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ORIGINAL PAPER

Moderating Factors in an Anti-stigma Intervention for African American Women with HIV in the United States: A Secondary Analysis of the UNITY Trial

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Abstract

African American women experience higher rates of HIV than other women in the United States, and stigma has been identified as an important determinant of engagement in HIV care. Our study examined whether key variables moderated the effect of an anti-stigma intervention on outcomes among African American women receiving treatment for HIV. Twelve potential moderators included: age, years lived with HIV, marital status, employment status, education level, PTSD diagnosis, alcohol use, social support, baseline CD4 count, baseline viral load, and number of children. Outcomes included changes in: HIV-related stigma, social support, depressive symptoms, PTSD symptoms, alcohol use, viral load, and engagement in HIV care. Results suggest that the intervention is associated with greater improvement in engagement in care among participants with PTSD or depression at baseline, and may help maintain engagement in care among participants experiencing certain mental health conditions. This provides opportunities to address discriminatory structural barriers that lead to stigma and drop-offs in HIV care.

Keywords HIV · Stigma · Moderation analysis · African American women

Resumen

En los Estados Unidos, mujeres afroamericanas experimentan tasas más altas de VIH que sus contrapartes no-negras, y el estigma ha sido identificado como un factor importante en esa diferencia. Este estudio analizó el efecto moderador de ciertas variables claves hacia una intervención anti-estigma para mujeres afroamericanas en los Estados Unidos. Del conocimiento previo sobre VIH y el estigma hacia mujeres afroamericanas con VIH, se derivaron doce posibles moderadores incluyendo: edad, años viviendo con VIH, estado civil, nivel de educación, diagnóstico de TEPT, puntuación de AUDIT, apoyo social, conteo de CD4, carga viral, y cantidad de hijos. Las variables clínicas observadas incluyeron estigma, apoyo social, síntomas de depresión y/o TEPT, uso de alcohol, carga viral, y el compromiso del paciente al tratamiento. Los resultados sugieren que la intervención anti-estigma está asociado con mayor mejoramiento en compromiso al tratamiento para esos participantes que padecían de TEPT o depresión al inicio del tratamiento. En adición, la intervención puede ayudar a mantener el compromiso al tratamiento para pacientes que padecen ciertas condiciones de salud mental.

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Introduction

African American women account for 11% of people diagnosed with HIV in the United States, and they constitute the majority of new infections among women [1, 2]. As of 2016, African American women have a rate of AIDS nearly 19 times higher than that of White women and are 18 times more likely to die from HIV-related causes [3]. Barriers like racial and gender discrimination, as well as structural factors such as reduced access to healthcare, contribute to the stigma experienced by African American women living with HIV and exacerbate the disparities that perpetuate these trends [1, 4, 5]. Stigma associated with having a positive HIV status, when combined with stigma resulting from the systematic marginalization of African Americans and negative perceptions of the medical community based on historic injustices, likely contributes to reduced engagement in HIV care [6]. The combined impact of the intersectional stigma that results from having three or more devalued identities, including being Black, female, and HIV positive, is not adequately captured by the stigma of these identities alone [7], and contributes to the challenges that cause African Americans living with HIV to be less likely to be engaged in HIV care than their White counterparts [8]. Further, some women's experiences with stressors related to histories of trauma, abuse, and mental distress exacerbate disengagement in care [9].

The HIV Care Cascade describes a continuum of five stages that a person with HIV typically undergoes. It starts with receiving the HIV diagnosis, followed by establishing a link to care, engaging in and retaining care, receiving a prescription for anti-retroviral therapy, and achieving viral suppression [10]. As a group, African Americans represent a smaller percentage of success at all levels of the HIV Care Cascade than Whites, and a smaller percentage in 4 of the 5 levels (linked to care, retained in care, prescribed ART, and achieved viral suppression, but not diagnosed) than Hispanic/Latinos [11]. These statistics highlight profound racial disparities with respect to HIV care in the United States and reinforce the importance of interventions that focus on marginalized communities. An overall distrust of the medical community drawn from the legacy of abuse and mistreatment of African Americans in United States medical history, as well as ongoing experiences of racism reinforce the potential hesitancy within the Black community to engage in care [6].

The positive role of social support in promoting healthy behaviors among people living with HIV is well established and has been researched in many settings [12]. While few studies focus specifically on these factors among African American women, current research suggests the importance of social support in engagement in HIV care worldwide. A 2014 systematic review of the global literature emphasizes the positive association of HIV-related social and partner support in promoting condom use in Uganda, South Africa, and the United States [12]. Other studies have established the positive association of social support with medication adherence, improvements in CD4 T cell count, and better perceived quality of life [13–15], all of which are related to engagement in care.

