

Biopsychosocial Mechanisms Linking Discrimination to Health: A Focus on Social Cognition

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This research is supported by American Heart Association Strategically Focused Research Network Grant #15SFDRN24180024, American Heart Association 2015 – 2019 “Discrimination and allostatic load among American Indians”, PI: Irene Blair; Co-Investigator: Elizabeth Brondolo.

Abstract

This chapter presents a theoretical framework that highlights the role of social cognition in mediating the effects of discrimination on health. This framework suggests that through alterations in schemas and appraisal processes, long-term discrimination increases the experienced frequency, intensity and duration of threat exposure and concomitant distress. At the same time, the ability to recover from threat exposure may be

impaired by the effects of discrimination on cognitive control processes (e.g., attentional disengagement) that are necessary for modulating stress responses. Together, these processes may influence the ability to initiate and sustain health-promoting behavior, avoid health-impairing behavior, attenuate stress reactivity and facilitate stress recovery.

Through effects on these processes, persistent exposure to discrimination may potentiate sustained dysregulation of psychophysiological systems responsible for maintaining health.

The broad effects we discuss are based on a consideration of the multiple levels at which discrimination occurs and the high frequency of discrimination to which some individuals and groups are exposed. For this same reason, individual-level intervention efforts targeting stress or health beliefs and behavior are unlikely to be sufficient without changes to the larger social environment.

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Discrimination is a broad construct referring to group-based prejudicial attitudes, beliefs and behavior (Gee, Ro, Shariff-Marco, & Chae, 2009). Discrimination exposes members of minority groups to persistent threats of social exclusion, economic hardship, injustice and harm. The effects of these threats may be compounded because of significant barriers to the development of effective and safe options for addressing discrimination and its consequences (see Brondolo et al., 2009). By increasing threat exposure and reducing coping resources, discrimination is considered a significant psychosocial stressor for targeted group members (Brondolo, Brady, Libby, & Pencille, 2010; Clark, Anderson, Clark, & Williams, 1999). A growing body of research documents the association of discrimination to negative mental and physical health outcomes (for review see Paradies et al., 2015).

The goal of this chapter is to present a framework for considering the biopsychosocial processes through which discrimination impair health (see Figure 1). The framework we propose places heavy emphasis on social cognition. Broadly, social cognition mediates the interpretation of and responses to the social world (Fiske & Taylor, 2013). Social cognition includes the mental structures and processes (e.g., schemas and appraisal processes) that reflect and influence the ways in which individuals perceive and evaluate themselves, others and the world at large (Box A). Social cognition also encompasses the cognitive control processes necessary for regulating attention, integrating and organizing information, and promoting cognitive flexibility (Box B). Together, schemas and appraisal processes and cognitive control processes interact to jointly influence other components of social cognition, including those involved in motivation, engagement and persistence (Box C).

Our framework suggests that discrimination alters schemas and appraisal processes, influencing the perception, anticipation and recollection of discrimination-related threat (Path A). As a consequence, one of the long-term effects of discrimination is an increase in the experienced frequency, intensity and duration of threat exposure and concomitant distress (Brondolo, Ng, Pierre, & Robert, 2016; Lewis, Cogburn, & Williams, 2015). At the same time, the ability to recover from (increased) threat exposure may be impaired by the effects of discrimination on cognitive control processes necessary for modulating stress responses (Path B: Murphy, Richeson, Shelton, Rheinschmidt, & Bergsieker, 2013). Together, discrimination-related changes in schemas, appraisals and cognitive control are likely to influence the choice of motivational goals, as well as engagement and persistence. Motivation and engagement (or disengagement) influence the ability to initiate and sustain health promoting behavior, avoid health impairing behavior, attenuate stress reactivity and facilitate stress recovery (Paths D, E & F: Hofmann, Schmeichel, & Baddeley, 2012). Over the long run, persistent threat exposure and consequent changes to stress reactivity and health behavior may potentiate sustained dysregulation of psychophysiological systems responsible for maintaining health (Paths I: McEwen & Gianaros, 2010).

This chapter begins with a description of the multiple levels on which discrimination operates. Next, we explain the conceptual framework, with its emphasis on the role of social cognition. In the subsequent sections evidence is presented for each component of the framework, and areas in need of further research are identified. Throughout the chapter we discuss the ways in which bidirectional relationships among discrimination, social cognition, and physiological processes serve as barriers to stress recovery and perpetuate the effects of

discrimination on health. A primary goal is to illustrate the importance of integrating research on social, psychological, and biological processes to inform comprehensive approaches to reducing health disparities.

Before continuing, we must acknowledge a focus on the negative effects of discrimination and disadvantage, particularly with regard to social cognition. It is therefore important to emphasize that the challenges facing targeted communities and individuals can also provide opportunities for growth. These challenges may help individuals to join together for a common cause; to strengthen their faith; to develop pride and resilience; and to bring to light pressing moral issues. As members of targeted groups articulate concerns about justice and opportunity, they may change the way others think and feel about members of their group; and in the process, they may also change their own social cognition (Brondolo & Jean-Pierre, 2014). Individual, family and community efforts to support equality and opportunity may also foster the development of social cognitive processes that can promote health and well being (Brannon, Markus, & Taylor, 2015). In the concluding sections of this chapter, we outline areas for further research on these issues.

### **Discrimination**

Although we focus on race and ethnicity-based discrimination, our model may have implications for other types of discrimination as well. Discrimination can occur on cultural, institutional, and interpersonal levels (Clark et al., 1999; Harrell 2000). Discrimination across these levels creates social and physical environments that influence the degree to which members of a targeted group are protected from harm, allowed to hold power, able to gain access to economic resources, and able to achieve full social inclusion. More detailed definitions and

conceptualizations of the multiple levels of discrimination are available elsewhere (e.g., Gaertner & Dovidio, 2005; Krieger 1999). We briefly review these levels here.

Cultural discrimination includes media presentations or other mass communications that disseminate negative attitudes and stereotypes about a group and its members (Dixon & Azocar, 2007). Institutional discrimination refers to the policies or procedures of institutions (i.e., government, business, schools, churches, etc.) that consistently result in unequal treatment, even when those effects are not deliberately intended (Gee et al., 2009). Some examples of the outcomes of institutional discrimination include residential and educational segregation, unequal exposure to environmental toxins, and differential law enforcement (Gee & Payne-Sturges, 2004; Kramer & Hogue, 2009).

Interpersonal discrimination has been defined as “discriminatory interactions between individuals whether in their institutional roles or as public and private individuals” (Krieger, 1999, p. 301). This form of discrimination is experienced in the form of blatant or subtle actions that restrict social inclusion, safety, and opportunity, or communicate disrespect and stigmatization. Interpersonal discrimination makes social interactions more unpredictable, uncontrollable and threatening (Brondolo et al., 2010).

Interpersonal discrimination is highly prevalent. Our studies suggest that more than 94% of Asian, Latino(a) or Black Americans have experienced this form of discrimination over the course of their lifetime (Brondolo et al., 2005; Kwok et al., 2011). In one study, Black and Latino(a) individuals reported an average of five episodes of interpersonal ethnic/racial discrimination during the previous week (Brondolo et al., 2008). Other investigators report between 60% and 98% of Black participants report experiences with major types of discrimination, such as experiences of discrimination in housing, employment, or in interactions

with the criminal justice system, among other examples (Broman, Mavaddat, & Hsu, 2000; Kessler, Mickelson, & Williams, 1999).

The effects of discrimination on health may be exacerbated by the effects of social disadvantage. Members of groups who face stigmatization and discrimination may also be more likely to experience social disadvantage in the form of barriers to quality education and asset accumulation, and face greater exposure to threats to safety and health (Ayscue & Orfield, 2015; Williams & Collins, 2001). Social class has independent effects on both social cognition and health processes (Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012); and these effects may moderate, and sometimes exacerbate the effects of discrimination on health.

### **Social Cognition: Definitions and a Conceptual Framework**

Discrimination shapes the social environment, driving the types of demands that targeted individuals face and constraining the resources they have available to respond to those demands (Brondolo, 2015). The social environment, in turn, shapes social cognition and its underlying neurobiological substrates (Blair & Raver, 2012; Fiske & Taylor, 2013). In this framework (shown in Figure 1), we review the ways in which the effects of discrimination on social cognition may mediate the relationship of discrimination to health. The framework specifically highlights the effects of discrimination and social cognition on outcomes including unhealthy behavior, heightened stress reactivity and impaired stress recovery, all risk factors for a wide range of chronic illnesses.

