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FAMILY PROCESS

ORIGINAL ARTICLE

Depressed mood and environmental mastery as potential pathways linking family relationship quality and disease self-management for African Americans with hypertension

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Abstract

African Americans are at significantly greater risk of hypertension and worse cardiovascular outcomes than other racialized groups, yet hypertension intervention effects remain limited. Thus, it is necessary to understand the potential mechanisms whereby interventions may be more effectively targeted to improve health. Supported by prior research evidence and guided by the Biobehavioral Family Model, this study examined associations between family relationship quality, psychological wellbeing, and self-management behaviors for African Americans with hypertension. Data were pooled from three Midlife Development in the U.S. projects, resulting in a sample of 317 African Americans (63.4% female, M_{age} = 53.32) with self-reported high blood pressure in the past 12 months. We tested four cross-sectional multiple mediator models, with depressed mood and environmental mastery mediating associations between family strain and exercise, smoking, problematic alcohol use, and stress-eating. Environmental mastery mediated the association between greater family strain and decreased odds of achieving recommended exercise levels; greater odds of reporting problematic alcohol use; and greater stress-eating. Though family strain was associated with depressed mood in each model, this variable did not serve as an indirect pathway to self-management behaviors. Family strain,

and the potential pathway identified via environmental mastery, may be a meaningful predictor of disease self-management for African Americans with hypertension. Longitudinal studies are needed to examine directionality and to support intervention trials for improving self-management and hypertension outcomes.

KEYWORDS
family relations, healthcare disparities, hypertension, minority health, psychological resilience, self-management

INTRODUCTION

African Americans are at significantly greater risk of being diagnosed with hypertension, and worse cardiovascular outcomes, than all other racial/ethnic groups (Shah et al., 2020). This health disparity has prompted many efforts to develop interventions that improve hypertension among African Americans, with a focus on improving self-management behavior (Fortuna et al., 2015; Ogedegbe et al., 2014). Though hypertension interventions for African Americans demonstrate improvements in lifestyle modifications, including diet and blood pressure monitoring (Fortuna et al., 2015; Lewis-Boyer et al., 2020; Ogedegbe et al., 2014), effect sizes remain limited and hypertension control among African Americans remains worse than among white patients (Diaz et al., 2021).

One explanation for the shortcomings of these behavioral health interventions is the primary focus on the individual patient with hypertension, failing to account for the impact of family relationships on disease self-management (Flynn et al., 2013; Yang et al., 2019). This gap persists despite repeated evidence supporting links between family relationship quality and individual patient behavior for African Americans (Warren-Findlow et al., 2013). In fact, family members substantially influence African American patients' hypertension self-management. Specifically, when family relationships are supportive, family members encourage lifestyle change (Flynn et al., 2013) and provide emotional and instrumental support for self-management (Woods et al., 2022; Yang et al., 2019). Conversely, conflictual family relationships are linked to greater cardiovascular risk for African Americans (Ford et al., 2019). Strained and unsatisfying family relationships can interfere with patient self-management (Fongwa et al., 2015) via increasing patients' stress, decreasing their emotion regulation, and decreasing a patient's focus on their own needs (Yang et al., 2019).

Though chronic stress is increasingly modeled as a contributor to high blood pressure, it is infrequently a target of interventions (Spruill et al., 2019). Moreover, family stress is rarely conceptualized as part of the chronic stress profile that contributes to hypertension (Cuevas et al., 2017). This limited focus on chronic stress is a significant gap for African American patients, given the documented contributions of discrimination-related stress to health disparities (Spruill et al., 2019), as well as newer research documenting family relationship quality as a link between discrimination and health for this population (Priest et al., 2020). However, the specific links between family stress and disease self-management for African Americans with hypertension remain unclear (Cuevas et al., 2017). Research exploring possible mechanisms of effect, linking family strain and patient self-management, is necessary to establish possible mutable areas to be targeted by future family-based interventions.

Theoretical orientation – The Biobehavioral Family Model plus environmental mastery

Few studies test specific mediation pathways linking social relationships and cardiovascular health (Chin & Cohen, 2020). Though research supports stressful family relationships impact health behavior (Roberson et al., 2018), evidence for *how* family stress may impact disease self-management is limited. This is particularly critical information for African Americans with hypertension – failing to understand the family stress-self-management pathway in sufficient detail prevents the development of interventions tailored for this at-risk population. Developing this knowledge has been limited by a lack of organizing, specified, multilevel systemic models. One such multilevel, systemic theoretical model that posits pathways by which family relationships impact health is the Biobehavioral Family Model (BBFM; Wood, 1993; Wood, 2018). Developed first to theorize stress pathways to pediatric asthma, the model has subsequently been expanded, and supported, for use in explaining the health of adult family members (Priest et al., 2019; Woods et al., 2014; Woods et al., 2020; Woods & Denton, 2014) including African Americans (Priest et al., 2020).

The BBFM posits that family relational process impacts physical health via psychobiological stress pathways, or, *biobehavioral reactivity* (Wood, 2018). Biobehavioral reactivity is "conceptualized as the degree or intensity with which an individual family member responds physiologically, emotionally, and behaviorally to stressors or emotional stimuli" (p. 3–4, Wood et al., 2021). Biobehavioral reactivity, as defined in the BBFM, is similar to emotion regulation/dysregulation, in that it reflects an individual family member's ability to regulate their response to stressful emotion, including behavioral and physiological responses experienced in the face of distress. As a result, biobehavioral reactivity is most often operationalized as disorders of emotion regulation or stress exacerbation, especially negative affect (i.e., hopelessness, loneliness, irritability, shame; Woods et al., 2020) and depression (Priest et al., 2019; Roberson et al., 2018; Wood, 2018; Woods & Denton, 2014). Depressed mood reflects emotion dysregulation, including psychological (e.g., sadness, guilt) and physiological (e.g., insomnia, psychomotor agitation) symptoms comprising biobehavioral reactivity in the face of chronic, prolonged stress. Specific to the current study, prior meta-analyses have supported depressive symptoms as a risk factor for hypertension, predicting a 42% increased risk of hypertension incidence (Meng et al., 2012). Proposed depression–hypertension links include metabolic dysregulation, inflammatory processes, and, relevant to the current study, self-management adherence (Cohen et al., 2015; Pennix et al., 2013).

In total, the BBFM posits that family relationships that are strained, conflictual, and critical (i.e., a negative family emotional climate) increase individual family member stress and contribute to worse biobehavioral reactivity. Greater biobehavioral reactivity contributes to disease activity via psychobiological pathways (i.e., neurophysiological stress responses) that wear and tear on the body. In other words, biobehavioral reactivity serves as the pivotal mechanism of effect in the model, whereby chronic family stress conveys negative effects on physical health via chronic stress experienced by individual family members. The BBFM also theorizes reciprocal pathways of effect among family functioning and individual wellbeing, whereby relational, emotional, and biological processes are considered mutually impactful (Wood, 1993; Wood, 2018). In other words, the BBFM posits how family relationship quality affects the etiology and potentiation of disease, but also suggests that worsening disease activity can increase individual and family stress.

