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A Review of Literature: The Mental Health Benefits of Walking and Bicycling

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INTRODUCTION

The number of Americans who are overweight or obese has focused attention on the health benefits of physical activity in recent years. The U.S. Surgeon General recommends at least 30 minutes of moderate activity each day to foster weight loss, reduce the risk of chronic disease and lower mortality rates (Powell, Spain et al. 1986; Slattery, Jacobs et al. 1989; Folsom, Prineas et al. 1990; Helmrich, Ragland et al. 1991; Kono, Shinchi et al. 1991; Leon and Connett 1991; Paffenbarger, Hyde et al. 1993; Paffenbarger and Leung 1994; Blair, Kohl et al. 1995; Giovannucci, Ascherio et al. 1995). Walking is often recommended for individuals to obtain regular physical activity because it is widely accessible, readily adopted and is rarely associated with injury (Trust for America's Health 2007). At the same time, the popular press has touted walking as a way to improve mental health and calming the mind by relieving stress, anxiety and even depression.

The original intent of this white paper was to review the literature on the mental health benefits of walking. However, as we began our database search, it became clear that few published studies have documented specific mental health outcomes from walking, although many more examined relationships between levels of physical activity and mental health symptoms such as anxiety and depression. Some, such as Nelson et al. (2007) attempted to translate the subjects' level and amount of physical activity into walking speed and frequency by rate of energy expenditure. Others, such as Carmack et al. (1999) examined the effect of leisure physical activity (which could include walking) on the physical symptoms and anxiety associated with minor stress. We also found a few studies that examined the link between walking and mental performance or cognitive functioning. A study by Kramer et al. (1999) found that subjects assigned to an aerobic walking program (as opposed to anaerobic stretching and toning) showed substantial improvements in mental functions, such as the speed at which they could switch between tasks.

However, since walking – whether for recreation or transportation -- is considered an accessible means of gaining moderate physical activity, we reasoned that research documenting the mental health benefits of physical activity could

reasonably be applied to walking. Given the breadth of the topic, we limited our search to mental health conditions that appeared to be most relevant to walking as physical activity in the popular and academic literature: mood disorders, such as anxiety and depression, cognitive functioning and social capital or networks. We included the last topic because walking has been shown to increase social capital and social networks, which in turn may have a positive effect on mental well-being. Our intent is not to provide a comprehensive review of the research on the association between physical activity and mental health. Rather, our goal is to provide a brief summary of three areas of inquiry on physical activity and mental health that may lay the groundwork for more specific research into the relationship between walking as physical activity and positive mental health outcomes.

METHODS

Searches were performed using Medline, Web of Science and Google Scholar to compile articles on physical activity and its relationship with physical and mental health. Search terms related to the topic of physical activity and mental health included: physical activity, physical fitness, mental health, bicycling, walking, health-related quality of life, social capital. References cited in relevant articles were also reviewed.

Physical Activity and Mental Health Benefits

The interaction between physical activity and mental health has been investigated to a lesser degree, but research in the field of physical activity and mental health is substantial and growing. Just this year, the journal *Mental Health and Physical Activity* was established to promote additional interdisciplinary research in the field. The primary focus of mental health research has been on establishing the relationship between physical activity and specific mood disorders, such as depression and anxiety. Another common area of research focuses on the mental health impact of physical activity on specific populations, such as people with physical conditions (cancer, diabetes, surgery and the physically disabled) and the mental health and cognitive functioning of older adults. A less studied subset of research examines positive symptomologies, such as health-related

quality of life, self-esteem, positive affect, self-efficacy, and general mood.

Mood Disorders

Multiple studies have found a positive association between physical activity or exercise and the alleviation of symptoms of depression and anxiety (Ross and Hayes 1988; Stephens 1988). Blumenthal et al. (1999) demonstrated that an exercise training program is equally as effective as standard antidepressant therapy in reducing depression among those diagnosed with major depressive disorder. Importantly, the efficacy of exercise is similar for individuals with less severe forms of depression (Greist, Klein et al. 1979). Individuals treated with exercise intervention have also been found to have significantly lower relapse rates in follow-up evaluations than those treated with medication therapy only (Babyak, Blumenthal et al. 2000).

