

Interpersonal Mechanisms Linking Close Relationships to Health

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Close relationships play a vital role in human health, but much remains to be learned about specific mechanisms of action and potential avenues for intervention. This article provides an evaluation of research on close relationships processes relevant to health, drawing on themes from major relationship science theories to present a broad conceptual framework for understanding the interpersonal processes and intrapersonal pathways linking relationships to health and disease outcomes. The analysis reveals that both social connection and social disconnection broadly shape biological responses and behaviors that are consequential for health. Furthermore, emerging work offers insights into the types of social dynamics that are most consequential for health, and the potential pathways through which they operate. Following from this analysis, the authors suggest several research priorities to facilitate the translation of discoveries from relationship science into relationship-based interventions and public health initiatives. These priorities include developing finer grained theoretical models to guide research, the systematic investigation of potential mediating pathways such as dyadic influences on health behavior and physiological coregulation, and taking into account individual differences and contextual factors such as attachment style, gender, socioeconomic status, and culture. In addition, a pressing need exists for laboratory and field research to determine which types of interventions are both practical and effective.

Keywords: close relationships, health, biopsychosocial pathways, social support, dyadic effects

Close relationships are undeniably linked to health and well-being across the life span, but less is known about the mechanisms through which close relationships promote (or hinder) health. Close relationships represent a health risk factor equal to or greater than known health risk factors such as smoking, body mass index, and physical activity (Holt-Lunstad, Smith, & Layton, 2010), making it essential to understand how close relationship processes lead to

health risks or benefits. Recent theoretical models (Feeney & Collins, 2015; Graber, Laurenceau, Miga, Chango, & Coan, 2011; Pietromonaco, Uchino, & Dunkel Schetter, 2013) suggest that supportive close relationships promote health both by helping people cope with stress and by enabling them to fulfill basic needs for social connection such as love, intimacy, companionship, and security. Relationships also may benefit health through processes that foster exploration, personal growth, and goal strivings, all of which are essential for health and well-being. This article evaluates empirical findings related to specific close relationships processes relevant to health, and presents a broad framework for understanding the interpersonal processes and intrapersonal pathways through which they operate. The analysis focuses on *dyadic* processes and is organized around two themes, *social connection* and *social disconnection*. These themes are rooted in contemporary models of health, resilience, and thriving, and in major theories within relationship science including evolutionary approaches, attachment theory, and interdependence theory.

Evolutionary approaches and attachment theory suggest that humans have a basic need for social connection that evolved in the interest of survival and reproduction, and that social disconnection is painful because it runs

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benefit from social support, to give care to others, and to capitalize on opportunities for personal growth and meaning through their social relationships (Feeney & Collins, 2015). Attachment processes are especially evident under conditions of stress, which is of central interest to health psychologists, and they are implicated in a variety of health-related outcomes (Feeney & Collins, 2015; Pietromonaco, Uchino, et al., 2013; Pietromonaco, DeVito, Ge, & Lembke, 2015). Interdependence theory highlights microlevel interaction processes through which partners mutually influence each other’s outcomes (Kelley & Thibaut, 1978), emphasizing the importance of a dyadic perspective in areas such as how partners’ dynamically influence each other’s health behaviors (Lewis & Butterfield, 2007).

Drawing on processes highlighted in these theories, Figure 1 presents a broad conceptual framework for understanding how commonly studied relationship processes may be connected to health outcomes through psychosocial, behavioral, and biological mediators, and how individual difference and contextual factors influence and/or moderate these processes. This framework is intended as a general guide for organizing and reviewing the literature, for identifying plausible pathways through which *interpersonal* dynamics (social connection and disconnection) affect health-relevant *intrapersonal* factors

counter to this fundamental need (Baumeister & Leary, 1995; Bowlby, 1969). In addition, attachment theory suggests that individuals’ history of interactions with their closest partners (“attachment figures”) shapes their ability to regulate emotions and behavior, to solicit and