Though similar theoretical frameworks have been proposed, linking the quality of close relationships to health behaviors and health outcomes for adults (Kiecolt-Glaser & Wilson, 2017; Pietromonaco et al., 2013; Slatcher & Schoebi, 2017), these models frequently emphasize the intimate/marital partnership. However, family relationships other

than intimate partnerships remain largely understudied, and merit greater attention given recent research findings supporting their importance for determining long-term health outcomes (Woods et al., 2020). Moreover, specific to African American health outcomes, prior research has outlined the contributions of non-marital family relationship quality to hypertension self-management and lifestyle change (Flynn et al., 2013; Thornton et al., 2019; Woods et al., 2022; Yang et al., 2019) which may align with African American cultural prioritizations of communal healing and family networks (Boykin et al., 1997; Chioneso et al., 2020).

In total, utilizing a theoretical model that specifically posts the effects of family relationship quality, defined more broadly than the quality of intimate/marital relationships, on health is critical for guiding tests of potential pathways to hypertension self-management for African Americans. The BBFM has been supported in laboratory-based tests, observational research, and longitudinal epidemiological studies (Wood et al., 2021) and is likely the most explicit and empirically supported biopsychosocial model of families and health (Woods, 2019). The model has specifically been supported for use in explaining African American health outcomes (Priest et al., 2020).

Environmental mastery – Expanding the BBFM

The BBFM is also an intentionally heuristic model, intended to invite adaptations that enhance its applicability to a particular physical disease or cultural context (Lim et al., 2022). In this study, we draw on a parallel line of research specific to psychosocial resilience, and its potential impact on cardiovascular health outcomes, to test an expansion of the BBFM. Positive psychological well-being is impactful for both biological and behavioral factors contributing to cardiovascular health (DuBois et al., 2015; Kubzansky et al., 2018), including hypertension (Trudel-Fitzgerald et al., 2014). Boehm and Kubzansky (2012) highlight the role of positive psychological well-being in promoting restorative, and minimizing deteriorative, processes impacting cardiovascular disease activity. Of particular interest is the construct of environmental mastery, which is a type of coping resource reflecting the variation in which a person perceives life experiences to be under their control versus outside of their influence, and how well they perceive they are managing their life situations (Ryff, 2014; Ryff, 2017). In other words, environmental mastery is defined as a person's ability to shape or shift their surrounding environments to meet their needs (Ryff, 2017). Ryff (2014) explains that a person high in environmental mastery feels competent in "managing the environment" and "makes effective use of surrounding opportunities," while a person low in environmental mastery may have difficulty managing daily life, and feels unable to change or improve their context (p. 12). Self-efficacy, a related construct, similarly reflects perceptions of control and a sense of competence to enact roles and behaviors; however, a person's sense that they are able to locate, adapt, or manipulate (i.e., act on) a surrounding context to meet their own needs is "unique to environmental mastery" (p. 23, Ryff & Singer, 2006).

Ryff (1989, 2017) outlines a theoretical model of eudaimonic well-being, global, psychological well-being that emphasizes meaning-making and self-realization, which posits six unique components, including *environmental mastery*. Prior tests of Ryff's eudaimonic well-being model demonstrate strong connections between environmental mastery and physical health outcomes (Ryff et al., 2015). Important for the current study, Radler et al. (2018) recently used a sample from the Midlife in the United States (MIDUS) study to demonstrate that adults with persistently high levels of environmental mastery have significantly higher levels of HDL cholesterol and lower levels of triglycerides, as compared to adults with persistently low levels of mastery. The authors suggest that mastery is a unique aspect of eudaimonic well-being that

may reflect a specific psychophysiological pathway to cardiovascular health. Additional research has tied limited environmental mastery to an increased risk of cardiovascular mortality (Surtees et al., 2006). Importantly, mastery is considered a modifiable factor, thus potentially an aspect of resilience that may be targeted in behavioral interventions (Radler et al., 2018). Thus, though each of the eudaimonic well-being components may be well-suited to exploring the impact of resilience on hypertension self-management, environmental mastery is a particularly strong contender for a pathway to management adherence.

Resilience and African Americans' cardiovascular health

Environmental mastery may be especially relevant to exploring African Americans' hypertension self-management. Prior research has highlighted that African American adults tend to have higher levels of environmental mastery compared to White counterparts (Kim et al., 2020). However, few studies have investigated resilience as a factor for cardiovascular health among African Americans, and even fewer have tested environmental mastery, specifically (Johnson & Magnani, 2020; Topel et al., 2019). One exception is a recent study by Kim et al. (2020) which determined higher levels of environmental mastery were linked to better cardiovascular health for African Americans. However, the authors state that evidence for *how* this aspect of psychosocial wellbeing contributes to cardiovascular health for African Americans is limited. In other words, testing environmental mastery as a possible mechanism of effect, linked to behavioral factors key to hypertension self-management, may be a significant addition to the literature, and inform future longitudinal studies and intervention development.

Psychological resilience is infrequently researched in explorations of cardiovascular health determinants among African Americans (Kim et al., 2020; Topel et al., 2019), and may prove an important intervention target (Labarthe et al., 2016). Further, tests of psychosocial wellbeing are important in broadening the literature's focus beyond the impacts of stress on African Americans' health. Thus, we used the BBFM to guide the development of the present hypotheses, and incorporated environmental mastery as an additional potential mediator in the model. Though recent summaries of the BBFM theoretical approach have suggested the expansion of the model to incorporate family members' resilience (Wood et al., 2021), to our knowledge, research studies have yet to test resiliency constructs as BBFM mediators.

Present study

Hypertension accounts for 50% of the racial disparities in mortality observed between African American and White adults (Musemwa & Gadegbeku, 2017). There continue to be gaps in being able to move the needle on hypertension self-management behaviors among this most at-risk group. Exploring psychosocial factors that may be associated with cardiovascular health risk for African Americans may identify possible areas to intervene and improve hypertension self-management, thereby contributing to a reduction in health disparities. Based on previous research and the BBFM (Wood, 1993; Wood, 2018), we designed a cross-sectional study of potential pathways by which a negative family emotional climate may impact hypertension self-management for African Americans. As stated above, the BBFM is a heuristic model, intended to invite adaptations to enhance its applicability (Wood et al., 2021). As such, we incorporated into our models an aspect of psychological resilience, and specifically test depressed mood and environmental mastery as potential links between negative family emotional climate (operationalized as family strain) and self-management behavior for African American adults with

hypertension. In total, we test four multiple mediator models (Figure 1) using cross-sectional national data, hypothesizing that:

1. Greater family strain will be associated with greater depressed mood, and decreased environmental mastery;
2. Greater depressed mood and decreased environmental mastery will each be associated with a decreased likelihood of aerobic exercise, greater likelihood of current smoking and problematic alcohol use, and greater stress-eating; and
3. Family strain will demonstrate nonsignificant direct associations with each self-management behavior, such that it will be significantly indirectly linked via depressed mood and environmental mastery.

METHOD

Sample

Data for the present study were from the Midlife Development in the United States (MIDUS), a national study of biopsychosocial pathways to aging currently in its third wave. Data collection for this project began in 1995–1996 with the original MIDUS sample of 7108 Americans aged 25–74 (Brim et al., 2018). MIDUS researchers initially used random-digit dialing to obtain a sample of English-speaking, noninstitutionalized American adults. The initial telephone interview was followed by a mailed self-administered questionnaire during the first MIDUS survey, as well as each subsequent MIDUS data collection. A follow-up survey of initial MIDUS participants, MIDUS 2, was conducted between 2004–2006, and a third wave of data collection (MIDUS 3) was completed in 2013–2014 (Ryff et al., 2017a). In addition, a MIDUS Refresher study was completed between 2011 and 2014, including an additional 3577 U.S. adults, a national probability sample aged 25–74 (Ryff et al., 2017b). The purpose of this Refresher project was to expand the MIDUS sample and strengthen cross-project analyses. The Refresher project used the same survey protocol and assessments as the main MIDUS project.

