Access to Social Support in Life and in the Laboratory

Combined Impact on Cardiovascular Reactivity to Stress and State Anxiety

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Abstract

Social support is associated with lower cardiovascular disease risk. We examined the effects of perceived network support and availability of functional support in the laboratory on blood pressure and heart rate (HR) reactivity to acute stress. When functional support was available, participants with low perceived network support had significantly lower HR reactivity than participants with high perceived network support ($p = .04$). Conversely, when functional support was not available, participants with low perceived network support had significantly higher HR reactivity ($p = .05$). Self-reported anxiety post-stressor was significantly higher when functional support was not mentioned ($p = .03$).

Keywords

- *acute stress*
- *anxiety*
- *cardiovascular disease*
- *cardiovascular reactivity*
- *social support*

VARIOUS types of low social support confer a risk of 1.5 to 2.0 of negative coronary heart disease (CHD) events in healthy populations and in patients with CHD (Lett et al., 2005). However, there is substantial variability in the manner in which social support is conceptualized and measured across studies. This variability may stem from the absence of either a universally accepted definition or a widely applied theoretical account of social support.

Social support is a multidimensional concept. For example, a distinction is often made between structural support, which encapsulates the size, type, density and frequency of contact with the network of people surrounding an individual (i.e. network support), and functional support, which refers to the apparent benefit provided by that structure (Lett et al., 2005). Structural support assessed via self-report reflects subjective perceptions of network support (i.e. *perceived network support*). Functional support can further be categorized as *available* or *enacted* (Tardy, 1985). Whereas *available support* refers to potential access to a particular type of support from the environment, *enacted support* refers to the manifestation of available support in the form of actual support received from others. The correlations between available and enacted support are low indicating that the two dimensions are not interchangeable (Sarason, Sarason, & Pierce, 1990). A number of researchers have suggested that the relationship between perceived availability of support and health outcomes may be more reliable than the relationship between enacted support and health outcomes (Cohen & Wills, 1985; Helgeson, 1993). In fact, the enactment of support may affect health solely through its impact on the receiver's perceptions of its availability (Sarason et al., 1990).

The identification of the types of social support that predict outcomes, as well as for whom and under what circumstances, is fundamental to social support research (Lett et al., 2005). Multiple nonlinear processes related to social support are likely to interact in their effects on health (Cloninger, 2005), but the overlap between different types of social support limits the potential for epidemiological research on this topic. However, it might be possible to examine such interactions in the laboratory setting where social support can be modelled.

Most laboratory social support research within health psychology is derived from the *social support reactivity hypothesis* (Lepore, 1998), which asserts that social support enhances health prospects by preventing or attenuating harmful physiological responses to stress, including cardiovascular reactivity to stress (CVR). Excessive and prolonged CVR has been implicated in the aetiology of hypertension and CHD (Treiber et al., 2003). People with exaggerated levels of CVR are believed to be at increased lifetime risk of CHD as a result of gradual cardiac hypertrophy, of re-setting of resting BP levels, or of third variables that underlie both CVR and disease (Lovallo & Gerin, 2003).

Most research into social support and CVR has focused on the effects of enacted support. Such research involves providing de facto enacted support during laboratory stress, and examining its impact on CVR. In general, studies employing this protocol have reported an attenuating effect of social support on CVR (Kamarck, Manuck, & Jennings, 1990; Lepore, Allen, & Evans, 1993). Only one published study examined the effects of a laboratory analogue of the *availability* of social support on CVR (Uchino & Garvey, 1997). In this study, one group of participants was told that instrumental support was available to them during a laboratory-based task, whereas the availability of support was not mentioned to the control group. A significant attenuating effect of availability of support on systolic blood pressure (SBP) and diastolic blood pressure (DBP) was found.

Although Uchino and Garvey were the first to show that availability of functional support can influence CVR, they did not include a condition where participants were explicitly informed that functional support would *not* be available. Thus, it is not clear from the study whether availability of functional support attenuated CVR or whether its perceived *non*-availability exacerbated CVR (O'Donovan & Hughes, 2006). Furthermore, the research protocol used may have exhibited poor construct validity by confounding availability of functional support with social-exchange reciprocity motivations. Specifically, when describing the availability of support, the researcher told participants: 'I appreciate your participation in this experiment, and I'd like to be helpful if you should need any help' (Uchino & Garvey, 1997, p. 19). Such a statement incorporates far more than just an indication of available support by promising the participants future rewards (in the form of gratitude) for task completion. This fundamentally restructures the support provider–recipient relationship by allowing the recipient (i.e. the participant) to provide something in return.