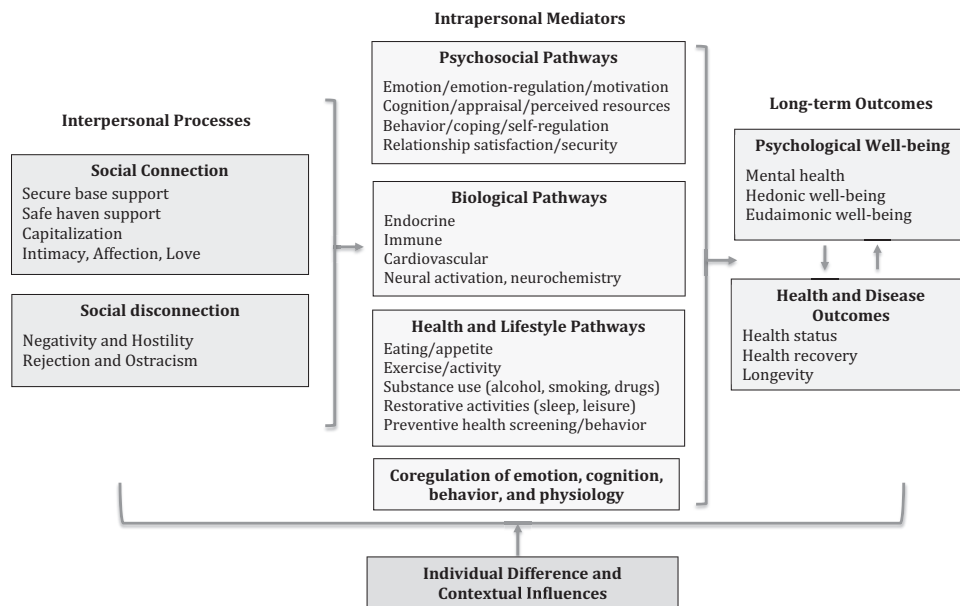


Figure 1. Organizing framework. The framework shown above identifies key interpersonal processes that are consequential for health, and suggests plausible intrapersonal mechanisms through which they operate. (The boxes include examples of these processes rather than an exhaustive list.) Although not depicted here, it is assumed that the proposed mechanisms/mediators have complex relationships with each other, and that there are feedback loops from the mediators and outcomes to social connection/disconnection. Key individual difference and contextual influences may include attachment style, approach versus avoidance social goals, gender, early adversity, social class, and culture.



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(mediating mechanisms) and health outcomes, and for evaluating where the evidence supports a particular pathway and where more evidence is needed.

Social Connection: Processes That Protect and Promote Health

Close relationships can protect and promote health in many ways. Historically, research has focused on structural features of relationships (e.g., *social networks*, *social integration*) or on global perceptions of network support (e.g., *perceived available support*) that can serve as resources when coping with stress. The current analysis moves beyond this literature to draw attention to the dyadic, interpersonal processes that may underlie these links, and to the importance of close relationships not only for coping with adversity but also for cultivating positive well-being and health in the absence of adversity (Feeney & Collins, 2015). Guided by theoretical models in relationship science, this analysis focuses on three key interpersonal processes: (a) social support in the context of stressful life events (*safe haven support*); (b) social support in the context of exploration, goal strivings (*secure base support*) and positive life events (*capitalization*); and (c) intimacy, affection, and love.

Social Support in the Context of Stress or Adversity

During times of stress, close relationships can protect health by buffering individuals from the negative effects of stress and by facilitating recovery and resilience (Cohen, 2004; Uchino, 2009). From an attachment theoretical per-

spective, this form of social support is labeled *safe haven support* (Collins & Feeney, 2000) or *source of strength support* (Feeney & Collins, 2015)—and it emphasizes the role of close relationships as a haven of comfort, security, and aid during difficult times. Empirical work in this area investigates the microdynamics of *enacted or received social support* in dyadic interaction and in daily life. Although studies vary widely in how social support is operationalized, and in the health-related outcomes studied, they consistently reveal the beneficial effects of enacted support during times of stress.

Experimental studies provide causal evidence that enacted support buffers the effects of acute stress on physiological responses. For example, the presence of a close, nonevaluative support provider during a stressor buffers individuals from cardiovascular reactivity (e.g., pulse rate, blood pressure; Allen, Blascovich, Tomaka, & Kelsey, 1991), and a romantic partner's caring verbal support (Collins, Jaremka, & Kane, 2016) reduces cortisol reactivity to acute laboratory stressors. Daily experience studies further show that social support predicts healthier daily cortisol profiles (Ditzen, Hoppmann, & Klumb, 2008; Slatcher, Robles, Repetti, & Fellows, 2010) and reduced susceptibility to infection and illness, especially under stress (Cohen, Janicki-Deverts, Turner, & Doyle, 2015).

In addition, experimental and observational studies show that real or imagined support from a significant other attenuates stress appraisals and cardiovascular reactivity and facilitates emotional recovery from acute stressors (Collins & Feeney, 2000; Collins et al., 2016; Jakubiak & Feeney, 2016b; Kane, McCall, Collins, & Blascovich, 2012; Smith, Ruiz, & Uchino, 2004). People who feel understood and accepted appraise the physical world as less daunting. For example, participants who were led to feel understood (vs. misunderstood or control) had higher pain tolerance to ice water, perceived a hill as less steep, and estimated shorter distances to target locations (Oishi, Schiller, & Gross, 2013). The imagined or symbolic presence of close others reduces perceptions of pain (Master et al., 2009) and attenuates neural activity in brain regions associated with threat (Eisenberger et al., 2011). These findings suggest that a supportive partner's presence may act as an implicit safety signal, reducing perceptions of threat (Eisenberger et al., 2011), which can have downstream consequences for health and coping with health challenges. Neuropeptides involved in social bonding (e.g., endogenous opioids, oxytocin) may mediate these effects (Ditzen & Heinrichs, 2014; Eisenberger & Cole, 2012).

