MINORITY STRESS, SELF-REGULATION, AND EXECUTIVE FUNCTION: AN EXPERIMENTAL INVESTIGATION OF GAY AND LESBIAN ADULTS

by

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ABSTRACT

Health disparities based on sexual orientation are partially attributable to minority stress. However, the mechanisms underlying how minority stress affects health are poorly understood. Theory and preliminary evidence within neuropsychology and social psychology are beginning to suggest that chronic experiences of rejection may contribute to cognitive depletion, particularly in the area of executive function, as well as difficulties with self-regulation of health behaviors. If present, these executive and self-regulatory depletion effects may begin to explain how minority stress contributes to health disparities. The current study was an experimental investigation of gay and lesbian adults (N = 141) that involved having participants engage in a stressful, evaluative interpersonal task with a confederate who they were led to believe held either positive or negative views toward sexual minorities. We examined how experimental condition affected cognition (an executive function battery administered at baseline and after the manipulation) and self-regulation (number of healthy and unhealthy snacks chosen at the end of the lab session). We also tested mediators of these effects, including state anger and anxiety, expressive suppression, cognitive interference, and disclosure of sexual orientation. Consistent with hypotheses, participants in the antigay condition chose a greater number of unhealthy snacks. Contrary to hypotheses, these participants actually showed greater improvement in cognitive performance than participants in the progay condition. This effect was mediated by state anger. Possible explanations for this

unexpected pattern of findings as well as future research directions are discussed. Despite limitations, this study was the first to experimentally manipulate minority stress in this population and to observe effects on executive and self-regulatory depletion.

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INTRODUCTION

The topic of civil rights for lesbian, gay, and bisexual (LGB) individuals has dominated social debates in recent years. This increased attention has resulted in significant improvements for LGB people in the United States, including legal protection against hate crimes and employment discrimination and access to marriage and partner benefits for same-sex couples. Although attitudes toward sexual minorities have improved over the past few decades (Bowman & Foster, 2008; Davis, Smith, & Marsden, 2010; Loftus, 2001), continued social prejudice and discrimination remain problematic for LGB people. According to law enforcement statistics, 19.6% of the 7,164 hate crime victims in the United States in 2012 were targeted based on their perceived sexual orientation (Federal Bureau of Investigation, 2013). A recent meta-analysis demonstrated that LGB individuals are more likely to experience a variety of forms of harassment and victimization than heterosexual individuals, with 56% of LGB people reporting verbal harassment, 50% sexual harassment, and 44% discrimination (Katz-Wise & Hyde, 2012).

The Minority Stress Model and Health Disparities

The minority stress model (Meyer, 1995, 2003) proposes that experiences of discrimination, chronic expectations of rejection, internalized homophobia, and stress associated with concealing sexual orientation result in detrimental consequences for mental health. Indeed, LGB adults are more likely to be diagnosed with a mood or anxiety disorder and are more likely to consider and attempt suicide than heterosexual

adults (Institute of Medicine, 2011; King et al., 2008). Furthermore, minority stress experiences are associated with negative mental health effects among LGB individuals (Mays & Cochran, 2001; Swim et al., 2009; Szymanski, 2005, 2009).

A recent extension of this model also addresses the effects of minority stress on physical health (Lick, Durso, & Johnson, 2013). Some disparities are found in health behaviors: lesbian and bisexual women are less likely to access preventive healthcare services (Institute of Medicine, 2011); more likely to smoke cigarettes, drink alcohol, and use illicit substances (Burgard, Cochran, & Mays, 2005; Case et al., 2004; Conron, Mimiaga, & Landers, 2010; Diamant, Wold, Spritzer, & Goldberg, 2000; McCabe, Bostwick, Hughes, West, & Boyd, 2010); and are at greater risk of obesity (Boehmer, Bowen, & Bauer, 2007; Case et al., 2004; Cochran et al., 2001; Conron et al., 2010) than heterosexual women; gay and bisexual men are also more likely to use alcohol and illicit substances (Conron et al., 2010) and evidence greater sexual risk behaviors (Institute of Medicine, 2011) compared to heterosexual men. Other disparities are found in physical health status: lesbian and bisexual women may be at heightened risk for breast cancer and cardiovascular disease compared to heterosexual women (Diamant & Wold, 2003; Institute of Medicine, 2011); gay and bisexual men are at heightened risk for HIV/AIDS and anal cancer compared to heterosexual men (CDC, 2012; Institute of Medicine, 2011; Koblin et al., 1996). Evidence suggests that minority stress predicts many of these poor health behaviors, as well as indicators of physical health, including global self-reported health and specific physical symptoms (Denton, Rostosky, & Danner, 2014; Frost, Lehavot, & Meyer, 2013; Hatzenbuehler, Nolen-Hoeksema, & Erickson, 2008; Huebner & Davis, 2007; Rosario, Scrimshaw, & Hunter, 2009).

Minority Stress and Cognitive and Self-Regulatory Depletion

Although the vast majority of research on the negative effects of minority stress has focused on mental and physical health, theory and evidence from converging sources is beginning to suggest that minority stress may also predict poor executive function (EF) and self-regulation and that these challenges may be responsible for some of the health disparities documented among minority populations. Although there is considerable debate about the definition of EF, it has been conceptualized as the "set of higher-order neurocognitive processes that allow higher organisms to make choices and to engage in purposeful, goal-directed, and future-oriented behavior" (Suchy, 2009). EF is responsible primarily for controlled, effortful processes that demand focused attention. EF contributes to self-regulation, including the ability to engage in health-relevant behaviors (e.g., control alcohol use, eat a healthy diet; Hofmann, Schmeichel, & Baddeley, 2012).

Theoretical and empirical research on the association between stress, regulation, and cognition may also inform our understanding of this link. The "self-regulatory resource model" or "strength model of self-control" (Baumeister & Vohs, 2003; Baumeister, Vohs, & Tice, 2007) proposes that self-regulation reflects a finite resource that can be diminished through overuse. Previous work has shown that individuals exhaust this same resource when coping with stress, suppressing emotions, and engaging in health behaviors (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Muraven, Tice, & Baumeister, 1998). The resource model states that performing multiple tasks that use this same resource within a discrete period of time results in impaired performance on all of the tasks because attention is divided. Evidence suggests that self-regulation need not be excessively demanding or lengthy to result in difficulties across completely

independent domains (Baumeister, Vohs, & Tice, 2007; Hagger, Wood, Stiff, & Chatzisarantis, 2010). For example, difficulties in regulating healthy eating and exercise are typically related to difficulties in regulating emotions, alcohol use, and other areas. Self-regulation difficulties of this sort are evident even in short laboratory studies (for a meta-analysis, see Hagger, Wood, Stiff, & Chatzisarantis, 2010).

Despite similar underlying concepts examined in neuropsychological research on EF and cognitive depletion and in the social psychological literature on self-regulation and ego depletion, attempts at reconciling these concepts have been rare. Hofmann and colleagues (2012) discussed this discrepancy in the literature and proposed that EF may reflect the *capacity* for self-regulation and may explain failure in the ability to regulate effectively across domains (ego depletion). These authors also suggested that "state reductions" in EF are possible and may represent the "underlying conceptual mechanism" for many of the depletion effects documented in the social psychological literature.

Minority stress experiences among LGB people likely tax executive and self-regulatory resources. Popular and theoretical books, such as *The Velvet Rage* (Downs, 2012), *The Best Little Boy in the World* (Tobias, 1973), and *Latino Gay Men and HIV* (Diaz, 1998), have long described this phenomenon without referring explicitly to EF. These readings have described the cognitive and emotional effort involved in impression management for LGB people, particularly gay and bisexual men. Together, these books propose that facing minority stress contributes to difficulties with self-regulation that may be responsible for some of the problems documented in LGB communities (e.g., sexual risk, alcohol and drug abuse, depression and suicide, health disparities).

