GUIDELINE FOR ISOLATION PRECAUTIONS IN HOSPITALS

PART I. Evolution of Isolation Practices

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Introduction

To assist hospitals in maintaining up-to-date isolation practices, the Centers for Disease Control and Prevention (CDC) and the Hospital Infection Control Practices Advisory Committee[1](HICPAC) have revised the *CDC Guideline for Isolation Precautions in Hospitals*. HICPAC was established in 1991 to provide advice and guidance to the Secretary, Department of Health and Human Services (DHHS); the Assistant Secretary for Health, DHHS; the Director, CDC; and the Director, National Center for Infectious Diseases (NCID), regarding the practice of hospital infection control and strategies for surveillance, prevention, and control of nosocomial infections in U.S. hospitals. HICPAC also advises the CDC on periodic updating of guidelines and other policy statements regarding prevention of nosocomial infections.

The revised guideline contains two parts. Part I, "Evolution of Isolation Practices," reviews the

evolution of isolation practices in U.S. hospitals including their advantages, disadvantages, and controversial aspects and provides the background for the HICPAC-consensus recommendations contained in Part II, "Recommendations for Isolation Precautions in Hospitals." The guideline supersedes previous CDC recommendations for isolation precautions in hospitals.[2-4]

The guideline recommendations are based on the latest epidemiologic information on transmission of infection in hospitals. The recommendations are intended primarily for use in the care of patients in acute-care hospitals, although some of the recommendations may be applicable for some patients receiving care in subacute-care or extended-care facilities. The recommendations are not intended for use in day care, well care, or domiciliary care programs. Because there have been few studies to test the efficacy of isolation precautions and gaps still exist in the knowledge of the epidemiology and modes of transmission of some diseases, disagreement with some of the recommendations is expected. A working draft of the guideline was reviewed by experts in infection control and published in the *Federal Register* for public comment. However, all recommendations in the guideline may not reflect the opinions of all reviewers.

HICPAC recognizes that the goal of preventing transmission of infections in hospitals can be accomplished by multiple means and that hospitals will modify the recommendations according to their needs and circumstances and as directed by federal, state, or local regulations. Modification of the recommendations is encouraged if (1) the principles of epidemiology and disease transmission are maintained, and (2) precautions are included to interrupt spread of infection by all routes that are likely to be encountered in the hospital.

Summary

The Guideline for Isolation Precautions in Hospitals was revised to meet the following objectives: (1) to be epidemiologically sound; (2) to recognize the importance of all body fluids, secretions, and excretions in the transmission of nosocomial pathogens; (3) to contain adequate precautions for infections transmitted by the airborne, droplet, and contact routes of transmission; (4) to be as simple and user friendly as possible; and (5) to use new terms to avoid confusion with existing infection control and isolation systems.

The revised guideline contains two tiers of precautions. In the first, and most important, tier are those precautions designed for the care of all patients in hospitals regardless of their diagnosis or presumed infection status. Implementation of these "Standard Precautions" is the primary strategy for successful nosocomial infection control. In the second tier are precautions designed only for the care of specified patients. These additional "Transmission-Based Precautions" are used for patients known or suspected to be infected or colonized with epidemiologically important pathogens that can be transmitted by airborne or droplet transmission or by contact with dry skin or contaminated surfaces.

Standard Precautions synthesize the major features of Universal (Blood and Body Fluid) Precautions (designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation (designed to reduce the risk of transmission of pathogens from moist body substances). Standard Precautions apply to (1) blood; (2) all body fluids, secretions, and excretions **except sweat** regardless of whether or not they contain visible blood; (3) nonintact skin; and (4) mucous membranes. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.

Transmission-Based Precautions are designed for patients documented or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens for which additional precautions beyond Standard Precautions are needed to interrupt transmission in hospitals. There are three types of Transmission-Based Precautions: Airborne Precautions, Droplet Precautions, and Contact Precautions. They may be combined together for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

The revised guideline also lists specific clinical syndromes or conditions in both adult and pediatric patients that are highly suspicious for infection and identifies appropriate Transmission-Based Precautions to use on an empiric, temporary basis until a diagnosis can be made; these empiric, temporary precautions are also to be used in addition to Standard Precautions.

Early Isolation Practices

The first published recommendations for isolation precautions in the United States appeared as early as 1877, when a hospital handbook recommended placing patients with infectious diseases in separate facilities,[5] which ultimately became known as infectious disease hospitals. Although this practice segregated infected patients from noninfected patients, nosocomial transmission continued to occur because infected patients were not separated from each other according to their disease, and few, if any, aseptic procedures were practiced. Personnel in infectious disease hospitals began to combat problems of nosocomial transmission by setting aside a floor or ward for patients with similar diseases[6] and by practicing aseptic procedures recommended in nursing textbooks published from 1890 to 1900.[5]

In 1910, isolation practices in U.S. hospitals were altered by the introduction of the cubicle system of isolation, which placed patients in multiple-bed wards.[6] With the cubicle system, hospital personnel used separate gowns, washed their hands with antiseptic solutions after patient contact, and disinfected objects contaminated by the patient. These nursing procedures, designed to prevent transmission of pathogenic organisms to other patients and personnel, became known as "barrier nursing." Use of the cubicle system of isolation and barrier nursing procedures provided general hospitals with an alternative to placing some patients in infectious disease hospitals.

During the 1950s, U.S. infectious disease hospitals, except those designated exclusively for tuberculosis, began to close. In the mid-1960s, tuberculosis hospitals also began to close, partly because general hospital or outpatient treatment became preferred for patients with tuberculosis. Thus, by the late 1960s patients with infectious diseases were housed in wards in general hospitals, either in specially designed, single-patient isolation rooms or in regular single or multiple-patient rooms.

CDC Isolation Systems

CDC Isolation Manual

In 1970, CDC published a detailed manual entitled *Isolation Techniques for Use in Hospitals* to assist general hospitals with isolation precautions.[2] A revised edition appeared in 1975.[3] The manual could be applied in small community hospitals with limited resources, as well as in large, metropolitan, university-associated medical centers.

The manual introduced the category system of isolation precautions. It recommended that

hospitals use one of seven isolation categories (Strict Isolation, Respiratory Isolation, Protective Isolation, Enteric Precautions, Wound and Skin Precautions, Discharge Precautions, and Blood Precautions). The precautions recommended for each category were determined almost entirely by the epidemiologic features of the diseases grouped in the category, primarily their routes of transmission. Certain isolation techniques, believed to be the minimum necessary to prevent transmission of all diseases in the category, were indicated for each isolation category. Because all diseases in a category did not have the same epidemiology (i.e., were not spread by exactly the same combination of modes of transmission), with some requiring fewer precautions than others, more precautions were suggested for some diseases than were necessary. This disadvantage of "over-isolation" for some diseases was offset by the convenience of having a small number of categories. More importantly, the simple system required personnel to learn only a few established routines for applying isolation precautions. To make the system even more user friendly, instructions for each category were printed on color-coded cards and placed on the doors, beds, or charts of patients on isolation precautions.

By the mid-1970s, 93% of U.S. hospitals had adopted the isolation system recommended in the manual.[7] However, neither the efficacy of the category approach in preventing spread of infections nor the costs of using the system were evaluated by empirical studies.

By 1980, hospitals were experiencing new endemic and epidemic nosocomial infection problems, some caused by multidrug-resistant microorganisms and others caused by newly recognized pathogens, which required different isolation precautions from those specified by any existing isolation category. There was increasing need for isolation precautions to be directed more specifically at nosocomial transmission in special-care units, rather than at the intrahospital spread of infectious diseases acquired in the community.[8] Infection control professionals and nursing directors in hospitals

with particularly sophisticated nursing staffs were increasingly calling for new isolation systems that would tailor precautions to the modes of transmission for each infection and avoid the over-isolation inherent in the category-specific approach. Further, new facts about the epidemiology and modes of transmission of some diseases made it necessary for CDC to revise the isolation manual. Toward that end, during 1981-1983, CDC Hospital Infections Program personnel consulted with infectious disease specialists in medicine, pediatrics, and surgery; hospital epidemiologists; and infection control practitioners about revising the manual.

CDC Isolation Guideline

In 1983, the *CDC Guideline for Isolation Precautions in Hospitals*[4] (hereafter referred to as the isolation guideline) was published to take the place of the 1975 isolation manual; it contained many important changes. One of the most important was the increased emphasis on decision-making on the part of users. Unlike the 1975 manual, which encouraged few decisions on the part of users, the isolation guideline encouraged decision-making at several levels.[9-10] First, hospital infection control committees were given a choice of selecting between category-specific or disease-specific isolation precautions or using the guideline to develop a unique isolation system appropriate to their hospital's circumstances and environments. Second, personnel who placed a patient on isolation precautions were encouraged to make decisions about the individual precautions to be taken (e.g., whether the patient's age, mental status, or condition indicated that a private room was needed to prevent sharing of contaminated articles). Third, personnel taking care of patients on isolation precautions were encouraged to decide whether they needed to wear a mask, gown, or gloves based on the likelihood of exposure to infective material. Such decisions were deemed necessary to isolate the infection but not the patient and to reduce the costs associated with unnecessary isolation precautions.

In the category-specific section of the guideline, existing categories were modified, new categories were added, and many infections were reassigned to different categories. The old category of Blood Precautions, primarily directed toward patients with chronic carriage of hepatitis B virus (HBV), was renamed Blood and Body Fluid Precautions and was expanded to include patients with AIDS and body fluids other than blood. The old category of Protective Isolation was deleted because of studies demonstrating its lack of efficacy in general clinical practice in preventing the acquisition of infection by the immunocompromised patient for whom it had originally been described.[11-12] The 1983 guideline contained the following categories of isolation: Strict Isolation, Contact Isolation, Respiratory Isolation, Tuberculosis (acid-fast bacilli [AFB]) Isolation, Enteric Precautions, Drainage/Secretion Precautions, and Blood and Body Fluid Precautions. As with the category approach in the former CDC isolation manuals, these categories tended to over-isolate some patients.

In the disease-specific section of the guideline, the epidemiology of each infectious disease was considered individually by advocating only those precautions (e.g., private room, mask, gown, and gloves) needed to interrupt transmission of the infection. In place of the categories and signs of the category-specific approach, a chart listed all diseases posing the threat of in-hospital transmission, with checks in columns indicating which precautions were required for each. Because precautions were individualized for each disease, hospitals using the system were encouraged to provide more initial training and inservice education and to encourage a much higher level of attention from patient-care personnel. Although disease-specific isolation precautions eliminated over-isolation, personnel might be prone to mistakes in applying the precautions, particularly if the disease was not seen regularly in the hospital,[9-10] if there was a delay in diagnosis, or if there was a misdiagnosis. Placing disease-specific isolation precautions in a hospital computerized information system resulted in more accurate use of the system.[13]

Because gaps existed in the knowledge of the epidemiology of some diseases, disagreement was expected, and occurred, regarding the placement of individual diseases within given categories, especially diseases with a respiratory component of transmission.[14] Placing measles in Respiratory Isolation (designed to prevent transmission of large-particle droplets) rather than in a category that had provisions for preventing transmission by airborne droplet nuclei and placing rubella and respiratory syncytial virus (RSV) infection in Contact Isolation were controversial.[15] There was also disagreement about the lack of a recommendation for adult patients with influenza, the need for a private room for pediatric patients with RSV infections, and the length of time that precautions should be maintained.[15] The lack of empiric studies on the efficacy and costs of implementing the recommendations contributed to the disagreements.

