Editorial

Editorial: Introducing the 2013 Volume of Epidemiologic Reviews on Aging

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Over the past several decades, from 1935 to 2010, death rates have decreased by 60% in the United States after accounting for the aging of the population (1). Decreases in mortality rates have resulted in dramatic increases in the population of older adults (those ≥65 years of age), from about 3 million at the turn of the 20th century to over 40 million in 2010 (2). By 2050, the number of Americans 65 years of age or older is projected to more than double to 88.5 million. The baby boomers are driving this increase, with the first of them crossing over the age of 65 years in 2011. Of these 88.5 million older people, 19 million will be 85 years of age or older (2).

How do these demographic changes affect the nation’s public health? An estimated 5.2 million older Americans have Alzheimer’s disease, and incidence rates are projected to double by 2050 (3). Among Americans, the rate of mobility disability increased between 1998 and 2006 (4). Long-term care expenditures doubled between 1990 and 2001, reaching $132 billion, and public financing of long-term care is projected to increase 20%–21% by 2020 (5). The aging of the US and world populations dictates that we must prepare to meet the health care needs of many older people. The 13 articles to be published in the forthcoming issue of Epidemiologic Reviews devoted to aging illustrate how epidemiologic studies are contributing to a better understanding of numerous questions related to healthy aging, exceptional longevity, age-related diseases, physical function, and cognitive aging, as well as other phenotypes crucial to understanding of numerous questions related to healthy aging, exceptional longevity, age-related diseases, physical function, and cognitive aging, as well as other phenotypes crucial to improving the health of our growing older population.

Several themes emerge in these articles. One theme is the elusive search for the “perfect” measure of biological aging. How would we know a perfect measure if we found one? In the review by Engelfriet et al. (6), the authors discuss the work of B. Strehler (7), who wrote in 1962 that changes seen with advancing age should be cumulative, progressive, intrinsic, deleterious to biological function, and universal, that is, observed in all members of the species. The American Federation for Aging Research proposed that a perfect biomarker of aging “…must predict the rate of aging (the biological age….where a person is in their own lifespan) and it must monitor a basic mechanism that underlies the aging process” (6, p. 145). Sanders and Newman (8) noted in their review that any such candidate marker must: 1) be biologically plausible; 2) be able to be tested repeatedly and accurately without harming the person; and 3) predict the rate of aging. Currently, it appears unresolved how to clearly differentiate between biologic aging and age-related disease processes or whether doing so is even possible. Salive (9) noted that 67% of Medicare fee-for-service participants have multiple chronic diseases, with a prevalence of 82% in people 85 years of age or older, which emphasizes the reality that few older adults survive into later life disease-free. Yet, these reviews clearly illustrate that we can advance knowledge and move toward improving the health of older adults without having to find a biologic marker of aging that is completely independent of underlying pathophysiology.

Although many measures of biologic aging have been investigated in animal models, Engelfriet et al. noted that translation to humans is difficult because of the “far greater organizational complexity of the mammalian body” (6, p. 145). Nonetheless, epidemiologists have been inspired by laboratory studies to investigate numerous pathways, including those pertaining to cell senescence, energy metabolism, reproductive function and hormones, protein and lipid metabolism, wear and tear mechanisms, inflammation, and organ-specific biomarkers (6). Irisin, one particularly interesting muscle biomarker that was highlighted in that review, is a hormone that can be measured in human blood and that is stimulated by exercise in mice. Telomere length and attrition as possible biomarkers of aging were addressed in several reviews in this issue of Epidemiologic Reviews (6, 8, 10). Sanders and Newman noted that “evidence suggests that, of the basic biological processes, telomere length most likely reflects somatic growth before the end of puberty and cellular senescence and oxidative stress after puberty” (8, p. 114). Although the epidemiologic data are weak or inconclusive on whether telomere length is related to risk of death in humans (8), whether it is a cause or consequence of age-related processes like inflammation (8), and whether contemporaneous or childhood socioeconomic status as markers of lifelong allostatic load results in shorter telomeres (10), these reviews leave open the possibility that telomere length and telomerase activity could be...
related to degenerative phenotypes in older people. Several authors point to the promise of improved epidemiologic designs that allow for “longitudinal studies with repeated measurements of relevant biomarkers” as cohorts age (6, p. 145) and the use of life course approaches (8). In addition, new technologies such as proteomics and metabolomics have shown promise in bridging the gap between laboratory studies in simpler species and human populations (6).

