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GENDER IDENTITY, INTERPERSONAL INTERACTIONS, AND AMBULATORY BLOOD PRESSURE

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ABSTRACT
Schemas related to gender identity have been hypothesized to influence the salience of events, the degree to which they are perceived as threatening, and the recruitment of coping efforts when faced with a schema relevant stressor. Literature examining the effects of gender identity on psychophysiological responses to stressors has relied on laboratory studies. We examined the association of feminine gender identity and contextual variables on ambulatory blood pressure (ABP) in a sample of New York City Traffic Enforcement Agents (TEA) in real world contexts. Multilevel regression modeling revealed that femininity was associated with elevations in ambulatory diastolic blood pressure when the TEA was engaged in a gender-relevant interpersonal task. These findings show that identity-related schemas may influence engagement and cardiovascular responses to gender salient activities.

Keywords:
ambulatory blood pressure, gender identity, person by situation interaction.

RESUMEN
Los esquemas de género determinan la importancia que tiene un evento para una persona, si este se percibe como amenazante, y las estrategias de afrontamiento que se utilizan para afrontarlo. Los estudios que examinan los efectos de la identidad de género sobre las respuestas fisiológicas se han realizado en laboratorios. Examinamos la asociación de identidad de género femenina y variables de contexto laboral y su impacto en la presión arterial ambulatoria en agentes de tránsito (AT), fuera del laboratorio. Utilizamos un modelo de regresión multinivel, que mostró elevaciones en la presión ambulatoria diastólica cuando los AT interactuaban en contextos género-relevantes. Estos hallazgos señalan que los esquemas relacionados a la identidad de género influencian los esfuerzos que las personas realizan para enfrentar situaciones estresantes y las respuestas cardiovasculares.

Palabras Clave:
presión arterial ambulatoria, identidad de género, interacción persona x situación.

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Researchers have highlighted the role of identity in determining psychological and physiological responses to stressors (Thoits, 2013). Identity influences the salience of events, the degree to which they can be perceived as threatening, and the recruitment of coping responses (Thoits, 2013). Person × Situation models suggest that the effects of identity-related variables on psychological and physiological responses may emerge most clearly in situations which are likely to activate or threaten identity (Ben-Zeev, Fein, & Inzlicht, 2005; Mor & Inbar, 2009).

Gender identity is a highly salient component of personal identity and it is comprised of gender-related schemas (i.e., mental structures composed of gender-relevant ideas, affects, and attitudes) (Mor & Inbar, 2009). These schemas reflect the internalization of cultural norms (Bem, 1981a), as well as individual-level conceptualizations. When gender schemas are incorporated into self-identity, they reflect the degree to which an individual identifies as masculine and/or feminine (Bem, 1981b).

Theory and research suggest that activation of schemas may influence cardiovascular reactivity to and recovery from stressful stimuli through the effects of schemas on appraisal processes (Lash, Gillespie, Eisler, & Southard, 1991; Smith, Ruiz, & Uchino, 2004). Schema-driven appraisals of an event's salience and potential for threat and harm can influence the individual's response (i.e., the degree to which the individual will approach or avoid the situation) and drive the acute mobilization of physiological resources (Lash, et al., 1991; Maier, Waldstein, & Synowski, 2003). Appraisal processes can also hinder stress recovery by intensifying distress and triggering rumination, which results in prolonged cardiovascular activation (Brosschot, Gerin, & Thayer, 2006).

