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Physiological Measures of Wellness and Message Processing

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Summary and Keywords

Research has shown that the expression of affection and other forms of prosocial communication between two or more people promotes wellness and has the potential to increase life expectancy. The human body contains multiple physiological subsystems that all contribute to the overall health and well-being of an individual; the simple act of engaging in prosocial communication has been shown to positively influence one's health and well-being. The specific benefits of engaging in prosocial communication are not limited to one specific physiological subsystem; it is the pervasiveness of this benefit that is so important. The benefits of prosocial communication range from building the body's defense systems to increasing the effectiveness of recovery; in essence, prosocial communication increases the body's overall integrity and rejuvenating power. These benefits have been observed for a variety of prosocial behaviors, including the expression of affection, touch, social support and cohesion, and social influence. The health benefits of prosocial communication point to the importance of considering prosocial communication when designing health and risk messages.

Keywords: prosocial communication, affection, health, stress, physiology

Humans are a profoundly social species—among the most social of all the social primates—so it is easy to understand why the quality of social and relational interaction has such a strong and pervasive association with health and well-being. On the range of human interactions, prosocial communication stands out as a principal predictor of physical and mental wellness and quality of life, as demonstrated especially in research conducted since the 1990s associated with physiological measures of wellness. In particular, affectionate communication has been linked to improved stress management and to both higher and lower immunocompetence. In many ways, affectionate communication functions as a form of positive support, often the goal of interventions aimed at promoting uptake and maintenance of habits designed to achieve health and reduce risk (e.g., risks associated with exaggerated physiological responses to stressors).

This article introduces some of these principal physiological measures, defining their role in assessing communication outcomes and elucidating their benefits and limitations. The overarching aims focus on defining physiological measures utilized in communication research, and conveying their roles in demonstrating the significance of communication—specifically prosocial/affectionate communication—for health and wellness. This serves the purposes of introducing methods to health and risk communicators that they may want to incorporate in planning assessment of strategic messaging and arguing for prosocial/affectionate messages' place in health and risk messaging.

Prosocial communication comprises those expressive behaviors—both verbal and nonverbal—that encode messages of care and support for the receiver. Floyd and Morman (1998) explained in reference to affectionate communication that such communication can denote messages of care and support explicitly, such as the statement "I love you." Prosocial communication also can connote messages of care and support more implicitly, however. When one person spends time and attention listening to or doing favors for another, for instance, such behaviors can carry a strong connotation of love, affection, and care (see, e.g., Floyd, 2014).

Prosocial communication is of interest to social and behavioral scientists not only because it contributes to relationship quality (Jakubiak & Feeney, IN PRESS) and affects interpersonal perceptions (Gentsch, Panagiotopoulou, & Fotopoulou, 2015), but also because it supports physical health and mental wellness. This article begins with a brief overview of the physiological systems typically studied in research on prosocial communication, and then reviews findings relating health outcomes to affectionate communication, interpersonal touch, cohesion and social support, and social influence. Finally, it concludes with informed speculations about how such methods and findings also can be useful for health and risk message designers.

Physiological Systems

To appreciate how prosocial communication can affect the body, it is useful to review the systems, outcome measures, and measurement tools commonly used in psychophysiological research. Social science research employing a psychophysiological approach typically focuses on processes and outcomes in the brain and central nervous system, as well as the cardiovascular, hematologic, endocrine, and immune systems. Each system is briefly reviewed in this section.

Brain and Central Nervous System

Although it accounts for only 2% of an average human's body mass, the brain consumes approximately one-fifth of the body's energy. With the exception of certain reflex actions, the brain controls every activity and function in the body. The cerebrum, whose frontal, parietal, occipital, and temporal lobes comprise the largest part of the brain, governs functions related to language and communication, olfaction, learning and memory, movement, emotion, and sensory processing, among others. Other neurological structures, including the cerebellum and brain stem, serve important functions related to consciousness, pain sensitivity, muscle movement, equilibrium, and cardiovascular and respiratory control. The brain and spinal cord together comprise the central nervous system, whose purpose is to coordinate virtually all bodily activity and movement.