We focus in particular on the central roles of two components of social cognition: schemas and appraisal processes (Box A) and cognitive control processes (Box B). Schemas are mental structures comprised of networks of linked thoughts, feelings, attitudes, images and sensations (Ghosh & Gilboa, 2014; Landau, Meier, & Keefer, 2010). Schemas provide an

interpretative context for processing new experiences (McKenzie, Robinson, Herrera, Churchill, & Eichenbaum, 2013).

Individuals hold schemas about the self, other people, and the world. These schemas incorporate an *affective tone* or valence (Markus & Wurf, 1987). For example, schemas can reflect a perception of the self as accepted or rejected; other people as warm or hostile; and the world as safe or threatening (Beck, 1987). Schemas also incorporate the *attributes* (e.g., behaviors, phenotypic characteristics) associated with the self and with others, including members of racial or ethnic groups (Oyserman, 2008). Schemas develop over time through life experiences and observations of others. They are shaped through formal and informal educational experiences. Schemas also reflect both the conscious and non-conscious processing of messages from the surrounding culture (Brondolo et al., 2016). Schemas can develop and operate outside conscious awareness, and therefore can be considered part of the automatic or implicit components of social cognition (Beck & Haig, 2014).

Discrimination at all levels may contribute to the development of negative schemas (Path A) through cultural communications, institutional policies and practices, and interpersonal interactions. Cultural discrimination, including the widespread dissemination of racial and ethnic stereotypes extends the type and range of attributes (i.e., physical characteristics as well as social behaviors) that are linked to racial and ethnic group identity (Contrada et al., 2001). As a consequence, more characteristics and behaviors may elicit discriminatory treatment from prejudiced individuals. More circumstances and actions may activate schemas related to concerns about facing discrimination among targeted individuals.

Unfair or demeaning treatment at work or in other institutions may lead to schemas that the larger world is unjust and uncontrollable (Borders & Liang, 2011). Discriminatory

interpersonal interactions may lead to the development of schemas reflecting a view of other people as harsh or rejecting, particularly if they belong to a group likely to hold biased beliefs (Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002).

Schemas trigger and/or are accompanied by appraisal processes. Appraisal processes are involved in evaluating the salience and potential threat presented by the events. Studies of stereotype threat suggest that depending on the context, even minor cues – such as asking an individual to report on his or her race – are effective in activating schemas related to issues of race and discrimination. Activation of these schemas may trigger threat appraisals, even when individuals are not aware of these effects (Schmader & Croft, 2011).

The neural structures hypothesized to serve as the substrates of schemas may facilitate activation, by enabling connections among components of linked schemas (e.g., linked through their relationship to discrimination, race, or distress) (for discussion on neural substrates of schemas, see McKenzie et al., 2014). Rapid communication among areas of the brain is facilitated by the processes that govern the formation of connections among brain regions and regulate cell signaling (Tse et al., 2011). This activation can trigger psychophysiological reactivity – activation of affective, neuroendocrine, autonomic or immune systems (Path E: Gianaros & Wager, 2015). Consequently, repeated (even implicit) exposure to current, anticipated, or recollected discrimination may be accompanied by psychophysiological reactivity during daily life, with repeated activation preventing stress recovery (Path H).

The effects of discrimination on stress recovery are compounded by the effects of discrimination on cognitive control processes (Path B), the second component of social cognition incorporated in this framework. Cognitive control processes include the components of working memory and executive function which are involved in controlling the focus of attention, shifting

perspective, and generating new appraisals and coping responses (Hofmann, Schmeichel & Baddeley, 2012). These processes enable a reflective, intentional mode of response, and they are critical to regulating stress reactivity and enabling stress recovery (Carver, Johnson, & Joormann, 2009). Turning attention away from negative feelings can help regulate the intensity of the affective response and potentially disrupt rumination about negative events and emotions (Gotlib & Joorman, 2010). Shifting mental perspective can facilitate the re-appraisal of the meaning and salience of an experience, and contribute to the capacity to regulate emotions (Gross, 2002).

On an acute basis, discrimination is associated with impairments in cognitive flexibility, including decrements in the ability to shift attention and engage other aspects of working memory (Path B: Murphy et al., 2013). Over time, persistent threats from discrimination and social disadvantage may shape the neurobiological processes involved in cognitive control (Javanbakht, King, Evans, Swain, Angstadt, Phan, & Liberzon, 2015). These disadvantage-related changes to neurobiological processes have been associated with heightened stress reactivity and attenuated recovery from stress (Paths F and H; Gianaros & Wagner, 2015).

Together, schemas and appraisal processes and cognitive control processes interact to jointly influence goal-directed actions, shaping motivational goals, initiating engagement/disengagement, and facilitating persistence in goal directed behavior (Path C). As a consequence, these social cognitive processes influence the ability to set and achieve health promotion goals (Path D). These integrated processes are also intimately involved in self-regulation of psychophysiological reactivity and recovery (Paths E & F; Bongard, Al'Absi, & Lovallo, 2012).

The central theme of this chapter is that persistent discrimination and its long-term effects on social cognition expose targeted individuals to greater stress and undermine opportunity for stress recovery. Interconnections among elements in this framework and bidirectional relations among the components create a significant barrier to recovery. For example, the combined effects of schemas and appraisal processes may alert individuals to potential threats and sustain attention to those threats, heightening psychophysiological reactivity and limiting recovery (Paths A, C, E, & F: Brondolo et al., 2016; Lewis et al., 2015). The negative effects of discrimination on cognitive control processes also make it difficult to shift attention from these threats, and consequently undermine stress recovery (Paths B, C, F & H: Chen & Miller, 2013). Negative (discrimination-influenced) schemas and appraisal processes may promote smoking, unhealthy eating, and other health-impairing behaviors (Paths A, C, & D), and discrimination further impairs cognitive control processes involved in regulating these behaviors (Paths B, C, F, H, & G). There are bidirectional relationships that compound the effects of discrimination. For example, obesity, partly a product of unhealthy eating and lower levels of physical activity, further impairs cognitive control processes (see Heyward et al., 2016); and obesity itself also triggers additional types of discrimination (Carr & Friedman, 2005). Greater exposure to stress and limitations to stress recovery have clear implications for both physical and mental health, and may lead to outcomes including greater allostatic load and more sustained depression and anxiety (McEwen & Gianaros, 2010).

Our bottom line in considering this complexity is that interventions to reduce discrimination and its effects on health must take into account processes that operate across biopsychosocial levels and act in a bidirectional fashion. This requires a mechanistic knowledge

of the effects of the discrimination and disadvantage on a broad range of outcomes considered together, rather than in isolation. Substantial new research is needed to clarify these pathways and provide guidance for the development of new and effective interventions. In the next sections, we will work through the framework in stages, examining evidence for the pathways and areas of needed research.

### **Path A: Discrimination, Negative Schemas and Threat Appraisals**

As shown in Path A, we propose a link between exposure to discrimination and the development of negative schemas and heightened threat appraisals. The evidence suggests that all levels of discrimination directly and indirectly influence the relational schemas (i.e., the internal representations and expectancies of others) held by both majority and minority group members, and also influence other types of schemas about the predictability and controllability of the world at large. These schemas and concomitant threat appraisals may add to the burden of threat exposure in everyday life across a wide range of circumstances.

On a cultural level, media presentations influence the schemas individuals hold about members of their own group and those of other racial/ethnic groups (Dovidio, 2009). Even subtly biased media presentations have been demonstrated to influence viewers' perceptions of the warmth and competence of members of different racial/ethnic groups (Weisbuch, Pauker, & Ambady, 2009). For example, studies of racial disparities in local news media presentations of crime suggest that Black individuals are not consistently more likely than Whites to be depicted as perpetrators, but are significantly less likely to be depicted as victims of crime. These depictions may lead viewers to develop schemas about Black individuals that incorporate negative stereotypes about their potential for violence. As a consequence, individuals desire greater social distance from Blacks and feel less empathy or concern for them (Dixon, 2008).

Media presentations also affect schemas held by targeted individuals. When Black individuals view media coverage about other Blacks, and they judge this coverage to be negative, they are more likely to be concerned that members of other racial/ethnic groups will hold negative views of their group and consequently treat them unfairly (Fujioka, 2005). Essentially, these media presentations shape negative relational schemas about others, and may heighten threat appraisals as individuals anticipate the possibility of discriminatory treatment.

