REVIEW ARTICLES

Infrastructure and resources for an aging population: embracing complexity in translational research

KEVIN P. HIGH

WINSTON-SALEM, NC

The population of the United States and most industrialized nations is undergoing rapid expansion of persons aged 65 years and older. This group experiences more illness, disability, and dependency than young adults and consumes the majority of heath care resources. This demographic change presents a number of challenges to current research infrastructure aimed at translating discoveries to improved human health. Key issues include the need to expand the workforce trained in aging research, development of specific resources and harmonization of measures and outcomes, and a culture change within the scientific community. In particular, complexity must be represented within research design and embraced as an important aspect of review panel critiques. (Translational Research 2014;163:446–455)

Abbreviations: AGS = American Geriatrics Society; CTSA = Clinical and Translational Science Award; DWJS = Dennis W. Jahnigen Scholars; EMR = Electronic medical record; GEMSSTAR = Grants for Early Medical and Surgical Specialists in Aging Research; NHP = nonhuman primate; NIA = National Institute on Aging; NIH = National Institutes of Health; OAIC = Older Americans Independence Center; PROMIS = Patient-Reported Outcomes Measurement Information System; RCDC = Research Career Development Cores; SPPB = Short Physical Performance Battery; TFWS = T. Franklin Williams Scholars; VA = Veterans Affairs

INTRODUCTION

Why focus on aging research?

During the past 2 centuries, median life expectancy in humans has increased markedly from about age 45 to nearly age 80. It is generally agreed that most of this gain has come from improved sanitation, public health measures (eg, workplace safety), and advances in treating/preventing infections. However, during the past 50 years, remarkable medical advances for prevalent causes of middle-age mortality such as cardiovascular disease and many types of cancer have also played a role. These developments have resulted in rapidly increasing populations of older adults in all industrialized nations. For example, by 2030, approximately 1 in 5 Americans will be 65 years or older (Fig 1). This trend is occurring in developing countries as well, and at a much faster rate than occurred in Europe and the United States. United Nations aging statistics suggest more people age 80 years and older will live in developing than in developed countries by 2025.[2]

As medical interventions have reduced death rates from acute illness there has been an increasing population living, and aging, with accumulated chronic illnesses. Many older adults experience multiple chronic conditions, which increases the risk of functional limitation and dependency.[3,4] It is, of course, much more

From the Wake Forest School of Medicine, Winston-Salem, NC.

Submitted for publication June 7, 2013; revision submitted September 1, 2013; accepted for publication September 5, 2013.

Reprint requests: Kevin P. High, Professor of Medicine/Infectious Diseases, Wake Forest School of Medicine, 100 Medical Center Boulevard, Winston-Salem, NC 27157-1042; e-mail: khigh@wakehealth.edu.

1931-5244/$ - see front matter

http://dx.doi.org/10.1016/j.trsl.2013.09.001

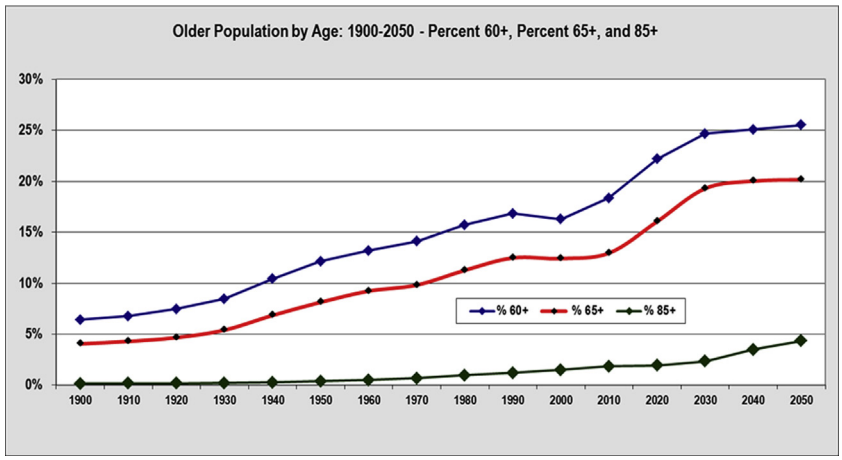

Fig 1. Increasing population of old and very old persons in the United States. Reproduced with permission from ref. 1.

expensive to care for those with multiple chronic conditions, and older adults account for the vast majority of health care expenditures as a result of their higher burden of illness and disability.

Life span vs "Healthspan". Despite marked increases in median life span, the *maximum* human life span has remained essentially constant at just more than 100 years. This realization has led to the concept of "healthspan"—the period of time one spends in healthy, active life before the occurrence of chronic conditions, functional limitation, dependency, or death (reviewed by Kirkland[5]). Extending healthspan rather than focusing just on life span has become a major goal of gerontology and geriatric research. Focusing on healthspan may have a greater impact on health care cost than addressing life span extension only. Surviving one illness essentially means we live to experience another illness and another and another, increasing the lifetime cost of health care for an individual. However, improving healthspan has the potential to be markedly cost-saving if one can push severe, debilitating illnesses to the very end of life, reducing the time one requires high-cost, labor-intensive care and support.

"Return on Investment" of aging research. Of course, the goal of most biomedical research is to expand both healthspan *and* life span. From this dual viewpoint, aging research dwarfs the potential payback of research focused on any single disease. For example, the average life span of a 50-year-old human in the developed world is about 31 additional years. Because age is such a strong risk factor for multiple illnesses across many organ systems, addressing aging itself has a much greater benefit for extending life span, and certainly healthspan, than curing cancer, heart disease, diabetes mellitus, stroke, or any one illness.[5] Thus, investing in aging research is likely to pay dividends in both life span and healthspan—and at least rivals, if not exceeds, the impact of research aimed at cure or prevention of specific diseases. Despite these strong arguments, aging research is often a difficult "sell" to the public, public/elected officials, or even the scientific community for support.

This article describes the state of the current workforce and infrastructure available for translational research in aging, and suggests important changes that are required to further translational research in aging and the care of older adults. It is imperative that isolated illness be studied in the most appropriate models, that multimorbidity be included explicitly rather than excluded, and that outcomes of value to older adults (eg, functional independence, quality of life), not just survival, be *primary* end points for translational aging research. Although convincing the public of this need is an essential, long-term goal, it is more important in the short term to engage the scientific community and advance a change in the culture to one that embraces complexity—the key element, in my opinion, needed to advance aging research across the translational continuum.

Last, two key aspects of research infrastructure are *not* part of this review. Research funding is, of course, required to address the issues outlined, but the economics of research funding and priority setting go beyond the scope of this review. Similarly, critical end-of-life issues are also entwined integrally in aging research, but palliative care and end-of-life research is a separate, although related, standing area of research that requires more space than is available within this review. Both issues, frankly, are also outside my expertise, and thus this review focuses on the common issues outlined in the previous paragraph.