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The Benefits of Social Support on Health and Well-Being in Military Populations: 
Examining Mechanisms, Source of Support, and 
the Reach of a Workplace Well-Being Intervention

by

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requirements for the degree of

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in
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Social support is essential for health and well-being. Although the salubrious effects of social relationships have been established, important questions remain such as: the mechanisms driving these beneficial effects, the extent that promoting social support in the workplace can benefit workers and their romantic partners, and if support from important but less close sources of support (like supervisors) can offer additional health benefits beyond support from closer relationships (like romantic partners). Over three studies, I explored these topics in the context of military couples (Studies 1 & 2) and in partnered service members (Study 3) on health and well-being outcomes that are relevant to these populations [e.g., post-traumatic stress disorder (PTSD), sleep disturbances]. The first study examined the mechanisms driving salubrious effects of romantic partners, demonstrating that perceived partner responsiveness (PPR) was associated with higher sleep quality for both members of military couples, lower pain for veterans, and that affect mediated these associations. The second study evaluated whether a workplace intervention, which incorporated supervisor supportiveness trainings and worker sleep tracking, could foster improved well-being, mental health and social connection in service member workers and their romantic partners. Specifically, Study 2 found that the intervention improved well-being (which was assessed with life satisfaction) and social connection (assessed with loneliness and PPR) of military couples in the treatment group relative to the control group. An intervention effect did not emerge for the mental health indicator, PTSD symptom severity, for military couples but it was significant for service members in initial models, which suggests that the intervention may ameliorate PTSD
severity for workers but not their romantic partners. The purpose of the Study 3 was to
determine if supervisor support offered additional benefits on health outcomes (PTSD
symptom severity and sleep dissatisfaction) for service members after controlling for the
likely more potent effects of romantic partner support. Supervisor support was not
associated with subsequent PTSD symptom severity or sleep dissatisfaction, although the
initial (i.e., unconstrained) model revealed a significant negative association with PTSD
symptom severity at a subsequent wave. Supplemental analyses revealed that supervisor
support was negatively associated with psychological distress (i.e., a broad mental health
indicator). This suggests that supervisor support offers additional benefits for
psychological health beyond the benefits of romantic partner support. Taken together,
these studies clarified mechanisms by which social relationships influence health,
established that a workplace intervention can promote the well-being and social
connection of workers and their romantic partners, and that supervisor support is a unique
and important resource for worker mental health. These findings have implications for
the general public and for practitioners in the fields of public health and organizational
psychology.
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Too often we underestimate the power of a touch, a smile, a kind word, a listening ear, an honest compliment, or the smallest act of caring, all of which have the potential to turn a life around.

— Leo Buscaglia
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Chapter 1: Introduction

Social determinants of health and well-being

Social connection is essential for health and well-being (Pietromonaco & Collins, 2017). The Belongingness Hypothesis states that individuals are pervasively driven to form and maintain enduring, positive, and significant interpersonal relationships with at least some minimum number of contacts (Baumeister & Leary, 1995). These researchers argued that because social connection was beneficial to the survival and evolution of mankind, mechanisms have developed to positively reinforce social contact and the pursuit of belongingness with rewarding emotions (e.g., joy, contentedness) and to punish any perceived potential threats to social bonds with painful emotions (e.g., distress, sadness) (Baumeister & Leary, 1995). In her writing about the core social motives, or the underlying processes that drive human affect, cognition and behavior, Fiske (2004) theorized that the need to belong is so fundamental that it underlies the other core social motives (such as the need to understand the world) and the satisfaction of the need to belong promotes thriving psychologically and physically. Supportive social relationships consistently emerge as one of the strongest predictors of well-being (Huppert, 2014). Thus, across the diverse traditions of well-being research, the fundamental role that social relationships play is consistently highlighted as a precipitating factor (e.g., Diener & Suh, 1997; Ryff, 1989).

Social connection can be fostered by positive interactions such as getting close to another person (i.e., intimacy), celebrating positive news (i.e., capitalization), or helping someone (i.e., social support) (Pietromonaco & Collins, 2017). Social disconnection
results from unrewarding, negative or hostile interactions with others (Pietromonaco & Collins, 2017). Whereas the fulfillment of the need to belong (i.e., social connection) fosters well-being and health benefits, a lack of fulfillment of the need to belong (i.e., social disconnection) can cause a wide variety of harmful effects in the short-term which can accumulate to foster deleterious long-term outcomes (Pietromonaco & Collins, 2017). For example, spousal criticism sets into motion maladaptive stress responses such as elevated blood pressure and poorer immune responses (Robles et al., 2014). These maladaptive stress responses can accumulate to contribute to significant health problems in the long-term (e.g., Chida & Steptoe, 2010). Lacking supportive social relationships is as deleterious to physical health as more established risk factors like smoking and a lack of physical exercise (Holt-Lunstad et al., 2010). Chronic unfulfillment of the need to belong can result in loneliness, which can increase suicide risk (Heinrich & Gullone, 2006).

**Theoretical framework linking interpersonal processes to health and well-being**

In the broader scientific and medical community, the understanding of the determinants of health transitioned from the biomedical model to the biopsychosocial model of health in the late twentieth century (Revenson, 2012). The biomedical model attributes disease to a cause originating within the body (e.g., genetics, pathogens) and is unrelated to and separate from psychological processes and dysfunction. This stems from the dualistic view that the mind and body are separate rather than interconnected parts of the same whole as embodied by the monistic view. The biomedical model arose from the Scientific Revolution and aimed to empirically determine and treat biological causes of
illnesses (e.g., infection, injury) (Wootton, 2016). The utility of the biomedical model can be ascertained by the leaps in medical science and practice it informed (e.g., eradication of many acute illnesses with vaccines). Over the late 19th and 20th centuries, researchers raised critiques about the biomedical model such that it was a reductionist paradigm embodying a single-cause, single effect approach and therefore did not take into account the psychosocial context that shapes health or how the psychosocial context interacts with biology (Wade & Halligan, 2017). Indeed, many of the common ailments in the U.S. today that cause the highest number of fatalities (such as heart disease) are chronic conditions that result from the interaction of biological (e.g., genetic vulnerabilities), psychological (e.g., emotional reactivity, neuroticism), and social (e.g., stressful interpersonal interactions) factors, rather than solely being caused by biological factors (Wade & Halligan, 2017). Additionally, the biopsychosocial model offers helpful perspective for understanding, preventing and treating acute diseases like the novel coronavirus disease 2019 (COVID-19) (Kop, 2021). For example, social factors like homelessness and economic pressures preclude compliance with social distancing measures that would otherwise reduce disease transmission of COVID-19 (Kop et al., 2021). The biopsychosocial model can be considered a systems theory model advocating for a holistic understanding of health focused on examining the interplay of biological, psychological, and social structures and processes at multiple levels of analysis (such as health-relevant laws at the macro-level of the social domain) (Revenson, 2012). Although the biopsychosocial model has reached prominence in research and some areas of patient care (e.g., chronic pain treatment), the general public often privileges biological causes as
the main causes of health difficulties over psychological and social causes (Wade & Halligan, 2017).

In the field of health psychology, the biopsychosocial model has been elaborated upon to more precisely examine the role of social factors, which have been relatively understudied compared to biological and psychological factors, in contributing to health and well-being. Pietromonaco and Collins (2017) proposed an organizational framework featuring interpersonal processes (i.e., the social domain) facilitating intrapersonal processes that include psychosocial processes (including affective, cognitive, behavioral and relationship security/satisfaction), health and lifestyle processes (such as exercise and substance use) as well as biological processes (such as endocrine and cardiovascular processes), which interact to ultimately impact health and well-being outcomes.

Interpersonal processes are series of behaviors or experiences unfolding between two or more people whereas intrapersonal processes are series of behaviors, emotions, thoughts, or biological functions unfolding within the person. One of the main interpersonal processes that have been studied in connection to health is social support in the context of adversity. A sizeable body of research linked social support to a wide variety of beneficial physical and psychological outcomes in multiple disciplines of research (Bavik et al., 2020).

**Social Support**

Social support is a complex and abstract concept for which many definitions have been proposed. Some theorists argue that it cannot be defined because a single comprehensive definition would not accurately capture this multifaceted meta-construct
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(e.g., Cohen, 1992; Vaux, 1988). Albeit, a definition of social support that is useful is “emotional, informational, or practical assistance from significant others, such as family members, friends, or coworkers; (and that) support actually may be received from others or simply perceived to be available when needed” (Thoits, 2010, p. S46). This definition encapsulates received support (i.e., enacted behaviors) and perceived support (i.e., perception about the availability of support). Once causal evidence was found to link social support to health outcomes (as reviewed by House et al., 1988), researchers became interested in understanding the mechanisms driving these effects. In their groundbreaking piece, Cohen and Wills (1985) proposed two hypotheses about how social support could impact health: the stress-buffering hypothesis and the main effect hypothesis. In short, the stress-buffering hypothesis asserts that social support impacts health by protecting individuals from the ill effects of stress in the context of adversity such as when one “leans on” a friend during the hard times. The main effect hypothesis posited that social relationships can foster health outside the context of adversity.

Although Cohen and Wills (1985) originally framed these hypotheses as comparative (i.e., which effect better explains the association between social support and well-being), social relationships have been found to benefit health and well-being through both proposed mechanisms (Bavik et al., 2020).

Researchers have raised the issue that the vast majority of social support research has focused on social support provision in the context of adversity (i.e., a type of support that has been termed a “negativity buffer” or “stress buffer”) whereas other contexts and other types of social support have received considerably less attention (Berkman et al.,...
2000; Feeney & Collins, 2015). The field began to shift in the 2000s when research increasingly began to explore how relationships help us *thrive* rather than just to survive (Feeney & Collins, 2015), which is consistent with the main effect hypothesis. For example, a study showed that the interpersonal process of capitalization (i.e., celebrating positive events) fostered health benefits when the sharing of good news (e.g., a job promotion) was met with constructive and enthusiastic celebratory responses whereas destructive (e.g., critical) or passive (e.g., indifferent) responses were harmful (Gable et al., 2004).

Although perceived support (i.e., the perceived availability of support) has been consistently linked to health benefits, the associations between received support (i.e., enacted behaviors delivered to the recipient) and health outcomes are less consistently positive and sometimes negative (see Maisel & Gable, 2009 for review). Multiple factors (e.g., timing, quality and quantity of the support) have emerged as factors that determine the effectiveness of received support (Cutrona & Russell, 1990; Jacobson, 1986). The determinants of support effectiveness that are explored throughout this body of work include responsiveness and the source of support.

**Perceived partner responsiveness**

Research has found that the provision of social support can be ineffective or even harmful if it is delivered in a way that is unresponsive to the needs of the recipient (Maisel & Gable, 2009). Perceived partner responsiveness (PPR) is the perception that one’s partner cares for, understands and validates them (Reis, 2012; Reis & Shaver, 1988). Although this perception is often considered a relatively stable global evaluation
of one’s partner, responsiveness is also a situational perception stemming from evaluations of particular behaviors (Maisel & Gable, 2009). PPR is most commonly studied in its connection to the intimacy process, a series of repeated and reciprocal interactions involving emotional validation of increasingly personal and meaningful information being disclosed (Laurenceau et al., 2005; Reis & Shaver, 1988), which fosters it. Responsive behaviors can take many forms such as demonstrating understanding and care for the other’s needs when providing assistance (Maisel & Gable, 2009), providing space for a partner to work towards their goals (Feeney, 2004), and enthusiastically and constructively celebrating a partner’s good news (e.g., earning a promotion; Gable et al., 2004) but what unites responsiveness is that it makes a person feel that their partner truly “gets them” and their core values and cares about their welfare. Reis (2012) has argued that PPR underlies all beneficial interpersonal processes as it is the most irreducible element of what makes relationships rewarding and satisfying and therefore beneficial to health. Indeed, other researchers have argued that PPR is critical to success in relationships and that it is central to a variety of theories in the field of interpersonal relationships such as Attachment Theory (Clark & Lemay, 2010). Although PPR is a perception that can be fostered in any relationship, such as with friends or family members, this dissertation explores PPR exclusively in connection to romantic partners throughout the different studies. PPR is assessed as a driver of health benefits like: reduced pain and improved sleep quality for military couples in Study 1 and reduced PTSD symptom severity, psychological distress and sleep dissatisfaction in Study 3. It is also assessed an outcome of a workplace intervention for military couples in
Study 2. PPR will be described in more detail below in connection with romantic partners.

**Source of support**

Although any social contact can be a source of support (i.e., the person who support is received or perceived from), not all sources of support are effective and even the same behaviors performed by different sources of support can be differentially effective. In other words, the source of support has emerged as a determinant of the effectiveness of the social support for a variety of populations (e.g., Li et al., 2014; Van Woerden et al., 2011). For example, cancer patients rated certain types of received support to be beneficial only when it came from certain sources such as romantic partners being rated as effective at providing emotional support (e.g., empathy, compassion) but ineffective at providing informational support (e.g., advice) (Dakof & Taylor, 1990). The Convoy Model of Social Relations (Khan & Antonucci, 1980) posits that we are supported by various individuals throughout our lives and the effectiveness of social support from any particular source (or person in our convoy) is in large part determined by the closeness (i.e., emotional intimacy) in the relationship. Closeness is contributed to by structural (e.g., how often we interact with this person) and functional (e.g., the degree to which we rely on them) dimensions of relationships. Convoys can include relationships that are close (e.g., supervisors, neighbors), closer (e.g., friends, coworkers), and closest (e.g., romantic partners and best friends). The composition of one’s convoy is influenced by personal (e.g., age, gender, race) and situational (e.g., role expectations, norms) factors. For example, compared to men, women often have more positive
relationships and negative relationships (Birditt & Antonucci, 2007), which means that women may experience higher levels of both support and strain from their convoy and these experiences can translate to mixed health effects for women.

Romantic partners and supervisors are two distinct relationships that are important convoy members in their respective domains, home and work, and have been found uniquely influence health and well-being. The effects of social support from these relationships have mostly been explored in separate bodies of literature such as the effects of the romantic partner being explored largely in epidemiological work, health psychology, and psychological research about interpersonal relationships whereas the effects of the supervisor has been assessed mostly in organizational psychology. Part of this dissertation, Study 3 aimed to bridge these distinct areas of literature by examining if supervisor support provides additional benefits beyond the likely more potent support that romantic partners provide.

**Romantic partner.** Romantic partners are particularly impactful sources of support given that they are often the most frequent and enduring contact, the primary source of support (Barger & Cribbet, 2016; Birditt & Antonucci, 2007), as well as the attachment figure for most adults (see review by Slatcher & Selcuk, 2017). Early work has suggested that the romantic partners play such an integral role as the most important source of support that after accounting for their effect, receiving support from others fails to produce additional benefits to well-being or distress (Ruehlman & Wolchik, 1988). A high-quality romantic relationship characterized by high PPR has been shown to be a significant resource for health and well-being (Kiecolt-Glaser & Wilson, 2017; Slatcher
PPR has been associated with daily benefits like decreased anxiety and arousal (Selcuk et al., 2017) and healthier diurnal cortisol patterns (Slatcher et al., 2015) as well as long-term benefits like reduced mortality risk 10 years later (Selcuk & Ong, 2013) and 20 years later (Stanton et al., 2019).

Adults often turn to their romantic partner to soothe them when they are worried or hurt, which attachment theorists term safe haven support (Feeney & Collins, 2015). This is an example of the social regulation of emotion, or the powerful effects that close relationships (and particularly romantic partners) have on emotions (Krahé et al., 2013). Through the social regulation of emotion, researchers have found that close others like romantic partners can powerfully influence a variety of health outcomes. In the context of pain, the analgesic effects of social relationships is largely driven by their impact on emotion-regulation which powerfully reduces pain (Cervero, 2012) and this phenomenon has been experimentally demonstrated in laboratory settings (Krahé et al., 2013). The health impact of the social regulation of emotion was explored in a daily diary study of military couples in Study 1 of this dissertation in which the impact of PPR on pain and on sleep quality is found to be mediated by affect. Additionally, romantic partners are integral for psychological outcomes of well-being and mental health. Elements of the intimacy process like disclosing emotional or personal information have been associated with lower PTSD symptoms (e.g., Bowen et al., 2010) and PPR has been associated with higher well-being (Selcuk et al., 2016). Finally, the purpose of Study 3 was to examine if supervisor support has additional beneficial effects on physical and psychological health outcomes beyond the likely more potent influence of romantic partner support (assessed
with PPR). In sum, responsive partners profoundly contribute to physical and psychological health and a key mechanism underlying this effect is the social regulation of emotion (Farrell et al., 2018).

**Supervisor.** Although the romantic partner is likely to be the most influential source of support on health for the reasons summarized above, supervisor supportiveness has also been found to be beneficial for their workers. Supervisors are uniquely positioned to prevent and ameliorate the ill effects of work-related stress, which is consistently ranked among the leading causes of stress (APA, 2019; Kaiser et al., 2008). Supervisors can impact their employees’ well-being and therefore, psychological and physical health outcomes, through a variety of other ways including: making employees feel valued as a team member (i.e., emotional support) as well as having the discretionary ability to distribute material resources (i.e., tangible support) and alter their employees’ schedules and tasks to accommodate their needs (i.e., instrumental support) (Harms et al., 2017). Supportive supervisors have been found to improve well-being (Hammer et al., 2011) and reduce psychological distress (Kossek et al., 2011). Accordingly, the lack of supervisor support has risen as a consistent and strong predictor of poor detrimental health-related outcomes (e.g., low self-rated health, stress and burnout symptoms) (Hämmig, 2017). Additionally, in the military population from which our sample is drawn, the supervisor and the employee share many important commonalities stemming from their shared culture (i.e., the military culture) which includes shared understandings, challenges, and experiences (like combat exposure). These similarities between support
provider (the supervisor) and support recipient (the employee) are a major factor that can optimize the social support process (Lakey et al., 1996), making it more effective.

The research about the health relevance of supervisor support has been largely rooted in the Conservation of Resources (COR) theory (Hobfoll, 1989). COR asserts that individuals are motivated to conserve their current resources (e.g., objects, energies) and seek out additional resources; they experience stress when they lose resources. This theory also states that individuals will invest resources to prevent or recover from resource loss and to gain further resources. Therefore, since social support from their supervisors creates resources (e.g., improved mood) and protects resources (e.g., time when scheduling changes are requested) for employees, the employees might then invest them these new resources into their nonwork life with their romantic partner and family, which will further result in greater resource gains (such as greater positivity experienced with family). Using COR terminology, initial resource gains garnered from the supervisor’s support will lead to further resource gains in the future, such as when they interact with their romantic partner at home. Effects garnered in the workplace can spillover into nonwork domains (e.g., returning home from work in a bad mood or conversely, in a good mood after a productive and interesting day) where it can crossover to affect the workers’ friends and loved ones (e.g., emotion contagion in which one’s romantic partner becomes irritable upon interacting with their angry loved one who just returned from a frustrating day at work) (e.g., Bolger et al., 1989; Story & Repetti, 2006).

The phenomenon of supervisor social support impacting the well-being and health of workers and their families could also be situated within the Pietromonaco and Collins
(2017) framework that guides this body of research. In this framework, supervisor social support is a type of interpersonal process of social connection that facilitates health and well-being for the recipient (the worker) by facilitating intrapersonal processes (e.g., improvements to mood, reduced negativity). This conceptualization is less resource-focused than COR’s theoretical framing (Hobfoll, 1989) but is still consistent with COR such that that supervisor support (which would be termed a resource in COR) can set into motion positive health-promoting processes for the worker (i.e., further resource investment and gain in COR). Additionally, Pietromonaco and Collins (2017) recognize that health and well-being are interdependent phenomenon in that close others like romantic partners mutually foster these outcomes (Hoppmann et al., 2011; Reed et al., 2013), which has parallels to the process of positive crossover effects by which positive moods and well-being that were initially garnered at work are transmitted from the worker to the romantic partner in the COR theory (1989). Pietromonaco and Collins’ (2017) framework can apply to any type of relationship including with one’s supervisor. Therefore, this broader framework presents a useful way to theoretically integrate the research concerning salubrious effects of supportiveness from both supervisors and from romantic partners, which have been largely studied in separate theoretical traditions. Study 3 assesses the effects of supportiveness from these two distinct sources of support on the outcomes of PTSD symptom severity, psychological distress and sleep dissatisfaction.
Workplace interventions

It has long been recognized that workplaces can promote or degrade worker well-being (Sauter et al., 1990). As reviewed above, supervisors play a pivotal role in the lives of the employees they lead, which makes them a promising target for social support interventions in the workplace (Kelloway & Barling, 2010). Therefore, researchers have become increasingly interested in creating the efficacious trainings to foster social support skills in supervisors and to evaluate these workplace interventions (Hammer & Perry, 2019). Such supervisor supportiveness trainings have been found to promote daily well-being for workers (Mohr et al., 2021) as well as PPR in workers and their romantic partners (Study 2), demonstrating potential crossover effects (Brady et al., 2021). This dissertation includes an evaluation of a workplace intervention, that incorporated supervisor supportiveness trainings and worker sleep tracking (which included actigraph-collected sleep data, personalized sleep feedback and goal-setting), on a variety of well-being outcomes in service member employees and their romantic partners in Study 2. Additionally, Study 3 explores the associations between the intervention and subsequent perceptions of supportiveness of the romantic partner and the supervisor, PTSD symptom severity, psychological distress, and sleep dissatisfaction of service member workers.

The Military Context

This body of work explores the phenomena of social support promoting and protecting health in military-connected couples (i.e., in which at least one partner is a current or former service member; Studies 1 and 2) and in partnered service members (i.e., married or cohabitating service members; Study 3). Almost half of military
personnel are married (47.6%; Department of Defense, 2020), so assessing the population of military couples and married service members includes much of the larger military population. Military service is a high-risk occupation in which military personnel are exposed to extreme job demands, high-pressure situations, as well as potentially traumatic, injurious or fatal combat during deployment, and therefore they experience high levels of stress and mental health issues (Skogstad et al., 2013; Williamson et al., 2019). In part due to the military service being a high-risk occupation, the military population is at increased risk of significant challenges to their health and well-being (e.g., Williamson et al., 2019). Additionally, there is evidence that the current generation of service members contends with unique challenges to their health and well-being compared to earlier generations. The approximately 3 million service members that participated in Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), or Operation New Dawn (OND) have higher rates of medical needs, mental health needs and disability claims than previous generations of U.S. veterans (e.g., of the Vietnam War; Autor et al., 2016; Nock et al., 2013; Wenger et al., 2018). This is likely due to a confluence of factors including: increased pace and length of deployments (as the same individuals serve repeatedly and for longer periods than in previous wars), unpredictable and stressful combat experiences (such as exposure to improvised explosive devices), and the increased likelihood of survival of previously fatal injuries due to advancements in providing high-quality emergency medical care quickly (Hosek et al., 2006). The deleterious effects of military service on the psychological well-being of service members and veterans are apparent from the higher rates of mental health issues than the
general public. For example, individuals who have deployed are approximately twice as likely to develop PTSD than the general public (Gates et al., 2012; Trautmann et al., 2017). Military populations also contend with high rates of health problems that can diminish their quality of life. Chronic pain and sleep disturbances are prevalent among current and former service members (Nahin, 2017; Plumb et al., 2014; Troxel et al., 2015). In conclusion, post-9/11 service members and veterans have higher prevalence of psychological and physical health problems.

These deleterious outcomes are not experienced in a vacuum by the service member or veteran, but rather their romantic partner and the rest of their family are impacted by the diminished health and well-being of their loved one who served. Both members of the military couple cope with health problems experienced by the veteran and these health problems share a bidirectional relationship with relationship functioning, in which health problems can interfere with relationship functioning and strained relationships can exacerbate health problems (Lewis et al., 2012; Trump et al., 2015). Therefore, military researchers have called for chronic health problems in military populations to be researched and treated in the context of the romantic relationship and family such as with couple-centered or family-centered care approaches, respectively (e.g., Lewis et al., 2012; Lewis et al., 2013; MacDermid Wadsworth et al., 2013). In the broader literature about the intersection of close relationships and health, researchers have become increasingly interested in uncovering the influence that members of a couple (or other close dyads) have on their own and each other’s health to capture the nuances of relationship processes on health (Reed et al., 2013). The standard for
conducted this type of research is dyadic analysis, which can simultaneously examine
the interdependencies between a partner’s predictor and the person’s outcome (i.e., a
partner effect) as well as the traditionally explored influence that a person has on their
own outcome (i.e., actor effect; Reed et al., 2013). Study 1 is informed by this literature
and utilizes dyadic analysis to uncover interdependencies and nuances regarding the
influence of the intimacy process on relevant health outcomes for military populations,
pain and sleep quality. Additionally, the dyadic nature of health and well-being is
reflected in the analytical approaches featured in Studies 2 and 3. Study 2’s evaluation of
a workplace well-being intervention focused on how the intervention impacted the
worker’s romantic partner in addition to the worker themselves because any
improvements to worker well-being were hypothesized to facilitate well-being
improvements for the romantic partner for the above-summarized reasons. Finally, Study
3 modeled the influence of supportive romantic partners on health outcomes while
exploring the potential additional benefit of supervisor support.

Present Investigation

The three studies in this dissertation are thematically connected by their focus on
the power of social connection to promote health. The first study, Chapter 2, was focused
on how responsive romantic partners promote health. Specifically, it assessed the
interpersonal mechanism of responsiveness (meant to represent the intimacy process) in
regard to its facilitation of the intrapersonal mechanism of emotion regulation to
ultimately reduce pain and promote sleep quality. The second study, Chapter 3, featured
experimental evidence garnered from a workplace well-being intervention that targeted
worker sleep and supervisor supportiveness. Chapter 3 assesses the extent to which this intervention fosters well-being, social connection and mental health in the service member workers and the workers’ romantic partners (i.e., crossover effects). The third study, Chapter 4, was focused on who promotes particular mental and physical health outcomes. Specifically, Chapter 4 examines if supervisor supportiveness can offer additional health benefits (i.e., lower PTSD symptom severity, psychological distress, and sleep dissatisfaction) after the likely more potent effects of romantic partner supportiveness is accounted for.
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Chapter 2: Perceived Partner Responsiveness, Pain, and Sleep: A Dyadic Study of 
Military-Connected Couple

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Author Contribution Statement

AnnaMarie O’Neill conceptualized an earlier version of this study for her 
master’s thesis. She performed the data analysis, drafted the original manuscript and 
revised the manuscript. Cynthia Mohr and Todd Bodner assisted with the data analysis.
Cynthia Mohr and Leslie Hammer acquired funding for the larger grant project, designed the research project, and directed data collection. Cynthia Mohr, Todd Bodner, and Leslie Hammer supervised this study and reviewed and edited the writing for this study.
Abstract

Objective: The health-promoting influence of supportive close relationships has been extensively documented, yet the mechanisms of this effect are still being clarified. Leading researchers have theorized that examining particular interpersonal interactions and the mediating intrapersonal processes they facilitate is the key to understanding how close relationships benefit health. The purpose of this study was to investigate the influence of perceived partner responsiveness (PPR) on pain and sleep quality via affect in a sample of veterans and spouses (collectively called military-connected couples).

