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Effect of Laughter Yoga on Psychological Well-being and Physiological Measures

Cindy Miles, CLYT; Elizabeth Tait, PhD, MHS; Marc B. Schure, PhD; Marianne Hollis; PhD, RN

ABSTRACT

Context • In 2014, laughter yoga (LY) achieved the intermediate level, tier 2, under the Title III-D Evidence-based Disease Prevention and Health Promotion Program through the Administration on Aging (AOA). Further research is needed to qualify LY under the criteria for the highest tier, tier 3, to assure continued funding for LY classes at senior centers.

Objectives • The study intended to demonstrate further the benefits of LY and to qualify LY as tier 3 under Title III-D.

Design • Using a quasi-experimental design, the research team conducted a preintervention/postintervention study in 3 phases.

Setting • The study was done in a variety of community centers. Phase 1, a pilot phase, was limited to North Carolina, and phase 2 was conducted in multiple states. Phase 3 was held at the North Carolina Area Agency on Aging's annual Volunteer Appreciation meeting.

Participants • Participants in phases 1 (n = 109) and 2 (n = 247) enrolled in LY classes. Classes were advertised by fliers posted in community and in retirement centers. The ability of participants to participate in a class was based solely on their desire to participate, regardless of age, ability, health status, or physical impairment. Phase 3 (n = 23) was a convenience sample only. All phases were voluntary.

Outcome Measure • The pre- and posttests for all 3 phases were Likert-scale surveys, 10 questions on the Psychological Outcomes of Well-being (POWB) survey. Pulse and other physiological measurements were also assessed pre- and postintervention. Analysis included a *t* test on each of the 10 POWB and physiological measures for all phases.

Results • All 10 POWB measures for phases 1 and 2 showed significant improvements between the pre- and postintervention testing ($P < .001$). Phase 3, the control, showed no significant improvement.

Conclusions • The initial study demonstrated that LY meets the criteria to qualify for tier 3 under the Title III-D Evidence-based Disease Prevention and Health Promotion Program and that a large number of Americans, regardless of age and physical ability, could benefit from LY. (*Adv Mind Body Med.* 2016;30(1):12-20.)

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Numerous studies have shown the health benefits of laughter.[1-3] In 1994, Madan Kataria, MD, a physician from India, developed laughter yoga (LY).[1] LY combines real and simulated laughter that often results in yogic breathing.[4] In the practice, laughter is simulated as a body exercise in a group,[4] which often results in spontaneous, genuine laughter.[5]

The purpose of the current quasi-experimental, case-control study was to demonstrate the benefits of LY and to qualify it as meeting the criteria for the highest tier, tier 3, under the Title III-D Evidence-based Disease Prevention and Health Promotion Program.

What then defines a program as *evidence based*, and why is that attribution important?

Evidence-based

Evidence-based (EB) programs are based on scientific research.[6] The Older Americans Act (OAA) is considered a major vehicle for the federal government to deliver needed services to the aging.[7] Titles III and IV of the OAA reaffirm the Administration on Aging's (AOA's) commitment to making sure that EB programs are accessible to older Americans.[8] EB health-promotion programs have been shown to reduce the need for costly medical interventions as well as patients' dependency on governmental programs. Standards exist for grading clinical research under EB criteria.[8] On February 14, 2014, the North Carolina Division of Aging and Adult Services formally approved LY as an intermediate level, or tier 2, program under the Title III-D Evidence-based Disease Prevention and Health Promotion Program.

To be awarded tier 3, a program must also meet 3 additional criteria in addition to meeting the criteria for tiers 1 and 2. Tier 3 programs must also (1) be proven effective for an older-adult population, using an experimental or a quasi-experimental design; (2) have been fully translated into programs at 1 or more community site(s); and (3) have developed and disseminated products that are available to the public.[9]

Benefits of Laughter

Methodologically, it is important to distinguish between humor and laughter or simulated laughter.[10] Humor and laughter are not synonymous. Simulated laughter can mimic the effects of laughter.[11] Laughter is a physiological event, whereas humor is a subjective construct.[12]

The effects of laughter are physical.[10] Laughter can provide an aerobic workout and, by increasing vascular blood flow, reduce blood pressure.[13] Likewise, simulated laughter has been found to boost mood and produce a feeling of psychological well-being.[11] Self-induced or simulated smiling had been found to be a mood enhancer.[11] Compared to aerobic exercise, laughter has been shown to be more effective in decreasing anxiety.[14,15]

Studies have shown the beneficial effects of laughter, real or simulated, on different body systems, including the mental, hormonal, and immunological.[5,16] As a group-exercise program, laughter has been found to be at least as effective as medication in treating depression and improving life satisfaction for elderly depressed women.[4,17] Laughter is cathartic and can bring about a metamorphosis in emotions.[1]

