Assessment of Mood:

Examining Mood Measurement in Psychology, Health, and Medicine

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To appear in the *Cambridge Handbook of Psychology, Health, and Medicine (3rd Edition)*

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Advances in psychology, physiology, and medicine have led to rigorous examinations of the role of affect and emotion in health. We review the role of negative and positive emotions in health research and discuss some of the most prominent measures of mood.

Negative emotions and health

Researchers have focused on specific experiences of negative affect that have emerged as important risk factors in health. We examine three negative emotions below: anger, anxiety, and sadness/depression.

ANGER

Several studies have reported on the negative health consequences of anger on cardiovascular responses and incidence of coronary heart disease (CHD) (Kawachi *et al*., 1996). Hostility is a greater risk factor for CHD than smoking, high blood pressure and high cholesterol (Chaput *et al*., 2002). Hostility is related to heightened cardiovascular stress (Davis *et al*., 2000) and delayed cardiovascular recovery from evocative situations, an important factor in the development of hypertension and cardiovascular disease (Faber & Burns, 1996). There is some evidence that inhibiting anger is related to heart disease (MacDougall *et al*., 1985), consistent with the finding that emotional suppression produces increased cardiovascular reactivity (Roberts, Levenson, & Gross, 2008). In patients with CHD, hostility exacerbates symptoms and increased mortality (Wong, Sin, & Whooley, 2014).

Hostility is implicated as a predictor in the development of depression (Stewart, Fitzgerald, & Kamarck, 2010), another negative emotion related to heart disease (Anderson, 2003). In addition, for formerly depressed patients, hostility is associated with increases in subsequent depressive symptoms (Rude, Chrisman, Denmark, & Maestas, 2012), implicating a connection to depression relapse.

ANXIETY

Although stress can be beneficial most studies have found an association between symptoms of anxiety and risk of developing CHD, even when factors like family history of CHD were considered (Kubzansky & Kawachi, 2000). This link may exist because of repeated activation of the sympathetic nervous system and suppression of immune system function (Schneiderman, 1987), less likelihood to engage in health-promoting behaviors, or greater likelihood to engage in risky health behaviors (Kubzansky & Arthur, 2004). Individuals with anxiety are at increased risk of atherosclerosis (Paterniti *et al*., 2001) and hypertension (Markovitz *et al*., 1991). For patients recovering from heart-related ailments, anxiety exacerbates symptoms, resulting in decreased quality of life (Benyamini, Roziner, Goldbourt, Drory, & Gerber, 2013) and a decline in functioning (Shen *et al*., 2011).

DEPRESSION

Clinical depression is associated with a three-fold increase in risk for heart disease (Anderson, 2003), making it dangerous for people with heart ailments. Numerous studies consistently demonstrate a prospective relation between occurrence of major depressive

episodes and incidence of myocardial infarction (heart attacks), ischemic heart disease and cardiac death (Anderson, 2003), as well as a dose-response association between the magnitude of depression and future cardiac events (Rosanski *et al*., 1999). Rumination, which is often associated with depression, prolongs cardiovascular activation following stress, playing a role in hypertension (Key, Campbell, Bacon, & Gerin, 2008). These data suggest that risk for CHD associated with depression exists along a continuum, according to the magnitude of depressive symptoms.

Depression also plays an important role in the diagnosis of cancer. Evidence indicates that experiences of negative affect are related to an increased risk of developing cancer, and one groundbreaking prospective study examining depression and cancer incidence discovered that participants with chronic depression had an 88% greater risk of developing cancer. The results of this study are compelling, but the researchers cautioned that further studies are needed to determine the direction of causality, for depressed mood could be a consequence of early-stage, undetected cancer (Pennix *et al*., 1998). Research also indicates that repression or lacking cognitive awareness of negative affect has been identified as the most important predictor of cancer incidence (McKenna *et al*., 1999), in addition to accelerating cancer progression (Jenson, 1987).

Positive emotions and health

Just as individuals with a negative affective style are at greater risk for developing health problems, individuals with a positive emotional style experience potential health benefits. Recent research, for instance, has demonstrated that positive emotional

experiences serve as a protective factor against the common cold (Cohen *et al*., 2003), while optimism buffers against the advancement of disease and death (Taylor *et al.*, 2000), decreases incidence of heart attacks (Kubzansky & Kawachi, 2002), and quickens recovery following surgery (Carver & Scheier, 1998). Positive emotions have even been linked to a longer lifespan, for a longitudinal study on nuns discovered that those with the happiest journal content lived 7-10 years longer than less happy nuns (Danner *et al*., 2001).

There is evidence that some discrete positive emotions have distinct health benefits. Gratitude improves sleep (Wood *et al*., 2009), whereas awe, is associated with a boosted immune system (Stellar *et al*., 2015) and increased well-being (Rudd, Vohs, & Aaker, 2012). Humor protects against heart disease (Clark *et al*., 2001), strengthens the immune system, and buffers against stress (Bennett, 2003). Some studies have shown mixed results, thus further research is needed to obtain conclusive results (Martin, 2002;).

