



Resting frontal brain activity: linkages to maternal depression and socio-economic status among adolescents

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Abstract

We tested the prediction that resting frontal brain asymmetry would be a marker of vulnerability for depression among adolescents. Baseline electroencephalographic (EEG) activity was recorded from 12 to 14-year-old adolescents whose mothers had a history of depression (high risk group) and whose mothers were lifetime-free of axis I psychopathology (low risk group). High risk adolescents demonstrated the hypothesized pattern of relative left frontal hypo-activity on alpha-band measures. Such effects were specific to the mid-frontal region and generally consistent across reference montages. Socio-economic status (SES) also predicted alpha asymmetry. When the effects of SES and risk status were jointly assessed, SES contributed unique variance to the prediction of frontal brain asymmetry. The implications of the observed relations among maternal depression, SES, and frontal brain asymmetry are discussed.

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1. Frontal brain asymmetry and depression

In this study, we assessed whether adolescents who are at-risk for depression differ in patterns of resting frontal brain activity when compared to low risk adolescents. We

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addressed this question because of evidence from a variety of sources indicating a linkage between unipolar depression and decreased activity of left relative to right hemisphere frontal brain regions (for reviews, see Davidson, 1995, 1998b; Davidson et al., 2002; Tomarken and Keener, 1998). Consistent with this conclusion are: (a) neurological studies indicating that the severity of depressive symptomatology is correlated with the proximity of a left-hemisphere lesion to the frontal pole (e.g., Morris et al., 1996; Pohjasvaara et al., 2002; Robinson and Downhill, 1995; Shimoda and Robinson, 1999); (b) regional cerebral blood flow (rCBF) studies showing that clinically depressed participants demonstrate relative decreases in left frontal activity when compared to non-depressed control participants (e.g., Baxter et al., 1989; Bench et al., 1992; Ebert et al., 1991; Martinot et al., 1990); (c) resting electroencephalographic (EEG) studies showing that clinically depressed individuals (Allen et al., 1993) or individuals characterized by elevated scores on the Beck Depression Inventory (Beck and Steer, 1987) demonstrate relative left frontal hypo-activity when compared to controls (Schaffer et al., 1983); and, (d) studies showing that transcranial magnetic stimulation of the left frontal cortex (which may well increase left frontal activity) produces clinical improvement in depressed individuals (e.g., George et al., 1997; Pascual-Leone et al., 1996). As a cautionary note, we should add that not all findings have been consistent in these areas (e.g., Dam et al., 1989; House et al., 1990; MacHale et al., 1998). In addition to these empirical linkages are theoretical perspectives proposing that left frontal dysfunction may be a neural substrate of core features of unipolar depression. For example, consistent with the approach-withdrawal model of frontal asymmetry (Davidson and Tomarken, 1989; Fox, 1991), several commentators have proposed that anhedonia reflects a deficit in a neural approach system, one component of which is the left frontal cortex (e.g., Davidson, 1998a).

2. Left frontal hypo-activity and vulnerability to depression: children of depressed mothers

Of prime importance in the present context are EEG studies indicating that resting frontal brain asymmetry may indicate heightened vulnerability to depression. For example, two studies have found that currently euthymic individuals who have a history of depression demonstrate left frontal hypo-activity relative to control participants (Allen et al., 1993; Henriques and Davidson, 1990). Unfortunately, studies of individuals with remitted depression cannot distinguish whether left frontal hypo-activity is a vulnerability factor for depression or a consequence of depression (Alloy et al., 1999). An assessment of at-risk populations who have not yet manifested depression represents a more direct test of whether left frontal hypo-activity indicates vulnerability. One such population is children of depressed parents. Such children exhibit a range of negative outcomes and psychiatric diagnoses compared to children of parents without a psychiatric history (Downey and Coyne, 1990; Gelfand and Teti, 1990) and appear to be at particularly heightened risk for developing depression (Hammen, 1991; Warner et al., 1992; Weissman et al., 1992, 1997).

Several studies have found that infants of depressed mothers do in fact exhibit left frontal hypo-activity (e.g., Dawson et al., 1997; see also Field et al., 1995; Jones et al., 1997).

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