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## The association of stressful life events on weight loss efforts among African American breast cancer survivors

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### Abstract

**Objective**—This study examined whether stressful life events were associated with weight loss, central adiposity, and health behavior changes of African American breast cancer survivors (AABCS) participating in a weight loss intervention.

**Methods**—We conducted a secondary-data analyses of Moving Forward, a weight loss efficacy trial for AABCS conducted in 2011–2014. Two-hundred forty-six eligible women were randomized to a 6-month interventionist-guided (IG) or self-guided (SG) weight loss intervention. Data was collected on height, weight, self-reported diet, and self-reported physical activity. Stress (e.g., financial, legal, employment, relationships, safety, prejudice) was measured using an abbreviated version of the Crisis in Family Systems (CRISYS) urban life stress measure. Generalized linear models stratified by group examined the degree to which stress was associated with weight loss or changes in central adiposity, physical activity, and diet during the intervention (Months 1–6) or maintenance (Months 7 to 12) phases.

**Results**—Participants reported a median of 3.0 life stressors (range 0 to 22) mostly relating to relationships, safety concerns, and financial problems. In the IG group during the intervention phase, exposure to life stressors was not associated with weight loss ( $p = 0.15$ ) or change in central adiposity ( $p = 0.69$ ), physical activity ( $p = 0.15$ ), or diet ( $p = 0.26$ ). We found similar associations for the maintenance phase and in the SG group.

**Conclusion/Implications**—Despite facing stress across a myriad of domains (e.g., relationships, safety, finances), AABCS were successful at initiating and maintaining behaviors to achieve weight loss, reductions in central adiposity, and behavioral changes. Future randomized

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Declarations

**Conflict of interest** The authors declare no competing interests.

controlled trials are warranted that include more strategies to address the challenges that AABCS face, to determine whether AABCS in particular might benefit from interventions that address barriers (e.g., stress management) to weight loss. Such strategies are critical for improving quality of life and lowering the risk of cancer recurrence.

### Keywords

Weight loss; African American breast cancer survivors; Stressful life events

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### Introduction

African American women have disproportionately higher rates of obesity at breast cancer diagnosis and gain twice as much weight as white women in the years after diagnosis [1]. Racial inequities in weight gain and obesity, among other complex factors (e.g., racial segregation, poverty, food and health-care access), contribute to higher rates of all-cause and cancer mortality among African Americans [1]. Addressing inequities in weight gain may help to reduce cancer mortality rates among African American women [2]. Though lifestyle interventions can often result in more balanced diets, an increase in physical activity, and intentional weight loss leading to improved health outcomes and wellness of African American breast cancer survivors (AABCS) [3–8], behavioral changes and weight loss among African American women are often modest [8]. Intervention trials have documented weight losses ranging from 0.5 to 3.6% in 6 months among AABCS—lower than those reported in studies with predominately white cancer survivor samples (1.5 to 13.9%) with durations ranging from less than 6 to 12 months or more [3, 5–7, 9–12]. Limitations of previous studies with AABCS include small samples and minimal exploration of factors influencing outcomes [8].

Studies show that AABCS experience many challenges that may diminish their efforts to engage in physical activity [8]. These challenges include personal barriers (e.g., time), social support, and environmental characteristics (e.g., access to facilities). Less is known about how these challenges may impact their response to weight loss interventions. Furthermore, AABCS may face unique social factors that impact behavioral and physiological changes [13].

Stress is one challenge shown to affect weight loss, health outcomes, and behavioral change in the general population [14, 15]. Oman and King examined the effect of life events (i.e., stress) on subsequent exercise adherence in a 2-year randomized clinical trial of exercise training and found that life events did not influence the adoption of exercise behavior but did disrupt maintenance of that behavior [16]. Furthermore, in a 1-year randomized controlled weight loss trial, Gavin and colleagues found that experiencing at least one stressful life event was associated with weight gain (after controlling for physical activity) [17]. These studies consistently showed how stressful life events are inversely associated with weight loss and behavior change—but nearly all of these studies lacked racial diversity in their sampling, limiting generalizability. The underrepresentation of African Americans in these studies means the key life events contributing to stress experienced more often by African Americans, such as discrimination and racism, may not have been captured. More research

is needed to elucidate the relationship between stress, behavior change, and weight loss among African Americans, particularly during times of increased stress, such as after a cancer diagnosis.

