Curr Psychiatry Rep (2014) 16:476
DOI 10.1007/s11920-014-0476-6

GERIATRIC DISORDERS (W MCDONALD, SECTION EDITOR)

Strategies for Successful Aging: A Research Update

Alexandrea L. Harmell · Dilip Jeste · Colin Depp

Published online: 19 August 2014

Abstract Population aging is an enormous public health issue and there is clear need for strategies to maximize opportunities for successful aging. Many psychiatric illnesses are increasingly thought to be associated with accelerated aging, therefore emerging data on individual and policy level interventions that alter typical aging trajectories are relevant to mental health practitioners. Although the determinants and definition of successful aging remain controversial, increasing data indicate that psychiatric illnesses directly impact biological aging trajectories and diminish lifestyle, psychological, and socio-environmental factors that seem to reduce risk of morbidity and mortality. Many interventions designed to enhance the normal course of aging may be adjunctive approaches to management of psychiatric illnesses. We highlight recent data on interventions seeking to promote healthy aging, such as cognitive remediation, physical activity, nutrition, and complementary and alternative treatments for older people with and without psychiatric illnesses.

Keywords Geriatric psychiatry · Cognition · Psychiatric disorders · Aging · Interventions · Health behaviors

This article is part of the Topical Collection on *Geriatric Disorders*

D. Jeste · C. Depp (✉)
Department of Psychiatry, University of California, San Diego, 9500 Gilman Dr, La Jolla, CA 92093-0664, USA
e-mail: cdepp@ucsd.edu

D. Jeste · C. Depp
Sam and Rose Stein Institute for Research Aging, UC San Diego, La Jolla, CA 92093-0664, USA

C. Depp
VA San Diego Healthcare System, San Diego, CA, USA

A. L. Harmell
SDSU/UCSD Joint Doctoral Program in Clinical Psychology, San Diego, CA, USA

Introduction

While much of the focus of research on aging has been on the determinants of mortality, illness, and disability, a growing body of work has begun to assess modifiers and interventions to improve upon the usual course of aging. More recently, research has delivered promising data on strategies that might alter the course of typical aging among people with psychiatric disorders, which seem to be associated with accelerated aging. It is important to note that there is yet no consensus definition of successful aging. As such, there is no standard outcome upon which the effectiveness of successful aging strategies could be uniformly gauged. Several recent reviews have outlined the various operationalized definitions of successful aging [1•, 2, 3], with variation both in the components of the definitions (e.g, freedom from disability, social engagement), the nature of their measurement (e.g, subjective, objective) and criteria upon which "success" is determined (e.g, normative, ipsative).

With the lack of a consensus on a definition of successful aging in mind, we define a "successful aging strategy" as a potentially modifiable characteristic or intervention that is intended to enhance the functioning of older adults who could be characterized as aging normally. We focus on recent research on established interventions, such as physical activity, cognitive training, and nutrition/dietary interventions. We also discuss earlier stage work in emerging interventions, such as complementary and alternative therapies, social interventions, and those focused on enhancing positive psychological traits.

Relevance to Psychiatry

There is accumulating evidence for "accelerated aging" in psychiatric disorders [4, 5]. Population-based estimates of the average years of life lost to diseases such as bipolar

disorder or schizophrenia are between one and two decades [6]. Although some of this increased mortality is due to suicide, the bulk of lost years of life appears to be attributable to the higher rate of age-associated medical comorbidities, which occur at an earlier age than in the general population. In addition, emerging biomarkers that may enable tracking of biological aging, such as the telomere, have been studied in schizophrenia, depression, and other psychiatric illnesses [7, 8]; there is some indication that these biomarkers indicate a faster rate of biological aging among people with psychiatric illnesses. Psychiatric disorders may have both direct impact on systems that are implicated in aging biology (e.g., immune system) and indirect effects through unhealthy health behaviors (e.g., smoking, sedentary lifestyle) and lower participation in activities that are associated with better functioning in aging (e.g., social and cognitive stimulation). Formal models of progressive lifespan courses of illness have been proposed, such as "neuroprogression" in bipolar disorder or accelerated aging in HIV [9]; these models integrate knowledge about disease course and brain aging. Thus, there is growing recognition of the overlap between the modifiers of long-term outcome in aging and in psychiatric illnesses. We review individual strategies, keeping in mind their relevance to psychiatric conditions, next.

