CARDIOVASCULAR REACTIVITY IN RESPONSE TO GENDER STATUS THREAT: THE ROLE OF PRECARIOUS MANHOOD BELIEFS

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ABSTRACT OF THE THESIS

Cardiovascular Reactivity in Response to Gender Status Threat: The Role of Precarious Manhood Beliefs

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The current study aimed to determine if the socially constructed nature of manhood leads men to experience a pattern of cardiovascular reactivity that has been identified as a threat (versus challenge) response when asked to speak about a time they felt their masculinity was being questioned. To test this, men had their cardiovascular system monitored using electrocardiogram (EKG), impedance cardiography (IC), and blood pressure (BP) measurements. During monitoring, participants were assigned randomly to recall a time when they felt like less of a man (i.e., gender-relevant condition) or to describe their typical day (i.e., neutral condition). Then participants completed measures of precarious manhood beliefs (PMB) and gender identity (GI). When men talked about a time they felt like less of a man, they were expected to show a primarily vascular cardiovascular pattern, indicative of threat, rather than a primarily myocardial pattern typically associated with challenge. This effect was expected to be more pronounced

among men who highly endorse PMB and strongly identify with their gender. However, PMB interacted with speaking topic to reveal that men high in PMB, compared to men low in PMB, showed a greater *challenge* pattern when speaking about an event in which they felt like less of a man. These results lend support for the proposition that gender-related stress contributes to the sex differences found in cardiovascular reactivity, disease rates, and mortality. By understanding the interaction of gendered beliefs, gender identity, and gender threats, health and wellbeing may be improved.

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On average, men die younger than women from many of the leading causes of death (Kochanek, Murphy, Xu, & Tejada-Vera, 2016). Further, for many preventable causes of death, men continue to outrank women overall (Heron, 2016). For example, accidents are the third leading cause of death for men compared to the sixth leading cause for women. Suicide is the seventh leading cause of death for men compared to the fourteenth for women.

However, the number one leading cause of death for men and women is cardiovascular disease (CVD; Heron, 2016). Overall, 24.5% of deaths for men are from diseases of the heart compared to 22.3% for women. While these mortality rates are comparable, diseases of the heart become the number one cause of death for men at age 45 compared to age 80 for women (Heron, 2016). Further, across all age groups, heart failure-related deaths are higher among men than women (Ni & Xu, 2015). In addition, the largest contributor to CVD mortality is coronary heart disease (CHD), and men have higher rates of CHD than women (Mosca, Barrett-Connor, & Wenger, 2011). Even when looking at cardiovascular problems where men and women have comparable morbidity rates (e.g., hypertension), men are significantly less likely than women to report taking their medication, and to have their condition under control (e.g., Yoon, Fryar, & Carroll, 2015; Nwankwo, Yoon, Burt, & Gu, 2013).

Cardiovascular disease is of particular importance not only because it is the leading cause of death in the United States, but because many controllable behaviors influence its onset and progression. Diet, exercise, smoking behavior, the occurrence of

major or reoccurring stress, and medication adherence appear to affect CVD. Therefore, to prevent and control CVD, attention needs to focus on lifestyle choices and behaviors that are often influenced by cultural norms.

Gender Stereotypes

Cultural norms surrounding gender (i.e., gender norms) are shared beliefs about acceptable behavior for men and women. Prescriptive and proscriptive gender norms direct how men and women should and should not behave, respectively (Prentice & Carranza, 2002). Overall, gender norms allow women to express emotion and care for their health. However, gender norms make few concessions for men to care for their health. Specifically, men are commonly prescribed to be agentic, strong, and stoic, and therefore men may feel pressured to handle health problems on their own and to not rely on others for help (Addis & Mahalik, 2003).

To elaborate, women are traditionally expected to be communal and nurturing. Men are expected to be agentic and less emotionally expressive (Prentice & Carranza, 2002). These gendered expectations can shape how women and men behave. For example, consistent with their caregiving prescription (Barnett, 2006), women are more likely to utilize general and preventative healthcare services than men, even when controlling for sex specific care (Vaidya, Partha, & Karmakar, 2012; Bertakis, Azari, Helms, Callahan, & Robbins, 2000). Since preventive care is a primary factor in earlier disease detection, it may be an important contributor to men's higher mortality rates. Further, men, consistent with their stoicism prescription, are less likely than women to express pain and to describe their symptoms to physicians (McCaffery & Ferrell, 1992; Robinson et al., 2001; Kroenke & Spitzer, 1998; Van Wijk & Kolk, 1997). Neglecting to

detect or to disclose symptoms negatively impacts a physician's ability to correctly diagnose and treat patients, and this also likely contributes to gender health disparities.

Typically, men who endorse traditionally masculine views are less likely to engage in preventative care, to report symptoms of health problems, and to seek medical and mental healthcare when needed (O'Brien, Hunt, & Hart, 2005; Berger, Levant, McMillan, Kelleher, & Sellers, 2005; Mahalik, Burns, & Syzdek, 2007). Further, men who endorse traditional notions of masculinity are more likely to engage in risky behaviors that can jeopardize their health. For example, in general, men are more likely than women to smoke, drink excessively, eat high fat diets, drive without a seatbelt, engage in physically aggressive behaviors, and practice unsafe sex (Mahalik, et al., 2007; Eagly & Steffen, 1986; Wardle, Hasse, Steptoe, Nillapum, Jonwutiwes, & Bellisle, 2004; Wilson & Daly, 2004; Shearer, Hosterman, Gillen, & Lefkowitz, 2005).

Precarious Manhood

Why do men choose to engage in hazardous behaviors at the expense of their wellbeing? When men engage in behaviors that are generally considered feminine or not masculine, they often experience anxiety (Bosson & Michniewicz, 2013). For example, in one study, men were asked to braid either hair or rope. The men who engaged in the feminine task (i.e., hair braiding) displayed more implicit anxiety than men who performed the masculine task (Bosson, Vandello, Burnaford, Weaver, & Wasti, 2009). For men, failing to act in a masculine manner, or acting in a feminine manner, can induce a gender threat and consequent anxiety. The current study evaluated the physiologic concomitants of anxiety resulting from gender threats in men.