Finally, a recurring theme in dyadic research on enacted support is the importance of support quality (Feeney & Collins, 2015). To promote positive outcomes, enacted support must be *sensitive* and *responsive* to the support recipient's goals, needs, and preferences (Collins & Feeney, 2000), leading the recipient to feel understood, validated,

and cared for (Maisel & Gable, 2009; Selcuk & Ong, 2013). Recent work suggests that, in some circumstances, the best support may be *invisible*—subtle, indirect, and unnoticed by the support recipient—because it allows individuals to obtain the benefits of support without the potential costs (e.g., lowered self-efficacy or increased feelings of debt; Bolger & Amarel, 2007; Howland & Simpson, 2010).

Social Support in the Context of Exploration, Goal-Strivings, and Positive Life Events

Although stress-buffering is the most widely studied form of support, recent theoretical perspectives emphasize the health benefits of social support during nonstressful times (Feeney & Collins, 2015; Lakey & Orehek, 2011). This work focuses on the importance of close relationships in helping people enhance their positive well-being by facilitating exploration, goal strivings, and personal growth in the absence of stress or adversity—referred to by attachment theorists as *secure base support* or *relational catalyst support* (Feeney, 2004; Feeney & Collins, 2015)—and by celebrating positive life events—referred to as *capitalization* (Gable & Reis, 2010). These support processes have implications for building good health by reducing or repairing the health-damaging effects of stress during difficult times, and increasing the health-promoting effects of positive emotion, leisure, and personal strengths that are cultivated during good times (Feeney & Collins, 2015; Pressman et al., 2009; Pressman & Cohen, 2005).

Experimental and observational work shows that secure base support fosters goal success and personal growth. For example, when romantic partners provide responsive support for personal goals (e.g., they are enthusiastic and affirming of one's aspirations), recipients are more likely to engage in exploration, to attain goals over time, and to show increased personal growth (Feeney, 2004; Jakubiak & Feeney, 2016a). These outcomes are important because the successful pursuit of meaningful goals predicts subjective well-being (Jakubiak & Feeney, 2016a)—which is an important predictor of health (Sheldon et al., 2010)—and because many goals involve health-promoting behaviors such as healthy eating, exercise, and leisure activities.

Capitalization. Seeking out others in response to positive life events (e.g., successes, accomplishments) strengthens social relationships and fosters well-being (Gable & Reis, 2010; Reis et al., 2010). When people share personal positive events with close others, and when others respond actively and constructively (e.g., expressing pride or enthusiasm) versus passively or destructively, disclosers experience increased positive affect beyond the impact of the event itself (Gable & Reis, 2010). These effects are important because positive affect predicts better objective health outcomes such as cardiovascular health (Boehm & Kubzansky, 2012).

Secure base and capitalization support also build trust, intimacy, and positive interpersonal expectancies, including increases in perceived responsiveness and available support (Gable, Gosnell, Maisel, & Strachman, 2012). These effects are important because perceived available support is linked to morbidity and mortality (see Uchino, 2009, for a review). Responsive secure base and capitalization support also build psychosocial resources and personal fortitudes—such as self-worth, self-efficacy, and perceived control (Feeney, 2004; Feeney & Thrush, 2010)—which can buffer stress and foster adaptive coping during more difficult times.

Although few studies have examined links between positive forms of support and objective health outcomes, two diary studies showed that daily spousal support for goal strivings was associated with greater daily goal progress; and goal progress was associated with daily improvements in physical (sleep quality, somatic symptoms), psychological, and relational well-being (Jakubiak & Feeney, 2016a). More research is needed on the health implications of support received in the context of goal strivings, personal growth, and positive life experiences.

Intimacy, Affection, and Love

Because human beings have a fundamental need for attachment and belonging, people are most likely to thrive when they feel intimately connected to significant others. Feelings of intimacy, which foster health, can emerge in any social interaction in which individuals come to feel understood, accepted, and cared for (Collins & Feeney, 2004)—including the social support interactions already noted above, as well as emotional and physical intimacy outside of specific support contexts (e.g., companionship, sharing experiences, and physical affection).