Activity in the brain is typically measured through various neuro-mapping techniques. One technique is the electroencephalogram (EEG), which assesses electrical activity in various neurological regions via electrodes attached to the scalp (Abou-Khalil & Musilus, 2006). A second approach, positron emission tomography (PET), measures photons released when electrons in the brain collide with positrons that are produced by the breakdown of molecules in radioactively labeled water previously injected into the participant (Muehllehner & Karp, 2006). Magnetic resonance imaging (MRI) maps the movement of hydrogen protons after they have been aligned magnetically and then had their alignment disrupted (Elster, 1986). Finally, functional magnetic resonance imaging (fMRI) indexes changes in blood flow to specific regions of the brain by measuring the magnetic properties of blood (Matthews & Jezzard, 2004).

Nervous system activation beyond neurological activity is often indexed via outcomes such as galvanic skin response, skin temperature, and pupil dilation, all of which are indicative of general arousal. Galvanic skin response measures changes in perspiration that indicate arousal, stress, or both (Vetrugno, Liguori, Cortelli, & Montagna, 2003). Skin temperature is assessed with probes attached to the epidermis and is often considered an indirect measure of changes in emotion or stress (e.g., Rimm-Kaufman & Kagan, 1996). Pupil dilation, which is an indicator of interest, arousal, and affective processing, can react to stimuli in as fast as a fifth of a second and is measured via a pupillometer (Partala & Surakka, 2003).

Cardiovascular System

The cardiovascular system—also known as the *circulatory system*—comprises the heart and the various arteries, veins, capillaries, and other vessels through which blood is circulated. The heart contracts on a continuous basis to distribute oxygenated blood to the body and deoxygenated blood to the lungs (where it is reoxygenated).

Social science research measures two aspects of cardiovascular activity most often. First, *pulse rate* indexes the number of contractions the heart undergoes during a specified duration, such as a minute. Second, *blood pressure* comprises the force exerted against the arterial walls by circulating blood. Systolic blood pressure is the force of arterial exertion during cardiac contractions (i.e., when the heart is in systole), and diastolic blood pressure is the force of exertion when the heart is at rest in between beats (i.e., in diastole). Pulse rate and blood pressure are both responsive to changes in ambient temperature, arousal, metabolic demand, and emotion (see Borg & Linderholm, 2009).

Hematologic System

Hematology is the branch of medicine dealing with blood, blood chemistry, and blood disorders. Some characteristics of blood chemistry are strongly responsive to changes in perceptual and socioemotional experiences. For example, exposure to a stressful event can elevate blood glucose, which fuels the fight-or-flight response (Garrett & Grisham, 2002). Blood glucose can be measured in its average circulating level, or in the form of *glycosylated hemoglobin* (abbreviated as HbA_{1c}), an index of the average level of blood glucose over the previous 10 to 12 weeks. Social scientists have measured both forms of glucose as markers of stress and social behavior (see, e.g., Floyd, Hesse, & Haynes, 2007; Halford, Cuddihy, & Mortimer, 1990).

Social scientists have also measured *blood lipids*, such as cholesterol and triglycerides, and *lipoproteins*, such as high-density lipoprotein (HDL, also called “good cholesterol”) and low-density lipoprotein (LDL, also called “bad cholesterol”). Similar to glucose, lipids and lipoproteins are elevated in the bloodstream in response to stressors (Stoney, Matthews, Mcdonald, & Johnson, 2007), as well as to feelings of depression and levels of social and emotional support (Horsten, Wamala, Vingerhoets, & Orth-Gomer, 1997; Ormiston, Wolkowitz, Reus, & Manfredi, 2003).

Endocrine System

The *endocrine system* consists of a network of glands that produce and secrete hormones. A *hormone* is a chemical that binds to cells containing receptor sites specific to that hormone. Once bound, these chemicals alter the metabolic processes of the receptor cells. Hormones are measured by submitting body fluids to biochemical *assays*, which are procedures for quantifying the amount or activity of a biologic substance (see Floyd & Roberts, 2009).

Research in the social sciences has focused primarily on the activities of particular glands, including the pituitary and adrenal glands. The pituitary gland produces eight different hormones, four of which have been of interest to social scientists. First, *oxytocin* initiates uterine contractions and the let-down reflex in expectant mothers, and it also appears to play a key role in attachment and emotional bonding (Young & Wang, 2004). Second, *vasopressin* regulates water absorption by the kidneys and is also implicated in pair bonding (Hammock & Young, 2006). Third, *prolactin* stimulates milk production in lactating women and is active in response to emotion in both women (Turner et al., 2002) and men (Fleming, Corter, Stallings, & Steiner, 2002). Finally, the *adrenocorticotropic hormone* initiates one of the body's principal responses to stressors, known as the *hypothalamic-pituitary-adrenal (HPA) axis* (Aguilera, 1994).

