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Memory and Executive Functioning in Young Women Reporting Mood Symptoms

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Memory and Executive Functioning in Young Women Reporting Mood Symptoms" submitted by Kim M. Galbraith in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The present study investigated mood problems in young women in relationship to memory and executive functioning. Participants were 30 dysphoric and 126 non-dysphoric women between the ages of 18 and 25. The Structured Clinical Interview for the DSM-IV (SCID-I) was used for assessment of mood disorders, and the Beck Depression Inventory – Second Edition (BDI-II), Beck Anxiety Inventory (BAI), and Brown Attention-Deficit Disorder (ADD) Scale for Adults were used to determine the severity of depressive, anxiety and attention symptoms, respectively. Working memory was assessed using two subscales from the Wechsler Memory Scale – Third Edition (i.e., Letter-Number Sequencing and Spatial Span). Executive functioning was assessed using the Wisconsin Card Sorting Test – 64 Card Version: Computer Version for Windows, the Stroop Color and Word Test, and the Controlled Verbal Fluency Task (FAS). This study found partial support for the existence of cognitive deficits in young women presenting with mood symptoms. The dysphoric group exhibited auditory working memory deficits and executive functioning deficits on part of a verbal fluency task. No group differences were found for visual working memory or on the executive functioning tasks, the WCST and Stroop Color and Word Test. Those participants with more severe depressive symptoms demonstrated greater auditory memory problems, were more impaired on a number of WCST measures, and generated fewer total number of words on FAS than women with less severe symptoms. The study also found that the history of mood symptoms did not influence memory abilities but did have some minimal influence on executive functioning as measured by the WCST and Stroop but not the FAS. No relationship was found between performance on cognitive tests and either

anxiety or attention level; however, the dysphoric group did report higher levels of anxiety and attentional problems.

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INTRODUCTION

Overview

Over the last few decades, investigations into the possible relationship between mood disorders and cognitive functioning have become more and more frequent. Studies to-date have documented the occurrence of cognitive deficits in patients with mood disorders, especially in areas such as executive functioning, verbal and nonverbal memory, sustained attention and visuospatial skills.

Most of the existing studies looking at mood problems and cognitive functioning have reported findings using middle aged or elderly patients (Grant, Thase, & Sweeney, 2001). These studies with "older" adult populations (mean ages in the 30's and 40's) have found impairments in areas such as memory and executive functioning. It is not known if young adults experience similar cognitive deficits, as very few studies have specifically examined cognitive functioning in this age group. If young adults with mood problems are found to have significant cognitive deficits, gaining a better understanding of their specific deficits may help clinicians to implement intervention strategies and reduce the degree of impairment in social, occupational or other important areas of functioning.

The objective of the proposed study was to investigate mood problems in young adults, and more specifically, to determine if there is a relationship between their mood difficulties and their memory and executive functioning. The literature on mood disturbances in young adults will be discussed, followed by a description of studies which have examined cognitive functioning in patients with mood problems. Methodological weaknesses in the literature to-date will also be briefly discussed.

Mood Disorders in Adolescents and Young Adults

Mood disorders are often divided into depressive disorders and bipolar disorders, both of which are characterized by disturbances in affect. The most common mood disorder is major depressive disorder (Calev, Pollina, Fennig, & Banerjee, 1999). The essential feature of major depressive disorder is a minimum two week period characterized by depressed mood or the loss of interest/pleasure in activities (see Appendix A for diagnostic criteria). Common symptoms include sleep difficulties (insomnia or hypersomnia), changes in appetite or weight, psychomotor agitation or retardation, low energy, feelings of worthlessness or extreme guilt, difficulty concentrating or making decisions, and recurrent thoughts of death. A less severe but more chronic form of this disorder is dysthymic disorder (see Appendix B for diagnostic criteria). Dysthymic disorder is characterized by chronic depressed mood for at least half the time over two years.

Mood disorders are one of the most common mental health problems. A review of several studies has suggested that 13% to 20% of the population have depressive symptoms at some point in time and that 2% to 3% will be functionally impaired or hospitalized (Gold, Goodwin, & Chrousos, 1988). Studies on prevalence of major depressive disorder have reported a wide range of figures. According to the Diagnostic and Statistical Manual for Mental Disorders – Fourth Edition (DSM-IV), the lifetime risk for major depressive disorder in community samples is between 10% to 25% for women and 5% to 12% for men, indicating that twice as many women are afflicted as compared to men (APA, 1994). A variety of biological, psychological and sociocultural influences are hypothesized to play a role in the higher rates of depression but determinants of sex

differences are still being studied and have yet to be put into an integrated etiologic - pathogenetic model (Piccinelli & Wilkinson, 2000).

Epidemiological studies of adolescent depression indicate that 6% to 8% of adolescents meet criteria for a diagnosis of major depression (Hammen & Rudolph, 1996), and recent studies have suggested that the prevalence of depression in youths is increasing. For example, the Cross-National Collaborative Group (1992) has reported growing rates of early onset depression in those born in more recent decades. Possible reasons for this trend have yet to be determined as analysis of historical, social, economic and biological factors has yet to be completed. Researchers believe that factors such as retrospective recall and labeling cannot fully account for the rising rates of depression, which has been found to be increasing in many different countries.

According to the DSM-IV, two-thirds of individuals with major depressive episodes recover completely but one-third continue to have symptoms and are at an increased risk for future episodes. In contrast to these DSM-IV data, a 25-year follow-up study found that only 11% of cases were single episode (Angst, Kupfer, & Rosenbaum, 1996). Recurrent episodes have been linked to poor social and cognitive functioning, such as problems with concentration, learning and retention of material, psychomotor impairments, executive and memory functions (Calev et al., 1999).

Studies with adolescents have found that most of them will experience recurrent episodes of depression. For example, a longitudinal study with youths found that 26% experienced a new episode within 1 year of recovery, 40% within 2 years and 72% within 5 years (Kovacs et al., 1984). Functional impairment has been found to occur in depressed adolescents (Kovacs & Goldston, 1991). Specifically, problems in school and

social difficulties (e.g., social withdrawal, social perception problems) can have long term consequences on development. This area has become an important clinical concern given the accumulating evidence of recurrent future episodes and associated impairment.

Given the suggestion that the rate of depression in young people is rising and that a depressive episode can have long-term implications, gaining a better understanding of depression in young people is critical. Of the studies that have been completed to-date with young people, college/university students have often been used. The use of this "convenience" sample has been questioned as researchers voiced concern about whether the depressive symptoms experienced by college students are similar to depression seen in psychiatric patients (Coyne & Gotlib, 1983; Gotlib, 1984). However, a review of depression research with university/college students found that "it remains to be demonstrated empirically that depression in analogue samples of college students is different from the depression experienced by clinically depressed patients (Vredenberg, Flett, & Krames, 1993, p.334).

A number of studies have suggested that mild depressive symptoms or distress can cause a certain degree of impairment and suffering and therefore should be investigated. For example, one group of researchers has begun to study what they call subsyndromal symptomatic depression (SSD). They define SSD as "...the simultaneous presence of any two or more symptoms of depression, present for most or all of the time, at least 2 weeks in duration, associated with evidence of social dysfunction...." (Judd, Rapaport, Paulus, & Brown, 1994, p.27). These researchers have advocated the importance of better understanding subthreshold mood states which they believe can have a significant impact on psychosocial functioning. Research has also suggested that

subclinical depression is a significant risk factor for developing more severe depression (Gotlib, Lewinsohn, & Selley, 1995). Studying milder levels of depressive symptoms has important implications for gaining a better understanding of the impact of severity of depression on functioning.

Vredenburg, Flett and Krames (1993) have advocated that there are some very important reasons for studying depressed mood in a university/college population including the finding that an "alarming number of college students either commit suicide or have demonstrable high levels of suicide ideation" (p.335) and that the high level of suicidality is related to the rising levels of depression reported in adolescents and young adults. The chronic level of distress associated with adapting to new environments, making age appropriate transitions (e.g., moving out of their parents' house), financial concerns and continual social and academic stressors, make college students an excellent population for researching depression. It is also likely that college students will be less likely to have multiple co-existing disorders that could interfere with the research findings as compared to a clinical sample. Vredenburg, O'Brien and Krames (1988) gave further support for studying college students by suggesting that college samples are less likely to seek formal treatment for their depression and therefore are more similar to the general population where many people do not initiate treatment.

Cognitive Functioning

The last few decades have spawned a growing number of studies examining cognitive functioning in patients with mood disorders. Of the studies completed over the last 20 years, most researchers would agree that depressed patients do display cognitive deficits (Elliott et al., 1996). Executive functioning, verbal and nonverbal memory,

sustained attention and visuospatial skills have all been areas in which deficits have been reported (e.g., Sweeney, Kmiec, & Kupfer, 2000; Wolfe, Granholm, Butters, Saunders, & Janowsky, 1987).

Relatively few studies have examined cognitive functioning in young adults. Literature searches found articles which studied depressed "younger" adults whose mean ages were actually in the late 30's (e.g., Fossati, Amar, Raoux, Ergis, & Allilaire, 1999; Grant, Thase, & Sweeney, 2001; Purcell, Maruff, Kyrios, & Pantelis, 1997). To the author's knowledge, no studies have examined cognitive functioning in adolescents with depressed mood. A few studies were found examining cognitive functioning in children with mood problems, but the majority of the studies in children focused more generally on academic performance and scholastic achievement (e.g., Kaslow, Tanenbaum, Abramson, Peterson, & Seligman, 1983; Lauer et al., 1994).

When studies have used young samples (i.e., mean ages in the early 20's), some have not utilized diagnostic interviews to confirm diagnoses but have instead relied only on a self-report questionnaire such as the Beck Depression Inventory. This is a common practice when using a college/university sample. Although this approach is less time consuming and requires less formal training of the researcher, this is not the best approach due to diagnostic uncertainty. The use of a semi-structured or structured interview allows researchers to sort participants by diagnostic categories and to exclude participants who report other diagnoses such as bipolar disorder.

Working Memory

Working memory refers to active memory that is involved in processing of auditory or visual information and also in the temporary storage of this incoming

information. This type of memory is usually assessed by either adding to the amount of information that needs to be stored during a task or requiring the participant to perform two tasks at the same time (Wechsler, 1997). A number of studies have attempted to assess working memory in depressed patients and most have not found deficits (e.g., Fossati, Amar, Raoux, Ergis & Allilaire, 1999; Gass & Russell, 1986; Ilsely, Moffoot, & O'Carroll, 1995). Further support for the lack of working memory difficulties comes from a recent meta-analysis examining patterns of neurocognitive functioning in depressed patients. The study found a small effect size for working memory (Zakzanis, Leach, & Kaplan, 1998). However, the results of this meta-analysis must be interpreted carefully in that 45% of the subjects were on medication at the time of testing and the mean age at time of testing was 55 years.

Several studies have found support for working memory difficulties in depressed patients. A study comparing 22 clinically depressed unmedicated outpatients to 30 healthy controls (mean ages = 40.6 and 40.2 respectively) found that the depressed group scored significantly below the controls on a measure of working memory (The Paced Auditory Serial Addition Test) (Landrϕ, Stiles, & Sletvold, 2001). The results from this study supported the findings by Breslow, Kocsis, and Belkin (1980) who compared 21 depressed inpatients (5 of whom were taking antidepressant medications) to 21 control subjects (mean ages = 48.0 and 44.4 respectively) and found that the depressed group was more impaired then the control group on the Digit Span Forwards and Digit Span Backwards task from the Wechsler Memory Scale. Another study also found deficits in working memory when comparing 24 participants with major depression to 21 non-depressed participants (mean ages = 39 and 39 respectively) but only on the Digits

Backwards component of the Digit Span subtest (Channon, Baker, & Robertson, 1993). Elliott and colleagues (1996) compared 28 depressed in- and out-patients (all taking various medications, and with a mean age of 49.9) to 22 control subjects (with a mean age of 48.1) and found that the depressed group was more impaired than the control group on a variety of tests including a spatial working memory task from the Cambridge Neuropsychological Test Automated Battery.

