

Neuropsychological Correlates of Cultural Wounding: *Implications for Risks of Diabetes Mellitus and Cardiovascular Disease*

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July 1, 2009

STEREOTYPES are invented and promulgated to ‘explain’ or ‘justify’ subtle-to-overt policies of intimidation, exploitation, or subjugation of one group by another. That such stereotypes as dirty, lazy, sneaky, greedy, exotic, and sexy have been used to describe Europeans by Chinese, Jews by Gentiles, Arabs by Jews, Jews by Arabs, and blacks by whites would suggest a degree of universality in oppressive stereotypes (Allport, 1958; Isaacs, 1975; Shipler, 1986). Although the particularity of stereotypes associated with different ethnic groups has been identified, the extent to which stereotyped groups identify with stereotyped projections is less well investigated.

In the U.S., our best estimate is that about one-in-three blacks believe as racist do that blacks are mentally defective intellectually, morally, and emotionally and physically gifted athletically, sexually, and artistically (Taylor & Grundy, 1996; Taylor & Obiechina, in press). In four public housing communities located in a large metropolitan area, almost 50 percent of black mothers tested identified at a clinically high level with white racist concepts of blacks (Taylor & Obiechina, in press). From Taylor’s (1996) taxonomy of more than 144 forms of racial prejudice and discrimination, these findings are not altogether surprising. Indeed, major sectors of our national economy depend on the materialization of racist stereotypes we unselfconsciously embrace: Multimillion-dollar industries profit from the disproportionate number of blacks in special education programs (intellectually inferior), in prison (morally impaired), and in mental health hospitals (emotionally unstable). Other multimillion-dollar industries in welfare (sexually exotic), sports (athletically commandeering), and entertainment (artistically gifted) depend on blacks imaging themselves as racists do. The accelerating growth of these industries may well serve to increase the risk of identifying with these racist stereotypes by blacks and whites.

Studies summarized in Table 1 suggest that blacks who identify with racist stereotypes which deny and undermine their humanity are at risk of a wide range of mental and social health problems.

Table 1: Relationship Between Internalize Racism and Indicators of Mental and Social Health

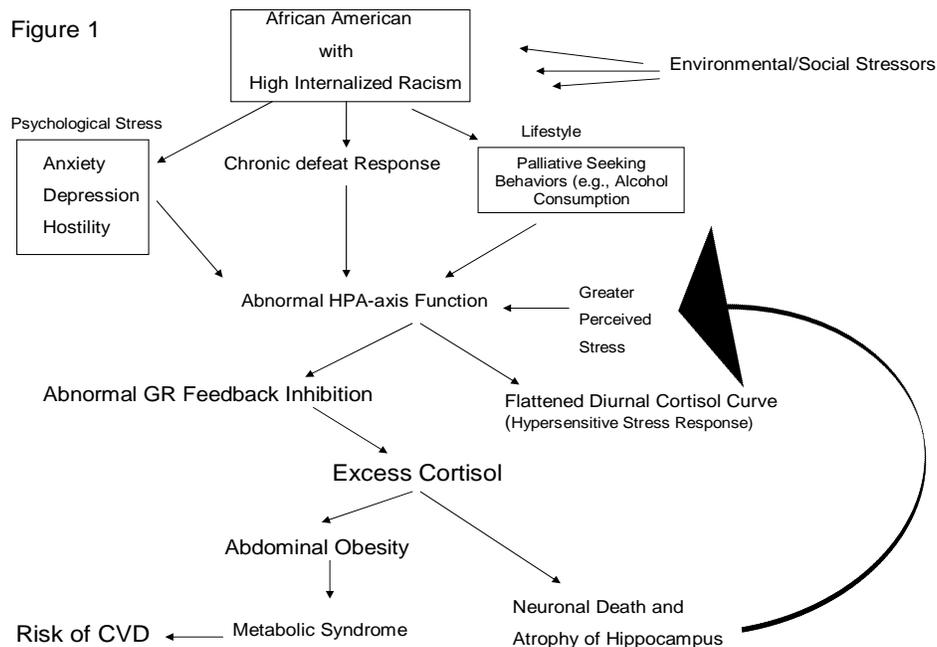
Dependent Variable Evaluated	Relationship Between Internalized Racism and Dependent Variable	Investigators
Alcohol Consumption	Direct	Taylor & Jackson (1990a & 1990b)
Aggressive Behaviors	Direct	Denton (1985); Taylor (in press)
General Mental Health Symptoms	Direct	Taylor & Jackson (1991)
Depressive Symptoms	Direct	Franklin (1986); Taylor, Henderson & Jackson (1991); Tomes, Brown, Semanya & Simpson (1990)
Marital Satisfaction	Inverse	Taylor (1992); Taylor & Zhang (1990)
Disclosive Disposition	Inverse	Taylor & Tull (submitted)
Empathic Capacity	Inverse	Barrett (1976)
Structural Outcomes: Education and Income	Inverse	Murrell (1989)