For this study, we pooled data from three distinct MIDUS studies, conducted at approximately the same time period (2011–2014) to derive the present sample of African American adults with hypertension. Our first subsample was culled from the MIDUS 3 project (Ryff et al., 2017a), and our second subsample included participants in the MIDUS Refresher core sample (Ryff et al., 2017b). Our third and final subsample included participants in the MIDUS Refresher Milwaukee survey (Ryff et al., 2018). Data from the MIDUS Refresher Milwaukee sample were collected in 2012–2013 ($N = 508$). This Milwaukee survey was conducted to replenish the original MIDUS 2 Milwaukee sample (surveyed in 2005–2006) with an additional probability sample of African Americans from Milwaukee County, Wisconsin, stratified by age, gender, and income. Broadly, the Milwaukee surveys of the MIDUS project were initiated to grow the number of racial minority participants.

For each of these datasets, we specifically used a subsample of African American adults who reported having experienced or having been treated for high blood pressure or hypertension in the past 12 months to test the present hypotheses. In total, the present sample includes 317 African American adults with hypertension (58 MIDUS 3 participants, 68 MIDUS Refresher core participants, and 191 MIDUS Refresher Milwaukee participants).

Measures

Each of the following measures are completed via the MIDUS projects' self-administered questionnaires. Descriptive statistics and inter-variable correlations are found in Table 1.

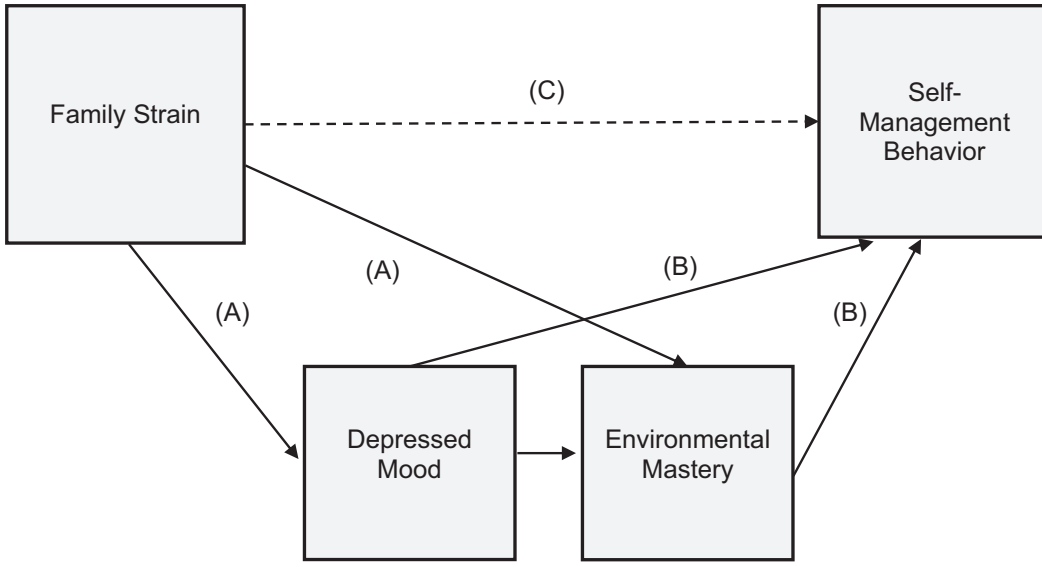

FIGURE 1 Biobehavioral Family Model theoretical orientation applied to hypertension self-management behaviors (operationalized as aerobic exercise, smoking, problematic alcohol use, and stress-eating). Hypothesis 1 is a test of (A) paths, Hypothesis 2 is a test of (B) paths, and Hypothesis 3 is a test of path (C), in four separate models (i.e., one model per self-management behavior)

Family strain

Negative family emotional climate was operationalized as family strain, included as the independent variable in each of the four models tested. We specifically selected a non-marital family strain measure given (a) the unique importance of family functioning for hypertension self-management among African Americans (Woods et al., 2022), and (b) the impact of family stress for hypertension outcomes (Cuevas et al., 2017). The family strain measure (Walen & Lachman, 2000) included by MIDUS researchers prompted respondents with the following: "Thinking about the members of your family, *not* including your spouse/partner…" and included four items, which asked participants how often family members "make too many demands on you," "criticize you," "let you down when you are counting on them," and, "get on your nerves?" Items were rated on a scale of 1 (*often*) to 4 (*never*); subsequently, each of the items was reverse coded. Scale scores were calculated using the mean of participants' responses; higher scores indicate greater family strain. MIDUS researchers employed mean imputation to accommodate missing data for this measure, and scale scores are calculated for participants who provide at least one item response (Ryff et al., 2017a). Reliability estimates for this scale ranged from $\alpha = 0.80$ (Milwaukee Refresher and MIDUS 3) to 0.81 (MIDUS Refresher).

Mediators

Two mediating variables representing biobehavioral reactivity and psychological resilience were included in each of the four models tested: depressed mood and environmental mastery.

Depressed mood

To measure depressed mood, we used a seven-item major depression assessment derived from the World Health Organization's (1990) Composite-International Diagnostic Interview-Short Form (CIDI-SF; Kessler et al., 1998). Participants were asked, "During the

TABLE 1 Participant reports of family strain, depressed mood, environmental mastery, and health behaviors: Correlations and descriptive statistics ($N = 317$)

Variables	1	2	3	4	5	6	7	8	9	10
1. Family strain	–									
2. Depressed mood	0.191**	–								
3. Environmental mastery	−0.273***	−0.345***	–							
4. Exercise	0.099	−0.057	0.146*	–						
5. Smoking	0.162*	0.158**	−0.186**	−0.045	–					
6. Problematic alcohol use	0.262***	0.200***	−0.272***	0.032	0.201***	–				
7. Stress-eating	0.084	0.139*	−0.293***	0.024	−0.017	0.130*	–			
8. Age	−0.254***	−0.128*	0.095	−0.128*	−0.141*	−0.110	−0.047	–		
9. Sex	0.009	0.026	0.026	0.051	−0.144*	−0.243***	0.086	0.685	–	
Discrimination	0.172**	0.054	−0.079	0.098	−0.036	0.127*	0.069	0.197***	−0.011	–
M	2.25	0.82	36.27	0.51	0.25	0.13	4.18	53.32	0.63	16.24
SD	0.72	2.12	7.49	0.50	0.43	0.33	2.08	11.40	0.48	6.39

Note: Exercise coded as 0 for *did not achieve recommended aerobic activity levels* and 1 for *achieved recommended aerobic activity levels*. Smoking coded as 0 for *not currently smoking cigarettes* and 1 for *smoking cigarettes regularly (at least a few every day)*. Problematic alcohol use coded as 0 for *no problematic alcohol use* and 1 for *problematic alcohol use*. Sex coded as 1 for *female* and 0 for *male*.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

past 12 months, was there ever a time when you felt sad, blue, or depressed, for two weeks or more in a row?" Participants who responded "yes" were then asked two questions assessing how much of the day participants felt this way, and for how many days of the 2 weeks. Participants who reported their depressed affect lasted most of the day or all day long, on almost every day or every day of the 2 weeks, were asked an additional seven depression questions. These seven items specifically assessed seven symptoms of depressed mood, including for example: "lose interest in most things?" and "have a lot more trouble concentrating than usual?" Participants were asked to respond to these seven items dichotomously: yes (1) or no (0), and scale scores were calculated via summing yes responses (Wang et al., 2000). The CIDI-SF major depression subscale score is continuous, ranging from 0 (*lowest depression*), which indicates a participant denied the occurrence of 2 weeks of depressed affect (or, acknowledged depressed affect to the initial prompt, but denied any additional symptoms), to 7 (*highest depression*). Scale scores are not diagnostic, in the short form, though higher scores indicate a greater probability of meeting criteria for Major Depressive Disorder, and prior research has supported scores of 3 or greater indicate a probable diagnosis of a major depressive episode (Nelson et al., 2001). Dichotomous responses to these items prevent assessing internal reliability with the current sample, though the measure is widely validated and supported (Walker & Druss, 2015). Solely 13.2% of the current sample scored above 3 on this measure, indicating probable depression.

