Research paper

Exercise and Functional Disability in Older Adults

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Abstract

The purposes of the present study were to determine whether exercise is associated with functional disability in a dose-dependent manner and to identify a threshold for exercise benefit. The original data were collected using a national telephone survey technique. The current investigation was restricted to persons in the sample at baseline who were aged 60 or older. Functional disability, the primary dependent variable, was the summation of subject responses to five questions pertaining to functional limitation. Exercise was the independent variable in each of the three categories: strenuous exercise, moderate exercise, and walking. Age was used as a covariate in all statistical models. Descriptive data revealed a favorable linear relationship between exercise and functional disability. Tests of statistical significance partially supported a dose-dependent relationship between exercise and functional protection. Some exercise was better than none at all and high frequency exercise was better than some exercise with respect to functional impairment. However, a lower threshold for exercise effectiveness with respect to functional disability was not discovered.

Keywords: *Exercise, functional disability, dose dependent, exercise threshold, older adults*

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Need for Study

According to the Centers for Disease Control and Prevention (CDC, 2008), exercise and other forms of physical activity offer an array of benefits to the population in general and older adults in particular. Positive outcomes routinely associated with regular exercise include lower risk of hypertension, reduction in the incidence of diabetes, prevention or delay of osteoporosis, lower serum triglycerides and cholesterol, decreased incidence of obesity, fewer reports of depressive symptoms, and less stress, among other benefits (CDC, 2011). Unfortunately, though older adults stand to benefit most from exercise, a large percentage of seniors report no exercise at all.

Recent data (U.S. Statistical Abstract, 2011) indicated older adults have not embraced an exercise habit, with over 45% of those aged 65 to 74 years reporting no physical activity and over 55% of seniors aged 75 and older reporting no physical activity. A sedentary lifestyle is a risk factor for a host of chronic conditions and other disorders, including heart disease, stroke, several types of cancer, diabetes, and osteoporosis (CDC, 2008). In fact, the impact of physical inactivity is comparable to the health threat associated with smoking (Pate et al., 1995). Conversely, regular exercise is associated with beneficial changes in the risk factors associated with chronic conditions (CDC, 2008), which makes the absence of physical activity among older adults even more troubling.

Although exercise has been associated with a longer lifespan, recently more concern has focused on the quality of life represented by that longer lifespan. Hence, within the field of therapeutic recreation specifically and the health care community more generally, discussion has turned to functional ability as a potential benefit of a regular program of exercise.

Functional abilities are typically those skills that a person must practice for personal care (activities of daily living—ADLs) and to take care of their immediate living environment (independent activities of daily living—IADLs). Enumeration of ADLs and IADLs encompasses a wide range of skills such as personal hygiene, stair climbing, driving, cleaning, cooking, and other routine personal management activities.

Recent emphasis within the field of therapeutic recreation has underscored the importance of evidence-based practice and functional outcomes related to therapeutic recreation service (Skalko & Morgan, 2011). For example, Witman and Ligon (2011) maintained, "The majority of outcome-oriented RT goals are aimed at improving recreation/leisure functioning although many also address goals specific to domains such as social, psychological, and physical functioning" (p. 3). Aquadro (2011) also emphasized functional outcomes in her farewell message to the American Therapeutic Recreation Association membership: "Improving function and independence for the consumers has such a dramatic effect on their lives and that of their family and friends" (p. 10).

Finally, Buettner and Richeson (2012) recently reported on the field's research agenda and identified categories of research emphasis. Among the most important research priorities were functional change and identification of optimal frequency and duration of interventions (dosage). Furthermore, "functional mobility" was among the top 12 research areas identified for the

field. The present study addressed both functional ability and the dosage of exercise necessary for avoiding functional disability in a large, representative sample of older adults.