Laboratory studies have demonstrated that gender schemas are associated with cardiovascular activation in response to gender-relevant tasks. However, the direction of the relationship between gender schemas and cardiovascular activation is not yet clear (Whited & Larkin, 2009). For example, Consenzo and colleagues examined the association of masculinity to increases in cardiovascular reactivity in response to a masculine relevant task (serial subtraction task) (Consenzo, Franchina, Eisler, & Krebs, 2004). In the masculine relevant condition, participants were told that men generally perform better than women on this task. Among men, those with high masculinity scores had greater increases in systolic blood pressure (SBP) than those with lower masculinity scores. The authors suggest that because the task was presented as gender-relevant, men with stronger masculine identity were more motivated and engaged, and consequently manifested higher levels of cardiovascular activation. In contrast, others have reported that cardiovascular reactivity may be increased when there is a mismatch between personal identity and task demands (i.e., when men are asked to perform tasks that are traditionally considered feminine) (Davis & Matthews, 1996; Smith, Gallo, Goble, Ngu, & Stark, 1998). These results may also reflect inexperience with the gender relevant tasks, as individuals may show greater activation when confronting unfamiliar demands. Further research is needed to clarify the differential contributions of gender and gender identity to psychophysiological reactivity to gender-relevant tasks.

This paper aims to examine the association of gender identity to changes in affect, behavior, and blood pressure during gender relevant tasks and to address three methodological issues presented by prior research. First, earlier studies on the role of gender identity and psychophysiological reactivity have been conducted in the context of laboratory experiments (Consenzo, et al., 2004; Davis & Matthews, 1996; Eliezer, Major, & Mendes, 2010; Smith, et al., 1998), highlighting a need for studies of cardiovascular reactivity in real world contexts (Zanstra & Johnston, 2011). ABP monitoring can provide an effective means of investigating the cardiovascular effects of gender-relevant experiences in everyday life (Bowen, et al., 2012; Brondolo, et al., 2009; Brondolo, et al., 2004; Brondolo, et al., 1999; Grassi, et al., 2013; Hermida, et al., 2001; Karlin, Brondolo, & Schwartz, 2003).

To obtain estimates of the effects of gender schemas on responses during naturally-occurring activities, we examine the association of gender identity to changes in affect, behavior, and blood pressure during the workday in New York City Traffic Enforcement Agents (TEAs). TEAs are a valuable employee group in which to study the effects of sex and gender, since men and women have the same job

responsibilities and perform the same duties. TEAs also provide an opportunity to investigate the degree to which the association of gender identity to cardiovascular activation depends on the gender relevance of the task (i.e. potentially stressful interpersonal interactions. Situations involving interpersonal stressors may be particularly effective in activating gender identity-related schemas, as maintaining interpersonal relations has been more closely associated with women and femininity (Buhrmester, Furman, Wittenberg, & Reis, 1988; Bussey & Bandura, 1999; Whited & Larkin, 2009). Although the limited evidence is not fully consistent (Whited & Larkin, 2009), some findings from laboratory studies suggests that interpersonal stress is more salient and activating (i.e., associated with greater psychophysiological response) for women than for men (Lundberg, de Chateau, Winberg, & Frankenhaeuser, 1981; Smith, et al., 1998; Stroud, Salovey, & Epel, 2002; Stroud, Niaura, & Stoney, 2001). TEAs face the possibility of interpersonal stress as they encounter motorists who are potentially angry about receiving summonses for vehicular violations. For TEAs these naturally-occurring salient interpersonal interactions occur under relatively consistent conditions, making it feasible to systematically examine the effects of gender identity on psychophysiological responses to real world events.

Research on TEAs permits us to address a second important methodological issue. In prior literature, it has been difficult to determine whether gender-relevant tasks elicit differential affective and cardiovascular responses because they activate gender schemas or because of differential familiarity with the task. Interacting with members of the public is a task which is required of and familiar to both male and female TEAs. This permits a clearer focus on the role of gender identity.

To understand the mechanisms through which gender identity affects cardiovascular activation, it is important to identify potential mediators of this relationship including cognitive, affective, and behavioral responses. Assessment of these mediators has been largely confined to measures obtained in laboratories (Consenzo, et al., 2004; Davis & Matthews, 1996; Eliezer, et al., 2010; Smith, et al., 1998). Work on racial identity and responses to race-related stressors suggests that daily diary protocols can provide insight into the ways in which identity-related schemas influence responses to identity-relevant experiences in real world settings (Burrow & Ong, 2010). For example, Burrow and Ong (2010) found that racial identity moderates affective reactivity to daily race-related stressors through the use of diary reports (Burrow & Ong, 2010).