Method: Military-connected couples (N = 162) completed 32 days of daily diaries. Mediated actor-partner interdependence models were conducted using multilevel structural equation modeling to assess the effects of PPR at baseline on the daily levels of positive affect, negative affect, pain, and sleep across the following 32 days. Results: Indirect effects emerged such that affect mediated the association between PPR and pain for veterans only whereas affect mediated the association between PPR and sleep quality for both partners. Daily direct effects emerged as well; for example, positive affect was positively associated with higher sleep quality for both partners and lower pain for veterans. Partner effects were revealed such as veteran PPR was positively associated with spouse positive affect. Overall, greater PPR was associated with positive health outcomes for military-connected couples. Conclusion: The implications of this study include providing insights for couple-oriented interventions for preventing and treating pain and sleep problems in couples who are at high risk of these health problems such as military-connected couples.
Introduction

High-quality close relationships have been consistently associated with improved health but the mechanisms underlying this phenomenon are still being clarified. Researchers have argued that the key to addressing this gap is to examine social connection because it can facilitate downstream intrapersonal processes which ultimately impact health (Pietromonaco & Collins, 2017). The present study investigated whether perceived partner responsiveness (PPR) was associated with lower pain and higher sleep quality through affect (as depicted in Figure 2.1). We studied veterans and their spouses, collectively termed military-connected couples, who face unique relationship challenges and are at higher risk of pain and sleep disturbances.

Pain and sleep problems can cause difficulty in daily functioning and can degrade health over time. Evidence suggests that military populations may struggle with these problems more than civilian populations. For example, nationally representative studies have shown that the prevalence of severe pain (i.e., frequent and bothersome) is higher in veterans than nonveterans from the same age group (18–39; Nahin, 2017). Regular military activities that involve extreme physical demands contribute to substantial wear and tear. Additionally, the post 9/11 generation of service members have higher incidence of pain compared to earlier generations, likely due to a confluence of factors such as the increased duration and pace of deployments and increased likelihood of survival of injuries due to advancements in medical care (Hosek, Kavanagh, & Miller, 2006).

Approximately one third of American adults do not meet the recommended minimum duration of seven hours per night (National Sleep Foundation, 2012). In the
military population, the prevalence rate of short sleep duration may be twice as high (63%) with one large study of service members finding that 31% reported a six hour duration and an additional 32% reported durations of five hours or less (Troxel et al., 2015). Although the prevalence rates of sleep problems in civilian and military populations have not been compared in the same study evidence suggests sleep problems may be more prevalent in the latter population (Troxel et al., 2015). These researchers reviewed the contributing factors for sleep problems in the military, which include irregular schedules, crowded sleeping environments, combat exposure increasing likelihood of traumatic brain injuries and posttraumatic stress disorder, military cultural values like viewing sleep as a luxury, as well as difficulties with reintegration into civilian life. Military spouses also contend with factors causing sleep difficulties such as physical separation from their romantic partner, which contributes to them having lower sleep duration than their civilian counterparts (see Brooks Holliday, Haas, Shih, & Troxel, 2016, for review). Further, pain and sleep problems can exacerbate one another. This bidirectional influence has been replicated across the life span, in different countries, and with clinical and relatively healthy samples (Andersen, Araujo, Frange, & Tufik, 2018).

The social context of a romantic relationship can play a role in the development and maintenance of health problems in at least two ways. First, the health problems are interdependent in that the health issue of one can degrade the health of their partner (e.g., Lewis, Lamson, White, & Russoniello, 2013). For example, arthritic pain can degrade partner sleep quality (Martire, Keefe, Schulz, Parris Stephens, & Mogle, 2013), which is
an example of a partner effect (i.e., the influence of a partner’s predictor on one’s own outcome). Second, social relationships strongly influence health in beneficial or deleterious ways, depending on the degree to which they satisfy core needs (such as belonging and being understood; see review by Pietromonaco & Collins, 2017). Researchers and clinicians have called for close relationships to be leveraged alongside more routinely targeted biological and psychological factors for an integrated approach informed by the biopsychosocial model in order to prevent and treat health problems (see review by Kiecolt-Glaser & Wilson, 2017).

One promising yet understudied mechanism linking close relationships to health outcomes, and particularly to pain and sleep, is intimacy. According to the intimacy process model proposed by Reis and Shaver (1988), intimacy is fostered through iterative and reciprocal interactions in which one person discloses emotional information and the other person responds to that disclosure in a way that makes the disclosing person feel that their partner cares for, understands and validates them (i.e., perceived partner responsiveness or PPR). Although the intimacy process and the resulting appraisal of PPR have been relatively understudied as a predictor of physical health, longitudinal studies have discovered promising results. For example, greater PPR predicted lower mortality 10 years later (Selcuk & Ong, 2013) and on the daily level, PPR has also been found to decrease anxiety and arousal (Selcuk, Stanton, Slatcher, & Ong, 2017).

PPR and the broader construct of intimacy are associated with relationship constructs (e.g., relationship quality and social support) that have been previously assessed in connection with both pain and sleep. The degree to which individuals
appraise their relationship as high-quality depends heavily on having supportive interactions over time that fulfill their core social needs, which is tantamount to intimacy and PPR (Reis, 2012). Social support, another commonly studied health-relevant relationship construct, is only beneficial when it is responsive to the recipient’s needs (i.e., the matching-hypothesis) and further, received social support can be detrimental to health when it is unresponsive (Maisel & Gable, 2009). Therefore, the constructs of intimacy and PPR would, by definition, underlie relationship quality and also afford an unambiguous prediction of positive effects on health because it excludes unresponsive social support. Taken together, PPR is the most irreducible essence of what makes relationships close and rewarding, and therefore beneficial to health (Reis, 2012).

Pain is an unpleasant experience created by the brain using input from biological, psychological and social factors to alert the person to actual or potential tissue damage so that sustained damage can be tended to and further damage can be avoided (i.e., biopsychosocial model of pain; Turk & Monarch, 2002). The influence of social relationships on pain is complex and they can both increase or ameliorate pain (see Krahé, Springer, Weinman, & Fotopoulou, 2013 for brief review). For example, invalidation in the forms of social rejection and critical responses to pain expressions can cause and increase pain, respectively. On the other hand, validating and positive experiences with close others can foster analgesic effects because these experiences positively impact emotional states (as reviewed in Krahé et al., 2013). Indeed, a wealth of evidence has suggested that the crux of close relationship’s analgesic effects is the social regulation of emotion. A systematic review of laboratory studies in which pain was
experimentally induced in healthy participants found that positive interactions (e.g., demonstrating empathy) promoted emotion-regulation to reduce pain (Krahé et al., 2013). Research with chronic pain samples has mirrored evidence from lab experiments; for example, one study of individuals with chronic pain and their significant others found that responsiveness to verbal expressions of pain (e.g., supportiveness rather than indifference or criticism) improved physical functioning, suggesting lower pain (Wilson, Martire, & Sliwinski, 2017). Taken together, validating interactions and supportive close others signal safety and drive the social regulation of emotion which, in turn, reduces pain.

It is important to differentiate responsiveness from the interpersonal process of solicitous responses (i.e., overly helpful) to pain expressions (e.g., wincing or talking about pain), which reinforces pain expressions. This dynamic has been extensively studied in couples and conceptualizes pain expression as a behavior that may be reinforced by spousal response if the person with chronic pain finds their spouse’s response to be rewarding in some way. Yet, emotional validation and solicitousness are distinct constructs (reviewed by Cano & Williams, 2010). An example of a solicitous behavior would be for the spouse of a person recovering from surgery to tie her shoes without asking if that is what she needs, potentially undermining her sense of autonomy. In contrast, responsive behavior might include offering help but also encouraging her to keep trying and to reframe the pain as temporary and necessary to regaining flexibility. Unlike solicitousness, PPR is not limited to pain-related interactions, but rather is a global appraisal. The present study is about the somatization of PPR in the forms of lower
pain and higher sleep quality in a nonclinical sample rather than an examination of pain communication in a clinical sample suffering from chronic pain.

The social context within which sleep occurs has been increasingly recognized as impacting the behavioral process of sleep (Troxel, 2010). Analogous to the growing call in the larger close relationship and health research, sleep research has begun to pinpoint particular interpersonal interactions that drive the influences of social relationships on sleep. Components of the intimacy process and the emotional changes they foster have been found to be especially sleep-relevant. Self-disclosures of negative events are predictive of improved sleep for both partners (Kane, Slatcher, Reynolds, Repetti, & Robles, 2014). Drawing from the same sample as the present study, Arpin, Starkey, Mohr, Greenhalgh, and Hammer (2018) found that responsive reactions to disclosures of good news (i.e., capitalization) predicted less sleep difficulty for spouses. In general, PPR has been associated with lower self-reported sleep problems through the mechanism of downregulation of vigilance, which is a relative lowering of emotional and physiological arousal that is essential for sleep (Selcuk et al., 2017). In sum, PPR promotes sleep quality, likely through the downregulation of vigilance.

The purpose of this study is to examine associations among PPR, affect, pain and sleep quality in military-connected couples. We assessed the influence of PPR on the health outcomes through the affective mediators with the Actor-Partner Interdependence Mediated Model (APIMeM; Ledermann, Macho, & Kenny, 2011; conceptual model presented in Figure 2.1). Positive affect (PA) and negative affect (NA) were analyzed in separate APIMeMs because they function independently (Deiner & Emmons, 1984). As
reviewed above, the affective processes that PPR is hypothesized to facilitate are emotion-regulation and downregulation of vigilance in the contexts of pain and sleep, respectively, and these processes have many commonalities like the emotions resulting from them. Thus, we operationalized them with the resulting emotions, higher PA and lower NA, that would produce analgesic and sleep-fostering effects.

An actor effect is the influence of one’s predictor on one’s own outcome (e.g., veteran PPR predicting veteran pain). Regarding actor effects (which pertain to both partners of the couple), in the first APIMeM, we hypothesized that PA will mediate the relationships between PPR and lower pain (H1a) and higher sleep quality (H1b) on average over the 32-day period. Turning to the second APIMeM, we hypothesized that NA would mediate the relationships between PPR and lower pain (H2a) and higher sleep quality (H2b) on average over the 32-day period. Our hypotheses exclusively address indirect effects because this was the main focus of the study. The directional hypotheses were informed by experimental work showing that validating interactions or the priming of validating close others can reduce pain through promoting emotionregulation (Krahé et al., 2013). Another study found that sleep benefits derived from PPR were mediated by decreased symptoms of depression and anxiety (Selcuk et al., 2017). Finally, we investigated the research question regarding the presence of associations for partner effects. Frequently, dyadic phenomena have been examined from an individualistic approach (Kenny, Kashy, & Cook, 2006) and thus, there was not the same empirical foundation to pose hypotheses about partner effects that there was for actor effects.
Method

Study Overview

Data for this study were collected as part of the Study for Employment Retention of Veterans (SERVe; ClinicalTrials.gov Identifier NCT03085953), a randomized controlled trial evaluating the effectiveness of the Veteran-Supportive Supervisor Training which was designed to increase employment retention and personal well-being for current or former service members. For more information about SERVe and our sample, see Hammer, Wan, Brockwood, Mohr, and Carlson (2017). We used preintervention data from the baseline survey of the larger SERVe study and preintervention data from the 32-day daily diary component study, the Daily Family Study (DFS). The baseline survey of SERVe was administered about one to two weeks before the DFS.

Participants

From the sample of 509 veterans participating in the baseline survey of SERVe, 395 veterans were invited to participate in the DFS because they were married or cohabiting with a romantic partner for at least six months. To be eligible to participate in the DFS, both partners of the couple had to complete the baseline SERVe survey, resulting in 260 eligible couples.1 The sample was reduced from the 173 couples who participated in the DFS to the final analyzable sample of 162 couples after excluding couples who completed a pilot version of the survey (N = 9) and responded in a nonmatching reporting window (N = 2; see inclusion criteria below). On average, the participants were in their late thirties and were mostly Caucasian (83.3% of veterans;
80.9% of spouses). Most of the veterans were men (88.9%) and most of the spouses were women (89.5%). Although there were no inclusion criteria regarding sexual orientation, our sample almost exclusively consisted of opposite sex couples (99.4%). On average, couples reported a relationship length of 12 years (SD = 8.5), and a majority were parents (78.4%). See Table 2.1 for more descriptive statistics.

**Procedure and Measures**

The DFS was a 32-day web-based diary survey. Survey links were emailed to participants once daily for 32 days and were required to be completed between 5:00 PM and 11:00 PM. For the veterans who did not work regular hours (i.e., shift workers; 18% of sample), both partners completed their surveys during the 5:00 AM to 11:00 AM reporting window. The survey took 5–10 min to complete. Participants were asked to complete their surveys separately and to refrain from discussing survey responses with their partner. On average, participants completed approximately 24 survey days, resulting in an average compliance of 78%. All research activities were approved by an Institutional Review Board and the U.S. Army Medical Research and Material Command, Human Research Protection Office. Each member of couple could receive up to $90 for their participation depending on the number of completed surveys.

**Perceived partner responsiveness.** An adapted form of the 3-item measure from Laurenceau and colleagues (1998) was administered at one time point, in the SERVe baseline survey which was collected prior to the DFS. An example item is, “To what

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Note that there were no significant differences between the baseline sample of the larger SERVe study (N = 260) and the subsample who participated in the baseline DFS (N = 173) on relevant study variables that we administered in both surveys (e.g. PPR, pain, sleep quality).
degree do you feel understood by your spouse/partner?” Response options ranged from 1 (“not at all”) to 7 (“very much”). Higher scores indicated higher PPR and the three items were averaged to create a composite score ($\alpha = .87$; $M = 5.86$, $SD = 1.25$ for veterans; $M = 6.12$, $SD = 0.98$ for spouses).

**Pain.** Pain was assessed in the DFS with a single item. The participants were asked to rate their “average level of pain experienced” on a single-item visual analog scale (VAS) ranging from 0 (“no pain”) to 100 (“unbearable pain”; Mattacola, Perrin, Gansneder, Allen, & Mickey, 1997). Veterans reported an average of 17.80 ($SD = 21.02$) and spouses reported 13.30 ($SD = 17.67$) for pain.

**Positive and negative affect.** Moods were assessed in the DFS using items from various scales (e.g., Watson & Clark, 1999). Respondents were asked to indicate the extent to which they are currently feeling: angry, ashamed, grateful, guilty, happy, lonely, relaxed and sad. Response options ranged from 1 (“not at all”) to 5 (“extremely”). These mood items were grouped into categories of PA (grateful, happy, relaxed) and NA (angry, ashamed, guilty, lonely and sad) and then averaged by the number of items in the category. We computed the day-level internal consistency for both the PA subscale and the NA subscale on 3 days representing the beginning (Day 3), middle (Day 16), and end (Day 29) of the diary recording period, with resulting alpha reliabilities of .80, .80, and .77, respectively for PA and .74, .72, and .75, respectively for NA. Mean PA for our

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$^2$ Since the pain variable referred to pain experienced over the past 24 hours and that this variable was collected at the same time as affect, there was some overlap in these variables. Alternative analyses featuring a pain outcome that was not reverse-lagged were conducted and the results were mostly the same except that daily associations between affect and pain were significant for spouses in those models. Our final analyses feature reverse-lagged pain because it was more consistent with the temporal precedence ideal for mediation models.
sample was $M = 2.88$ (SD = 0.99) for veterans and $M = 3.14$ (SD = 0.99) for spouses. Mean NA was $M = 1.16$ (SD = 0.33) for veterans, and $M = 1.19$ (SD = 0.42) for spouses.

Sleep quality. A single-item adapted from the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) was administered in the DFS. The item was “How would you rate last night’s sleep quality overall?” The response options ranged from 1 (“very bad”) to 4 (“very good”). On average, sleep quality was 2.73 (0.68) for veterans and 2.79 (SD = 0.76) for spouses.

**Data Analytic Strategy**

The dyadic daily diary data was assessed at two levels with the observations within dyad members at the lower level (also referred to as level 1 or the daily level) and the dyad members at the higher level (also referred to as level 2, the aggregate or average level over the 32 days). We conducted APIMeMs (Ledermann et al., 2011) using multilevel structural equation modeling (Preacher, Zyphur, & Zhang, 2010) in order to account for this nesting, differentiate daily from aggregate effects, estimate partner effects in addition to actor effects, as well as to estimate multiple outcomes in the same model. Our focal predictor, PPR, was a level 2 variable (assessed once, in the baseline survey of SERVe) whereas the mediators and the outcomes were level 1 variables (assessed daily in the DFS) and therefore the resulting APIMeMs were 2–1–1 multilevel mediation models. Level 2 predictors were grand-mean centered whereas level 1 predictors were person-mean centered. Given that the reports of pain and sleep quality referred to the previous day’s experiences (e.g., today’s report of sleep quality referred to yesterday’s sleep period), these variables were reverse-lagged by one day so these
outcomes followed the mediators temporally. Military status was the distinguishing variable between partners (Kenny et al., 2006). We conducted our analyses with Mplus Version 8 (Muthén & Muthén, 2018). Maximum likelihood estimation was used to estimate and test the individual model parameters and Bayesian estimation was used to create 95% credibility intervals for the hypothesized indirect effects. Fit indices are not reported because the models were just identified. We reviewed the close relationships-pain and -sleep literature and did not find uniformly used covariates or theoretical rationale from which covariates were drawn; rather, we identified covariates that have been previously used that would be theoretically important for our study, which we controlled for (age, deployment history, parental status, and relationship length). See Table 2.2 for correlations between covariates and primary study variables.

**Results**

Model parameters are reported in Table 2.3. The indirect effects are reported in Table 2.4. We present figures of the results of the two APIMeMs (Figures 2S and 3S) as well as results from the preliminary analyses in the online supplemental materials. In brief, preliminary analyses showed that PPR was negatively associated with pain for veterans and positively associated with sleep quality for both members of the couple.

**APIMeM 1: PPR - Positive Affect—Pain and Sleep Quality**

The first APIMeM featured PA as the mediator through which PPR was associated with pain and sleep quality over the 32-day study. The majority of hypotheses, which only concerned actor effects, were fully supported. The indirect effect in which PA was found to mediate the association between PPR and pain emerged for veterans (b = -
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1.60, p < .01; see row 1 of Table 2.4; explaining 18.20% of the total effect (TE)) but not for spouses (b = -0.10, ns; see row 8 of Table 2.4), thus providing partial support to H1a. Full support was found for H1b such that PA mediated the association between PPR and sleep quality emerged for veterans (b = 0.05, p < .001; Table 2.4, row 9; explaining 40.66% of the TE) and for spouses (b = 0.07, p < .001; Table 2.4, row 16; explaining 27.78% of the TE).

Multiple partner effects emerged, affirming the research question regarding the presence of partner effects. The indirect effect from veteran PPR to spouse sleep quality through spouse PA (b = 0.04, p < .05; Table 2.4, row 14; explaining -31.09% of the TE). Veteran PPR was associated with spouse PA in the aggregate level (b = 0.13, p < .01; Table 2.3, row 2). Veteran PA was negatively associated with spouse sleep quality in the daily level (b = -0.05, p < .05; Table 2.3, row 7).

APIMeM 2: PPR - Negative affect – Pain and Sleep Quality

The second APIMeM featured NA as the mediator through which PPR was associated with pain and sleep quality over the 32-day study. The majority of the hypotheses in this model were at least partially supported. NA was found to mediate the association between PPR and pain for veterans (b = -2.66, p < .001; see row 17 of Table 2.4; explaining 3.27% of the TE) but this effect did not emerge for spouses (b = -0.31, ns; see row 24 of Table 2.3), thus lending partial support to H2a. Full support was

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3 This percentage of the total effect explained is negative. This may seem unusual but it is consistent with the concept of inconsistent mediation (MacKinnon, 2008) which suggests that two competing component processes of a mediation result in the total effect incorrectly appearing like no meditational processes are occurring. In this case, PPR-positive affect has a positive association whereas positive affect-pain has a negative association, resulting in this negative value of percentage of total effect explained.
found for H2b such that NA mediated the association between PPR and sleep quality for veterans ($b = 0.03, p < .001$; Table 2.4, row 25; explaining 8.01% of the TE) and spouses ($b = 0.05, p < .001$; Table 2.4, row 32; explaining 12.23% of the TE). Turning to the research question about the presence of partner effects, the partner effect that emerged was veteran PPR being associated with higher spouse pain ($b = 2.33, p < .05$; Table 2.3, row 11). Beyond results pertaining to hypotheses and the research question, there were some interesting findings worth noting such as daily fluctuations in NA being associated with sleep quality for spouses ($b = -0.08, p < .05$; Table 2.3, row 17) but not veterans ($b = 0.73, ns$; Table 2.3, row 16).

**Discussion**

This dyadic daily diary study of veterans and their spouses suggests that supportive relationships foster analgesic and sleep-promoting effects through the social regulation of emotion. The hypothesized indirect effects for pain emerged for veterans only whereas indirect effects emerged for both partners for sleep quality. These findings are consistent with the affective states (such as greater relaxation and less sadness) that would be expected to result from social regulation of emotion resulting from having a responsive partner. Additionally, partner effects emerged, which demonstrated pathways of interdependence.

A number of asymmetrical patterns emerged in our results, including some actor effects that were different between veterans and spouses, as well as between the daily and aggregated levels that warrant discussion. The analgesic effect of PPR was limited to
veterans in both API MeMs, and we believe that this does not mean responsive relationships would not lower pain in spouses but rather that is likely reflective of a floor effect given that spouses had significantly lower pain than veterans. Similarly, differential patterns were found for NA between partners in that daily NA was predictive of daily sleep quality for the spouses but not the veterans. In contrast, the analogous paths for PA did not show such patterns in that daily PA was associated with at least some daily health outcomes for both partners. This may also be due to spouses having significantly higher NA than veterans and thus, a floor effect may be present for veterans.

Two of the four partner effects that emerged suggested a beneficial effect such that veteran PPR was associated with higher spouse PA and higher aggregated sleep quality through spouse PA. In contrast, veteran PA was associated with lower spouse sleep quality in the daily level and veteran PPR was associated with worsened spouse pain in the aggregate level. These results may indicate some nuanced dynamics relating to responsive support-giving. Specifically, the beneficial partner effects (e.g., veteran PPR providing both mood and sleep benefits on the aggregate level) suggest that responding to a partner’s needs can provide emotional and health benefits to the support-giver over the long-term whereas the detrimental partner effects (e.g., veteran PA lowering sleep quality for their partners on the daily level) may suggest that the social regulation of emotion can also have short-term costs for the responsive support-giver. Alternately, spouses who have higher PA in general may be perceived as responsive to their veteran partners. In regard to why similar effects did not emerge for veterans (e.g., spouse PPR–veteran PA), it is possible the association found in the raw data with
bivariate correlations, $r = .23, p < .001$ is not significant enough to be significant in a larger regression model in which estimates for each pathway controls for all other pathways.

Although the present study has many strengths like our use of dyadic daily diary data and an advanced analytic approach that parsed apart distinct sources of variance, it also has limitations. Gender is confounded with the distinguishing variable of military status because the majority of veterans were men and the majority of spouses were women. Thus, we were not able to examine gender effects. Our use of single-item measures for the outcomes, which we did to reduce participant burden, is a methodological limitation. However, single-item scales have been utilized in assessing daily sleep outcomes (e.g., Lee, Crain, McHale, Almeida, & Buxton, 2017) and have demonstrated high construct validity when compared to other measures of pain intensity and pain behaviors (Turk & Melzack, 2011). Finally, the purpose of this study was to test how responsive relationships promote health through intrapersonal mechanisms as guided by current relationship theory (Pietromonaco & Collins, 2017). However, alternative models featuring the reverse direction in which pain and sleep were specified to influence PPR are plausible, such that a restless night could impede relationship functioning or partner perception. Such an alternative model is outside the scope of this paper and further, PPR was assessed before the daily variables.

The present study contributes to the pain and sleep literature in a few ways that may help inform future work. Our findings complement experimental work documenting the social modulation of pain (see Krahé et al., 2013) with more ecologically valid
evidence of this process occurring naturalistically in couples at high risk of health problems. We believe our work complements the operant pain model, which focuses on problematic spousal behaviors reinforcing pain expressions. Rather than conflicting with this model, our findings highlight the need to broaden the focus from problematic couple or social support interactions to consider other close relationships processes that can alter pain. For more about the intimacy process applied to the context of chronic pain communication, see Cano and Williams (2010).

Turning to the sleep literature, we built on previous work establishing that capitalization-related PPR promotes sleep (Arpin et al., 2018) and here we broadened our scope by examining PPR more generally and by investigating the intrapersonal mediator of affect. Our mediational model focusing on the critical role of the downregulation of vigilance was informed by Selcuk et al. (2017). We replicated their work with a dyadic sample to uncover interdependence, a daily experience method to see how this process unfolds over time, a new operationalization of downregulation of vigilance with less severely worded NA items (e.g., “sad” instead of “depressed”) and by adding items reflecting PA (e.g., “relaxation”) to represent the range of emotional experiences of vigilance and its downregulation, respectively, and by establishing these associations occurring closer in time (e.g., PPR was collected 1–2 weeks before the mediators and outcomes, which were both assessed each day in the DFS) thus providing more foundation for causality. This study is the first to our knowledge to test a dyadic model reflecting the bidirectional influences of pain and sleep, both within-person and within-couple.
We believe that the present study has made several unique theoretical contributions to the literature. First, although affective processes have emerged as one of the most powerful drivers of health-relevant effects of relationships, as the direct associations between close relationships and affect as well as between affect and health have been extensively established, the complete indirect path connecting these phenomena has been underestablished (Farrell, Imami, Stanton, & Slatcher, 2018). Therefore, our study contributes to the burgeoning body of literature aiming to connect these pieces in a mediational model. Second, we expanded the recently growing literature connecting PPR to health outcomes, and this is important because PPR is a critical construct that underlies many other constructs in relationship science, and it is the essence of what makes close relationships satisfying. Further, these findings demonstrate that health benefits of close relationships are not limited to the context of buffering the effects of stress through processes like social support (stress-buffering hypothesis), but rather close relationships also promote health through satisfying a variety of interpersonal needs (e.g., need to belong and to be understood; main effects hypothesis). Third, our approach of utilizing multilevel structural equation modeling to assess dyadic daily diary data enabled us to parse apart daily effects from aggregated effects and allowed for potential interdependence in these phenomena to be revealed.

