



A Prospective Pilot Study Evaluating Feasibility and Preliminary Effects of *Breathe Easier*: A Mindfulness-based Intervention for Survivors of Lung Cancer and Their Family Members (Dyads)

Integrative Cancer Therapies
Volume 19: 1–14
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DOI: 10.1177/1534735420969829
journals.sagepub.com/home/ict


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Abstract

Objective: Symptom burden remains a distressing problem for survivors with non-small-cell lung cancer (stages I-IIIa). This pilot study evaluated feasibility and preliminary effects of a tailored mindfulness-based intervention, *Breathe Easier*, which encompasses meditation, 2 levels of mindful hatha yoga, breathing exercises, and participant interaction. **Methods:** Participants were recruited from 2 cancer programs in the US Southeast. A family member was required for participation. Sixty-two participants enrolled (20% recruitment) and 49 completed the intervention (79% retention). Participants chose level 1 yoga (basic) or level 2 (more advanced). Of the completers, survivors were 39% male and 65% Black. A community-based participatory research framework helped identify the specific needs and interests of potential participants and foreseeable barriers to implementation. A 2-month prospective, 1-group, pre-post design evaluated feasibility. Intervention dosage was measured using written protocols. Attendance and completion of daily home assignments measured adherence. Acceptability was assessed using a 10-item questionnaire, completed at three time points. Preliminary outcome data collected pre- and post-intervention tested the hypothesis that participants who received the 8-week intervention *Breathe Easier* would, post-intervention, demonstrate (a) less dyspnea, (b) less fatigue, (c) less stress, (d) improved sleep, (e) improved anxiety and depression, and (f) improved functional exercise capacity. Exit interviews were conducted, transcribed verbatim, and analyzed for content using descriptive statistics. **Results:** Quantitative and qualitative measures indicated strong feasibility. Over time, level 1 participants had statistically less dyspnea, fatigue and improved exercise capacity, as well as improved sleep, and stress scores. Level 2 participants experienced slightly increased dyspnea and fatigue but improved sleep, stress, and exercise capacity. All participants experienced anxiety and depression within normal limits pre- and post-intervention. Five major themes emerged out of exit interviews: Learning to *Breathe Easier*; Interacting with Others as a Personal Benefit; Stretching, Releasing Tension, and Feeling Energized; Enhancing Closeness with Committed Partners; Refocusing on Living; and Sustaining New Skills as a Decision. **Conclusions:** The study offers insight into the feasibility of an 8-week in-person mindfulness-based intervention with a unique subset of understudied survivors of lung cancer and family members. Outcome data interpretation is limited by the 1-group design and sample size.

Keywords

lung neoplasm, dyads, family intervention, mindfulness, symptom management

Submitted July 17, 2020; revised September 14, 2020; accepted September 28, 2020



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Introduction

Changes in smoking patterns, improvements in early detection, and advances in understanding of the genomics of lung cancer and treatment options have led to increased numbers of long-term survivors of non-small-cell lung cancer (NSCLC).¹ After curative therapies, long-term survivors with smoking-related comorbidities such as COPD and heart disease, experience a complex array of symptoms that have debilitating effects on their physical and psychological functioning and may seriously compromise their overall QOL.²⁻⁷ Often occurring in clusters, the most common symptoms include dyspnea, fatigue, sleep disturbances, and distressed mood. The prevalence of depressive and anxiety symptoms is also high among lung cancer survivors, ranging from 20% to 47%.⁸ Compared to survivors of other cancer types, survivors of lung cancer report the highest rates of distress resulting in lower QOL.^{9,10} For survivors of lung cancer, the extent of the resection, comorbid conditions, smoking status, and physical activity level can further exacerbate symptoms.^{5,7}

Family members and friends of survivors of lung cancer also have to cope with its psychological impact on the survivor, themselves, and others.¹¹⁻¹⁵ Survivors and their family members react to a serious illness as a unit, and as a result, both have a genuine need for help from health-care providers.¹⁵⁻¹⁷ Family members provide emotional and practical support to survivors, plus have to cope with their own concerns, including the uncertainty surrounding the course of the illness and fear of losing their partner or loved one. More than half of family members of lung cancer survivors report negative emotional effects of caregiving.¹¹ Previous research shows that both survivors and family members live with unhealthy lifestyle behaviors and compromised health.^{11,16,17} An emerging consensus in the literature is that when both the survivor and family member are treated simultaneously, the well-being of each individual may improve. When their needs are not addressed, family members are at risk for impaired mental and physical health which in turn affects the survivor. Interestingly, most interventions focus on individual behavior. However, the past decade has seen a growth in interventions exploring the effects of family members (and their behaviors) on each other when a serious illness is diagnosed in one of them.¹⁵ We believe an even greater emphasis is needed on dyad-focused interventions.

Mindfulness-Based Interventions

Over the past 2 decades, mindfulness-based stress reduction (MBSR) has come to be regarded as a promising psychosocial intervention for survivors of cancer. In MBSR group training, participants gradually learn to disengage from dysfunctional thinking and experience the emotions and bodily sensations of the present moment.^{18,19} A meta-analysis of 29 RCTs with survivors of cancer ($N=3476$ participants) concluded that there is significant evidence for the use of mindfulness-based interventions for reducing anxiety, depression, fatigue, and stress, and for improving QOL, posttraumatic growth, and mindfulness.²⁰ Though mindfulness-based interventions seem to be effective with various cancers, the majority of studies target women diagnosed with breast cancer. Three pilot studies have targeted patients with advanced lung cancer and their partners.²¹⁻²³ The smallest study conducted a content evaluation and testing of a single-arm, 4-week mind-body intervention ($N=7$ couples). The researchers concluded that the intervention was acceptable, with indication of psychosocial benefit for both patients and partners.²¹ A mixed-method pilot study enrolled patients ($n=19$) and partners ($n=16$). All participants “felt positive” about participation in a peer group and with their partner. There was no significant change in psychological distress. Among the family members, there was a significant decrease in caregiver burden.²² An RCT involving patients ($n=63$) and partners ($n=44$) demonstrated that patients who received the MBSR-based intervention compared to usual care reported less psychological distress.²³ Qualitative findings revealed that MBSR training initiated a process of change among all participants. Overall, the study showed that participating in MBSR was feasible for this population of patients with advanced lung cancer and their family members.²³

Carlson and Speca, both leaders in the field of complementary medicine, have published widely about their well-established and tested Mindfulness-Based Cancer Recovery (MBCR) program.²⁴ Their program has been designed and tested with survivors of breast, colorectal, prostate, and mixed cancer populations with good results. Modeled after MBSR, MBCR encompasses meditation, yoga, and participant interaction specific to those cancers.²⁴ Long-term follow-up results were published from an RCT (MINDSET),²⁵ the first and largest study to show that women with breast cancer treated with MBCR, as opposed to treatment with

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supportive expressive group therapy, reported greater reduction in mood disturbance (primarily fatigue, anxiety, and confusion) and in stress symptoms (including tension, sympathetic arousal, and cognitive symptoms). Most benefits were maintained over 12 months.²⁵ The MINDSET study is the first comparative effectiveness study demonstrating that “women with breast cancer who participated in a MBCR program were more able to cope with cancer survivorship and to more fully embrace and enjoy life.”^{25(p758)}

The long-term goal of this research is to improve clinical outcomes for survivors of NSCLC (stages I-IIIa) and their family members. The objective is to test an intervention called *Breathe Easier* utilizing the evidence-based MBSR and MBCR programs as a foundation. This article presents data from a pilot study designed to evaluate the feasibility and preliminary effects of an intervention that consists of breathing exercises, mindfulness-based meditation, gentle movements (mindful hatha yoga for varying skill levels), and participant interaction designed specifically to address issues of importance to survivors of lung cancer and their family members.