Qualitative research has highlighted the linkages between stigma and social support and engagement in HIV care among African American women. When evaluating risks and benefits of engagement in care, stigma was associated with hesitation engaging in HIV care, whereas social connections were described as advantageous in maintaining HIV care and disclosure of HIV serostatus [1, 9, 16, 17]. Perceived stigma has also been found to be associated with a decreased likelihood of status disclosure [16], further reinforcing the complex interactions between elements that influence HIV care. Post-traumatic stress disorder (PTSD) and depression are both common mental health conditions in people living with HIV, and have also been associated with HIV-related stigma and inversely related to social support [18]. Furthermore, Black women living with HIV have strongly expressed the desire for interventions designed specifically for them and the particular experiences and adversities present in their lives [9]. Interventions that emphasize stigma reduction, resilience, and social support have been proposed [1, 16, 17].

UNITY is an anti-stigma intervention that brings an intersectional approach to targeting HIV-related stigma among African American women living with HIV. The intervention is formatted as a stigma-reduction workshop that incorporates education, contact with affected persons, counseling strategies, and training in coping skills [19]. This approach draws from Black feminist social justice work and takes into account the complex dynamics of race, gender, class, and other variables that contribute to systematic oppression by offering tools to address the overlapping stigmas of race, gender, and HIV [20, 21]. Results from the intervention demonstrated a reduction in stigma and an increase in social support among both the treatment arm and the comparison arm (a breast cancer stigma reduction workshop), suggesting the utility of both approaches for stigma reduction [22]. While overall stigma reduction and increased social support among treatment and comparison arms was a significant finding, between-group intervention effects were mostly null, suggesting the importance of evaluating moderators. In cases where an intervention is effective among some subgroups but not others, evaluating moderators can illuminate what factors determine for whom the treatment is effective.

This moderation analysis uses data from the UNITY randomized controlled trial (RCT) to evaluate whether twelve baseline variables predicted differences in intervention

response to seven clinical outcomes. Five moderator variables were examined to evaluate the impact of sociodemographic factors: (1) age, (2) marital status, (3) employment, (4) education level, and (5) having children. In addition, three variables were evaluated due to their relevance to populations living with HIV: (6) years living with HIV, (7) having an undetectable viral load at baseline, and (8) having a baseline CD4 count of at least 350 cells/mm^3. The remaining variables pertain to baseline mental health and were deemed to be particularly relevant to the intervention: (9) social support, (10) PTSD diagnosis, (11) risky alcohol use, and (12) depressive symptoms.

Methods

Study Settings

Data were drawn from the UNITY study [22], a stigma-reduction trial conducted at three HIV-specialty clinics: two in Chicago, Illinois and one in Birmingham, Alabama. The intervention arm participated in group workshops designed to reduce HIV-related stigma, and the comparison arm participated in a breast cancer education group workshop. Both workshops spanned 2 days, with an additional "booster" session 6 months later.

Participants

This secondary analysis used the inclusion criteria from the UNITY study, which is as follows: HIV-positive adult women who self-identified as African American, had confirmed HIV positive status, and were receiving HIV treatment at one of the three participating clinics. Participants were recruited directly from their respective clinics, where staff posted study information and eligibility criteria in clinic rooms. Research coordinators described the study procedures during clinic visits to patients who were interested and eligible. Women born in Africa, of Afro-Caribbean descent, or who identified as Black Latino were excluded due to the culturally specific nature of the research. Of the participants who enrolled, half were randomized into the UNITY stigma-reduction workshop arm and half to the breast cancer workshop comparison arm. Data were collected at screening, baseline intervention day 1, baseline intervention day 2, 4 months post-intervention, 6-month booster session, and 8 and 12 months post-intervention.

Treatment Conditions

UNITY Intervention (Treatment Group)

The UNITY intervention was adapted from the International Center for Research on Women's HIV Stigma Toolkit, which is widely used and evidence-based [19]. The intervention was designed to cater specifically to African American women living with HIV and experiencing intersectional stigma related to HIV, gender, and race. In the UNITY workshop, peer-facilitators lead group sessions in discussions and exercises about stigma and coping skills. A full description of the intervention has been described elsewhere [22, 23].

Breast Cancer Workshop (Comparison Group)

The control comparison for this RCT was a workshop for breast cancer education that was designed to match the timeframe and structure of the UNITY intervention. The content, which was related to breast cancer among African American women, contained similar elements of education, skill building, and peer support/counseling.

Measures

Sociodemographic and clinical information (i.e., age, educational attainment, time since HIV diagnosis) was collected from all participants at baseline prior to the interventions. CD4+T cell count and HIV viral load were collected from participants' medical records.

