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Chapter I

Review of the Literature

The 12-month prevalence rate of Major Depressive Disorder (MDD) in the United States population is 6.7 percent, and the rate of any mood disorder is 9.5 percent (Kessler, Chui, Demler & Walters, 2005). The lifetime prevalence rate of MDD is 15.8 percent (Kessler et al.). MDD ranks second among medical illnesses for the number of years lost due to premature death or disability, behind ischemic heart disease (Dunn, Trivedi, Kampert, Clark & Chambliss, 2005). Of persons who experience MDD, it is estimated that only 23 percent seek treatment, and only 10 percent receive treatment from a mental health professional, with more people seeking help from their primary-care physician (Dunn et al.). People with MDD may not seek treatment due to the stigma associated with treatment, lack of insurance, or because their insurance does not cover mental health treatment (Dunn et al.). Even if the individual’s employer covers mental health services, he/she may fear losing his or her job if the employer knows that he/she is in treatment. Finally, people may not seek treatment from a mental health professional simply because they are unaware that they are experiencing symptoms of MDD.

According to the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV), a diagnosis of Major Depressive Episode (MDE) requires either depressed mood most of the day, nearly every day or loss of interest in nearly all pleasurable activities. In addition, four or more of the following symptoms are necessary: 1) significant weight loss or weight gain or significant decrease or increase in appetite, 2)
insomnia or hyper-somnia nearly every day, 3) psychomotor agitation or retardation, 4) fatigue or loss of energy, 5) feelings of worthlessness or inappropriate guilt, 6) diminished ability to think or concentrate, and 6) recurrent thoughts of death or recurrent suicidal ideation. The symptoms must be present almost every day, during the same 2-week period, represent a change from previous functioning, and cause significant impairment in social, occupational or other areas of functioning (American Psychiatric Association [APA], 2000).

People may experience less severe acute depression, sometimes referred to as subclinical or minor depression. The symptoms and diagnostic criteria of subclinical depression mirror those of major depression, but definitions of this disorder vary in terms of duration and number of symptoms required, as well as the cutoff scores on depression scales (Allart-Van Dam, Hosman, Hoogduin & Schap, 2003). Because of the differences in definitions, lifetime prevalence estimates of subclinical depression vary from 10 percent to 23 percent (Allart-Van Dam et al.). Persons with subclinical depression are at 4.4 times greater risk of developing MDD within a year when compared to people who are not experiencing depression. In addition, for people experiencing subclinical depression, the use of disability services and benefits and medication and medical-emotional consultations is proportionally equal to that of clinical depression (Allart-Van Dam et al.).

At the present time, sub-clinical depression is not included in the DSM-IV as a diagnosable mood disorder. However, research diagnostic criteria for minor depressive disorder are provided (APA, 2000). The diagnostic criteria are similar to those required for a MDE. The person must experience either depressed mood most of the day, nearly
every day or loss of interest in nearly all pleasurable activities. However, at least two additional criteria, but less than five, must be present during the same two week period. In addition, the final criterion to receive a diagnosis of Minor Depressive Disorder requires no previous Major Depressive, Manic, Mixed, or Hypomanic Episode (APA, 2000). Some investigators may not agree with the final criterion because they do not want to exclude patients with a history of MDD. Hence, subclinical depressive symptoms in patients with a history of MDD would be difficult to classify (Feldman, Robbins & Jaffe, 1998).

Prevalence rates of depression in college students may be higher than the general population which may be due to a variety of reasons (Furr, Westefeld, McConnell & Jenkins, 2001; Kisch, Leino & Silverman, 2005). Many of today’s college students experience competing demands on their time, including academic, work, and other role conflicts, which may lead to increased stress and an increased risk of depression. Many students are not prepared for the increased demands of college life and do not work to prevent depressive symptoms or they simply do not have the tools to do so. Therefore, they may be less likely to seek help until they are in crisis. In a national survey of college students, Kisch et al. reported that 22 percent of participants reported feeling so depressed that it was difficult to function three or more times during the past school year. In addition, Furr et al. reported that 53 percent of students in their study had experienced what the students would label as depression since entering college. Also, only 17 percent of those who reported feeling depressed actually sought counseling (Furr et al.). Thus, because a small percentage of students seek psychological services for their distress, it is important for the students to find other ways to cope with their depression. Instead of
seeking psychological services, some students who are experiencing depression may use social support, exercise, or other methods to cope with their depression. Within a year, 85 percent of cases of major depression have remitted; therefore, many students' depressive symptoms, especially subclinical symptoms, may improve before they feel the need to seek formal treatment (Maxmen & Ward, 1995). When depressive symptoms return, students may use coping methods that have helped alleviate symptoms in the past, or they may decide to seek treatment at that time, especially if symptoms worsen.

There are several reasons for the higher rate of depression among college students including social problems, hopelessness, academic problems, and an interaction of multiple factors (Furr et al., 2001). Of the college students who reported feeling depressed since entering college, the most frequently cited contributing factors were grade problems (53%), loneliness (51%), money problems (50%), relationship problems with boyfriend/girlfriend (48%), hopelessness (26%), parental problems (25%), and helplessness (17%) (Furr et al., 2001).

Alcohol use is another contributing factor in the increase of depressive symptoms in college students (Hussong, Hicks, Ley & Curran, 2001). The relationship between alcohol use and mood has been studied, but the relationship between the two still remains unclear. It is uncertain whether people drink alcohol because they feel depressed, or if drinking alcohol causes people to feel depressed. The relationship can be cyclical—people who feel depressed may drink alcohol, which leads to further depression and subsequently more alcohol consumption. Hussong et al. found that college students, aged 18-20 years, with fewer friendships tended to drink more alcohol than those with more supportive friendships which led to an increase in sadness and hostility. In addition,
these participants tended to have an increase in negative mood following an increase in drinking, leading to a cyclical relationship between negative mood and alcohol consumption. Voelker (2004) also reported that the combination of stress, sleep loss, and substance abuse increases the risk of depression for college students. This is especially relevant for first year students who often experience increased stress in a new environment, including greater academic pressures. The frequent result is a loss of sleep and increased alcohol consumption.

With increasing rates of depression and other mental health issues on college campuses, many schools are broadening from a primary focus on student academic development, to include the development of the whole student, intellectually, psychologically, physically, and even morally and spiritually. A significant decline in a student’s psychological well-being not only negatively affects the student, but negatively affects those around him or her, and the university as well. Therefore, the students as well as the universities would benefit from programs that promote prevention and early identification of depression and other mental health issues by providing social support and strategies to encourage and maintain self-care (Field, Elliot & Korn, 2006). One such program is Action for Depression Awareness, Prevention, and Treatment (ADAPT) developed by counseling center professionals on one urban campus. This program incorporates a community psychology perspective with the idea that “…student depression can best be understood as resulting from the stressful educational environment,” and that “…the university is viewed as a system that can provide positive resources while serving to alleviate some problems that result from depression” (Field et al., 2006, p.105).
After a needs assessment planning phase, the ADAPT program disseminated information about depression, suicidality, prevention and treatment, and helpful ways to talk with someone suffering from depression through the counseling center website and in a brochure distributed to parents, students, faculty, and staff. The program also provided psycho-educational seminars to faculty and staff. To reach more students, the ADAPT program recruited the Student Performing Arts program to develop a play based on one student’s experience of depression and the reactions of others. This play was followed by discussion groups facilitated by counseling center staff to increase the understanding of the relationship between stress and depression, decrease stigma and motivate students to use prevention strategies. In addition, participants were taught relaxation strategies such as diaphragmatic breathing, visualization, and/or progressive muscle relaxation and they received additional information and resources about depression to take home. A videotape of the play was produced so that it could be utilized as a psycho-educational tool in the classroom and future workshops. Program evaluation results proved the success of the ADAPT program and showed that it had a positive impact on the university community’s knowledge and response to depressed students (Field et al., 2006). Colleges and universities could benefit from developing, expanding, and improving programs like ADAPT and utilizing them on campus to aid in the prevention and early detection of depression, dissemination of information, and to decrease stigma associated with depression and mental health treatment.

*Traditional Interventions for Depression*

There are many treatment options for individuals with depression, including biomedical and psychosocial therapies. Often, a combination of treatments is the best
method (Maxmen & Ward, 1995). If untreated, major depression usually lasts three to
nine months; within a year, 85% of cases have remitted (Maxmen & Ward, 1995).

Biological treatments of depression include medications (i.e., tricyclic
antidepressants (TCAs), atypical antidepressants, selective serotonin re-uptake inhibitors
(SSRIs), and monoamine-oxidase inhibitors (MAOIs)) and electroconvulsive therapy
(ECT). ECT is typically used for patients with severe depression who do not respond to
other forms of treatment. Electricity in psychiatric treatment has been used since the
1850s. ECT originally was used with schizophrenic patients, but today is more
commonly used with depressed patients. In the past, ECT treatments were more
dangerous, but current uses of ECT are much safer, and have proved to be efficacious
with some patients that do not respond to other treatments (Overholser, 2002).

Psychotherapy may be used alone to treat MDD, or in addition to medication.
Cognitive-behavioral therapy originated in the 1960s and focuses on changing thought
patterns and activity levels. From a cognitive-behavioral perspective, distorted
cognitions are of particular clinical interest in major depression. “Depressed patients
view the world through gray-tinted glasses. To them, everything is bleak – their life,
their world, their future, and their treatment” (Maxmen & Ward, 1995, p. 208).
Depressed individuals tend to dwell on the negative aspects of life, and thus experience
helplessness and hopelessness leading to a very low self-esteem and low self-worth and
suicidal preoccupations (Maxmen & Ward). Therefore, homework assignments are
important in discovering irrational beliefs and eliminating automatic thinking and activity
scheduling is used to find activities that elevate mood. Fava, Ruini, and Belaise (2007)
found that patients who received cognitive-behavioral therapy had fewer relapses (40%) than those who received drug therapy alone (90%) at a 6-year follow-up.

Another treatment for depression is short-term psychodynamic psychotherapy (STPP). STPP is generally time limited (16-30 sessions) and begins with the development of a strong therapeutic alliance and positive transference between the therapist and client. Then, STPP focuses on conflicts or themes identified early in therapy, the client’s experiences in the “here and now,” and present symptoms. Seven frequently cited features of STPP are a focus on affect, resistance, identification of consistent patterns, past experiences, interpersonal experiences, the therapeutic relationship, and wishes, dreams or fantasies (Leichsenring, Rabung & Leibing, 2004). In a meta-analysis of STPP treatment, STPP was significantly better than no treatment in reducing symptoms, addressing problems and improving social functioning. STPP did not differ significantly from other forms of psychotherapy, such as cognitive-behavioral and interpersonal therapies (Leichsenring, Rabung & Leibing, 2004).

Group therapy is another psychotherapeutic treatment for depression. McDermet, Miller, and Brown (2001), in a meta-analysis of group therapy for depression, showed that after treatment, the average treated participant scored one standard deviation lower on measures of depressive symptoms than the average untreated participant. An advantage of group therapy is the educational nature which utilizes psychoeducational methods including lectures, workshops, or bibliotherapy. Also, in a group, people are more aware of maladaptive cognitions and behaviors. Members share experiences and give honest appraisals and feedback to help correct inaccurate thoughts and promote appropriate behavior. Challenges to irrational or maladaptive thinking and behavior may
be more effective and accurate coming from several peers rather than just the therapist. In addition, the social environment facilitates generalization of learning to real-life situations (Rice, 2004).

*Alternative Treatments for Depression*

As mentioned earlier, there are many reasons why people with depression do not seek mental health treatment, such as the significant stigma associated with seeking services, lack of insurance, or having insurance that does not cover mental health services. Therefore, it is important to note self-help strategies that a person may engage in to alleviate some depressive symptoms. Although these strategies may be helpful, they are most beneficial in combination with more traditional forms of treatment, such as medication or psychotherapy, and may only be helpful to those with mild depression (Babyak et al., 2000). Some of these strategies are exercise, eating a balanced diet, getting enough sleep, stress-management techniques, finding hobbies and social groups, meditation and yoga, eating omega-3s (fish) and tryptophan (turkey, salmon and milk) in the diet, spending time outdoors, light therapy, and avoiding alcohol, caffeine and tobacco (Cukrowicz et al., 2006; Even, Schroder, Friedman & Rouillon 2008; Giacobbi, Hausenblas & Frye, 2005; Hussong et al., 2001; Young, 1993).