Attention to this possibility in the empirical literature has been rare, but studies

suggest that experiences of stigma are cognitively and emotionally depleting. Inzlicht, McKay, and Aronson (2006) performed multiple studies on stereotype threat, showing that marginalized individuals are less able to effectively regulate (across domains) after their identity is challenged. Stereotype threat refers to the idea that cognitive or academic performance is worse for members of stigmatized groups when negative stereotypes about them are emphasized (Steele & Aronson, 1995). In one of Inzlicht and colleagues' (2006) studies, African American participants who were informed that the Stroop test (a measure of executive attention) was an intelligence test performed more slowly than African American individuals who were not told it was an intelligence test, and more slowly than White participants in either condition. Another study investigated self-regulation on a handgrip exertion task after a stereotype threat manipulation among women and found this same effect for the threatened group of women. A related experiment by Salvatore and Shelton (2007) measured how quickly participants completed the Stroop after manipulating their perceptions of whether job files were evaluated differently based on race/ethnicity of the candidate. This study showed that simply perceiving that discrimination has occurred against others in one's group negatively impacts cognitive performance, even when the discrimination is not directly experienced. Finally, a multistudy investigation by Baumeister, DeWall, Ciarocco, and Twenge (2005) showed that both experiencing rejection and also expecting future rejection impairs self-regulation, again across a variety of regulation-relevant domains. It is reasonable to suspect that these findings might extend to LGB people experiencing depletion in minority stress situations.

Mechanisms for Executive and Self-Regulatory Depletion

Why would minority stress predict cognitive and self-regulatory depletion for LGB individuals? I propose three major processes for the current study: First, encountering prejudice will likely result in increased attempts to manage impressions, most notably concealment of sexual orientation for LGB people. Research has shown that attempting to present oneself favorably or differently makes subsequent regulation and EF tasks more difficult. Second, encountering prejudice likely elicits an emotional response (e.g., anxiety, anger), along with active attempts to regulate or suppress their expression. Expressive suppression is a strong predictor of executive depletion. Third, encountering prejudice may produce cognitive interference as attention is divided among distracting thoughts and intentional suppression of or rumination on those thoughts. This type of cognitive interference depletes key resources useful for self-regulation. Research to support these claims is reviewed in the following sections.

Concealment of Sexual Orientation

Marginalized participants are motivated to dispel negative expectations of interaction partners about their group. Impression management attempts have been documented among obese women stigmatized regularly based on their weight (Miller, Rothblum, Barbour, Brand, & Felicio, 1990; Miller, Rothblum, Felicio, & Brand, 1995) and women in general who have been primed to expect discrimination (Kaiser & Miller, 2001). Shelton, Richeson, and Salvatore (2005) found that ethnic minority participants who anticipated prejudice prior to an interracial interaction behaved in a more engaging and involved manner. It appeared that this impression management was interpersonally effective in that interaction partners rated the interactions more favorably; however, the

minority participants who were primed reported less favorable ratings of the interaction.

In an eight-part investigation, Vohs, Baumeister, and Ciarocco (2005) demonstrated that attempting to manage impressions in stressful situations results in subsequently reduced capacity to self-regulate. For example, individuals instructed to act in way that is "boastful" around friends but "modest" around strangers had difficulty persisting on a task. A 9-day experience sampling study by Pachankis and Hatzenbuehler (2013) demonstrated negative health consequences for young gay and bisexual men for a different form of impression management: coping with minority stress by focusing on areas of achievement. Although self-regulatory consequences were not examined, other research has suggested that finding alternate ways to measure self-worth in response to prejudice can increase self-esteem but negatively impact self-regulation (Crocker, Brook, Niiya, & Villacorta, 2006).

A specific form of impression management relevant to LGB individuals and to minority stress theory (Meyer, 2003) is disclosure or concealment of sexual orientation. Disclosure is conceptualized as a fundamental feature of healthy LGB identity development (Calzo, Antonucci, Mays, & Cochran, 2011; D'Augelli, 1994) but minority stress experiences may lead LGB individuals to conceal their orientation across contexts (Pachankis, 2007). Research has repeatedly documented that intentionally concealing one's sexual orientation is associated with poor mental and physical health outcomes (e.g., Scrimshaw, Siegel, Downing Jr., & Parsons, 2013; Ullrich, Lutgendorg, & Stapleton, 2003). Pachankis (2007) elaborated on the theoretical possibility that concealing might also be cognitively depleting.

A recent study published by Critcher and Ferguson (2013) investigated this issue

in a sample of heterosexual college students, half of whom were told to conceal their sexual orientation during an interview task. This group showed a variety of difficulties with cognition and self-regulation after the task, including deficits in "spatial reasoning," "interpersonal restraint" (i.e., responding to an angry email), "physical stamina" on a handgrip task, and EF as measured by the Stroop. The remarkable aspect of these findings is that participants were heterosexual (not typically marginalized) and were asked to conceal only briefly during a laboratory study, yet wide-ranging effects were observed across multiple domains implicated in cognition and self-regulation.

Negative Emotions and Suppression

Another possible link between minority stress and cognitive depletion is the negative emotions individuals experience when stressed (e.g., anger, anxiety) and attempts at expressive suppression. Expressive suppression is defined as "an emotion regulation strategy characterized by effortful control of facial affect and other automatic emotional responses, such as laughter or crying" (Franchow & Suchy, 2010; Gross, 1998). A growing body of research suggests that effortfully suppressing emotional expression contributes to problems in verbal and working memory (Richards & Gross, 2000; Schmeichel, 2007), executive depletion (Franchow & Suchy, 2014), and self-regulation difficulties (Baumeister, Schmeichel, & Vohs, 2007). Across a variety of studies, researchers have instructed participants to suppress their emotional responses (usually to emotional videos) and have found that they are subsequently dysregulated (e.g., Muraven, Tice, & Baumeister, 1998). Most relevant for the current study, this inability to self-regulate when inhibiting emotional expression implies that individuals are more susceptible to impulses and immediate rewards (Baumeister & Alquist, 2009).

Franchow and Suchy (2014) argued that similar cognitive processes and even regions of the brain are implicated in both expressive suppression and EF. These authors also demonstrated that the amount of recent suppression reported by participants was strongly associated with performance on a battery measuring multiple facets of EF.

Research in the stress literature (e.g., Lazarus, 1991) has found that experiences perceived as outside of one's control (like those that characterize minority stress) often result in expressive suppression as an emotion-focused strategy, whereas controllable situations may elicit more active responses. Matheson and Cole (2004) found that inducing stress based on the social identity of college students resulted in expressive suppression. Research on stereotype threat has also shed some light on emotion regulation as a potential mechanism for the link between minority stress and executive depletion. Johns, Inzlicht, and Schmader (2008) investigated this mechanism in four experiments, which corroborated the idea that targets of stereotype threat intentionally suppress emotion (in this case, anxiety) and that this effortful regulation is responsible for poorer performance on tasks related to EF. It is reasonable to suspect that LGB individuals who encounter minority stressors experience negative emotions along with attempts to suppress them during daily interactions. This emotional response and regulation strategy may be related to decreased executive performance.