Executive Functioning

Executive functioning refers to skills such as the ability to shift and maintain a cognitive set, to inhibit an automatic response, to plan and to organize. Deficits in executive functioning can impair the ability to learn and retain skills (Martínez-Arán et al., 2000).

A number of studies have found that depressed patients were significantly more impaired on tests of executive function compared to control patients (e.g., Channon et al., 1996; Degl'Innocenti, Ågren, & Bäckman, 1998; Grant, Thase, & Sweeney, 2001; Martin et al., 1991; Merriam et al., 1999; Paradiso et al., 1997; Trichard et al., 1995). For example, Degl'Innocenti and colleagues found deficits in executive functioning in 17 participants with major depression (mean age = 48.2) compared to 17 healthy control subjects (mean age = 49.0) using measures such as Verbal Fluency, the Stroop test and the Wisconsin Card Sorting Test (WCST). Channon (1996) compared 28 dysphoric undergraduates (mean age = 22.3) to 28 controls (mean age = 21.0) on the WCST and found that the dysphoric group made significantly more perseverative and non-perseverative errors and took significantly more trials to carry out the task.

The results from studies have not consistently revealed deficits in executive functioning in patients with unipolar depression. For example, 30 young, unmedicated outpatient women experiencing depression (mean age = 20.33) were compared to 30 non-depressed women (mean age = 20.20). Using measures such as the Verbal Fluency Test and the Stroop Color and Word Test, the researchers found no differences between the two groups on any of the executive functioning measures (Crews, Harrison, & Rhodes, 1999). The authors suggest that the lack of significant findings may be due to the type of sample used since previous studies which had found deficits in executive functioning had typically used inpatients and/or medicated subjects. Additional support that depressed patients do not always experience significant problems with executive functioning comes from the previously mentioned meta-analysis that compared 726 patients with depression to 795 healthy normal controls and found a small effect size for tests of conceptual reasoning (i.e., Wisconsin Card Sorting Task) (Zakzanis, Leach, & Kaplan, 1998).

Symptom Pattern, Chronicity and Severity

Several factors have been found to be related to the severity of the cognitive dysfunction. Some studies have suggested that cognitive functioning is more impaired in patients experiencing psychotic symptoms (e.g., Nelson, Sax, & Strakowski, 1998; Jeste et al., 1996; Schatzberg et al., 2000). For example, a study comparing patients with unipolar depression, bipolar disorder, and schizophrenia to control subjects on a battery of neuropsychological tests found that the unipolar and bipolar groups without psychotic features performed similarly to the control group (Albus et al., 1996). However, patients with mood disorders who also had psychotic features performed as poorly as the group with schizophrenia.

Studies have also suggested that chronicity can influence cognitive functioning in patients with mood disorders. For example, results from a recent study with patients with unipolar and bipolar disorders revealed that patients with recurrent episodes were more impaired than patients who had experienced only a single episode (Kessing, 1998). Basso and Bornstein (1999) also found that chronicity of illness was correlated with cognitive impairments. A comparison of patients with recurrent versus first-episode major depression revealed that those with recurrent major depression had significantly more memory deficits than those with single episodes. However, several studies of patients with mood disorders have found that the duration of illness was not related to cognitive deficits (e.g., Verdoux & Liraud, 2000).

The research on the relationship between cognitive functioning and symptom severity has also been inconsistent. Several studies have suggested that the more severe the affective state, the greater the cognitive deficits (e.g., Martin, Oren and Boone, 1991; Merriam, Thase, Haas, Keshavan, & Sweeney, 1999). For example, Martin and colleagues (1991) found that depressive symptom severity was associated with diminished performance on the WCST. Other studies have found no relationship between symptom severity in an affective state and cognitive functioning (e.g., Degl'Innocenti et al., 1998; Fossati et al., 1999; Miller, Faustman, Moses, & Csernansky, 1991). Keilp, Sackeim, Brodsky, Oquendo, Malone, and Mann (2001) also found that depressed patients with a history of serious suicide attempts performed more poorly on tests of executive functioning than those with less lethal or no previous attempts.

There is also a growing suggestion in the literature that age may contribute to cognitive dysfunction. Since most people experience recurrent depressive episodes,

younger subjects will not have extensive histories of depression, and as a result, researchers such as Crews et al. (1999) and Purcell et al. (1997) believe that younger patients will have fewer problems with their cognitive functioning. Unfortunately, most studies have samples with very diverse ages or have specifically focused on older groups (i.e., geriatrics). Therefore, it is unknown at this time whether age plays a role in cognitive dysfunction experienced by people with mood problems.

Thus to-date, the information on cognitive functioning in mood disorders is equivocal but suggests that several variables such as chronicity, severity, and age may be relevant. Further studies are needed to sort out the issue of cognitive dysfunction in these populations and to replicate existing evidence. Several authors have suggested that the major reason for the diverging results from various studies is poor methodology.

Methodological Problems

Many studies on cognitive functioning with mood-disordered patients have suffered from methodological problems, such as lack of control groups, small sample sizes, no follow-ups, the lack of clear remission criteria, and insufficient information on chronicity (e.g., number of episodes) and severity (e.g., severity of past episodes).

One problem often cited is that many studies have looked at affective disorders in general and have failed to differentiate between unipolar and bipolar disorder. Even when studies have specified the type of affective disorder, the affective group (e.g., bipolar disorder) were often used as a control group (e.g., to compare with schizophrenia) and sometimes consisted only of patients with psychotic symptoms. Another problem is that many patients in prior studies have been inpatients, thus the ability of these groups to be representative of other patients with mood disorders is questionable. In addition, some

studies have not diagnostically classified their participants (e.g., they have instead relied on self-report rating scales) or have failed to obtain the affective state of the subjects at the time of testing (e.g., re-administered a rating scale).

Probably one of the largest concerns has been the possible influence that medications may have on cognitive functioning. Most studies on cognitive functioning report limitations in terms of the unknown influence of medications such as antidepressants on their results. Some studies have suggested that antidepressant drugs with high anticholinergic activity can impair memory (Knegtering, Eijck, & Huijsman, 1994; Richardson, Keegan, Bowen, Blackshjaw, Cebrian-Perez, Dayal, et al., 1994; Spring, Gelenberg, Garvin, & Thompson, 1992). The primary concern with using participants who are taking medication is that these studies may not be generalizable to participants not on medication (which is more typical of people with milder depression). Thus, there is a need to consider medication influences when looking at cognitive functioning.

Another interesting methodological issue raised by Crews et al. (1999) was that anxiety levels should be measured in studies on cognitive functioning with depressed patients. In their study, they found that the depressed women scored significantly higher on a self-report measure of anxiety than the control group. The authors suggest that it is important to measure anxiety as it may also have a substantial impact on measures of cognitive functioning. A recent study by Kizilbash, Vanderploeg, and Glenn (2002) examined the effects of depression and anxiety on memory performance and found deficits in immediate recall and the amount of information acquired as measured using the California Verbal Learning Task. The authors suggested that the presence of anxiety

may partially account for the effects of depression on memory performance found in previous studies. Vredenburg et al. (1993) also support the use of anxiety questionnaires in order to determine if anxiety is present and possibly influencing the cognitive variables.

The present study explored cognitive functioning in young adults and addressed many of these methodological issues. First, this study examined working memory and executive functioning in young adults, an area that has been understudied. Second, the study tested young adults who are unmedicated. The use of unmedicated participants eliminated any possibility that cognitive deficits may be a result of medications. Given recent findings that severity and chronicity may influence the degree of cognitive impairments, this study obtained a thorough history (e.g., number of episodes). Suggestions of sex differences in cognitive functioning also indicated the need to decide whether to include gender as a significant variable to analyze. Given studies such as the one by Duff and Hampson (2001), who found that some prefrontal functions may be sexually differentiated, and the general knowledge that approximately twice as many women are afflicted with depression as compared to men, this study examined cognitive functioning only in women. Lastly, this study was specific to student populations and was looking at "dysphoria" rather than clinical depression. Dysphoria refers to participants who score in the mildly depressed range or above on a rating scale such as the BDI-II but do not meet formal diagnostic criteria for a major depressive disorder. Since previous studies with older adult, clinically depressed populations have suggested deficits in both memory and executive functioning and since these deficits can influence psychosocial

functioning, examining these processes in dysphoric, young adults was expected to be informative.

Goals and Hypotheses

Goals

(1) To determine if unmedicated young women with mood difficulties have deficits in working memory and executive functioning.

(2) If cognitive deficits are present, to determine which cognitive domains are most affected.

(3) To determine if there is a relationship between cognitive deficits and variables such as severity (e.g., severity of current mood problems), chronicity (e.g., number of episodes) and other problems (e.g., anxiety, substance use).

Hypotheses

1. Young women with mood symptoms will display deficits in working memory and executive functioning in comparison to young women without mood symptoms.
2. Additional Variables:
    a) Severity – those participants with more severe current mood problems will display greater cognitive deficits.
    b) History – those participants with more a severe and/or chronic history of mood episodes (e.g., multiple episodes) will display more cognitive impairments.
    c) Co-existing Problems – those with high scores on the anxiety or attentional measures will display more cognitive impairments.

METHOD

Participants

Participants were recruited through the Department of Psychology Bonus Credit System which offers students credit towards courses in exchange for participating in studies ongoing in the department. All participants were university students who were currently taking a psychology course.

General Inclusion/Exclusion Criteria

1. Participants were excluded if they were currently (or within the previous month) taking any psychiatric medication.
2. Participants who met criteria on the SCID-I (Structured Clinical Interview for DSM-IV Axis I Disorders) for bipolar disorder were excluded as were any participants endorsing two or more psychotic symptoms on the Psychotic Screener of the SCID-I.
3. Participants were excluded if there was evidence of substance abuse/dependence within the previous month, dementia, mental retardation, or any other significant psychiatric disorder (e.g., a previous diagnosis of attention-deficit/hyperactivity disorder (AD/HD)).
4. Any serious neurological disorder (e.g., cerebral palsy, epilepsy) or head injury (e.g., moderate or severe concussion, coma) that affected language or comprehension resulted in exclusion because of the compromise to the validity of the outcome measures.
5. Participants with unstable medical conditions were excluded; i.e., conditions that required medication change in the previous month or that required more than two visits to a physician (not the regular family doctor or psychiatrist) in the previous 6

months. This criterion was not intended to exclude people who had hypertension, asthma, arthritis, or stable problems such as cardiac, renal, hematological, cancer, lung, or gastrointestinal disease.

6. Participants who did not seem to adequately understand the interview and/or questionnaires or were not able to express themselves clearly due to language difficulties (e.g., reading comprehension) were excluded. However, if English was not their first language but they seemed to adequately understand questions and could express themselves well, they were not excluded, and the information was documented along with general clinical history information.

Inclusion/Exclusion Criteria for Dysphoric Group

1. Young females aged 17-25 years with a score of 13 or above on the Beck Depression Inventory were included in the dysphoric group.

Inclusion/Exclusion Criteria for the Non-Dysphoric Group

1. Young females aged 17-25 years with a score of 12 or below on the BDI and who currently did not meet criteria for major depressive disorder or dysthymic disorder were included in the non-dysphoric group. The SCID-I was used to confirm that the participant did not meet criteria for a mood disorder.

Actual Sample

Of the original 176 women interviewed, a total of 156 were included in the study. Twenty women were excluded for a variety of reasons: 5 had a very poor understanding of the English language (e.g., could not understand interview questions); 2 had a previous diagnosis of AD/HD; 2 had a previous diagnosis of a neurological disorder (e.g.,

epilepsy, cerebral palsy), 2 had neurological injuries, 1 reported significant substance use, 6 reported a history of having had a significant head injury, and 2 were incomplete (i.e., not all cognitive tests were done). All participants completed the study even if excluded from the final sample. The final sample consisted of 126 non-dysphoric subjects and 30 dysphoric. One participant in the dysphoric group currently met criteria for major depressive disorder and three met criteria for dysthymic disorder. The sample was also then matched by age, ethnicity and whether English was their first or second language. This matched sample consisted of 25 adults in the dysphoric group and 25 adults in the non-dysphoric group. None of the 25 participants in the non-dysphoric group were currently depressed or had a history of depression and none of the 25 participants in the dysphoric group met criteria for major depressive disorder. Statistical analyses were run for both samples.

