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BRIEF REPORT

Marital Quality Buffers the Association Between Socioeconomic Status and Ambulatory Blood Pressure

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Abstract

Background Socioeconomic status is robustly associated with rates of death and disease. Psychophysiological stress processes are thought to account for a portion of this association.

Purpose Although positive and supportive relationships can buffer psychophysiological stress responses, no studies have examined whether the quality of a primary adult relationship—marriage—may buffer the negative association between socioeconomic status and stress-related disease processes.

Methods The current study examines the interaction between income and marital quality (supportive vs. ambivalent) on individuals' daily ambulatory blood pressure, a valid and reliable indicator of cardiovascular risk.

Results Results revealed that supportive marital relationships buffered the otherwise higher ambulatory diastolic blood pressure associated with low income.

Conclusions Results are consistent with the buffering hypothesis of social support and suggest that a supportive spouse may buffer stress-related autonomic processes linking low socioeconomic status to risk for cardiovascular disease.

Keywords Socioeconomic status · Income · Marital quality · Relationship quality · Physical health · Ambulatory blood pressure

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Lower socioeconomic status (SES) is associated with increased rates of death and disease [1, 2]. Higher prevalence and severity of stress and negative emotional states have been hypothesized to account for a portion of this association [2, 3]. In addition to these risk factors, resources that may protect against poor health, such as positive and supportive social relationships, also vary by SES. For example, lower SES individuals report lower levels of social support and poorer marital quality [4, 5]. However, not all individuals of low SES report poor quality social relationships, and there is some indication that social relationships may protect against the otherwise negative impact of lower SES on health (e.g., [6]).

Outside the context of social class, supportive social relationships have been associated with decreased rates of death and disease and the protective effect of social support on health is substantial [7]. Supportive social relationships have been proposed to protect health, in part, by buffering the negative health consequences associated with psychosocial stress [8]. This buffering is thought to occur, in part, by dampening psychophysiological stress responses [9] such as sustained autonomic arousal, which appear to link stress to risk for cardiovascular disease [10, 11]. Hence, under increased stress, social support should be beneficial; however, social support may have little effect in the absence of significant stress, when there is little to "buffer" against. Hence, inasmuch as lower SES individuals experience more stress, supportive social relationships are expected to be more physiologically beneficial at lower levels of SES.

One of the primary sources of social support for many adults is their spouse. Similar to the literature on social support in general, the quality of this specific relationship has also been linked to health, including risk for cardiovascular disease. For example, marriages characterized as supportive (positive) as compared to ambivalent (both positive and negative) are associated with lower

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ambulatory blood pressure and less calcification of the coronary arteries, both robust risk factors for cardiovascular disease [12, 13].

Although some large studies have shown that marital status (married vs. not married) may moderate the relationship between SES and morbidity and mortality [14–16], only one prior study has examined the potential moderating effect of aspects of marital *quality* on the association between SES and health. In a longitudinal study including a large number of individuals (N=1849), Choi and Marks [17] found that increases in marital happiness were more closely associated with increases in self-reported health for individuals with more education and that increases in marital conflict were more closely linked to increases in functional impairment for individuals with less income. Hence, findings were not consistent with the buffering hypothesis. Instead, for individuals of lower SES, one aspect of positive marital change was less beneficial and one aspect of negative change was more detrimental. However, there were several limitations of this study as marital happiness and marital conflict were operationalized using only one item each and health outcomes examined were self-reported.

The current study examines whether the quality of spousal relationships buffers the association between socioeconomic status and ambulatory blood pressure in daily life. Given the evidence that (1) SES is related to cardiovascular disease and death, likely, in part, through the mechanism of sustained activation of stress-related autonomic responses, which promote atherogenesis [18, 19] and (2) marital quality is thought to be related to disease, in part, through these same processes [20]; sustained activation of cardiovascular autonomic responses is a theoretically and empirically viable pathway through which marital quality may buffer the negative psychophysiological correlates of low social status. Additionally, ambulatory blood pressure allows for a comparison of overall blood pressure load as a result of stressors and challenges encountered during daily life, consistent with the idea that lower SES individuals encounter stressors more frequently and that this increased exposure leads to increased disease risk. In addition to being a more proximal index of the psychophysiological processes of interest, ambulatory blood pressure is also a better predictor of future cardiovascular risk than blood pressure taken in arguably less social settings such as the clinic due its greater reliability and ecological validity [21–25].