A more recent psychotherapeutic intervention tool is the internet. Internet-based therapy has been used as an intervention for mental and physical health issues including PTSD, anxiety, smoking cessation, drinking, body image, depression, and weight loss (Barak, Hen, Boniel-Nissim, & Shapira, 2008). Internet-based therapy comes in many forms, such as e-mail contact, interactive websites, web-cam contact, and online chat. A recent meta-analysis of 92 internet-based interventions, found an overall effect size of
0.53 (Barak et al.). In 14 of those studies, internet-based therapy was compared to traditional face-to-face treatment for the same problem; there was no statistically significant difference between the average weighted effect sizes. Depression was the central issue in 16 of the internet-based intervention studies. These studies yielded an effect size of 0.32. Internet-based therapy was most effective for participants in the young (e.g., 19-24 years) and adult (e.g., 25-39 years) age ranges. There was not a statistically significant difference between web-based therapy (e.g., self-help, website-based therapy) and e-therapy (e.g., human communication). Chat and e-mail therapy were more effective than forum and webcam therapy. This meta-analysis shows promise for internet-based psychotherapeutic interventions (Barak et al.).

The Relationship between Exercise and Mood in the General Population

Much research has studied the relationship between exercise and mood. Studies have found that increased exercise is associated with fewer depressive symptoms (Dunn et al., 2005; Harris, Cronkite & Moos, 2006). In a meta-analysis, North, McCullagh, and Tran (1990) identified 80 studies that measured the effect of exercise on depression. This meta-analysis included studies with participants who were initially clinically depressed as well as participants who were initially not clinically depressed. For clinically depressed participants, the depression could be the primary disorder, or secondary to another disorder. In addition, this meta-analysis considered cardio-respiratory or aerobic endurance and muscular strength or endurance forms of exercise but did not consider flexibility a form of exercise. There were five sources of participants identified including: medical/psychological patients, high school students, health club members, community citizens, and college students/faculty. North et al. reported that greater
amounts of physical activity lead to better mood. Depression scores decreased significantly more in exercise groups compared to control groups and the positive effect of exercise may last after the end of the program. In addition, the effect size was not related to the initial level of participants’ depression; participants who were initially clinically depressed and those who were not clinically depressed experienced a decrease in depression scores with exercise.

Teychenne, Ball, and Salmon (2008) reviewed 27 observational studies and 40 intervention studies that examined the association between the amount of physical activity and level of depression. Only studies that included adult participants were included in this review. Studies that included psychologically healthy adults, as well as adults experiencing depressive symptoms or clinical depression were included. Five observational studies presented adequate information on different weekly doses of physical activity. All five reported that both high and low doses of physical activity, from one to seven hours per week, were associated with decreased depression. Five intervention studies reported that both high and low doses of physical activity per week were associated with decreased depression as well. Thirteen intervention studies prescribed greater than 150 mins of physical activity a week, which is in line with the recommended public health dose; seven studies found a negative relationship between exercise and depressive symptoms. Twelve intervention studies prescribed 90-150 mins of physical activity per week; 10 studies found a negative relationship between exercise and depressive symptoms. Nine intervention studies prescribed less than 90 mins of physical activity per week; eight studies found a negative relationship between exercise and depressive symptoms.
In another meta-analysis, Craft and Landers (1998) examined 37 studies on the relationship between exercise and clinical depression. This meta-analysis included studies with participants with clinical depression as the primary disorder or participants with depression as a symptom of another mental disorder. The age range of participants was from 12 years to greater than 60 years of age, with the majority of participants in the 29 to 40 year age range. The results showed that increased exercise was related to a reduction in depressive symptoms. Participants who experienced an initial moderate to severe level of depression experienced the greatest benefit from exercise, followed by participants who experienced an initial mild to moderate depression. In addition, participants who were involved in an exercise program for 9 to 12 weeks showed significantly greater reductions in depression than those involved in an exercise program for eight weeks or less. On the other hand, there were no significant differences in the type of intervention; all intervention groups, including running, walking, anaerobic and aerobic groups, showed significant improvements in depression scores, and none were significantly different from each other. In addition, there were no significant differences between exercise intervention, and group or individual psychotherapy and behavioral interventions, in reducing symptoms of depression. There was a significant difference between exercise intervention and wait-list control. This meta-analysis suggests that many forms of exercise may be beneficial in reducing depressive symptoms, and that these benefits may rival that of individual and group psychotherapy, as well as other behavioral interventions.

Because of the positive relationship between exercise and mood, many researchers are looking to exercise as a possible tool for preventing and treating
depression. In a review of intervention studies that examined the relationship between exercise and depression, Martinsen (2005) reported that aerobic exercise was as effective as psychotherapy in reducing symptoms of depression. Physically active individuals have a reduced tendency to develop depression. Moreover, participants who exercised at moderate levels of intensity experienced larger reductions in depression than those who exercised at a low intensity level. In addition, 16 weeks of three 30-minute sessions of aerobic exercise per week produces psychological benefits for patients suffering from moderate and major depressive disorders and this benefit rivals that of antidepressant medication (Blumenthal et al., 1999).

In a review that examined physical activity and depression, Teychenne et al. (2008) included 13 randomized controlled trials; four showed a small effect size, three showed a medium effect size and five showed a large effect size. In a literature review of nine studies, Martinsen (1987) found that aerobic exercise was more effective than placebo and no treatment in reducing depressive symptoms. Also, aerobic exercise was as effective as other treatment methods such as group psychotherapy, some forms of individual psychotherapy, as well as meditation and relaxation.

Dunn et al. (2005) found that an exercise schedule consistent with public health recommendations (i.e., adults should engage in 30 minutes of moderate-intensity exercise, most days of the week; Pate et al., 1995), was an effective treatment for 42 percent of participants with mild to moderate Major Depressive Disorder. This was similar to a remission rate of 36 percent for cognitive behavioral therapy and 42 percent for antidepressant medication found by the National Institute of Mental Health (NIMH) in the Collaborative Depression Study (Pate et al.). Surprisingly, the results did not
Depend on whether participants exercised three or five times a week; just getting people
to exercise three times a week might alleviate some symptoms of depression, as long as
they engage in at least 30 minutes of moderate-intensity physical activity (Dunn et al.).

In a 10-year longitudinal study, Harris et al. (2006) found that depressed
participants with higher levels of physical activity tended to have less concurrent
depression than participants with lower levels, even after controlling for age, gender,
medical problems and negative life events. In another study, Babyak et al. (2000)
evaluated the benefits of exercise at a six-month follow-up. Participants who met criteria
for MDD were randomly assigned to an exercise, medication, or combined group. After
four months, participants in all three groups showed significant improvement in
symptoms of depression as measured by the BDI and the Hamilton Rating Scale for
Depression (HRSD). After ten months, participants in the exercise condition had
significantly lower relapse rates than the medication condition. These two studies
suggest that exercise can have some long lasting effects on the prevention of depressive
episodes, as long as the exercise is maintained. In addition, exercise can be more
beneficial in the long run than medication because once the medication is removed, the
person is at risk for relapse. Hence, exercise may be a better option for some people.

In another study, Annesi (2004) found that an exercise group showed significantly
more improvement in scores on the Profile of Mood States (POMS) Tension, Depression,
Vigor, and Fatigue scales (McNair, Lorr & Droppleman, 1971, 1981, 1992) than a no-
exercise control group. Ahmadi, Samavat, Sayyad and Ghanizadeh (2002) found that an
exercise condition involving body building was associated with lower mean scores on the
Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961) in a group of female athlete participants ages 17 to 55.

Prior research has indicated a relationship between personality and mood: speculatively, extraversion tends to be related to positive mood and neuroticism to negative mood (Costa & McCrae, 1980). Milton, Lane and Terry (2005) investigated whether personality influenced the mood enhancement quality of exercise in females. The authors hypothesized that participants who engaged in exercise would experience significant elevations in mood across all personality types. In addition, they conjectured that individuals who scored high in extroversion would experience positive mood before and after exercise and individuals who scored high on neuroticism would experience negative mood before and after exercise, which is consistent with previous research (Hepburn & Eysenck, 1989). Lastly, they hypothesized that the measures of personality would interact with exercise-induced mood changes. Results showed that there was a main effect for mood change over time and that female exercisers experienced significant mood enhancement immediately following 60 minutes of exercise regardless of personality type (stable introvert, stable extrovert, neurotic introvert and neurotic extrovert). In addition, as hypothesized, results showed that participants high in neuroticism reported more negative mood (higher Anger, Confusion, Depression and Fatigue and lower Vigor) before and after exercise compared to participants that were low in neuroticism. Extroverts only reported lower Confusion scores on the mood scale than introverts. According to this study, women with a variety of personality types experience positive mood immediately after 60 minutes of exercise. However, the researchers did not examine how long these benefits lasted.
Exercise Interventions

The Centers for Disease Control and Prevention (CDC) recommends people engage in aerobic activity at a moderate level (i.e., brisk walking, biking on level ground, softball, volleyball) for 2 hours and 30 minutes per week or vigorous aerobic activities (i.e., jogging, soccer, basketball, swimming laps, biking faster than 10 mph) for 1 hour and 15 minutes per week. In addition, the CDC recommends people engage in strength training two days per week (CDC, 2008).

There is a robust literature assessing the use of cognitive interventions to increase exercise. One such intervention is Move to Improve- a social-ecologic intervention to increase physical activity designed for use in the workplace (Dishman, Dejoy, Wilson, & Vandenberg, 2009). Dishman et al. (2009) included 1442 participants who were employees of The Home Depot, Inc. from diverse regions of the U.S. Each site was randomly assigned to the 12-week intervention condition or the health education control condition. In the intervention condition, participants began by setting personal goals that were targeted toward meeting or exceeding the public health recommendations for physical activity (e.g., equal to or greater than 150 minutes per week of moderate-to-vigorous physical activity (MVPA) or equal to or greater than 10,000 pedometer steps each day). Each participant received a handbook that detailed the program components, benefits, incentives, and participant responsibilities. It also contained instructions for using the pedometer, daily logs and bi-weekly tools to guide the participant through the intervention (i.e., goal-setting, overcoming obstacles, sedentary temptations, avoiding relapse, staying motivated and keep on moving).
Managers were encouraged to support employee participation. Employee-management steering committees met regularly to help implement the intervention and set group and organizational goals and incentives. Environmental prompts, or signs encouraging physical activity and its benefits, were also placed throughout the workplace. These prompts were placed in high traffic areas and reminded employees to take the stairs, take a walk break, etc.; they were changed bi-weekly. Participants in the control condition completed a CDC health-risk appraisal and received monthly newsletters describing the health benefits of physical activity. Results showed there were large statistically significant increases in MVPA among intervention participants during the first two weeks and, on average, they exceeded 300 minutes of MVPA per week after week 6. Pedometer steps also increased to over 9000 steps per day after week 5. In addition, the intervention group had significantly greater increases in MVPA as well as in walking compared to the control group. During the last six weeks of the intervention, there was an increase from 31 percent to 51 percent of intervention participants who were regularly physically active. The results of the Move to Improve intervention provide support for the usefulness of goal-setting to reach physical activity goals that are consistent with public health recommendations (Dishman et al., 2009). This study showed that cognitive interventions can be helpful in increasing physical activity.

Active for Life, a similar intervention, is the American Cancer Society’s 10-week, worksite-based program to increase physical activity and fruit and vegetable intake. This program uses strategies such as incentives, a team approach, and targeting social norms related to physical activity. Active for Life was implemented and assessed in 10 facilities of Group Health Cooperatives, a nonprofit healthcare system in the Pacific Northwest.
and 1167 employees participated (Green, Cheadle, Pellegrini, & Harris, 2007). Each participant set weekly goals for minutes of physical activity and earned points for each minute. If they achieved their weekly goal, they were encouraged to set a higher goal for the next week. All participants received a pedometer and those who completed the program received athletic socks and bicycle lights. A team prize of a lunch and rope-jumping entertainment was awarded for the group with the highest points, individual prizes were awarded for success stories, and those who completed evaluations were entered into a drawing to win gift cards or a spa day. At a 10-week follow-up, there were large statistically significant increases in physical activity, and 67% of participants reported they were “feeling better overall” and 53% had increased energy. Participants also indicated they were motivated most by setting a personal goal, signing up and making a commitment, and having a pedometer to track steps (Green et al.).

The internet is increasingly being used as a tool to boost physical activity. In a systematic review of the literature, van den Berg, Schoones & Vliet Vlieland (2007) identified 10 randomized controlled trials that assessed use of the internet as an intervention to increase physical activity for adults, using pre- and post-test measures. Of three studies that compared an internet-based intervention to a wait-list control, two reported a significantly greater increase in physical activity in the treatment group compared to the control group. Four studies compared two groups that both received internet-based interventions, but different amounts of contact by the researcher; one of these studies reported a significant difference in change of physical activity level. Two of the other studies did not have the primary goal of increasing physical activity rather the goal was to decrease body weight and waist circumference. Van den Berg et al. rated
only half of the 10 studies as having good methodological quality, with the most common flaws being a lack of information about randomization and lack of information about blinding of the outcome assessor. Internet-based interventions show promise for increasing physical activity levels, but more research is needed to determine the most effective content and length of such programs.

