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Social support, social strain and inflammation: Evidence from a national longitudinal study of U.S. adults

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ABSTRACT

Social relationships have long been held to have powerful effects on health and survival, but it remains unclear whether such associations differ by function and domain of relationships over time and what biophysiological mechanisms underlie these links. This study addressed these gaps by examining the longitudinal associations of persistent relationship quality across a ten year span with a major indicator of immune function. Specifically, we examined how perceived social support and social strain from relationships with family, friends, and spouse at a prior point in time are associated with subsequent risks of inflammation, as assessed by overall inflammation burden comprised of five markers (C-reactive protein, interleukin-6, fibrinogen, E-selectin, and intracellular adhesion molecule-1) in a national longitudinal study of 647 adults from the Midlife Development in the United States (1995–2009). Results from multivariate regression analysis show that (1) support from family, friends, and spouse modestly protected against risks of inflammation; (2) family, friend, and total social strain substantially increased risks of inflammation; and (3) the negative associations of social strain were stronger than the positive associations of social support with inflammation. The findings highlight the importance of enriched conceptualizations, measures, and longitudinal analyses of both social and biological stress processes to elucidate the complex pathways linking social relationships to health and illness.

A large and growing body of social, demographic, and epidemiologic research has firmly established the important role of social relationships and connections in shaping social and physical functioning and well-being of individuals. Social ties and support have been linked to improved mental and physical health (George et al., 1989; Cornwell and Waite, 2009), a greater capacity to cope with stress (Aneshensel and Stone, 1982; Thoits, 2011), and increased longevity (Berkman and Syme, 1979; House et al., 1988). As the empirical evidence for these links continues to accrue, recent studies have increasingly attended to various social, psychological, and behavioral processes linking social relations to health (Smith and Christakis, 2008; Thoits, 2011; Umberson et al., 2010). However, important gaps exist in measurements of social relationships, specifications of biophysiological mechanisms, and study designs. To address these gaps, the current study examined how both perceived social support and social strain from relationships with family, friends, and spouses are associated with five markers of inflammation in a national longitudinal study of adults in the United States. By assessing both the positive and the negative qualities of social relationships and associating different domains of such relationships with a more comprehensive measure of inflammation over time, the current study provides unique insight into the multifaceted and dynamic links between one's social and physical worlds and contributes to the understanding of the process by which social conditions "get under the skin" to influence health.

1. Social relationships and health: integration, support, and strain

Studies over the past several decades have provided overwhelming evidence for the importance of social involvement and interpersonal relationships on individual well-being. However, differences in the conceptualization and measurement of social relations across studies prohibit a direct comparison of the strengths or directions of the associations between specific aspects of social relationships with health, making generalization of these

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associations difficult. What is clear is that social relations are multidimensional and their links to health are multifaceted.

Some studies investigated social relations by using the number of an individual's significant social ties, the frequency of contact with social connections, and participation in social organizations and groups, thus emphasizing the role of quantitative or structural aspects of one's social network in predicting health outcomes (e.g., Berkman and Syme, 1979; Ertel et al., 2008). While the links between the number of social network ties and health are strong, a count of such relationship ties is not synonymous with the quality of social relationships, as individuals can still perceive isolation despite having many social ties, while conversely, having one or several close social connections may lead to greater perceived support (Kiecolt-Glaser et al., 2010). Aligned with this qualitative conceptualization of social relationships, a number of studies have measured social relationships through individual appraisal of the quality of support received from significant members of one's social network, including perceptions of closeness, caring, and understanding from others (Lett et al., 2007; George et al., 1989; Lyyra and Heikkinen, 2006). Furthermore, there is evidence that a lack of perceived support and companionship is predictive of poorer health (Cacioppo and Hawkley, 2003; Cornwell and Waite, 2009). Collectively, these suggest that perceived presence of supportive relationships has the capacity to protect individuals from the adverse health outcomes associated with chronic stress, while the perceived absence of such relationships increases disease risks.