Beyond these theoretical contributions, we believe that this study builds on a body of literature that has practical implications for public health. Our findings suggest that harnessing the health-promoting power of responsive social relationships could be an essential part of complete biopsychosocial interventions from those aiming to promote
good health in well populations (i.e., primary intervention), prevent health problems in people at heightened risk of developing them (i.e., secondary intervention), and ameliorate symptoms in unwell populations (i.e., tertiary intervention). Given that our sample is from a high-risk population, our findings especially warrant future investigation of secondary interventions and specifically those that elevate the focus from the individual to the couple. Such a couple-oriented intervention could optimize relationship functioning and intimacy in order to help military-connected couples better overcome the barriers to intimacy they face (e.g., long separations; Baptist et al., 2011), in order to ultimately prevent the development of health problems for which they are at higher risk. Indeed, there are growing calls to address such individual-level health issues with a couple-oriented or family-oriented approach (e.g., Lewis et al., 2013). To our knowledge, couple-oriented interventions have been reserved for tertiary interventions, and thus we cannot speak to the efficacy of such interventions at the secondary stage of intervention or how its benefits would offset the additional costs involved. However, the efficacy of couple-oriented tertiary interventions aimed at treating chronic health problems has been demonstrated with effect sizes that rival and sometimes exceed those of individual-level conventional psychosocial interventions or usual care on relevant biopsychosocial factors [such as higher relationship functioning ($d = 0.17, p < .01$) and lower pain ($d = 0.19, p < .01$)] (Martire, Schulz, Helgeson, Small, & Saghafi, 2010; Smith et al., 2019). These effect sizes emerged despite considerable variation in the content of the interventions (e.g., partner education, relaxation techniques). A step toward improving their efficacy would be to compare specific intervention strategies (Smith et al., 2019) and further,
these authors proposed that enhancing empathy (i.e., understanding and compassion) would be critical in the context of chronic pain. Regarding particular intervention strategies to enhance couple-oriented interventions with health promotion or treatment aims, we advocate for strategies that optimize the intimacy process and we believe that PPR would serve as helpful assessment tool that addresses the essence of whether close relationships will be health-promoting or not—the degree to which they satisfy our core social needs. Given our recommendation of a new proximal target of intervention as well as an assessment tool, our study fits into the Phase 1a of ORBIT, a model aimed at translating empirical research findings to inform behavioral interventions (Czajkowski et al., 2015).

Conclusion

The dominant health paradigm is the biopsychosocial model and yet, social influences of health are sometimes neglected in research and are often not incorporated into prevention and treatment. The present study highlights the importance of close relationships in connection to pain and to sleep quality. Romantic partners are an enduring, frequent interaction partner as well as the primary source of support for most adults. Therefore, optimizing these interactions so they are more responsive and therefore satisfying of core social needs could foster far-reaching health benefits. The present study investigated these processes with military-connected couples who contend with worsened sleep, and higher rates of pain; yet our findings likely generalize to a larger, nonmilitary population also at heightened risk of experiencing these difficulties. This study lends
support for the approach of investigating relationship influences on health in couples and further, raises awareness that supporting one another has far-reaching benefits for health.
Table 2.1.

Descriptive statistics about the primary study variables and demographic variables

<table>
<thead>
<tr>
<th>Primary study variables</th>
<th>Veteran M(SD)</th>
<th>Spouse M(SD)</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived partner responsiveness</td>
<td>5.86 (1.25)</td>
<td>6.12 (0.98)</td>
<td>t(159) = -2.71**</td>
</tr>
<tr>
<td>Positive affect</td>
<td>2.88 (0.99)</td>
<td>3.14 (0.99)</td>
<td>t(3,330) = -11.38***</td>
</tr>
<tr>
<td>Negative affect</td>
<td>1.16 (0.33)</td>
<td>1.19 (0.42)</td>
<td>t(3,330) = 3.19***</td>
</tr>
<tr>
<td>Pain</td>
<td>17.80 (21.02)</td>
<td>13.20 (17.67)</td>
<td>t(3,270) = 11.26***</td>
</tr>
<tr>
<td>Sleep quality</td>
<td>2.73 (0.68)</td>
<td>2.79 (0.76)</td>
<td>t(3,329) = -4.13***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>Veteran M(SD) or Freq(%)</th>
<th>Spouse M(SD) or Freq(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>38.2 (9.10)</td>
<td>36.4 (9.10)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>144 (88.9%)</td>
<td>17 (10.5%)</td>
</tr>
<tr>
<td>Female</td>
<td>18 (11.1%)</td>
<td>145 (89.5%)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>2 (1.2%)</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Asian</td>
<td>0 (0%)</td>
<td>8 (4.9%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>2 (1.2%)</td>
<td>2 (1.2%)</td>
</tr>
<tr>
<td>White or Caucasian</td>
<td>135 (83.3%)</td>
<td>131 (80.9%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (0.6%)</td>
<td>2 (1.2%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Multiple</td>
<td>21 (13.0%)</td>
<td>18 (11.1%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>0 (0%)</td>
<td>3 (1.9%)</td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>9 (5.6%)</td>
<td>11 (6.8%)</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>42 (25.9%)</td>
<td>41 (25.3%)</td>
</tr>
<tr>
<td>Completed college with degree/certificate</td>
<td>77 (47.5%)</td>
<td>81 (50.0%)</td>
</tr>
<tr>
<td>Graduate study in progress or completed</td>
<td>34 (21.0%)</td>
<td>26 (16.0%)</td>
</tr>
<tr>
<td>Deployment history</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never deployed</td>
<td>24 (14%)</td>
<td>--</td>
</tr>
<tr>
<td>Deployed 1 or more times</td>
<td>138 (85.2%)</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dyadic demographic variables</th>
<th>Dyad M(SD) or Freq(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship length (in years)</td>
<td>12.00 (8.53)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>In a committed relationship (not cohabitating)</td>
<td>2 (1.2%)</td>
</tr>
<tr>
<td>Cohabitating (but not married)</td>
<td>13 (8.0%)</td>
</tr>
<tr>
<td>Married</td>
<td>146 (90.1%)</td>
</tr>
<tr>
<td>Civil commitment or union</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Parental status</td>
<td></td>
</tr>
<tr>
<td>At least one partner indicated children</td>
<td>127 (78.4%)</td>
</tr>
<tr>
<td>Neither partner indicated children</td>
<td>35 (21.6%)</td>
</tr>
</tbody>
</table>
Table 2.2.

Within-veteran, within-spouse, inter-partner correlations and among study variables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>.42***</td>
<td>-1.9**</td>
<td>.42***</td>
<td>-3.9**</td>
<td>.28***</td>
<td>-.04*</td>
<td>-.08***</td>
<td>-.09***</td>
<td>-.06***</td>
</tr>
<tr>
<td>2.</td>
<td>-.13***</td>
<td>.16***</td>
<td>-.30**</td>
<td>.39**</td>
<td>-.39***</td>
<td>.03</td>
<td>.12***</td>
<td>.09***</td>
<td>-.14***</td>
</tr>
<tr>
<td>3.</td>
<td>.40***</td>
<td>-.08*</td>
<td>.39***</td>
<td>-.32***</td>
<td>.49***</td>
<td>.12***</td>
<td>-.18***</td>
<td>.06***</td>
<td>.06***</td>
</tr>
<tr>
<td>4.</td>
<td>-.31***</td>
<td>.19***</td>
<td>-.36***</td>
<td>.51***</td>
<td>-.38**</td>
<td>-.11***</td>
<td>-.04**</td>
<td>-.04**</td>
<td>-.22**</td>
</tr>
<tr>
<td>5.</td>
<td>.24***</td>
<td>-.23***</td>
<td>.50***</td>
<td>-.35***</td>
<td>.19***</td>
<td>.02*</td>
<td>-.12***</td>
<td>-.05**</td>
<td>.16***</td>
</tr>
<tr>
<td>6.</td>
<td>-.08***</td>
<td>-.02</td>
<td>.00</td>
<td>-.11***</td>
<td>.14***</td>
<td>-.08***</td>
<td>-.02</td>
<td>.26***</td>
<td>.70***</td>
</tr>
<tr>
<td>7.</td>
<td>.07***</td>
<td>.05***</td>
<td>-.11***</td>
<td>-.04**</td>
<td>-.05***</td>
<td>-.04**</td>
<td>1.00***</td>
<td>-.13***</td>
<td>-.01</td>
</tr>
<tr>
<td>8.</td>
<td>-.12***</td>
<td>-.01</td>
<td>.06***</td>
<td>.05***</td>
<td>-.04**</td>
<td>.26***</td>
<td>-.13***</td>
<td>1.00***</td>
<td>.26***</td>
</tr>
<tr>
<td>9.</td>
<td>-.10***</td>
<td>-.06***</td>
<td>-.09***</td>
<td>-.14***</td>
<td>.11***</td>
<td>.72***</td>
<td>-.01</td>
<td>.25***</td>
<td>1.00***</td>
</tr>
</tbody>
</table>

Note: Interpartner correlations presented along the diagonal, within-veteran correlations presented above the diagonal, and within-spouse correlations presented below the diagonal. PPR = perceived partner responsiveness; PA = positive affect; NA = negative affect; Sleep = sleep quality; Dep. Hx = deployment history of the veteran (never deployed/deployed 1 or more times); Parent Stat.= at least one partner indicated that they were a parent (yes/no); Relat. Length = relationship length in years; *significant at p < .05; ** significant at p < .01; *** significant at p < .001.
### Table 2.3.

Estimates for direct effects of perceived partner responsiveness, positive affect and negative affect on pain and sleep quality

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Intercepts</th>
<th>APIMeM 1: PPR - Positive Affect – Pain and Sleep Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Veteran Positive Affect</td>
<td>Spouse Positive Affect</td>
</tr>
<tr>
<td>1</td>
<td>-0.17**</td>
<td>-0.28, -0.06</td>
</tr>
<tr>
<td>2</td>
<td>V PPR</td>
<td>0.26***</td>
</tr>
<tr>
<td>3</td>
<td>S PPR</td>
<td>0.06</td>
</tr>
<tr>
<td>4</td>
<td>V PA</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>S PA</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Residual Variance</td>
<td>0.51***</td>
</tr>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>V PA</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>S PA</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Residual Variance</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 2.3. (continued)

Estimates for direct effects of perceived partner responsiveness, positive affect and negative affect on pain and sleep

<table>
<thead>
<tr>
<th></th>
<th>APIMeM 2: PPR - Negative Affect – Pain and Sleep Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Veteran Negative Affect</td>
</tr>
<tr>
<td></td>
<td>b (SE) 95% CI</td>
</tr>
<tr>
<td>Level 2</td>
<td></td>
</tr>
<tr>
<td>10 Intercept</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
<td>11 V PPR</td>
<td>-0.07***</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
<td>12 S PPR</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
<td>13 V NA</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>14 S NA</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Residual</td>
<td>0.04***</td>
</tr>
<tr>
<td>Variance</td>
<td>(0.01)</td>
</tr>
</tbody>
</table>

Level 1

|                |                         |                         |              |              |                         |                         |
| 16 V NA        | -                       | -                       | -            | -            | 0.06                    | -1.31, 1.21            |
|                |                         |                         |              |              | (0.70)                  | (0.76)                 |
| 17 S NA        | -                       | -                       | -            | -            | 0.35                    | -0.79, 1.31            |
|                |                         |                         |              |              | (0.58)                  | (0.63)                 |
| 18 Residual    | -                       | -                       | -            | -            | 90.58***                | 86.31                  |
| Variance       |                         |                         |              |              | (2.18)                  | (94.85)                |

Note. Estimates are unstandardized per recommendations from Kenny and colleagues (2006). See Figures 2S and 3S for a graphical depiction of these results. Bold text indicates significant path estimates. V = Veteran, S = Spouse, PPR = perceived partner responsiveness; * significant at p<.05, ** significant at p<.01, *** significant at p<.001.
Table 2.4.

Path estimates for indirect effects of perceived partner responsiveness on pain and sleep quality through positive affect in APIMeM 1 and through negative affect in APIMeM 2

<table>
<thead>
<tr>
<th>APIMeM 1: PPR - Positive Affect – Pain and Sleep Quality</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Row</td>
<td>Predictor</td>
<td>Mediator</td>
<td>Outcome</td>
<td>Estimate (SE)</td>
</tr>
<tr>
<td>1</td>
<td>V PPR</td>
<td>V PA</td>
<td>V Pain</td>
<td>-1.60** (0.69)</td>
</tr>
<tr>
<td>2</td>
<td>V PPR</td>
<td>S PA</td>
<td>V Pain</td>
<td>0.02 (0.36)</td>
</tr>
<tr>
<td>3</td>
<td>S PPR</td>
<td>V PA</td>
<td>V Pain</td>
<td>-0.37 (0.53)</td>
</tr>
<tr>
<td>4</td>
<td>S PPR</td>
<td>S PA</td>
<td>V Pain</td>
<td>0.06 (0.68)</td>
</tr>
<tr>
<td>5</td>
<td>V PPR</td>
<td>V PA</td>
<td>S Pain</td>
<td>-0.26 (0.47)</td>
</tr>
<tr>
<td>6</td>
<td>V PPR</td>
<td>S PA</td>
<td>S Pain</td>
<td>-0.04 (0.27)</td>
</tr>
<tr>
<td>7</td>
<td>S PPR</td>
<td>V PA</td>
<td>S Pain</td>
<td>-0.04 (0.16)</td>
</tr>
<tr>
<td>8</td>
<td>S PPR</td>
<td>S PA</td>
<td>S Pain</td>
<td>-0.10 (0.50)</td>
</tr>
<tr>
<td>9</td>
<td>V PPR</td>
<td>V PA</td>
<td>V Sleep</td>
<td>0.05*** (0.02)</td>
</tr>
<tr>
<td>10</td>
<td>V PPR</td>
<td>S PA</td>
<td>V Sleep</td>
<td>0.01 (0.01)</td>
</tr>
<tr>
<td>11</td>
<td>S PPR</td>
<td>V PA</td>
<td>V Sleep</td>
<td>0.01 (0.02)</td>
</tr>
<tr>
<td>12</td>
<td>S PPR</td>
<td>S PA</td>
<td>V Sleep</td>
<td>0.01 (0.01)</td>
</tr>
<tr>
<td>13</td>
<td>V PPR</td>
<td>V PA</td>
<td>S Sleep</td>
<td>0.00 (0.01)</td>
</tr>
<tr>
<td>14</td>
<td>V PPR</td>
<td>S PA</td>
<td>S Sleep</td>
<td>0.04* (0.02)</td>
</tr>
<tr>
<td>15</td>
<td>S PPR</td>
<td>V PA</td>
<td>S Sleep</td>
<td>0.00 (0.00)</td>
</tr>
<tr>
<td>16</td>
<td>S PPR</td>
<td>S PA</td>
<td>S Sleep</td>
<td>0.07*** (0.02)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APIMeM 2: PPR - Negative Affect – Pain and Sleep Quality</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Row</td>
<td>Predictor</td>
<td>Mediator</td>
<td>Outcome</td>
<td>Estimate (SE)</td>
</tr>
<tr>
<td>17</td>
<td>V PPR</td>
<td>V NA</td>
<td>V Pain</td>
<td>-2.66*** (0.90)</td>
</tr>
<tr>
<td>18</td>
<td>V PPR</td>
<td>S NA</td>
<td>V Pain</td>
<td>0.04 (0.24)</td>
</tr>
<tr>
<td>19</td>
<td>S PPR</td>
<td>V NA</td>
<td>V Pain</td>
<td>-0.82 (0.90)</td>
</tr>
<tr>
<td>20</td>
<td>S PPR</td>
<td>S NA</td>
<td>V Pain</td>
<td>0.77 (0.70)</td>
</tr>
<tr>
<td>21</td>
<td>V PPR</td>
<td>V NA</td>
<td>S Pain</td>
<td>-0.56 (0.48)</td>
</tr>
<tr>
<td>22</td>
<td>V PPR</td>
<td>S NA</td>
<td>S Pain</td>
<td>-0.00 (0.14)</td>
</tr>
<tr>
<td>23</td>
<td>S PPR</td>
<td>V NA</td>
<td>S Pain</td>
<td>-0.13 (0.29)</td>
</tr>
<tr>
<td>24</td>
<td>S PPR</td>
<td>S NA</td>
<td>S Pain</td>
<td>-0.31 (0.47)</td>
</tr>
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<td>V PPR</td>
<td>V NA</td>
<td>V Sleep</td>
<td>0.03*** (0.01)</td>
</tr>
<tr>
<td>26</td>
<td>V PPR</td>
<td>S NA</td>
<td>V Sleep</td>
<td>0.00 (0.01)</td>
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<tr>
<td>27</td>
<td>S PPR</td>
<td>V NA</td>
<td>V Sleep</td>
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<tr>
<td>28</td>
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<td>30</td>
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<td>S Sleep</td>
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<td>32</td>
<td>S PPR</td>
<td>S NA</td>
<td>S Sleep</td>
<td>0.05*** (0.02)</td>
</tr>
</tbody>
</table>

Notes. Bold text indicates significant path estimates. V = Veteran, S = Spouse, PPR = perceived partner responsiveness, PA = Positive Affect, NA = Negative Affect; * significant at p<.05, ** significant at p<.01, *** significant at p<.001.
Figure 2.1.

*Conceptual model*

Conceptual model depicting the theorized actor-partner mediational associations between intimacy and PPR, affect and the health outcomes of pain and sleep quality. The solid lines depict actor effects whereas the dashed lines depict partner effects. The two health outcomes were tested simultaneously in each model whereas the affective mediators were tested in two separate models, one for positive affect and one for negative affect.
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Chapter 3: Improving well-being in military couples through a Total Worker Health® Intervention

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Author Contribution Statement

AnnaMarie O’Neill performed the data analysis in consultation with Cynthia Mohr, Jacquelyn Brady, and Todd Bodner. AnnaMarie O’Neill drafted the original manuscript and revised the manuscript. Cynthia Mohr, Jacquelyn Brady, Todd Bodner, Tori Crain, and Leslie Hammer reviewed and edited the manuscript. Cynthia Mohr, Todd Bodner, Tori Crain, and Leslie Hammer acquired funding for the larger grant project, designed the research project, and directed data collection. AnnaMarie O’Neill assisted with data collection. Cynthia Mohr, Todd Bodner, and Leslie Hammer supervised this study.
Abstract

The workplace plays a powerful role in shaping the well-being of workers and their romantic partners. Workplaces that prioritize workers’ well-being, through approaches such as *Total Worker Health*® (TWH) informed interventions, which include both health and safety protection and promotion, can foster improved health for both members of the dyad, but this has yet to be rigorously tested in a workplace cluster-randomized controlled trial framework. The present study evaluates the effect of a *TWH* intervention that paired supportive supervisor training with worker sleep tracking on well-being, mental health and social connectedness among full-time members of the National Guard and their romantic partners (N=360 military or 720 individuals). Utilizing an intent-to-treat approach and 2-level random effects models, the workplace intervention was found to promote life satisfaction at 4- and 9-months post-baseline, while also reducing loneliness and promoting perceived partner responsiveness at 9-months for both service members and their romantic partners (i.e., couple-level effects). Significant effects did not emerge for the intervention on each partner’s post-traumatic stress disorder (PTSD) symptoms, but initial models revealed significantly lower levels of PTSD for service members. This study extends previous understandings of workplace intervention effectiveness by demonstrating improvements in well-being among couples.
Introduction

Military couples encounter significant and unique challenges which can undermine their well-being. In addition to commonplace, yet significant stressors that civilian couples contend with (such as difficulty juggling work and family roles), military couples also experience unique stressors stemming from one or both member’s military service and their shared military lifestyle (Trail et al., 2017; Wan et al., 2018). Both service members and their romantic partners are at elevated risk of various issues that are detrimental to well-being such as poor psychological and physical health, strained social relationships and engagement in unhealthy behaviors (e.g., heavy episodic drinking) (Lewis et al., 2013; Trail et al., 2017). Further, close relationships (like with their romantic partner) are integral in shaping health and well-being (Selcuk et al., 2016), and one person’s health problems can undermine their own as well-being as their partner’s well-being and health (e.g., Lewis et al., 2013), thus creating a destructive feedback loop. Therefore, advancing couples’ well-being has risen as a workplace priority in the U.S. Military. Research has suggested that the most efficacious workplace well-being interventions are those that target multiple levels of analysis (e.g., individual and organizational factors) and aim to both protect well-being from occupational hazards (such as work-related stress) while also promoting wellness (Anger et al., 2015; LaMontagne et al., 2007). The present study evaluates a workplace well-being intervention evaluated with couples. The intervention targets were to promote supervisor support and service member sleep, leading to improvements in well-being through social connection. Partners are hypothesized to benefit from the workplace intervention, despite
being more distal recipients, due to the mutual influence of close others on well-being (e.g., Hatfield et al., 1994; Reed et al., 2013; Westman, 2001).

We aim to advance the field’s understanding in a several ways. Firstly, we use Total Worker Health® (“TWH”) intervention approach that was developed by National Institute for Occupational Safety & Health (NIOSH). A TWH approach refers to policies, programs and practices that integrate protection from work-related safety and health hazards (e.g., work-life stress; Hammer & Sauter, 2013) with promotion of injury and illness prevention to advance well-being (Schill & Chosewood, 2013; Tamers et al., 2019). Although this approach is supported by the literature (e.g., LaMontagne et al., 2007), few studies have rigorously evaluated TWH-informed interventions. Therefore, this study aims to fill that gap by utilizing gold standard methods in intervention science like rigorous intervention design (e.g., cluster-randomized control trial) and conservative intervention analyses (e.g., intent-to-treat analyses). Secondly, we examine a global indicator of well-being (i.e., life satisfaction), in addition to mental health (i.e., PTSD symptom severity) and social connection outcomes (i.e., loneliness and perceived partner responsiveness), which were selected because of the centrality of these factors to well-being and their importance in the military population. Therefore, this study will provide a more nuanced understanding of well-being-related outcomes that this multifaceted intervention could theoretically impact. Thirdly, although crossover effects flowing from the workplace to one’s romantic partner have been documented in observational research (e.g., Westman, 2001), this is the first TWH intervention study on couples of which we are aware. The present work, which utilizes dyadic data (i.e., surveys from the service
members and their romantic partners), aims to advance the field’s understanding about the potential reach of a workplace intervention into the lives of couples. This work may elevate the way that organizational researchers and practitioners appraise the benefits of a workplace intervention, given the dyadic nature of health and well-being (e.g., Reed et al., 2013). We expected that this intervention will facilitate improvements in well-being that will reverberate through a household, contributing to gains in well-being for both members of the couple.

Work-Family Stress and Well-Being

Work as a determinant of well-being. Workplaces can promote or degrade worker well-being (Hammer & Brady, 2021). According to Organizational Support Theory, workers trade effort and contributions to their organization in exchange for benefits (including socio-emotional benefits), and their experiences inform their generalized perception about the degree to which their organization values their work and cares about their well-being (e.g., Rhoades & Eisenberger, 2002). Yet, work can also be detrimental to well-being if workplace stressors are severe or chronic (e.g., high workload, role ambiguity, lack of social support at work) (Warr & Nielsen, 2018). Indeed, one type of stress stemming from work, work-family stress (or the difficulty integrating one’s roles as worker and family member), is regularly rated a top stressor for most demographics of workers (e.g., APA, 2019; Kossek & Ollier-Malaterre, 2013).

A large body of research investigating spillover and crossover effects between work and home has documented that the boundary between the two domains is permeable such that moods, stressors, and resources can be transmitted from one domain to another (i.e.,
a spillover effect) and can influence people in that domain (i.e., a crossover effect) (Westman, 2001). For example, experiencing positive events at work is associated with less marital conflict that day (Doumas et al., 2003) and daily work-related stress is associated with subsequent destructive interpersonal processes at home in dual-income couples (Story & Repetti, 2006). This body of work suggests that workplaces that prioritize their workers’ well-being would not only reap returns on their investment in terms of being staffed by higher performing workers, but also would improve the home life of their workers and the well-being of their romantic partners (e.g., Hammer & Brady, 2021).

**Military couples.** In addition to general work-related stressors with which civilian couples also contend, military couples face military work-related stressors (e.g., deployment and training for service members; underemployment and unemployment for romantic partners), military lifestyle-related stressors (e.g., periodic separations, shifting roles in the household, concern for their loved one’s safety when apart), health and well-being problems [e.g., high prevalence of psychological and physical health problems (such as sleep disturbances), high prevalence of unhealthy behaviors (like heavy episodic drinking)] as well as relationship problems (Lewis et al., 2013; Trail et al., 2017; Troxel et al., 2015; Wan et al., 2018). Each of these stressors and issues have implications for well-being, such as the military couple’s relationship problems which are extremely detrimental because having rewarding relationships (especially with one’s romantic partner) is a central predictor of well-being (Diener & Seligman, 2004; Selcuk et al., 2016). Thus, military couples are prime candidates for workplace well-being.
interventions. Further, the availability of resources to aid in coping with stressors vary across the military, with some subgroups like National Guard service members having less access to resources compared to their active duty counterparts such as support groups on base (Burrell et al., 2003) and consistent access to medical benefits through the military (Hummer & Hepner, 2021). The high level of stressors paired with the relative lack of resources may help explain the higher levels of psychological health issues (such as depression and PTSD) found in service members from the National Guard compared to other branches (Griffith, 2010).

**Workplace well-being interventions**

Advancing worker well-being has risen as a workplace priority in the past two decades in the U.S. (Hammer & Brady, 2021; Schill & Chosewood, 2013) and around the globe (WHO, 2010). In addition to the benefits of well-being for workers (e.g., improved health, more rewarding social relationships), the organization garners benefits from being staffed by workers with higher well-being (e.g., higher job performance and reduced turnover intention) (Diener & Seligman, 2004; Warr & Nielsen, 2018). Considering the mutual benefits for workers and organizations, it is prudent that workplaces, particularly high-risk workplaces (i.e., those that present the potential for serious and unforeseeable danger; such as the military), take steps to protect and promote the well-being of their workers. The present study evaluates the effectiveness of a workplace well-being intervention that aimed to promote the distal outcome of well-being for both service members and romantic partners by promoting the proximal targets of supervisor social support and service member worker sleep.
Supervisor support interventions. Supervisor support interventions are based in social support theory which asserts that supportive others can positively impact health and well-being directly (like by fostering pleasant moods) and indirectly (by buffering the negative effects of stress) (Bavik et al., 2020). In their systematic review, Bavik and colleagues (2020) found that overall, social support promotes a variety of beneficial health and well-being outcomes across various populations - this connection has long been supported in literatures from various disciplines. In their review of supervisor support, Hammer and colleagues (2007) found significant correlations between employee reports of supervisor support and well-being outcomes. Furthermore, meta-analytic evidence has found that lacking social support is one of the most robust risk factors for the development of PTSD in the general population (Ozer et al., 2003) and for experiencing greater symptom severity of PTSD in the military population (Blais et al., 2021).

Supervisors play a pivotal role in the lives of their employees, which makes them an important target for social support interventions in the workplace. Supervisors are well-positioned to benefit their workers’ health and well-being through various behaviors such as providing emotional support (e.g., listening empathetically to concerns) and mobilizing instrumental support (like distributing resources and allowing for more schedule flexibility) in order to accommodate employees’ needs (Harms et al., 2017). One large study found that lacking supervisor support was the strongest or the only statistically significant predictor of various health and well-being outcomes (e.g., self-rated health, stress) after controlling for other sources of social support (which included
spouses, relatives, friends, coworkers) (Hämmig, 2017). Lacking supervisor support is a risk factor for mental health problems (Sinokki et al., 2009) whereas having a supportive supervisor is associated with lower mental health symptoms (such as for PTSD) in high-risk occupations including soldiers (Adler et al., 2014) and firefighters (Stanley et al., 2019). Supervisor support is also beneficial for workers’ relationship outcomes at home, such as dyadic functioning (Brady et al., 2021). Due to the critical role that supervisors play in worker health and well-being, interest has grown in establishing the most efficacious trainings to enhance social support skills in supervisors (Hammer & Perry, 2019).