Previous research on social support and CVR has been neglectful of some individual differences that

have the potential to moderate the association between social support and CVR. In particular, perceived network support has received scant attention. Measures of perceived support possess psychometric characteristics typically associated with stable individual difference variables (Sarason, Sarason, & Shearin, 1986), and scores from the quantity subscale of the Short-Form Social Support Questionnaire (SSQ-N), which assesses structural support (Sarason, Sarason, Shearin, & Pierce, 1987), have been associated with CVR in laboratory settings. Three experimental studies suggested that high perceived network support, as measured with the SSQ-N, was associated with *elevated* CVR to stressors (Hughes, 2007; Hughes & Curtis, 2000; Roy, Steptoe, & Kirschbaum, 1998). A number of different theoretical accounts support the idea that social relationships have negative as well as positive consequences [e.g. social comparison theory (Festinger, 1954], social equity theory (Adams, 1963)]. Furthermore, if an individual has many social ties, then the likelihood of vicarious distress as a result of a loved one's misfortune is increased (Rook, Dooley, & Catalano, 1991). Negative effects of social ties may be exacerbated for individuals with larger social networks, and reflected in higher CVR in the laboratory setting. Conversely, higher perceived network support may be associated with a preference for socially mediated coping, and thus with exaggerated CVR in socially isolated laboratory settings (Hughes, 2007). However, a fourth study, which also employed the SSQ-N, reported no effects of perceived network support on CVR (Tardy, Thompson, & Allen, 1989). The inconsistency of these findings is likely to result from the small number of relevant studies, together with their low power and the heterogeneity of their designs. However, it is also possible that perceived network support interacts with other variables, such as situational availability of support, to yield overall positive effects in the naturalistic setting.

We examined main and interactive effects of self-reported perceived network support and in-laboratory availability of functional support on CVR and state anxiety. Availability of functional support in the laboratory was operationalized at three levels: functional support available; functional support not available; and functional support not mentioned (control). We hypothesized that participants in the functional-support-available condition would have lower CVR than those in the functional-support-not-available or control conditions. In light of previous research, we predicted that participants with high perceived network support would have greater CVR than participants with low perceived network support. We also predicted a perceived network support × availability of functional support interaction effect for CVR. The pattern of results for state anxiety was expected to mirror the pattern for CVR.

Method

Participants

Participants were selected from a pool of 219 female psychology undergraduates. Exclusion criteria included chronic illness and use of medications, including the oral contraceptive pill. Of the eligible 152 participants, those scoring in the top and bottom tertiles on the SSQ-N (Sarason et al., 1987) were invited to take part. Thirty-seven high scorers (M SSQ-N = 42.70, SD = 6.99; M age = 18.89, SD = 3.67) and 37 low scorers (M SSQ-N = 19.97, SD = 5.96; M age = 19.40 years, SD = 4.44) were recruited and randomly assigned to one of three conditions: a functional-support-available condition (n = 26); a functional-support-not-available condition (n = 25); and a control condition, where functional support was not mentioned (n = 23). The mean body mass index (BMI) was 21.62 (SD = 2.87) kg/m^2, and there were 14 smokers in the sample. Participants provided informed consent and institutional ethical guidelines were strictly adhered to. Course credit was given to participants for taking part. Gender differences in CVR to social interactions have been documented (Smith, Limon, Gallo, & Ngu, 1996). We chose an all-female sample because we were not interested in gender effects per se and because we wanted to employ a relatively homogenous sample with respect to CVR and social support.

Stressor

Participants read three passages aloud into a microphone and in front of a video camera. The experimenter told participants that their performance would be graded and compared with that of other participants. The passages comprised three non-emotive magazine articles that dealt with material not related to the participants' academic coursework (the articles concerned property, fruit and electricity); Fleisch-Kincaid readability scores for all three corresponded to a reading age of less than 15 years. Six pilot participants from the screened sample reported no difficulty pronouncing any

words in the passages. The task was chosen to maximize social-evaluative threat (i.e. performance can be negatively evaluated by others), which has been found to be an important component of tasks that elicit the stress response (Dickerson & Kemeny, 2004). Unlike other speech tasks, the reading task ensures that participants are speaking for the entire duration of the task. Furthermore, because each participant is provided with a script, the topics covered by the participants are standardized.