The aim of this study is to test the hypothesis that gender identity is associated with daily ABP levels during gender-relevant stressors. Specifically, we predict that feminine gender identity will be positively associated with the magnitude of ABP response during interpersonal stressors but not during non-interpersonal tasks. We also test the hypothesis that affective and coping responses at the time of the interpersonal interactions mediate the relationship of gender identity to cardiovascular activation. The use of ABP monitoring and diary-based data permits the examination of the association of gender identity (i.e., femininity) to affective, behavioral, and BP responses during real time salient workday activities.

Methods

Participants

These data were collected as part of a larger longitudinal study that explored the effects of anger-related traits and interpersonal interactions on ABP. Further details of this study have been published and additional information on TEA's psychophysiological responses is available (Brondolo, et al., 2009; Brondolo, et al., 1999; Karlin, Brondolo, & Schwartz, et al., 2003). The participants were newly hired TEAs who were enrolled in a training program and were attending classes and field exercises with colleagues throughout the day. The training program lasted 9 weeks. Upon completion, TEAs began issuing summonses in the field and were monitored for 6 weeks after beginning foot patrol. The sample included 71 TEAs. There were 34 men and 37 women in the sample of whom 56 were Black, 4 were Latino, 7 were White and 4 were Asian. The mean age of the sample was 37.7 years (*SD* = 8.2, range: 25-57 years).

A total of 71 TEAs had complete data from the initial day of field monitoring (after completing the training program), and 47 of these TEAs also had data from a second monitoring day conducted 6 weeks later. We included the data from the second field monitoring day, where available, to increase the number of observations obtained in the field for comparisons of interpersonal and non-interpersonal work activities. Individuals who had both days of testing did not differ from those with only one day of testing. Latino (a) participants, however, were less likely to have completed both days of testing ($\chi^2_{(df=3)} = 8.91, p < .03$).

Participants completed all questionnaires while they were in the Training Academy. On the field testing days, participants wore an ambulatory monitor from the beginning of their workday until bedtime. Blood pressure and diary measurements were made every 20 minutes during the workday and every 45 minutes after work hours. Participants completed a diary entry at the time of every waking reading. Participants were provided with instructions on methods for terminating or initiating a BP reading. A research staff member was available 24 hours a day.

Measures

Demographic information. A brief survey was used to obtain information on sex, age, race, and education. Height and weight were measured at the first visit by research assistants.

Gender schema. The Bem Sex Role Inventory-Short Form (BSRI-SF) was used to collect data on gender schema. The SBRI-SF is a 40-item measure that consists of adjectives that are designated as feminine, masculine or neutral and is used frequently in sex typing and gender role research (Heller, Watson, & Ilies, 2004). Responses are presented on a 7-point scale that asks participants how well a particular adjective describes them. For this study, we used continuous scores of femininity and masculinity. Coefficient alphas for the BSRI-SF range from .84 to .87. Test retest reliability measures range from .76 to .91 (Heller, et al., 2004).

Hostility. Trait hostility was measured using the Cook-Medley Hostility Scale (Ho), a 50-item questionnaire derived from the Minnesota Multiphasic Personality Inventory (MMPI) (Cook & Medley, 1954). Scores on the Ho have been associated with a number of health risks, including hypertension, coronary artery disease, and CHD (Cook & Medley, 1954). Psychometric properties of the scale, which are well established, include good internal consistency and moderate test-retest reliability (Barefoot, Dahlstrom, & Williams, 1983; Cook & Medley, 1954; Shekelle, Gale, Ostfeld, & Paul, 1983; Smith, 1992). Consistent with our prior work and that of other investigators, we modified the standard True/False response format to have participants rate their responses on a 6-point scale (Houston & Vavak, 1991). The Cronbach's alpha for this sample indicated a high level of internal consistency (alpha = 0.91).