Measures

Participants were administered the Structured Clinical Interview for the DSM-IV Axis I Disorders – Research Version (SCID-I: First, Gibbon, Spitzer, & Williams, 1996) which is a comprehensive, semi-structured instrument that adheres closely to the DSM-IV decision trees for psychiatric diagnosis. An important aspect of the SCID-I is that it has modules which enable clinicians to administer the sections that concern them most. For this particular study, the mood module and the psychotic screener were used. Rates of disorders reported are lifetime prevalences (i.e., if the full criteria have ever been met during the participant's life).

The primary investigator, Ms. Galbraith, had been trained on the SCID and had administered over 150 for several different studies (i.e., research for her masters, and two

different studies ongoing at the University of Calgary). Ms. Galbraith had been independently observed for both studies to ensure reliability of her interviews. Ms. Galbraith's Research Assistant (RA) was also trained to administer the SCID. Training included having the RA observe the administration of the interview, having the RA practice numerous times on Ms. Galbraith, observing the RA independently administer the interview, and listening to the first 12 administrations via audiotapes. To ensure inter-rater reliability, approximately every fourth interview was evaluated by Ms. Galbraith, which at the end of the study was 29% of the tapes. The overall percent agreement between the RA and the principal investigator was 96% with a kappa of 0.88, indicating excellent inter-rater reliability.

Demographic and clinical history information was also obtained. Participants were asked about whether they had any first degree relatives who had been formally diagnosed with a mood disorder. All participants were asked if they had ever used alcohol/drugs, and if they answered yes, they were asked the last time they used such substances in order to ascertain if substance was still in their system. They were then asked the average number of times they had used these substances in the previous month and the average quantity consumed in the previous month. If there was concern about substance problems (by either participant and/or the investigator), the Drug Abuse Screening Test (DAST-10) (Skinner, 1982) was used. This test was modified to restrict questions about substance use to the previous month.

Rating Scales

1. The Beck Depression Inventory-II (BDI-II) (Beck, Steer & Brown, 1996) has been widely used for the assessment of cognitions associated with depression for both

psychiatric patients as well as the normal population. The BDI-II consists of 21 symptoms. The respondents rate the intensity of these symptoms on a scale from 0 to 3. The BDI-II is a self-administered questionnaire with an administration time of 5 – 10 minutes. This questionnaire is used with adults and adolescents 13 years and older. The assessment of symptoms corresponds to criteria in the DSM-IV. The BDI-II was based on several outpatient samples and a college sample. Internal consistency (coefficient alpha) for the outpatient sample was .92 and for the college sample was .93. Test-retest reliability (1 week) for the outpatient sample was .93 (Beck et al., 1996). The recent analysis by Dozois, Dobson, and Ahnberg (1998) reported new cutoff scores for the BDI-II that would allow for comparison with past research using the BDI. Dozois and colleagues strongly suggested that these new cutoffs be used for evaluating undergraduate samples. The cutoffs are as follows: 0-12 = Nondepressed; 13-19 = Dysphoric; 20-63 = Dysphoric or Depressed (Dozois, Dobson, & Ahnberg, 1998).

2. The Beck Anxiety Inventory (BAI) (Beck & Steer, 1993) is another widely used scale, for the assessment of the severity of anxiety in adults and adolescents. The BAI is a 21 item self-report scale. The respondents rate the intensity of the symptoms on a 4-point Likert scale. Administration time is approximately 5 to 10 minutes. The BAI has high internal consistency, with a coefficient alpha of .92. Test-retest reliability (1 week) was found to be .75 (Beck et al., 1993).

3. Brown Attention-Deficit Disorder (ADD) Scale for Adults (Brown, 1996) is a 40 item scale that is used as a self-report measure of attentional abilities with adults 18 years old or older. The Brown ADD Scale provides the following clusters: a) activating and organizing to work: asks questions related to getting organized and started on work-

related tasks; b) sustaining attention and concentration: asks questions about chronic problems in sustaining attention to work-related tasks; c) sustaining energy and effort: asks questions about keeping up consistent energy and effort for work-related tasks, daytime drowsiness, slow processing of information etc.; d) managing affective interference: asks questions about difficulties with mood and sensitivity to criticism; and e) utilizing working memory and assessing recall: asks questions about forgetfulness in daily routines and problems in recall of learned material. Estimated completion time is 20-40 minutes. The Brown ADD Scales have been found to have a high level of internal consistency, with a coefficient alpha of .96. This rating scale was used to determine the severity of attentional symptoms present in the participants.

Cognitive Measures

1. Working Memory. The Wechsler Memory Scale – Third Edition (WMR-III; Wechsler, 1997) was used to assess working memory. Specifically, the Letter-Number Sequencing subtask which asks participants to repeat a series of letters and numbers back to the examiner was used as a verbal way of assessing working memory. The Spatial Span subtask, which asks participants to tap blocks in a sequence following the examiner, was used as a visual way of assessing working memory. The scores were analyzed by auditory versus visual modality presentation.

2. Executive Functioning.

Several different tests have often been used together to assess different aspects of frontal lobe functioning (e.g., Degl'Innocenti et al., 1998; van Gorp, Altshuler, Theberge, Wilkins, & Dixon, 1998). The present study used the following tests:

a) Wisconsin Card Sorting Test – 64 Card Version: Computer Version for Windows (WCST-64:CV Research Edition; Heaton, 1981) requires participants to sort cards according to color, form or number. After 10 consecutive correct responses, the sorting principle shifts. This task assesses a participant's reactive cognitive flexibility: that is, their ability to shift and maintain cognitive sets. This measure provides information such as the number of categories achieved (i.e., the number of correct runs of ten sorts, also considered a measure of overall performance) and perseverative errors (i.e., a measure of the inability to shift a cognitive set).

b) Stroop Color and Word Test contains three parts each of which is timed for 45 seconds (Stroop, 1935; Golden, 1978). The participant first reads a list of words (e.g., green, red or blue) printed in black ink. Second, the participant reads a list of colors which are x's printed in green, red or blue ink. Third, the participant is asked to name the color of the ink that the word is printed in, while ignoring the printed words (which are green, red or blue). This task measures ability to shift cognitive sets as well as to inhibit an automatic response. This measure provides a score for the word reading trial, the color naming trial, and the color-word trial.

c) Controlled Verbal Fluency Task (FAS) requires the participant to generate as many words as possible beginning with the letters F, A, and S (60 seconds is allowed for each letter) (Benton & Hamsher, 1989). This task assesses verbal fluency, which is a sensitive measure of executive function, and provides a total score for the number of words correctly produced.

Procedure

Participant Ascertainment

Young adult women were recruited through a web-based system that allowed Ms. Galbraith or her Research Assistant to set up appointments at their own discretion. Each appointment took approximately 75 minutes. Appointment times, a brief description of the study (see Appendix C for description of Bonus Credit Recruitment) and location of study were listed on the web and participants signed up and then had the responsibility of showing up for the study at the designated time. Once the participants had completed the study, Ms. Galbraith or her RA would then assign bonus credits through the web system which the students could then allocate to one of their courses. Since their participation was more than an hour, students were allowed to receive two bonus credits, which gave them an additional two percent on their final letter grade for a psychology course.

Testing Procedure

All testing was carried out by the primary investigator (Ms. Galbraith) or her Research Assistant: 53% of the participants were seen by Ms. Galbraith and 47% were seen by her RA. After obtaining written consent (see Appendix D for Consent Form), the following procedure was followed.

a) Participants were interviewed using the Mood Module and the Psychotic Screener of the SCID-I (Structured Clinical Interview for DSM-IV Axis I Disorders) to ascertain if they met criteria for current or past major depressive disorder and/or dysthymic disorder. This clinical interview also excluded those participants meeting criteria for bipolar disorder or who had a history of psychotic symptoms. Participants were also asked basic demographic and clinical information.

b) Participants were asked to complete three questionnaires: the Beck Depression Inventory – 2nd Edition (to assess degree of mood problems and to classify participants into the dysphoric versus control groups), the Beck Anxiety Inventory (to assess degree of anxiety), and the Brown Attention-Deficit Disorder Scales (to determine the severity of self-reported attentional problems).

c) Participants then completed the cognitive tasks. Working memory was assessed using two subtests from the Wechsler Memory Scale – Third Edition (WMS-III). Executive functioning was assessed using the Wisconsin Card Sorting Test, the Stroop Color and Word Test, and the Controlled Verbal Fluency Task.

At the completion of the study, debriefing was provided as required by the Department of Psychology Ethics Committee.

Ethical Considerations

If participants requested feedback about their participation, the interviewer provided general information regarding the overall clinical picture while not attaching diagnostic labels: e.g., if the person met criteria for major depressive disorder, they were told that they may be experiencing depressive symptoms and that they should go to the University Counselling Center or to their family physician. All participants were offered the opportunity to receive a summary of the overall findings of the study at the conclusion of the project.

In the event of uncovering current suicidal thoughts while interviewing a participant, several steps were to be followed. First, they were to be advised that their mood symptoms were of a significant concern. Second, they were to be reminded that the investigator had a duty to take action if she believed that the person was presenting or

was likely to present a danger to themselves. If the participant had a therapist, it was to be suggested that they contact their therapist to let them know how they were feeling. In the event that the participant was not seeing a therapist, they were to be advised to go to their family physician. If the participant began to feel worse before seeing their therapist/family physician, they were to be advised to go to the nearest Emergency department for assistance. They were also to be told about the 24-hour Distress Line (266-1605). In fact, no participants revealed significant suicidal thoughts that warranted following the above protocol. In most cases, participants displaying dysphoric mood were given a resource sheet on where to obtain help in the community which included the University counseling center (see Appendix E for Resource and Information list).

RESULTS

Demographic variables were analyzed first, followed by the clinical variables, for differences between the two groups (dysphoric and non-dysphoric). Next, multivariate analyses of variance (MANOVAs) were performed to compare the two groups on their scores for working memory and executive functioning. Since the dependent variables were assumed to be moderately correlated and/or conceptually related, the MANOVA was preferred to the ANOVA. Using MANOVAs improves the chance of discovering the relationship between the variables and protects against inflated Type I errors. The relationships between cognitive functioning and the following variables were also examined: severity of current mood symptoms, history of mood symptoms, anxiety and attentional problems, and history of depression. The results are presented first for the entire sample (N=156) and then for matched samples of 25 each. The significance level for all analyses was set at .05. Due to the exploratory nature of this study, the Bonferroni correction was not used. Although univariate F tests were stated despite a non-significant overall effect for group, any significant univariate findings were interpreted cautiously. Statistical Package for the Social Sciences (SPSS 11.0) was used to conduct all analyses.

Demographic Information

One hundred and fifty-six females participated: 126 in the non-dysphoric group and 30 in the dysphoric group. The age of the participants ranged from 18 to 25 years, with a mean age of 21 for both groups (see Table 1). There were no differences between the groups with respect to age, t (154) = -1.52, $p > .05$. None of the participants were currently taking psychiatric medication and only 12 participants reported taking prescription medication (with the exception of contraceptives). Four of the twelve

Table 1

Participants' Ages

Variable	Groups					
	Non-Dysphoric		Dysphoric		Total	
	M	SD	M	SD	M	SD
Age	21.20	1.76	20.66	1.63	21.09	1.74

* $p < .05$; **$p < .01$

participants were taking asthma medication and the remaining eight were taking various medications for medical problems (e.g., endometriosis, hypothyroidism, arthritis). No group differences were found for marital status as most of the participants were unmarried (χ^2 (1, $\underline{N}$ = 156) = 0.49, $\underline{p}$ > .05) and none had children. No group differences emerged for educational level (χ^2 (3, $\underline{N}$ = 156) = 5.21, $\underline{p}$ > .05), as 91% of the sample were working on their undergraduate degree (see Table 2). No group differences were found for ethnicity (χ^2 (5, $\underline{N}$ = 156) = 3.45, $\underline{p}$ > .05) or for whether English was their first or second language, χ^2 (1, $\underline{N}$ = 156) = 2.20, $\underline{p}$ > .05 (see Table 3). The Blishen Index (Blishen, Carroll, & Moore, 1987) was used as a measure of socio-economic status (SES). However, since it uses occupation as an estimate of socioeconomic status and the majority of the students were full-time students, a useful measure of SES was not obtainable.