Cultural discrimination also influences the attributes (e.g., behaviors, phenotypic characteristics) paired with membership in different racial/ethnic groups as well as attitudes towards those attributes. Given the wide range of information about racial and ethnic stereotypes communicated in the media, a much broader range of characteristics may be capable of evoking discrimination-related threat either from discriminatory behavior or from activation of discrimination-related schema. For example, a variety of media depict Blacks as more likely to feel and express anger than members of other groups, and the anger expression is often cast in a negative light (Adams-Bass, Stevenson, & Kotzin, 2014). As a consequence, Blacks may encounter rejection or disapproval from others when they are observed expressing anger. Expressing anger may also activate negative schemas about others who may discriminate against them. These schemas increase Black Individuals' anticipation that other people will treat them in a discriminatory manner if they express anger, and/or these schemas may trigger memories of past events in which they were treated or observed others being treated in a discriminatory manner. Targeted individuals may also experience concerns about social rejection from members of one's own group if they fail to engage in behaviors consistent with the perceived norms for one's ethnic/racial group (i.e., own-group conformity concerns: Contrada et al., 2000).

Substantial research documents the effects of institutional discrimination, and in particular the effects of neighborhood segregation and disadvantage on social cognition (e.g., McCoy, Roy, & Raver, 2015). For example, neighborhood disadvantage has been linked to maternal responsiveness, which influences the development of negative schemas about the self and interactions with others (e.g., de Baca, Wahl, Barnett, Figueredo & Ellis, 2016; Wade, Moore, Astington, Frampton, & Jenkins, 2015). As one specific example, investigators have noted that children from disadvantaged environments are more likely than those from advantaged areas to interpret the ambiguous behavior of other children as hostile, suggesting they hold more negative schemas about the warmth and trustworthiness of other children (Chen & Miller, 2013).

Individual-level discrimination, including episodes of race-related social exclusion, rejection, and physical harassment, has been linked to social cognition, and the bulk of the evidence on the relationship of discrimination to social cognition comes from these studies (see review in Brondolo et al., 2016). Specifically, discrimination has been related to negative relational schemas including race-based rejection sensitivity (Mendoza-Denton et al., 2002), stigma consciousness (Pinel, 1999), stereotype confirmation concerns, and own-group conformity concerns (Contrada et al., 2000; 2001). Each of these constructs implies conceptions of others as potentially rejecting, unfair, and/or harsh.

Discrimination is also related to negative schemas about the world, which may arise as individuals face unjust outcomes and persistent barriers. Discrimination is positively related to schemas about the world that reflect a perception that the world is persistently unjust and unfair (e.g., unjust world beliefs (Borders & Liang 2011), and cynicism and hostility (Hunte, King, Hicken, & Lewis, 2013).

Discrimination influences the development of schemas related to social group identity, as targeted individuals face significant threats to belonging and connection with the larger world. Discrimination appears to enhance racial and ethnic identity (Lee & Ahn, 2013), and particularly to strengthen racial identity centrality (i.e., the importance of racial group membership to one's personal identity). Other forms of structural disadvantage (e.g., low socioeconomic status (SES)) may also heighten a sense of individual vulnerability. Low SES may create a drive toward interdependence among group members and change the relationship between self and social group identity (Kraus et al., 2012). Consequently, schemas held by individuals targeted by discrimination and disadvantage may reflect greater concerns with solidarity and the importance of loyalty to the group rather than individual autonomy or differentiation (Contrada et al 2000; Kraus et al., 2012).

Additional support for the hypothesis that discrimination affects aspects of social cognition comes from studies which have examined the relationship of discrimination to threat appraisals. In one study of Black and Latino(a) adults, lifetime discrimination was positively correlated with threat appraisals concerning potential new experiences of discrimination (Brondolo et al., 2005). Similarly, in other studies, individuals who had faced higher levels of discrimination were more likely to view day-to-day interactions as negative, exclusionary, unfair or harassing (Broudy et al., 2007), or to perceive events as stressful (Paradies & Cunningham, 2012). Some evidence suggests that relational schemas mediate the relationship of discrimination to threat appraisals and psychological distress (Mendoza-Denton et al., 2002).

New research is framing these discrimination-related schemas and appraisals in terms of the constructs of social vigilance or anticipatory or expectations of rejection (Lewis et al., 2015).

These constructs imply internal schemas and/or appraisal processes which may heighten the anticipation of threat.

### **Schema Activation**

At any given moment, salient triggers in the environment or in the individual's own thought processes can activate discrimination-related schemas, producing changes to appraisal processes, motivation and behavior. Processes involved in the activation of race-related schemas have been examined in priming studies, including those investigating stereotype threat effects (Schmader & Croft, 2011). These studies suggest that depending on the context, even minor cues - such as asking an individual to report on his or her race - are effective in activating schemas related to issues of race and discrimination and influence motivation and the capacity for engagement.

The neural structures that underpin schemas may facilitate schema activation. Researchers hypothesize that schemas are represented in the brain by neural networks that link areas responsible for processing different types of information (e.g., the sensory, affective, and semantic aspects of an experience; Van Kesteren, Ruiter, Fernández, & Henson, 2012). The multiple, overlapping layers of neuronal connections contain related information across a variety of domains (i.e., information about the event and its physical context, sensory properties, meaning, and salience, etc.). This structure permits more associations to be made among different types of information and facilitates the ability to activate the schema network with minimal cues (McKenzie et al., 2013). The physiological processes that are involved in regulating communication across the network act very rapidly and allow for almost immediate connections across regions of the brain that process very different types of information (Roux & Ulhaas, 2014, Tse et al., 2011).

Interconnections among components of a schema allow for a sense of coherent and connected experience. However, the underlying neural structure of schemas makes it likely that schemas will share components. Activating one component may trigger activation of other related schemas. For example, when individuals hold several negative schemas (i.e., schemas related to failure, isolation, rejection), events that trigger any one schema are likely to trigger the others, magnifying the potential to appraise events as threatening (Ghosh & Gilboa, 2014).

Although our interpretation is speculative, research on the neural basis of schemas may explain the power of limited phenotypic, cultural or social cues to rapidly activate appraisals of threat. The wide range of negative stereotypes about some racial and ethnic groups may create multiple schemas about the self and others that incorporate these stereotypes. These schemas may be linked by their connection to race/ethnicity, negative moods or to memories of other incidents of discrimination, among other attributes. With a highly developed network of schemas formed vis-à-vis persistent discrimination, activation of one schema can activate other linked schemas.

The salience of race and the frequency of exposure to discrimination in daily life make it likely that schemas about discrimination and its effects are readily accessible. For individuals who are routinely targeted for exclusion, phenotypic or cultural cues may be sufficient to signal the potential for exclusion or rejection, even before the social interaction has started (Goodwin, Williams, & Carter-Sowell, 2010). For example, even subtle communications of exclusion may serve to activate negative schemas about other people who are harsh or rejecting (Williams, 2007), and trigger threat appraisals, even when individuals are not entirely aware of these effects and do not consciously report social pain (Marien, Custers, Hassin, & Aarts, 2012).

Stress recovery may also be limited because social exclusion is a potent and persistent stressor (Muscatell & Eisenberger, 2012). Momentary episodes of exclusion activate brain regions associated with threat, even when individuals are included and accepted most of the time (Themanson, Khatcherian, Ball, & Rosen, 2013). Other studies of psychophysiological processes associated with acute experiences of social threat suggest that over time, individuals show habituation to inclusion, but not to exclusion (Kelly, McDonald, & Rushby, 2012). Attributions to discrimination appear to attenuate recovery (Goodwin et al., 2010).

In sum, each episode of exclusion or rejection can serve as a threat or stressor. Discrimination at all levels also shapes the development of negative schemas, which govern perceptions of and response to the others and the world, and may potentiate perceptions of social threat. Consequently, throughout the day, both from external sources (e.g., interpersonal discrimination) and internal sources (e.g., the anticipation or recall of discriminatory events via activation of negative schemas), individuals may be exposed to repeated experiences of social threat and concomitant stress. Links among schemas may facilitate the generalization of the threat response across different types of events. Repeated threat activation may limit opportunities for recovery.

