

Original Article

A Phase I Feasibility Study of Yoga on the Physical Health and Coping of Informal Caregivers

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Family and friends who provide unpaid care to an individual with a disease or disability (known as informal caregivers) experience numerous threats to their physical health as a result of providing care. In spite of evidence that participation in physical and leisure activities can be health promoting, informal caregivers have reported diminished or completely absent leisure participation. Hatha yoga has documented therapeutic benefits, including reduced anxiety, as well as improved muscle strength and endurance and flexibility. The purpose of this study was to determine the feasibility of conducting an 8-week yoga program with informal caregivers, and to gather pilot data on the effects of yoga on the physical fitness and coping of informal caregivers. Caregivers were randomized into a yoga intervention ($n=8$) or control group ($n=9$). The yoga sessions were 2.5 hours/week for 8 weeks and consisted of a variety of pranayama (breathing) and asana (postures) activities and were led by a certified yoga instructor. Four caregivers (two in each group) dropped out of the study. After the conclusion of the 8-week yoga program, lower body strength increased significantly for those in the yoga group and other notable trends occurred in terms of coping, upper body strength and aerobic endurance. Caregivers in the control group experienced an unexpected increase in lower body flexibility. These findings indicate that caregivers in a yoga program may receive some benefits. Future studies are encouraged to test the efficacy of yoga as an intervention for caregivers.

Keywords: yoga – informal caregivers – physical health – coping – pilot study

Introduction

Complementary and alternative medicine (CAM) is increasing in prevalence in the United States. The use of CAM in research studies is also emerging, and when undertaken in a scientifically sound method, can provide evidence about the effectiveness of the CAM technique (1). The consensus of these studies together, will provide the basis for evidence-based practice (2,3). Hatha yoga is one such CAM technique in which the evidence is beginning to build. Hatha yoga is becoming increasingly popular in Western culture particularly as a

tool for stress reduction and improving physical fitness. In Eastern cultures, yoga has traditionally been a part of life, and practitioners of yoga are thought to be able to achieve high states of relaxation and self-regulation of stress. Hatha yoga uses a combination of asanas (postures), pranayamas (breathing) and dhyana (meditation). Although the exact mechanism is unknown, evidence suggests that the combination of these behaviors are most beneficial when utilized together (4). Raub (5) delineated the health benefits of participating in asanas and pranayamas and asserted ‘they cause a beneficial influence on the four major systems of the human body: for locomotion, through the musculo-skeletal system; for oxygen delivery, through the cardiopulmonary system and for the nervous and the endocrine control systems. Thus, the combination of

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body, mind and breath control forms a natural basis for the psychophysiological effects of Hatha Yoga...’ (p. 798). These effects may be quite beneficial for individuals who experience stress.

Informal caregivers experience very high levels of chronic stress and may experience impaired coping abilities as a result (6). Informal caregivers are typically *unpaid* family members and friends, who provide *more than normal or expected care* primarily in the home setting for an individual who has a chronic disease or disability (7). Informal caregiving typically requires substantial amounts of uncompensated time and effort for months or years, involving physically, mentally, financially and socially taxing tasks (7). The number of informal caregivers nationwide is enormous, and growing. A national survey by the National Alliance for Caregiving/American Association of Retired Persons (NAC/AARP) (8) found that the number of informal caregivers tripled from 1988 to 1996 to 44.4 million people. Caregiving tasks may be unpleasant and physically demanding and often cause a disruption in familial roles and the vocational/avocational activities of the caregiver. Further, it has been well documented that caregivers experience significant threats to their mental and physical health as a result of providing care (9,10). If the caregiver experiences negative health outcomes, their ability to continue to care for the care recipient may be impaired. Caregivers who experience a great deal of distress may negatively impact the care recipient and this distress may determine if the care recipient will be able to remain at home.

The physical and psychological benefits of physical activity are well known. In fact, Jennen and Uhlenbruck (11) found that physical activity can prevent negative health effects and may promote healthy aging. However, caregivers often discontinue health-promoting behaviors such as physical activity. As such, researchers have emphasized the importance of physical activity since research findings suggest that it has positive effects on physical (e.g. immune system) and mental health (e.g. anxiety, depression) (12–15). Hatha yoga is one form of physical activity that, based upon previous research, may show promise for improving the health of caregivers (5,16–22).

