Spring 5-15-2012

Golf: An Alternative Form of Physical Activity for an Aging Population

Lisa Richardson
Coastal Carolina University

Golf: An Alternative Form of Physical Activity for an Aging Population

2012

By

Lisa Richardson

Exercise and Sport Science

Submitted in Partial Fulfillment of the
Requirements for the Degree of Bachelor of Science
In the Honors Program at
Coastal Carolina University

May 2012

Every year, Myrtle Beach, South Carolina is a short and long-term destination for vacationers, golfers, and aging adults seeking retirement in the sun. For most of these senior citizens, the warmer year round climate makes an excellent foundation for a more relaxing and active independent lifestyle. Unfortunately, for many aging adults, the risk of losing this independence in life is a hard, but sometimes inevitable, idea to imagine. Sadly, in attempts to maintain the lifestyle they enjoy, many forget one easy and effective way to maintain both their health and hopefully their independence: daily physical activity. Physical inactivity is a huge cause of health related problems and possibly even death in all age groups, but as one ages the risk of developing health issues greatly increases, which places a higher importance on engaging in physical activity. Research shows that getting even the minimum recommended daily physical activity can promote healthier blood pressure, cholesterol levels, muscle function, mental health as well as help to decrease falls, and the risks of many diseases (Mazzeo et al., 2001; Hirsch et al., 2010; Weerdesteyn et al., 2006; Scherder et al., 2005) . In order to gain these benefits, adherence to a program and finding time for activity is a must, which can be an overwhelming and hard task to accomplish. Some factors are thought to help, such as using leisure and enjoyed activities as modalities for exercise, making the exercise into a group activity, and taking on the activity in shorter bouts (Hughes et al., 2008). It has been found that breaking an exercise into multiple ten minute bouts can provide the same results as a lump bout of the same time (American College of Sports Medicine, 2010). Though little research has been done on its effectiveness as a modality of physical activity, golf, due to the considerable amounts of walking involved and the social and leisure nature of the game, could be used as an option of physical activity for older adults. In this literature review, the primary goal is to investigate the literature regarding how much energy an older adult could predictably expend while walking a

round of golf and to see if this amount of expenditure could help aging adults meet their daily minimum physical activity recommendations, making golf a creative and useful possibility in exercise prescription. The review will also look at the total health benefits that could be received from using golf as a modality of exercise.

Methods

In order to conduct this literature review scholarly articles were found using the online databases, Academic Search Premier, Health Source- Consumer Edition, Health Source: Nursing/Academic Edition, MEDLINE, MLA Directory of Periodicals, Primary Search, PsycARTICLES, Psychology and Behavioral Sciences Collection, SocINDEX with Full Text, SPORTDiscus with Full Text, PsycINFO, and EBSCO Host through the Coastal Carolina University library website. To narrow and refine the search the keywords of, golf, elderly, walking, physical health, mental health, exercise adherence, physical activity, leisure activity, accelerometer, pedometer, health benefits, exercise recommendations, older adults, Alzheimer's Disease, cognition, cardiac, falls, balance, and exercise prescription were used. From these searches, articles from the fields of exercise science, health promotions, gerontology, and psychology were found and closely examined to better investigate the proposed research questions and overall thesis.

Effects of Physical Inactivity on Health

As we age, one of our most common fears is the loss of our independence, whether it be due to declines in physical health or in mental health. Although aging and some bodily declines are a part of life, participation in some physical activity on a daily basis can help one to prolong

these healthy, able years. Unfortunately according to the American College of Sports Medicine (ACSM), "older adults are the least physically active of all age groups" with only about 21% "engaging in regular activity" (American College of Sports Medicine, 2010). The ACSM finds that for an older adult population, deemed as 65 years or older: "overwhelming evidence exists that supports the benefits of physical activity in (a) slowing physiologic changes of aging that impair exercise capacity; (b) optimizing age-related changes in body composition; (c) promoting psychological and cognitive well-being; (d) managing chronic diseases; (e) reducing the risks of physical disability; and (f) increasing longevity" (American College of Sports Medicine, 2010). Physical inactivity for any age group is a huge risk factor for health related issues, including risk of cardiovascular disease, which is the leading cause of death in America, but as we age, the risks of staying inactive only increase (Centers for Disease Control and Prevention, 2012).