From Taylor, J., Obiechina, C., & Harrison, S. (1998). Toward a psychology of liberation and restoration: Answering the challenge of cultural alienation. In R.L. Jones (Ed.), *African American Mental Health*. Hampton, VA: Cobb & Henry, 283-301.

Moreover, blacks who identify with racist stereotypes present higher levels of insulin resistance, glucose intolerance, abdominal adiposity, cortisol production, and systolic blood pressure which place them at higher risk of cardiovascular disease and diabetes mellitus (Tull, Wickramasuriya, Fraser, &

Taylor, 2001; Tull, Butler, Taylor, Chambers, et al., in press; Tull, Butler, Taylor, Fraser, et al., 2001; Wickramasuriya, Taylor, Smith-Burns, et al., 1999).

How shall we account for the relationship between internalized racism and risk factors associated with physical disease and emotional conditions that increase the risk of physical disease? Adapting the empirically supported proposition of Per Björnthorp (3) that chronic defeat responses to psychosocial stress trigger cascading arousal effects on the HPA-axis that lead to cortisol dysregulation, abdominal obesity, and metabolic anomalies associated with risks of diabetes mellitus and cardiovascular disease, we hypothesize that internalized racism induces a mindset predisposing its victims to defeatist attitudes and responses when confronted with social and environmental stress. We therefore expect that internalized racism will be associated positively with measures of psychological distress, abnormal HPA-axis function, poor cortisol regulation, abdominal obesity, insulin resistance and glucose intolerance—precisely what we have found in studies summarized in Table 1 and in the preceding paragraph. We outline in Figure 1 our complete theory of expectations guiding our research thus far.



The overall purpose of this study series is to understand how racism and its internalization influence neuropsychological processes that increase risks of diabetes mellitus and cardiovascular disease in African American adults. Toward this end we raise five questions that motivate five corresponding aims of this investigation:

- Does exposure to racialistic incidents activate pain centers in the brain (Specific Aim 1)?
- Does exposure to racialistic incidents activate areas of the brain associated with dysphoric mood and conditions—anxiety, depression, and hostility (Specific Aim 2)?
- Do racist stereotypes affect areas of self-representation in the brain more profoundly among persons high in internalized racism relative to persons low in internalized racism (Specific Aim 3)?
- Are areas of the brain associated with cognitively challenging tasks underactivated in persons high in internalized racism relative to persons low in internalized racism (Specific Aim 4)?
- Among persons high in internalized racism, is there a greater risk relative to persons low in internalized racism of neuronal damage in areas of the brain associated with the encoding of memory and the neuroregulation of stress (Specific Aim 5)?

Specific Aim 1: *to evaluate the extent to which racialistic incidents activate areas of the brain associated with experiences of social exclusion and rejection and to determine whether this activation is moderated by level of internalized racism.*

Following Figure 1, we are evaluating whether neuropsychological effects of racism as environmental or exogenous stressor is conditioned by the ‘host’ variable internalized racism. If we argue as would appear reasonable that racialistic incidents increase the sense of social rejection or exclusion of its victims, we can take advantage of a recent report carrying the provocative title, *Does Rejection Hurt? An fMRI Study of Social Exclusion*, (Eisenberger, et al., 2003). These investigators presented evidence of increased blood flow to the anterior cingulate cortex and the right ventral prefrontal cortex following an experimental manipulation that simulated the experience of social exclusion (see also Panksepp, 2003, whose results are similar). Figure 2 taken from Eisenberger et al (2003) summarizes neuropsychological effects of social exclusion using fMRI.