Review of Literature

Mobily (2009) reviewed the literature pertaining to exercise as a modality in therapeutic recreation practice and found only a few intervention and retrospective studies that pertained to functional outcomes. He suggested "recreational level" (mild to moderate) exercise was within the scope of service for therapeutic recreation and represented the threshold level of physical activity needed for limiting functional disability.

Wang (2008) published one of the few studies in the therapeutic recreation field pertaining to exercise and function in older adults. Data from a large, representative, nationwide sample of adults (Wang selected only adults aged 65 years or older for analysis) were analyzed to determine the relationships among physical activity (at least once per month), reported days of poor health in the last month, and number of days poor health that prevented subjects from engaging in their normal daily activities. The results showed physical activity was associated with fewer days of poor health and less interference with normal daily activities. The findings were also significant insofar as the criterion for classifying a subject as "physically active" was set at a very low level.

Several intervention studies in the therapeutic recreation literature have come close to looking at the relationship between exercise and functional abilities/disabilities. Richeson, Croteau, Jones, and Farmer (2006) found that counseling and education in support of the use of a pedometer provoked significant improvement in functional fitness indicators by older adults. Likewise, Mobily, Mobily, Lane, and Semerjian (1998) found that strength training at a senior center was associated with improvement in functional fitness assessments after 8 weeks of participation. However, neither study looked at markers of functional ability/disability associated with independent living capability.

One single subject study examined functional outcomes; Mobily and Verburg (2001) reported a case study intervention with an older woman with fibromyalgia. Following an aquatic exercise intervention, their subject reported that pain associated with fibromyalgia interfered less with daily life activities (home chores, work, etc.) than before 4 months of aquatic exercise. Although therapeutic recreation citations pertaining to functional outcomes are not plentiful, the study of the relationship between physical activity or exercise and function among older adults outside the therapeutic recreation literature is more common.

Yorston, Kolt, and Rosenkranz (2012) analyzed data from subjects 65 and older gathered from a larger population study of adults 45 and older. Variables included in the study were the number of times, hours, and minutes of physical activity in the last 7 days (classified as sedentary [0 min], not meeting guidelines [1 to 149 min], or meeting guidelines [≥ 150 min]) and physical function. The authors classified functional limitation scores as severe, significant, slight, or no functional limitations. Yorston et al. included only subjects with complete data on all variables in their analyses. Fifty-three

percent reported no functional limitations. The relationship between physical activity and physical function was statistically significant ($r = 0.166$, $p \leq 0.001$). Regression analysis was used, and the relationship between physical activity and function remained significant after controlling for demographic and other health behavior variables (age, sex, education, smoking, body mass index, etc.). In their discussion, the authors maintained that those older subjects reporting high levels of exercise (middle and highest tertiles) also had better functional ability than those who exercised less.

Chou, Hwang, and Wu (2012) reviewed (meta-analysis) research published from 2001 to 2010 contrasting the effects of exercise versus control conditions on various functional measures. Using weighted mean differences, they reported that exercise groups performed better on tests of gait speed, balance, and activities of daily living.

Jacobson, Smith, Fronterhouse, Kline, and Boolani (2012) randomly assigned subjects to strength training and control conditions. After 12 weeks of strength training, subjects in the treatment group demonstrated significantly higher scores on muscle strength and endurance as well as balance and functional capacity.

Hauer et al. (2012) completed a randomized control trial with physically capable, outpatient subjects with mild to moderate dementia. They randomly assigned subjects to resistance training or (low intensity) motor placebo activity groups. Following 3 months of intervention, the resistance training group performed significantly better than the control subjects on several physical performance measures and physical functioning.

Lorenz et al. (2012) studied the effects of exercise and social activity interventions with 119 long-term care subjects. Intervention groups were an exercise group (5 days per week), a social activity group (5 days per week), a combined exercise and social activity group (5 days per week), and a control group (usual care). Exercise and exercise plus social activity groups showed significant improvements in functional ability (nursing home physical performance test), whereas the usual care and social activity only groups showed functional decline over the intervention period (7 weeks).

