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The Stress-Buffering Effects of Functional Social Support on Ambulatory Blood Pressure

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Abstract

Objective—Social support is a reliable predictor of cardiovascular health. According to the buffering hypothesis, stress is one mechanism by which support is able to affect physiological processes. However, most of the experimental evidence for the hypothesis comes from laboratory studies. Ambulatory blood pressure protocols examine participants in their natural environment, where they are more likely to encounter personally relevant real-world stressors. Furthermore, prior work shows that examining support by its specific functional components reveals additional independent links to health.

Methods—The current study aimed to examine the stress-buffering effects of functional social support on ABP. 188 participants completed a one day ABP assessment along with measures of functional social support and both global perceived stress and momentary stress at time of reading.

Results—Results indicated main effects for both stress measures. Global support, emotional, tangible, and informational support only moderated the effects of momentary stress, but not global stress, in predicting ABP. Informational support was the most consistent stress-buffering predictor of ABP, predicting both ambulatory SBP and DBP.

Conclusions—The predicted values in ABP for informational support achieved health-relevant differences, emphasizing the value of examining functional support beyond global support alone.

Keywords

Social support; ambulatory blood pressure; stress-buffering hypothesis; informational support; health

Social support is a reliable predictor of cardiovascular health, including morbidity and mortality (Holt-Lunstad, Smith, & Layton, 2010). The stress-buffering hypothesis posits social support may be linked to health because it reduces stress appraisals or weakens the association between stress and negative health outcomes (support X stress interaction, Cohen & Wills, 1985). Prior evidence for the stress-buffering hypothesis usually examines the later mechanism using measures of perceived functional social support, which refers to the internal perception that support is available in one's network should it be needed, as opposed to received social support, which refers to actual enacted support, and structural support, which measures the make-up of one's network (e.g. number of ties). Traditional conceptualizations of specific types of functional support include emotional (affirmations of one's worth) informational (provision of information or advice) tangible (provision of material or financial resources), and belonging support (provision of social leisure and belonging).

Most evidence for the buffering effects of social support on cardiovascular health comes from laboratory experiments. However, laboratory studies often manipulate acute stress, which may result in stressors that are less personally relevant or have *weaker* real world consequences. Thus, ambulatory blood pressure (ABP) methodologies can complement laboratory research by modeling daily life stress responses beyond assessing global stress with retrospective self-report and is in itself a clinically important measure of cardiovascular risk (Kamarck et al., 2005). In fact, one prior ABP study found that participants with relatively higher perceived social support had less stress-related increases in ABP compared to their counterparts with low social support (Steptoe, 2000). However, this study only measured global social support. Importantly, prior theoretical and experimental evidence suggests that individual support functions (e.g. emotional, informational, tangible, belonging) have their own independent links to health, including ABP (Bowen et al., 2012).

Thus, examining specific support functions provides insight into mechanisms underlying the association between global support and health. For example, emotional and informational support are most consistently linked to health benefits, as they may be perceived as more welcome or helpful across a variety of stressors (e.g. controllable and uncontrollable), or are less likely to activate the costs of social support that can confound any benefits (e.g. relational debt, decreased self-efficacy, Cohen & Wills, 1985). The current study expanded upon previous findings by examining the specific links to individual support functions. Emotional and informational support were predicted to be the most consistent stress-buffering functions.

Methods

Participants

As part of a larger project on relationships and health, 94 healthy heterosexual couples were recruited from the community. Exclusion criteria were based on prior work (Uchino & Garvey, 1997): no history of chronic disease with a cardiovascular component or cardiovascular prescription medication use, and no recent history of psychological disorders. The study was approved by the authors' Institutional Review Board. The average participant's age was 29.6 ($SD = 8.6$). Most participants were White (83%), college educated (62%), with an income of 40,000+ (66.4%). The average body mass index was 25.6 ($SD = 5.13$).