Measures

Cardiovascular measures

The Dinamap Pro100 vital signs monitor (Critikon Corporation, Tampa, Florida) was used to measure systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) from the upper non-dominant arm using the oscillometric method.

Psychometric measures The Short-Form Social Support Questionnaire (SSQ; Sarason et al., 1987) was used to measure perceived network support (SSQ-N). The SSQ-N, which asks respondents to identify the number of persons they can count on to provide different types of support, demonstrates sound psychometric properties (Sarason et al., 1987, 1990). The SSQ-N had good internal consistency in our sample (Cronbach's $\alpha = .90$). State anxiety was measured using the psychometrically sound state form of the State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). State anxiety data were missing for two participants in the functional-support-available condition who did not complete the questionnaire properly. The STAI had good internal consistency in our sample (Cronbach's $\alpha = .88$).

Self-ratings Seven-point Likert scales were used for self-ratings. The performance scale comprised participants' ratings of their own performance with regard to clarity, accuracy, interestingness, relaxed delivery and competence relative to other hypothesized participants. The performance scale demonstrated good internal consistency (Cronbach's $\alpha = .75$). Participants also rated: (a) how evaluative they felt the experimental context was; and (b) how easy they felt it would have been to ask for help during the experiment. The final 41 participants, who were spread across availability of support conditions, were asked to rate how much support they felt they had during the entire study and how much support they felt they had during their task.

Procedure

Participants were instructed to avoid caffeine, alcohol, smoking and exercise for two hours prior to participation. During a 10-minute baseline period, participants were given popular magazines to browse through in order to help establish genuine resting cardiovascular levels (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992). Instructions for the task were presented by the female researcher after the baseline period. In the functional-support-available condition, the instructions included the following statement: 'My job is to be available to provide you with help, if you need it, during your task. If there are words in any of the passages that are unfamiliar, I will tell you what they are. If you have any questions or you need help of any other kind during the experiment, please don't hesitate to ask me.' In the functional-support-not-available condition, the corresponding statement was: 'My job is to supervise the experiment. If there are words in any of the passages that are unfamiliar, or if you get stuck for some other reason, I will not tell you what they are or to help you in any way.' In the functional support not mentioned (i.e. control) condition, no reference was made to the availability or non-availability of functional support.

Following these instructions, the researcher left the room and a computerized system led participants through the rest of the procedure. Participants first completed questionnaires, including the STAI, and then performed the reading task for six minutes. Finally, participants provided the required self-ratings and repeated the STAI. Measurements of SBP, DBP and HR were taken each minute during the final three minutes of the baseline period, and during each minute of the six-minute reading task.

Data analysis

Cardiovascular reactivity change scores were computed for each of SBP, DBP and HR by subtracting baseline from elevated levels (Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991). Change scores for anxiety were computed by subtracting post-reading-task scores from pre-reading-task scores on the STAI. Manipulation check analyses included: *t*-tests to examine differences between baseline and stressor cardiovascular measures, and differences between groups reporting high and low perceived network support; and analyses of variance (ANOVA) to examine differences across availability of functional support conditions.

A two-way (perceived network support × availability of functional support) ANOVA was employed to examine main and interactive effects of perceived network support and availability of functional support on measures of cardiovascular activity at baseline, and on anxiety change scores and pre- and post-reading-task anxiety. Two-way (perceived network support × availability of functional support) analyses of covariance (ANCOVA) were employed to examine differences in cardiovascular change scores, with baselines entered as covariates in order to control for the effect of initial values (Benjamin, 1967), and to examine differences in post-reading-task anxiety after controlling for self-rated performance by entering performance as a covariate. Significant effects were followed with post-hoc simple effects and main effects contrasts analyses. Statistical significance was set at $p \leq .05$.

Results

There were no statistically significant differences across perceived network support groups or availability of functional support groups in anthropometric variables or health behaviours. There were no significant main or interactive effects of perceived network support and availability of functional support on baseline cardiovascular activity. The stressor task produced significant elevations in SBP, $t(73) = 10.34$, $p < .001$; DBP, $t(73) = 10.86$, $p < .001$; and HR, $t(73) = 14.35$, $p < .001$.