Beyond studies of social support and health, less attention has been given to the detrimental effects of relational strain on mental and physical well-being. Investigations of social strain and health have acknowledged that social connections are not explicitly positive in nature, but instead function in a balance of both benefits and costs (Walen and Lachman, 2000). Studies investigating the relative contribution of social support and strain on individual well-being suggested that negative social relations represent a distinct construct from positive aspects of social networks (Finch et al., 1989; Rook, 1984), emphasizing the need to assess measures of both support and strain. Furthermore, there is evidence that negative social exchanges have a more substantial impact on mental health than positive aspects of social relationships. Social strain, characterized by greater interpersonal conflict, frequent criticisms, and excessive demands from significant members of one's social network, has the potential to act as a direct source of psychosocial distress (Finch et al., 1989; Newsom et al., 2003, 2005). Research has also identified negative effects of strained relationships on physical health outcomes, particularly linking spousal conflict to increased risk of coronary heart disease and mortality (Eaker et al., 2007; Umberson et al., 2006).

2. Inflammation: the biophysiological link between social relationships and health

The physiological processes underlying the association between social relationships and health have been increasingly investigated in recent empirical research. One area of growing interest is the role of inflammation in linking social factors to physical health outcomes. Inflammation has been identified as a reliable predictor of many morbidity conditions, including cardiovascular disease, diabetes, dementia, and arthritis (Ershler and Keller, 2000). While acute inflammatory response to a particular pathogen or injury is a crucial part of immunity, systemic and low-grade inflammation with no clear pathogenic target damages healthy tissues over time, therefore increasing risk for age-related chronic illnesses (McEwen, 1998; Alley et al., 2008; Hwang et al., 1997).

Research across behavioral neuroscience, immunology, and epidemiology has found chronic psychosocial stress to be a strong predictor of inflammation in the absence of infection or injury. Studies have found that the physiological processes involved in the stress response (i.e., the hypothalamic–pituitary–adrenal axis and the sympathetic nervous system) can act to modulate inflammatory processes, thus providing evidence of a crucial biosocial linkage between experiences of psychosocial stress and the illness consequences of inflammation (Black and Garbutt, 2002). Several studies have documented that chronic stress diminishes the ability of the immune system to respond to anti-inflammatory signals (Cohen et al., 2012; Miller et al., 2002), and others have linked particular psychosocial stressors to immune dysregulation (Friedman and Herd, 2010; Kiecolt-Glaser et al., 2005).

3. Gaps in previous research

While the link between chronic stress and inflammation has been increasingly documented, the particular aspects of social relationships that contribute to immune function have not been fully specified due to several limitations in measurement and study design. First, measures of social relations that are used in biosocial research are often limited to indicators of social network size (Ford et al., 2006; Loucks et al., 2006; Yang et al., 2013). While a few studies have identified the beneficial effects of social support on immune function (Uchino, 2006), these have specifically focused on the role of social support in affecting the immune function and inflammatory processes of female cancer patients (Lutgendorf et al., 2005; Costanzo et al., 2005). An investigation of whether inflammatory processes are similarly influenced by social support in a national sample is needed to determine whether this association also exists in the absence of devastating medical events and the associated extreme physiological and health-related stress.

Second, studies assessing the role of social relationships in affecting inflammatory processes have not investigated whether it may differ by the function and source of the social relationship. While there is evidence for the physiological influence of social support, few studies have investigated the relation between poor relationship quality and adverse physiological outcomes. Evidence for the link between social strain and inflammation is limited but indicates a positive correlation. In particular, interpersonal stress from romantic partners, family and friends was associated with higher CRP and IL-6 levels six months later (Kiecolt-Glaser et al., 2005), and incidence of marital conflict increased long-term production of IL-6 and tumor necrosis factor alpha (TNFα) (Miller et al., 2009). Given the evidence of the differential effects of positive and negative functions of social relationships on health, we further investigated the relative contribution of social support and strain on physiological indicators of health. Assessment of both social support and strain expands upon prior research that links social support to better health outcomes, while also determining whether evidence implicating social strain as a more significant predictor of psychosocial distress extends to physiological outcomes. In addition to different functions that social relationship may serve, sources or domains of supportive or strained relationships from one's networks can also contribute to variations in health. For example, Mendes de Leon et al. (1999) found that the linkage between social relationships and disability in older adults varied by the type of relationship, such that the number of friend and relative contacts was significantly linked to disability and recovery, while ties with children and confidants were not associated with disability. Expanding these findings to an assessment of underlying physiological processes, our study distinguishes between three sources of social relations, including family, friends, and spouse, to assess both positive and negative functions of social relationships in relation to inflammation.