Paterson and Warburton's (2010) systematic literature review revealed that greater physical activity was associated with higher functional status and less functional limitation/disability (about a 50% risk reduction). They suggested that the evidence may indicate a dose–response relationship such that moderate through high levels of physical activity were associated with better functional status. They also concluded that evidence for light physical activity was equivocal. The authors maintained that additional research was needed to identify the minimum intensity (threshold) of physical activity associated with functional independence. Paterson and Warburton's findings supported a minimal threshold for improvement/maintenance of functional status of at least moderate intensity exercise. They defined "moderate–high physical activity" as 30 to 60 min per day for 150 to 180 min per week (identical to the CDC). Paterson and Warburton concluded that "…prospective studies provided evidence regarding a long-term lifestyle of physical activity, whereas … exercise training interventions add that a short-term physical ac-

tivity intervention…is also effective… in reducing functional impairment" (p. 13).

Therefore, based upon previous research and the priorities in therapeutic recreation practice pertaining to functional outcomes, the purposes of the present study were twofold: to determine whether exercise is associated with functional disability in a linear/dose-dependent manner and to determine whether a threshold exists at which exercise is of no benefit with respect to functional limitations. Accordingly, the researcher hypothesized the following:

1. A linear relationship exists between exercise and functional disability: the greater the frequency of exercise and the greater the intensity of exercise, the less the functional disability (i.e., a dose-dependent relationship).

2. The threshold at which exercise continues to be significantly associated with less functional disability disappears at the lowest level of exercise reported by subjects in the current data base, in this case, walking only.

Method

Subjects

The "aging, status, and the sense of control" panel study data base served as the source of subjects for the present investigation. Mirowsky and Ross (2008) collected the original data using a national telephone survey technique, and the data became publicly available when archived by the National Institutes of Health. The subjects were selected based on random digit dialing with an oversampling of individuals aged 60 or older. The current investigation was restricted to persons in the sample at baseline (1995) who were aged 60 or older. Of the original sample of 2,592 predominantly white (91.2%) subjects, 1,103 were included in the present investigation. Inclusion criterion was age 60 or older at the time of baseline with non-missing data on the variables used in the present study.

Dependent Variables

Functional disability was the primary dependent variable. It was the summation of subject responses to five questions pertaining to functional limitation: difficulty climbing stairs, difficulty kneeling or stooping, difficulty lifting or carrying objects weighing less than 10 lb, difficulty with household work (preparing meals, cleaning, etc.), and difficulty shopping or getting around town. Mirowsky and Ross (2002) developed the scale for the purposes of their study (see Mirowsky & Ross, 2002, for more detailed scoring instructions). The response index for each of the functional limitation questions was the same across the five items: no difficulty (score of 1), some difficulty (score of 2), or a great deal of difficulty (score of 3); "don't know" responses and refusals were coded as missing. The scores for the five items were summed to achieve a total functional disability score. Therefore, high scores on functional disability indicated more impairment and could range from no impairment (a total score of 5) to maximal impairment on the five tasks (a total score of 15).

An internal consistency analysis was conducted for the functional disability scale composed of the five ques-

tions mentioned above. Statistical computation of Cronbach's alpha for the scale yielded a reliability coefficient of 0.82. Inter-item correlations were also of acceptable magnitude, ranging from 0.34 to 0.61. Positive correlations of moderate value among the five items generally indicated that the five skills making up the scale were related and representative of a similar "population" of functional disability content. In other words, no significant content sampling errors were detected in the scale of functional disability used in this study.