Physical Activity

Physical activity contributes to reducing the risk of several diseases associated with aging including cardiovascular disease, metabolic disease, and osteoarthritis. According to the American College of Sports Medicine guidelines, at least 150 minutes of moderate weekly physical activity (30 minutes, 5 days/week) is recommended to obtain health benefits [10]. In a review by Brown, Peiffer, and Martins (2013) [11], the authors describe several epidemiological studies demonstrating a relationship between higher levels of physical activity and lower levels of cognitive decline and/or enhanced cognitive functioning in domains such as verbal memory, executive functioning, attention, and global cognition. One study of 1324 subjects reported that moderate (as opposed to light or vigorous) exercise in mid-life and late-life was associated with a reduced risk of mild cognitive impairment [12]. Other studies have used more objective measures of physical activity such as actigraph accelerometers (Barnes et al. 2008) or respiratory fitness estimates as assessed by having participants walk on a treadmill and measuring peak oxygen consumption [13]. In these studies, individuals with the highest daytime movement performed better on cognitive functioning tests and individuals with the lowest baseline cardio-respiratory fitness performed the worst on all cognitive tests.

Several randomized controlled studies have attempted to increase physical activity in older adults with encouraging results. For example, Erickson et al. (2011) [14] compared sedentary nondemented older adults participating in a walking program with a group who did only stretching exercises. The walking group demonstrated many positive outcomes including improved cardiovascular fitness as evidenced by a 7.8 % increase in VO_2 max, improvement in spatial memory, a 2 % increase in hippocampal volume, and an increase in brain-derived neurotrophic factor (BDNF). In a large 24 week intervention program, 150 individuals aged 50 and over with subjective memory complaints and/or mild cognitive impairment were randomized to either an exercise intervention program which consisted of 150 minutes of moderate exercises three days a week over 18 months or a usual care control group. At the completion of the study, the intervention group improved in cognitive function significantly on the Alzheimer Disease Assessment Scale [15].

A number of studies have examined physical activity interventions in samples of patients with psychiatric illnesses. In a recent meta-analysis of 39 randomized controlled trials across various types of physical activity in people with mental illness, reductions in depression and symptoms of schizophrenia were reported along with improvements in aerobic capacity and quality of life [16]. Other studies have reported similar positive effects of physical activity in patients with depression [17], anxiety [18], PTSD [19], and schizophrenia [20].

Cognitive Stimulation/Remediation

The evidence that neuroplasticity is preserved into later life has paved the way for cognitive interventions to attempt to slow or delay the onset of cognitive decline. It has been proposed that cognitively-stimulating activities may delay future decline. Consequently, many older adults are being encouraged to independently engage in daily cognitive stimulating activities such as reading, practicing crossword puzzles, and playing board/card games. There is some evidence to suggest that frequent engagement in cognitively stimulating activities for at least six hours per week may reduce the risk of incident dementia [21]. Research has further suggested that participating in these activities may be effective in altering the rate of cognitive declined in persons diagnosed with dementia [22]. Teasing apart causal effects, as well as which and how frequent/intense cognitive activities must be remains to be established.

In a systematic review of 21 cognitive intervention studies ranging from 13 to 242 healthy older adults (mean age 63.5 to 80.2 years), it was concluded that cognitive interventions can be effective in improving various aspects of objective cognitive functioning including memory performance, executive functioning, processing speed, attention, fluid intelligence, and subjective cognitive performance. These interventions varied in design with some addressing working memory by

computerized training, teaching memory strategies, improving learning abilities by training metacognitive skills, or improving attention by promoting selective attention tasks [23•]. Important questions for the future are whether cognitive interventions generalize to improvements in activities of everyday living (e.g., driving, paying bills, medication management) and whether the mechanism of these interventions is by structural brain changes or alterations in neural activity.

There has been recent interest in cognitive rehabilitation in patients with psychiatric illness, with a particular focus on technology-assisted cognitive training. For example, in patients with schizophrenia, tablets and computerized cognitive training programs have shown some success in improving neuropsychological functioning [24, 25]. Moreover, computerized cognitive training three times per week for eight consecutive weeks in patients with unipolar depression and bipolar patients in the depressive phase of the disorder has been shown to result in fewer cognitive failures, fewer dysexecutive incidents, and improved neuropsychological scores [26].

