

Emerging Health Care-Associated Infections in the Geriatric Population

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The increasing number of persons >65 years of age form a special population at risk for nosocomial and other health care-associated infections. The vulnerability of this age group is related to impaired host defenses such as diminished cell-mediated immunity. Lifestyle considerations, e.g., travel and living arrangements, and residence in nursing homes, can further complicate the clinical picture. The magnitude and diversity of health care-associated infections in the aging population are generating new arenas for prevention and control efforts.

The term geriatric refers to the aging human population, and geriatrics refers to the medical field that deals with clinical problems specific to old age and the aging. Neither these definitions nor the medical literature specifies a precise age range to delineate this group. Cutoffs of 50, 60, 65, and 70 years, none entirely satisfactory, have been used to identify the elderly (1,2). These differing cutoffs reflect the limitations of using chronologic age as a marker for senescence, often viewed as a fundamental characteristic of the group. Regardless, human populations continue to age at an impressive rate. In 1900, only 1% of the earth's population—15 million persons—was >65 years of age (3). By 1992, 6% of the global population, or 342 million persons, were in this category. By the year 2050, these figures will have risen to 20% and 2.5 billion, respectively.

From the standpoint of health care, the geriatric population is diverse. Most Americans 65 to 84 years of age enjoy sufficient health for full function (3). Nevertheless, many persons in this group and even more in the ≥ 85 age group constitute a definable population at increased risk for nosocomial and other health care-associated infections. The 1.5 to 1.8 million residents of nursing homes in the United States epitomize this group at risk (4). Although their experiences frequently dominate discussions about health care-associated infections in the elderly, the problem is much broader. This article focuses on three categories of risk factors—impaired host defenses, lifestyle considerations, and living arrangements—and provides specific examples of emerging health care-associated infections.

Factors Related to Impaired Host Defenses

The elderly have defective host defenses that compromise their ability to ward off infectious agents; factors influencing immunocompetence include immune senescence, changes in nonadaptive immunity, chronic diseases, medications, malnutrition, and functional impairments. T-lymphocyte production and proliferation decline with age, resulting in decreased cell-mediated immunity and decreased antibody production to new antigens (3-5). Thinning skin, enlarged

prostate, diminished cough reflex, and other anatomic or physiologic accompaniments of aging are changes in nonadaptive immunity that render the elderly more vulnerable to infection. Chronic diseases—cancer, atherosclerosis, diabetes mellitus, dementia—predispose to certain types of infection. Medications such as sedatives, narcotics, anticholinergics, and gastric acid suppressants may further suppress innate defenses. Malnutrition, which reduces cell-mediated immunity, is common in nursing home residents (4) and may be more common in the geriatric community at large than is generally realized (6). Finally, functional impairments (e.g., immobility, incontinence, dysphagia) can complicate aging and enhance susceptibility to infection. These impairments may necessitate the use of urinary catheters, feeding tubes, and other invasive devices that magnify susceptibility.

Alone or in combination, these defects in host defense(s) place geriatric populations in the forefront of nosocomial infection statistics. Data from the National Nosocomial Infections Surveillance system for the period 1986-1990 indicated that persons 65 years of age accounted for 54% of all nosocomial infections (7). Similarly, Gross and colleagues observed a decade-specific risk for nosocomial infection of 10 per 1,000 discharges from birth through the fifth decade. However, this risk steadily rose from the fifth decade onward, exceeding 100 infections per 1,000 discharges in patients ≥ 70 years of age (8). Finally, Saviteer and coworkers, who reported a similar increase in nosocomial infections after the fifth decade (9), calculated daily nosocomial infection rates of 0.43% and 0.63% for persons aged ≤ 60 years and ≥ 60 years, respectively. The higher infection rates in the elderly were not attributable to increased lengths of stay.

Geriatric patients, like transplant recipients, may be compared to "sentinel chickens"—the first to be affected by new or emerging infections in hospitals and other health-care environments that care for adult patients. For example, the mean age of affected patients in a nosocomial outbreak of gastroenteritis caused by a small round-structured virus was 65 years (10).