Unlike men, when women engage in gender-inconsistent behaviors, they do not typically experience increased anxiety (Vandello & Bosson, 2013; Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008). This gender difference likely results from norms concerning the way gender is conceptualized. Manhood is socially constructed, associated less with nature and more closely with culture than womanhood (Reynolds & Haslam, 2011). It is not linked to a discrete biological event, and instead must be earned through social action (Vandello et al., 2008). In many preindustrialized nations, the transition from boyhood to manhood is marked by dangerous or painful rituals. For example, in order to be considered men, the Satere-Mawe tribe in the Amazon requires boys to endure twenty, ten minute trials with their hands being attacked by stinging ants (National Geographic, 2016).

Industrialized nations typically do not have formal manhood initiations. Instead, the actions required to achieve manhood entail following traditional gender roles. Boys may be considered men when they behave in masculine ways (e.g., sexual conquest of women) and avoid feminine behaviors (e.g., display emotions other than anger). There is no specific ritual that men can follow in many industrialized nations in order to earn their manhood; hence, the transition into manhood is often considered precarious.

Once a boy initially proves himself to be a man, he must do so continually. When men engage in feminine or unmasculine behaviors, they risk losing their manhood status. Acting outside of prescribed gender norms brings about stress and anxiety over the potential or actual loss of status (Vandello et al., 2008; Vandello & Bosson, 2013). That is not to say that men do not engage in traditionally feminine behaviors, rather, this is discouraged, and men are unlikely to embrace feminine behaviors publically (McCreary,

1994). For example, in structured interviews with stay-at-home fathers men described taking great joy in their new caregiving role, a role typically prescribed to women, while also relaying negative reactions and notable teasing from acquaintances concerning the loss of their manhood (Rochlen, Suizzo, McKelly, & Scaringi, 2008).

The current study treats precarious manhood beliefs (PMB) as an individual difference variable. Several researchers have used instruments based on precarious manhood theory to measure personal beliefs. For example, to determine if beliefs about manhood's instability could predict confrontation of sexual prejudice, Kroeper, Sanchez, and Himmelstein (2014) measured individuals' endorsement of precarious manhood beliefs. In another study PMB was measured to predict how masculinity threats affect perceptions of sexist humor (O'Connor, Ford, & Banos, 2017). Therefore, PMB may be an important predictor of who is most susceptible to gender threats. The current study was one of the first to test PMB as a moderator of cardiovascular reactivity to gender threats.

Gender Identity and Precarious Manhood. Not all men experience anxiety after a gender threat. Anxiety and subsequent negative reactions after a gender threat are moderated by how strongly men identify with their gender (Schmitt & Branscombe, 2001; Aidman & Carroll, 2003; Bosson & Michniewicz, 2013; Weaver & Vescio, 2015). Specifically, when men view being a man as a central aspect of their identity, they are more likely to be affected by gender threats. For example, men who strongly identified with their gender rated nonprototypical (i.e., less masculine) men less favorably after a gender threat (Schmitt & Branscombe, 2001). The current study continued exploring the relationship between gender threats and GI. Specifically, the relationships between

gender threats, GI, and PMB were examined. The effects of PMB, in particular, have received little attention, with only two prior studies exploring their link with gender threats and behavior (Kroeper et al., 2014; O'Connor et al., 2017).

Since beliefs that manhood is precarious (i.e., PMB) are culturally pervasive (Vandello et al., 2008), stronger GI for men may be positively associated with stronger PMB. Essentially, men who believe their GI is important may be more likely to endorse widely held notions of manhood (i.e., PMB). While it seems plausible that GI and PMB correlate positively, with men who place more value on their GI endorsing PMB more strongly than men low in GI, GI and PMB are distinct constructs and may be unrelated. Specifically, men may identify strongly with their gender, but define manhood in a way that is not precarious. Here, no strong relationship would be found between GI and PMB. As a result, PMB may be an important factor with as much predictive validity as GI for determining which men are susceptible to a stress response after a gender threat.

Stress and Gender

In sum, men experience more anxiety after a gender threat than women. The anxiety brought on by the threat of losing gender status can be considered part of a stress response. When an individual is exposed to a potential stressor, a cognitive-evaluative appraisal process ensues. During primary appraisal, individuals determine if their physical or psychological well-being is in question. This may lead to the appraisal of harm/loss (i.e., damage to well-being has already been sustained), a threat appraisal (i.e., harm or loss appears possible), or challenge (i.e., there is an element of threat but also a potential for positive gain or growth) (Lazarus & Folkman, 1984). Secondary appraisal involves assessing one's ability to cope, that is, to deal effectively with the stressor or

manage its impact. An imbalance between primary and secondary appraisal leads to a stress response, which entails negative emotions, such as anxiety, and biological responses (e.g., cardiovascular reactivity due to enhanced sympathetic-adrenal-medullary activity) that are potentially damaging to physical health (Chida & Steptoe, 2010; Lagraauw, Kuiper, & Bot, 2015).

I propose that the processes of cognitive appraisal and coping central to Lazarus and Folkman's (1984) theory of psychological stress, outlined above, can usefully be integrated with concepts derived from the study of self and social identity (Contrada & Ashmore, 1999). Many forms of threat, harm/loss, and challenge arise from the perception that situational factors have negative implications for valued aspects of one's self concept. It follows that many forms of coping involve cognitive and behavioral means of restoring/repairing some aspect of self. Men who endorse culturally shared PMB and place importance in their GI would be expected to appraise a situation in which they act outside their prescribed gender norms as threatening (i.e., the potential stressor is self-relevant). This is especially likely if they perceive that the non-gender normative behavior is unavoidable and believe they have no ready means of coping with its consequences (i.e., avoiding the potential loss of their manhood status). The current study focuses on gender as one potential facet of social identity involved in psychological stress and coping processes.