Independent Variable

Exercise served as the independent variable in all of the analyses. Subjects were asked how often they participated in each of three categories of exercise: strenuous exercise (running, swimming, etc.), moderate exercise (dancing, gardening, etc.), and walking. Participation was computed for each of the three categories to arrive at the frequency of exercise for each subject for strenuous exercise, moderate exercise, and walking. Next, the CDC's (2008) recommendation of 30 min of moderate physical activity 5 days a week, or 20 min of vigorous exercise at least 3 days per week, or an equivalent combination of walking, moderate exercise, and vigorous exercise was applied as a benchmark. Accordingly, the CDC's exercise recommendation translated into four categories of exercise in the present investigation: no exercise, some exercise (but did not meet CDC's recommendation), met CDC's recommendation, or exceeded CDC's recommendation.

A subject was classified as "meeting the CDC recommendation" if he or she reported strenuous exercise three or more times per week, reported moderate exercise or walking five or more times per week separately, or attained an exercise frequency of five times per week by combining two or three of the exercise categories. Those doing more were classified as "exceeding the CDC recommendation" (moderate exercise five times per week and walking once per week or walking five times per week and strenuous exercise two times per week, etc.). Subjects classified into the "some exercise" category were those reporting walking or moderate exercise less than five times a week or strenuous exercise less than three times per week but any exercise separately or in combination more than two times per month. Subjects classified into the "no exercise" category reported little (two times per month or less) or no exercise of any type.

Using the CDC's recommendation for exercise as a benchmark is not unprecedented. Paterson and Warburton (2010) and Yorston et al. (2012) used a similar technique for classifying exercise when evaluating studies pertaining to physical activity and functional status; they classified exercise according to vigorous, moderate, or light activity based on activity types. Their approach was used as a basis for the classification of exercise in this study.

Covariate

Age was used as a covariate in each statistical model because age has been reliably correlated with functional disability and chronic conditions. The older a person's age, the more likely he or she is to report functional limitation or one or more chronic conditions (National Center for Health Statistics, 2011). The ages of those selected for the present study ranged from 60 to 95 years, with a mean age of 71.35 (± 7.40 years) and median age of 70.

Statistical Analysis

Planned comparisons were based on several analyses of covariance (ANCOVAR) models, beginning with the most inclusive, highest order model. The full ANCOVAR model (N = 1,101 subjects) used all categories of exercise (strenuous exercise, moderate exercise, and walking) to determine the level of exercise effort (no exercise, some exercise, met CDC's recommendation, and exceeded CDC's recommendation). The second reduced ANCOVAR model (N = 900 subjects) removed strenuous exercise (accomplished by selecting only subjects reporting no strenuous exercise) from the classification of exercise into four levels of effort (no exercise, some exercise, met CDC's recommendation, and exceeded CDC's recommendation). The third reduced ANCOVAR model (N = 537 subjects) removed strenuous exercise and moderate exercise (accomplished by selecting only subjects reporting no strenuous exercise and no moderate exercise) from the classification of exercise into three levels of effort (no exercise, some exercise, and met CDC's recommendation). The third reduced ANCOVAR model did not include the fourth level of exercise (exceeded CDC's recommendation), which could be achieved only by summing frequencies across two or more categories of exercise (strenuous exercise, moderate exercise, and walking).

Exercise dosage was studied in two ways. Each of the three ANCOVAR models was based on a different dosage of exercise, with the full model including all three categories of exercise representing the highest dosage. The second model, wherein exercise was calculated based on moderate exercise and walking only, represented an intermediate dosage. The third model, which used only walking to calculate exercise level, represented the weakest dosage. In addition, exercise dose effects were compared within each ANCOVAR model. That is, total functional disability scores between levels of exercise were compared.

Results

ANCOVAR for the complete model (including strenuous and moderate exercise and walking summed) is reported in Table 1. Inspection of the F tests revealed that age, as expected, had a significant impact on functional disability, $F(1, 1096) = 11.76$, $p \leq 0.001$. Once the variance attributable to age was extracted, the exercise variable continued to exert a significant and favorable impact on functional disability, $F(3, 1096) = 21.57$, $p \leq 0.001$. Inspection of the means (see Table 4) for each of the four levels of exercise showed a linear effect: The higher the frequency of exercise, the lower the functional disability (higher scores indicated more impairment). Post hoc tests between exercise group means (see Table 4) showed that the significant F test was a function of the differences between the no exercise group and the remaining three groups. Also, a significant difference was found between subjects classified into the some exercise group and those in the group exceeding the CDC recommendation for exercise.

