HAPI

Health
And
Places
Initiative

August 2015

Physiology and Psychology of Aging, Health, and Place

A RESEARCH BRIEF
VERSION 1.1

Photo by Ann Forsyth

The HEALTH AND PLACE INITIATIVE (HAPI) investigates how to create healthier cities in the future, with a specific emphasis on China. Bringing together experts from the Harvard Graduate School of Design (HGSD) and the Harvard School of Public Health (HSPH), it creates a forum for understanding the multiple issues that face cities in light of rapid urbanization and an aging population worldwide.

Health and Places Initiative
http://research.gsd.harvard.edu/hapi/
Harvard Graduate School of Design

The Research Briefs series summarizes recent research on links between human health and places at the neighborhood or district scale and provides background for a number of other forthcoming products—a set of health assessment tools, planning and urban design guidelines, urban design prototypes, and neighborhood cases. While the Research Briefs draw out implications for practice, it is these other tools that really provide specific, real-world guidance for how to create healthy places.

The following people were involved in the Research Brief Series:

Series Editors: Ann Forsyth and Laura Smead
Contributors: Laura Smead, with Yannis Orfanos, Joyce Lee, and Chuan Hao (Alex) Chen
Copy Editor: Tim Czerwienski
Layout Designers: Yannis Orfanos, with Laura Smead and Weishun Xu
Thanks to Heidi Cho, Lydia Gaby, Andreas Georgoulias, Joy Jing, Emily Salomon, and Dingliang Yang for assistance and to Rebecca Miles for helpful comments.

Suggested Citation:
Health and Places Initiative. 2015. Physiology and Psychology of Aging, Health, and Place. A Research Brief. Version 1.1. http://research.gsd.harvard.edu/hapi/

Big ideas

- The proportion of older people is increasing worldwide, especially in countries with higher incomes and those with lower birth rates, such as China.
- Old age (65 years and older) is generally characterized by increasing physical problems (of varying rates), and an increase in both multiple and chronic diseases.
- Mental health issues like depression and anxiety are also relatively common for older persons, but should not be considered a normal part of the aging process. Keeping engaged mentally and socially are important to preventing depression and cognitive decline.
- People 85 years and older have the highest rates of disability and dementia.
- As the proportion of older people increases, so too do the overall rates of disability.
- There is a great deal of individual variation, however, in the rate of health change in older people related to personal differences (e.g. biology, life history).
- Environmental, psychological, and social factors, as well as behaviors such as getting regular exercise, eating a healthy diet, not smoking, and not drinking excessively, can help to prevent or moderate many common chronic diseases.
- Planning and design can thus help support older people managing the aging process but are only part of the picture. For example, good planning and design for older people provides a built environment supportive of multiple ability levels (universal design), safe and appealing outdoor recreational resources, a health facility network accessible by transport (public or private), and multiple affordable housing options (multigenerational housing, single apartments, assisted living facilities).

What the Research Says

The topic of this research brief—the physical and psychological aspects of aging—is very broad. As such, unlike the other briefs in this series, we rely less on individual research studies and instead draw together information from a variety of overview materials and major research trends, such as "successful aging" and "age friendly cities" work.

Health Issues

Old age is conventionally thought of as 65 years of age and older.

Example: Timiras' *Physiological Basis of Aging and Geriatrics* (2007) describes common terms related to aging and methods in its first chapter. She states, "Old age in humans is conventionally accepted as the stage in the life cycle that beings at around 65 years of age and terminates with death" (Timiras 2007, 4).

No single theory or mechanism to explain aging has emerged. Rather it seems to be a result of multiple causes.

Example: Taylor and Johnson's *Physiology of Exercise and Healthy Aging* discusses theories of aging: "To date, no one theory has found acceptance by the scientific community…we suggest that, in all likelihood, aging is not caused by any single factor but is due to an aggregate of causes" (Taylor and Johnson 2007, xxiv).

Old age is characterized by prevalence of multiple and chronic diseases.

Example: According to Timiras' (2007) *Physiological Basis of Aging and Geriatrics*, "One of the main characteristics of old age pathology is comorbidity, that is, the multiplicity of diseases simultaneously affecting the same individual…Another characteristic of the elderly is that diseases tend to be chronic and debilitating rather than acute and self-limiting; symptoms tend to be more subtle and vague" (Timiras 2007, 33).