The Relationship between Exercise and Mood in College Students

Although many studies on exercise and depression in the general population include participants with clinical depression (Babyak et al., 2000; Dunn et al., 2005), most studies in the college population include participants with a range of depressive symptoms, including sub-clinical or minor depression and possibly MDD (Cai, 2000; Joiner & Tickle, 1998). For example, Babyak et al. only included participants who met DSM-IV criteria for MDD and scored at least 13 on the HRSD. This study examined exercise as a possible treatment for individuals with MDD. On the other hand, like many studies in the college population, Cai included college students from general physical activity classes whose symptoms of depression ranged from none to severe. The purpose of this study was to examine the benefits of physical exercise and participants can have mental health benefits without initially meeting full criteria for MDD.

Many studies have also examined the relationship between depression and exercise in college students. Entering college is a major transition. Several student activities and self-care behaviors are likely to change, including the frequency of exercise and dietary patterns (Bray & Born, 2004; Racette, Deusinger, Strube, Highstein & Deusinger, 2005). Bray and Born (2004) found that the frequency of vigorous physical activity in 145 first year college students significantly declined from previous levels
during this transition. They also discovered that students who were more physically active had more positive mood profiles, lower levels of tension and fatigue, and higher levels of vigor. Racette et al. (2005) reported that 30 percent of first year college students and sophomores participated in no exercise on a regular basis. Interestingly, the amount of aerobic exercise declined, whereas stretching exercise increased. In addition, body weight increased in 70 percent of students and decreased in 26 percent of the students from the beginning of freshman year to the end of sophomore year. This increase in body weight in the majority of students may be associated with the decrease in participation in physical activity as well as cafeteria buffets. Petruzzello and Motl (2006) reported that whereas 66 percent of first year college students reported adequate amounts of physical activity in high school, only 44 percent reported adequate amounts of physical activity in the first two months of college. Also, students who were more physically active reported higher levels of energy and less tension. Hence, first year students could benefit from developing and maintaining an exercise routine when beginning college. This routine might promote wellness and good self-care, reduce or prevent depressive symptoms, and help increase energy and decrease levels of tension and stress.

In a meta-analysis of college students’ physical activity behaviors, Keating, Guan, Pinero and Bridges (2005) reported that between 36 and 50 percent of college students do not engage in an adequate amount of physical activity. In addition, 85 percent of college seniors who exercised regularly were still physically active 5 or 10 years later, and 81 percent of college seniors who were physically inactive were still physically inactive 5 or 10 years later. Thus, physical activity behaviors developed in college will likely be
maintained after college and this makes the promotion of healthy behavior in college students that much more important.

Giacobbi et al. (2005) found that participants’ mood was related to the amount of exercise they engaged in on a given day. In this study, 106 college students completed the NEO-Five-Factor Inventory, the Daily Life Experiences Inventory, the Nowliss Mood Adjective Checklist, and the Leisure-Time Exercise Questionnaire for eight consecutive days. The students also rated the desirability, and undesirability of each daily event they experienced on a scale from 0-6. The researchers then used hierarchical linear modeling to analyze the data and found that a greater amount of exercise was associated with reports of more positive mood, even when fluctuations in daily negative or positive events were controlled. Therefore, exercise may help someone who is feeling depressed alleviate some of his or her symptoms, or lead to a more positive mood in non-depressed individuals. In addition, regular exercise may also help prevent feelings of depression or prevent relapse of depressive symptoms (Giacobbi et al.).

*Exercise Intervention Studies in the College Student Population*

Balkin, Tietjen-Smith, Caldwell and Shen (2007) conducted a study on exercise and depression in young adult female college students. Volunteer participants from aerobics classes and from weightlifting classes completed a BDI-II before the study began and then again after six weeks. Results showed that BDI-II scores were significantly lower for the aerobics group, but there were no statistically significant differences for the weightlifting group. This study suggests that some forms of exercise, such as weightlifting, may not be as effective in decreasing symptoms of depression. On the other hand, in a meta-analysis of 37 studies on exercise and depression, Craft and
Landers (1998) found that all forms of exercise were effective in reducing depressive symptoms, including anaerobic exercise, but this meta-analysis did not only include college students; it included studies with participants ranging from 12 to over 60 years of age.

Adams, Moore, and Dye (2007) also found a negative relationship between aerobic and anaerobic exercise and depression in college students. According to their study, participants that engaged in vigorous or moderate exercise at least three times a week were less likely to report being depressed than those who exercised less than three times a week. They also found that those who participated in strength training two or more times per week, including push-ups, sit-ups, or weight-lifting, were less likely to report depression than those who reported no strength training. In addition, the authors found that participants who engaged in strength training were less likely to have reported experiencing anxiety in the previous 12 months than those who did not engage in strength training, whereas vigorous or moderate exercise was not associated with anxiety. The authors hypothesized that strength training appeared to have a more consistent association with mental health than vigorous or moderate exercise because the relaxation of muscle tissue may assist in improved mood and thus positive mental health. Further research is needed to determine if anaerobic exercise has the same benefits as aerobic exercise, and the possible explanations for the proposed benefits.

Another method of exercise studied is self-defense classes (Cai, 2000). In this study, participants were assigned to one of three groups: 1) guided imagery integration with self-defense, 2) tai chi chuan integration with self-defense, and 3) self-defense only control group. Participants engaged in 50 min sessions, three times per week, and
completed the POMS’ anxiety and depression scales during the first and eighth weeks. Cai (2000) found that participants in groups one and two had significantly lower depression and anxiety scores than the control group after eight weeks. These general physical activity classes were offered as course credit by the university, which may be an effective way toget students involved in exercise.

McCann and Holmes (1984) examined exercise as a possible intervention for depressive symptoms. Women in a general psychology course were administered the BDI. Participants who scored above an 11 were chosen to be in the study and were randomly assigned to an aerobic exercise condition, placebo (15-20 minutes of progressive muscle relaxation 4 days a week), or no treatment condition. After 5 and 10 weeks, participants completed another BDI. Results showed that participants in the aerobic exercise condition had significantly greater reductions in BDI scores than participants in the placebo or no treatment condition. However, this study did not examine any possible mediator variables such as participation in mental health treatment.

Most research on exercise interventions for depression is conducted over several weeks. On the other hand, Berger and Owen (1998) conducted research on acute mood changes after a single episode of exercise. Participants completed the POMS immediately before and after jogging at three intensities and were instructed to respond according to how they felt “right now.” Results showed that joggers from all three intensity levels reported significant mood changes on tension, depression, anger, vigor, fatigue and confusion. Participants reported “feeling better” after high intensity as well as moderate and low intensity jogging. Therefore, students may benefit from even a single jogging session, regardless of intensity. This finding is in contrast to Martinsen
(2005) who reported that moderate intensity exercise led to greater reductions in depressive symptoms than low intensity exercise. Further research is needed to determine the intensity level that produces the most benefit, and even if intensity level matters.

There are many reasons why first year college students may not engage in a sufficient amount of exercise. For example, students may believe they do not have enough time to exercise, exercise requires too much physical effort, it is embarrassing to exercise in front of others, or that exercise would interfere with family responsibilities (Grubbs & Carter, 2002). Grubbs and Carter (2002) identified these as perceived barriers to regular physical exercise. Additional barriers identified by students include their school workload is too high, studying for exams, amotivation, anergia, job demands, having friends who are not physically active, and having other priorities (Ebben & Brudzynski, 2008; Gyurcsik, Bray & Brittain, 2004). Perceived benefits of exercise include increased physical fitness, improved physical appearance, increased stamina and muscle tone, and improved strength (Grubbs & Carter, 2002). Students have also identified other benefits including improved general health, stress reduction, enjoyment/pleasure, increased self esteem, preventative health, vigor, and it makes them feel better (Ebben & Brudzynski, 2008). When students recognized significantly more “perceived benefits” than “perceived barriers,” they were more likely to engage in regular exercise (Grubbs & Carter, 2002). Therefore, a key factor to increasing exercise among college students may be helping them recognize the benefits and reducing the perceived barriers of exercise. Research with the college student population has examined the use of the internet and email as interventions to increase physical activity by incorporating
perceived benefits and barriers, as well as other cognitive interventions (Parrott, Tennant, Olejnik, & Poudevigne, 2008; Suminski & Petosa, 2006).

There are a number of health behavior predictors for college students. Self-efficacy may be the most cited correlate of exercise behavior (Levy & Cardinal, 2006). For example, Von Ah, Ebert, Ngamvitroj, Park and Kang (2004) found that self-efficacy was the only significant predictor for five health behaviors, including exercise; perceived stress and social support were not significant predictors. Higher levels of self-efficacy resulted in decreased levels of alcohol consumption and increased physical activity, nutrition behavior, general safety behaviors, and sun-protective behaviors. In addition, higher self-efficacy and lower perceived barriers to physical activity increased the likelihood that participants engaged in physical activity (Von Ah et al.). Another strong predictor of college student exercise behavior is the stage of change based on the Transtheoretical Model (TTM) of behavior change (Prochaska & DiClemente, 1983). Levy and Cardinal (2006) and Pinto and Marcus (1995) both found a relationship between student stage of change and levels of physical activity. Exercise interventions that are tailored to the participants’ stage of change may increase the effectiveness of the intervention. Future research is needed on creating interventions for different stages.

Research shows that focusing on the positive benefits of exercise and encouraging participants to engage in physical activity with positively framed messages (PFM) is more effective in increasing physical activity in college students than negatively framed messages (NFM) that focus on discontinuing sedentary behavior (Parrott et al., 2008). Parrott and colleagues randomly assigned participants to a control condition or to one of two treatment groups that received email messages: one group received PFM and a
second group received NFM. The emails contained a statement from the CDC promoting
the health benefits of physical activity and a second message, either a PFM or NFM,
depending upon the treatment group to which the participant was assigned. Results
showed that participants who received PFM reported significantly higher exercise levels
than participants in both the NFM condition and the control group (Parrott et al.).

Another avenue for increasing exercise is the use of the internet. Suminski and
Petosa (2006) used Web-assisted instruction promoting the use of social cognitive theory
(SCT) strategies to help promote physical activity behavior. Students enrolled in 20
health and fitness courses at a Midwestern university were assigned to a control,
comparison, or treatment condition. The control group curriculum included topics such
as cancer avoidance, sexuality, and AIDS awareness and did not include any material
related to exercise or fitness. The comparison group attended lectures on health and
fitness and a variety of exercise topics as well as SCT strategies to promote and sustain
physical activity. The comparison group also had three weekly laboratory sessions in
which the students engaged in 1 hour of physical activity and completed a reading or
writing assignment on fitness. The treatment group was enrolled in the same fitness and
exercise course as the comparison group, but the treatment group was also required to
complete a Web-based program that targeted SCT variables. The Web-based program
assessed past and current exercise behavior and included information about goal-setting,
time management, exercise preferences and enjoyment level, problem solving and
exercise adherence, planning for long-term exercise, and environmental (social and
physical) awareness. Students completed one assignment per week for nine weeks.
Results showed that students in the treatment condition displayed significant increases in
knowledge of SCT strategies; they were more likely to use self-regulation strategies than students in the comparison or control condition. In addition, students in the treatment condition reported that the Web activities were helpful and that they would use the SCT strategies in the future (Suminski & Petosa).

Other cognitive interventions are also effective in increasing exercise behavior. Cholewa and Irwin (2008) found that college student participants who used an on-line logbook to track their physical activity (e.g., frequency, duration, goals, and progress) significantly increased their physical activity. Werch et al. (2008) assessed the efficacy of a brief image-based multiple-behavior intervention. The Behavior-Image Model (BIM) was designed to promote healthy behavior through the use of positive goals or images and health-risk awareness (Werch, 2007). It focuses on using positive, gain-framed (benefits) messages rather than negative, loss-framed (costs) messages (Werch, 2007). One component of the BIM is pairing health-promoting habits, such as physical activity and sleep, and presenting them to reinforce and strengthen each other. “For example, physical activity can enhance one’s quality of sleep, while adequate sleep is important to maintaining and improving a person’s physical fitness and performance” (Werch et al., p. 682). Werch et al. followed the BIM model, and used messages like these in their study to promote healthy behaviors. Participants in the treatment condition received a one-on-one consultation with a fitness specialist; PowerPoint slides were used periodically to reinforce key images and health behaviors; participants received a one-page goal plan to facilitate behavior change. Participants in the control condition received a health education brochure. Results showed small positive effects, although not statistically significant, for an increase in moderate exercise for participants in the
treatment condition (Werch et al.). Email, internet, or other cognitive interventions may be a great way to help increase physical activity on college campuses by reaching a large number of students.