The problem of tuberculosis (TB) deserves particular mention in the context of waning cell-mediated immunity. The elderly have not only this risk factor but also higher frequencies of latent infection, stemming from exposures during an era when TB was more prevalent. TB is the most

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commonly reported notifiable disease in persons ≥ 65 years of age (3). In 1995, 23% of reported cases in the United States occurred in this age group. Elderly persons living in the community have twofold increased rates of active disease. As a health care-associated infection in this age group, TB comes to the fore in hospital and nursing home outbreaks (11). Elderly persons living in long-term care facilities have fourfold increased rates of active TB. The combination of decreased cell-mediated immunity and high prevalence of latent infection suggests that TB will continue to reemerge in geriatric populations.

Decreased cell-mediated immunity may also predispose geriatric patients to nosocomial cryptosporidiosis. A microbiologic review for a 325-bed hospital in Rhode Island identified 36 patients with cryptosporidiosis (12); 13 of these patients were in the 63- to 93-year age group (mean 77 years). In seven of these older patients, nosocomial acquisition was suspected. In addition, outbreaks of this disease have occurred in elderly nursing home residents (13). Thus, cryptosporidium may be an emerging health care-associated infection in the aged.

Factors Related to Lifestyle Considerations

The lifestyles of the elderly may entail additional risk factors for both acquiring and transmitting health care-associated infections. In western countries retired persons use their increased leisure time to travel, including domestic trips to visit family, cruises or tours to foreign countries, or volunteer work in developing countries, which put elderly travelers at risk for infections. In addition, recreational activities such as golfing, spelunking, hunting, and gardening may bring the elderly into contact with unusual pathogens. Volunteer work, visiting ill friends in the hospital, and other patterns of socialization also expose the geriatric population to infections that may be transmitted or acquired in the health care setting.

Several factors specifically related to health care deserve attention in this regard. The first concerns outpatient visits. The elderly spend increased amounts of time visiting their physicians, potentially exposing themselves to various contagious diseases in the health-care environment. They also make frequent use of food services and providers of prepared foods, which carry some risk for transmitting foodborne diseases. These infections may then enter the health-care system and lead to secondary cases. Adult day-care centers and home care services, which have proliferated under medical auspices in recent years, provide additional avenues for geriatric populations to acquire health care-associated infections.

The impact of these lifestyle factors on nosocomial and other health care-associated infections has not been well documented. Several observations provide examples of the potential influence of these factors. A recent report from Taipei described a nosocomial outbreak of malaria resulting from contamination of a computed tomography injection device with blood from a returning traveler (14). Likewise, a 1998 outbreak of influenza in Alaska and the Yukon Territories, where 60,000 to 70,000 tourists visit each summer, further delineated the potential role of travel (15). Prospective surveillance in 1998 identified 2,199 cases of acute respiratory illnesses in 12 hospitals and clinics in Alaska and the Yukon Territory. Among these illnesses, 35% of cases in tourists and tourism workers met criteria for

influenzalike illness and 3.2% for pneumonia. Median ages were 60 years for all persons with acute respiratory illnesses and 72 years for all persons with pneumonia. Fifty of the persons with pneumonia required hospitalization.

The role of lifestyle factors related to health care has received little attention, but one recent publication illustrates the potential problem. A 4-year study of acute respiratory illnesses in three senior day-care centers documented the annual occurrence of viral respiratory infections in 16 to 43 elderly participants and 6 to 23 staff (16). Identified pathogens included influenza A, influenza B, respiratory syncytial virus, coronavirus, parainfluenza virus, and rhinovirus. Of special importance, an educational campaign stressing the importance of handwashing combined with use of a portable virucidal foam product cut the infection rate by 50% during the fourth year. This article describes a new setting for health care-associated infections and confirms that traditional approaches to prevention still apply.

Factors Related to Living Arrangements

The spectrum of living arrangements for geriatric populations ranges from private residences in the community to skilled nursing homes. Between these extremes are retirement homes, assisted living facilities, foster and group homes, chronic disease hospitals, and other arrangements that provide for the needs of persons with sustained self-care deficits (4). Little is known about the role that these arrangements play in the overall scope of health care-associated infections. However, during the last 15 years several studies have examined the problem of health care-associated infections in skilled-nursing homes (2,4).

Nursing homes are residential facilities for persons who require nursing care and related medical or psychosocial services (4). Approximately 90% of nursing home residents fall into the geriatric age range. As a group, nursing home residents exhibit virtually all the risk factors for infections associated with the geriatric population. As a consequence, infections occur commonly in this setting, and emerging health care-associated infections are no exception. Three types of endemic infections occur regularly in all these facilities: urinary tract infections, lower respiratory tract infections—principally pneumonia, and various skin and soft tissue infections (4) (Table). In the United States, the overall rates for nursing home-acquired infection are 3 to 7 infections per 1,000 resident day, or 1.6 to 3.8 million infections per year (4).