Physical Activity Recommendations and Adherence Levels

The 2010 Edition of ACSM's Guidelines for Exercise Testing and Prescription states that individuals 65 or greater should complete a minimum of 30 minutes of aerobic exercise daily at a moderate level of intensity in order to "promote and maintain health" while avoiding the risk of injury (American College of Sports Medicine, 2010). According to Mazzeo and Tanaka, caution must be used in prescribing vigorous or high intensity levels to elderly due to higher risks of injury or falls (Mazzeo et al., 2001). A low to moderate intensity workload has been proven to lower blood pressure and risk factors for heart disease, diabetes, and obesity while eliminating some risk associated with using a higher intensity work rate (Mazzeo et al., 2001). A study by Dear, Porter, Ready, found that older adults using a pull cart for nine holes of golf spent only 4% of the time, based on heart rate reserve, on the course at a very high intensity level, which according to Mazzeo et al. would make golf a possible effective, but safer workload for older

adults (Dear et al., 2010). One past study using various trial groups found that prescribing a higher frequency of exercise does not seem to harm the client's adherence to the exercise regime, while prescribing a higher intensity of the same exercise usually resulted in poor adherence (Perri et al., 2002). From these past studies, we can gather that finding the right balance of intensity for the age group is a very important part of prescribing activities and can ultimately help keep the client safe and adhering to the program suggested.

Aerobic activities are often used in exercise programs due to their wide range of benefits as well as their need for little to no equipment. Walking, though used by all age groups, is noted as "one of the most common and among the most practical leisure-time activities practiced by older adults" possibly due to the as the simplicity and low risk of the exercise (Weuve et al., 2004). Finding an activity that is enjoyable and works with one's schedule is important to help increase adherence and keep one motivated to come back the next day. Many people stop exercising because of the difficulty in monitoring their exercise. However, the use of pedometers and accelerometers has made this easier and helped lead to more activity being accomplished (Koizumi et al., 2009). Leisure time physical activity can be a very effective way to encourage exercise for older persons. This can include daily acts of living, such as house work, grocery shopping, climbing stairs, or other activities done for ten or more minutes that causes a moderate intensity level (Hughes et al., 2008). Studies have shown that "older individuals can make significant health improvements without improving aerobic power by participating in moderate activity for short 10-min bouts or even through routine daily activities" (Dear et al., 2010). Leisure time activity can often go unnoticed as a mode of physical activity because it can feel so light or enjoyable that one does not see it as work, such as golfing or gardening, but the benefits are still the same as other non-leisure physical activities. Research has

shown that "adults who in engage in leisure time physical activity (LTPA) maintain their functional independence and have fewer hospitalizations compared with adults who do not" (Hughes et al., 2008). Adherence to any exercise program can be extremely difficult, but finding the right balance of enjoyment and social interaction can help encourage one to get moving. In a study completed by Hughes, McDowell, and Brody, a correlation was found that participants who were married had a much higher rate of activity than those who were exercising alone (Hughes et al., 2008). However, the social benefits of exercise applied to the non-married groups as well, showing that exercising or completing any activity with a partner or friend could help to increase one's adherence to a program due to the social nature (Hughes et al., 2008). Another benefit of physical activity is increases in psychological well-being. According to a study completed by De Carvalho Bastone and Filho, an improvement in depression and cognition was seen after an exercise training program when done in a group setting (De Carvalho Bastone et al., 2004). Due to the popularity of walking, one could hypothesize that because the game of golf involves an estimated 4 to 5 miles of walking per 18 hole round, could easily add a fun and possibly more effective way to get daily physical activity (Krobriger et al., 2006). Golf, if it does meet the physical activity recommendations, could be an excellent addition to an exercise program due to its fun and group natures. Due to these aspects of the game, golf could be an excellent choice of activity for older persons.