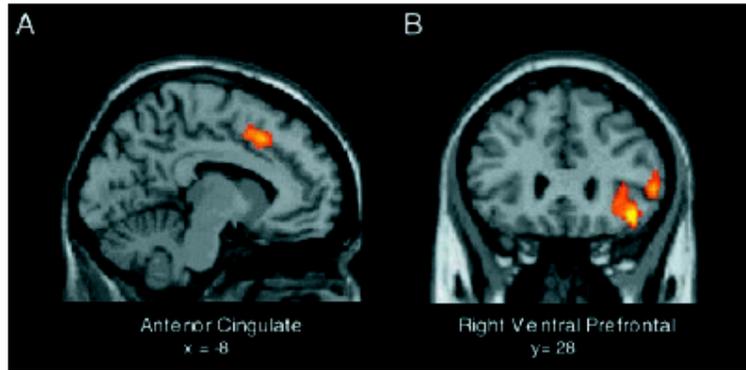


Fig. 2. (A) Increased activity in anterior cingulate cortex (ACC) during exclusion relative to inclusion. (B) Increased activity in right ventral prefrontal cortex (RVPFC) during exclusion relative to inclusion.

Hypotheses

Utilizing 10 persons high in internalized racism and 10 low in internalized racism matched for age, sex, BMI, right-handedness, and socioeconomic status, we expect using fMRI that:

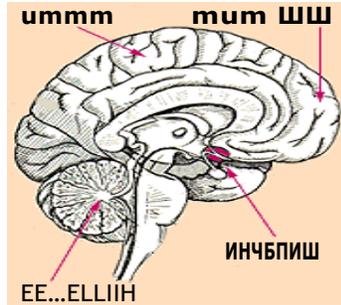
1. Racialistic incidents that are individual, overt, and behavioral will activate greater cerebral blood flow to the anterior cingulate cortex and the right ventral prefrontal cortex than those which are institutional, covert, and attitudinal which in our previous research are more difficult to discern. We also will be positioned to determine the type of racialistic incidents that may be the most hurtful to persons low and high in internalized racism and those that may be differentially hurtful to each level of internalized racism.
2. When exposed to racialistic incidents, we expect there will be greater cerebral blood flow to the anterior cingulate cortex and the right ventral prefrontal cortex among persons high in internalized racism relative to persons low in internalized racism. This expectation is based primarily on prior studies indicating that persons high in internalized racism tend to perceive intimate other and intra-racial others as less accepting and disclosive toward them than persons low in internalized racism (Taylor, 1992; Taylor & Rogers, 1993; Taylor & Tull, submitted). This sociocentrifugal representation of others is expected to prime the disposition of persons high in internalized racism to decode racialistic incidents which also are sociocentrifugal in nature. This rejection-by-others schema we believe will underlie the greater activation of the anterior cingulated cortex and the right ventral prefrontal cortex in persons with high relative to low levels of internalized racism.

Significance

Is racism a form of rejection hurt? Neuropsychologically, does it hurt like physical pain which also activates the anterior cingulate cortex and the right ventral prefrontal cortex? Identification of the neuropsychological substrate is important in understanding how racism as an exogenous construct contributes to the cascading activation of the HPA-axis that leads to cortisol dysregulation and metabolic abnormalities associated with risks of diabetes mellitus and cardiovascular disease.