One crucial function of positive emotions is to undo cardiovascular reactivity associated with negative emotions. Experiences of negative emotions are associated with autonomic nervous system activation that prepare the body for fight-or-flight (Cacioppo *et al*., 2000), whereas positive emotions function as efficient antidotes for the lingering cardiovascular effects of negative emotions, 'undoing' the after-effects of negative emotional experiences (Fredrickson *et al*., 2000). Positive affect is correlated with lower levels of cortisol, heart rate, and blood pressure, all of which aid post-stress recovery (Steptoe & Wardle, 2005). Higher dispositional positive affect has been linked to more complete cardiovascular recovery following stressful academic testing (Papousek *et al*., 2010), and experimental evidence suggests that participants induced to experience

positive emotions of ranging intensity (high-amusement to low-contentment) exhibit faster cardiovascular recovery after exposure to emotionally evocative films in comparison to a neutral control condition (Fredrickson *et al*., 2000). Positive emotions not only form psychological resilience but also serve as protection to cardiovascular and stress-related illnesses (Tugade & Fredrickson, 2004).

Mood assessment procedures

Self-report methods originate from the idea that the best way to know how people feel is to ask them. Self-report procedures can assess mood as they are currently experienced, called 'state' or 'momentary report'; over a specified time frame, called 'retrospective report'; or in general, called 'trait' or 'global report'.

Numerous self-report measures are currently used in the health sciences and each assesses different aspects of mood. Some target a single type of mood, such as anxiety, depression, or anger. The most widely-used measure of anxious mood is the Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, 1983). Popular measures of depressed mood include the Centre for Epidemiologic Studies-Depression Scale (CES-D; Radloff, 1977) and variants of the Beck Depression Inventory (BDI; Beck, 1996; Beck *et al*., 1961). Common anger-related mood measures include the MMPl-2 Anger Content Scale (Hathaway & McKinley, 1989) and the Spielberger Anger-Out Expression Inventory (Spielberger, 1988).

Other measures sample more than one type of mood. The widely used Profile of Mood States (POMS; McNair *et al*., 1971/1981) is a 65-item scale that yields a total mood

index, plus a single index of positive mood and five indices of negative mood . The 40-item Derogatis Affects Balance Scale (DABS; Derogatis, 1996) measures several positive and negative mood dimensions and is often used in clinical psychology related fields. The Multiple Affect Adjective Checklist Revised (MAACL-R; Zuckerman & Lubin, 1985) is a 132-item scale that assesses five dimensions of mood, and combines these for superordinate measures of dysphoria and positivity.

Although these scales measure distinct mood states, respondents typically have some difficulty distinguishing mood states of the same valence. Reports of negative mood experience tend to correlate so highly that measures of anxiety, sadness, fear and so on, often fail to capture any unique variance (Feldman, 1993). Even scales that are explicitly built to measure discrete emotions suffer from high correlations between like-valenced states (Watson & Clark, 1994). Individuals also vary greatly in the tendency with which they represent feelings as categorically distinctive experiences , an individual difference termed emotional granularity (Barrett, 2004).

Several strategies address the weak discriminant validity in discrete mood reports and granularity differences across people. Single mood measures (e.g. STAI; BDI) are best used in conjunction with other mood measures to determine whether participants are feeling 'anxiety', 'depression' or general undifferentiated feelings of negativity (Watson & Clark, 1984). Measures sampling more than one type of mood should be analyzed for their psychometric properties, but at minimum can be considered valid measures of positive and negative affective states (Feldman, 1993). Regardless of whether one's emotional granularity is high or low, verbal reports do appear to be valid regarding feelings of valence

(pleasure-displeasure) and arousal (high activation-low activation) (Barrett, 2004). Another option is to explicitly measure the broad dimensions of mood, with a scale such as the he Positive and Negative Activation Schedule (PANAS; Watson, Clark & Tellegen, 1988), which explicitly assesses high arousal positive valence and negative valence.

The time frame of mood assessment

Time frame is an important issue, for mood can be measured in the present moment (How do you feel right now?), retrospectively over increasingly extended time intervals (How have you felt this day? week? month?), and globally (How do you feel in general?). Momentary reports capture immediate affective states, which fluctuate in response to changing events and conditions, constituting 'state' mood. In contrast, global and longer-term retrospective reports capture enduring beliefs about the types of moods experienced, constituting 'trait' mood (Robinson & Clore, 2002). Many existing mood measures come in state and trait forms or can be easily adapted to different time frames. Choosing the appropriate time frame in measurement is important because state and trait reports are psychologically distinct and each is suited to different types of health-related investigations.

State mood measures d should be used when seeking to measure current mood or mood in response to events or situations. The strictest state format is asking people how they feel currently, either at a single time point (typically in the lab) or at repeated occasions (typically outside the lab) using a method called experience-sampling methodology (ESM). These intensive, longitudinal self-report procedures allow

respondents to document their feelings and behaviors on repeated occasions within the context of everyday life. ESM typically uses a device (e.g. cell phone) that allows respondents to report their momentary experience multiple times a day. Momentary self-reports are often considered the gold standard of state mood measurement because they capture mood in the moment, unbiased by memory processes.