Methods

Conceptual Framework

Preliminary studies involving the target population,^{13,14,26,27} existing evidence, advice from a team of experts, and community stakeholders informed protocol development and study design. These sources suggest that targeting multiple behaviors (stress management, physical activity) will lead to greater change than targeting only one behavior.²⁴ Applying community-based participatory research principles enhanced the impact of the intervention by identifying the specific needs and interests of the participants and foreseeable barriers to implementation. Guiding principles of community-based participatory research acknowledge that academic, clinical, and community partners all have expertise and are co-learners.²⁸ Survivors and family members from previous preliminary studies were invited to participate and guide the development of this intervention.

Design

Using a 2-month prospective, 1-group pre/post design, this study evaluated recruitment, retention, intervention dosage, adherence, and acceptability. Dosage was measured using written protocols. Attendance and completion of daily home assignments measured adherence. Acceptability (of family involvement, study materials, time needed for home assignments, group dynamics) was assessed using a 10-item questionnaire at 3 data collection points during the intervention administration. Preliminary outcome data related to dyspnea, fatigue, stress, sleep disturbance, anxiety, depression

and functional exercise capacity were collected pre/post intervention for future study planning.²⁹⁻³⁴ Six outcome measures were used, and dyadic qualitative exit interviews were conducted after the intervention was completed. The outcome measures were as follows:

1. FACIT–Dyspnea 10 Item Short Form (Part 1): Uses 10 items and a 4-point rating scale to measure functional breathing limitations over the past 7 days. Total scores range 0-40; higher scores refer to worse dyspnea.²⁹
2. FACIT Fatigue Scale (Version 4): Uses 13 items and a 4-point Likert scale to measure individual fatigue during usual activity over the past 7 days. Total scores range 0-40; higher scores refer to less fatigue.³⁰
3. Perceived Stress Scale: Uses 10 items (7 positive) and 5 response options to measure perceived stress over the past 30 days. Total scores range 0-21, with higher scores referring to high stress.³¹
4. Pittsburgh Sleep Quality Assessment: Uses 19 items across 7 components (0-3 scale per component) to measure quality of sleep in the past month. Components include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, and use of sleeping medication, daytime dysfunction. Global scores (summing all component scores) range 0-21, with higher scores (greater than 5) indicating more severe complaints and higher levels of sleep disturbance.³²
5. Hospital Anxiety and Depression Scale: Uses 14 items, half measuring anxiety and the other half depression, all on a 0-3 scale. Participants complete items after being asked to “reflect on how they have been feeling during the past week.” Scores for each subscale range 0-21 with higher scores referring to more severe anxiety or depression. Total scores (indicating overall emotional distress levels) range 0–42.³³
6. 6 Minute Walk Test: Measures functional exercise tolerance. The test consists of walking a measured level distance at a self-determined pace. The test score is the total distance traveled in a 6-minute period.³⁴

Recruitment

Using cancer registry data, a convenience sample was recruited from 2 American College of Surgeons–approved cancer programs in the US Southeast. A family member was required for participation (1 survivor + 1 family member=1 dyad). For the purposes of this study, a “family member” was defined as a relative or, in the absence of a relative, a close friend. Experience with MBSR or its components was not required (see Figure 1).