Golf and Physical Activity

Golf, is an extremely popular leisure activity for all age groups, especially with in the Myrtle Beach area. "According to the National Golf Foundation, approximately 26 million Americans participate in golf" (Krobriger et al., 2006). Unfortunately golf has been considerably

understudied in the area of energy expenditure and effectiveness as a mode of physical activity to gain health benefits (Lyerly, 2009). The few studies which have examined golf as an effective modality of physical activity have "established that regular golf participation may enhance fitness" (Krobriger et al., 2006). Studies have looked at the amounts of walking and exertion used while playing a round, but even fewer have studied this information for an elderly population. "The walking associated with a game of golf has been reported to be of moderate intensity, long in duration, and an interval form of exercise that can maintain or increase aerobic capacity in older people" (Kras et al., 2002). In a 2002 study conducted by Kras and Larsen, the health benefits of walking carrying clubs and walking with a pull cart of clubs versus riding a round of nine holes of golf were examined. This study also looked into the differences in benefits when comparing various course landscapes. Twelve male subjects between the ages of 42 and 57 completed three treatments, walking carrying clubs, walking with a pull cart, and riding in and electric cart, on three courses, one flat and two hilly (Kras et al., 2002). To monitor the intensity of activity each subject was outfitted with a heart rate monitor which recorded any changes during the rounds (Kras et al. 2002). For each individual subject a target heart rate zone (THR), a common measure of activity intensity, was calculated. In this study, time spent at 40% or higher was considered at least moderate intensity, which is an intensity level shown to provide health benefits (Kras et al., 2002). Overall results showed that the landscape of a course provided very significant changes in intensity level. Hilly courses provided over 30% of total time spent in a moderate intensity during the round for both walking treatments while the flat course only provided 6% moderate activity while carrying clubs and 4.16% while pulling clubs (Kras et al., 2002). Results showed little difference between the two walking treatments, showing that using a pull cart rather than carrying clubs provides just as much benefit, which

could be a helpful factor for an older population. The energy costs of walking versus riding nine holes of golf resulted in a vast difference of time spent in a target heart rate zone. Of the three rounds, even the hilliest course only provided 4.25% of time spent working in a moderate zone when riding (Kras et al., 2002). Encouraging one to walk rather than ride could help to improve one's amounts of daily activity and provide them with health benefits. It is thought that "regular walking during golf may decrease the prevalence of risk factors associated with cardiovascular disease and increase functional mobility" (Dear et al., 2010).

Another recent study completed in 2010 by Dear, Porter, and Ready, investigated the amount of energy expended for older adults while mowing the lawn for forty minutes and golfing nine holes (Dear et al., 2010). For the study 18 men, with an average age of 71.2 years, were chosen and tested. In order to measure energy expenditure each subject was connected to a "portable metabolic system and global positioning system" while mowing and golfing to measure "oxygen consumption and walking velocity and distance" (Dear et al., 2010). Based on the amount of oxygen consumed when tested and individual pre-test results done on subjects a conversion is completed to express energy expended in kilocalories (kcal). Results showed that an elderly population golfing nine holes with a pull cart spent 64 minutes and 58% of their time working at a moderate or higher intensity, 4% which were in a very hard class, meeting the ACSM 1998 guidelines which required completing 30 minutes in a moderate or higher intensity based on percent heart rate reserve (%HRR) (Dear et al., 2010). The average energy expenditure from this study while walking nine holes of golf did not meet the up–to-date 2008 requirements due to a new expenditure rating method which uses percent oxygen consumption reserve (%VO_2R), but lawn mowing did, which could be another alternative physical activity to be researched (Dear et al., 2010). While golfing nine holes, averaging 122 minutes of activity,

subjects burned an average of 310 kcal (Dear et al., 2010). From these results, "less than 5 hr of golfing (approximately 285 min) is required to meet the ACSM guidelines (700–2,000 kcal/week)" which could possibly be met by playing only one full 18 hole round, depending on the course landscape and distance (Dear et al., 2010). This study also revealed that, in an elderly population, walking nine holes provided excellent walking distances, an average of 2.8 miles covered (Dear et al., 2010).