HIV-Related Stigma

Internalized and experienced HIV-related stigma was measured using the 14-item Stigma Scale for Chronic Illness (SSCI) [24]. The 14-item version of this scale has been validated for use among African Americans living with HIV and has demonstrated good reliability (Cronbach's alpha = 0.93) [24]. It includes questions pertaining to the experience of stigma (e.g., "Because of my illness I felt left out of things") in the domains of internalized and enacted stigma. In our study, the scale demonstrated good reliability (Cronbach's alpha = 0.93).

Social Support

The 19-item Medical Outcomes Study-Social Support Survey (MOS-SSS) [25] was used to measure perceived social support. This scale has been validated for use among people with chronic illnesses [25] and has demonstrated good reliability (Cronbach's alpha = 0.96) among Black women living with HIV [26]. It includes questions related to availability of emotional support (e.g., "Someone you can count on to listen to you if you need to talk") as well as physical support (e.g., "Someone to take you to the doctor if you needed it"), affectionate support (e.g., "Someone who hugs you"), and positive social interaction (e.g., "Someone to have a good time with"). In our

study, the scale demonstrated good reliability (Cronbach's alpha = 0.96).

PTSD Symptoms

PTSD symptom severity was assessed using the PTSD Checklist [27]. The PTSD Checklist is a 17-item scale designed to measure trauma symptoms that has demonstrated good internal consistency (Cronbach's alpha = 0.93) and diagnostic efficiency [27]. It has been used to measure trauma symptoms among people living with HIV [29] and in studies in which large proportions of participants were Black women [30]. It includes questions regarding the frequency of symptoms related to trauma in the past month (e.g., "Repeated disturbing memories, thoughts, or images of a stressful experience from the past"). In our study, the checklist demonstrated good reliability (Cronbach's alpha = 0.94).

Depressive Symptoms

We used the eight-item Patient Health Questionnaire (PHQ-8) to assess depressive symptoms in our study. The PHQ-8 is a measure of depressive symptoms suitable for research settings [31]. The PHQ-8 has demonstrated acceptable internal consistency (Cronbach's alpha = 0.79–0.86) among racially and ethnically diverse populations [32] and is validated for use in both clinical and research settings [28]. It includes questions related to the frequency of depressive symptoms in the past 2 weeks (e.g., "Feeling down, depressed, or hopeless"). The measure showed good internal consistency in our study (Cronbach's alpha = 0.88).

Alcohol use

Alcohol use was assessed using the ten-item Alcohol Use Disorders Identification Test (AUDIT). The AUDIT has been validated for assessing alcohol use, misuse, and dependence [33]. It contains questions regarding alcohol consumption (e.g., "How often do you have a drink containing alcohol?") as well as feelings regarding alcohol consumption (e.g., "How often in the last year have you felt guilt or remorse after drinking?"). In our study, the AUDIT demonstrated good internal consistency (Cronbach's alpha = 0.86).

Engagement in Care

Engagement in care was assessed by quantifying routine HIV care appointment attendance over time, calculated by dividing the number of visits attended by the total number of visits scheduled. All HIV-related visits to primary care providers were extracted from the medical record for a period of 12 months preceding baseline assessments to 64 weeks following the workshops.

Data Analysis

Longitudinal moderation analyses were conducted using generalized estimating equation (GEE) models to evaluate whether baseline factors moderated treatment effects on outcome variable trajectories. The potential moderator baseline variables assessed were: (1) age in years, (2) years living with HIV, (3) marital status (married vs. not married), (4) has living children (yes vs. no), (5) employment status (employed vs. not employed), (6) education level (high school graduate vs. not a high school graduate), (7) PTSD diagnosis (yes vs. no; a PTSD checklist score of 50 used as a cut-off), (8) Alcohol Use Disorders Identification Test (AUDIT) score (0 to 31; used as a continuous measure to maximize statistical power to detect potential moderation effects, as scores were relatively normally distributed), (9) social support (0 to 44), (10) PHQ-8 score (10 or higher vs. < 10), (11) CD4 count (350 cells/mm^3 vs. < 350), (12) viral load (over 200 copies/mL vs. 200 and under). The study outcomes evaluated were changes in: (1) total stigma score (SSCI), (2) social support score (MOS-SSS), (3) depressive symptoms (PHQ-8), (4) PTSD symptoms (PTSD Checklist), (5) AUDIT score (0–31), (6) detectable viral load, and (7) engagement in care (attendance). We excluded five models in which the moderator variable and the outcome variable overlap (e.g., baseline social support as a moderator for change in social support over time).

