of these problems have been well addressed in this manual.

Litigation for negligence is becoming increasingly common and often involves possible deficiences in control of infection procedures. This further emphasises the importance of having well-defined procedures and ensuring that they are implemented by training of staff and audit.

The prevention of infection is one of the requirements for good quality of care of patients and is relevant to all members of staff. Protection of staff from infection is now a major consideration and is backed by health and safety legislation. Hospitals should have an infection control organization which includes an infection control doctor, usually the medical microbiologist in the UK, and one or more infection control nurses, depending on the size of the hospital and the type of patient. These are members of the team who should meet daily or at least several times a week. The infection control committee is an expansion of the team and meets less frequently. It is important for approving policies and programmes, and for making recommendations which have a major financial implication to the Chief Executive. Collaboration with the community is also necessary and the Consultant in Communicable Disease Control (CCDC) should be a member of the infection control committee.

It is obviously necessary, in view of the problems described, for every hospital to have an infection control manual. To produce such a manual is a major task and it is time wasting for every hospital to produce it's own. This manual, originally produced by Dr. Damani and his colleagues for Craigavon hospital, covers all the main policies required in a hospital. It has been expanded to include basic information on the various topics and is now generally applicable to other hospitals in the UK and many other countries. It will be particularly useful in countries or hospitals which are setting up new infection control programmes. However, although national and hospital guidelines are important, individual departments differ and the final decisions should be made by local infection control staff.

This manual contains a wealth of practical advice, a number of useful tables, diagrams, definitions and essential references. The policies are detailed and provide sufficient instructions to carry out individual procedures. Infection control staff will

find this manual useful for producing shorter manuals for individual wards. These should be introduced as part of an ongoing educational programme to ensure the manuals are not only read but are followed by nursing and medical staff and administrators. The manual should also be useful in preparing audit programmes. I congratulate Dr. Damani on producing a comprehensive and useful manual of procedures.

G. A. J. Ayliffe
1997

Preface to the Second Edition

A fundamental activity in health care establishments is to continually improve the quality of care and provide a safe working environment. Central to this activity is an effective infection control strategy, which prevents the acquisition of infection within the health care environment.

The second edition of this book has been thoroughly revised and rearranged. Four new chapters *Principles of infection control, Design and maintenance of health care facilities, Epidemiology and biostatistics*, and *Infection control information resources* have been added as I have found that these subjects are especially useful to infection control practitioners.

While revising the book I have made changes that are in keeping with current guidance and the recommendations made by various professional and statutory bodies with an overall intention to provide advice based on current evidence and the fundamental principles of infection control.

The scope of this book is intentionally broad and, whilst it does not attempt to cover all aspects of infection control in detail, it aims to serve as a practical manual on infection control procedures and provide essential information on the most important issues relating to infection control on a day-to-day basis.

Nizam N. Damani
November, 2002

Preface to the First Edition

…by forseeing in a distance, which is only done by men of talents, the evils which arise from them are soon cured; but when, from want of foresight, they are suffered to increase to such a height that they are perceptible to everyone, there is no remedy.

NICCOLÒ MACHIAVELLI

Prevention of infection acquired in the health care setting remains a major goal for all health care personnel because of increased morbidity and mortality for patients. In addition, it utilizes resources that could be used elsewhere in health care.

Studies in the UK, Europe and North America indicate that approximately 10% of patients develop infection whilst in hospital. Evidence in the US suggests that one third of hospital-acquired (nosocomial) infections could be prevented. Therefore financial benefit to the health care provider could be substantial by prevention of such infections.

Although in recent years there have been an increased allocation of resources directed to the problem on infection control services, the resources allocated have been constrained. This is because in the recent years the very nature of the hospital has changed. With the reduction in numbers of beds, the sickest patients have been concentrated in hospital and the throughput of patients has increased. Patients are often subjected to more aggressive diagnostic and therapeutic procedures and a greater number of health care workers (HCWs) are involved in the patient's management. In addition, newer varieties of the microorganisms are responsible for a wider spectrum of nosocomial infection, and bacterial isolates are becoming more resistant to the standard antibiotic therapies.