Short-term retrospective reports can be used when practicalities prohibit the use of EMA, or when researchers are expressly seeking to measure people's retrospections of their mood states. Short-term retrospective reports asks people how they felt over the past hour, day, or week. and tend to be fairly accurate when compared to momentary self-reports averaged over that interval ; however, retrospections across a week appear to relate more to averaged end-of-day reports than to averaged momentary reports, suggesting that weekly reports are retrospections on already aggregated memories (Parkinson *et al*., 1995). Although generally accurate, short-term retrospective reports can reflect several systematic biases, including being disproportionately influenced by people's affective state at the time of recall (Singer & Salovey, 1988), by the most intense experience that is remembered ('peak effect'), and sometimes by the most recent experience remembered ('end effect') (Fredrickson, 2000). People tend to overestimate the intensity of their positive and negative moods because they neglect to incorporate the duration of certain neutral experiences into memory (Thomas & Diener, 1990). In addition, people are typically poor at accurately recalling their mood states over longer time frames (e.g. two weeks or more), instead reporting their beliefs about how they felt during that time (Robinson & Clore, 2002).

For other investigations, it may be important to tap people's trait beliefs about their mood-related experiences by using global self-reports. Trait beliefs are typically stable and shaped by a multitude of factors, including actual experience, cultural norms, and personal values. These reports can be strong predictors of enduring health related risk factors. For example, people who describe themselves as anxious or high in hostility tend to show a higher risk for CHD and hypertension, presumably because their global self-reports display their enduring affective reactions. It is important not to use trait ratings as proxies for state mood or assume that trait ratings will necessarily predict affective experience in a given instance.

A final consideration occurs when adapting an existing measure to alternate time frames. Some measures (e.g. STAI, POMS,PANAS) already exist in various state and trait forms that have been validated and found to be reliable. Most mood measures are robust enough to be adapted to state and trait forms simply by changing the nature of the instructions. Research has shown that psychometric properties for trait adjective rating scales are typically preserved across time frames (Watson & Clark, 1994); however, it is crucial to run comparative psychometric analyses for any adapted measure.

Psychophysiological measures

From early pioneering work in the field of psychology (James, 1884), many researchers believe it is possible to measure emotional states more objectively by assessing their psychophysiological correlates, with specific emotions comprised of unique patterns of behavioral and physiological activation. These theories often examine cardiovascular

(e.g. heart rate, finger pulse amplitude, blood pressure), electrodermal (e.g. digital skin temperature) and facial (e.g. facial electromyography) indices. Consistent evidence for emotion-specific patterning of peripheral nervous system responses (PNS) remains elusive. Although individual studies sometimes report distinct autonomic correlates for different emotions (Christie & Friedman, 2004), meta-analytic summaries generally fail to find distinct patterns of PNS responses for each basic discrete emotion (Cacioppo *et al*., 2000). For example, studies have found that anger, depression, and anxiety are all marked by an increase in heart rate and skin conductance (Davydov, Zech, & Luminet, 2011; Fernandez *et al*., 2012; Soto, Roberts, Pole, Levenson, & Burleson, 2012),), displaying a lack of discrete physiological patterns for specific emotions. However, PNS responses do appear to configure for conditions of threat and challenge (Tomka et al., 1997; Quigley *et al*., 2002), and for positive versus negative affect (Cacioppo *et al*., 2000;) suggesting that patterns of cardiovascular responding can be used to characterize appraisals (threat, challenge) and affect (positive, negative), but not necessarily discrete emotions. Vocal acoustics (Russell *et al*., 2003) and pupillometry studies (Tichon, Wallis, Riek, & Mavin, 2014) have not been found to indicate discrete emotional states, but rather general valence . Facial electromyography measurements also coordinate around valence (Cacioppo *et al*., 2000) or intensity of affect (Messinger, 2002), but a facial coding program called FaceReader (Noldus, 2014) has obtained initial support for ability to distinguish discrete emotions. FaceReader can read happiness, sadness, surprise, anger, fear, and disgust, and has been used to distinguish facial emotions in Youtube videos (Lewinski, 2015) . Studies have found

that FaceReader produces high agreement between facial and self-report data (Harley, Bouchet, Hussain, Azevedo, & Calvo, 2015).

Recommendations for measurement

It is possible to offer several recommendations when measuring affect and emotion in health-related research. First, empirical evidence does not strongly support the view that discrete emotions (e.g. anger, sadness, fear) cause distinct and recognizable behavioral and physiological patterns. Self-report and physiological measures seem to reliably and validly a person's affective state, so it may be logical to address the role of affective functioning (e.g. affective reactivity, propensity to be threatened or challenged) in questions regarding health and human functioning. Second, people vary in their emotional granularity and tend to use discrete emotion scales to report positive and negative affect, so it is important to assess discriminant validity in reports of discrete emotions. Studies that include only one measure of emotion may mistakenly assume that there is a discrete emotional effect driving health outcomes when in fact it is something more broadly defined. Finally, state and trait reports of emotion are not synonymous, and a researcher's choice of one over the other should depend on whether episodic or semantic representations of experience are of interest.

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