Occasionally, new etiologic agents crop up as causes of these endemic infections. For example, in a 2-year serologic study of selected pathogens causing respiratory tract infections and febrile episodes in two Canadian long-term care facilities, Orr and colleagues identified a positive serologic response to *Chlamydia pneumoniae* in 9.4% of 224

Table. Endemic infection rates in long-term care facilities (4), United States, 1978–1989

Category of infection	Rate (no. of infections/ 1,000 resident care days)
All infections	1.8 to 13.5
Urinary tract infections	0.1 to 3.5
Respiratory tract infections	0.3 to 4.7
Skin and soft tissue infections	0.1 to 2.1

febrile episodes (17). These positive responses were associated with 12% of respiratory infections, including 5 of 30 pneumonias and 6.5% of infections of unknown origin. These data suggest that *C. pneumoniae* may be an emerging health care-associated infection in this setting.

Outbreaks also account for a proportion of the health care-associated infections observed in nursing homes (2,4). Respiratory infections and gastroenteritis occur most frequently. Although no national data on frequency of occurrence are available, published reports suggest that outbreaks are not uncommon. During 1970 to 1984, outbreak reports constituted approximately one-third of publications on infections in long-term care facilities (18). From 1975 to 1987, the Centers for Disease Control and Prevention (CDC) received reports from 26 states about 115 foodborne outbreaks in nursing homes (19). Of the 106 outbreaks investigated by CDC's Hospital Infections Program during the last decade, 6% occurred in long-term care facilities (20).

Emerging pathogens account for some of the outbreaks in nursing homes. During the last decade, *Streptococcus pyogenes*—the “flesh-eating” bacterium—was identified in nursing homes (21). More recently, a foodborne outbreak of gastroenteritis caused by both *Salmonella heidelberg* and *Campylobacter jejuni* was reported (22). Loeb and colleagues recently described an outbreak of respiratory illness caused by *L. sainthelensi* in two Canadian nursing homes (23). These and other reports emphasize the vulnerability of frail, elderly residents who share common sources of air, food, water, and health care in nursing homes.

Health care-associated infections caused by antimicrobial drug-resistant bacteria have caused both endemic infections and outbreaks in nursing homes in the United States. The frequent movement of patients between hospitals and nursing homes undoubtedly facilitates the transfer of resistant microbes (24). During the last 2 decades, gram-negative uropathogens with multidrug resistance and methicillin-resistant *S. aureus* have received the most attention (25). Gram-negative enteric bacilli have recently become resistant to fluoroquinolones and extended-spectrum cephalosporins (26). In addition, vancomycin-resistant enterococci and penicillin-resistant pneumococci have been identified in long-term care facilities (27-29). The appearance of the latter organism, which is seldom regarded as a nosocomial pathogen, again underscores the unique situation of this health-care setting. Because of the frequent interchange of patients between hospitals and nursing homes, infections caused by antimicrobial drug-resistant bacteria will continue to emerge in geriatric populations.

Recognition of such threats has prompted new interest in the prevention and control of infections associated with long-term care facilities. Recent guidelines have addressed requirements for infection control programs, as well as influenza, antimicrobial use, and antimicrobial resistant pathogens (25,30-32). Although reports from the 1980s described numerous deficiencies in infection control practices in nursing homes, recent reports have been more encouraging (4,33,34). A survey of 136 long-term care facilities in New England indicated that 98% had persons dedicated to infection control activities for a median of 8 hours per week (33). Nevertheless, protection of the vulnerable elderly residents in nursing homes merits additional attention, and changes in nursing home licensure and certification requirements may be needed at both state and national levels

(35). Surveillance activity in less conventional care settings is a necessary first step in evaluating potential hazards.

Conclusions

The vulnerable geriatric population plays a leading role in the scope of nosocomial and health care-associated infections. As the world's population ages, its role is likely to increase. As health care continues to move beyond hospital walls, the spectrum of health care-associated infections in the elderly will continue to expand, reflecting their multiple risk factors for infectious diseases. Infection control practitioners and hospital epidemiologists are well advised to follow and study the aging population in the evolving health-care system. Undoubtedly, they will find new opportunities to prevent health care-associated infections. In addition, they may be able to develop strategies to prevent the diverse contagions of the elderly from entering hospitals.

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