The groups differed significantly in their history of major depressive disorder, χ^2 (1, $\underline{N}$ = 156) = 15.03, $\underline{p}$ < .05. Forty-three percent of the dysphoric group as compared to 13% of the non-dysphoric group had experienced at least one major depressive disorder in their lifetime, and one participant in the dysphoric group currently met criteria for a major depressive disorder. The dysphoric group were also more likely to currently meet criteria for dysthymic disorder, χ^2 (1, $\underline{N}$ = 156) = 12.85, $\underline{p}$ < .05. Ten percent of the dysphoric group and none of the non-dysphoric group currently met criteria for dysthymic disorder. There was no difference between the groups on family history of first-degree relatives with internalizing disorders, χ^2 (1, $\underline{N}$ = 156) = 0.81, $\underline{p}$ > .05. No differences were found between the groups on whether they were currently receiving

Table 2

Marital Status and Education Level of Participants

Variable	Groups		
	Non-Dysphoric N (%)	Dysphoric N (%)	Total N (%)
Marital Status			
Married or Living with someone	8 (6.3)	3 (10.0)	11 (7.1)
Single	118 (93.7)	27 (90.0)	145 (92.9)
Education Level Completed			
Graduated highschool	8 (6.3)	3 (10.0)	11 (7.1)
Part university	116 (92.1)	26 (86.7)	142 (91.0)
Completed university degree	0 (0.0)	1 (3.3)	1 (0.6)
Part graduate school	2 (1.6)	0 (0.0)	2 (1.3)

* $p < .05$. ** $p < .01$.

Table 3

Ethnicity and Language of Participants

Variable	Groups		
	Non-Dysphoric N (%)	Dysphoric N (%)	Total N (%)
Ethnicity			
Caucasian	81 (64.3)	16 (53.3)	97 (62.2)
Asian	28 (22.2)	11 (36.7)	39 (25.0)
South Asian	9 (7.1)	2 (6.7)	11 (7.1)
Black	3 (2.4)	0 (0.0)	3 (1.9)
Hispanic	1 (0.8)	0 (0.0)	1 (0.6)
Other	4 (3.2)	1 (3.3)	5 (3.2)
English			
First language	100 (79.4)	20 (66.7)	120 (76.9)
Second language	26 (20.6)	10 (33.3)	36 (23.1)

* $p < .05$. ** $p < .01$.

treatment (χ^2 (1, N = 156) = 1.24, p > .05), on their histories of past treatment, (χ^2 (1, N = 156) = 0.11, p > .05), on hospitalizations for emotional reasons (χ^2 (1, N = 156) = 1.24, p > .05), on suicide attempts (χ^2 (1, N = 156) = 0.09, p > .05), or on history of having sustained a concussion (χ^2 (1, N = 156) = 0.12, p > .05). Two participants (1 in dysphoric and 1 in non-dysphoric groups) were currently receiving treatment and 28 participants (6 in dysphoric and 22 in non-dysphoric groups) had received treatment in the past for emotional problems. Additionally, no group differences were found on history of substance use (χ^2 (1, N = 156) = 0.44, p > .05), current alcohol use (χ^2 (1, N = 156) = 0.19, p > .05) or current drug use (χ^2 (1, N = 156) = 0.41, p > .05).

The groups were formed on the basis of the severity of depressive symptoms and thus were found to differ in their levels of depression, t (33) = 10.61, p < .01. Twenty participants fell within the dysphoric range (scoring between 13 and 19 on the BDI-II) and ten participants fell within the dysphoric or depressed range (scoring between 20 to 63 on the BDI-II). The dysphoric group also reported higher anxiety levels (t (35) = 6.29, p < .01). Fifty-one out of the 156 participants fell within the mild anxiety range (scored between an 8 to 15 on the BAI), and 15 participants fell within the moderate anxiety range (score between 16 to 25 on the BAI). Only 2% of the non-dysphoric group fell within the moderate anxiety range as compared to 40% of the dysphoric group. No participants in either group fell within the severe anxiety range on the BAI. Results of a MANOVA showed a significant overall effect for group in terms of attentional difficulties (Wilks' Lambda F(5,150)=13.45, p < .01). Univariate F tests on the subscales on the attention measure revealed that the dysphoric group scored higher on all five

subscales: organizing and activating for work subscale ($F(1,154)=25.51$, $p < .01$), sustaining attention and concentration subscale ($F(1,154)=10.84$, $p < .01$), sustaining energy and effort subscale ($F(1,154)=15.38$, $p < .01$), managing affective interference subscale ($F(1,154)=63.34$, $p < .01$), and utilizing working memory subscale ($F(1,154)=8.80$, $p < .01$) (see Table 4). A closer examination of the scores revealed that the mean of the non-dysphoric group fell within the "ADD possible but not likely" range which is a score less than 40. A score below 40 is the range that individuals without attention problems are expected to fall within. The mean of the dysphoric group fell within the "ADD probable but not certain" range which is a score between 40 to 54. A score between 40 and 54 suggests that the group was having some difficulties with their attention abilities.

Group Comparisons on Cognitive Functioning

As reported above (Table 4) significant differences emerged between the dysphoric and non-dysphoric groups on anxiety and attention; however, these two measures were not significantly correlated with any of the cognitive measures (see below for further information on correlations). Therefore, multivariate analyses of covariance were not needed to control for these variables as potential confounders. It should also be noted that the non-dysphoric group did not differ significantly from published norms on auditory working memory ($t(224) = 1.50$, $p > .05$) but did differ on visual memory, scoring slightly higher than the normative sample ($t(224) = 2.19$, $p < .05$) (Wechsler, 1997). The non-dysphoric group did not differ from the WCST published norms for number of perseverative errors ($t(160) = 1.22$, $p > .05$) or non-perseverative errors ($t(160) = 0$, $p > .05$) but did achieve more categories than the normative sample ($t(160) = -$

Table 4

Mean Scores on BDI-II, BAI and Brown ADD Scales

	Groups			
	Non-dysphoric		Dysphoric	
Variable	M	SD	M	SD
BDI-II	5.00	3.43	18.70	6.87**
BAI	5.74	4.69	14.63	7.40**
Brown ADD	28.33	15.40	45.87	16.67**
Subscale 1[a]	7.45	4.30	11.83	4.15**
Subscale 2[b]	9.48	5.06	12.93	5.55**
Subscale 3[c]	4.64	3.91	7.90	4.77**
Subscale 4[d]	3.28	2.64	8.07	4.06**
Subscale 5[e]	3.34	2.89	5.13	3.32**

Note. Higher scores indicate greater severity
[a] organizing and activating for work. [b] sustaining attention and concentration. [c] sustaining energy and effort. [d] managing affective interference. [e] utilizing working memory
* $p < .05$. ** $p < .01$.

20.16, $p < .05$) (Yeudall, Fromm, Reddon, and Stefanyk, 1986). On the Stroop, the non-dysphoric group did not differ significantly from the norms on the word reading, (t (164) = -1.74, $p > .05$), color naming (t (164) = -0.64, $p > .05$), or color-word trials (t (164) = -0.35, $p > .05$) (Connor, Franzen, and Sharp, 1988). On FAS, the non-dysphoric group had similar results to the normative sample on number of 'F' words generated (t (160) = -1.02, $p > .05$) and number of 'S' words generated (t (160) = -0.59, $p > .05$), but did produce significantly fewer 'A' words (t (160) = -2.40, $p < .05$) (Yeudall et al., 1986).

Group differences on working memory (auditory and visual memory) were analyzed using a MANOVA (Table 5). The overall effect for group was significant (Wilks' Lambda $F(2,153)=3.33$, $p<.05$). The results of univariate F tests showed group differences on auditory memory ($F(1,154)=4.02$, $p<.05$), with the dysphoric group scoring significantly lower than the non-dysphoric group. No group differences emerged for visual memory ($F(1,154)=0.62$, $p>.05$).

Next, group differences on executive functioning measures (total number of correct responses on the WCST, color-word score from the Stroop, and total number of correct words generated using 'F', 'A', and 'S') were analyzed using a MANOVA (Table 6). The overall effect for group was not significant (Wilks' Lambda $F(3,152)=1.98$, $p>.05$) and univariate F tests revealed no group differences for total number of correct responses on the WCST ($F(1,154)=2.53$, $p>.05$), ability to read the color of the ink of printed words (color-word trial) on Stroop ($F(1,154)=0.21$, $p>.05$), or total number of correct words generated on FAS ($F(1,154)=3.76$, $p>.05$).Group differences on the WCST measures (perseverative errors, non-perseverative errors, number of conceptual level responses, trials to complete the first category, categories completed) were analyzed

Table 5

Auditory and Visual Working Memory

	Non-Dysphoric		Dysphoric		F	P	ES[a]
Variable	M	SD	M	SD			
Working Memory					3.33	0.04	
Auditory	10.83	2.64	9.80	1.90	4.02	0.05	0.03
Visual	11.16	1.93	11.47	1.87	0.62	0.43	0.00

Note. Data are presented as scaled scores to adjust for age.
[a] = Effect size

Table 6

Executive Functioning Measures

Variable	Non-dysphoric M	Non-dysphoric SD	Dysphoric M	Dysphoric SD	F	P	ES
Executive Functioning					1.98	0.12	
WCST							
Total # Correct Responses	53.00	5.69	50.90	9.09	2.53	0.11	0.02
Stroop							
Color-Word Score	49.25	8.62	48.47	8.34	0.21	0.65	0.00
FAS							
Total # Words	41.67	9.02	38.03	10.07	3.76	0.05	0.03

using a MANOVA (Table 7). The overall effect for group was not significant (Wilks' Lambda $F(5,150)=1.00$, $p>.05$). Univariate F tests revealed no group differences for perseverative errors ($F(1,154)=2.88$, $p>.05$), non-perseverative errors ($F(1,154)=1.75$, $p>.05$), number of conceptual level responses (i.e., consecutive correct responses occurring in runs of three or more) ($F(1,154)=2.98$, $p>.05$), categories completed ($F(1,154)=0.96$, $p>.05$), and trials to complete the first category ($F(1,154)=1.81$, $p>.05$). There was a trend for the dysphoric group to score lower on total number of FAS words generated compared to the non-dysphoric group; however, this finding should be interpreted cautiously since the overall group effect was not significant.

Group differences on Stroop measures (word reading, color naming and color-word trials) were analyzed using a MANOVA (Table 7). The overall effect for group was non-significant (Wilks' Lambda $F(3,152)=0.17$, $p>.05$) and univariate F tests revealed no group differences for word reading ($F(1,154)=0.44$, $p>.05$), color naming ($F(1,154)=0.36$, $p>.05$), or color-word trials ($F(1,154)=0.21$, $p>.05$).

Group differences on the Controlled Verbal Fluency Task (FAS) measures (total number of 'F' words generated, total number of 'A' words generated and total number of 'S' words generated) were analyzed using a MANOVA (Table 7). The overall effect for group was significant (Wilks' Lambda $F(3,152)=3.21$, $p<.05$). The results of univariate F tests showed that the dysphoric group produced fewer 'F' words than the non-dysphoric group ($F(1,154)=7.34$, $p<.01$). No differences emerged for total number of 'A' words ($F(1,154)=0.12$, $p>.05$) and total number of 'S' words ($F(1,154)=3.23$, $p>.05$).