ANCOVAR for the first reduced model is reported in Table 2. Similar to the complete model, age had a significant and predictable effect on functional disability, $F(1, 895) = 9.27$, $p \leq 0.007$. Likewise, once age effects were extracted from the dependent variable, the effects of exercise (in this case restricted to moderate exercise and walk-

Table 1

ANCOVAR for Functional Disability x Exercise (Strenuous and Moderate Exercise, Walking)

Source	*df*	Mean Square	*F*	*p*
Intercept	1	68.70	14.56	0.001
Age (Covariate)	1	55.49	11.76	0.001
Exercise	3	101.77	21.57	0.001
Error	1096	4.72		

ing) remained significant and in the expected direction, $F(3, 895) = 16.08$, $p \leq 0.001$. Review of Table 4 again revealed a linear relationship between level of exercise and functional disability, with more frequent exercise levels associated with lower functional disability. Post hoc follow-up contrasts (see Table 4) again indicated the differences between those not exercising and the remaining three groups drove the significant F test. Unlike the first model, however, no other significant between group differences were discovered.

Table 2

ANCOVAR for Functional Disability x Exercise (Moderate Exercise and Walking)

Source	*df*	Mean Square	*F*	*p*
Intercept	1	47.43	9.27	0.002
Age (Covariate)	1	37.36	7.31	0.007
Exercise	3	82.24	16.08	0.001
Error	895	5.12		

Table 3

ANCOVAR for Functional Disability x Exercise (Walking Only)

Source	*df*	Mean Square	*F*	*p*
Intercept	1	29.77	4.60	0.032
Age (Covariate)	1	22.92	3.54	0.060
Exercise	2	61.63	9.52	0.001
Error	533	6.47		

The final ANCOVAR for the second reduced model is reported in Table 3. In this case, exercise level was computed based only on walking and omitted subjects reporting moderate and strenuous exercise. Unlike the two previous ANCOVARs, age was not statistically significant in the walking only model, $F(1, 533) = 3.54$, $p = 0.060$. Nevertheless, once variance attributable to age was extracted, the now familiar pattern again emerged, a significant and linear effect of exercise on functional disability, $F(2, 533) = 9.52$, $p \leq 0.001$. Inspection of the means for each level of exercise in the walking only model demonstrated a linear effect; greater frequencies of exercise were related to less functional limitation (see Table 4). Post hoc tests between groups (see Table 4) in the final analysis replicated those of the previous models: Subjects reporting no exercise were significantly more apt to report functional disability than subjects in the some exercise and met CDC recommendation groups.

In sum, analyses of the data partially supported the research hypothesis pertaining to a dose-dependent relationship between exercise and reported functional disability. A clear, favorable, and uniform linear relationship was discovered between amount of exercise reported and functional protection attained: More exercise was associated with less reported functional impairment across the three ANCOVAR models. In other words, when exercise included strenuous activity (as in the complete model), the benefit was greater than when exercise was restricted to moderate activity and walking only. Likewise, when exercise included moderate exercise and walking, the effect on functional disability was greater than when exercise was limited to walking only.

Further support of a dose-dependent relationship was largely unconfirmed by post hoc follow-up tests. Although those reporting no exercise were certainly significantly disadvantaged compared to the remaining exercise groups, with the exception of the contrast between the some exercise group and the exceeding CDC recommendation group in the full model, remaining comparisons were not significant.