Diary-based assessments. Participants completed paper and pencil diaries each time their BP was assessed. The diary inquired about location, posture, use of caffeine, cigarettes and alcohol, eating, mood, social interactions, and activities.

Daily activities: During the workday, activities included eating, being on break, traveling (i.e., to and from patrol locations), issuing summons, patrolling and looking for violations, and paperwork.

Interactions with motorists/pedestrians. A series of diary items assessed the frequency and quality of interactions with motorists which occurred as BP was measured. TEAs were asked if they were talking at the time of cuff inflation (yes or no), and were then asked to indicate if they were interacting with a motorist or pedestrian.

State Affect. The affect items included "happy/excited", "irritated/annoyed", "relaxed/satisfied", "nervous/tense", "angry", "sad/hurt", "interested". These items have been used successfully in previous studies of TEAs (Brondolo, et al., 1999). The affect items were completed with a magnitude estimation scale consisting of 30 barcodes arranged vertically on the page to facilitate data entry. The uppermost barcode indicated the maximum score for that emotion (i.e., 30), and the bottom barcode indicated the minimum score for that emotion (i.e., 1). Participants were instructed to draw a line through the bar code that represented their response to each item. This procedure was initially established to facilitate automated data entry, although technical difficulties ultimately necessitated manual coding.

Anger coping. The diary also assessed anger-coping responses, modeled on Harburg and colleagues (Harburg, Gleiberman, Roeper, Schork, & Schull, 1978). If participants indicated they had a conflictual interaction with another person, diary items inquired if they had expressed their anger (Anger-Out), hidden or suppressed their anger (Anger-In) or reacted calmly (Anger-Calm). Each type of anger expression strategy was rated on a 6-point scale. We have analyzed data from this type of diary in our previous studies (Brondolo, et al., 2009; Brondolo, et al., 1999).

Ambulatory Blood Pressure. As in our prior research (Brondolo, et al., 2008; Brondolo, et al., 2004; Brondolo, et al., 1999), measures of systolic BP (SBP), diastolic BP (DBP), and heart rate (HR) were collected throughout the workday using the Suntech Accutracker II (Suntech Medical Instruments, Raleigh, North Carolina), an instrument with documented reliability and validity (Brondolo, et al., 2008).

Data Analytic Plan

Procedures for detection and deletion of potentially artifactual readings were identical to those used in our prior studies (Brondolo, et al., 2009; Brondolo, et al., 2008; Brondolo, et al., 2004; Brondolo, et al., 1999). If the difference between SBP and DBP was less than 20mmHg or exceeded 90 mmHg, then SBP, DBP, and HR readings were deleted from the analysis. If ABP readings were accompanied by error codes indicating a problem with the equipment (i.e., ECG leads, cuff or cables) then SBP, DBP, and HR readings were also deleted. If either SBP or DBP was considered to be erroneous, then both BP readings were removed from subsequent analyses. Once error readings were deleted, BP readings were included in the following ranges: SBP was greater than 85 and less than 196 mmHg, DBP was greater than 41 but less than 130 mmHg, and HR values were greater than 46 and less than 195 beats per minute (bpm).

Preliminary analyses investigated demographic differences in independent variables (i.e., sex and feminine gender schema) and outcome variables (i.e., daily mood, anger-coping, and ABP). Multilevel mixed (MLM) models were estimated using PROC Mixed (SAS Institute) in order to test the relationship between sex, feminine gender identity, and ABP level across the testing day with all observations used in these analyses. The intercept (between-person variance) was treated as a random effect, and a sp(pow) error structure was used to handle the expected serial autocorrelation of within-person residuals. To examine femininity differences in BP during interpersonal vs. non-personal workplace activities, MLM analyses examined interactions of sex-type with Type of Activity.