This study aims to broaden the literature on weight loss studies among medically at-risk populations (e.g., Diabetes Prevention Program (DPP), Weight Loss Maintenance Trial (WLM)) by examining challenges to health-centered behavioral change among AABCS. Though previous studies were not specific to cancer survivors, these programs have helped other at-risk participants identify and overcome the challenges they face in adhering to lifestyle interventions through intensive programming that includes health education and telephone counseling [18–20]. These efforts have resulted in high percentages of weight loss (e.g., >5%) [18]. In a similar fashion, this study seeks to understand the challenges—namely the stressful life experiences—experienced by AABCS in particular as they participate in intensive weight loss interventions to inform future programs.

Cancer survivors also face numerous unique stressful life experiences, including ongoing symptom burden, financial challenges, and relationship strain, among others [21–24]. Past weight loss studies have not included measurements of these stressful life experiences and typically use a generalized measure of stress (e.g., perceived stress scale) that captures feelings or thoughts without describing specific life events [25–27]. A multidimensional measure capturing stressful life events across several domains (e.g., CRISYS) can target not only these experiences unique to survivorship, but also those frequently faced by communities of color in urban environments. This can provide a greater understanding of the stress AABCS face on multiple axes—a key component to understanding just how intersecting factors affect intentional weight loss.

Stress is an important measure of study to understand obstacles to behavioral changes, but also due to the effects of stress on the body. Stress can trigger behavioral dysregulation, leading to increased food intake and decreased physical activity [28], but physiological stress responses also affect weight through neuroendocrine pathways, such as the hypothalamic-pituitary-adrenal axis (HPA axis). These effects can lead to increased central obesity and lipid production [14]. A better understanding of stressful life experiences and their relation to weight management is needed, particularly in AABCS, to inform future intervention efforts.

In this study, we examine whether there is an association between stressful life events and weight loss, waist reduction, and behavior change among AABCS.

## Methods

Moving Forward was a community-based, randomized, weight loss intervention trial with 246 overweight/obese AABCS. Survivors were recruited between September 2011 and September 2014 through direct contact by letter and phone using hospital cancer registry contact information from three Chicago-area academic cancer centers and community-based efforts, including referrals from oncologists, flyers, social media, and presentations [29]. The

study was delivered in eight Chicago Park District facilities located within predominately African American communities.

Eligible participants were female AABCS (stages I–III), 18 years of age, with a body mass index (BMI) of  $\leq 25$  kg/m<sup>2</sup> at time of recruitment, at least 6 months post-treatment at time of recruitment (hormonal therapy allowed), physically able to participate in a moderate physical activity program per healthcare provider approval, and agreeable to study procedures. Women were excluded if they were pregnant or planning to become pregnant during the study, taking prescription weight loss medication, or planning weight loss surgery in the coming year. Survivors were randomly assigned to either a 6-month Moving Forward Interventionist-Guided program (IG) or the Moving Forward Self-Guided program (SG) using a random digit generator following the baseline interview.

Goals at 6-month data collection for both programs were 5% weight loss, decreased caloric intake (~500 kcal), increased fruit and vegetable consumption, and increased physical activity (minimum 150 min per week) compared to baseline measures in accordance with the American Cancer Society cancer survivor guidelines [30]. The intervention was described in detail previously [4]. Briefly, IG met as a group twice-weekly for in-person classes with supervised exercise and twice-weekly text messaging targeting enhanced self-efficacy, social support, and access to health promotion resources. Participants in the IG and SG received a detailed program binder developed in collaboration with AABCS that addressed weekly topics central to cognitive behavioral approaches to weight loss including goal setting, stimulus control, mindful eating, and identifying and addressing barriers to behavior change. Weekly topics were grounded in principles of culturally competent interventions. Resources such as a guide to a resistance training exercise routine, recipes, and motivational materials were also included. SG participants did not attend classes or receive text messages. At 6 months, both groups received monthly newsletters with reinforcing information from the curriculum, news of local healthy eating and exercise resources, and participant testimonials.

## Ethics

The study procedures were reviewed and approved for ethical treatment of human subjects by the University of Illinois at Chicago Institutional Review/Ethics Board (IRB# 2011-0614). Each participant provided written informed consent.

