Published in final edited form as:

Ann Behav Med. 2017 February ; 51(1): 13–17. doi:10.1007/s12160-016-9823-7.

Self-expansion is associated with better adherence and obesity treatment outcomes in adults

Xiaomeng Xu¹, Tricia M. Leahey², Katherine Boguszewski³, Katie Krupel⁴, Kimberly A. Mailloux⁴, and Rena R. Wing⁴

¹Department of Psychology, Idaho State University, Pocatello, Idaho, USA

²Department of Allied Health Sciences, University of Connecticut, Storrs, CT, USA

³Department of Psychology, University of Virginia, Charlottesville, VA, USA

⁴Department of Psychiatry and Human Behavior, Warren Alpert Medical School of Brown University, The Miriam Hospital/Weight Control and Diabetes Research Center, Providence, Rhode Island, USA

Abstract

Background—Previous studies have shown that self-expansion (e.g., increasing positive self-content via engaging in novel, rewarding activities) is associated with smoking cessation and attenuated cigarette cue-reactivity.

Purpose—This study examined whether self-expansion is associated with better adherence, weight loss, and physical activity (PA) outcomes within a weight loss intervention.

Methods—Participants from Shape Up Rhode Island 2012, a Web-based community wellness initiative, took part in a randomized controlled trial that involved a 12-week behavioral weight loss intervention (1). At baseline and post-intervention, objective weights and self-reported self-expansion and PA were obtained from 239 participants. Treatment adherence was assessed objectively.

Results—Self-expansion during treatment was significantly associated with percent weight loss including clinically significant weight loss (i.e. 5%), minutes of PA, and treatment adherence. These results held after controlling for relevant covariates.

Conclusions—This is the first study to show that self-expansion is associated with better behavioral weight loss outcomes including weight loss, adherence, and PA. These results suggest that self-expansion is a promising novel target for future research which could inform health interventions.

Corresponding author: Xiaomeng (Mona) Xu, Idaho State University, Department of Psychology, 921 S. 8th Ave, Stop 8112, Pocatello, ID 83209, USA; xuxiao@isu.edu; 1+ (208) 282-3541; Fax 1+ (208) 282-4832.

Statement of Conflict of Interest and Adherence to Ethical Standards

Author Tricia Leahey is Chief Scientist and a paid consultant at WayBetter, Inc. Her work with WayBetter is unrelated to this project. Remaining authors have no conflicts of interest to declare.

All authors verify that this research was carried out with adherence to appropriate ethical standards (e.g., those set by the American Psychological Association). Specifically, the research was approved by The Miriam Hospital's Institutional Review Board, all study personnel completed appropriate ethical training, and all participants provided written informed consent to be part of the study.

Keywords

self-expansion; weight loss; physical activity; adherence; obesity

The self-expansion model (2) states that one of the main intrinsic motivations of behavior is that people seek to enhance their abilities to achieve goals by increasing their identities and resources. This process is characterized by novelty, excitement, and interest or challenge and is rooted in approach motivation which positively influences perceptions of and motivation to engage in behaviors (3), and leads to increases in self-efficacy (4). Self-expansion has also been shown to lead to increased effort and persistence on subsequent physical and cognitive tasks (5). Thus, self-expansion is thought to influence behavior partly because positive changes to the self-concept and increases in motivation and self-efficacy promote engagement (e.g., greater beliefs that one is more capable and able to accomplish tasks), behavioral attempts, and persistence.

This evidence suggests that self-expansion has significant implications for health behaviors as engaging in these behaviors often requires motivation, self-efficacy, and exertion of effort. For example, one study found that smokers who successfully quit experienced significantly more self-expanding events (e.g. taking a trip, making a new friend, etc.) in their lives prior to their quit attempt compared with smokers who tried to quit but ultimately failed (6). Even among smokers who relapsed, there was a significant positive correlation between the number of self-expanding events prior to the quit attempt and how long smokers were able to abstain (6). Self-expansion has also been found to attenuate cigarette-cue reactivity in the brain among overnight abstinent smokers, potentially through a mechanism of reward substitution (7).