Table 7

WCST, Stroop and FAS

Variable	Non-dysphoric		Dysphoric		F	P	ES
	M	SD	M	SD			
WCST					1.00	0.42	
Total correct	52.99	5.69	50.90	9.09			
Perseverative errors	5.48	2.49	6.37	2.97	2.88	0.09	0.02
Non-perseverative errors	5.52	3.82	6.73	6.68	1.75	0.19	0.01
Conceptual level responses	51.02	7.54	48.03	11.87	2.98	0.09	0.02
Categories completed	4.33	0.93	4.13	1.28	0.96	0.33	0.01
Trials to complete 1st category	14.18	6.77	16.27	10.68	1.81	0.18	0.01
Failure to maintain set	0.71	5.35	0.20	0.48			
Learning to learn	1.05	4.52	-0.29	5.45			
Stroop					0.17	0.92	
Word Reading	108.93	13.88	107.03	14.92	0.44	0.51	0.00
Color Naming	80.09	11.06	78.77	9.66	0.36	0.55	0.00
Color-word	49.25	8.62	48.47	8.35	0.21	0.65	0.00
FAS	41.67	9.02	38.03	10.07	3.21	0.03	
F	14.40	3.55	12.67	4.23	7.34	0.01	0.05
A	11.57	3.67	11.33	3.38	0.12	0.75	0.00
S	15.78	3.85	14.33	4.19	3.23	0.07	0.02

Note. Data are presented as raw scores

Relationship between Cognitive Functioning and Current Severity of Mood Symptoms

Correlations were performed to examine the relationship between cognitive measures and current severity of mood symptoms, as measured by the BDI-II (see Appendix F). In the overall sample, those with more severe depressive symptoms had poorer auditory memory ($r = -0.18$, $p < .05$) but no visual memory difficulties ($r = 0.05$, $p > .05$). Those participants with more severe mood problems made significantly fewer correct responses on the WCST ($r = -0.20$, $p < .05$), and more perseverative errors ($r=0.16$, $p<.05$), as well as non-perseverative errors ($r = 0.20$, $p < .01$). These participants also made fewer conceptual level responses ($r = -0.21$, $p < .01$), completed fewer categories ($r = -0.19$, $p < .05$), and were impaired on their learning to learn (i.e., their conceptual efficiency across consecutive categories) ($r = -0.25$, $p < .01$). Participants with more severe mood problems had no significant difficulties on the Stroop with word reading ($r = -0.14$, $p > .05$), color naming ($r = -0.11$, $p > .05$), or naming the color of the ink of printed words (color-word trial) ($r = -0.13$, $p > .05$). However, they produced significantly fewer 'F' words ($r = -0.17$, $p < .05$) and overall, produced fewer words when all the trials were combined ('F', 'A', and 'S') ($r = -0.17$, $p < .05$). No difficulties were found when asked to produce 'A' words ($r = -0.10$, $p > .05$) or 'S' words ($r = -0.14$, $p > .05$). It should be noted, however, that even the correlations that reached statistical significance were modest (<0.30).

Correlations were also examined within each group. For the dysphoric group, those with more severe depressive symptoms made more non-perseverative errors on the WCST ($r = 0.38$, $p < .05$), completed fewer categories ($r = -0.38$, $p < .05$), took more trials to complete the first category ($r = 0.38$, $p < .05$), and were more likely to fail to maintain a

set (r = 0.42, p <.05). No significant findings were found on working memory measures, Stroop trials or the FAS test.

For the non-dysphoric group, those with more severe depressive symptoms had poorer auditory working memory (r = -0.19, p <.05), were more impaired on their learning to learn on the WCST (r = -0.22, p <.05), and produced fewer 'A' words (r = -0.23, p <.05) and fewer words overall on FAS (r = -0.20, p <.05).

Relationship between Cognitive Functioning and History of Mood Symptoms

Correlations were performed to examine the relationship between cognitive measures and history of mood (number of lifetime major depressive episodes experienced and severity of a past episode) (see Appendix F). No relationship was found between number of lifetime major depressive episodes and memory. Participants with a greater number of major depressive episodes were found to make more non-perseverative errors (r = 0.17, p<.05), to achieve fewer categories (r = -0.21, p <.05), to require more trials to complete first category (r = 0.19, p <.05), to be more impaired in their learning to learn on the WCST, and to read fewer words on the Stroop test (r = -0.16, p <.05). Participants with more severe past major depressive episodes were found to be more impaired in their learning to learn on the WCST (r = -0.19, p<.05) and in their ability to read the color of the ink of the printed word in the Color-Word trial on the Stroop (r = -0.18, p<.05). See Appendix F for relationships within the dysphoric and non-dysphoric groups.

Relationship between Cognitive Functioning and Anxiety and Attention Symptoms

No significant correlations were found between cognitive functioning and the clinical variables of anxiety and attention as measured by the BAI and Brown ADD Scales (see Appendix F).

Cognitive Functioning in Participants with and without a History of Depression

A closer examination of the total sample revealed that 29 participants had at one time experienced at least one past major depressive episode (13 in the dysphoric group and 16 in the non-dysphoric group). These participants were compared on cognitive measures to those who had never experienced a clinical depressive episode. Group differences on working memory measures (auditory and visual memory) were analyzed using a MANOVA (see Appendix F). The overall effect for group was non-significant (Wilks' Lambda $F(2,153)=2.39$, $p>.05$). However, the results of univariate F tests showed that the group with a history of depression had poorer auditory working memory than the group with no history of depression ($F(1,154)=4.25$, $p<.05$). Since the overall group effect was non-significant, this finding must be interpreted cautiously. No group differences were found for visual working memory ($F(1,154)=0.00$, $p>.05$). No other significant differences were found on other cognitive measures (i.e., WCST, Stroop and FAS). Of interest, the relationships among mood, anxiety and attention were examined in those with and without a history of depression. Those with a history of depression had higher depressive scores, $t(32) = -3.34$, $p < .05$, and higher anxiety scores, $t(34) = -4.01$, $p < .05$. No significant differences were found between the groups on attentional problems ($t(35) = -1.75$, $p > .05$).

Miscellaneous Findings

A comparison on cognitive measures between those participants who learned English as their first language versus those who learned English as their second language revealed no significant differences (see Appendix F). However, those who learned

English as their second language reported significantly more difficulties with attention, t (154) = -3.67, $p < .05$.

Analyses for Groups Matched for Age, Ethnicity and Language

In addition to the above results using the two complete groups (30 dysphoric and 126 non-dysphoric), two smaller groups were derived from the original sample by matching on age, ethnicity and whether English was their first or second language. More specifically, every participant in the dysphoric group was matched to a participant in the non-dysphoric group based on same age (e.g., 19), same ethnicity (e.g., Asian) and same history of whether they learned English as their first or second language. Five participants in the dysphoric group could not be matched to any of the non-dysphoric group based on ethnicity (i.e., there were no more Asian participants in the non-dysphoric group to match). Therefore, the final sample for the dysphoric group was 25 participants who were matched to 25 non-dysphoric participants. In this newly derived sample, the non-dysphoric group participants had no current or past history of depression and the dysphoric group had no participants who currently met criteria for depression.

The findings for the two samples matched for age, ethnicity, and language (N=50) were exactly the same as for the entire sample (N=156) with regard to group differences on demographic and clinical variables with the exception of two subscales scores on the Brown ADD Scales: no group differences were found for the sustaining attention and sustaining energy subscales, which were significantly different in the original unmatched groups. The MANOVAs also revealed the exact same findings as the unmatched group with regard to group differences on the WCST, Stroop and FAS: no differences between the groups on the WCST and Stroop tasks but the dysphoric group produced fewer "F"

words on FAS than the non-dysphoric group. On the working memory measures, however, the overall effect for group was non-significant (Wilks' Lambda $F(2,47)=2.66$, $p>.05$). The univariate F test was significant for auditory memory ($F(1,48)=4.98$, $p<.05$) and non-significant for visual memory ($F(1,48)=0.09$, $p>.05$) (same findings as for the unmatched sample). However, the significant finding for auditory memory should be interpreted cautiously since the overall group effect was not significant.

DISCUSSION

The present study provided information on the relationship between mood symptoms and cognitive functioning. Hypothesis one stated that young women with mood symptoms would display deficits in working memory and executive functioning in comparison to young women without mood symptoms. The present study found partial support for this hypothesis. The dysphoric group scored lower on an auditory working memory task than those in the non-dysphoric group; however, no differences emerged between the two groups on a visual working memory task. Other studies with depressed participants have also found poor auditory working memory as compared to controls (e.g., Breslow, Kocsis, & Belkin, 1980, Channon, Baker, & Robertson, 1993, and Landrϕ, Stiles, & Sletvold, 2001). A possible explanation for the difference found between auditory and visual memory is that the participants seemed more interested in the visual task as compared to the auditory task. For example, participants often commented that they were curious about the spatial span equipment used for the visual task. The novelty of the spatial span task may have facilitated their encoding of information by increasing their attention to the task. This idea is based on the theory that deficits in memory may be a result of poor encoding caused by poor attention and concentration (e.g., Sweeney, Wetzler, Stokes, & Kocsis, 1989). An alternative explanation is that the Spatial Span subtest, which is a new task to the WMS-III, may not be an adequate measure of working memory. A recent study by Wilde and Strauss (2002) raised concerns about this task as they found no differences between the forward and backward raw scores with their clinical sample and one-third of their sample showed better performance on the backward trial of the task as compared to the forward trial.

The study also found partial support for executive dysfunction in the dysphoric group on a measure of verbal fluency. The dysphoric group generated fewer 'F' words than the non-dysphoric group. No differences were noted for number of 'A' and 'S' words generated. The dysphoric group may have had greater difficulty with flexibly adapting to this new verbal task. In addition, the vocabulary size for 'F' is the smallest as compared to the other letters so this particular trial may have been the most difficult (Spreen & Strauss, 1998). No differences were found between the groups on the WCST or Stroop Color and Word Test. As reviewed in Chapter One, a number of studies have found support for executive deficits in depressed patients (e.g., Degl'Innocenti et al., 1998; Fossati et al., 1999; Grant et al., 2001; Merriam et al., 1999; Paradiso, Lamberty, Garvey, & Robinson, 1997; Trichard et al., 1995). The minimal findings of executive deficits in the current study may be due to the sample having less severe depression (i.e., dysphoria) as compared to clinically depressed samples that are usually studied. Also, previous studies have frequently used inpatients as their clinical group who certainly have more severe psychiatric problems than the dysphoric university students studied here. In addition, many of the previous studies have included patients on medications, which may have accounted for some of the previous significant findings.

One study which was conducted on a similar university population (Channon, 1996) did find executive function deficits. A closer examination of that study revealed that the control group was scoring much lower than the published norms for the WCST and lower than the non-dysphoric group in the current study on number of perseverative and non-perseverative errors. In fact, the number of perseverative errors made by the dysphoric group in the study by Channon was very similar to the number made in the

current study. It is likely that fewer executive deficits would have been found in this study had the control group been more representative of normative findings.

Although memory and executive functioning were formally measured using neuropsychological tests, these cognitive abilities can also be examined through responses on the Brown ADD Scales which has a number of subscales that ask about memory (e.g., utilizing working memory subscale) and executive functioning (e.g., organizing and activating for work subscale). As depressive scores increased, participants scored higher on all of the subscales on the Brown ADD Scales. Thus, from a qualitative perspective, participants experiencing more depressive symptoms (i.e., the dysphoric group) reported having greater difficulties on questions related to everyday functioning that involved their memory and executive functioning abilities.

A contributing factor to the memory and executive functioning differences between the dysphoric and non-dysphoric groups may have been motivation. One theory that attempts to account for impaired cognitive functioning in depressed patients suggests that they have impaired motivation on tasks that require sustained effort (Tariot & Weingartner, 1986). One of the subscales on the Brown ADD Scales, the sustaining energy and effort subscale, measured this construct and was found to be significantly worse in the dysphoric group. Thus, a possible explanation for the differences found between the groups may be related to inability to learn information that requires sustained effort and therefore involving motivation.

The second hypothesis stated that participants with more severe depressive symptoms would be more likely to have greater cognitive deficits. This study found that as the depressive symptoms became more severe, participants demonstrated greater

auditory memory problems, had more difficulty on a number of WCST measures (e.g., made fewer total number of correct responses, had greater perseverative and non-perseverative errors), and generated fewer total number of words on FAS. Other studies have also found a relationship between increasing depressive symptoms and impairment on WCST measures (e.g., Martin, Oren, & Boone, 1991; Merriam et al., 1999).