## Measures

**Demographic data**—Demographics included age, education (highest year completed), and self-reported annual household income.

**Breast cancer diagnosis and treatment information**—Breast cancer diagnosis was self-reported by participants interested in the study during the eligibility screening. Diagnosis and stage of cancer were confirmed by their primary care physician who submitted written approval for respondents prior to participation.

**Attendance**—We calculated attendance for IG participants only by counting the number of sessions participants attended out of 48 total.

### Weight and Central adiposity

**Body mass index (BMI)**—Height (baseline only) was measured to the nearest 0.1 cm using a portable stadiometer (Seca). Weight was measured to the nearest 0.1 kg using a digital scale (Tanita), with participants wearing light clothes without shoes. Two measurements for height and weight were taken. If there was a discrepancy of more than 0.5 cm for height or 0.2 kg for weight between the first and second measurements, a third measurement was taken. The mean of the two most closely aligned measurements was used to calculate BMI (weight (kg)/height (m)<sup>2</sup>).

**Central adiposity**—Central adiposity was measured with a measuring tape to the nearest 0.1 cm at the level midway between the lower rib margin and the iliac crest, with the participant breathing out gently. Two measurements were taken, unless there was a discrepancy of more than 1 cm; then, a third measurement was taken.

### Behavioral outcomes

**Modified activity questionnaire Kriska and Caspersen [31]**—The modified activity questionnaire assessed self-reported leisure activity and television viewing. For leisure activity, respondents reviewed a list of 17 popular activities (e.g., walking, gardening) and selected those that they performed on at least 10 occasions in the last year. This activity questionnaire has been used in many large studies with diverse samples, including cancer survivors [32], and has well-established reliability and validity (Cronbach's  $\alpha$  ranged from 0.67 to 0.71) [31]. Participants were also given an opportunity to report leisure activities that were not on the list. Respondents then provided information on average frequency and duration for each activity. Responses were used to calculate the number of hours/week the participant engaged in moderate and vigorous physical activity (MVPA), along with total MET-hours per week. The questionnaire also asked how many hours per day the participant usually spends watching television.

### Dietary intake

A Healthy Eating Index (HEI) was calculated by NutritionQuest using the interviewer administered Block 2005 Food Frequency Questionnaire, a measure well validated with diverse populations (Cronbach's  $\alpha$  ranged from 0.58 to 0.70) [33, 34]. HEI was developed by the US Department of Agriculture to assess diet quality [35]. The HEI scores a set of foods based on the amount of variety in the diet and compliance with specific dietary guidelines and recommendations. Overall score for the HEI ranges from 0 to 100 and is composed of scores from the 13 components that reflect the key recommendations in the Dietary Guidelines for Americans. A higher score represents higher adherence to guidelines.

### Contemporary life stress

Crisis in Family Systems (CRISYS) is a self-reported measure validated for use to quantify contemporary sources of life stress in urban and low-income populations (Cronbach's  $\alpha$  =

0.78). While some studies have used generalized measures of stress, it was important for us to capture a broader range of stressful life events faced by our study population. The original measure included 64 life events or stressors [36], but an abbreviated version 41 items was used based on recommendations from our study's Community Advisory Board (CAB) [37] who contributed meaningfully to intervention development and measurement selection. Related to the CRYISIS, the CAB identified items they saw as inappropriate or irrelevant for our study population given the expected age and life stage of most. For example, several items query about pregnancy (being pregnant, miscarriage, abortion), being in school and having teachers, and dealing with young children (teachers, illnesses). Other items left out referred to community conditions (i.e., dealing with mice, rats, insects in your home). The CAB believed these conditions would not be common and could be seen as offputting. The remaining list of stressful life events covered the following categories: financial, legal, employment, relationships, safety at home and in the community, medical issues pertaining to participants or others, home issues, difficulty with authority, and prejudice. Events reflected those occurring over the course of the 6-month intervention period, completed at the 6-month assessment (post-intervention) or the 6-month maintenance period (12-month assessment). Participants indicated whether they experienced each event by responding "yes" or "no." A total score reflected the simple sum of stressful life events endorsed by the participant. The stressful life events reported were all weighted the same.

Weight, central adiposity, and each behavioral outcome were measured at baseline, post-intervention (6 months), and maintenance (12 months) unless noted otherwise.