As new epidemiologic data became available, several subsequent CDC reports[16-18] updated portions of the isolation guideline. Updated recommendations for management of patients with suspected hemorrhagic fever were published in 1988.[16] The recommendation for Respiratory Isolation for acute erythema infectiosum was superseded by a 1989 report that recommended Respiratory Isolation for human parvovirus B19 (the causative agent for erythema infectiosum) only when infected patients were in transient aplastic crisis or had immunodeficiency and chronic human parvovirus B19 infection.[17]

Recommendations for Tuberculosis (AFB) Isolation were updated in 1990[18] because of heightened concern about nosocomial transmission of multidrug-resistant tuberculosis,[19-20] particularly in settings where persons with human immunodeficiency virus (HIV) infection were receiving care. The 1990 tuberculosis guidelines emphasized (1) placing a hospital patient with confirmed or suspected tuberculosis in a private room that has lower, or negative, air pressure compared with surrounding

areas; (2) reducing mycobacterial contamination of air by dilution and removal of airborne contaminants; and (3) wearing particulate respirators, rather than standard surgical masks, when hospital personnel shared air space with an infectious tuberculosis patient. Subsequent recommendations reemphasized the importance of early diagnosis and treatment of tuberculosis.[21] In 1993, a second edition of the guidelines for preventing the transmission of tuberculosis in health care facilities was published in draft for public comment.[22] After review of written comments, the guidelines were modified and published.[23]

Universal Precautions

In 1985, largely because of the HIV epidemic, isolation practices in the United States were altered dramatically by the introduction of a new strategy for isolation precautions, which became known as Universal Precautions (UP). Following the initial reports of hospital personnel becoming infected with HIV through needlesticks and skin contamination with patients' blood, a widespread outcry created the urgent need for new isolation strategies to protect hospital personnel from bloodborne infections. The subsequent modification of isolation precautions in some hospitals produced several major strategic changes and sacrificed some measures of protection against patient-to-patient transmission in the process of adding protection against patient-to-personnel transmission. In acknowledgment of the fact that many patients with bloodborne infections are not recognized, the new UPapproach for the first time placed emphasis on applying Blood and Body Fluid Precautions universally to all persons regardless of their presumed infection status.[24] Until this time, most patients placed on isolation precautions were those for whom a diagnosis of an infectious disease had been made or was suspected. This provision led to the new name of Universal Precautions.

In addition to emphasizing prevention of needlestick injuries and the use of traditional barriers such as gloves and gowns, UP expanded Blood and Body Fluid Precautions to include use of masks and eye coverings to prevent mucous membrane exposures during certain procedures and the use of individual ventilation devices when the need for resuscitation was predictable. This approach, and particularly the techniques for preventing mucous membrane exposures, was reemphasized in subsequent CDC reports that contained recommendations for prevention of HIV transmission in healthcare settings.[25-28]

In 1987, one of these reports[27] stated that implementation of UP for all patients eliminated the need for the isolation category of Blood and Body Fluid Precautions for patients known or suspected to be infected with bloodborne pathogens; however, the report stated that other category- or disease-specific isolation precautions recommended in the CDC isolation guideline[4] should be used as necessary if infections other than bloodborne infections were diagnosed or suspected.

The 1987 report was updated by a 1988 report[28] that emphasized two important points: (1) blood was the single most important source of HIV, HBV, and other bloodborne pathogens in the occupational setting, and (2) infection control efforts for preventing transmission of bloodborne pathogens in healthcare settings must focus on preventing exposures to blood, as well as on delivery of HBV immunization. The report stated that UP applied to blood, to body fluids that had been implicated in the transmission of bloodborne infections (semen and vaginal secretions), to body fluids from which the risk of transmission was unknown (amniotic, cerebrospinal, pericardial, peritoneal, pleural, and synovial fluids), and to any other body fluid visibly contaminated with blood, but not to feces, nasal secretions, sputum, sweat, tears, urine, or vomitus unless they contained visible blood. Although HIV and HBV surface antigen (HBsAg) had been found in some of the fluids, secretions, or excretions to

which UP did not apply, epidemiologic studies in the healthcare and community settings had not implicated these substances in the transmission of HIV and HBV infections. However, the report noted that some of the fluids, secretions, and excretions not covered under UP represented a potential source for nosocomial and community-acquired infections with other pathogens and referred readers to the CDC isolation guideline.

Body Substance Isolation

In 1987, a new system of isolation, called Body Substance Isolation (BSI), was proposed, after 3 years of study by infection control personnel at the Harborview Medical Center in Seattle, Washington, and the University of California at San Diego, California, as an alternative to diagnosis-driven isolation systems.[29] BSI focused on the isolation of all moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage, and other body fluids) from all patients, regardless of their presumed infection status, primarily through the use of gloves. Personnel were instructed to put on clean gloves just before contact with mucous membranes and nonintact skin, and to wear gloves for anticipated contact with moist body substances. In addition, a "Stop Sign Alert" was used to instruct persons wishing to enter the room of some patients with infections transmitted exclusively, or in part, by the airborne route to check with the floor nurse, who would determine whether a mask should be worn. Personnel were to be immune to or immunized against selected infectious diseases transmitted by airborne or droplet routes (measles, mumps, rubella, and varicella), or they were not to enter the rooms housing patients with these diseases. Other issues related to implementing BSI in a university teaching hospital were described.[30]

Among the advantages cited for BSI were that it was a simple, easy to learn and administer

system, that it avoided the assumption that individuals without known or suspected diagnoses of transmissible infectious diseases were free of risk to patients and personnel, and that only certain body fluids were associated with transmission of infection. The disadvantages of BSI included the added cost of increased use of barrier equipment, particularly gloves;[31] the difficulty in maintaining routine application of the protocol for all patients; the uncertainty about the precautions to be taken when entering a room with a "Stop Sign Alert"; and the potential for misapplication of the protocol to overprotect personnel at the expense of the patient.[32]

In a prospective study,[33] a combination use of gown and glove protocols similar to BSI led to lower infection rates in a pediatric intensive care unit (ICU), and, in other studies, similar combinations of barriers were associated with lower rates of nosocomial RSV infection in a pediatric ICU[34] and of resistant gram-negative organisms in an acute-care hospital.[35] However, in none of these studies, initiated before publication of BSI, were the authors attempting to evaluate BSI, nor were they able to separate the effect of gloves from that of gowns or from gloves and gowns used in combination.

Controversial aspects of BSI have been summarized.[15,36] BSI appeared to replace some, but not all, of the isolation precautions necessary to prevent transmission of infection. BSI did not contain adequate provisions to prevent (1) droplet transmission of serious infections in pediatric populations (e.g., invasive *Haemophilus influenza*, *Neisseria meningitides* meningitis and pneumonia, and pertussis); (2) direct or indirect contact transmission of epidemiologically important microorganisms from dry skin or environmental sources (e.g., *Clostridium difficile* and vancomycin-resistant enterococci); or (3) true airborne transmission of infections transmitted over long distances by floating droplet nuclei. Although BSI emphasized that a private room was indicated for some patients with some diseases transmitted exclusively, or in part, by the true airborne route, it did not emphasize the

need for special ventilation for patients known or suspected of having pulmonary tuberculosis or other diseases transmitted by airborne droplet nuclei. The lack of emphasis on special ventilation was of particular concern to CDC in the early 1990s because of multidrug-resistant tuberculosis.[18-19]

BSI and UP shared many similar features designed to prevent the transmission of bloodborne pathogens in hospitals. However, there was an important difference in the recommendation for glove use and handwashing. Under UP, gloves were recommended for anticipated contact with blood and specified body fluids, and hands were to be washed immediately after gloves were removed.[27-28] Under BSI, gloves were recommended for anticipated contact with any moist body substance, but handwashing after glove removal was not required unless the hands were visibly soiled.[29] The lack of emphasis on handwashing after glove removal was cited as one of the theoretical disadvantages of BSI.[15,37-38] Using gloves as a protective substitute for handwashing may have provided a false sense of security, resulted in less handwashing, increased the risk of nosocomial transmission of pathogens, because hands can become contaminated even when gloves are used[39] and are easily contaminated in the process of removing gloves, and contributed to skin problems and allergies associated with the use of gloves.[40-41] On the other hand, proponents of BSI have noted that studies of handwashing have indicated relatively low compliance by hospital personnel,[42-43] that glove use may have been easier to manage than handwashing, and that frequent handwashing may have led to eczema, skin cracking, or, in some persons, clinical damage to the skin of the hands.[44] Although use of gloves may have been better than no handwashing, the efficacy of using gloves as a substitute for handwashing has not been demonstrated.

OSHA Bloodborne Pathogens Regulations

In 1989, the Occupational Safety and Health Administration (OSHA) published a proposed rule regarding occupational exposure to bloodborne pathogens in hospitals and other healthcare settings.[45] The proposed rule, based on the concept of UP, raised concerns in the infection control community. Among them were concerns about the use of "visibly bloody" as a marker for the infectious risk of certain body fluids and substances, the imbalance toward precautions to protect personnel and away from protection for patients, the lack of proven efficacy of UP, and the costs for implementing the proposed regulations.[46-50] After a series of OSHA public hearings and review of written comments, the proposed rule was modified, and the final rule on occupational exposure to bloodborne pathogens was published in 1991.[51] Although the final rule was expected to improve occupational safety in the care of patients infected with bloodborne pathogens, its impact on the cost of patient care and on nosocomial infection control has remained undefined. Information on complying with the OSHA final rule has been made available by the American Hospital Association[52] and others.[53]

The Need For A New Isolation Guideline

By the early 1990s, isolation had become an infection control conundrum.[54] Although many hospitals had incorporated all or portions of UP into their category- or disease-specific isolation system and others had adopted all or portions of BSI,[55-56] there was much local variation in the interpretation and use of UP and BSI, and a variety of combinations was common. Further, there was considerable confusion about which body fluids or substances required precautions under UP and BSI. Many hospitals espousing UP really were using BSI and vice versa. Moreover, there was continued lack of agreement about the importance of handwashing when gloves were used[14-15,27-29,37-38,57-58] and the need for additional precautions beyond BSI to prevent airborne, droplet, and contact transmission.[14-15,27-29,31,36,59-60] Some hospitals had not implemented appropriate guidelines for preventing transmission of

tuberculosis, including multidrug-resistant tuberculosis.[61] As other multidrug-resistant microorganisms[62-63] were emerging, some hospitals failed to recognize them as new problems and to add appropriate precautions that would contain them.

In view of these problems and concerns, no simple adjustment to any of the existing approaches--UP, BSI, the CDC isolation guideline, or other isolation systems--appeared likely to solve the conundrum. Clearly what was needed was a new synthesis of the various systems that would provide a guideline with logistically feasible recommendations for preventing the many infections that occur in hospitals through diverse modes of transmission. To achieve this, the new guideline would (1) have to be epidemiologically sound; (2) have to recognize the importance of all body fluids, secretions, and excretions in the transmission of nosocomial pathogens; (3) have to contain adequate precautions for infections transmitted by the airborne, droplet, and contact routes of transmission; (4) have to be as simple and user friendly as possible; and (5) have to use new terms to avoid confusion with existing systems.

Based on these considerations, this guideline was subsequently developed. It contains three important changes from previous recommendations. First, it synthesizes the major features of UP[27-28] and BSI[29-30] into a single set of precautions to be used for the care of all patients in hospitals regardless of their presumed infection status. These precautions, called Standard Precautions, are designed to reduce the risk of transmission of bloodborne and other pathogens in hospitals. As a result of this synthesis, a large number of patients with diseases or conditions that previously required category- or disease- specific precautions in the 1983 CDC isolation guideline[4] now are covered under Standard Precautions and do not require additional precautions. Second, it collapses the old categories of isolation precautions (Strict Isolation, Contact Isolation, Respiratory Isolation, Tuberculosis Isolation,

Enteric Precautions, and Drainage/Secretion Precautions) and the old disease-specific precautions into three sets of precautions based on routes of transmission for a smaller number of specified patients known or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens; these Transmission-Based Precautions, designed to reduce the risk of airborne, droplet, and contact transmission in hospitals, are to be used in addition to Standard Precautions. Third, it lists specific syndromes in both adult and pediatric patients that are highly suspicious for infection and identifies appropriate Transmission-Based Precautions to use on an empiric, temporary basis until a diagnosis can be made. These empiric, temporary precautions are also designed to be used in addition to Standard Precautions. The details of the guideline recommendations are presented in Part II, "Recommendations for Isolation Precautions in Hospitals."