Cognitive Interference

Yet another potential mechanism for the association between minority stress and executive depletion is cognitive interference, including "intrusive thoughts and the suppression of intrusive thoughts about stressors" (Stawski, Sliwinski, & Smyth, 2009). It has been hypothesized that the experience of stress interferes with attentional resources

necessary for multiple cognitive processes by dividing attention (e.g., Kahneman, 1973; Stawski, Sliwinski, & Smyth, 2006). Klein and Boals (2001) illustrated that individuals who reported experiencing more intrusive and distracting thoughts associated with stress also scored lower on working memory tests. Subsequent research has also demonstrated effects on processing speed and episodic memory (Stawski, Sliwinski, & Smyth, 2006).

The first study to examine this link experimentally was an investigation of college students who underwent the Trier Social Stress Test before testing of episodic memory (Stawski, Sliwinski, & Smyth, 2009). The authors found that the participants who underwent the stress task reported significantly higher cognitive interference than the control group, including both greater frequency of distracting thoughts about the stress task and "intentional suppression" of those thoughts. Decline in episodic memory was significantly higher in both the stressor condition and among participants who endorsed greater cognitive interference. However, interference did not mediate the association between stress condition and episodic memory performance. The authors speculated that the mediation results were nonsignificant due to the measure of cognitive performance chosen (i.e., episodic memory). Specifically, the authors posited that cognitive interference may be more likely to mediate the association between stress and EF, given that attention is divided when interference is high. Episodic memory is potentially less relevant to cognitive interference as a mechanism (Naveh-Benjamin, Kilb, & Fisher, 2006). However, a more recent investigation of older adults found that cognitive interference partially mediated the association between stressful life events and memory perception over time (Stawski, Mogle, & Sliwinski, 2013). If minority stress results in cognitive interference, this construct may contribute to EF depletion among LGB adults.

Current Study Rationale and Hypotheses

Minority stress is the prevailing explanation for health disparities between LGB and heterosexual individuals, yet our present understanding of how that might occur is very limited. One plausible route to health disparities involves the potential for minority stress experiences to lead to deficits in EF and self-regulation. Williams and Thayer (2009) noted that poor EF predicts a variety of medical conditions, including "obesity, diabetes, hypertension and vascular disease, lung disease, and HIV/AIDS" (p. 103). These same medical conditions have important behavioral and lifestyle components that are likely impacted by one's ability to regulate. Understanding these effects and the underlying mechanisms is important for developing prevention and intervention efforts and targeting these efforts to specific high-risk groups.

The current study examined the association between encountering social prejudice and both EF and self-regulation in an experimental study of gay and lesbian adults. Mechanisms of interest included disclosure of sexual orientation, state anger and anxiety, expressive suppression, and cognitive interference. The following predictions were proposed based on theoretical expectations as well as the existing empirical literature.

1. Participants interacting with an antigay confederate (antigay condition) will exhibit poorer performance on the subsequent cognitive tasks measuring EF and poorer self-regulation as evidenced by choosing a greater number of unhealthy snacks upon leaving the lab session, compared to participants interacting with a progay confederate (progay condition).
2. Disclosure of sexual orientation, state anger and anxiety, expressive suppression, and cognitive interference during the manipulation task will mediate the

association between experimental condition and cognitive and self-regulatory performance. Specifically, participants in the antigay condition will be less likely to disclose their sexual orientation during the task, report increased anger and anxiety after the task, use suppression as an emotion regulation strategy, and experience intrusive thoughts than participants in the progay condition. These mechanisms will be responsible for the depletion effects observed.

METHOD

Participants

The IRB of the University of Utah approved this study. For participant recruitment, our research team contacted individuals who provided contact information at the local LGB pride festival and indicated a willingness to participate in research and also utilized targeted Facebook advertising. Participants were eligible for the study if they were between the ages of 18-60 and self-identified as lesbian or gay.

Participants were 150 self-identified lesbian and gay adults. The first 9 participants were regarded as pilot cases while the researchers were testing and refining aspects of the protocol. These participants were not included in study analyses, resulting in a sample size of 141 participants (71 male, 70 female) who were run through an identical protocol. The mean age of the sample was 26 years (*SD* = 6.85; range = 18-58 years). Participants were 83% European American, 7% Hispanic/Latino, 6% Asian/Pacific Islander, and 4% African American or "other" category. For highest education level completed, 9% of the sample reported high school graduate, 47% some college or technical school degree, 31% college degree, and 12% professional or graduate degree. Modal personal income of the sample was between $16,000-$25,000 annually. The relatively low socioeconomic position of this sample was likely due to the younger age of participants, including many who were currently attending college.

Procedure

Participants were led to believe through email and telephone exchanges after recruitment that they were eligible to participate in two separate studies: (1) an online survey about their experiences as a gay or lesbian adult, and (2) a lab-based experiment about the health effects of diverse participant interactions that did not specify inclusion or exclusion criteria based on sexual orientation. The online questionnaire took approximately 30-45 minutes to complete and included questions on sociodemographic information, sexual attraction, identity development, risk behaviors, minority stress experiences, and mental health. Responses to the online survey were linked to the lab-based data via a unique number assigned to each participant.

Figure 1 provides a schematic diagram of lab study procedures. The order of the procedure and wording of the script were adapted from previous research within this lab (see Cundiff, 2013). Research assistants were blind to participant condition and read directly from the lab script. When participants arrived, they were told that their interaction partner would be arriving in the next few minutes and would be directed to a separate lab room. During informed consent, the following information was shared:

> *This study is about how diverse individuals, based on race/ethnicity, gender, sexual orientation, and other characteristics, interact and evaluate each other in interview situations. We're doing this study because we know that social interactions can have powerful positive and negative effects on our health, in particular our cardiovascular health. But we don't have a clear understanding of why some social interactions are good for health while others have the opposite effect. So we are studying how the social interaction you participate in influences your heart rate and blood pressure as well as hormone levels.*

Participants then completed the baseline cognitive tests. Given that the larger study included a physiological component, electrodes and blood pressure cuff were placed, followed by a 10-minute, minimally engaging, baseline task, followed by a

cortisol sample. Participants then completed the measure of baseline state affect.

Next, participants were provided with verbal information about the task, which was presented as an evaluative task based on the interviewee's intelligence, competence, and likeability. They were told to disclose as much or little personal information about themselves as they would like. Participants were led to believe that they were interacting with a participant in another room through microphone and speaker so that "how attractive, unattractive, or similar to you the other person is doesn't affect how you interact with them or how you react to them in terms of heart rate and blood pressure." They were led to believe they would meet the other participant at the end of the study.

Participants drew a slip of paper out of a cup that resulted in the participant being "randomly assigned" to the role of interviewee. After leaving the room to presumably inform the other participant about their role and obtain a "Q&A" form, this information was given to the participant. They were prompted to "look it over to know a little more about" the other participant. The handwriting was gender-matched to the participant.

A recording then led participants through the task instructions and the interview task. In the instructions, participants were reminded of their role, the evaluative nature of the task, and were given the "rules" of the interaction (that there would be 90 seconds to speak and they should speak for the entire interval in response to each question, followed by 90 seconds of silence during which time the interviewer would rate their responses and the interviewee could begin contemplating their answer to the next question listed on a sheet of paper in front of them). The prerecorded confederate then began with each interview question, followed by the participant's 90-second response, followed by 90 seconds of silence. The voice of the prerecorded confederate was also gender-matched.