The adrenal glands are of interest to social scientists primarily because they produce *cortisol*, a steroid hormone that is elevated in response to stress (Burke, Davis, Otte, & Mohr, 2005). These glands also secrete small quantities of *androgens*, the male sex hormones, and *estrogens*, the female sex hormones (Rainey, Carr, Sasano, Suzuki, & Mason, 2002). Androgen levels in women and estrogen levels in men are regulated by the adrenal glands.

Immune System

The *immune system* comprises a coordination of structures and processes that protect the body against disease by identifying and destroying tumor cells and pathogens (Klosterman, 2009). The immune system employs two separate but interrelated responses: the *innate* immune response and the *adaptive* immune response. Innate immunity is a nonspecific immune response that uses inflammation, antibodies, and/or a cellular response to react to threats but does not generate ongoing immunity to those threats. In contrast, adaptive immunity uses a pathogen-specific response that generates immunity—or *immunological memory*—that impedes a pathogen's ability to cause illness if the body encounters it again.

No single outcome provides a standard, global assessment of immune function, also known as *immunocompetence* (see Farnè, Boni, Corallo, Gnugnoli, & Sacco, 1994). To investigate immunocompetence, some researchers assess the number of one or more specific immune cells in the body. An adequate number of different types of immune cells is necessary for the body to mount an effective immune defense, so cell counts provide one assessment of that ability. Some studies count white blood cells, which are known as *leukocytes* (Bongartz, Lyncker, & Kossman, 1987). Others focus on specific forms of leukocytes, such as eosinophils (Schmid-Ott et al., 2001) or various forms of leukocytes called *lymphocytes*, including T-helper cells (Kawakami et al., 1997) and T-cytotoxic cells (Scanlan, Vitaliano, Ochs, Savage, & Borson, 1998). Still others count the number of natural killer cells (Brosschot et al., 1991).

A second approach to adjudicating immunocompetence is to quantify the production of various proteins, including antibodies and cytokines. In social science research, three commonly measured types of antibodies are immunoglobulin A (Deinzer & Schüller, 1998), immunoglobulin G (Nakata et al., 2000), and immunoglobulin M (Glaser, Mehl, Penn, Speicher, & Kiecolt-Glaser, 1986). Commonly measured cytokines include interleukin-1β (Pugh et al., 1999), interleukin-2 (Rapaport & Stein, 1994), and interleukin-6 (Goebel, Mills, Irwin, & Ziegler, 2000). In most cases, higher levels of antibody or cytokine correspond to stronger immune function, but two exceptions are worth noting. Proinflammatory cytokines—such as interleukin-1, interleukin-6, and tumor necrosis factor-α—are elevated in response to systemic inflammation and therefore reflect weaker immune function (Ershler & Keller, 2000). Similarly, antibodies against latent viruses—such as Epstein-Barr virus or herpes simplex virus—are elevated in response to viral replication, which can reflect a breakdown in cellular immune response (Jenkins & Baum, 1995).

People differ in their level of immunocompetence, and some of that variation is attributable to characteristics of the social environment (see Hertz-Picciotto et al., 2008; Kiecolt-Glaser et al., 1988). Two studies have demonstrated relationships between the communication of affection and immunocompetence, although their results conflict. In a study of healthy adults, for instance, Floyd, Pauley et al. (2014) found that participants' traitlike level of affectionate communication was directly related to the efficacy of natural killer cells ($\beta = .43$), a form of white blood cell that attacks virally infected cells, as well as to circulating levels of immunoglobulin M (IgM), an antibody that leads other immune cells to destroy invading substances ($\beta = .36$). These findings suggest that the tendency to communicate affection is associated with higher immunocompetence, and yet Floyd, Hesse, Boren, and Veksler (2014) reached a contradictory conclusion, finding that trait affection is correlated with the number of antibodies to latent Epstein-Barr virus (EBV; Spearman's $\rho = .24$). Higher numbers of EBV antibodies connote an impaired ability of the immune system to keep EBV in a latent state, so this finding suggests that the tendency to communicate affection is related to lower immunocompetence. These contrasting conclusions are not necessarily reflective of differences in sample size or sample characteristics; rather, they likely reflect the complexity of the immune system itself and the fact that a given behavior may contribute to improvements in some outcomes of the system, while simultaneously impairing other outcomes.