In summary, this new guideline is another step in the evolution of isolation practices in U.S. hospitals. It is now recommended for review and use by hospitals with the following provision. No guideline can address all of the needs of the more than 6,000 U.S. hospitals, which range in size from 5 beds to more than 1,500 beds and serve very different patient populations. Hospitals are encouraged to review the recommendations and to modify them according to what is possible, practical, and prudent.

PART II. Recommendations For Isolation Precautions in Hospitals

The Hospital Infection Control Practices Advisory Committee

Rationale For Isolation Precautions in Hospitals

Transmission of infection within a hospital requires three elements: a source of infecting microorganisms, a susceptible host, and a means of transmission for the microorganism.

Source

Human sources of the infecting microorganisms in hospitals may be patients, personnel, or, on occasion, visitors, and may include persons with acute disease, persons in the incubation period of a disease, persons who are colonized by an infectious agent but have no apparent disease, or persons who are chronic carriers of an infectious agent. Other sources of infecting microorganisms can be the patient's own endogenous flora, which may be difficult to control, and inanimate environmental objects that have become contaminated, including equipment and medications.

Host

Resistance among persons to pathogenic microorganisms varies greatly. Some persons may be immune to infection or may be able to resist colonization by an infectious agent; others exposed to the same agent may establish a commensal relationship with the infecting microorganism and become asymptomatic carriers; still others may develop clinical disease. Host factors such as age; underlying diseases; certain treatments with antimicrobials, corticosteroids or other immunosuppressive agents; irradiation; and breaks in the first line of defense mechanisms caused by such factors as surgical operations, anesthesia, and indwelling catheters may render patients more susceptible to infection.

Transmission

Microorganisms are transmitted in hospitals by several routes, and the same microorganism may be transmitted by more than one route. There are five main routes of transmission--contact, droplet, airborne, common vehicle, and vectorborne. For the purpose of this guideline, common

vehicle and vectorborne transmission will be discussed only briefly, because neither play a significant role in typical nosocomial infections.

1. *Contact transmission*, the most important and frequent mode of transmission of nosocomial infections, is divided into two subgroups: direct-contact transmission and indirect-contact transmission.
    a. Direct-contact transmission involves a direct body surface-to-body surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person, such as occurs when a person turns a patient, gives a patient a bath, or performs other patient-care activities that require direct personal contact. Direct-contact transmission can also occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host.
    b. Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, or dressings, or contaminated hands that are not washed and gloves that are not changed between patients.
2. *Droplet transmission*, theoretically, is a form of contact transmission. However, the mechanism of transfer of the pathogen to the host is quite distinct from either direct- or indirect-contact transmission. Therefore, droplet transmission will be considered a separate route of transmission in this guideline. Droplets are generated from the source person primarily during coughing, sneezing, and talking, and during the performance of certain procedures such as suctioning and bronchoscopy. Transmission occurs when droplets containing microorganisms generated from the infected person are propelled a short distance through the air and deposited on the host's conjunctivae, nasal mucosa, or

mouth. Because droplets do not remain suspended in the air, special air handling and ventilation are not required to prevent droplet transmission; that is, droplet transmission ***must not*** be confused with airborne transmission.

3. *Airborne transmission* occurs by dissemination of either airborne droplet nuclei (small-particle residue [5 microns or smaller in size] of evaporated droplets containing microorganisms that remain suspended in the air for long periods of time) or dust particles containing the infectious agent. Microorganisms carried in this manner can be widely dispersed by air currents and may become inhaled by a susceptible host within the same room or over a longer distance from the source patient, depending on environmental factors; therefore, special air handling and ventilation are required to prevent airborne transmission. Microorganisms transmitted by airborne transmission include *Mycobacterium tuberculosis* and the rubeola and varicella viruses.
4. *Common Vehicle transmission* applies to microorganisms transmitted by contaminated items such as food, water, medications, devices, and equipment.
5. *Vectorborne transmission* occurs when vectors such as mosquitoes, flies, rats, and other vermin transmit microorganisms; this route of transmission is of less significance in hospitals in the United States than in other regions of the world.

Isolation precautions are designed to prevent transmission of microorganisms by these routes in hospitals. Because agent and host factors are more difficult to control, interruption of transfer of microorganisms is directed primarily at transmission. The recommendations presented in this guideline are based on this concept.

Placing a patient on isolation precautions, however, often presents certain disadvantages to the hospital, patients, personnel, and visitors. Isolation precautions may require specialized equipment and environmental modifications that add to the cost of hospitalization. Isolation precautions may make

frequent visits by nurses, physicians, and other personnel inconvenient, and they may make it more difficult for personnel to give the prompt and frequent care that is sometimes required. The use of a multi-patient room for one patient uses valuable space that otherwise might accommodate several patients. Moreover, forced solitude deprives the patient of normal social relationships and may be psychologically harmful, especially to children. These disadvantages, however, must be weighed against the hospital's mission to prevent the spread of serious and epidemiologically important microorganisms in the hospital.

Fundamentals of Isolation Precautions

A variety of infection control measures are used for decreasing the risk of transmission of microorganisms in hospitals. These measures make up the fundamentals of isolation precautions.

Handwashing and Gloving

Handwashing frequently is called the single most important measure to reduce the risks of transmitting organisms from one person to another or from one site to another on the same patient. The scientific rationale, indications, methods, and products for handwashing have been delineated in other publications.[64-72]

Washing hands as promptly and thoroughly as possible between patient contacts and after contact with blood, body fluids, secretions, excretions, and equipment or articles contaminated by them is an important component of infection control and isolation precautions. In addition to handwashing, gloves play an important role in reducing the risks of transmission of microorganisms.

Gloves are worn for three important reasons in hospitals. First, gloves are worn to provide a protective barrier and prevent gross contamination of the hands when touching blood, body fluids, secretions, excretions, mucous membranes, and nonintact skin;[27-29] the wearing of gloves in specified circumstances to reduce the risk of exposures to bloodborne pathogens is mandated by the OSHA bloodborne pathogens final rule.[51] Second, gloves are worn to reduce the likelihood that microorganisms present on the hands of personnel will be transmitted to patients during invasive or other patient-care procedures that involve touching a patient's mucous membranes and nonintact skin. Third, gloves are worn to reduce the likelihood that hands of personnel contaminated with microorganisms from a patient or a fomite can transmit these microorganisms to another patient. In this situation, gloves must be changed between patient contacts and hands should be washed after gloves are removed.

Wearing gloves does not replace the need for handwashing because gloves may have small, inapparent defects or may be torn during use, and hands can become contaminated during removal of gloves.[14-15,39,72-76] Failure to change gloves between patient contacts is an infection control hazard.[32]

Patient Placement

Appropriate patient placement is a significant component of isolation precautions. A private room is important to prevent direct- or indirect-contact transmission when the source patient has poor hygienic habits, contaminates the environment, or cannot be expected to assist in maintaining infection control precautions to limit transmission of microorganisms (i.e., infants, children, and patients with altered mental status). When possible, a patient with highly transmissible or epidemiologically important microorganisms is placed in a private room with handwashing and toilet facilities, to reduce

opportunities for transmission of microorganisms.

When a private room is not available, an infected patient is placed with an appropriate roommate. Patients infected by the same microorganism usually can share a room, provided they are not infected with other potentially transmissible microorganisms and the likelihood of reinfection with the same organism is minimal. Such sharing of rooms, also referred to as cohorting patients, is useful especially during outbreaks or when there is a shortage of private rooms. When a private room is not available and cohorting is not achievable or recommended,[23] it is very important to consider the epidemiology and mode of transmission of the infecting pathogen and the patient population being served in determining patient placement. Under these circumstances, consultation with infection control professionals is advised before patient placement. Moreover, when an infected patient shares a room with a noninfected patient, it also is important that patients, personnel, and visitors take precautions to prevent the spread of infection and that roommates are carefully selected.

Guidelines for construction, equipment, air handling, and ventilation for isolation rooms have been delineated in other publications.[77-79] A private room with appropriate air handling and ventilation is particularly important for reducing the risk of transmission of microorganisms from a source patient to susceptible patients and other persons in hospitals when the microorganism is spread by airborne transmission. Some hospitals use an isolation room with an anteroom as an extra measure of precaution to prevent airborne transmission. Adequate data regarding the need for an anteroom, however, is not available. Ventilation recommendations for isolation rooms housing patients with pulmonary tuberculosis have been delineated in other CDC guidelines.[23]

Transport of Infected Patients

Limiting the movement and transport of patients infected with virulent or epidemiologically important microorganisms and ensuring that such patients leave their rooms only for essential purposes reduce opportunities for transmission of microorganisms in hospitals. When patient transport is necessary, it is important that (1) appropriate barriers (e.g., masks, impervious dressings) are worn or used by the patient to reduce the opportunity for transmission of pertinent microorganisms to other patients, personnel, and visitors and to reduce contamination of the environment; (2) personnel in the area to which the patient is to be taken are notified of the impending arrival of the patient and of the precautions to be used to reduce the risk of transmission of infectious microorganisms; and (3) patients are informed of ways by which they can assist in preventing the transmission of their infectious microorganisms to others.

Masks, Respiratory Protection, Eye Protection, Face Shields

Various types of masks, goggles, and face shields are worn alone or in combination to provide barrier protection. A mask that covers both the nose and mouth, and goggles or a face shield are worn by hospital personnel during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions to provide protection of the mucous membranes of the eyes, nose, and mouth from contact transmission of pathogens. The wearing of masks, eye protection, and face shields in specified circumstances to reduce the risk of exposures to bloodborne pathogens is mandated by the OSHA bloodborne pathogens final rule.[51] A surgical mask generally is worn by hospital personnel to provide protection against spread of infectious large-particle droplets that are transmitted by close contact and generally travel only short distances (up to 3 feet) from infected patients who are coughing or sneezing.

An area of major concern and controversy over the last several years has been the role and selection of respiratory protection equipment and the implications of a respiratory protection program for prevention of transmission of tuberculosis in hospitals. Traditionally, although the efficacy was not proven, a surgical mask was worn for isolation precautions in hospitals when patients were known or suspected to be infected with pathogens spread by the airborne route of transmission. In 1990, however, the CDC tuberculosis guidelines[18] stated that surgical masks may not be effective in preventing the inhalation of droplet nuclei and recommended the use of disposable particulate respirators, despite the fact that the efficacy of particulate respirators in protecting persons from the inhalation of *Mycobacterium tuberculosis* had not been demonstrated. By definition, particulate respirators included dust-mist (DM), dust-fume-mist (DFM), or high-efficiency particulate air (HEPA) filter respirators certified by the CDC National Institute for Occupational Safety and Health (NIOSH); because the generic term "particulate respirator" was used in the 1990 guidelines, the implication was that any of these respirators provided sufficient protection.[80]

In 1993, a draft revision of the CDC tuberculosis guidelines[22] outlined performance criteria for respirators and stated that some DM or DFM respirators might not meet these criteria. After review of public comments, the guidelines were finalized in October 1994[23] with the draft respirator criteria unchanged. At that time, the only class of respirators that were known to consistently meet or exceed the performance criteria outlined in the 1994 tuberculosis guidelines and that were certified by NIOSH (as required by OSHA) were HEPA filter respirators. Subsequently, NIOSH revised the testing and certification requirements for all types of air-purifying respirators, including those used for tuberculosis control.[81] The new rule, effective in July 1995, provides a broader range of certified respirators that meet the performance criteria recommended by CDC in the 1994 tuberculosis guidelines. NIOSH has indicated that the N95 (N category at 95%) efficiency meets the CDC performance criteria for a

tuberculosis respirator. The new respirators are likely to be available in late 1995. Additional information on the evolution of respirator recommendations, regulations to protect hospital personnel, and the role of various federal agencies in respiratory protection for hospital personnel has been published.[80]

Gowns and Protective Apparel

Various types of gowns and protective apparel are worn to provide barrier protection and to reduce opportunities for transmission of microorganisms in hospitals. Gowns are worn to prevent contamination of clothing and to protect the skin of personnel from blood and body fluid exposures. Gowns especially treated to make them impermeable to liquids, leg coverings, boots, or shoe covers provide greater protection to the skin when splashes or large quantities of infective material are present or anticipated. The wearing of gowns and protective apparel under specified circumstances to reduce the risk of exposures to bloodborne pathogens is mandated by the OSHA bloodborne pathogens final rule.[51]

Gowns are also worn by personnel during the care of patients infected with epidemiologically important microorganisms to reduce the opportunity for transmission of pathogens from patients or items in their environment to other patients or environments; when gowns are worn for this purpose, they are removed before leaving the patient's environment, and hands are washed. Adequate data regarding the efficacy of gowns for this purpose, however, is not available.