However, research shows many chronic diseases associated with aging are preventable or modifiable, and related to the social, cultural, environmental, and lifestyle factors.

Example: In their classic paper introducing the idea of 'successful aging', Rowe and Kahn (1987) argue that, "The effects of the aging process [age-associated cognitive and physiologic deficits] itself have been exaggerated, and the modifying effects of diet, exercise, personal habits, and psychosocial factors underestimated" (Rowe and Kahn 1987, 143).

Example: Morgan and Kunkel's book, *Aging: The Social Context* reports, "In fact, research shows that some of the changes we think of as normal are modifiable, preventable, and related to socially influenced lifestyle choices and cultural practices" (Morgan and Kunkel 2001, 4).

Example: Timiras' (2007) *Physiological Basis of Aging and Geriatrics* describes, "As we consider the many cross-cultural differences that greatly influence aging, factors such as diet, exercise, drugs, and psychosocial environment should not be underestimated as potential moderators of the aging process. Taking these elements into account, the prospects for avoidance, or eventual reversal, of functional loss with age are vastly improved, and the risks of disability and disease are reduced. Successful or healthy aging in certain functions is a demonstration that aging may occur with little loss of function" (Timiras 2007, 27).

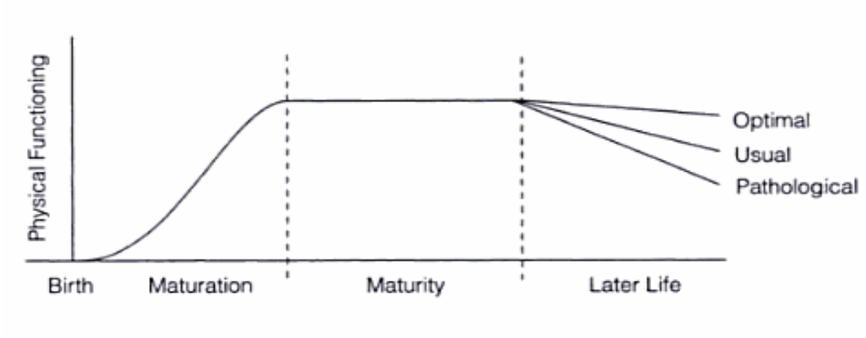
Therefore, it important to emphasize individual differences, and to relate the physical factors of old age with the social, interpersonal, and psychological environments.

Example: Timiras' (2007) *Physiological Basis of Aging and Geriatrics* sets forth that, "One cannot adequately treat disease without considering the psychologic, economic, and social situation of each individual. This global, 'holistic view' of the individual should apply to all ages, of course, but it becomes crucial for the elderly, for whom loneliness, social instability, and often, financial hardship have enormous impacts on health and wellbeing" (Timiras 2007, 33).

Example: Whitbourne's (2002) *The Aging Individual: Physical and Psychological Perspectives* describes overall life-span themes and issues: "Although elders who share the same ethnic or cultural background may share certain life experiences, their reactions to these experiences are likely to reflect their own unique psychological and physical capacity to cope with the events in their lives" (Whitbourne 2002, 2).

Example: Morgan and Kunkel (2001) illustrate this individual rate of physical aging in their book *Aging: The Social Context* (Morgan and Kunkel 2001, 5). Figure 1 shows how everyone experiences some physical decline as they get older, but not everyone changes at the same rate.

Figure 1. Optimal, usual, and pathological trajectories of old age.



Source: Morgan and Kunkel 2001, 5, used with permission.

Physiology of Aging

Table 1 below describes physical changes that come with aging, potential implications for policy, planning or design, and related references (see more in Table 5).

Table 1. Physiology of aging and policy or planning implications.[1]

Health Resource	Example of Healthy Planning Processes	Social and Physical Influences on Health
Access to barrier-free environments, quality transit, and safe roads and sidewalks	Universal design policies and planning, alternative transport options	Minimizes effects of decreases in bodily functions: hearing, vision, movement, strength, reaction time, organ function, etc. Potentially reduces some of the increase in disability and hospitalization.
Access to healthcare, environmental quality (noise, air, soil, water)	Geographic healthcare accessibility, but also noise control, air pollution control	Respond to and potentially reduce some of the increase in chronic conditions: High-blood pressure, arthritis, heart disease, cancer, diabetes, lung diseases
Access to affordable, stable, and appropriate housing	Universal design, housing options (multigenerational, assisted living), near transport options	Helps respond to and potentially reduce housing instability and hospitalization, which tends to increase with age (especially 85+ years)

1. CDC 2013, ii; Federal Interagency (Forum) 2012, 27; Morgan and Kunkel 2001, 4; NIH et al. 2007, 3, 10; Taylor and Johnson 2007, xx; WHO 2010, 1, 8; Research Briefs on geographic healthcare accessibility, noise, and air pollution.