General Population

Engaging in regular physical activity may also prevent mental health disorders or at least indicate the risk of future onsets of depression. Farmer et al. (1988) recorded physical activity levels for 1,497 women without depressive symptoms and followed up with a self-reported mental health questionnaire eight years later. Results of the study revealed that the women reported little to no physical activity were twice as likely to have developed depressive symptoms as those who reported moderate to high levels of activity. Other longitudinal cohort studies have also demonstrated that levels of physical activity are significant predictors of the risk for future depressive symptoms. In another longitudinal cohort study, Camacho et al. (1991) evaluated the mental health and levels of activity of 6,928 men and women over nine years. Participants with minimal depressive symptoms at baseline were at significantly higher risk of developing depressive symptoms at the end of the study if they had reported low physical activity levels at baseline. Another study observed the physical activity and health of male Harvard graduates over 23-27 years. Baseline physical activity was recorded in hours of weekly exercise and an estimation of kilocalories burned per week. Kilocalories expended per week were inversely associated with risk of depression. Men who reported exercising three or more hours per week were 27% less likely

to report having been diagnosed with depression at the end of the study than men who reported no hours of weekly exercise (Paffenbarger and Leung 1994).

Research also suggests that there may be a certain level of exercise recommended in order to improve mental health. Both Camacho et al. (1991) and Paffenbarger, Lee, Leung (1994) reported that significant differences in the mental health of participants in follow-up studies only occurred between participants who reported highest levels of activity and lowest levels of activity. Thus, participants reporting low or moderate levels of physical activity at baseline had similar risk for developing depression at the end of the studies. Similar mental health outcomes of moderate levels of physical activity and low levels of activity indicates that the recommended level of physical activity is likely to be on the high end of the exercise spectrum,

It is important to note that an association between levels of physical activity and risk of mental health disorders does not necessarily indicate a causal relationship between the two. People with better mental health may be more likely to engage in physical activity than others (Center for Disease Control and Prevention 1999). The association may also be attributable to an external variable, such as chronic physical conditions. Chronic conditions, such as cancer or diabetes, may limit a person's ability or ease to engage in physical activity while independently impacting their mental health.

Older Adults

Research has demonstrated that physical activity can be effective in improving the mental health of older adults. Similar to the impact of physical activity on the mental health of general populations, for older adults in the Alameda County Study, Strawbridge et al. (2002) found high levels of physical activity were associated with low prevalence of baseline depression. This relationship also existed at the five year follow-up, where physical activity was a strong predictor of new onsets of depression. Blumenthal et al. (1999) demonstrated that exercise training programs among older adults are equally as effective as standard antidepressant therapy in reducing depression among older adults diagnosed

with major depressive disorder. After 16 weeks, mental health improvements were equivalent between participants treated with antidepressants and those in the aerobic exercise program.

The dose-response relationship of physical activity and mental health for older adults appears to be similar to results from general population cohort studies. Mummery, Schofield, Caperchione (2004) showed that when controlling for physical conditions, both high and moderate levels of exercise had significant salutary effects on mental health compared to sedentary behavior. Thus, among older adults, getting the recommended weekly level of physical activity (150 minutes per week) had a significant impact on mental health, but this impact was not significantly improved with increasing the levels of activity over the recommended amount. Given the prevalence of depressive symptoms and the low rate of diagnosis among older adults, the promotion of a moderate amount of physical activity could be an important tool in improving psychological well-being for all older adults.