When the interaction was finished, study personnel gave participants another set of questionnaires, including assessments of state affect during the task, stressfulness of the task, and emotion regulation. Cardiovascular physiology continued to be monitored for 5 minutes posttask as a "recovery" period. The second and third cortisol samples were collected. Participants completed the same posttask cognitive battery with the addition of Information subtest. Participants were "unhooked" from the physiology equipment and video recording ended. The research assistant then brought in a bowl of healthy and unhealthy snacks and stated, "We are almost finished with the experiment. Just a few more questionnaires! Feel free to take a snack while you finish up." As participants completed the remaining questionnaires on cognitive interference, self-regulation, and ratings of the interaction partner, number and type of snacks chosen were discreetly recorded. Finally, participants were questioned to confirm that deception was successful and thoroughly debriefed before leaving the lab.

Prejudice Manipulation

Prejudice of the interaction partner was manipulated through one of the answers provided on the "Q&A" information form to this question: "What are two political issues that you are passionate about? What is your position on these issues and why?" Antigay condition: "As a straight person, I hope that increased support for gay marriage does not lead to more rights in other areas for gay people, such as teaching in schools. It's not a healthy lifestyle that we want to promote." Progay condition: "Even though I'm straight, I hope that increased support for gay marriage leads to more rights in other areas for gay people, such as teaching in schools. It's good to promote diversity." This manipulation (prejudiced attitudes of the interaction partner, rather than more blatant discrimination)

was chosen because of its external validity to the everyday lives of sexual minority men and women, who regularly encounter individuals who hold antigay attitudes and situations in which the threat of discrimination is ambiguous or subtle.

Interview Task

The interview task was adapted from Critcher and Ferguson (2013)'s research and from previous questions used in this lab with a similar paradigm. These questions were chosen because they were relevant enough to sexual orientation that they offer participants the opportunity to decide how much information to disclose. The interview was identical across conditions and included the following four questions: (1) Tell me about your daily schedule. Which parts do you choose and which parts do you have to do? What do the choices you make tell you about yourself as a person? (2) Think of your ideal dating partner. In what sorts of domains do you think that you would want the two of you to be similar? In what sorts of ways do you think it would benefit you to be different? (3) As you look into your future, how much of a challenge do you think it will be to strike a balance between your work life and your relationship life? (4) Would you be open to adopting children? Why or why not?

Measures

Demographics

Participants were asked demographic questions on the online questionnaire about their age, race/ethnicity, gender, sexual orientation, income, education level, and religion.

Disclosure of Sexual Orientation

Using a codebook designed by the researchers, two trained research assistants viewed the video recording of each participant's answers to interview questions and recorded the number of times each participant: (1) disclosed sexual orientation directly (e.g., "I'm gay/lesbian/queer"; "I am attracted to men/women"), (2) used same-sex pronouns (e.g., he/she, him/her, man/woman) or opposite sex pronouns, and (3) disclosed sexual orientation indirectly (e.g., "It would be difficult for me to have kids naturally"; explicitly gendered characteristic of ideal dating partner, such as beard or breasts). Discrepancies among coders were resolved through discussion as the codebook was developed and finalized for the pilot participants and then the first 40 participants. For the remaining participants, the two research assistants coded the remaining sample independently but overlapped on 15% in order to check reliability. The final, averaged kappa was .96 overall (.99 for question #1, .93 for question #2, .95 for question #3, and .97 for question #4). Multiple disclosure categories were created based on sum scores for each type of disclosure. Use of opposite sex pronouns did not occur often enough to obtain power to detect any effects based on this category. Because the results did not reveal differences by question or type of disclosure, overall number of disclosures across categories (direct, indirect, same-sex pronouns) was the variable used in analyses.

State Affect

Participants completed 12 items adapted from the State-Trait Personality Inventory (Spielberger, 1980) and commonly used in this lab to measure state anxiety and anger (e.g., Smith et al., 2009). This measure is sensitive to experimental manipulations (Nealey-Moore et al., 2007). The response scale ranged from 1 = *Not at all* to 5 =

Extremely. Participants completed these measures at baseline (Cronbach's alpha for anger = .72, anxiety = .81) and after the stressor task (alpha for anger = .88, anxiety = .85).

Expressive Suppression

Expressive suppression was measured by the Emotion Regulation Questionnaire (Gross & John, 2003) using the 4-item subscale for suppression. The response scale ranged from 1 = *Not at all* to 5 = *Extremely*. The scale has been shown to have good psychometric properties and has been adapted to a state (rather than trait) version (Butler, Lee, & Gross, 2007; Kashdam & Steger, 2006) in order to be used in experimental studies. This version asked participants to respond with respect to efforts to suppress emotion expression during the experimental task. An example item is "I controlled my emotions during the task by not expressing them." Cronbach's alpha was .73.

Cognitive Interference

Cognitive interference was assessed via a measure developed by Stawski, Sliwinski, and Smyth (2009) that consists of four items. The response scale ranged from 1 = *Not at all* to 5 = *Extremely*. This measure includes distracting thoughts and the suppression of these thoughts during the time 2 cognitive testing. Example questions include "how distracted did you feel by thoughts about the interview task while you performed the last series of cognitive testing?" and "how much did you feel yourself intentionally suppressing off-task thoughts about the interview task while you were performing the last series of memory tasks?." Cronbach's alpha for this scale was .88.

Cognitive Testing

A composite of several tests from the Delis-Kaplan Executive Function System battery (D-KEFS) (Delis, Kramer, Kaplan, & Holdnack, 2004), which is a well-validated, widely used measure of EF, were used in this study to measure cognitive depletion. In keeping with similar prior research (Franchow & Suchy, 2014; Williams, Suchy, & Kraybill, 2010), we used the scaled scores from the following tasks as measures of EF: Trail Making Test (Letter-Number Switching Condition completion time), Design Fluency (Filled Dots Condition total designs completed), Verbal Fluency (Letter Fluency Condition total words generated), and Color-Word Interference (Inhibition Condition completion time). We used the following tasks as measures of component processes (CP): Trail Making Test (Letter Sequencing Condition completion time) and Color-Word Interference (Color Naming and Word Reading Conditions completion time). A composite of scaled EF and CP scores was calculated for analyses. These measures were administered at baseline (Cronbach's alpha for EF = .57, CP = .61) and after the task (Cronbach's alpha for EF = .60, CP = .68). Cronbach's alpha for the total composite score calculated as the mean of EF and CP at baseline was .75 and after the task was .76.

Information, a subtest from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV) (Wechsler, Coalson, & Raiford, 2008), was administered after time 2 DKEFS subtests as a gross measure of intelligence. Participant scores on this subtest were used as covariates in analyses predicting EF and CP to ensure any effects are not due to group differences in general knowledge.

Self-Regulation

A behavioral measure of self-regulation was based on the number of snacks that participants chose while filling out the posttask questionnaires at the end of the lab study. Options included candy and chocolate (coded as "unhealthy") and nuts and raisins (coded as "healthy"). Research assistants discreetly recorded the number of each type of snack (healthy vs. unhealthy) that participants chose. This measure was selected based on prior research in the self-regulation literature (Tice, Bratslavsky, & Baumeister, 2001).

Analysis

Descriptive statistics were calculated to define the study sample and evaluate statistical assumptions. Correlations were conducted to determine whether any of the demographic characteristics were significantly associated with study outcomes (cognitive testing, snacks), which were then used as covariates in corresponding analyses.

To test the hypothesis that participants in the antigay condition would show poorer subsequent performance on the EF measures than participants in the progay condition (consistent with cognitive/executive depletion), a three-way 2 (score type: EF or CP) x 2 (time: baseline or after task) x 2 (condition: antigay or progay) mixed ANOVA was conducted. The repeated-measures independent variables were time and score type, and the between-subjects independent variable was experimental condition. Information subtest from the WAIS-IV was included as a covariate.