### Statistical Analyses

Descriptive statistics were calculated for all variables of interest at three time points: (1) baseline, (2) post-intervention (6 months), and (3) maintenance (12 months) including anthropometric and behavioral outcomes. Generalized linear models were stratified by group (IG or SG). Outcomes for IG and SG groups at baseline, post-intervention, and maintenance were assessed using generalized linear models. The primary outcomes were weight loss, central adiposity, physical activity, and diet. Model 1 adjusted for the outcome at baseline (weight, waist, MVPA, or diet) and percent classes attended (IG only). Model 2 additionally adjusts for age, income, education, and stage of diagnosis at baseline. Adjusted differences in the mean using the linear model are reported. Estimated standard errors for the adjusted differences for model 2 in the results below are reported given that the fit of model 2 was better than model 1 for the majority of the outcomes. The difference in outcomes (weight, waist, MVPA, or diet) between the IG and SG groups was assessed using *t* test and chi-square for continuous and categorical variables. *p* values were two-sided and significant at *p* = 0.05. All statistical analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC). Only women who were not missing the outcome (i.e., weight (*n* = 210 at post-intervention and *n* = 189 at maintenance), waist (*n* = 210 at post-intervention and *n* = 189 at maintenance), physical activity (*n* = 210 at post-intervention and *n* = 204 at maintenance), or diet (*n* = 212 at post-intervention and *n* = 204 at maintenance)) were included in the analyses.



## Results

We analyzed data from 246 participants (IG  $n=125$ , SG  $n=121$ ) at baseline, 212 participants post-intervention (IG = 111, SG  $n=101$ ), and 207 participants at maintenance (12 months) (IG = 107, SG = 100). Retention was 86% ( $n=212$ ) post-intervention and 84% ( $n=207$ ) at maintenance (12 months). Groups were comparable at baseline, and demographic characteristics are provided in Table 1. We provide medians of each outcome and our primary independent variable because the ranges were skewed. Median MVPA was 87.1 min/week (range 0–1023.5) at baseline; median HEI was 65.7 (range 38.9–93.9) at baseline. Median number of stressful life events was 3.0 (range 0–22.0) post-intervention (reflecting events over the previous 6 months). The most common stressful life events were related to relationships (e.g., got married, got divorced), safety, and financial (see Fig. 1). Over half of the women (57%) experienced changes in their relationship, such as getting divorced or breaking up with a partner. Nearly half (46%) had something in their neighborhood happen that made them feel unsafe. Over a third (39%) experienced financial changes such as missing a rent or mortgage payment or had their electricity cut off. In addition, over a third (34%) had a family member die or become ill.

### Are stressful life events associated with lower weight loss?

Table 2 shows the linear model for the association between stress and weight loss stratified by group (IG and SG). During the intervention, stress was not significantly associated with weight loss in the IG group ( $\beta = -0.23$ ,  $p = 0.15$ , model 2) or the SG group ( $\beta = 0.02$ ,  $p = 0.83$ , model 2). Similarly, for the maintenance phase (12 months), stress was not associated with weight loss among the IG group ( $\beta = -0.19$ ,  $p = 0.37$ , model 2) or SG group during maintenance ( $\beta = 0.12$ ,  $p = 0.14$ , model 2).

### Are stressful life events associated with physical activity?

Table 3 shows the linear model for the association between stress and change in physical activity stratified by group (IG and SG). Stress was not associated with change in physical activity in the IG or SG group during the intervention phase, respectively: ( $\beta = -1.10$ ,  $p = 0.15$ , model 2) or ( $\beta = 0.98$ ,  $p = 0.11$ , model 2). Similarly, during the maintenance phase, higher stress was not associated with physical activity change in the IG group ( $\beta = 1.52$ ,  $p = 0.11$ , model 2). In contrast, among the SG group, the association between stress and change in physical activity during the maintenance phase was not conclusive ( $\beta = -1.42$ ,  $p = 0.06$ ).

### Are stressful life events associated with central adiposity?

Supplementary Table 4 shows the linear model for the association between stress and change in central adiposity (i.e., central adiposity) stratified by group. Stress was not associated with change in central adiposity in the IG or SG group during the intervention phase, respectively: ( $\beta = -0.10$ ,  $p = 0.69$ , model 2), ( $\beta = -0.11$ ,  $p = 0.58$ , model 2) in fully adjusted models. Similarly, in the maintenance phase stress was not associated with change in central adiposity among the IG during the intervention or SG group ( $\beta = 0.07$ ,  $p = 0.72$ , model 2), ( $\beta = 0.05$ ,  $p = 0.78$ , model 2), respectively.