Study protocol

Eligible participants came to the laboratory on a work day morning and provided informed consent. Height and weight were assessed with a Health-o-Meter scale. Demographics, the Interpersonal Support Evaluation List (Cohen, Mermelstein, Kamarck, & Hoberman, 1985), and the Perceived Stress Scale were collected (Cohen, Kamarck, & Mermelstein, 1983). Participants completed a one day ABP assessment, typically from 8 am to 10 pm ($M = 14.01$ hours, $SD = 0.97$) on a work day in which they spent the evening at home with their spouse. The ABP monitor was set to take a random reading once every 30 minutes. Within 5 minutes of cuff inflation, individuals were instructed to complete questions (ADR, see below) on a provided palm pilot device using the Purdue Momentary Assessment Tool (Weiss et al., 2004). Following the study, participants were debriefed and compensated.

Measures

Interpersonal Support Evaluation List (ISEL)—A short-form 15-item ISEL (Cohen et al., 1985) assessed the perceived availability of specific support components. In the present study, the internal consistency of the global scale was adequate: .81 for the total scale. The subscales' internal consistency was .60 for tangible support (4 items), .69 for informational support (4 items), .57 for emotional support (3 items), and .66 for belonging support (4 items).

Perceived Stress Scale (PSS)—The 10-item PSS measures global perceived stress over the past month (Cohen et al., 1983). The scale's internal consistency was high (.85).

Ambulatory blood pressure (ABP)—The Oscar 2 (Suntech Medical Instruments, Raleigh, NC) is a reliable instrument that estimates ambulatory SBP and DBP via the oscillometric method (Goodwin, Bilous, Winship, Finn, & Jones, 2007). Readings were obtained via an inflatable cuff worn under clothing and a small control box attached to a belt. Outliers associated with artifactual readings were discarded if (a) SBP < 70 mmHg or > 250 mmHg, (b) DBP < 45 mmHg or > 150 mmHg, or (c) SBP / DBP < $[1.065 + (.00125 \times \text{DBP})]$ or > 3.0 Marler, Jacobs, Lehoczy, & Shapiro, 1988). Less than 3% of the ABP readings were discarded.

Ambulatory Diary Record (ADR)—The ADR measured basic variables that might influence ABP including posture, activity level, location, talking, temperature, prior exercise, and prior consumption of nicotine, caffeine, alcohol or a meal (Kamarck et al., 1998). The diary used a 1-item measure of momentary subjective stress ($M = 1.51$, $SD = 0.75$) experienced at the reading (How stressed do you feel right now? 1 = Very slight or not at all, 4 = Very much). ADR readings were examined to ensure compliance. In total, 7.2% of diary entries were discarded as they were not instigated within 5 minutes of an ABP reading (less than one ADR dropped on average per participant, $M = 0.78$, range = 0–7).

Results

Analyses

PROC MIXED was used to analyze ABP (SAS institute, Littell et al., 1996). The covariance structure for the two repeated measures factors of dyad (i.e., husband, wife) and measurement occasion (i.e., reading number) was modeled using the “type=un@ar(1)” option (Park & Lee, 2002). This model allows for examining ABP while controlling for the dyadic and measurement occasion dependency. The output of these random regression models were thus parameter estimates (b) with the appropriate within-subjects covariance structures considered. The Satterthwaite approximation was used to determine the appropriate degrees of freedom (Campbell & Kashy, 2002).

Preliminary analyses identified that potential control variables revealed age, gender¹, household income, body mass, posture, temperature, activity level, prior alcohol, and prior exercise were independent predictors of ambulatory SBP ($p's < .05$). Age, gender, household income, body mass, posture, activity level, and a prior meal independently predicted ambulatory DBP ($p's < .05$). These factors and time (e.g., first, second reading) were statistically controlled in all ABP analyses (Kamarck et al., 2005).

Do Functional Support Components Buffer Links Between Stress and ABP?