Each outcome variable was regressed on treatment condition, moderator variable, treatment × moderator, time, moderator × time, treatment × time, and treatment × time × moderator in separate GEE models. We evaluated each moderator variable by examining the magnitude and statistical significance ($p < 0.05$) of the treatment × time × moderator interaction. Gaussian GEE models were used for relatively normally distributed outcomes, logistic GEE models for the dichotomous viral load outcome, and Poisson GEE models to model the rate of appointment attendance.

Additional post hoc sensitivity analyses were conducted using the Benjamini and Hochberg procedure to account for multiple tests [34], assuming a maximum false discovery rate of 0.25.

Results

Our sample included 239 women, 124 of whom were randomly assigned to the UNITY intervention (treatment) group and 115 of whom were randomly assigned to the breast cancer workshop (comparison) group. The mean age

of participating women was 47.0 years in the UNITY group and 46.5 in the breast cancer group. Demographic characteristics of the study participants can be found in Table 1.

Table 2 summarizes the estimated intervention moderation effects (Cohen's *d*) from baseline to 12 months. The moderation analysis included 79 total models assessing the association of the 12 potential moderating variables with the seven study outcomes. Across these moderation analyses, we identified five statistically significant moderator effects across three outcomes. Marital status, employment, having graduated from high school, and baseline presence of PTSD diagnosis or clinically significant depressive symptoms were significant moderators of intervention effects on total stigma score, PTSD symptoms, having a detectable viral load, and engagement in care, respectively.

Figure 1a shows the predicted effect of the UNITY intervention verses the breast cancer workshop comparison in relation to total stigma score for participants that were married versus not married. The breast cancer workshop was associated with a greater decrease in total stigma from baseline to 12 months among married participants ($d = -0.47$, 95% CI −0.90, −0.06) compared to the UNITY group.

Figure 1b shows the predicted effect of the UNITY intervention versus the breast cancer comparison workshop in relation to PTSD symptoms for participants that were employed versus not unemployed. The intervention group was associated with consistent PTSD symptoms from baseline to 12 months for both employed and unemployed participants, whereas there was an increase in PTSD symptoms among comparison group participants who were employed ($d = 0.59$, 95% CI 0.16, 1.04).

Table 1 Descriptive statistics of moderator variables overall and by treatment condition

Moderators	Range	Overall		UNITY intervention		Breast cancer workshop	
		N	%	*n*	%	*n*	%
Marital status							
Not married	–	182	76.5	90	73.2	92	80.0
Married	[0, 1]	56	23.5	33	26.8	23	20.0
Has children							
No	–	137	58.5	67	55.4	70	61.9
Yes	[0, 1]	97	41.5	54	44.6	43	38.1
Employed							
No	–	122	55.2	65	56.0	57	54.3
Yes	[0, 1]	99	44.8	51	44.0	48	45.7
High school graduate							
No	–	89	38.2	46	38.0	43	38.4
Yes	[0, 1]	144	61.8	75	62.0	69	61.6
BL PTSD diagnosis							
No	–	158	66.4	79	64.2	79	68.7
Yes	[0, 1]	80	33.6	44	35.8	36	31.3
BL depressive symptoms							
PHQ-8 < 10	–	160	67.2	78	63.4	82	71.3
PHQ-8 ≥ 10	[0, 1]	78	32.8	45	36.6	33	28.7
BL HIV viral load							
Detectable (> 200)	–	105	44.1	54	43.9	51	44.3
Undetectable (≤ 200)	[0, 1]	133	55.9	69	56.1	64	55.7
BL CD4 count							
< 350 cells/mm^3	–	61	25.6	30	24.4	31	27.0
≥ 350 cells/mm^3	[0, 1]	177	74.4	93	75.6	84	73.0
			M (SD)		M (SD)		M (SD)
Age in years	[18, 73]	239	46.8 (10.5)	124	47.0 (11.1)	115	46.5 (9.9)
Years living with HIV	[0, 35]	236	14.2 (7.2)	123	14.6 (7.8)	113	13.7 (6.6)
BL social support	[0, 44]	238	30.6 (12.1)	123	30.6 (12.6)	115	30.6 (11.6)
BL alcohol problems	[0, 31]	238	3.1 (5.3)	123	3.2 (5.5)	115	3.0 (5.2)

BL Baseline, *PHQ-8* Patient Health Questionnaire depression scale

Table 2 Summary of moderation effects from baseline to 12 months across outcome variables