Cognitive Functioning

A wealth of research has shown that improvements in cardiovascular fitness are associated with improvements in cognitive functioning, including motor function, memory, cognitive speed and attention (Kramer, Hahn et al. 1999; Colcombe and Kramer 2003; Angevaren, Aufdemkampe et al. 2008). Weuve et al. (2004) found that higher levels of regular, long-term physical activity were associated with better cognitive performance among older women. Cognition was tested for 18,766 women between the ages of 70-81 (throughout 1995-2001) and then reevaluated two years later through telephone assessments (throughout 1997-2003). Physical activity was measured by reported levels of exercise from a 1986 questionnaire. The results showed a strong association between baseline reports of physical activity and better cognitive functioning and less cognitive decline among the women 11-17 years later. The effect of physical activity on cognitive functions has been less studied among other age groups. A recent study examining the memory capacities of middle-aged adults found that leisure-time physical activity and

exercise was associated with better memory performance (Richards, Hardy et al. 2003).

Social Capital

A wealth of research has established a link between social capital and mental health. As early as the turn of the century, sociologist Emile Durkheim identified social isolation as a predictor of poorer mental health. In comparing suicide rates of Protestants and Catholics, Durkheim noted the stronger social ties among Catholics as evidence for their lower suicide rates. More recently, research in this field has grown significantly. A study by Barnett and Gotlib (1988) revealed that social isolation and perceptions of low levels of social support were associated with the occurrence of depressive symptoms. Numerous other studies have confirmed the association between social capital and mental health, although the causality between the two variables remains unclear. Certain personality traits, such as introversion, may result in weaker social networks as well as poorer psychological well-being (Barnett and Gotlib 1988). Depression itself may also weaken social ties, indicating a possible reverse relationship (Kawachi and Berkman 2001).

Despite these limitations, research in this field generally supports the idea that social capital has a positive impact on mental health. Cohen and Wills (1985) describe two common models used to possibly explain the influence of social networks on mental health: the main effect model and the stress-buffering model (Kawachi and Berkman 2001). The main effect model states that participation in social networks may result in health-promoting behaviors, such as exercise, through social influence or an increased sense of belonging or self-esteem. Increases in the physical activity prompted by social integration, in turn provides additional mental health benefits from exercise. The stress-buffering model suggests that strong social networks may also alleviate mental distress prompted by stressful events.

The directionality of the link between social capital and physical activity is less understood. Social capital may influence physical activity, while physical activity may also improve social capital. A recent study by Lindstrom et al. (2003) found that higher levels of social participation and

support were linked to leisure-time physical activity. The study also suggested that improvements in social capital may be influential in mitigating low activity levels due to socioeconomic factors such as low educational attainment, low income, and unemployment. Lund (2003) concluded that access to neighborhood destinations, such as retail and parks, were likely to stimulate pedestrian travel. The physical activity of walking in one's neighborhood was significantly associated with increased unplanned interactions and formations of social ties with neighbors. The correlation between social capital and socioeconomic factors make this area of research more difficult. Wen et al. (2007) identified both social and neighborhood level socioeconomic factors to be independently associated with physical activity. However, as Wen et al. (2007) note, there is a need for similar research which focuses on physical activity meant for transportation as well as leisure-time exercise, to see if these relationships hold. In addition, there is a limiting inconsistency within this field of research over the taxonomy of social capital, social participation, social environment, etc. (McNeill, Kreuter et al. 2006). Despite these limitations, the links between social capital, mental health and physical activity indicate that physical activities, such as walking or biking, may increase social capital which, in turn, has been demonstrated to have a salutary effect on mental health.

CONCLUSION

While we may intuitively know that a good walk can help clear heads and calm minds, studies on this topic are not abundant. Researchers in public health have made much progress in demonstrating the physical health benefits of activities such as walking, but there is significantly less evidence on the mental health benefits of walking.