Research that Contradicts a Negative Relationship between Exercise and Depression

Although the majority of research indicates a positive relationship between exercise and mood, some studies have found the opposite. Brown and Blanton (2002) reported that women who participated in frequent moderate to vigorous physical activity were more likely to report suicidal behavior than inactive women, but sports participation, which included intramural or extramural participation, was a protective factor for suicidal behavior. On the other hand, inactive men had a greater chance of reporting suicidal behavior than active men. These results are in contrast to much of the research on physical activity and mood; however, there were many limitations to this study. The data collected was self-report and cross-sectional. Also, no conclusions can be drawn about causation. In addition, suicide attempters and those with suicide ideation were clumped together due to a small sample size, and the moderate physical activity category was limited to two behaviors. It is possible that other mediating and moderating factors were involved and led to skewed results. Joiner and Tickle (1998) found that women who reported higher levels of exercise showed increases in self-esteem and decreases in depressive symptoms while men with higher levels of exercise actually reported a decrease in self-esteem and an increase in depressive symptoms over the course of the study. On the other hand, this study had a small sample size of men ($n = 64$) compared to women ($n = 124$), a short time frame of only three weeks, and only 1
self-report item as an exercise measure. Again, other mediating factors such as academic pressures or life events may have played a role.

Thorne and Espelage (2004) examined the possible moderating effect of disordered eating on the relationship between exercise and psychological health in college students. In males, they found that exercise was associated with more positive psychological health. However, in females, exercise was associated with positive and negative psychological health. Along with other measures, participants completed the Eating Attitudes Test-26 (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982) which assesses pathological eating behaviors, attitudes and thoughts. The authors included this measure because of the high prevalence rate of eating disorders for females and societal pressures to be thin. Females who exercised and had a high EAT-26 score showed higher levels of depression and anxiety, whereas females who exercised and had a low EAT-26 score showed more positive affect. According to this study, females who exercise but have disordered and negative attitudes about eating, do not experience the same psychological benefits from exercise. Similar results were not found with the males in the study.

Ryan (2008) investigated the mediating effect of self-esteem and self-efficacy on the relationship between physical activity and depression. Results showed that physical activity is associated with decreases in depressive symptoms in undergraduates. On the other hand, when controlling for self-esteem and self-efficacy, the results indicated that the direct effect of physical activity on depressive symptoms was negligible. These results are correlational; additional research is needed to confirm these results.
Theories and Models in Health Behavior

Many theories and models explain the efficacy of exercise interventions. Mental and physical health promotion and improvement cannot be explained by one theory or model. It is more appropriate to consider an interaction of different theories and models developed through fundamental research (i.e., research on the determinants of behavior and development of methodologies), tracking population trends, intervention research, and application and program delivery (Glanz, Rimer, & Lewis, 2002). Theories and models are developed to explain behavior and ultimately achieve behavior change. The most salient theories and models for the proposed study include the Health Belief Model, Theory of Planned Behavior, Transtheoretical Model, and Social Cognitive Theory (Glanz et al.).

The Health Belief Model

The Health Belief Model (HBM) draws from Stimulus Response Theory and Cognitive Theory and was initially developed in the 1950s by a group of social psychologists in response to the limited success of a variety of programs of the U.S. Public Health Service (Glanz et al., 2002). The HBM is a value-expectancy theory which can be explained as follows: “(1) the desire to avoid illness or to get well (value) and (2) the belief that a specific health action available to a person would prevent (or ameliorate) illness (expectation)” (Glanz et al., 2002, p. 47). Major components of the HBM include perceived susceptibility, severity, benefits, and barriers, cues to action, and self-efficacy. According to the HBM, if a person believes he or she is susceptible to a condition, and that condition would have potentially serious consequences, and if he or she believes the
benefits outweigh the barriers to a plan of action, then the person will take action to prevent or control the condition.

The HBM focuses on changing cognitions about health concerns (Glanz et al., 2002). The intervention in the proposed study draws from components of the HBM, specifically benefits and barriers of exercise, which is consistent with previous research on exercise in the college population (Ebben & Brudzynksi, 2008; Grubbs & Carter, 2002; Gyurcsik, Bray, & Brittain, 2004; Parrott et al., 2008). When students can recognize significantly more benefits to exercise than barriers, they are more likely to engage in a sufficient amount of physical activity (Grubbs & Carter).

The Theory of Reasoned Action and the Theory of Planned Behavior

The Theory of Reasoned Action (TRA), and an extension, the Theory of Planned Behavior (TPB), are both based on the idea that individual motivational factors are determinants of the probability of executing a specific behavior (Glanz et al., 2002). The TRA was introduced in 1967, emphasizing that the most important predictor of behavior is a person’s behavioral intention. The TPB extends this idea; “…behavioral performance is determined jointly by motivation (i.e., intention) and ability (i.e., behavioral control)” (Glanz et al., 2002, p. 74). Therefore, a person’s perception of his/her control over a behavior (e.g., exercise), in conjunction with his/her intention, is expected to directly affect the specific behavior. This effect is moderated by a person’s attitude toward the behavior and subjective norm (i.e., whether significant people in the person’s life would approve or disapprove of the behavior, and whether the person is motivated to act accordingly).
Parrott et al. (2008) used the TPB to develop their email-based, physical activity intervention. The authors operated on the assumption that under the TPB, intention to engage in exercise behavior is influenced by affective attitude (i.e., enjoyment) and instrumental attitude (i.e., benefit), subjective norm, and perceived behavioral control. Moreover, the greater the person’s affective and instrumental attitude, subjective norm, and perceived behavioral control, the greater his or her intention to engage in physical activity. Parrott et al. used PFM and NFM and found that participants who received PFM reported significantly higher exercise levels than participants in both the NFM condition and control the control group. The intervention in the proposed study will use PFM to increase the affective and instrumental attitude, subjective norm, and perceived behavioral control of the participants which will increase their intention to engage in physical activity.

*The Transtheoretical Model*

The Transtheoretical Model (TTM) or Stages of Change (SOC) model was introduced by Prochaska in 1979 and continued to develop in the early 1980s. The TTM posits several stages of change, including precontemplation, contemplation, preparation, action, maintenance, and termination. In the *precontemplation* stage, people do not intend to take action in the near future, whereas in the *contemplation* stage, people intend to change within the next six months. In the *preparation* stage, people intend to take action in the immediate future, whereas in the *action* stage, people have made specific, intentional modifications in their behavior within the past six months. In the *maintenance* stage, people work to prevent relapse but do not apply change processes as often as in the action stage. Finally, in the *termination* stage, people no longer have temptation to
relapse to previous maladaptive ways, and have complete self-efficacy or the belief that they have complete control over their behavior. These stages do not always occur in order, and individuals can progress or regress through the stages at any time (Prochaska & DiClemente, 1983). The TTM operates on the assumption that no single theory can account for behavior change and thus integrates other major theories. According to the TTM, individuals engage in decisional balance, weighing the pros and cons of changing. Individuals with higher self-efficacy have greater confidence in their ability to change their behavior and prevent relapse (Glanz et al., 2002).

Researchers use the TTM and SOC to match an intervention to a participant’s readiness to change. For an individual to move from precontemplation to contemplation, he or she must recognize more advantages to behavior change than he/she previously did. To move from contemplation to action, the individual must recognize fewer disadvantages than he/she previously did, and recognize significantly more advantages than disadvantages (Glanz et al., 2002). In early stages, individuals typically use cognitive, affective and evaluative processes to initiate change, whereas in later stages individuals rely more on commitments, conditioning, contingencies, environmental controls and support for transitioning into the maintenance or termination stage (Glanz et al.). Many health behavior intervention programs such as smoking, alcohol, and drug cessation, weight control, safer sex, exercise acquisition, sunscreen use, and mammography screening use the TTM (Glanz et al.).

Levy and Cardinal (2006) and Pinto and Marcus (1995) found a significant relationship between student stage of change and levels of physical activity. For example, students in the stable sedentary group (i.e., those in the precontemplation and/or
contemplation stage at baseline and follow up) were significantly less physically active than students in the activity relapse group (i.e., those who moved from action or maintenance at baseline to contemplation or precontemplation at follow up) and stable active groups (i.e., those who were in action and/or maintenance at both time periods). Also, the stable active and activity adoption groups (i.e., those who moved from precontemplation, contemplation, or preparation at baseline to action or maintenance at follow-up) significantly increased their level of exercise over time (Levy & Cardinal). Pinto and Marcus reported that students in the action stage reported significantly more participation in jogging/running, weight lifting and cycling than students in other stages. Exercise interventions tailored to the participant stage of change may increase the effectiveness of the intervention, but more research is needed to create interventions for different stages. Intervention emails developed for the proposed study have been carefully worded to account for different stages of change among the participants. See Appendix A for examples.

Social Cognitive Theory

Social Cognitive Theory (SCT) developed from Bandura’s Social Learning Theory in the 1980s. According to SCT, behavior, personal factors (including cognitions), and environmental factors all interact (Glanz et al., 2002). “Health educators and behavioral scientists have creatively used SCT to develop interventions, procedures, or techniques that influence these underlying cognitive variables, thereby increasing the likelihood of behavioral change” (Glanz et al., 2002, p. 165). Key terms in SCT include reciprocal determinism, observational learning, positive reinforcement, reciprocal determinism, outcome expectations and expectancies, and self-efficacy. Reciprocal
determinism involves behavior which is influenced by the interaction of the characteristics of the person, the behavior of the person, and the environment. In observational learning, the person learns by observing the actions of another and through the positive reinforcement or reward received. Another key construct is outcome expectancies which are the anticipated outcomes of a behavior and incentives or values a person places on the outcome. Finally, in this context, self-efficacy is related to self-control of performance and emotional arousal (Glanz et al.).

SCT is used in the development of exercise interventions. Participants in the intervention condition in a study by Suminski and Petosa (2006) used a Web-based program to promote the use of SCT strategies such as knowledge and use of social support, self-efficacy, and self-regulation. The intervention was successful in increasing knowledge of SCT strategies (Suminski & Petosa). The intervention in the proposed study, incorporates SCT strategies including goal-setting, time management, determination of exercise preferences and enjoyment level, problem solving, exercise adherence, and planning for long-term exercise.

Summary

The lifetime prevalence rate of MDD in the general population is 15.8 percent (Kessler et al., 2005) and the lifetime prevalence estimate for subclinical depression varies from 10 percent to 23 percent (Allart-Van Dam et al., 2003). Prevalence rates of depression in college students may be greater than the general population at 22 percent or higher (Kisch et al., 2005).

The relationship between exercise and depression has been widely studied in the general population and the college student population. Most research has found a
negative relationship between exercise and depression (Adams et al., 2007; Cai, 2000; Giacobbi et al., 2005). Exercise has also been studied as an intervention tool to help reduce symptoms of depression. Studies have found that an increase in exercise is associated with a decrease in symptoms of clinical and subclinical depression in the general population, as well as the college student population (Balkin et al., 2007; Dunn et al., 2005). In addition, 30 minutes of moderate-intensity exercise, most days of the week was an effective treatment for 42 percent of participants with mild to moderate Major Depressive Disorder. This is similar to a remission rate of 36 percent for cognitive-behavioral therapy and 42 percent for antidepressant medication (Pate et al., 1995).

Entering college is a significant transition and a time during which self-care behaviors change. Despite the physical and mental health benefits, many students do not engage in a sufficient amount of exercise. According to Petruzzello and Motl (2006), about 22 percent of students who exercised in high school do not continue to exercise in the first couple months of college. On the other hand, research shows that there is a positive relationship between exercise and mood: students who engage in more exercise, experience more positive mood (Berger & Owen, 1998; Giacobbi et al., 2005). Recent research shows internet and email interventions may be an effective way to increase physical activity on college campuses by incorporating theories and models such as the HBM, TRA and TPB, TTM, and SCT (Glanz et al., 2002; Parrott et al., 2008; Suminski & Petosa, 2006). Increasing physical activity may assist students in maintaining a stable mood, during an unstable time.
Chapter II

Rationale and Hypotheses

The lifetime prevalence rate of MDD in the general population is 15.8 percent (Kessler et al., 2005) and the lifetime prevalence estimate for sub-clinical depression varies from 10 percent to 23 percent (Allart-Van Dam et al., 2003). Prevalence rates of depression in college students may be greater than the general population at 22 percent or even higher (Kisch et al., 2005). Traditional treatment for depression includes individual or group psychotherapy, antidepressant medication, or a combination of treatments. On the other hand, of persons who experience MDD, it is estimated that only 23 percent seek treatment, and only 10 percent receive treatment from a mental health professional, with more people seeking help from their primary-care physician (Dunn et al., 2005). Therefore, many people may prefer alternative self-help methods to manage depression, such as exercise.