Further, Mora-Ripoll[18] has shown that the human brain does not distinguish between real and simulated laughter. He indicates that simulated or self-induced laughter is increasingly gaining popularity worldwide. The health benefits of laughter are well-known; incorporating yogic breathing enhances those benefits.[19]

Laughter Yoga

LY was founded by Dr Kataria in 1994 as a combination of both yogic breathing and unconditioned laughter.[4] Dr Kataria's interest in laughter as a form of healing medicine was sparked by Norman Cousins' book, *Anatomy of an Illness as Perceived by the Patient: Reflections on Healing and Regeneration*, which discussed actively addressing a life-threatening illness through humor.[13,17] Cousins, when he was told that he had Marie-Strumpell disease, began his own research on the healing effects of laughter, based on research conducted by Hans Selye.[20] Cousins's doctors found that the pre- and posttests for a laughter-intervention class showed a cumulative drop of 5 points in the rate of erythrocyte sedimentation.[17,20] An elevated sedimentation rate can indicate the presence of inflammation.[21] Cousins found that 10 minutes of genuine belly laughter resulted in at least 2 hours of pain-free sleep.[17] Dr Kataria was intrigued and wondered whether similar results could be replicated with a group in a class-like environment.[4]

LY and Yoga Clubs

Dr Kataria formed the first laughter club with 4 volunteers who told jokes to each other.[4] After a few weeks, the attempts at humor failed; Dr Kataria then introduced yogic-breathing techniques that simulated laughter and childlike-playfulness exercises, which resulted in the LY program.[22] Dr Kataria found that the effect of those combined activities had a beneficial effect on both the mental and physical aspects of health; hence, the term *laughter yoga* was created.[4]

LY combines laughter with yogic breathing.[4] The laughter is simulated; participants laugh without relying on jokes, humor, or comedy.[4]

Laughter, LY, and Seniors

Laughter has been shown to improve mental functioning and increase memory, interpersonal responsiveness, and alertness.[14] Laughter can generate a *total-body* response that tones muscles, an especially important function for bedridden and wheelchair-bound individuals.[14] The digestion rate can be improved with laughing due to the engagement of muscles of the gastrointestinal system.[14] Laughter has also been shown to release endorphins and decrease pain.[23,24]

LY can be easily adapted to a variety of environments and skill levels. Its ease of use and portability help to make LY accessible to a variety of populations, including older adults.[19] McMahan has demonstrated the physiological benefits of laughter with older adults.[14]

LY can be done from a chair or wheelchair with a few simple modifications to encourage interaction with other club members.[17] LY classes can increase social interaction, which in turn can benefit mental and physical health. The lack of equipment costs and the flexibility of place and space help to make LY a cost-effective and entertaining way to introduce a pleasant form of exercise for people of varying ages and abilities.[17,19,25]

METHODS

The purpose of the current quasi-experimental, case-control study was to demonstrate that LY is effective with older-adult populations. The study was conducted in

3 phases. The pilot, phase 1, included only an intervention group and was conducted in North Carolina. Phase 2 also included only an intervention group and was conducted in 6 states: California, Illinois, Massachusetts, New Hampshire, New Mexico, and Rhode Island. Phase 3, the control element, was conducted with a control group in North Carolina only.

Participants

Participants in phases 1 and 2 were recruited using flyers distributed primarily through senior centers. The courses in senior centers were voluntary and free of charge. Other venues included community centers and libraries.

Participation in the study was voluntary. Individuals who chose to participate in the LY classes were not obligated to participate in the study unless they chose to do so. Class size ranged from 8 to 10 participants with 1 instructor. The ability of participants to participate in a class was based solely on their desire to participate, regardless of age, ability, health status, or physical impairment.

Participants in all groups were told that the study was examining specific outcomes from LY to see whether it could meet the federal criteria that had been established for EB, but very little other explanation was provided. Consultation on and review of the structure of the study protocol was provided by the PhD evaluator at the North Carolina Division of Aging & Adult Services. Consultation included, but was not limited to, used of intervention and control groups, data collection (participant demographics, outcome measures), and analysis strategy. No formal approval was required by the agency or LY International. Participation in all phases was voluntary and those individuals who did not want to participate did not. No incentives were offered for participation.

Phase 1. To find participants for the intervention group in phase 1, certified LY instructors (CLYLs) in North Carolina invited individuals in their LY classes to be participants in the study. A total of 114 individuals enrolled in the phase. Original enrollment was 118. Four individuals did not complete all data collection and were not used for analysis.

Phase 2. To find participants for the intervention group in phase 2, CLYLs from 6 additional states enlisted volunteers from their LY classes to participate in the study. A total of 300 individuals enrolled in the phase. Original enrollment was 352. A total of 52 individuals did not complete all data collection and were not used for analysis.