Activities of the nervous, cardiovascular, hematologic, endocrine, and immune systems are frequently indexed in social science studies that were focused on a range of prosocial communication behaviors. Representative research on affectionate communication, touch, social support, social influence, and intimacy is reviewed subsequently.

Affectionate Communication

Affectionate communication comprises the verbal and nonverbal behaviors that people use to express love, care, and fondness to others (Floyd, 2006A). Multiple studies have documented that the expression and receipt of affectionate messages are associated with physical health. In particular, affectionate communication has been shown to be strongly related to the body's ability to manage stress and to recover from stressful events. When people encounter stress-inducing events—*stressors*—it is adaptive to mount an adequate stress response, but also to avoid overreacting, as exaggerated stress responses can cause unnecessary damage to the body. Several studies have shown that the presence of affectionate communication serves to buffer or protect individuals from overreacting physiologically to threats. Grewen, Anderson, Girdler, and Light (2003), for example, found that hugging and holding hands with a romantic partner before a public-speaking stressor led to lower blood pressure responses to the stressor. Similarly, self-reporting more verbal and socially supportive affection prior to a laboratory stressor leads to lower cortisol and heart rate elevations in response to the stressor (Floyd et al., 2007B). These findings suggest that affectionate communication can help to keep individuals from experiencing exaggerated stress reactions.

Several studies have shown that affectionate communication correlates with regulation of the HPA axis, one of the body's principal systems for responding to stressors. One investigation demonstrated that affectionate communication in close relationships covaries strongly (r = .56) with 24-hour variation in cortisol levels, which is a marker of healthy HPA function (Floyd, 2006B). A follow-up study of marital dyads by Floyd and Riforgiate (2008) again found a significant positive association between affectionate communication and cortisol variation. Further research has even found that women who experienced physical affection or positive sexual interaction with a romantic partner on a particular day reported lower stress the following day (Burleson, Trevathan, & Todd, 2007). Floyd et al. (2007A) even demonstrated that engaging in written affectionate communication after a series of laboratory stressors accelerates the return of cortisol to baseline levels.

Interpersonal Touch

In the process of human development, touch is the first of the senses to emerge. Prelinguistic infants rely heavily on tactile exploration to make sense of their environments, and the receipt of touch from caregivers is essential to their healthy physical and emotional development. On the contrary, a lack of interpersonal touch during infancy and childhood can accompany delays in both physical and cognitive development (Gallace & Spence, 2010).

The importance of interpersonal touch (also known as *tactilics* or *haptics*) extends to adulthood and can be beneficial to one’s health. For instance, affectionate touch has been linked to immunocompetence, decreased heart rate, blood pressure, and lower stress, whereas a lack of touch has been linked to greater levels of stress and virus susceptibility.

What Is Interpersonal Touch?

Interpersonal touch is a diverse physical activity that represents tactile contact between two or more individuals. Touch can take place in a variety of situations, for many reasons and in many ways, and is not limited to hand-to-hand contact; any form of skin contact can be classified as touch (Hertenstein, 2011; Pisano, Wall, & Foster, 1986). Shaking hands, kissing, hugging, a pat on the back, and sexual intercourse are just a few ways in which humans use touch to communicate.

Jones and Yarbrough (1985) reported that interpersonal touch serves a wide variety of functions, such as to show positive and negative affect (Patterson, 1976), to indicate play, to serve a task (e.g., touch during a doctor’s physical exam), to regulate interaction (e.g., turn-taking), to influence others (Guéguen, Meineri, & Charles-Sire, 2010), and to heal (Kerr, Wasserman, & Moore, 2007; Tang, Tegeler, Larrimore, Cowgill, & Kemper, 2010).

Despite the numerous functions that touch serves, it is the context and interpretation of the touch that dictates whether it is received positively or negatively. For instance, many acts of violence and aggression involve touch. Physical bullying can involve direct contact between a bully and victim and typically includes harmful touching such as hitting, pinching, punching, and kicking (Aluede, Adeleke, Omoike, & Afen-Akpaida, 2008). In contrast, there are numerous benefits to touch in social relationships.