Given the literature reviewed above, we hypothesized that marital quality would buffer the association between SES and ambulatory blood pressure in daily life. More specifically, we expected that high-quality marriages would protect against the higher levels of stress-related autonomic activity associated with lower SES in everyday life.

Method

Participants

Participants were 94 healthy couples recruited from the community through newspaper ads and notices posted on campus. Participants were paid $75 or awarded 2 credit hours in the participant pool for their time. We excluded individuals who had medical conditions with a cardiovascular component (e.g., hypertension, diabetes), those who were taking cardiovascular prescription medications, and those with a diagnosed psychological condition for which they were being medically treated. Couples who had children currently living in the home were excluded as part of the larger project. Participants were all employed at least part-time, legally married and living together, and ranged in age from 18 years to 63 years with a mean age of 29.5. Most were White (83 %), college educated (62.4 %), and had an annual household income over $40,000 per year (66 %).

Procedures

Participants completed a 1-day ambulatory blood pressure assessment during a typical workday, usually from 8 to 10 pm (M=14.01 h, SD=0.97). After consent, participants filled out a demographic questionnaire, were fitted with the ambulatory blood pressure monitor, and were given a palm pilot to record diary entries on basic control variables (e.g., posture). Monitors were set to randomly obtain readings twice per hour. This random sampling procedure was intended to limit participants' anticipation of blood pressure readings and altering their activities accordingly. Participants were instructed to initiate a palm pilot diary within 5 min of each cuff inflation, and ambulatory readings were dropped from statistical analyses if participants failed to comply with this 5-min timeline. The average participant had fewer than one reading dropped from analysis due to noncompliance (M=.78, with a range from 0 to 7).

Measures

Income

Subjects were asked to report their annual household income, and descriptive statistics are reported in Table 1. To summarize, our measure of income ranged from $3000 to $40,000 or more, and, as such, truncated the upper end of the range for this variable. Three participants did not report income and were thus deleted from relevant analyses. Income was treated as a continuous variable in statistical analyses.

Table 1 Response frequencies for income

Annual household income	Frequency	Percent
$3000–$3999	2	1.1
$7000–$9999	3	1.6
$10,000–$14,999	6	3.2
$15,000–$19,999	6	3.2
$20,000–$29,999	26	14.1
$30,000–$39,999	21	11.4
$40,000 or more	121	65.4

Ambulatory Blood Pressure

The Oscar 2 (Suntech Medical Instruments, Raleigh, NC) was used to estimate ambulatory systolic blood pressure and ambulatory diastolic blood pressure. The Oscar was developed to meet the reliability and validity standards of the British Hypertension Society Protocol [26]. Outliers associated with artifactual readings were identified using the criteria outlined by Marler, Jacob, Lehoczky, and Shapiro [27]. These included (a) systolic blood pressure <70 mmHg or >250 mmHg, (b) diastolic blood pressure <45 mmHg or >150 mmHg, and (c) systolic blood pressure/diastolic blood pressure <[1.065+ (.00125×diastolic blood pressure)] or >3.0.

Marital Quality

Marital quality was measured using the Social Relationships Index [28], which measures both positivity and negativity in the relationship and has been linked to health in close relationships [13]. Spouses rated as 2 or greater on positivity and only 1 on negativity were categorized as supportive, and spouses rated as 2 or greater on both positivity and negativity were categorized as ambivalent. These cutoff values have been used consistently in prior work (e.g., see [13] for details). As previously reported elsewhere, 77 % of spouses in this sample were characterized as ambivalent and 23 % were characterized as supportive [12]. Nevertheless, analyses reported below also statistically control for continuous ratings of spousal positivity and negativity, to ensure that differences between our two categories (supportive, ambivalent) do not simply reflect differences in these main effects.