Environmental mastery

Building upon the findings of Radler et al. (2018), we examined environmental mastery as an aspect of eudaimonic well-being associated with cardiovascular health. A seven-item measure of environmental mastery was used, including the following example items: "In general, I feel I am in charge of the situation in which I live," "I have difficulty arranging my life in a way that is satisfying to me," and, "I am quite good at managing the many responsibilities of my daily life" (Ryff, 1989; Ryff & Keyes, 1995). Items were rated on a scale of 1 (*strongly agree*) to 7 (*strongly disagree*). Three items were reverse coded, and scale scores were constructed using the sum of participant responses; higher scores reflect greater environmental mastery. For this measure, mean imputation was utilized by the MIDUS researchers to accommodate missing data; scale scores were calculated for participants who provided at least four item responses (Ryff et al., 2017a). Reliability for this scale ranges from $\alpha = 0.71$ (Milwaukee Refresher) to 0.80 (MIDUS 3 and MIDUS Refresher).

Self-management

The present study tested four self-management behaviors as dependent variables: exercise, smoking, alcohol use, and stress-eating. Each self-management behavior is specified by the American College of Cardiology/American Heart Association (ACC/AHA; Whelton et al., 2018) as critical for cardiovascular risk among persons with hypertension. We have coded each variable according to ACC/AHA specifications of best proven nonpharmacological interventions for addressing hypertension.

Exercise

Exercise was assessed as a measure of whether participants engaged in moderate or vigorous physical activity at least several times a week during summer and/or winter, either while at their paid job, while performing chores in and around their home, or during their leisure or free time. Moderate physical activity was defined by MIDUS researchers, and for participants, as "not physically exhausting, but causes your heart rate to increase slightly and you typically work up a sweat" (Ryff et al., 2017a). Examples provided included light tennis, slow or light swimming,

and brisk walking. Vigorous physical activity was defined as activity causing "your heart to beat so rapidly that you can feel it in your chest and you perform the activity long enough to work up a good sweat and are breathing heavily," such as running, digging in the garden, or lifting heavy objects. For both moderate and vigorous physical activity, frequency was assessed using six items, organized by area (i.e., paid job, chores, leisure time) and time of year (i.e., summer, winter). Participants responded using a scale of 1 (*several times a week*) to 6 (*never*).

For the present study, exercise was coded dichotomously, to align with ACC/AHA non-pharmacologic intervention recommendations, which specify that persons with hypertension should aim to achieve aerobic activity 5–7 days per week at moderate intensity (Whelton et al., 2018). Thus, participants in this study who participated in either moderate or vigorous physical activity, in any area (i.e., paid job, chores, and leisure time), at either time of year, at a frequency of several times per week, were coded as "1" (*achieved recommended aerobic activity levels*), while participants who reported no moderate or vigorous physical activity at any time, or moderate/vigorous physical activity that occurred once per week or less frequently, were coded as "0" (*did not achieve recommended aerobic activity levels*).

Smoking

Smoking greatly exacerbates the risk of hypertension severity and worse cardiovascular outcomes. The ACC/AHA (Whelton et al., 2018) specifies cigarette smoking as a critical modifiable risk factor, and tobacco cessation as crucial for reducing cardiovascular risk. Thus, we coded participants dichotomously, as either "1," positive for smoking cigarettes regularly now (defined as "at least a few cigarettes every day"), or "0," not currently smoking cigarettes.

Problematic alcohol use

The ACC/AHA (Whelton et al., 2018) guidelines for hypertension state that alcohol can cause elevated blood pressure, and list moderation in alcohol intake as a best proven nonpharmacologic intervention for hypertension treatment. Specifically, for adults who consume alcohol, the ACC/AHA guidelines recommend 2 or fewer drinks daily for men, and less than or equal to 1 drink daily for women. Therefore, we included problematic alcohol use as a dependent variable, using a five-item measure assessing alcohol-related problems in the past 12 months, modified from the Michigan Alcohol Screening Test (Selzer, 1971) and validated by MIDUS investigators (Grzywacz & Marks, 1999). Items were prompted by, "During the past 12 months, did you have any of the following problems while drinking or because of drinking alcohol?" Sample items include, "Did you have such a strong desire or urge to use alcohol that you could not resist it or could not think of anything else?" and "Did you find that you had to use more alcohol than usual to get the same effect or that the same amount had less effect on you than before?" Participants who responded "yes" to any of the five items were coded as "1" (*problematic alcohol use*), while those who responded "no" to all four items were coded as "0" (*no problematic alcohol use*).

Stress-eating

The fourth self-management behavior we used in modeling included stress-eating, given the important impact of a healthy, intentional diet for treating hypertension (Whelton et al., 2018). Stress-eating was assessed using two items, prompted for participants by the phrase, "We are interested in what you generally do and feel when you experience stressful situations" (Carver et al., 1989; Kling et al., 1997). Items specifically asked, "I eat more than I usually do," and "I eat more of my favorite foods to make myself feel better," which participants rated on a scale of 1 (*a lot*) to 4 (*not at all*). The scale score was constructed as a sum of participant responses, which were first reverse coded such that higher scores reflect greater stress-eating. MIDUS researchers calculated this scale score for respondents who answered at least one of the two items. Reliability for this measure ranges from $\alpha = 0.83$ (Milwaukee Refresher) to 0.89 (MIDUS 3) and 0.90 (MIDUS Refresher).

Control variables

Given the impact of discrimination on health behaviors and outcomes for African Americans (Priest et al., 2020), we account for the impact of daily discrimination experienced by participants in each model. Additionally, we controlled for age, income, and sex (coded as "1" for *female* and "0" for *male*), given links between these characteristics and hypertension outcomes (Whelton et al., 2018).

Discrimination

A continuous measure of daily discrimination (Williams et al., 1997) was included as a control variable in each of the four models tested. This measure includes nine items aggregating the frequency of daily occurrences of nine types of discrimination, asking, to start, "How often on a day-to-day basis do you experience each of the following types of discrimination?" Examples of discrimination included, "You are treated with less courtesy than other people," and "You are threatened or harassed." Items were rated on a scale of 1 (*often*) to 4 (*never*), and responses were reverse coded such that higher scale scores (calculated using a sum of item responses) indicate greater daily discrimination. Scale scores were computed for participants that responded to at least five of the nine items; missing responses were imputed by MIDUS researchers using the mean value of completed items (Ryff et al., 2017a). Reliability estimates for the present subsamples ranges from $\alpha = 0.87$ (Milwaukee Refresher) to 0.91 (MIDUS 3) and 0.92 (MIDUS Refresher).