A key component of intimacy is the extent to which people believe that interaction partners understand, validate, and care for them (Laurenceau, Barrett, & Pietromonaco, 1998; Reis & Shaver, 1988). This *perceived partner responsiveness* provides individuals with core validation of the self, and leads to feelings of warmth, acceptance, belonging, and trust, all of which should foster emotional and physical well-being. These processes may be especially important in the context of illness and disease, when symptoms and treatments may damage self-image and self-esteem, and they also may have important implications for care seeking behavior.

Although studies have not yet examined links between responsive interactions and long-term health and disease outcomes, facets of intimacy have been linked to health-relevant psychosocial and physiological outcomes. For example, diary studies show that on days when people feel more understood and appreciated in social interactions they report fewer physical symptoms and greater positive affect, vitality, and life satisfaction (Lun, Kesebir, & Oishi, 2008;

Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), and on days when wives report higher (vs. lower) levels of self-disclosure, they experience better sleep quality that evening (Kane, Slatcher, Reynolds, Repetti, & Robles, 2014). A longitudinal study of couples also found that perceived partner responsiveness at Time 1 predicted healthier diurnal cortisol profiles 10 years later, and declines in negative affect mediated this effect (Slatcher, Selcuk, & Ong, 2015). In more recent follow-up analyses, Time 1 partner responsiveness predicted increases in eudaimonic (but not hedonic) well-being, and reduced emotional reactivity to daily stressors mediated this effect (Selcuk, Gunaydin, Ong, & Almeida, 2016). Finally, newlyweds who expressed more love and affection during lab interactions were more satisfied with their marriages and less prone toward divorce 1 year later (Graber et al., 2011). These findings are significant given that separation and divorce are associated with a greater risk of mortality and depression (Sbarra, 2015).

Brain imaging studies show that intimacy, acceptance, and romantic love are associated with neural activity that has implications for health (Morelli, Torre, & Eisenberger, 2014). For example, being accepted (vs. rejected) by a potential romantic partner increases activation in opioid receptors related to reward, positive affect, and analgesia (Hsu et al., 2013). In addition, when viewing images of one's romantic partner (vs. control images), people show activation in brain regions associated with attachment and reward (involving dopamine, and vasopressin receptors), and with regions implicated in mood, depression, and pain regulation (Acevedo, Aron, Fisher, & Brown, 2012). Love is not only rewarding, it may also boost energy and metabolic resources. For example, thinking about one's romantic partner (vs. a friend or other control) increases positive affect and blood glucose levels (Stanton, Campbell, & Loving, 2014).

Finally, growing evidence indicates that *physical* touch and intimacy broadly shape health through psychosocial and physiological pathways. In a diary study, romantic partners had lower cortisol levels on days with higher physical intimacy (holding hands, hugging), and daily positive affect mediated this effect (Ditzen et al., 2008). Another study showed that when people experienced increases in intimacy (from one day to the next), they experienced decreases in somatic symptoms the following day (Stadler, Snyder, Horn, Shrout, & Bolger, 2012).

Social Disconnection: Processes That Undermine Health

Relationships can be sources of support as well as stress, which can adversely influence health (Brooks & Dunkel Schetter, 2011; Rook, 2015). Guided by themes in major theoretical models in relationship science, the health implications of social disconnection are evaluated through illus-

trative studies on (a) negativity/hostility and (b) social rejection. Active, dyadic processes are emphasized here, but less active processes such as social isolation and low social integration also may create chronic stress and thereby impact health, for example, by influencing hypothalamic–pituitary–adrenal axis functioning in ways that hasten aging (Berkman, Glass, Brissette, & Seeman, 2000).

Negativity/Hostility

Interactions with close partners involving negativity or hostility—behaviors that often are unresponsive to partners' needs—have been linked to disrupted physiological stress responses (Robles, Slatcher, Trombello, & McGinn, 2014). Studies reviewed by Robles et al. have shown associations between spouses' hostile behaviors (e.g., criticizing) and elevated blood pressure, poorer immune responses, proinflammatory cytokine production, and slower wound healing. For example, wives whose negative behavior was more (vs. less) likely to be followed by husbands' withdrawal showed greater cortisol levels on a day including a conflict discussion (Kiecolt-Glaser et al., 1996). Similarly, anxiously attached wives (e.g., who desire reassurance) paired with avoidantly attached husbands (e.g., who prefer distance) showed atypical patterns of cortisol reactivity in anticipation of a conflict discussion (Beck, Pietromonaco, DeBuse, Powers, & Sayer, 2013), possibly because these spouses have difficulty being responsive to each other's needs. The accumulation of such disruptions in physiological stress responses may lead to increased health risks over the long term (Chida & Steptoe, 2010; Hamer, Endrighi, Venuraju, Lahiri, & Steptoe, 2012). For example, marital and family conflict and intimate partner violence have been associated with poorer physical health, such as cardiovascular disease, chronic pain, and obesity (Pietromonaco et al., 2015; Robles et al., 2014).