Within the scholar community, it is thought that engaging in at least 10,000 steps per day will successfully meet daily exercise requirements for most age groups, including older adults (Krobriger et al., 2006). In a 2006 study conducted by Krobriger, Smith, Hollman, and Smith, set to quantify the number of steps one takes when playing an 18 hole round of golf (Krobriger et al., 2006). To find this, researchers recruited 42 subjects, 12 males and 40 females, with an average age of 55 years to play three rounds of golf at three different courses while wearing an electronic pedometer (Krobriger et al., 2006). Results showed that subjects obtained a mean of 11, 948±1781 steps while walking a full 18 hole round of golf, with over 75% of all subjects meeting the 10,000 steps marker (Krobriger et al., 2006). Based on these findings, one could assume that most people could easily reach daily activity requirements by just walking a leisurely paced round of golf. In this study, the mean age of participants was 55 years, which according to ACSM does not constitute "older adult", but once at the age of 55 it is noted by the scholarly community within Exercise and Sport Science, including ACSM, that age is now a risk factor for cardiovascular disease (Krobriger et al., 2006; American College of Sports Medicine, 2010). Due to this factor the age population used in this study could be considered an older adult population due to the age related increased risk of heart disease.

Many of our simple "activities of daily living demand multidimensional complex tasks that require multi-joint coordination, lower limb muscle strength, and single-leg-stance control", in order to keep older adults independent being able to complete these acts of daily living is key (Tsang et al., 2010). Finding an exercise program or physical activity that benefits multiple components of these dynamic tasks can help to be more efficient and valuable to keeping a healthy lifestyle. Due to the unique features and landscapes of different golf courses "walking on the uneven golf fairway may enhance balance performance in single-leg stance" and help to "promote balance control in both static and perturbed single-leg stance, as well as multidimensional balance tests" creating a more stable and safe individual (Tsang et al., 2010). When planning physical activity for an older adult population focusing on balance can help prevent falls. According to a 2010 study by Tsang and Hui-Chan, "impaired postural control" was noted as a major factor of falls for older adults (Tsang et al., 2010). Due to the quick shifts in weight from two feet to one foot while swinging, "golf is a posture-challenging sport" which "demands sensory, motor, and dynamic postural control", making it an ideal method of physical activity and training for older adults (Tsang et al., 2010). Multiple systems must work well and in unison in order to complete and succeed in golf, which makes it not only good for physical health but also for mental and cognitive health. In the 2010 study completed by Tsang and Hui-Chan, static and dynamic balance control was compared between eleven older golfers and twelve non-golfing but healthy age matched controls. Single leg static balance was tested by measuring time stood on the subject's dominant leg with non-dominant off the floor and dynamic single leg balance was tested using a platform which swayed forward and backward causing changes to the center of body mass and measured in degrees of body sway (Tsang et al., 2010). Forward lunges were also completed using either the dominant or non-dominant leg and then measuring the

distance of the lunged foot from the stationary foot (Tsang et al., 2010). Results showed that the golfer group had a mean static single leg balance time of 28.1 seconds compared to the non-golfing control group who averaged 17.1 seconds (Tsang et al., 2010). The golf group also produced 3.5 degrees less body sway when balancing with the platform moving forward and 2.9 degrees less sway when moving backward (Tsang et al., 2010). These results showed that the golfing group had better static balance and stability standing longer on one leg, as well as balance and body sway control when placed on an uneven and changing surface. The golfing group also performed larger lunges with both legs when compared to those of the non-golfing group. In the assessments, "lunging is commonly used in the sports field to assess lower extremity flexibility, muscle strength, and balance" (Tsang et al., 2010). From the results of this study one could conclude that golfers compared to non-golfers have improved in these areas. "Falls resulting from perturbations caused by external displacements of the body's center of mass are not uncommon", this study showed that those older adults who were active golfers had better control of their body's sway when challenged with perturbations on a platform, "therefore, older golfers who are better able to maintain balance control in the face of perturbations could be expected to experience fewer falls. If so, golf could be a good balance-training approach for older adults" (Tsang et al., 2010).