### **Path B: Discrimination and Cognitive Control Processes**

The effects of discrimination on cognitive control processes may further impair recovery from threat. Acute episodes of discrimination may impair the capacity to engage cognitive control processes, including the ability to shift attention (Path B). In two studies, episodes of discrimination-related stress modeled in the laboratory were associated with acute decrements in attentional set shifting and other cognitive control capacities as assessed in an emotional Stroop task, among other tests (Inzlicht, McKay & Aronson, 2006; Murphy et al., 2013). In a third

study, exposure to a stressor potentially involving discrimination was associated with a reduction in cognitive flexibility, but only for middle class and not working class women (Townsend, Eliezer, Major, & Mendes, 2014). A fourth study showed that anticipating being negatively evaluated as a potential date caused overweight women who thought were visible to others to perform more poorly on cognitive control as assessed by the Stoop task (Blodorn, Major, Hunger & Miller, 2016).

It may be both more difficult and exhausting to engage cognitive control mechanisms when multiple, linked negative schema are activated, especially if they are activated repeatedly. More attention is allocated to managing threats associated with social exclusion when the individual is exposed to multiple and sustained episodes of social exclusion (Themanson et al., 2013). In comparison to majority group members, targeted minority group members may be less able to engage cognitive control processes because they face frequent episodes of race-related social exclusion and other forms of discrimination (Brondolo et al., 2009).

Over the long run, the effects of discrimination on attention may be explained by stress-related changes in the neural pathways subserving attention and other aspects of cognitive control processes. The effects of chronic stress on attentional set shifting are associated with changes to functional connectivity between the dorsal pre-frontal cortex and other areas of the brain. In some cases connections are attenuated, in others they are strengthened (Liston, McEwen, & Casey, 2009).

Some of these changes to cortical pathways are mediated by the effects of cortisol on the development of synaptic connections (Popoli, Yan, McEwen, & Sanacora, 2012). Under stress, connections are conserved between brain regions that facilitate the processing of information related to the most important (or threatening) demands; whereas other connections may be

pruned (Liston et al., 2009). The selective pruning of the connections among areas may improve efficiency of processing for the most salient demands, but the failure to preserve these connections may also limit aspects of cognitive flexibility required for long-term goals.

Studies using fMRI to investigate the neural effects of social disadvantage support this notion. For example, in comparison to high SES participants, low SES participants not only demonstrated greater activation in threat detection systems, they also had less functional connectivity between areas of the brain responsible for threat detection and response (i.e., amygdala nuclei) and areas of the brain engaged in cognitive control (i.e., nuclei in the medial pre-frontal cortex), potentially capable of attenuating threat responses (Javanbakht et al., 2015). Childhood poverty has also been associated with impairments in aspects of working memory and executive function, including the capacity to switch the focus of attention, and childhood poverty has also been associated with variations in the neural connections that support these abilities (Blair & Raver, 2012).

In sum, discrimination drives the environmental demands facing targeted individuals, and shapes the neural structures, which develop and operate in response to these demands. On an acute basis, discrimination reduces cognitive flexibility. Over the long run, persistent threat may shape the neural structures underlying the cognitive control processes that modulate the response to threat (Blair & Raver, 2012). These changes may improve the efficiency of responding to threatening environments - including those shaped by discrimination and disadvantage. But these changes may present functional barriers to the development of the cognitive flexibility needed for managing less threatening environments and developing a wider range of self-regulatory responses.

### **Path C: Integrated Outcomes – Goal Orientation, Approach and Avoidance**

Both schemas and cognitive control processes influence goal-orientation, including the choice of goals and the ability to engage and persist in the activities needed to reach the goal. In some cases the goals are approach-oriented and involve promotion of the self (e.g., cooking healthy food, learning a new skill) or promotion of the group (e.g., advocating for justice). In other cases, the goals are avoidance-oriented and involve harm prevention, including avoiding exposure to potential discrimination or stereotype threat (Brophy, 2013; Oyserman, 2015).

Schemas may operate in several ways to shape the choice of goals and the strategies used to achieve these goals. Schemas about the self, and the values that are important to the self and others (e.g., achievement, loyalty) are likely to influence the choice of goals. Schemas about one's own competence and other people's potential warmth and capability (vs. harshness and incompetence) reflect perceptions of the resources available to achieve one's goals. When schemas drive perceptions that the goal is valuable and social resources are available, then individuals may more readily engage. When schemas about others or the world drive the perception that the goal may be unachievable or goal achievement is too costly given the effort, then individuals may disengage or avoid (Blascovich, 2013).

Cognitive control processes are also necessary to achieve one's goals. These processes include the capacity to shift attention, and to identify and structure the activities needed to achieve the goal (Hofman et al., 2012). Perceptions about one's own cognitive control capacities may also influence the willingness to engage in particular tasks. When individuals perceive themselves as lacking the cognitive control capacities to support goal achievement, they may shift their focus to harm avoidance.

Discrimination may change the calculations individuals make when they determine which goals are worth pursuing, because targeted individuals must calculate the additional costs of

discrimination-related social threat. Individuals may set promotional goals – goals of improving health or status. But engagement with these goals (or even considering engagement with these goals) may activate other discrimination-related schemas about the self (e.g., related to concerns about conforming to group norms), schemas about other people (e.g., anticipated harsh or discriminatory interactions) or schemas about the world (e.g., potential unfair treatment restricting goal attainment). When activated, these schemas may evoke negative emotions and they may prompt disengagement.

Discrimination can lead to the development and activation of schemas with conflicting or unintended consequences on goal selection. For example, the effects of discrimination on social identity may also complicate the choice of goals and the anticipated consequences of achievement, as described in more detail in a chapter in this volume by Oyserman and Fisher. Members of low status groups often endorse characteristics commonly associated with stereotypes about their group, even when those characteristics are negative or potentially harmful (see Latrofa, Vaes, & Cadinu, 2012; Oyserman, Fryberg, & Yoder, 2007). For example, when certain unhealthy behaviors are seen as part of racial/ethnic identity, then individuals may feel a stronger attachment to those behaviors. Maintaining these characteristics may contribute to the goal of belonging and affiliation, despite costs to health.

A clearer assessment of the effects of discrimination on health behavior and stress reactivity requires a deeper understanding of the goals set by the individual. It may be necessary to evaluate the underlying schemas that drive those goals and are activated by efforts to achieve them (Inzlicht, Tullet, & Gutsell, 2012). Evaluating potential increases in social threat may help identify potential barriers to change. For example, efforts to change health behavior may require addressing threats to inclusion as well as the skills required for health promotion.

**Paths E and F: Discrimination and Stress Reactivity and Stress Recovery**

The foregoing sections have described evidence consistent with our proposal that persistent discrimination shapes individuals' social cognitive processes in a manner that increases threat appraisals (stress) and decreases the ability to modulate subsequent responses. The neural structures and processes underlying threat detection and response may potentiate the effects of discrimination on stress reactivity (Path E) and recovery (Path F). To fully appreciate the impact of these processes on health and well being, we turn next to a discussion of the evidence linking discrimination to physiological stress reactivity and recovery.

Perceptions of threat – social or physical – activate several physiological systems. This activation is a function of bidirectional pathways between the brain and the systems responsible for mediating stress responses throughout the body. Specifically, evaluating the threatening nature of environmental circumstances involves regions in the medial temporal lobe and the prefrontal cortex and their connections to subcortical regions (including the thalamus, periaqueductal gray, and pons; Gianaros & Wager, 2015). These brain areas are involved in the control of systems responsible for regulating physiological needs when responding to threat, including primarily the autonomic nervous system (including both the sympathetic-adrenomedullary (SAM) and parasympathetic branches) and the hypothalamic-pituitary axis (HPA), as well as other neurohormonal systems.

Some connections between cortical and subcortical regions serve to up-regulate activation (e.g., increasing sympathetic nervous system control of the heart with concomitant increases in heart rate); others serve to down-regulate the response (e.g., increasing parasympathetic control, with concomitant decreases in heart rate; for a review of these issues see Mendes & Muscatell in this volume as well as Gianaros & Wager, 2015).