Supportive supervisor trainings have been proven to facilitate improvements in worker well-being including reduced stress (Hammer et al., 2020), reduced psychological distress (which is an indicator for probable mental illness; Kossek et al., 2019), improved daily emotional well-being (i.e., increased calmness; Mohr et al., 2021), and extends to the well-being of worker relationships, including improved family relationships among couples (Brady et al., 2021). These interventions have been found to be more beneficial for those individuals experiencing high levels of work-family stress (Hammer et al., 2011). Supervisor support interventions are also laudable because, despite their original focus on reducing work-life stress, they have provided a detailed framework that can be modified to fit specific organizational stressors and are thereby useful across a wide range of organizational settings (i.e., healthcare workers, grocery store workers, organizations employing veterans; Hammer et al., 2011; Hammer et al., 2020; Odle-Dusseau et al., 2016).
One target of effective supervisor support interventions are family supportive supervisor behaviors (FSSB), which include instrumental support, emotional support, role-modeling, and win-win management (Hammer et al., 2009). One such study, Brady and colleagues (2021) found that supportive supervisor training (which included the FSSB training) improved the dyadic marital quality and parent-child relationship quality at 9-months for veteran workers and their romantic partners in a cluster-randomized controlled trial of a workplace intervention. The supervisor support training that is part of the TWH intervention in the present study is an integrated FSSB and sleep leadership behavior training (Adler et al., 2021), which will be described below.

The importance of sleep health. Sleep is essential for various components of well-being including daily emotion regulation (Palmer & Alfano, 2017), engagement in social relationships (Simon & Walker, 2018), maintenance of mental health (e.g., Spoormaker & Montgomery, 2008), and prevention of chronic disease (Watson et al., 2015). Sleep deficits are prevalent in American adults (Liu et al., 2016) and are more prevalent among certain groups like service members and their romantic partners (Holliday et al., 2016; Troxel et al., 2015). Given the integral role that sleep plays in worker well-being paired with the high prevalence of sleep problems in the general population and military (e.g., Liu et al., 2016; Troxel et al., 2015), increased energy has been invested in designing and evaluating workplace interventions that address the modifiable antecedents to sleep (e.g., Adler et al., 2017; Crain et al., 2019). Previous work has shown that group-level interventions such as teaching sleep leadership behaviors (Adler et al., 2021) and individual-level interventions such as delivering personalized feedback regarding sleep
patterns in addition to goal setting exercises (Adler et al., 2017) are both effective strategies to improve sleep, and thus both were utilized in the present workplace intervention.

The **Total Worker Health®** approach. The previously described approaches to occupational health have been integrated and advanced through a TWH approach, that involves both health and safety protection and promotion (Punnett et al., 2020). The TWH approach emphasizes targeting modifiable risk factors at multiple levels of analysis (e.g., the individual worker, the group’s supervisor) rather than exclusively focusing any one level of analysis. The TWH approach to worker health and safety thus goes beyond previous supervisor support interventions and health promotion interventions in that it is an organizational intervention approach that integrates the two and has therefore unsurprisingly been identified as a the most meaningful approach to date for addressing worker health and well-being (see Anger et al., 2015; LaMontagne et al., 2007).

**Present Study**

We predict that the two proximal mechanisms that the intervention activities will target, social support from the supervisor and worker sleep, will facilitate a diffuse set of beneficial well-being outcomes for the service members because of the empirical and theoretical evidence summarized above. We also predict that romantic partners will garner well-being benefits from this intervention (despite not directly receiving intervention activities) due to the interdependent nature of health and well-being in close relationships (Reed et al., 2013; Selcuk et al., 2016), emotional contagion (Hatfield et al., 1994), as well as crossover effects (e.g., Westman, 2001). Firstly, well-being is mutually
fostered in close relationships (e.g., Hoppmann et al., 2011; Selcuk et al., 2016).
Therefore, any improvements that the intervention fosters for the service members’ well-being would plausibly translate to improvements in their romantic partner’s well-being.
Secondly, social connection facilitates an array of salubrious changes occurring within a person (e.g., physiological, cognitive, emotional, and behavioral) (Pietromonaco & Collins, 2017). The intervention is expected to promote service member’s social connection with others such as with the supervisor specifically (who has been trained to be more supportive), with the romantic partner, and with others in general (e.g., given that improved sleep should improve social functioning). Therefore, the romantic partner will also benefit from the social connection that the intervention fosters within the romantic relationship. Finally, from an organizational perspective, supervisor support (and the effects it fosters such as improved mood) can be considered a resource that spills over into home domain where it promotes more positive interactions which translates to improved well-being in the romantic partner (i.e., a crossover effect; Westman, 2001).

**Hypotheses (H1-H4):** Relative to the control condition, service members and romantic partners in the treatment condition of the randomized control trial will have: higher life satisfaction (Hypothesis 1 or H1), lower PTSD symptom severity (H2), lower loneliness (H3), and higher perceived partner responsiveness (PPR; H4) post-intervention.

**Methods**

The intervention was informed by the TWH approach integrating health protection (supervisor supportive training) and health promotion (individual sleep
tracking). The cluster-randomized controlled trial included an intervention and waitlist control groups conducted from 2017 through 2020. Randomization was based on the existing organizational structure of the National Guard, in which we clustered military units based on geographical location, size, job type and branch (Hammer et al., 2021). Randomization occurred after baseline recruitment and survey data collection, so the study was double blind at randomization. Because of the nature of the intervention, blinding was not possible after treatment, but those in the control group were not explicitly told which group they were in. Many units were geographically or physically separated (e.g., separate buildings), reducing the potential contamination of treatment effects.

Survey data were collected at baseline and 4-months and 9-months post-baseline. Intervention activities (e.g., supervisor computer-based training and service member sleep tracking and feedback) were administered approximately 1-2 months after baseline data collection. For logistical reasons, all Army units completed study activities first, followed by Air units. The study protocols were approved by the University Institutional Review Board. For a more complete description of the study methods, see Hammer and colleagues (2021).

**Recruitment and data collection.**

We received support for our intervention proposal and timeline from the state’s Adjutant General of the National Guard, briefed top leadership, and briefed the unit leaders prior to recruitment of study participants. We provided unit leaders an email template to forward to their full-time unit staff that included study information and a link
for them to sign-up. Through the link, service members provided contact information, were screened for eligibility (i.e., worked 32 or more hours a week for the National Guard), and were provided pertinent information about the study. Additionally, service members were asked to provide their romantic partner’s contact information so that research staff could send the romantic partners a link to sign-up for the study. The romantic partners were invited to complete the online surveys but not to have their sleep tracked. Participants received a $25 gift card for each of the three survey data collections, and a $50 gift card for participation in each of the two sleep tracking data collections that involved wearing an actigraphy device for three weeks ($125 total).

**Participants**

Service member participants consisted of full-time workers of the National Guard. Their work roles varied from maintenance, logistics, engineering, medical, human resources, finance and supply, operations, special tactics, and security personnel. In the recruitment stage, 743 service members indicated that they had a romantic partner that they were married to or cohabiting with for at least six months and were subsequently invited to provide their romantic partner’s email address so that they could be recruited for participation in romantic partner survey. The final analyzable sample for the present investigation was 360 military couples (or 720 individuals). See Figure 3.1 for the CONSORT diagram for more information. On average, couples were in their late thirties (M=37.5, SD=7.7 for service members; M=36.2, SD=8.0 for romantic partners). service members were mostly male (85.6%) and romantic partners were mostly female (85.8%). The sample was mostly White (80.8% for service members; 82.5% for romantic
partners). The majority of the sample had attended at least some college or technical school (91.4% of service members; 88.6% of romantic partners). Most of the service members were enlisted (79.4%). The majority of the romantic partners were not in the National Guard (93.3%). The average relationship length for couples was 12.0 (SD=7.9). Most couples had children living at their home (74.7%). See Table 3.1 for couple demographics.

**Intervention Description**

The integrated TWH intervention consisted of two primary activities: 1) computer-based training for supervisors focused on FSSB and supervisor support for sleep (i.e., health protection), and 2) personalized feedback and goal-setting based on actigraph-collected sleep reports for both service members and supervisors (i.e., health promotion).

**Supportive Supervisor Training**

The training was an interactive, computer-based training that took approximately an hour to complete. Supervisors were mandated to take the trainings, which focused on how to provide support concerning family and sleep health. For example, supervisors were trained to provide emotional support and to act as a role model by enacting work-life balance and sleep-supportive behaviors. Learning checks were administered to assess understanding and supervisors had to retake the module if they did not pass the learning check. Two hundred fifteen supervisors were identified by the service member participants and out of that total, 156 supervisors were randomized to the treatment group.
and were sent a link to the training. The majority of supervisors completed the training (72.6%). For a more complete description of the training, see Hammer et al., (2021).

**Worker Sleep Tracking**

Philips-Respironics Actiwatch 2 devices that were worn on the wrist like watches for 21-day periods at baseline and at 9-months for service members in both the treatment and control groups. An algorithm was applied to create a personalized sleep report, which included a depiction of sleep and activity data, a mental acuity graph demonstrating the connection between sleep patterns and cognitive functioning, a comparative summary information on sleep metrics (e.g., sleep duration), and a list of resources for reliable information on sleep health (e.g., National Sleep Foundation). Trained staff delivered feedback to accompany the personalized sleep report in sessions that lasted 10-15 minutes and also worked with participants to engage in goal setting; Hammer et al. (2021) provides more information about the worker sleep tracking procedures.

**Measures**

Demographic information included age, gender, race, ethnicity, education, relationship length, parental status, and age of youngest child. The following measures were collected at baseline, 4-months and 9-months from both service members and their romantic partners.

**Life satisfaction.** The 5-item Satisfaction with Life scale (Diener et al., 1985) is considered a global indicator of well-being as it takes into account all the information the participant deems relevant (Diener & Seligman, 2004). Response options ranged from (1) *strongly disagree* to (5) *strongly agree*. The items were averaged to create a composite;
higher scores indicated higher life satisfaction. The scale demonstrated good reliability at each timepoint for service members and romantic partners (α = .88-.91 across survey time points and partners).

**PTSD Symptom Severity.** PTSD symptom severity reflects a critical mental health outcome for military populations (Trautmann et al., 2017) that is estimated to be more prevalent for service members in the National Guard than in other branches (Griffith, 2010). PTSD symptom severity were assessed using the 4-item abbreviated version of the PTSD Stress Checklist for DSM-5 (Price et al., 2016). Response options ranged from (0) *not at all* to (5) *extremely*. The items were summed to create a composite score in which higher values indicated greater PTSD symptoms. The scale demonstrated good reliability for service members and romantic partners (α = .83-.88 across survey time points and partners). We found that 4.2% of workers and 5.8% of romantic partners screened positive for PTSD based on the cutoff score of 10 or greater (Price et al., 2016).

**Loneliness.** Loneliness indicates that critical social needs are not consistently being met (e.g., the need to belong; Cacioppo & Patrick 2008) and thus it was selected as a general marker of social connection (or lack thereof). Loneliness was assessed with the 3-item Brief Loneliness Scale (Hughes et al., 2004), which inquired about being left out, isolation, and a lack of companionship. Response options included: (1) *hardly ever*, (2) *some of the time*, and (3) *often*. Items were averaged to obtain a total score with higher scores indicating more loneliness. The scale demonstrated good reliability for service members and romantic partners (α = .81-.90 across survey time points and partners).
Perceived Partner Responsiveness (PPR). PPR was selected to assess social connection within the romantic relationship. Relationship researchers have argued that PPR is the most fundamental element of what makes relationships close and rewarding, and thus beneficial to health and well-being (Reis, 2012). An adapted form (O’Neill et al., 2020) of the 3-item measure from Laurenceau and colleagues (1998) was used to assess PPR. Response options ranged from (1) not at all to (7) very much. The items were averaged to create a composite, with higher scores indicating higher PPR. The scale demonstrated good reliability for service members and romantic partners ($\alpha = .91-.94$ across survey time points and partners).

Data Analysis

Two-level random effects models were conducted using Mplus version 8 (Muthén & Muthén, 2018). Couples were nested within 20 groups in randomized units that were based on military unit and this nesting was accounted for in the models. We utilized an intent-to-treat approach in which participants in units randomized to receive the treatment were included in the treatment condition in the analysis regardless of whether the intervention components were received (i.e., supervisor completed the training and the worker completed the sleep tracking component). This approach is considered conservative, and it has been argued to be best practice for intervention analyses because it reduces bias and maintains generalizability (McCoy, 2017). Separate models were conducted for each outcome, resulting in 4 final models. The predictor was the condition (treatment condition = 1, control condition = 0). The models controlled for the baseline
values of the dependent variables, an approach consistent with recommendations from Bodner and Bliese (2018). Control variables were grand-mean centered.

Given our interest in effects on couples, we examined within-couple nonindependence (i.e., the degree to which service members and romantic partners are correlated on outcome measures) to determine the appropriateness of conducting dyadic analysis (Kenny et al., 2006). Next, we used a two-stage model building approach in which we sought to assess whether effects on outcomes were different across partners by applying couple constraints (first stage) and time by applying time constraints (second stage), and examining $\chi^2$ difference tests comparing the two sets of nested models (e.g., unconstrained model and couple-constrained model) for each of the outcomes. Proceeding to stage two would occur regardless of the outcome of stage one’s constraint-testing.

**Results**

Table 3.2 presents the means and standard deviations of the study variables for service members and romantic partners in the treatment and control groups at each wave. Average baseline scores indicated that: life satisfaction was high for service members [M=3.6 (SD=0.8)] and romantic partners [M=3.7 (SD=0.8)], loneliness was low for service members [M=1.4 (SD=0.5)] and romantic partners [M=1.6 (SD=0.6)], PPR was high for service members [M=6.0 (SE=1.2)] and romantic partners [M=5.9 (SE=1.2)], and PTSD was low for service members [M=2.2 (SE=2.9)] and romantic partners M=2.8 (SE=3.4)]. See Table 3.3 for correlations.
Two-stage Model Building

In the first stage (i.e., testing couple constraints), we found that models with couple constraints did not fit the data worse than the initial models (i.e., unconstrained) for any of the outcomes. Therefore, each model (for life satisfaction, PTSD, loneliness, PPR) includes couple constraints. Then, the results of stage two (i.e., testing time constraints) indicated that the initial main effects models for life satisfaction and for PTSD did not fit the data better than the couple-constrained and time-constrained main effects models, $\Delta \chi^2 (3) = 2.264, p = 0.51$ for life satisfaction and $\Delta \chi^2 (3) = 1.831, p = 0.61$ for PTSD. Therefore, the final models for life satisfaction and PTSD include both couple constraints and time constraints. To demonstrate the impact this had on the significance of effects, the initial model showed a significant effect of the condition on life satisfaction for romantic partners at 9-months ($b = 0.12, SE = 0.06, p < .05$) whereas the other estimates were not statistically significant but were in the same direction such as romantic partners at 4-months ($b = 0.09, SE = 0.09, p = .30$) and service members at 9-months ($b = 0.14, SE = 0.07, p = .05$). Once couple constraints and time constraints were applied, each of the effects were significant so that the condition increased life satisfaction for each of the partners in the couple and across time ($b = 0.09, SE = 0.04, 95\% CI [0.002, 0.180], p < .05$). Although this model-building approach led to retaining couple- and time-constraints that revealed additional significant effects for life satisfaction, the same process resulted in a loss of an initially significant effect for PTSD. Specifically, the initial models showed a significant negative effect of the condition on PTSD for service members at 4-months ($b = -0.50, SE = 14, p < .001$) whereas the other
effects were nonsignificant but were in the same direction [e.g., romantic partners at 4-months ($b = -0.35, SE = 0.25, p = .16$)]. When couple constraints and time constraints were applied, no significant effect emerged for the condition across partners and time ($b = -0.32, SE = 0.32, p = 0.31$). We utilized this approach to not overinterpret differences between partners or across time when only one partner’s effect or when only one timepoint, respectively, was statistically significant. This approach simplified the complexity of the models and aided in increasing the interpretability of the results. See Tables 3.4-3.7 for the path estimates for the initial models and the final models.

**Hypothesis Testing**

Tables 3.4-3.7 present more information about the path estimates in the final models. Statistically significant main effects of the intervention emerged for life satisfaction at 4- and 9-months for couples ($b = 0.09, SE = 0.05, 95\% CI [0.002, 0.180], p < .05$), such that the intervention predicted higher life satisfaction, thus supporting Hypothesis 1. Although the initial models showed main effects for PTSD, no significant main effects of the intervention emerged for PTSD for couples in the final models ($b = -0.32, SE = 0.32, 95\% CI [-0.941, 0.297], p = \text{ n.s.}$), thus failing to support Hypothesis 2. There was a statistically significant main effect of the intervention on couples’ loneliness at 9-months ($b = -0.12, SE = 0.02, 95\% CI [-0.154, -0.078], p < .001$), such that the intervention predicted lower loneliness, thus supporting Hypothesis 3. There was a statistically significant main effect of the intervention on couples’ PPR at 9-months ($b = 0.19, SE = 0.09, 95\% CI [0.010, 0.359], p < .05$), such that the intervention predicted higher PPR, thus supporting Hypothesis 4.
Discussion

The present study established that this TWH intervention improved the well-being and social connection of service members and their romantic partners. Both partners reported greater satisfaction with their lives at both 4- and 9-months, less loneliness at 9-months, and perceiving one another as more caring, validating and understanding (i.e., PPR) at 9-months following the intervention. However, significant intervention effects did not emerge for the mental health outcome of PTSD symptom severity. This study found that certain benefits could be observed soon after the intervention (i.e., life satisfaction) whereas other benefits took longer to be improved (i.e., loneliness and PPR). Another important finding regarding the reach of this intervention is that it positively impacted the workers’ romantic partners, who were more distal recipients of the intervention.

Contributions

This is the first study to evaluate the effects of a TWH intervention on couples. Our work corroborates Brady and colleagues’ (2021) finding that supervisor support training promotes couples’ family functioning (specifically, dyadic marital quality and parent-child relationships) and extends it by utilizing a different outcome, PPR, which is considered to be the most essential essence of what makes relationships close and rewarding (Reis, 2012). Further, we targeted an additional supervisor support training domain (sleep health) and an individual-level health promotion strategy (worker sleep tracking).
Rather than relying on a single variable to assess well-being, we expanded our evaluation to include central contributors to well-being (such as mental health and social connection) to gain more complete understanding of the specific ways that the intervention impacted well-being. Although prior work has established that supervisor support training can promote mental health (e.g., Kossek et al., 2019), the present study did not find significant intervention effects for PTSD symptom severity which may be due to low levels of PTSD symptom severity in the current sample (i.e., a floor effect). Future intervention studies should assess a wider variety of health and well-being outcomes (including multiple mental health indicators) to gain a more nuanced understanding of the beneficial effects of workplace well-being interventions.

The pattern of findings concerning the time points at which main effects emerged could help inform the design of future studies. The social connectedness outcomes (i.e., loneliness and PPR) were not significantly impacted at 4-months, but rather emerged at 9-months. Thus, future research may be advised to have relatively longer follow-up periods for social outcomes when evaluating similar workplace interventions. In contrast, life satisfaction had significant effects at both 4- and 9-months. It may be that changes within a person fostered by workplace interventions are reflected in changes in global well-being indicators before these psychological changes translate to improvements in social connection with others.

The present study has a number of pragmatic implications. Firstly, this study underscores the benefits of applying a positive psychological approach, which aims to increasing positive experiences of work (e.g., positive social interactions, social support).
Secondly, this intervention has public health implications given the wide array of benefits that positive well-being can garner for the individual (Diener & Seligman, 2004). Future work should assess such potential benefits (e.g., improved health) that this well-being intervention could plausibly promote beyond the specific outcomes evaluated in this study. Given that benefits of the well-being intervention crossed over to romantic partners, workplace well-being interventions may be a unique approach to promote public health.

Military couples face high levels of stressors as illustrated by this quote from a military spouse, “There’s always a reason as to why things don’t go the way they should and in the military things are always changing... We make a lot of sacrifices that other families don’t have to normally.” (Borah & Fina, 2017, p. 149). National Guard couples face unique stressors and have relatively fewer resources from the military with which to cope (e.g., Burrell et al., 2003; Griffith, 2010), which may contribute to the higher rates of mental health problems (like PTSD) for National Guard service members compared to active duty service members (Griffith, 2010). The extreme demands facing the National Guard have only increased since 2020, such as the highest rate of deployments (i.e., frequency and length) since World War II and the challenging nature of domestic deployments (e.g., civil unrest; pandemic relief; Beynon, 2021), which has caused leaders to voice concerns about retention of service members in the National Guard (Winkie, 2021). Therefore, an important pragmatic implications of this work is its significance for meaningfully supporting military couples and National Guard couples, specifically. Additionally, prior work has found that high worker well-being is associated
with lower turnover intentions (Warr & Nielsen, 2018), and thus improving the well-being of service members may translate to improved retention service members.

Limitations

This study focused on partnered workers so the generalizability to single workers may be limited. However, the majority of service members are married so it is likely that these findings generalize to that population. Further, the majority of the service member workers were male (85.6%) and the majority of the romantic partners were female (85.8%), so gender and proximity to the intervention (i.e., directly engaging with intervention activities) are confounded. Future studies should overrecruit female workers and male romantic partners. Further, the racial makeup of our sample was homogeneous with 80.8% of workers and 82.5% of romantic partners identifying as White, so future work should recruit larger samples that are more diverse.

Our sample consists of service members employed at National Guard installations, which is considered a high-risk occupation. Our findings may generalize to couples whose members work in other high-risk occupations like firefighters, police officers, paramedics, and nurses. Although future research would need to test this intervention in lower-risk occupations or with civilian working populations (e.g., grocery store workers), previous research suggests that workplace well-being interventions can foster benefits for such workers (Odle-Dusseau et al., 2016). For example, supervisor support training has been related to lower blood pressure (i.e., a marker of stress) in construction workers (Hammer et al., 2015). This suggests that workplace well-being interventions can have utility for workers across the occupational spectrum.
Conclusion

This investigation demonstrated that a TWH intervention aimed at promoting supervisor supportiveness and service member worker sleep can improve well-being and social connection for both service members and their romantic partners. Specifically, this rigorous evaluation found that the intervention improved life satisfaction, loneliness, and perceived partner responsiveness for both members of military couples in the treatment group relative to the control group. This study demonstrates that workplaces can promote supervisor social support and worker sleep to improve worker well-being that extends to the lives of romantic partners.
### Table 3.1.

**Demographic characteristics for service members and romantic partners**

<table>
<thead>
<tr>
<th>Variable</th>
<th>RP  n=360</th>
<th>SM  n=360</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)/N (%)</td>
<td>M (SD)/N (%)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>36.2 (8.0)</td>
<td>37.5 (7.7)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>309 (85.8%)</td>
<td>51 (14.2%)</td>
</tr>
<tr>
<td>Male</td>
<td>50 (13.9%)</td>
<td>308 (85.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0%)</td>
<td>1 (0.3%)</td>
</tr>
<tr>
<td>Missing</td>
<td>1 (0.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>1 (0.3%)</td>
<td>3 (0.8%)</td>
</tr>
<tr>
<td>Asian</td>
<td>15 (4.2%)</td>
<td>6 (1.7%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>1 (0.3%)</td>
<td>3 (0.8%)</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander or US territory</td>
<td>2 (0.6%)</td>
<td>4 (1.1%)</td>
</tr>
<tr>
<td>Latino or Hispanic</td>
<td>28 (7.8%)</td>
<td>30 (8.3%)</td>
</tr>
<tr>
<td>White</td>
<td>297 (82.5%)</td>
<td>291 (80.8%)</td>
</tr>
<tr>
<td>Multiple/other</td>
<td>12 (3.3%)</td>
<td>17 (4.7%)</td>
</tr>
<tr>
<td>Missing</td>
<td>4 (1.1%)</td>
<td>6 (1.7%)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>8 (2.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>32 (8.9%)</td>
<td>31 (8.6%)</td>
</tr>
<tr>
<td>Some college or technical school, no degree</td>
<td>106 (29.4%)</td>
<td>135 (37.5%)</td>
</tr>
<tr>
<td>College degree/certificate</td>
<td>167 (46.4%)</td>
<td>148 (41.1%)</td>
</tr>
<tr>
<td>Graduate degree or in progress</td>
<td>46 (12.8%)</td>
<td>46 (12.8%)</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours per week at Oregon National Guard (not including drill weekends)</td>
<td>41.5 (7.2)</td>
<td>43.1 (5.2)</td>
</tr>
<tr>
<td>for SMs or at current organization for RPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work tenure in years at the Oregon National Guard for</td>
<td>6.1 (6.6)</td>
<td>12.4 (7.3)</td>
</tr>
<tr>
<td>SMs or at current organization for RPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Branch of service of SMs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>-</td>
<td>181 (50.3%)</td>
</tr>
<tr>
<td>Air</td>
<td>-</td>
<td>179 (49.7%)</td>
</tr>
<tr>
<td><strong>Military status of SMs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enlisted</td>
<td>-</td>
<td>286 (79.4%)</td>
</tr>
<tr>
<td>Officer</td>
<td>-</td>
<td>59 (16.4%)</td>
</tr>
<tr>
<td>N/A</td>
<td>-</td>
<td>14 (3.9%)</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>1 (0.3%)</td>
</tr>
</tbody>
</table>

*Note. The sample size for this table was N=360 couples (N=720 individuals). RP - Romantic partner; SM - Service member.*
Table 3.2.

Descriptive statistics for primary study variables for control group and treatment group at each wave (baseline, 4- and 9-months post-baseline)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group (n=173)</th>
<th>Treatment group (n=184)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td></td>
<td>BL 4M 9M</td>
<td>BL 4M 9M</td>
</tr>
<tr>
<td>RP Life satisfaction</td>
<td>3.6 (0.8) 3.6 (0.8)</td>
<td>3.5 (0.8) 3.8 (0.7)</td>
</tr>
<tr>
<td>RP Loneliness</td>
<td>1.7 (0.6) 1.7 (0.6)</td>
<td>1.7 (0.7) 1.5 (0.5)</td>
</tr>
<tr>
<td>RP PPR</td>
<td>5.7 (1.4) 5.8 (1.3)</td>
<td>5.6 (1.4) 6.1 (1.0)</td>
</tr>
<tr>
<td>RP PTSD symptom severity</td>
<td>3.5 (4.0) 3.4 (3.9)</td>
<td>3.3 (3.5) 2.2 (2.8)</td>
</tr>
<tr>
<td>SM Life satisfaction</td>
<td>3.6 (0.8) 3.6 (0.7)</td>
<td>3.5 (0.8) 3.7 (0.8)</td>
</tr>
<tr>
<td>SM Loneliness</td>
<td>1.5 (0.5) 1.5 (0.6)</td>
<td>1.5 (0.6) 1.4 (0.5)</td>
</tr>
<tr>
<td>SM PPR</td>
<td>5.9 (1.3) 5.9 (1.5)</td>
<td>5.7 (1.4) 6.1 (1.1)</td>
</tr>
<tr>
<td>SM PTSD symptom severity</td>
<td>2.2 (2.9) 2.0 (3.0)</td>
<td>2.0 (2.9) 2.1 (2.9)</td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=360 couples (N=720 individuals). BL – Baseline; 4M – 4-month follow-up; 9M – 9-month follow-up. RP - Romantic partner; SM - Service member. PPR – Perceived partner responsiveness; PTSD – Post-traumatic stress disorder.
### Table 3.3.