Phase 3. To create a control group, the member of the research team who worked at the Southwestern Commission Area Agency on Aging invited the people who attended its annual Volunteer Appreciation meeting to participate in the phase 3 assessment. The researcher explained the need for a control group and asked for volunteers to participate. A total of 31 individuals enrolled in the phase. Seven individuals did not complete all data collection and were not used for analysis.

Procedures

Participants in all phases completed the Psychological Outcomes of Well-being (POWB) form, developed by Dr Kataria (Figure 1). The POWB forms were handed out at the beginning of classes for the intervention groups. Those groups completed the *before* side of the forms at their seats and then joined in a 60-minute LY class. At the conclusion of that class, the participants returned to their seats to complete the *after* side of the form. The control group completed the forms twice during the annual Volunteer Appreciation meeting. For phases 1 and 2, the completed POWB forms were collected by the CLYLs, and the forms were then packaged and sent to the student intern for coding. No identifying information was collected on the form.

Physiological measurements were also collected in all phases. In phase 1, a total of 5 measurements were collected: (1) systolic blood pressure, (2) diastolic blood pressure, (3) mean blood pressure, (4) blood oxygenation, and (5) heart rate in beats per minute (BPM). Blood oxygenation

Figure 1. POWB Pre- and Postintervention Surveys

First 3 Letters of Your First Name _____
First 3 Letters of Your Last Name_____
Your Age _____
Date_____
Location_____

HOW DO YOU FEEL?
Complete this page **Before** you take part in the Laughter Yoga Class.

Complete a new one **After** you take part in the Laughter Yoga Class.

To measure the immediate effects of Laughter Yoga:

Well-being Questions

	<Worst CIRCLE Best>
Enthusiasm	1 2 3 4 5 6 7 8 9 10
Energy level	1 2 3 4 5 6 7 8 9 10
Mood	1 2 3 4 5 6 7 8 9 10
Optimism	1 2 3 4 5 6 7 8 9 10
Stress level	1 2 3 4 5 6 7 8 9 10
Level of friendship with group members	1 2 3 4 5 6 7 8 9 10
Level of awareness about your breathing	1 2 3 4 5 6 7 8 9 10
Level of muscle relaxation	1 2 3 4 5 6 7 8 9 10
Level of mental relaxation	1 2 3 4 5 6 7 8 9 10
Ability to laugh without a reason	1 2 3 4 5 6 7 8 9 10

Abbreviation: POWB, psychological outcomes of well-being.

and blood pressure were not measured in phases 2 or 3 due to a lack of equipment. Therefore, the only physiological measurement collected in those phases was heart rate.

The completion of phase 1 resulted in the formal approval of LY as a tier 1 (minimal criteria) EB program by the North Carolina Division of Aging and Adult Services in August 2013. In phases 2 and 3, participants also completed a demographic form to provide data that included gender, race/ethnicity, a self-assessment of current health, and quality-of-life measures. The addition of the form was recommended by the North Carolina State Unit on Aging for phases 2 and 3 after LY had achieved its tier 1 status (Table 1). To achieve tier 2, practice in additional states was required, as was the introduction of a control group. Tier 2 was achieved in February of 2014.

Phase 1. This pilot phase began with the first CLYL training in October 2012 and concluded on June 30, 2013. All CLYLs were new to LY and were recruited by the principal investigator. Each was trained by the research team using the core curriculum from LY International. To ensure consistency, all CLYLs conducted LY sessions 1 or more times prior to administering the study. That practice was a deliberate part of their training to ensure that the new CLYLs would be consistent in conducting the LY classes that they would subsequently facilitate.

Phase 2. The research team randomly contacted 1 of the 6 LY master trainers who are located in the United States. That master trainer then recruited other CLYLs from 6 additional states to enlist volunteers to participate in the study. Master trainers have completed 60 hours of training, including 15 days in India with the founder. CYLTs receive 40 hours of training from either teachers or master trainers. CLYLs receive 20 hours of training from teachers or master trainers.

Phase 3. The members of the control group completed the demographics questionnaire as well as the *before* side of the POBW form at their seats at the start of the meeting. After the 2 forms were filled out and the first physiological readings were taken, the normal agenda for the Volunteer Appreciation meeting resumed. Sixty minutes after those first readings and tests, the meeting agenda was paused to give participants the opportunity to complete the second POWB test and physiological readings.