Psychology of Aging

Until around age 85, typical aging causes only minor declines in mental functioning. However, after age 85, rates of dementia increase dramatically.

Example: Morgan and Kunkel's (2001) *Aging: The Social Context* summarizes some effects of psychological aging: "Research on the physiology and psychology of aging shows that, in the absence of disabling disease, aging causes only minimal declines in functioning until age 85, at which point about 25% of elders begin to show [mental] frailty even in the absence of disease" (Morgan and Kunkel 2001, 6).

Example: The Organisation for Economic Co-operation and Development's (OECD) *Health at a Glance* 2013 reports, "Clinical symptoms of dementia usually begin after the age of 65, and the prevalence increases markedly with age. The disease affects more women than men. In Europe, 14% of men and 16% of women aged 80–84 years were estimated as having dementia in 2009, compared to less than 4% among those under 75 years of age (Alzheimer Europe, 2009). For people aged 90 years and over, the figures rise to 31% of men and 47% of women" (OECD 2013, 176).

Certain "toxic" personality traits seem to promote disease. Others may possibly prevent disease, but data is limited.

Example: Birren and Schaie's (2011) *Handbook of the Psychology of Aging*, describes, "In particular, hostility (the toxic component in type A behavior), anxiety, and depressive symptoms are risk factors for cardiovascular disease, and thus can be considered aging accelerators" (Birren and Schaie 2007, 91). However, "Evidence for personality processes as protective factors is weaker, but nonetheless intriguing; more work is badly needed" (Birren and Schaie 2007, 93).

Dementia, depression, and anxiety are the most common mental health problems for older adults worldwide.

Example: Using 2010 data from the Institute for Health metrics and evaluation's global burden of disease study, the WHO fact sheet on mental health and older adults (2013) reports that, "The most common neuropsychiatric disorders in this age group [aged 60 and older] are dementia and depression. Anxiety disorders affect 3.8% of the elderly population, substance use problems affect almost 1% and around a quarter of deaths from self-harm are among those aged 60 and above" (WHO 2013).

Example: Using data from the National Center for Injury Prevention and Control, the CDC's issue brief on "The State of Mental Health and Aging in America" (2008) points out that, "Older men have the highest suicide rate of any age group. Men aged 85 years or older have a suicide rate of 45.23 per 100,000, compared to an overall rate of 11.01 per 100,000 for all ages."

Place Issues

In most middle- and high-income countries, people are living longer and the proportion of the aging population is growing rapidly.

Example: Timiras (2007) summarizes reasons for these trends in *Physiological Basis of Aging and Geriatrics*: "Today, in several developed countries, the rise in the proportion of the elderly relative to the total population is associated with a decline in the proportion of young people. This phenomenon has to do not only with the increased longevity of the elderly, but also with the decrease in the number of the young persons. Despite a reduction in infant mortality worldwide, attributable to successful preventive public health and medical interventions, we have seen a concomitant reduction in fertility, which has been attributed to various socioeconomic and lifestyle factors" (Timiras 2007, 3).

Table 2 describes global aging statistics related to increased longevity and growing proportions of older people.

Table 2. Global trends in aging.[2]

Trend	Past (1950)	Present (2007-2010)	Future (2050)
Increased longevity, especially East Asia	< 45 years	72 years	--
Greater proportions of people 65 years+ (middle- and high-income countries)	8% total population aged 65+ years	16% total population aged 65+ years	26% total population aged 65+ years
Greater proportions of people 80 years+ (middle- and high-income countries)	--	4% population aged 80+ years	10% population 80+ years

2. NIH 2007; OECD 2013, 170; UN 2010, 372–373

Vulnerable Groups

Table 3 below describes vulnerable demographic groups, what they are vulnerable to, and related sources.