**Intragroup and intergroup correlations between primary study variables at each wave (baseline, 4- and 9-months post-baseline)**

<table>
<thead>
<tr>
<th>SM</th>
<th>Outcome</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS - BL</td>
<td>.32**</td>
<td>.69**</td>
<td>.65**</td>
<td>-.50**</td>
<td>-.45**</td>
<td>-.40**</td>
<td>.51**</td>
<td>.47**</td>
<td>.32**</td>
<td>-.40**</td>
<td>-.37**</td>
<td>-.33**</td>
<td></td>
</tr>
<tr>
<td>LS - 4M</td>
<td>.59**</td>
<td>.36**</td>
<td>.70**</td>
<td>-.54**</td>
<td>-.57**</td>
<td>-.47**</td>
<td>.52**</td>
<td>.53**</td>
<td>.43**</td>
<td>-.43**</td>
<td>-.46**</td>
<td>-.40**</td>
<td></td>
</tr>
<tr>
<td>LS - 9M</td>
<td>.62**</td>
<td>.57**</td>
<td>.26**</td>
<td>-.48**</td>
<td>-.50**</td>
<td>-.60**</td>
<td>.44**</td>
<td>.45**</td>
<td>.56**</td>
<td>-.38**</td>
<td>-.35**</td>
<td>-.43**</td>
<td></td>
</tr>
<tr>
<td>LON - BL</td>
<td>-.44**</td>
<td>-.35**</td>
<td>-.47**</td>
<td>.14**</td>
<td>.68**</td>
<td>.63**</td>
<td>-.54**</td>
<td>-.45**</td>
<td>-.37**</td>
<td>.46**</td>
<td>.46**</td>
<td>.38**</td>
<td></td>
</tr>
<tr>
<td>LON - 4M</td>
<td>-.38**</td>
<td>-.40**</td>
<td>-.49**</td>
<td>.71**</td>
<td>.19**</td>
<td>.62**</td>
<td>-.47**</td>
<td>-.54**</td>
<td>-.46**</td>
<td>.44**</td>
<td>.50**</td>
<td>.39**</td>
<td></td>
</tr>
<tr>
<td>LON - 9M</td>
<td>-.37**</td>
<td>-.33**</td>
<td>-.54**</td>
<td>.68**</td>
<td>.71**</td>
<td>.06**</td>
<td>-.47**</td>
<td>-.42**</td>
<td>-.59**</td>
<td>.49**</td>
<td>.42**</td>
<td>.54**</td>
<td></td>
</tr>
<tr>
<td>PPR - BL</td>
<td>.52**</td>
<td>.47**</td>
<td>.45**</td>
<td>-.55**</td>
<td>-.50**</td>
<td>-.46**</td>
<td>.44**</td>
<td>.72**</td>
<td>.60**</td>
<td>-.30**</td>
<td>-.22**</td>
<td>-.26**</td>
<td></td>
</tr>
<tr>
<td>PPR - 4M</td>
<td>.43**</td>
<td>.49**</td>
<td>.44**</td>
<td>-.40**</td>
<td>-.49**</td>
<td>-.41**</td>
<td>.73**</td>
<td>.43**</td>
<td>.65**</td>
<td>-.33**</td>
<td>-.34**</td>
<td>-.33**</td>
<td></td>
</tr>
<tr>
<td>PPR - 9M</td>
<td>.40**</td>
<td>.43**</td>
<td>.50**</td>
<td>-.45**</td>
<td>-.52**</td>
<td>-.54**</td>
<td>.69**</td>
<td>.71**</td>
<td>.37**</td>
<td>-.32**</td>
<td>-.22**</td>
<td>-.34**</td>
<td></td>
</tr>
<tr>
<td>PTSD - BL</td>
<td>-.32**</td>
<td>-.20**</td>
<td>-.38**</td>
<td>.48**</td>
<td>.42**</td>
<td>.47**</td>
<td>-.34**</td>
<td>-.27**</td>
<td>-.32**</td>
<td>.11*</td>
<td>.75**</td>
<td>.67**</td>
<td></td>
</tr>
<tr>
<td>PTSD - 4M</td>
<td>-.28**</td>
<td>-.24**</td>
<td>-.33**</td>
<td>.42**</td>
<td>.36**</td>
<td>.41**</td>
<td>-.35**</td>
<td>-.33**</td>
<td>-.29**</td>
<td>.71**</td>
<td>.08**</td>
<td>.64**</td>
<td></td>
</tr>
<tr>
<td>PTSD - 9M</td>
<td>-.30**</td>
<td>-.28**</td>
<td>-.38**</td>
<td>.46**</td>
<td>.40**</td>
<td>.46**</td>
<td>-.40**</td>
<td>-.28**</td>
<td>-.32**</td>
<td>.73**</td>
<td>.71**</td>
<td>.06**</td>
<td></td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=360 couples (N=720 individuals). BL – Baseline; 4M – 4-month follow-up; 9M – 9-month follow-up. RP - Romantic partner; SM - Service member. LS – Life satisfaction; LON – Loneliness; PPR – Perceived partner responsiveness; PTSD – Post-traumatic stress disorder symptom severity.

* and ** indicate significance at .05 and .01 levels, respectively. Bolded values on the diagonal are intergroup correlations between service members and romantic partners. The values under the diagonal are the intragroup correlations within the service member group and the values above the diagonal are the intragroup correlations within the romantic partner group.
### Table 3.4.

**Main effects of the workplace intervention on Life Satisfaction**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial Models</th>
<th></th>
<th>Final Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.68 (.12)**</td>
<td>3.64 (.31)**</td>
<td>3.56 (.05)**</td>
<td>3.60 (.04)**</td>
</tr>
<tr>
<td>Condition</td>
<td>.03 (.57)</td>
<td>.10 (.109)</td>
<td>.13 (.07)</td>
<td>.12 (.06)*</td>
</tr>
<tr>
<td>BL LS&lt;sub&gt;SM&lt;/sub&gt;</td>
<td>.48 (.13)**</td>
<td>.06 (.52)</td>
<td>.56 (.08)**</td>
<td>.13 (.05)**</td>
</tr>
<tr>
<td>BL LS&lt;sub&gt;RP&lt;/sub&gt;</td>
<td>.11 (.06)</td>
<td>.67 (.25)**</td>
<td>-.03 (.06)</td>
<td>.66 (.05)**</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.32 (.05)**</td>
<td>.32 (.12)**</td>
<td>.35 (.03)**</td>
<td>.35 (.03)**</td>
</tr>
<tr>
<td>Intercept V.</td>
<td>.00 (.19)</td>
<td>.00 (.69)</td>
<td>.00 (.02)</td>
<td>.00 (.03)</td>
</tr>
<tr>
<td>Total R²</td>
<td>.355</td>
<td>.479</td>
<td>.404</td>
<td>.423</td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=341 couples (N=682 individuals). 4M – 4-month follow-up, 9M – 9-month follow-up. SM - Service member; RP - Romantic partner. Est. - estimate; Condition: 1 = treatment, 0 = control. LS is Life Satisfaction and was assessed with the 5-item Satisfaction with Life scale (Diener et al., 1985); BL LS<sub>SM</sub> - Baseline life satisfaction for service members; BL LS<sub>RP</sub> - Baseline life satisfaction for romantic partners; Residual V. - residual variance; Intercept V. - intercept variance; Total R² - Amount of variance explained for each outcome by all of the predictors; BL LS<sub>SM</sub> and BL LS<sub>RP</sub> are grand-mean centered.

* and ** indicate significance at .05 and .01 levels, respectively. Bolded values are significant main effects for the intervention.

Results from the initial (unconstrained) models and the final (couple-constrained and time-constrained) model are on the left and right sides of the table respectively. Initial models consider both SM and RP in the same model but separate models for each time point. We used a two-stage model building approach in which the first stage tested whether intervention effects on the outcomes differed significantly between couple members (i.e., couple constraints) and then the second stage tested whether intervention effects on the outcomes differed significantly across time (4- and 9-months post-baseline; i.e., time constraints). Results indicated that the initial model for life satisfaction did not fit the data better than the couple-constrained and time-constrained main effects model, $\Delta \chi^2 (3) = 2.264, p = 0.51$ for life satisfaction. Applying these constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant (e.g., the effects for both partners at 9-months).
Table 3.5.

**Main effects of the workplace intervention on PTSD**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial Models</th>
<th>Final Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.01 (.12)**</td>
<td>2.73 (.23)**</td>
</tr>
<tr>
<td>Condition</td>
<td><strong>-51 (.15)</strong>**</td>
<td>-.34 (.25)</td>
</tr>
<tr>
<td>BL PTSD&lt;sub&gt;SM&lt;/sub&gt;</td>
<td>.67 (.05)**</td>
<td>.09 (.07)</td>
</tr>
<tr>
<td>BL PTSD&lt;sub&gt;RP&lt;/sub&gt;</td>
<td>-.01 (.04)</td>
<td>.67 (.04)**</td>
</tr>
<tr>
<td>Residual V.</td>
<td>3.74 (.61)**</td>
<td>4.19 (.61)**</td>
</tr>
<tr>
<td>Intercept V.</td>
<td>.02 (.04)</td>
<td>.13 (.14)</td>
</tr>
<tr>
<td>Total R²</td>
<td>.538</td>
<td>.598</td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=323 couples (N=646 individuals). 4M – 4-month follow-up, 9M – 9-month follow-up. SM - Service member; RP - Romantic partner. Est. - estimate; Condition: 1 = treatment, 0 = control. PTSD is post-traumatic stress disorder symptom severity and was assessed with the PTSD Stress Checklist for DSM-5 (Price et al., 2016); BL PTSD<sub>SM</sub> - Baseline PTSD for service members; BL PTSD<sub>RP</sub> - Baseline PTSD for romantic partners; Residual V. - residual variance; Intercept V. - intercept variance; Total R² - Amount of variance explained for each outcome by all of the predictors; BL PTSD<sub>SM</sub> and BL PTSD<sub>RP</sub> are grand-mean centered.

* and ** indicate significance at .05 and .01 levels, respectively. Bolded values are significant main effects for the intervention.

Results from the initial (unconstrained) model and the final (couple-constrained and time-constrained) model are on the left and right sides of the table respectively. Initial models consider both SM and RP in the same model but separate models for each time point. We used a two-stage model building approach in which the first stage tested whether intervention effects on the outcomes differed significantly between couple members (i.e., couple constraints) and then the second stage tested whether intervention effects on the outcomes differed significantly across time (4- and 9-months post-baseline; i.e., time constraints). Results indicated that the initial model for PTSD did not fit the data better than the couple-constrained and time-constrained main effects model, Δ χ² (3) = 1.831, p = 0.61 for PTSD. Applying these constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant (e.g., the effects at 4-months between partners).
### Table 3.6.

**Main effects of the workplace intervention on Loneliness**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial Models</th>
<th>Final Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.48 (.04)**</td>
<td>1.62 (.02)**</td>
</tr>
<tr>
<td>Condition</td>
<td>-.06 (.05)</td>
<td>-.01 (.03)</td>
</tr>
<tr>
<td>BL LON&lt;sub&gt;SM&lt;/sub&gt;</td>
<td>.71 (.05)**</td>
<td>-.01 (.05)</td>
</tr>
<tr>
<td>BL LON&lt;sub&gt;RP&lt;/sub&gt;</td>
<td>.02 (.04)</td>
<td>.71 (.06)**</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.15 (.02)**</td>
<td>.18 (.02)**</td>
</tr>
<tr>
<td>Intercept V.</td>
<td>.00 (.00)</td>
<td>.00 (.00)</td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=332 couples (N=664 individuals). 4M - 4-month follow-up, 9M - 9-month follow-up. SM - Service member; RP - Romantic partner. Est. - estimate; Condition: 1 = treatment, 0 = control. LON is Loneliness and was assessed with the 3-item Brief Loneliness Scale (Hughes et al., 2004); BL LON<sub>SM</sub> - Baseline loneliness for service members; BL LON<sub>RP</sub> - Baseline loneliness for romantic partners; Residual V. - residual variance; Intercept V. - intercept variance; Total R<sup>2</sup> - Amount of variance explained for each outcome by all of the predictors; BL LON<sub>SM</sub> and BL LON<sub>RP</sub> are grand-mean centered.

* and ** indicate significance at .05 and .01 levels, respectively. Bolded values are significant main effects for the intervention.

Results from the initial (unconstrained) models and the final (couple-constrained) model are on the left and right sides of the table respectively. Initial model consider both SM and RP in the same model but separate models for each time point. We used a two-stage model building approach in which the first stage tested whether intervention effects on the outcomes differed significantly between couple members (i.e., couple constraints) and then the second stage tested whether intervention effects on the outcomes differed significantly across time (4- and 9-months post-baseline; i.e., time constraints). Results indicated that the initial models for Loneliness did not fit the data better than the couple-constrained main effects model, Δ χ<sup>2</sup> (2) = 1.146, p = 0.56 for Loneliness. Applying these constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant.
Table 3.7.

Main effects of the workplace intervention on PPR

<table>
<thead>
<tr>
<th>Variable</th>
<th>SM 4m Est. (SE)</th>
<th>RP 4m Est. (SE)</th>
<th>SM 9m Est. (SE)</th>
<th>RP 9m Est. (SE)</th>
<th>SM 4m Est. (SE)</th>
<th>RP 4m Est. (SE)</th>
<th>SM 9m Est. (SE)</th>
<th>RP 9m Est. (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.10 (.04)**</td>
<td>5.98 (.02)**</td>
<td>5.81 (.08)**</td>
<td>5.74 (.07)**</td>
<td>6.09 (.04)**</td>
<td>5.95 (.06)**</td>
<td>5.84 (.05)**</td>
<td>5.73 (.03)**</td>
</tr>
<tr>
<td>Condition</td>
<td>-.04 (.06)</td>
<td>-.10 (.09)</td>
<td>.24 (.12)*</td>
<td>.11 (.12)</td>
<td>-.06 (.05)</td>
<td>-.06 (.05)</td>
<td>.19 (.09)*</td>
<td>.19 (.09)*</td>
</tr>
<tr>
<td>PPR&lt;sub&gt;SM&lt;/sub&gt;</td>
<td>.74 (.05)**</td>
<td>.09 (.05)</td>
<td>.68 (.08)**</td>
<td>.10 (.09)</td>
<td>.75 (.06)**</td>
<td>.09 (.05)</td>
<td>.69 (.08)**</td>
<td>.10 (.08)</td>
</tr>
<tr>
<td>PPR&lt;sub&gt;Rp&lt;/sub&gt;</td>
<td>.08 (.05)</td>
<td>.72 (.05)**</td>
<td>.08 (.06)</td>
<td>.65 (.06)**</td>
<td>.09 (.05)</td>
<td>.72 (.06)**</td>
<td>.07 (.06)</td>
<td>.63 (.06)**</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.66 (.09)**</td>
<td>.66 (.07)**</td>
<td>.78 (.09)**</td>
<td>1.09 (.14)**</td>
<td>.66 (.09)**</td>
<td>.66 (.07)**</td>
<td>.78 (.08)**</td>
<td>1.10 (.14)**</td>
</tr>
<tr>
<td>Intercept V.</td>
<td>.00 (.02)</td>
<td>.01 (.02)</td>
<td>.00 (.05)</td>
<td>.00 (.04)</td>
<td>.01 (.02)</td>
<td>.01 (.02)</td>
<td>.00 (.05)</td>
<td>.01 (.03)</td>
</tr>
<tr>
<td>Total R²</td>
<td>.592</td>
<td>.547</td>
<td>.487</td>
<td>.374</td>
<td>.592</td>
<td>.547</td>
<td>.487</td>
<td>.374</td>
</tr>
</tbody>
</table>

Note. The sample size for this table was N=314 couples (N=628 individuals). Condition: 1 = treatment, 0 = control. 4M – 4-month follow-up, 9M – 9-month follow-up; SM - Service member; RP - Romantic partner; Est. - estimate PPR was assessed with the 3-item perceived partner responsiveness measure from Laurenceau and colleagues (1998) and adapted by O’Neill et al. (2020); BL PPR<sub>SM</sub> - Baseline perceived partner responsiveness for service members; BL PPR<sub>Rp</sub> - Baseline perceived partner responsiveness for romantic partners; Residual V. - residual variance; Intercept V. - intercept variance; Total R² - Amount of variance explained for each outcome by all of the predictors; BL PPR<sub>SM</sub> and BL PPR<sub>Rp</sub> are grand-mean centered. * and ** indicate significance at .05 and .01 levels, respectively. Bolded values are significant main effects for the intervention.

Results from the initial (unconstrained) models and the final (couple-constrained) model are on the left and right sides of the table respectively. Initial model consider both SM and RP in the same model but separate models for each time point. We used a two-stage model building approach in which the first stage tested whether intervention effects on the outcomes differed significantly between couple members (i.e., couple constraints) and then the second stage tested whether intervention effects on the outcomes differed significantly across time (4- and 9-months post-baseline; i.e., time constraints). Results indicated that the initial models for PPR did not fit the data better than the couple-constrained main effects model, Δχ² (2) = 0.236, p = 0.88 for PPR. Applying these constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant (e.g., the 9-months effects between partners).
Figure 3.1.

CONSORT Diagram For Oregon MESH Study: Matched couple survey sample

*Denominator is entire sample at baseline

*Denominator is condition at baseline

*9 month surveys sent regardless of 4 mos. participation status
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Chapter 4: Does perceived supervisor supportiveness provide additional health benefits after considering perceived partner supportiveness? An examination of partnered service members’ support perceptions on sleep dissatisfaction, PTSD symptom severity, and psychological distress.

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Author Note
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Author Contribution Statement

AnnaMarie O’Neill performed the data analysis in consultation with Cynthia Mohr, Tori Crain, and Todd Bodner. AnnaMarie O’Neill drafted the original manuscript and revised the manuscript. Cynthia Mohr, Todd Bodner, and Leslie Hammer reviewed and edited the manuscript. Cynthia Mohr, Todd Bodner, Tori Crain, and Leslie Hammer acquired funding for the larger grant project, designed the research project, and directed data collection. AnnaMarie O’Neill assisted with data collection. Cynthia Mohr, Todd Bodner, and Leslie Hammer supervised this study.
Abstract

**Introduction:** Service members experience high rates of mental health problems like post-traumatic stress disorder (PTSD) as well as sleep disturbances, which each threaten quality of life and functioning at work and home. Social support has been identified as a critical resource that can be optimized for the prevention and the amelioration of these issues. It is crucial to identify which social relationships would be the most beneficial targets social support-based interventions aimed at safeguarding mental health and sleep in high-risk populations like service members. While the romantic partner is among the most profoundly influential sources of support on health and well-being outcomes, recent work has highlighted the pivotal role that supervisor support can play in promoting and protecting the mental health and physical health of their workers. The primary purpose of the present study is to assess the unique contributions of supervisor supportiveness on PTSD symptom severity and sleep dissatisfaction beyond that of romantic partner support. **Method:** Service members (N = 504) completed surveys at baseline and 4- and 9-months post-intervention. Cross-lagged panel models were used to assess the influence of general supervisor supportiveness (GSS) on subsequent PTSD symptom severity and sleep dissatisfaction after controlling for the influence of perceived partner responsiveness (PPR), the bidirectional associations of social support and health variables, military branch, and the workplace intervention condition from the larger study. **Results:** Baseline PPR was associated with PTSD symptom severity at both follow-ups but not with sleep dissatisfaction. Baseline GSS was not associated with sleep dissatisfaction and although the initial model revealed a
significant negative association with PTSD symptom severity at 4-months, this association was not retained in the final model in which equality constraints over time were applied. Supplemental analyses revealed significant negative associations between GSS and psychological distress, which is a broad mental health indicator. This suggests that supportive supervisors are a significant resource for the psychological health of their workers and that they foster unique benefits beyond that of supportive romantic partners.

**Conclusion:** The implications of this study include providing insights for social support interventions aimed at protecting and promoting psychological health in service members and other high-risk workers.
PTSD and Sleep Problems

Post-traumatic stress disorder (PTSD) and sleep disturbances are more prevalent in the military population than in the civilian population (Gates et al., 2012; Good et al., 2020; Trautmann et al., 2017; Troxel et al., 2015). These problems can undermine job performance as well as threaten quality of life by contributing to diminished health and strained social relationships (Gordon & Chen, 2014; Medic et al., 2017; Vogt et al., 2017). Given its symptoms like irritability and emotional numbing, it is unsurprising that PTSD can strain social relationships [particularly with romantic partners (Taft et al., 2011)] as well as hinder functioning at work (Adler et al., 2011). Similarly, sleep disturbances impair work functioning, social functioning with others (e.g., lower friendliness and sociability; Haack & Mullington, 2005), and relationship functioning with one’s romantic partner (e.g., Gordon & Chen, 2014). Further PTSD and sleep are mutually reinforcing and can create a vicious cycle in which poor sleep exacerbates PTSD symptoms (Babson et al., 2010; El-Solh et al., 2018) and PTSD erodes sleep (e.g., through symptoms like nightmares and hypervigilance) to such an extent that sleep disturbances have been dubbed the “hallmark of PTSD” (Ross et al., 1989).

Social Support

Fortunately, social support is powerful resource for prevention and amelioration of these interconnected health problems. Social support impacts health in multiple ways, both promoting it through facilitating positivity (e.g., positive moods, physiological changes) and reducing negativity (e.g., reducing psychological, physiological reactivity...
to stressors through assisting with coping) (Bavik et al., 2020). Meta-analytic evidence has found that lacking social support is a robust risk factor for developing PTSD in the general population (Brewin et al., 2000; Ozer et al., 2003) as well as for experiencing more severe PTSD symptoms in military populations (Blais et al., 2021). In the general public, a meta-analysis found that higher levels of social support is associated with improved sleep outcomes such as fewer sleep disturbances (Kent de Grey et al., 2018). A systematic review found that having supportive social relationships is associated with improved sleep outcomes whereas unsupportive, destructive interpersonal experiences (e.g., conflict, social rejection) and loneliness (i.e., an indicator of unfulfilled critical social needs) were associated with sleep disturbances and low quality sleep across a variety of populations (e.g., age groups, occupations) (Gordon et al., 2021).

Although social support can reduce PTSD symptoms and sleep disturbances, these health problems can actually erode social relationships thereby hindering the affected person from accessing or perceiving benefits from social support. In the trauma literature, Shallcross and colleagues (2016) found a bidirectional association between social support and PTSD symptoms such that lacking social support predicts PTSD (termed social causation, in the trauma literature) and PTSD erodes social support (termed social erosion). This body of work suggests that social support is a beneficial resource against PTSD but that PTSD can interfere with social support processes. Similarly, bidirectional relationships have been observed between sleep and social processes such as a night of poor sleep contributing to increased next day conflict while
conflict undermines restful sleep (Gordon et al., 2017). Taken together, social support, PTSD and sleep are complexly linked, mutually influential phenomena.

**Source of Support**

Although anyone can be a source of social support, not all sources of support are effective at impacting health (e.g., Li et al., 2014; Russell et al., 2016; Van Woerden et al., 2011). Even the same enacted behaviors (i.e., received support) or the same level of perceived support (i.e., the availability of support from a person) can having varying levels of effectiveness on health outcomes depending on the source of support. The Convoy Model of Social Relations (Khan & Antonucci, 1980) can be used to examine social relationships and how they differentially impact our health and well-being.

According to the Convoy Model, we are supported by various individuals throughout our lives and the effectiveness of social support from any particular source (or person in our convoy) is in large part determined by the closeness (i.e., emotional intimacy) in the relationship (Khan & Antonucci, 1980). Other dimensions of social relationships influence closeness such as structure (e.g., frequency of interactions; geographical proximity), function (e.g., what the individual relies on this source of support for) and quality (e.g., how positively the individual appraises their relationship with this source of support). One’s convoy can include relationships that are close (e.g., supervisors, neighbors), closer (e.g., friends, coworkers), and closest (e.g., romantic partners and best friends). Personal (e.g., age, gender, race) and situational (e.g., role expectations, norms) factors shape one’s convoy which, in turn, shape the person’s health and well-being. For example, women often have social networks consisting of more positive, intimate
relationships than men but they also are likely to retain unsupportive and low-quality relationships despite perceiving them negatively (Birditt & Antonucci, 2007).

**The romantic partner.** In general, the closer the relationship, the more effective the social support they provide. For most adults (including service members), their primary source of support is their romantic partner (Barger & Cribbet, 2016; Norwood et al., 1996). From an attachment theoretical perspective, which the Convoy Model is rooted in, romantic partners are likely the primary source of support because they have a special role as the attachment figure. As the attachment figure, they are the first person their loved one turns to for comfort when distressed and as well as for encouragement when they are pursuing goals (Feeney & Collins, 2015). Therefore, it is unsurprising that romantic partners are profoundly influential on shaping health outcomes. Having a high-quality marriage (i.e., which is characterized by high levels of supportiveness with few negative interactions) is a stronger predictor of mental and physical health than health behaviors like exercise (Robles et al., 2014). Theorists have increasingly begun to recognize that health is a dyadic phenomenon, meaning that it shaped by both factors originating from the individual (e.g., personality traits like optimism, engaging in healthy behaviors) and from their close relationships (e.g., role modeling of health behaviors, feeling supported which improves coping with negativity as well as savoring the positivity) (Reed et al., 2013). Military researchers have recommended that the dyadic nature of health be incorporated in research and in treatment by addressing the role that both partners of the military couple (i.e., a couple with at least one current or former service member) play in contributing to health outcomes (Lewis et al., 2013; MacDermid
Wadsworth et al., 2013). Therefore, I argue that service member health is best understood in the dyadic system in which romantic partners influence service member PTSD and sleep. Previous work has revealed the critical role that supportive romantic partners have on these health outcomes. Romantic partners who are supportive can significantly ameliorate PTSD symptoms (Bowen et al., 2010; Carter et al., 2011; Hoyt & Renshaw, 2014; Olson et al., 2018) and foster better sleep outcomes (Arpin et al., 2018; O’Neill et al., 2020). Responsive (i.e., accepting, caring, understanding) partners help us to feel safe and calm (Selcuk et al., 2010), which are essential emotional states for reducing mental health issues (like PTSD symptoms) and promoting high quality sleep.