One form of interpersonal touch in relationships that often produces positive effects is affectionate touch. According to Floyd (2006A), *affectionate touch* occurs when a sender attempts to convey kindness, love, or caring for a recipient through physical contact. Affectionate touch can include both sexual and nonsexual tactile behaviors that signify endearment and intimacy, including hugging, kissing, and holding hands (Pisano et al., 1986). In close relationships, people typically enjoy both giving and receiving affectionate touch (e.g., Anderson & McCormack, 2014; Jakubiak & Feeney, in press). There is evidence that when affectionate touch is regarded as both good and desired, it can positively benefit one's physical health.

Physical Benefits of Affectionate Touch

Positively valenced affectionate touch can provide a number of beneficial health outcomes. For instance, research has found that the receipt of affectionate touch covaries with stronger immune systems (Cohen, Janicki-Deverts, Turner, & Doyle, 2015), lower resting blood pressure (Holt-Lundstad, Birmingham, & Light, 2008; Light, Grewen, & Amico, 2005), and less overall stress (Cohen et al., 2015; Ditzen et al., 2007).

Research on physical intimacy and health indicates that being physically intimate is generally beneficial to overall well-being and the immune system. For instance, Stadler, Snyder, Horn, Shrout, and Bolger (2012) investigated the effect of changes in intimacy on romantic couples' somatic symptoms, which included backaches and muscle aches, headaches, insomnia, an upset stomach, rash or skin irritation, and being sick or injured over a 33-day period. When couples experienced an increase in physical intimacy, their somatic symptoms decreased over the following days.

People who receive affectionate touch also have less pronounced physiological reactivity to stressful events. For example, Ditzen, Hoppmann, and Klumb (2008) found that people who spent more time being physically intimate with their partners had less severe cortisol responses to work-related stressors. As cortisol level is an indicator of the body's stress response, they concluded that the amount of physical intimacy exchanged acts as a stress buffer; people had a less-pronounced cortisol response to stressors when they engaged in more physical intimacy. Similarly, in an earlier study, Ditzen et al. (2007) found that women who experienced physical partner contact before a stress induction exhibited lower heart rates and cortisol than did women who received either verbal social support or no social interaction. Whitcher and Fisher (1979) also found that patients who are touched by nurses the day before surgery show decreased stress, as evidenced both by self-reports and by physiological measures such as lower heart rate and blood pressure (see also Henricson, Ersson, Määttä, Segesten, & Berglund, 2008, who demonstrated a similar effect among intensive care patients). This stress-buffering effect is a relevant factor for physical health because stress has a widely recognized negative effect on general health (see Lynch, Everson, Kaplan, Salonen, & Salonen, 1998; Manuck, Kasprowicz, & Muldoon, 1990).

Affectionate touch is also relevant to hormone levels and blood pressure. In an experiment, Holt-Lundstad et al. (2008) trained one group of participants to give their romantic partners a head, neck, or shoulder massage for 30 minutes a day, at least three times a day. Another group simply recorded their daily intimate touch. After four weeks, couples in the intervention group had higher salivary oxytocin. Whereas oxytocin does not necessarily promote health directly, it does promote emotional bonding (Young & Wang, 2004), which can be beneficial to health. Further, there is some limited evidence that higher baseline oxytocin corresponds to lower resting systolic blood pressure (Light et al., 2005). The treatment group also experienced lower alpha amylase. Alpha amylase indicates autonomic nervous system arousal; therefore, those couples were experiencing less sympathetic nervous system activity. Men in the treatment group also had lower systolic blood pressure.

Much of the literature on affectionate touch and health focuses on specific acts of physical intimacy. The following sections briefly review the effect of kissing, hugging, and sexual intimacy on physiological measures of health.

Kissing

Kissing has both positive and negative health consequences. Because kissing involves close physical proximity and often the exchange of saliva, kissing can have deleterious health consequences due to disease transmission (e.g., Cowan et al., 2002; Schoch-Spana, 2000; Tully et al., 2006). In contrast, there is evidence that kissing specifically can benefit allergic reaction. In one study, participants had reduced allergic skin weal reactions to dust mites and pollen after a 30-minute kissing session (Kimata, 2003). The individuals in the control group who were not instructed to increase kissing did not experience any difference on these measures. Similarly, Kimata (2006) found that kissing for 30 minutes decreased allergen-specific immunoglobulin E (IgE) production. Because allergic skin weal reactions and IgE are increased by stress, Kimata proposed that kissing acts a stress-reducing activity, and that it can thereby buffer allergic reactions.