Table 3. Vulnerable groups in the aging population.[3]

Demographic group	Vulnerability
Oldest-old (85 or older)	Disability, mental frailty, and dementia
Men 85+	More likely to commit suicide
Low-income	Poorer general health outcomes (e.g. heart disease, mental health) and access to health care and other services

3. Adler and Ostrove 1999; CDC 2008; Morgan and Kunkel 2001, 6; NIA 2007, 12; OECD 2013, 176

China

Major chronic health conditions among older Chinese adults are common.

Example: Wu et al. (2013) conducted a study to estimate the prevalence of eight common chronic health conditions among older adults in China. They used data from the SAGE-China Wave 1, which included 13,157 people aged 50-plus years. Chronic medical conditions included angina, arthritis, asthma, stroke, diabetes, depression, chronic lung disease, and hypertension. They concluded, "Findings from this study indicated that major chronic conditions were common, so prevention and early intervention targeting adults aged 50 years and older should be prioritized" (Wu et al. 2013, e74176).

Things for Certain (or semi-Certain)

Old age is characterized by physical decline (at varied rates), as well as increased comorbidity of disease and chronic diseases (Timiras 2007, 33).

Research shows many chronic diseases associated with aging are preventable or modifiable, and related to the social environment and lifestyle choices.

Example: According to Whitbourne's *The Aging Individual: Physical and Psychological Perspectives* (2002), "Although the ultimate result of the aging process is a progressive loss of function, there are many steps that individuals can take to slow down the aging process, or to prevent deleterious effects of aging before they become apparent" (Whitbourne 2002, 2).

Things up in the Air

How to target prevention and intervention services to different groups of older people (demographics, countries, cultures).

Example: As described in the National Institute on Aging's (2011) *Global Health and Aging* report, "Health systems need better data to understand the health risks faced by older people and to target appropriate prevention and intervention services" (NIA 2011, 16-17).

Implications

In these HAPI Research Briefs we aimed to find implications for planning and design at roughly the neighborhood level. These could include quantifiable standards, more qualitative but yet evidence-supported insights, and other good practices. Not every topic has a full complement of these implications.

Many of the implications for healthier aging involve individual behaviors by older people. In these cases environments can mainly support healthier options or at least not provide barriers to such healthier behaviors. It is important to keep in mind that planning and design are only part of the picture, because a person's health and exposure to health risks in childhood and adulthood profoundly affects physical and cognitive functioning in later years (Wen and Gu 2011, 153).

Table 4 describes individual behaviors shown to have an effect on disease reduction and prevention in later years. Following this table are policy, planning, and design ideas to promote and support healthy aging (see Table 5).

Table 4. Individual behaviors to encourage healthy aging for those 65 years or older.[4]

Behavior	Guidelines	Effect
Get regular exercise	30 minutes of moderate-intensity endurance activity on most or all days of the week	Prevent many diseases: type 2 diabetes, certain cancers, obesity, osteoporosis/ osteoarthritis, cardiovascular disease
Eat a healthy diet with lots of fruits and vegetables	2.5 cups of vegetables and fruits per day; foods fortified with vitamin B_{12} (fortified cereals, dietary supplements)	Reduced risk of many chronic diseases: cardiovascular disease, certain types of cancer
Do not smoke or use tobacco products	No smoking or tobacco products	Reduced risk of cardiovascular disease and certain types of cancer
Avoid excessive use of alcohol	No more than 7 drinks a week, no more than 3 drinks per day; Do not drink and drive	Reduce risk of dependency, organ damage, accidents
Keep engaged mentally and socially	Spouse, family, friends, religious affiliation and attendance, employment, other community affiliations	Reduced risk of depression, stress, and cognitive decline; Promotes greater health, longevity and wellbeing, recovery from illness and injury, health behaviors
Get regular medical checkups	For example, annual physical or as recommended by a doctor	Disease prevention and management
Safety habits around the home and car	For example, wear a seat belt, use handrails and assistive equipment if necessary	Prevent falls and fractures, accidents

4. Birren and Schaie 2011, 96-97; Morgan and Kunkel 2001, 6; NIA 2009 (updated 2012), 3; NIA et al. 2011, 24; NIH 2013, 110; Resnick et al 2011, 6; Rowe and Kahn 1987, 146-147; Taylor and Johnson 2007, x; USDA 2010, 34-35; Whitbourne 2002, 10.

Photo by Ann Forsyth

Social engagement plays an important role in the health and wellbeing of older adults.