Previous studies have demonstrated consistent sex, age, race, and body mass index (BMI) differences in BP (Ewart & Kolodner, 1994; Hermida, et al., 2001; Kamarck, et al., 1998; Meininger, Liehr, Chan, Smith, & Mueller, 2004; Shapiro, Goldstein, & Jamner, 1996; White & Morganroth, 1989). Therefore, we included these variables as between-person covariates in all subsequent analyses of the effects of gender schema. Posture, caffeine, and smoking were included as time-varying covariates, as we have done in previous studies (Brondolo, et al., 2009). In addition, we have previously demonstrated the association of hostility to ABP during interactions with motorists in this sample (employing only Time 2 data). Hostility has been related to masculinity, and to ensure that the estimated effects of sex-type would be independent of hostility, we repeat the analyses including Cook Medley hostility as an additional covariate.

Results

Demographic Variations in independent and dependent variables

Femininity and masculinity were weakly positively correlated ($r = .24$, $p < .05$). Women (*mean* = 6.42, *SD*= 0.55) reported higher levels of femininity than did men (*mean* = 5.85, *SD* = 0.65, F (1,69) = 16.00, $p < .001$), but did not differ from men in masculinity ($p > .35$). There were no significant age, race, or education level differences in masculinity or femininity.

As expected, controlling for between-person covariates (i.e., age, race, and BMI) and within-person time-varying covariates (i.e., posture, caffeine, smoking, and alcohol use), there was a main effect of sex on ambulatory systolic blood pressure (ASBP) (*Estimate* = 8.63 mmHg, *SE* = 2.75, $t = 3.14$, $p < .003$) and ambulatory diastolic blood pressure (ADBP) (*Estimate* = 4.30 mmHg, *SE* = 2.05, $t = 2.10$, $p <$

.04). Men had higher adjusted ASBP (*mean* = 131.2 mmHg, *SE* = 3.2) and ADBP (*mean* = 81.2 mmHg, *SE* = 2.3) than did women (*mean* SBP = 122.5 mmHg , *SE* = 3.2; DBP *mean* = 76.9 mmHg, *SE* = 2.3).

Gender schemas, mood, and anger coping. To examine the association of gender identity (schemas) to daily moods and anger coping, we conducted MLM analyses with both femininity and masculinity entered as predictors and including all person-level and time-varying covariates.

Femininity: These analyses revealed that across the day, Femininity was not related to any measures of daily emotion. There was also no main effect of femininity on Anger Out or Anger In anger expression strategies throughout the day, but there was a significant interaction of femininity × Type of Activity on anger expression ($t = 2.88$, $p < .01$). During interactions with motorists/pedestrians, but not during non-interpersonal tasks, femininity was negatively associated with Anger-In (*Estimate* = -0.40, *SE* = 0.17, $t = -2.42$, $p < .03$).

Gender schemas and ABP level. In analyses of ASBP and ADBP, we examined the main effects of both femininity and masculinity across the full sample of men and women, controlling for between-person and observation level covariates, including sex. Femininity was not associated with ASBP or ADBP across the day. There was a significant main effect of masculinity on ASBP (*Estimate* = 2.71, *SE* = 1.32, $t = 2.06$, $p < .05$), but not on ADBP. There were no significant sex differences in the effects of masculinity or femininity on ASBP or ADBP (i.e., the interactions of sex × femininity and sex × masculinity on both ASBP and ADBP were not significant (all p's > .24)). Given the relationship of masculinity to ASBP, we include masculinity as an additional covariate in subsequent analyses.

Person × Situation Analyses: In the next set of analyses, we examined the effects of femininity and masculinity on BP levels during interpersonal vs. non-interpersonal workday activities. The analysis included the 666 observations occurring during episodes in which TEAs were talking to motorists and the 1084 observations in which they were looking for violations or issuing summonses without talking to anyone (non-interpersonal activity). For the majority of observations ($n = 451$) in which TEAs were talking to motorists, they were also looking for violations or issuing summonses. Predictors of ASBP and ADBP included the main effects of Type of Activity, femininity, masculinity, as well as the interactions of both masculinity and femininity with Type of Activity (interpersonal vs. not interpersonal). All person-level and time-varying covariates, including sex, were included in these analyses.