The current study sought to investigate the role of self-expansion in behavioral weight loss, an important health issue due to the high prevalence of overweight and obesity and their associations with disease and mortality (8–10). Additionally, as the literature on self-expansion and behavioral health has been thus far focused on smoking, this project makes a novel contribution to the field by focusing on obesity treatment. We hypothesized that self-expansion would be related to better outcomes such that those who were experiencing more self-expansion would show greater exerted effort and motivation via adherence to the program and would also have better weight loss outcomes.

Method

Participants

The research was approved by The Miriam Hospital's Institutional Review Board. Recruitment occurred through employers and advertisements for Shape Up Rhode Island 2012 (SURI), a community-based health campaign open to all adults in Rhode Island. SURI was a team-based community health campaign that provided all participants with a pedometer, community resources and newsletters on healthy eating and exercise, paper logs for recording weight and activity, small prizes / recognition for meeting exercise and weight loss goals, and a website that allowed participants to interact with one another, provide

social support, and compete with other teams on exercise and weight loss goals. SURI participants were invited to be screened for the study. Exclusion criteria included being under 18 or over 70 years of age, current or planned pregnancy (within the study period), Body Mass Index (BMI) $<25\text{kg/m}^2$, unreliable Internet access, non-English speaking, planned relocation (during the study period), previous participation at our research center, and uncontrolled medical condition(s). Those who reported a medical condition affected by weight loss (e.g., hypertension) were required to obtain physician's consent. A total of 268 eligible participants completed informed written consent and were randomized to one of three arms.

Design

Detailed descriptions of study design (including CONSORT information) and results are published elsewhere (1). The purpose of this study was to investigate the role of self-expansion on adherence and outcomes across all participants, regardless of study arm. All participants ($N = 268$) received an Internet behavioral weight loss intervention that has been used in prior SURI trials and has been shown to improve weight losses (11). Participants also had access to a website where they submitted daily weight, calorie, and PA information. Each week participants received evidence-based, automated feedback on their progress based on their submitted data, and were asked to view weekly video lessons based on the Diabetes Prevention Program (12).

Assessments

Participants were assessed by blinded staff at baseline and post-intervention (and received \$25). For this study, only participants who completed weigh-ins and questionnaires were included ($N = 239$, retention rate of 89.2%). No adverse events were reported.

Demographics—Gender, age, race, and education were collected at baseline.

Anthropometrics—Height was measured at baseline using a wall-mounted stadiometer. Weight (to the 0.1kg) was measured at both baseline and post-treatment using a digital scale.

Self-expansion—At baseline and post-treatment, participants answered 4 questions based on a shortened version of the 14-item Self-Expansion Scale (3, 5, 13) about their life “over the past 12 weeks.” Participants rated “how exciting has your life been”, “how boring has your life been”, “how interesting has your life been”, and “how much do you feel like you’ve grown as a person” on a 0 (not at all) to 6 (extremely) scale. Composite self-expansion scores were calculated by averaging these 4 items (boredom was reverse-coded). Cronbach's alpha for this composite was .80 at baseline and .85 post-treatment.

Treatment adherence—Adherence was defined as the number of weeks participants logged into the website and viewed videos, and the number of days (out of 84) participants provided information on weight, calories consumed, fat grams consumed, and PA minutes.

Physical activity—Participants completed the Paffenbarger Physical Activity Questionnaire (14), at baseline and post-treatment. The Paffenbarger assesses minutes of PA

over the prior week by multiplying daily minutes of brisk walking, recreation, sport and fitness activities (lifestyle activities such as household chores are excluded) by the number of times per week individuals report engaging in these activities, and then summing all the products.

Statistical Analyses

Correlations were conducted to test associations between baseline variables and to test associations between post-intervention measured self-expansion and outcomes (weight loss, adherence, and PA). To isolate the effects of self-expansion during treatment, post-intervention measured self-expansion was also examined after controlling for baseline-measured self-expansion (analyses were also conducted utilizing change scores [i.e., post-intervention self-expansion minus baseline self-expansion] and the pattern of results remained consistent; as such, we report only post-intervention scores controlling for baseline). A General Linear Model was conducted to test for self-expansion effects on clinically significant weight loss, defined as at least 5% of body weight (15). Paired-sample *t*-tests were conducted to determine whether post-intervention measured self-expansion and PA minutes significantly differed from baseline-measured self-expansion and PA minutes. Mediation analyses were conducted using the PROCESS macro for SPSS (16) and a bootstrap estimation approach with 1000 samples. Analyses were repeated with covariates. Although there were hypothesized directional effects for some of the analyses, because this is the first self-expansion study in the context of weight loss, caution was employed and all reported analyses utilized two-tailed tests.