### Are stressful life events associated with diet/Healthy Eating Index?

Supplementary Table 5 shows the linear model for the association between stress and changes in Healthy Eating Index score stratified by group. During the intervention phase, stress was not associated with dietary changes in the IG group ( $\beta = 0.42$ ,  $p = 0.26$ , model 2) or SG group ( $\beta = 0.25$ ,  $p = 0.33$ , model 2). Similarly, stress was not associated with maintenance of dietary changes among the IG ( $\beta = 0.05$ ,  $p = 0.92$ , model 2) or the SG ( $\beta = -0.21$ ,  $p = 0.44$ , model 2).

### Discussion

We examined the relationship between stressful life events and behavior change, central adiposity, and weight loss in a weight loss intervention trial targeting AABCS. The most commonly reported sources of stress for this study included relationships, lack of safety, and finances. Unexpectedly, analyses revealed no associations between these events and changes in weight, central adiposity, diet, or physical activity for either group (IG vs SG) during the intervention or maintenance phases.

To our knowledge, no other study has examined the association between stressful life events, behavior change, weight loss, and maintenance among cancer survivors. However, our results are partially consistent with previous studies examining the relationship between life events and behavior change, weight loss, and maintenance among overweight/obese adults [16] and adults with metabolic syndrome [17]. Similar to our findings, these studies report no association between stress and behavior change during the intervention phase [16]. Different from our results, these studies report an inverse association between stress and weight loss and behavior change during the maintenance phase [16, 17]. These inconsistencies may be due to several reasons, including different racial composition of the sample, survivor population, measure of stressful life events, and intervention components.

Unhealthy behavioral patterns like overeating and not exercising are common responses during times of stress [28]. Our participants may have controlled these common responses to stress post-intervention through learning how to manage stressful life events in more positive ways in Moving Forward. Participants may have learned specific ways to manage stress, including techniques for mindful eating, stimulus control, problem solving, and exercise offered in the program binder received by both the IG and SG groups. Skills related to paying attention to hunger and fullness cues also could have helped to better manage stress response to engage in problem eating behavior. Furthermore, Moving Forward encouraged increased exercise, which is known to reduce stress [38]. Past studies with women in the general population show women who practiced strategies taught during lifestyle interventions including problem solving skills, confrontive ways of coping with life's demands, relaxation techniques and others were more likely to succeed with weight loss maintenance [39–41].

Group affiliation may have also contributed to a lack of significant findings. The IG women's affiliation with Moving Forward likely helped the women reduce their stress by associating with other survivors in the group [42–44]. Taylor and colleagues showed that an effective coping mechanism for stress among females is to “tend and befriend,”



which includes engaging in protective behaviors and affiliating with social groups that may reduce their stressful exposure [44]. Further, the social support literature shows that befriending others has substantial mental and physical health benefits [42, 43]. The IG participants were included in group sessions where they bonded with other women, which may have led to mental and physical health benefits. This may explain why the IG group experienced a higher weight loss than the SG group. Perhaps, group affiliation led to attendance to intervention sessions (which included twice weekly supervised exercise) and greater adherence to the recommended behavioral changes.

Taken together, a weight loss curriculum that includes strategies to manage stress and group affiliation may have contributed to our lack of finding any association between stress, behavior change, central adiposity, and weight loss. Unfortunately, we did not measure group affiliation or coping/stress management techniques. Ideally, future studies will consider these constructs providing greater understanding of their influence on behavioral and weight loss outcomes in AABCS.

### Study limitations

Our study is not without limitations. Although we collected measures over time and saw significant changes, we cannot suggest causality between factors, and thus can only interpret our findings as associations. The CRYISIS measure includes questions related to severity and assignment as positive, negative, or neutral. To reduce participant burden, we eliminated these qualifiers (severity, positive and negative) in our data collection, which may have contributed to a null association. Although our validated measures are widely used in cancer survivor studies [31, 34], MVPA and dietary intake were self-reported, thus potentially leading to underreporting or overreporting activity and intake. Our participants reported high baseline levels of physical activity, which also may have contributed to null findings.