REFERENCES

- Angevaren, M., G. Aufdemkampe, et al. (2008). "Physical activity and enhanced fitness to improve cognitive function in older people without known cognitive impairment." Cochrane Database of Systematic Reviews 2.
- Babyak, M., J. A. Blumenthal, et al. (2000). "Exercise treatment for major depression: maintenance of therapeutic benefit at 10 months." Psychosomatic Medicine 62: 633-638.
- Barnett, P. A. and I. H. Gotlib (1988). "Psychosocial functioning and depression: distinguishing among antecedents, concomitants, and consequences." Psychological Bulletin 104(1): 97-126.

Approximately 20.9 million American adults, or about 9.5 percent of the U.S. population age 18 and older in a given year, have a mood disorder (National Institute of Mental Health 2008). This includes major depression, mild depression, and bipolarity. Wang (2003) notes that depression is associated with a economic burden of 58 billion each year in the US alone. Most of the research we found originates in the medical and mental health communities and defines physical activity as expenditure of energy, not by a particular type of activity. However, the presence of a few studies that use walking as the physical activity that is measured against mental health benefits demonstrate that walking is a worthy mode by which to measure physical activity and has the potential to provide mental health benefits.

As stated at the outset, our goal in this review was to review three areas of inquiry on physical activity and mental health that hold promise for more specific studies on the relationship between walking as physical activity and positive mental health outcomes. Based on our brief review, it appears that future research would be well-served to focus on how specific physical activities, such as walking, can improve psychological well-being. Evidence that demonstrates how walking can relieve symptoms of depression and anxiety has the potential improve individual health and quality of life, while avoiding the cost of treating disorders such as depression and anxiety. Research on the associations between walking and enhanced social capital or social networks also appears promising. This will require more cross-disciplinary research involving social scientists and urban/transportation planners to understand the complex relationships between pedestrian travel, land uses, neighboring behaviors and social network development as they apply to psychological well-being.