Diet/Nutrition

Dietary and nutritional interventions are among the most studied strategies in animals for extension of the lifespan and prevention of morbidity. Caloric restriction, for example, has been associated with substantially enhanced longevity in rodents, and to a lesser extent in primates [27]. Clinical trials in humans have also shown promise [28]. There is some evidence that obesity is associated with heightened risk for dementia when individuals are followed longitudinally. A recent study found that obesity was related to cognitive impairment in bipolar disorder and schizophrenia [29].

However, intersection of more specific dietary interventions with cognitive and emotional health has received comparatively less research than cognitive or physical activity interventions described above. A number of large clinical trials evaluating dietary supplements, such as Gingko Biloba [30] and vitamin D [29], have not shown significant benefit for cognition. In contrast to isolated supplements, dietary patterns, in particular the Mediterranean diet, have shown associations with reduced rates of depression [31] and lower risk for cognitive decline [32]. Adherence to the Mediterranean diet includes high consumption of fruit and vegetables, high ratio of polyunsaturated to saturated fats and low glycemic load. Frontiers in the understanding of diet and aging include research on the relationship between genetic risk and nutrition [33], as well as the intersection of the gut microbiome with mood and anxiety symptoms [34].

Complementary and Alternative Medicine

Yoga and meditation are potentially impactful interventions since they can be tailored to ability levels, addressing the needs of those with limited mobility as well as those seeking more challenging physical activity. Although yoga is considered an ancient practice, the research exploring its impact on health outcomes is relatively recent. In one observational, cross-sectional study surveying a sample of 211 women yoga practitioners aged 45-80 years, increased yoga experience predicted higher levels of positive psychological attitudes, mental mastery, subjective vitality, and transcendence (i.e., feelings of oneness with surroundings and unity with the community). The authors found a dose-response effect in that regular and more frequent yoga predicted the highest levels of psychological well-being [35].

Another promising area where yoga interventions seem to be of benefit is in improving sleep. In a study of older men and women (aged≥60) with insomnia, a 12 week, twice weekly intervention group (n=59) including yoga postures, meditative yoga, and daily practice of meditative yoga showed significant improvements in several areas including but not limited to overall sleep quality, fatigue, general well-being, depression, anxiety, and stress relative to a control group [36].

Meditation is also becoming increasingly popular and has shown some associations with reduced age-related cognitive decline. For example, in a cross-sectional study of older adults comparing the cognitive performance of long-term meditators (>10 years, n=20) and non-meditators (n=20), long-term meditators performed significantly better on measures of attention, processing speed, the ability to shift attention, and on tests using distracting factors [37]. Furthermore, in a review paper exploring the effects of meditation on attention, memory, executive functions, and other cognitive measures in older adults and adults suffering from neurodegenerative diseases, meditation techniques revealed a positive effect in several areas including attention, memory, verbal fluency, and cognitive flexibility [38].

Complementary and alternative treatments may also have a role in treating older adults with psychiatric disorders. For example, yoga interventions have shown some promise in helping older adults with late-life depression [39]. Furthermore, a meta-analysis including studies with patients with schizophrenia, anxiety, depression, and PTSD concluded that yoga-based interventions have a statistically significant effect as an adjunct treatment for major psychiatric disorders [40]. Additional studies have further corroborated the positive benefits of meditation in patients with schizophrenia [41], several types of anxiety disorders [42], and depression [43].

Social Engagement

The association between social engagement and health and well-being has been well-documented throughout the lifespan. In many ways, increased age can be considered a risk factor for social withdrawal, as a result of physical decline and retirement. A recent meta-analysis found that social engagement was as strong a protective factor for health as many other established risk factors [44]. Social engagement can be defined as making social and emotional connections with other people such as family/friends and the community (e.g., being an active participant in clubs, religious organizations, volunteer work). In 364 younger (21-59 years), older (60-89 years), and oldest-old (90-97 years) adults participating in the multidisciplinary Louisiana Health Aging Study, it was found that social engagement (indexed by hours spent outside of the home) was significantly associated with self-reported health as assessed by SF-36 physical component scores and a measure of objective health status [45]. Besides the number of relationships and amount of time spent outside of the home, the complexity of one's personal network or the different types of relationships one has acquired has also been deemed as important. In a sample of 2959 Dutch participants aged 54 to 85 assessed at baseline and six times over a 20-year period, older adults reporting a greater number of relationship types in their social network showed higher global cognitive functioning (as assessed by the Mini-Mental State Exam). Moreover, reductions in network complexity were associated with a decline in cognitive functioning [46]. The authors postulate that being embedded in a variety of different types of relationships exposes an individual to a wider range of activities than those embedded in more homogenous networks.