Potential Mental Health Benefits of Using Golf as a Form of Physical Activity

In addition to finding f playing a round of golf could not only meet the ACSM criteria for daily physical activity requirements, another goal was to see what types of age specific benefits could be obtained if golf did prove to be a possible effective modality. The use of golf as a possible exercise prescription could allow for more adherence, resulting in possible health

benefits, due to the leisure and enjoyable aspects of the activity. Due to the lack of past research conducted on the benefits of actually golfing as an exercise modality I broke golf down into one of its main physical components: walking.

Evidence from various research "suggests that physical activity may reduce the risk of poor cognition and early cognitive decline", which is a known precursor to dementia (Weuve et al., 2004). The loss of cognitive function and memory can be an extremely frustrating process for those affected by it, so preventing and delaying the onset of dementia or Alzheimer's Disease is an important factor in keeping the elderly independent and functioning. In a study conducted by Abbott, White, Ross, Masaki, Curb, and Petrovitch, older adult males (71-93) with no pre-existing cognitive decline tracked how much they walked per day for a two year period using surveys (Abbott et al., 2004). Testing for dementia was conducted as a baseline when subjects began the study in between 1991 and 1993. The dementia test was then again administered between 1994 and 1996 and finally was administered again between 1997 and 1999 to see how walking amounts possibly affected the onset of dementia as the subjects aged. Results showed that those reporting walking less than 0.25 miles a day had a 1.8 fold risk of dementia onset in subsequent years, and a 2.2 fold risk of Alzheimer's Disease when compared to the groups that reported walking more than 2 miles per day (Abbott et al., 2004). From these results one can see a correlation between physical activity and cognitive impairments. Biological factors along with environmental factors were not taken into consideration for this study, which could possibly cause some underlying predisposition for risk or protection of dementia with age. The use of a large subject pool, 2257 in total, provided good information which can be extended over masses, but only examined males, which leaves unanswered questions regarding whether or not these positive results would carry over to women. The results from this study compared to those of

the study completed by Krobriger, Smith, Hollman, and Smith, which showed that in one 18 hole round of golf subjects walked an average or 4 to 5 miles, help show the possibility that an older adult golfing a few times a week could help to slow the risk of dementia and Alzheimer's Disease (Krobriger et al., 2006).

A very similar study was conducted by Weuve, Kang, Manson, Breteler, Ware, and Grodstein, using a large subject pool from a previous study, which surveyed subjects every two years since 1986 on their weekly activity levels, 16,466 women aged 70-81 were followed up with between 1995 and 2001 to issue cognitive testing (Weuve et al., 2004). All participants had no previous mental or cognitive disorders when beginning the original study. The previously completed physical activity surveys addressed all activity types, leisure as well as planned, and especially highlighted walking. After averaging the data for each subject to find a personal yearly amount of exercise, based on METS (metabolic equivalence units), the women completed a cognitive exam via telephone once at the beginning of the current study and again 1.8 years later. The tests included general cognition, verbal memory, category fluency, and attention (Weuve et al., 2004). Those who reported the highest amounts of physical activity had a 20% lower risk of cognitive impairment with time versus those in the lowest category of physical activity. Women who reported walking just 1.5 hours a week versus those reporting less than 38 minutes per week resulted in differences in cognitive scores which were equivalent to those of women aged 1.5 years older than others. The results from this study show that keeping active, even with light walking in the years before older age, can help to keep cognition sharper and slow the decline of normal aging effects on the mind. Just as in the study completed by Abbott, many extraneous factors should be taken into consideration, such as misreporting and genetic predisposition as well as lifestyle factors such as diet and environment.