Much research has investigated the relationship between exercise and depression. Most studies have found a negative relationship between exercise and depressive symptoms in the general population and the college student population (Adams et al., 2007; Cai, 2000; Giacobbi et al, 2005); only a few studies have found the contrary (Brown & Blanton, 2002; Joiner & Tickle, 1998). In a meta-analysis of 80 studies, North et al. (1990) reported a greater amount of physical activity lead to better mood and depression scores decreased significantly more in exercise groups as compared to control groups. In addition, the effect size was not related to the initial level of depression of the
participants; participants who were initially clinically depressed and those who were not clinically depressed experienced a decrease in depression scores with exercise (North et al., 1990). In a review of intervention studies that examined the relationship between exercise and depression, Martinsen (2005) reported that aerobic exercise was as effective as psychotherapy in reducing symptoms of depression.

Previous research has generally found a positive relationship between exercise and mood and a negative relationship between depression and exercise. However, there have been a variety of methodological flaws. Some research has examined the relationship between college students’ exercise and depression using a cross-sectional design (Brown & Blanton, 2002; Ryan, 2008). Other studies (e.g., Joiner & Tickle, 1998) used a pre-post test methodology; however, the post-test occurred following a brief intervening period. Other studies (e.g., Bray & Born, 2004; Ryan 2008) have assessed the relationship retrospectively, whereas others only included women in the sample (Balkin et al, 2007; Wyshak, 2001). In addition, many studies (Berger & Owen, 1998; Bray & Kwan, 2006; Cai, 2000) utilized a more general measure of mental health that does not specifically assess depression, such as the POMS or the General Health Questionnaire-28 (GHQ-28; Goldberg & Hillier, 1979).

With increasing rates of depression, especially minor/subclinical depression, and other mental health issues on college campuses, many schools are shifting the focus from student academic development, to development of the whole student, intellectually, psychologically, physically, etc (e.g., the Jesuit concept of “curas personalis”). One area of interest is increasing student physical activity, which may benefit both psychological and physical well-being. With the rise of technology, recent research has evaluated the
use of the internet and email as tools to increase physical activity. Studies have shown that web-based programs or weekly email interventions may be an effective way to increase physical activity in the general population as well as in college students (Parrott et al., 2008; Suminski & Petosa, 2006).

The proposed study will examine the efficacy of a weekly informational and motivational email intervention in increasing physical activity levels of first year college over the course of their first semester. The email intervention will incorporate the use of cognitive techniques such as increasing perceived benefits and decreasing perceived barriers to exercise, problem-solving and time management techniques, etc. In addition, the proposed study will examine whether an increase in physical activity is associated with a subsequent decrease in minor/subclinical depressive symptoms. As a result of the review of the literature, the following hypotheses are made:

$H_1$: At the end of the semester, first year students who receive a weekly email intervention will report significantly greater exercise frequency and intensity as measured by the total score on the Leisure-Time Exercise Questionnaire (LTEQ) than first year students who do not receive a weekly email intervention.

$H_2$: At the end of the semester, first year students who receive a weekly email intervention will report significantly fewer symptoms of depression as measured by the Center for Epidemiologic Studies Depression Scale (CES-D Scale) than first year students who do not receive a weekly email intervention, after controlling for participation in counseling or therapy, if necessary.
H₃: First year students who engage in exercise frequently and intensely as measured by the total score on the LTEQ will report significantly fewer depressive symptoms as measured by the CES-D Scale, at the beginning and the end of the semester.
Chapter III
Method

Participants

Participants will be incoming first year students (class of 2013) at Xavier University in Cincinnati, Ohio. This class is expected to include approximately 1200 students. Undergraduate transfer and Center for Adult and Part-Time students, as well as graduate students, will not be eligible to participate.

Measures

The Leisure-Time Exercise Questionnaire (Godin, Jobin, & Bouillon, 1986).

The Leisure-Time Exercise Questionnaire (LTEQ) is a physical activity questionnaire that is reliable, valid, and easy to complete quickly (Godin & Shephard, 1985). Respondents are instructed to record on average, the number of times per week that they engage in at least 15 mins of strenuous (heart beats rapidly, e.g., running, soccer), moderate (not exhausting, e.g., fast walking, baseball), and mild (minimal effort, e.g., yoga, golf) exercise. A total leisure activity score is calculated using the following formula: \((9 \times \text{strenuous}) + (5 \times \text{moderate}) + (3 \times \text{mild}) = \text{total exercise metabolic equivalents (METS) per week}\) (Godin & Shephard). Then, respondents report how often they engage in any regular activity long enough to work up a sweat (often, sometimes, or never/rarely) and a frequency score is calculated for each category.

Two-week test-retest reliability coefficients were .48, .46, and .94 for mild, moderate, and strenuous exercise respectively, and .80 for self-report of sweat-inducing
exercise (Godin & Shephard, 1985). Concurrent validity with other activity measures ranges from .45 to .61 (Godin & Shephard). Concurrent validity between self-report level of leisure time activity and values of maximum oxygen intake, body fat, and muscular endurance was moderate (.38 - .54) (Godin et al., 1986). The LTEQ has previously been used with the depressed and non-depressed college student population (Giacobbi, Hausenblas & Frye, 2005; Thome & Espelage, 2004).

The directions for the LTEQ indicate, “Considering a 7-day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).” The directions for the LTEQ will be modified for this study to indicate the last 7-day period. These directions will direct the students to consider a specified time period, rather than a non-specific time, which could be in the more distant past, prior to their arrival on campus. In addition, some of the examples of activities in each category will be changed to be more consistent with activities of college students today. For example, in the “strenuous exercise” category, racquetball will replace squash, and in the “moderate exercise” category, softball will be used in addition to baseball. The LTEQ can be found in Appendix A.

_The Center for Epidemiologic Studies Depression Scale (Radloff, 1977)._ 

The Center for Epidemiologic Studies Depression Scale (CES-D) is a screening measure for current level of depressive symptoms designed for use with the general adult population and for research purposes (Radloff, 1977). The CES-D has 20 items from previously validated longer scales, is self-administered, and measures features of depression such as depressed mood, feelings of guilt and worthlessness, psychomotor
Depression and Exercise 43

retardation, loss of appetite and sleep disturbance, with an emphasis on the affective component of depressed mood (Radloff, 1977). The CES-D was also designed to detect depressive reactions to events in a person's life. Respondents report positive and negative experiences on a 4-point Likert-type scale: 0 = “Rarely or None of the Time (Less than 1 day),” 1 = “Some or little of the time (1-2 days),” 2 = “Occasionally or a Moderate Amount of the Time (3-4 days),” and 3 = “Most or All of the Time (5-7 days).” The scale takes less than 10 minutes to complete. A high score may be interpreted as “at risk” of depression or in need of treatment (Radloff, 1977).

The CES-D has high internal consistency reliability of .85 in the general population and .90 in an inpatient sample. Test-retest correlations are in the moderate range, between .45 and .70, and are generally larger for shorter time intervals (Radloff, 1977). The CES-D correlated moderately with interviewer ratings of depression, had good discriminant validity ratings between psychiatric inpatient and general population sample, and discriminated moderately among levels of severity within inpatient groups (Radloff, 1977). The CES-D has concurrent validity with the SCL-90 (.83) and the Hamilton rating scale (.50 to .80). A factor analysis of the 20 items of the CES-D revealed four factors: depressed affect, positive affect, somatic and retarded activity and interpersonal (Radloff, 1977). Shean and Baldwin (2008) found that the CES-D produced satisfactory levels of specificity and positive predictive value for current depressive disorder ratings in college students. The CES-D can be found in Appendix B.
Materials

Informational and Motivational Email Intervention

Seven weekly intervention email messages will be sent to participants who have been randomly assigned to the intervention condition to encourage them to participate in physical activity. The email intervention is based on previous research on increasing physical activity (Centers for Disease Control and Prevention [CDC], 2008; Cholewa & Irwin, 2008; Dishman et al., 2009; Ebben & Brudzynski, 2008; Green et al., 2007; Gyurcsik, Bray & Brittain, 2004; Petruzzello & Motl, 2006; Suminski & Petosa, 2006). The first email message will inform participants that there will be 6 additional weekly emails and they may discontinue participation at any time by deleting the emails. The subject heading of each email will be “Exercise tips from Kristen Wilson” and the message will begin with a motivational introduction followed by a few tips to begin and maintain an exercise routine. Then, there will be an FYI, including exercise related activities at Xavier University’s O’Connor Sports Center or on campus. At the end of each email, there will be a summary of the exercise tips from previous weeks.

The purposes of the first email are to introduce the intervention, normalize participants’ experience if they are not exercising, help them to begin thinking about an exercise routine, set some specific exercise goals, and to begin logging their activity (Cholewa & Irwin, 2008; Dishman et al., 2009.; Petruzzello & Motl, 2006). The exercise tips in the second email will include encouraging participants to use a pedometer to track their steps and to find a work-out buddy. It will provide information on the recommended weekly amount of physical activity. This email is based on research by Cholewa and Irwin, Dishman et al., Green et al. (2007), and CDC (2008). The third and fourth email
messages will focus on the benefits and barriers of exercise and are based on research by Dishman et al., Ebben and Brudzynski (2008), and Gyurcsik et al. (2004). The fifth email will emphasize the importance of getting enough sleep and good time management skills and their interaction with physical activity and energy levels (CDC; Suminski & Petosa). The sixth email includes tips on trying new activities, increasing motivation, and problem-solving with barriers to exercise (CDC; Suminski & Petosa, 2006). The final email will provide tips on setting long-term fitness goals and long-term benefits of exercise (CDC; Suminski & Petosa). Also, the final email will remind participants that they will receive another email in a week about completing the survey a second time. The intervention emails can be found in Appendix D.

Procedure

An invitation email (see Appendix C) will be sent to all incoming first year students aged 18 years and older to their Xavier account by the Xavier University’s Office of Decision Support during the second week of the fall 2009 semester and a reminder follow-up email will be sent one week later to students who did not complete the requested measures. This is considered the Time 1 data collection.

Participants will be randomly assigned to an email intervention or control condition. Participant groups will be stratified based on age, gender, ethnicity, campus residency status (i.e., resident or commuter), and geographical area of their home (i.e., Greater Cincinnati or not). Participants in the intervention condition will receive seven weekly emails encouraging them to engage in physical activity (See Appendix D). Participants in the control condition will not receive this intervention. All students who complete the measures at the beginning of the semester will be sent another invitation
email two weeks before Thanksgiving break to complete the same measures (see Appendix C). A reminder email will be sent the following week to encourage students to participate. This is considered the time two data collection.

Participation will be voluntary and incentivized. Participants completing the first set of questionnaires will be entered into a drawing for a chance to win one of two gift cards. Students in the control group and the treatment group who complete the measures at both data collection points will be entered into another drawing for a chance to win one of two gift cards per group. The email will indicate that by participating in the study, students are giving informed consent.

Participants will complete two measures on-line: the Leisure-Time Exercise Questionnaire (L-TEQ; Godin, Jobin, & Bouillon, 1986) and The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The measures will be administered on two occasions, once at the beginning of the semester (e.g., Time 1) and once later in the semester (e.g., Time 2). It is expected to take approximately 10 to 15 minutes to complete both measures. The data collection will remain “open” for two weeks at each data collection point.

Demographic data (i.e., age, gender, race/ethnicity, major, if the student lives on campus or is a commuter, and if the student is from Greater Cincinnati) will be collected by the Office of Decision Support from the Xavier University Server. Two questions will be added, “Please select one response to the following question: I get most of my exercise from…” and “Select all responses that apply to the following question: I also get exercise from…” will be added at Time 1 and Time 2 to assess the nature of participant exercise. An additional question, “Did you receive mental health treatment (e.g.,
psychological counseling or psychotherapy) this semester?” will be included at time two to account for this potential confound in the data analysis. Finally, at Time 2, intervention participants will be asked if they read the email messages, how many email messages they read (from 0 to 7), and how carefully they read the email messages (on a Likert-type scale from 1 to 7). See Appendix E for the additional questions.