Specific Aim 2: *to evaluate the extent to which racialistic incidents activate areas of the brain associated with the processing of negative emotions and to determine whether this activation is different for persons high and low in internalized racism.*

Converging lines of evidence in human affective neuroscience suggest that the amygdaloid complex which coordinates the actions of the autonomic and endocrine systems is involved in processing the experience of negative emotions:



- Activation of the amygdala is associated with fear, anxiety, and general negative affectivity in both normal samples and in clinical populations with affective disorders (e.g., Abercrombie et al., 1998; Birmbauer et al., 1998; Breiter, Rauch, Kwong, Baker, & Rosen, 1996; Rauch et al., 1996).
- In healthy subjects the amygdala is implicated in various emotion-eliciting situations (e.g., Lane et al., 1997; Irwin et al., 1996; Ketter et al., 1996; Schneider et al., 1996; Zald & Pardo, 1996).
- With exception of a recent study by Anderson & Phelps (2002), lesions in the amygdaloid complex have been associated with impairments in conditioned fear responses (Bechara et al., 1995; LaBar, LeDoux, Spencer, & Phelps, 1995), fear potentiated startle (Funayama, Grillon, Davis, & Phelps, 2001), and arousal-enhanced memory (LaBar & Phelps, 1998; Adolphs et al., 1997).
- Activation of the amygdala with presentation of symptom-eliciting stimuli to patients with obsessive-compulsive disorder (Breiter et al., 1996), the imagining of combat-related scenes in patients with posttraumatic stress disorder (Rauch et al., 1996), and the viewing of neutral human faces in patients with social phobia (Birmbauer et al., 1998).
- Differential activation of the amygdala associated with the experience of a wide range of negative affects (Schneider et al., 1996; Zald & Pardo, 1996; Zald, Lee, Fluegel, & Pardo, 1998).
- In clinical populations, differential amygdala activation has been noted in patients with depression relative to healthy volunteers during resting baseline scans (Abercrombie et al., 1998; Drevets et al., 1992), and similar activations have been demonstrated in healthy volunteers during various affective challenges, such as the induction of sad moods (Lane et al., 1997; Schneider et al., 1995) and the viewing of unpleasant relative to neutral pictures (Irwin et al., 1996).
- Pharmacological induction of fear is associated with increased cerebral blood flow changes to the amygdala (Ketter et al., 1996).

Hypotheses

Utilizing 10 persons high in internalized racism and 10 low in internalized racism matched for age, sex, BMI, right-handedness, and socioeconomic status, we expect using fMRI that:

1. There will be greater baseline cerebral blood flow in the amygdala among persons high in internalized racism relative to persons low in internalized racism. This expectation is based on research findings indicating that persons high in internalized racism present with higher levels of dysphoric symptoms—*anxiety, depression, and hostility* (see Table 1). This relationship persists even when controlling for education, income, occupation, life events, and social support, and religious commitment.
2. There will be relatively greater cerebral blood flow in the amygdala of persons high in internalized racism than persons low in internalized racism following exposure to scenarios depicting racialistic incidents.

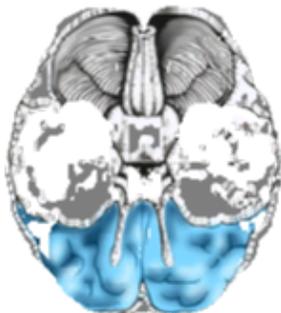
Significance

From Figure 1, the production of negative affects (*anxiety, depression, hostility*) contribute to the abnormal activation of the HPA-axis, its cascading effects influencing insulin resistance and associated risks of diabetes mellitus and cardiovascular disease. Here we attempt to identify how neuropsychological structures contribute to this cascading effect. Recalling that activation of the amygdala triggers defensive behaviors and autonomic arousal including rapid heartbeat and raised blood pressure along with pituitary-adrenal axis stimulation, results of this study may help to clarify neuropsychological pathways that underlie effects of racism and its internalization on risks of diabetes mellitus and cardiovascular disease.