Analyses

Preliminary analyses

Given the disparate sample size in each subsample, as well as unique recruitment strategies for the MIDUS core samples (MIDUS 3 and MIDUS Refresher) versus the MIDUS Refresher Milwaukee sample, we first utilized analyses of variance to test between group differences in family strain, environmental mastery, depressed mood, and stress-eating (i.e., each continuous variable). Second, χ^2 was used to test subsample differences in each of the dichotomous dependent variables.

Hypothesis testing

The present hypotheses reflect a multiple mediator model. Specifically, we analyzed across four distinct models whether family strain was indirectly related to specific self-management behaviors considered especially relevant to persons with hypertension, via depressed mood and environmental mastery. We simultaneously estimated the direct association of family strain with each self-management behavior, as well as the indirect effect through each mediator individually, as well as the full indirect effect via both mediating variables. This allows us to estimate individual parameters shown in Figure 1, as well as our hypothesized mediation pathways, while also controlling for age, sex, income, and discrimination.

Each model's pathways were tested in SPSS (Version 26.0; IBM Corp, 2019) using the PROCESS macro (Hayes, 2013). The PROCESS macro estimates unstandardized regression coefficients, standard errors, *p*-values, and 95% confidence intervals, and uses maximum likelihood logistic regression for our three dichotomous dependent variables (Models 1–3), and maximum likelihood to estimate associations with stress-eating (Model 4). Logistic regression coefficients for Models 1 through 3 use a log-odds metric. PROCESS also uses listwise deletion

to accommodate missing data (Hayes, 2013), and we utilized bootstrapping ($n = 5000$ resamples) to estimate each model, presenting bias-corrected-and-accelerated confidence intervals. Model fit statistics, as well as individual parameter estimates for total, direct, and indirect effects, are presented. Finally, we converted all coefficients to effect sizes for ease of interpretation (Cohen's *d* for linear regression; odds ratios for the dichotomous dependent variables of Models 1–3).

Post-hoc analyses

As the present data are cross-sectional, it is plausible the pathways we have hypothesized may operate in the reverse, as well (i.e., self-management → biobehavioral reactivity → negative family emotional climate). As such, we tested each model a second time via path analyses in MPlus (Version 8; Muthén & Muthén, 2017) using a maximum likelihood estimator with robust standard errors to accommodate missing data. Finally, we tested each model in reverse, entering our self-management dependent variables as exogenous predictors, and family strain as the endogenous variable, in order to compare model fit statistics. Model fit statistics are presented for each: we use Akaike's Information Criteria (AIC) and Bayesian Information Criteria (BIC) to compare models including dichotomous self-management variables (Models 1–3), and χ^2, root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) to compare our stress-eating model results. Lower AIC and BIC values indicate improved model fit. Optimized model fit for Model 4 will be demonstrated via lower χ^2 (despite same sample size), RMSEA (<0.10), and SRMR (≤0.05).

RESULTS

Sample demographics

The sample of 317 African American MIDUS participants with hypertension was 63.4% female ($n = 201$), with an average age of 53.32 years (SD = 11.40, median = 53.00) and average total household income (including wage, pension, social security, and other sources) of $48,678.81 (SD = $56,446.57, median = $30,125.00). Of these, 304 participants confirmed a physician had previously diagnosed them with high blood pressure, an average of 9.65 years prior (SD = 8.85). As a result, 92.4% of the full subsample reported having taken high blood pressure medication in the past, and 84.9% reported that they currently take medication.

Additionally, almost all (99.1%; $n = 314$) of the participants reported completing a blood pressure test in the prior year; the majority (54.9%; $n = 174$) had a test <1-month prior. At that reading, 39.4% of participants ($n = 125$) self-reported that their numbers indicated slightly raised or high blood pressure, with an average systolic blood pressure of 137.14 (SD = 23.09; $n = 194$ reporting) and diastolic blood pressure of 81.57 (SD = 16.20; $n = 180$ reporting). Of participants reporting exact blood pressure readings, most can be classified as elevated blood pressure or hypertension ($n = 166$ elevated/hypertensive systolic pressure of 120 or greater; $n = 107$ hypertensive diastolic pressure of 80 or greater) per current American Heart Association guidelines (Whelton et al., 2018).

Missing data

Though the PROCESS macro utilizes listwise deletion for accommodating missing data (Hayes, 2013), we sought to assess missingness patterns specific to participants who provided

telephone interview data (e.g., reports of current smoking) but did not provide self-administered questionnaire data (e.g., including the family strain measure). Participants missing responses on the self-administered questionnaire did not differ in income ($F = 0.28$, $p = 0.596$) or sex ($\chi^2 = 2.82$, $p = 0.114$) compared to participants with full survey completion. However, missing data was significantly associated with age (i.e., those missing data were significantly younger; $F = 21.91$, $p < 0.001$) and MIDUS subsample (core versus Milwaukee; $\chi^2 = 54.99$, $p < 0.001$). There was 100% self-administered questionnaire completion for MIDUS core (i.e., MIDUS 3 and MIDUS Refresher) participants. In other words, each of our participants missing self-administered questionnaire data derived from the MIDUS Refresher Milwaukee sample ($n = 66$; $\chi^2 = 50.61$, $p < 0.001$). Thus, data are missing at random, and we include participants' MIDUS dataset (0 = *core* or 1 = *Milwaukee*) as a control variable in each model test to account for parameter estimate bias caused by missingness.

Preliminary analyses

Inter-variable correlations do not demonstrate multicollinearity concerns (Table 1). That is, the strongest correlation occurred between depressed mood and environmental mastery, and the size of the association remained moderate ($r = -0.345$, $p < 0.001$). The remaining significant correlations indicated small-to-moderate effects (all remaining correlations were <0.30).

Tests of group differences between subsamples in family strain, environmental mastery, depressed mood, and stress-eating (i.e., each continuous variable) demonstrated significant differences in family strain ($F = 8.64$, $p < 0.001$) and stress-eating ($F = 5.06$, $p < 0.01$). Depressed mood ($F = 1.57$, $p > 0.05$) and environmental mastery ($F = 2.91$, $p > 0.05$) did not significantly differ between participant subsamples (Table S1).

Tests of group differences between subsamples in smoking ($\chi^2 = 15.30$, $p < 0.001$) and problematic alcohol use ($\chi^2 = 8.02$, $p = 0.018$) demonstrated significant differences in reports of these behaivors, as well. Participants in the Milwaukee subsample were more likely to report engaging in both smoking and problematic alcohol use. Reports of exercise did not significantly differ between participant subsamples ($\chi^2 = 4.68$, $p = 0.097$).

As described above, we include participants' MIDUS dataset (0 = *core* or 1 = *Milwaukee*) as a control variable in each model test to account for estimate bias related to MIDUS subsample.

Hypothesis testing

Exercise

Model 1 tested the multiple mediatior model for Exercise. The full model likelihood ratio was 22.96 ($p < 0.01$, Nagelkerke $R^2 = 0.128$, Cox Snell = 0.096), indicating a good fit to the data. Greater family strain was associated with greater depressed mood, as well as lower environmental mastery; greater depressed mood was also significantly associated with lower environmental mastery (Table 2). Environmental mastery was associated with a 5% greater likelihood of achieving recommended aerobic activity levels; depression was not linked to achieving aerobic activity levels. Tests of indirect effects demonstrate a significant indirect effect of family strain linked to exercise via environmental mastery for this sample (Table 3). Specifically, greater family strain is associated with an 8% decreased odds of achieving aerobic activity levels by potentially lowering one's capacity to feel mastery over their environment. Though there was a significant indirect effect via depression plus environmental mastery, as well, the

upper limit of the confidence interval neared zero and the effect was weaker than the mediation via mastery alone.