Evidence supports the physical health benefits of yoga. Women with hyperkyphosis who participated in a yoga intervention twice a week for 12 weeks improved significantly in the ability to stand quickly, move faster and reach longer, as well as reported increased physical self-awareness and well being (23). Yoga has also been shown to decrease pain and tenderness in the hands and increase finger range of motion and grip strength in several clinical trials with individuals with osteoarthritis (24,25). There is also evidence that yoga practice improves muscle strength and endurance, flexibility and cardiopulmonary endurance (26). In a preliminary trial

with stroke survivors, subjects who adhered to the yoga program experienced the most benefits in terms of mobility and balance (27). Further, a randomized trial demonstrated that an 11-week program of yoga done for at least 1 hour each day was as effective in controlling hypertension as traditional hypertensive medications (28). The practice of Hatha yoga has been associated with increased relaxation, flexibility, balance, strength and overall fitness. Focus on slow breathing which occurs in yoga can improve heart rate variability and baroreflex sensitivity by coordinating cardiovascular rhythms (17).

A national survey in the United States reported that yoga participants described feeling that yoga minimized symptoms in health conditions (29). Researchers from this same study recommended well-designed controlled trials to substantiate the health and psychological benefits believed to accrue from yoga practice. It is difficult to enroll caregivers in intervention studies as they have numerous other duties which make regular attendance at a community-based intervention difficult (30–32). Therefore, this study sought to determine the feasibility of a yoga program for caregivers, as well as gather pilot data on the influence that yoga may have on the physical health and coping of caregivers.

Methods

This study utilized an experimental design, with caregivers randomized into either a control group or the yoga intervention. Following the intervention, interviews were conducted with the caregivers in the yoga group to determine specific aspects that influenced the feasibility of running a yoga intervention with informal caregivers. Data for this investigation were a part of a study that examined the influence of yoga on the overall quality of life for informal caregivers. Therefore, the specific aim of this part of the study was to determine the effects of an 8-week yoga program on the physiological well being and coping of informal caregivers. Caregivers in the yoga intervention were encouraged to attend yoga for 2.5 hours/week (two sessions at 1.25 hours each) for 8 weeks. These sessions consisted of a variety of pranayama (breathing) and asana (postures) activities and were led by a certified yoga instructor (please see Appendix A for the list of the asanas utilized in the program and the properties thought to be associated with each). The asanas were selected from the yoga traditions of BKS Iyengar and Sri K. Pattabhi Jois specifically to enhance coping and physical well being of the caregivers. Yoga participants were encouraged to practice yoga at home. To do so, they were given workbooks with suggested sequences, a picture of each pose and space for any adaptation they had made to the pose. The subjects were also given yoga mats, blocks and blankets for class and home-based practice. The yoga instructor inquired with the subjects each week to determine

if there were any difficulties in performing any of the poses at home. However, adherence to home yoga practice was not monitored between classes.

Subjects in the control group were asked to maintain their routine activities and not initiate any new physical activities for the duration of the study. Control subjects were tested at time-matched points (baseline and 8 weeks) to correspond with the data provided by those in the experimental group. At the conclusion of 8 weeks, caregivers in both groups were assessed for physical functioning again, and caregivers in the experimental group were encouraged to continue participation in the activities on their own. The study was approved by the local Institutional Review Board, and all caregivers signed informed consent forms prior to testing and involvement in the study. Additionally, the research staff telephoned each subject after the post-testing to ask questions related to feasibility and logistical concerns. The researchers and data analysis coordinator remained blinded until data analysis was completed.

Procedures

Caregivers who responded to advertisements in local newspapers, flyers, or referrals via an E-newsletter were screened for eligibility by the project coordinator. In order to qualify for inclusion in this study, individuals met the following criterion: 1) provide informal (unpaid) care for a person with a disease or disability, 2) identify self as primary caregiver, 3) be willing and physically able to participate in a physical activity intervention, 4) be willing to not initiate any other physical activity during the 8 weeks of the study intervention and 5) be greater than 18 years old. Participants were excluded from participation in the study if they self-reported any of the following: 1) serious cardiac conditions (i.e. hospitalization for myocardial infarction or heart surgery within 3 months, history of congestive heart failure, documented serious and unstable cardiac arrhythmias, hypertrophic cardiomyopathy, severe aortic stenosis, angina or dyspnea at rest or during activities of daily living), 2) history of serious chronic obstructive pulmonary disease or oxygen dependence, 3) severe weight bearing pain, 4) history of significant psychiatric illness defined by diagnosis of bipolar affective disorder, psychosis, schizophrenia or medication refractory depression, 5) self-report of uncontrollable diabetes with recent weight loss, diabetic coma, or frequent insulin reactions and 6) previously enrolled in a clinical trial about the caregiving experience or yoga or were not able to attend yoga 2×/week if assigned to the experimental group. If an individual was deemed eligible for the study, he/she was first stratified by age (</> 50) and years caregiving (</> 5) (33), and then randomized into either the control group or the yoga group. Appointments were then made for the caregivers to sign the informed