Kissing has also been linked to decreases in overall stress. Floyd et al. (2009) found that as romantic partners increased their kissing behavior, they reported their lives as less stressful, as compared to a no-kissing control group. As previously discussed, this reduction in stress assists in lowering blood pressure and promoting a stronger immune system, both of which contribute to a greater physical well-being.

Hugging

Hugging also corresponds to health. Cohen et al. (2015) asked individuals in romantic relationships about the amount of hugging and social support they received from their partners. They then quarantined the participants and exposed them to one of two rhinoviruses. Those who perceived more frequent hugging and greater social support were less likely to experience infection from the virus (based on viral-specific antibody levels). Of the individuals who did become infected, those who perceived more social support and hugging also experienced less nasal congestion. Cohen et al. (2015) explained that affectionate communication has the potential to decrease the experience of stress, thereby strengthening one’s immune system by making it harder for a virus to replicate once in the human body (Cohen, Doyle, & Skoner, 1999). However, the experience of affectionate touch may reduce the amount of felt stress, thus bolstering protection against viral infection.

Sexual Intimacy

A few studies suggest that sexual intercourse specifically has distinct desirable physiological health outcomes. For instance, Brody (2006) found that, when exposed to a stressor, people who had experienced penile-vaginal intercourse within the previous 14 days had lower blood pressure reactivity than people who had engaged in noncoital sex, masturbation, or no sexual acts. Similarly, Brody, Veit, and Rau (2000) found that frequency of sexual intercourse was related to greater heart rate variability and lower diastolic blood pressure. Furthermore, there is an inverse relationship between frequency of orgasms and premature mortality (Levin, 2007). One possible explanation for the beneficial effect of sex on health is the release of oxytocin, which can increase the buffering effect of social support on the cortisol stress response (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003), during orgasm. However, these studies did not control for orgasm frequency, and this explanation does not align with the finding of Brody et al. (2000) that sexual intercourse, but not masturbation, is related to greater heart rate variability and lower diastolic blood pressure. Therefore, further research is necessary to draw definite conclusions about the mechanism by which intercourse affects physiological health.

Cohesion and Social Support

Physiological health is bolstered not only from personal care, but also from the support provided by one's social networks. *Social support* is a broad term referring to the means by which people's social networks assist in both the emotional and physical regulation of their well-being (see Barrera, 1986; Gottlieb & Bergen, 2010; MacGeorge, Feng, & Thompson, 2008). Several empirical studies have illuminated connections between social support and health. For instance, Uchino, Cacioppo, and Kiecolt-Glaser (1996) found that stronger social support networks lead to greater immunocompetence, which is beneficial both for preventing disease and for surviving existing diseases. In a study of HIV+ men, Theorell et al. (1995) found that over a five-year period, HIV+ men who experienced low social support from their social networks showed a 64% decrease in helper T-cells, whereas those with high social support from their social networks showed only a 37% decrease. Although both groups showed a decrease in helper T-cells, the high social support group decreased at about half the rate of the low social support group, indicating that social support can drastically inhibit the rate of helper T-cell deterioration.

The link between social support and immune function also has been studied in reference to cancer patients, where researchers have examined the relationship between social support and natural killer cell activity (e.g., Lutgendorf et al., 2005; Uchino, 2006). Natural killer cells play a key role in the detection and host rejection of cancerous and virally infected cells. Lutgendorf et al. (2005) found that ovarian cancer patients who had greater social support also had greater natural killer cell activity in peripheral blood and in tumor-infiltrating lymphocytes.

Social support also has been studied in relation to both chronic pain and depression in cancer survivors. Research has shown that chronic pain experienced by breast cancer survivors is far more pervasive than for adults with histories of other cancer types, with roughly 30% experiencing chronic pain in the five years after treatment (Peuckmann et al., 2009; Sheridan et al., 2012). Between 30% and 40% of cancer survivors show an increase in depressive symptoms (Bower, 2008; Mitchell, Ferguson, Gill, Paul, & Symonds 2013; Reyes-Gibby, Aday, Anderson, Mendoza, & Cleeland, 2006). Despite these negative posttreatment symptoms, a study by Hughes et al. (2014) has found that one’s social support network may assist in reducing the severity of said symptoms. Of 164 breast cancer survivors, those with greater social support prior to treatment experienced lower levels of depressive symptoms and pain over six months after treatment than did those with less social support. Further investigation found that women with greater pretreatment social support had lower levels of interleukin 6, a proinflammatory cytokine that can cause increased pain, negative mood, lethargy, and loss of appetite (Dantzer, O’Connor, Freund, Johnson, & Kelley, 2008). Ultimately, the results of Hughes et al. (2014) provide evidence that one’s social support system prior to cancer treatment may play a pivotal role in the amount of pain and depressive symptoms experienced posttreatment. Those individuals with a weaker social support network, therefore, may be at a greater risk of posttreatment pain and depression.