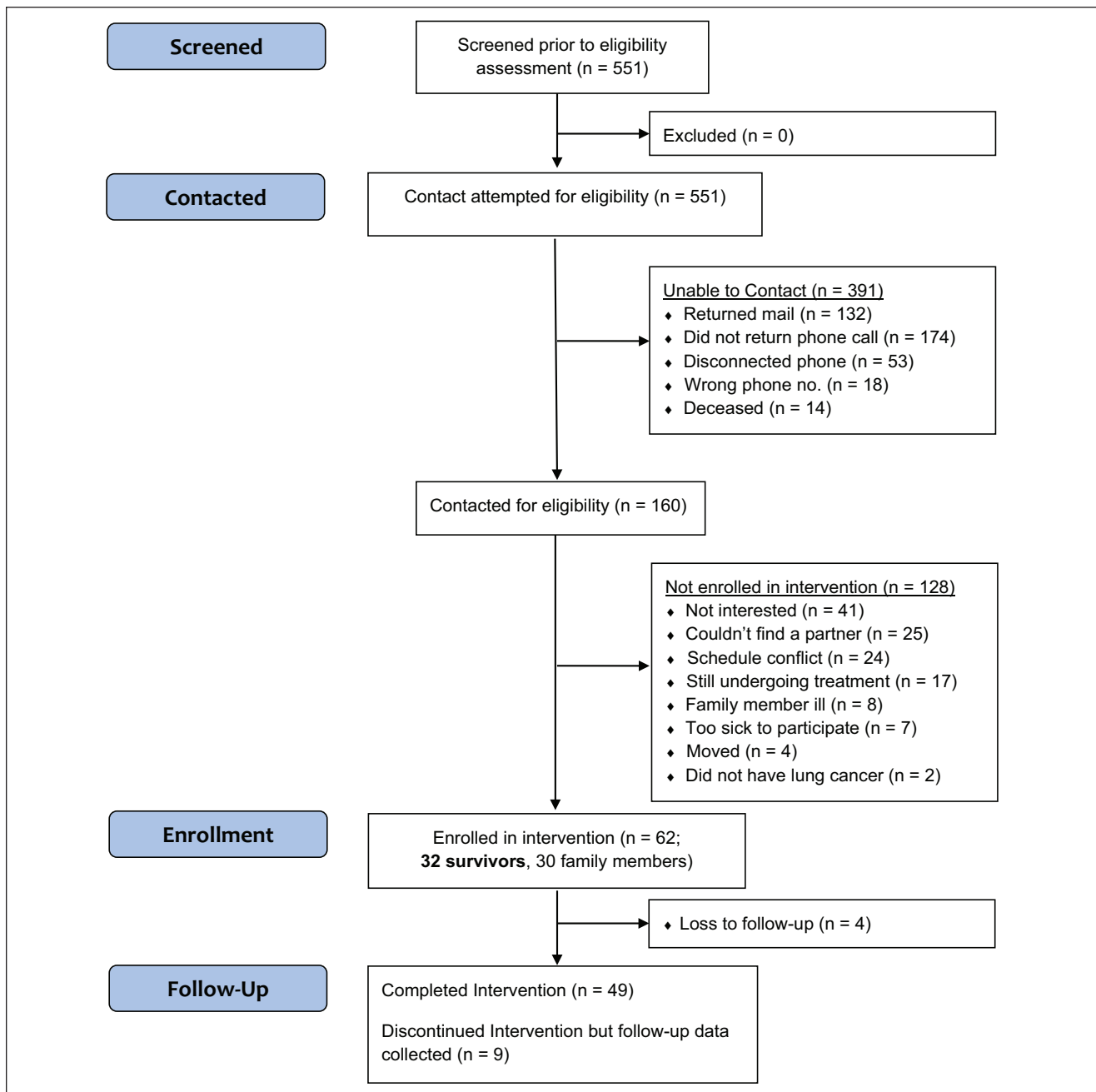


Figure 1. Recruitment and enrollment⁴⁶.

All participants had to be at least 21 years of age, able to speak and read English, and capable of giving informed consent. To be eligible, survivors had to have completed treatment for the initial diagnosis of NSCLC (stages I-IIIa) within the past 12 years, be willing and able to complete an 8-week in-person course as well as home activities, and have a family member willing to jointly participate. Exclusion criteria consisted of survivors with a known diagnosis of advanced (IIIb, IIIc, or IV) lung cancer or a diagnosis of small-cell lung cancer.

The primary recruitment method included a mailed, IRB-approved, culturally sensitive invitation to potential participants from the survivor's medical oncologist followed by a phone call from a research associate. In total, 551 letters were mailed to survivors of lung cancer (stages I-IIIa) diagnosed between 2007 and 2018.³⁵ Using a telephone script written in plain language, all interested survivors were screened for eligibility (see Figure 1). The telephone interactions were designed to strengthen trust in the research team, build credibility, and increase patient understanding of the

Table 1. Intervention Adherence^a.

Factors	Level 1 goals	Level 1 survivors (n = 19)	Level 1 FMs (n = 18)	Level 2 goals	Level 2 survivors (n = 7)	Level 2 FMs (n = 5)
Attendance:						
Sessions (8 wk)	80%	91%	90%	80%	93%	95%
Retreat	70%	79%	83%	70%	86%	80%
Breathing Exercises, min/d ^b	15.3 (5 wk)	17.2	13.5	15.3 (2 wk)	12.5	14.4
Meditations, min/d ^b	18.2 (6 wk)	18.0	18.3	15.1 (5 wk)	13.7	13.6
Yoga, min/d ^b	31.5 (4 wk)	24.2	22.5	45.8 (6 wk)	42.0	45.7

Abbreviation: FM, family member.

^aIntervention adherence data were measured by a daily self-report assignment log (with the exception of attendance).

^bMean assignment minutes based on a 5-days-per-week practice schedule.

study.³⁶ For participation, a \$100 “thank you” gift was given in 3 payments over the 10-week study period.

Setting

Each 8-week session of *Breathe Easier* was conducted in the same urban community setting. An accessible and comfortable studio, with ample free parking adjacent to a major university, was reserved for each session and co-facilitated by an advanced practice nurse and a board-certified psychiatrist, both of whom were mindfulness practitioners with 6 years of teaching experience.

Intervention, Procedures, and Materials

Approval was obtained from 2 IRBs (1 academic, 1 health system), and every participant gave written consent to participate in the study. A safety plan was developed to prevent and manage adverse events during study implementation. The intervention was modeled after MBSR and MBCR programs.^{19,24} MBSR was developed at the Massachusetts Medical Center^{18,19} and MBCR developers modified it to make it more relatable for persons with cancer.²⁴ MBCR was further modified for our study, the content tailored for survivors of lung cancer and their family members. The program had 10 in-person, small group sessions, which included an orientation session (for informational and consenting purposes) and a retreat (for program protocol, see Table in the Supplement). Altogether, there were 21 contact hours. With the exception of the retreat, each weekly session lasted 2 hours and was held on a weekday in the afternoon or evening. The retreat, held on a Saturday between the sixth and seventh weeks, was originally scheduled to last 6 hours but was modified to 4 hours due to participant fatigue and limits on participants’ portable oxygen use. At each session, brief content on topics of interest was presented first for approximately 20 minutes that included participant interaction. These content areas included dyspnea and COPD, physical activity and fatigue, insomnia, body balance, stress, communication,

and mindfulness. Two levels of the intervention were designed. All mindful hatha yoga activities were referred to as “gentle movements.” Level 1 (the more popular format) included sitting yoga poses only, whereas level 2 included 2 additional meditations plus sitting, standing, and floor yoga poses. All yoga sessions included both individual and partner poses. Two experienced mindfulness instructors and 2 research team members attended each session.

Each participant received an inexpensive track phone programmed as an MP3 player, and instructions guiding participants through all practice exercises (yoga, meditations, breathing) were recorded and loaded onto the phone for home use. Meditations and breathing practices were recorded in both a male/female voice. Track phone use was demonstrated, and written operating instructions were provided. Some participants used earbuds, but most used the speaker feature of the phone. Each participant was given a program manual, attractively designed by the research team in a flip chart–styled tabletop binder. The manual was written in plain language. It included the weekly agenda, background information, and transcriptions of all the practices. Participants had the option of listening and/or reading about the practices. Assignment logs were distributed weekly so participants could record how many minutes per day they performed an activity (yoga, meditation, breathing exercise). Participants turned in their logs weekly to the research team for data collection purposes.

Data Collection

A demographic form captured demographic and personal health information about each participant. To enhance the rigor of the intervention, the 4-person intervention team monitored the dose measured in minutes weekly. Intervention dose was measured closely using 2 timed protocols (see Table, Supplement). Adherence was measured by (1) attendance at 8 weekly 2-hour sessions, (2) attendance at the Saturday retreat, and (3) completion of homework assignments. Assignment logs explicitly stated the weekly assignments and time goals (see Table 1). Additionally, weekly

classes provided time for assignment review and discussion. The weekly assignment log measured adherence to home assignments. An acceptance evaluation questionnaire, developed by Hollen et al (2013) to measure acceptance using a 4-point Likert-type scale, was adapted with permission.³⁷ Possible responses to 10 questions were Strongly Disagree, Disagree, Agree, or Strongly Agree. Acceptability was measured at weeks 2, 5, and 8. The Nic-Alert Saliva Test was used to verify the participants' self-reported smoking status. This test is an immune-chromatographic assay that quantifies cotinine within 20 minutes through a small sample of saliva.³⁸ Instruments with good psychometric properties measured variables of interest pre- and post-intervention.²⁹⁻³⁴ The consent process and baseline data collection for each dyad took approximately 2 hours. Data collection post-intervention plus the qualitative interview took approximately 2 hours per dyad also.