consent and participate in pretesting. Twenty-five caregivers met the initial inclusion criteria. Of these caregivers, eight (32%) were not willing to participate in the study. These caregivers did not differ significantly in terms of age or years caregiving from the 17 caregivers who agreed to participate in the study. Nine caregivers were randomized into the control group, and eight into the yoga group. Of the eight caregivers in yoga, three had excellent attendance (>90% of sessions), one had moderate attendance (44% of sessions), two had poor attendance (<15% of sessions) and two dropped from the study. At time two (T2, post 8-week yoga intervention), there were six participants in the yoga group and seven participants in the control group. Two caregivers (13%) in the control group were lost to attrition because of an inability to reach the individual or an unwillingness to schedule the post-test. Therefore, 13 participants completed the 8-week study, and the data reflect the scores of these individuals only.

Following T2, subjects in the yoga group and those who dropped out of the study were contacted to determine their perceptions of the intervention design, the feasibility of participating in an intervention, and if there were any issues that would have facilitated participation in the study. More specifically, the interviews were conducted with the four yoga participants who attended a majority of the classes to better understand their experience in the study and how to improve the study and the two yoga participants who did not attend more than one session to understand what may have influenced the poor attendance. Further, interviews were conducted with seven caregivers who dropped out of the study (two after the intervention began and five who dropped prior to the commencement of the intervention) to help us understand if their reasons for dropping out of the study were due to study design issues.

Measures

Demographics

Demographic information such as age, years caregiving, race/ethnicity, marital status, co-resident status, relationship to care recipient, employment status and length of time in caregiving (in hours/day and number of months) were collected in a locally developed questionnaire.

Caregiver Coping

The Sense of Coherence (SOC) questionnaire is a global measure of the ability to mobilize adaptive coping resources. The SOC is a 13-item, self-report scale which has been utilized in over 20 countries (34,35). The items are measured on a seven-point Likert-type scale, and possible scores on the SOC range from 13–91, with

higher scores indicating better ability to cope. This scale has demonstrated strong internal validity, reliability and test–retest correlations (34,36).

Caregiver Physical Fitness

A functional fitness test was utilized to measure a variety of functional fitness levels among the caregivers (37). Test–retest coefficients have ranged from 0.80 to 0.96 and criterion-related validity values range from 0.71 to 0.84 (37). This fitness evaluation is comprised of six tests. A summary of each test follows, however, the summary is not intended to represent the entire protocol; rather it is a brief description of each test in the battery.

The *Chair Stand Test* was used to measure lower body strength. This test involved the participant sitting in a chair and raising to a full standing position as many times as possible in 30 seconds. The *Arm Curl Test* was used to measure upper body strength, through the use of arm curls with hand weights (3 pounds for women; 5 pounds for men). The score is dependent on the number of full curls completed within 30 seconds. The *2-minute Step Test* measures aerobic endurance by asking participants to step in place as many times as possible in a 2-minute period. The *Chair Sit and Reach Test* was utilized to measure lower body flexibility. In this test, seated participants extend one leg, bend forward and try to touch their toes or beyond if possible. Scores are inches proximal to the toes (this counts as a negative score), or distal beyond the toes (this counts as a positive score). The test to measure upper body flexibility was the *Back Scratch Test*. This test entails participants standing, placing their hand over the same shoulder and reaching down the middle of the back as far as possible. Participants place their other arm around the back of the waist with palm up, reaching up the middle of the back as far as possible, trying to touch or overlap the extended middle fingers of both hands. Negative scores are the inches between the fingers that do not touch, while positive scores are the number of inches that overlap. Finally, the *Eight-Foot Up and Go Test* was utilized to assess agility and dynamic balance. On the signal, participants were asked to rise from the chair, walk as quickly as possible around either side of the cone and sit back down in the chair.