The supervisor. Another important source of support is the service member’s supervisor. Supervisors are positioned to be influential in the health of their employees (Hämmig, 2017), which is due in part to their mitigation of work stress (Hämmig, 2017; Kossek et al., 2011) and fostering well-being and feelings of connectedness (Mohr et al., 2021; O’Neill et al., under review). Because supervisors are tasked with delegating work, providing feedback about performance, and providing instrumental support (e.g., rescheduling, reassignments of work as needed), they are a frequent social contact of their employees and one that is regularly relied upon for functioning effectively at work as well as managing work-life conflicts (Kaiser et al., 2008). The Convoy Model would suggest that these structural and functional dimensions of the employee’s relationship with their supervisor enhance the closeness of the relationship as well as the supervisor’s ability to provide effective support and ultimately, to influence health outcomes.

Empirical evidence has accumulated to demonstrate the health benefits of supervisor
support. For example, a large study of Swiss employees found that although multiple sources of support (spouses, relatives, friends, coworkers, supervisors) are important for health and well-being, lacking supervisor support was the strongest or the only statistically significant predictor of various health outcomes (e.g., self-rated health, stress, and burnout symptoms) after adjusting for all single sources of social support (Hämmig, 2017). Experimental evidence shows that supervisor support contributes to worker well-being as supervisor supportiveness trainings were found to reduce worker stress (Hammer et al., 2020), improve worker daily emotional well-being (i.e., increased calmness; Mohr et al., 2021), and reduce worker psychological distress (i.e., a global mental health indicator; Kossek et al., 2019). Further, supervisor supportiveness is a robust predictor of the particular health outcomes of interest. Employees with supportive supervisors report lower PTSD symptoms in a variety of high-risk occupations (i.e., in which workers are exposed to dangerous, life-threatening or otherwise stressful situations) like in firefighters (Stanley et al., 2019), medical military personal (Adler et al., 2017), police officers (Stephens & Long, 2007), and soldiers (Adler et al., 2014). Likewise, lacking social support from the supervisor is a risk factor for mental health problems (Rugulies et al., 2006; Sinokki et al., 2009). In addition to the wealth of evidence demonstrating the beneficial influence of supportive supervisors on mental health and well-being outcomes, a recent systematic review highlighted the positive association between supervisor support on employee sleep outcomes specifically (Gordon et al., 2021). Experimental evidence has demonstrated that trainings for supportive supervisor behavior contributed to improved sleep in their workers, relative to the control
group (Crain et al., 2019; Olsen et al., 2015). Taken together, the supervisor can be an effective source of support, which has major implications for psychological and physical health outcomes alike.

**Present Study**

The primary aim of this study is to determine if supportiveness perceived from supervisors would have an additional benefit on improving mental health and physical health outcomes above and beyond supportiveness perceived from romantic partners. Most research about the influence of supervisor support on these health outcomes does not account for the dyadic nature of health, in which romantic partners strongly influence these outcomes. Few studies have examined if supervisor support is beneficial for other health outcomes (e.g., stress) after accounting for other sources of support (Hämmig, 2017; Jenkins and Elliott, 2004; Van Daalen et al., 2005; Van Woerden et al., 2011). Fewer studies still have examined this question for the health outcomes of interest (e.g., PTSD symptom severity, psychological distress, sleep outcomes). Such studies have pointed to the supervisor as the most important source of support for alleviating PTSD symptom severity (Stanley et al., 2019) after controlling for other sources of support (family, friends and coworkers). However, that study’s social support measure precluded the ability to examine the unique contributions of these two important relationships because support from romantic partners was aggregated into the larger family/friends category (Stanley et al., 2019), which may have diluted the potency of romantic partner support.

Answering this question would fill theoretical gaps and help inform social support interventions. Theoretically, this study may help clarify apparent paradoxes in the
literature, such as empirical studies suggesting that supervisor support is more beneficial than romantic partner support for health (Hämmig, 2017) although theory and empirical findings would suggest the reverse, that romantic partner support is more beneficial for health (Khan & Antonucci, 1980; Robles et al., 2014) but that supervisors can also contribute unique beneficial effects. Additionally, this work will provide a more complete portrait of likely the most important sources of support for service members. Therefore, this study will also provide insights into targets of social support interventions for these health outcomes (i.e., if supervisors should be targeted in addition to romantic partners).

This is important because more precise targeting of social support interventions will maximize the benefits of often-limited social intervention funding. Safeguarding the psychological and physical health of service members will not only be beneficial for the individual and their romantic partner (given the dyadic nature of health; Reed et al., 2013), but will also bolster the operational readiness of the military force.

Hypotheses

Based on prior work, I expected that perceived support from the romantic partner will garner beneficial effects on PTSD symptom severity and sleep dissatisfaction (e.g., Blais et al., 2021; O’Neill et al., 2020) and that a bidirectional influence of PTSD and sleep outcomes will be observed (Shallcross et al., 2016). The following hypotheses pertained to the primary aim of this study. Perceived support from supervisors is hypothesized to foster additional benefits beyond that of perceived support from romantic partners on PTSD symptom severity (Hypothesis 1) and sleep dissatisfaction (Hypothesis 2) for service members. Additionally, supplemental analyses will explore the potential
additional benefit of perceived support from supervisors beyond that of perceived support from romantic partners on psychological distress (i.e., a more general indicator of mental health; Kessler et al., 2002).

Methods

Study Overview

Data for this study were collected as part of a study conducted from 2017 through 2020 in one state of the Pacific Northwest of the U.S. evaluating the effectiveness of the Military Employee Sleep Health (MESH; ClinicalTrials.gov Identifier W81XWH-16-1-0720), a cluster-randomized controlled trial evaluating the effectiveness of workplace intervention on well-being, psychological and physical health, and relationship outcomes of full-time service members of the Air and Army National Guard and their romantic partners. The workplace intervention consisted of supportive supervisor trainings and worker sleep tracking for service member employees (i.e., personalized sleep feedback and goal setting among individual workers) (Adler et al., 2017). Randomization was conducted at the unit level rather than the individual level, such that 20 randomization units were formed, in which service members from geographically and functionally similar National Guard units were pooled together, by branch, from 60 existing units (Hammer et al., 2021). Service members and their romantic partners were surveyed three times over the course of the study. Pre-intervention data from the baseline survey and post-intervention data from 4-month and 9-month follow ups were utilized for the present investigation. Participants received a gift card for $25 for completing each of the three surveys. The study protocols were approved by the Institutional Review Board of Oregon
Health & Science University (OHSU). For a more complete description of the study, see Hammer and colleagues (2021).

**Intervention Description**

MESH consisted of a computer-based supervisor trainings for support regarding multiple domains (family and sleep) and worker sleep tracking for service members. The supervisor training was based on previous empirically-tested supportive supervisor training for family supportive supervisor behaviors (Hammer et al., 2011) and sleep leadership (Adler et al., 2021). The personalized sleep feedback was generated from actigraph assessments over a period of 3 weeks and the report in addition to specific areas for improvement as well as a sleep goal setting activity were delivered by trained research staff. The intervention components were administered to the waitlist control group once the 9-month follow-up survey data collection was complete. Subsequent to the baseline assessment, supervisors in the treatment group received interactive, computer-based training.

**Participants**

With the Adjutant General’s support and following a briefing of top National Guard leadership, service members were recruited to participate via emails from their unit’s leadership, which described the study and provided a link to a brief screening and study sign-up survey (Hammer et al., 2021). The intervention participants who responded to the baseline survey ($n = 704$), who were full-time service member workers (at least 32 hours a week) of the National Guard holding a wide variety of roles from maintenance to finance, were randomly assigned to the treatment group ($n = 358$) or control group ($n = 346$).
346). See Figure 4.1 for the CONSORT diagram. Out of the participants who responded to the baseline survey \((n = 704)\), 540 participants indicated that they were married to or cohabiting with for at least six months. Therefore, the final sample of partnered service members was 540 participants (which consisted of 269 from in the control group and 271 from the treatment group). On average, participants were in their late thirties (M=36.9, SD=9.0). Participants were mostly male (78.0%) and mostly White (80.9%). The majority of the sample had attended at least some college or technical school (89.4% of workers). The majority of the participants were married (85%) and the remaining were cohabitating (15%). The average relationship length for couples was 10.7 years (SD=8.4). Most couples had children living at their home at least three days per week (67.5%). On average, participants had been in the Oregon National Guard for 11.2 years (SD=7.2) and work 42.0 hours a week (SD=4.8), not including drill weekends. Most participants worked regular daytime shifts (83.1%) whereas the others worked other schedules like rotating shift (8.3%) and regular night shift (3.0%). On average, participants worked with their supervisor for 3.5 years (SD=4.3). See Table 4.1 for more descriptive statistics.

In terms of military experience, 60.2% of the sample had experienced military deployments to a variety of locations (e.g., to combat zones, domestic and international locations). The average duration of their last deployment was 7.3 months (SD=4.7) and it had been an average of 6.0 years (SD=4.2 years) since their last deployment. Participants who deployed reported an average of 3.9 combat exposure events (SD=5.3; range 0-22) such as being attacked, having an improvised explosive device explode nearby, or seeing someone be injured or killed.
A minority of the sample had sleep problems that were diagnosed and treated. Regarding sleep apnea, 11.5% said they were diagnosed with it and 7.6% said that they received treatment for it. Three percent reported a diagnosis for insomnia and 1.9% reported receiving treatment. Approximately five percent reported a diagnosis for restless leg syndrome and 1.1% reported receiving treatment. Finally, 1.9% reported some other diagnosed sleep disorder and 1.3% reported receiving treatment for that disorder. The majority of participants reported never using sleeping pills or other medications to help them sleep (70.5%) and the next largest percentage reported rarely using them (e.g., once a month; 11.2%).

**Measures**

The following measures were collected from the participants at baseline (BL) and 4-months (4m) and 9-months (9m) post-intervention.

**General supervisor supportiveness.** Perceived supervisor support was assessed with Yoon and Lim’s (1999) 3-item General Supervisor Support scale. The instructions stated “The following section contains questions about your experiences with your Tech/AGR supervisor for your full-time job at the Oregon National Guard. Please read each statement carefully and rate the extent to which you agree with each statement based on the scale below. If you find a statement to be not at all applicable to you, select N/A”. The participants rated the following items on a scale from (1) strongly disagree to (5) strongly agree. “My supervisor can be relied upon when things get tough on my job,” “My supervisor is willing to listen to my job-related problems,” and “My supervisor really does not care about my well-being”. The final item was reverse-coded so that all
scores for items indicated greater supervisor supportiveness. The items were averaged to create a composite. The scale demonstrated adequate reliability at each timepoint ($\alpha = .74-.79$ across survey timepoints).

**Perceived partner responsiveness.** An adapted form (O’Neill et al., 2020) of the 3-item measure from Laurenceau and colleagues (1998) was used to assess perceived support from romantic partners. The items were, “To what degree do you feel accepted by your spouse/partner?,” “To what degree do you feel understood by your spouse/partner?,” and “To what degree do you feel cared for by your spouse/partner?”. Response options ranged from (1) *not at all* to (7) *very much*. The items were averaged to create a composite, with higher scores indicating higher PPR. The scale demonstrated good reliability at each timepoint ($\alpha = .93-.94$ across survey timepoints).

**Post-traumatic stress symptom (PTSD) severity.** PTSD symptom severity was assessed using the 4-item abbreviated version of the PTSD Stress Checklist for DSM-5 (Price et al., 2016). The scale instructions were “Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then indicate how much you have been bothered by that problem IN THE PAST MONTH. How much were you bothered by...” The items included the following: “Repeated disturbing memories, thoughts, or images of the stressful experience,” “Having physical reactions… when something reminded you of the stressful,” “Avoiding activities or situations because they reminded you of the stressful experience,” and “Having difficulty concentrating”. Response options ranged from (0) *not at all* to (5) *extremely*. The items were summed to create a composite score in which higher values
indicated greater PTSD symptoms. The scale demonstrated good reliability at each
timepoint for workers (α = .82-.89 across survey timepoints). The summed score was
used for hypothesis testing. Twenty-one participants (2.9% of the sample) screened
positive for PTSD based on the cutoff score of 10 or greater (Price et al., 2016). Although
few participants screened positive for a probable PTSD diagnosis, even subclinical PTSD
can cause significant distress and impairment rivaling that of clinical levels of PTSD
(e.g., Marshall et al., 2001; Stein et al., 1997).

**Psychological distress.** Psychological distress was assessed with the 6-item scale
from the K-6 Mental Health Screening Questionnaire (Kessler et al., 2002). Participants
were asked to reflect on how often they felt the following during the past month: “so
depressed that nothing could cheer you up,” “hopeless,” “restless or fidgety,” “that
everything was an effort,” “worthless,” and “nervous”. Responses ranged from (1) all of
the time to (5) none of the time. Items were reverse-scored and averaged so that higher
scores reflected higher psychological distress. The scale demonstrated good reliability at
each timepoint for workers (α = .87-.91 across survey timepoints). This measure is a
global indicator of psychological problems and mental health is used to briefly screen for
mental health problems in clinical and research settings (Kessler et al., 2002).

**Sleep dissatisfaction.** The 8-item PROMIS: Sleep Disturbance scale from Yu et
al., (2012) was administered. Analyses revealed a two-factor structure of this scale such
that items loaded onto the insomnia factor or the sleep dissatisfaction factor, the latter of
which was used in this study. Participants were asked about their sleep for the past 7
days. Example items included “My sleep was restless” and “I had trouble staying asleep”
and responses ranged from (1) not at all to (5) very much. The factor estimates were t-transformed using the health measures scoring website, www.healthmeasures.net.

**Analysis**

Cross-lagged panel analysis was utilized to investigate the unique influence of supervisor support on health outcomes. Analyses were conducted with Mplus Version 8 (Muthén & Muthén, 2018) using maximum likelihood estimation. The workplace intervention and military branch (0 - Army or 1 - Air) were controlled for. Other potential covariates (e.g., parental status) were not included due to the complexity of the model. Additionally, participants were nested within their work unit (i.e., multilevel modeling). Finally, I used a model-building approach (detailed below) in which I sought to assess the appropriateness of equality constraints in order to simplify the model.

Cross-lagged analysis is an exploratory approach used to bolster evidence for causal hypotheses (Kenny & Harackiewicz, 1979). The main focus of cross-lagged analysis is to assess directionality by assessing cross-lagged paths between different variables at different waves (e.g., the influence of perceived supervisor support at BL on sleep dissatisfaction at 4m). Cross-lagged panel models are considered statistically conservative because they control for prior levels of the dependent variable and correlations within waves. An advantage of this analysis is establishing relative magnitude in associations and temporal precedence when experimental data is not available (Newsom, 2015). Because each of the primary study variables (PTSD, sleep and social support) are mutually influential, this model was deemed appropriate for
hypothesis-testing about the additional benefit of supervisor support on these health outcomes.

Results

Descriptive Statistics for Study Variables

Table 4.2 presents the descriptive information about the primary study variables at each wave. Average baseline scores indicated that: GSS is high ($M = 4.30; SD = 0.82$); PPR was high ($M = 6.00; SD = 1.29$), PTSD symptom severity was low ($M = 2.04; SD = 2.86$), psychological distress was low ($M = 1.61; SD = 0.64$), and sleep dissatisfaction was low ($M = 53.71; SD = 7.48$). See Table 4.3 for correlations among primary study variables.

Model Building

To simplify the interpretation of the model, equality constraints (i.e., setting parallel effects to be equivalent) were tested on effects across time (e.g., BL PPR-4m PTSD and BL PPR-9m PTSD) given that at least one of the effects were significant and that the effects did not have opposite signs (e.g., both were positive). Hereafter, these equality constraints are referred to as “time constraints”. Time constraints did not fit the data worse than the initial, unconstrained models for the effect of BL PPR on PTSD at both subsequent waves, $\Delta \chi^2 (1) = 2.364, p = .121$, and for the effect of BL GSS on PTSD at both subsequent waves, $\Delta \chi^2 (1) = 2.404, p = .121$. Therefore, the final model includes both time constraints. To demonstrate the impact this had on the significance of effects, the initial model showed a significant effect of BL PPR on PTSD at 9m ($b = - .354$, SE = .177, $p < .05$), while the final model that had time constraints showed significant effects
for BL PPR on 4m PTSD and on 9m PTSD \((b = -0.263, SE = 0.091, p < .01)\). While this model-building approach lead to this additional significant effect of PPR on PTSD, the same process resulted in a loss of an initially significant effect for GSS on PTSD.

Specifically, the initial model showed a significant effect of BL GSS on PTSD at 4m \((b = -0.400, SE = .182, p < .05)\), but when the time-constraint was applied, the effect was lost \((b = -0.246, SE = .145, p = .091)\). The final model showed acceptable fit based on several indices \(\chi^2 (2) = 1.974, p = 0.372; SRMR = .006\). Tables 4.4 and 4.5 present the estimates from the initial and final models, respectively.

**Hypothesis Testing**

Significant effects of BL PPR emerged for PTSD symptom severity at 4m and 9m \((b = -0.263, SE = 0.091, 95\% CI [-0.440, -0.085], p < .01)\), such that perceiving one’s partner as supportive was associated with lower subsequent PTSD symptom severity.

Contrary to expectations, BL PPR was not a significant predictor of sleep dissatisfaction at 4m \((b = -0.407, SE = 0.225, 95\% CI [-0.848, 0.034], p = 0.070)\) or at 9m \((b = -0.284, SE = 0.457, 95\% CI [-1.180, 0.611], p = 0.534)\). BL GSS did not reach conventional levels of significance as a significant predictor of PTSD symptom severity at 4m and 9m \((b = -0.246, SE = 0.145, 95\% CI [-0.531, 0.039], p = 0.091)\), thus failing to support for Hypothesis 1 regarding the influence of perceived supervisor support on subsequent PTSD symptom severity. BL GSS did not emerge as a significant predictor of sleep dissatisfaction at 4m \((b = -0.574, SE = 0.478, 95\% CI [-1.510, 0.363], p = 0.230)\) or at 9m \((b = -0.246, SE = 0.145, 95\% CI [-0.980, 0.368], p = 0.091)\), thus failing to support for Hypothesis 2. In summary, perceived support from the romantic partner was found to be
beneficial for one health outcome (PTSD symptom severity), whereas perceived support from the supervisor did not emerge as a significant predictor of either health outcome. See Table 4.5 and Figure 4.2 for more complete presentations of the findings about the associations between GSS, PPR, PTSD symptom severity and sleep dissatisfaction.

**Supplemental Analyses**

The supplemental analysis substituted a global indicator of mental health, psychological distress, for PTSD symptom severity in the original cross-lagged panel model. Time constraints were tested in this model with the same model-building approach outlined above. Time constraints did not fit the data worse than the initial (i.e., unconstrained) models for the effect of BL PPR on psychological distress at both subsequent waves, \( \Delta \chi^2 (1) = 2.746, p = .098 \), and for the effect of BL GSS on psychological distress at both subsequent waves, \( \Delta \chi^2 (1) = 1.617, p = .204 \). Therefore, the final model includes both time constraints. Tables 4.6 and 4.7 present the estimates from the initial and final models, respectively.

Statistically significant effects of BL PPR emerged for psychological distress at 4m and 9m \((b = -0.075, SE = 0.024, 95\% CI [-0.122, -0.029], p < .001)\), such that perceiving one’s partner as supportive was associated with lower subsequent psychological distress. BL GSS was negatively associated with psychological distress at 4m and 9m \((b = -0.069, SE = .031, 95\% CI [-0.130, -0.008], p < .05)\), such that perceiving one’s supervisor as supportive was associated with lower subsequent psychological distress. Therefore, supervisor support was associated with additional psychological health benefits above and beyond the beneficial effects of romantic partner
supportiveness. See Table 4.7 and Figure 4.3 for more complete presentations of the findings about the associations between GSS, PPR, psychological distress and sleep dissatisfaction.

**Discussion**

The purpose of this study was to gain a better understanding of the potential additional health benefits of supervisor support for service member workers beyond that of the likely more potent benefits of romantic partner support. The results of the present study failed to support the hypotheses that supervisor support provides additional benefits for service member PTSD symptom severity and sleep dissatisfaction. However, supplemental analyses revealed that supervisor support reduced service member psychological distress [which is a general indicator of probable mental health issues (Kessler et al., 2002)] beyond that of the reductions fostered by romantic partner support. This suggests that supervisor support is a powerful resource for amelioration of common mental health symptoms for their employees in this high-risk workplace. The results from the supplemental analyses are consistent with previous observational research demonstrating that supervisors are an effective source of support for well-being (e.g., lower stress; Hämmig, 2017) and experimental work demonstrating that supervisors who are trained to be supportive can reduce psychological distress in healthcare workers who are also ‘sandwiched’ between childcare and eldercare responsibilities (Kossek et al., 2019). The lack of hypothesized results concerning PTSD symptom severity and sleep dissatisfaction is inconsistent with previous work demonstrating such health benefits of supervisor support (e.g., Crain et al., 2019; Gordon et al., 2021; Stanley et al., 2019).
Rather than contradicting that research by suggesting that supervisor support does not influence these outcomes, a more compelling explanation of the lack of observed effects is that of floor effects due to the low levels of these problems detected in this sample so the potential benefit of supervisor support could not be observed. The present work builds upon a nascent body of literature that has explored the unique contributions of various sources of support (e.g., romantic partners, family, supervisors) (Hämmig, 2017; Stanley et al., 2019) by demonstrating that the supervisor is a unique, critical source of support for mental health and that supervisor support provides additional benefits over those fostered by support from the romantic partner. The results imply that promoting supervisor support would protect and promote service member mental health. It is also likely that such implications extend to other high-risk workplaces (e.g., firefighters) and workers contending with high levels of stressors [like the sample of healthcare workers juggling childcare and eldercare responsibilities in Kossek et al., 2019)].

**Strengths**

This study benefited from several methodological strengths which bolster the validity and generalizability of the findings. Firstly, this sample utilized in the present work consisted of full-time employed service members at the National Guard. This sample is highly generalizable to not only the larger National Guard but also other populations of high-risk employees (e.g., firefighters). Secondly, this study also benefited from the usage of psychological distress, which is a mental health construct that is more generalizable than PTSD symptom severity to the broader population of working adults because it reflects symptoms stemming from common mental health problems (e.g.,
depression, anxiety) (Kessler et al., 2002). Finally, the present work’s analytical approach included a cross-lagged panel analysis, which is considered a statistically conservative methodology because it controls for not only the stability of variables over time but all other cross-lags (i.e., the influence of a variable on another variable at a different timepoint). Although the model did not find the hypothesized associations of supervisor support on primary health outcomes of interest, it was an appropriate model choice because it accounted for the interdependent nature of health (i.e., by including romantic partner support) and the bidirectional interplay between social support, PTSD symptom severity and sleep. Therefore, it provided a more complete picture of the influences of service member health outcomes than alternative statistical tests like a multiple regression. However, it is important to note that this usage (i.e., exploring one particular direction of effects while controlling for bidirectional associations) is different from its traditional exploratory purpose of dissecting bidirectional effects. It is possible that the reverse direction could be driving the phenomenon (i.e., health impacting social support) and this reverse direction could be positive or negative. For example, individuals experiencing greater psychological distress may seek more social support in order to cope and thus psychological distress would be positively associated with perceived support at subsequent waves. In contrast, mental health issues like PTSD can strain relationships and interfere with support-seeing processes (Shallcross et al., 2016) and thus PTSD symptoms would be negatively associated with perceived support at subsequent waves. Although this paper was not focused on assessing this reverse direction, it is interesting that the health variables were not found to predict subsequent social support variables.
Limitations

Three potential limitations concerning the results of this study should be noted.
Firstly, the sample consists of service members who are employed full-time, in long-term romantic relationships, and have low levels of the health problems explored in this work. Therefore, they are likely high-functioning and well-adjusted, given that they do not seem to have issues that may otherwise make it difficult to continue working (e.g., a severe mental illness). As mentioned above, the low base rate of PTSD symptom severity and sleep problems presents the possibility that the lack of hypothesized results might be explained by floor effects. Although the usage of this nonclinical sample was a limitation for detecting the effect of supervisor support on these outcomes, the results might be more generalizable to the working population of service members and veterans than clinical samples (like those recruited from hospitals). To better examine the potential unique benefit of supervisor support, future work should utilize a larger sample so that individuals with higher levels of PTSD and sleep problems might be included. While this is a limitation, it also makes it more noteworthy that effects of supervisor support on psychological distress were found with this high-functioning, nonclinical sample.

Secondly, the sample consisted of partnered service members, most of whom had a romantic partner who also participated in the larger study. Couples who self-select into psychological research studies generally have high-quality relationships (Aron et al., 2000) and service members who have romantic partners perceive higher levels of support availability in general than their single service member counterparts (Herbert et al., 2018), which would collectively suggest that the high levels of PPR and GSS found in
this sample may not be representative of the larger population of partnered adults (which include those with low relationship quality) or the larger population of service members (which include singletons). Therefore, the results may not generalize to these populations. However, the range restriction of the social support variables to the higher end of the scale (i.e., given that most of the participants view their romantic partner and their supervisor as highly supportive) should have made it more difficult to detect effects. Therefore, it speaks to the robustness of the effect of supervisor support on psychological distress that the effect was detected in this sample and it suggests that these effects might be stronger in the broader population of partnered adults and service members.

Thirdly, it is unclear if the timeframe of the follow-up waves is appropriately spaced to observe beneficial effects of supportive supervisors for these health outcomes. Future work should test alternative timeframes (e.g., one month) to determine the most appropriate timescale to observe the beneficial effects of supervisor support.

**Future directions**

Like all research, the generalizability of the findings are qualified by the nature of the sample used. This sample was mostly male and mostly White, which reflects the racial composition of the population in the U.S. state where the sample was recruited (Oregon; U.S. Census Bureau, 2022) as well as the racial and gender composition of the military (Department of Defense, 2020). The Minority Stress Model asserts that underrepresented groups, like women and non-White adults in the military workplace, often experience higher stress and less social support to cope with the stress (Meyer, 2003). For example, women perceive social support to be less available in the military workplace (i.e., in their
unit) than men (Kline et al., 2013) and other research has found that lacking supervisor support is associated with detrimental outcomes like severe depressive symptoms for women but not men (Rugulies et al., 2006). Further, the issue for exacerbated for intersectional populations (i.e., those that have multiple underrepresented backgrounds) like non-White women veterans who perceive lower social support availability than White women veterans (Lehavot et al., 2019). Since the present study’s sample was mostly male, it is possible that the more influential effects of having supervisor support that women service members might experience were not captured. Previous work with a sample of firefighters who were mostly women found that supervisor support was more influential on PTSD symptom severity than other sources including family, friends and coworkers (Stanley et al., 2019). This suggests that women benefit greatly from supervisor support in male-dominated, high-risk workplaces. Future studies should work to have balanced samples of male and female participants that are racially and ethnically diverse to disentangle potential demographic differences regarding the health benefits of perceived supervisor support.