Threat appraisals, including those elicited by social threats, trigger the release of cortisol, epinephrine and norepinephrine (among other neurohormones: see Gianaros & Wager, 2015/Path E1). These hormones, in turn, affect a number of systems (e.g., neuroendocrine, immune, autonomic systems), with the goals of mobilizing energy and bodily defenses to prepare for “fight or flight.” The patterning of physiological responses to stressors depends in part on the participants’ perceptions of the degree of threat presented by the task as well as their level of motivation and engagement, factors which reflect social cognitive processes (Blascovich, 2013; Bongard et al., 2012). For example, both defending oneself against a threat and actively pursuing a goal may elicit increases in blood pressure and heart rate, but the underlying cardiovascular processes driving those increases may differ depending on the participants’ appraisals of the task. Some threats, including social threats, are specifically linked to activation of the HPA (Dickerson & Kemeny, 2004). The effects of combining social threats with other demands may be particularly deleterious for individuals experiencing other disruptions to HPA functioning as a consequence of exposure to other long term stressors (DeSantis, Adam, Hawkley, Kudielka, & Cacioppo, 2015).

Once the threat passes, these systems typically return to baseline levels to allow normal bodily functions to resume. If the threat is severe or prolonged, however, return to normal function (stress recovery) is delayed and chronic dysregulation may occur (Path I). Persistent dysregulation combined with (or driving) unhealthy behavior can lead to serious health implications, including cardiovascular disease, metabolic disorders and compromised immune function (Path J).

### **Discrimination and Acute Stress Reactivity (Path E)**

We are not the first to consider the effects of discrimination in terms of stress and accompanying physiological processes. Interested readers are referred to more detailed theoretical analysis and empirical reviews (Mendes & Muscatell in this volume as well as Lewis et al., 2015; Paradies et al., 2015). Our goal here is to examine the evidence that social cognitive processes play a role in the relationship of discrimination to stress reactivity and recovery.

A number of laboratory studies have shown that acute exposure to discrimination-related threats is accompanied by an acute stress response among targeted group members. Greater cardiovascular reactivity (e.g., increased heart rate and blood pressure) is consistently observed when members of stigmatized groups are asked to think about discriminatory events (e.g., Cooper, Thayer, & Waldstein, 2014); are exposed to discrimination portrayed in media (e.g., Armstead, Lawler, Gordon, Cross, & Gibbons, 1989); or anticipate a group-related identity threat in the lab (e.g., Eliezer, Major, & Mendes, 2010). A limited number of studies have found relationships of race-related threats to increases in neuroendocrine response mediated through cortisol (e.g., Richman & Jonassaint, 2008) and class or SES-related discrimination on inflammatory responses mediated through interleukin-6 and other markers (e.g., John-Henderson, Rheinschmidt, Mendoza-Denton, & Francis, 2014, also see Mendes & Muscatell in this volume).

The bulk of the literature on discrimination and stress reactivity has not included explicit measures of social cognition. However, some studies have conducted manipulations intended to affect social cognition. The results of these studies suggest the importance of social cognitive processes as drivers of physiological reactivity. For example, one study examined cardiovascular reactivity to stressful tasks (i.e., responding to accusations of shop-lifting) which were overtly race-related or presumably non-race-related. The investigators found that Black participants in

the non-race-related condition showed unexpectedly high cardiovascular reactivity. Subsequent analyses revealed that some of the participants interpreted the neutral situation as discriminatory, and these perceptions were associated with greater reactivity (Merritt, Bennett, Williams, Edwards, & Sollers, 2006). One interpretation is that prior experiences with race-related injustice (specifically unjust accusations of crime) influenced the development of participants' schemas about other people's prejudicial beliefs. These schemas may have been activated during this laboratory paradigm, intensifying cardiovascular reactivity.

The effects of discrimination on social cognition may influence stress responses across a wider range of stress exposures. In an ambulatory monitoring study adolescent participants provided diary entries on negative affect, among other variables, and saliva cortisol five times a day for three days (Doane & Zeiders, 2014). As expected, cortisol levels were higher when individuals reported negative affect. However, the within-person relationship of negative affect to cortisol was seen primarily for individuals who had reported high levels of prior discrimination in the past year.

These findings suggest the possibility that discrimination may intensify threat appraisals during everyday life stressors and potentiate reactivity to other stressors. This interpretation is consistent with results of ambulatory blood pressure monitoring studies. As we have reviewed previously, most ambulatory monitoring studies indicate that discrimination is associated with higher levels of blood pressure during the day as individuals engage in daily activities (Brondolo, Love, Pencille, Schoenthaler, & Ogedegbe, 2011). However, one study suggests that these effects were seen only among older adults (Beatty et al., 2016). To date, studies have not explicitly tested the hypothesis that schemas and threat appraisals mediate the relationship of discrimination to ABP.

Recent laboratory research has included more explicit examinations of the ways in which schemas may attenuate or exacerbate psychophysiological reactivity to discrimination-related stressors. In series of studies, investigators examined the role of schemas as modifiers of psychophysiological reactivity to discrimination-related stress (see Richman, Bennett, Pek, Siegler, & Williams, 2007; Townsend et al., 2014; Townsend, Major, Gangi, & Mendes, 2011; Townsend, Major, Sawyer, & Mendes, 2010). For example, in one study, the investigators examined cardiovascular responses in a sample of Latina women interacting with a prejudiced (vs. non-prejudiced) White confederate during a difficult memory task (Townsend, et al., 2010). They tested the moderating effects of schemas about the world, including system-justifying beliefs. System justifying beliefs (i.e., beliefs that status and rewards are distributed fairly by society) were negatively related to the magnitude of cardiovascular threat responses when interacting with a non-prejudiced interviewer and marginally positively associated with threat responses when interacting with the prejudiced interviewer. The investigators suggest that system-justifying beliefs may attenuate appraisals of threat when experiences are in line with predictions about the world, but may exacerbate reactivity when expectations are violated, consistent with the worldview verification model (Major, Kaiser, O'Brien, & McCoy, 2007).

Socioeconomic status also affects schemas that may influence psychophysiological reactivity to discrimination (Townsend et al., 2014). The authors suggest that middle class individuals are more likely to hold schemas about personal control or agency (i.e., beliefs that one's actions influence the outcome of events); whereas working class individuals may be more likely to hold schemas about the value of adaptation to the environment. The authors hypothesize that discrimination may be more threatening to middle class individuals, because discrimination disrupts beliefs in one's ability to exert personal control over the outcomes of events.

To test these hypotheses, the authors subjected a sample of Latina women to mock interviews in which they were provided with negative feedback by a White woman (i.e., an experimental confederate who did vs. did not communicate prejudice). The findings support their hypotheses. Among the middle-class Latinas, cortisol reactivity was higher when participants interacted with the prejudiced vs. the non-prejudiced interviewer; whereas among working-class Latinas cortisol reactivity did not vary based on the interviewer's level of prejudice.

A recent paper expands on these data and documents the role of racial/ethnic discrimination in the formation of schemas among Black participants (Lucas et al., 2016). The authors found that racial discrimination is positively associated with the development of negative schemas; specifically, beliefs in an unjust world that reflect the notion that fairness and justice are not accessible to all. In their study, cortisol and immune reactivity were assessed in response to laboratory tasks in which both procedural justice and participant outcomes were manipulated. When individuals held schemas that reflected the notion that the world is persistently unjust, they were less likely to show neuroendocrine or immune activation in response to injustice modeled in the lab. In some sense, the current injustice was predictable and consistent with their worldview; and therefore out of their personal control. In contrast, when individuals did not endorse beliefs in an unjust world and were exposed to injustice, participants were more likely to view the situation as discriminatory and to demonstrate increased physiological reactivity to the injustice. For these individuals, the unfair treatment was less expected and more threatening, and consequently more activating. This pattern is consistent with the worldview verification model of Major et al (2007).

Overall these experimental data suggest that discrimination may be linked to the development of schemas about justice and social evaluation; whereas social class may be linked

to the development of schemas about personal agency. In turn, these schemas shape the degree to which different environmental events are viewed as personally salient and potentially threatening. Some schemas may also modulate task engagement and persistence, and influence cognitive, affective, and behavioral responses to the task demands, ultimately driving the patterning of stress reactivity.

Schemas such as unjust world beliefs, may reduce stress reactivity by diminishing the unpredictability and personal salience of discrimination-related threats. But persistent beliefs that the world is unjust may reduce an individual's sense of agency and optimism, and lead to disengagement and possibly depression (Lench & Chang, 2007). Schemas, which are depressogenic, may exert long-term effects on HPA functioning, which may undermine stress recovery over the long run (Burke, Davis, Otte, & Mahr, 2005).