The second hypothesis also stated that participants with more severe and/or chronic history of mood episodes would be more likely to display cognitive impairments. The current study found that a greater number of major depressive episodes was related to difficulties on a few measures on the WCST and on one part of the Stroop. No relationship was observed between number of episodes of depression and performance on FAS. The current study also found that the number of major depressive episodes experienced was not related to memory; that is, participants with a greater number of lifetime major depressive episodes were not more impaired on working memory measures. The absence of a relationship between number of prior episodes of depression and cognitive impairment has been found by several studies (e.g., Grant, Thase, and Sweeney, 2001) but not consistently. Kessing (1998) found that patients with recurrent episodes were significantly more impaired than patients with single episodes on various cognitive tests. However, the participants were much younger in age in the current study and in the study by Grant and colleagues (2001) as compared to those in Kessing's study. Those in Kessing's study were in their 50s and 60s and therefore their histories may not have been as severe or chronic. The association between number of episodes and cognitive functioning may be more apparent with increasing age. The current study did find that the more severe a past major depressive episode, that is, the most recent or most

significant in terms of severity, the slower the learning to learn (i.e., efficiency across consecutive categories) and the slower the ability to name the color of the ink that the word is printed in on the Stroop Color-Word trial. However, the correlations were relatively modest and their reliability is questionable given that participants were required to retrospectively recall the severity of the episode.

The second hypothesis also stated that those participants with higher scores on the anxiety or attentional measures would display greater cognitive impairments. This study found no relationship between anxiety and attention scores, and performance on cognitive tests. However, the dysphoric group did report higher levels of anxiety and attentional difficulties as compared to the non-dysphoric group. Increased anxiety levels in a depressed group as compared to a non-depressed group have been found in previous studies (e.g., Crews et al., 1999). To the author's knowledge, no previous studies have had participants complete a self-report measure of attention. The findings of the current study suggest that those reporting depressive symptoms also report higher levels of other emotional/behavioral difficulties. This supports the importance of including questionnaires and/or completing interviews that ask about difficulties beyond depression.

Miscellaneous Findings

Additional statistical analyses revealed that participants who learned English as their second language reported having more attention difficulties as measured by the Brown ADD Scales. It may be that the students whose first language was not English found tasks that involved language skills to be more difficult. Perhaps they are

translating information to their native language which impacted their abilities to pay attention, organize, and sustain their energy in the classroom setting.

Strengths and Limitations of the Findings

One strength of this study was that it examined working memory and executive functioning in young adults, an area that has been under-investigated. Most of the studies to-date have used samples with diverse age ranges or have focused on older samples, that is, geriatric samples. Examining cognitive functioning in a sample with milder depressive symptoms was a second important strength of this study as it is valuable to understand the impact of the severity of depressive symptoms on functioning. The present study provided support for the relationship between depressive symptomatology and cognitive functioning in mildly affected women: increasing depressive symptoms were associated with increasing cognitive difficulties.

Another important strength of this study was the examination of the history of depression. This study found some modest relationships between number of prior episodes of depression and cognitive functioning as measured by the WCST and Stroop. In addition, some modest relationships were observed between severity of past depressive experiences and cognitive dysfunction as measured by the WCST and Stroop. Unfortunately, there was insufficient time to go through the history of depressive episodes to determine time periods and age of onset of the episodes.

Another strength of this study was the diagnostic classification of the sample. Prior studies have been criticized for not using structured interviews to confirm diagnoses, instead relying on self-report questionnaires. Using a diagnostic interview

enabled the researcher to determine current and/or past mood disorder history and to exclude those with diagnoses that were unsuitable for the study such as a bipolar disorder or a psychotic disorder. As mentioned above, this study also included an anxiety questionnaire as researchers such as Vredenburg et al. (1993) have emphasized the importance of determining whether anxiety is present and possibly influencing the cognitive variables. This study also included a self-report questionnaire on attentional problems which provided qualitative information on memory and executive functioning. Finally, an important strength of this study was the exclusion of participants who were taking psychiatric medication.

One of the most obvious limitations of this study is the inclusion of only females in the sample. The results are therefore not generalizable to males as it is unclear whether there would be gender differences. From a methodological viewpoint, the inclusion of only females was important as too few male participants would have been recruited to allow for sufficient power to analyze the samples by gender. Research has indicated possible gender differences in the organization of the brain and thus the inability to analyze the findings by gender would have been a significant methodological limitation.

Another limitation of the study was the use of a university student sample which limits the generalizability of the findings. Motivation to participate in a study (i.e., are the participants who sign up for a study different from those that do not participate?) and higher educational level are issues to consider. Although this university sample was more educated then the general population, the milder depressive symptomatology observed in the sample is more representative of the degree of mood problems that would be more commonly seen in the general population. It has also been argued that this dysphoric

population is more typical of the general population in that they are not as likely to have other psychiatric conditions (Vredenburg et al., 1993).

Another possible limitation of this study was the use of a new computer version of the Wisconsin Card Sorting Test – 64 Card Version. Although initial studies have suggested a general equivalence between computerized and manual administrations of the WCST, to-date no equivalence data has been gathered for the computerized administrations of the Windows version of the WCST. As a result, the normative scores must be interpreted cautiously. Also, this study used the abbreviated form of the WCST; that is, the 64 card version as opposed to the original 128 card version. Although the use of a short form reduces reliability, the WCST-64 correlates highly with the long form. However, according to Spreen and Strauss (1998), "studies of the WCST-64 performance in patients with focal frontal lobe dysfunction and other disorders compromising executive function are also needed" (p.219).

A final limitation of this study was the sample size of the dysphoric group. A larger sample size was needed to detect the small effect sizes for a few of the statistical analyses. All the demographic and clinical analyses had sufficient power; however, several of the MANOVAs revealed small effect sizes that suggested that although the non-dysphoric group was large enough (N=126), the dysphoric group was not large enough (N=30) to detect these small effect sizes. According to Cohen (1998), conventional effect sizes are small (0.2), medium (0.5) and large (0.8). The present study found effect sizes between 0.001 and 0.05 for the MANOVAs on cognitive functioning which therefore impacted the power. In order to have detected these small effect sizes, the dysphoric group needed to have at least 45 participants for a MANOVA with 2

variables and at least 60 participants for a MANOVA with 5 variables. Generally, these effect sizes were very small suggesting that the differences between the groups in this study were fairly minimal.

Directions for Future Research

Future research is needed to replicate the findings of a relationship between depressive symptoms and cognitive functioning. Although memory has been routinely studied over the years, fewer studies have focused on working memory and newer assessment methods have been recently devised (e.g., Wechsler Memory Scales – Third Edition) that warrant further evaluation. A more thorough examination of this relationship in different age groups will be important such as with adolescents and with adults that are young, middle aged, and geriatric.

Examination of the impact of severity of depressive symptoms on cognitive functioning needs to be further explored given the inconsistent findings in the literature to-date. It would be of interest to compare those with mild subclinical depressive symptoms to those who meet criteria for major depressive disorder with mild, moderate and severe levels to see if a pattern emerges of more severe cognitive functioning deficits associated with increasing severity of depressive symptoms. In general, the depression field has lacked studies that have explored the impact of the continuity of depression scores on various areas (Flett, Vredenburg, & Krames, 1997). Flett and colleagues have argued that it is important to gain a better understanding of the association between mild and severe forms of depression for conceptual, measurement (e.g., how to assess) and clinical/practical reasons (e.g., when to intervene). The findings of the present study of increasing cognitive difficulties with increasing depressive scores provides further

support for the need to better understand mood problems that are not necessarily meeting diagnostic criteria for depression.

A more thorough examination of depressive history could also be carried out to determine the relationship between these factors and cognitive functioning. All of the above suggestions for future research need to be generalized to community samples that include both men and women of various educational levels. Continuing to examine the relationship of cognitive performance with other clinical variables such as anxiety and attention and other depression subtypes such as depression with psychotic features will be of importance.

Future research should continue to explore the mechanisms involved in the relationship between mood problems and cognitive functioning. According to Elliott et al. (1996), "research has yet to provide a coherent theoretical framework adequately to explain these deficits" (p.975). However, a number of theories have been hypothesized to explain the mechanisms involved. Only the most relevant theories that may account for the current study results are described below.

One of the more popular frameworks for understanding memory impairments was proposed by Hasher and Zacks (1979). They built a theory around the idea that memory encoding is impacted by attentional requirements. This theory originated from Kahneman (1973) who hypothesized that mental operations vary in the amount of attentional capacity they require. Hasher and Zacks suggested that mental operations that are automatic require few attentional resources whereas effortful processes require more attention resources. Individuals under stress, such as depression, will show a decreased performance on memory tasks that require effortful processing. Thus, depressed

participants will perform more poorly on effortful tasks, tasks that are demanding and require attention and effort, but automatic tasks which do not require attention or effort are spared. A considerable body of research has supported this theory as reviewed by Hartlage, Alloy, Vázquez, and Dykman (1993).

Another explanation for poor memory performance in depressed individual is related to conservative response bias. This theory proposes that depressed individuals will perform poorly on tests of memory because they tend to be conservative in the way they respond to test questions (e.g., Dunbar & Lishman, 1984). Some researchers have suggested that this conservative approach is related to motivational deficits (e.g., McAllister, 1981). Research has revealed that reduced motivation is a feature in depressive symptomatology; however, support for this theory has been equivocal. For example, a study by Richards and Ruff (1989) did not find support for the impact of motivation on cognitive test performance. In this study, participants were randomly assigned to motivation and no-motivation conditions. Those in the motivation condition were given specialized instructions with regard to effort, were told they would receive feedback on their performance, and were offered a monetary reward. The no-motivation group did not receive any specialized instructions, feedback, or reward. They found no differences between their groups on cognitive tests. However, a study by Elliott and colleagues (1996) found that motivation did have a role in cognitive functioning. In this study, participants were provided feedback on their performance on tasks. Depressed participants were significantly influenced by their perceived failure on tasks which had a detrimental effect on their subsequent performance. According to the researchers, this

oversensitivity to negative feedback is a highly specific form of motivation impairment. This sensitivity to failure is consistent with the theoretical position of Beck who has suggested that depressed individuals are more likely to pay attention to negative thoughts (e.g., Beck, 1967). According to his theory, depressed individuals have cognitive distortions or negative thinking styles that predispose them to be more sensitive to negative life events than non-depressed individuals.

On executive functioning tasks, depressed individuals making perseverative errors have been hypothesized to be using increasingly conservative cognitive strategies in problem solving or using increasingly incorrect strategies. As stated by Martin (1991), whether these perseverative errors "reflect a cognitive style characteristic of depression or are signs of focal or generalized organic dysfunction remains to be clarified" (p. 689). Many of the studies on executive functioning suggest that the deficits are related to frontal lobe dysfunction.

Generally, the models derived to-date tend to support either cognitive or biological mechanisms as being responsible for the underlying cognitive deficits. Various biological models have been proposed to account for cognitive impairment in depression. One is the 'fronto-subcortical dementia' model (see Robbins et al., 1992 for review). This model suggests that those with depression have abnormalities in the neurotransmitter systems in areas such as the thalamus, striatum and connections into the prefrontal cortex. These abnormalities result in slowing of cognitive processes, difficulties with problem solving and other cognitive abilities. Another model is one proposed by Flor-Henry and colleagues which explains neuropsychological deficits in depression as being due to right-hemisphere dysfunction (e.g., Flor-Henry, 1983). Functional and structural

neuroimaging studies have supported the idea of abnormalities in the brains of depressed individuals, particularly in the frontal lobe. For a review on research involving the frontal lobe dysfunction in affective disorders, see Powell and Miklowitz (1994).

It is likely that none of the current theories can by themselves fully account for the deficits observed in cognitive functioning in depressed individuals. An integrated model of depression that incorporates biological and cognitive variables will probably best account for the observed cognitive deficits. Unfortunately, methodological difficulties in distinguishing between the various models have made work in the field challenging; however, as technology improves and more studies are conducted, it is hoped that a better understanding of the mechanisms associated with cognitive dysfunction will be determined.