It would seem as though having a stronger social support system is beneficial for the body’s defense against disease. However, social support also may be beneficial for the prevention of certain diseases, such as cardiovascular disease. One reason that social support may be beneficial to cardiac patients is because of the aforementioned stress-buffering qualities that it can provide. By reducing the amount of stress that cardiac patients endure, they may be at less risk of experiencing dangerous cardiovascular changes (e.g., high blood pressure spikes), whereas lack of social support may exacerbate these problematic symptoms (Uchino, 2006). For instance, Wang, Mittleman, and Orth-Gomer (2005) found that women already diagnosed with coronary artery disease showed signs of faster disease progression over a three-year period when their perceived emotional social support was low.

Social Influence

Prosocial messages also can affect health, simply by increasing the chances that someone will make healthy behavioral choices. The social control hypothesis of Umberson (1987) claims that relationships enhance health because close friends and relatives persuade people to participate in healthy behaviors and refrain from unhealthy behaviors. Social influence, or social control, is defined an attempt to influence another person using actions or expressed opinions (Lewis & Butterfield, 2007). Specifically, *positive* social influence (as opposed to negative social influence) comprises prosocial messages such as positive reinforcement, persuasion, influencing by example, and logic.

In essence, the use of social influence regarding health-enhancing behavior communicates that the actor cares about the other person's well-being. Whereas social influence can have direct physiological outcomes when presented in the form of socially supportive messages, its principal health effects ensue when targets listen to the message and react in a way that is beneficial to their health. Individuals are more likely to act on health-related social influence when those messages come from someone to whom they feel close (Lewis & Rook, 1999); therefore, such messages from friends, family, and partners can be quite salient.

Empirical evidence indicates that positive social influence from a partner or a social network member predicts the occurrence of targeted behaviors, such as exercise, relaxation, diet, going to the doctor, sleep, smoking cessation, drinking less caffeine, wearing a seatbelt, and losing weight (Lewis & Butterfield, 2007; Lewis & Rook, 1999). Clearly, most of these acts have short- and long-term physiological consequences. For instance, stopping smoking may improve short-term respiratory heath, but it also lowers the chance of lung cancer in the future.

As indicated previously, social influence concerning health behaviors comes in two forms: one that encourages health-promoting choices and another that discourages health-compromising choices. As an example of social influence that encourages health-promoting behavior, many researchers have noted that positive social influence can lead to beneficial outcomes regarding diet and exercise (e.g., Burke & Segrin, 2014; Lewis & Butterfield, 2007).

Beyond encouraging healthy behavior, social influence is also helpful for discouraging behavior that can have negative health consequences. In a sample of smokers, for instance, Scholz et al. (2013) found an inverse relationship between positive social influence from a partner regarding smoking cessation and the number of cigarettes smoked. Similarly, Westmaas, Wild, and Ferrence (2002) found that a higher number of influence attempts from partners, friends, and spouses was associated with greater reduction in smoking for men. Each of these influence attempts comprises prosocial messages sent by people who care about the target, making social influence an excellent example of how hearing and reacting to a prosocial message can benefit health.

It is important to note that these social influence messages are prosocial messages focused on encouragement and modeling. Social influence that incites negative emotions such as fear and shame (i.e., negative social influence; Lewis & Butterfield, 2007) also can affect behavior, although there is some evidence suggesting that negative social influence messages are more likely to backfire than positive social influence messages (Craddock, vanDellen, Novak, & Ranby, 2015).

In order for social influence to benefit a person's health, the message must be focused on health enhancement rather than encouraging health-compromising behavior. For example, in their survey of 105 couples, Markey, Markey, and Gray (2007) found that messages from a partner aimed at improving health predicted the targeted outcomes, but health-undermining messages (such as encouraging excessive drinking) predicted *unhealthy* outcomes. Thus, people close to us have the ability to affect our health via social influence, for better or worse.