A second theme in this issue of Epidemiologic Reviews pertains to the causes of Alzheimer’s disease, dementia, and cognitive aging. Mawanda and Wallace (11) reviewed the evidence that Alzheimer’s disease might have an infectious etiology. They studied in detail evidence relating central nervous system or systemic infections with 4 pathogens: herpes simplex virus-1, Chlamydia pneumonia, Borrelia burgdorferi, and Helicobacter pylori. Inflammation is related to Alzheimer’s disease neuropathology, and the involvement of autophagies and of immune dysregulation have been suggested as possible causes, but no single infectious agent has been conclusively linked with Alzheimer’s disease. Vagelatos and Eslick (12) reviewed the evidence on whether diabetes is a risk factor for Alzheimer’s disease by conducting a meta-analysis of 15 epidemiologic studies, and they found a pooled risk ratio of 1.57 and a possible interaction between type 2 diabetes mellitus and the apolipoprotein E4 gene. The authors noted that cerebral infarcts were more common in people with type 2 diabetes mellitus, and mixed neuropathology in the brain involving both Alzheimer’s disease and cerebrovascular changes is thus also more common. Obesity, a potent precursor of diabetes, was reviewed as a risk factor for cognitive aging by Dahl and Hassing (13) in 11 population-based epidemiologic studies of dementia-free cohorts. They found that midlife but not late-life obesity was associated cognitive decline in later life and that the direction of association and causality are not clear. Doets et al. (14) reviewed the evidence that vitamin B12 intake or serum levels could be related to cognitive function in older people, but they found insufficient evidence to recommend specific vitamin B12 intakes or levels to promote maintenance of cognitive function. Clouston et al. (15) reviewed the evidence that changes in physical function like grip strength and walking speed precede changes in cognitive performance and vice versa. Brain white matter integrity may be a common cause underlying declines in both functional domains, but the observed associations to date have not been strong or consistent enough to support a firm conclusion. They encourage future prospective studies with repeated measures of physical and cognitive function to determine the order in which declines occur.

A third theme that emerged is the role of modifiable behavioral risk factors in several important aging phenotypes, including longevity and exceptional survival (16), multiple morbidities (9), and functional decline (17). Here we are talking about our epidemiologic “usual suspects” of smoking, unhealthy diet, alcohol consumption, adiposity/obesity, and physical inactivity. Newman and Murabito provided a nice review of the demography of exceptional survival, including the fascinating statement that “that the likelihood of making it from birth to age 90 years is similar to the likelihood of making it from age 90 to 100 years” (16, p. 182). Healthy diet and caloric restriction are particularly intriguing areas of inquiry, as illustrated in a long-term, prospective study of people from Okinawa. The authors noted that caloric restriction appears to cause a reduction in growth factor signaling response, but it is clearly not required for long life. Indeed, recent evidence has suggested that overweight people have lower mortality (18) than those currently classified as normal weight. Schaap et al. (17) found clear evidence that obesity, determined as having a body mass index (weight (kg)/height (m)2) over 30, a larger waist circumference, and low muscle strength, as measured by grip or knee extensor strength, are associated with functional decline. They concluded that the role of muscle mass seems much less important than the role of fat mass in maintaining function. These reviews and the totality of the evidence suggest that energy intake and metabolism, muscle strength, and healthy body weights are rather crucial for healthy aging. Prevention guidelines for healthy aging have yet to incorporate the evidence that older people currently classified as overweight but not obese may have certain resiliencies that reduce mortality, preserve function, and prevent disease events like hip fracture.

Lastly, a theme of this issue was that harsh environments can contribute to unhealthy aging. The persistence of socioeconomic status differentials in mortality into later life in European countries (19), even those with substantial health and social welfare programs, suggests that aging humans are affected by insufficient resources and the many, mostly unmeasured, environmental qualities that coincide with low socioeconomic status. Tansey et al. (20) reviewed the evidence that veterans who had fought in active combat experienced worse general health and were more likely to have hearing loss, musculoskeletal disorders, infections, cirrhosis, skin conditions, stomach conditions, neurologic conditions, and cardiovascular disease than were civilians of similar age. They argued persuasively that the special circumstances of wartime in young adulthood should be considered in aging research.

The wide range of topics covered in this issue of Epidemiologic Reviews is a reminder of how vast the field of aging is, how much epidemiologic studies are contributing to our evolving understanding of how to promote healthy aging, and how much we have yet to learn. The many suggestions for improved research methods are valuable directions for designing future studies. The elegant synthesis provided by these papers should inspire us to move forward to identify and test novel interventions to preserve the health, independence, and quality of life of older people.

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REFERENCES


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