



Supplementary Information for

Mindfulness training reduces loneliness and increases social contact
in a randomized controlled trial

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Supplementary Materials & Methods

Participants & Procedure

Exclusion Criteria: Since blood and saliva samples were collected in the parent trial, participant exclusion criteria included: chronic mental or physical disease; hospitalization for mental or physical illness in the past 3 months; medication use that interferes with hypothalamic-pituitary-adrenal axis (HPA) or immune system functioning; current antibiotic, antiviral, or antimicrobial treatment; current oral contraceptive use or pregnancy; recreational drug use; and bloodborne pathogen risk due to travel to countries on the CDC travel alert list in the past 6 months. Finally, in order to test the effects of developing mindfulness skills in a novice population, those with a regular systematic mindfulness meditation or related mind-body practice (>2 times per week) were excluded. Study data was collected between February 2015 and April 2016. Trial recruitment was stopped when the goal of enrolling 150 participants was reached^{1,2}. The ambulatory assessment data reported here were not analyzed until the complete dataset was collected.

Randomization Procedures & Blinding: Subject IDs were assigned sequentially, and a computerized random number generator was used to pre-assign one of three condition codes to each ID in blocks of 8, 16, or 24 using a 3:3:2 randomization sequence (Monitor+Accept : Monitor Only : control). Trained study staff enrolled eligible participants and instructed participants to download their assigned intervention by code. All participants were blind to study condition, and study staff were blind to condition in 76% of baseline sessions. Study managers who contacted participants during the intervention period were not blind to condition code; study managers also served as experimenters in cases when blind research assistants were unavailable (e.g., during semester breaks)^{1,2}.

Interventions

Participants were randomly assigned to receive one of three 14-lesson smartphone-based interventions: Monitor+Accept, Monitor Only, or Coping control (described in detail below, in *Figure S2*, and in refs.^{1,2}). To maximize experimental control in isolating the effects of monitoring and acceptance instruction, all three interventions were delivered by the same female instructor and were matched on attentional demand, length, structure, and delivery tone of voice. To equalize expectancies at the baseline appointment, all participants viewed the same 5-minute introductory video explaining how to prepare for and what to expect in the training program, and “mindfulness” was not mentioned during the study period. Participants were required to complete lessons in order and could not skip or repeat lessons. Each 20-minute lesson trained specific techniques through didactic explanation (what the technique was and how it would help) and formal guided practice (i.e., meditation practice in the MA and MO interventions and guided thinking in the control intervention), and participants were expected to complete brief daily homework practice (3-10 minutes per day). To equalize nonspecific contextual factors, all interventions were grounded in personal and ethical goals (i.e., that the skills developed through the training program would not only benefit oneself, but could ultimately be used in the service of others), provided positive feedback (e.g., instructor encouragement; suggestions to tune into the positive effects of each lesson), and focused one lesson on applying the training skills within social interactions. An unblinded study manager contacted all participants by phone on Days 3 and 9 of the intervention program to answer training-specific questions, address difficulties, and encourage program adherence. After the 14-day intervention period, the training program was deactivated (although a training program of choice was provided to participants at the completion of the study). Intervention scripts are available for research purposes by request.

Monitor + Accept (MA): MA participants first learned foundational concentration skills, which enabled them to (1) monitor their present-moment body experience (‘sensory clarity’) while (2) welcoming and accepting each experience (‘equanimity’). Specifically, concentration was described as stable attention on the intended target, which in this intervention was physical and emotional body experiences. Monitoring (‘sensory clarity’) was explained in terms of two dimensions: resolution (*discriminating* types of experiences) and sensitivity (*detecting* subtle sensations). In practice, a simple labeling strategy (the word ‘feel’) was used to maintain focus on present-moment experience and facilitate detection and discrimination. Acceptance (‘equanimity’) was trained through three tangible strategies that embody the attitude of acceptance: participants were encouraged to (a) maintain a state of global *body relaxation*, (b) *mentally welcome* all physical and emotional body experiences, and (c) use a gentle, matter-of-fact tone of voice (an ‘*equanimity tone*’) while labeling these experiences. These strategies—receptivity and softness in the body, mind, and voice—induce equanimity even during challenging experiences when authentic equanimity is difficult to actualize, and over time they create a more effortless orientation of acceptance toward experience. MA participants practiced responding to social interactions while maintaining body awareness and equanimity in Lesson 4 and in homework practice. Specifically, MA participants listened to an excerpt while learning to detect its emotional impact on the body, with a focus on opening to and allowing these body sensations to unfold in their own time. Bringing equanimity to social interactions was described as key for deriving fulfillment from them.

Monitor Only (MO): The MO program trained participants only to concentrate on and (1) monitor physical and emotional body experience (as described above), with no instruction on acceptance. MO participants similarly learned to maintain body awareness in social interactions

in Lesson 4 and in home practice. Specifically, they practiced detecting and untangling the emotional impact of an excerpt on the body, with clarity being key for promoting fulfilling social interactions.