Follow-up Interviews

The interviews followed a prescribed line of questioning dependent upon the individual's group (yoga or attrition), with caregivers able to elaborate as needed, and the interviewer was permitted to follow a pertinent line of questioning should he/she deem it appropriate. Questions for the yoga group included 'What are your thoughts about the location/time/parking/number of classes per week? How would you improve the intervention?'

Questions for those in the attrition group included 'What made you call about the study? What are your thoughts on the time requirement of the study? What if anything, could we have done so that it would have been easy for you to participate?'

Data Analysis

There were six physical fitness tests in this study: lower body strength, upper body strength, aerobic endurance, lower body flexibility, upper body flexibility, balance and agility and one coping measure, the SOC. To test the normality of the data, Shapiro–Wilks tests were conducted for each scale. If the data were normally distributed, independent *t*-tests were used to examine group differences in physical fitness and coping at T1 and T2, and paired *t*-tests were used to examine within group changes from T1 to T2. If the data were not normally distributed, Wilcoxon signed rank tests were utilized to compare within group differences between T1 and T2, and Kruskal–Wallace tests were utilized to examine between group changes from T1 to T2. The results of these analyses are found in Table 2. For all analyses in the study, the alpha level was set at 0.05, and the tests were two-tailed.

It was hypothesized that the plot of each outcome would tend to be linear. A significant deviation from the normality hypothesis was found for the following scales for the yoga group at T1: body mass index (BMI), lower body strength, upper body flexibility and SOC. Further, normality assumptions were violated for BMI and upper body flexibility in the yoga group at T2. For the control group at T1, lower body flexibility and upper body flexibility were not normally distributed and at T2, upper body flexibility was not normal.

Results: Characteristics of Caregivers

The mean values of the following demographic characteristics were not significantly different between the yoga and control groups, indicating the groups did not differ from one another substantially. Table 1 displays the details of the demographic information. The mean age (in years) of the caregivers was 59, and the mean amount of time providing care/day was 5 hours. The mean length of time caregiving was 121 months; however, there was a woman who cared for her adult daughter who had been providing care for the lifetime of her daughter, which increased this overall mean. Four caregivers at T1 (31%) had scores of a mean BMI over than 30, which indicates obesity. The mean BMI for the group was 30.73 (SD=10.84), which may not be fully representative of the group, as there was one morbidly obese individual in the group. Most of the caregivers were white (92.3%), and were daughters (38.4%) taking care of parents. Interestingly, 15% of the caregivers

Table 1. Socio-demographic characteristics of caregivers ($N=13$)

Variable	<i>N</i>	%	<i>M</i>	<i>SD</i>	Range
Age					
Yoga	6		55.17	14.96	30–75
Control	7		62.71	10.84	52–86
Total	13		59.23	12.94	30–86
Length (in months) of caregiving					
Yoga	6		143.67	124.98	18–336
Control	7		102.29	143.25	20–420
Total	13		121.38	131.26	18–420
Hours/day caregiving					
Yoga	6		5.37	6.34	1–18
Control	7		4.93	3.58	2–12
Total	13		5.14	4.81	1–18
Gender					
Male	4	31			
Female	9	69			
Race					
White	12	92.3			
African American	1	7.7			
Employment					
Full time	4	31			
Part time	2	15			
Not employed	7	54			
Live with care recipient					
Yes	8	62			
No	5	38			
Relationship to care recipient[†]					
Daughter	5	38.4			
Spouse	4	30.8			
Son	1	7.7			
Other	1	7.7			
More than 1 care recipient	2	15.4			

[†]There were two participants who took care of more than one care recipient. Their relationships to care recipients were daughter and daughter-in-law, son and son-in-law.

in this study also took care of more than one person. Many of the caregivers were employed (15% part-time, 31% full-time) and most lived with the care recipient (62%).

The Kruskal–Wallis tests revealed that the yoga group did not differ significantly from the control group in terms of BMI, lower body strength, lower body flexibility, upper body flexibility and SOC at T1. Independent *t*-tests revealed no significant differences between the yoga and control groups at T1 in terms of upper body strength, aerobic endurance and balance. At T2, the Kruskal–Wallis tests did not reveal a significant difference between the yoga and control group for BMI and upper body flexibility.