Patient-Care Equipment and Articles

Many factors determine whether special handling and disposal of used patient-care equipment and articles are prudent or required, including the likelihood of contamination with infective material; the ability to cut, stick, or otherwise cause injury (needles, scalpels, and other sharp instruments [sharps]); the severity of the associated disease; and the environmental stability of the pathogens involved.[27,51,82-84] Some used articles are enclosed in containers or bags to prevent inadvertent exposures to patients, personnel, and visitors and to prevent contamination of the environment. Used sharps are placed in puncture-resistant containers; other articles are placed in a bag. One bag is adequate if the bag is sturdy and the article can be placed in the bag without contaminating the outside of the bag[85]; otherwise, two bags are used.

The scientific rationale, indications, methods, products, and equipment for reprocessing patient-care equipment have been delineated in other publications.[68,84,86-91] Contaminated, reusable critical medical devices or patient-care equipment (i.e., equipment that enters normally sterile tissue or through which blood flows) or semicritical medical devices or patient-care equipment (i.e., equipment that touches mucous membranes) are sterilized or disinfected (reprocessed) after use to reduce the risk of transmission of microorganisms to other patients; the type of reprocessing is determined by the article and its intended use, the manufacturer's recommendations, hospital policy, and any applicable guidelines and regulations.

Noncritical equipment (i.e., equipment that touches intact skin) contaminated with blood, body fluids, secretions, or excretions is cleaned and disinfected after use, according to hospital policy. Contaminated disposable (single-use) patient-care equipment is handled and transported in a manner that reduces the risk of transmission of microorganisms and decreases environmental contamination in the hospital; the equipment is disposed of according to hospital policy and applicable regulations.

Linen and Laundry

Although soiled linen may be contaminated with pathogenic microorganisms, the risk of disease transmission is negligible if it is handled, transported, and laundered in a manner that avoids transfer of microorganisms to patients, personnel, and environments. Rather than rigid rules and regulations, hygienic and common sense storage and processing of clean and soiled linen are recommended.[27,83,92-93] The methods for handling, transporting, and laundering of soiled linen are determined by hospital policy and any applicable regulations.

Dishes, Glasses and Cups, and Eating Utensils

No special precautions are needed for dishes, glasses and cups, or eating utensils. Either disposable or reusable dishes and utensils can be used for patients on isolation precautions. The combination of hot water and detergents used in hospital dishwashers is sufficient to decontaminate dishes, glasses and cups, and eating utensils.

Routine and Terminal Cleaning

The room, or cubicle, and bedside equipment of patients on Transmission-Based Precautions are cleaned using the same procedures used for patients on Standard Precautions unless the infecting microorganism(s) and the amount of environmental contamination indicate special cleaning. In addition to thorough cleaning, adequate disinfection of bedside equipment and environmental surfaces (e.g., bedrails, bedside tables, carts, commodes, doorknobs, faucet handles) is indicated for certain pathogens, especially enterococci, which can survive in the inanimate environment for prolonged

periods of time.[94] Patients admitted to hospital rooms previously occupied by patients infected or colonized with such pathogens are at increased risk of infection from contaminated environmental surfaces and bedside equipment if they have not been cleaned and disinfected adequately. The methods, thoroughness, and frequency of cleaning and the products used are determined by hospital policy.

HICPAC Isolation Precautions

There are two tiers of HICPAC isolation precautions. In first, and most important, tier are those precautions designed for the care of all patients in hospitals, regardless of their diagnosis or presumed infection status. Implementation of these "Standard Precautions" is the primary strategy for successful nosocomial infection control. In the second tier are precautions designed only for the care of specified patients. These additional "Transmission-Based Precautions" are for patients known or suspected to be infected by epidemiologically important pathogens spread by airborne or droplet transmission or by contact with dry skin or contaminated surfaces.

Standard Precautions

Standard Precautions synthesize the major features of Universal (Blood and Body Fluid) Precautions[27-28] (designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation[29-30] (designed to reduce the risk of transmission of pathogens from moist body substances) and applies them to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status. Standard Precautions apply to (1) blood; (2) all body fluids, secretions, and excretions **except sweat**, regardless of whether or not they contain visible blood; (3) nonintact skin; and

(4) mucous membranes. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.

Transmission-Based Precautions

Transmission-Based Precautions are designed for patients documented or suspected to be infected with highly transmissible or epidemiologically important pathogens for which additional precautions beyond Standard Precautions are needed to interrupt transmission in hospitals. There are three types of Transmission-Based Precautions: Airborne Precautions, Droplet Precautions, and Contact Precautions. They may be combined together for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

Airborne Precautions are designed to reduce the risk of airborne transmission of infectious agents. Airborne transmission occurs by dissemination of either airborne droplet nuclei (small-particle residue [5 microns or smaller in size] of evaporated droplets that may remain suspended in the air for long periods of time) or dust particles containing the infectious agent. Microorganisms carried in this manner can be dispersed widely by air currents and may become inhaled by or deposited on a susceptible host within the same room or over a longer distance from the source patient, depending on environmental factors; therefore, special air handling and ventilation are required to prevent airborne transmission. Airborne Precautions apply to patients known or suspected to be infected with epidemiologically important pathogens that can be transmitted by the airborne route.

Droplet Precautions are designed to reduce the risk of droplet transmission of infectious agents.

Droplet transmission involves contact of the conjunctivae or the mucous membranes of the nose or mouth of a susceptible person with large-particle droplets (larger than 5 microns in size) containing microorganisms generated from a person who has a clinical disease or is a carrier of the microorganism. Droplets are generated from the source person primarily during coughing, sneezing, or talking and during the performance of certain procedures such as suctioning and bronchoscopy. Transmission via large-particle droplets requires close contact between source and recipient persons, because droplets do not remain suspended in the air and generally travel only short distances, usually 3 feet or less, through the air. Because droplets do not remain suspended in the air, special air handling and ventilation are not required to prevent droplet transmission. Droplet Precautions apply to any patient known or suspected to be infected with epidemiologically important pathogens that can be transmitted by infectious droplets.

Contact Precautions are designed to reduce the risk of transmission of epidemiologically important microorganisms by direct or indirect contact. Direct-contact transmission involves skin-to-skin contact and physical transfer of microorganisms to a susceptible host from an infected or colonized person, such as occurs when personnel turn patients, bathe patients, or perform other patient-care activities that require physical contact. Direct-contact transmission can also occur between two patients (e.g., by hand contact), with one serving as the source of infectious microorganisms and the other as a susceptible host. Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, in the patient's environment. Contact Precautions apply to specified patients known or suspected to be infected or colonized (presence of microorganism in or on patient but without clinical signs and symptoms of infection) with epidemiologically important microorganisms than can be transmitted by direct- or indirect-contact.

A synopsis of the types of precautions and the patients requiring the precautions is listed in Table 1.

Empiric Use of Airborne, Droplet, or Contact Precautions

In many instances, the risk of nosocomial transmission of infection may be highest before a definitive diagnosis can be made and before precautions based on that diagnosis implemented. The routine use of Standard Precautions for all patients should reduce greatly this risk for conditions other than those requiring Airborne, Droplet, or Contact Precautions. While it is not possible to prospectively identify all patients needing these enhanced precautions, certain clinical syndromes and conditions carry a sufficiently high risk to warrant the empiric addition of enhanced precautions while a more definitive diagnosis is pursued. A listing of such conditions and the recommended precautions beyond Standard Precautions is presented in Table 2.

The organisms listed under the column "Potential Pathogens" are not intended to represent the complete or even most likely diagnoses, but rather possible etiologic agents that require additional precautions beyond Standard Precautions until they can be ruled out. Infection control professionals are encouraged to modify or adapt this table according to local conditions. To ensure that appropriate empiric precautions are implemented always, hospitals must have systems in place to evaluate patients routinely according to these criteria as part of their preadmission and admission care.

Immunocompromised Patients

Immunocompromised patients vary in their susceptibility to nosocomial infections, depending

on the severity and duration of immunosuppression. They are generally at increased risk for bacterial, fungal, parasitic, and viral infections from both endogenous and exogenous sources. The use of Standard Precautions for all patients and Transmission-Based Precautions for specified patients, as recommended in this guideline, should reduce the acquisition by these patients of institutionally acquired bacteria from other patients and environments.

It is beyond the scope of this guideline to address the various measures that may be used for immunocompromised patients to delay or prevent acquisition of potential pathogens during temporary periods of neutropenia. Rather, the primary objective of this guideline is to prevent transmission of pathogens from infected or colonized patients in hospitals. Users of this guideline, however, are referred to the *Guideline for Prevention of Nosocomial Pneumonia*[95-96] for the HICPAC recommendations for prevention of nosocomial aspergillosis and Legionnaires' disease in immunocompromised patients.

Recommendations

The recommendations presented below are categorized as follows:

Category IA. Strongly recommended for all hospitals and strongly supported by well-designed experimental or epidemiologic studies.

Category IB. Strongly recommended for all hospitals and reviewed as effective by experts in the field and a consensus of HICPAC based on strong rationale and suggestive evidence, even though definitive scientific studies have not been done.

Category II. Suggested for implementation in many hospitals. Recommendations may be supported by suggestive clinical or epidemiologic studies, a strong theoretical rationale, or definitive studies applicable to some but not all hospitals.

No recommendation; unresolved issue. Practices for which insufficient evidence or consensus regarding efficacy exists.

The recommendations are limited to the topic of isolation precautions. Therefore, they must be supplemented by hospital policies and procedures for other aspects of infection and environmental control, occupational health, administrative and legal issues, and other issues beyond the scope of this guideline.

I. Administrative Controls

A. Education

Develop a system to ensure that hospital patients, personnel, and visitors are educated about use of precautions and their responsibility for adherence to them. *Category IB*

B. Adherence to Precautions

Periodically evaluate adherence to precautions, and use findings to direct improvements. *Category IB*

II. Standard Precautions

Use Standard Precautions, or the equivalent, for the care of all patients. *Category IB*

A. Handwashing

1. Wash hands after touching blood, body fluids, secretions, excretions, and

contaminated items, whether or not gloves are worn. Wash hands immediately after gloves are removed, between patient contacts, and when otherwise indicated to avoid transfer of microorganisms to other patients or environments. It may be necessary to wash hands between tasks and procedures on the same patient to prevent cross-contamination of different body sites. *Category IB*

2. Use a plain (nonantimicrobial) soap for routine handwashing. *Category IB*
3. Use an antimicrobial agent or waterless antiseptic agent for specific circumstances (e.g., control of outbreaks or hyperendemic infections) as defined by the infection control program. *Category IB* (See Contact Precautions for additional recommendations on using antimicrobial and antiseptic agents.)