Manipulation checks for social support and evaluation potential

There were no differences in mean ratings of how supportive the experimenter was across availability of functional support conditions, $F(2, 70) = .79$, $p = .46$, or between groups reporting high and low perceived network support, $F(1, 71) = .02$, $p = .90$. However, participants in the functional-support-not-available condition did rate it as significantly more difficult ($M = 4.38$, SD = 1.61) to ask for help during the experiment than those in the functional-support-available ($M = 2.50$, SD = 1.48) or control ($M = 2.65$, SD = 1.11) conditions $F(2, 70) = 13.05$, $p < .001$. There were no significant differences between participants high and low in perceived network support on how difficult it was to ask for help.

There were no significant differences in ratings of availability of support during the entire study across conditions. However, main effects contrasts revealed that participants in the functional-support-not-available condition reported significantly lower availability of functional support during the task ($n = 15$; $M = 5.93$, SD = 1.79) than those in either the functional-support-available ($n = 12$; $M = 2.00$, SD = 1.21) or control ($n = 14$; $M = 2.86$, SD = 1.41) conditions, $F(2, 38) = 26.18$, $p < .001$. In summary, while participants did not differ across functional support conditions in their ratings of how supportive the experimenter was, they did differ with regard to how difficult it was to ask for help, and with regard to how much functional support they felt was available to them during the reading task.

There were no significant between group differences in ratings of how evaluative the experiment was, or how nervous about being observed the participants were, and there were no between group differences in self-ratings of task performance.

Perceived network support, availability of functional social support and CVR

There were no significant main effects of either perceived network support or availability of functional support on SBP, DBP or HR reactivity. However, a significant interaction between the two variables was found for HR reactivity, $F(2, 67) = 4.28$, $p = .039$, $\eta^2 = .11$ (Fig. 1). Specifically, there were significant differences in HR change scores between the high and low perceived network support groups in both the functional-support-available and functional-support-not-available conditions. In the functional-support-available condition, the group with high perceived network support had significantly higher HR change scores ($M = 6.85$, SD = 10.73) than the group with low perceived network support ($M = 2.01$, SD = 3.10; $p = .04$). In the functional-support-not-available condition, however, the group with high perceived network support had significantly lower HR changes scores ($M = 1.52$, SD = 1.79) than the group with low perceived network support ($M = 6.12$, SD = 6.85; $p = .05$). There were no significant differences in HR change scores between participants reporting high and low perceived network support in the control condition.

Anxiety

We examined between group differences in both pre- and post-reading-task anxiety scores, and in anxiety change scores. There were no significant main or interaction effects with respect to

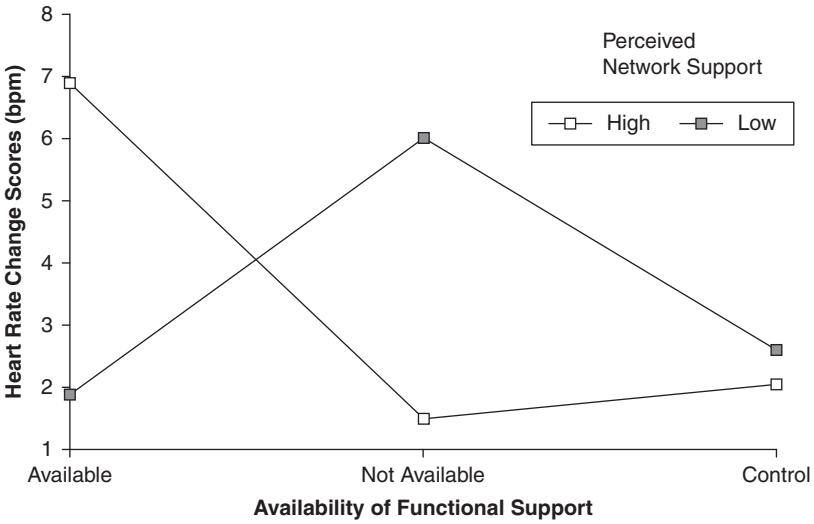

Figure 1. Heart rate (HR) change scores across availability of laboratory support conditions in participants with high versus low perceived network support. A significant interaction between perceived network support and availability of laboratory social support is shown (p = .04). Participants with high perceived network support had significantly higher HR reactivity than participants with low perceived network support in the functional-support-available condition (p = .04). Conversely, participants with high perceived network support had significantly lower HR reactivity in the functional-support-not-available condition than participants with low perceived network support (p = .05).

pre-reading-task anxiety or anxiety change scores. However, we did find a significant main effect for availability of functional support on post-reading-task anxiety, $F(2, 68) = 30.28$, $p = .03$ (Fig. 2). Participants in the control condition demonstrated significantly greater post-task-anxiety scores (M = 36.91, SD = 8.61) than participants in either the functional-support-available (M = 31.35, SD = 7.32; $p = .011$) or functional-support-not-available (M = 32.16, SD = 6.44) conditions ($p = .03$).