Challenge and Threat Physiology

One limitation of past research on precarious manhood is that men may be unwilling to disclose negative affect after a gender threat. On explicit self-report measures of anxiety, men typically do not report more discomfort when receiving gender

threatening information. However, implicit measures of anxiety show that men have more anxiety-related thoughts after a gender threat (Vandello & Bosson, 2013). The current study expanded on past research by employing impedance cardiography (IC) measures before and during a gender threat, to provide an implicit indication of threat and anxiety through physiologic concomitants. To date, the effects of precarious manhood have not been examined by observing its impact on stress-related, sympathetic nervous system (SNS) influences on the heart and blood vessels.

When an individual experiences a stress response, greater SNS activity is observed. The SNS readies the body for action during times of stress, while activity of the parasympathetic nervous system (PNS), which functions to relax the body, may be down-regulated. Sympathetic influence on the cardiovascular system is typically documented by increased heart rate (HR), a shorter pre-ejection period (PEP), and increased cardiac output (CO) and total peripheral resistance (TPR; Tomaka, Blascovich, Kibler, & Ernest, 1997). Impedance cardiography noninvasively measures cardiac activity by monitoring the PEP time intervals and CO (Tomaka et al., 1997). Specifically, PEP is indicative of SNS influences on the heart (Blascovich & Kelsey, 1990). TPR can be estimated on the basis of IC indices and concomitant blood pressure (BP) measures. In sum, IC can be employed to support inferences about SNS-based cardiovascular responses to gender-related stressors.

In addition to general SNS influence on the heart, different patterns of cardiac responding are thought to be associated with different cognitive appraisals of stressors. Recall that challenge and threat evaluations are generated by the process of primary cognitive appraisal. A challenging situation will typically involve greater cardiovascular reactivity, because the body is readying itself for action in order to meet, attempt to succeed at, and

grow from a challenge. An individual will appraise a situation as challenging and display a corresponding cardiovascular pattern when they believe their resources can meet or exceed the demands of the stressor (i.e., the potential stressor is controllable; Blascovich, 2008a). A threatening situation will also involve greater cardiovascular reactivity in order to ready the body for action, but the stressor here is appraised as harmful without the opportunity for benefits or growth (Lazarus & Folkman, 1984) or uncontrollable (Blascovich, 2008a). Therefore, general increases in cardiac reactivity alone (e.g., BP and HR elevations) cannot determine if increased SNS activity represents a response to a psychologically challenging or threating stressor. However, Blascovich and colleagues have proposed that distinct cardiovascular patterns associated with different psychological appraisals can be observed using the measures derived from IC and BP readings (Tomaka et al., 1997). Physiologically, a challenge pattern is associated with greater cardiac activity (i.e., PEP and CO) and less vascular resistance (i.e., TPR) indicating beta-sympathetic adrenal medullary activation and enhancing cardiac performance (Tomaka et al., 1997; Mendes, Reis, Seery, & Blascovich, 2003). A threat pattern is associated with alpha-sympathetic adrenal medullary activation, as well as pituitary-adrenal-cortical activation, reflected by less change in CO and greater increases in TPR (Tomaka et al., 1997; Mendes et al., 2003). Therefore, an added benefit of IC is that cardiovascular consequences of challenge and threat appraisals may be differentiated. In the current study, men who experienced a gender threat were expected to show a cardiovascular pattern wherein CO and PEP were lower while TPR was elevated (i.e., cardiovascular threat pattern).

Current Study

The aim of the current study was to determine how gendered beliefs (i.e., PMB) and GI interact to influence men's experiences with a gender-relevant stressor with respect to its impact on the cardiovascular system. The current study expands on the existing literature in several ways.

First, the interaction of PMB and gender threats has only been documented in two studies thus far (Kroeper et al., 2014; O'Connor et al., 2017). Precarious manhood beliefs may be an important individual difference variable that determines whom gender threats are most likely to affect over and above the predictions made by GI. Additionally, while GI has been looked at in past research regarding gender threats, the importance of GI for cardiovascular reactivity is not well established. Gender identity may be a better indicator of vulnerability to gender threats than gender alone.

Second, past research on precarious manhood has not employed cardiovascular reactivity as a possible implicit indication of anxiety. Men may be unable to recognize or be unwilling to explicitly admit anxiety after a gender threat. Cardiovascular reactivity is an automatic process men are unlikely to be able to control, making it a useful measure of potential stress responding after a gender threat. Additionally, cardiovascular reactivity is implicated in the development of CVD (Chida, & Steptoe, 2010). Therefore, observing the influence of gender threats on the cardiovascular system may lead to important observations concerning men's health.

Lastly, the current study will expand theoretical work by Lazarus by examining how gender can influence appraisal, and expand theoretical work by Blascovich by examining how gender can influence threat and challenge cardiovascular patterns. Neither theory has explicitly incorporated gender and precarious manhood in this manner.

The current study assigned men to a speaking topic (gender-relevant, neutral) and recorded continuous, gender-related, individual difference predictors (i.e., PMB and GI) to test the following hypotheses:

(i) I expected a main effect of speaking topic where men in the gender-relevant condition would show greater cardiovascular reactivity, revealed by a cardiovascular pattern more indicative of threat than challenge, compared to men in the neutral condition.

(ii) I expected the effect of gender threat to be moderated by PMB, resulting in a two-way interaction. That is, men who strongly endorse beliefs that manhood is precarious were predicted to show stronger cardiovascular threat patterns after a gender threat than men who do not strongly endorse precarious manhood beliefs and men in the neutral condition.

(iii) Additionally, I expected the relationship between PMB and gender threat to be moderated by GI, resulting in a three-way interaction. Men who strongly endorse PMB and are in the gender-relevant condition were predicted to show stronger cardiovascular threat patterns than men who do not endorse PMB and men in the neutral condition when GI is high.

In sum, stronger PMB and GI in men who are subjected to a gender threat will lead to a more pronounced biological stress response manifested in a cardiovascular pattern indicative of threat more so than challenge.