Social Rejection

Social rejection, which threatens fundamental needs to belong and to maintain social connections (Baumeister & Leary, 1995), has been tied to health-related biological responses. Threats to the social self (social evaluation, rejection) have been linked to greater cortisol reactivity (Dickerson, Gruenewald, & Kemeny, 2004; Ford & Collins, 2010), proinflammatory cytokine activity (Dickerson et al., 2004), and inflammation (Slavich, Way, Eisenberger, & Taylor, 2010). Inflammation also heightens sensitivity to social threat: Participants who received an inflammation-inducing low-dose endotoxin showed greater activity in the amygdala when viewing socially threatening images, which, in turn, was associated with feeling disconnected from others during the task (Inagaki, Muscatell, Irwin, Cole, & Eisenberger, 2012).

Social threats also are associated with poorer sleep patterns and risky behavior such as smoking, binge eating, and less physical activity, which may accumulate to adversely affect health over time. In one daily diary study, students who had lower (vs. higher) self-esteem reported poorer sleep quality, riskier health behaviors, and more physical symptoms on days when they felt more socially rejected (Ford & Collins, 2013). Other work has shown that women who perceived themselves as overweight and who were reminded of the stigma of being overweight (which presumably activated a social threat for these women) felt less able to control their eating and ate more calories than those who read a control article or who did not perceive themselves as overweight (Major, Hunger, Bunyan, & Miller, 2014). All of this work suggests that social threat and exclusion shape health-related biological responses and behavior in ways that are likely to erode health and well-being, particularly if these processes recur over time.

Individual Difference and Contextual Influences

Although many individual difference and contextual factors (e.g., gender, early adversity, poverty, culture, family structure) may influence the processes shown in Figure 1, the focus here is on factors emphasized in relationship science: relational orientations (attachment styles, interpersonal sensitivity, and social goals). Relational orientations shape how people construe their relationship partners and social interactions, and may be linked to health-relevant interpersonal processes by altering cognitive, affective, and behavioral responses in relevant social contexts. Relationship orientations may affect social connection/disconnection directly (i.e., as *main effects*) by influencing the quantity or quality of social connection/disconnection experiences, or by moderating the effects of social connection/disconnection on mediating pathways and health outcomes. For example, relationship orientations may affect people's willingness and ability to cultivate supportive and intimate interactions, or their tendency to experience interpersonal conflict. They may lead individuals to construe social situations in more threatening ways (e.g., overperceiving rejection), and undermine their ability to benefit from protective relationship processes (e.g., failing to see acceptance). As a result, individuals with different relational orientations may be more or less sensitive to the effects of social connection or disconnection on the mediators or outcomes indicated in Figure 1.

Attachment Style and Interpersonal Sensitivity

People differ in their expectations and beliefs about their partner's responsiveness and availability, which is reflected in their *attachment style* (Beck, Pietromonaco, DeVito, Powers, & Boyle, 2014; Pietromonaco & Beck, 2015).

Securely attached individuals expect partners to be responsive. Anxiously attached individuals worry that partners will be insufficiently responsive to their needs and are hypervigilant to potential relationship-related threats. Avoidantly attached individuals expect that partners are unlikely to be responsive and prefer self-reliance. Individuals showing either form of attachment insecurity often perceive situations affording either social connection or disconnection differently from those who are securely attached (e.g., Collins & Feeney, 2004; Pietromonaco & Beck, 2015). As a result, attachment insecurity may moderate the link between social connection/disconnection and biological responses to stress, health behaviors, and health outcomes. For example, insecurely attached children and adults are more likely than securely attached to show dysregulated cortisol responses, greater cardiovascular reactivity and inflammation, poorer immune function, riskier health behavior, and poorer health (e.g., clinically diagnosed conditions in children, self-reported physical illnesses in adults) over time (Jaremka, Glaser, Loving, et al., 2013; Pietromonaco, DeBuse, & Powers, 2013; Pietromonaco et al., 2015; Pietromonaco & Powers, 2015), possibly because they are more sensitive to the harmful impact of stressful experiences or less sensitive to the beneficial effects of social connection.