Control Variables

Using a palm pilot, participants were asked to provide information on basic variables that might influence ambulatory blood pressure [29]. These included posture (lying down, sitting, standing), activity level (1=no activity, 4=strenuous activity), location (work, home, other), talking (no, yes), temperature (too cold, comfortable, too hot), prior exercise (no, yes), and prior consumption of nicotine, caffeine, alcohol, or a meal (no, yes). Consistent with prior research, preliminary analyses revealed that age, gender, body mass, posture, temperature, activity level, prior alcohol, prior exercise, and recent meal were independent predictors of higher ambulatory blood pressure ($p<.05$). Thus, these factors along with time (i.e., first reading, second reading) were statistically controlled in all analyses of ambulatory blood pressure.

Overview of Analyses

Analyses were performed using Proc Mixed (SAS Institute) in order to model these complex, three-level data (repeated measures within person and people within couples). This method accounts for statistical non-independence of these nested data. In the present study, we modeled the covariance structure for the two repeated measures factors of dyad (i.e., husband, wife) and measurement occasion (i.e., reading number) using the direct (Kronecker) product. This was modeled using the "type=un@ar [1]" option, which is a within-subjects covariance profile containing the product of the two separate covariance matrices [30]. As recommended by Campbell and Kashy [31], we used the Satterthwaite approximation to determine the appropriate degrees of freedom.

Results

Relationship quality and socioeconomic status (i.e., income) have both previously been shown to have significant associations with ambulatory blood pressure when examined independently in this sample [13, 18]. When marital quality and income are entered simultaneously into the model predicting systolic blood pressure, they have independent effects ($b=.97$, $p<.05$ and $b=-1.7$, $p<.001$, respectively), but marital quality was not independently associated with diastolic blood pressure above and beyond income ($b=.37$, $p>.05$ and $b=-.64$, $p<.01$ respectively). Notably, income was not significantly associated with spouse positivity, negativity, or ambivalence (all $r<.10$, $p>.40$).

Results revealed a significant interaction between income and marital quality on ambulatory diastolic blood pressure, both before and after statistically controlling for continuous ratings of spouse positivity and negativity in the relationship ($b=-.91$, $p<.001$ and $b=-.92$, $p<.001$, respectively). Supportive marital relationships (compared to ambivalent ones) were associated with decreased diastolic blood pressure in daily life among lower income individuals (see Fig. 1), buffering the otherwise more negative autonomic impact of low socioeconomic status ($M=78.5$ vs. 80.3 mmHg). There was no significant effect of marital quality on ambulatory diastolic blood pressure for higher status (+1SD) participants ($p>.05$; mean diastolic blood pressure of 76.9 vs. 76.1 mmHg). Though the pattern of findings was similar, we

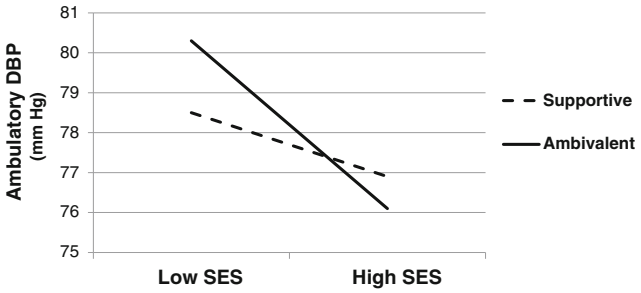

Fig. 1 The quality of marital support buffers the association between income and ambulatory diastolic blood pressure (*DBP*). "Low SES" in this sample is an annual income of $30,000 or less

did not find a statistically significant interaction between income and marital quality on systolic blood pressure (b=−.41, p=.29). Hence, the negative association between income and systolic blood pressure was not significantly moderated by marital quality.

Discussion

Perceived marital quality (ambivalent vs. supportive) moderated the relationship between income and ambulatory diastolic blood pressure. There was no main effect of income on marital quality, indicating that lower SES was not reliably associated with poorer marital quality. However, among subjects who reported lower income (annual income less than $30,000), supportive marriages buffered the otherwise more negative autonomic impact of low socioeconomic status in daily life. There was no significant effect of marital quality on ambulatory diastolic blood pressure among individuals with higher income. Unlike diastolic blood pressure, the negative association between income and systolic blood pressure was not significantly moderated by marital quality. Hence, the buffering effect of marital quality was most prominent during the resting phase of the cardiac cycle (diastolic blood pressure). Interestingly, diastolic blood pressure, compared to systolic blood pressure, is a significantly better predictor of CHD risk in younger (<50) individuals [32]. Hence, we may see stronger results on diastolic blood pressure, because diastolic blood pressure is a better indicator of disease progression in our sample.