Smoking

Model 2 tested the associations between family strain and the likelihood of currently smoking regularly, via the same mediating pathways as Model 1. The full model likelihood ratio equaled 21.70 ($p < 0.01$, Nagelkerke $R^2 = 0.138$, Cox-Snell = 0.090), indicating the model fit the data well. Greater family strain was significantly associated with greater depressed mood, as well as decreased environmental mastery (Table 4). Contrary to our hypotheses, family strain was not associated directly nor indirectly (via depressed mood or environmental mastery) with the likelihood of smoking for this sample of African Americans with hypertension (Table 3).

Problematic alcohol use

Model 3 tested problematic alcohol use as the dependent variable. The full model likelihood ratio for Model 3 was 47.90 ($p < 0.001$, Nagelkerke $R^2 = 0.388$, Cox-Snell = 0.190), indicating this model fit the data well. Greater family strain was significantly associated with greater depressed mood as well as decreased environmental mastery (Table 5). Greater environmental mastery was associated with a decreased likelihood of problematic alcohol use. Neither family strain nor depressed mood were significantly associated with alcohol use. Tests of indirect effects demonstrated a significant mediation effect linking family strain to problematic alcohol use via both depressed mood and environmental mastery, as well as solely via environmental mastery (with a stronger indirect effect for the latter single mediator model; Table 3). Specifically, greater family strain was associated with a 20% greater likelihood of reporting problematic drinking via lower environmental mastery.

Stress-eating

The model fit statistics for stress-eating indicated Model 4 was a fit to the data ($F = 4.86$, $p < 0.001$, $R^2 = 0.152$). Again, greater family strain was significantly associated with greater depressed mood, as well as lower environmental mastery. Similar to Model 1, solely environmental mastery was significantly associated with stress-eating, demonstrating a negative association whereby greater mastery was associated with less stress-eating (Table 6). Tests of indirect effects suggest a mediation effect whereby family strain is associated with stress-eating via environmental mastery (Table 3). The association between greater family strain and greater stress-eating has a small effect size (Cohen's $d = 0.138$), linked in this sample by the possible impact of family strain on lowering one's feeling of having mastery of their environment. Though confidence intervals also demonstrate a significant indirect effect of family strain → depressed mood → environmental mastery → stress-eating, the effect was weak, and the lower limit of the confidence interval neared zero.

Post-hoc analyses

Path analyses for Model 1 (exercise) indicate a good fit to the data (AIC = 2844.85, BIC = 2899.86); testing the model in reverse (exercise → family strain) worsened model fit

TABLE 2 Unstandardized regression coefficients, effect size (Cohen's *d* for continuous outcomes; odds ratios for dichotomous outcomes), standard errors, and confidence intervals of family strain, environmental mastery, and depressed mood on exercise, Model 1 ($N = 228$)

Parameter estimate	Coeff.	Cohen's *d*/OR	SE	95% CI	*p*
Family strain → depression	**0.512**	**0.16**	**0.209**	**0.099, 0.924**	**0.015**
Family strain → environmental mastery	**−1.744**	**0.17**	**0.692**	**−3.108, −0.380**	**0.012**
Depression → environmental mastery	**−1.022**	**0.30**	**0.220**	**−1.455, −0.589**	**0.000**
Family strain → exercise	0.136	1.145	0.218	−291, 0.563	0.533
Depression → exercise	−0.007	0.993	0.072	−0.148, 0.133	0.922
Environmental mastery → exercise	**0.046**	**1.047**	**0.021**	**0.004, 0.088**	**0.031**
Age → exercise	−0.008	0.992	0.015	−0.037, 0.021	0.582
Sex → exercise	0.304	1.355	0.298	−0.280, 0.888	0.308
Discrimination → exercise	**0.074**	**1.077**	**0.026**	**0.023, 0.125**	**0.004**
Dataset → exercise	**0.937**	**2.551**	**0.370**	**0.211, 1.662**	**0.011**
Income → exercise	0.004	1.004	0.003	−0.001, 0.010	0.113

Note: Controls are age, sex, discrimination, income, and dataset (associations with family strain, depression, and environmental mastery omitted from the table). Sex coded as 1 for *female* and 0 for *male*. Dataset coded as 0 for *MIDUS core* (i.e., MIDUS 3 and MIDUS Refresher) and 1 for *Milwaukee Refresher*.

Significant coefficients indicated in bold.

Abbreviations: 95% CI, bias-corrected confidence interval; Coeff., unstandardized regression coefficient; OR, odds ratio.

(AIC = 3091.24, BIC = 3150.13) and the indirect effect via environmental mastery was nonsignificant ($\beta = -0.019$, $p = 0.12$). Similarly, path analyses for Model 2 (smoking) indicate good fit to the data (AIC = 2774.09, BIC = 2829.10) made worse when we tested the model in reverse (AIC = 3365.84, BIC = 3428.81). As with our initial model-testing, above, neither path analysis approach demonstrated a significant indirect effect: family strain was not directly, nor indirectly, associated with the likelihood of smoking for this sample.

Path analysis results for Model 3 (problematic alcohol use) demonstrated a good fit of our hypothesized model to the data (AIC = 2655.09, BIC = 2710.10). Fit was worsened when testing the model in reverse (alcohol use → family strain; AIC = 3325.30, BIC = 3388.15) and the indirect effects via both depression ($\beta = 0.014$, $p = 0.39$) and environmental mastery ($\beta = 0.032$, $p = 0.065$) were nonsignificant. Last, path analysis results for Model 4 (stress-eating) demonstrated good model fit ($\chi^2 = 20.44$, $p = 0.03$; RMSEA = 0.067; SRMR = 0.058). Testing Model 4 in reverse (stress-eating → family strain) resulted in a model with poor fit ($\chi^2 = 34.10$, $p < 0.000$; RMSEA = 0.102; SRMR = 0.081) and the indirect association via environmental mastery was nonsignificant ($\beta = 0.012$, $p = 0.07$).

DISCUSSION

Behavioral interventions for hypertension self-management have resulted in mixed effects for African Americans (Fortuna et al., 2015; Ogedegbe et al., 2014). One implication is the need to better understand psychosocial variables associated with self-management behaviors that may be specifically targeted by future interventions, especially the potential impact of patients' closest relationships (Flynn et al., 2013; Woods et al., 2022). The results of this study revealed a pattern that partially supports our hypothesized pathways, guided by an expanded BBFM. Most importantly, environmental mastery, a resilience construct we incorporated in the present models, stands out as a potential mediator linking family relationship quality and hypertension self-management.