Related constructs that capture difficulties with interpersonal interactions or interpersonal sensitivity (e.g., rejection sensitivity, neuroticism) also have been linked to the onset and diagnosis of disease and mortality rates. Chronically hostile individuals show greater cardiovascular reactivity in negative (but not positive) social interactions (Holt-Lunstad, Smith, & Uchino, 2008) and are at greater risk for cardiovascular disease (Chida & Steptoe, 2009), and neuroticism is associated with objective assessments of disease incidence and mortality (Lahey, 2009). One meta-analysis suggests that constructs related to interpersonal sensitivity (e.g., introversion, rejection sensitivity) are linked to a greater risk of contracting an infectious disease and possibly for developing cardiovascular disease (Marin & Miller, 2013), although methodological concerns limit this analysis (Smith, 2013). Relational orientations may shape whether social connection or disconnection increases or reduces health risks and outcomes.

Social Goals

People enter social relationships with different goals that can influence relationship functioning, and in turn, promote or impair health. For example, approach-oriented social goals lead people to move toward desired positive social outcomes such as intimacy and companionship, whereas avoidance-oriented social goals lead people to retreat from undesired negative outcomes such as rejection (Gable & Impett, 2012). In work primarily examining relationships

between friends or romantic partners, people who chronically hold approach social goals are more likely, over time, to be satisfied with their social life, less lonely, and to have greater psychological well-being, whereas those who hold avoidance social goals are more likely to experience anxiety and loneliness, and to report more physical health symptoms (Gable & Impett, 2012). Similarly, people who hold compassionate interpersonal goals (a focus on others' needs and well-being) evidence better psychological well-being and relationship quality than those who hold self-image goals (a focus on one's own needs and well-being; Canevello & Crocker, 2011). Although these interpersonal goals have not yet been studied in relation to objective physical health outcomes, they are likely to shape experiences of social connection or disconnection and mediating processes, thereby contributing to downstream health outcomes.

Potential Mediating Mechanisms

Social relationships may influence subsequent health and disease outcomes through many mechanisms. Figure 1 illustrates several plausible mediating pathways, with an emphasis on select *intrapersonal* processes—psychological, biological, and behavioral—that are likely to result from *interpersonal* experiences of social connection/disconnection. Although not shown in the figure, it is assumed that the proposed mediators can influence or interact with each other (e.g., emotion regulation can influence health behavior, restorative activities can influence immune function), multiple mediators can operate simultaneously, and complex feedback loops may exist between mediators, health outcomes, and social connection/disconnection. Few studies have directly tested whether one or more of the mediating pathways (e.g., endocrine responses) account for the link between specific forms of social connection/disconnection and specific health outcomes (e.g., cardiovascular health). Furthermore, testing integrated models including multiple mediators will facilitate an understanding of how social relationships may translate into health outcomes (Pietromonaco, Uchino, et al., 2013).

Psychosocial Pathways

Emotion. Emotional responses to social connection or disconnection are likely to be a principle pathway linking close relationships to health outcomes. For example, responsive support reduces negative affect generated by stressors (e.g., stress, anger) that compromise health (Krantz & McCeney, 2002) and fosters positive affective states (e.g., gratitude, love, belonging) that protect health (Pressman & Cohen, 2005). Social connection thereby can help individuals sustain a positive affective balance, facilitate emotion regulation, and build resilience (Feeney & Collins, 2015). Social disconnection, in contrast, elicits potent negative

emotions (e.g., anger, anxiety, depression) that can erode health. Affective states linked to social connection and disconnection likely shape health via multiple downstream pathways including physiological responses (e.g., cardiovascular and cortisol reactivity) and health behaviors (e.g., diet, exercise, sleep), but few studies have examined these specific linkages. One illustrative study showed that on days when couple members shared more physical intimacy, they experienced more positive affect and had healthier cortisol profiles (Ditzen et al., 2008).

Cognition. Social connection/disconnection can shape health and disease outcomes by changing the way people appraise the world, evaluate their coping resources, and construe the self and others (Feeney & Collins, 2015). For example, enacted support reduces the degree to which stressors are perceived as threatening and bolsters perceived (and actual) coping resources. These appraisals, in turn, may shape physiological and coping responses to stressors, and influence the willingness to approach new challenges. For example, one study showed that participants who imagined warm touch from their romantic partner (vs. verbal support) appraised a cold pressor task as less painful and were more willing to take on a second, more challenging task (Jakubiak & Feeney, 2016b). Social connection/disconnection also shapes self-evaluations and self-construals (e.g., self-efficacy, self-esteem, perceived control), which can impact coping and health behavior. For example, social support received during good times (e.g., secure base and capitalization support) increases self-efficacy, perceived control, and interpersonal trust (Feeney, 2004; Gable & Reis, 2010), which may foster more adaptive coping options such as problem-solving or positive reframing, whereas social rejection diminishes self-worth, perceived control, and interpersonal trust (Smart Richman & Leary, 2009), which may trigger maladaptive coping strategies such as rumination, escape, avoidance, and substance use. These specific linkages have yet to be explored in the literature and are fruitful avenues for future research.