Statistical Analyses

Descriptive statistics were computed on all variables using Stata v. 14 (StataCorp LLC, College Station, TX). *T*-tests or chi-square tests were performed to assess for subset differences. The primary statistical test was paired *t*-tests in which each participant's baseline and post-intervention measures were compared. For categorical outcomes, a chi-square test compared the baseline frequencies. Stratified analyses were conducted separately due to within-dyad correlation and a desire to estimate effects for each group. For each outcome variable, differences between survivors and family members, between baseline (T1) and post-intervention (T2) measures, and the interaction were calculated. All statistical tests used a Cronbach α of 0.10 as the cutpoint for meaningful differences. The authors are aware that this is a nontraditional cutpoint (the usual being 0.05); however, this more lenient cutpoint was necessary due to the pilot design of the study and the consequentially smaller convenience samples.³⁹

For qualitative interview data, audio recordings were transcribed verbatim by a professional service. Each audio recording was reviewed by a research team member in a timely manner to maximize observations, discussion climate, and recall. The transcribed discussions, field notes, and other observations were imported into the qualitative software program NVIVO Pro v.12 (QSR International Pty Ltd, Victoria, Australia) for organization purposes. A multi-step thematic analysis plan was used in which the transcripts were first read in their entirety for initial themes and then subjected to line-by-line analysis with the goal of revealing and refining the data into categories, themes, and patterns that summarize the content of the discussions.⁴⁰ Discussions were reviewed using an iterative approach to better understand the participants' viewpoints. Each reader identified themes of the transcripts and specific quotes that were

particularly representative of the themes. Transcript review meetings involved a discussion on personal reflexivity, and acknowledgment of how individual experiences and prior knowledge influence interpretations of the data.⁴¹

Results

Feasibility

Recruitment and retention were measured over a 15-month period. Invitations were sent to 551 survivors. We were unable to contact 391 (71%). Of 160 eligible survivors (29%) screened, 32 enrolled (20% recruitment rate) and 26 completed the intervention (81% retention rate) (see Figure 1).⁴² The greatest challenges to recruitment were returned mail due to unknown current address (132 of 391 unreachable survivors [34%]) and survivors not returning phone calls after messages were left ($n=174$ [45%]). A small number ($n=14$ [4%]) were identified as deceased. Among the survivors successfully reached, about a third were not interested in taking part in the study (41 of 128 [32%]), while others could not find a partner to participate with them (25 of 128 [20%]). Thirty family members enrolled, and 23 of them (77%) completed the intervention. Most of the 23 participating family members were spouses ($n=17$ [74%]); 4 were adult children (17%), 5 were close friends (22%), 1 was a pastor (4%), and 4 were other relationships (17%). Of the 62 enrolled participants, 49 (79%) completed the intervention. Level 1 was completed by 19 survivors and 18 family members; level 2 by 7 survivors and 5 family members. Only participants with complete data sets were analyzed. The 13 enrollees who did not complete the intervention included 2 survivors who were too ill to complete the course (along with their respective spouses). One dyad (a survivor undergoing treatment for her cancer and her father) did not have time to complete the program. One survivor and his spouse lost interest after a couple weeks of participation. Two survivors and their spouses, as well as an additional adult son of a survivor, completed the consent process but never began the intervention.

Among survivors, the average times since their diagnosis were 3.65 years (level 1) and 3.22 years (level 2). Most of the 26 survivors who completed the intervention were female ($n=16$ [62%]) and Black ($n=17$ [65%]). Participating survivors were significantly older ($\bar{x}=66.5$ years, $SD=5.5$) than the family members ($\bar{x}=60.2$ years, $SD=14.1$; $P=.040$). A majority of participants described themselves as married, high school graduates, and retired. In addition to all survivors having a diagnosis of lung cancer (required for eligibility), some family members had cancer also (6 of 23 intervention completers [26%]). These family members' cancer types included breast, lung, prostate, and pancreatic. Interestingly, 2 family members were newly diagnosed with lung cancer during or after attending the intervention. One was

diagnosed with early-stage NSCLC and survived. The other, diagnosed with advanced COPD and stage IV NSCLC, died several months after the intervention ended. Family members' medical histories included other serious illnesses as well, such as unstable diabetes and COPD. About half of survivors were diagnosed with COPD (12 of 26 intervention completers [46%]), and some wore oxygen ($n=7$ [27%]). Two survivors (8%) and 3 family members (13%) were current smokers. A majority of participants maintained a smoke-free home (18 of 26 survivors [69%]; 15 of 23 family members [65%]) (see Table 2).

Both survivors and family members exceeded attendance expectations (goals were 80% weekly attendance and 70% retreat attendance). There was moderately strong adherence to the at-home practices (measured by self-report): breathing exercises, meditations, and yoga. Many participants were unable to maintain a 7-day weekly practice schedule. A 5-day schedule was more attainable for meeting goals. Participants' highly positive ratings of the intervention indicated strong acceptability. Overall, more than 90% of participants (survivors and family members) strongly agreed that the participant manual was easy to read, the audio recordings were easy to use, sharing their thoughts in a group was comfortable, learning gentle movements/yoga helped them, and involving a family member was important (see Table 3).

Preliminary Outcome Results

This pilot study explored preliminary outcomes of the intervention with respect to symptom reduction. Even though significance is not sought in an unpowered pilot study, we were interested to observe the outcome direction.³⁹ Preliminary data tested the hypothesis that participants who receive an 8-week intervention will demonstrate, post-intervention, (a) less dyspnea, (b) less fatigue, (c) less stress, (d) improved sleep, (e) improved anxiety and depression, and (f) improved functional exercise capacity (see Table 4).

Overall, survivors experienced greater changes in symptom scores than family members. Level 1 participants who were inexperienced with mindfulness practices seemed to benefit the most. All level 2 participants had some prior experience with mindfulness practices. Both survivors and family members in the level 1 intervention reported significantly less dyspnea ($P=.093$), with survivors experiencing greater benefits ($P=.075$) post-intervention.²⁹ Additionally, both survivors and family members reported moderate fatigue at baseline, with significant improvement post-intervention ($P=.075$).³⁰ Sleep quality also improved post-intervention.³¹ Participants' stress levels slightly improved from being average.³² Surprisingly, for level 1 and 2 participants, pretest scores were within normal limits for both anxiety and depression; these scores slightly changed from pre- to post-intervention.³³ The 6-minute walk test was used

to measure change in functional exercise capacity (see Table 4).³⁴ Level 1 participants enjoyed significantly improved exercise capacity over the course of the intervention (survivors, $P=.09$; family members, $P=.05$).