Coping control: The Coping control training program (referred to in the lessons as ‘MyTime’) was developed to parallel the structure of MA and MO without encouraging focus on or acceptance of present experience. Instead, participants were instructed to freely reflect and let their minds drift (in contrast to concentration developed in MA and MO), reframe or reappraise past and anticipated events (with past and future emphasis contrasting present-focused monitoring, and change strategies contrasting acceptance strategies), and analyze and solve personal problems (again encouraging active change rather than acceptance of momentary experiences). Participants could reflect on, reframe, and analyze personal relationships and interactions, among other topics. In Lesson 5, control participants practiced reflecting while listening to an excerpt, analyzing the thoughts and feelings of the subject of the excerpt and considering how the excerpt might apply to their own lives. The Coping control program was designed to be useful for managing stress (reinforcing common reappraisal and coping strategies; see Carver et al., 1989; Ochsner & Gross, 2005) without training mindfulness, and was included to control for nonspecific effects of undergoing a training program (e.g., treatment expectancies, daily time and effort toward the goal of reducing stress).

Measures

In addition to ambulatory assessments of loneliness and social isolation, retrospective global measures of loneliness, social isolation, and social support were assessed at baseline and post-intervention lab assessments. Second, exploratory measures of reactions to social

interactions were assessed in a subset of EMA data. Finally, condition differences in treatment adherence and treatment expectancies were tested.

Retrospective Loneliness: UCLA Loneliness Scale: The UCLA Loneliness Scale³ was administered at the baseline and post-intervention lab assessments. This 20-item scale measured the extent to which participants felt lonely “in general” over the past two weeks on a 4-point Likert scale ranging from 1 (*never*) to 4 (*always*). Relevant items were reverse-coded and all items were summed to create a total loneliness score, with higher scores reflecting higher loneliness. The scale was reliable at baseline (Cronbach’s $\alpha=.94$) and post-intervention ($\alpha=.93$).

Retrospective Social Isolation: Social Network Index (SNI): The Social Network Index (SNI)⁴ was administered at the baseline and post-intervention lab assessments. The SNI assesses the number of high-contact social roles (also called ‘network diversity’) and the total number of people in one’s social network (also called ‘network size’) from a list of 12 social role categories (spouse, parent, child, child-in-law, close relative, close friend, church member, student, employee, neighbor, volunteer, other group member). For the measure of social network size, the total number of people participants see or talk to on a regular basis across all social roles was summed, and for the measure of social roles, the total number of role categories endorsed out of 12 was summed.

Retrospective Social Support: Interpersonal Support Evaluation List (ISEL): The Interpersonal Support Evaluation List-12 (ISEL-12)⁵ was administered at the baseline and post-intervention lab assessments. This 12-item scale measured the perceived availability of social support on a 4-point scale ranging from 0 (*Definitely False*) to 3 (*Definitely True*). Relevant items were reverse-coded and all items were summed to create a total social support score, with higher scores reflecting higher social support. Social support subscale scores (Appraisal,

Belonging, Tangible) were calculated by summing 4 subscale items each. The total scale was reliable at baseline (Cronbach's $\alpha=.91$) and post-intervention ($\alpha=.88$), and subscales showed acceptable reliability (Appraisal: $\alpha=.84$ and $.84$; Belonging: $\alpha=.82$ and $.80$; Tangible $\alpha=.78$ and $.71$).

Reactions to Social Interactions: On EMA surveys, when participants reported having at least one social interaction since the last survey (82% of surveys; all participants who completed EMA surveys reported at least one social interaction at both pre- and post-intervention), three follow-up questions assessed participants' reactions to their most recent social interaction. Responses were given using 7-point Likert scales ranging from 1 (*not at all*) to 7 (*extremely*). Follow-up questions assessed feelings of connection to the interaction partner ("How connected did you feel to this person or people during the interaction?"), the meaningfulness of the interaction ("How meaningful was this interaction to you?"), and feelings of rejection during the interaction ("Did you feel rejected during the interaction?"). On these outcomes, 20-40% of the total variance occurred between individuals, 0-5% was explained at the day level, and 55-77% occurred within individuals. Two-level models were used to analyze these outcomes, as described in *Analyses*.

Treatment Adherence: The smartphone training application automatically timestamped the initiation and completion of each lesson in the 14-day at-home training period. This electronic timestamp was used to calculate the total number of at-home lessons completed for each individual.

Treatment Expectancies: To evaluate whether both training programs produced equivalent perceived treatment benefits, participants completed an adapted 6-item Credibility/Expectancy Questionnaire⁶ to assess their beliefs about the efficacy of the training

program at post-intervention. Logical (e.g., “how successful do you think this program will be in reducing your stress symptoms?”) and emotional (e.g., “how much improvement in your symptoms do you think will occur?”) subscales were averaged to create an overall measure of positive treatment expectancies (Cronbach’s $\alpha=.95$).

Analyses

The assumption of dependence in ambulatory assessment data was confirmed in unconditional models. For the diary-assessed objective social isolation outcomes, empty 2-level models showed that 48-58% of the total variance occurred between individuals, whereas 42-52% of variance occurred within individuals; for diary-assessed loneliness, an empty 2-level model showed that 46% of the total variance occurred between individuals, whereas 54% of variance occurred within individuals. For the EMA objective social isolation outcome, an empty 3-level model showed that 33% of the total variance occurred between individuals, 2% was explained at the day level, and 64% occurred within individuals. Because very little variance was explained at the day level, 2-level models were used for both diary and EMA data.