To test the hypothesis that participants in the antigay condition would select a greater number of unhealthy (but not healthy) snacks at the end of the lab session than participants in the progay condition (consistent with self-regulatory depletion), negative binomial regression models were conducted separately for each outcome (healthy snacks

and unhealthy snacks). These models were chosen because the outcomes are count variables and do not meet normality assumptions. Age was included as a covariate.

Mediation analyses using bootstrapping procedures for estimating indirect effects (Hayes, 2009) were conducted to test the mediation hypotheses (that sexual orientation disclosure, expressive suppression, change in state anger and anxiety, and cognitive interference would mediate associations between condition and EF and self-regulation).

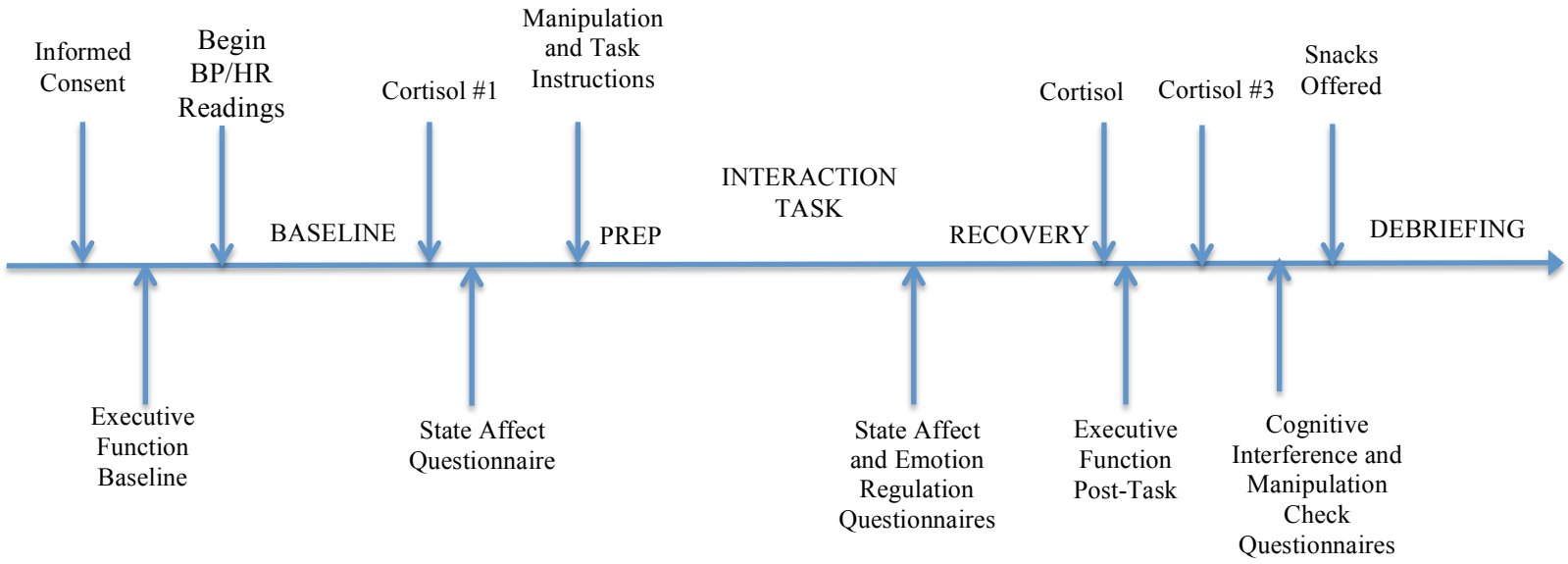

Figure 1. This figure is a schematic diagram of lab study procedures.

RESULTS

Demographic and Baseline Associations

To ensure successful randomization, baseline differences by condition in responses to the online questionnaire were assessed. Condition was not associated with sex, age, race/ethnicity, education, income, religiosity, relationship status, outness, sexual attraction, or other sexual identity development and minority stress variables. There were also no differences by condition in health behaviors and sexual risk behaviors. At baseline during the lab session, participants did not differ by condition in state anger, anxiety, or self-conscious emotions and did not differ on EF or CP testing scores.

Several associations emerged between demographic and main study variables. White participants (M = 2.85, SD = .92) were significantly more likely than racial/ethnic minority participants (M = 2.27, SD = .84) to suppress emotion during the stressor task, $t(137) = 2.85$, $p = .005$. Higher education level was significantly related to increased disclosure of sexual orientation during the task, $r = .19$, $p = .03$. Lesbian women (M = 2.36, SD = 1.02) were more likely than gay men (M = 1.92, SD = .88) to report cognitive interference related to the stressor task during testing, $t(139) = -2.78$, $p = .006$. Older participants chose a greater number of healthy snacks at the end of the lab session than younger participants, $r = .20$, $p = .02$. Importantly, cognitive performance on the scaled EF and CP measures was not associated with any of the demographic variables.

Manipulation Check

Multiple items were included at the end of the lab session to confirm that experimental condition was manipulated appropriately. Participants were asked the following open-ended question: "What information about the other participant do you remember from the Q&A information form you were given before the task?" and recorded their responses on a form. Only 5.7% of the sample (N=8) did not mention the manipulation information associated with their condition in response to this question.

Participants were asked how much they would like to be friends with the other participant, as well as how negative or hostile and positive or tolerant they perceived their attitudes to be toward people who identify as gay or lesbian, with response options from 1= *Not at all* to 5 = *Extremely*. These questions were asked at the very end to avoid raising suspicion about the true study aims before the experiment ended. Participants in the antigay (M = 3.56, SD = 1.19), relative to the progay (M = 1.25, SD = .68), condition were significantly more likely to describe the other participant's attitudes as negative or hostile, $t(111.88) = 14.14$, $p < .001$. Participants in the antigay (M = 1.94, SD = 1.00), relative to the progay (M = 3.97, SD = 1.12), condition were also significantly less likely to describe their attitudes as positive or tolerant, $t(137) = -11.28$, $p < .001$. Finally, participants in the antigay (M = 1.80, SD = .90), relative to the progay (M = 2.81, SD = .85), condition were significantly less likely to report that they would want to be friends with the other participant, $t(137) = -6.75$, $p < .001$.

Finally, participants were asked to rate how stressful they found each of the interview questions. Participants in the antigay condition (M = 3.15, SD = 1.15) found the second question (i.e., ideal dating partner) to be significantly more stressful than

participants in the progay condition ($M = 2.60$, $SD = 1.20$), $t(131) = 2.72$, $p = .007$. No significant differences were found in stress ratings for the other three questions.

Bivariate Correlations (Main Study Variables)

Bivariate correlations among study variables are presented in Table 1. Participants in the antigay condition (relative to the progay condition) reported a higher level of state anger, along with greater attempts to suppress negative emotions, during the task. There were no differences in state anxiety, number of sexual orientation disclosures, or self-reported cognitive interference during subsequent testing by condition. Participants in the antigay condition actually performed *better* on cognitive testing after the stressor task on both the EF and CP composite measures relative to participants in the progay condition. Participants in the antigay condition selected a greater number of unhealthy snacks prior to leaving the lab session than participants in the progay condition. There were no significant differences in the number of healthy snacks chosen.

Participants who reported higher state anger and anxiety after the task also reported greater expressive suppression and cognitive interference. Participants who reported higher state anger (but not anxiety) demonstrated significantly better performance on both EF and CP subtests at time 2 and selected more unhealthy snacks at the end of the lab session. Expressive suppression and disclosure of sexual orientation during the stressor task were unrelated bivariately to cognitive testing or snacks. Cognitive interference was related only to decreased EF scores at time 2.