To examine if self-ratings of performance accounted for the relationship between availability of functional support and anxiety, we repeated our analysis adjusting for performance scores. The effect for availability of functional support on post-reading-task anxiety remained significant, $F(2, 68) = 3.07$, $p = .05$, but the effect size (as measured with partial eta squared; η^2) was reduced from .97 to .08.

Anxiety and CVR

When we repeated the two-way ANCOVA for HR reactivity with state anxiety change scores entered as an additional covariate, the perceived network support × availability of functional support interaction remained significant, $F(2, 64) = 3.48$, $p = .04$ and there was no significant change in effect size ($\eta^2 = .10$ versus $\eta^2 = .11$). There were no differences in the observed patterns of significant findings when we adjusted for smoking, age or BMI.

Discussion

Our findings indicate that perceived network support moderates the effects of availability of functional support on HR reactivity. When functional support was not available, participants with high perceived network support had significantly *lower* HR reactivity to acute stress than participants with low perceived network support. Conversely, when functional support was available, participants with high perceived network support had significantly *higher* HR reactivity to acute stress than participants with low perceived network support. Participants in both the functional-support-available and functional-support-not-available conditions had significantly lower post-reading-task anxiety than participants in the control condition. Self-reported

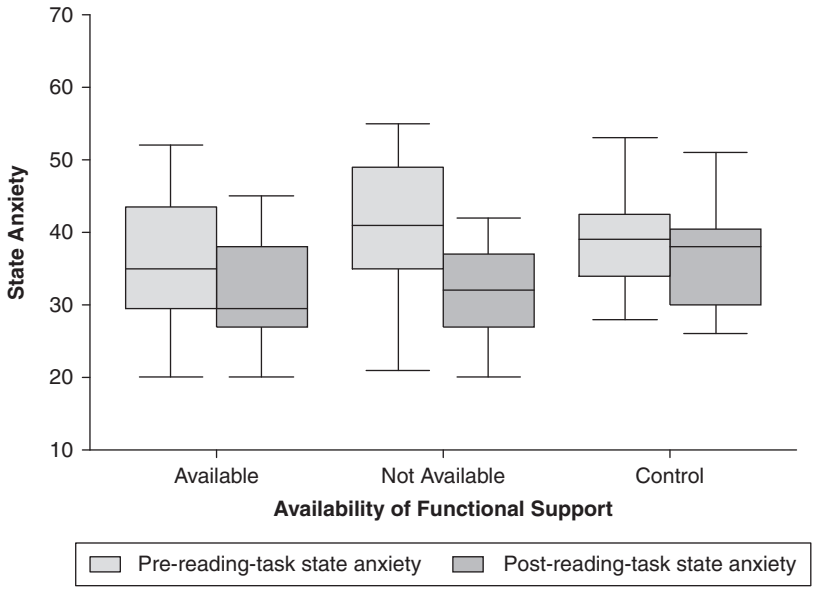

Figure 2. Pre- and post-reading-task state anxiety across availability of laboratory support conditions. There were no significant differences across conditions in pre-reading-task anxiety ($p > .05$). However, participants in the functional-support-available and functional-support-not-available conditions had significantly lower post-reading-task anxiety ($p = .03$).

anxiety did not appear to mediate the interaction effect with respect to HR reactivity.

Interaction of perceived network support and availability of functional support

Participants with low perceived network support appeared to benefit from the availability of functional support, as evidenced by lower HR reactivity, whereas participants with high perceived network support did not. The lowest mean HR reactivity levels for participants with low perceived network support were observed in the functional-support-available condition. Participants with low perceived network support may benefit more from the availability of support because they ordinarily assume that social support is *not* available, and thus they experience relief when it is explicitly offered. The highest HR reactivity for participants with low perceived network support occurred when functional support was explicitly *not* available to them. It is possible that high levels of perceived network support buffered against the negative effects of the explicit non-availability of functional support. In the functional-support-available condition, however, high perceived network support was associated with elevated HR reactivity, perhaps indicating that such participants become more sensitive to impending stress when they are primed by the notification that help may be required (their high perceived network support indicating a preference for social coping; see Hughes, 2007).