- Blair, S. N., H. W. Kohl, 3rd, et al. (1995). "Changes in physical fitness and all-cause mortality. A prospective study of healthy and unhealthy men." Journal of the American Medical Association **273**: 1093-1098.
- Blumenthal, J. A., M. Babyak, et al. (1999). "Efforts of exercise training on older patients with major depression." Archives of Internal Medicine **159**.
- Camacho, T. C., R. E. Roberts, et al. (1991). "Physical activity and depression: evidence from the Alameda County study." American Journal of Epidemiology **134**.
- Carmack, C. L., E. Boudreaux, et al. (1999). "Aerobic fitness and leisure physical activity as moderators of the stress-illness relation." Annals of Behavioral Medicine **21**(3).
- Center for Disease Control and Prevention (1999). The effects of physical activity on health and disease. General's Report on Physical Activity & Health: 135-142.
- Cohen, S. and T. A. Wills (1985). "Stress, social support, and the buffering hypothesis." Psychological Bulletin **98**(2): 310-357.
- Colcombe, S. and A. F. Kramer (2003). "Fitness effects on the cognitive function of older adults: a meta-analytic study." Psychological Science **14**(2).
- Farmer, M. E., B. Z. Locke, et al. (1988). "Physical activity and depressive symptoms: the Nhanes I epidemiologic follow-up study." American Journal of Epidemiology **128**(8).
- Folsom, A. R., R. J. Prineas, et al. (1990). "Incidence of hypertension and stroke in relation to body fat distribution and other risk factors in older women." Stroke: The Journal of the American Heart Association **21**: 701-706.
- Giovannucci, E., A. Ascherio, et al. (1995). "Physical activity, obesity, and risk for colon cancer and adenoma in men." Annals of Internal Medicine **122**(5): 327-334.
- Greist, J. H., M. H. Klein, et al. (1979). "Running as treatment for depression." Comprehensive Psychiatry **20**(1): 41-54.
- Helmrich, S. P., D. R. Ragland, et al. (1991). "Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus." The New England Journal of Medicine **325**(3): 147-152.
- Kawachi, I. and L. F. Berkman (2001). "Social ties and mental health." Journal of Urban Health: Bulletin of the New York Academy of Medicine **78**(3).
- Kono, S., K. Shinchi, et al. (1991). "Physical activity, dietary habits and adenomatous polyps of the sigmoid colon." Journal of Clinical Epidemiology **44**(11): 1255.
- Kramer, A. F., S. Hahn, et al. (1999). "Ageing, fitness and neurocognitive function." Nature **400**.
- Leon, A. S. and J. Connett (1991). "Physical activity and 10.5 year mortality in the multiple risk factor intervention trial (MRFIT)." International Journal of Epidemiology **20**: 690-697.
- Lindstrom, M., M. Moghaddassi, et al. (2003). "Social capital and leisure time physical activity: a population based multilevel analysis in Malmo, Sweden." Journal of Epidemiol Community Health **57**: 23-28.
- Lund, H. (2003). "Testing the Claims of New Urbanism: Local Access, Pedestrian Travel, and Neighboring Behaviors." Journal of the American Planning Association **69**(4): 414-430.
- McNeill, L. H., M. W. Kreuter, et al. (2006). "Social environment and physical activity: a review of concepts and evidence." Social Science & Medicine **63**: 1011-1022.
- Mummery, K., G. Schofield, et al. (2004). "Physical activity dose-response effects on mental health status in older adults." Australian and New Zealand Journal of Public Health **28**(2).
- National Institute of Mental Health. (2008, June 26, 2008). "The numbers count: mental disorders in America." Retrieved 10/28/2008, 2008, from <http://www.nimh.nih.gov/health/publications/the-numbers-count-mental-disorders-in-america.shtml>.
- Nelson, D. B., M. D. Sammel, et al. (2007). "Effect of physical activity on menopausal symptoms among urban women." Medicine and Science in Sports and Exercise **40**(1).
- Paffenbarger, R. S., R. T. Hyde, et al. (1993). "The association of changes in physical-activity level and other lifestyle characteristics with mortality among men." The New England Journal of Medicine **328**: 538-545.
- Paffenbarger, R. S. and L. R. Leung (1994). "Physical activity and personal characteristics associated with depression and suicide in American college men." Acta Psychiatrica Scandinavica **Suppl. 377**: 16-22.
- Powell, K. E., K. G. Spain, et al. (1986). "The status of the 1990 objectives for physical fitness and exercise." Public Health Reports **101**(1).

- Richards, M., R. Hardy, et al. (2003). "Does active leisure protect cognition? Evidence from a national birth cohort." Social Science & Medicine **56**: 785-792.
- Ross, C. E. and D. Hayes (1988). "Exercise and psychologic well-being in the community." American Journal of Epidemiology **127**(4): 762-771.
- Slattery, M. L., D. R. Jacobs, et al. (1989). "Leisure time physical activity and coronary heart disease death. The US railroad study." Circulation **79**: 304-311.
- Stephens, T. (1988). "Physical activity and mental health in the United States and Canada: evidence from four population surveys." Prev Med **17**(1): 35-47.
- Strawbridge, W. J., S. Deleger, et al. (2002). "Physical activity reduces the risk of subsequent depression for older adults." American Journal of Epidemiology **156**: 328-334.
- Trust for America's Health (2007). *F as in fat: how obesity policies are failing in America*. J. Levi, E. Gadola and L. Segal. Washington, D.C., Trust for America's Health.
- Wang, P. S., G. Simon, et al. (2003). "The economic burden of depression and the cost-effectiveness of treatment." International Journal of Methods in Psychiatric Research **12**(1).
- Wen, M., C. R. Browning, et al. (2007). "Neighbourhood deprivation, social capital and regular exercise during adulthood: a multilevel study in Chicago." Urban Studies **44**(13): 2651-2671.
- Weuve, J., J. H. Kang, et al. (2004). "Physical activity, including walking, and cognitive function in older women." Journal of the American Medical Association **292**(12): 1454-1461.