B. Gloves

Wear gloves (clean nonsterile gloves are adequate) when touching blood, body fluids, secretions, excretions, and contaminated items. Put on clean gloves just before touching mucous membranes and nonintact skin. Change gloves between tasks and procedures on the same patient after contact with material that may contain a high concentration of microorganisms. Remove gloves promptly after use, before touching noncontaminated items and environmental surfaces, and before going to another patient, and wash hands immediately to avoid transfer of microorganisms to other patients or environments. *Category IB*

C. Mask, Eye Protection, Face Shield

Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions. *Category*

IB

D. Gown

Wear a gown (a clean nonsterile gown is adequate) to protect skin and prevent soiling of clothing during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions, or cause soiling of clothing. Select a gown that is appropriate for the activity and amount of fluid likely to be encountered. Remove a soiled gown as promptly as possible and wash hands to avoid transfer of microorganisms to other patients or environments. *Category IB*

E. Patient-Care Equipment

Handle used patient-care equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately. Ensure that single-use items are discarded properly. *Category IB*

F. Environmental Control

Ensure that the hospital has adequate procedures for the routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces, and ensure that these procedures are being followed. *Category IB*

G. Linen

Handle, transport, and process used linen soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures and contamination of clothing, and that avoids transfer of microorganisms to other patients

and environments. *Category IB*

H. Occupational Health and Bloodborne Pathogens

1. Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; and when disposing of used needles. Never recap used needles, or otherwise manipulate them using both hands, or any other technique that involves directing the point of a needle toward any part of the body; rather, use either a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath. Do not remove used needles from disposable syringes by hand, and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers, which are located as close as practical to the area in which the items were used, and place reusable syringes and needles in a puncture-resistant container for transport to the reprocessing area. *Category IB*

2. Use mouthpieces, resuscitation bags, or other ventilation devices as an alternative to mouth-to-mouth resuscitation methods in areas where the need for resuscitation is predictable. *Category IB*

I. Patient Placement

Place a patient who contaminates the environment or who does not (or cannot be expected to) assist in maintaining appropriate hygiene or environmental control in a private room. If a private room is not available, consult with infection control professionals regarding patient placement or other alternatives. *Category IB*

III. Airborne Precautions

In addition to Standard Precautions, use Airborne Precautions, or the equivalent, for patients known or suspected to be infected with microorganisms transmitted by airborne droplet nuclei (small-particle residue [5 microns or smaller in size] of evaporated droplets containing microorganisms that remain suspended in the air and that can be dispersed widely by air currents within a room or over a long distance). *Category IB*

A. Patient Placement

Place the patient in a private room that has (1) monitored negative air pressure in relation to the surrounding areas, (2) 6 to 12 air changes per hour, and (3) appropriate discharge of air outdoors or monitored high-efficiency filtration of room air before the air is circulated to other areas in the hospital.[23] Keep the room door closed and the patient in the room. When a private room is not available, place the patient in a room with a patient who has active infection with the same microorganism, unless otherwise recommended,[23] but with no other infection. When a private room is not available and cohorting is not desirable, consultation with infection control professionals is advised before patient placement. *Category IB*

B. Respiratory Protection

Wear respiratory protection (N95 respirator) when entering the room of a patient with known or suspected infectious pulmonary tuberculosis.[23,81] Susceptible persons should not enter the room of patients known or suspected to have measles (rubeola) or varicella (chickenpox) if other immune caregivers are available. If susceptible persons must enter the room of a patient known or suspected to have measles (rubeola) or varicella, they should wear respiratory protection (N95 respirator).[81] Persons immune to measles (rubeola) or varicella need not wear respiratory protection. *Category IB*

C. Patient Transport

Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, minimize patient dispersal of droplet nuclei by placing a surgical mask on the patient, if possible. *Category IB*

D. Additional Precautions for Preventing Transmission of Tuberculosis

Consult CDC *Guidelines for Preventing the Transmission of Tuberculosis in Health-Care Facilities*[23] for additional prevention strategies.

IV. Droplet Precautions

In addition to Standard Precautions, use Droplet Precautions, or the equivalent, for a patient known or suspected to be infected with microorganisms transmitted by droplets (large-particle droplets [larger than 5 microns in size] that can be generated by the patient during coughing, sneezing, talking, or the performance of procedures). *Category IB*

A. Patient Placement

Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, maintain spatial separation of at least 3 feet between the infected patient and other patients and visitors. Special air handling and ventilation are not necessary, and the door may remain open. *Category IB*

B. Mask

In addition to wearing a mask as outlined under Standard Precautions, wear a mask when working within 3 feet of the patient. (Logistically, some hospitals may want to implement the wearing of a mask to enter the room.) *Category IB*

C. Patient Transport

Limit the movement and transport of the patient from the room to essential purposes

only. If transport or movement is necessary, minimize patient dispersal of droplets by masking the patient, if possible. *Category IB*

V. Contact Precautions

In addition to Standard Precautions, use Contact Precautions, or the equivalent, for specified patients known or suspected to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct contact with the patient (hand or skin-to-skin contact that occurs when performing patient-care activities that require touching the patient's dry skin) or indirect contact (touching) with environmental surfaces or patient-care items in the patient's environment. *Category IB*

A. Patient Placement

Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, consider the epidemiology of the microorganism and the patient population when determining patient placement; consultation with infection control professionals is advised before patient placement. *Category IB*

B. Gloves and Handwashing

In addition to wearing gloves as outlined under Standard Precautions, wear gloves (clean nonsterile gloves are adequate) when entering the room. During the course of providing care for a patient, change gloves after having contact with infective material that may contain high concentrations of microorganisms (fecal material and wound drainage). Remove gloves before leaving the patient's environment and wash hands immediately with an antimicrobial agent or a waterless antiseptic agent.[72,94] After glove

removal and handwashing, ensure that hands do not touch potentially contaminated environmental surfaces or items in the patient's room to avoid transfer of microorganisms to other patients or environments. *Category IB*

C. Gown

In addition to wearing a gown as outlined under Standard Precautions, wear a gown (a clean nonsterile gown is adequate) when entering the room if you anticipate that your clothing will have substantial contact with the patient, environmental surfaces, or items in the patient's room, or if the patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contaminated environmental surfaces to avoid transfer of microorganisms to other patients or environments. *Category IB*

D. Patient Transport

Limit the movement and transport of the patient from the room to essential purposes only. If the patient is transported out of the room, ensure that precautions are maintained to minimize the risk of transmission of microorganisms to other patients and contamination of environmental surfaces or equipment. *Category IB*

E. Patient-Care Equipment

When possible, dedicate the use of noncritical patient-care equipment to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions) to avoid sharing between patients. If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use for another patient. *Category IB*

F. Additional Precautions for Preventing the Spread of Vancomycin Resistance

Consult the HICPAC report on preventing the spread of vancomycin resistance for

additional prevention strategies.[94]

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TABLE 1

SYNOPSIS OF TYPES OF PRECAUTIONS AND PATIENTS REQUIRING THE PRECAUTIONS*

Standard Precautions

Use Standard Precautions for the care of all patients

Airborne Precautions

In addition to Standard Precautions, use Airborne Precautions for patients known or suspected to have serious illnesses transmitted by airborne droplet nuclei. Examples of such illnesses include:

Measles
Varicella (including disseminated zoster)†
Tuberculosis§

Droplet Precautions

In addition to Standard Precautions, use Droplet Precautions for patients known or suspected to have serious illnesses transmitted by large particle droplets. Examples of such illnesses include:

Invasive *Haemophilus influenzae* type b disease, including meningitis, pneumonia, epiglottitis, and sepsis

Invasive *Neisseria meningitidis* disease, including meningitis, pneumonia, and sepsis

Other serious bacterial respiratory infections spread by droplet transmission, including:
- **Diphtheria (pharyngeal)**
- **Mycoplasma pneumonia**
- **Pertussis**
- **Pneumonic plague**
- **Streptococcal (group A) pharyngitis, pneumonia, or scarlet fever in infants and young children**

Serious viral infections spread by droplet transmission, including:
- **Adenovirus†**
- **Influenza**
- **Mumps**
- **Parvovirus B19**
- **Rubella**

Contact Precautions

In addition to Standard Precautions, use Contact Precautions for patients known or suspected to have serious illnesses easily transmitted by direct patient contact or by contact with items in the patient's environment. Examples of such illnesses include:

Gastrointestinal, respiratory, skin, or wound infections or colonization with multidrug-resistant bacteria judged by the infection control program, based on current state, regional, or national recommendations, to be of special clinical and epidemiologic significance

Enteric infections with a low infectious dose or prolonged environmental survival, including:

Clostridium difficile

For diapered or incontinent patients: enterohemorrhagic *Escherichia coli* O157:H7, *Shigella*, hepatitis A, or rotavirus

Respiratory syncytial virus, parainfluenza virus, or enteroviral infections in infants and young children

Skin infections that are highly contagious or that may occur on dry skin, including:

Diphtheria (cutaneous)
Herpes simplex virus (neonatal or mucocutaneous)
Impetigo
Major (noncontained) abscesses, cellulitis, or decubiti
Pediculosis
Scabies
Staphylococcal furunculosis in infants and young children
Zoster (disseminated or in the immunocompromised host)†

Viral/hemorrhagic conjunctivitis

Viral hemorrhagic infections (Ebola, Lassa, or Marburg)*

***See Appendix A for a complete listing of infections requiring precautions, including appropriate footnotes.**
†Certain infections require more than one type of precaution.
§See CDC *Guidelines for Preventing the Transmission of Tuberculosis in Health-Care Facilities*.[23]

TABLE 2

CLINICAL SYNDROMES OR CONDITIONS WARRANTING ADDITIONAL EMPIRIC PRECAUTIONS TO PREVENT TRANSMISSION OF EPIDEMIOLOGICALLY IMPORTANT PATHOGENS PENDING CONFIRMATION OF DIAGNOSIS*

Clinical Syndrome or Condition†	Potential Pathogens§	Empiric Precautions
DIARRHEA		
Acute diarrhea with a likely infectious cause in an incontinent or diapered patient	Enteric pathogens¶	Contact
Diarrhea in an adult with a history of recent antibiotic use	*Clostridium difficile*	Contact
MENINGITIS	*Neisseria meningitidis*	Droplet
RASH OR EXANTHEMS, GENERALIZED, ETIOLOGY UNKNOWN		
Petechial/ecchymotic with fever	*Neisseria meningitidis*	Droplet
Vesicular	Varicella	Airborne and Contact
Maculopapular with coryza and fever	Rubeola (measles)	Airborne
RESPIRATORY INFECTIONS		
Cough/fever/upper lobe pulmonary infiltrate in a HIV-negative patient or a patient at low risk for HIV infection	*Mycobacterium tuberculosis*	Airborne
Cough/fever/pulmonary infiltrate in any lung location in a HIV-infected patient or a patient at high risk for HIV infection[23]	*Mycobacterium tuberculosis*	Airborne
Paroxysmal or severe persistent cough during periods of pertussis activity	*Bordetella pertussis*	Droplet
Respiratory infections, particularly bronchiolitis and croup, in infants and young children	Respiratory syncytial or parainfluenza virus	Contact

RISK OF MULTIDRUG-RESISTANT MICROORGANISMS		
History of infection or colonization with multidrug-resistant organisms**	**Resistant bacteria****	**Contact**
Skin, wound, or urinary tract infection in a patient with a recent hospital or nursing home stay in a facility where multidrug-resistant organisms are prevalent	**Resistant bacteria****	**Contact**
SKIN OR WOUND INFECTION		
Abscess or draining wound that cannot be covered	***Staphylococcus aureus*, Group A streptococcus**	**Contact**

***Infection control professionals are encouraged to modify or adapt this table according to local conditions. To ensure that appropriate empiric precautions are always implemented, hospitals must have systems in place to routinely evaluate patients according to these criteria as part of their preadmission and admission care.**

†Patients with the syndromes or conditions listed below may present with atypical signs or symptoms (e.g., pertussis in neonates and adults may not have paroxysmal or severe cough). The clinician's index of suspicion should be guided by the prevalence of specific conditions in the community as well as clinical judgement.

§The organisms listed under the column "Potential Pathogens" are not intended to represent the complete or even most likely diagnoses, but rather possible etiologic agents that require additional precautions beyond Standard Precautions until they can be ruled out.

¶These pathogens include enterohemorrhagic *Escherichia coli* O157:H7, *Shigella*, hepatitis A, and rotavirus.

