

Influence of Aging and Environment on Presentation of Infection in Older Adults



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KEYWORDS

• Older adults • Immunosenescence • Frailty • Thermoregulation • Malnutrition

KEY POINTS

- Age-related physiologic changes affect several organ systems and contribute to increased vulnerability to infections.
- With aging comes immunosenescence, affecting both the adaptive and innate immune systems, and contributing to an increased risk of infection.
- Older adults experience a reduced febrile response caused by altered thermoregulation and a decrease in mean body temperature.
- Addressing malnutrition and dehydration among older adults may reduce their risk of infection.
- Knowledge of debilitated older adults' functional and cognitive baseline may support early recognition of infection and discernment of conditions not related to infection.

Disclosure: See at the last page.

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INTRODUCTION

The topic of human longevity has invited extensive scientific and philosophic debate. Haller, a prominent Swiss physiologist of the 18th century, thought that people ought to live to 200 years. Buffon, an 18th century French naturalist, was of the opinion that when someone did not die from some accident or disease they would reach 90 or 100 years.¹ Nobel laureate Élie Metchnikoff, arguably the father of modern immunology and gerontology, found it “impossible to accept the view that the high mortality between the ages of 70 and 75 indicates a natural limit of human life.” In his 1907 book, *The Prolongation of Life*, he equated aging with a disease process that can be studied and possibly cured until death inevitably settles in from “natural causes.” He suggested that, similar to the instinct of sleep, there could be an instinct of death that is neither due to diseases nor accidents, but rather the result of age-related physiologic changes. He thought these changes were the result of self-digesting macrophages and poisoning by intestinal microbiota.¹ Although this theory has been disproved, his contributions to immunology and gerontology were groundbreaking and continue to shape our understanding of infectious processes in older adults.

A testament to the contributions by these pioneers in the field of gerontology, people are living longer such that the number of older adults is rapidly increasing, both in the United States and globally. In 2015, approximately 617 million people were 65 years or older, representing 8.5% of the 7.3 billion people worldwide.² Projections estimate that by 2050, approximately 1.6 billion people will be 65 years or older, with the proportion nearly doubling to 16.6% of the total world population. In the United States, the proportion of people projected to be 65 years or older by 2050 will constitute more than 20% of our total population.² Bartels and Naslund³ famously described this demographic trend as the “silver tsunami.” Understanding the process of aging and how it influences the clinical presentation of diseases in general, and infectious diseases in particular, is a necessity for modern practitioners.

Aging changes the risk of and the clinical presentation of infection. This is due to factors intrinsic to individuals fortunate enough to age and to the environment in which they reside. Intrinsic factors include age-related physiologic changes, which can sometimes result in frailty, a pathologic state. Some age-related changes also influence the clinical manifestation of infection, presenting as alterations in temperature regulation, cognitive decline, and malnutrition.⁴ Environmental factors also play a role, particularly those related to the living situation (eg, nursing home), and the health care setting to which older adults present. In combination, these factors make it difficult for health care workers to determine whether changes in clinical status are due to infection. This may contribute to a low threshold for prescribing systemic antimicrobials, which in turn increases older adults’ risk for acquiring multidrug-resistant organisms (MDRO) and *Clostridium difficile*.

Herein we review the age-related physiologic changes that may progress to frailty; these include both immune and organ-specific changes. We also address clinical factors that influence the manifestation of infections in older adults. Finally, we consider the influence of the external environment on the presentation and evaluation of infections in older adults, with consideration of the subjective roles and perspectives of caregivers within different settings.

PATHOPHYSIOLOGIC FACTORS INFLUENCING INFECTION RISK AND PRESENTATION IN OLDER ADULTS

With aging, physiologic changes occur that affect the immune system as well as various organ systems. Aging itself is not a disease, yet as time passes, the

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