Method

Participants

A sample size of 98 was determined *a priori* through power analysis using 7 predictors (i.e., the independent variable, two continuous variables, all two-way interactions, and the predicted three-way interaction), alpha = .05, power = .80, and a medium effect size. Effect size estimation is based on previous work studying precarious manhood and anxiety (Vandello et al., 2008). Participants were recruited through the undergraduate research pool at a large northeastern university. Participants were between the ages of 17 and 48 (M = 19.49, SD = 4.03), and identified as Asian/Pacific Islander (44.2%), White (26.3%), Black/African American (10.5%), Biracial (8.4%), Other (7.4%), and Native American/Alaskan Native (1.1%). Two participants preferred not to report their race. An additional question asked if participants identified as Hispanic/Latino (16.8%).

In order to screen out participants who may have been questioning their gender identity, a demographics survey was administered prior to participation in the study in the mass testing pool. Students qualified for the study if they identified as cisgender men (i.e., had a gender identity that aligns with their biological sex). In addition, eligible participants were required to have no history of hypertension, cardiovascular disease, diabetes mellitus, neurological or psychiatric disorders, or head injuries with a loss of consciousness (>10 min), no current use of medications that influence the cardiovascular system, and had to be fluent in English.

A total of 191 participants were recruited for the study. However, 52 participants failed to arrive at their scheduled part 2 sessions. Further, 2 participants entered wrong IDs for part 1 and could not have their part 1 responses linked to their part 2 responses. An additional 6 participants were not fluent in English and 8 participants had diabetes mellitus, psychiatric disorders, or were taking medications that affected the heart. This left a sample of

123 eligible participants. Due to technical errors, baseline BP was not collected for 10 participants, and an additional 18 participants had IC recordings that were too noisy or waveforms that were too irregular to reliably use in analyses. A total of 95 participants were used in analyses.

Procedure

Each participant completed an online survey at least 24 hours before attending a single, individual laboratory session lasting about 1 hour. The online survey embedded measures of PMB and GI in a longer questionnaire to disguise the main variables of interest. Informed consent was obtained before participants completed the online survey. Participants who completed the survey were then invited to participate in person for the second part of the study. During the in-person experiment, participants were told that they would be performing a written and spoken task on memories, in addition to completing several personality questionnaires, while cardiovascular activity was recorded noninvasively.

At the beginning of the in-person part 2 session, video/audio informed consent for permission to video record the speaking task was obtained before seven electrodes were placed on the participants' skin in accordance with standard practice (Sherwood, Allen, Fahrenberg, Kelsey, Lovallo, & van Doorne, 1990). Impedance cardiography and EKG measures were obtained using a MindWare Bionex unit (Model 50-3711-02) and BioLab acquisition software 3.1. In addition, a blood pressure cuff was placed over the participant's non-dominant arm. Systolic and diastolic blood pressure was obtained using a Dinamap Vital Signs Monitor (Model Pro 100). After the electrodes and blood pressure monitor were connected, participants were instructed to relax while seated upright watching a nature

documentary for ten minutes to obtain a "plain vanilla" baseline measure of cardiac activity (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992).

When the baseline phase ended, participants began the main study task. Participants were assigned randomly to a writing topic. Half of the participants were asked to write about a time when they felt like less of a man (i.e., gender-relevant condition). The remaining participants wrote about their typical day (i.e., neutral condition). After a five minute writing period, participants talked about their topic aloud while being video and audiotaped. Participants had five minutes on video to talk about their writing prompt. During the writing and speaking tasks, cardiovascular activity was recorded. After the five minute video session, participants relaxed comfortably for ten minutes in order to record cardiovascular recovery. After the recovery period, participants completed demographic information, were probed for suspicion, debriefed, and awarded credit.

Measures

Cardiovascular measures. The following physiological measures were quantified: Systolic blood pressure (SBP), diastolic blood pressure (DBP), PEP, TPR, CO, and HR. Pre-ejection period is determined by isovolumic contraction time and inversely reflects SNS influence on the heart (Tomaka et al., 1997). CO is the amount of blood ejected from the left ventricle per minute. Averaging PEP and CO values across one minute time intervals is conventional (Tomaka et al., 1997), and was done in the current study. TPR reflects overall systemic vascular resistance across all major atrial trees, and is derived from the formula: (mean arterial pressure/CO) x 80 (Sherwood et al., 1990). Mean arterial pressure was derived from BP recordings using the formula [((2 x DBP) + SBP) / 3] (Cywinski, 1980). To determine threat and challenge cardiovascular patterns, CO and TPR were used to compute a

single challenge-threat index (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Seery, Weisbuch, Hetenyi, Blascovich, 2010).

Precarious Manhood Beliefs (PMB). This scale consists of two previously used measures. First appearing in Vandello et al. (2008), 7 items assessed the degree to which people hold beliefs that manhood is an elusive and tenuous state. These items were internally consistent (α = .85). However, later work by Kroeper et al. (2014) found Vandello et al.'s (2008) scale to have low reliability, prompting the creation of their own measure addressing PMB. This 6-item scale was found to be internally reliable (α = .83). The present study included both scales, but used the most reliable in the regression analyses. The Vandello et al. (2008) measure (α = .80) and Kroeper et al. (2014) measure (α = .78) were both reliable, but the original Vandello et al. (2008) measure was more reliable in this sample and therefore used in the analyses. Higher scores on each scale correspond to a greater belief that manhood is hard to earn and easy to lose.

Gender Identity (GI). A subscale of the Collective Self-Esteem Scale (Luhtanen & Crocker, 1992) was modified by Schmader (2002) to assess the importance of GI to an individual. An additional item was added to the scale that directly asked how central gender is to the respondent's identity. This five item measure was internally reliable in the current sample (α = .80). Responses were made on a 7-point scale with higher scores indicating a stronger identification with one's gender. Gender identity has been found to moderate reactions to gender threats (Schmitt & Branscombe, 2001; Bosson & Michniewicz, 2013; Weaver & Vescio, 2015).

Results

The current study incorporated a mixed design with a set of continuous predictors of gender-related individual difference variables, namely, PMB and GI. The main mode of analysis was hierarchical multiple regression.