These results have implications for the literature linking SES to cardiovascular disease and go beyond simply documenting that lower SES is associated with lower marital quality or higher risk for poor cardiovascular health. Instead, these results suggest that a supportive spouse may reduce the risk of poor cardiovascular health we already know to be associated with lower SES and establish that this may occur by buffering stress-related autonomic processes thought to link low SES to risk for cardiovascular disease. Findings also provide additional support for the idea that stress-related autonomic differences associated with differences in everyday social experiences may be one mechanism linking both lower SES and poor marital quality (at least at lower levels of SES) to poor cardiovascular health. Results are also consistent with predictions from the buffering hypothesis of social support, lending additional support to this theoretical perspective.

These results also have implications for the literature linking marital quality to cardiovascular disease. A recent review and meta-analysis of the association between relationship quality and physical health concluded that the "key question for future marriage and health research will be as follows: For whom is marital quality especially beneficial or detrimental," ([20], p.176). The current findings not only suggest that marital quality may buffer the negative psychophysiological correlates of low SES but also that high-quality marital relationships may be especially beneficial for the health of individuals lower in SES. Alternatively, the results shown in Fig. 1 could also be interpreted as evidence that an ambivalent relationship may be especially detrimental for the health of individuals lower in SES. Although supportive marriages are stress-buffering, it is also possible that ambivalent marriages are stress-enhancing and may add to the strain of being in a low SES environment. Future research will be needed to test the different antecedents and mediators linking aspects of marital quality to the SES and health link. Independent of the interpretation, marital quality, like some other risk and protective factors for poor health, appears to function differently across socioeconomic strata.

If future research continues to support this buffering effect of a supportive marriage in lower SES populations, these results may also have intervention and public policy implications. Although there was no main effect of income on relationship quality in this sample, perhaps due to the restricted upper range of income, other work has found that marital quality is not equally distributed across socioeconomic strata; high-quality, stable marriages are less common and marital dissolution more common for those of lower SES (e.g., [33, 34]). These disparities have spurned social policies designed to improve marital quality and stability for lower SES individuals [4], in part with the goal of promoting health and well-being [35]. Hence, it is important to examine whether marital quality is, in fact, associated with poor health and its precursors at lower levels of economic resources, as policy suggests. Results of the current study provide initial support for the idea that policies targeting marital quality in lower SES couples may be beneficial for physical health, specifically risk for cardiovascular disease.

Limitations and Conclusions

The current findings may not generalize beyond the largely Caucasian, legally married, heterosexual population studied

here. Our measure of income was significantly truncated, though this restriction of range is most likely to weaken our ability to find the differences reported here instead of artificially inflate them. Although participants were monitored frequently and on a typical workday, they wore monitors for only 1 day and results may be different if more days, and thus a broader swath of social experience, are captured. Notably, methodological studies suggest that sampling in the current study was sufficient to accurately approximate typical blood pressures [36]. Lastly, the measure of marital quality used here, which considered both positive and negative aspects of the marital relationship, may differ from other measures of this construct in its association with health, or its ability to buffer the association between low SES and health-relevant processes. Social support is hypothesized as a primary mechanism through which higher marital quality is associated with lower stress-related autonomic activity (e.g., [20]), and social support is the specific construct thought to buffer the effect of stress on health. Hence, the current measure of marital quality, which was conceived as a measure to capture variations in social support, may be a more powerful moderator of stress-related disease processes. Different (we hypothesize weaker) results may be found in studies using measures of marital quality less closely aligned with the literature linking social support to physical health.

This is the first study to show that supportive marital relationships can buffer the untoward effects of low SES on an objective risk factor for disease and provide initial support for the idea that policies targeting marital quality in lower SES couples may be beneficial for physical health. Linking both SES and marital quality to ambulatory blood pressure in daily life is consistent with theory and suggestions that differences in everyday social interactions and support processes may account for a portion of the association between SES and health [1, 37, 38] and the association between marital quality and health [20].

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Cundiff, Birmingham, Uchino, and Smith declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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