Moderator variable	Outcome variable						
	HIV-related stigma	Social support	PTSD symptoms	Depressive symptoms	Alcohol problems	Detectable viral load	Engagement in care
	d [95% CI]	*d* [95% CI]	*d* [95% CI]	*d* [95% CI]	*d* [95% CI]	*d* [95% CI]	*d* [95% CI]
Age in years[a]	0.12 [−0.07, 0.31]	−0.01 [−0.24, 0.23]	0.03 [−0.17, 0.23]	−0.09 [−0.29, 0.10]	0.14 [−0.06, 0.35]	0.14 [−0.25, 0.56]	0.11 [−0.25, 0.51]
Years living with HIV[a]	−0.07 [−0.27, 0.14]	0.03 [−0.15, 0.21]	−0.03 [−0.26, 0.19]	−0.15 [−0.33, 0.02]	−0.06 [−0.27, 0.15]	0.12 [−0.19, 0.45]	0.12 [−0.29, 0.53]
Married	**−0.47 [−0.90, −0.06]**	−0.39 [−0.85, 0.09]	−0.06 [−0.59, 0.48]	0.01 [−0.43, 0.44]	−0.44 [−1.07, 0.26]	0.50 [−0.49, 1.45]	0.12 [−0.67, 0.88]
Has children	0.11 [−0.27, 0.48]	0.03 [−0.39, 0.46]	−0.26 [−0.69, 0.20]	0.14 [−0.22, 0.51]	−0.01 [−0.51, 0.50]	−0.19 [−0.93, 0.57]	0.02 [−0.73, 0.82]
Employed	0.11 [−0.25, 0.46]	0.38 [0.00, 0.78]	**0.59 [0.16, 1.04]**	0.31 [−0.06, 0.67]	0.03 [−0.47, 0.51]	0.08 [−0.70, 0.89]	−0.04 [−0.86, 0.77]
High school graduate	0.07 [−0.34, 0.49]	0.34 [−0.05, 0.75]	−0.41 [−0.89, 0.05]	0.18 [−0.22, 0.55]	0.51 [−0.02, 1.10]	**−0.78 [−1.51, −0.02]**	0.19 [−0.57, 1.01]
BL social support[a]	0.10 [−0.07, 0.30]	–	0.05 [−0.18, 0.29]	−0.07 [−0.24, 0.11]	0.12 [−0.09, 0.34]	0.20 [−0.19, 0.58]	0.29 [−0.08, 0.64]
PTSD diagnosis	−0.31 [−0.70, 0.06]	−0.09 [−0.48, 0.30]	–	0.11 [−0.29, 0.51]	−0.29 [−0.87, 0.30]	0.15 [−0.65, 0.93]	**0.88 [0.07, 1.66]**
High BL PHQ-8	−0.19 [−0.60, 0.19]	0.00 [−0.42, 0.40]	−0.14 [−0.70, 0.35]	–	−0.45 [−1.08, 0.18]	−0.60 [−1.58, 0.39]	**1.04 [0.29, 1.83]**
BL alcohol problems[a]	−0.06 [−0.25, 0.13]	0.15 [−0.05, 0.36]	0.00 [−0.28, 0.27]	−0.03 [−0.23, 0.17]	–	−0.13 [−0.44, 0.17]	0.02 [−0.39, 0.41]
BL undetectable viral load	0.00 [−0.17, 0.17]	0.00 [−0.19, 0.19]	0.07 [−0.15, 0.28]	0.09 [−0.08, 0.26]	−0.15 [−0.38, 0.08]	–	−0.22 [−0.55, 0.09]
BL CD4 count ≥ 350	0.16 [−0.27, 0.62]	−0.30 [−0.78, 0.16]	0.11 [−0.34, 0.56]	−0.37 [−0.73, −0.01]	−0.26 [−0.75, 0.20]	0.24 [−0.66, 1.19]	−0.38 [−1.18, 0.39]

Statistically significant results ($p < 0.05$) are highlighted in bold

A positive versus negative moderation effect corresponds with better outcomes among UNITY participants at higher versus lower levels of the moderator variable, respectively

d Cohen's *d*, *CI* Confidence interval, *BL* Baseline, *PHQ-8* Patient Health Questionnaire depression scale

[a]Effect sizes are scaled to a 1 SD change in the moderator

Figure 1c shows the predicted effect of the UNITY intervention versus the breast cancer comparison workshop in relation to detectable viral load for participants with a high school degree or higher versus some high school or less. The intervention group was associated with consistent viral load from baseline to 12 months for participants across education levels, whereas there was a greater decrease in viral load among comparison group participants with a high school degree or higher ($d = -0.78$, 95% CI −1.51, −0.02).

Figure 2 shows the predicted effect of the UNITY intervention versus the breast cancer comparison workshop on engagement in care by (a) presence of PTSD diagnosis and (b) presence of clinically significant depressive symptoms. The intervention group was associated with more consistent attendance of HIV-related visits over time (i.e., engagement in care) than the comparison group among participants meeting criteria for PTSD ($d = 0.88$, 95% CI 0.07, 1.66) and for those with clinically significant depressive symptoms ($d = 1.04$, 95% CI 0.29, 1.83).