The data will be collected by the Office of Decision Support. To be entered into the incentive drawing, it will be necessary for students to provide their name (first and last), their Xavier email address, and a local telephone or cell phone number. The Office of Decision Support will monitor the data collection and will notify the researcher or faculty supervisor of any CES-D scores 28 or higher, at either the Time 1 or Time 2 data collection point (based on the cut-off score used by Radloff, 1991). The researcher or her faculty supervisor will contact the student to discuss the survey results and make referrals to on-campus resources, as appropriate. An excel data file with no identifying information will be sent to the student by the Office of Decision Support following the data collection.

**Power Analysis**

In the fall of 2008, 860 first year students enrolled at Xavier University. Carini, Hayek, Kuh, Kennedy, and Ouimet (2003) found that the response rate of college students to web surveys is 40 percent. With a response rate of 40 percent for the proposed study, the sample is expected to be 344 students. Cohen’s (1988) power tables outline the minimum number of participants needed to produce various effect sizes. According to Cohen (1988), with a data set of at least 344, this study should have adequate power to detect a medium effect.
Chapter IV

Proposed Analyses

The general aim of this study is to obtain more detailed information about the relationship between depression and exercise in first year college students as well as to evaluate the effectiveness of an email intervention in increasing physical activity behavior in students. Descriptive statistics will be calculated for the Center for Epidemiologic Studies Depression Scale (CES-D Scale; Radloff, 1977) and the Leisure-Time Exercise Questionnaire (LTEQ; Godin & Shephard, 1985), as well as the age, gender, race/ethnicity, major, if the student lives on campus or is a commuter, and if the student is from Greater Cincinnati. Attrition rates will be reported for the intervention and control groups.

The first hypothesis will examine the change in exercise frequency and intensity of first year students in the treatment condition compared to first year students in the control condition, as measured by the LTEQ. To test this hypothesis, a repeated measures $2 \times 2$ analysis of variance (ANOVA) will be conducted to test for differences between the intervention and control groups, from the beginning of the semester to the end of the semester. Those participants who report that they did not read the intervention emails will be separated from those who indicate that they did. A secondary analysis, using an independent-samples $t$-test, will compare these groups (i.e., those who read the email message and those who did not) on the post-test measures. The $p$ value for the hypothesis will be set at .05.
The second hypothesis will examine the change in depressive symptoms of first year students in the treatment condition compared to first year students in the control condition, as measured by the CES-D Scale. Participants with a minimal initial level of depressive symptoms will be excluded from this analysis. The cut-off score for exclusion will be determined based on the distribution of CES-D scores in this sample. In order to test this hypothesis, a repeated measures 2 x 2 ANOVA will be conducted to test for differences between the intervention and control groups, from the beginning of the semester to the end of the semester. Two analyses will be conducted. One analysis will include participants who indicated they received mental health treatment during the semester. In a second analysis, participants who reportedly received mental health treatment will be removed from the sample, since their involvement in mental health treatment may represent a potential confound on the reported level of depression. The results of the first analysis will be compared to the second to examine whether there is a difference in level of depression with those persons who received mental health treatment in the sample and with them removed from the sample. Those participants who report that they did not read the intervention emails will also be separated from those who indicate that they did. A secondary analysis, using an independent sample t-test, will compare these groups (i.e., those who read the email message and those who did not) on the post-test measures. The $p$ value for the hypothesis will be set at .05.

The third hypothesis is a manipulation check and examines the potential negative relationship between exercise frequency and intensity as measured by the LTEQ and depressive symptoms as measured by the CES-D Scale, at the beginning and the end of
the semester. To test this hypothesis, a correlation will be conducted to test for a significant relationship. The $p$ value for the hypothesis will be set at .05.

Limitations

There are potential limitations to this study. First, there will be factors other than exercise that contribute to a change in depressive symptoms over the course of the semester, including significant losses, relationship stress, academic stress, healthy adjustment over the course of the semester, and use of other self-help methods. Second, the LTEQ and CES-D Scale are self-report measures; it is possible that the participants may respond in a socially desirable manner, and thus not answer the questions completely honestly or accurately. Third, there may be differences between those who self-select to participate in the study, and those who choose not to participate, and these differences cannot be assessed. Finally, due to the pre-post test design of the study, there may be significant attrition from the pre to post-test assessment and there may be more attrition in the control group compared to the intervention group.
References


Annesi, J. J. (2004). Mood states of formerly sedentary younger and older women at weeks 1 and 10 of a moderate exercise program. *Psychological Reports, 94*, 1337-1342.


Appendix A

Godin Leisure-Time Exercise Questionnaire

1. During the last 7-day period (this past week), how many times did you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).

<table>
<thead>
<tr>
<th>Times Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) STRENUOUS EXERCISE (HEART BEATS RAPIDLY)</td>
</tr>
<tr>
<td>(i.e. running, jogging, hockey, football, soccer, racquetball, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)</td>
</tr>
<tr>
<td>____________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Times Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) MODERATE EXERCISE (NOT EXHAUSTING)</td>
</tr>
<tr>
<td>(i.e. fast walking, baseball/softball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)</td>
</tr>
<tr>
<td>____________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Times Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>c) MILD EXERCISE (MINIMAL EFFORT)</td>
</tr>
<tr>
<td>(i.e. yoga, archery, fishing from river bank, bowling, horse-shoes, golf, snow-mobiling, easy walking)</td>
</tr>
<tr>
<td>____________</td>
</tr>
</tbody>
</table>

2. During the last 7-day period (this past week), during your leisure-time, how often did you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

<table>
<thead>
<tr>
<th>OFTEN</th>
<th>SOMETIMES</th>
<th>NEVER/RARELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. □</td>
<td>2. □</td>
<td>3. □</td>
</tr>
</tbody>
</table>
Appendix B

CES-D Scale

INSTRUCTIONS FOR QUESTIONS: Below is a list of the ways you might have felt or behaved. Please indicate how often you have felt this way during the past week.

0 Rarely or None of the Time (Less than 1 Day)
1 Some or a Little of the Time (1-2 Days)
2 Occasionally or a Moderate Amount of Time (3-4 Days)
3 Most or All of the Time (5-7 Days)

During the past week:

1. I was bothered by things that usually don’t bother me. 
2. I did not feel like eating; my appetite was poor.
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I felt that I was just as good as other people.
5. I had trouble keeping my mind on what I was doing.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt fearful.
11. My sleep was restless.
12. I was happy.
13. I talked less than usual.
15. People were unfriendly.
16. I enjoyed life.
17. I had crying spells.
18. I felt sad.
19. I felt that people dislike me.
20. I could not get “going.”
Appendix C

Pre-test Email Text (to be sent August 31, 2009)

Dear Xavier Student:

My name is Kristen Wilson and I am a student in Xavier’s clinical psychology doctoral program working under the direction of Dr. Renee’ Zucchero. I am writing to invite you to participate in my doctoral research about mood and exercise. I am asking you to complete a short survey, which should take about 10-15 minutes. Your participation will help us better understand the relationship between mood and exercise, and to evaluate the effectiveness of an email intervention in increasing physical activity behavior in college students. After completing the survey, you will be entered into a prize drawing. Two winners will be randomly chosen to win either a $75 or $50 gift card and will be notified via email. This email was sent to all Xavier incoming freshman; if all such students complete this survey, the odds of winning the drawing would be approximately 2 in 1,200.

You may receive some additional emails throughout the semester. Also, you will receive another invitation email to complete the same survey two weeks before Thanksgiving break. After completing the second survey, you will be entered into another drawing for a chance to win another $85 or $65 gift card. There will be a total of four gift cards awarded.

Your participation is completely voluntary and you may refuse to participate. In addition, you have the freedom to withdraw from the study at any time. By completing the survey, you are giving your consent to participate. Please be truthful and genuine in answering the questions.

Your responses will be kept confidential and there is no known risk to participation. If you do experience any negative feelings or have concerns upon completion of the survey, you can contact Xavier University’s Health and Counseling Center at 513-745-3022 or Psychological Services Center at 513-745-3531. In addition, we will follow up by telephone with students who display significant symptoms of depression.

If you have questions about your participation, please contact Dr. Renee’ Zucchero at (513) 745-3911 or Kristen Wilson at (513) 535-6914. Xavier University’s Institutional Review Board (IRB) has approved this study. If you have any questions or concerns, you may contact the IRB at 513-745-2870.

Thank you for your participation!

Sincerely,
Kristen A. Wilson, M.A.
Doctoral Candidate
Renee’ Zuccher, Ph.D.
Assistant Professor
Faculty Supervisor

Reminder/Follow-up Email Text (to be sent September 8, 2009)

Dear Xavier Student:

My name is Kristen Wilson and I am a student in Xavier’s clinical psychology doctoral program working under the direction of Dr. Renee’ Zuccher. About a week ago, you should have received an email requesting your participation in my doctoral research. This is a friendly, second request for your participation in my research about mood and exercise.

I am asking you to complete a short survey, which should take about 10-15 minutes. Your participation will help us better understand the relationship between mood and exercise, and to evaluate the effectiveness of an email intervention in increasing physical activity behavior in college students. After completing the survey, you will be entered into a prize drawing. Two winners will be randomly chosen to win either a $75 or $50 gift card and will be notified via email. This email was sent to all Xavier incoming freshmen; if all such students complete this survey, the odds of winning the drawing would be approximately 2 in 1,200.

You may receive some additional emails throughout the semester. Also, you will receive another invitation email to complete the same survey two weeks before Thanksgiving break. After completing the second survey, you will be entered into another drawing for a chance to win another $85 or $65 gift card. There will be a total of four gift cards awarded.

Your participation is completely voluntary and you may refuse to participate. In addition, you have the freedom to withdraw from the study at any time. By completing the survey, you are giving your consent to participate. Please be truthful and genuine in answering the questions.

Your responses will be kept confidential and there is no known risk to participation. If you do experience any negative feelings or have concerns upon completion of the survey, you can contact Xavier University’s Health and Counseling Center at 513-745-3022 or Psychological Services Center at 513-745-3531. In addition, we will follow up by telephone with students who display significant symptoms of depression.

If you have questions about your participation, please contact Dr. Renee’ Zuccher at (513) 745-3911 or Kristen Wilson at (513) 535-6914. Xavier University’s Institutional
Review Board (IRB) has approved this study. If you have any questions or concerns, you may contact the IRB at 513-745-2870.

Thank you for your participation!

Sincerely,
Kristen A. Wilson, M.A.
Doctoral Candidate

Renee' Zucchero, Ph.D.
Assistant Professor
Faculty Supervisor
Post-test Email Text (to be sent November 9, 2009)

Dear Xavier Student:

My name is Kristen Wilson and I am a student in Xavier’s clinical psychology doctoral program working under the direction of Dr. Renee’ Zucchero. As you might recall, you completed a survey to participate in my doctoral research about mood and exercise in September. I am emailing you again to request that you complete the same questionnaire a second time. If you complete the questionnaire, that will take no longer than 10-15 minutes, you will automatically be entered into another drawing to win an $85 or $65 gift card. There will be a total of 4 gift cards awarded - two $85 gift cards and two $65 gift cards. Winners will be notified via email. By completing the following questionnaire, you are providing consent to participate.

Responses will be kept confidential. There is no known risk to completing the questionnaires and your participation is completely voluntary. If you do experience any negative feelings upon completion of the questionnaires, you can contact Xavier University’s Health and Counseling Center at 513-745-3022 or the Psychological Services Center at 513-745-3531. In addition, we will follow up by telephone with students who report significant symptoms of depression.

Should you have questions regarding your participation, please contact Dr. Renee’ Zucchero at 513-745-3911 or Kristen Wilson at 513-535-6914. Xavier University’s Institutional Review Board (IRB) has approved this study. If you have any questions or concerns, you may contact the IRB at 513-745-2870.

Thanks again for your participation!

Sincerely,
Kristen A. Wilson, M.A.
Doctoral Candidate

Renee’ Zucchero, Ph.D.
Assistant Professor
Faculty Supervisor
Reminder/Follow-up Email Text (to be sent November 16, 2009)

Dear Xavier Student:

My name is Kristen Wilson and I am a student in Xavier’s clinical psychology doctoral program working under the direction of Dr. Renee’ Zucchero. As you might recall, you participated in my doctoral research about mood and exercise in September. About a week ago, you should have received an email requesting that you complete the same questionnaire a second time. This is a friendly, follow-up request for your participation in my research.

If you complete the questionnaire, that will take no longer than 10-15 minutes, you will automatically be entered into another drawing to win an $85 or $65 gift card. There will be a total of 4 gift cards awarded - two $85 gift cards and two $65 gift cards. Winners will be notified via email. Your participation is completely voluntary. By completing the survey, you are giving your consent to participate. Please be truthful and genuine in answering the questions.