Table 2. Change in physiological measures before and after yoga intervention ($N=13$)

Variable	Mean T1 (<i>SD</i>)	Mean T2 (<i>SD</i>)	% change	% <i>SD</i> change	<i>p</i>
BMI					
Yoga	32.87 (14.01)	32.07 (12.9)	–2	±7.92	0.249
Control	28.9 (7.94)	28.83 (8.31)	–0.2	±4.66	0.766
LB STRE					
Yoga	19 (9.78)	24 (8.72)	26	±10.84	0.027*
Control	16.14 (8.26)	14.71 (6.63)	9	±19.73	0.506**
UB STRE					
Yoga	18.83 (4.26)	20.33 (4.5)	8	±5.63	0.521**
Control	17.21 (4.01)	16.29 (3.15)	–5	±21.45	0.415**
AERO					
Yoga	103.33 (24.15)	113.67 (15.67)	10	±35.11	0.204**
Control	93 (42.34)	99.14 (23.95)	7	±43.43	0.748**
LB FLEX					
Yoga	3.16 (3.18)	4.08 (4.96)	29	±55.97	0.313**
Control	0.36 (1.38)	2.36 (3.35)	556	±1.43	0.498*
UP FLEX					
Yoga	–2.25 (8.71)	–1 (7.69)	–56	±11.71	0.171*
Control	0 (4.19)	0.22 (3.64)	2.2	±13.13	0.343*
BLN					
Yoga	5.31 (1.04)	5.41 (1.11)	2	±6.73	0.653**
Control	5.67 (1.52)	5.07 (1.78)	–11	±17.11	0.584**
SOC					
Yoga	57.5 (10.58)	60.5 (7.01)	5	±33.74	0.596*
Control	59.71 (4.96)	56.57 (2.64)	–5	±46.77	0.118**

SD = standard deviation, *BMI* = Body mass index, *LB STRE* = lower body strength, *UP STRE* = upper body strength, *AERO* = aerobic endurance, *LB FLEX* = lower body flexibility, *UP FLEX* = upper body flexibility, *BLN* = balance and agility. *Denotes signed rank test. **Denotes paired *t*-test.

Independent *t*-tests did not reveal a significant difference between the yoga and control groups in terms of lower body strength, upper body strength, aerobic endurance, lower body flexibility, balance and SOC.

Results: Physical Function Parameters

To examine within group changes for the yoga group, Wilcoxon signed ranks tests were utilized to examine the results of BMI, lower body strength, upper body flexibility and SOC pretest to post-test. A significant difference was found in the results of lower body strength from T1 to T2 for caregivers in the yoga group ($Z = -2.207$, $p < 0.05$). That is, caregivers in the yoga group improved their lower body strength during the 8-week yoga program. No significant differences were found for BMI, upper body flexibility and SOC. Paired *t*-tests did not reveal any significant differences in terms

of upper body strength, aerobic endurance, or balance for participants in the yoga group.

For the control group, Wilcoxon signed rank tests were used to examine the results of lower body flexibility and upper body flexibility T1 to T2. No significant differences were found, nor were there significant differences found in the paired *t*-tests for BMI, upper body strength, lower body strength, aerobic endurance, balance and SOC.

Although the majority of the parameters were not statistically significantly different, trends in yoga group compared with control group from T1 to T2 indicated improved physical functioning. Using the method to show percent change modelled by Kolasinski and colleagues (38), we computed the following formula for each physical fitness test:

$$\text{Percent change from baseline} = \frac{[(\text{Final value} - \text{baseline value}) \div \text{baseline value}] \times 100\%}{}$$

Following the 8-week yoga group, caregivers in the yoga group increased their coping ability by 5%, while coping for the caregivers in the control group decreased by 5%. Individuals in the yoga group experienced improved lower body strength by 26%, while lower body strength for caregivers in the control condition decreased by 9%. The caregivers in the yoga group also experienced an increase in their upper body strength (8%), while the caregivers in the control group experienced a decline (-5%). Further, aerobic endurance increased by 10% for individuals in the yoga group, while it increased by 7% for those in the control group. Yoga participants also experienced an increase in lower body flexibility (29%), while those in the control group experienced an increase of 556%. This is due to one individual having an 8-inch increase in her sit and reach test. If this one subject's data is not accounted for, the mean reach for the control group increased by 1 inch (i.e. 239%). Upper body flexibility improved for those in the yoga group (56%) and for those in the control condition (2%). There was a slight increase of balance and agility over time (2%) for those in the yoga condition, while those in the control condition decreased (-11%). There were no reported adverse events during the yoga sessions.