Based on these two very similar studies, walking, even at a light pace, can seem to slow the effects of aging on the mind and help to keep cognition sharp. Research has shown that activity completed before one has the onset of dementia or cognitive impairment can be very beneficial to the person, but do these same effects carry over once decline in mental functioning is already present? For those already affected by some cognitive impairment, the use of exercise may not have the same lasting effects as it does for those who were able to begin earlier. In a study done by Scherder, Paasschen, Deijen, Knokke, Orlebeke, Burgers, Devriese, Swaab, and Sergeant, 43 older adults with some known mild cognitive impairment (MCI) were split into two varying exercise groups. One group in which the subjects would do light walking for 30 minutes a day 3 days a week for 6 weeks, and one group in which subjects completed some hand and facial exercises for the same duration and time (Scherder et al., 2005). A control group that completed no treatments was also used to test results against. Executive functioning in the brain significantly improved immediately after the end of the 6 week period for both treatment groups when compared to the control, but the improvements did not last when tested again 6 weeks post treatment. These results help to stress the importance of getting active in an earlier stage of aging and staying active to help keep the benefits. Although the results did not stay with the subject after discontinuing the program the improvements may stay or even improve more if one continues with an exercise program such as this. The light course walking while golfing could provide such an outlet for someone with mild cognitive impairments to help improve mentally and physically. This study did use a much older and frail population than others, with a mean age of 86; future studies may want to examine if the same results would occur when using a younger impaired group.

In older adults, the risk of depression can also grow due to health declines and possible lack of independence. A study which looked at an older, already institutionalized population, saw improvement in depression and cognition after completing an exercise training program a group setting when matched against a control group which did not participate in physical or social activities (De Carvalho Bastone et al., 2004). The exercise program used in this study consisted of other activities aside from walking, such as strengthening and mobility activities as well. Though is cannot be told which portion of the program, the social aspect or the physical aspect, benefitted the subjects the most the results still showed that a combination of the two can produce improvements. Due to the social and group nature of the game, golf could be an excellent choice of activity for older persons or those suffering mental afflictions. If functionality will not allow all of the skills that golf requires, swinging, bending down, simply walking along with a group for a round could possibly show the same effects if it is done in a socially emphasized setting.

Potential Physical Health Benefits of Golf as a Form of Physical Activity

Past studies on have shown "that regular walking during a round of golf, carrying a bag, had many positive effects of the health and fitness of sedentary middle-aged males including high adherence to golf and exercise and lower risk of injury" (Kras et al., 2002). Another study showed that "regular walking during golf may decrease the prevalence of risk factors associated with cardiovascular disease and increase functional mobility", helping to keep older adults healthy and moving (Dear et al., 2010). As noted in the ACSM guidelines and earlier in this study, health benefits can be gained by meeting the minimum 30 minutes of recommended exercise daily. Research done by Dear, Porter, and Ready found that for older adult males,

averaged at 71 years old, golfing 9 holes with a pull cart took an average of 122.2 minutes, 64 of which were at a moderate to hard intensity, which easily fulfills the daily recommendation for this population (Dear et al., 2010). "Falls have been identified as one of the major causes of morbidity and mortality in older adults" (Tsang et al., 2010). Studies showed that "32% of community-dwelling older participants over the age of 75 were reported to have fallen at least once in the previous year" in Western countries, such as America (Tsang et al., 2010). For the older population, the risk of falling comes with much greater consequences, such as hospitalization, immobility, and possibly dependence on another, due to fractures from a decline in bone mass with age as well as the heightened risk for osteoarthritis. Due to this heightened risk, the importance of working on and maintaining balance and stability is key to help keep older adults healthy. As noted in the studies by Abbott and Weuve, it is important to start and adhere to an exercise program as one ages to help prevent health declines before they happen (Weuve et al., 2004). Habitual physical activity beginning in early old age and continuing for multiple years has been found to result in less bone mass loss as well as a slowing of balance deterioration (Daly et al., 2008). In the research conducted by Daly, Ahlborg, Ringsberg, Gardsell, Sernbo, and Karlsson, those 50 years of age and older who began as active individuals and stayed active, had significantly less bone loss as well as greater balance retention than those who were inactive to begin and stayed inactive over a ten year period (Daly et al., 2008). Due to the flexibility of the game of golf, the ability to use pull carts rather than carry the bags or even use an electric cart, one could stay active playing by just modifying their playing methods, possibly allowing them to continue their activity as they age and help prevent such bone and balance losses. This study used a slightly younger population than others which may have resulted in lower numbers in bone mass loss due to lack of age-related, unavoidable loss. These

results do show that beginning early with activity and staying active while aging can help to slow the effects of bone loss and retain balance skills, which are essential to older adult's health. Participation in a short duration, low intensity exercise training program has also been shown to decrease fall rates in seniors by 18% when compared to a control group and improve obstacle avoidance and balance confidence (Weerdesteyn et al., 2006). As seen in the study by Tsang and Hui-Chan, older golfers had not only better static balance, but better dynamic balance and lower leg ability than those who did not play golf. Therefore, "golf could be a good balance-training approach for older adults" (Tsang et al., 2010).