As expected, the cognition composite scores were strongly positively correlated, including both EF and CP at times 1 and 2. However, these measures were not bivariately associated with choice of healthy or unhealthy snacks at the end of the lab session.

Executive Function

Seven participants in the sample were found to have a scaled score below 4 on at least one of the DKEFS subtests. These cases were removed from analyses involving EF and/or CP scores because they were unusually low for a nonclinical sample, and likely reflected either problems with test administration or cognitive impairment. Information from the WAIS-IV was significantly correlated with EF scores at time 1 ($r = .24$, $p = .005$) and time 2 ($r = .23$, $p = .008$), as well as CP scores at time 1 ($r = .18$, $p = .04$). Given these associations, participant scores on Information were used as covariates in all analyses to ensure that effects were not due to differences in knowledge or intelligence.

A three-way mixed ANOVA predicting cognitive scores revealed a significant main effect of time, $F(1,131) = 19.56$, $p < .001$. Specifically, participant cognitive performance overall was significantly better at time 2 ($M = 12.10$, $SE = .13$) than time 1 ($M = 11.07$, $SE = .12$), suggesting a practice effect. A significant interaction effect between time and condition was also present, $F(1,131) = 14.66$, $p < .001$. This interaction is graphed in Figure 2. Analysis of simple effects revealed that cognitive scores increased from time 1 to time 2 in both the antigay condition ($F(1,131) = 225.82$, $M_{diff} = 1.26$, $SE = .08$, $p < .001$) and the progay condition ($F(1,131) = 85.31$, $M_{diff} = .80$, $SE = .09$, $p < .001$). Although no difference by condition in cognitive score was observed at time 1 testing ($F(1,131) = 1.52$, $M_{diff} = .30$, $SE = .25$, $p = .22$), a significant difference was found at time 2 ($F(1,131) = 8.96$, $M_{diff} = .77$, $SE = .26$, $p = .003$), such that individuals in the antigay condition ($M = 12.48$, $SE = .18$) performed better cognitively after the stressor task than participants in the progay condition ($M = 11.72$, $SE = .18$). The three-way interaction between time, condition, and type of testing was not significant. Cognitive performance

was better in the antigay condition (relative to the progay condition) at time 2 on both EF tests ($F(1,131) = 5.56$, $M_{diff} = .71$, $SE = .30$, $p = .02$) and CP tests ($F(1,131) = 9.00$, $M_{diff} = .82$, $SE = .28$, $p = .003$).

Self-Regulation

Due to the significant association between participant age and number of healthy snacks chosen during the experiment, age was entered as a covariate in negative binomial regression analyses predicting snacks. Experimental condition significantly predicted unhealthy snacks ($B = -.47$, $SE = .22$, $p = .04$), such that individuals in the antigay condition chose significantly more unhealthy snacks at the end of the lab session than participants in the progay condition. Experimental condition was not significantly related to healthy snacks ($B = -.29$, $SE = .19$, $p = .14$).

Mediators

Although the cognitive testing analyses were best interpreted using ANOVA models that could account for both between-subjects and repeated-measures variables, the following mediation analyses shifted to an OLS regression framework in order to utilize standard bootstrapping techniques for estimation of indirect effects (Hayes, 2009). EF composite score at time 2 was entered as the dependent variable. Information score, EF composite at time 1, and change in CP composite scores from time 1 to time 2 were entered as statistical controls. Experimental condition was entered as the independent variable. All potential mediators were entered simultaneously.

Mediation results are presented in Table 2. The only variable that emerged as a significant mediator of the association between condition and EF scores was the change

in state anger from baseline to after task. The "A" path revealed that experimental condition significantly predicted anger change score, such that individuals in the antigay condition reported a greater increase in state anger from baseline to after the stressor task than individuals in the progay condition. The "B" path revealed that anger change score marginally predicted EF score, such that individuals who reported a greater increase in anger from baseline to after task performed better on EF testing than individuals who reported less increase in state anger. The "AB" path revealed that the indirect effect of condition on EF score through change in state anger was significant. In other words, the association between experimental condition and EF performance was partially explained by change in state anger from baseline to after the stressor task. None of the other variables significantly mediated this association. However, the "A" path was significant for expressive suppression, such that individuals in the antigay condition reported greater use of emotion suppression as a strategy during the stressor task compared to participants in the progay condition.

In the separate mediation models predicting unhealthy and healthy snacks chosen at the end of the lab session, age was entered as statistical control. Experimental condition was entered as the independent variable. All potential mediators were entered simultaneously. Results are presented in Table 3. None of the variables emerged as significant mediators of the association between condition and either unhealthy or healthy snacks. However, the "A" paths were significant for expressive suppression, change in state anger, and change in state anxiety, such that individuals in the antigay condition reported greater use of emotion suppression as a strategy during the stressor task, greater

increase in state anger, and less increase in state anxiety, compared to participants in the progay condition.[1]

Note

1. We note that experimental condition had a different effect on change in state anxiety in this analysis than in the previous mediation analysis (where condition was unrelated to change in state anxiety). This likely resulted because of differences in the analytic sample used in each test (i.e., the analysis for snacks contained an additional 7 participants that had been removed from the analysis of cognitive testing because of scores that were likely invalid) and in the covariates (i.e., Information subtest, EF time 1, and change in CP score were included in the cognition model; age was included in the snacks model).

Table 1
Bivariate Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Condition											
2. State Anger (Task)	-.28***										
3. State Anxiety (Task)	.11	.37***									
4. Emotion Suppression	-.31***	.29***	.22**								
5. Cognitive Interference	.06	.23**	.34***	.04							
6. Disclosure Orientation	.05	.15	.02	-.10	.12						
7. EF Time 1	-.13	.14	-.03	.15	-.11	-.11					
8. EF Time 2	-.22*	.18*	-.05	.14	-.17*	-.13	.89***				
9. CP Time 1	-.10	.09	-.10	.11	-.09	-.08	.59***	.56***			
10. CP Time 2	-.26**	.20*	-.07	.10	-.05	-.06	.60***	.61***	.81***		
11. Healthy Snacks	-.11	-.04	-.16	.01	-.13	-.01	.06	.03	.01	.01	
12. Unhealthy Snacks	-.17*	.17*	.01	.11	-.13	.08	.04	.05	.05	.07	.06

Note. Bivariate correlations between all study variables are presented. *p<.05; **p<.01; ***p<.001 (2-tailed). Condition was coded as 1 = antigay condition, 2 = progay condition.

Table 2
Results of Mediation Models (Predicting Executive Function)

Potential Mediators	Executive Function		
	A Path	B Path	AB Path
Sexual Orientation Disclosure	.38 (*.75*)	-.01 (*.02*)	-.01 (*.02*)
Change in State Anger	**-.36 (*.15*)**	.19 (*.11*)	**-.06 (*.04*)**
Change in State Anxiety	.17 (*.14*)	-.11 (*.11*)	-.02 (*.03*)
Expressive Suppression	**-.59 (*.16*)**	-.06 (*.09*)	.03 (*.06*)
Cognitive Interference	.16 (*.18*)	-.15 (*.08*)	-.02 (*.03*)

Note. Bootstrapping techniques were used to conduct mediation analyses to determine whether each of the variables listed as "potential mediators" mediated the association between experimental condition and EF scaled composite at time 2. Mediators were entered simultaneously. Covariates included EF scaled composite at time 1, change in CP scaled composite from time 1 to time 2, and Information subtest scaled. The "A Path" represents the association between experimental condition and each potential mediator. The "B Path" represents the association between each potential mediator and EF at time 2. The "AB Path" represents the indirect path from experimental condition to EF through potential mediators. The values in this table are displayed as path coefficient (*standard error*). Statistically significant results (at the $p < .05$ level) are indicated with bold text.