With respect to discovering an exercise threshold, finding that an exercise effect was significant in all three models refuted the notion that walking for exercise is the activity level at which no benefit was accrued. Stated in a more affirmative way, subjects in the

Table 4

Functional Disability: Estimated Marginal Means for Exercise Level x Model

Exercise Level	Complete Model	Mod. Ex. & Walking	Walking Only
No Exercise	7.57_{a}	7.59_{a}	7.63_{a}
Some Exercise	6.63_{bc}	6.66_{b}	6.87_{b}
Met CDC Rec.	6.48_{b}	6.49_{b}	6.58_{b}
Exceeded CDC Rec.	6.09_{bd}	6.16_{b}	

Note. Means with differing subscripts are significantly different at $p < 0.05$ based on the Sidak post hoc test.

current study who practiced walking as the only form of exercise still reported significantly less functional disability.

Discussion

The encouraging result overall was that exercise among older adults was associated with less functional impairment. Furthermore, the inspection of descriptive data supported the supposition that a linear and dose-dependent relationship existed between physical activity and functional disability, such that more exercise was associated with less functional disability. A favorable dose-dependent relationship persisted across three different ANCOVAR models designed to assess the graded effects of physical activity from strenuous exercise to moderate exercise to walking. In general, subjects in the two reduced models reported more functional impairment than those in the full model.

Review of the means in Table 4 was of further interest; the greatest benefit from exercise in all models was associated with the difference between no exercise and the remaining levels of exercise. Although it was somewhat surprising that exercise below the level of the CDC recommendation was significantly more beneficial than no exercise, this finding is consistent with the CDC's recommendation in one sense. For those who cannot meet the 5-days-per-week of moderate exercise standard, some exercise is better than no exercise (CDC, 2008). However, how much benefit with respect to functional disability is derived from exercise that falls short of the recommended standard remains in question.

Although it was disappointing not to find a consistent relationship between group post hoc test differences besides the contrasts between no exercise and the remaining three levels of exercise, it was remarkable that exercise at any level had a significant impact on functional disability in this cohort. This is the case because the cohort studied was extraordinarily healthy. The mean functional disability score for all subjects was 6.61, which indicates very little limitation. A score of 5 across the five functional behaviors represented no limitation, with a score of 15 indicating complete impairment. Subjects also reported an average of 1.91 chronic conditions (of a maximum of nine), with the most commonly reported chronic conditions unlikely to impact the ability to exercise (i.e., high blood pressure and arthritis were each reported by almost half of the subjects). Subjects also smoked at a very low rate (14.1% reported smoking). Future studies may wish to pursue the dose-dependent question as well as the second research question (i.e., what is the lowest threshold at which exercise is of benefit?) with a more impaired sample of subjects to evoke more significant differences.

The second research hypothesis was not supported; the ANCOVAR model employing walking only to define exercise remained significantly and negatively associated with functional disability. Furthermore, like the relationship between the complete model and functional disability and the relationship between the moderate exercise/walking model and functional disability, the walking only model continued to demonstrate a linear association with functional disability. Both levels of exercise were superior to no exercise relative to functional disability. Hence, walking as physical activity was not identified as the threshold at which exercise is no longer of benefit with respect to functional disability.

For the purposes of the present study, the author assumed that strenuous exercise, moderate exercise, and walking represented linear increments in exercise effort. That is, strenuous was more energy intensive than moderate and moderate was more energy intensive than walking. However, because exercise frequency was measured in the original study and not exercise intensity, it is possible that walking only represented another form of moderate exercise instead of being a proxy for mild exercise. Comparison of functional disability scores for the moderate exercise/walking model versus walking only model (see Table 4) is consistent with this interpretation (i.e., that walking may be another form of moderate exercise).

Identifying the lower threshold for exercise benefits therefore remains a challenge for the exercise behavior research community. It may be simply a matter of asking the right questions in future studies. Straightforward items requesting the frequency of mild or light activity (daily stretching, a casual stroll, or light manual activities, etc.) might be needed to plumb the correct depth of the exercise benefit threshold. Questions about mild or light exercise were not part of the current data base.