Main analyses examined if social support moderated links between stress and ABP using two different measures of global and momentary stress levels. One requirement for an adequate test of the buffering hypothesis is a main effect of stress to insure an adequate range of measurement (for further step-by-step testing of stress-buffering effects see Cohen & Wills, 1985). In preliminary analyses, the PSS predicted higher ambulatory SBP ($p < .05$), and marginally predicted higher ambulatory DBP ($p < .07$). The momentary stress item predicted higher ambulatory SBP ($p < .01$) and DBP ($p < .05$). Ancillary analyses also showed that global stress predicted greater momentary stress ($p < .001$), whereas participants higher in social support reported overall lower perceived global ($p's < .05$) and momentary daily stress ($p's < .05$; with the exception of belonging support, $p = .07$).

There were no significant buffering effects for social support on the links between global stress and ABP. However, there were *significant interactions involving momentary stress* (see online supplemental tables). First, overall social support moderated the link between

¹Analyses also examined whether gender interacted with stress and social support. Overall, the associations were not significant, suggesting similar patterns across gender.

momentary stress and SBP ($b = -1.92$, $t(3733) = -1.97$, $p = .05$). A focus on specific support components revealed that emotional support buffered the links between momentary stress and ambulatory DBP ($b = -1.25$, $t(3444) = -1.93$, $p = .05$) with a similar buffering link for tangible support on ambulatory SBP ($b = -1.61$, $t(3734) = -2.30$, $p = .02$). However, the most consistent predictor of stress buffering links was found for informational support which significantly buffered both ambulatory SBP ($b = -1.53$, $t(3512) = -2.10$, $p = .04$) and DBP ($b = -1.41$, $t(3329) = -2.49$, $p = .01$) as shown in Figure 1. Importantly, adding global stress to the models did not alter the significant buffering links reported above.

Exploratory follow-up analyses were conducted to examine if these specific dimensions which showed significant stress-buffering links were relatively independent predictors of ABP. When both informational and tangible support were contrasted in the same model, none of the stress-buffering terms were significant, indicating overlap in predicting ambulatory SBP. However, including both informational and emotional support as moderators in the prediction of DBP showed that only informational support continued to act as a stress buffer ($p < .02$).

Discussion

Consistent with our hypothesis, informational support consistently buffered the link between momentary stress and both ambulatory SBP and DBP. These findings emphasize the utility of examining individual support functions as opposed to global support exclusively and suggest that the perceived availability of social ties that can provide helpful information or advice is a particularly pertinent support resource in the context of stress. In fact, it may be the stable nature of perceived informational support which enables it to be a significant coping resource in buffering links between momentary daily life stress and ABP. It was also important that the stress-buffering links between social support and ABP were only found for the momentary stress measure and not general perceived stress over the prior month. This finding may be due to the fact that links were stronger between momentary stress and ABP compared to global perceived stress and ABP given the short-term nature of the study. It is possible that stronger buffering associations might be found for global stress if ABP was assessed over a longer period of time or in more chronically stressed populations.

Several measurement and conceptual issues in the current study limit the conclusions we can draw. First, social support was only administered at baseline so we cannot address issues regarding how potential changes in support influence ABP. Additionally, we do not know if participants high in perceived support went on to actually receive support during stress. This is an important issue, as perceived and received support are separable constructs and the simple perception that support is available appears helpful (Uchino, 2009). Further research measuring perceived and received functional support during daily life is needed. Given the relatively lower internal consistencies of our shorter ISEL subscales, future studies might also use the full-length version to increase measurement reliability. Future research might also examine whether specific support dimensions “match” to particular types of stress (Cutrona & Russell, 1990).

Additionally, the current sample's demographics may limit generalizability. First, all participants were married. Thus, it is possible the current findings are more relevant for individuals with access to a close relationship as a source of "built-in" support. The sample was also predominantly college-educated Caucasians and participants were excluded for cardiovascular health issues. Thus, caution should be exerted in generalizing these findings to diverse samples or clinical populations. In spite of these limitations, the study maintains potential for application, as ABP predicts cardiovascular morbidity more accurately than using clinic readings alone and preliminary evidence suggests it is a cost effective diagnostic tool (Mayor, 2011). Thus, informational support buffering effects in the face of momentary stress may, over time, protect against cardiovascular morbidity by reducing ABP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Figure 1.
Predicted ambulatory DBP and SBP one SD above and below the mean of informational support and momentary stress.