By contrast, schemas, such as John Henryism or Super Woman Schema may emerge as a defense against the threat of discrimination to personal agency or control. John Henryism (James, LaCroix, Kleinbaum, & Strogatz, 1984) and Super Woman Schema (Woods-Giscombé, 2010) incorporate beliefs that intense effort on the part of the individual are necessary to overcome the barriers created by discrimination. In the short term, some evidence suggests that these schemas are associated with greater cardiovascular activation, potentially reflecting greater effort or increased threat (Flaskerud, 2012). Much less is known about the long-term effects of heightened efforts to control the environment, when aspects of the situation may not be under individual control. To accurately interpret the effects of discrimination on health, it will be necessary to carefully evaluate the effects of schemas that may attenuate or exacerbate the impact of discrimination-related stress on psychophysiological response both over the short term and the long-term.

**Discrimination and Stress Recovery (Path F)**

Evidence from both laboratory and field studies suggest that discrimination may limit physiological recovery after stress exposure (Path F). Although the data are limited, they are consistent in suggesting that perceived discrimination prolongs physiological activation and/or disrupts normal diurnal patterning. For example, in the study by Merritt et al. (2006) in which Black individuals demonstrated greater cardiovascular reactivity to a non-race-related stressor than a blatant racism stressor, those who reported perceiving racism in the context of the non-race-related laboratory challenge (i.e., listening to a vignette of someone being accused of shoplifting) also had elevated levels of BP during rest periods after the task. Other studies suggest discrimination may result in sustained activation following stress exposure, even when the stressor is not overtly related to race. Racial discrimination was associated with poorer flow mediated dilation (a measure of endothelial function) following, but not during, a stressful math task (Wagner, Tennen, Finan, Ghuman, & Burg, 2013).

These laboratory studies raise the possibility that discrimination may activate social cognitive processes that sustain the experience of threat, even when the acute threat has ended. Discrimination-influenced schemas may be readily and repeatedly activated even when there are only subtle links between the new stressor and discrimination. For example, some actions and activities (e.g., challenging academic tasks, receiving negative feedback) may be more capable than others of evoking social threat and discrimination-related concerns among individuals frequently targeted for discrimination (Brondolo & Jean-Pierre, 2014). Explicit perseverative cognitions, including rumination and anticipatory threat concerns can prolong activation following these threats (Brosschot, Gerin, & Thayer, 2006). However, physiological reactivity may persist even when individuals are unaware of the reasons for their discomfort (i.e., they do

not consciously recognize the concerns about discrimination evoked by the experience.) They may be less able or likely to engage in active coping when the threat and/or the experience of distress are not processed consciously. Recent studies have highlighted the ways in which reactivity may persist as a function of sustained, but non-conscious, negative affect (Broschott et al., 2014).

Field research has also been used to examine the effects of discrimination on indices of daily recovery from stress across multiple physiological systems. Specifically, most but not all studies (see reviews by Brondolo et al., 2011; Dolezsar, McGrath, Herzig, & Miller, 2014) indicate that discrimination is associated with higher levels of blood pressure during the night, suggesting poorer recovery from daily stress and disruptions to circadian rhythms. Similarly, persistent discrimination was associated with disruptions in the normal circadian rhythm, expressed as flatter diurnal slopes in cross sectional (Huynh, Guan, Almeida, McCreath, & Fuligni, 2016) and prospective studies (Adam et al., 2015); but see Doane and Zeiders (2014) for null results and Fuller-Rowell, Evans, and Ong (2012) for inverse effects. However, to our knowledge, there has been very limited investigation of the social cognitive processes that may mediate the relationship of discrimination to measures of daily or longer-term recovery of the HPA or the autonomic nervous system in field studies.

The relationship of discrimination to both nocturnal ambulatory blood pressure and disruptions in diurnal patterns of cortisol release may be a function of the effects of discrimination on sleep. Discrimination has been consistently associated with sleep impairments (see Grandner et al., 2012 for review and data). Impairments in sleep may be a critical driver of difficulty in physiological recovery across systems (Faraut, Boudjeltia, Vanhamme, & Kerkhofs, 2012).

### **Paths D and G: Discrimination and Health Behavior**

Discrimination has been associated with a wide variety of negative health behaviors (for a meta-analytic review of earlier works, see Pascoe & Richman, 2009). For example, the data on discrimination and substance use are substantial and largely demonstrate a positive relationship. Over 20 studies using cross-sectional surveys, daily diaries and years-long longitudinal data show that experiences of discrimination predict higher rates of smoking (e.g., see review in Brondolo et al., 2015). An equally large number of studies – also with a variety of methods -- show that experiences of discrimination predict higher rates of drinking and drug abuse. Longitudinal analyses from the Family and Community Health Study (FACHS) provide particularly compelling evidence. In a study of Black parents and children, experiences of discrimination were linked over time with reports of substance (smoking, alcohol, illicit drugs) use and abuse for both the children/young-adults and the parents (e.g., Gibbons et al., 2014). A smaller body of research suggests that discrimination is associated with less healthy eating choices and more frequent food consumption (Cozier et al., 2014).

Schemas and cognitive control processes may mediate the relationship of discrimination to health behavior. Greater distress may increase risk for negative health behaviors, including the consumption of food and cigarettes (Path G: Jackson et al., 2009). Distress may heighten the perceived benefits of substance use (e.g., in terms of stress reduction or pleasure) or reduce resistance to substance use by exacerbating the discomfort associated with cravings (Eissenberg & Thomas, 2004). These negative emotions may be an outcome of discrimination-related negative schemas, but research has not yet addressed this question.

The relationship of discrimination to schemas related to social and personal identity may alter commitment to particular health behaviors and affect the motivation to change unhealthy

behavior (Paths C and D: Steele, 1997). When specific health behaviors or characteristics (e.g., a slimmer figure) are not depicted as part of the norm for one's group, these characteristics may be rejected, considered irrelevant, or viewed as outside of one's control (Hebl, King, & Perkins, 2009). The effects of biased depictions of behavioral norms (e.g., race differences in the depiction of overweight individuals) can have particularly deleterious effects when group and individual identity are closely related. As just one example, commercial television and movies present many more overweight Black versus White Americans (Tirodkar & Jain, 2003). When negative health behaviors (e.g., eating particular unhealthy foods) are closely associated with group identity, stronger identification may become a potential barrier to adopting alternative behaviors. Some minority individuals (including Black, Latino and Native American individuals) view unhealthy behaviors (e.g., eating unhealthy foods, not exercising) as part of their minority group identity. In a series of studies, when group identity was primed (made salient), individuals who viewed unhealthy behaviors as part of their group identity were less likely to endorse the benefits of healthy behaviors (Oyserman et al., 2007). These issues are discussed in greater detail in Oyserman and Fisher's chapter in this volume.

On a more positive note, some experimental evidence suggests that modifying media presentations about weight can change the norms individuals internalize and apply to evaluate health outcomes (Hebl et al., 2009). Race-related group norms can also decrease unhealthy behavior. For example, when Black youth living in neighborhoods with more White youth had higher racial identity and viewed substance use as inconsistent with normative behavior for their group, they reported less willingness to use substances (Stock et al., 2013). Changes in identity-based motivation can make a difference in behavior (Oyserman, 2015).

The effects of discrimination on health behavior may also be partly a function of discrimination-related changes in the deployment of cognitive control processes, particularly the processes needed to shift attention from the short-term benefit of substance use or eating to the longer-term benefits for health (Paths C and D: Koffarnus, Jarmolowicz, Mueller, & Bickel, 2013). Several laboratory studies suggest that acute episodes of social exclusion and/or race-related discrimination are associated with greater consumption of snack foods (Inzlicht & Kang, 2010), greater accessibility of substance-related thoughts (Stock et al., 2011), and greater willingness to use alcohol or drugs (e.g., Gerrard et al., 2012). However, these studies have not directly tested attentional processes or cognitive flexibility as mediators of the relationship of discrimination to substance use in daily life.

In sum, the effects of discrimination on social cognition may influence health behavior through multiple pathways. The effects of discrimination on identity-related schemas may influence the characteristics that individuals view as salient for their sense of self and belonging (Path A, D). The relationship of discrimination to negative schemas about the self, others, and the world may heighten threat appraisals that can serve as a stress triggers for initiating and maintaining unhealthy behavior. (Paths A, E & G). The effects of discrimination on cognitive processes control processes may limit the ability to keep long term health promoting goals in mind, impairing the ability to self-regulate health behavior. (Paths C and D) Additional research is needed to explicitly test hypotheses about the role of these both schema and cognitive control processes as mediators of the relationship of discrimination to excess consumption in real world settings.