TABLE 3 Indirect effects of family strain on health behaviors via depressed mood and environmental mastery

	Point estimate	SE	95% CI
Exercise			
Via depressed mood	−0.004	0.045	−0.108, 0.082
Via environmental mastery	**−0.080**	**0.052**	**−0.224, −0.008**
Depressed mood → environmental mastery[a]	**−0.024**	**0.018**	**−0.077, −0.001**
Via total indirect	−0.108	0.069	−276, 0.000
Smoking			
Via depressed mood	0.057	0.058	−0.011, 0.226
Via environmental mastery	0.057	0.058	−0.023, 0.209
Depressed mood → environmental mastery[a]	0.017	0.019	−0.005, 0.076
Via total indirect	**0.131**	**0.078**	**0.010, 0.312**
Problematic alcohol use			
Via depressed mood	0.106	0.087	−0.014, 0.347
Via environmental mastery	**0.185**	**0.109**	**0.023, 0.436**
Depressed mood → environmental mastery[a]	**0.055**	**0.041**	**0.006, 0.170**
Via total indirect	**0.346**	**0.142**	**0.122, 0.652**
Stress-eating			
Via depressed mood	0.011	0.038	−0.058, 0.098
Via environmental mastery	**0.132**	**0.064**	**0.030, 0.283**
Depressed mood → environmental mastery[a]	**0.040**	**0.026**	**0.006, 0.112**
Via total indirect	**0.184**	**0.074**	**0.059, 0.355**

Note: Controls are age, sex, discrimination, income, and dataset.

Significant coefficients indicated in bold.

Abbreviation: 95% CI, bias-corrected confidence interval.

[a]Depressed mood → environmental mastery = serial mediation, testing family strain's indirect effect on a health behavior via depressed mood then environmental mastery.

Specifically, environmental mastery significantly mediated the association between family strain and a decreased likelihood of achieving recommended levels of aerobic exercise, a greater likelihood of problematic alcohol use (but not smoking), and increased stress-eating. In total, these findings suggest a possible pathway by which a negative family emotional climate (i.e., family strain) may compromise the sense of environmental mastery and control that African Americans with hypertension experience, thereby potentially inhibiting the practice of health behavior targets critical for disease self-management. In contrast, participants reporting a greater sense of mastery over their environments were significantly more likely to report achieving self-management goals, thereby pointing to a possible protective mechanism important for intervention aims. In other words, among African Americans with hypertension who report stressful and chaotic family relationships, it may be that utilizing family-based interventions to decrease family strain could potentially bolster adherence to hypertension self-management behaviors via improving the sense of control that patients have, and their perceptions that they are capable of creating change in their immediate context.

Indeed, recent research has demonstrated the effects of a family-based dyadic partnership program on improving relationship quality, hypertension patients' self-care, as well as their self-efficacy via learned dyadic communication skills, mutual decision-making, increased support, and gratitude (Zeng et al., 2021). Boulware et al. (2020) recently tested a hypertension self-management intervention for disadvantaged African Americans that was designed, in part, using family member feedback about the role of family in treatment adherence. The

TABLE 4 Unstandardized regression coefficients, effect sizes (Cohen's *d* for continuous outcomes; odds ratios for dichotomous outcomes), standard errors, and confidence intervals of family strain, environmental mastery, and depressed mood on smoking, Model 2 ($N = 229$)

Parameter estimate	Coeff.	Cohen's *d*/OR	SE	95% CI	*p*
Family strain → depression	**0.514**	**0.16**	**0.208**	**0.104, 0.925**	**0.014**
Family strain → environmental mastery	**−1.765**	**0.17**	**0.689**	**−3.123, −0.406**	**0.011**
Depression → environmental mastery	**−1.023**	**0.31**	**0.219**	**−1.455, −0.591**	**0.000**
Family strain → smoking	0.164	1.179	0.256	−0.338, 0.666	0.521
Depression → smoking	0.106	1.112	0.075	−0.041, 0.254	0.158
Environmental mastery → smoking	−0.025	0.978	0.024	−0.072, 0.023	0.313
Age → smoking	−0.020	0.820	0.018	−0.055, 0.015	0.267
Sex → smoking	−0.417	0.659	0.349	−1.100, 0.267	0.232
Discrimination → smoking	0.008	1.008	0.029	−0.049, 0.064	0.787
Dataset → smoking	0.678	1.970	0.428	−0.161, 1.517	0.113
Income → smoking	−0.004	0.997	0.004	−0.011, 0.004	0.353

Note: Controls are age, sex, discrimination, income, and dataset (associations with family strain, depression, and environmental mastery omitted from the table). Sex coded as 1 for *female* and 0 for *male*. Dataset coded as 0 for *MIDUS core* (i.e., MIDUS 3 and MIDUS Refresher) and 1 for *Milwaukee Refresher*.

Significant coefficients indicated in bold.

Abbreviations: 95% CI, bias-corrected confidence interval; Coeff., unstandardized regression coefficient; OR, odds ratio.

TABLE 5 Unstandardized regression coefficients, effect sizes (Cohen's *d* for continuous outcomes; odds ratios for dichotomous outcomes), standard errors, and confidence intervals of family strain, environmental mastery, and depressed mood on problematic alcohol use, Model 3 ($N = 227$)

Parameter estimate	Coeff.	Cohen's *d*/ OR	SE	95% CI	*p*
Family strain → depression	**0.526**	**0.17**	**0.209**	**0.115, 0.937**	**0.012**
Family strain → environmental mastery	**−1.776**	**0.17**	**0.692**	**−3.140, −0.412**	**0.011**
Depression → environmental mastery	**−1.009**	**0.30**	**0.221**	**−1.444, −0.575**	**0.000**
Family strain → alcohol use	0.442	1.556	0.379	−0.302, 1.186	0.244
Depression → alcohol use	0.202	1.224	0.104	−0.002, 0.405	0.052
Environmental mastery → alcohol use	**−0.104**	**0.901**	**0.043**	**−0.187, −0.021**	**0.015**
Age → alcohol use	0.020	1.020	0.031	−0.041, 081	0.518
Sex → alcohol use	**−1.405**	**0.245**	**0.533**	**−2.450, −0.361**	**0.008**
Discrimination → alcohol use	**0.092**	**1.096**	**0.041**	**0.011, 0.172**	**0.025**
Dataset → alcohol use	**1.453**	**4.278**	**0.673**	**0.134, 2.773**	**0.031**
Income → alcohol use	0.001	1.001	0.006	−0.010, 0.012	0.867

Note: Controls are age, sex, discrimination, income, and dataset (associations with family strain, depression, and environmental mastery omitted from the table). Sex coded as 1 for *female* and 0 for *male*. Dataset coded as 0 for *MIDUS core* (i.e., MIDUS 3 and MIDUS Refresher) and 1 for *Milwaukee Refresher*.

Significant coefficients indicated in bold.

Abbreviations: 95% CI, bias-corrected confidence interval; Coeff., unstandardized regression coefficient; OR, odds ratio.

intervention (though not family-based) targeted patients' social contexts, as well as their sense of confidence in enacting hypertension self-management behaviors, resulting in blood pressure improvements over 12 months. Feelings of competence among people with hypertension,

TABLE 6 Unstandardized regression coefficients, standard errors, effect sizes, and confidence intervals of family strain, environmental mastery, and depressed mood on stress-eating, Model 4 ($N = 226$)

Parameter estimate	Coeff.	Cohen's *d*	SE	95% CI	*p*
Family strain → depression	**0.513**	**0.16**	**0.210**	**0.100, 0.926**	**0.015**
Family strain → environmental mastery	**−1.725**	**0.17**	**0.691**	**−3.087, −0.364**	**0.013**
Depression → environmental mastery	**−1.017**	**0.31**	**0.220**	**−1.450, −0.584**	**0.000**
Family strain → stress-eating	0.125	0.04	0.198	−0.266, 0.516	0.528
Depression → stress-eating	0.022	0.02	0.065	−0.106, 0.151	0.735
Environmental mastery → stress-eating	**−0.077**	**0.27**	**0.019**	**−0.115, −0.039**	**0.000**
Age → stress-eating	**−0.027**	**0.13**	**0.014**	**−0.054, −0.0003**	**0.047**
Sex → stress-eating	0.378	0.09	0.273	−0.160, 0.916	0.168
Discrimination → stress-eating	−0.004	0.01	0.023	−0.049, 0.040	0.844
Dataset → stress-eating	**−1.212**	**0.24**	**0.328**	**−1.859, −0.565**	**0.000**
Income → stress-eating	−0.003	0.07	0.003	−0.008, 0.002	0.243

Note: Controls are age, sex, discrimination, income, and dataset (associations with family strain, depression, and environmental mastery omitted from the table). Sex coded as 1 for *female* and 0 for *male*. Dataset coded as 0 for *MIDUS core* (i.e., MIDUS 3 and MIDUS Refresher) and 1 for *Milwaukee Refresher*.