Specific Aim 3: *to explore whether areas of the brain associated with self-representation respond differently to stereotypical and counter-stereotypical words and to evaluate whether response to these words is conditioned by level of internalized racism.*

The conclusion of studies in social cognition support the social constructivist's claim that 'believing is seeing' which inverts the logical positivist's claim that 'seeing is believing'. Our findings suggest that persons high and low in internalized racism are radically different in every component of information processing (Taylor, 1995)—encoding (what they notice), encoding (what they remember of what they've noticed), retrieving (what they recall of what they've remembered), and interpreting (what they make of what they've retrieved). Correspondingly, we expect that areas of the brain associated with self-representation will be more profoundly activated in persons high in internalized racism by words such as 'stupid' or 'ignorant' than 'smart' or 'competent' with just the reverse pattern predicted for persons low in internalized racism.

How do our general expectations relate to neuroimaging studies of episodic memory? Several reviews indicate that episodic memory involves different regions in the frontal lobe of the cerebral cortex, encoding processes differentially engaging the left prefrontal areas and retrieval processes the right prefrontal areas (Buckner, 1996; Nyberg, Cabeza & Tulving, 1996; Tulving, 1998). This differential location of encoding and retrieval processes is the centerpiece of the hemispheric encoding/retrieval asymmetry model described by Tulving, et al. (1994). That the right prefrontal cortex is associated with representations of the self is suggested from studies of patients with lesions in the right-frontal cortex who report disturbances in self-awareness (Luria, 1973; Stuss, 1991; Wheeler, Stuss, & Tulving, 1997). Consistent also are results of a PET study in which subject retrieval of emotional memories from their past showed activation of right prefrontal areas as well as other regions in the right hemisphere (Fink et al, 1996).



Ventral View

It has been demonstrated that words processed with reference to self are better remembered than words processed with respect to semantic content (Symons & Johnson, 1997). For example, the person would remember the word *stubborn* better after answering the self-referential question 'Does the word *stubborn* describe you?' than after answering the semantic question 'Does *stubborn* mean the same as *obstinate*' (Rogers, Kuiper, & Kirker, 1977)? It would appear that the concept of self as a rich schematic structure encodes new information related to it more efficiently than information unrelated to it (Craik et al., 1999). The most recent evidence suggests that both left and right prefrontal lobes are activated in self-referential tasks (Craik, et al., 1999). In this application which assumes that cultural identity is an integral aspect of one's self-representation, four levels of encoding depth will be evaluated (Craik et al, 1999; Craik & Tulving, 1975; Craik, Moroz, et al., 1999; Rogers, Kuiper, & Kirker, 1977), participants being asked to answer 'yes' or 'no' to questions administered during fMRI imaging:

- **Structural:** *Is the word a capital letter?* For example, A...b...Z...k.
- **Phonemic:** *Does the word rhyme with RED?* For example, FRED.
- **Semantic:** *Would the word fit in this sentence: He met a _____ in the hood.* For example, RUN.
- **Referential:** *Does this word describe blacks?* A randomized mixture of neutral words (e.g., blue, meadow, metal), counter-stereotypical words (e.g., smart, wise, mature), and stereotypical words (ignorant, silly, sexy) will be presented randomly to persons preidentified as high and low in internalized racism.

Hypotheses

Utilizing 10 persons high in internalized racism and 10 low in internalized racism matched for age, sex, BMI, right-handedness, and socioeconomic status, we project two sets of hypotheses using fMRI imaging of radioactive tracers in the left and right prefrontal lobes.

On the neuroimaging side, we expect that:

embedded in a different color texts (e.g., the name *red* might be embedded in a green color text). The capacity to focus on the relevant within the context of distracting and interfering cues may well have implications for coping styles and efficiencies associated with stressful living.

In general, increased blood flow to the anterior cingulate gyrus or to the left inferior precentral sulcus is associated with the interference condition of the Stroop Word Color Test (e.g., Meade, et al., 2002). Diminution of response particularly in the anterior cingulate gyrus is associated with mood and schizophrenic disorders (e.g., Carter, et al., 1999; George et al., 1997).