Results: Feasibility

The interviews lasted 10 minutes to 2 hours. Those in the yoga group were the most verbose and provided much feedback about enjoying the intervention. For those in the yoga group, the primary reason given for participating in the study for all four active yoga participants was that they were interested in the intervention. These women stated that they enjoyed doing it and they felt the physical and psychological benefits from it.

For example, MT, a 55-year-old caregiver, said, 'I didn't feel guilty for taking the time for the yoga because I was seeing the benefits'. Further, the four active yoga participants reported that yoga was a peaceful time and helped them relax. Two of the yoga participants identified that they felt better overall as a result of participating in yoga. Other physical benefits perceived by the yoga participants included better posture, improved flexibility and balance.

For the caregivers who dropped out of the study, the primary reason cited by seven informal caregivers (two who did not participate in more than one yoga session and four who were eligible to participate but declined) were time commitments. For example, SD, a 40-year-old caregiver in the group that declined participation, mentioned that she has a full-time job and two preteens. When there was a conflict, the intervention would not be her priority over the family. In fact, five of the seven caregivers who reported schedule problems were employed. Caregivers, especially employed caregivers, reported that they were very busy. They were trying to balance their job, family and providing care. Leisure activities or interventions were often neglected in their must-do list, which supports findings by Dewey and colleagues (39) that women tend to give up their leisure time to provide care.

The caregivers who declined to participate identified that the reasons they called about this study was to seek interaction with other caregivers, share information with other caregivers, see how other people were dealing with being a caregiver, learn how to be a better caregiver, help other people to understand caregivers and seek time for themselves. Caregivers in the attrition group also reported that a monetary incentive would be a bonus, but was not a primary motivation.

Research with this population can be difficult for a variety of reasons. Health problems plagued the caregivers and care recipients in this study. Two caregivers in the yoga group (one with excellent attendance and one with poor) had major surgery during the intervention period and another had gallstones. Also, one care recipient passed away at the end of the intervention period, and one was institutionalized during the intervention period. The caregivers of these care recipients who had health issues did not drop from the study, but were very difficult to reach for follow-up testing. Several caregivers who declined to participate did so because they perceived their care recipient as too sick to leave them alone.

Finally, to make the intervention more feasible to caregivers, we were interested in the caregivers' opinion about location and schedule of the intervention. Location was not a concern for the active yoga participants. Though they preferred a convenient location, they reported that they were able to overcome the problems of transportation and parking. Researchers also

sought opinions from caregivers in the attrition group and non-active yoga group about logistical issues. Caregivers' schedules varied greatly, person to person. Some caregivers preferred weekends, while others preferred weekdays. Of course, due to varying individual situations, it was impossible for one time to meet the needs of all caregivers. The caregivers suggested that numerous class time choices be made available, and the number of hours required/week be reduced so that people could choose from the times and reduce interference with their schedules.

Finally, two concerns arose regarding misperceptions on the part of the participants. A male caregiver identified that he did not attend yoga because he felt uncomfortable not wearing shoes. However, 'not wearing shoes' is not a requirement of yoga. Another male caregiver cited that he perceived trouble with parking on campus, and did not attend as a result.

Caregivers were given the option at the end of the program to choose a gift card to a local store, or a gift certificate to a yoga program for 8 weeks of classes. The four caregivers with excellent attendance chose the gift certificate to the yoga program, while all other caregivers opted for gift cards to the local store.

Discussion

This study utilized an intervention of Hatha yoga and a variety of asanas and pranayamas to understand physical fitness and coping changes that may occur as a result of an 8-week program for informal caregivers. Lower body strength significantly increased for the caregivers in the yoga group, which supports the work of Tran and colleagues (40). Although not statistically significant, results indicated trends toward intra-individual improvements from T1 to T2 in the yoga group for coping, upper body strength, upper body flexibility, balance and agility and aerobic endurance. Our findings are consistent with the results of researchers who found increases in upper and lower body strength and endurance in a healthy young sample (ages 18–27) (40). These findings also support Kolasinski and colleagues (23) who reported increased strength and flexibility after an 8-week Iyengar Yoga program for individuals over 50 with osteoarthritis (38).