Your responses will be kept confidential and there is no known risk to participation. If you do experience any negative feelings or have concerns upon completion of the survey, you can contact Xavier University’s Health and Counseling Center at 513-745-3022 or Psychological Services Center at 513-745-3531. In addition, we will follow up by telephone with students who display significant symptoms of depression.

If you have questions about your participation, please contact Dr. Renee’ Zucchero at (513) 745-3911 or Kristen Wilson at (513) 535-6914. Xavier University’s Institutional Review Board (IRB) has approved this study. If you have any questions or concerns, you may contact the IRB at 513-745-2870.

Thank you for your participation!

Sincerely,
Kristen A. Wilson, M.A.
Doctoral Candidate

Renee’ Zucchero, Ph.D.
Assistant Professor
Faculty Supervisor
Appendix D

**Intervention Emails**

**Subject: Exercise Tips from Kristen Wilson**

**Email #1 (to be sent on September 21, 2009)**

Dear Xavier Student,

Thank you for participating in my research study! As you will recall, you completed a survey within the last few weeks. You were selected to receive weekly emails to encourage you to be physically active. This is the first email in a series of seven weekly emails that you will receive. We hope you find them beneficial! You have the option of opting out of this study at any time. If you decide that you do not want to participate, please delete emails you receive from us.

Oftentimes, people have a difficult time developing a regular exercise routine. Studies have shown that many people who exercised in high school, do not exercise in college. As a first year college student in a time of transition, you may face some challenges in developing your own exercise habits. We hope to help you decrease these challenges and discover the benefits you personally experience from exercise.

Here are Kristen's exercise tips of the week:

- Before beginning an exercise routine, you may consider setting some personal fitness goals. Think about your recent exercise habits. Are you happy with your exercise routine? We encourage you set realistic goals based on what you are already doing or not doing. For example, if you are currently exercising once a week, you may want to set a goal to exercise two or three times a week. If you enjoyed a particular sport in high school, you might consider joining a related intramural activity here at Xavier.
- Studies have shown that people who log their physical activity are more likely to follow a consistent work-out routine. We strongly encourage you to use the attached goal and tracking sheet to write down your personal goals and log your weekly physical activity.

FYI: To find out what’s going on at O’Connor Sports Center, visit www.xavier.edu/recsports. There is a fitness link that lists all of the group exercise classes, schedules for the personal trainers (free to students!), contacts for the Club Sports programs, and dates for all of the intramural programming. Facility hours and monthly pool and gym calendars are posted there as well.

Thanks again for your participation!
Look for another exercise tip this time next week.
Email #2 (to be sent on September 28, 2009)

Dear Xavier Student,

We hope you’ve started or enhanced your exercise routine! If not, we encourage you to start this week.
Here are Kristen’s exercise tips of the week:

- Try using a pedometer to track your daily steps and then increase the number of steps you take each day. A pedometer is a device that tracks the number of steps you take. The recommended number of steps each day is 10,000 or more. You can purchase a pedometer at a sporting goods store, such as Dick’s Sporting Goods, or Target for $25 or less.
- Find a work-out buddy to encourage you to stick to your exercise routine.
- The CDC (Centers for Disease Control and Prevention) recommends 2 hours and 30 minutes of moderate aerobic activity each week (i.e., brisk walking, biking on level ground, softball, volleyball) or 1 hour and 15 minutes of vigorous aerobic activity each week (i.e., jogging, soccer, basketball, swimming laps, biking faster than 10 mph). In addition, the CDC recommends that you strength train 2 days per week.
- If you’re not achieving the amount or intensity of exercise provided in these recommendations on a regular basis, we encourage you to set smaller weekly goals to work toward reaching the CDC recommendations.

FYI: Did you know that the facilities at O’Connor Sports Center include an indoor pool, a gymnasium, Hammer Strength room, Nautilus cardiovascular room, and racquetball/handball courts? Access to the facilities is free to students with your All Card. To find out what’s going on at O’Connor this week, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zuccher, Ph.D

P. S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the last email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Sources: (Cholewa & Irwin, 2008; Dishman et al., 2009; Green et al., 2007; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #3 (to be sent October 5, 2009)

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some goals you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!
Here are Kristen’s exercise tips of the week:

- Incentives are a good way to keep you motivated to exercise. When you reach your goals, you may want to reward yourself. Some examples are spending time with friends, going to a movie, reading a book or magazine for pleasure, attending a fun activity on campus, or going on an off-campus outing.
- Some common benefits of exercise are stress relief, improved physical and mental health, enjoyment/pleasure, and increased fitness.
- Think about how exercise helps you and what motivates you to stay active.

FYI: Did you know that a variety of fitness classes are offered at the Sports Center, including ZUMBA, Turbo-Kick, spinning, and yoga? To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P.S.
Tip 1: Remember to use the goal and tracking sheet that we sent with the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned last week? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps, and find a work-out buddy.

Sources: (Dishman et al., 2009; Ebben & Brudzynski, 2008)
Email #4 (to be sent on October 12, 2009)

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some goals you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!

Here are Kristen’s exercise tips of the week:

- You may have discovered that there are barriers to exercise. Some commonly cited barriers among college students are: school workload being too great, stress due to exams, job demands, other campus activities/involvement, friends who are not physically active, lack of motivation, and lack of sleep.
- Here are some tips to overcoming common barriers.
- If you do not have a 30 minute block of time to exercise, try exercising for 10 minutes, 3 times during the day.
- Take a 10 minute, brisk walk as a study break to wake you up and clear your head.
- Use stairs rather than an elevator or walkway.
- Remember, exercise is good for your overall health and well-being! Make exercise part of your routine and build it into your schedule so that you feel the benefits of increased energy, reduced stress, and improved physical and mental health.

FYI: Did you know fitness trainers are available at the O’Connor Sports Center and are free to students with their All Card? Each person must complete a FREE assessment which includes all mandatory paperwork, goal setting, and screening. Working with a trainer is a great way to increase your motivation to exercise on a regular basis! To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P. S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps, and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.

Sources: (Ebben & Brudzynski, 2008; Gyurcsik, Bray & Brittain, 2004; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #5 (to be sent on October 19, 2009)

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some new goals that you can achieve. Remember that some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself! Here are Kristen’s exercise tips of the week:

- Are you sleeping well? One benefit of physical activity is that it can enhance your quality sleep. In return, getting enough sleep is important to maintain and improve your physical fitness and performance. Try to get 7-9 hours of sleep each night (as recommended by the CDC).
- If you’re having trouble falling asleep or getting enough sleep, try going to bed and waking up at the same time each day, only using your bed for sleeping (not reading or studying), avoid physical activity within a few hours before bed, and avoid large meals before bed.
- Getting enough sleep and developing an exercise routine require good time management skills. For tips on time management, visit Xavier’s Learning Assistance Center website at http://www.xavier.edu/lac/Time-Management.cfm.

FYI: Did you know that the registration deadline for the intramural basketball and volleyball tournament, floor hockey, and racquetball ladder is October 27th? If you don’t have a team but still want to play, you can fill out a free agent form. What a great way to meet new people and increase your level of activity! To find out what’s going on at O’Connor, visit www.xavier.edu/reesports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P. S.
Tip 1: Remember to use your goal and tracking sheet that I sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.

Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.

Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!

Sources: (http://www.cdc.gov/Features/Sleep/; http://www.xavier.edu/lac/Time-Management.cfm; Suminski & Petosa, 2006)

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Email #6 (to be sent on October 26, 2009)

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some new goals that you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!

Here are Kristen’s exercise tips of the week:

- If you’re having trouble sticking to an exercise routine, maybe you haven’t found something you enjoy. Try switching up the physical activities you engage in until you find something that motivates you to keep exercising. Try something new. Maybe you could join an intramural or club team or take exercise classes at the O’Connor Sports Center. Get some friends together for a pick-up basketball, ultimate Frisbee, soccer, or another game. You can do strength training in your dorm room by doing push-ups, sit-ups, wall-sits, free weights, etc. The important thing is to find your personal exercise preferences to increase your enjoyment level and motivation to keep exercising!

- If you haven’t been active in awhile, or can’t find something you enjoy, try walking around campus. There are plenty of hills and stairs to give you plenty of exercise! If you are experiencing barriers to exercise, figure out what is getting in the way and problem solve to get around those barriers.

FYI: Did you know that Xavier has a variety of club sports teams, from boxing to lacrosse, from rugby to ultimate frisbee? Joining a club sport is a great way to increase your commitment to exercising regularly and meet people who have a similar interest as you. To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Keep up the good work! Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P.S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.
Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!
Tip 5: Remember to get 7-9 hours of sleep each night and use good time management skills!

Sources: (Suminski & Petosa, 2006; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #7 (to be sent on November 2, 2009)

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some new goals that you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!

This is the last week of Kristen’s exercise tips! We hope that you continue with your physical activity goals and set some long-term goals so your exercise routine will become part of your lifestyle. Studies show that physical activity behaviors developed in college are likely to be maintained after college, which makes the development of your fitness routine now that much more important!

• Set some long-term fitness goals to plan for long-term exercise, follow your progress, and reward yourself for reaching goals!
• When you reach your goals, try being active longer each time or being active more often. If you get bored, try new things.
• We’ve discussed a lot of the immediate benefits of exercise, but there are long-term benefits, too. When you are not physically active, you are more likely to get heart disease, type 2 diabetes, have high blood pressure and high blood cholesterol, and to have a stroke.
What you do (or don’t do) today, tomorrow, or next week really can have a positive impact on your physical and overall health and well-being!

FYI: Did you know that the O’Connor Sports Center pool is a recreational pool geared toward lap swimmers and is available daily for usage? During the fall and winter, a dip in the pool can feel great and it is great exercise, too! To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks Again for Your Participation!
You will receive another email next week about completing the second survey for our study. Remember if you complete the survey, you will be entered into another drawing and winners will be randomly chosen to win an $85 and a $65 gift card.

Kristen Wilson, M.A.
Renee’ Zuccheri, Ph.D

P.S.
Tip 1: Remember to use your goal and tracking sheet that I sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.
Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!
Tip 5: Remember to get 7-9 hours of sleep each night and use good time management skills!
Tip 6: Find activities you enjoy. Identify your barriers to exercise. Problem solve to reduce the barriers.

Sources: (Suminski & Petosa 2006; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)
Email Attachment

Goal and Tracking Sheet

My fitness goal for the week of _________: ________________________________________

My long-term fitness goal: _______________________________________________________

<table>
<thead>
<tr>
<th>What I did</th>
<th>Effort (vigorous, moderate, mild)</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>Total hours or minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. jogging</td>
<td>vigorous</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90</td>
</tr>
</tbody>
</table>

Total number of hours or minutes this week: ________________________________

Adapted from CDC: Physical activity for everyone
http://www.cdc.gov/physicalactivity/everyone/getactive/index.html
Appendix E

Additional Questions:

1. Please select one response to the following question: I get **most** of my exercise from (administered at Time 1 and Time 2)
   a. Varsity team sports  
   b. club sports  
   c. intramural sports  
   d. weight lifting/strength training  
   e. running/jogging  
   f. treadmill  
   g. elliptical  
   h. biking  
   i. swimming  
   j. exercise classes  
   k. other, please list ____________

2. Select **all** responses that apply to the following question: I also get exercise from (administered at Time 1 and Time 2)
   a. Varsity team sports  
   b. club sports  
   c. intramural sports  
   d. weight lifting/strength training  
   e. running/jogging  
   f. treadmill  
   g. elliptical  
   h. biking  
   i. swimming  
   j. exercise classes  
   k. other, please list ____________

3. Did you receive mental health treatment (e.g., psychological counseling or psychotherapy) this semester? (Time 2 only)
   a. Yes  
   b. No

4. Did you read the email messages designed to increase your level of exercise?
   a. Yes  
   b. No

5. How many email messages did you read?
   0 1 2 3 4 5 6 7

6. How carefully did you read the email messages?
   1 2 3 4 5 6 7
   Not at all  Somewhat Carefully  Very Carefully
Chapter V: Dissertation

Abstract

Prevalence rates of depression in college students may be higher than in the general population. Many students are not prepared for the increased demands of college life and the majority of students who report feeling depressed do not seek mental health treatment. Research shows that increased physical activity is associated with fewer symptoms of depression, yet many students do not engage in a sufficient amount of exercise. This study examined the effectiveness of an informational and motivational email intervention on physical activity and depressive symptoms in first year college students. Participants completed the Leisure-Time Exercise Questionnaire (LTEQ; Godin, Jobin, & Bouillon, 1986) and Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), which measure frequency and intensity of physical activity and symptoms of depression, respectively, during the second and twelfth weeks of the fall 2009 semester. The researcher compared changes in student physical activity and symptoms of depression among those who received an email intervention with those who did not. There were no significant differences in changes of physical activity or depressive symptoms between the intervention and control groups. These results are discussed in the context of previous research. The implications of the study’s results and its limitations are also described.
The Impact of an Informational and Motivational Email Intervention on Physical Activity and Depression in First Year College Students

Kessler, Chui, Demler & Walters (2005) estimated the 12-month prevalence rate of Major Depressive Disorder (MDD) in the United States population to be 6.7%, and the rate of any mood disorder to be 9.5%. Prevalence rates of depression in college students may be higher than the general population (Furr, Westefeld, McConnell & Jenkins, 2001; Kisch, Leino & Silverman, 2005). In a national survey of college students, Kisch et al. reported that 22 percent of participants reported feeling so depressed that it was difficult to function three or more times during the past school year. In addition, Furr et al. reported that 53 percent of students in their study had experienced what the students would label as depression since entering college.