Preliminary Analyses

A MANOVA tested baseline physiological (PEP, CO, TPR) and individual difference responses (PMB, GI) by condition to determine if any initial differences existed between participants. This analysis revealed no significant differences $F(1,92) = 0.79$, $p = .56$. Since baseline responses did not differ among levels of the between-subjects factor, reactivity scores were used as the primary dependent variable (Mendes, Blascovich, Lickel, & Hunter, 2002). To control for baseline cardiovascular activity, reactivity scores for the speaking task were computed by subtracting the last minute of each participant's baseline reading from the average of their speaking task readings (Seery, Blascovich, Weisbuch, & Vick, 2004). Correlations between the cardiovascular indexes (i.e., CO, TPR, PEP) across each phase of the study (i.e., baseline and speaking task) were examined (see Table 1). Then, a challenge-threat index was created. Each participant's CO and TPR reactivity score were converted into *z* scores and summed. TPR was assigned a weight of +1 and CO a weight of -1 so that larger values correspond to greater threat (Seery, Weisbuch, Blascovich, 2009).

Before conducting the main hierarchical regression analysis, the assumptions of multiple regression were examined in order to establish that they had been met. To screen for potential outliers and confirm linear relationships between variables, the appropriate correlations and scatter plots were reviewed. An examination of correlations (see Table 1) revealed that no independent variables (i.e., PMB, GI, or speaking topic) were highly

correlated, *p*s > .10. Further, GI and PMB, were screened for multicollinearity by computing a variance inflation factor (VIF). There was no evidence of multicollinearity (i.e., VIF < 10; Tabachnick & Fidell, 2001). Skew, kurtosis, and normality were also checked by examining Q-Q plots and histograms. Based on the skewness in the boxplots, deviations in the Q-Q plots, and Shapiro-Wilk test (p <.001) outliers (n = 2) were excluded from the analyses.

Main Analyses

A hierarchical multiple regression analysis was conducted with the challenge-threat index for the speaking task as the dependent variable. Speaking topic condition was effects coded (neutral = -1, gender-relevant = 1). Continuous predictors (i.e., PMB and GI) were centered. A product term that carries information about the relevant interaction effects was computed by multiplying the focal predictors together. Product terms were computed for all two-way interactions and the predicted three-way interaction. Speaking topic was added in the first step of the regression, followed by GI and PMB entered in the second step, then all 2-way interactions entered in the third step, and finally the predicted 3-way interaction entered in the last step (Aiken & West, 1991). The regression results are presented in Table 2.

To determine if the model was appropriate to the data, residual plots were examined for evidence of homoscedasticity, and unduly influential observations were removed (n = 8) if they exceeded the conventional Cook's D threshold (4/n; Tabachnick & Fidell, 2001).

The hierarchical multiple regression was not significant at step one, F (1, 80) = .589, p = .445, or step two, ΔR^2 = .023, p = .404. However, step three resulted in a

significant ΔR^2 = .126, F (6, 75) = 2.316, p = .042. GI approached significance, B = -.586, t(75) = -1.753, p = .084. Further, PMB by speaking topic interaction was significant, B = -2.027, t(75) = -3.163, p = .002. Squaring the semipartial correlation coefficient for the interaction indicated a medium effect (Cohen, Cohen, West & Aiken 2003), sr^2 = .112. Lastly, in step four the three-way interaction was not significant, ΔR^2 = .006, p = .488.

The significant interaction between speaking topic and PMB was plotted following Cohen, et al.'s (2003) procedures (see Figure 1). Conditional effects for low (i.e., -1 SD) and high (+1 SD) PMB were calculated using Hayes's (2012) PROCESS macro. PMB significantly moderated the relationship between speaking condition and the challenge-threat index while controlling for GI. Among men who were low in PMB (-1 SD), participants in the gender-relevant condition demonstrated significantly more of a cardiovascular threat profile (i.e., less of a challenge profile) compared to men in the neutral condition, B = 1.91, SE = .73, p = .011, 95% CI = [.46, 3.37]. In contrast, men who were high in PMB (+1 SD) demonstrated a marginally significant inverse effect, such that men in the gender-relevant condition demonstrated less of a threat profile (i.e., more of challenge profile) compared to those men in the neutral condition, B = -1.30, SE =.76, p = .090 , 95% CI = [-2.82, .21].

While using a challenge-threat index is standard practice among Blascovich and colleagues (e.g., Blascovich et al., 2004; Seery et al., 2010; Seery et al., 2004; Seery et al., 2009), using a single index does not allow observations to be made concerning the individual contributions of the cardiovascular constituents (i.e., CO, TPR, and PEP). To determine how PMB, GI, speaking topic, and their interactions may differentially affect CO, TPR, and PEP reactivity to create a challenge or threat profile, separate hierarchical

regressions were run for each cardiovascular outcome. Speaking topic was entered in step one, PMB and GI were entered in step two, all two-way interactions were entered in step three, and the three-way interaction was entered in step four.

Mirroring the regression analysis conducted using the challenge-threat index, only step three of the regression predicting CO reactivity was significant, $\Delta R^2 = .142$, F (6, 75) = 2.575, $p = .025$. Again, GI approached significance, $B = .453$, $t(75) = 1.805$, $p = .075$. Further, the interaction term between PMB and speaking topic was again significant $B = 1.638$, $t(75) = 3.408$, $p = .001$.

The significant interaction between speaking topic and PMB for CO reactivity was plotted following Cohen, et al.'s (2003) procedures. Conditional effects for low (i.e., -1 SD) and high (+1 SD) PMB were calculated. Hayes's (2012) PROCESS macro was again employed to examine these effects. PMB significantly moderated the relationship between speaking condition and the challenge-threat index while controlling for GI. Among men who were low in PMB (-1 SD), those in the gender-relevant condition showed significantly less CO reactivity compared to men in the neutral condition, $B = -0.65$, $SE = .27$, $p = .02$, 95% CI = [-1.20, -.11]. In contrast, men who were high in PMB (+1 SD) showed a significant inverse effect, such that men in the gender-relevant condition showed more CO reactivity compared to those men in the neutral condition, $B = .83$, $SE = .28$, $p = .02$, 95% CI = [.10, 1.23]. This pattern of CO reactivity further corroborates results from the regression using the challenge-threat index as the dependent variable. That is, men low in PMB in the gender-relevant condition were likely appraising the speaking task as threatening, while men high in PMB in the gender-relevant condition were more likely appraising the speaking task as a challenge.

