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Stress-buffering effects of volunteering on salivary cortisol: Results from a daily diary study

Sae Hwang Han*, Kyungmin Kim, Jeffrey A. Burr

Department of Gerontology, University of Massachusetts Boston, USA

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ABSTRACT

Based on the theoretical foundations of the caregiving system model, which holds that prosocial behavior can be conceptualized in relation to a neurobiological stress-buffering mechanism, we addressed the question of whether daily volunteering yields buffering effects in terms of suppressing a neuroendocrine response (i.e., salivary cortisol) to daily stressors. We used daily diary data from the second wave of the National Study of Daily Experiences (NSDE II), which is part of the Midlife in the United States study (MIDUS II), a nationally representative survey of middle-aged and older adults. Analyzing a sample of volunteers (N = 340), we tested the buffering role of daily volunteer work for the same day stressors-salivary cortisol response relationship (person-day observations, N = 1,042). Findings from multilevel models indicated that the relationship between daily stressors and cortisol output was attenuated on days when volunteering was performed compared to days volunteering was not performed. Our findings are suggestive of a unique, but unobserved, neurobiological mechanism underlying the link between volunteering and better health. Volunteer programs designed to help others in need may be considered as an intervention strategy for individuals living under stressful conditions.

1. Introduction

There is now an extensive literature on the salubrious health effects of volunteering among older adults (Anderson et al., 2014). Various mechanisms have been proposed and tested to explain the link between volunteering and health. The mechanisms include those that are explained by the social features of volunteering, such as the context of a formal organizational structure within which the activity is conducted and the social role it provides (Greenfield and Marks, 2004; Mutchler et al., 2003), as well as the social support, social control, and interpersonal relationships generated by this activity (Fried et al., 2004; Han et al., 2017). Other research focuses on the psychological benefits associated with volunteering, such as increases in mastery (Thoits and Hewitt, 2001) and self-efficacy (Müller et al., 2014). Recently, the focus on the positive social and psychological aspects of volunteering has been extended to factors that are more neurobiological in nature, and researchers are beginning to uncover empirical evidence of the association between volunteering and markers across distinct human biological and physiological systems (Burr et al., 2016; Kim and Ferraro, 2014; Nelson-Coffey et al., 2017). Prosocial behavior, such as formal volunteering, can be conceptualized in relation to a neurobiological "caregiving system" in the human brain that is health-promoting via a stress-buffering mechanism (Brown and Brown, 2017). This approach provides theoretical grounding for the "under the skin" association between volunteering and health. Despite these advances, empirical evidence for the stress-regulatory function of volunteering is rare and requires further evaluation.

The aim of this study is to investigate the association between volunteering and health from a neurobiological perspective framed within the caregiving system model. Specifically, we employ data from a daily diary study to test whether volunteer activity suppresses a specific neuroendocrine response (i.e., cortisol secretion) to stress that individuals experience on a daily basis. This daily diary design also offers an opportunity to reduce shortcomings associated with social selection processes found in earlier studies of volunteering and health (i.e., healthy volunteer effect; Li and Ferraro, 2005) by taking a within-person analytic modeling approach, where subjects are treated as their own controls. To our knowledge, no other study to-date has examined the stress-buffering effects of volunteering for cortisol levels using a daily dairy study design.

1.1. The caregiving system model

The caregiver system model (CSM; Brown and Brown, 2017; Brown and Cialdini, 2015) integrates accumulated insights from multidisciplinary research on prosocial behavior that provides a framework

* Corresponding author. Department of Gerontology, University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA 02125–3393, USA.
E-mail addresses: saehwang.han001@umb.edu (S.H. Han), kyungmin.kim@umb.edu (K. Kim), jeffrey.burr@umb.edu (J.A. Burr).

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for the neurobiology of prosocial behavior, as well as a theoretical basis for understanding the health benefits associated with helping behavior. Formal volunteering, commonly defined as unpaid work performed under the auspices of a formal organization with the intent of benefitting others, is considered a relevant marker of prosocial behavior within this framework (Brown and Brown, 2017; Morrow-Howell, 2010). However, according to the CSM, it is volunteer activity directed towards caring for others in need, and not work directed towards other more impersonal purposes, that is relevant to the neural and hormonal caregiving system developed over the long history of human evolution (Brown and Brown, 2017).

The CSM posits that social bonds and interdependence between individuals enable persons to provide help to those in need without being exploited (Brown and Brown, 2017). The central argument of the model is that when a person perceives others are in need of help, there is an interaction between social and neurobiological factors (e.g., social bonding, interdependence, hormonal correlates) and available resources (e.g., ability to help, history of providing and receiving care). In this context, the medial preoptic area (MPOA) of the hypothalamus activates the caregiving system in the brain (Brown and Cialdini, 2015). The caregiving system in turn promotes helping behavior by increasing the other-focused motivation to actively provide care (via empathy and compassion), as well as by inhibiting motivations that compete with providing care (e.g., self-serving or reward-seeking behavior). That is, the motivational conflict of moving beyond self-interest to provide help for others is reconciled through a stress regulation process (Brown and Brown, 2017; Brown and Cialdini, 2015). The neuroendocrine modulation involving specific hormones, such as oxytocin (OT) and arginine vasopressin, is considered to be instrumental to the model, as these hormones play key roles in social bonding, being primed to meet the needs of others, and stress regulation in the processes of the activation and maintenance of the caregiving system (Brown and Cialdini, 2015; MacDonald and MacDonald, 2010).