Qualitative Findings

Within a week of intervention completion, 21 in-person, guided interviews were conducted with 20 survivors (80%) and 19 family members (83%), with most ($n=18$ [86%]) interviewing in dyads. The goal was to gather more data regarding feasibility. Examples of questions included, "Tell us about the day you decided to enroll in this program. What were you both hoping to gain from it?"; "As a survivor and family member, tell us your opinion of the timing of this program (up to several years after your initial diagnosis)?"; "What is your general understanding of how the meditation practices (breathing exercises and gentle movements) may help you?"; "What part of the program helped you most?"; "Was 8 weeks enough time for you to learn these new skills?"; and "How did you feel about the group format?"

Five major themes emerged from these interviews, revealing the perspectives of participants after completing the intervention: Learning to Breathe Easier; Interacting with Others as a Personal Benefit; Stretching, Releasing Tension, and Feeling Energized; Enhancing Closeness with Committed Partners; Refocusing on Living; and Sustaining New Skills as a Decision. In the following sections, each theme is discussed and illustrated with quotations from participants.

Learning to Breathe Easier. Breathing difficulties represent the primary burdensome symptom for survivors of lung cancer. The theme of Learning to Breathe Easier was evident in responses referencing a need for improvement in participants' breathing, an overall greater awareness of their breath, the positive effects this awareness has on their stress levels and feelings of well-being, and the program's positive effect on their breathing. The need for improvement in a participant's breathing was elicited by asking, "What brought you to this program?" Responses included specific references to a need for help, as 1 survivor (level 1 dyad 1, whom we will call 1D1-S) expressed desiring "anything that would help me in dealing with my breathing issues" and another survivor (1D13-S) wished "to strengthen my breathing, open up my lungs." One survivor (1D1-S) described his oxygen use as burdensome and wanted "to become less dependent on oxygen." When considering how this program had helped them to meet these goals, all dyads had positive sentiments, with 1 survivor (level 2, dyad 6, or 2D6-S) stating, "*Breathe Easier* helps to expand your lung capacity. It helps to exercise your body muscles. It helps you to think clearer. And hopefully help you live better. That's what it did for me." Similarly, another survivor

Table 2. Participant Profile (N=49).

Characteristics	Level 1 survivors	Level 1 FMs	Level 2 survivors	Level 2 FMs	Survivors, both levels	FMs, both levels
n (completed intervention)	19	18	7	5	26	23
Mean age, years (SD, years)	67.4 (5.8)	62.3 (12.1)	64.3 (4.1)	52.8 (19.7)	66.5 (5.5)	60.2 (14.1)
Gender:						
Male	8 (42%)	10 (56%)	2 (29%)	3 (60%)	10 (38%)	13 (57%)
Female	11 (58%)	8 (44%)	5 (71%)	2 (40%)	16 (62%)	10 (43%)
Racial background:						
Black ^a	12 (63%)	11 (61%)	5 (71%)	3 (60%)	17 (65%)	14 (61%)
White	7 (37%)	7 (39%)	2 (29%)	2 (40%)	9 (35%)	9 (39%)
Marital status:						
Single	2 (11%)	1 (6%)	2 (28%)	1 (20%)	4 (15%)	2 (9%)
Married	12 (63%)	13 (72%)	5 (72%)	4 (80%)	17 (65%)	17 (73%)
Divorced	4 (21%)	2 (11%)	0	0	4 (15%)	2 (9%)
Widowed	1 (5%)	2 (11%)	0	0	1 (4%)	2 (9%)
Highest educational achievement:						
College graduate	6 (32%)	7 (39%)	3 (43%)	1 (20%)	9 (35%)	8 (35%)
Some college	8 (42%)	7 (39%)	3 (43%)	3 (60%)	11 (42%)	10 (43%)
High school graduate	2 (11%)	3 (17%)	1 (14%)	1 (20%)	3 (12%)	4 (18%)
Some high school	2 (11%)	1 (6%)	0	0	2 (8%)	1 (4%)
No high school	1 (5%)	0	0	0	1 (4%)	0
Annual income: ^b						
< \$20 000	4 (22%)	2 (13%)	2 (40%)	0	6 (26%)	2 (10%)
\$20 000-\$49 000	7 (39%)	7 (44%)	1 (20%)	2 (50%)	8 (35%)	9 (45%)
\$50 000-\$99 000	5 (28%)	7 (44%)	1 (20%)	0	6 (26%)	7 (35%)
\$100 000+	0	0	1 (20%)	2 (50%)	1 (4%)	2 (10%)
Employment status:						
Employed	4 (21%)	4 (22%)	3 (43%)	2 (40%)	7 (27%)	6 (26%)
Unable to work	5 (26%)	3 (17%)	2 (29%)	1 (20%)	7 (27%)	4 (18%)
Retired	10 (53%)	11 (61%)	2 (29%)	2 (40%)	12 (46%)	13 (57%)
General health:						
Fair/Poor	9 (47%)	2 (11%)	4 (57%)	0	13 (50%)	2 (9%)
Good/Very Good	10 (53%)	15 (83%)	3 (43%)	5 (100%)	13 (50%)	20 (87%)
Excellent	0	1 (6%)	0	0	0	1 (4%)
Lives alone	2 (11%)	2 (11%)	0	0	2 (8%)	2 (9%)
COPD (comorbidity)	8 (42%)	1 (6%)	4 (57%)	0	12 (46%)	1 (4%)
History of cancer	26 (100%)	5 (22%)	7 (100%)	1 (20%)	26 (100%)	6 (26%)
Current smoking status:						
Every day	2 (11%)	2 (11%)	0	0	2 (8%)	2 (9%)
Some days	0	1 (6%)	0	0	0	1 (4%)
Non-smoker	17 (89%)	15 (83%)	7 (100%)	5 (100%)	24 (92%)	20 (87%)
Never smoker	1 (5%)	8 (44%)	1 (14%)	4 (80%)	2 (8%)	12 (52%)
Home oxygen use	4 (21%)	0	3 (43%)	0	7 (27%)	0
Smoke-free home:						
No	4 (21%)	2 (11%)	0	0	4 (15%)	2 (9%)
Yes	12 (63%)	12 (67%)	6 (86%)	3 (60%)	18 (69%)	15 (65%)
N/A	3 (16%)	4 (22%)	1 (14%)	2 (40%)	4 (15%)	6 (26%)

For some characteristics, columns may not sum to exactly 100% due to rounding.

Abbreviation: FM, family member.

^aReflects participants who responded that they are "Black or African American."

^bNot all participants reported annual income. Of level 1 participants, 18 survivors and 16 FMs reported income; among level 2, 5 survivors and 4 FMs.

(1D7-S) said the "breathing exercises were the best part for me. I used to cough a lot, and now I don't cough that much.

And I'd be walking, and I'd just run out of breath sometimes, and now I don't run out of breath" (1D6-S and

Table 3. Acceptability^a.