Availability of functional social support and CVR

In contrast with our findings, Uchino and Garvey (1997) reported that participants in the functional-support-available condition had attenuated CVR relative to participants in the control condition. Sample characteristics (e.g. sex or cultural differences) or task differences may account for the inconsistency in findings. Furthermore, we excluded the problematic sentence, 'I appreciate your participation in this experiment, and I'd like to be helpful if you should need any help', from the instructions employed by Uchino and Garvey. Our data indicate that the availability of functional support in isolation from a statement of gratitude was not sufficient to exert an attenuating main effect on CVR.

Previous research has established that evaluation potential (the potential for participants to feel that they are being evaluated by those observing their performance on stressor tasks) is a likely contaminating variable in studies of laboratory analogues of

social support (Thorsteinsson & James, 1999). In our experiment, evaluation potential was kept high, but constant, across laboratory conditions.

Perceived network support and CVR

Our results are consistent with a previous finding that perceived network support has no main effect on CVR (Tardy et al., 1989), but contrasts with other research that found positive associations (Hughes & Curtis, 2000; Roy et al., 1998). Interestingly, both previous studies demonstrating perceived network support–CVR relationships did so when employing non-social stressors to elicit CVR (Hughes & Curtis, 2000; Roy et al., 1998); whereas the study where no effect was found (Tardy et al., 1989) employed a socially oriented speech task. The present study is consistent with this trend in finding no effect for a socially evaluative speech–task stressor.

People reporting high levels of perceived network support may be particularly disposed towards investing heavily in social relationships and towards seeking social approval. In an experimental setting, such participants may exert more effort to complete tasks (in order to please the experimenter), and thus exhibit greater CVR. The difference between social and non-social stressors in this regard may relate to the positive association between perceived network support and extraversion (Tong et al., 2004). Extraverts enjoy social situations more than introverts and they also favour being with other people over being alone. The enjoyment of social situations may buffer against the stress of socially evaluative stressors in extraverts or people with high perceived network support.

Social support and anxiety

There were no significant differences in anxiety change scores or pre-reading-task anxiety among groups. However, participants in the functional-support-available and functional-support-not-available conditions reported lower post-reading-task anxiety than did participants in the control condition. We suggest that those participants whose attention was explicitly drawn to social support (i.e. those in the functional-support-available and functional-support-not-available conditions) may have assumed that help would actually be required in order to complete the task. As a result, the fact that they did *not* need help during the task may have led them to rate their performance as better and, consequently, their anxiety post-reading task was lower. We found some support for this interpretation in our data, highlighting potential positive effects of offering support even when it is not needed.

Uchino and Garvey (1997) used a six-item scale to measure anxiety after the completion of a speech task; they did not find a main effect for availability of functional support on anxiety scores. The discrepancy between our findings and the findings of the previous study may again be explained with reference to the experimenter's expressions of both gratitude and a desire to help in Uchino and Garvey's support manipulation. It is possible that participants who heard this instruction would not have experienced relief at not asking for help; they were told that it was the experimenter's wish to help them. Thus, participants in the support-available-condition would have been in the same position as those in the control (support not mentioned) condition; that is, there would be no relief as a result of completing the task without asking for help.

Implications and conclusion

The present study established effects for HR, but not for SBP or DBP, suggesting the invocation of cardiac (rather than vascular) psychosomatic pathways. Irregular or extreme fluctuations of HR are independent risk factors for adverse cardiovascular health outcomes in humans (Falcone, Buzzi, Klersy, & Schwartz, 2005), and large HR responses to fear-eliciting stimuli were associated with marked and significant exacerbation of coronary atherosclerosis in cynomolgus monkeys (Manuck, Adams, McCaffery, & Kaplan, 1997). Factors associated with elevated HR reactivity to stress may be especially relevant to theoretical models underpinning standardized social interventions for cardiac rehabilitation. Overall, our findings draw attention to the potential benefits of the availability—as distinct from the enactment—of social support. In addition, the present study underlines the importance of considering interactions between different types of social support both in laboratory research and, by extension, in the implementation of socially supportive interventions.

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