Table 3
Results of Mediation Models (Predicting Healthy and Unhealthy Snacks)

Potential Mediators		Healthy Snacks		Unhealthy Snacks	
	A Path	B Path	AB Path	B Path	AB Path
Sexual Orientation Disclosure	.37 (*.76*)	.00 (*.02*)	.00 (*.02*)	.02 (*.31*)	.01 (*.03*)
Change in State Anger	**-.48 (*.14*)**	-.04 (*.13*)	.02 (*.07*)	.16 (*.14*)	-.08 (*.08*)
Change in State Anxiety	**.35 (*.13*)**	-.26 (*.14*)	-.09 (*.06*)	-.03 (*.16*)	-.01 (*.06*)
Expressive Suppression	**-.52 (*.16*)**	.03 (*.11*)	-.02 (*.06*)	.09 (*.13*)	-.04 (*.07*)
Cognitive Interference	.18 (*.18*)	-.10 (*.10*)	-.02 (*.03*)	-.21 (*.12*)	-.04 (*.05*)

Note. Bootstrapping techniques were used to conduct mediation analyses to determine whether each of the variables listed as "potential mediators" mediated the association between experimental condition and healthy and unhealthy snacks (in separate models). Mediators were entered simultaneously. Age was entered as a covariate. The "A Path" represents the association between experimental condition and each potential mediator. The "B Path" represents the association between each potential mediator and number of healthy or unhealthy snacks selected. The "AB Path" represents the indirect path from experimental condition to each snack type through potential mediators. The values in this table are displayed as path coefficient (*standard error*). Statistically significant results (at the $p < .05$ level) are indicated with bold text.

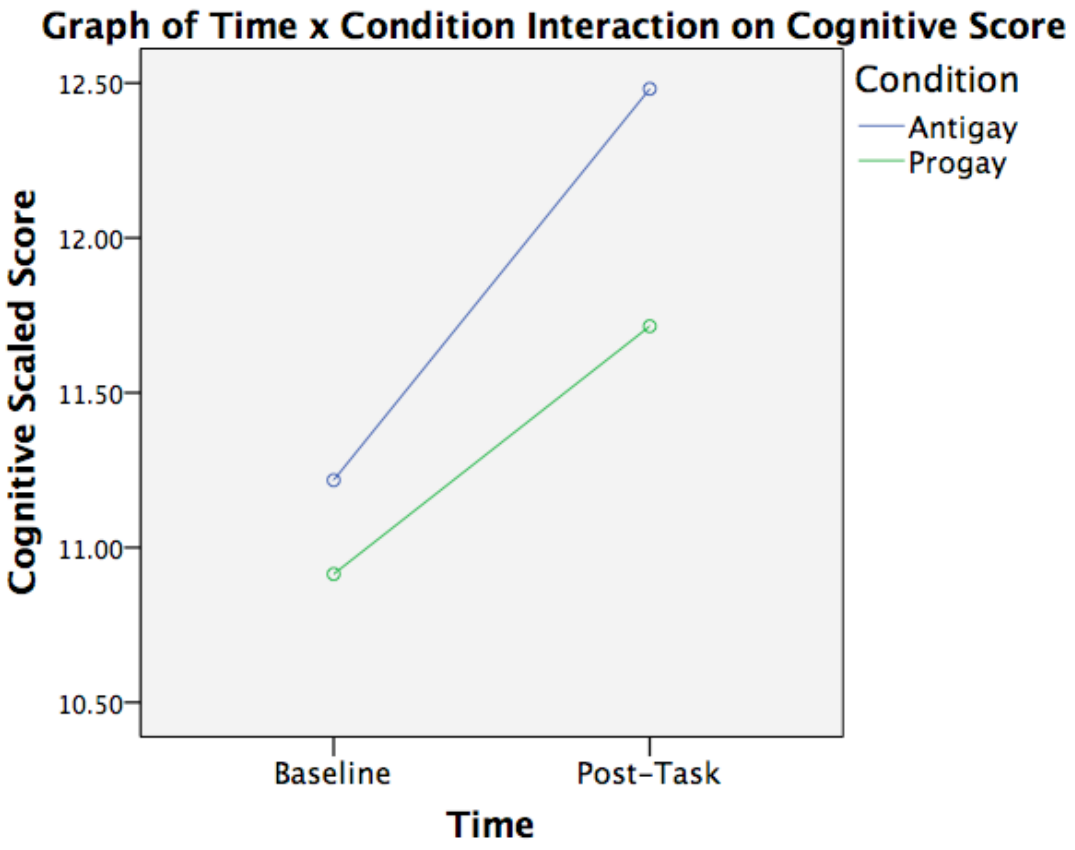

Figure 2. This figure illustrates the time by condition interaction on cognitive scores.

DISCUSSION

This experimental study of gay and lesbian adults examined how a minority stress manipulation affected executive depletion and self-regulation, and explored potential mechanisms for these effects. Consistent with hypotheses, participants who interacted with a confederate holding antigay views showed evidence of self-regulatory depletion by selecting a larger number of unhealthy snacks at the end of the study. Unexpectedly, the opposite effect occurred for cognitive scores relevant to EF, with participants performing better after interaction with the antigay confederate. No differences were found by type of testing (EF or CP), such that this heightened performance in the antigay condition was true across both types of tests. Interestingly, this difference by condition in EF performance was partially mediated by change in state anger from baseline to after the stressor task.

Although the effects we observed on executive and component processes were unexpected in the context of our hypotheses, the neuropsychological literature offers competing theories about the effects of anger on EF. Although some theoretical work has suggested that intense emotions (positive or negative) represent a form of "cognitive load" that may result in poor performance, other theoretical work focused on motivation has posited that negative mood states (including anger) might have a beneficial impact on cognitive, especially executive, performance (Mitchell & Phillips, 2007). The rationale is that negative mood (especially anger) contributes to heightened threat perception and

increased motivation for the task at hand. Preliminary evidence has shown that negative mood can prevent use of "heuristics" (i.e., mental short-cuts) and increase alertness or focused attention (Park & Banaji, 2000). Research on anger specifically has similarly shown a "narrowing" effect on attentional processing (Fredrickson & Branigan, 2005). In presenting these competing theories, Mitchell and Phillips (2007) argued that the EF testing batteries most often used in short, lab-based studies demand the type of focused attention that might result from negative mood states.

Similarly, theoretical and empirical work within the field of LGB health may also shed light on this unexpected finding. Evidence for the "best little boy in the world" hypothesis (Pachankis & Hatzenbuehler, 2013) demonstrates that sexual minority men compensate for domains in which they expect rejection and barriers to success (e.g., societal ideals regarding standards of masculinity/femininity, traditional relationships) by excelling in areas over which they have more control over their performance (e.g., academics, competition, care around physical appearance). Thus, motivational factors complicate associations of minority stress and cognitive depletion in this particular population. If individuals in our antigay condition have grown accustomed to responding to minority stress with increased motivation for performance, it is possible that motivation to excel accounted for our findings on cognitive performance, particularly if participants believed they were being evaluated.