There was no significant main effect of Type of Activity on ASBP (*Adjusted mean* ASBP: Interpersonal Activity = 135.11mmHg (*SE* = 1.64) and Non-Interpersonal Activity = 133.33 (*SE* = 1.72), $p > .20$) or ADBP (*Adjusted mean* DBP: Interpersonal Activity = 80.95 (*SE* = 1.19) and Non-Interpersonal Activity = 81.32 (*SE* = 1.19), $p > .67$), suggesting that on average ABP is similar in these two conditions in this sample.

For ADBP, there was a significant interaction of femininity × Type of Activity (*Estimate* = -3.27, *SE* = 1.39, $t = -2.36$, $p < .02$). The interaction of masculinity and Type of Activity was non-significant ($p > .60$). The interaction of femininity × Type of Activity remained significant when the interaction of masculinity × Type of Activity was removed from the equation ($p < .03$). The effect also remained significant when hostility was included as an additional covariate.

The interaction of femininity × Type of Activity on ADBP is displayed in Figure 1. Post-hoc analyses revealed that femininity was associated with increases in BP only when TEAs were engaged in interpersonal interactions (i.e., interacting with motorists) (*Estimate* = 4.28, *SE* = 1.99, $t = 2.15$, $p < .04$), but not when they were engaged in non-interpersonal activities (i.e., looking for violations and issuing summons without interacting (*Estimate* = 1.37, *SE* = 1.94, $t = 0.71$, $p > .48$). The interaction of femininity × Type of Activity was not significant for ASBP.

The association of femininity to DBP was not mediated by the daily mood or anger expression, since femininity was not related to any measures of daily mood, and momentary anger coping style was not associated with DBP in this sample.

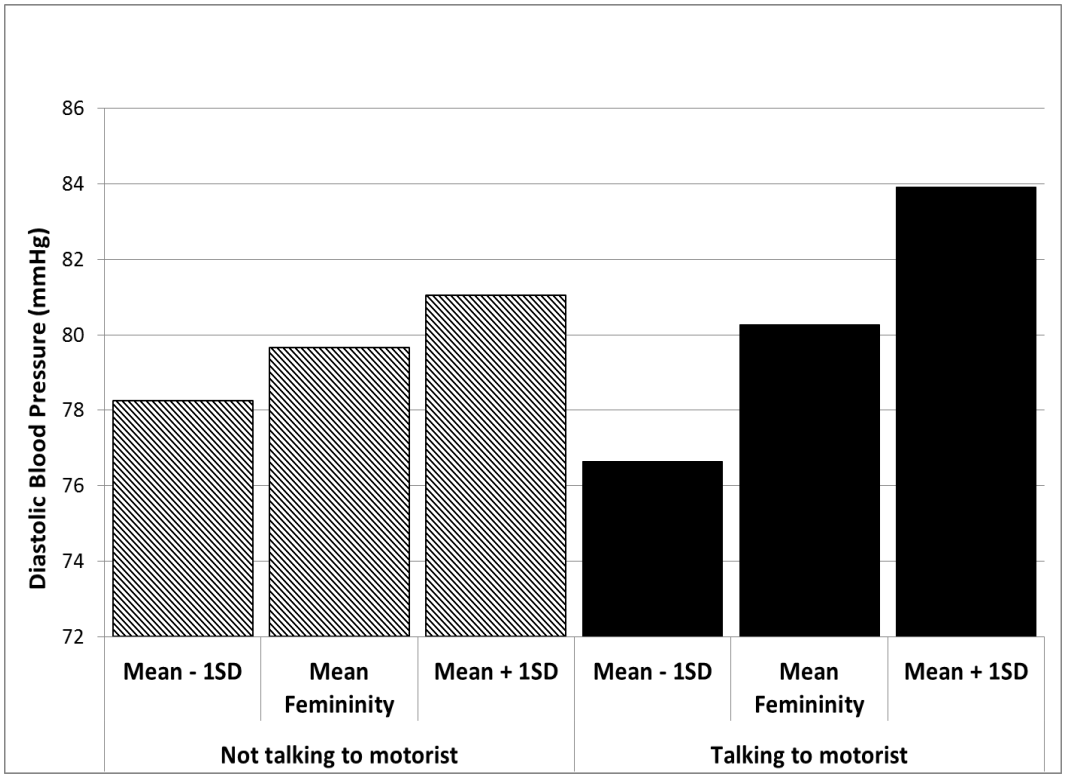

Figure 1. Predicted Scores showing the relationship of Trait Femininity to Diastolic BP when TEAs are vs. are not engaged in Interpersonal Interactions.