Although hospital-acquired infection has been worrying health care professionals for many years, more recently it is worrying patients and the public as well. This is due to emerging new pathogens coupled with heightened public awareness caused by AIDS, blood-borne hepatitis (B&C), methicillin-resistant *Staph. aureus* (MRSA), and more recently by *Clostridium difficile*, multidrug resistant tuberculosis (MDR-TB),

vancomycin resistant enterococci (VRE) and *E. coli* 0157 making their control more problematic and challenging for infection control personnel world wide.

Until the 1960s, recommendations on the control of infection were subjective, based on personal observations and anecdotes. The art beginning to emerge but the science was lacking. It is only in the past two decades that infection control has been taken as a serious issue although there are still areas where practice is still ritualist and controversial. An attempt has been made in this book to provide practical advice to the HCW on the control of infection based on current scientific knowledge and recommendation from various bodies on prevention and control of infection in the health care setting.

Nizam N. Damani
1997

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- Gavin Smith of Greenwich Medical Media for seeing the book through completion.
- Finally, I thank my wife Laila and my children Numair and Namiz for their understanding and willingness to accommodate their life to my chaotic schedules.

Contents

Abbreviations

AAFB	Acid and Alcohol Fast Bacilli
ACDP	Advisory Committee on Dangerous Pathogens
A & E	Accident and Emergency Department
AIDS	Acquired Immune Deficiency Syndrome
AZT	Azidothymidine (Zidovudine)
BS	British Standard
BBV	Blood-borne Viruses
BSE	Bovine Spongiform Encephalopathies
CDC	Centers for Disease Control and Prevention
CDSC	Communicable Disease Surveillance Centre
CFU	Colony forming units
CI	Confidence Interval
CJD	Creutzfeldt-Jakob Disease
DHSS	Department of Health and Social Services
DoH	Department of Health
EIA	Enzyme Immuno Assay
ELISA	Enzyme Linked Immunosorbent Assay
ERCP	Endoscopic retrograde cholangiopancreatography
GRE	Glycopeptide resistant Enterococci
GISA	Glycopeptide resistant *Staphylococcus aureus*
HAV	Hepatitis A Virus
HBIG	Hepatitis B Immunoglobulin
HBeAg	Hepatitis B e antigen
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B Virus
HC	Health Circular
HCV	Hepatitis C Virus
HCW	Health Care Worker
HEPA	High efficiency particulate air
HEV	Hepatitis E Virus
HIV	Human Immunodeficiency Virus
HMSO	Her Majesty's Stationery Office
HN	Health Notice
HSE	Health and Safety Executive
IV	Intravenous
ICC	Infection Control Committee
ICD	Infection Control Doctor
ICN	Infection Control Nurse
ICT	Infection Control Team

ICU	Intensive Care Unit
MDA	Medical Device Agency
MDR-TB	Multi-drug resistant Tuberculosis
MRSA	Methicillin-resistant *Staphylococcus aureus*
NaDCC	Sodium Dichloroisocyanurate
NNIS	National Nosocomial Surveillance System
OPA	Orthophthaladehyde
PCR	Polymerase Chain Reaction
PHLS	Public Health Laboratory Service
ppm av Cl_2	Parts per million of available chlorine
QAC	Quaternary Ammonium Compound
RIBA	Recombinant immunoblot assay
SCBU	Special Care Baby Unit
SSD	Sterile Supply Department
SSI	Surgical Site Infection
TB	Tuberculosis
UTI	Urinary Tract Infection
vCJD	New variant Creutzfeldt-Jakob Disease
VHFs	Viral Haemorrhagic Fevers
VISA	Vancomycin resistant *Staphylococcus aureus*
VRE	Vancomycin resistant Enterococci
VZIG	Varicella Zoster Immunoglobulin
WHO	World Health Organization

Glossary of Infection Control Terms

ANTISEPSIS	The destruction or inhibition of microorganisms on living tissues having the effect of limiting or preventing the harmful results of infection.
ANTISEPTIC	A chemical agent used in antisepsis.
CARRIER	A person (host) who harbours a microorganism (agent) in the absence of discernible clinical disease. Carriers may shed organisms into environment intermittently or continuously and therefore act as a potential source of infection.
CASE	A person with symptoms.
CHEMOPROPHYLAXIS	The administration of antimicrobial agents to prevent the development of an infection or the progression of an infection to active manifest disease.
COHORT	A group of patients infected or colonized with same microorganism, grouped together in a designated area of a unit or ward.
COLONIZATION	The presence of microorganisms at a body site(s) without presence of symptoms or clinical manifestations of illness or infection. Colonization may be a form of carriage and is a potential method of transmission.
COMMENSAL	A microorganism resident in or on a body site without causing clinical infection.
COMMUNICABLE PERIOD	The time in the natural history of an infection during which transmission may take place.