Significant coefficients indicated in bold.

Abbreviations: 95% CI, bias-corrected confidence interval; Coeff., unstandardized regression coefficient; OR, odds ratio.

and their sense that they can enact change, is a powerful tool for self-management. Helping to develop this confidence and mastery by directly improving patients' close family relationships may be an especially valuable approach for African Americans, given the unique role of family support for health concerns in the African American community (Flynn et al., 2013; Warren-Findlow & Prohaska, 2008; Woods et al., 2022). Lastly, family-based interventions may particularly benefit from a culturally-responsive medical family therapy approach, given the emphasis on enhancing *agency* and *communion* in order to improve adaptation to illness (McDaniel et al., 1992) – two constructs with likely overlap to environmental mastery and family emotional climate, respectively.

In addition, the BBFM, in its fundamental conceptualization, posits mutual, reciprocal effects, whereby families impact health, and individual family members' health also impacts family functioning. Given this, and that our data are cross-sectional, it is important to consider potential alternate interpretations for the present findings (as have other recent studies using the BBFM; Lim et al., 2022). For example, one possibility is that African Americans who have hypertension and manage the condition well – i.e., they exercise as recommended, avoid problematic alcohol use, or avoid overeating—may have fewer health-related negative impacts on their sense of resilience and the quality of their close family relationships. Disease self-management can also be stressful—for patients, as well as their families (Moss et al., 2019). It may be that, in the context of hypertension (and the many lifestyle changes that accompany a diagnosis), family relationships become stressed while working to maintain and support self-management, and that the stress of chronic illness worsens individual family member psychological wellbeing (Yang et al., 2019). Though the results of our post-hoc analyses provide additional support for the present models, future tests of this adapted BBFM using longitudinal data are crucial to examine directionality.

Overall, specific aspects of resiience may be relevant for unique physiological processes (Radler et al., 2018). The results of the present study may highlight environmental mastery as a component of eudaimonic well-being that is particularly relevant for self-management behaviors among African Americans with hypertension. This study represents an advance over prior research that has used composite scores of resilience (Johnson & Magnani, 2020), in that we specified

environmental mastery as a possible positive pathway to health. Moreover, the addition of mastery into the BBFM suggests a potential mechanism of effect in the model that is worthwhile of future study. Of note, the BBFM's construct of family emotional climate allows for theorizing the role of supportive family processes and provides an advantage over alternate family health models due to its consideration of both positive and negative family relationship quality (Wood, 2018). Thus, incorporating considerations of family-level resilience (Patterson, 2002) in future tests of the BBFM with African Americans facing chronic illness will be an important next step.

Hypertension outcomes are highly dependent on self-care and active disease management (Whelton et al., 2018), especially for African Americans who experience the disease at disproportionate rates and with worse outcomes than other groups (Shah et al., 2020). However, we do not test an aspect of individual family members' resilience to suggest a replacement for initiatives to engage community partners in addressing health disparities, or as an area to intervene without first considering social justice-informed efforts to address racism-based trauma. Indeed, though in the present study we position participants' experiences of discrimination as a control variable, in order to test the present pathways while accounting for the well-established effects of discrimination on health, we acknowledge that prior research has suggested discrimination may also serve as an exogenous variable in the BBFM. Priest et al. (2020) found that discrimination was associated with negative impacts on family relationship quality for African Americans, serving as a potential kickstart for stress pathways to disease activity. Thus, family-based interventions to improve family conflict and promote environmental mastery should occur with a truly multisystemic lens, acknowledging the impacts of systemic racism and increasing healthcare accessibility, for example. Indeed, behavioral interventions for hypertension in African American samples that solely target positive psychological wellbeing and resilience are unlikely to demonstrate meaningful impacts (Boutin-Foster et al., 2016). Dyadic qualitative research has highlighted that African Americans with hypertension, and their family members, simultaneously give voice to the need to acknowledge the impact of racism-related stress on their health, as well as to actively engage family members in bolstering family support to improve patient stress as part of disease self-management interventions (Woods et al., 2022). Recent research has also supported the health benefits of family-based interventions for African Americans that directly promote resilience and buffer relationship quality from the impacts of contextual stressors, including racism (Barton et al., 2021). Intervention development in this area should be guided by empirically-supported, systemic, multilevel models, such as the BBFM, in order to maximize intervention effectiveness for this most at-risk group.

Limitations and future research

This study advances the existing literature via exploring specific psychosocial mechanisms linked to self-management behaviors that are critically important for African Americans with hypertension. However, this study is not without limitations. First, the data from this study are self-reported, and as such, sample selection was limited to participants reporting a hypertension diagnosis that may not be medically accurate. Related, the present subsamples have yet to be followed in subsequent MIDUS projects. Thus, these data are cross-sectional and do not reflect risk trajectories. Though the BBFM theorizes reciprocal pathways by which families affect health and vice versa, we are primarily interested in, from the perspective of informing future family-based intervention development, the pathways by which family stress may affect self-management for this population. Thus, we hypothesized the present directionality, but were unable to test causality. Further, though each of the psychosocial variables we have included in this study (family strain, depressed mood, and environmental mastery) is amenable to change, and potentially important for

reducing hypertension morbidities among African Americans, the present effects were small, and may be further affected by structural inequities not assessed in this study. In total, longitudinal research is an indicated next step to confirm the present pathways, delineate directionality, and to test possible reciprocal pathways and the contributions of structural barriers to hypertension self-management over time.

Additionally, while we test a measure of non-marital family relationship quality, we do not know the types of relationships referenced by participants (e.g., siblings, parents, children, etc.) nor their level of involvement in helping with participants' actual health needs. Recent research suggests important differences in family assessment results specific to whom respondents consider when completing these measures (Priest et al., 2018). Thus, future investigations of the impacts of close family relationships on African Americans' hypertension may benefit by specifying the family member and type of family relationship that each participant considers to be most relevant for their health.

CONCLUSION

The present study highlights a potential mediation pathway linking family strain to specific self-management behaviors via environmental mastery for African Americans with hypertension. Importantly, these two factors may reflect individual- and family-level factors amenable to intervention for a population at high risk of cardiovascular disease and hypertension-related mortality. Further, psychological resilience may be a valuable area of theoretical expansion for the BBFM. An indicated next step is to evaluate the longitudinal impacts of family relationships and resilience on disease self-management for this population. Family-based intervention research guided by theory-driven, empirically supported modeling may help to move the needle on self-management intervention effectiveness, and hypertension control, for African Americans.

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