Post-Hoc Sensitivity Analyses Using the Benjamini–Hochberg Adjustment

None of the moderation effects reported in Table 2 remained statistically significant after accounting for multiple tests.

Discussion

This study was a secondary analysis of a randomized trial that compared the UNITY anti-stigma intervention for African American women with HIV to a comparison breast cancer workshop to investigate whether 12 baseline characteristics were prospectively associated with changes in seven intervention outcomes. The exploratory nature of the analysis was meant to evaluate a number of significant moderator variables to gain further insight into the relationship between the UNITY intervention and the study outcomes in different sub-groups. We found that marital status, employment

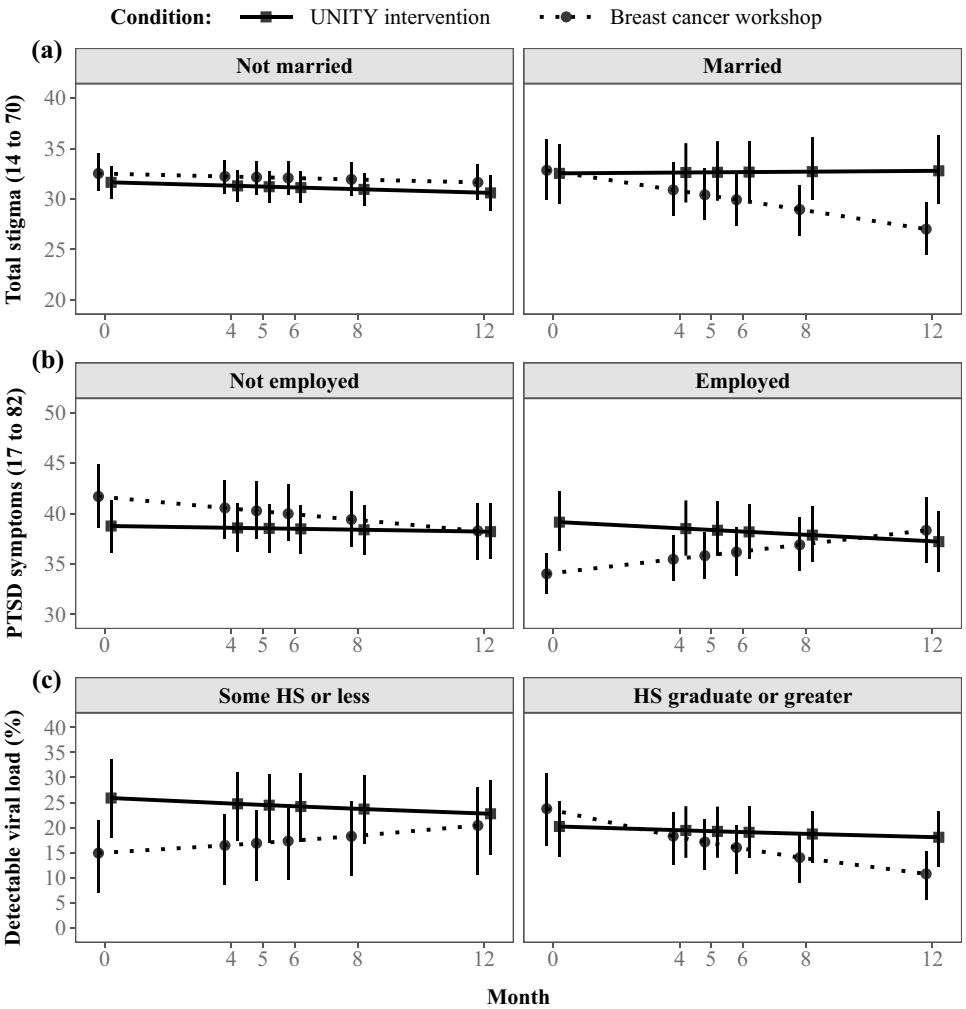

Fig. 1 Moderation of intervention effect by **a** marital status (not married vs. married), **b** employment (not employed vs. employed), and **c** education (some high school or less, high school graduate or greater). Non-overlapping confidence intervals correspond with a statistically significant difference at $p < 0.05$. *HS* high school