Acceptability statements	Level 1 survivors (n=19)	Level 1 FMs (n=18)	Level 2 survivors (n=7)	Level 2 FMs (n=5)	Survivors, both level (n=26)	FMs, both levels (n=23)
Manual was easy to read (%)	54 (95%)	48 (96%)	17 (85%)	10 (83%)	71 (92%)	57 (93%)
Manual was easy to use (%)	53 (93%)	48 (96%)	17 (85%)	9 (75%)	70 (91%)	57 (93%)
Time needed for home activities was acceptable (%)	51 (89%)	40 (80%)	18 (90%)	10 (83%)	69 (90%)	50 (81%)
The pictures in the manual were helpful (%)	51 (89%)	42 (84%)	15 (75%)	10 (83%)	66 (86%)	52 (84%)
Audio recording were easy to use (%)	53 (93%)	45 (90%)	19 (95%)	12 (100%)	72 (94%)	57 (93%)
Audio recordings were helpful (%)	55 (96%)	48 (96%)	18 (90%)	12 (100%)	73 (95%)	60 (98%)
The class studio was comfortable (%)	56 (98%)	48 (96%)	19 (95%)	12 (100%)	75 (97%)	60 (98%)
Sharing my thoughts with others was comfortable (%)	54 (95%)	48 (96%)	20 (100%)	12 (100%)	74 (96%)	60 (98%)
Learning yoga helped me (%)	52 (91%)	49 (98%)	20 (100%)	11 (92%)	72 (98%)	60 (98%)
Involving a family member is important (%)	50 (88%)	48 (96%)	20 (100%)	12 (100%)	70 (91%)	60 (98%)

Abbreviation: FM, family member.

^aAcceptability was measured 3 times during each intervention. Numbers (%) indicate those who responded Strongly Agree or Agree to the statement.

Table 4. Preliminary Outcomes.

Measure (score range)	Survivors' mean scores	FMs' mean scores	P value, survivors	P value, FMs	P value, combined
Level 1 (n=37)	n=19	n=18			
Dyspnea (0–40) ^a	T1 = 10.70 T2 = 7.00	T1 = 6.21 T2 = 5.00	.075	.566	.093
Fatigue (0–52) ^b	T1 = 32.32 T2 = 36.16	T1 = 35.50 T2 = 39.00	.114	.354	.075
Sleep (0–21) ^c	T1 = 10.00 T2 = 8.05	T1 = 8.39 T2 = 7.61	.194	.611	.197
Stress (0–40) ^d	T1 = 15.37 T2 = 14.89	T1 = 13.89 T2 = 13.44	.840	.853	.782
Depression (0–21) ^e	T1 = 5.47 T2 = 4.58	T1 = 4.11 T2 = 4.61	.421	.661	.785
Anxiety (0–21) ^e	T1 = 7.16 T2 = 5.89	T1 = 7.50 T2 = 6.39	.229	.303	.133
6MWT	T1 = 236.71 T2 = 249.24	T1 = 305.11 T2 = 328.12	.09	.05	.061
Level 2 (n=12)	n=7	n=5			
Dyspnea (0–40) ^a	T1 = 10.57 T2 = 11.29	T1 = 2.20 T2 = 3.40	.851	.790	.746
Fatigue (0–52) ^b	T1 = 38.43 T2 = 37.14	T1 = 39.40 T2 = 40.80	.857	.868	.975
Sleep (0–21) ^c	T1 = 10.00 T2 = 8.86	T1 = 5.20 T2 = 4.00	.194	.611	.197
Stress (0–40) ^d	T1 = 14.71 T2 = 13.29	T1 = 14.80 T2 = 14.80	.787	.898	.767
Depression (0–21) ^e	T1 = 4.14 T2 = 4.14	T1 = 3.40 T2 = 3.25	1.0	.848	.901
Anxiety (0–21) ^e	T1 = 7.16 T2 = 5.89	T1 = 7.50 T2 = 6.39	.229	.303	.133
6MWT	T1 = 229.7 T2 = 264.0	T1 = 327.2 T2 = 369.6	.11	.14	.12

All statistical tests used a Cronbach α of 0.10 for the cutpoint.

Abbreviations: T1, pre-intervention score; T2, post-intervention score; FM, family member; 6MWT, 6-minute walk test.

^aMeasured with the FACIT-Dyspnea Short Form Part 1.

^bMeasured with the FACIT Fatigue Scale (v. 4).

^cMeasured with the Pittsburgh Sleep Quality Index.

^dMeasured with the Perceived Stress Scale (v. 4).

^eMeasured with the Hospital Anxiety and Depression Scale.

1D10-S echoed this concept). While survivors most frequently expressed program benefits as being an ability to breathe better and a reduction in the anxiety and stress that accompanies dyspnea, it was quite common for family members to report unexpected benefits. Some family members mentioned learning “different ways to breathe that I didn’t know about” (level 1, dyad 1, or 1D1-FM; this was echoed by 1D12-FM). Many family members stated something similar to this: “The breathing exercises are good

from a relaxation and stress management point of view” (1D1-FM through 1D14-FM).

Interacting with Others as a Personal Benefit. The group dynamic of the in-person class was identified as a source of added benefit. The inability to breathe well promotes the desire to stay at home, where one can avoid exerting oneself and can easily obtain assistance, thus creating a sense of safety. However, not putting oneself in an environment that

intensifies vulnerability inherently creates social isolation. The stigma of lung cancer (which affects both survivors and family members) further compounds this sense of isolation. Therefore, a key feature of *Breathe Easier*, as 1 survivor (1D10-S) stated, is to create a sense of camaraderie or community: “It just was nice hearing [others’] stories and seeing how they were progressing. It felt like I wasn’t alone” (1D13-S echoed this sentiment). Similarly, many survivors of lung cancer have never met another survivor of lung cancer, so the ability to bring survivors together often had notable effects for both survivors and family members. A few survivors (1D3-S, 1D7-S, 1D10-S, 1D14-S) said something akin to, “I loved meeting other people. I had never known anybody else with lung cancer.” One survivor described the social aspect of this experience as “bringing a new self-awareness when you observe other people going through almost the same thing, it’s unique to see somebody else going through what you’re going through and hearing each other’s challenges” (1D13-S, echoed by 2D7-S). Beyond the bonding that comes through shared experiences, the effect of interacting with others sometimes was the motivating factor to be a part of the group. One survivor stated that one of the best parts of the program was “getting out of the house . . . the social part of it, and without that I’m not sure if I could have done the program on my own” (1D6-S; echoed by survivors and family members of 1D8 and 1D11).