Meanwhile, the strengths of this study are the randomized design, the focus on an underserved population, a multidimensional measure of stress that includes discrimination, analyses of challenges experienced by AABCS (i.e., stress), and the use of validated measures. Though a causal link was not established between stress and behavior outcomes, our findings open future avenues of research in several related fields.

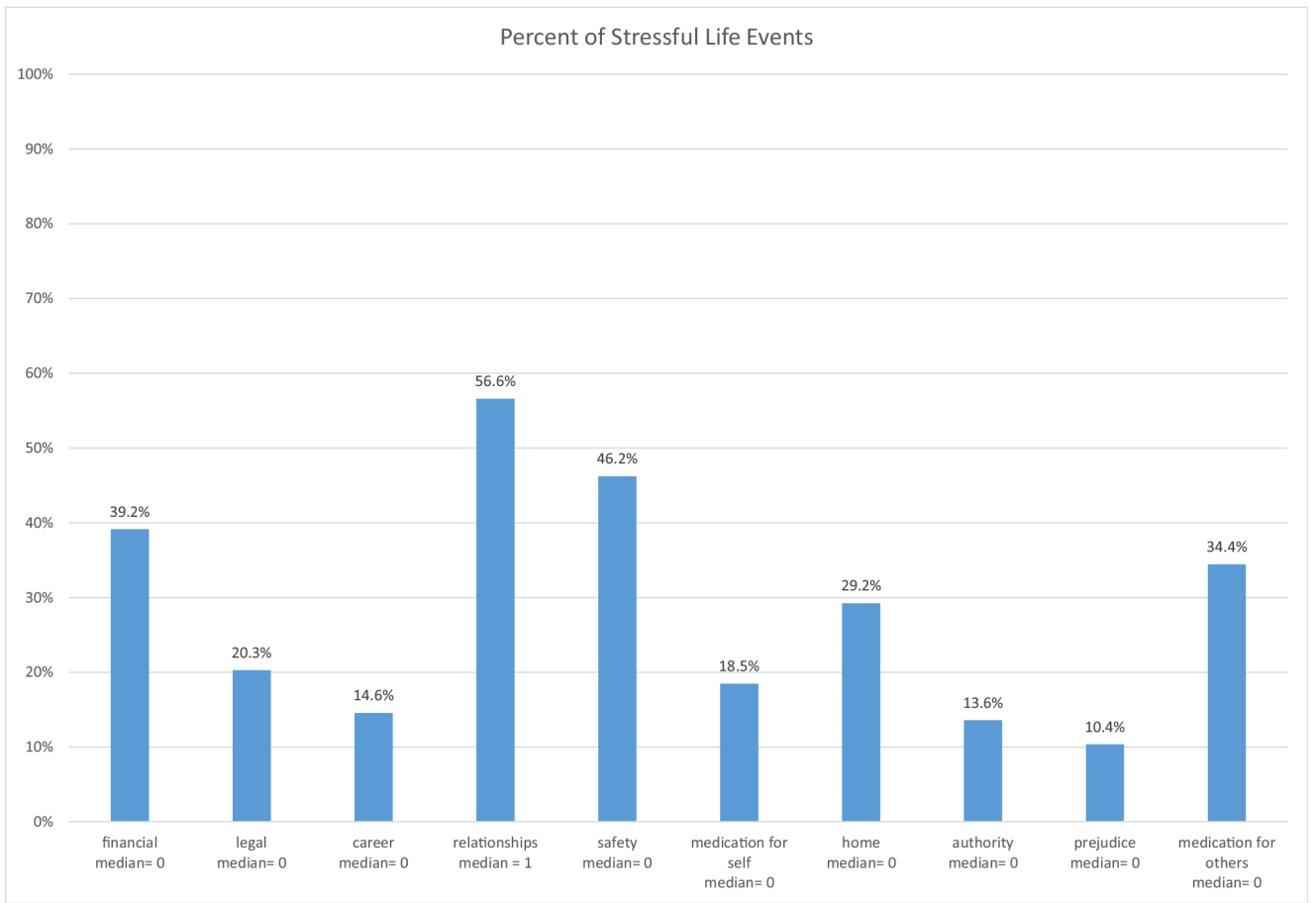
In conclusion, the relationship between stressful life events and outcomes from a weight loss intervention targeting AABCS remains unclear. We did find that AABCS who experienced stress were generally able to engage in positive health behavior changes that led to weight loss, though the weight loss achieved and maintenance therein was modest. Although this initial study did not demonstrate a clear relationship between stress and outcomes, further research is needed to better understand the complex role of stress as well as other challenges in weight loss attempts (including studies of African American women without cancer) to inform enhanced programming. Future studies may include a more intentional focus on stress management and/or group affiliation to promote greater impact than was achieved in this and other lifestyle interventions with AABCS.