Supplementary Results

Preliminary Analyses

Participants in all conditions were highly adherent to the training programs, with no condition differences in treatment adherence ($F(2,146)=0.40, p=.670$). On average, participants completed 13.49 of the 14 lessons. Similarly, participants in all conditions were adequately adherent to both baseline and post-intervention ambulatory assessments, on average completing 91% of baseline surveys and 86% of post-intervention surveys. There were no condition differences in baseline or post-intervention EMA or diary compliance (see *Table S2*). There were no condition differences in the counterbalance of EMA days ($\chi^2(2)=3.10, p=.21$). However, there

was a relationship between day of the week and social outcomes in this sample; in general, people felt the most lonely and had the fewest social interactions on Sundays (see *Tables S4a-S4c*). Thus, day of week was included as a covariate in all EMA analyses. There were no baseline differences on any of the primary, secondary, or exploratory outcome measures (see *Table S2*). Finally, the post-intervention assessment took place an average of 4.66 ± 1.88 days after the end of the intervention, with no differences between conditions ($F(2,146)=1.03$, $p=.360$). At this assessment, there were no condition differences in treatment expectancies ($F(2,146)=1.55$, $p=.22$), indicating similar perceptions of treatment benefits across all three training conditions.

Secondary Analyses

Although ambulatory assessments are known to be more sensitive and less susceptible to retrospective reporting biases⁷, we nonetheless tested for condition differences in retrospective global trait measures of loneliness and social isolation, as well as social support (all measured in the laboratory at pre- and post-intervention). We predicted that MA training would decrease retrospective loneliness and social isolation and increase social support compared to MO and control trainings, with no differences between MO and control. To evaluate these hypotheses, MLMs focused on time \times condition interactions in retrospective global social outcomes (using all available data).

Retrospective Loneliness

Global trait loneliness (UCLA Loneliness) measured “in general over the last two weeks” at baseline and post-intervention lab assessments significantly decreased across all conditions (main effect of time: $\chi^2(1)=37.43$, $p<.0005$). Contrary to predictions, there was no time \times condition interaction on global ratings of loneliness ($\chi^2(2)=1.63$, $p=.442$) (*Table S3*).

Retrospective Social Isolation

On the global measure of social network diversity (SNI), there was no main effect of time on number of social roles filled ($\chi^2(1)=0.21, p=.648$) and no time \times condition interaction ($\chi^2(2)=0.35, p=.839$) (Table S3). On average, participants reported interacting with people in 7 different social role categories in the past two weeks at both baseline and post-intervention. Likewise, there was no effect of time ($\chi^2(1)=0.30, p=.585$) and no time \times condition interaction ($\chi^2(2)=2.54, p=.281$) on social network size; participants reported regular contact with an average of 26 people across baseline and post-intervention lab assessments.

Retrospective Social Support

On the global measure of social support (ISEL-12), there was a main effect of time ($\chi^2(1)=5.57, p=.018$), such that all conditions reported increases in social support overall from pre- to post-intervention. This effect was specific to feelings of belonging ($\chi^2(1)=3.85, p=.050$) rather than appraisals of support ($\chi^2(1)=3.39, p=.066$) or tangible support ($\chi^2(1)=2.93, p=.087$). There was no time \times condition interaction on social support overall ($\chi^2(2)=0.32, p=.852$; Table S3) or on any subscales.

Exploratory Analyses

When participants reported having social interactions (in 82% of EMA surveys), follow-up items probed their reactions to their most recent social interaction. Exploratory MLM analyses of this subset of data tested the prediction that MA-trained participants would show increases in feelings of connection and meaningfulness in response to social interactions and show decreases in feelings of rejection compared to MO- and control-trained participants.

Reactions to Social Interactions

Contrary to predictions, EMA MLM analyses suggested that MA and MO trainings were

equally effective for maintaining subjective social connection compared to control training. Specifically, there was a significant time \times condition interaction on feelings of connection during the most recent social interaction ($\chi^2(2)=9.66, p=.008$). Both MA- and MO-trained participants reported feeling significantly more connected from pre- to post-intervention compared to control-trained participants (MA vs. control: $\chi^2(1)=6.55, p=.011$; MO vs. control: $\chi^2(1)=8.70, p=.003$), and MA and MO participants did not differ ($\chi^2(1)=0.19, p=.661$). However, these effects were driven by significant decreases in feelings of connection among control participants (mean change=-0.32, $p=.005, d=-.35$) rather than significant increases among MA or MO participants (MA mean change=0.05, $p=.587, d=.05$; MO mean change=0.11, $p=.239, d=.12$) (*Tables S3 and S4d*).

Similarly, MLM analyses revealed a significant time \times condition interaction on ratings of meaningfulness of the most recent social interaction ($\chi^2(2)=21.60, p<.0005$). Again, both MA- and MO-trained participants perceived significantly more meaning in their social interactions from pre- to post-intervention compared to control-trained participants (MA vs. control: $\chi^2(1)=12.07, p=.001$; MO vs. control: $\chi^2(1)=20.76, p<.0005$), and MA and MO participants did not differ ($\chi^2(1)=1.47, p=.225$). MO-trained participants showed significant increases in meaningfulness of social interactions from pre- to post-intervention (mean change=0.29, $p=.001, d=.30$), whereas MA-trained participants did not change significantly (mean change=0.14, $p=.138, d=.14$) and control participants showed significant decreases (mean change=-0.35, $p=.002, d=-.38$) (*Tables S3 and S4d*).