Behavior. Social connection/disconnection may shape health and disease outcomes through a variety of behavioral routes including patterns of coping and self-regulation. For example, social connection processes that attenuate negative mood states and boost positive ones can enhance or replenish self-regulatory resources, which can lead to better health practices (e.g., diet, exercise) and self-care. In contrast, social disconnection is resource-consuming and can interfere with self-regulation and increase risky health behaviors (Ford & Collins, 2013). Likewise, cognitive appraisals (e.g., reduced threat, enhanced self-efficacy) and positive emotions can foster adaptive coping and creative problem solving (Feeney & Collins, 2015). Social support in good and bad times can lead to the development of fortitudes (e.g., skills, capacities, perceptions of available support) that contribute to resilience, whereas social discon-

nection can undermine these resources. Support for exploration and intimate interactions can also increase participation in leisure activities (Pressman et al., 2009) and play (Van Vleet & Feeney, 2015), which promote health through psychosocial and physiological pathways.

Relationship satisfaction and security. Social connection/disconnection may shape health outcomes by influencing the development of secure and satisfying close relationships. For example, responsive support enhances satisfaction, intimacy, and trust (Carnelley, Pietromonaco, & Jaffe, 1996; Collins & Feeney, 2000; Gleason, Iida, Shrout, & Bolger, 2008), whereas hostility, blame, and ambivalence erode relationship quality (Clark & Lemay, 2010; Uchino, Smith, & Berg, 2014). Although many of these factors have not been linked directly to health, relationship quality is associated with biological stress responses, immune function, health behavior, and health outcomes such as disease severity and incidence, cardiovascular events, and mortality (Jaremka, Glaser, Malarkey, & Kiecolt-Glaser, 2013; Robles et al., 2014).

Biological Pathways

Social connection/disconnection may impact downstream health outcomes via biological responses, but limited knowledge exists about whether biological responses observed in the lab or to daily stressors actually predict health outcomes years later. Meta-analytic evidence suggests that cardiovascular reactivity to some acute lab stressors (e.g., cognitive stress, public speaking) predicts later cardiovascular risk (e.g., hypertension, coronary artery calcification) 3 or more years later (Chida & Steptoe, 2010). Less evidence exists for the longer term health implications of cortisol responses to acute stressors, but one study of 466 adults suggests that cortisol reactivity to acute cognitive stress tasks is associated with an increase over time in coronary artery calcification (Hamer et al., 2012). Future work needs to determine which types of physiological responses (e.g., cardiovascular, cortisol, immune responses) to which types of stressors (e.g., cognitive stress, relational conflict) or positive relationship processes (e.g., social support, social acceptance) are mediating mechanisms that shape downstream health outcomes, especially if the response patterns accumulate over time (Pietromonaco, Uchino, et al., 2013).

Health and Lifestyle Pathways

Close relationship partners are poised to influence each other's health and lifestyle behaviors such as eating, physical activity, restorative activities (sleep, leisure), substance use, health care utilization, and adherence to medical regimens (Pietromonaco, Uchino, et al., 2013). Emerging research highlights the importance of the relationship context

and the interpersonal processes through which partners may shape each other's health behaviors and outcomes (Beck et al., 2013; Pietromonaco et al., 2015). For example, spouses with a low body mass index (BMI) who expressed high (vs. low) hostility during a conflict had higher levels of appetite-stimulating hormones and reported poorer eating habits (Jaremka et al., 2016). Dyadic processes contribute to smoking (Lewis & Butterfield, 2007), sleep (Troxel, 2010), weight loss (Novak & Webster, 2011), and management of one partner's diabetes (Stephens et al., 2013). For example, one diary study found that on days when spouses provided support and encouragement about following the recommended diet, their partners with Type 2 diabetes were more likely to adhere to their diet on the following day, but on days when spouses exerted pressure or coercion, partners were less likely to adhere to their diet on the following day (Stephens et al., 2013). Despite the importance of dyadic processes, little research has directly examined these processes or the situational and individual difference variables or restorative activities (e.g., leisure) that might modulate efforts to improve health behavior. This area presents the opportunity to test a variety of theoretically interesting hypotheses with potential implications for health.