Insights

While individual behavior is the most important factor for healthy aging, planners and policy makers can support individuals in these activities in several ways. A number of recent studies and reviews have described policy and planning interventions that are supportive of healthy aging, especially the World Health Organization's (2007) *Checklist of Essential Features of Age-friendly Cities*. These topics are also discussed in more detail in the related syntheses of physical activity, healthy eating options, universal design, social capital, healthcare access, and safety. Table 5 summarizes some age-friendly environmental characteristics with intervention examples and potential health impacts.

Table 5. Environmental features which support healthy aging[5]

Environmental Features	Intervention Examples	Potential Health Impact
Land use promotes walkability (density, mixed use, connectivity)	• Smart Growth development patterns • Retrofitting suburbs • Walkways and cycle paths • Age-friendly residences close to shops	Physical activity, walking
Safe and accessible streets and sidewalks	• Pedestrian countdown signals (slower walking speeds) • Adequate lighting • Clear signage (wayfinding) • Benches • Smooth, level, non-slip surfaces • Sufficient sidewalk width for wheelchairs • Curb cuts • Priority access for pedestrians • Low traffic noise • Public toilets available	Safety (traffic), physical activity (walking), independence and wellbeing
Affordable, accessible homes (universal design)	• Build into new construction (ideally), but also retrofitting, funding, zoning, development incentives, or design requirement • Low-income housing programs • Age-specific housing • Options of designs to accommodate single living, multigenerational, and assisted living housing • Universal design features like single level, ramps, wide doorways, etc.	Safety (accidents), greater independence and wellbeing
Accessible buildings (universal design)	• Elevators, escalators, ramps • Wide doorways and passageways • Suitable stairs with railings • Non-slip flooring • Rest areas and public toilets with handicap access • Adequate signage	Safety (accidents), greater independence and wellbeing

5. Hunter et al. 2011, 357-359, 360, 361, 363; Parra 2010, 1073; WHO 2007, 12-17, 20-27, 30-34, 44, 58-59, 71

Table 5. Environmental features which support healthy aging.[5] (continued)

Environmental Features	Intervention Examples	Potential Health Impact
Safety from crime (real or perceived), lighting, etc.	• Surveillance cameras • Self-organized groups to establish safety in numbers • Lighting	Safety (crime), physical activity (walking), mental health
Adequate transportation (personal, public, or specialized transport options)	• Driving conditions: enhancements to highway design (wayfinding), lower speed routes, connectivity of streets, reduced intersection widths, complete street design • Transportation options: taxis, community transport, para-transit options; available, safe, affordable, and reliable public transportation (vehicles and stations) with handicapped accessibility and seating, adequate parking (handicapped accessible)	Independence, wellbeing, social and community life, mental health
Density of parks, greenspace (perceived as safe)	• Plenty of available parks and greenspace • Small, quiet areas • Special gardens or areas just for older people • Park maintenance	Physical activity (walking), mental health, "good" reported health status
Pleasant and clean environment	• Noise ordinances • Sanitation, street cleaning, and garbage collection • Adequate public toilets	Mental health, physical activity, wellbeing
Public events that are accessible, affordable, and appealing	• Located and scheduled conveniently to older people • Open admission, affordable • Diversity of events and activities	Social capital, wellbeing, mental health, supports cognitive, mental and social activity
Volunteering, employment and training options	• Volunteer databases • Policy and legislation to prevent discrimination • Part-time, seasonal employment options • Employment programs for older workers • Accessible workplaces • Civic advisory boards include older people	Social capital, wellbeing, mental health, supports cognitive, mental, and social activity
Community and health services	• Geographically accessible health services • Retirement and nursing homes integrated into larger community • Affordable home care services • Emergency planning for older people	Health prevention and maintenance

Sources

Adler, Nancy E. and Joan M. Ostrove. 1999. "Socioeconomic status and health: what we know and what we don't." *Annals of the New York Academy of Sciences* 896(1): 3–15.

Birren, James E. and K. Warner Schaie. 2011. *Handbook of the Psychology of Aging.* Burlington, MA: Elsevier Academic Press.

Centers for Disease Control and Prevention and National Association of Chronic Disease Directors. 2008. "The State of Mental Health and Aging in America Issue Brief 1: What Do the Data Tell Us?" Atlanta, GA: National Association of Chronic Disease Directors.