****Resistant bacteria judged by the infection control program, based on current state, regional or national recommendations, to be of special clinical or epidemiological significance.**

APPENDIX A

TYPE AND DURATION OF PRECAUTIONS NEEDED FOR SELECTED INFECTIONS AND CONDITIONS

Infection/Condition	Precautions Type*	Duration†
Abscess		
Draining, major[1]	**C**	**DI**
Draining, minor or limited[2]	**S**	
Acquired immunodeficiency syndrome (AIDS)[3]	**S**	
Actinomycosis	**S**	
Adenovirus infection, in infants and young children	**D, C**	**DI**
Amebiasis	**S**	
Anthrax		
Cutaneous	**S**	
Pulmonary	**S**	
Antibiotic-associated colitis (see *Clostridium difficile*)		
Arthropodborne viral encephalitides (eastern, western, Venezuelan equine encephalomyelitis; St. Louis, California encephalitis)	**S[4]**	
Arthropodborne viral fevers (dengue, yellow fever, Colorado tick fever)	**S[4]**	
Ascariasis	**S**	
Aspergillosis	**S**	
Babesiosis	**S**	
Blastomycosis, North American, cutaneous or pulmonary	**S**	
Botulism	**S**	
Bronchiolitis (see respiratory infections in infants and young children)		
Brucellosis (undulant, Malta, Mediterranean fever)	**S**	

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Infection/Condition	Precautions Type*	Duration†
Campylobacter gastroenteritis (see gastroenteritis)		
Candidiasis, all forms including mucocutaneous	S	
Cat-scratch fever (benign inoculation lymphoreticulosis)	S	
Cellulitis, uncontrolled drainage	C	DI
Chancroid (soft chancre)	S	
Chickenpox (varicella) (see F[5] for varicella exposure)	A, C	F[5]
Chlamydia trachomatis		
Conjunctivitis	S	
Genital	S	
Respiratory	S	
Cholera (see gastroenteritis)		
Closed-cavity infection		
Draining, limited or minor	S	
Not draining	S	
Clostridium		
C. botulium	S	
C. difficile	C	DI
C. perfringens		
Food poisoning	S	
Gas gangrene	S	
Coccidioidomycosis (valley fever)		
Draining lesions	S	
Pneumonia	S	
Colorado tick fever	S	
Congenital rubella	C	F[6]
Conjunctivitis		
Acute bacterial	S	
Chlamydia	S	
Gonococcal	S	
Acute viral (acute hemorrhagic)	C	DI
Coxsackie virus disease (see enteroviral infection)		
Creutzfeldt-Jakob disease	S[7]	

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Infection/Condition	Precautions Type*	Duration†
Croup (see respiratory infections in infants and young children)		
Cryptococcosis	**S**	
Cryptosporidiosis (see gastroenteritis)		
Cysticercosis	**S**	
Cytomegalovirus infection, neonatal or immunosuppressed	**S**	
Decubitus ulcer, infected		
Major[1]	**C**	**DI**
Minor or limited[2]	**S**	
Dengue	**S[4]**	
Diarrhea, acute--infective etiology suspected (see gastroenteritis)		
Diphtheria		
Cutaneous	**C**	**CN[8]**
Pharyngeal	**D**	**CN[8]**
Ebola viral hemorrhagic fever	**C[9]**	**DI**
Echinococcosis (hydatidosis)	**S**	
Echovirus (see enteroviral infection)		
Encephalitis or encephalomyelitis (see specific etiologic agents)		
Endometritis	**S**	
Enterobiasis (pinworm disease, oxyuriasis)	**S**	
Enterococcus species (see multidrug-resistant organisms if epidemiologically significant or vancomycin resistant)		
Enterocolitis, *Clostridium difficile*	**C**	**DI**
Enteroviral infections		
Adults	**S**	
Infants and young children	**C**	**DI**
Epiglottitis, due to *Haemophilus influenzae*	**D**	**U[24 HRS]**
Epstein-Barr virus infection, including infectious mononucleosis	**S**	
Erythema infectiosum (also see Parvovirus B19)	**S**	
***Escherichia coli* gastroenteritis (see gastroenteritis)**		

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Infection/Condition	Precautions Type*	Duration†
Food poisoning		
Botulism	**S**	
Clostridium perfringens* or *welchii	**S**	
Staphylococcal	**S**	
Furunculosis--staphylococcal		
Infants and young children	**C**	**DI**
Gangrene (gas gangrene)	**S**	
Gastroenteritis		
***Campylobacter* species**	**S**[10]	
Cholera	**S**[10]	
Clostridium difficile	**C**	**DI**
***Cryptosporidium* species**	**S**[10]	
Escherichia coli		
Enterohemorrhagic O157:H7	**S**[10]	
Diapered or incontinent	**C**	**DI**
Other species	**S**[10]	
Giardia lamblia	**S**[10]	
Rotavirus	**S**[10]	
Diapered or incontinent	**C**	**DI**
***Salmonella* species (including *S. typhi*)**	**S**[10]	
***Shigella* species**	**S**[10]	
Diapered or incontinent	**C**	**DI**
Vibrio parahamolyticus	**S**[10]	
Viral (if not covered elsewhere)	**S**[10]	
Yersinia enterocolitica	**S**[10]	
German measles (see rubella)		
Giardiasis (see gastroenteritis)		
Gonococcal ophthalmia neonatorum (gonorrheal ophthalmia, acute conjunctivitis of newborn)	**S**	
Gonorrhea	**S**	
Granuloma inguinale (donovanosis, granuloma venereum)	**S**	
Guillain-Barre syndrome	**S**	
Hand, foot, and mouth disease (see enteroviral infection)		
***Hantavirus* pulmonary syndrome**	**S**	

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Infection/Condition	Precautions Type*	Duration†
Helicobacter pylori	S	
Hemorrhagic fevers (for example, Lassa and Ebola)[9]	C[9]	DI[9]
Hepatitis, viral		
Type A	S	
Diapered or incontinent patients	C	F[11]
Type B--HBsAg positive	S	
Type C and other unspecified non-A, non-B	S	
Type E	S	
Herpangina (see enteroviral infection)		
Herpes simplex (*Herpesvirus hominis*)		
Encephalitis	S	
Neonatal[12] (see F[12] for neonatal exposure)	C	DI
Mucocutaneous, disseminated or primary, severe	C	DI
Mucocutaneous, recurrent (skin, oral, genital)	S	
Herpes zoster (varicella-zoster)		
Localized in immunocompromised patient, or disseminated	A, C	DI[13]
Localized in normal patient	S[13]	
Histoplasmosis	S	
HIV (see human immunodeficiency virus)	S	
Hookworm disease (ancylostomiasis, uncinariasis)	S	
Human immunodeficiency virus (HIV) infection[3]	S	
Impetigo	C	U[24 HRS]
Infectious mononucleosis	S	
Influenza	D[14]	DI
Kawasaki syndrome	S	
Lassa fever	C[9]	DI
Legionnaires' disease	S	
Leprosy	S	
Leptospirosis	S	
Lice (pediculosis)	C	U[24]

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Infection/Condition	Precautions Type*	Duration†
Listeriosis	**S**	
Lyme disease	**S**	
Lymphocytic choriomeningitis	**S**	
Lymphogranuloma venereum	**S**	
Malaria	**S[4]**	
Marburg virus disease	**C[9]**	**DI**
Measles (rubeola), all presentations	**A**	**DI**
Melioidosis, all forms	**S**	
Meningitis		
Aseptic (nonbacterial or viral meningitis) (also see enteroviral infections)	**S**	
Bacterial, gram-negative enteric, in neonates	**S**	
Fungal	**S**	
***Haemophilus influenzae*, known or suspected**	**D**	**U[24 HRS]**
Listeria monocytogenes	**S**	
***Neisseria meningitidis* (meningococcal) known or suspected**	**D**	**U[24 HRS]**
Pneumococcal	**S**	
Tuberculosis[15]	**S**	
Other diagnosed bacterial	**S**	
Meningococcal pneumonia	**D**	**U[24 HRS]**
Meningococcemia (meningococcal sepsis)	**D**	**U[24 HRS]**
Molluscum contagiosum	**S**	
Mucormycosis	**S**	
Multidrug-resistant organisms, infection or colonization[16]		
Gastrointestinal	**C**	**CN**
Respiratory	**C**	**CN**
Pneumococcal	**S**	
Skin, wound, or burn	**C**	**CN**
Mumps (infectious parotitis)	**D**	**F[17]**
Mycobacteria, nontuberculosis (atypical)		
Pulmonary	**S**	
Wound	**S**	

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Infection/Condition	Precautions Type*	Duration†
Mycoplasma pneumonia	D	DI
Necrotizing enterocolitis	S	
Nocardiosis, draining lesions or other presentations	S	
Norwalk agent gastroenteritis (see viral gastroenteritis)		
Orf	S	
Parainfluenza virus infection, respiratory in infants and young children	C	DI
Parvovirus B19	D	F[18]
Pediculosis (lice)	C	U[24 HRS]
Pertussis (whooping cough)	D	F[19]
Pinworm infection	S	
Plague		
Bubonic	S	
Pneumonic	D	U[72 HRS]
Pleurodynia (see enteroviral infection)		
Pneumonia		
Adenovirus	D, C	DI
Bacterial not listed elsewhere (including gram-negative bacterial)	S	
Burkholderia cepacia in cystic fibrosis (CF) patients including respiratory tract colonization	S[20]	
Chlamydia	S	
Fungal	S	
Haemophilus influenzae		
Adults	S	
Infants and children (any age)	D	U[24 HRS]
Legionella	S	
Meningococcal	D	U[24 HRS]
Multidrug-resistant bacterial (see multidrug-resistant organisms)		
Mycoplasma (primary atypical pneumonia)	D	DI

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Infection/Condition	Precautions Type*	Duration†
Pneumonia (cont.)		
Pneumococcal	**S**	
Multidrug-resistant (see multidrug-resistant organisms)		
Pneumocystis carinii	**S[21]**	
***Pseudomonas cepacia* (see *Burkholderia cepacia*)**	**S[20]**	
Staphylococcus aureus	**S**	
***Streptococcus*, Group A**		
Adults	**S**	
Infants and young children	**D**	**U[24HRS]**
Viral		
Adults	**S**	
Infants and young children (see respiratory infectious disease, acute)		
Poliomyelitis	**S**	
Psittacosis (ornithosis)	**S**	
Q fever	**S**	
Rabies	**S**	
Rat-bite fever (*Streptobacillus moniliformis* disease, *Spirillum minus* disease)	**S**	
Relapsing fever	**S**	
Resistant bacterial infection or colonization (see multidrug-resistant organisms)		
Respiratory infectious disease, acute (if not covered elsewhere)		
Adults	**S**	
Infants and young children[3]	**C**	**DI**
Respiratory syncytial virus infection, in infants and young children, and immunocompromised adults	**C**	**DI**
Reye's syndrome	**S**	
Rheumatic fever	**S**	
Rickettsial fevers, tickborne (Rocky Mountain spotted fever, tickborne typhus fever)	**S**	
Rickettsialpox (vesicular rickettsiosis)	**S**	
Ringworm (dermatophytosis, dermatomycosis, tinea)	**S**	

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Infection/Condition	Precautions Type*	Duration†
Ritter's disease (staphylococcal scalded skin syndrome)	S	
Rocky Mountain spotted fever	S	
Roseola infantum (exanthem subitum)	S	
Rotavirus infection (see gastroenteritis)		
Rubella (German measles) (also see congenital rubella)	D	F[22]
Salmonellosis (see gastroenteritis)		
Scabies	C	U[24 HRS]
Scalded skin syndrome, staphylococcal (Ritter's disease)	S	
Schistosomiasis (bilharziasis)	S	
Shigellosis (see gastroenteritis)		
Sporotrichosis	S	
Spirillium minus disease (rat-bite fever)	S	
Staphylococcal disease (S. aureus)		
Skin, wound, or burn		
Major[1]	C	DI
Minor or limited[2]	S	
Enterocolitis	S[10]	
Multidrug-resistant (see multidrug-resistant organisms)		
Pneumonia	S	
Scalded skin syndrome	S	
Toxic shock syndrome	S	
Streptobacillus moniliformis disease (rat-bite fever)	S	
Streptococcal disease (group A *Streptococcus*)		
Skin, wound, or burn		
Major[1]	C	U[24 HRS]
Minor or limited[2]	S	
Endometritis (puerperal sepsis)	S	
Pharyngitis in infants and young children	D	U[24 HRS]
Pneumonia in infants and young children	D	U[24 HRS]
Scarlet fever in infants and young children	D	U[24 HRS]
Streptococcal disease (group B *Streptococcus*), neonatal	S	