Intervention

The intervention phases were LY classes given by CLYLs, who volunteered their time to teach the LY courses. All classes followed the same structure and basic exercises. A typical laughter class began with energetic chants of "ho-ho, ha-ha-ha," and hand-clapping.[26] Full-hand, palm-on-palm, finger-on-finger clapping was done to stimulate pressure points and increase energy levels, whereas the "ho-ho, ha-ha-ha" activated the diaphragm, which prepared the body to breathe deeply throughout the practice.[27]

The LY class was led through a variety of laughter exercises with names such as milkshake laughter, lion laughter, and shake-hands laughter, to promote playfulness among the members.[26] Forced laughter quickly became genuine as each group worked together on the exercises.[17,26] The LY exercises lasted anywhere from 20 minutes to 1 hour and generally ended with group chanting and/or meditation.[17]

Outcome Measures

Phase 1. To ensure fidelity with the collection of physiological data, CLYLs were issued identical Food and Drug Administration (FDA)-approved, automatic blood-pressure cuffs (EastShore Medical Supply, Algoma, WI, USA) and pulse oximeters (Clinical Guard, Atlanta, GA, USA) and were trained on the proper protocol and use of the equipment by the research team. Heart rate was displayed on identical, FDA-approved pulse oximeters, which were given to each of the CLYLs. Each instructor was trained in the equipment use and then practiced using the equipment until demonstrating reliably consistent readings. To ensure internal validity, all CLYLs were trained by the research team using the same training materials. In the training, the physiological measures were taken and recorded by the CLYLs who would be performing the procedures in the study's LY classes after they had received instruction from the CLYLs who taught the class on the proper procedures to take them. The training CLYLs offered assistance as needed.

Phase 2. To ensure fidelity in the collection of physiological data, an instructional video was viewed by each collaborating LY instructor prior to giving the classes.[28] The video demonstrated the proper method and established the standards for measuring pre- and postintervention heart rates, using the radial-artery measurement technique. The instructors demonstrated the technique to participants in the intervention groups, who then took their own pulse rates, with the instructors giving timed start-and-stop commands, according to the protocol established in the instructional video. When necessary, the instructors assisted participants in locating their pulse points. Data were contributed by CLYLs, leaders, and master trainers from California, Illinois, Massachusetts, New Hampshire, New Mexico, and Rhode Island.

Phase 3. The member of the research team who was present demonstrated the radial-artery method of taking a pulse, after which the participants measured their own pulse rates, with the researcher giving timed start-and-stop commands. When necessary, the researcher assisted participants in locating their pulse points.

Data Analyses

Data were analyzed in SPSS version 21 (Release Version 21.0.0.0, SPSS Statistics for Windows, Version 21.0, IBM Corporation, Armonk, NY, USA). Based on the type of data and the research goal, which was the identification of differences between baseline and the end of the intervention, and the small sample size for phase 3, the current research team chose the paired-samples *t* test as the most appropriate method of statistical analysis to examine the changes from preintervention to postintervention for repeated-measures groups, where the same participants are tested more than once. A paired-samples *t* test was calculated to compare the