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**Fig. 1.**  
Percent of contemporary life stressors

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Characteristics for the African American breast cancer survivors participating in Moving Forward: a behavioral weight loss intervention

Table 1

Variable	Group			p value
	Total (n = 246) n (%)	Interventionist guided (n = 125) n (%)	Self-guided (n = 121) n (%)	
Age, years				0.308
n	246	125	121	
Mean ± SD	57.5 ± 10.1	56.8 ± 10.0	58.1 ± 10.1	
Range	30.6–82.2	33.0–82.0	30.6–79.8	
Education				0.399
Some HS, HS grad, GED	59 (24.0)	24 (19.2)	35 (28.9)	
Some college, associate's degree, 2-year certificate	93 (37.8)	48 (38.4)	45 (37.2)	
College graduate	47 (19.1)	24 (19.2)	23 (19.0)	
Graduate or professional degree	47 (19.1)	29 (23.2)	18 (14.9)	
Combined family income, last 12 months, \$				0.208
< 20,000	58 (23.6)	24 (24.0)	28 (23.1)	
20,000–39,999	56 (22.8)	25 (20.0)	31 (25.6)	
40,000–59,999	48 (19.5)	20 (16.0)	28 (23.1)	
60,000–79,999	33 (13.4)	18 (14.4)	15 (12.4)	
80,000	50 (20.3)	32 (25.6)	18 (14.9)	
Missing	1 (0.4)	0 (0.0)	1 (0.8)	
Cancer stage*				0.187
I	85 (38.3)	51 (44.0)	34 (32.1)	
II	98 (44.1)	46 (39.7)	52 (49.1)	
III	39 (17.6)	19 (16.4)	20 (18.9)	
Missing	24	9	15	
Central adiposity, cm				0.529
Mean ± SD	113.2 ± 15.2	112.6 ± 15.3	113.9 ± 15.1	
Missing	0	0	0	
Range	81.5–169.6	81.5–169.6	84.6–166.3	
6-month weight change, kg				<0.001
n	210	110	100	



Variable	Group				p value
	Total (n = 246) n (%)	Interventionist guided (n = 125) n (%)	Self-guided (n = 121) n (%)	n (%)	
Mean ± SD	-2.5 ± 4.3	-3.5 ± 4.7	-1.4 ± 3.5		
Missing	36	15	21		
Range	-15.9–13.4	-15.9–13.4	-13.3–6.2		
MVPA at baseline, min/week	246	125	121		0.913
Mean ± SD	164.0 ± 207.9	162.6 ± 188.5	165.5 ± 226.9		
Missing	0	0	0		
Range	0–1023.5	0–1015.4	0–1023.5		
6-month MVPA change, min/week					0.206
n	212	111	101		
Mean ± SD	89.1 ± 301.8	114.2 ± 248.7	61.6 ± 350.2		
Missing	34	14	20		
Range					
12-month MVPA change, min/week					<0.001
n	204	104	100		
Mean ± SD	90.2 ± 274.9	108.7 ± 275.7	71.0 ± 274.2		
Missing	42	21	21		
HEI at baseline					0.380
n	221	112	109		
Mean ± SD	65.1 ± 111.1	65.7 ± 111.4	64.4 ± 10.8		
Missing	25	13	12		
6-month HEI change					0.034
n	190	100	90		
Mean ± SD	5.0 ± 10.1	6.4 ± 10.0	3.3 ± 10.1		
Missing	56	25	31		
12-month HEI change					0.402
n	184	94	90		
Mean ± SD	4.4 ± 10.2	5.0 ± 9.5	3.8 ± 10.8		
Missing	62	31	31		
CRISYS, at 6 months, count					0.209
n	212	111	101		