Finally, baseline feelings of social rejection during recent social interactions were low, and MLM analyses revealed no main effect of time ($\chi^2(1)=1.48, p=.223$) or time \times condition interaction ($\chi^2(2)=2.71, p=.258$) on changes in feelings of social rejection (*Tables S3 and S4d*).

Supplementary Discussion

The *Supplementary Exploratory Analyses* qualify the primary findings. There was little effect of either mindfulness intervention on changing participants' reactions to recent social interactions, although both MA and MO interventions were more effective for maintaining feelings of connectedness and meaning compared to the Coping control intervention. Instead, the benefits of two-week MA over MO and control interventions were specific to increasing social interaction behaviors and reducing feelings of loneliness in daily life. It is possible that acceptance is not an important ingredient of mindfulness training for promoting feelings of social connection, or that additional acceptance skill development is needed. Specifically, a two-week dose of mindfulness training may begin to change social behavior in ways that increase social contact and reduce loneliness, but longer-term mindfulness practice and more ingrained trait mindfulness skills may be necessary to foster perceptions of closeness and connection in social interactions^{8,9}. Shorter-term mindfulness training may begin by breaking down barriers that can hold people back from social interactions (e.g., negative biases, distress, social anxiety, avoidance), and with more practice, people may develop greater skill in listening and empathizing with others' thoughts and feelings in ways that promote feelings of closeness and connection. It is also possible that most interactions throughout the day are not particularly influential with regard to perceptions of closeness or loneliness; future research might find ways to identify high-impact social interactions and weight these interactions in analyses.

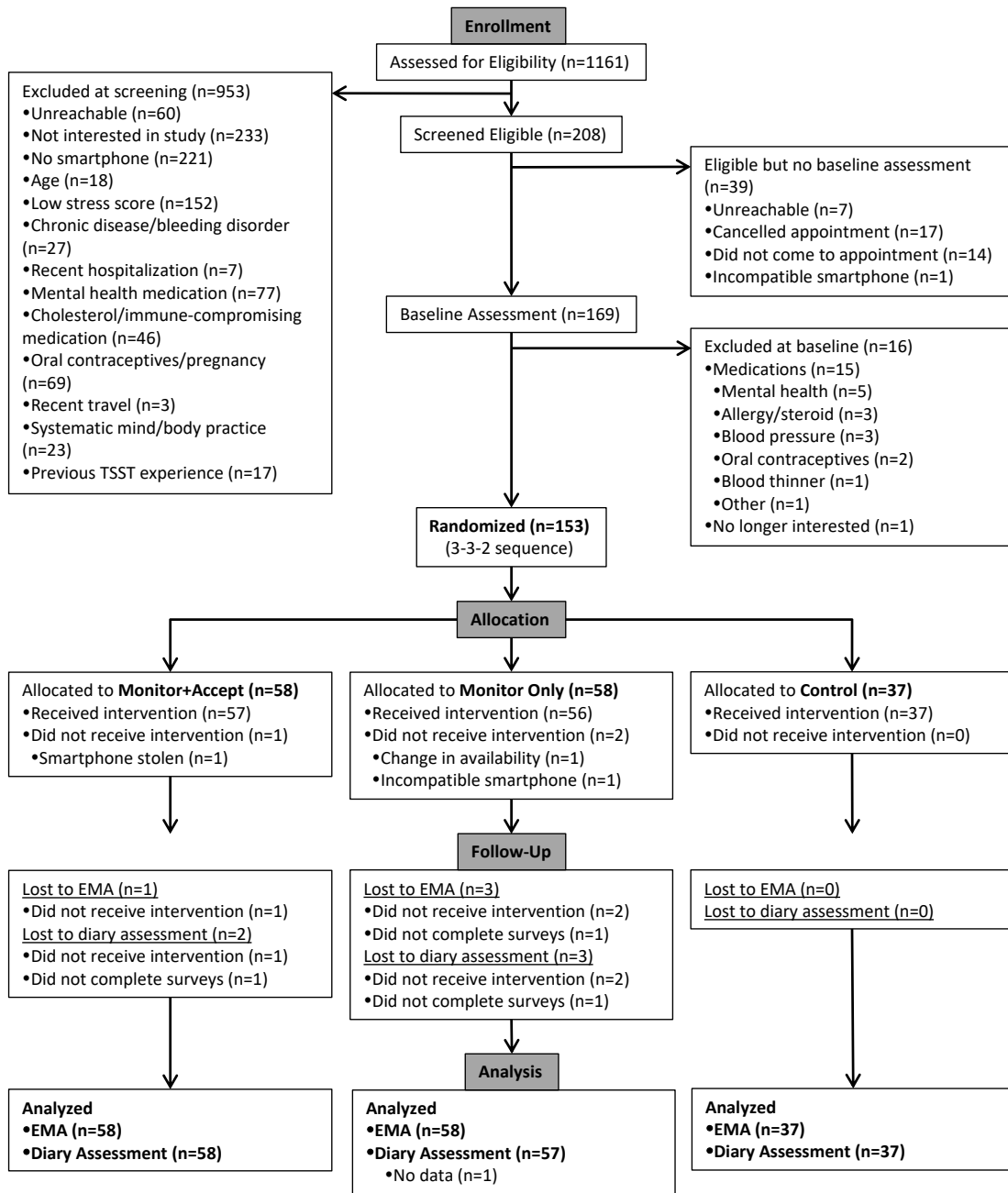


Figure S1. CONSORT flow chart.