The emotional turmoil of a diagnosis of lung cancer may be amplified by feelings of shame. There is a pervading perception that lung cancer is a life-threatening disease one brings upon oneself through one’s own actions (ie, smoking cigarettes). Although smoking cigarettes is a leading cause of lung cancer, not all people diagnosed with lung cancer have smoked; indeed, in our study, 2 of the survivors had never smoked. One female survivor, who had never smoked cigarettes and attributed her lung cancer to a past work environment, found the group dynamic to be enlightening. She stated: “I always wondered where the symptoms and the ailment came from. Meeting other people, I saw that a lot of other survivors were going through the same thing. And we could talk to each other, and when you talk over things, you learn a lot more” (1D5-S).

Stretching, Releasing Tension, and Feeling Energized. *Breathe Easier* explored the effects that yoga would have on survivors of lung cancer and their family members. During level 1, the gentle movement exercises were adapted to a beginner skill level and were primarily performed while sitting in a chair. Participants’ responses to these movements were exceedingly positive. The theme of Stretching, Releasing Tension, and Feeling Energized was characterized by responses referencing yoga, an ability to reach or bend farther, and the motivation and energy that emerged over the course of the program. Although some survivors indicated initial hesitancy toward the performance of gentle

movements, due to the physical nature of the activity or to performing them within a group setting, their concerns were allayed by the low intensity and gentleness of the movements. This concern was characterized well by a survivor who stated, “I’m very limited on my abilities to walk and breathe all at the same time, so the movements allowed me to enjoy some form of exercise without really feeling like I had to walk 10 miles or be able to twist into a pretzel, and yet still reap the benefits. So that was really good” (1D15-S). Other survivors responded similarly: “The gentle movements were much slower and easier than I expected. I stretched muscles that I don’t normally use. I can stretch and reach the floor with my hands, which I couldn’t do the first couple of times” (1D3-S, echoed by 1D4-S, 1D5-S, 1D6-S, 1D12-S, and 1D14-S). The movement of their joints through more ranges of motion and in different positions allowed participants to feel more open and relaxed in a safe environment. Responses frequently indicated that survivors had not realized how tight many of their muscles had become over time, and these exercises “improved the feeling of being able to do more” (survivor members of 1D5, 2D5, 1D6, 2D6, 1D7, 2D7, 1D13, 2D13, 1D14, 2D14). One survivor (1D7-S) admitted that, before the program, he wore flip-flops because he couldn’t bend comfortably to reach his feet to put on shoes; that changed when he became more flexible. Response to the gentle movements proved similarly positive among the family members, with one stating, “The stretches helped me, it actually gave me some energy. I’m not sure why but it helped me feel a little more motivated” (1D12-FM, with a similar concept expressed by 1D3-FM, 1D4-FM, 1D6-FM, 1D8-FM, 1D11-FM, 2D4-FM).

Enhancing Closeness with Committed Partners. Inviting a family member to join the program was required for each survivor. Often, these family members enrolled with the idea that they were solely supporting the survivor. However, the findings revealed unanticipated benefits for the family members and their relationship with the survivor, including an increased awareness of the survivor’s condition, enhanced personal well-being, and an enhanced closeness with the survivor. One family member with serious chronic illnesses, a son to a female survivor, joined because “he figured it would help her.” He added, “But since I came to the group, I found that it helped me as well” (1D13-FM). Similarly, a husband commented that he “didn’t think it would help [him].” He continued, “But when I came in and participated, it helped me too, because I’ve always been kind of short-winded and I think it benefited me with my breathing as well as hers” (1D4-FM). Several family members revealed that they were not aware of the extent of the survivor’s symptoms. One commented that “the program makes you more aware of the other person and what they’re going through, and what

they're doing" (1D3-FM; echoed by 1D4-FM, 1D6-FM, 1D10-FM, 1D14-FM, and 2D6-FM). Survivors appreciated their partners becoming more familiar with their condition and the state of their health. A female survivor noted that her husband, who had been reluctant to join the program at first, "got more insight into my condition when he could see that others had the same issues, and he became more familiar with how to approach these symptoms" (2D6-S). The most frequent theme in relation to the dyad nature of the program was enhanced closeness. One partner stated, "*Breathe Easier* brought us closer together, number one. And there's no way to measure the importance of what we've gained out of it" (1D10-S). Another family member (wife to a survivor) responded that the program made her feel "pride and enthusiasm for health, and to feel a part of each other's lives . . . a part not of [the survivor's] sickness but of his wellness" (1D4-FM).

Refocusing on Living. When questioned if *Breathe Easier* changed them in any way, survivors and family members had many responses regarding a renewed focus on their lives. Comments related to increasing in confidence, feeling rejuvenated, feeling more open, and being more motivated. One survivor described his change this way: "BE [*Breathe Easier*] helped me to focus on where I am in my life, focus on where I could be in my life, focus on where I will be in my life, and it just gave me a new sense of confidence" (1D4-S). Similarly, the meditation, yoga, and breathing practices elicited a response from another survivor (2D14-S), who stated, "I just feel like I got another chance, BE opened up so much more than who I was before the program." Likewise, another survivor commented on how his illness had him "focused on physical limitations to the detriment of being focused on other things." He added, "This class helped focus on the things in my life outside of my pain" (2D1-S). Family members also reported a new sense of life. Many of the changes they reported gaining a new ability to respond to life stressors and a new perspective on their partner's needs and abilities, garnering a fresh appreciation and motivation for their relationship as well as their own life. One family member stated, "The program got me motivated now and wanting to go do more things while I have my health" (1D5-FM).

Sustaining New Skills as a Decision. An important component of *Breathe Easier* is development of skills and strategies that participants can continue to practice and benefit from after the program ends. Participants verbalized a desire for a program extension (beyond 8 weeks) and for a level 3 (anticipating responsibility for their own continued efforts). They understood that, to continue to benefit from these learned skills, they needed to sustain these skills more independently. One survivor stated, "I hope that I will have the maturity and the determination to sustain my new skills

beyond the 8 weeks. It's a lot easier to do it when you have a weekly meeting and an assignment" (2D4-S). Similarly, another survivor stated, "The more that I practice my movements and meditations, the better my stamina will become" (1D7-S). The need to make a schedule to practice on their own was recognized by many, including this family member: "I just need to do it at the same time every day and be consistent. And that works best when it is written into my schedule" (2D4-FM). Others agreed that they would need to stay aware of their newfound skills each day but did not necessarily suggest the desire for a schedule. For example, 1 survivor stated, "When I'm doing something, I'll just need to remember to just stop and think, 'Well, I need to meditate for a little, I need to breathe with more awareness'" (1D10-S).

Discussion

This is the first study to demonstrate the feasibility of an in-person mindfulness-based intervention conducted in small groups for survivors of early-stage lung cancer and their family members. The qualitative component enhanced the quantitative evaluation by providing greater insight into the participants' need for symptom relief, social interaction, and safe strategies to facilitate communication, stress reduction, physical activity, and wellness.