Results

Self-Expansion Baseline Associations

Baseline participant characteristics are presented in Table 1. Mean self-expansion (possible range of 0–6) at baseline was 3.50 (*SD* = 1.11). Baseline self-expansion was not significantly associated with baseline BMI or demographics. Baseline self-expansion differed significantly by study arm $F(2,236) = 3.17, p = .044, \eta^2 = .026$. Thus, treatment arm was included as a covariate in analyses.

Self-Expansion and Adherence

On average, participants logged into the website 10.06 weeks (± 3.10) out of the 12, and viewed 6.78 (± 3.80) of the 12 weekly videos. Out of the 84 days of the intervention, participants provided weight information for 67.38 days (± 24.15); calories information for 65.67 days (± 24.93); fat grams information for 65.41 days (± 25.03); and PA minutes for 48.25 days (± 24.22).

Self-expansion significantly increased during treatment to 3.88 (*SD* = 1.14) [paired $t(238) = 6.55, p < .001$, Cohen's $d = 0.34$]. Post-intervention measured self-expansion, controlling for study arm and baseline-measured self-expansion, was significantly positively related to how often participants logged onto the website and reported self-monitoring information (weight, calories consumed, fat grams consumed, and PA minutes), and this adherence was in turn significantly related to percentage weight loss (see Table 2).

Self-Expansion and Physical Activity

PA for participants at baseline averaged 154.47 minutes per week ($SD = 171.64$). This rose to 244.26 minutes per week ($SD = 200.22$) at post-intervention, which was a significant increase, paired $t(238) = 7.735$, $p < .001$, Cohen's $d = 0.48$. Baseline self-expansion was associated with baseline PA minutes, although this association did not reach significance $r(239) = .11$, $p = .095$. Baseline self-expansion was significantly associated with post-intervention PA minutes $r(239) = .25$, $p < .001$.

Post-intervention self-expansion was significantly positively related to post-intervention total activity minutes per week, $r(239) = .21$, $p = .001$. The relationship between post-intervention self-expansion and post-intervention PA minutes remained significant after controlling for study arm and baseline PA minutes [$pr(235) = .20$, $p = .002$], but became non-significant after additionally controlling for baseline self-expansion [$pr(234) = .08$, $p = .249$].

Self-Expansion and Weight Loss Outcomes

Percentage weight loss ($M = 5.90\%$, $SD = 4.90\%$) was significantly correlated with post-intervention measured self-expansion, $r(239) = .24$, $p < .001$, indicating that higher levels of self-expansion during intervention were associated with better weight loss outcomes. This relationship remained significant after controlling for study arm and baseline-measured self-expansion $pr(235) = .22$, $p = .001$.

Of the 239 completers, 128 (53.6%) attained clinically significant weight loss (5% or more of baseline weight) at the end of the 12-week intervention. Those who achieved clinically significant weight loss were significantly more likely to have reported higher levels of self-expansion at 12-weeks ($M = 4.09$, $SD = 0.95$) than those who did not ($N = 111$; $M = 3.63$, $SD = 1.28$); $F(1,237) = 9.98$, $p = .002$, $\eta^2_{\text{partial}} = .040$. This result remained significant after adding study arm and baseline level of self-expansion as covariates, $F(1,235) = 6.53$, $p = .011$, $\eta^2_{\text{partial}} = .027$.

Mediation analyses were conducted to investigate whether adherence mediated the effect of post-intervention self-expansion on percent weight loss (with baseline self-expansion and study arm as covariates). Total number of days that participants logged into the study website was chosen to represent adherence in this model as it was a prerequisite for the other adherence metrics (i.e., participants had to log in to view videos or record their calories, weight etc.). Self-expansion was a significant predictor of adherence, $b = .67$, $t(235) = 2.8$, $p = .006$ (a path), adherence was a significant predictor of percent weight loss, $b = .85$, $t(234) = 9.96$, $p < .001$ (b path), and self-expansion was a significant predictor of percent weight loss $b = 1.26$, $t(235) = 3.41$, $p < .001$ (c path). However, after controlling for the mediator (adherence), this effect was reduced $b = .70$, $t(234) = 2.2$, $p = .029$ [Sobel's test, $Z = 2.69$, $p = .007$] consistent with partial mediation, and the indirect effect was significant $b = .57$, $SE = .23$, 95% CI = .1215, 1.031.