Adapted from ref. ¹, with permission from Elsevier, and from ref. ².

	Monitor + Accept	Monitor Only	Coping control
Lesson 1	<p><i>Introduction:</i> Intro to the course and three core skills:</p> <ul style="list-style-type: none"> • Concentration: ability to maintain focus on present-moment experiences • Clarity (Monitoring): ability to pinpoint exactly what you're experiencing in each moment • Equanimity (Acceptance): openness to experience 	<p><i>Introduction:</i> Intro to the course and two core skills:</p> <ul style="list-style-type: none"> • Concentration: ability to maintain focus on present-moment experiences • Clarity (Monitoring): ability to pinpoint exactly what you're experiencing in each moment 	<p><i>Introduction:</i> Intro to the course (MyTime) and three core skills:</p> <ul style="list-style-type: none"> • Reflection: guided exploration of thoughts; mind can wander where it wants • Analytic Thinking: analyze and think deeply about thoughts and ideas that occur during reflection • Problem-Solving: techniques for tackling problems that are apparent through analytic thinking
Lesson 2	<i>Concentration I:</i> developing a deeper understanding of concentration	<i>Concentration I:</i> developing a deeper understanding of concentration	<i>Reflection I:</i> choosing to control thought content or get lost in mind wandering
Lesson 3	<i>Concentration II:</i> concentrating continuously on body experience	<i>Concentration II:</i> concentrating continuously on body experience	<i>Reflection II:</i> letting the mind wander toward pleasant thoughts or toward or away from unpleasant thoughts
Lesson 4	<i>Concentration III:</i> maintaining focus on body experience while listening to someone speak (with topic options)	<i>Concentration III:</i> maintaining focus on body experience while listening to someone speak (with topic options)	<i>Reflection III:</i> pleasant guided imagery with option to let the mind drift
Lesson 5	<i>Concentration IV:</i> labeling body experiences to maintain focus	<i>Concentration IV:</i> labeling body experiences to maintain focus	<i>Reflection IV:</i> reflecting while listening to someone speak (Shakespeare monologues)
Lesson 6	<i>Concentration V:</i> labeling different types of body experiences	<i>Concentration V:</i> labeling different types of body experiences	<i>Analytic Thinking I:</i> remembering a positive experience and considering how to make future experiences more positive
Lesson 7	<i>Equanimity I:</i> maintaining global body relaxation to promote equanimity	<i>Clarity I:</i> discriminating different types and patterns of body sensations	<i>Analytic Thinking II:</i> imagining a positive experience in the future (e.g., goal achievement)
Lesson 8	<i>Equanimity II:</i> promoting equanimity by intentionally using a matter-of-fact tone of voice when labeling	<i>Clarity II:</i> detecting subtle or faint body sensations, and increasing sensual fulfillment by detecting subtle pleasure	<i>Analytic Thinking III:</i> reframing a past negative experience
Lesson 9	<i>Clarity I:</i> discriminating different types and patterns of body sensations	<i>Clarity III:</i> introduction to six types of sensory discrimination with respect to body experience: quality, quantity, spatiality, instant of onset, what triggers what, types of change	<i>Analytic Thinking IV:</i> reframing an anticipated future negative experience
Lesson 10	<i>Clarity II:</i> detecting subtle or faint body sensations, and increasing sensual fulfillment by detecting subtle pleasure	<i>Clarity IV:</i> recognizing physical and emotional themes of body experience	<i>Problem-Solving I:</i> time management and planning out your day
Lesson 11	<i>Equanimity III:</i> developing equanimity by applying a welcoming attitude toward all experiences	<i>Clarity V:</i> recognizing "energy flow" (changes) in body experience	<i>Problem-Solving II:</i> time management and reflecting on yesterday's plans and accomplishments
Lesson 12	<i>Clarity III:</i> recognizing four basic categories of body experience (physical, emotional, restful, "energy flow")	<i>Clarity VI:</i> exploring three basic categories of body experience (physical, emotional, "energy flow")	<i>Problem-Solving III:</i> identifying a problem and the causes of stress
Lesson 13	<i>Equanimity IV:</i> integrating the three equanimity strategies: body relaxation, tone of voice, welcoming attitude	<i>Clarity VII:</i> choosing to focus on one or all three themes of body experience	<i>Problem-Solving IV:</i> considering barriers and solutions to a problem
Lesson 14	<i>Course Review:</i> guided practice through the major strategies learned in the preceding 13 lessons	<i>Course Review:</i> guided practice through the major strategies learned in the preceding 13 lessons	<i>Course Review:</i> guided practice through the major strategies learned in the preceding 13 lessons

Figure S2. Lesson content of each intervention program.

Adapted from ref. ¹, with permission from Elsevier.

Table S1. Baseline characteristics of randomized participants.