CONTACT	An exposed individual who might have been infected through transmission from another host or the environment.
CONTAMINATION	The presence of microorganisms on a surface or in a fluid or material.
DISINFECTANT	A chemical agent which under defined conditions is capable of disinfection.
ENDEMIC	The usual level or presence of an agent or disease in a defined population during a given period.
ENDOGENOUS INFECTION	Microorganisms originating from the patient's own body which cause harm in another body site.
EPIDEMIC	An unusual, higher than expected level of infection or disease by a common agent in a defined population in a given period.
EPIDEMIOLOGY	The study of the occurrence and cause of disease in populations.
EXOGENOUS INFECTION	Microorganisms originating from a source or reservoir which are transmitted by any mechanism to a person, i.e. contact, airborne routes etc.
FLORA	Microorganisms resident in an environmental or body site.
HOSPITAL-ACQUIRED INFECTION (***Nosocomial infection***)	Infection acquired during hospitalization; not present or incubating at the time of admission to hospital.
IMMUNITY	The resistance of a host to a specific infectious agent.
IMMUNOCOMPROMISED	A state of reduced resistance to infection that results from malignant disease, drugs, radiation illness or congenital defect.
INCIDENCE	The number of new cases of a disease (or event) occurring in a specified time.
INCIDENCE RATE	The ratio of the number of new infections or disease in a defined population in a given period to the number of individuals at risk in the population.

INCUBATION PERIOD	The time interval between initial exposure to the infectious agent and the appearance of the first sign or symptoms of the disease in a susceptible host.
INDEX CASE	The first case to be recognized in a series of transmissions of an agent in a host population.
INFECTION	The damaging of body tissue by microorganisms or by poisonous substances released by the microorganisms.
ISOLATION	The physical separation of an infected or colonized host from the remainder of the at risk population in an attempt to prevent transmission of the specific agent to other individuals and patients.
MICROBIOLOGICAL CLEARANCE	The reduction of the number of pathogenic microorganisms in a specimen below that detectable by conventional means.
MICROORGANISM	A microscopic entity capable of replication. It includes bacteria, viruses and the microscopic forms of algae, fungi and protozoa.
OUTBREAK	An outbreak may be defined as the occurrence of disease at a rate greater than that expected within a specific geographical area and over a defined period of time.
PATHOGEN	A microorganism capable of producing disease.
PATHOGENICITY	The ability of an infectious agent to cause disease in a susceptible host.
PREVALENCE RATE	The ratio of the total number of individuals who have a disease at a particular time to the population at risk of having the disease.
RESERVOIR	Any animate or inanimate focus in the environment in which an infectious agent may survive and multiply which may act as a potential source of infection.
SEROCONVERSION	The development of antibodies not previously present resulting from a primary infection.
SOURCE	Place where microorganisms are growing or have grown.

SPORADIC CASE	A single case which has not apparently been associated with other cases, excreters or carriers in the same period of time.
STERILE	Free from all living microorganisms.
STERILIZATION	A process which renders an item sterile.
STERILIZING AGENT (***Sterilant***)	An agent or combination of agents which under defined conditions leads to sterilization.
SURVEILLANCE	A systematic collection, analysis, and interpretation of data on specific events (infections) and disease, followed by dissemination of that information to those who can improve the outcomes.
SUSCEPTIBLE	A person presumably not possessing sufficient resistance (or immunity) against a pathogenic agent who contracts infection when exposed to the agent.
TRANSMISSION	The method by which any potentially infecting agent is spread to another host.
VIRULENCE	The intrinsic capabilities of a microorganism to infect host and produce disease.
ZOONOSIS	An infectious disease transmissible from vertebrate animals to humans.