### **Path I: Discrimination and Long-Term Dysregulation in Psychophysiological Systems**

As suggested in Path I, the association of discrimination to persistent stress reactivity,

limited stress recovery, and negative health behaviors may account for the association of discrimination to allostatic load. The concept of allostatic load takes into account the effects of the stress response across many of the major body systems – particularly over the long-term. Allostatic load serves as a global assessment of bodily “wear and tear” (McEwen & Gianaros, 2010), and may serve as evidence of impaired recovery or dysregulation of physiological systems following stress exposure, likely in combination with behavioral risk factors, (e.g., low activity, high food intake, interpersonal conflict). Higher allostatic load has been associated with increased mortality (Seeman, McEwen, Rowe, & Singer, 2001).

A longitudinal study of Black adolescents provides evidence of the causal direction of the relation between discrimination and allostatic load (Brody et al., 2014). Participants completed measures of perceived discrimination when they were 16, 17 and 18 years old. Components of allostatic load (e.g., diastolic and systolic blood pressure, overnight levels of epinephrine, norepinephrine and cortisol, body mass index and C-reactive protein) were assessed when they were 20 years old. Controlling for other stressors and risk factors (e.g., SES risk, general perceived stress, depressive symptoms, and unhealthy behavior), the authors found that the discrimination reported in prior years predicted higher allostatic load at 20-yr of age.

Of further interest was the finding that this effect was moderated by emotional support, such that participants who had received high levels of emotional support in adolescence did not show the effect. Allostatic load was significantly elevated only for Black participants who had experienced both high levels of prior discrimination and little emotional support. These findings raise the possibility that the relationship of discrimination to allostatic load may be partly mediated through the effects of support on the development of positive relational schemas. Positive relational schemas may attenuate or buffer reactivity to other stressors including

subsequent negative interpersonal interactions. These findings are discussed further in the chapter in this volume by Barton and Brody.

Taking an econometric approach, Johnston and Lordan (2012) examined changes in population-level data in the U.K. between 1999 and 2004, hypothesizing that increased discrimination against Muslims during that period (post 9/11/01 bombings in the US and subsequent terrorist attacks that affected many European individuals) would show negative health effects in this population. Comparisons between Muslims and Non-Muslim minority group members showed higher allostatic load across time for the Muslims than the non-Muslims.

Most recently, investigators examined mediators of the relationship of discrimination to allostatic load (Tomfohr, Pung, & Dimsdale, 2016). Black adults had higher allostatic load than White adults. In a serial mediation analysis, these differences were explained by race differences in discrimination. The effects of discrimination on allostatic load were mediated via anger and impaired sleep. These findings provide support for the notion that discrimination impairs health through social cognitive processes and their subsequent effects on physiological reactivity and recovery. The long-term effects of discrimination may increase risk for higher levels of allostatic load.

### **Summary and Integration**

Cultural, institutional, and interpersonal discrimination shape the social context in which targeted minority group members live. Discrimination not only exposes individuals to unsafe and unjust circumstances, this exposure influences the development of a wide range of social cognitive processes that can increase the overall burden of threat facing minority group members (Brondolo et al., 2016). Discrimination shapes schemas that increase concerns about being judged, rejected or harmed by others during interactions in everyday life (Path A). These

concerns may increase the degree to which targeted individuals anticipate new threats and access memories of past discriminatory events (Lewis, et al 2015; Hatzenbeuler, Nolen-Hoeksma, & Dovidio, 2009). The neural structures engaged in the detection of social threat and the development of expectations (schemas) about new threats make it likely that even minimal cues may be sufficient to rapidly activate threat responses (McKenzie et al., 2013; Tse et al., 2011). Repeated threats, a combination of current, anticipated and recollected threat exposures, are accompanied by psychophysiological stress reactivity to a wide range of stressors in day-to-day life (Path E). These repeated threats may also interrupt the process of recovery (Path H), potentially driving rumination, disrupting the diurnal cortisol rhythm, preventing nocturnal blood pressure dipping, and impairing sleep (Path F: Huynh et al., 2016; Brondolo et al 2011; Grander, 2010).

Discrimination also impairs stress recovery through its effects on cognitive control processes, including the capacity to shift attention and perspective (Paths B: Murphy et al., 2007). Persistent threat and the strategies individuals learn to address these threats shape the neural structures and processes responsible for modulating threat responses (Path B2: Blair & Raver, 2012). These effects can create a vicious cycle in which it is more difficult to rapidly recover from threat exposure or modify responses to threat (Path F).

Schemas and cognitive control processes may also interact to shape goal directed behavior (Path C), influencing the capacity for engagement (or disengagement) as individuals encounter daily demands. The effects of discrimination on the social cognitive processes that drive goal-directed behavior are likely to influence health behavior choices (Path D).

Discrimination affects the degree of social threat that accompanies the choice of health-related goals (Oyserman et al., 2007). As individuals pursue goals that may elicit discriminatory

behavior (i.e., changing eating behavior or pursuing activities not typical for members of their group), the presence of social threat may change the patterning of psychophysiological pathways activated to support goal attainment. Over the long run, possibly through pathways linked to long term changes to systems involved in stress reactivity, stress recovery and health behavior, discrimination is linked to higher levels of allostatic load (Path I: Brody et al., 2014).

Transactional relationships among psychobiological systems within the individual can further drive reactivity and impair recovery. Heightened stress reactivity can drive unhealthy behaviors (e.g., smoking, substance) aimed at regulating stress response (Path G: Jackson et al., 2009). Discrimination-related changes to cognitive control mechanisms may reduce the capacity to shift perspective and view health behavior in a different context (Paths C2 to D: Inzlicht, et al., 2006). The effects of discrimination on schemas and cognitive control processes may interact to contribute to the emotional burdens – the depressive symptoms and negative moods – that are consistently associated with exposure to discrimination (Path E, I: Brondolo et al., 2016). These emotional burdens may undermine health directly and reduce the personal resources needed for emotional and physiological recovery and health promoting activities.

The social environment also makes recovery difficult. Environments in which race is made salient (e.g., through repeated media exposure and repeated targeting of minority group members) may have the effect of intensifying racial centrality and the personal salience of race-related threats. But shifting attention away from racial injustice is clearly not a long-term solution. Eliminating discrimination requires attention to injustice, even when that attention results in pain.

The fight against discrimination takes sustained energy. The anger evoked by injustice may help fuel that energy (Scott, Trost, Bernier, & Sullivan, 2013). On a group level, anger may

motivate social change. But on an individual level, sustained anger is exhausting. Anger may drive substance use (Gibbons et al., 2014), stress reactivity (see Suls & Bunde, 2005), disrupt sleep (Tomfohr et al., 2016), and anger appears to serve as a mediator of the relationship of discrimination to allostatic load (Brody et al, 2014, Tomfohr, et al., 2014)

Changing the deleterious effects of discrimination on health behavior and stress reactivity and recovery is not a simple process. Individual-level intervention efforts targeting stress or health beliefs and behavior may be insufficient to improve health disparities. The effects of institutional discrimination (e.g., unequal housing quality, unequal access to educational, political, and economic resources) may overwhelm the social, material and personal resources available to make individual-level changes. And being asked to make individual-level changes that require unavailable resources may add to the burden of anger and frustration.

Even when individuals make efforts to change their thoughts, feelings and actions, the social environment may constrain the benefits of their efforts. The evidence suggests that efforts to change social cognition and self-regulation on an individual level can be effective, but they are sometimes accompanied by increases in signs of physiological dysregulation, including increases in blood pressure and signs of epigenetic aging (see Brody et al., 2013; Miller, Yu, & Brody, 2015).

Changes to the larger social environment are likely to be necessary to sustain the individual-level changes in social cognition hypothesized to produce health effects. Major experimental studies, such as Moving to Opportunity (in which individuals were randomly assigned to move to a neighborhood with more resources) provide insight into the ways in which the social environment can improve mental health (e.g., improve school outcomes, reduce criminal activity) and physical health (e.g., reduce obesity and diabetes) (Ludwig et al., 2013).

However, there is still limited information about the ways in which changes to the social environment affect social cognition and health.