Table 1. Demographic Data of Initial Participants in Phases 1, 2, and 3

	Phase 1 NC (Pilot)		Phase 2 Multistate		Phase 3 Control	
	n	%	n	%	n	%
Total	114	100%	300	100%	31	100%
Gender						
Female	NA	NA	238	79%	25	81%
Male	NA	NA	62	21%	6	19%
Hispanic/Latino or Spanish origin						
Yes	NA	NA	18	6%	3	10%
No	NA	NA	278	93%	27	87%
Unknown	NA	NA	4	1%	1	3%
Blank	NA	NA	0	0%	0	0%
Race/ethnicity						
American Indian	NA	NA	1	0%	1	3%
Asian or Asian-American	NA	NA	8	3%	NA	NA
Black or African-American	NA	NA	21	7%	NA	NA
Hawaiian Native or Pacific Islander	NA	NA	0	0%	NA	NA
White or Caucasian	NA	NA	251	84%	30	97%
Other or blank	NA	NA	19	6%	NA	NA
Age range (y)						
<20	0	0%	4	1%	NA	NA
20 to ≤30	6	5%	12	4%	NA	NA
30 to ≤40	17	15%	22	7%	1	3%
40 to ≤50	14	12%	38	13%	NA	NA
50 to ≤60	21	18%	73	24%	3	10%
60 to ≤70	24	21%	77	26%	7	23%
70 to ≤80	22	19%	48	16%	11	35%
80 to ≤90	9	8%	18	6%	9	29%
≥90	0	0%	8	3%	NA	NA
Blank	1	1%	0	0%	0	0
Military service						
No	NA	NA	278	93%	23	74%
Yes	NA	NA	20	7%	8	26%
Blank	NA	NA	2	1%	0	0%
Provider told had chronic conditions						
Arthritis/rheumatic disease	NA	NA	77	16%	16	32%
Breathing/lung disease	NA	NA	48	12%	2	6%
Cancer	NA	NA	38	11%	6	19%
Depression or anxiety disorders	NA	NA	52	16%	0	0%
Diabetes	NA	NA	24	7%	6	22%
Heart disease	NA	NA	10	3%	3	14%
Hypertension (high blood pressure)	NA	NA	73	17%	2	4%
Osteoporosis (low bone density)	NA	NA	21	5%	1	2%
Other chronic condition	NA	NA	25	6%	8	18%
Stroke	NA	NA	1	0%	1	2%
Blank	NA	NA	110	18%	5	8%
Region						
Blank	NA	NA	16	5%	1	3%
Midwest	NA	NA	54	18%	0	0%
West	NA	NA	58	19%	0	0%
South	NA	NA	61	20%	30	97%
Northeast	NA	NA	111	37%	0	0%
Number of people currently in household (including yourself)						
1	NA	NA	78	26%	6	19%
2	NA	NA	120	40%	21	68%
3	NA	NA	56	19%	2	6%
4	NA	NA	32	11%	1	3%
5	NA	NA	6	2%	0	0%
>5	NA	NA	3	1%	0	0%
Blank	NA	NA	5	2%	1	3%
Have you ever taken this workshop before?						
Yes	NA	NA	175	58%	9	29%
No	NA	NA	120	40%	20	65%
Blank	NA	NA	5	2%	2	6%
How did you hear about this class?						
Church faith-based group	NA	NA	2	1%	1	3%
Flyer/poster	NA	NA	28	9%	0	0%
Friend/family	NA	NA	108	35%	6	19%
Healthcare provider	NA	NA	3	1%	0	0%
Newspaper ad/article	NA	NA	30	10%	0	0%
Other	NA	NA	56	18%	13	42%
Senior center announcement	NA	NA	32	10%	8	26%
UHC/AARP	NA	NA	0	0%	1	3%
Blank	NA	NA	51	16%	2	6%
In general, would you say your health is:						
Excellent	NA	NA	59	20%	5	16%
Fair	NA	NA	15	5%	5	16%
Good	NA	NA	87	29%	10	31%
Very good	NA	NA	139	46%	11	34%
Blank	NA	NA	0	0%	1	3%
How would you rate your overall quality of life?						
0-3, very poor to poor quality	NA	NA	2	1%	0	0%
4-6, average quality	NA	NA	60	20%	2	6%
7-10, good to excellent quality	NA	NA	237	79%	29	94%
Blank	NA	NA	1	0%	0	0%
Number of times hospitalized in the past 6 mo						
0	NA	NA	287	96%	29	94%
1	NA	NA	9	3%	2	6%
2	NA	NA	2	1%	0	0%
3	NA	NA	1	0%	0	0%

Abbreviations: NC, North Carolina; NA, not available; UHC/AARP, UnitedHealthcare/American Association of Retired Persons.

Table 2. Paired *t* Test of the 10 Indicators of POWB and of Physiological Measures

	Phase 1 n = 109			Phase 2 n = 247			Phase 3 n = 23		
POWB Results	**Mean**	**SD**	***t***	**Mean**	**SD**	***t***	**Mean**	**SD**	***t***
Enthusiasm	-0.92	1.20	-7.99[a]	-2.05	1.62	-19.98[a]	-0.08	0.50	0.43
Energy level	-1.25	1.56	-8.36[a]	-2.55	1.64	-24.53[a]	-0.08	0.78	0.60
Mood	-1.02	1.08	-9.86[a]	-2.23	1.73	-20.32[a]	0.04	0.86	0.81
Optimism	-1.07	1.26	-8.92[a]	-2.04	1.77	-18.20[a]	0.00	0.59	1.00
Stress level	-1.32	2.22	-6.24[a]	-1.83	2.94	-9.80[a]	0.17	0.70	0.26
Level of friendship with group	-1.00	1.64	-6.41[a]	-1.98	1.89	-16.43[a]	-0.42	0.93	0.038[b]
Level of awareness about breathing	-1.60	2.01	-8.33[a]	-2.69	2.00	-21.15[a]	-0.21	0.59	0.096[c]
Level of muscle relaxation	-1.75	1.62	-11.32[a]	-2.98	1.76	-26.68[a]	-0.04	0.69	0.77
Level of mental relaxation	-1.80	1.74	-10.82[a]	-3.04	1.94	-24.66[a]	-0.21	0.98	0.31
Ability to laugh without a reason	-1.51	2.03	-7.81[a]	-2.58	2.21	-18.39[a]	-0.13	1.33	0.65
Physiological Results									
Heart rate (BPM)	1.35	11.90	1.19	4.51	12.27	5.79[a]	-1.63	3.62	-2.20[b]
Systolic	5.11	14.65	3.66[a]	NA	NA	NA	NA	NA	NA
Diastolic	1.24	8.70	1.49	NA	NA	NA	NA	NA	NA
Mean blood pressure	2.52	8.62	3.07[d]	NA	NA	NA	NA	NA	NA
Blood oxygenation	-0.55	4.42	-1.32	NA	NA	NA	NA	NA	NA

Abbreviations: POWB, psychological outcomes of well-being; SD, standard deviation; BPM, beats per minute; NA, not available.