Characteristic	Full Sample (N=153)	Monitor + Accept (N=58)	Monitor Only (N=58)	Control (N=37)	Condition Difference Statistic ^a
Age in years	32.42 (13.68)	32.76 (14.21)	32.64 (12.93)	31.54 (14.31)	$F(2,150)=0.10$
Sex					$\chi^2(2)=0.75$
Female	103 (67.32%)	39 (67.24%)	41 (70.69%)	23 (62.16%)	
Male	50 (32.68%)	19 (32.76%)	17 (29.31%)	14 (37.84%)	
Race					$\chi^2(8)=14.49$
American Indian/Alaska Native	1 (0.65%)	0 (0.00%)	0 (0.00%)	1 (2.70%)	
Asian	33 (21.57%)	15 (25.86%)	13 (22.41%)	5 (13.51%)	
Black/African American	33 (21.57%)	14 (24.14%)	16 (27.59%)	3 (8.11%)	
White/Caucasian	81 (52.94%)	28 (48.28%)	28 (48.28%)	25 (67.57%)	
Bi- or Multi-Racial	5 (3.27%)	1 (1.72%)	1 (1.72%)	3 (8.11%)	
Ethnicity					$\chi^2(2)=1.40$
Hispanic or Latino	7 (4.58%)	2 (3.45%)	2 (3.45%)	3 (8.11%)	
Not Hispanic or Latino	146 (95.42%)	56 (96.56%)	56 (96.56%)	34 (91.89%)	
Education Level					$\chi^2(14)=14.26$
GED	3 (1.96%)	1 (1.72%)	1 (1.72%)	1 (1.72%)	
High School Diploma	20 (13.07%)	9 (15.52%)	10 (17.24%)	1 (2.70%)	
Technical Training	1 (0.65%)	1 (0.65%)	0 (0.00%)	0 (0.00%)	
Some College	41 (26.80%)	15 (25.86%)	12 (20.69%)	14 (37.84%)	
Associate Degree	10 (6.54%)	4 (6.90%)	2 (3.45%)	4 (10.81%)	
Bachelor's Degree	48 (31.37%)	15 (25.86%)	21 (36.21%)	12 (32.43%)	
Master's Degree	26 (16.99%)	10 (17.24%)	11 (18.97%)	5 (13.51%)	
MD, PhD, JD, PharmD	4 (2.61%)	3 (5.17%)	1 (1.72%)	0 (0.00%)	

Note: Data are reported as means (SD) or numbers (%). ^aAll $ps > .05$.

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Table S2. Adherence, treatment expectancies, and pre-intervention outcomes of randomized participants.

Characteristic	Full Sample (N=153)	Monitor + Accept (N=58)	Monitor Only (N=58)	Control (N=37)	Condition Difference Statistic ^a
Intervention Drop-outs	3 (1.96%)	1 (1.72%)	2 (3.45%)	0 (0.00%)	$\chi^2(2)=1.42$
Intervention Adherence (lessons) ^b	13.49 (1.20)	13.44 (1.52)	13.60 (0.91)	13.39 (1.04)	$F(2,146)=0.40$
Treatment Expectancies ^c	5.37 (1.90)	5.71 (1.77)	5.26 (2.02)	5.05 (1.86)	$F(2,146)=1.55$
Pre-Intervention EMA Compliance	10.81 (1.35)	10.71 (1.32)	10.90 (1.32)	10.84 (1.32)	$F(2,150)=0.31$
Pre-Intervention Diary Compliance ^d	2.87 (0.43)	2.81 (0.43)	2.91 (0.42)	2.89 (0.43)	$F(2,149)=0.90$
Post-Intervention EMA Compliance	10.14 (2.41)	9.98 (2.36)	10.02 (2.36)	10.41 (2.36)	$F(2,150)=0.42$
Post-Intervention Diary Compliance ^d	2.80 (0.62)	2.76 (0.60)	2.83 (0.60)	2.81 (0.60)	$F(2,149)=0.19$
Ambulatory Assessment Counterbalance					$\chi^2(2)=3.10$
Pre: Thurs-Sat; Post: Sun-Tues	103 (67.32%)	44 (75.86%)	36 (62.07%)	23 (62.16%)	
Pre: Sun-Tues; Post: Thurs-Sat	50 (32.68%)	14 (24.14%)	22 (37.95%)	14 (37.84%)	
Pre-Intervention Loneliness					
Diary-Assessed Loneliness ^d	2.15 (1.16)	2.25 (1.16)	1.97 (1.15)	2.26 (1.15)	$\chi^2(2)=2.23$
Global UCLA Loneliness	43.91 (11.14)	42.98 (11.12)	44.48 (11.16)	44.46 (11.12)	$\chi^2(2)=0.64$
Pre-Intervention Social Isolation					
EMA Social Interactions	2.54 (1.58)	2.58 (1.58)	2.60 (1.58)	2.40 (1.57)	$\chi^2(2)=0.42$
Diary Social Interactions ^d	9.85 (5.84)	9.06 (5.83)	10.19 (5.82)	10.55 (5.81)	$\chi^2(2)=1.81$
Diary Interaction Partners ^d	7.71 (4.54)	6.92 (4.53)	7.79 (4.51)	8.84 (4.50)	$\chi^2(2)=4.14$
Global Social Roles (SNI)	7.36 (2.27)	7.43 (2.27)	7.38 (2.27)	7.22 (2.27)	$\chi^2(2)=0.21$
Global Network Size (SNI)	26.07 (20.18)	26.87 (20.18)	24.28 (20.18)	27.62 (20.18)	$\chi^2(2)=0.77$
Pre-Intervention Social Support					
Global Soc. Support (ISEL)	25.92 (7.26)	25.79 (7.25)	25.96 (7.28)	26.05 (7.25)	$\chi^2(2)=0.03$
Pre-Intervention Reactions to Social Interactions					
EMA SI: Connected	4.01 (0.96)	4.13 (0.96)	3.95 (0.95)	3.95 (0.96)	$\chi^2(2)=1.29$
EMA SI: Meaningful	3.82 (0.97)	3.92 (0.97)	3.65 (0.96)	3.95 (0.97)	$\chi^2(2)=3.07$
EMA SI: Rejected	1.33 (0.47)	1.31 (0.46)	1.36 (0.46)	1.30 (0.46)	$\chi^2(2)=0.55$