One limitation of the present study alluded to above related to the intensity of subjects' effort. Exercise intensity was not directly measured in this study; only exercise frequency was assessed. The assumption that any level of exercise met or exceeded the CDC's recommended weekly physical activity requirement was inferred from the frequencies of three different types of exercise reported by the subjects. Furthermore, the author assumed the complete ANCOVAR model with exercise computed as a function of all three exercise forms was more intense than the second model where exercise was a function of moderate exercise and walking only may not have completely reflected the intensity of subject effort in any exercise choice. Likely, this was also the case for the third ANCOVAR model where exercise was solely computed from the subject's response to the walking question.

Also, because the original data were gathered retrospectively, relying on subject recall and not the result of a randomized intervention trial where exercise behavior can be directly monitored, cause and effect cannot be inferred. In other words, functional disability could have a detrimental effect on the type and frequency of exercise behavior at all levels of effort (strenuous exercise, moderate exercise, and walking). Nevertheless, the results can be understood to demonstrate an encouraging relationship in a predictable direction: The more frequently a subject exercised, the less likely the report of functional disability.

Implications for Practice

The results proved to be encouraging for direct service as well as scope of practice for the therapeutic recreation profession. Programming and encouraging exercise and physical activity for older adults is clearly supported by the findings of this study, even at levels below the CDC recommendation. In fact, Nelson et al. (2007) maintained, "There is substantial evidence that older adults who do less activity than recommended still achieve some health benefits" (p. 1442). Furthermore, because the functional disability–exercise effect relationship was apparent at the

lowest increment of exercise (i.e., some instead of none), the practitioner can adjust the dosage of physical activity to the elderly person's level of impairment and still expect to obtain measured results from the intervention.

Although therapeutic recreation professionals should not expect most seniors to be able or willing to participate in strenuous exercise (the mean frequency of strenuous exercise in this cohort was less than once per week), the results of the present study suggest that sound functional outcomes should be expected with moderate exercise and walking. Dosage at each level of exercise could also be graded according to frequency of practice per week, with the ultimate goal of attaining the CDC's standard of 5 days a week.

Furthermore, insofar as it is more realistic to expect older adults to be attracted to lower intensity moderate exercise and walking in preference to strenuous exercise, the practitioner can recommend a level of exercise within a reasonable margin of safety. This is also likely to attract more reluctant older participants to exercise because apprehension about injury or death from exercise participation is reportedly a significant obstacle (O'Brien Cousins, 2000).

Conclusions

The findings of this study partially supported a dose-dependent relationship between exercise and functional disability. The relationship was in a favorable direction in all three statistical models of incremental "intensity" of exercise examined. The results did not confirm the second research hypothesis: Walking was not identified as the threshold at which physical activity is no longer beneficial. Walking continued to be significantly and negatively correlated with functional limitations. Further research is needed to explore and identify the level at which physical activity is no longer of functional benefit. Identification of an exercise threshold is especially important for the field of therapeutic recreation because many light recreational activities are implemented in practice and it would be useful to know whether any produce benefit with respect to functional disability. The findings offer encouraging news for practitioners insofar as even modest amounts of exercise hold the promise of some functional improvement.

References

Aquadro, M. A. (2011). President's farewell message. *ATRA Newsletter, 27*(3), 10.

Buettner, L. L., & Richeson, N. (2012). ATRA research agenda. *Annual in Therapeutic Recreation, 10*, 68–69.

Centers for Disease Control and Prevention. (2008). Facts about physical activity. Retrieved from http://www.cdc.gov/physicalactivity/data/facts.html

Centers for Disease Control and Prevention. (2011). The benefits of physical activity. Retrieved from http://www.cdc.gov/physicalactivity/everyone/health/index.html

Chou, C., Hwang, C., & Wu, Y. (2012). Effect of exercise on physical function, daily living activities, and quality of life in frail older adults: A meta-analysis. *Archives of Physical Medicine and Rehabilitation, 93*, 237–244.