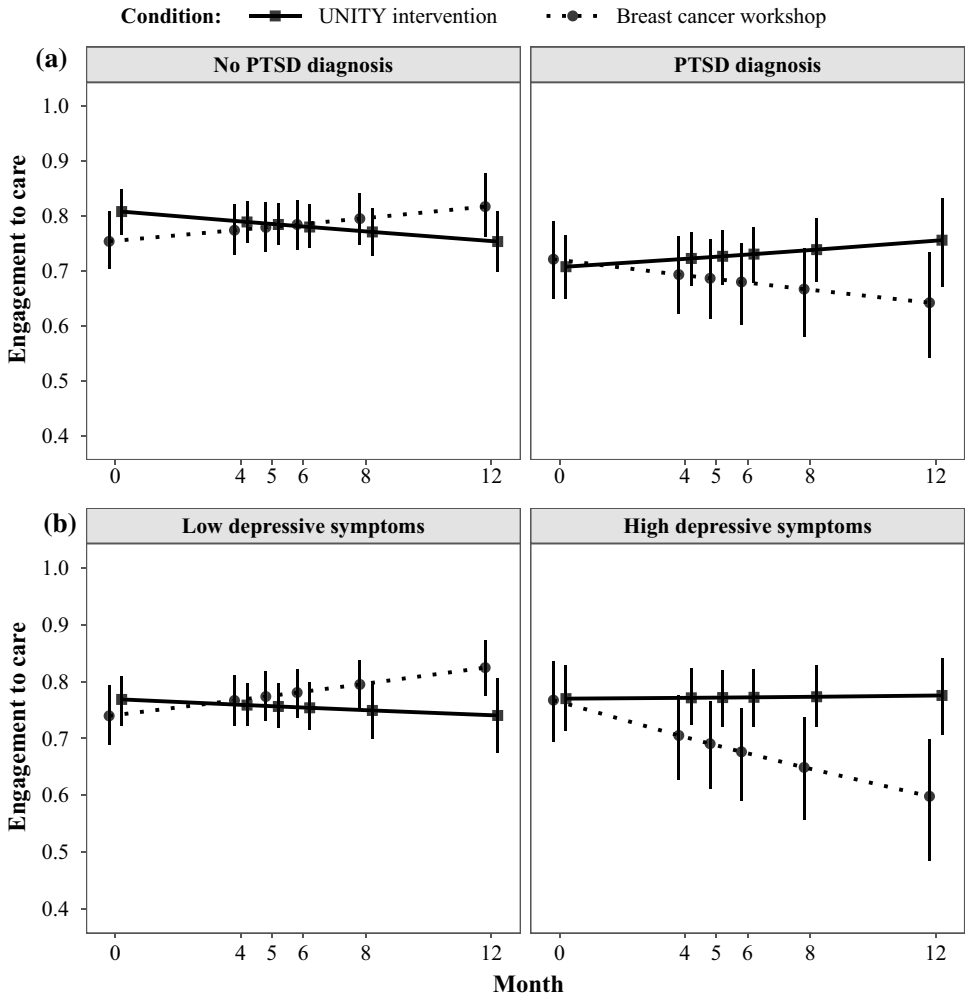

Fig. 2 Moderation of intervention effect by **a** PTSD diagnosis (no PTSD diagnosis vs. PTSD diagnosis), **b** high depressive symptoms (low symptoms vs. high symptoms). Non-overlapping confidence intervals correspond with a statistically significant difference at $p < 0.05$

status, educational attainment, PTSD diagnosis, and higher depressive symptoms moderated the relationship between the UNITY intervention and the primary outcomes. Specifically, UNITY was associated with improved engagement in care among those meeting criteria for PTSD or with clinically significant depressive symptoms at baseline. Additionally, UNITY was associated with greater stability of PTSD symptoms across all levels of employment, whereas employed participants in the comparison condition worsened over time. The breast cancer workshop was associated with a greater reduction in stigma than the UNITY group among married participants (as compared to unmarried) as well as a greater reduction in HIV viral load among participants with at least a high school education (as compared to less educational attainment).

Collectively, three of the five statistically significant moderator findings indicated better response to UNITY compared to the breast cancer workshop in certain subgroups. These findings suggest that UNITY may help maintain and improve engagement in care, especially among individuals with PTSD and with high depressive symptoms. This moderator effect is particularly relevant in the context of people living with HIV, where trauma-related disorders such as PTSD and mood disorders like depression are more prevalent than in the general population [35, 36]. Research has linked poorer mental health with lower levels of engagement in HIV care, which has implications for disease management and HIV-related outcomes [35, 37–39]. Similarly, mental health issues like PTSD and depression can increase stigma and negatively affect coping strategies and willingness to disclose HIV status, all of which are linked to antiretroviral adherence, engagement in HIV care, and ultimately improved HIV treatment outcomes [39, 40]. Previous studies examining the links between mental health, stigma, and social support among people living with HIV generally agree on the importance of considering the intersection of these variables when developing care strategies and interventions for this population [41]. The increased levels of engagement in care among people who meet criteria for PTSD and with higher levels of depressive symptoms is encouraging because maintaining engagement in care is likely more difficult for those with mental health conditions

and higher internalized stigma. Further, UNITY's role in maintaining consistent PTSD symptoms (as opposed to an increase within the comparison group) among employed participants may indicate that the intervention does not exacerbate existing trauma, though more work is needed to inform how to address the role of trauma symptoms in HIV-related stigma. Anti-stigma interventions like UNITY may create positive trends generating better engagement in care among those with certain mental health conditions at baseline and also further maintain (not exacerbate) symptoms associated with these conditions over time.