Note: Data are reported as means (SD) or numbers (%). Intervention Drop-outs is reported as number of drop-outs at the completion of the intervention period. Ambulatory assessment compliance is reported as number of surveys completed of 12 possible EMA surveys and 3 possible diary surveys at pre- and post-intervention. EMA = Ecological Momentary Assessment.

^aAll $ps > .05$.

^bN=150 (MA N=57; MO N=56; Control N=37).

^cN=149 (MA N=56; MO N=56; Control N=37).

^dN=152 (MA N=58; MO N=57; Control N=37).

Adapted with permission from ref. ².

Table S3. Secondary and Exploratory Analyses.

Outcome	Monitor + Accept (N=58)			Monitor Only (N=58)			Control (N=37)			Time x Condition Difference
	Pre	Post	<i>d</i>	Pre	Post	<i>d</i>	Pre	Post	<i>d</i>	
Retrospective Loneliness										
Global Loneliness (UCLA)	42.98(1.46)	39.40(1.47)	.46	44.48(1.47)	41.37(1.47)	.40	44.46(1.83)	39.30(1.83)	.67	$\chi^2(2)=1.63$
Retrospective Social Isolation										
Global Social Roles (SNI)	7.43(0.30)	7.34(0.30)	-.06	7.38(0.30)	7.19(0.30)	-.12	7.22(0.37)	7.27(0.37)	.03	$\chi^2(2)=0.35$
Global Network Size (SNI)	26.87(2.65)	32.14(2.65)	.40	24.28(2.65)	24.24(2.65)	.00	27.62(3.32)	25.59(3.32)	-.16	$\chi^2(2)=2.54$
Retrospective Social Support										
Global Soc. Support (ISEL)	25.79(0.95)	26.54(0.96)	.15	25.96(0.96)	26.78(0.96)	.16	26.05(1.19)	27.35(1.19)	.26	$\chi^2(2)=0.32$
Reactions to Social Interactions										
EMA SI: Connected	4.13 (.13)	4.18 (.13)	.05	3.95 (.12)	4.05 (.13)	.12	3.95 (.16)	3.62 (.16)	-.35	$\chi^2(2)=9.66$
EMA SI: Meaningful	3.92 (.13)	4.06 (.13)	.14	3.65 (.13)	3.94 (.13)	.30	3.95 (.16)	3.59 (.16)	-.38	$\chi^2(2)=21.60$
EMA SI: Rejected	1.31 (.06)	1.33 (.06)	-.04	1.36 (.06)	1.35 (.06)	.03	1.30 (.08)	1.41 (.08)	-.21	$\chi^2(2)=2.71$

Note: Data are reported as means (SE) adjusted for day of week. *d* = Cohen's *d* effect size estimate. SNI = Social Network Index; ISEL = Interpersonal Support Evaluation List; EMA = Ecological Momentary Assessment; SI = Social Interactions.

***p<.05**

Table S4a. Multilevel mixed effects linear model results for diary-assessed loneliness.

	Loneliness	
	<i>B</i> (SE)	<i>z</i>
Intercept^a (γ_{00})	2.40 (.18)	13.62*
Time (pre vs. post) (γ_{10})	-0.49 (.12)	-4.01*
Condition		
MA vs. MO (γ_{01})	-0.28 (.21)	-1.32
MA vs. control (γ_{02})	0.01 (.24)	0.05
Condition × Time		
MA vs. MO × pre vs. post (γ_{11})	0.51 (.17)	3.09*
MA vs. control × pre vs. post (γ_{12})	0.49 (.19)	2.61*
Day of Week		
Monday (γ_{20})	-0.07 (.12)	-0.60
Tuesday (γ_{30})	-0.27 (.12)	-2.21*
Thursday (γ_{40})	-0.17 (.13)	-1.36
Friday (γ_{50})	-0.19 (.13)	-1.52
Saturday (γ_{60})	-0.21 (.13)	-1.67
	Estimate	95% CI
Within-subjects error (r_{ii})	1.08 (.06)	0.97, 1.20
Between-subjects error (u_{0i})	0.94 (.13)	0.71, 1.24

Note: N=152.

^aReference group: condition: MA; time: Pre; day of week: Sunday.

* $p < .05$

Table S4b. Multilevel mixed effects linear model results for EMA social isolation.