While the caregivers in the yoga intervention improved in lower body flexibility, the caregivers in the control group did as well. The dramatic increase in the control groups' lower body flexibility was unexpected and due to an overall mean increase of 1 inch (if the individual who improved by 8 inches is removed from the calculation). This increase could be due to a number of possibilities, including a Hawthorne Effect (i.e. that caregivers improved as a result of being observed), or a practice effect (i.e. caregivers may have learned the stretch from

the pretest and practiced). Nonetheless, improvements in flexibility also occurred for the caregivers in the yoga group. Finally, it is important to note that in coping, lower body strength, upper body strength, upper body flexibility and balance and agility, caregivers in the yoga group showed trends toward improvement, while caregivers in the control group trended toward decreased ability on the same parameters during the 8-week period. These findings should be explored in a larger study, but it is possible that a yoga program is protective against physical decline for this population.

There were several lessons learned, including the concerns of recruitment and intervention design. Researchers have found that it is difficult to conduct intervention studies with informal caregivers in a clinical trial, especially those that are randomised (41). This is because caregivers often are busy with family, work and caregiving. By definition, caregivers have numerous duties to which they must attend. Asking caregivers to add one more duty by participating in a research study is quite a challenge. Though caregivers might be willing to participate in research, it obviously is not a priority.

Time constraints were the primary problem for our non-participants. 'Lack of time' was found as the primary reason for dropping the study. In numerous studies, time constraints are often reported as a reason why caregivers drop out, with attrition rates ranging from 16% to 50% (31,32,42). In addition, physical activity studies also experience moderate attrition rates, with typical rates ranging from 3% to 41% (43). As previously mentioned, we had a 32% decline to participate after the first phone call and 24% attrition after the study began. Perhaps the area that can be improved upon by researchers to make yoga more palatable to older individuals is to clearly describe the yoga intervention, and ask if there are any questions. This may help avoid misconceptions such as the ones voiced by the participants in this study. The research coordinator attempted to reach those who were not attending by telephone to determine if these types of issues were the reason for their absence, but was not able to reach them by telephone.

The subjects who did participate in the yoga sessions perceived benefits from this intervention. When motivation or interest in research is high, attendance tends to correspond. Some studies have reported the main reason for attrition was the participants' perception of not needing the intervention (31,44). In our study, the caregivers were less concerned about compensation, but were concerned about the benefits they would derive from the research. The interview data indicated the three active participants in yoga group reported thoroughly enjoying yoga classes, and they reported feeling relaxed from it. Perception of benefits from intervention might enhance attendance and enrollment in caregiving studies. The fact that caregivers who participated in yoga chose

to further pursue yoga classes is to be likely indicative of their satisfaction with yoga as an activity.

Limitations

There are some limitations related to this research. The sample size was small, and our attrition rate was moderate. Two of the six individuals in the yoga group did not attend greater than one session, which may have diluted the effects of yoga on the three individuals that attended most. Moreover, the intervention may have been too short to expect significant changes in physical fitness and coping. Additional limitations include the lack of monitoring the between-yoga-session practice, and the levels of physical activity for the control group. Further, the small cell sizes did not permit multivariate comparisons and several parametric tests were conducted without controlling for Type I error. Thus, clinical significance of the findings is unclear. In spite of these concerns, the implications are that in a group of older, mostly overweight adults, yoga may serve to increase strength and flexibility.

Recommendations for Future Research

Future studies should consider more home-based practice (perhaps accompanied with video/DVD) and only one (rather than two) class meetings/week. As King and Brassington (45) and Waelde *et al.* (46) advocated, home-based activity may help alleviate some of the participation constraints often expressed by caregivers. Also, future research should utilize a larger sample, which would allow for an examination of treatment effects according to the amount of yoga practiced. In addition, future studies should identify *a priori* guidelines about who to include in analyses based on level of attendance, and compare these findings with other physical activities such as walking.

Conclusion

This study found that an 8-week Hatha yoga program for informal caregivers has the potential to increase the coping ability, strength, flexibility and endurance of informal caregivers. These components may in turn, enhance an individuals' ability to negotiate their life situation. Thus, Hatha yoga needs to be further investigated as a tool to enhance quality of life dimensions for informal caregivers.