Coregulation

Coregulation—the dynamic, reciprocal maintenance of psychophysiological homeostasis, or equilibrium, between partners—has widespread implications for emotional and physical health (Sbarra & Hazan, 2008). For example, couple members show similarity in their cortisol levels in their daily lives (Saxbe & Repetti, 2010) and spouses' cortisol patterns during conflict become more similar over time (Laws, Sayer, Pietromonaco, & Powers, 2015). Concordant physiological patterns are dyadic variables that may serve as a pathway to downstream health outcomes. Whether coregulation processes promote or impair health, however, depends on the nature of the physiological linkages, which is likely driven by features of the relationship context such as partners' relationship satisfaction (Laws et al., 2015).

Future Directions and Conclusion

The rich theoretical foundation of relationship science and its focus on dyadic interactions in the lab and in daily life have the potential to guide theory-based translational work. Several research priorities will facilitate the translation of discoveries from relationship science into relationship-based interventions and public health initiatives.

Finer grained theoretical models are needed to understand the biological pathways linking specific relational processes to health endpoints (Eisenberger & Cole, 2012; Pietromonaco, Uchino, et al., 2013). Few studies have examined links between microlevel interpersonal dynamics and mac-

role-level health outcomes such as morbidity and longevity, although a few examples exist (Haase, Holley, Bloch, Verstaen, & Levenson, 2016; Smith et al., 2011). For example, for wives, greater coronary artery calcification was observed when they were low in warmth during conflict, and when they and their husbands were low in affiliation; for husbands, greater coronary artery calcification was found when they were high in dominance, and when they were low in control but their wives were high in control (Smith et al., 2011). These microlevel marital processes may be more closely connected to objective health outcomes than global reports of marital quality, and therefore research relying solely on self-reported marital quality may underestimate the link between marital processes and objective health outcomes (Smith et al., 2011). Capturing microlevel processes (e.g., using advances in mobile technology and daily ambulatory assessments) over time may better reveal the link to objective health outcomes.

Our framework draws from recent theoretical advances (Feeney & Collins, 2015) emphasizing the importance of social connection in both good times and bad times. More needs to be known about how positive relationship processes are associated with immediate and long term biological outcomes, and the specific pathways linking these processes to health. Just as positive and negative affectivity have independent effects on health (Cohen & Pressman, 2006), different forms of social connection and social support may have unique pathways to health.

More knowledge also is needed about proximal and distal mediators linking relationship processes to health. Most studies have emphasized stress appraisals and physiological stress responses as mediators, but other mechanisms, including the largely untested mediating pathways in Figure 1, may link close relationships to health. More needs to be known about how specific relationship processes influence self-regulation and health behavior, and about the complex links among mediators. It also would be valuable to assess multiple physiological systems and markers (e.g., cardiovascular, hypothalamic–pituitary–adrenal activity) to begin to identify interrelationships among biological pathways (e.g., Ge, Pietromonaco, DeBuse, Powers, & Granger, 2016).

Systematic investigation also is needed for key moderators that might alter links between social connection/disconnection and health. In addition to the relational moderators focused on here, other factors to be examined include gender, culture, early adversity, and social class. It also will be important to extend this analysis beyond romantic relationships (which have been the focus of most research) because (a) friends and family are often central to feelings of social connection; (b) many adults do not have romantic partners; and (c) friendships may yield unique benefits for health, thereby offering a fruitful context for relationship-based interventions.

Finally, a pressing need exists for exploratory translational lab and field research before large scale interventions can be confidently designed. Which relationship processes are most modifiable? Which are likely to yield the greatest benefits? Although large-scale interventions may seem daunting, even small interventions may produce large effects. For example, a 21-min intervention to foster the reappraisal of marital conflicts preserved marital quality over 2 years, and declines in conflict-related distress mediated this effect (Finkel, Slotter, Luchies, Walton, & Gross, 2013). Combining assessments of health-relevant parameters with such interventions are needed to determine if improvements in relationship processes are accompanied by improvements in health outcomes. One couple education intervention (vs. control) reduced cortisol reactivity during lab conflict discussions (Ditzen, Hahlweg, Fehm-Wolfsdorf, & Baucom, 2011), and a brief communication training reduced blood pressure reactivity during problem solving discussions in adults with hypertension (Ewart, Taylor, Kraemer, & Agras, 1984). Similarly, spouses who received an intervention to enhance warm physical contact showed greater posttreatment decreases in α -amylase and blood pressure, and greater increases in salivary oxytocin compared to controls (Holt-Lunstad, Birmingham, & Light, 2008).

Decades of research have established the importance of close relationships for human health, but much remains to be learned about specific mechanisms of action and potential avenues for intervention. Emerging work offers insights into the types of social dynamics that are consequential for health, and the pathways through which they operate. To move forward, both a sustained emphasis on interpersonal processes as well as collaborative efforts between close relationships scholars and health psychologists are needed. The current analysis is intended to be useful in inspiring and guiding this next generation of research.

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