Discussion

This is the first study to examine self-expansion within a behavioral weight loss intervention. Self-expansion significantly increased over the course of the intervention and was associated with better objective adherence and weight loss outcomes, including a greater likelihood of achieving a clinically significant (5%) weight loss.

Self-expansion significantly increased from baseline to post-intervention. The nature of this self-expansion was not explicitly assessed for, but it is possible that the intervention itself was a source of self-expansion. That is, participants may have found their lives more exciting because they were engaged in an intervention that included learning new things (about weight loss, their own abilities etc.), behavioral prescriptions/challenges, and social interaction. In addition, these self-expanding activities/experiences may have provided substitute rewards in place of food rewards (e.g., high fat, high calorie palatable foods). This idea is consistent with past behavioral weight loss research which shows that food-related reinforcement decreases as non-food reinforcement increases, and this shift is associated with weight loss (17). In this study, participants were asked to decrease consumption of calorically dense (and likely highly-palatable) foods. Self-expansion activities may have served as possible substitutes for these food rewards. Thus, prescribing novel, rewarding self-expanding activities during a health behavior change intervention may provide substitutes for food rewards, thereby promoting better treatment outcomes. Additional research is warranted that further elucidates the reward substitution process for health behavior change.

In line with past research showing that self-expansion is rooted in approach motivation and can lead to increased exertion, self-expansion in this study was related to increased adherence and effort in the context of the intervention. Participants' self-expansion was positively related to following intervention instructions by logging onto the study website and providing self-monitoring information. Further, the association between self-expansion and percent weight loss was partially mediated by this effortful adherence.

Limitations of this study include a predominantly White and female sample and that self-expansion was only measured twice (pre and post intervention), and the focus of the study was on global self-expansion. Future studies with more frequent and varied assessments of self-expansion are needed to determine the time-course (e.g. if self-expansion on a particular day is related to adherence and PA on that same day or if the effect is lagged or cumulative) and specificity of effects (e.g. if self-expansion specific to PA or weight loss is a better predictor than global life self-expansion). Future research is needed to determine whether there are aspects of a behavioral weight loss program to lead to increases in self-expansion and if so, whether there are ways to enhance this effect. In light of reward substitution theory, it may also be important to consider prescribing self-expanding activities outside of the behavioral weight loss program (e.g., if appealing, try yoga or dancing for the first time). Such activities may be inherently rewarding thereby reducing the need for food reward, which could increase adherence to caloric recommendations and improve weight loss outcomes.

This is the first study to examine the role of self-expansion in adherence, PA, and obesity treatment outcomes. Results suggest that self-expansion is an important novel target for future research and has potentially important implications in behavioral health interventions.

Acknowledgments

We recognize the contributions of the following staff at the Weight Control and Diabetes Research Center at The Miriam Hospital and the Warren Alpert Medical School of Brown University: Linda Gay, RD; Elizabeth Kuhl, PhD; Pamela Coward, MEd; Kelley Strohacker, PhD; Richard Daniello; Michelle Fisher, RN; Deborah Ranslow-Robles; Kevin O'Leary, MS. We also recognize the contributions of the following staff at Shape Up Rhode Island: Robert Vitek and Jenna Lafayette. We also thank Claudio Nigg, PhD for his comments on an early draft of this manuscript.

This study was supported by the National Institute of Diabetes and Digestive and Kidney Diseases (5R18DK083248-04). The funding source had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; or the preparation, review, or approval of the manuscript. The ClinicalTrials.gov Identifier for the study is NCT01560130.