Hypotheses

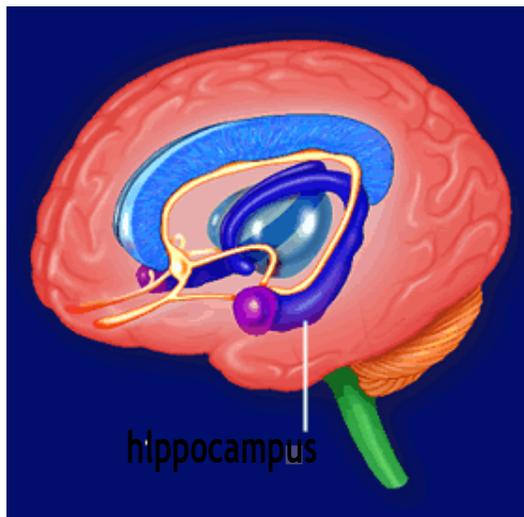
Utilizing 10 persons high in internalized racism and 10 low in internalized racism matched for age, sex, BMI, right-handedness, and socioeconomic status, we expect using fMRI that:

1. Regional blood flow to the anterior cingulate gyrus or to the left inferior precentral sulcus will be greater for persons low in internalized racism than persons high in internalized racism during administration of the interference condition of the Stroop Word Color Test.
2. Errors will be greater under the interference condition for persons high in internalized racism than than for persons low in internalized racism.
3. The differences in errors between the second and third conditions of Stroop administration will be greater for persons high in internalized racism than for persons low in internalized racism.
4. Differences in time-to-completion of the second and third conditions of Stroop administration will be greater for persons high in internalized racism than for persons low in internalized racism.

Significance

If these hypotheses are supported, we would have both performance and neuropsychological data that potentially shed light on the Björnthorp's (3) chronicity of stress proposition. If exposure to challenging cognitive tasks is associated with attenuated activation of regions of the brain associated with such tasks and if there is diminished success in coping with such tasks, it seems reasonable to assume that high levels of dysphoric symptoms would continue unabatedly—an implication one would associate with HPA-axis dysregulation and heightened risks of diabetes mellitus and cardiovascular disease (see Figure 1). As well there may be at least partial clues here for explaining the racial academic achievement gap that Ogbu (2003) attributes to academic disengagement even among socioeconomically advantaged black students.

Specific Aim 5: *to explore whether degree of neuronal damage in the hippocampus is associated with type of cultural identity*



Although basal levels of cortisol are required for the health and normal functioning of the hippocampus, chronic stress and consequent cortisol elevation are associated with hippocampal dysfunction and volume reduction. The hippocampus which is crucial for encoding and retrieving memory is also an important modulator of the HPA-axis response to stress (see Figure 1). The hippocampus sends neuronal projections to the hypothalamus to initiate the cascade of cortisol release and is itself a major target organ for glucocorticoid action in the brain.

The toxic effects of stress and cortisol on the hippocampus derived from preclinical studies in diverse species. These findings were first observed in primates: vervet monkeys that

died spontaneously following severe stress from poor and overcrowded housing had damage to the CA3 hippocampal subfield (Uno, et al., 1989). This damage was subsequently related to cortisol,

(Sapolsky, et al., 1990) which across species has been demonstrated to decrease dendritic branching (Wolley et al., 1990) and increase neuronal loss (Uno et al, 1990). The impairments in hippocampus-dependent memory that result from stress can persist beyond the resolution of the stress response and the normalization of cortisol levels (Ohl, 1999).

Hypotheses

Utilizing 10 persons high in internalized racism and 10 low in internalized racism matched for age, sex, BMI, right-handedness, and socioeconomic status, we expect using structural MRI that:

1. There will be greater volume reduction in the CA3 region of the hippocampus among persons high in internalized racism relative to those low in internalized racism.
2. In word list learning, as measured by the Selective Reminding Test, persons low in internalized racism will outperform persons high in internalized racism.

Significance

If internalized racism is associated with neuronal damage and corresponding cognitive impairment on an emotionally neutral word learning task as hypothesized, results would add to our knowledge of untoward effects associated with racism and its internalization by blacks. These neuronal and performance impairments may contribute to diminished success in coping with daily hassles and life events that add to level of perceived stress, cascading effects on the HPA-axis, and corresponding risks of diabetes mellitus and cardiovascular disease (see Figure 1).

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