Variable	Group			p value
	Total (n = 246) n (%)	Interventionist guided (n = 125) n (%)	Self-guided (n = 121) n (%)	
Mean $\pm$ SD	4.0 $\pm$ 3.5	3.7 $\pm$ 2.9	4.3 $\pm$ 4.1	
Missing	34	14	20	
Percent of classes attended				
Interventionist guided	125 (54.9)	125 (54.9)	NA	

*BMI* body mass index, *HEI* healthy eating index, *HS* high school, *MVPA* moderate-to-vigorous physical activity, *SD* standard deviation

\* Percents do not include missing

**Table 2**

Association between stressful life events and weight loss stratified by group

Interventionist guided <i>Parameter</i>	Intervention: Baseline to 6 months				Maintenance: 6 to 12 months							
	Model 1		Model 2		Model 1		Model 2					
	$\beta$	S.E.	$\beta$	S.E.	$\beta$	S.E.	$\beta$	S.E.				
Intercept	10.40	2.30	<0.001	17.28	4.87	0.001	9.51	2.96	0.002	10.99	6.49	0.094
Stressful life events	-0.11	0.13	0.396	-0.23	0.16	0.147	-0.07	0.17	0.693	-0.19	0.21	0.368
<i>Adj R-sq</i>	0.195		0.119		0.195		0.119		0.119		0.119	
<i>AICC (smaller is better)</i>	426.465		427.558		426.465		427.558		426.465		427.558	
<i>SBC (smaller is better)</i>	333.294		364.198		333.294		364.198		333.294		364.198	
Self-guided <i>Parameter</i>	Model 1		Model 2		Model 1		Model 2					
	$\beta$	S.E.	$p$	$\beta$	S.E.	$p$	$\beta$	S.E.	$p$	$\beta$	S.E.	$p$
Intercept	0.23	1.97	0.909	2.54	4.51	0.574	1.26	1.52	0.410	1.11	3.47	0.751
Stressful life events	0.04	0.09	0.625	0.02	0.10	0.830	0.12	0.07	0.082	0.12	0.08	0.143
<i>Adj R-sq</i>	-0.010		-0.073		0.027		0.027		-0.046		-0.046	
<i>AICC (smaller is better)</i>	354.170		336.134		273.964		273.964		261.320		261.320	
<i>SBC (smaller is better)</i>	259.565		277.028		186.108		186.108		205.737		205.737	

Note. Model 1 adjusts for baseline weight, percent classes attended (IG only). Model 2 additionally adjusts for age, income, education, and breast cancer stage

Note. Model 1 adjusts for baseline weight. Model 2 additionally adjusts for age, income, education, and breast cancer stage

**Table 3**  
Association between stressful life events and physical activity stratified by group from 6 to 12 months

Interventionist guided Parameter	Intervention: Baseline to 6 months						Maintenance: 6 to 12 months					
	Model 1			Model 2			Model 1			Model 2		
	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>
Intercept	9.08	6.01	0.134	42.44	16.07	0.010	1.31	7.26	0.857	-31.73	20.44	0.124
Stressful life events	-0.86	0.65	0.192	-1.10	0.74	0.145	1.11	0.80	0.168	1.52	0.93	0.105
Adj <i>R</i> -sq	0.277			0.275			0.039			0.044		
<i>AICC</i> (smaller is better)	781.983			731.635			755.604			719.213		
<i>SBC</i> (smaller is better)	679.249			662.349			660.525			654.396		
Self-guided Parameter	Model 1			Model 2			Model 1			Model 2		
	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>	$\beta$	S.E.	<i>p</i>
Intercept	6.64	3.27	0.045	9.62	18.47	0.604	3.93	3.72	0.293	17.35	21.93	0.432
Stressful life events	0.79	0.53	0.137	0.98	0.61	0.114	-1.08	0.60	0.077	-1.42	0.73	0.055
Adj <i>R</i> -sq	0.037			0.111			0.045			0.061		
<i>AICC</i> (smaller is better)	722.446			646.521			724.741			652.674		
<i>SBC</i> (smaller is better)	626.875			587.415			632.066			595.623		

Note. Model 1 adjusts for baseline physical activity, percent classes attended (IG only). Model 2 adjusts for age, income, education, and breast cancer stage  
Note. Model 1 adjusts for baseline physical activity. Model 2 adjusts for age, income, education, and breast cancer stage