Staying physically active is an important factor is helping to maintain, and possibly increase, the healthy years that an older adult has as they age. According to Hirsch, Diehr, Newman, Gerrior, Pratt, Lebowitz, and Jackson, the amounts of physical activity that an older adult gets is associated to the years of healthy life they will experience. The study used self-report questionnaires about physical activity amounts, as well as the amount of difficulty felt while completing acts of daily living, such as getting out of bed or using the toilet, and tracking over an eleven year period. Results showed that those who had the highest reported physical activity amounts also "were less likely to have hypertension, diabetes, obstructive lung disease, or coronary heart disease" (Hirsch et al., 2010). The most active quartile also resulted in having less functional impairment and more years of life without any impairment of acts of daily living. Overall results showed that those older adults, especially those 75 or older, who had the highest amounts of physical activity benefited in years of healthy life. Researchers estimated an extra 1.49 years of healthy life could added for those males, and 1.06 years for women, 75 and older who had high amounts of physical activity when compared to sedentary individuals of the same age group.

Conclusion

Being able to prescribe an activity that one may already love or could easily learn allows for better adherence to exercise and rehabilitation programs. In the few studies that were conducted on similar topics, most use middle-aged population, such as in the studies conducted by Krobriger and Kras. In this review, focusing on an older adult population was most important because of the beneficial gains that could come from staying active using a lower intensity modality, such as golf. For a younger population, a higher intensity activity may be necessary in order to meet the daily recommended amounts of physical activity due to heart rate reserve differences and functional capacity levels.

Golf, which consists of play that can be sped up or slowed down with more breaks, could be a useful exercise choice for a variety of age groups due to the manipulability of intensity level. Getting sufficient daily steps usually becomes more difficult with age, possibly due to less daily tasks requiring leaving the home or physical deterioration. With the use of a simple pedometer, walking is an easy way to track just how much exercise one is getting throughout the day and could easily be used on the golf course to track activity levels and keep one motivated to reach their daily step goal. Research has also shown that older adults who do participate in golf had better balance skills than those older adults who did not play the sport, which shows that golf could be an effective way to help improve balance and prevent falls for the elderly (Tsang et al., 2010). The promotion of walking through the use of a social and game like scenario, as golfing, might make it easier to convince older adults to get moving again. Being able to prescribe a more appealing modality for exercise could help to increase the daily activity of older adults and help

them gain the health benefits associated with exercise, and hopefully keep them independent and healthy longer.

This review focused on the scholarly research surrounding the hypothesis of golf being an appropriate and effective modality of exercise for and older adult population. Many future studies in the field could be conducted to help answer this hypothesis. Further research could assess the amount energy expended while playing a round of golf using multiple different techniques, pedometers, accelerometers, or portable metabolic carts, to gain a better understanding of how golf could be integrated into an exercise program. It would also be important to study the energy spent while swinging a club to see how that aspect of the game provides health benefits for possibly flexibility and balance. For future research on this topic I would also suggest investigating if riding in an electric cart for a round of golf could meet the ACSM's daily recommendations. Also then looking into the differences in energy spent when different cart rules are placed on the course. A 90 degree rule could yield less walking when riding, while a cart path only course could possibly provide significant expenditure from the walking to and from the ball on the course. These differences and effects of these varying rules could be beneficial to know when prescribing an exercise plan. Looking into the conditions of a course could also be beneficial for a repeat of this study, such as using a course with longer holes, more hills, or tougher terrain to work through, all of which could change the energy one uses while playing.