[a]$P < .001$.
[b]$P < .05$.
[c]$P < .10$.
[d]$P < .01$.

mean pretest scores with the mean posttest scores of phase 1 and 2 data. The alpha level of $P < .05$ was considered statistically significant for all analyses. Statistical analysis was conducted on the 10 POWB questions for all 3 phases and on the 3 physiological measurements for phase 1 and on the 1 physiological measurement for phases 2 and 3. No statistical analyses were done on the demographic data collected for phases 2 and 3.

RESULTS

Participants

Only those participants who completed the pre- and postintervention class surveys were included in the study.

Phase 1. The median age for phase 1 participants was 57 years, with the youngest being 26 years and the oldest 89 years. Of the 114 who initially began the study, only 109 completed both the pre- and postintervention surveys.

Phase 2. The median age for phase 2 participants was 58 years, with the youngest being 12 years and the oldest 94 years. Of the 300 who initially began the study, only 247 completed both surveys and were included in the study.

Phase 3. The median age for phase 3 participants was 78 years, with the youngest being 46 years and the oldest 96 years. Of the 31 who initially began the study, only 23 completed both surveys and were included in the study.

Well-being Results

All 10 POWB measures for phases 1 and 2 showed significant differences ($P < .001$) between the preintervention and postintervention tests.

For phase 1, the following were found: enthusiasm, $t_{109} = -7.99$, $P < .001$; energy level, $t_{109} = -8.36$, $P < .001$; mood, $t_{109} = -9.86$, $P < .001$; optimism, $t_{109} = -8.92$, $P < .001$; stress level, $t_{109} = -6.24$, $P < .001$; friendship with group, $t_{109} = -6.41$, $P < .001$; awareness about breathing, $t_{109} = -8.33$, $P < .001$; muscle relaxation, $t_{109} = -11.32$, $P < .001$; mental relaxation, $t_{109} = -10.82$, $P < .001$; and ability to laugh without a reason, $t_{109} = -7.81$, $P < .001$.

For phase 2, the following were found: enthusiasm, $t_{247} = -19.98$, $P < .001$; energy level, $t_{247} = -24.53$, $P < .001$; mood, $t_{247} = -20.32$, $P < .001$; optimism, $t_{247} = -18.20$, $P < .001$; stress level, $t_{247} = -9.80$, $P < .001$; friendship with group, $t_{247} = -16.43$, $P < .001$; awareness about breathing, $t_{247} = -21.15$, $P < .001$; muscle relaxation, $t_{247} = -26.68$, $P < .001$; mental relaxation, $t_{247} = -24.66$, $P < .001$; and ability to laugh without a reason, $t_{247} = -18.39$, $P < .001$.

For phase 3, the only measures of significance were the following: (1) the level of friendship with group members—$t_{23} = 0.038$, $P < .05$, with the difference being statistically significant; and (2) the level of awareness about breathing—$t_{23} = 0.096$, $P < .10$, with the difference trending toward significance (Table 2).

Table 3. Percentage Changes Between Preintervention and Postintervention Test Results

	Phase 1 (n = 109)			Phase 2 (n = 247)			Phase 3 (n = 23)		
Physiological Outcomes of Well-being	**Pre**	**Post**	**% Change**	**Pre**	**Post**	**% Change**	**Pre**	**Post**	**% Change**
Enthusiasm	8.18	9.07	11%	6.71	8.80	31%	7.10	7.43	5%
Energy level	7.53	8.73	16%	6.18	8.70	41%	6.67	7.03	5%
Mood	8.21	9.22	12%	6.74	9.00	33%	7.53	7.57	0%
Optimism	8.14	9.19	13%	6.92	8.98	30%	7.57	7.60	0%
Stress level	6.96	8.27	19%	6.11	7.98	31%	7.03	7.14	2%
Level of friendship with group members	8.01	9.01	12%	6.77	8.73	29%	7.43	7.73	4%
Level of awareness about breathing	7.50	9.10	21%	5.96	8.57	44%	6.53	7.10	9%
Level of muscle relaxation	7.25	9.02	24%	5.72	8.69	52%	6.50	6.41	-1%
Level of mental relaxation	7.25	9.06	25%	5.78	8.77	52%	6.72	6.83	2%
Ability to laugh without a reason	7.46	8.95	20%	6.53	9.04	39%	6.07	6.38	5%
Physiological Results									
Heart rate (BPM)	78.22	76.86	2%	74.03	69.66	6%	71.93	73.60	-2%

Abbreviation: BPM, beats per minute.

