

# Occupational Therapy in Chronic Progressive Disorders: Enhancing Function and Modifying Disease

## MeSH TERMS

- chronic disease
- human activities
- motor activity
- occupational therapy

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A major goal of occupational therapy is to improve health and participation of clients through engagement in occupation. According to the American Occupational Therapy Association (AOTA; 2007), occupation includes engaging in activities of daily living, instrumental activities of daily living, education, work, play, leisure, and social participation.

AOTA's strategic planning initiative for the *Centennial Vision* in 2017 resulted in the following shared vision statement: "We envision that occupational therapy is a powerful, widely recognized, science-driven, and evidence-based profession with a globally connected and diverse workforce meeting society's occupational needs" (AOTA, 2007, p. 613). Occupational therapy researchers have engaged with two elements of the vision statement in particular, namely, helping occupational therapy develop into (1) a science-driven and (2) an evidence-based profession. The efforts, partially reflected in articles published in the *American Journal of Occupational Therapy*, have begun to clarify outcome measures that are valid, reliable, sensitive, and easy to use in clinical settings. The efforts are also beginning to clarify the effectiveness of occupational therapy in chronic disorders.

Implicit in the *Centennial Vision* is that occupational therapy must evolve with changes in medicine and health science. In this editorial, I present some recent advances in health science and

neuroscience that have considerable implications for occupational therapy research and practice.

## Physical Activity and Mortality in Chronic Disorders

Recently the *British Medical Journal* published an important meta-analytic study comparing the effectiveness of exercise and drug interventions on mortality outcomes in chronic disorders (Naci & Loannidis, 2013). The study examined 305 published randomized controlled trials (total of 339,274 participants), of which 57 trials (total of 14,716 participants) included physical activity as an intervention. No statistically significant differences in mortality outcomes were found when comparing physical activity and drug intervention in prevention of coronary heart disease and prediabetes. Note that physical activity was more effective than drug intervention for individuals who had a stroke.

This meta-analysis is important for several reasons. It is the first study to examine the impact of physical activity on mortality, which traditionally has not received the same attention as medical or surgical interventions. Second, level of physical activity is a modifiable factor, despite the fact that population-level physical activity is reported to be low. The American College of Sports Medicine (ACSM) has

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recommended at least 30 min of moderate-intensity activity daily (Nelson et al., 2007). In the United States, less than 50% of adults meet the guidelines for physical activity (National Center for Health Statistics [NCHS], 2013).

## Physical Activity as a Disease Modifier

Over the past few years, physical activity has been recognized for its importance as a disease modifier for chronic diseases, such as Alzheimer's disease (AD). In AD and in its prodrome, mild cognitive impairment, there is evidence of loss of neuronal volume in the hippocampus (which is implicated in memory) and the prefrontal cortex (which is important for executive function; Erikson, Weinstein, & Lopez, 2012). Recent work has revealed a relationship between engagement in physical activity and reduced incidence of developing dementia (Buchman et al., 2012; Sattler, Erickson, Toro, & Schröder, 2011). Although the greatest reduction in dementia risk occurred in people who were physically active as young adults, reduction of dementia risk was also seen in older adults who became physically active later in life (Middleton, Barnes, Lui, & Yaffe, 2010). Physical activity was also reported to improve cognitive function and delay the onset of AD in people with mild cognitive impairment (Lautenschlager et al., 2008). Thus, it appears that engaging in physical activity has benefits in reducing dementia risk irrespective of the age at which physical activity begins.

The beneficial effects of physical activity are partially mediated through modification in the size of brain areas that typically diminish with aging, such as the hippocampus (Bugg & Head, 2011). Physical activity preserves the volume of the prefrontal cortex in older adults (Weinstein et al., 2012). Thus, it appears that physical activity provides protective benefits by altering brain physiology.

There is also emerging evidence for the benefits of exercise as a disease modification agent in Parkinson's disease (PD; Petzinger et al., 2011). PD is a chronic disorder characterized by neuronal loss of dopami-

nergic cells in the substantia nigra (pars compacta), a nucleus of the basal ganglia (Kandel, Schwartz, Jessell, Seigelbaum, & Hudspeth, 2013). Loss of dopaminergic cells leads to symptoms of bradykinesia, rigidity, resting tremor, and gait and balance impairments, which affect functional independence. Using a mouse model of PD, a recent study demonstrated that intensive treadmill exercise improved motor performance by modifying dopamine transmission (Petzinger et al., 2007).

Engagement in physical activity not only preserves volume of certain brain regions but also has the potential to modify neural transmission. According to researchers, physical activity needs to involve skill learning, with high level of complexity, intensity, and repetition (Petzinger et al., 2011). All of these factors are typically evaluated and manipulated by occupational therapists during activity analysis.

## Implications for Occupational Therapy

Even with all the benefits of physical activity, it appears that changing behavior to include higher levels of physical activity is harder than one might expect, given that less than 50% of adults engage in recommended levels of activity (NCHS, 2013). According to Marteau, Hollands, and Fletcher (2012), people typically engage in two categories of behavior: reflective and automatic. They proposed that long-term behavioral change is possible only if activity becomes part of automatic routine behavior.

Evidence for this proposal can be seen in a study that used an animal model of Huntington's disease (HD), a fatal, degenerative disorder that leads to a loss of neurons in the striatum, which are part of the basal ganglia. The disease is characterized by motor, cognitive, and behavioral impairments that lead to functional dependence and reduction in quality of life. As with PD, HD has no cure, and pharmacological intervention only provides symptomatic relief. van Dellen, Blakemore, Deacon, York, and Hannan (2000) randomized mice with the HD gene mutation to one of two interventions: occupational

therapy (which included environmental enrichment in the form of engagement in social play) and control (which included solitary activity without enrichment). In the enriched mice, volume of the striatum was preserved, and onset of motor impairments was delayed, leading van Dellen et al. to suggest that occupational therapy based on the principles of environmental enrichment may have a similar effect in humans.

Studies led by occupational therapists have shown that occupational therapy consisting of lifestyle intervention can help prevent the loss of function typically seen in aging (Clark et al., 2001, 1997, 2012). The Clark et al. studies have demonstrated that embedding occupational therapy interventions in the daily routines of independently living older adults has a tremendous benefit in improving independence and delaying or preventing loss of function.

## Conclusion

Converging lines of evidence suggest that engagement in functional activity as part of our daily routine may not only improve function but also have important disease-modifying benefits. Given the expertise that occupational therapists have in using functional goal-oriented occupations, occupational therapists have an emerging role in disease modification and prevention. ▲

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