References

1. Leahey TM, Subak L, Fava J, et al. Benefits of adding small financial incentives or optional group meetings to a web-based statewide obesity initiative. *Obesity*. 2014; 23:70–76. [PubMed: 25384463]
2. Aron, A., Aron, EN., Norman, C. The self-expansion model of motivation and cognition in close relationships and beyond. In: Clark, M., Fletcher, G., editors. *Blackwell handbook in social psychology*, Vol. 2: Interpersonal processes. Oxford, England: Blackwell; 2001. p. 478-501.
3. Mattingly BA, McIntyre KP, Lewandowski GW Jr. Approach motivation and the expansion of self in close relationships. *Pers Relat*. 2012; 19:113–127.
4. Mattingly BA, Lewandowski GW Jr. An expanded self is a more capable self: The association between self-concept size and self-efficacy. *Self Identity*. 2013; 12:621–634.
5. Mattingly BA, Lewandowski GW Jr. The power of one: Benefits of individual self-expansion. *J Posit Psychol*. 2013; 8:12–22.
6. Xu X, Floyd AHL, Westmaas JL, Aron A. Self-expansion and smoking abstinence. *Addict Behav*. 2010; 35:295–301. [PubMed: 19931986]
7. Xu X, Aron A, Westmaas JL, Wang J, Sweet LH. An fMRI study of nicotine-deprived smokers' reactivity to smoking cues during novel/exciting activity. *PLoS ONE*. 2014; 9:e94598. [PubMed: 24727905]
8. Bhaskaran K, Douglas I, Forbes H, dos-Santos-Silva I, Leon DA, Smeeth L. Body-mass index and risk of 22 specific cancers: A population-based cohort study of 5.24 million UK adults. *Lancet*. 2014; 384:755–765. [PubMed: 25129328]
9. Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *JAMA*. 2003; 289:76–79. [PubMed: 12503980]
10. Adams KF, Schatzkin A, Harris TB, et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *N Engl J Med*. 2006; 355:763–778. [PubMed: 16926275]
11. Leahey TM, Thomas G, Fava JL, et al. Adding evidence-based behavioral weight loss strategies to a statewide wellness campaign: A randomized trial. *Am J Public Health*. 2014; 104:1300–1306. [PubMed: 24832424]
12. Diabetes Prevention Program Research Group. The Diabetes Prevention Program: Description of the Lifestyle Intervention. *Diabetes Care*. 2002; 25:2165–2171. [PubMed: 12453955]
13. Lewandowski, GW., Jr, Aron, A. The self-expansion scale: Construction and validation. Poster presented at: The Society of Personality and Social Psychology Annual Meeting; February 2002; Savannah, GA.
14. Paffenbarger RS Jr, Wing AL, Hyde RT. Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol*. 1978; 108:161–175. [PubMed: 707484]
15. Wing RR, Lang W, Wadden TA, et al. Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care*. 2011; 34:1481–1486. [PubMed: 21593294]

16. Hayes, AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. NY: The Guilford Press; 2013.
17. Buscemi J, Murphy JG, Berlin KS, Raynor HA. A behavioral economic analysis of changes in food-related and food-free reinforcement during weight loss treatment. *J Consult Clin Psychol*. 2014; 82:659–669. [PubMed: 24660672]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Participant characteristics at baseline.

Participant Characteristic	N=239 (percentage)
Female, n (%)	199 (83.3)
Age, mean (SD)	46.8 (10.4)
Race/Ethnicity, n (%)	
Non-Hispanic White	211 (88.3)
Non-White	26 (10.9)
Education	
Vocational/High School	17 (7.1)
Some College	45 (18.8)
College Graduate	102 (42.7)
Post-graduate	74 (31.0)
Weight, kg, mean (SD)	85.4 (17.9)
BMI, kg/m ² , mean (SD)	31.4 (6.0)
Self-Expansion (possible range 0–6), mean (SD)	3.50 (1.11)

Note: Two participants did not respond to Race/Ethnicity, and one participant did not respond to Education.

Table 2

Post-intervention measured self-expansion (controlling for study arm and baseline-measured self-expansion) in relation to adherence and percentage weight loss.

	1	2	3	4	5	6	7	8
1. Self-expansion assessed post-intervention	1.000							
2. # of weeks logged into study website	.180**	1.000						
3. # of weekly lessons viewed	.115†	.613***	1.000					
4. # of days monitored weight	.201**	.924***	.546***	1.000				
5. # of days monitored calories consumed	.189**	.902***	.545***	.961***	1.000			
6. # of days monitored fat grams	.190**	.894***	.546***	.958***	.998***	1.000		
7. # of days monitored physical activity minutes	.182**	.745***	.484***	.794***	.795***	.795***	1.000	
8. Percentage weight loss	.217***	.563***	.467***	.589***	.575***	.575***	.582***	1.000

t
p<.10,

*
p<.05,

**
p<.01,

p .001