Hauer, K., Schwenk, M., Zieschang, T., Essig, M., Becker, C., & Oster, P. (2012). Physical training improves motor performance in people with dementia: A randomized controlled trial. *Journal of the American Geriatric Society, 60*, 8–15.

Jacobson, B. H., Smith, D., Fronterhouse, J., Kline, C., & Boolani, A. (2012). Assessment of the benefit of powered exercise for muscular endurance and functional capacity in elderly participants. *Journal of Physical Activity and Health, 9*, 1030–1035.

Lorenz, R. A., Gooneratne, N., Cole, C. S., Kleban, M. H., Gurpreet, K. K., & Richards, K. C. (2012). Exercise and social activity improve everyday function in long-term care residents. *American Journal of Geriatric Psychiatry, 20,* 468–476.

Mirowsky, J., & Ross, C. E. (2002). Depression, parenthood and age at first birth. *Social Science and Medicine, 54*, 1281–1298.

Mirowsky, J., & Ross, C. E. (2008). Education and self-rated health. *Research on Aging, 30*, 93–122.

Mobily, K. E. (2009). The role of exercise and physical activity in therapeutic recreation service. *Therapeutic Recreation Journal, 43*(2), 9–26.

Mobily, K. E., Mobily, P. R., Lane, B. K., & Semerjian, T. Z. (1998). Using progressive resistance training as an intervention with older adults. *Therapeutic Recreation Journal, 32*(1), 42–53.

Mobily, K. E., & Verburg, M. D. (2001). Aquatic therapy in community-based therapeutic recreation: Pain management in a case of fibromyalgia. *Therapeutic Recreation Journal, 35*(1), 57–69.

National Center for Health Statistics. (2011). Functional limitations in older adults. Retrieved from http://www.healthindicators.gov/Indicators/Functionallimitationsinolderadults_1245/Profile/Data

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., . . . Castaneda-Sceppa, C. (2007). Physical activity and public health in older Americans: Recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports & Exercise, 39*, 1435–1445.

O'Brien Cousins, S. (2000). "My heart couldn't take it": Older women's beliefs about exercise benefits and risks. *Journal of Gerontology: PSYCHOLOGICAL SCIENCES,* 55B, P283–P294.

Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C., . . . Wilmore, J. H. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association, 273*, 402–407.

Paterson, D. H., & Warburton, D. (2010). Physical activity and functional limitations in older adults: A systematic review related to Canada's physical activity guidelines. *Journal of Behavioral Nutrition and Physical Activity, 7*, 38–60.

Richeson, N. E., Croteau, K. A., Jones, D. B., & Farmer, B. C. (2006). Effects of a pedometer-based intervention on physical performance and mobility-related self-efficacy of community-dwelling older adults: An interdisciplinary preventive health care intervention. *Therapeutic Recreation Journal, 40*(1), 18–32.

Skalko, T. K., & Morgan, L. (2011). ATRA federal public policy: The year in review—A look to 2012. *ATRA Newsletter, 27*(4), 1–2.

U.S. Statistical Abstract. (2011). *Age-adjusted percentage of persons engaging in physical activity and fitness by selected characteristics: 2008*. Washington, DC: U.S. Census Bureau.

Wang, Y. (2008). Physical activity and health-related quality of life in older adults: Findings from the BRFSS 2000. *Annual in Therapeutic Recreation, 16*, 105–116.

Witman, J., & Ligon, M. (2011). Planning and implementation in recreation therapy: Some benchmarks. *ATRA Newsletter, 27*(2), 2–4.

Yorston, L. C., Kolt, G. S., & Rosenkranz, R. R. (2012). Physical activity and physical function in older adults: The 45 and up study. *Journal of the American Geriatric Society, 60,* 719–725.