On-going national events can also provide insight into the ways in which social change can influence the development of social cognition and health. For example, recent difficult but largely successful efforts to remove the Confederate flag from government buildings and other properties represent a change in discrimination at the cultural level. Tragic deaths and environmental disasters across the country have propelled efforts to improve institutional discrimination, directing an examination of and change in law enforcement practices and environmental safety. Vigorous efforts by Michelle Obama and other leaders have made healthy food consumption a very visible and engaging part of the national conversation about health.

These social actions may have risks of their own (e.g., backlash); but changes to institutional policies and cultural communications may also change social cognition. As individuals participate in and observe effective community or national strategies for addressing the threats created by discrimination, they may develop more positive and hopeful schemas about themselves, others and the world at large. And in turn, these schemas may enhance resilience and reduce threat appraisals on a day-to-day basis, potentially improving health over time. Visible efforts to make health food more accessible in low-income communities may change the relationship of health habits to social identity. Assessing the effects of social change on social cognition will be an important goal for future research.

The threats associated with discrimination and disadvantage not only influence the content of thoughts and feelings, but also the underlying neural structures and processes which subserve threat detection and response. This raises the possibility that efforts to reduce stress reactivity and improve stress recovery may require more sustained effort for those who have

faced chronic discrimination and disadvantage. Consequently, interventions may need to be more intensive and offered for longer periods.

### **New Research and Future Directions**

The research on discrimination that we discuss here is based largely on measures of individual-level discrimination. Many, although not all studies, included Black or Hispanic samples. Individuals may be stigmatized and discriminated against on a number of group dimensions, including social class, gender, sexual orientation, religion, nationality or disability status, among other dimensions. To build a more generalized model of the effects of discrimination, it will be critical to test hypotheses about the effects of discrimination on social cognition and stress processes among other groups targeted for discrimination.

Different kinds of discrimination (e.g., social exclusion vs. physical threat) may have different psychobiological effects. There is a need for research to clarify the ways in which different types and intensities of exposure to discrimination influence social cognition. Race-related social exclusion may be associated with different types of schemas and symptoms than race-related threat (Brondolo et al., 2011). The effects of discrimination on social cognition may also vary depending on the degree to which it is paired with other types of traumatic events, including exposure to violent crime. Issues related to the intersection of racial discrimination with other social status and contextual variables, including nativity and residential segregation must be addressed (Williams, Priest, & Anderson, 2016).

With few exceptions (see reviews in Lee & Ahn, 2013; Paradies et al., 2015), the studies examining the relationship between discrimination, social cognition and health have employed cross-sectional designs. It will be critical to use longitudinal models to examine how these social cognitive processes are affected by discrimination over time. Longitudinal studies can also

illuminate the ways in which schema activation (and subsequent changes in stress reactivity or health behavior) is affected by day-to-day changes in the social environment. Continued research on the effects of acute and chronic stress on the development of connections among brain areas is critical. Studies that incorporate measures of neuropsychological processes into studies of the mental and physical health effects of discrimination will be increasingly valuable.

In this chapter we focused on the effects of discrimination on pathways primarily related to threat stress reactivity. However, discrimination also increases alienation and disenfranchisement, and may lead to health impairments through pathways related to depression. Some of these effects may be associated with long-term changes in the regulation of the HPA axis and other mechanisms. To build more comprehensive models of the effects of discrimination and social cognition on health, it will be necessary to examine the relationships of discrimination and social cognition to physiological reactivity and recovery across a wide range of outcomes.

As several review papers have documented, the effects of discrimination on mental health outcomes are consistent and robust; discrimination is linked to depression, anxiety, and even psychosis in some populations, and social cognition may mediate some of these effects (see Brondolo et al 2016; Paradies et al., 2015). The effects of individual level discrimination on health risk factors, including indices of stress reactivity and recovery or health behavior are clear and generally consistent (Pascoe & Richman, 2009). However, the effects on physical disease outcome are only just emerging, and the data suggest that there may be important moderators of these effects (e.g., Everson-Rose et al., 2015). Further research is needed to understand the role of genetic, environmental, behavioral or social factors that either attenuate or exacerbate the effects of discrimination on health.

Although more research is needed on the relationship of discrimination to health, there is reason to be hopeful. Multidisciplinary research is permitting a more mechanistic and comprehensive understanding of the ways in which discrimination affects health. Greater public attention to health disparities supports the efforts of researchers to address this critical problem.

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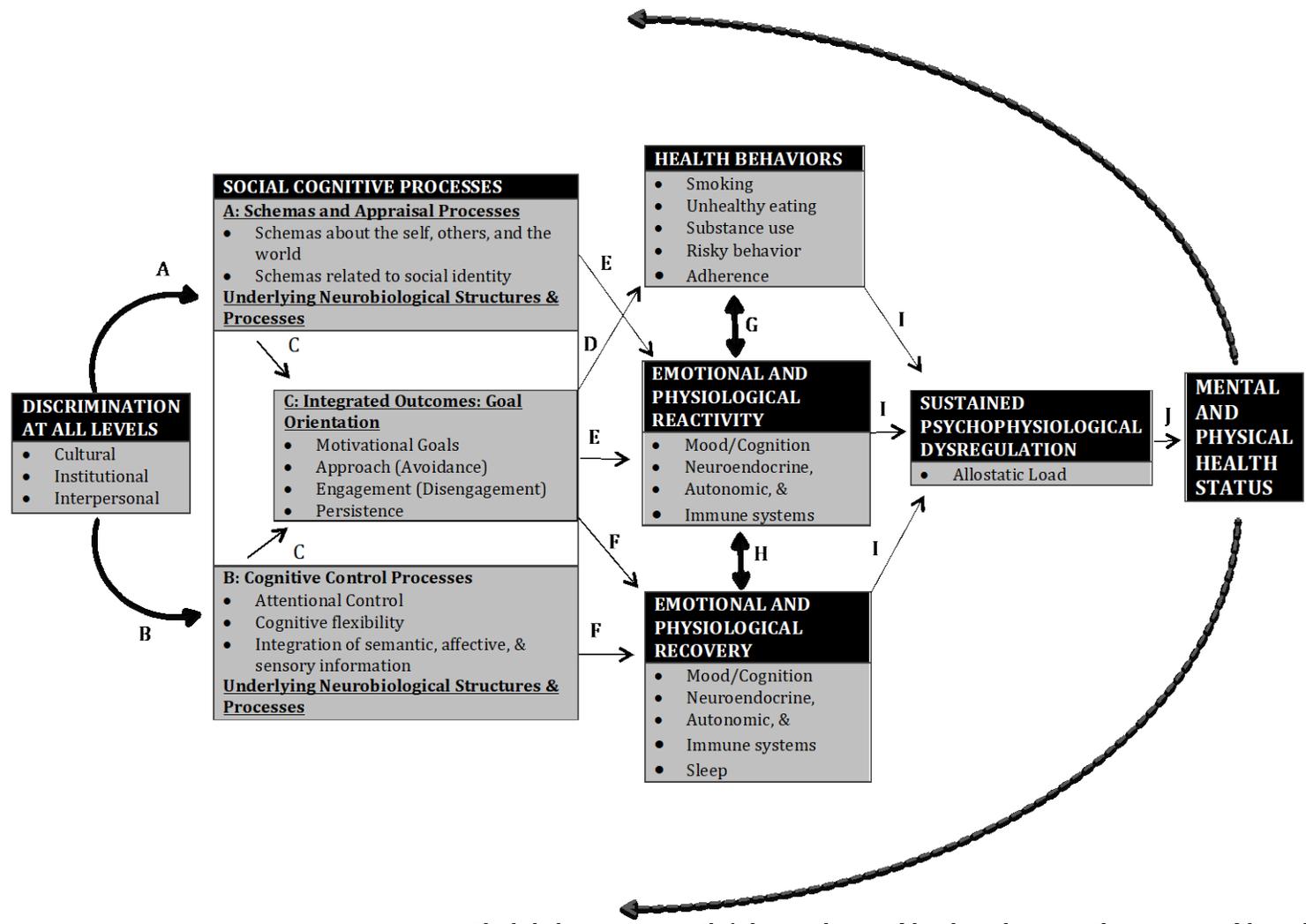
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Figure 1. A Biopsychosocial Model of the Role of Social Cognitive Processes in the Relationship of Discrimination to Health



The dashed arrows represent the bidirectional nature of the relationships among the components of this model