When aimed at changing health-related behaviors, social influence messages can affect our well-being because they can increase the likelihood of making healthier decisions. These messages are particularly salient when they are sent from close others. Social influence, therefore, is one of many ways that interpersonal communication can be used deliberately to improve health.

The experience of sending and receiving prosocial communication has vital implications for health and wellness. Both direct and indirect pathways link prosocial communication with a healthier life, as seen by better immunocompetence and lower stress load, among other effects. Prosocial communication also can be used to influence others to live a healthier lifestyle by avoiding health-compromising behaviors and engaging in health-promoting behaviors. The use of prosocial communication should be considered as a complement to modern medicine and health message design, in that it can add directly to the overall wellness of a patient (e.g., reducing stress or strengthening the immune system) or influence the person to adhere to health-promoting behaviors and avoid compromising behaviors.

Relating Health Measures and Prosocial Communication to Health and Risk Message Design

The research linking prosocial communication to physiological health benefits has implications for the design of effective health and risk messages. Specifically, there is reason to believe that when people receive prosocial communication—such as that characterized by affection, empathy, and compassion—they feel listened to and understood. In turn, they may feel less stress about the message, may pay better cognitive attention to it, and may be more likely to follow its recommendations.

A robust amount of literature has investigated the use of negative emotion—such as that produced by appeals to fear or anger—in health and risk messages. Compelling evidence suggests that a negative affective approach can enhance message recipients' abilities to process message details cognitively (e.g., Das, de Wit, & Stroebe, 2003). Nonetheless, positive emotion shows advantages over negative emotion in message processing. For instance, a happy mood promotes greater message scrutiny than a sad mood for uplifting messages, although it promotes less message scrutiny for depressing messages (see, e.g., Wegener, Petty, & Smith, 1995).

The efficacy of prosocial and positive affect communication may lie in its ability to induce calm, minimize distress, and promote open-mindedness in message recipients. Relevant to this claim is the work of positive psychology scholar Barbara Fredrickson. First, her *undoing hypothesis* (Fredrickson & Levinson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000) posits that when positive emotions are induced, they serve to counteract the physiological problems associated with negative emotion. From that premise, one can deduce that prosocial messages—whether verbal or nonverbal—can reduce distress and its physiological sequelae in their receivers. Second, Fredrickson's *broaden-and-build theory* (Fredrickson, 2001, 2004; Garland et al., 2010) proposes that inducing positive affect builds cognitive resources, promotes creativity, and broadens people's abilities to consider diverse perspectives. This theory would suggest that receivers of health and risk messages are motivated to receive those messages in an active, open-minded manner to the extent that the messages induce positive emotion.

Indeed, such an approach can motivate people not only to be more receptive to a message's recommendations, but also to comply with them. Compelling evidence that prosocial communication enhances compliance comes from the literature on physician empathy. Specifically, physicians' empathic and interpersonal skills have been cited as a critical determinant of whether patients adhere to prescribed treatment regimens (DiMatteo et al., 1993). Hojat et al. (2010) found that higher levels of trait empathy predicted patient compliance rates of more than 80%. Eisenthal, Emery, Lazare, and Udin (1979) reported that physicians' expressions of understanding, in particular, predicted patient compliance in a psychiatric setting, whereas Freemon, Negrete, Davis, and Korsch (1971) reported the same in a pediatric context. Moreover, objectively coded nonverbal communication skills, such as physicians' sensitivity, tone of voice, and decoding ability, predict patients' compliance with scheduled physician appointments (DiMatteo, Hays, & Prince, 1986).

Adapting a Prosocial Frame in Health and Risk Messaging

Multiple studies support the contention that prosocial communication, in its wide variety of forms, promotes a diversity of health and well-being indices, including stress management, immunocompetence, and cardiovascular function. To the extent that people are appreciated, loved, supported, and listened to, they tend to thrive, which is perhaps unsurprising for a species with pronounced needs for affiliation and social inclusion (see, e.g., Baumeister & Leary, 1995). One important implication of the strong link between prosocial communication and wellness is that health and risk messages may benefit from adopting a prosocial frame. Several studies support the contention that communication behaviors that induce positive affect and convey empathic understanding promote both cognitive processing and compliance, which are aspirational outcomes for many messages regarding health and risk.

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