References

Abbott, R.D., White, L.R., & Ross, G.W. (2004). Walking and Dementia in Physically Capable Elderly Men. *Journal of the American Medical Association,* 292(12), 1447-1453.

American College of Sports Medicine. *ACSM's Guidelines for Exercise Testing and Prescription.* Philadelphia: Lippincott Williams & Wilkins, 2010. Print.

Centers for Disease Control and Prevention. "Heart Disease Facts." *CDC.* Centers for Disease Control and Prevention, 23 Mar. 2012. Web. 29 Mar. 2012.

Daly, R. M., Ahlborg, H. G., & Ringsberd, K. (2008). Association Between Changes In Habitual Physical Activity and Changes In Bone Density, Muscle Strength, and Functional Performance In Elderly Men and Women. *Journal of the American Geriatrics Society,* 56(12), 2252-2260.

Dear, J. B., Porter, M. M., & Ready, A. E. (2010). Energy Expenditure During Golfing and Lawn Mowing in Older Adult Men. *Journal of Aging and Physical Activity,* 18(2), 185-200.

De Carvalho Bastone, A., Filho, W. J. (2004). Effect of an Exercise Program on Functional Performance of Institutionalized Elderly. *Journal of Rehabilitation Research & Development,* 41(5), 659-668.

Hirsch, C.H., Diehr, P., & Newman, A.B. (2010). Physical Activity and Years of Healthy Life in Older Adults: Results From the Cardiovascular Health Study. *Journal of Aging and Physical Activity,* 18(3), 313-334.

Hughes, J. P., McDowell, M. A., & Brody D. J. (2008). Leisure-Time Physical Activity Among US Adults 60 or More Years of Age: Results From NHANES 1999-2004. *Journal of Physical Activity & Health,* 5(3), 347-358.

Koizumi, D., Rogers, N. L., & Rogers, M. E. (2009). Efficacy of an Accelerometer-Guided Physical Activity Intervention in Community-Dwelling Older Women. *Journal of Physical Activity and Health,* 6(4), 467-474.

Kras, J. M., & Larsen, B. T. (2002). A Comparison of the Health Benefits of Walking and Riding During a Round of Golf. *International Sports Journal,* 6(1), 112-116.

Krobriger, S. L., Smith, J., & Hollman, J. H. (2006). The Contribution of Golf to Daily Physical Activity Recommendations: How Many Steps Does It Take to Complete a Round of Golf?. *Mayo Clinic Proceedings,* 81(8), 1041-1043.

Lyerly, G. W. (2009). Golf: The Effect of Walking Versus Riding on Energy Expenditure. Coastal Carolina University Enrichment Grant.

Mazzeo, R. S., & Tanaka, H. (2001). Exercise Prescription for the Elderly: Current Recommendations. *Sports Medicine,* 31(11), 809-818.

Nelson, M.E., Rejeski, W.J., & Blair, S.N. (2007). Physical Activity and Public Health in Older Adults : Recommendation from the American College of Sports Medicine and the American Heart Association. *Medical Science Sports Exercise,* 39(8), 1435-1445.

Perri, M. G., Anton, S. D., & Durning, P. E.. (2002). Adherence to Exercise Prescriptions: Effects of Prescribing Moderate to Higher Levels of Intensity and Frequency. *Health Psychology,* 21(5), 452-458.

Scherder, E. J.A., Van Paasschen, J., & Deijen, J.B. (2005). Physical Activity and Executive Functions in the Elderly with Mild Cognitive Impairment. *Aging and Mental Health,* (9)3, 272-280.

Tsang W.W.N., Hui-Chan C. W. Y. (2010). Static and Dynamic Balance Control in Older Golfers. *Journal of Aging and Physical Activity,* (18)1, 1-13.

Weerdesteyn, V., Rijken, H., & Geurts, A. C.H. (2006). A Five-Week Exercise Program Can Reduce Falls and Improve Obstacle Avoidance in the Elderly. *Gerontology*, 52(3), 131-141.

Weuve, J., Kang, J.H., & Manson, J.E. (2004). Physical Activity, Including Walking, and Cognitive Function in Older Women. *Journal of the American Medical Association*, 292(12), 1454-1461.