Clinical Implications

A number of studies are suggesting that milder forms of depression need to be studied as those falling in this group are at risk for later developing clinical depression (e.g., Gotlib, Lewinsohn, and Seeley, 1995). The present study examined a dysphoric group who scored in the mildly depressed range on the BDI-II and mildly anxious range on the BAI. Although significant differences were found between the dysphoric and non-dysphoric groups on auditory working memory and a measure of verbal fluency, the clinical/functional significance was minimal. It is likely that in a classroom/work setting, these deficits would not significantly impair their ability to learn/function. However, it should be noted that from a qualitative perspective, the dysphoric group scores on the Brown ADD Scales do suggest they feel they are having functional difficulties with such activities as attending to information and organizing. Other studies have suggested

impairment in functioning in those with subclinical depression (Gotlib et al., 1995). The impact of subclinical depressive symptoms on psychosocial functioning remains to be fully determined.

There are several implications for clinical practice based on the current study. In terms of clinical assessment, clinicians may want to consider routinely using a measure of affective status before doing cognitive testing. If an individual is scoring high such as in the moderate to severe range with regard to mood problems, it will be important to emphasize that the cognitive results may be a minimal estimate of their ability based on the possible impact of the mood symptoms on their cognitive abilities. In terms of therapy approaches, those with mild depressive symptoms may need help on working on their beliefs about their ability levels. Those with more severe depressive symptoms may actually need more specific strategies to help them improve their memory (e.g., training patients to focus their attention) or to help them to compensate for their memory problems (e.g., writing down important information).

Conclusions

This study found partial support for the existence of cognitive deficits in young women presenting with mood symptoms. The dysphoric group exhibited auditory working memory deficits and executive functioning deficits on part of a verbal fluency task. Those participants with more severe depressive symptoms demonstrated greater auditory memory problems, were more impaired on a number of WCST measures, and generated fewer total number of words on FAS. The study also found that the history of mood symptoms had a minimal influence on cognitive functioning in these young adults. No relationship was found between anxiety and attention levels, and performance on

cognitive tests; however, the dysphoric group did report higher levels of anxiety and attentional problems, as measured using the BAI and Brown ADD Scales.

The present study provided some initial support for the importance of examining the relationship between mood and cognitive functioning. Further studies are needed to examine the impact of different demographic variables such as gender and ages, and different clinical variables such as anxiety, depression severity and history. Gaining a better understanding of the relationship between mood and cognitive functioning has important clinical implications for both assessment and treatment of those with mood problems.

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APPENDIX A

DSM-IV Diagnostic Criteria for a Major Depressive Episode

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

Note: Do not include symptoms that are clearly due to a general medical condition, or mood-incongruent delusions or hallucinations.

(1) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by other (e.g., appears tearful). **Note:** In children and adolescents, can be irritable mood.

(2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others)

(3) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. **Note:** In children, consider failure to make expected weight gains.

(4) Insomnia or hypersomnia nearly every day

(5) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)

(6) Fatigue or loss of energy nearly every day

(7) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)

(8) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)

(9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific play, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms do not meet criteria for a Mixed Episode

C. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

D. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).

E. The symptoms are not better accounted for by Bereavement, i.e, after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation.

Note. From "Diagnostic and statistical manual of mental disorders" (4th ed.). (p. 327), American Psychiatric Association, 1994, Washington, DC: Author.

APPENDIX B

DSM-IV Diagnostic Criteria for Dysthymic Disorder

A. Depressed mood for most of the day, for more days than not, as indicated either by subjective account or observation by others, for at least 2 years. **Note:** In children and adolescents, mood can be irritable and duration must be at least 1 year.

B. Presence, while depressed, of two (or more) of the following:

   (1) poor appetite or overeating

   (2) insomnia or hypersomnia

   (3) low energy or fatigue

   (4) low self-esteem

   (5) poor concentration or difficulty making decisions

   (6) feelings of hopelessness

C. During the 2-year period (1 year for children or adolescents) of the disturbance, the person has never been without the symptoms in Criteria A and B for more than 2 months at a time.

D. No Major Depressive Episode has been present during the 2 years of the disturbance (1 year for children or adolescents); i.e., the disturbance is not better accounted for by chronic Major Depressive Disorder, or Major Depressive Disorder, In Partial Remission.

   Note: There may have been a previous Major Depressive Episode provided there was a full remission (no significant signs or symptoms for 2 months) before development of the Dysthymic Disorder. IN addition, after the initial 2 years (1 year in children or

adolescents) of Dysthymic Disorder, there may be superimposed episodes of Major Depressive Disorder, in which case both diagnoses may be given when the criteria are met for a Major Depressive Episode.

E. There has never been a Manic Episode, a Mixed Episode, or a Hypomanic Episodes, and criteria have never been met for Cyclothymic Disorder.

F. The disturbance does not occur exclusively during the course of a chronic Psychotic Disorder, such as Schizophrenia or Delusional Disorder.

G. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).

H. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

Note. From "Diagnostic and statistical manual of mental disorders" (4th ed.). (p. 332), American Psychiatric Association, 1994, Washington, DC: Author.

APPENDIX C

Bonus Credit Recruitment

Research Project: MEMORY & EXECUTIVE FUNCTIONING, Time Required: 120 min, Bonus Credits: 2, Description:Must be 17-25 yrs old and currently have depression OR have *never* had depression. Consists of an interview and tasks assessing cognitive functioning.

APPENDIX D

Consent Form

FACULTY OF MEDICINE

Department of Paediatrics
Alberta Children's Hospital
Telephone: (403) 229-7365
Fax: (403) 543-9100
Email: kaplan@ucalgary.ca

CONSENT FORM

Title: Memory and Executive Functioning in Young Adults Reporting Mood Symptoms
Investigators: Kim M. Galbraith, M.Sc., Ph.D. Candidate, Bonnie Kaplan, Ph.D., & Samuel Chang, M.D.

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Purpose and Significance
You are invited to participate in a study that will investigate cognitive functioning in young adults who may have mood disorders. Most studies of cognitive function have focused on either adults (with a mean age typically in the 40's) or on older adults (over 65). Very few studies have focused on young adults reporting mood symptoms, an area which needs to be examined given the importance of having intact cognitive functioning at a time when educational and vocational training are prominent issues.

Study Procedures
Participation in this study requires one meeting that will take approximately two hours. You will be asked to answer some interview questions, complete three questionnaires about your mood, anxiety and attention, and complete several tasks that assess your memory ability as well as your executive functioning (e.g., your ability to plan, organize and inhibit an automatic response).

Confidentiality
All information about you that is collected in this study will be held in the strictest confidence. Some of the data will be stored on a computer at the Behavioural Research Unit at the Alberta Children's Hospital, where it will be entered by a code number and not your name. The only people who will have access to the information required for this research project are the study investigators and designated staff. If the results of this study are published, participant data will be anonymous. Your name will never appear in any reports related to this study.

Liability and Compensation
As health care professionals, it is our responsibility to place patient well being above all else. It is with this in mind that we have undertaken this research project. We do not anticipate any harm will come to you as a result of our study. In the event that you suffer injury as a result of participating in this research no compensation will be provided for you by The University of Calgary, the Calgary Regional Health Authority, Kim Galbraith, Dr. Bonnie Kaplan, Dr. Samuel Chang or the other members of the research team. You still have all your legal rights. Nothing said here about treatment or compensation in any way alters your right to recover damages.

Your participation in this study is completely voluntary. If you do not want to participate in this study, or if you decide part-way through that you want to stop, you are certainly free to do so.

In signing this form I fully understand that I am participating in this study as part of my educational experience in the Psychology Department. In exchange for my time I expect to gain some understanding of research and some

of the ideas currently being explored in psychology. If, after the study, I feel I have not gained sufficient educational benefit, or have other concerns regarding this experience, I may register my concerns with Dr. S. D. Boon, Chair: Psychology Department Ethics Committee (Human Participants). She will insure that my comments are acted upon with no fear that I will be identified personally. Dr. Boon can be reached at: A231B, 220-5564, sdboon@ucalgary.ca.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research, please contact:

Dr. Bonnie Kaplan,
229-7365

If you have any questions concerning your rights as a possible participant in this research, please contact Pat Evans, Associate Director, Internal Awards, Research Services, University of Calgary, at 220-3782.

Participant	Date
Investigator	Date
Witness	Date

A copy of this consent form has been given to you to keep for your records and reference.

APPENDIX E

Resources and Information

RESOURCES AND INFORMATION

CLINICAL SERVICES	CONTACT INFORMATION
Family physicians	Yellow pages
Psychiatrists	Yellow pages
Psychologists	Yellow pages
Emergency Services	Phone 911
Calgary Regional Health Authority Cognitive Therapy Program (Colonel Belcher Hospital) Psychiatric Assessment Service (Foothills Hospital) Psychiatric Outpatient Service (Peter Lougheed Hospital) Crisis Assessment (Rockyview Hospital)	Need referral from G.P. for most programs
Provincial Mental Health Board Central office Northwest office Northeast office	G.P. or self-referred 297-7311 297-7345 297-7196
Calgary Association of Self Help	266-8711
Emotions Anonymous	247-5381
Calgary Family Services	269-9888
Catholic Family Services	233-2360
Jewish Family Services	287-3510
University Counselling Services - 325 MacEwan Student Center	220-5893

ORGANIZATIONS	CONTACT INFORMATION
Canadian Mental Health Association (Calgary office)	297-1700
Depression & Manic Depression Assoc. of AB (Edmonton)	1-888-757-7077

Useful websites:
www.psychologyinfo.com/depression
www.bestsitez.com/depression
www.depression.com (sponsored by a drug company)
www.depression-net.com (sponsored by a drug company)
www.ndmda.org (National Depressive & Manic Depressive Assoc. in the U.S.)

APPENDIX F

Tables

Table F1

Correlations between Working Memory and Current Severity of Mood Symptoms

Variable	BDI Scores		Total
	Non-Dysphoric	Dysphoric	
Working Memory			
Auditory	-0.19*	0.17	- 0.18*
Visual	-0.11	0.25	0.05

* $p < .05$; **$p < .01$

Table F2

Correlations between Executive Functioning and Current Severity of Mood Symptoms

Variable	BDI Scores		
	Non-Dysphoric	Dysphoric	Total
WCST			
Total correct	- 0.09	- 0.28	- 0.20*
Perseverative errors	0.14	- 0.01	0.16*
Non-perseverative errors	0.03	0.38*	0.20**
Conceptual level responses	- 0.11	- 0.26	- 0.21**
Categories completed	- 0.10	- 0.38*	- 0.19*
Trials to complete 1st category	- 0.12	0.38*	0.14
Failure to maintain set	- 0.08	0.42*	- 0.06
Learning to learn	- 0.22*	- 0.38	- 0.25**
Stroop			
Word Reading	- 0.17	- 0.18	- 0.14
Color Naming	- 0.12	- 0.19	- 0.11
Color-Word	- 0.13	- 0.28	- 0.13
FAS	- 0.20*	0.17	- 0.17*
F	- 0.12	0.21	- 0.17*
A	- 0.23*	0.06	- 0.10
S	- 0.15	0.14	- 0.14

* $p < .05$; **$p < .01$

Table F3

Correlations between Working Memory and History of Mood Symptoms in Total Sample (N=156)

Variable	# of Lifetime MDE	Severity of a past MDE
Working Memory		
Auditory	-0.12	- 0.14
Visual	-0.06	- 0.00

* $p < .05$; ** $p < .01$

Table F4

Correlations between Executive Functioning and History of Mood Symptoms in Total Sample (N=156)

Variable	# of Lifetime MDE[a]	Severity of past MDE
WCST		
Total correct	- 0.15	-0.09
Perseverative errors	0.08	0.07
Non-perseverative errors	0.17*	0.09
Conceptual level responses	- 0.12	-0.07
Categories completed	- 0.21**	- 0.09
Trials to complete 1st category	0.19*	0.10
Failure to maintain set	0.13	-0.02
Learning to learn	- 0.16*	-0.19*
Stroop		
Word Reading	-0.15	-0.14
Color Naming	-0.16*	-0.13
Color-Word	-0.14	-0.18*
FAS	-0.02	-0.07
F	-0.04	-0.06
A	-0.06	-0.08
S	0.04	-0.03

[a]major depressive episode
* $p < .05$. ** $p < .01$.

