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Controversies in geriatric medicine

The role of vaccination in successful independent ageing



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ABSTRACT

Ageing increases the risk and severity of infectious diseases, especially when chronic diseases are present. Healthcare providers generally view vaccination as a childhood intervention and consider vaccination of the elderly not to be sufficiently effective due to immunosenescence. However, the burden of frequent vaccine-preventable diseases, such as influenza, pneumococcal disease and herpes zoster, increases with age, so that the perceived lower vaccine effectiveness should be considered in the context of this higher burden. Vaccination can prevent infection and mortality hospitalization and functional decline, and their consequences thereby having a positive impact. The use of medications will be reduced (e.g. antibiotics, analgesics) and therefore the iatrogenic risk would be lower. This contributes to an improved quality of life and to successful ageing. Many countries recommend influenza and pneumococcal vaccination in the elderly and, more recently, some recommend the live-attenuated herpes zoster vaccine. However, better guidelines and recommendations, especially for frail individuals are needed. Protection may be improved by offering vaccination to younger, fitter individuals, before they become frail. In addition, offering vaccination to caregivers and others who are in contact with the elderly could also improve protection. Many studies have demonstrated that influenza, pneumococcal and herpes zoster vaccinations in the elderly are cost-effective and can even be cost-saving. Healthcare providers and public health decision-makers need to understand more fully the value of vaccination and to consider it as an important preventive tool in the promotion of successful ageing.

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1. Introduction

Ageing is one of the greatest social and economic challenges of the 21st century. Life expectancy is continuing to increase and many populations are going through major demographic changes resulting in a much older population structure. It is estimated that by 2025, more than 20% of Europeans will be aged ≥ 65 years, with a bigger increase of those aged ≥ 80 years. Since ill health and disability increases with age, ageing populations place a greater burden on society generally and healthcare systems in particular.

Abbreviations: BADL, basic activities of daily living; IADL, instrumental activities of daily living; CMV, cytomegalovirus; HZ, herpes zoster; VZV, varicella zoster virus; PHN, post-herpetic neuralgia; ZBPI, Zoster Brief Pain Inventory; PCV, pneumococcal conjugate vaccine; HCPs, healthcare professionals.

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In this paper, we will examine the role of vaccination in a global approach to successful, independent ageing and increased healthy-life expectancy.

2. Higher risk of infectious diseases in the elderly

Ageing does not affect people's health in the same way, but about 80% of older people (≥ 65 years old) have at least one underlying chronic disease ('usual ageing'), and 25% have more than three underlying chronic diseases [1]. While some seniors 'age successfully' and have no underlying chronic diseases, others become frail and can need long-term care in specialised facilities. It is not easy to predict how people will age, but many factors have been reported to contribute, such as chronic diseases, functional status, ageing immune system (immunosenescence), loss of mechanical barrier function and increased risk of exposure in congregated settings, including nursing homes [2]. Poor nutritional status and lack of physical activity can contribute to an increased

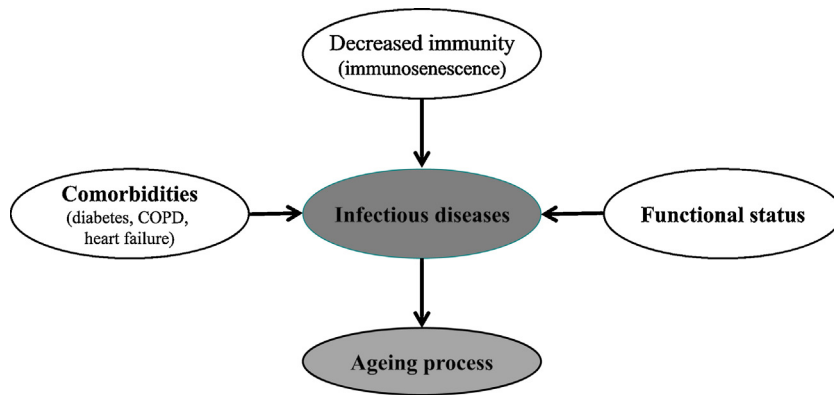


Fig. 1. Older adults have decreased immunity and a higher prevalence of comorbidities that increase their risk of infections. In addition, their performance of basic activities of daily living prior to infection is a major determinant of survival after infection [3].

risk for infectious diseases in the elderly and the presence of underlying chronic diseases increase the risk of complications (Fig. 1) [3–5]. Recent research in geroscience is beginning to provide insights into how fundamental biologic processes of aging, such as inflammation, oxidative stress, tissue senescence including the immune system, and dysregulation of a variety of homeostatic mechanisms, could be delayed to extend ‘healthspan’, i.e. the healthy period of life and delay the development of chronic diseases and disability [6].