Centers for Disease Control and Prevention. 2013. *The State of Aging and Health in America 2013.* Atlanta, GA.

Farley, Alistair, Ella McLafferty, and Charles Hendry. 2011. *The Physiological Effects of Ageing: Implications for Nursing Practice.* Oxford, UK: Wiley-Blackwell.

Federal Interagency Forum on Aging Related Statistics (FORUM). June 2012. *Older Americans 2012: Key Indicators of Wellbeing. Federal Interagency Forum on Aging-Related Statistics.* Washington, DC: U.S. Government Printing Office. www.agingstats.gov.

Hunter, Rebecca H., Kathy Sykes, Sarah G. Lowman, Richard Duncan, William A Satariano, and Basia Belza. 2011. "Environmental and policy change to support healthy aging." *Journal of Aging and Social Policy* 23(4): 354–371.

Morgan, Leslie and Suzanne Kunkel. 2001. *Aging: The Social Context.* Thousand Oaks, CA: Pine Forge Press

National Institute on Aging, National Institutes of Health, U.S. Department of Health and Human Services, and U.S. Department of State. 2007. "Why Population Aging Matters: A Global Perspective." Publication Number 07-6134.

National Institute on Aging, National Institutes of Health, U.S. Department of Health and Human Services, and the World Health Organization. 2011. "Global Health and Aging." NH Publication no. 11-7737.

National Institute on Aging and National Institute of Health. 2009 (Reprinted 2013). "Exercise and Physical Activity: Your Everyday Guide from the National Institute on Aging at NIH." Publication No. 09-4258.

National Institute on Aging, National Institutes of Health, and U.S. Department of Health and Human Services. 2009, Updated 2012. "AgePage: Alchohol Use in Older People."

OECD. 2013. *Health at a Glance 2013: OECD Indicators.* OECD Publishing. http://dx.doi.org/10.1787/health_glance-2013-en.

Parra, Diana C., Luis F. Gomez, Olga L. Sarmiento, David Buchner, Ross Brownson, Thomas Schimd, Viviola Gomez, and Felipe Lobelo. 2010. "Perceived and objective neighborhood environmental attributes and health related quality of life among the elderly in Bogota, Colombia." *Social Science and Medicine* 70: 1070–1076.

Resnick, Barbara, Lisa P. Gwyther, Karen A. Roberto. 2011. *Resilience in Aging: Concepts, Research, and Outcomes.* London: Springer.

Rowe, John W., and Robert L. Kahn. 1987. "Human Aging: Usual and Successful." *Science,* 237(4811): 143–149.

Taylor, Albert W., and Michel J. Johnson. 2007. *Physiology of Exercise and Health Aging.* Champaign, IL: Human Kinetics.

Timiras, Paola S. 2007. *Physiological Basis of Aging and Geriatrics,* Fourth Edition. New York, New York: Informa Healthcare USA, Inc.

United Nations Department of Economic and Social Affairs/Population Division. 2011. *World Population Prospects: The 2010, Volume 1: Comprehensive Tables.* New York: United Nations.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. 2010. *Dietary Guidelines for Americans, 2010. 7th Edition,* Washington, DC: U.S. Government Printing Office.

Wen, Ming and Danan Gu. 2011. "The Effects of Childhood, Adult, and Community Socioeconomic Conditions on Health and Mortality among Older Adults in China." *Demography* 48: 153–181.

Wu, Fan, Yanfei Guo, Paul Kowal, Yong Jiang, Min Yu, Xinjian Li, Yang Zheng, and Jiying Xu. 2013. "Prevalence of Major Chronic Conditions among Older Chinese Adults: The Study on Global AGEing and Adult Health (SAGE) Wave 1." *PLoS ONE* 8(9): e74176.

Whitbourne, Susan Krauss. 2002. *The Aging Individual: Physical and Psychological Perspectives.* New York, New York: Springer Publishing Company, Inc.

World Health Organization. 2007. *Global Age-friendly Cities: A Guide.* Geneva: WHO.

World Health Organization. 2010. *World Health Organization's Global Status Report on Noncommunicable Diseases Executive Summary.* Geneva: WHO.

World Health Organization. 2013. "Mental health and older adults." Fact sheet Nº381. Geneva: WHO. http://www.who.int/mediacentre/factsheets/fs381/en/. Accessed June 18, 2014.