For phase 1, the percentage changes in the measures from preintervention to postintervention were as follows: (1) enthusiasm—an 11% increase, from 8.2 to 9.1; (2) energy level—a 16% increase, from 7.5 to 8.7; (3) mood—a 12% increase, from 8.2 to 9.2; (4) optimism—a 13% increase, from 8.1 to 9.2; (5) stress level scale—a 19% increase, from 7.0 to 8.3; (6) level of friendship—a 12% increase, from 8.0 to 9.0; (7) breathing awareness—a 21% increase, from 7.5 to 9.1; (8) muscle relaxation—a 24% increase, from 7.3 to 9.0; (9) level of mental relaxation—a 25% increase, from 7.3 to 9.1; and (10) ability to laugh without a reason—a 20% increase, from 7.5 to 9.0 (Table 3).

For phase 2, the changes in the measures from preintervention to postintervention were as follows: (1) enthusiasm—a 31% increase, from 6.71 to 8.80; (2) energy level—a 41% increase, from 6.18 to 8.70; (3) mood—a 33% increase, from 6.74 to 9.00; (4) optimism—a 30% increase, from 6.92 to 8.98; (5) stress level—a 31% increase, from 6.11 to 7.98; (6) level of friendship with group members—a 29% increase, from 6.77 to 8.73; (6) breathing awareness—a 44% increase, from 5.96 to 8.57; (8) muscle relaxation—a 52% increase, from 5.72 to 8.69; (9) mental relaxation—a 52% increase, from 5.78 to 8.77; and (10) ability to laugh without a reason—a 39% increase, from 6.53 to 9.04.

A summary graph of the percentage changes between the pre- and postintervention data indicates that the multistate, phase 2 intervention group had much higher percentages of change in POWBs as compared with the North Carolina-only, phase 1 intervention group and the phase 3 control group (Figure 2).

Physiological Results

In analyzing phase 1 physiological measurements, only 2 measures resulted in significance differences between preintervention and postintervention: (1) systolic blood pressure—$t_{109} = 3.66$, $P < .001$; and (2) mean blood pressure—$t_{109} = 3.07$, $P < .01$ (Table 2).

Pre- and postintervention heart rates for phases 2 and 3 revealed significant results in both phases. For phase 2, heart rates had very significant results—$t_{247} = 5.79$, $P < .001$. For phase 3, changes in heart rate were modestly significant—$t_{23} = -2.20$, $P < .05$ (Table 2).

For phase 2, the overall postintervention heart rate was decreased by 4.37 heart beats (6%), from 74.03 to 69.66 (Table 3). For phase 1, the overall postintervention heart rate was decreased by 1.36 heart beats (2%), from 78.22 to 76.86. For phase 3, the overall postintervention heart rate was increased by 1.67 heart beats (-2%).