The isolating nature of lung cancer, uniqueness of the intervention, smaller volume of stage I-IIIa survivors compared to the volume of survivors with more advanced stages, and dyadic requirement impeded recruitment. Only 20% of eligible survivors agreed to participate. (However, this is comparable to other studies with survivors of lung cancer.²³) Evidence exists that studies recruiting survivors with lung cancer and dyads are known to have higher refusal rates—a consideration for future recruitment plans.^{26,43,44} Of those contacted, 32% were not interested. Moreover, an overall 19% dropout rate resulted in missing data. Though a limitation, that rate is lower than in other mindfulness-based intervention studies targeting survivors of cancer.²¹ New strategies are needed to minimize the dropout rate. For example, each dyad met with 2 research team members during a consenting session prior to a group orientation. Perhaps that process should be reversed with a group orientation preceding the consenting and data collection session. This reversed order would provide an additional opportunity for potential participants to make a final decision prior to enrollment.

Despite difficulties with recruitment, the retention, adherence, and acceptability results suggest that participants were interested and engaged. Overall, participants in both levels experienced some symptom benefits over time, with those in the level 1 group (all new to mindfulness practices) experiencing the greatest improvements. Anxiety and depression were not major distresses to either group

initially but did improve as well along with dyspnea, fatigue, stress, sleep, and functional exercise capacity.

Dyadic interventions are described as holding great promise because they simultaneously target survivors, family members, and relationship factors that have an impact on health-related issues like symptom management and rehabilitation.^{45,46} We found that some family members and friends were initially reluctant to participate but grew to value the experience as they realized the benefits to the survivor and, often unexpectedly, to themselves. Other studies recruiting survivors of lung cancer and partners found denial of the need for a support intervention to be the primary reason for refusing participation.²³ Consistent with the literature and our experiences, family members experienced their own burden from the survivors' symptoms (either from cancer or other chronic diseases) to a degree similar to or even greater than that of the survivors.^{21,22} Family members easily recalled the anxiety, depression, and stress associated with their survivors' new diagnosis of lung cancer, yet, surprisingly, they did not rate their anxiety and depression above normal limits before or after this intervention.

In a previous dyadic behavior modification study, family members were interested in having more control over the timing of the intervention.⁴³ In that study, survivors thought that intervention during the treatment phase was "perfect timing" for skill development and behavior change, whereas family members thought that such timing was too stressful for them to make changes or add any new activity to their schedule.⁴³ In this study, the average time since diagnosis was 3.65 years (level 1) and 3.22 years (level 2); this timing for program participation seemed to better suit all involved.

One of the greatest strengths of this study was the socioeconomic profile of the sample. Relatively equal numbers of males and females and of 2 major racial backgrounds (White and Black [Participants' race options included "Black or African American"; in this paper, for the sake of brevity, we have simplified this category to "Black."]) took part. This representative nature of the sample differed from other mindfulness studies involving survivors of lung cancer in which race was not reported or not diverse.²¹⁻²³ Also, this is the first study to solely recruit survivors who were diagnosed with earlier-stage NSCLC (stages I-IIIa), a more able group than those with advanced-stage or mixed stages of lung cancer.²¹⁻²³ There were no adverse events or participant deaths during the study. We understand that many social and cultural factors influence the participation of minorities in clinical trials.³⁶ We credit our primary recruitment method with this diverse profile. Personal invitations were mailed to survivors at their homes and targeted both genders; these invitations were culturally sensitive, used plain language, and were signed by the survivor's own medical oncologist. After invitations were mailed, a research associate called the survivor directly to describe the study,

using an office phone with a familiar caller ID. Telephone etiquette and engagement was emphasized. This process promoted trust. A second strength was that fidelity was carefully monitored. Two protocols (levels 1 and 2) were developed by the intervention team and reviewed each week before and after each session. Each intervention segment was timed, as were the home assignments. An additional strength was the integration of experienced mindfulness instructors. Both instructors had a health-care clinical background and were similar in age to the participants. The research team felt these factors contributed positively. The studio was not in a clinical setting or on an academic campus. A food/beverage budget and a kitchen assured the availability of drinks or small snacks, giving added comfort to the setting (especially important for the participants who experienced nicotine withdrawal during the 2-hour sessions).

A limitation of this pilot feasibility study was the 1-group design and small sample size, which limit the power of the analyses. The collection of data using self-reported measures has limitations, as well as the burden of required measures. Unanticipated communication barriers may yield inaccurate results.⁴⁴ With this vulnerable population there were 5 individuals who were unable to respond to the measures without assistance. For each of those 5 individuals the PI read each question and set of response items to the participant verbatim which lengthened the process of data collection. The time required for some participants to respond to all the required self-reported measures was a burden. In 2 instances, the data collection process needed to occur over 2 separate visits. Due to dropouts, there was missing data. Participants with missing data were not included in the analysis.

Conclusions

A recent systematic review of mindfulness-based interventions tested by RCTs among various types of survivors with cancer showed that these interventions can be used as adjuvant therapy for the management of cancer-related symptoms.¹⁸ Unlike previous reviews, this one included populations other than women with breast cancer.^{18(p1574)} However, only 1 study in the review focused on survivors with lung cancer.²¹ Our study adds to the science of mindfulness-based intervention research with this diverse vulnerable population. In 2019, Badr et al published a state of the science paper on dyadic interventions for cancer survivors and caregivers; in the paper, the researchers identified future research areas.⁴⁵ Many of these areas—inclusion of individuals with diverse racial backgrounds, lower socioeconomic status, diverse dyadic relationships other than husband/wife, and longer-term survivors—were built into our design, thus demonstrating further the strength of our study.

Breathe Easier demonstrates the importance of developing and testing interventions for survivors of lung cancer and their family members, both of whom experience distress related to the diagnosis of lung cancer and its impact on their lives. *Breathe Easier* needs to be evaluated further to determine its efficacy as an adjuvant therapy complementing standard care to promote the self-management of symptoms and the health and wellness of survivors of lung cancer and their family members. Exploring delivery mechanisms is a special interest of the *Breathe Easier* team. We developed and tested a mobile app prototype of this intervention that requires additional development and testing to maximize efficient delivery and potential widespread dissemination.^{46,47}

Acknowledgments

The authors would like to thank Dr. Linda Carlson, PhD, C Psych, Professor and Enbridge Research Chair in Psychosocial Oncology, Department of Oncology, and Adjunct Professor, Department of Psychology, University of Calgary, Canada, for her early consultation on this intervention. Also, the authors want to recognize Jenne Stewart, PMHCNS-BC and T. Hilda White, MD, Upstream: *A Center for Mindfulness Practice & Holistic Health* for their dedication to this program and its participants.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by a grant from the Bristol Myers Squibb Foundation (BMSF). Dr. Karen Kane McDonnell is supported also by an American Cancer Society (ACS) Mentored Research Scholar Grant #MRSG-17-152-01. Neither the BMSF nor the ACS had any role in the study design, data analyses and interpretation, writing of the manuscript, or decision to submit this manuscript for publication.

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Supplemental Material

Supplemental material for this article is available online.

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