Infectious diseases in seniors often accelerate the decline in their functional status. This can be measured by the decline in basic and instrumental activities of daily living (BADL and IADL). BADL include personal care and hygiene, mobility and being able to get in and out of bed or up from a chair or sofa, toileting, bathing and feeding. IADL include cleaning and laundering, cooking and preparing food, shopping, gardening, driving or using public transport, managing medications and being able to handle finances. Many causes of catastrophic disability, defined as loss of independence for ≥ 3 BADL, are preventable. For example, pneumonia and influenza infections, which are ranked 3rd among these causes can be prevented by vaccination [7–9]. Among those who experience catastrophic disability, 72% have been hospitalised; 33% of seniors are more disabled at hospital discharge compared with their pre-illness baseline and half of them will never recover their previous level of independence [10]. Moreover, the one-year mortality rate in seniors discharged with new or additional BADL disabilities was reported to be 41.3%. Failure to recover was predicted independently by age, cardiovascular disease, dementia, cancer, low albumin and higher number of dependencies in IADLs [11]. A clinical prediction rule developed for assessing the risk of serious influenza-associated complications showed that while age was important (i.e. 58 points for those ≥ 90 vs. 0 for those < 70), other factors also contribute, such as ≥ 1 outpatient visit/month (33 points) or previous hospitalisation for influenza or pneumonia (63 points) [12]. Vaccination against seasonal influenza has also been shown to protect against pneumonia, complications and even death, and is one means of preventing hospitalization [13–15]. Therefore, one effective means of preventing this decline is to prevent infectious diseases.

The frailty profile is partly explained by an imbalance between inflammatory and anti-inflammatory processes, which leads to a low-grade chronic pro-inflammatory state termed inflammaging [16]. Inflammatory mediators are important in resistance to infectious diseases during life, but with age they are not efficiently neutralised and are constantly present, leading to inflammaging and unsuccessful ageing. These chronic inflammatory processes increase susceptibility to chronic diseases and infectious diseases. The production of anti-inflammatory mediators in response to this

chronic inflammation has been associated with more successful ageing. Current efforts to increase health span centre on slowing the fundamental biological processes of aging such as inflammation/oxidative stress, increased senescence, mitochondrial dysfunction, impaired proteostasis and reduced stress resistance [6].

Persistent infection with cytomegalovirus (CMV), which belongs to the herpes family of viruses, is very common. The infection can be spread by organ transplant, respiratory droplets, saliva, sexual contact and urine, and most people are infected by mid-life. Although most people will come into contact with CMV in their lifetime, healthy people generally do not have symptoms although the virus remains in a persistent state in multiple sites in the body. CMV seropositivity has been reported to increase with age and persistent CMV infection causes CD8⁺ T cells to become permanently differentiated, with poor proliferative response, the senescent phenotype, which contributes to inflammaging [17].

2.1. Vaccine-preventable infectious diseases that contribute to catastrophic disability in seniors

Many infectious diseases, such as influenza and pneumonia, show J-curves for incidence and mortality, with younger and older individuals having a higher burden of disease and mortality. In contrast, the curve for immunity is a reverse J-curve, increasing from a young age up to a peak at about 50 years, and then declining. The decline is not homogeneous; some seniors retain good natural immunity and have good responses to vaccination, while others are more susceptible to infection (as discussed above) and have lower responses to vaccination. In addition to pneumonia and influenza, herpes zoster (HZ), another vaccine-preventable disease, can contribute to functional decline and loss of autonomy [18–20]. The higher disease burden and the lower immunity contribute to the higher risk for catastrophic disability.

Primary infection with varicella zoster virus (VZV) causes varicella and then the virus remains latent in the sensory ganglia [21]. HZ is due to reactivation of the latent VZV and, although the exact mechanism of reactivation is not well known, declining immunity with age (immunosenesence) has been reported to be the main risk factor [21]. The complications of HZ can be neurological, ophthalmic, dermatological and visceral, but the most important, both in terms of incidence and severity is postherpetic neuralgia (PHN) [21]. HZ occurs more frequently in older individuals, with about 2/3rd of cases in those aged ≥ 50 years and about 2/3rd of PHN in those aged ≥ 70 years [18,19,22–25].

Even when analgesics and antiviral treatment are initiated soon after onset, chronic PHN can occur. For example, in a French study of HZ in general practice (ARIZONA), 80% of the patients received treatment but 10% had PHN at 1 year [18,26]. A specific tool, the

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