Table F5

Correlations between Working Memory and History of Mood Symptoms in Non-Dysphoric Group (N=126)

Variable	# Lifetime MDE[a]	Severity of a past MDE
Working Memory		
Auditory	- 0.19*	- 0.15
Visual	- 0.18**	- 0.02

[a]major depressive episode
* $p < .05$; ** $p < .01$

Table F6

Correlations between Executive Functioning and History of Mood Symptoms in Non-Dysphoric Group (N=126)

Variable	# of Lifetime MDE[a]	Severity of past MDE
WCST		
Total correct	- 0.06	0.05
Perseverative errors	0.06	- 0.00
Non-perseverative errors	0.05	- 0.07
Conceptual level responses	- 0.03	0.08
Categories completed	- 0.16	- 0.03
Trials to complete 1st category	0.06	- 0.03
Failure to maintain set	0.18*	-0.01
Learning to learn	- 0.09	-0.13
Stroop		
Word Reading	- 0.24**	-0.20*
Color Naming	- 0.25*	-0.21*
Color-Word	- 0.19*	-0.16
FAS	- 0.07	-0.04
F	- 0.04	0.02
A	- 0.08	-0.06
S	- 0.07	-0.06

[a]major depressive episode
* $p < .05$. ** $p < .01$.

Table F7

Correlations between Working Memory and History of Mood Symptoms in Dysphoric Group (N=30)

Variable	# Lifetime MDE[a]	Severity of a past MDE
Working Memory		
Auditory	0.23	0.01
Visual	0.10	- 0.04

[a]major depressive episode
* $p < .05$; ** $p < .01$

Table F8

Correlations between Executive Functioning and History of Mood Symptoms in Dysphoric Group (N=30)

Variable	# of Lifetime MDE[a]	Severity of past MDE
WCST		
Total correct	- 0.19	- 0.17
Perseverative errors	- 0.01	0.07
Non-perseverative errors	0.26	0.20
Conceptual level responses	- 0.16	- 0.16
Categories completed	- 0.25	- 0.13
Trials to complete 1st category	0.30	0.21
Failure to maintain set	0.13	- 0.05
Learning to learn	- 0.24	- 0.28
Stroop		
Word Reading	0.02	- 0.01
Color Naming	0.03	0.04
Color-Word	- 0.04	- 0.25
FAS	0.24	0.03
F	0.18	0.01
A	- 0.02	- 0.12
S	0.42*	0.17

[a]major depressive episode
* $p < .05$. ** $p < .01$.

Table F9

Correlations between Working Memory and Anxiety and Attention

Variable	BAI	Brown ADD Scales
Working Memory		
Auditory	-0.08	-0.03
Visual	-0.02	0.15

* $p < .05$. ** $p < .01$.

Table F10

Correlations between Executive Functioning and Anxiety and Attention

Variable	BAI	Brown ADD Scales
WCST		
Total correct	-0.13	-0.09
Perseverative errors	0.12	0.10
Non-perseverative errors	0.12	0.08
Conceptual level responses	-0.14	-0.10
Categories completed	-0.12	-0.06
Trials to complete 1st category	0.12	0.08
Failure to maintain set	-0.03	-0.11
Learning to learn	-0.12	-0.12
Stroop		
Word Reading	-0.08	-0.03
Color Naming	-0.06	-0.05
Color-Word	-0.09	-0.08
FAS	-0.08	-0.14
F	-0.04	-0.14
A	-0.09	-0.12
S	-0.10	-0.10

* $p < .05$. ** $p < .01$.

Table F11

Working Memory in Participants with and without a History of Depression

	No history of MDE		At least 1 MDE		F	P
Variable	M	SD	M	SD		
Working Memory					2.39	0.10
Auditory	10.83	2.63	9.76	1.92	4.25	0.04
Visual	11.22	1.98	11.21	1.65	0.00	0.97

Note. Data are presented as scaled scores to adjust for age.

Table F12

Executive Functioning in Participants with and without a History of Depression

	No history of MDE		At least 1 MDE		F	P
Variable	M	SD	M	SD		
WCST					1.00	0.42
Total correct	52.80	5.74	51.66	9.18		
Perseverative errors	5.56	2.53	6.04	2.88	0.79	0.38
Non-perseverative errors	5.63	3.82	6.31	6.84	0.54	0.47
Conceptual level responses	50.64	7.65	49.62	11.96	0.33	0.57
Categories completed	4.35	0.94	4.07	1.25	1.81	0.18
Trials to complete 1st category	14.32	6.89	15.72	10.54	0.79	0.37
Failure to maintain set	0.68	5.34	0.35	0.61		
Learning to learn	1.15	4.85	-0.74	3.68		
Stroop					0.99	0.40
Word Reading	109.32	13.48	105.24	16.20	2.00	0.16
Color Naming	80.45	10.96	77.14	9.75	2.24	0.14
Color-Word	49.56	8.27	47.10	9.54	1.96	0.16
FAS					0.24	0.87
F	14.00	3.73	14.04	4.00	0.00	0.97
A	11.60	3.69	11.17	3.24	0.34	0.56
S	15.47	3.84	15.65	4.43	0.06	0.82

Note. Data are presented as raw scores

Table F13

Working Memory in Participants who Learned English as their First Language versus Second Language

	First Language		Second Language		F	P
Variable	M	SD	M	SD		
Working Memory					0.39	0.68
Auditory	10.68	2.59	10.44	2.40	0.43	0.62
Visual	11.18	1.89	11.36	2.03	0.26	0.61

Note. Data are presented as scaled scores to adjust for age.

Table F14

Executive Functioning in Participants who Learned English as their First Language versus Second Language

	First Language		Second Language		F	P
Variable	M	SD	M	SD		
WCST					0.12	0.99
Total correct	52.48	6.43	52.97	6.79		
Perseverative errors	5.70	2.81	5.47	1.75	0.21	0.65
Non-perseverative errors	5.82	4.22	5.55	5.43	0.09	0.76
Conceptual level responses	50.28	8.51	51.00	8.91	0.19	0.66
Categories completed	4.28	1.00	4.36	1.02	0.20	0.65
Trials to complete 1st category	14.55	7.06	14.67	9.58	0.01	0.94
Failure to maintain set	0.72	5.48	0.28	0.57		
Learning to learn	0.82	4.93	0.79	3.96		
Stroop					0.88	0.45
Word Reading	109.33	13.43	106.00	15.93	1.56	0.21
Color Naming	80.58	10.19	77.33	12.41	2.54	0.11
Color-Word	49.48	8.59	47.86	8.37	0.99	0.32
FAS					1.28	0.28
F	13.84	3.72	14.56	3.89	1.00	0.32
A	11.66	3.47	11.08	4.06	0.70	0.40
S	15.57	3.95	15.28	3.98	0.15	0.70

Note. Data are presented as raw scores

Table F15

Participants' Ages in Matched Groups

Variable	Groups					
	Non-Dysphoric		Dysphoric		Total	
	M	SD	M	SD	M	SD
Age	20.41	1.47	20.34	1.37	21.09	1.74

* $p < .05$; **$p < .01$

Table F16

Marital Status and Education Level of Participants in Matched Groups

Variable	Groups		
	Non-Dysphoric N (%)	Dysphoric N (%)	Total N (%)
Marital Status			
Married or Living with someone	2 (8.0)	3 (12.0)	5 (10.0)
Single	23 (92.0)	22 (88.0)	45 (90.0)
Education Level Completed			
Graduated highschool	2 (8.0)	2 (8.0)	4 (8.0)
Part university	23 (92.0)	23 (92.0)	46 (92.0)
Completed university degree	0 (0.0)	0 (0.0)	0 (0.0)
Part graduate school	0 (0.0)	0 (0.0)	0 (0.0)

* $p < .05$. ** $p < .01$.

Table F17

Ethnicity and Language of Participants in Matched Groups

Variable	Groups		
	Non-Dysphoric N (%)	Dysphoric N (%)	Total N (%)
Ethnicity			
Caucasian	16 (64.0)	16 (64.0)	32 (64.0)
Asian	8 (32.0)	8 (32.0)	16 (32.0)
South Asian	1 (4.0)	1 (4.0)	2 (4.0)
Black	0 (0.0)	0 (0.0)	0 (0.0)
Hispanic	0 (0.0)	0 (0.0)	0 (0.0)
Other	0 (0.0)	0 (0.0)	0 (0.0)
English			
First language	18 (72.0)	19 (76.0)	37 (74.0)
Second language	7 (28.0)	6 (24.0)	13 (26.0)

* $p < .05$. ** $p < .01$.

Table F18

Mean Scores on BDI-II, BAI and Brown ADD Scales in Matched Groups

	Groups			
	Non-dysphoric		Dysphoric	
Variable	M	SD	M	SD
BDI-II	4.60	3.15	18.04	6.37**
BAI	4.52	4.23	14.28	7.45**
Brown ADD	31.12	18.61	45.08	16.68**
Subscale 1[a]	8.44	5.06	11.40	4.03*
Subscale 2[b]	11.04	5.81	12.84	5.10
Subscale 3[c]	5.40	4.43	7.76	4.76
Subscale 4[d]	3.28	3.12	7.96	4.23**
Subscale 5[e]	2.92	2.99	5.16	3.42*

Note. Higher scores indicate greater severity
[a] organizing and activating for work. [b] sustaining attention and concentration. [c] sustaining energy and effort. [d] managing affective interference. [e] utilizing working memory
* $p < .05$. ** $p < .01$.

Table F19

Auditory and Visual Working Memory in Matched Groups

	Non-dysphoric		Dysphoric		F	P	ES[a]
Variable	M	SD	M	SD			
Working Memory					2.66	0.08	
Auditory	11.60	2.90	10.04	1.95	4.98	0.03	0.09
Visual	11.84	1.86	11.68	1.86	0.09	0.76	0.00

Note. Data are presented as scaled scores to adjust for age.
[a] = Effect size

Table F20

Executive Functioning Measures in Matched Groups

Variable	Non-Dysphoric M	Non-Dysphoric SD	Dysphoric M	Dysphoric SD	F	P	ES
Executive Functioning					0.55	0.65	
WCST							
Total # Correct Responses	53.04	5.65	51.92	6.92	0.39	0.53	0.00
Stroop							
Color-Word Score	49.24	6.20	49.28	8.57	0.00	0.99	0.00
FAS							
Total # Words	40.68	8.66	37.40	10.33	1.48	0.23	0.03

Table F21

WCST, Stroop and FAS in Matched Groups

Variable	Non-dysphoric		Dysphoric		F	P	ES
	M	SD	M	SD			
WCST					1.14	0.36	
Total correct	53.04	5.65	51.92	6.92			
Perseverative errors	5.44	2.60	6.28	2.99	1.12	0.30	0.02
Non-perseverative errors	5.48	3.58	5.80	4.28	0.08	0.78	0.00
Conceptual level responses	51.48	7.01	49.32	9.19	0.87	0.36	0.02
Categories completed	4.20	0.91	4.24	1.05	0.02	0.89	0.00
Trials to complete 1st category	13.64	5.14	14.52	5.80	0.32	0.57	0.01
Failure to maintain set	0.40	0.65	0.20	0.50			
Learning to learn	1.38	3.57	-0.50	5.62			
Stroop					0.28	0.84	
Word Reading	107.52	12.20	107.44	15.50	0.00	0.98	0.00
Color Naming	81.36	8.26	79.64	9.47	0.47	0.50	0.01
Color-word	49.24	6.20	49.28	8.57	0.00	0.99	0.00
FAS	40.68	8.66	37.40	10.33	3.33	0.03	
F	14.20	3.44	11.72	4.12	5.36	0.03	0.10
A	11.12	3.18	11.32	3.29	1.37	0.25	0.00
S	15.76	4.03	14.36	4.42	0.05	0.83	0.03

Note. Data are presented as raw scores