To determine how TPR reactivity may have been affected by PMB, GI, speaking topic, and their interactions a hierarchical regression analysis was conducted. Speaking topic was entered in step one, PMB and GI were entered in step two, all two-way interactions were entered in step three, and the three-way interaction was entered in step four.

Step one was marginally significant, F (1, 80) = 3.60, p = .06. There was a main effect of speaking topic on TPR reactivity, such that men in the gender-relevant condition (M = 72.73, SD = 112.95) displayed more TPR reactivity than men in the neutral condition (M = 24.59, SD = 116.61). No other steps where significant, ΔR^2s > .263. No change in TPR is consistent with a threat profile. However, a challenge profile typically entails TPR decreases (Mendes et al., 2002).

The hierarchical multiple regression predicting PEP reactivity had a marginally significant ΔR^2 at step two, ΔR^2 = .067, p = .065 and at step four, ΔR^2 = .039, p = .07. In step two, only GI was significance, B = .359, t(78) = 2.11, p = .038. In step four, GI was again significant, B = .351, t(74) = 2.304, p = .024. This relationship was qualified by a marginally significant three-way interaction, B = .27, t(74) = 1.836, p = .07. However, simple effects revealed no meaningful interpretation, all ps > .098.

Discussion

The purpose of the current study was to determine if men show different cardiovascular responses to the threat of lost gender status depending on PMB and GI. Past work has shown that threats to gender status typically elicit anxiety and threat-related cognitions among men (Vandello et al., 2008; Vandello & Bosson, 2013). Therefore, I expected to see this mirrored in cardiovascular reactivity through PMB and GI moderating

cardiovascular patterns associated with threat. When men recalled a time they failed to live up to the expectations set by their prescribed gender norms, a cardiovascular pattern indicative of a threat response was predicted to be present more so in men who endorse PMB and strongly identify with their gender (i.e., score highly on GI) compared to men who do not endorse PMB or strongly identify with their gender.

In contrast, PMB interacted with speaking topic to reveal that men high in PMB showed a greater *challenge* pattern when speaking about an event in which they felt like less of a man. When exploring the individual contributions of CO, TPR, and PEP this pattern was driven mostly by CO. Challenge responses are represented by an increase in CO and decreases in TPR and PEP (Mendes et al., 2002). Men in the gender-relevant condition high in PMB showed greater increases in CO from baseline compared to high PMB men in the neutral condition. However, TPR reactivity only differed by speaking topic, not PMB. Further, PEP did not significantly differ by speaking topic or PMB. Therefore, men who were high in PMB showed a greater challenge response to the gender-relevant topic through their challenge-threat index, and increases in CO, but not through decreases in TPR or PEP.

Although I originally predicted men high in PMB would show a greater threat response when speaking about losing their status as a real man, a pattern of challenge is not inconsistent with past research on coping or precarious manhood. People are more likely to engage in approach-motivated coping when they feel they have the resources necessary to deal effectively with or control the stressor (Blascovich, 2008a). Further, beliefs can alter how a situation is appraised (Blascovich, 2008a). Holding beliefs that manhood can be achieved or is a controllable status (i.e., endorsing PMB) is therefore likely to influence appraisal in a way consistent with challenge. Men high in PMB may believe that threats to

their gender status are stressors which can be overcome as implied by research showing that men engage in more masculine behaviors after a gender threat. For example, after receiving feedback that he is not as masculine as other men (i.e., the potential stressor), a man is more likely to engage in a punch bag task (i.e., cope) in order to reassert his gender status (see Bosson et al., 2009). In this example, the man is engaging in problem-focused coping (i.e., coping in which the stressor is dealt with directly) (Blascovich, 2008a). If men did not appraise gender status threats as challenges engaging in problem-focused coping would be less likely. Thus, holding beliefs that manhood can be earned may act as a cognitive resource that men utilize when appraising a gender status threat, and that ultimately contributes to a challenge appraisal and problem-focused coping. Future studies should investigate the relationship between challenge appraisals of a gender status threat and coping strategies as McCrae (1984) found that coping styles fluctuate depending on the type of appraisal.

Men low in PMB were not expected to show a threat pattern when speaking about their status as real men. However, men low in PMB in the gender-relevant condition displayed more of a cardiovascular threat profile compared to low PMB men in the neutral condition. When examining the individual contributions of CO, TPR, and PEP, men low in PMB in the gender-relevant condition had less CO reactivity than men low in PMB in the neutral condition consistent with a threat profile (Mendes et al., 2002). A threat response entails CO decreasing or remaining unchanged from baseline. Further, TPR did not deviate significantly from baseline by PMB. No change or an increase in TPR is thought to reflect a threat profile (Mendes et al., 2002). Lastly, PEP did not differ significantly by speaking topic or PMB. However, decreases in PEP are typical of a threat profile (Mendes et al., 2003). Therefore, men low in PMB showed a cardiovascular pattern more indicative of threat in the

gender-relevant condition compared to low PMB men in the neutral condition as documented by a greater challenge-threat index driven primarily by CO reactivity and TPR (non-) reactivity.

Although a threat profile is inconsistent with the original hypothesis, this result is not inconsistent with past research. Men low in PMB do not hold beliefs that their gender status can be earned, therefore these men do not have a belief system which may serve as a resource bolstering feelings of controllability during secondary appraisal (Blascovich, 2008a; Lazarus & Folkman, 1984). This lack of ability to effectively handle the potential stressor (i.e., loss in gender status) likely results in a threat appraisal.