	Number of Social Interactions	
	<i>B</i> (SE)	<i>z</i>
Intercept^c (γ_{00})	2.24 (.24)	9.24*
Time (pre vs. post) (γ_{10})	0.40 (.12)	3.25*
Condition		
MA vs. MO (γ_{01})	0.02 (.29)	0.08
MA vs. control (γ_{02})	-0.18 (.33)	-0.54
Condition × Time		
MA vs. MO × pre vs. post (γ_{11})	-0.46 (.17)	-2.74*
MA vs. control × pre vs. post (γ_{12})	-0.38 (.19)	-2.06*
Day of Week		
Monday (γ_{30})	0.13 (.12)	1.05
Tuesday (γ_{40})	0.18 (.12)	1.45
Thursday (γ_{50})	0.17 (.13)	1.36
Friday (γ_{60})	0.28 (.13)	2.16*
Saturday (γ_{70})	0.15 (.13)	1.15
Time of Day (γ_{20})	0.08 (.03)	2.34*
	Estimate	95% CI
Within-subjects error (r_{ii})	4.02 (.10)	3.82, 4.23
Between-subjects error (u_{0i})	2.10 (.27)	1.64, 2.69

^cReference group: condition: MA; time: Pre; day of week: Sunday; time of day: first survey (9-11:30am).

* $p < .05$

Table S4c. Multilevel mixed effects linear model results for diary-assessed social isolation.

	Number of Social Interactions		Number of Interaction Partners	
	<i>B</i> (SE)	<i>z</i>	<i>B</i> (SE)	<i>z</i>
Intercept^a (γ_{00})	3.60 (.16)	22.28*	3.17 (.14)	23.11*
Time (pre vs. post) (γ_{10})	0.38 (.10)	3.87*	0.31 (.09)	3.31*

Condition				
MA vs. MO (γ_{01})	0.24 (.21)	1.16	0.17 (.17)	1.03
MA vs. control (γ_{02})	0.36 (.23)	1.54	0.39 (.19)	2.04*
Condition × Time				
MA vs. MO × pre vs. post (γ_{11})	-0.27 (.13)	-2.03*	-0.34 (.13)	-2.67*
MA vs. control × pre vs. post (γ_{12})	-0.42 (.15)	-2.82*	-0.43 (.14)	-3.06*
Day of Week				
Monday (γ_{20})	0.14 (.10)	1.47	0.21 (.09)	2.28*
Tuesday (γ_{30})	0.36 (.10)	3.64*	0.37 (.09)	3.91*
Thursday (γ_{40})	0.26 (.10)	2.59*	0.42 (.10)	4.44*
Friday (γ_{50})	0.40 (.10)	4.03*	0.52 (.09)	5.54*
Saturday (γ_{60})	0.27 (.10)	2.70*	0.31 (.10)	3.25*
	Estimate	95% CI	Estimate	95% CI
Within-subjects error (r_{ii})	0.67 (.04)	0.61, 0.75	0.61 (.03)	0.55, 0.68
Between-subjects error (u_{0i})	0.97 (.13)	0.75, 1.25	0.60 (.08)	0.45, 0.78

Note: N=152.

^aReference group: condition: MA; time: Pre; day of week: Sunday.

* $p < .05$

Table S4d. Multilevel mixed effects linear model results for EMA reactions to social interactions outcomes.

	Connectedness		Meaningfulness		Rejection	
	<i>B</i> (SE)	<i>z</i>	<i>B</i> (SE)	<i>z</i>	<i>B</i> (SE)	<i>z</i>
Intercept^c (γ_{00})	4.21 (.16)	26.13*	3.76 (.16)	23.54*	1.28 (.08)	15.93*
Time (pre vs. post) (γ_{10})	0.05 (.10)	0.54	0.14 (.09)	1.48	0.02 (.05)	0.41
Condition						
MA vs. MO (γ_{01})	-0.18 (.18)	-1.02	-0.27 (.18)	-1.51	0.05 (.09)	0.64
MA vs. control (γ_{02})	-0.18 (.20)	-0.90	0.02 (.20)	0.12	-0.01 (.10)	-0.06
Condition × Time						
MA vs. MO × pre vs. post (γ_{11})	0.06 (.13)	0.44	0.15 (.13)	1.21	-0.04 (.07)	-0.52
MA vs. control × pre vs. post (γ_{12})	-0.37 (.15)	-2.56*	-0.49 (.14)	-3.47*	0.09 (.08)	1.17
Day of Week						
Monday (γ_{30})	-0.40 (.10)	-4.12*	-0.13 (.09)	-1.38	0.02 (.05)	0.43
Tuesday (γ_{40})	-0.35 (.10)	-3.54*	-0.14 (.09)	-1.49	-0.03 (.05)	-0.53
Thursday (γ_{50})	-0.30 (.10)	-3.02*	-0.09 (.10)	-0.90	-0.05 (.05)	-1.03
Friday (γ_{60})	-0.51 (.10)	-2.07*	0.03 (.10)	0.26	-0.01 (.05)	-0.20
Saturday (γ_{70})	-0.00 (.10)	-0.04	0.10 (.10)	0.98	0.07 (.05)	1.22
Time of Day (γ_{20})	0.05 (.03)	2.02*	0.08 (.02)	3.24*	0.01 (.01)	0.81
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Within-subjects error (r_{ii})	2.00 (.06)	1.89, 2.12	1.85 (.05)	1.75, 1.96	0.55 (.02)	0.52, 0.58
Between-subjects error (u_{0i})	0.67 (.09)	0.51, 0.88	0.70 (.10)	0.54, 0.91	0.15 (.02)	0.11, 0.20

^cReference group: condition: MA; time: Pre; day of week: Sunday; time of day: first survey (9-11:30am).

* $p < .05$

Supplementary References

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