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Appendix A: Pranayamas and Asanas Utilized in an 8-week Intervention Developed by Jennifer Cameron, Certified Yoga Instructor

Pranayama

Three-part Breathing (Full Puraka & Rechaka/Inhalation & Exhalation)

- Releases belly tension
- Encourages full use of lungs/chest freeing constrictions

Asanas

Standing

Samasthiti/Tadasana (Equal Standing/Mountain)

- Builds stability and grounding
- Builds base for all other poses

Cat/Cow

- Develops fluidity in spine

Adho Mukha Svanasana (Downward-Facing Dog)

- Greatly reduces stiffness and blockage in shoulder joint
- Allows blood to flow back to heart
- Frees up restriction around lung and diaphragm supporting relaxed breath rhythm

Padangusthasana (Hand to Toe Forward Bend)

- Builds energy in legs
- Lengthens legs and back

Parighasana (Kneeling Triangle)

- Opens side waist (abdominal obliques) relieving restrictions from collapsed spine, emotional stress and collapsed posture
- Allows for greater ease in breathing
- Reduces scoliosis curvature in lower spine

Virabhadrasana II (Warrior 2)

- Builds stamina and strength for arms and legs
- Tones abdominal organs

- Builds calm intensity
- Builds special awareness

Parsvakonasana (Extended Side Angle)

- Creates elasticity in hip
- Streamlines sidebody

Parsvottanasana (Pyramid)

- Quiets the mind
- Energizes the legs, frees spinal energy
- Balances sacrum

Padottanasana (Wide Leg Forward Bend)

- Reduces fatigue by rejuvenating brain
- Tones legs
- Frees hip joints and sacrum

Trikonasana (Triangle)

- Tones legs and hips and teaches leg alignment
- Frees restrictions in spine
- Builds harmony, balance and grace and brings tranquility to mind

Caturanga Dandasana (Modified) (Plank)

- Strengthens core awareness and musculature
- Strengthens shoulder girdle awareness and musculature

Virabhadrasana I (Warrior 1)

- Builds stamina through inner core strength

Garudhasana (Eagle) (Arms Only)

- Keeps shoulder flexible
- Opens upper back

Arm to Wall Stretch

- Frees restrictions in front shoulders
- Develops freedom in chest and heart center
- Stimulates chest and throat lymph movement

Virasana (Hero)

- Builds elasticity in ankles, knees while supporting vertical spine

Belly

Balasana (Child's Pose)

- Quiets and cools mind
- Gentle release for back

Bhujangasana (Cobra)

- Strengthens lower back
- Develops awareness of core body
- Develops shoulder and neck alignment

Shalabhasana (Locust)

- Makes low back light and flexible
- Tones digestive fire through abdominal compression

Balancing

Vrksasana (Tree)

- Increases balance and eliminates stiffness in ankles, knees and hips

Virabhadrasana III (Modified) (Warrior 3)

- Builds stamina in legs and inner core

Seated

Pascimottanasana (Sitting Forward Bend)

- Cools energy
- Lengthens back and back of legs

Purvottanasana I (Reverse Table Top)

- Extends anterior body
- Opens front shoulders

Janu Sirsasana

- 'Most therapeutic of all forward bends' Little, 2004
- Develops elasticity and balances tension across low back
- Is a crucial preventive pose in cases of lower back strain

Maricyasana III (Modified) (Seated Twist)

- Revives body from fatigue
- Reduces asymmetry in lumbar spine
- Tones kidneys
- Stimulates peristalsis in intestines

Reclining*Gomukhasana (Modified to Reclining) (Cow Face Pose)*

- Opens pelvis and outer hips
- Tones pelvic floor and viscera
- Opens shoulders

Supta Padangusthasana (Supine Hand to Toe)

- Opens inner legs
- Brings blood to pelvic diaphragm and viscera
- Relieves cramping in low back
- Eliminates fatigue
- Stretches and tones meridians of spleen, kidney and liver

Setubandhasana Sarvangasana (Bridge)

- Brings blood to heart, lungs and throat
- Makes shoulder girdle more elastic

Jathara Parivartanasana I (Reclining Twist)

- Tones abdominal viscera
- Relieves low back and hip tension through gentle spinal twist

Viparita Karani (Feet Up Wall)

- Reduces fatigue in legs
- Rejuvenating for lungs and brain, excellent overall tonic

Savasana (Corpse) (Supported and Unsupported)

- Restores mind and body
- Allows one to absorb practice

Parivrtta Parsvakonasana (Revolved Side Angle)

- Demands elasticity in spine and hip
- Strengthens inner legs and core balance



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