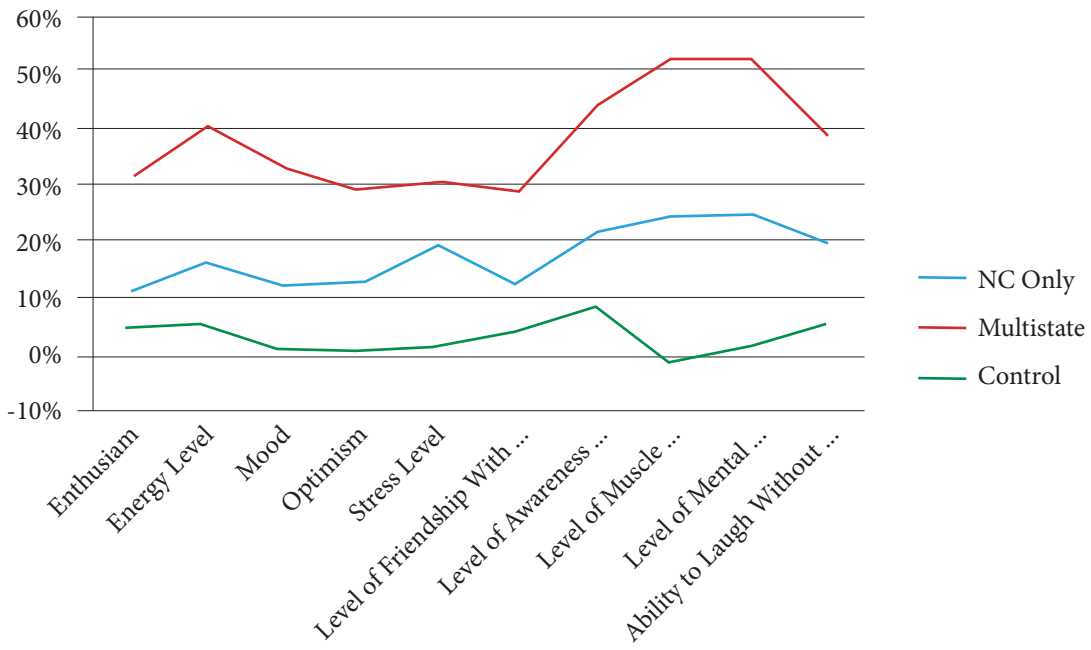
DISCUSSION

Based on the findings of the current preliminary study, 1 hour of LY positively affected physiology and well-being for the 2 intervention groups as compared with the control group that did not participate in LY.

The differences noted between phases 1, 2, and 3 in percentage changes between pre- and postintervention are understandable. The participants in the control group did nothing to affect their POWBs beyond hearing the annual report. The fact that the control group's pulse increased could be an indication of stress as a result of being in a study or stress resulting from the annual report findings.

The differences in the POWB results between phases 1 and 2 could be explained by the fact that the phase 2 trainers had vastly more experience in giving LY classes as compared with the phase 1 trainers. Renshaw et al[29] have shown that experienced instructors, in many cases, have greater success in imparting knowledge and skills as compared with newly trained instructors. The phase 2 instructors had an average of 5 years of experience teaching LY classes, and many were

Figure 2. Graphical Representation of Preintervention to Postintervention Changes in POWB



Abbreviations: POWB, psychological outcomes of well-being; NC, North Carolina.

certified to teach other EB courses. The phase 1 instructors were newly trained to teach LY classes, and none of them had experience with teaching EB courses.

Potential Biases

Several limitations existed with the current study. The sample size was small. The phase 1 instructors were newly trained and all had received their training and instruction directly from the primary investigator, potentially introducing an issue with external validity. The similarity of results from phase 2, however, where the instructors had received their LY instruction from a variety of sources, would indicate that bias was not present. The phase 2 instructors also had on average 5 years of experience in teaching LY classes, and although the CLYLs for phase 1 had no experience with EB courses, several were certified to train some other EB classes.

Figure 2 displays a clear difference in the results from phase 2 as compared with phase 1, indicating that the newly trained instructors were perhaps less effective as compared with the more-experienced instructors. The phase 3 group was small and limited to 1 meeting at 1 location. Although all participants were told few details about the study, they were told about the study's aims, which introduced an issue of internal-validity bias.

The POWB stress level measure is scored identically to the other 9 measures, 1 being worst and 10 being best. Although the postintervention score numbers were higher, indicating improvement in the individual's stress level, future use of the POWB should include consideration of changing the scale for this item.

The same student intern collected and coded all the forms. Data were not re-entered for reliability/validation checking by an external reviewer, introducing possible data entry errors. The scale used to measure well-being was created by the creator of the LY program, introducing potential bias. Participation was voluntary. The sample used in the study may be different from the general population in that they chose to take the course and were self-selected to participate in the study.

Evidence-based

In keeping with the Title III-D OAA EB criteria, the research team believes that the current study met all 3 tier 3 standards. The study was (1) able to demonstrate that LY was effective with an older-adult population, using a quasi-experimental design; (2) fully translated into classes at 1 or more community sites; and (3) provided products that were available to the public through the LY Web site[i] and through the training that the CLYLs received.

CONCLUSIONS

The purpose of the current initial study was to demonstrate that LY meets the criteria to qualify for the highest tier, tier 3, in the Title III-D Evidence-based Disease Prevention and Health Promotion Program and that a large number of Americans, regardless of age and physical ability, could benefit from LY. The research team believes that those

i. Web site available at http://www.laughteryoga.org.

goals have been met. The preliminary results support the fact that the current, quasi-experimental, case-control study demonstrated that LY is easily implemented in a variety of locations and that LY has activities to support healthy lifestyles and promote healthy behaviors that can potentially reduce the need for more costly medical interventions. Those individuals who participated in the current initial study demonstrated statistical improvements in all of the well-being measures and most of the physiological measures.

More research is needed. Further experimental studies are planned to change the preintervention to postintervention well-being scale (POWB) to a scale that has been vetted by an agency independent of the LY organization. In addition, changes need to be made to address the lack of blinding and to increase the sample size of any future study. The control population needs to be more representative of the intervention population, both in size of population and in location. The researchers hope to continue their research with the aims of obtaining long-term, EB results and of demonstrating quantifiably that LY can promote healthy behaviors and reduce the need for more costly medical interventions.

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AUTHOR DISCLOSURE STATEMENT

The authors have no conflicts of interest to disclose.

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