**Implications**

This study has major implications for workplaces seeking to protect the mental health of their employees as well as for public health practitioners aiming to find new strategies prevent mental illness in vulnerable populations. These implications are perhaps more important now than ever in light of the fallout from the coronavirus disease 2019 (COVID-19) pandemic and efforts meant to reduce its spread (e.g., lockdowns, remote work).
Workers spend many of their waking hours at work and their supervisor plays a pivotal role in their daily life, so it follows that work and their supervisor can promote or degrade worker well-being (Kelloway & Barling, 2010). Advancing worker health and well-being has risen as a priority in many workplaces (Hammer & Brady, 2021; Schill & Chosewood, 2013), but many of the strategies proposed for achieving this goal are not evidence-based (Gayed et al., 2018; LaMontagne et al., 2014). The findings in this study suggest that it would be worthwhile for workplaces to invest in supervisor supportiveness interventions as a primary strategy for protecting and promoting worker well-being and mental health. Field experiments have demonstrated that training supervisors to be supportive can foster improvements in worker stress (Hammer et al., 2020) and psychological distress (Kossek et al., 2019). Supervisor supportiveness trainings (i.e., a group-level intervention) would likely have a larger impact than social support trainings targeting other important relationships in workers’ lives (like romantic partners in a couple-level intervention) because supervisors can benefit each of their workers while romantic partners would mostly benefit their loved ones (e.g., their significant other). Further, supervisor supportiveness trainings can foster well-being improvements in workers’ loved ones such as their romantic partners (e.g., increased life satisfaction and reduced loneliness; O’Neill et al., under review), further demonstrating that supervisor supportiveness interventions can have significant reach. Supervisor support interventions would be particularly beneficial in high-risk workplaces to safeguard employees’ mental health against the occupational hazards (e.g., traumatic events) to which they are exposed.
From a public health perspective, supervisor supportiveness trainings can be considered a novel avenue for intervention to help to safeguard vulnerable populations before clinical intervention is required. From prevention to treatment, traditional individual-level approaches to mental health focus mainly on changing maladaptive processes within a person that contribute to mental health problems (e.g., cognitive distortions in cognitive behavioral therapy; Beck & Fleming, 2021) rather than directly targeting the social systems that contribute to mental health problems (e.g., the family, the workplace). Therefore, it would be beneficial to supplement individual-level approaches with group-level approaches like supervisor supportiveness trainings. Indeed, research has suggested that the most efficacious workplace well-being interventions are multilevel (e.g., individual and organizational factors) (Anger et al., 2015; LaMontagne et al., 2007). Supervisor supportiveness trainings are a unique way to protect mental health because it constitutes a group-level effort and it can be efficiently delivered to virtually any workplace.

The COVID-19 pandemic has presented significant challenges for mental health globally (e.g., Mahmud et al., 2022; Torales et al., 2020). Additionally, certain groups have been disproportionately affected by the pandemic (e.g., younger people, women, individuals with existing mental health conditions; Tran et al., 2020). National Guard service members and their loved ones are another group that were disproportionately impacted by the pandemic and major national events unfolding during the pandemic. National Guard service members were deployed domestically to respond to the pandemic, natural disasters, and the pro-Trump January 6th attack on the U.S. Capitol (Beynon,
National Guard officials are concerned about the mental health and employment retention of their service members in light of these challenging deployments and the increased pace of deployments (Winkie, 2021). Efforts to systematically address mental health problems are needed now more than ever (Ghebreyesus, 2020; Gruber et al., 2021). Supervisor supportiveness trainings represent an effective approach to protecting the mental health of workers (Sinclair et al., 2020).

**Conclusion**

Service members are exposed to extreme stressors (e.g., dangerous working conditions, high-stakes situations) which can contribute to PTSD, other psychological problems and sleep problems. These problems can threaten their health, well-being, relationships and ability to function at work and at home. Thus, it is imperative to learn more about resilience factors (e.g., social support) that can be harnessed to prevent and ameliorate these health problems. While supervisor support has been found to be influential on PTSD and sleep outcomes in previous work, their influence has not been assessed while accounting for the likely more influential support from romantic partners or the interconnected nature of PTSD, sleep and social support. The final model in the present study did not find additional benefits supervisor supportiveness beyond the influence of romantic partners on PTSD and sleep outcomes, but this may be due floor effects (i.e., low base rate of PTSD and sleep problems in this sample). However, supplemental analyses revealed that supervisor supportiveness fostered beneficial effects for psychological distress above and beyond the beneficial effects of romantic partner supportiveness. Workplace interventions are being designed to protect and promote the
health and well-being of workers, which is especially important for service members and other high-risk workers. This study suggests that the targeting the supervisor for social support trainings would be an effective intervention strategy to reduce psychological distress, but that more research is needed concerning PTSD- and sleep-related outcomes to determine the influence that supervisor support may play. Taken together, this study underscores the importance of having supportive supervisors in addition to supportive romantic partners for the psychological health of service members.
Table 4.1.

Demographic characteristics for service members ($N = 540$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>36.87 (9.00)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>118 (21.9%)</td>
</tr>
<tr>
<td>Male</td>
<td>421 (78.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>7 (1.3%)</td>
</tr>
<tr>
<td>Asian</td>
<td>10 (1.9%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>6 (1.1%)</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander or US territory</td>
<td>5 (0.9%)</td>
</tr>
<tr>
<td>Latino or Hispanic</td>
<td>48 (8.9%)</td>
</tr>
<tr>
<td>White</td>
<td>437 (80.9%)</td>
</tr>
<tr>
<td>Multiple/other</td>
<td>24 (4.4%)</td>
</tr>
<tr>
<td>Missing</td>
<td>3 (0.6%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>57 (10.6%)</td>
</tr>
<tr>
<td>Some college or technical school, no degree</td>
<td>243 (45.0%)</td>
</tr>
<tr>
<td>College degree/certificate</td>
<td>206 (38.1%)</td>
</tr>
<tr>
<td>Graduate degree or in progress</td>
<td>34 (6.3%)</td>
</tr>
<tr>
<td>Branch of service</td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>229 (42.4%)</td>
</tr>
<tr>
<td>Air</td>
<td>311 (57.6%)</td>
</tr>
<tr>
<td>Military rank</td>
<td></td>
</tr>
<tr>
<td>Enlisted</td>
<td>474 (87.8%)</td>
</tr>
<tr>
<td>Officer</td>
<td>38 (7.0%)</td>
</tr>
<tr>
<td>N/A</td>
<td>27 (5.0%)</td>
</tr>
<tr>
<td>Missing</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>Deployment history</td>
<td></td>
</tr>
<tr>
<td>Deployed</td>
<td>325 (60.2%)</td>
</tr>
<tr>
<td>Never deployed</td>
<td>203 (37.6%)</td>
</tr>
<tr>
<td>Missing</td>
<td>12 (2.2%)</td>
</tr>
<tr>
<td>Time since last deployment (in years)</td>
<td>5.96 (4.16)</td>
</tr>
<tr>
<td>Employment with the Oregon National Guard (ONG)</td>
<td></td>
</tr>
<tr>
<td>Hours worked per week at ONG (not including drill weekends)</td>
<td>42.04 (4.77)</td>
</tr>
<tr>
<td>Work tenure in years at the ONG</td>
<td>11.21 (7.17)</td>
</tr>
<tr>
<td>Work shift</td>
<td></td>
</tr>
<tr>
<td>Regular day shift</td>
<td>449 (83.1%)</td>
</tr>
<tr>
<td>Other shifts</td>
<td>91 (16.9%)</td>
</tr>
<tr>
<td>Length of working relationship with supervisor (in years)</td>
<td>3.49 (4.33)</td>
</tr>
<tr>
<td>Relationship status</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Cohabitating</td>
<td>81 (15.0%)</td>
</tr>
<tr>
<td>Married</td>
<td>459 (85.0%)</td>
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</table>

<table>
<thead>
<tr>
<th>Relationship length (in years)</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>10.74 (8.40)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Parental status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent</td>
<td>407 (75.5%)</td>
</tr>
<tr>
<td>Non-parent</td>
<td>130 (24.1%)</td>
</tr>
<tr>
<td>Missing</td>
<td>3 (0.6%)</td>
</tr>
</tbody>
</table>
Table 4.2.

Descriptive statistics for primary study variables at each wave (baseline, 4- and 9-months post-baseline)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>4-month follow-up</th>
<th>9-month follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>N</td>
<td>M (SD)</td>
</tr>
<tr>
<td>GSS</td>
<td>4.30 (0.82)</td>
<td>535</td>
<td>4.21 (0.82)</td>
</tr>
<tr>
<td>PPR</td>
<td>6.00 (1.29)</td>
<td>527</td>
<td>5.92 (1.38)</td>
</tr>
<tr>
<td>PTSD</td>
<td>2.04 (2.86)</td>
<td>524</td>
<td>1.87 (2.83)</td>
</tr>
<tr>
<td>Distress</td>
<td>1.61 (0.64)</td>
<td>528</td>
<td>1.54 (0.69)</td>
</tr>
<tr>
<td>Sleep</td>
<td>53.71 (7.48)</td>
<td>526</td>
<td>52.49 (8.05)</td>
</tr>
</tbody>
</table>

Note. The sample size ranged from 380 to 535 depending on the variable and wave. GSS - general supervisor support, PPR - perceived partner responsiveness, PTSD – post-traumatic stress disorder symptom severity, Distress – psychological distress, Sleep - sleep dissatisfaction.

Perceived supervisor support was assessed with the General Supervisor Support scale (Yoon & Lim, 1999). Perceived partner responsiveness was assessed with a scale of the same name from Laurenceau and colleagues (2005) that was adapted by O’Neill and colleagues (2020). Post-traumatic stress disorder symptom severity was assessed with the PTSD Stress Checklist for DSM-5 (Price et al., 2016). Psychological distress was assessed with the 6-item scale from the K-6 Mental Health Screening Questionnaire (Kessler et al., 2002). Sleep dissatisfaction was assessed with the PROMIS: Sleep Disturbance scale from (Yu et al., 2012).
Table 4.3.

Correlations between primary study variables at each wave (baseline, 4- and 9-months post-baseline) (N=540)

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
<th>11.</th>
<th>12.</th>
<th>13.</th>
<th>14.</th>
<th>15.</th>
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</thead>
<tbody>
<tr>
<td>1. GSS - BL</td>
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<td>1</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2. GSS – 4m</td>
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</tr>
<tr>
<td>3. GSS – 9m</td>
<td>.18***</td>
<td>.20***</td>
<td>.14**</td>
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</tr>
<tr>
<td>4. PPR – BL</td>
<td>.25***</td>
<td>.23***</td>
<td>.17**</td>
<td>.73***</td>
<td>1</td>
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</tr>
<tr>
<td>5. PPR – 4m</td>
<td>.22***</td>
<td>.19***</td>
<td>.68***</td>
<td>.71***</td>
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</tr>
<tr>
<td>6. PPR – 9m</td>
<td>-.21***</td>
<td>-.17***</td>
<td>-.16**</td>
<td>-.35***</td>
<td>-.33***</td>
<td>-.30***</td>
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</tr>
<tr>
<td>7. PTSD – BL</td>
<td>-.26***</td>
<td>-.21***</td>
<td>-.13*</td>
<td>-.34***</td>
<td>-.36***</td>
<td>-.26***</td>
<td>.67***</td>
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<tr>
<td>8. PTSD – 4m</td>
<td>-.16**</td>
<td>-.10*</td>
<td>-.39***</td>
<td>-.29***</td>
<td>-.35***</td>
<td>.68***</td>
<td>.57***</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9. PTSD – 9m</td>
<td>-.20**</td>
<td>-.14**</td>
<td>-.11*</td>
<td>-.37***</td>
<td>-.35***</td>
<td>-.39***</td>
<td>.55***</td>
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<td>.65***</td>
<td>.62***</td>
<td>.62***</td>
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<td></td>
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<tr>
<td>10. Distress – BL</td>
<td>-.26***</td>
<td>-.21***</td>
<td>-.11*</td>
<td>-.44***</td>
<td>-.44***</td>
<td>-.35***</td>
<td>.54***</td>
<td>.65***</td>
<td>.58***</td>
<td>.67***</td>
<td>1</td>
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<tr>
<td>11. Distress – 4m</td>
<td>-.16**</td>
<td>-.13*</td>
<td>-.11*</td>
<td>-.37***</td>
<td>-.35***</td>
<td>-.39***</td>
<td>.55***</td>
<td>.51***</td>
<td>.65***</td>
<td>.62***</td>
<td>.62***</td>
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<tr>
<td>12. Distress – 9m</td>
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<td>-.13**</td>
<td>-.11*</td>
<td>-.37***</td>
<td>-.27***</td>
<td>-.23***</td>
<td>.37***</td>
<td>.30***</td>
<td>.28***</td>
<td>.39***</td>
<td>.25***</td>
<td>.24***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Sleep – BL</td>
<td>-.18***</td>
<td>-.15**</td>
<td>-.09</td>
<td>-.28***</td>
<td>-.24***</td>
<td>-.19***</td>
<td>.32***</td>
<td>.34***</td>
<td>.28***</td>
<td>.33***</td>
<td>.36***</td>
<td>.29***</td>
<td>.60***</td>
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</tr>
<tr>
<td>14. Sleep – 4m</td>
<td>-.15**</td>
<td>-.10</td>
<td>-.07</td>
<td>-.28***</td>
<td>-.21***</td>
<td>-.26***</td>
<td>.35***</td>
<td>.36***</td>
<td>.33***</td>
<td>.39***</td>
<td>.36***</td>
<td>.32***</td>
<td>.52***</td>
<td>.56***</td>
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<td>15. Sleep – 9m</td>
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</tbody>
</table>

Notes. *, **, and *** indicate significance at .05, .01 and .001, respectively. BL - Baseline, 4m – 4-months post-baseline, 9m – 9-months post-baseline. GSS - general supervisor support, PPR - perceived partner responsiveness, PTSD – post-traumatic stress disorder symptom severity, Distress – psychological distress, Sleep - sleep dissatisfaction.
Table 4.4.

Initial (unconstrained) model investigating the associations between supervisor support and romantic partner support, PTSD symptom severity and sleep dissatisfaction over time (N = 540)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GSS 4m</th>
<th>GSS 9m</th>
<th>PPR 4m</th>
<th>PPR 9m</th>
<th>PTSD 4m</th>
<th>PTSD 9m</th>
<th>Sleep 4m</th>
<th>Sleep 9m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.48 (.44)**</td>
<td>1.03 (.63)</td>
<td>.84 (.64)</td>
<td>-.10 (.59)</td>
<td>3.51 (1.65)*</td>
<td>2.27 (1.87)</td>
<td>26.19 (3.65)**</td>
<td>19.37 (6.28)**</td>
</tr>
<tr>
<td>GSS BL</td>
<td>.61 (.05)**</td>
<td>.25 (.09)**</td>
<td>.19 (.07)**</td>
<td>.02 (.09)</td>
<td>-40 (.18)*</td>
<td>.02 (.25)</td>
<td>-.64 (.47)</td>
<td>-.22 (.34)</td>
</tr>
<tr>
<td>GSS 4m</td>
<td>-</td>
<td>.37 (.09)***</td>
<td>-</td>
<td>.10 (.08)</td>
<td>-</td>
<td>-.07 (.24)</td>
<td>-</td>
<td>.53 (.52)</td>
</tr>
<tr>
<td>PPR BL</td>
<td>.04 (.02)</td>
<td>.01 (.05)</td>
<td>.75 (.06)***</td>
<td>.38 (.06)***</td>
<td>-.21 (.12)</td>
<td>-.35 (.18)*</td>
<td>-.38 (.21)</td>
<td>-.31 (.44)</td>
</tr>
<tr>
<td>PPR 4m</td>
<td>-</td>
<td>.02 (.07)</td>
<td>-</td>
<td>.45 (.05)***</td>
<td>-</td>
<td>.08 (.14)</td>
<td>-</td>
<td>.07 (.39)</td>
</tr>
<tr>
<td>PTSD BL</td>
<td>-.01 (.02)</td>
<td>-.035 (.02)</td>
<td>-.03 (.02)</td>
<td>-.02 (.03)</td>
<td>.59 (.06)***</td>
<td>.51 (.09)***</td>
<td>.22 (.12)</td>
<td>.34 (.19)</td>
</tr>
<tr>
<td>PTSD 4m</td>
<td>-</td>
<td>.04 (.02)</td>
<td>-</td>
<td>.02 (.03)</td>
<td>-</td>
<td>.24 (.11)*</td>
<td>-</td>
<td>.05 (.15)</td>
</tr>
<tr>
<td>Sleep BL</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>.01 (.02)</td>
<td>-.02 (.02)</td>
<td>.58 (.04)***</td>
<td>.27 (.08)***</td>
</tr>
<tr>
<td>Sleep 4m</td>
<td>-</td>
<td>.00 (.01)</td>
<td>-</td>
<td>.00 (.01)</td>
<td>-.14 (.10)</td>
<td>.08 (.07)</td>
<td>-.19 (.18)</td>
<td>-.31 (.33)</td>
</tr>
<tr>
<td>Condition</td>
<td>-.04 (.06)</td>
<td>.04 (.09)</td>
<td>.02 (.09)</td>
<td>.22 (.08)**</td>
<td>-.27 (.19)</td>
<td>.37 (.27)</td>
<td>-.99 (.76)</td>
<td>-1.11 (.58)</td>
</tr>
<tr>
<td>Branch</td>
<td>-.15 (.07)*</td>
<td>.03 (.09)</td>
<td>-.14 (.10)</td>
<td>.08 (.07)</td>
<td>-.19 (.18)</td>
<td>-.31 (.33)</td>
<td>.07 (.75)</td>
<td>.24 (.57)</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.41 (.03)***</td>
<td>.48 (.04)***</td>
<td>.85 (.09)***</td>
<td>.73 (.08)***</td>
<td>4.17 (.53)***</td>
<td>4.40 (.56)***</td>
<td>39.63 (4.99)***</td>
<td>36.27 (4.10)***</td>
</tr>
</tbody>
</table>

Note. *, **, and *** indicate significance at .05, .01 and .001 levels, respectively. BL - baseline, 4m - 4 months, 9m - 9 months; Branch: 0 - Army, 1 - Air; Condition of workplace intervention: 0 – control, 1 – treatment; Est. - estimate; GSS - general supervisor support; PPR - perceived partner responsiveness; PTSD - post-traumatic stress disorder symptom severity; Sleep - sleep dissatisfaction; Residual V. - residual variance.

For simplicity, only cross-lags (an association between two different variables like PPR and PTSD) and autoregressions (an association between the same variables like PPR at BL predicting PPR at 4m) are presented. The synchronous correlations are not presented. Only significant cross-lags that pertain to hypotheses or supplemental analyses are bolded (i.e., GSS on subsequent health outcomes).

Results are from the initial model in which no equality constraints over time (i.e., time constraints) were included.
Table 4.5.

Final (constrained) model investigating the associations between supervisor support and romantic partner support, PTSD symptom severity and sleep dissatisfaction over time (N = 540)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GSS 4m (Est. (SE))</th>
<th>GSS 9m (Est. (SE))</th>
<th>PPR 4m (Est. (SE))</th>
<th>PPR 9m (Est. (SE))</th>
<th>PTSD 4m (Est. (SE))</th>
<th>PTSD 9m (Est. (SE))</th>
<th>Sleep 4m (Est. (SE))</th>
<th>Sleep 9m (Est. (SE))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.48 (.44)**</td>
<td>1.03 (.63)</td>
<td>-.12 (.58)</td>
<td>3.22 (1.53)*</td>
<td>2.60 (1.65)</td>
<td>26.06 (3.81)**</td>
<td>19.50 (6.31)**</td>
<td></td>
</tr>
<tr>
<td>GSS BL</td>
<td>.61 (.05)**</td>
<td>.25 (.09)**</td>
<td>.18 (.07)**</td>
<td>.04 (.09)</td>
<td>-.25 (.15)</td>
<td>-.25 (.15)</td>
<td>-.57 (.48)</td>
<td>-.28 (.46)</td>
</tr>
<tr>
<td>GSS 4m</td>
<td>-</td>
<td>.37 (.089)**</td>
<td>-.09 (.082)</td>
<td>-</td>
<td>.08 (.20)</td>
<td>-</td>
<td>.06 (.40)</td>
<td>-</td>
</tr>
<tr>
<td>PPR BL</td>
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<td>.01 (.05)</td>
<td>.75 (.06)**</td>
<td>.37 (.05)**</td>
<td>-.26 (.09)**</td>
<td>-.26 (.09)**</td>
<td>-.41 (.23)</td>
<td>-.31 (.34)</td>
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<td>PPR 4m</td>
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<td>-</td>
<td>.45 (.043)**</td>
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<td>.04 (.13)</td>
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</tr>
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<td>-.03 (.02)</td>
<td>-.03 (.02)</td>
<td>-.02 (.03)</td>
<td>.59 (.06)**</td>
<td>.52 (.09)**</td>
<td>.23 (.12)</td>
<td>.34 (.19)</td>
</tr>
<tr>
<td>PTSD 4m</td>
<td>-</td>
<td>.04 (.02)</td>
<td>-.02 (.03)</td>
<td>-</td>
<td>.23 (.10)*</td>
<td>-</td>
<td>.05 (.15)</td>
<td>-</td>
</tr>
<tr>
<td>Sleep BL</td>
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<td>.00 (.01)</td>
<td>.00 (.01)</td>
<td>.00 (.06)</td>
<td>.01 (.02)</td>
<td>-.02 (.03)</td>
<td>.58 (.04)**</td>
<td>.27 (.08)**</td>
</tr>
<tr>
<td>Sleep 4m</td>
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<td>.00 (.01)</td>
<td>-</td>
<td>.00 (.01)</td>
<td>-</td>
<td>.02 (.03)</td>
<td>-</td>
<td>.34 (.10)**</td>
</tr>
<tr>
<td>Condition</td>
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<td>.04 (.09)</td>
<td>.02 (.09)</td>
<td>.22 (.08)**</td>
<td>-.28 (.19)</td>
<td>.39 (.27)</td>
<td>-.10 (.76)</td>
<td>-.11 (.58)</td>
</tr>
<tr>
<td>Branch</td>
<td>-.15 (.07)**</td>
<td>.04 (.09)</td>
<td>-.17 (.10)</td>
<td>.08 (.07)</td>
<td>-.19 (.17)</td>
<td>-.30 (.32)</td>
<td>.07 (.76)</td>
<td>.24 (.57)</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.41 (.03)**</td>
<td>.48 (.04)**</td>
<td>.85 (.09)**</td>
<td>.73 (.08)**</td>
<td>4.18 (.54)**</td>
<td>4.43 (.56)**</td>
<td>39.63 (4.99)**</td>
<td>36.27 (4.10)**</td>
</tr>
</tbody>
</table>

Note. *, **, and *** indicate significance at .05, .01 and .001 levels, respectively. BL - baseline, 4m - 4 months, 9m - 9 months; Branch: 0 - Army, 1 - Air; Condition of workplace intervention: 0 - control, 1 - treatment; Est. - estimate; GSS - general supervisor support; PPR - perceived partner responsiveness; PTSD - post-traumatic stress disorder symptom severity; Sleep - sleep dissatisfaction; Residual V. - residual variance.

For simplicity, only cross-lags (an association between two different variables like PPR and PTSD) and autoregressions (an association between the same variables like PPR at BL predicting PPR at 4m) are presented. The synchronous correlations are not presented. Only significant cross-lags that pertain to hypotheses or supplemental analyses are bolded (i.e., GSS on subsequent health outcomes).

Results are from the final model which included two sets of equality constraints over time. One set of time constraints held the effect of BL PPR on 4m PTSD to be equivalent to the effect of BL PPR on 9m PTSD, while the other set of time constraints held the effect of effect of BL GSS on 4m PTSD to be equivalent to the effect of BL GSS on 9m PTSD. Results indicated that the initial model did not fit the data better than constrained model. Applying these time constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant.
Table 4.6.

Initial (unconstrained) model investigating the associations between supervisor support and romantic partner support, psychological distress and sleep dissatisfaction over time (N = 540)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GSS 4m Est. (SE)</th>
<th>GSS 9m Est. (SE)</th>
<th>PPR 4m Est. (SE)</th>
<th>PPR 9m Est. (SE)</th>
<th>Distress 4m Est. (SE)</th>
<th>Distress 9m Est. (SE)</th>
<th>Sleep 4m Est. (SE)</th>
<th>Sleep 9m Est. (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.40 (.44)**</td>
<td>.96 (.63)</td>
<td>.71 (.65)</td>
<td>-.14 (.65)</td>
<td>1.94 (.29)***</td>
<td>.86 (.30)***</td>
<td>25.35 (3.86)***</td>
<td>16.50 (5.88)***</td>
</tr>
<tr>
<td>GSS BL</td>
<td>.62 (.05)***</td>
<td>.24 (.09)**</td>
<td>.22 (.07)**</td>
<td>.01 (.09)</td>
<td>-.10 (.05)*</td>
<td>- .01 (.03)</td>
<td>- .66 (.47)</td>
<td>- .15 (.34)</td>
</tr>
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<td>.38 (.09)***</td>
<td>-</td>
<td>.11 (.08)</td>
<td>-</td>
<td>.01 (.04)</td>
<td>-</td>
<td>.49 (.51)</td>
</tr>
<tr>
<td>PPR BL</td>
<td>.05 (.03)*</td>
<td>.00 (.04)</td>
<td>.77 (.06)***</td>
<td>.36 (.06)***</td>
<td>-.11 (.03)***</td>
<td>-.01 (.04)</td>
<td>-.38 (.21)</td>
<td>-.17 (.44)</td>
</tr>
<tr>
<td>PPR 4m</td>
<td>-</td>
<td>.03 (.07)</td>
<td>-</td>
<td>.45 (.05)***</td>
<td>-</td>
<td>-.04 (.03)</td>
<td>-</td>
<td>.11 (.42)</td>
</tr>
<tr>
<td>Distress BL</td>
<td>.03 (.08)</td>
<td>-.15 (.09)</td>
<td>.00 (.11)</td>
<td>-.16 (.10)</td>
<td>.62 (.06)***</td>
<td>.40 (.07)***</td>
<td>.89 (.65)</td>
<td>1.11 (.70)</td>
</tr>
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<td>.15 (.09)</td>
<td>-</td>
<td>.11 (.11)</td>
<td>-</td>
<td>.31 (.06)***</td>
<td>-</td>
<td>1.18 (.35)**</td>
</tr>
<tr>
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<td>-.00 (.01)</td>
<td>.01 (.01)</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>-.01 (.05)</td>
<td>-.01 (.01)</td>
<td>.58 (.04)***</td>
<td>.28 (.08)**</td>
</tr>
<tr>
<td>Sleep 4m</td>
<td>-</td>
<td>.00 (.01)</td>
<td>-</td>
<td>.00 (.01)</td>
<td>-</td>
<td>.00 (.00)</td>
<td>-</td>
<td>.32 (.10)**</td>
</tr>
<tr>
<td>Condition</td>
<td>-.05 (.06)</td>
<td>.03 (.09)</td>
<td>.00 (.09)</td>
<td>.23 (.08)**</td>
<td>-.05 (.05)</td>
<td>-.04 (.05)</td>
<td>-.96 (.76)</td>
<td>-1.11 (.58)</td>
</tr>
<tr>
<td>Branch</td>
<td>-.13 (.07)*</td>
<td>.04 (.09)</td>
<td>-.12 (.09)</td>
<td>.09 (.07)</td>
<td>-.02 (.05)</td>
<td>-.02 (.05)</td>
<td>-.02 (.80)</td>
<td>.14 (.57)</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.42 (.03)***</td>
<td>.48 (.04)</td>
<td>.86 (.09)***</td>
<td>.72 (.08)***</td>
<td>.24 (.03)***</td>
<td>.25 (.03)***</td>
<td>39.63 (4.91)***</td>
<td>35.76 (3.99)***</td>
</tr>
</tbody>
</table>

Note. *, **, and *** indicate significance at .05, .01 and .001 levels, respectively. BL - baseline, 4m - 4 months, 9m - 9 months; Branch: 0 - Army, 1 - Air; Condition of workplace intervention: 0 - control, 1 - treatment; Est. - estimate; GSS - general supervisor support; PPR - perceived partner responsiveness; Distress - psychological distress; Sleep - sleep dissatisfaction; Residual V. - residual variance.