Lastly, while GI has been found to moderate reactions to gender threats (Schmitt & Branscombe, 2001; Bosson & Michniewicz, 2013; Weaver & Vescio, 2015), GI only marginally predicted cardiovascular reactivity. Further, GI did not significantly interact with speaking topic or PMB. It may be that GI is more important for predicting behavioral rather than physiological outcomes, or that if other studies had included PMB they would have found results consistent with the ones in this paper. Specifically, PMB may be a better predictor of who is susceptible to gender status threats. Importantly, GI and PMB were only moderately correlated. Therefore, the relationship between gender threats and GI may be explained by the shared variance between PMB and GI. Future studies are needed to explicate the relationship between PMB, GI, and gender threats.

The current study contributes to the literature on precarious manhood theory by focusing on an implicit indication of anxiety not previously employed. This study was the first, of which I am aware, to measure cardiovascular challenge and threat patterns to gendered stressors using IC with a focus on PMB. The ability to observe a cardiovascular

threat versus challenge pattern provides physiological evidence that strengthens the claim that stress/anxiety is experienced by men because manhood is conventionally precarious. In addition, the cardiovascular measures used in this study allow inferences to be made concerning implications for men's cardiovascular health. It is reasonable to predict that prolonged or frequent stress responses arising from gender threats may harm men's cardiovascular health and ultimately influence gender discrepancies in CHD progression and mortality (for review on chronic stress and cardiovascular health see Lagraauw et al., 2015). A cardiovascular challenge pattern is often projected to be less physiologically damaging than a threat profile (Obrist, 1981; Obrist, Light, Sherwood, Allen, Langer, Koepke, 1986; Blascovich, 2008b). However, if men experiencing a challenge pattern are more likely to engage in coping strategies after a gender status threat the nature of these coping strategies may themselves be health-damaging. Many traditionally masculine behaviors men may use to cope with potential gender status threats involve risky behaviors such as avoiding preventative care, failing to report symptoms of health problems, and not seeking medical and mental healthcare when needed (O'Brien et al., 2005; Berger et al., 2005; Mahalik et al., 2007).

Further, the current study investigated the impact of PMB and GI on appraisals of threat. PMB was a significant predictor of vulnerability to a gender threat. This finding will hopefully spur new research on coping strategies men can employ to diminish a stress response after a gender threat. Specifically, if endorsement of PMB by men consistently predicts greater vulnerability to gender threats, then one way to decrease threatening experiences and possibly alleviate chronic stress caused by gender could be to design interventions that reconstruct manhood as a permanent state.

Limitations

As with any single study, conclusions to be drawn from the proposed study are limited. For example, although a cardiovascular threat pattern can implicate future heart problems, CVD progression was not be measured directly in the current study. However, cardiovascular reactivity to laboratory mental stressors is associated with future cardiac health, particularly for men (for review see Chida & Steptoe, 2010).

Additionally, this study may have underestimated stress responses, because participants recalled a past event. Past events may be recalled incorrectly, and time may ameliorate initial feelings of stress/anxiety. The found effects may be exacerbated when men experience, rather than recall, gender threats. However, much past work utilizes laboratory-created threats (i.e., false feedback on tests ostensibly designed to measure "gender knowledge"; Vandello & Bosson, 2013). The extent to which people experience gender threatening situations outside the lab is a critique often raised when laboratory-created gender threats are employed. Therefore, the current study drew on ecologically valid gender threats (i.e., participants experienced these threats in the past outside of the laboratory), and provides preliminary insight into the frequency at which men experience threats to their gender status. It is noteworthy that no men were unable to recall a time that made them feel like less of a real man.

Lastly, conclusions drawn concerning the predicted three-way interaction should be taken with caution as the current study was underpowered. Data collection is continuing until the necessary sample size is acquired to detect the potential three-way interaction.

Future Directions

Cognitive appraisal and coping were not directly measured in the current study. Future studies should include appraisal and coping measures when exploring reactions to gender threats. Of particular interest, one way men may cope with gender threats is to avoid health information. If caring for one's health is seen as feminine, men may be particularly reluctant to seek out health information after a gender threat. Further, when men do not avoid health information after a gender threat, they may not be able to effectively encode such information since stress often disrupts information processing (Eysenck & Calvo, 1992). Avoiding or incorrect encoding of cardiovascular health information may contribute to men's CVD development and progression.

Future studies should also observe cardiovascular reactivity in response to in-the-moment gender threats either through laboratory conditions or through ambulatory cardiovascular monitoring. Further, other physiological indices (e.g., heart rate variability) should be employed in future research.

Ultimately, the current study provides support for precarious manhood theory through novel measures of cardiovascular reactivity and explored the influence PMB exerts on the appraisal of potentially gender-threating stressors. Further, utilizing cardiac measures allows informed inferences to be drawn concerning the potential influence conceptualizations of gender can have on health. Continuing to explore the ways gendered beliefs influence stress can benefit clinical practice and potentially increase wellbeing and longevity.

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Table 1

Correlations Among and Descriptive Statistics For Key Study Variables

Variables	*M* (*SD*)	1	2	3	4	5	6	7	8	9	10
1. Challenge-Threat Index	-0.61 (2.43)		.07	-.01	-.05	-.27*	.29**	.05	-.07	-.15	.09
2. Baseline CO	11.89 (5.25)			-.74***	-.32**	.94***	-.73***	-.18	-.07	-.03	-.12
3. Baseline TPR	657.43 (302.06)				.26*	-.73**	.93***	.15	.05	.01	.04
4. Baseline PEP	124.47 (13.46)					-.30**	.23*	.83***	.08	-.21	.07
5. Speaking CO	12.47 (5.34)						-.80***	-.20	-.04	.02	-.12
6. Speaking TPR	704.92 (318.45)							.14	.03	-.02	.11
7. Speaking PEP	124.12 (12.80)								.01	-.09	.13
8. PMB	4.30 (.84)									.12	-.18
9. GI	4.48 (1.09)										-.02
10. Speaking Topic											

Note: Baseline CO, TPR, and PEP are the mean values collected for the last minute of the baseline period. Speaking CO, TPR, and PEP are the mean values averaged across the five minute speaking period.

*$p \leq .05$. **$p \leq .01$. ***$p < .001$.