Apart from providing an explanation for the neurobiological mechanisms that guide helping behavior, the CSM also provides a framework that explains the widely documented health benefits for the helper that is often restricted to helping behaviors based on an other-focused motives (e.g., volunteering) and not those based on self-serving motivations, such as obligation (e.g., caregiving; Anderson et al., 2014; Brown and Brown, 2017; Burr et al., 2017). The health benefits associated with the other-focused helping behavior can be explained by the stress-buffering mechanism underlying the caregiving system and its hormonal correlates, which are known to have downstream health benefits (Brown and Cialdini, 2015). In particular, increased levels of OT associated with helping others attenuate the physiological and psychological responses to various forms of stress that individuals experience, through neuroendocrine mechanisms involving the hypothalamus-pituitary-adrenal (HPA) axis functioning (Heinrichs et al., 2009). The OT hormone has been a major focus in the stress-buffering literature, and its role in dampening the HPA response to stress has been widely documented, where a large body of research using human subjects has indicated the stress-buffering effects of OT on stress hormones, especially salivary cortisol (for a review, see Hostinar et al., 2014). To be clear, we do not interpret the CSM to indicate that prosocial behaviors like volunteering under the auspices of formal organizations are directly related to the release of healthy hormones. Rather, the CSM provides a foundation for expecting such pro-social helping behaviors to help regulate the relationship between stress and the release of these hormones (for a detailed description of the neurobiological basis for the stress-buffering mechanism underlying the CSM, refer to Brown and Brown, 2017).

1.2. Daily stress and stress reactivity

The role of stress for health and well-being is well-established in the literature (Acabchuk et al., 2017; Thoits, 2010) and there is increasing evidence that accumulation of minor stressors experienced on a daily basis, often described as daily hassles (e.g., arguments with others, work deadlines), is a critical determinant of health (Almeida et al., 2011). Further, it is not exposure to these stressors that is important for health outcomes per se, but rather it is the individual variation in reactivity to stressors that accounts for variability in health (Almeida et al., 2011). One of the key physiological markers of stress reactivity is the release of cortisol from the adrenal cortex. Although cortisol plays an essential role in stress regulation, elevated and chronic exposure to this stress hormone is detrimental for physical and mental health (Piazza et al., 2010). In this study, we examine overall secretion of diurnal cortisol (i.e., from wake time to sleep time) assessed daily, an indicator of cortisol output known to be associated with daily stressors (Stawski et al., 2013).

1.3. The stress-buffering effects of volunteering

Despite the extensive literature on volunteering and health, studies that examine the stress-buffering effects of volunteering are limited. Two studies based on U.S. samples show mixed findings; volunteering did not buffer the detrimental effects of role-loss on affective well-being in later life (Greenfield and Marks, 2004), but the activity was shown to buffer the adverse effects of widowhood on depressive symptoms (Li, 2007). Additional evidence of the stress-buffering effects of volunteering comes from a study framed by the CSM, where Poulin (2014) shows that a greater number of hours devoted to volunteering was protective against stressful life events (e.g., serious illness, natural disaster). Further evidence on the stress-buffering hypothesis comes from studies on other forms of helping behavior. A recent daily diary study by Raposa et al. (2016) demonstrates that prosocial behaviors (e.g., holding an open door, asking someone if they need help) directed toward strangers and acquaintances attenuates the negative effects of daily stressors on psychological health outcomes. Other studies regarding prosocial behaviors indicate that instrumental help provided to family members and friends (Brown et al., 2008), social support given to others in a religious setting (Krause, 2006), and charitable behaviors, such as donating blood or giving money to charity (Poulin and Holman, 2013) buffer the adverse effects of stress. Importantly, Poulin and Holman (2013) provide evidence that different genotypes associated with the OT receptor gene account for the stress-buffering effect, thereby providing some support for the CSM.

1.4. Study question and hypothesis

Guided by the CSM and recent findings from the empirical literature, we address the question of whether volunteering provides a buffer for the neuroendocrine reactivity (as measured by diurnal cortisol secretion) to daily stressors. To reiterate, the hypothesized relationship between volunteering and stress-reactivity is related to a stress-buffering mechanism. The CSM does not provide theoretical grounding to expect a direct relationship between volunteering and cortisol output. We assume that volunteer work activates the caregiving system, promoting the secretion of OT (unobserved in this study due to data limitations). Thus, we hypothesize that the relationship between daily stressors and cortisol response among volunteers will be attenuated on days when individuals volunteer as compared to days when they do not volunteer.

2. Design and methods

2.1. Data & study sample

The data were taken from the second wave of the *National Study of Daily Experiences* (NSDE II; Almeida et al., 2009), which is a random subsample of the *National Survey of Midlife Development in the United States* (MIDUS II), representative of Americans ages 35 to 84 (Brim