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Streptococcal disease (not group A or B) unless covered elsewhere	**S**	
Multidrug-resistant (see multidrug-resistant organisms)		
Strongyloidiasis	**S**	
Syphilis		
Skin and mucous membrane, including congenital, primary, secondary	**S**	
Latent (tertiary) and seropositivity without lesions	**S**	
Tapeworm disease		
***Hymenolepis* nana**	**S**	
***Taenia solium* (pork)**	**S**	
Other	**S**	
Tetanus	**S**	
Tinea (fungus infection dermatophytosis, dermatomycosis, ringworm)	**S**	
Toxoplasmosis	**S**	
Toxic shock syndrome (staphylococcal disease)	**S**	
Trachoma, acute	**S**	
Trench mouth (Vincent's angina)	**S**	
Trichinosis	**S**	
Trichomoniasis	**S**	
Trichuriasis (whipworm disease)	**S**	
Tuberculosis		
Extrapulmonary, draining lesion (including scrofula)	**S**	
Extrapulmonary, meningitis[15]	**S**	
Pulmonary, confirmed or suspected or laryngeal disease	**A**	**F[23]**
Skin-test positive with no evidence of current pulmonary disease	**S**	
Tularemia		
Draining lesion	**S**	
Pulmonary	**S**	
Typhoid (*Salmonella typhi*) fever (see gastroenteritis)		
Typhus, endemic and epidemic	**S**	

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Infection/Condition	Precautions Type*	Duration†
Urinary tract infection (including pyelonephritis), with or without urinary catheter	**S**	
Varicella (chickenpox)	**A, C**	**F[5]**
***Vibrio* parahaemolyticus (see gastroenteritis)**		
Vincent's angina (trench mouth)	**S**	
Viral diseases **Respiratory (if not covered elsewhere)** **Adults** **Infants and young children (see respiratory infectious disease, acute)**	**S**	
Whooping cough (pertussis)	**D**	**F[19]**
Wound infections **Major[1]** **Minor or limited[2]**	**C** **S**	**DI**
***Yersinia enterocolitica* gastroenteritis (see gastroenteritis)**		
Zoster (varicella-zoster) **Localized in immunocompromised patient, disseminated** **Localized in normal patient**	**A, C** **S[13]**	**DI[13]**
Zygomycosis (phycomycosis, mucormycosis)	**S**	

[1]No dressing or dressing does not adequately contain drainage.

[2]Dressing covers and adequately contains drainage.

[3]Also see syndromes or conditions listed in Table 2.

[4]Install screens in windows and doors in endemic areas.

[5]Maintain precautions until all lesions are crusted. The average incubation period for varicella is 10 to 16 days with a range of 10 to 21 days. After exposure, use varicella zoster immune globulin (VZIG) when appropriate, and discharge susceptible patients if possible. Place exposed susceptible patients on Airborne Precautions beginning 10 days after exposure and continue until 21 days after last exposure (up to 28 days if VZIG has been given). Susceptible persons should not enter the room of patients on precautions if other immune caregivers are available.

[6]Place infant on precautions during any admission until 1 year of age unless nasopharyngeal and urine cultures are negative for virus after age 3 months.

[7]Additional special precautions are necessary for handling and decontamination of blood, body fluids and tissues, and contaminated items from patients with confirmed or suspected disease. See latest College of American Pathologists (Northfield, Illinois) guidelines or other references.

[8]Until two cultures taken at least 24 hours apart are negative.

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[9]Call state health department and CDC for specific advice about management of a suspected case. During the 1995 Ebola outbreak in Zaire, interim recommendations were published.[97] Pending a comprehensive review of the epidemiologic data from the outbreak and evaluation of the interim recommendations, the 1988 guidelines for management of patients with suspected viral hemorrhagic infections[96] will be reviewed and updated if indicated.

[10]Use Contact Precautions for diapered or incontinent children <6 years of age for duration of illness.

[11]Maintain precautions in infants and children <3 years of age for duration of hospitalization; in children 3-14 years of age, until 2 weeks after onset of symptoms; and in others, until 1 week after onset of symptoms.

[12]For infants delivered vaginally or by C-section and if mother has active infection and membranes have been ruptured for more than 4-6 hours.

[13]Persons susceptible to varicella are also at risk for developing varicella when exposed to patients with herpes zoster lesions; therefore, susceptibles should not enter the room if other immune caregivers are available.

[14]The *Guideline for Prevention of Nosocomial Pneumonia*[95-96] recommends surveillance, vaccination, antiviral agents, and use of private rooms with negative air pressure as much as feasible for patients for whom influenza is suspected or diagnosed. Many hospitals encounter logistic difficulties and physical plant limitations when admitting multiple patients with suspected influenza during community outbreaks. If sufficient private rooms are unavailable, consider cohorting patients, or at the very least, avoid room-sharing with high risk patients. See *Guideline for Prevention of Nosocomid Pneumonia*[95-96] for additional prevention and control strategies.

[15]Patient should be examined for evidence of current (active) pulmonary tuberculosis. If evidence exists, additional precautions are necessary (see tuberculosis).

[16]Resistant bacteria judged by the infection control program, based on current state, regional, or national recommendations, to be of special clinical and epidemiologic significance.

[17]For 9 days after onset of swelling.

[18]Maintain precautions for duration of hospitalization when chronic disease occurs in an immunodeficient patient. For patients with transient aplastic crisis or red cell crisis, maintain precautions for 7 days.

[19]Maintain precautions until 5 days after patient is placed on effective therapy.

[20]Avoid cohorting or placement in the same room with a CF patient who is not infected or colonized with *B. cepacia.* Persons with CF who visit or provide care and are not infected or colonized with *B. cepacia* may elect to wear a mask when within 3 feet of a colonized or infected patient.

[21]Avoid placement in the same room with an immunocompromised patient.

[22]Until 7 days after onset of rash.

[23]Discontinue precautions only when TB patient is on effective therapy, is improving clinically, and has 3 consecutive negative sputum smears collected on different days, or TB is ruled out. Also see CDC *Guidelines for Preventing the Transmission of Tuberculosis in Health-Care Facilities*[23]

REFERENCES

1. Garner JS. The CDC Hospital Infection Control Practices Advisory Committee. *Am J Infect Control* 1993;21:160-162.

2. National Communicable Disease Center. *Isolation Techniques for Use in Hospitals*, 1st ed. Washington: U.S. Government Printing Office; 1970. PHS Publ. No. 2054.

3. Center for Disease Control. *Isolation Techniques for Use in Hospitals*, 2nd ed. Washington: U.S. Government Printing Office; 1975. HHS Publ. No. (CDC) 80-8314.

4. Garner JS, Simmons BP. *CDC Guideline for Isolation Precautions in Hospitals*. U.S. Department of Health and Human Services, Public Health Services, Centers for Disease Control, Atlanta; 1983. HHS Publ. No. (CDC) 83-8314, *Infect Control* 1983;4:245-325, and *Am J Infect Control* 1984;12:103-163.

5. Lynch T. *Communicable Disease Nursing*. St. Louis: Mosby, 1949.

6. Gage ND, Landon JF, Sider MT. *Communicable Disease*. Philadelphia: FA Davis, 1959.

7. Haley RW, Shachtman RH. The emergence of infection surveillance and control programs in U.S. hospitals: an assessment, 1976. *Am J Epidemiol* 1980;111:574-591.

8. Schaffner W. Infection control: Old myths and new realities. *Infect Control* 1980;1:330-334.

9. Garner JS. Comments on CDC guideline for isolation precautions in hospitals, 1984. *Am J Infect Control* 1984;12:163.

10. Haley RW, Garner JS, Simmons BP. A new approach to the isolation of patients with infectious diseases: alternative systems. *J Hosp Infect* 1985;6:128-139.

11. Nauseef WM, Maki DG. A study of the value of simple protective isolation in patients with granulocytopenia. *N Engl J Med* 1981;304:448-453.

12. Pizzo PA. The value of protective isolation in preventing nosocomial infections in high risk

patients. *Am J Med* 1981;70:631-637.

13. Jacobson JT, Johnson DS, Ross CA, Conti MT, Evans RS, Burke JP. Adapting disease-specific isolation guidelines to a hospital information system. *Infect Control* 1986;7:411-418.

14. Goldmann DA. The role of barrier precautions in infection control. *J Hosp Infect* 1991;18:515-523.

15. Goldmann DA, Platt R, Hopkins C. Control of hospital-acquired infections. In: Gorbach SL, Bartlett JG, Blacklow NR, eds. *Infectious Diseases*. Philadelphia:WB Saunders, 1992:chap 45:378-390.

16. Centers for Disease Control. Management of patients with suspected viral hemorrhagic fever. *MMWR* 1988;37(3S):1-16.

17. Centers for Disease Control. Risks associated with human parvovirus B19 infection. *MMWR* 1989;38:81-88,93-97.

18. Centers for Disease Control. Guidelines for preventing the transmission of tuberculosis in health-care settings, with special focus on HIV-related issues. *MMWR* 1990;39(RR-17):1-29.

19. Centers for Disease Control. Nosocomial transmission of multidrug-resistant tuberculosis to health-care workers and HIV-infected patients in an urban hospital--Florida. *MMWR* 1990;39:718-722.

20. Centers for Disease Control. Nosocomial transmission of multidrug-resistant tuberculosis among HIV-infected persons--Florida and New York, 1988-1991. *MMWR* 1991;40:585-591.

21. Centers for Disease Control and Prevention. Initial therapy for tuberculosis in the era of multidrug resistance: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR* 1993;42(RR-7):1-8.

22. Centers for Disease Control and Prevention. Draft guidelines for preventing the transmission of tuberculosis in health-care facilities, second edition. *Federal Register* 1993;58(195):52810-52850.

23. Centers for Disease Control and Prevention. Guidelines for preventing the transmission of tuberculosis in health-care facilities, 1994. *MMWR* 1994;43(RR-13):1-132, and *Federal Register*

1994;59(208):54242-54303.

24. Centers for Disease Control. Recommendations for preventing transmission of infection with human T-lymphotropic virus type III/lymphadenopathy-associated virus in the workplace. *MMWR* 1985;34:681-686,691-695.

25. Centers for Disease Control. Recommendations for preventing transmission of infection with human T-lymphotropic virus type III/lymphadenopathy-associated virus during invasive procedures. *MMWR* 1986;35:221-223.

26. Centers for Disease Control. Update: human immunodeficiency virus infections in health-care workers exposed to blood of infected patients. *MMWR* 1987;36:285-289.

27. Centers for Disease Control. Recommendations for prevention of HIV transmission in health-care settings. *MMWR* 1987;36(2S):1S-18S.

28. Centers for Disease Control. Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. *MMWR* 1988;37:377-382,387-388.

29. Lynch P, Jackson MM, Cummings J, Stamm, WE. Rethinking the role of isolation practices in the prevention of nosocomial infections. *Ann Intern Med* 1987;107:243-246.

30. Lynch P, Cummings MJ, Roberts PL, Herriott MJ, Yates B, Stamm WE. Implementing and evaluating a system of generic infection precautions: body substance isolation. *Am J Infect Control* 1990;18:1-12.

31. McPherson DC, Jackson MM, Rogers JC. Evaluating the cost of the body substance isolation system. *J Healthcare Material Mgmt* 1988;6:20-28.

32. Patterson JE, Vecchio J, Pantelick EL, Farrel P, Mazon D, Zervos MJ, Hierholzer WJ. Association of contaminated gloves with transmission of *Acinetobacter calcoaceticus var. anitratus* in an intensive care unit. *Am J Med* 1991;91:479-483.