Consistent with study hypotheses (which predicted a self-regulation depletion effect in the antigay condition), participants who believed they were interacting with an antigay confederate chose a greater number of unhealthy (but not healthy) snacks at the end of the lab session than participants in the progay condition. None of the hypothesized

variables explained this effect. This finding provides support for the self-regulatory resource model, which proposes depletion in regulation of emotions, thoughts, and behaviors when this self-regulation resource is overused or exhausted in response to stress (Baumeister & Vohs, 2003; Baumeister et al., 2007). The current study demonstrated that minority stress results in self-regulatory depletion, at least in this single domain that was examined behaviorally (number of healthy and unhealthy snacks). A key tenet of the resource model contends that self-regulatory depletion is not domain-specific (Hagger et al., 2010; Tangney et al., 2004). In other words, depletion in one area (e.g., over-eating) is likely to also predict depletion in other domains (e.g., sexual risk, substance misuse). The implication is that dysregulation may occur more broadly in response to minority stress and may explain some of the health disparities documented in this population.

Contrary to hypotheses, most of the mediators proposed and tested did not explain either the executive or self-regulatory findings. Video-coded disclosure of sexual orientation during the task did not mediate the main outcomes. Although the researchers were interested in concealment as well, it was not possible to assess intentional concealment through the coded video interactions because very few individuals in the sample engaged in behaviors that would suggest overt concealment (e.g, using opposite-sex pronouns to refer to a dating partner or lying directly about their sexual orientation). Research by Scrimshaw and colleagues (2013) has documented that disclosure and concealment of sexual orientation should be conceptualized as separate scales rather than as opposite ends of the same spectrum. In other words, concealment is not the same as less disclosure. Given that most individuals in LGB research are “out” about their sexual

orientation in their daily lives, intentional concealment may have been the more effortful and unfamiliar strategy, thus making it a more likely mediator candidate than disclosure. Moreover, concealment is likely more subtle than the absence of disclosure, potentially involving aspects of gender presentation that are harder to code behaviorally (e.g., lowering or raising voice pitch or tone, discussing topics that are traditionally masculine or feminine). Future research should examine these more nuanced aspects of impression management.

Similarly, expressive suppression and cognitive interference did not mediate the association between condition and the main study outcomes as expected. However, expressive suppression as a regulation strategy was endorsed to a greater extent in the antigay condition than the progay condition during the stressor task, even in models accounting for all other variables of interest. Even though expressive suppression was not related to EF or self-regulation in this study, it has been shown in the literature to have a range of negative outcomes. Specifically, research has documented an association between suppression and poor social functioning, such that intentionally suppressing can result in reduced interpersonal connections and even increased psychophysiological reactions in both the individual suppressing and interaction partners (Butler et al., 2003). Other research has documented negative effects of expressive suppression on symptoms of depression, anxiety, and posttraumatic stress (Moore, Zoellner, & Mollenholt, 2008).

Taken together, the results showed opposite effects for EF and self-regulation. This is particularly surprising from the perspective that EF represents "the underlying conceptual mechanism" (Hoffman et al., 2012) for self-regulatory depletion documented in the social psychological literature. It is plausible that, on the surface, the cognitive

testing portion of the study was perceived as a challenge measuring intellectual ability or as part of the evaluative nature of the interpersonal task (even though this was not intended), whereas the behavioral self-regulation measure was better masked in terms of any evaluative component or intent. Following this logic, it is possible that experimentally-induced changes in state anger increased motivation and focused attention in the short term while participants were completing the cognitive task, overriding any possible depletion effects. However, when participants were later given the opportunity to select healthy or unhealthy snacks – an activity in which focused attention or motivation likely offer little benefit – they showed evidence of depletion. Although speculative, it may be that marginalized individuals are able to respond to minority stress with heightened performance on tasks perceived as evaluative in the short-term but with longer-term costs in terms of ability to regulate behaviors, thoughts, and emotions. This short-term benefit may be a learned response for coping effectively with social rejection through competition and success in performance domains that may result in subsequent self-regulatory depletion that contributes to other health disparities. It may also be that the short-term nature of the current study resulted in a short-term cognitive benefit for the participants who experienced prejudice (due to the effect of state anger on motivation) but that a longer-term assessment of the chronic effects of minority stress experiences might reveal depletion in EF as well.

Limitations of the current study should be acknowledged. First, this study utilized a community-based convenience sample of mostly "out" and mostly White gay and lesbian adults. Caution is advised in generalization of results to the full range of diverse individuals within the lesbian and gay community, to individuals who are less open about

their sexual orientation, or to bisexual men and women. Second, a possible alternative explanation for results is that individuals in the antigay condition were angry and motivated and, therefore, performed the cognitive tasks more quickly than participants in the control condition but not necessarily more accurately. Errors on the cognitive tests are currently being calculated and may subsequently reveal a more nuanced understanding of this phenomenon. Third, as with any study, imperfect measurement of our constructs may have impacted the results. The EF and CP composite scores had lower than expected reliabilities. Although these measures (composites of subtests from a well-validated testing battery) represent significant improvement compared to prior studies that have assessed cognitive depletion by using only one subtest or measures that have not been standardized or validated, the low reliabilities suggest that including a greater number of subtests to fully assess the EF construct would be ideal. Additionally, the behavioral measure of self-regulation (snacks chosen at the end of the lab session) assessed only one potential regulatory domain and future research would benefit from more comprehensive assessment of self-regulatory depletion. Finally, between the time that this literature was reviewed, hypotheses were developed, and the study was designed and conducted, and the time that results were analyzed and this manuscript was written, the literature on self-regulatory depletion has been criticized and the replicability of results called into question (Carter, Kofler, Forster, & McCullough, 2015; Carter & McCullough, 2014). This debate is ongoing and controversial so no definitive conclusions can be made at this time; however, it is important to note that the self-regulatory resource model and the ego depletion phenomenon may not be as robust as previously assumed.

Despite limitations, this study is the first to use an experimental paradigm to

assess the effects of minority stress on EF and self-regulation among gay and lesbian adults, as well as to test potential mechanisms. The experimental method in this study allows for making stronger causal conclusions than have been made from the cross-sectional survey designs overwhelmingly employed in this research area. The results further our understanding of ways in which LGB individuals are affected by experiences of minority stress, including perceived discrimination, concealment of sexual orientation, expectations of rejection, and internalized homophobia, which are prevalent in this population. Attitudes toward sexual minorities and legal rights in the U.S. are undoubtedly improving over time, particularly in the past few years. However, this increased visibility and attention to these issues (including constant media coverage of public votes, executive orders, and court decisions that directly impact the lives of LGB Americans) has likely resulted in more frequent interaction between LGB individuals and those who hold antigay attitudes. LGB individuals face decisions about whether to conceal or disclose sexual orientation regularly in their daily lives across contexts. These results suggest complex associations, which warrant additional study.

Future research should attempt to replicate the findings from this study and also determine whether the long-term effects of chronic experiences of minority stress are different than the effects that can be observed following an acute stressor in the laboratory. If executive and self-regulatory depletion is observed in response to chronic minority stress, it will be important to evaluate how this depletion impacts various health behaviors and ultimately health outcomes and disparities. These depletion effects may have implications for intervention development, given research on the potential of mindfulness-based stress reduction and similar approaches for improving EF (Heeren,

Van Broeck, & Philippot, 2009). On the other hand, if the acute positive effects on cognition documented in the study are replicated more generally, this could represent a form of resiliency or an adaptive way to respond to prejudice that actually benefits marginalized groups. Additionally, future research should seek to understand whether other variables beyond those examined in this study moderate and/or mediate these findings. State anger emerged as a mechanism for the unexpected effects for EF and CP scores. However, the field could benefit from better understanding for whom and under what circumstances the findings hold true as well as the underlying mechanisms for these effects.

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