Several intervention studies have aimed at reducing social isolation in later life by focusing on improving social skills, enhancing social support, increasing opportunities for social contact, and addressing maladaptive social cognition [47]. One such intervention program is The Seniors Centre Without Walls, which provides free educational programming to older adults via telephone to try to address the social needs of older adults who are restricted due to physical, financial, or geographical reasons. Individuals are given a set time to be on the phone with a session leader as well as other participants of the program. Participants of this program reported making friends on the phone and feeling more connected to the community. These participants also said that the program made them feel less lonely, happier, and helped them cope better with depression [48].

In psychiatric disorders, a large number of studies show that social withdrawal, loneliness, and lack of support exacerbate or contribute to psychiatric symptomatology. Most of the focus in psychiatric disorders has been on targeting deficits in skills that arise from the illnesses. There are longstanding data on social skills training in patients with schizophrenia, with evidence for improvements in social isolation, social discomfort, and quality of life post-treatment [49]. Social cognition training is another avenue to enhancing social functioning in schizophrenia [50].

Positive Psychological Traits

When older adults are asked about what defines successful aging in qualitative studies, a recurring theme is personality variables, such as resilience, adaptability and optimism. Adaptation to disability and losses is at the core of several major theories of successful aging [51]. In recent work, higher scores on a self-reported measure of resilience were associated with a mitigation of the impact of depressive symptoms on subjective successful aging [52••]. There is emerging neurobiology of resilience that maps onto work in post-traumatic stress. Similar to resilience, there are striking associations between optimism at mid-life and longevity [53] that remain even after multiple covariates are accounted for. There appears to be a complex genetic basis for these traits and both are heritable, with a large proportion of environmental variation [54]. It is unclear how best to promote resilience and optimism, particularly in the specific context of age related changes, yet there are a number exciting biological and non-pharacologic interventions that are in early phases of development [55•]. Less well understood are psychological traits that are specifically associated with aging, such as wisdom [56] or those that extend to the social domain, such as altruism and compassion [9]. Each is associated with positive psychological adjustment in older age samples, and interventions such as intergenerational volunteering [57] that taps into these traits appears to have a tangible impact on cognitive and emotional health in older adults as well as the communities they serve.

Conclusions

A number of themes are apparent in integrating the literature across the potential successful aging strategies. One is that attaining precision around the type, frequency, and dose of each of these strategies is highly challenging and perhaps impossible to estimate. For example, it will likely never be known how frequently and at what level of difficulty one should perform crossword puzzles to achieve an effect. Moreover, variation in the dose and type of intervention intersects with the individual, in particularly their current capacity, vulnerability and subsequent adherence to the intervention. As such, there is increasing attention to systemic and ecological approaches to successful aging strategies. For example, dietary patterns are examined rather than specific nutrients, and neighborhoods are examined with regard to

their support of healthy eating and exercise [58•]. Even broader still, policy efforts include alterations at the community and social policy level that may increase the likelihood of successful aging [59].

A primary implication for mental health practitioners is that it may be best to view depression and other psychiatric illnesses as having a direct biological impact on the phenotypes associated with successful aging, as well as an indirect and powerful reduction of access to successful aging through the diminished engagement in lifestyle and social behaviors that seem to lengthen the health span. Aggressive recognition and treatment of illnesses like depression may have salutary effects on aging trajectories that extend well beyond psychiatric symptoms. Interventions studied in healthy older adults such as dietary change or physical, social, and cognitive engagement could provide new avenues to diminishing the impact of psychiatric disorders on the aging process.

Compliance with Ethics Guidelines

Conflict of Interest Alexandrea L. Harmell, Dilip Jeste and Colin Depp declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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