33. Klein BS, Perloff WH, Maki DG. Reduction of nosocomial infection during pediatric intensive care by protective isolation. *N Engl J Med* 1989;320:1714-1721.

34. Leclair JM, Freeman J, Sullivan BF, Crowley CM, Goldmann DA. Prevention of nosocomial respiratory syncytial virus infections through compliance with gown and glove isolation precautions. *N Engl J Med* 1987;317:329-334.

35. Weinstein RA, Kabins SA. Strategies for prevention and control of multiple drug-resistant nosocomial infection. *Am J Med* 1981;70:449-454.

36. Garner JS, Hierholzer WJ. Controversies in isolation policies and practices. In: Wenzel RP, ed. *Prevention and Control of Nosocomial Infections*. 2nd ed. Baltimore: Williams & Wilkins, 1993:chap 6:70-81.

37. Garner JS, Hughes JM. Options for isolation precautions. *Ann Intern Med* 1987;107:248-250.

38. Weinstein RA, Kabins SA. Isolation practices in hospitals. *Ann Intern Med* 1987;107:781-782.

39. Doebbeling BN, Pfaller MA, Houston AK, Wenzel RP. Removal of nosocomial pathogens from the contaminated glove: implications for glove reuse and handwashing. *Ann Intern Med* 1988;109:394-398.

40. Sussman GL, Tarlo S, Dolovich J. The spectrum of IgE-mediated response to latex. *JAMA* 1991;255:2844-2847.

41. Bubak ME, Reed CE, Fransway AF, et al. Allergic reactions to latex among health-care workers. *Mayo Clin Proc* 1992;67:1075-1079.

42. Albert RK, Condie F. Hand-washing patterns in medical intensive care units. *N Engl J Med* 1981;304:1465-1466.

43. Preston GA, Larson EL, Stamm WE. The effect of private isolation rooms on patient care practices, colonization and infection in an intensive care unit. *Am J Med* 1981;70:641-645.

44. Larson E, Leyden JJ, McGinley KJ, Grove GL, Talbot GH. Physiologic and microbiologic

changes in skin related to frequent handwashing. *Infect Control* 1986;7:59-63.

45. Department of Labor. Occupational Safety and Health Administration. Occupational exposure to bloodborne pathogens; proposed rule and notice of hearings. *Federal Register* 1989;54(102):23042-23139.

46. Doebbeling BN, Wenzel RP. The direct costs of universal precautions in a teaching hospital. *JAMA* 1990;264:2083-2087.

47. Eickhoff TC. The cost of prevention. *Infect Dis News* 1991;4:6.

48. Fahey BJ, Koziol DE, Banks SM, Henderson DK. Frequency of nonparenteral occupational exposures to blood and body fluids before and after universal precautions training. *Am J Med* 1991;90:145-153.

49. Klein RS. Universal precautions for preventing occupational exposures to human immunodeficiency virus type 1. *Am J Med* 1991;90:141-153.

50. Wong ES, Stotka JL, Chinchilli VM, Williams DS, Stuart CG, Markowitz SM. Are universal precautions effective in reducing the number of occupational exposures among health care workers? *JAMA* 1991;265:1123-1128.

51. Department of Labor. Occupational Safety and Health Administration. Occupational exposure to bloodborne pathogens; final rule. *Federal Register* 1991;56(235):64175-64182.

52. American Hospital Association. *OSHA's Final Bloodborne Pathogens Standard: A Special Briefing*. American Hospital Association 1992, Item No. 155904.

53. Bruning LM. The bloodborne pathogens final rule. *AORN J* 1993;57:439-461.

54. Jackson MM, Lynch P. An attempt to make an issue less murky: a comparison of four systems for infection precautions. *Infect Control Hosp Epidemiol* 1991;12:448-450.

55. Pugliese G, Lynch P, Jackson MM. *Universal Precautions: Policies, Procedures, and Resources*. Chicago: American Hospital Association, pp 7-87, 1991.

56. Birnbaum D, Schulzer M, Mathias RG, Kelly M, Chow AW. Adoption of guidelines for universal precautions and body substance isolation in Canadian acute-care hospitals. *Infect Control Hosp Epidemiol* 1990;11:465-472.

57. Lynch P, Cummings MJ, Stamm WE, Jackson MM. Letter. *Infect Control Hosp Epidemiol* 1991;12:139.

58. Birnbaum D, Schulzer M, Mathias RG, Kelly M, Chow AW. Letter. *Infect Control Hosp Epidemiol* 1991;12:140.

59. Gurevich I. Letter. *Infect Control Hosp Epidemiol* 1992;13:191.

60. Jackson MM, Lynch P. Letter. *Infect Control Hosp Epidemiol* 1992;13:191-192.

61. Rudnick JR, Kroc K, Manangan L, Banerjee S, Pugliese G, Jarvis W. 1993. Are U.S. hospitals prepared to control nosocomial transmission of tuberculosis? Abstr Annu Conf Epidemic Intelligence Srv 1993, p 60.

62. Institute of Medicine. *Emerging Infections: Microbial Threats to Health in the United States*. 1st ed. Washington, DC: National Academy Press, 1992.

63. Centers for Disease Control and Prevention. Nosocomial enterococci resistant to vancomycin--United States, 1989-1983. *MMWR* 1993;42:597-599.

64. Lowbury EJL, Lilly HA, Bull JP. Disinfection of hands: removal of transient organisms. *Br Med J* 1964;2:230-233.

65. Sprunt K, Redmon W, Leidy G. Antibacterial effectiveness of routine handwashing. *Pediatrics* 1973;52:264-271.

66. Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. *Ann Intern Med* 1975;83:683-690.

67. Food and Drug Administration. The tentative final monograph for over-the counter topical antimicrobial products. *Federal Register* 1978;43:1210-1249.

68. Garner JS, Favero MS. *Guideline for handwashing and hospital environmental control.* Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, CDC, 1985.

69. Larson E. APIC guideline for use of topical antimicrobial products. *Am J Infect Cont* 1988;16:253-266.

70. Ehrenkranz NJ. Bland soap handwash or hand antisepsis? The pressing need for clarity. *Infect Control Hosp Epidemiol* 1992;13:299-301.

71. Larson E. Skin cleansing. In: Wenzel RP, ed. *Prevention and Control of Nosocomial Infections*. 2nd ed. Baltimore: Williams and Wilkins, 1993:chap 20:450-459.

72. Larson EL, 1992, 1993, and 1994 Association for Professionals in Infection Control and Epidemiology Guidelines Committee. APIC Guideline for handwashing and hand antisepsis in health care settings. Am J Infect Control 1995;23:251-269.

73. Paulssen J, Eidem T, Kristiansen R. Perforations in surgeons' gloves. *J Hosp Infect* 1988;11:82-85.

74. DeGroot-Kosolcharoen J, Jones JM. Permeability of latex and vinyl gloves to water and blood. *Am J Infect Control* 1989;17:196-201.

75. Kotilainen HR, Brinker JP, Avato JL, Gantz NM. Latex and vinyl examination gloves: quality control procedures and implications for health care workers. *Arch Intern Med* 1989;149:2749-2753.

76. Olsen RJ, Lynch P, Coyle MB, Cummings J, Bokete T, Stamm WE. Examination gloves as barriers to hand contamination and clinical practice. *JAMA* 1993:270:350-353.

77. Health Resources and Services Administration. Guidelines for construction and equipment of hospital and medical facilities. Rockville, Maryland: US Department of Health & Human Services, Public Health Service, 1984. PHS Publ. No. (HRSA) 84-14500.

78. American Institute of Architects (AIA), Committee on Architecture for Health. Chapter 7: General hospital. In: Guidelines for construction and equipment of hospital and medical facilities. The American Institute of Architects Press, Washington, D.C., 1993.

79. American Society of Heating, Refrigerating, and Air Conditioning Engineers. Chapter 7: Health Facilities. In: 1991 Application Handbook. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., Atlanta, Georgia, 1991.

80. Jarvis WR, Bolyard EA, Bozzi CJ, et al. Respirators, recommendtions, and regulations: The controversy surrounding protection of health care worker protections from tuberculosis. *Ann Intern Med* 1995;122:142-146.

81. Department of Health and Human Services and Department of Labor. Respiratory protective devices; final rules and notice. *Federal Register* 1995;60)110):30336-30402.

82. Rutula WA, Mayhall CG. The Society for Hospital Epidemiology of America Position paper: medical waste. *Infect Control Hosp Epidemiol* 1992;13:38-48.

83. Rhame FS. The inanimate environment. In: Bennett JV, Brachman PS, eds. *Hospital Infections. 3rd ed.* Boston: Little, Brown and Co, 1992:chap 15:299-333.

84. Rutula WA. Disinfection, sterilization, and waste disposal. In: Wenzel RP, ed. *Prevention and Control of Nosocomial Infections*. 2nd ed. Baltimore: Williams and Wilkins, 1993:chap 21:460-495.

85. Maki DG, Alvarado C, Hassemer C. Double-bagging of items from isolation rooms is unnecessary as an infection control measure: a comparative study of surface contamination with single and double-bagging. *Infect Control* 1986;7:535-537.

86. American Society for Healthcare Central Services. *Recommended Practices for Central Service: Sterilization*. Chicago: American Hospital Association, 1988.

87. American Society for Healthcare Central Services. *Recommended Practices for Central Service: Decontamination*. Chicago: American Hospital Association, 1990.

88. Rutula WA. APIC guideline for selection and use of disinfectants. *Am J Infect Control* 1990;18:99-117.

89. Bond WW, Ott BJ, Franke KA, McCracken JE. Effective use of liquid chemical germicides on

medical devices: instrument design problems. In: Block SS, ed. *Disinfection, Sterilization, and Preservation*. 4th ed. Philadelphia: Lea and Febiger, 1991:chap 64:1097-1106.

90. Favero MS, Bond WW. Sterilization, disinfection, and antisepsis. In: Ballows A, Hausler WJ, Herrmann KL, Isenberg HO, Shadomy HJ, eds. *Manual of Clinical Microbiology*. 5th ed. Washington: American Society for Microbiology 1991:chap 24:183-200.

91. Favero MS, Bond WW. Chemical disinfection of medical and surgical materials. In: Block SS, ed. *Disinfection, Sterilization and Preservation*. 4th ed. Philadelphia: Lea and Febiger, 1991:chap 35:617-641.

92. Pugliese G, Hunstiger CA. Central services, linens, and laundry. In: Bennett JV, Brachman PS, eds. *Hospital Infections*. 3rd ed. Boston: Little, Brown and Co, 1992:chap 16:335-344.

93. Joint Committee on Healthcare Laundry Guidelines. Guidelines for healthcare linen service - 1994. Hallandale, Florida: Textile Rental Services Association of America, 1994.

94. Hospital Infection Control Practices Advisory Committee. Recommendations for preventing the spread of vancomycin resistance. *Am J Infect Control* 1995;23:87-94, *Infect Control Hosp Epidemiol* 1995;16:105-113, and MMWR 1995; 44(No. RR-12):1-13.

95. Tablan OC, Anderson LJ, Arden NH, Breiman RF, Butler JC, McNeil MM, Hospital Infection Control Practices Advisory Committee. Guideline for prevention of nosocomial pneumonia: Part I. Issues on prevention of nosocomial pneumonia--1994. *Am J Infect Control* 1994;22:247-266, *Infect Control Hosp Epidemiol* 1994;15:587-604, and *Respir Care* 1994;12:1191-1209.

96. Hospital Infection Control Practices Advisory Committee. Guideline for prevention of nosocomial pneumonia: Part II. Recommendations for prevention of nosocomial pneumonia. *Am J Infect Control* 1994;22:266-292, *Infect Control Hosp Epidemiol* 1994;15:604-627, and *Respir Care* 1994;12:1209-1236.

97. Centers for Disease Control and Prevention. Update: Management of patients with suspected

viral hemorrhagic fever - United States. *MMWR* 1995;44:475-479.