Table 2

Summary of Hierarchical Regression Analysis for Variables Predicting the Challenge-Threat Index

	Model 1			Model 2			Model 3			Model 4		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Speaking topic	.21	0.27	.09	.18	.27	.08	.17	.26	.07	.19	.27	.08
GI				-.32	.25	-.14	-.59	.33	-.26	-.58	.34	-.26
PMB				-.12	.33	-.04	.71	.41	.25	.70	.41	.24
PMBxGI							.02	.28	.01	.18	.36	.07
PMBxSpeaking							-2.03	.64	-.46**	-2.06	.65	-.47**
GIxSpeaking							.70	.48	.22	.66	.49	.21
PMBxGIxSpeaking										-.39	.56	-.10
R^2		.09			.17			.40			.40	
F for change in R^2		.59			.92			3.74*			.49	

Note: GI and PMB were centered at their means.

*$p \leq .05$. **$p \leq .01$.

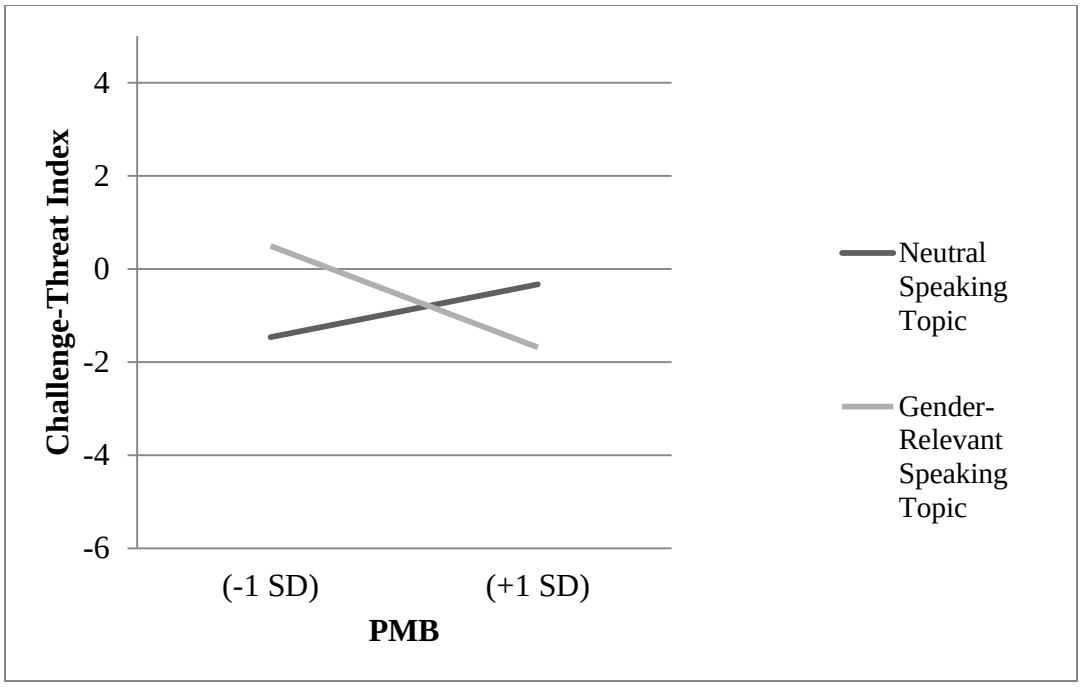

Figure 1. Effect of speaking topic (neutral, gender-relevant) for men with high and low PMB on the challenge-threat index. PMB is centered. Lower scores on the challenge-threat index represent a pattern of cardiovascular activity thought to be associated more with a challenge appraisal, while higher scores are thought to represent more of a threat appraisal.

Appendix A

Gender Identity (GI) – (Schmader, 2002)

1 = Strongly Disagree – 7 Strongly Agree

For the following statements, please indicate the extent to which you agree or disagree with each statement.

1. Being a man (woman) is an important reflection of who I am.
2. Being a man (woman) is important to me.
3. Being a man (woman) has very little to do with how I feel about myself.
4. I value being a man (woman).
5. My gender is central to my identity.

Precarious Manhood Beliefs (PMB) – (Vandello et al., 2008)

1 = Strongly Disagree – 7 = Strongly Agree

For the following statements, please indicate the extent to which you agree or disagree with each statement.

1. It is fairly easy for a man to lose his status as a man.
2. A male's status as a “real man” sometimes depends on how other people view him.
3. Some boys do not become men, no matter how old they get.
4. Other people often question whether a man is a “real man.”
5. Manhood is something that can be taken away.
6. Manhood is not assured—it can be lost.

7. Manhood is not a permanent state, because a man might do something that suggests that he is really just a “boy.”

Precarious Manhood Beliefs (PMB) – (Kroeper et al., 2014)

1 = Strongly Disagree – 7 = Strongly Agree

For the following statements, please indicate the extent to which you agree or disagree with each statement.

1. It’s fairly easy for a man to lose his status as a man.
2. A male’s status as a real man sometimes depends on how other people view him.
3. A man needs to prove his masculinity.
4. A boy needs to become a man; it doesn’t just happen.
5. The title of “manhood” needs to be reserved for those who deserve it.
6. You’re not a man if you don’t like masculine things.

Appendix B

Neutral Writing Condition Prompt

We are interested in people's typical experiences. In particular we are interested in times when people do things that are routine. Please think about a time in your life when you had a typical routine. These should be things that you did almost every day consistently over a period of time.

In the space below, please describe your most typical day experience (what you did, who saw you, what they said or did, etc.) in as much detail as possible.

Gender-Relevant Writing Prompt Condition

We are interested in people's experiences with gender. In particular we are interested in times when people do things that make them seem like they are NOT an ideal member of their gender, in the eyes of other people. Please think about a time in your life when you did something (or something happened to you) - in front of other people- that made you feel bad about your status as a "real man (woman)", and perhaps even insecure as a member of your gender. This should be something that would make most other people see you as "not a real man (woman)."

In the space below, please describe your experience (what you did, who saw you, what they said or did, etc.) in as much detail as possible.