The reduction of stigma among married participants and the decreased viral load among more educated participants was specific to participants in the breast cancer workshop comparison condition and may suggest the effectiveness of education-focused workshop interventions in these populations. Although it is unclear why the breast cancer workshop differentially affected married participants or those with higher educational attainment, previous research has found that partner support is associated with greater engagement in care among people living with HIV [42]. Furthermore, a relationship between HIV-related stigma and breast health beliefs [43] is supported by cross-sectional research. Other research has suggested that interventions with a focus on self-validation, self-empowerment, and self-care may be beneficial for many psychosocial adversities faced by Black women living with HIV [9]. In this way, it is possible that a workshop containing these elements and designed to target breast health beliefs helped diminish HIV-related stigma among some, though not all, individuals.

The HIV Care Cascade has opportunities for patient drop-off at each of its five stages. In the United States as of 2016, an estimated 86% of all persons with HIV have received an initial HIV diagnosis, but only 30% have reached the last stage of achieving viral suppression [44]. Our results provide insight into opportunities for addressing patient drop-off by identifying which moderator variables are most strongly associated with outcomes within subgroups. The relationship between engagement in care and the intervention among those with PTSD and depression may suggest the utility of such workshops as a preventative strategy for patient drop-off within these populations. Research suggests the protective role of social support on HIV treatment adherence among people who meet the criteria for PTSD [18]. The UNITY intervention's effectiveness in maintaining engagement in care among people with PTSD and depression suggests the utility of the intervention in the "engaging and retaining care" step of the Cascade, which is crucial for achieving viral suppression and other positive HIV-related health outcomes.

The decrease in PTSD symptoms among those in the comparison group who were employed may also indicate the appropriateness of the workshops to those living with PTSD. While the intervention itself was not associated with any stigma reduction effect, a decrease in PTSD symptoms, which has been associated with lower perceptions of physical illness and negative health behaviors among people living with HIV [45], may suggest that group-based educational workshop models are particularly well-suited to those who meet the criteria for PTSD. The reduction in stigma among married women in the breast cancer education arm may also suggest the efficacy of workshop-style interventions among married women. Stigma reduction is associated with higher self-efficacy and care-seeking behaviors among people living with HIV, and so may provide opportunities for addressing engagement and retention in care within the Care Cascade.

Limitations

Our study had several limitations that are important to address for fully understanding the context of our results. First, we acknowledge the increased risk of chance findings (i.e., Type I error) when reporting the results of multiple (79) moderation analyses. Relatedly, the sensitivity analysis that was conducted to adjust for multiple testing yielded no statistically significant results. While we understand the possibility of generating statistically significant results by chance and the limitations of multiple testing, we emphasize the exploratory nature of the analysis and the importance of reporting all associations given the lack of research on moderators of stigma reduction interventions. With the dearth of research dedicated specifically to assessing the complex challenges faced by African American women in achieving effective HIV care, studies that provide insight into possible avenues for interventions are valuable, even when exploratory in nature.

Conclusion

The need for research to clarify and better understand variables that impact African American women's experiences with stigma and HIV is substantial. Our moderation analysis provides insight into the factors associated with the effectiveness of an intervention aimed at reducing HIV-related stigma and improving HIV health-related outcomes; the findings suggest opportunities to address drop-offs in HIV care and lay important groundwork for future research. Our findings show that workshop-style interventions can vary in effectiveness across different subgroups of individuals and reinforce the relevance and appropriateness of anti-stigma interventions that address

the intersectional experiences and adversities of the group for whom the intervention is designed. The results are a first step in understanding how to provide HIV care that prioritizes the experiences of African American women and recognizes the interactive effects of race, gender, class, and other variables that contribute to the systematic oppression that keeps some people from attaining the highest quality disease management [46]. Our hope is that our preliminary research unveils directions and priorities for further research that can more rigorously examine the complex linkages between clinical, psychosocial, and demographic variables that facilitate or hinder HIV care in this and other marginalized and under-researched communities. The moderating variables uncovered in our analysis provide an important foundation and impetus for further research.

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Compliance with Ethical Standards

Conflict of interest The authors report no conflict of interest.

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