For simplicity, only cross-lags (an association between two different variables like PPR and Distress) and autoregressions (an association between the same variables like PPR at BL predicting PPR at 4m) are presented. The synchronous correlations are not presented. Only significant cross-lags that pertain to hypotheses or supplemental analyses are bolded (i.e., GSS on subsequent health outcomes).

Results are from the initial model in which no equality constraints over time (i.e., time constraints) were included.
Table 4.7.

Final (constrained) model investigating the associations between supervisor support and romantic partner support, psychological distress and sleep dissatisfaction over time (N = 540)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GSS 4m Est. (SE)</th>
<th>GSS 9m Est. (SE)</th>
<th>PPR 4m Est. (SE)</th>
<th>PPR 9m Est. (SE)</th>
<th>Distress 4m Est. (SE)</th>
<th>Distress 9m Est. (SE)</th>
<th>Sleep 4m Est. (SE)</th>
<th>Sleep 9m Est. (SE)</th>
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</thead>
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<tr>
<td>Intercept</td>
<td>1.46 (.45)**</td>
<td>94 (.69)</td>
<td>.90 (.64)</td>
<td>-22 (.65)</td>
<td>1.53 (.22)***</td>
<td>1.23 (.31)***</td>
<td>24.17 (3.73)***</td>
<td>16.92 (5.91)***</td>
</tr>
<tr>
<td>GSS BL</td>
<td>.62 (.05)***</td>
<td>24 (.09)**</td>
<td>.20 (.07)**</td>
<td>.02 (.09)</td>
<td>-.07 (.03)*</td>
<td>-.07 (.03)***</td>
<td>-.58 (.48)</td>
<td>-.21 (.35)</td>
</tr>
<tr>
<td>GSS 4m</td>
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<td>.38 (.09)***</td>
<td>-</td>
<td>.10 (.08)</td>
<td>-</td>
<td>.04 (.04)</td>
<td>-</td>
<td>.51 (.51)</td>
</tr>
<tr>
<td>PPR BL</td>
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<td>.01 (.04)</td>
<td>.75 (.06)***</td>
<td>.38 (.06)***</td>
<td>-.08 (.02)***</td>
<td>-.08 (.02)***</td>
<td>-.29 (.21)</td>
<td>-.23 (.44)</td>
</tr>
<tr>
<td>PPR 4m</td>
<td>-</td>
<td>.03 (.07)</td>
<td>-.45 (.05)***</td>
<td>-</td>
<td>.00 (.03)</td>
<td>-</td>
<td>.15 (.42)</td>
<td>-</td>
</tr>
<tr>
<td>Distress BL</td>
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<td>-.15 (.09)</td>
<td>-.01 (.11)</td>
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<td>.65 (.05)***</td>
<td>.38 (.07)***</td>
<td>.97 (.64)</td>
<td>1.08 (.69)</td>
</tr>
<tr>
<td>Distress 4m</td>
<td>-</td>
<td>.15 (.08)</td>
<td>-</td>
<td>.11 (.11)</td>
<td>-</td>
<td>.31 (.07)***</td>
<td>-</td>
<td>1.17 (.35)***</td>
</tr>
<tr>
<td>Sleep BL</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>-.00 (.01)</td>
<td>.01 (.01)</td>
<td>-.01 (.00)</td>
<td>-.01 (.00)</td>
<td>.58 (.04)***</td>
<td>.28 (.08)***</td>
</tr>
<tr>
<td>Sleep 4m</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>-.00 (.01)</td>
<td>.00 (.01)</td>
<td>-</td>
<td>.00 (.00)</td>
<td>-</td>
<td>.32 (.10)***</td>
</tr>
<tr>
<td>Condition</td>
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<td>.00 (.09)</td>
<td>.23 (.08)***</td>
<td>-.05 (.05)</td>
<td>-.04 (.05)</td>
<td>-.97 (.75)</td>
<td>-.11 (.58)</td>
</tr>
<tr>
<td>Branch</td>
<td>-.13 (.07)*</td>
<td>.04 (.09)</td>
<td>-.12 (.10)</td>
<td>.09 (.07)</td>
<td>-.03 (.05)</td>
<td>-.00 (.06)</td>
<td>-.04 (.80)</td>
<td>.15 (.57)</td>
</tr>
<tr>
<td>Residual V.</td>
<td>.42 (.03)***</td>
<td>.48 (.04)***</td>
<td>.86 (.09)**</td>
<td>.72 (.08)***</td>
<td>.24 (.03)***</td>
<td>.25 (.03)***</td>
<td>39.65 (4.91)***</td>
<td>35.77 (3.99)***</td>
</tr>
</tbody>
</table>

Note. *, **, and *** indicate significance at .05, .01 and .001 levels, respectively. BL - baseline, 4m - 4 months, 9m - 9 months; Branch: 0 - Army, 1 - Air; Condition of workplace intervention: 0 – control, 1 – treatment; Est. - estimate; GSS - general supervisor support; PPR - perceived partner responsiveness; Distress – psychological distress; Sleep - sleep dissatisfaction; Residual V. - residual variance.

For simplicity, only cross-lags (an association between two different variables like PPR and Distress) and autoregressions (an association between the same variables like PPR at BL predicting PPR at 4m) are presented. The synchronous correlations are not presented. Only significant cross-lags that pertain to hypotheses or supplemental analyses are bolded (i.e., GSS on subsequent health outcomes).

Results are from the final model which included two sets of equality constraints over time. One set of time constraints held the effect of BL PPR on 4m Distress to be equivalent to the effect of BL PPR on 9m Distress, while the other set of time constraints held the effect of effect of BL GSS on 4m Distress to be equivalent to the effect of BL GSS on 9m Distress. Results indicated that the initial model did not fit the data better than constrained model. Applying these time constraints provided methodological benefits of simplifying the model and not overinterpreting differences between effects that were in the same direction but one did not emerge as significant.
Figure 4.1.

Consort diagram for Oregon MESH Study: Employee survey sample

Eligible Sample Population (n=1770)

Signed up to participate (n=975)

Provided informed consent (n=944)

Excluded: Identified as ITT Supervisor (n=215)
Excluded: Did not complete survey (n=25)

Identified as Employee, Completed Baseline Survey & Randomized (n=704)

Treatment

Intervention Group at Baseline
n=358 / 50.9%\textsuperscript{a}

Excluded: No response (n=63)

Intervention Group at 4 mos.
n=295 / 82.4%\textsuperscript{b}

Excluded: No response (n=83)

Intervention Group at 9 mos.\textsuperscript{*}
n=275 / 76.8%\textsuperscript{b}

Control

Control Group at Baseline
n=346 / 49.1%\textsuperscript{a}

Excluded: No response (n=57)

Control Group at 4 mos.
n=289 / 83.5%\textsuperscript{b}

Excluded: No response (n=72)

Control Group at 9 mos.\textsuperscript{*}
n=274 / 79.2%\textsuperscript{b}

Note.
\textsuperscript{a} Denominator is entire sample at baseline
\textsuperscript{b} Denominator is condition at baseline
\textsuperscript{*} 9 month surveys sent regardless of 4 mos. participation status
Figure 4.2.

Cross-lagged panel model investigating associations between perceived supportiveness from one’s supervisor and from one’s romantic partner, PTSD symptom severity and sleep dissatisfaction over time (N = 540)

Note. BL = baseline; 4m = 4 months; 9m = 9 months; GSS – general supervisor support; PPR – perceived partner responsiveness; PTSD - post-traumatic disorder stress symptom severity; Sleep - sleep dissatisfaction. Cross-lagged regressions that are significant at least at p<.05 are presented in colored lines, with red lines representing negative associations and blue lines representing positive associations. Autoregressive effects that are significant at least at p<.05 are presented in gray dotted lines. Correlations and nonsignificant regressions are not presented in these figures. Results are from the final model which included two sets of constraints. One set of constraints held the effect of BL PPR- on 4m PTSD to be equivalent to the effect of BL PPR on 9m PTSD, while the other set of constraints held the effect BL GSS-4m PTSD to be equivalent to the effect of BL GSS- 9m PTSD. Results indicated that the initial model did not fit the data better than constrained model. Applying these constraints provided methodological benefits of simplification of the model and avoiding overinterpretation of the differences between effects that were in the same direction but one did not emerge as significant.
Figure 4.3.

Cross-lagged panel model investigating associations between perceived supportiveness from one’s supervisor and from one’s romantic partner, psychological distress and sleep dissatisfaction over time (N = 540)

Note. BL = baseline; 4m = 4 months; 9m = 9 months; GSS – general supervisor support; PPR – perceived partner responsiveness; Distress – psychological distress; Sleep is sleep dissatisfaction. Cross-lagged regressions that are significant at least at p<.05 are presented in colored lines, with red lines representing negative associations and blue lines representing positive associations. Autoregressive effects that are significant at least at p<.05 are presented in gray dotted lines. Correlations and nonsignificant regressions are not presented in these figures. Results are from the final model which included two sets of constraints. One set of constraints held the effect of BL PPR on 4m Distress to be equivalent to the effect of BL PPR on 9m Distress, while the other set of constraints held the effect BL GSS on 4m Distress to be equivalent to the effect of BL GSS on 9m Distress. Results indicated that the initial model did not fit the data better than constrained model. Applying these constraints provided methodological benefits of simplification of the model and avoiding overinterpretation of the differences between effects that were in the same direction but one did not emerge as significant.
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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5158299/


https://doi.org/10.1300/j013v41n02_04


Chapter 5: Discussion

The overarching aim of this three-study dissertation was to assess the interplay of supportive relationships, health and well-being in military populations. This body of work aimed to: 1) explore the mechanisms by which close relationships exert their salubrious effects; 2) determine if workplace intervention efforts to train supportiveness in supervisors and promote sleep in workers can promote well-being, mental health, and social connection in their workers and romantic partners; and 3) determine if supervisor support can foster additional health benefits beyond those fostered by romantic partner support.

Contributions

This dissertation has made several important advancements in the study of social determinants of health. Specifically, Study 1 found that the intimacy process is a health-relevant, interpersonal pathway that facilitates downstream affective processes which ultimately fosters daily reductions in pain for veterans and increases in sleep quality in both partners of military couples. This work answered the call of researchers to explore the influence of interpersonal processes other than stress-buffering social support and to do so in an ecologically valid way such as with daily diary methodology and dyadic data analysis (Pietromonaco & Collins, 2017). Further, it demonstrated that the social regulation of emotion is a critical pathway by which romantic partners impact these health outcomes. It was among only a handful of studies to connect the widely established close relationship-emotion and emotion-health links together in a complete indirect path in which close relationships are proposed to promote health through
affective processes (Farrell et al., 2018). Study 2 demonstrated that a workplace well-being intervention which addressed multiple levels of analyses by combining supervisor supportiveness trainings (i.e., a group-level strategy aimed at health protection) with personalized sleep feedback for workers (i.e., an individual-level strategy aimed at health promotion) was an effective way to promote the well-being and social connectedness of service member workers and their romantic partners. Study 2 filled a gap in the literature noted by researchers regarding the lack of rigorous evaluations of such multipronged workplace well-being interventions (Anger et al., 2015). Additionally, this work joined a nascent body of research focused on evaluating crossover effects of workplace well-being interventions into the outcomes of the worker’s loved ones (Brady et al., 2021). Finally, Study 3 showed that supervisor supportiveness fosters improved mental health (specifically, lower psychological distress) after controlling for prior levels of mental health, romantic partner supportiveness, and sleep. This finding extends previous work (e.g., Kossek et al., 2019; Stanley et al., 2019) and highlights the pivotal role that supervisors play in the mental health of their workers in military settings.

**Military context**

This research was conducted with military couples (i.e., romantic relationships in which at least one member is or was a service member; in Studies 1 and 2) and partnered service members from the National Guard (i.e., married or cohabitating with their romantic partner; in Study 3), which is an important context in which to assess how social relationships promote health and well-being outcomes. This body of work examined many prevalent health problems for military populations such as pain and post-traumatic
stress disorder (PTSD) (Nahin, 2017; Trautmann et al., 2017). Rather than being experienced in a vacuum, these health problems profoundly impact the well-being, health and relationship functioning of service members’ romantic partners (Lewis et al., 2013). Therefore, the mutual influence of romantic partners is important to assess (Study 1) and to account for when examining the influence of other sources of support (Study 3). Additionally, the military context is relevant for intimacy-related and stress-related relationship processes explored in this work. Military couples contend with many unique challenges and barriers to their intimacy and relationship functioning, such as periodic separations from one another due to training or deployment (e.g., Baptist et al., 2011; Trail et al., 2017; Wan et al., 2018). Resources that may help service members and their families cope (such as support groups on base) may be less available to National Guard military couples in part because they live off base. High levels of stress and low levels of coping resources can contribute to disastrous consequences like suicide, which have been increasing in the Army (across active and National Guard components) and is believed to be contributed to by risk factors like substance abuse, mental health conditions, and relationship problems (Griffith, 2017). In this context, the findings from Study 2 such as the workplace intervention improving PPR in National Guard military couples was especially noteworthy because of the high levels of stressors that these couples contend with and the relative dearth of resources that are available for them. This body of work provides important insights about social dynamics of health in military populations, which may generalize to couples who work in other high-risk occupations (i.e., those that present the potential for serious and unforeseeable danger which can be traumatic,
injurious, or even fatal; e.g., firefighters, nurses) or couples who have similarly high levels of work-stress.

**What have I learned about social relationships and health?**

Broadly, I have learned that having a supportive romantic partner is essential for daily and longer-term (i.e., over the course of 4-months and 9-months) health and well-being (Studies 1 and 3). Additionally, I have learned that romantic partners are not the only salubrious source of support. Rather, my work highlights the position of supervisors as influential members of one’s social convoy (i.e., social network of close others; Khan & Antonucci, 1980) for mental health, which was a finding that emerged despite controlling for the supportiveness of one’s romantic partner (who is likely the service member’s primary and most influential convoy member; Barger & Cribbet, 2016; Norwood et al., 1996) (Study 3). Through my evaluation of a workplace well-being intervention (Study 2), I have learned that training supervisors to be more supportive in tandem with delivering personalized sleep feedback to service member workers is an effective way to promote well-being and social connection of service member workers and their romantic partners. The latter finding is noteworthy given romantic partners were distal recipients of the intervention (in that they did not receive personalized sleep feedback nor did they have a supervisor who received supportiveness training).

This dissertation highlights the importance of nurturing supportive relationships, both at work and at home, for health and well-being. This message is perhaps more important now than ever in light of the coronavirus disease 2019 (COVID-19) pandemic, which has contributed significant stress and interrupted opportunities for social
connection (e.g., at work, school, and special events). During the COVID-19 pandemic, individuals were recommended or compelled to avoid social contact with people who are not members of their household. Public health protocols (e.g., closing of restaurants, prohibition of social events) were initiated in March 2020 in the U.S. to slow the spread of the pandemic (Taylor, 2021). As a result of these public health initiatives, daily life was disrupted for many which included job loss, in-person activities like work and school being transitioned to remote work and learning, and working parents being forced to quit or reduce hours at work to provide childcare because of school closures. The pandemic interrupted social life, contributed to high levels of stress, increased reliance on maladaptive coping strategies (like drinking to cope), and has led to devastating psychological health outcomes (like burnout, depression and suicide) that may not be fully appreciated for some time (Mohr et al., 2021; Prasad et al., 2021; Sinclair et al., 2020). In addition to this stress stemming from the response to COVID-19, the disease itself directly impacted and ended many lives with approximately 55,000,000 infections and approximately 820,000 deaths in the U.S. by the end of 2021 (CDC, 2022). Early research suggests that some individuals were more psychologically affected by the pandemic than others (e.g., younger people, women, individuals with existing mental health conditions; Tran et al., 2020). National Guard service members and their loved ones are another group that were likely uniquely impacted by the pandemic and major national events that occurred in the same time period. National Guard service members were deployed domestically during 2020-2022 to aid in: pandemic relief (e.g., at understaffed hospitals and vaccination sites), natural disasters (e.g., extreme wild fire
seasons), response to protests, and securing the U.S. Capitol on January 6th after the pro-Trump insurrection (Beynon, 2021). In fact, the National Guard was mobilized more times and for longer periods in 2020 than any time since World War II (Winkie, 2020). These challenging domestic deployments were met with resistance from some segments of the public and fears of martial law conspiracy theorists, which further stressed National Guard service members (Lamothe, 2020). The increased operational tempo and extreme demands are feared to cause significant psychological strain and reduced retention of National Guard service members (Winkie, 2021). Taken together, the significant stressors that the general public has experienced and additional extreme demands that the National Guard service members and their families have faced in recent years underscore the need for social support.

**Strengths**

The confidence with which one can make inferential claims depends on the nature of the data analyzed and the appropriateness of the analytical approach utilized. This body of work has many significant methodological strengths relating to both the data and the analyses.

**Data**

All studies utilized data collected from naturalistic field settings, that were appropriate to address my research questions. Study 1 utilized daily diary data which has advantages over cross-sectional research (e.g., reduced memory bias) (Bolger et al., 2003). Additionally, this daily diary dataset had an average compliance rate of 78% (i.e., participants completed an average of approximately 24 survey days out of 32), which is
comparable to the compliance in other daily diary studies (e.g., Harris et al., 2003; Mohr et al., 2005). Each of the studies utilized data from cluster-randomized control trials that were randomized by military unit (rather than individual participant), which is an advantageous design for reducing the risk of contamination effects that can occur when individuals from treatment and control groups are in frequent contact and therefore intervention-related information (e.g., sleep hygiene tips) may be shared by treatment participants to control participants. Contamination effects can result in the underestimation of intervention effects (i.e., differences between the treatment and control groups on intervention outcomes) (Craven et al., 2001). Further, collection of baseline data and multiple follow-up waves was an advantageous design for the aims of this work such detecting intervention effects and determining if an observed effect is replicated at a subsequent wave.

Analysis

As the aphorism goes, “Essentially, all models are wrong, but some are useful” (Box & Draper, 1987, p. 424). In other words, all statistical models are simplifications of reality because they cannot fully replicate the complexity of the real world, like the vast range of factors that could influence the outcomes of interest. However, some models can provide insights because they incorporate the most critical components of the phenomenon of interest. Throughout this body of work, I utilized statistical methodology to build models that would most accurately reflect the core drivers of the phenomenon of interest as informed by social psychological research in order to make strong inferences. Study 1’s use of daily dyadic data analysis probed the interdependence of health within
close relationships (Reed et al., 2013) as well as assessing phenomena close in time to their occurrence (rather than retrospective reports) (Bolger et al., 2003). Study 2’s evaluation of the impact of the workplace intervention utilized gold standard methods in intervention science like controlling for baseline values of the outcome variables (as recommended by Bodner & Bliese, 2018) and utilizing intent-to-treat analytical approach (as recommended by McCoy, 2017). Intent-to-treat approach refers to analyzing participants based on their random assignment regardless of the dosage of intervention activities and materials actually received (e.g., whether the supervisor completed the training or workers received personalized sleep feedback and set goals for improvement) and the benefits of the intent-to-treat approach include reducing bias and maintaining generalizability (McCoy, 2017). Study 2 took a dyadic approach to examining intervention effects in the couple by assessing both worker and romantic partner outcomes in the same model, which reflects the influence of crossover effects (i.e., experiences or resources from the workplace impacting the worker’s loved ones; Westman, 2001) as well as the dyadic nature of health and well-being such that they are mutually fostered in close relationships (e.g., Reed et al., 2013). Study 3 utilized cross-lagged panel models to reflect the previously established bidirectional relationships between mental health, sleep, and social support (e.g., Babson et al., 2010; El-Solh et al., 2018; Gordon et al., 2017; Kent de Grey et al., 2018; Ross et al., 1989; Shallcross et al., 2016) as well as the dyadic nature of health by including the influence of romantic partner support (Reed et al., 2013) in my models for which I was primarily interested in the potential additional benefits of supervisor supportiveness on health outcomes. Taken
together, these strengths helped to more accurately reflect the core dimensions of phenomenon (as informed by social psychological research) and bolstered the validity and generalizability of the findings.

Limitations

Two important limitations of this body of work should be noted. Firstly, only partnered individuals and couples were included in this work, thus limiting generalizability to singletons. Additionally, couples who self-select into research studies generally have high-quality relationships (Aron et al., 2000) and partnered service members report higher levels of perceived support than single service members (Herbert et al., 2018), therefore, it is possible that the samples assessed in this dissertation had higher levels of perceived support from romantic partners and supervisors than the larger population of military personnel and military couples. While this is a limitation, this potential range restriction in social support variables (i.e., because participants view their partner and others as highly supportive) should have made it more difficult to detect effects and therefore, it speaks to the robustness of the findings (in Study 1 and 3).

Secondly, the samples utilized throughout this work have low levels of the health problems of interest (e.g., pain in Study 1 and PTSD in Studies 2 and 3), presenting the possibility that the lack of hypothesized results might be explained by floor effects. This limitation should be tempered with prior work suggesting that even subclinical levels of PTSD can be detrimental (Marshall et al., 2001), so it is important to assess these outcomes in these nonclinical populations. Although the usage of nonclinical samples limited the ability to detect beneficial effects of social support (Study 1 and 3) and the
workplace intervention (Study 2) on these outcomes, these findings may be more generalizable to the working population of service members and veterans as well as other high-risk workers than studies that recruited clinical samples (such as through the Veterans Health Administration system). Additionally, the low base rates of these health problems make it more noteworthy that beneficial effects of social support were observed (such as that beneficial effects of supervisor support on psychological distress in Study 3).

**Future directions**

The data utilized in this work were collected from a racially homogenous U.S. state in the Pacific Northwest (86.7% White; U.S. Census Bureau, 2022) and from a military population in which most service members are male (81.3% of the total force) and White (70.2% of the total force) (U.S. Department of Defense, 2020), and therefore the homogeneous demographic makeup of these samples reflect the larger population from which they are drawn. Thus, this work may not be generalizable to non-White or female service members and veterans, who would be considered underrepresented groups in the military workplace (DoD, 2020).

Previous theoretical and empirical work suggests that the phenomena explored in this dissertation may differ based on demographic factors like race and gender. According to the Minority Stress Model (Meyer, 2003), underrepresented groups are theorized to experience higher levels of stress due to stigmatization (e.g., daily microaggressions) and to possess fewer resources with which to cope (such as economic resources and social support resources; e.g., Coleman et al., 2019), ultimately
contributing to negative health outcomes. Gender and racial health disparities have been found for the health outcomes explored in this work, as I will illustrate with PTSD. Black and African Americans have been found to have higher rates of PTSD compared to White Americans, a disparity that persisted after controlling for social support (Alegria et al., 2013). PTSD is estimated to be approximately twice as prevalent in women than men (Hu et al., 2017). Additionally, female service members are much more likely to experience certain types of traumatic events than their male counterparts such as military sexual trauma (i.e., sexual harassment or assault experienced in connection with military service), which a large study of veterans found that approximately 41% of women and 4% of men who deployed post-9/11 have experienced (Barth et al., 2016). Military sexual trauma is associated with host of issues [such as lower perceived unit support (Laws et al., 2016) and feeling betrayed by military peers and leaders (Monteith et al., 2016)] that may interfere with victims/survivors receiving the protective benefits of social support and can also contribute to suicidal ideation (Monteith et al., 2016; Monteith et al., 2017).

In addition to gender and racial health disparities, previous work also suggests that there are demographic differences in social support, which is the focus of the present work. The Convoy Model of Social Relations (Khan & Antonucci, 1980) asserts that personal factors (such as age, gender, race) and situational factors (e.g., role expectations, norms) shape one’s convoy, the social support they receive/perceive from convoy members, and ultimately one’s health. Research has been mixed regarding levels of social support in the military for various underrepresented groups and those with intersectional identities (such as Black or African American women). Some work suggests that current
or former service members from underrepresented groups perceive lower social support than their male or White counterparts (Kline et al., 2013; Lehavot et al., 2019) whereas other work finds the opposite (Herbert et al., 2018). Therefore, more work is needed to determine the role that race and gender play in perception of levels of support as well as the interaction between social support processes and health outcomes in the military context.

In addition to gendered health disparities and social support differences in the military reviewed above, gender likely plays a role in the support processes in the romantic relationship. Women tend to have larger social convoys consisting of both more positive relationships and more negative relationships than men (Birditt & Antonucci, 2007), and thus women may both be more benefited and harmed by their convoy. Additionally, the widely documented health and well-being benefits stemming from being in a romantic relationship are gendered in that men have been found to benefit more (Stronge et al., 2019), which is theorized to be partly due to men relying on their romantic partner as their sole source of support whereas women tend to have a broader and more diverse network of supportive social ties (Taylor, 2011). Taken together, the benefits women receive from their social relationships may be reduced from experiencing the stress of being the main source of support that their male romantic partner relies on or from retaining relationships that are characterized by negativity. The low percentage of female and non-White service members in these samples preclude the assessment of gender and race as moderators of the phenomena explored in this work. Additionally, it was outside the scope of this work to examine the interaction of social support with
trauma type (e.g., combat-related, military sexual trauma, racial stigmatization-related trauma), but this would likely be an important area for future research. Future work should overrecruit these underrepresented groups to explore if and how social support interacts with identity and identity-related stressors to predict health outcomes.

**Conclusion**

Broadly, this work established that supportive relationships with romantic partners and supervisors are essential for the health and well-being in military populations and that workplace intervention efforts that include supervisor supportiveness trainings can promote the well-being and social connection of service member workers and their romantic partners. This dissertation has made several important advancements in the study of social determinants of health. Rigorous analytical approaches (e.g., longitudinal dyadic data analysis; intervention analyses with an intent-to-treat approach) were utilized to examine these phenomena in both experimental and observational studies. Taken together, these studies highlight the importance of nurturing supportive relationships for health and well-being for the general public and for practitioners in the fields of public health and organizational psychology. This takeaway is perhaps more important now than ever given the high level of stress and disruptions to social life caused by the COVID-19 pandemic.
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