Discussion

Schemas are mental structures which are hypothesized to influence attention, memory and motivation. Schemas related to gender identity have been demonstrated to be associated with cardiovascular reactivity to gender-relevant tasks in the laboratory. To our knowledge this is the first study to examine the association of gender-related schemas to the magnitude of BP responses to naturally occurring gender-relevant activities.

We studied these relationships in NYC Traffic Agents. In this workforce, men and women perform the same duties and are exposed to the same type of workday demands and stressors. The TEAs serve as enforcers of rules and regulations, a traditionally male activity (Steptoe, Cropley, & Joekes, 2000). They also encounter workplace stressors which may differentially activate feminine gender identity, including interpersonal interactions with motorists or pedestrians.

Consistent with theoretical models of Person × Situation interactions, the association of femininity with behavioral and cardiovascular activation emerged only during the gender-relevant activity. Those high on femininity were less likely to inhibit angry feelings (i.e., to use Anger-In), but only during interactions with motorists/pedestrians. Further, the effects of femininity on DBP emerged only when TEAs were interacting with motorists/pedestrians.

In these interpersonal interactions, TEAs face potential conflicts with the motorists or pedestrians angry about receiving summonses. The TEA must resolve the interaction as quickly and safely. Individuals with a stronger feminine gender identity may perceive these interpersonal conflicts as more salient and potentially threatening to their sense of self and their safety, and may therefore exert greater efforts to resolve the situation. The negative association with Anger-In suggests that individuals high in femininity may continue the interactions for a longer period or work harder in trying to resolve the

conflict. Studies have shown, however, that this prolonged engagement does not necessarily improve outcomes (Prokos & Padavic, 2002).

Laboratory studies have suggested that schemas, including those related to gender, influence behavior and cardiovascular activation. This study provides confirmation of the role of schemas in shaping coping and cardiovascular reactivity in daily life. Independent of biological sex, a feminine gender identity influenced reactivity to potentially threatening interpersonal encounters. This work is aligned with recent reviews suggesting that schemas and other personality characteristics must be studied in context, placing special emphasis on Person x Situation interactions (Aronson, Burgess, Phelan, & Juarez, 2013). Ambulatory monitoring studies provide insight into the effects of mental processes on events which have high ecological validity and occur frequently in the course of everyday life.

Limitations. The nature of the data collected in the diaries limits our ability to fully interpret the content of the interactions and the level of effort expended by participants. The use of additional and new ambulatory technology (e.g., such as the EAR), which permits capturing speech might improve the ability to conduct analyses of the quality of these interactions. Actigraphy would permit more detailed evaluations of the intensity of physical effort exerted on patrol. Although femininity was reliably associated with psychological responses (i.e., mood and anger coping) during the day, these psychological variables do not explain the associations of gender identity with ABP. Further research will be required to identify the pathways through which gender schemas affect cardiovascular reactivity. Other personality dimensions may be associated with gender schema and account for these effects. However, we found that hostility was not a substantial confounder of the relationships of gender schema to mood, anger expression or ABP.

Despite these limitations, these findings provide support for the notion that gender schemas influence the interpretation of and response to gender-relevant workplace interactions, and that these gender schemas also are associated with daily cardiovascular reactivity to gender relevant events. Understanding the mechanisms through which mental structures such as schemas influence affective and cardiovascular reactivity can provide new targets for behavioral medicine interventions to mitigate the effects of stress on health.

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