The higher rates of depression may be due to the fact that many of today's college students experience competing demands on their time, including academic, work, and other role conflicts, which may lead to increased stress and an increased risk of depression. Many students are not prepared for the increased demands of college life and do not work to prevent depressive symptoms or they simply do not have the skills to do so. There are additional reasons for the higher rate of depression among college students including social problems, hopelessness, academic problems, and an interaction of multiple factors (Furr et al., 2001). Among college students who reported feeling depressed since entering college, the most frequently cited contributing factors were grade problems (53%), loneliness (51%), money problems (50%), relationship problems with boyfriend/girlfriend (48%), hopelessness (26%), parental problems (25%), and
helplessness (17%; Furr et al.). Alcohol use is another contributing factor in the increase of depressive symptoms in college students (Hussong, Hicks, Ley & Curran, 2001; Voelker, 2004). Therefore, they may be less likely to seek help until they are in crisis.

Of persons who experience MDD, it is estimated that only 23 percent seek treatment, and only 10 percent receive treatment from a mental health professional, with more people seeking help from their primary-care physician (Dunn, Trivedi, Kampert, Clark & Chambliss, 2005). Likewise, only 17 percent of college students who reported feeling depressed actually sought counseling (Furr et al., 2001). Thus, because a small percentage of students seek psychological services for their distress, it is important for them to find other ways to cope with their depression. Instead of seeking psychological services, some students may use social support, exercise, or other methods to cope with their depression. Within a year, 85 percent of cases of untreated major depression remit; therefore, many students’ depressive symptoms, especially subclinical symptoms, may improve before they feel the need to seek formal treatment (Maxmen & Ward, 1995).

With increasing rates of depression and other mental health issues on college campuses, many schools are broadening from a primary focus on student academic development, to include the development of the whole student, intellectually, psychologically, physically, and even morally and spiritually. A significant decline in a student’s psychological well-being negatively affects the student, those around him or her, and the university, as well. Therefore, students and universities might benefit from programs that promote strategies to encourage and maintain self-care (Field, Elliot & Korn, 2006). Examples of self-help strategies that students could use to alleviate depressive symptoms are exercise, eating a balanced diet, getting enough sleep, stress-
management techniques, finding hobbies and social groups, meditation and yoga, eating omega-3s (fish) and tryptophan (turkey, salmon and milk), spending time outdoors, light therapy, and avoiding alcohol, caffeine, and tobacco (Cukrowicz et al., 2006; Even, Schroder, Friedman & Rouillon 2008; Giacobbi, Hausenblas & Frye, 2005; Hussong et al., 2001; Young, 1993). Although these strategies may be helpful, they are most beneficial in combination with more traditional forms of treatment, such as medication or psychotherapy and may only be helpful to those with mild depression (Babyak, Blumenthal, Herman, Khatri, Doraiswamy, et al., 2000).

The Relationship between Exercise and Mood in the General Population

Because of the positive relationship between exercise and mood, many researchers are examining exercise as a possible tool for preventing and treating depression. In a review of intervention studies that examined the relationship between exercise and depression, Martinsen (2005) reported that aerobic exercise was as effective as psychotherapy in reducing symptoms of depression. In addition, 16 weeks of three 30-min sessions of aerobic exercise per week produced psychological benefits for patients suffering from moderate and major depressive disorders, and this benefit rivaled that of antidepressant medication (Blumenthal et al., 1999).

Dunn et al. (2005) found that an exercise schedule consistent with public health recommendations (i.e., adults should engage in 30 min of moderate-intensity aerobic exercise, most days of the week; Pate et al., 1995), was an effective treatment for 42 percent of participants with mild to moderate Major Depressive Disorder. This was similar to a remission rate of 36 percent for cognitive behavioral therapy and 42 percent
for antidepressant medication found by the National Institute of Mental Health (NIMH) in the Collaborative Depression Study (Pate et al.).

In a 10-year longitudinal study, Harris, Cronkite and Moos (2006) found that depressed participants with higher levels of physical activity tended to have less concurrent depression than participants with lower levels of physical activity, even after controlling for age, gender, medical problems, and negative life events. These results suggest that exercise can have long lasting effects on the prevention of depressive episodes, as long as the exercise is maintained. Moreover, in the long run, exercise may be more beneficial than medication because once the medication is discontinued the person is at risk for relapse. Hence, exercise may be a better option for some people.

There is a robust literature assessing the use of cognitive interventions to increase exercise. One such intervention is Move to Improve - a social-ecologic intervention to increase physical activity designed for use in the workplace (Dishman, Dejoy, Wilson, & Vandenberg, 2009). Results showed that during the last six weeks of the intervention, the percentage of intervention participants who were regularly physically active increased from 31 to 51 percent (Dishman et al.). Active for Life, a similar intervention, used strategies such as incentives, a team approach, goal-setting, and targeting social norms related to physical activity (Green, Cheadle, Pellegrini, & Harris, 2007). At a 10-week follow-up, there were statistically significant increases in physical activity; 67 percent of participants reported they were “feeling better overall,” and 53 percent reported increased energy. Participants also indicated they were motivated most by setting a personal goal, signing up and making a commitment, and having a pedometer to track steps (Green et al.).
The Relationship between Exercise and Mood in College Students

Although many studies on exercise and depression in the general population include participants with clinical depression (Babyak et al., 2000; Dunn et al., 2005), most studies in the college student population include participants with a range of depressive symptoms, including sub-clinical or minor depression and possible MDD (Cai, 2000; Joiner & Tickle, 1998). The purpose of the current study was to examine the relationship between physical exercise and symptoms of depression and whether participants would experience mental health benefits without initially meeting full criteria for MDD.

Entering college is a major transition. Several student activities and self-care behaviors are likely to change, including the frequency of exercise and dietary patterns (Bray & Born, 2004; Racette, Deusinger, Strube, Highstein & Deusinger, 2005). Bray and Born (2004) found that the frequency of vigorous aerobic physical activity in 145 first year college students significantly declined from previous levels during this transition. They also discovered that students who were more physically active had more positive mood profiles, lower levels of tension and fatigue, and higher levels of vigor. Petruzzello and Motl (2006) reported that whereas 66 percent of first year college students reported adequate amounts of physical activity in high school, only 44 percent reported adequate amounts of physical activity in the first two months of college. Hence, first year students might benefit from developing and maintaining an exercise routine when beginning college. This routine might promote wellness and good self-care, reduce or prevent depressive symptoms, and help increase energy and decrease levels of tension and stress.
In a meta-analysis of college students’ physical activity behaviors, Keating, Guan, Pinero and Bridges (2005) reported that 85 percent of college seniors who exercised regularly were still physically active 5 or 10 years later, and 81 percent of college seniors who were physically inactive were still physically inactive 5 or 10 years later. Thus, physical activity behaviors developed in college will likely be maintained after college, and this activity makes the promotion of healthy behavior in college students that much more important.

Giacobbi et al. (2005) found that participants’ mood was related to the amount of exercise they engaged in on a given day. Specifically, a greater amount of exercise was associated with reports of more positive mood, even when fluctuations in daily negative or positive events were controlled. Therefore, exercise may help someone who is feeling depressed alleviate some symptoms, or lead to a more positive mood in non-depressed individuals. In addition, regular exercise may help prevent feelings of depression or prevent relapse of depressive symptoms (Giacobbi et al.).

There is evidence that other forms of exercise, such as strength training and self-defense classes, also have mental health benefits. The Centers for Disease Control and Prevention (CDC, 2008) recommends people engage in aerobic activity at a moderate level (e.g., brisk walking, biking on level ground, softball, volleyball) for 2 hours and 30 minutes per week or vigorous aerobic activities (e.g., jogging, soccer, basketball, swimming laps, biking faster than 10 mph) for 1 hour and 15 minutes per week. In addition, the CDC recommends people engage in strength training two days per week (CDC, 2008). Adams, Moore, and Dye (2007) found a negative relationship between aerobic and anaerobic exercise and depression in college students. Moreover, those who
participated in strength training two or more times per week, including push-ups, sit-ups, or weight-lifting, were less likely to report depression than those who reported no strength training.

There are many reasons why first year college students may not engage in a sufficient amount of exercise. Grubbs and Carter (2002) identified these reasons as *perceived barriers to regular physical exercise*. Barriers identified by students included their school workload being too high, studying for exams, amotivation, anergia, job demands, having friends who are not physically active, and having other priorities (Ebben & Brudzynski, 2008; Gyrresik, Bray & Brittain, 2004). *Perceived benefits* of exercise identified by students included increased physical fitness and improved health; improved physical appearance and strength; increased stamina and muscle tone, and self-esteem; stress reduction; enjoyment/pleasure; and preventative health (Ebben & Brudzynski). When students recognized significantly more “perceived benefits” than “perceived barriers,” they were more likely to engage in regular exercise (Grubbs & Carter).

Research with college students has examined the use of the internet and email interventions to increase physical activity. Incorporating perceived benefits and barriers, and other cognitive interventions into internet-based or email interventions, may be an effective way to reach a large number of students (Parrott, Tennant, Olejnik, & Poudrevigne, 2008; Suminski & Petosa, 2006).

*Theories and Models in Health Behavior*

The efficacy of exercise interventions in increasing physical activity can best be explained by an interaction of different theories and models (Glanz, Rimer, & Lewis, 2002). The first is the Health Belief Model (HBM) which draws from Stimulus Response
Theory and Cognitive Theory (Glanz et al., 2002). According to the HBM, if a person believes the benefits outweigh the barriers of a behavior change, then the person will take action to prevent or control the particular behavior. The HBM focuses on changing cognitions about health concerns (Glanz et al., 2002). The intervention in the current study drew from components of the HBM, specifically identifying benefits and barriers of exercise, which is consistent with previous research on exercise in the college students (Ebben & Brudzynksi, 2008; Grubbs & Carter, 2002; Gyurcsik, Bray, & Brittain, 2004; Parrott et al., 2008).

Another theory that explains the components of behavior change is the Theory of Reasoned Action (TRA), and an extension, the Theory of Planned Behavior (TPB). Both are based on the idea that individual motivational factors are determinants of the probability of executing a specific behavior and emphasize that the most important predictor of behavior is a person’s behavioral intention (Glanz et al., 2002). Therefore, a person’s perception of his/ her control over a behavior (e.g., exercise), in conjunction with his/ her intention, is expected to directly affect the specific behavior. This effect is moderated by a person’s attitude toward the behavior and subjective norm (i.e., whether significant people in the person’s life would approve or disapprove of the behavior, and whether the person is motivated to act accordingly; Glanz et al.). The researcher included statements in the current email intervention that were aimed at increasing participant affective attitude (i.e., enjoyment of exercise) and instrumental attitude (i.e., benefits of exercise) to increase their intention to engage in physical activity.

The Transtheoretical Model (TTM) or Stages of Change (SOC) model was introduced by Prochaska in 1979. According to the TTM, individuals engage in
decisional balance (i.e., weighing the pros and cons) of change. Researchers use the TTM and SOC to match an intervention to a participant’s readiness to change. For an individual to move from one stage of change to the next, the individual must recognize fewer disadvantages than he/she previously did, and significantly more advantages than disadvantages (Glanz et al., 2002). Many health behavior intervention programs, such as exercise acquisition, use the TTM (Glanz et al.). Levy and Cardinal (2006) and Pinto and Marcus (1995) found a significant relationship between student stage of change and levels of physical activity. Intervention emails developed for the current study were carefully worded to account for different stages of change among the participants.

Social Cognitive Theory (SCT) developed from Bandura’s Social Learning Theory in the 1980s. According to SCT, behavior, personal factors (including cognitions), and environmental factors all interact (Glanz et al., 2002). The intervention in this study incorporates SCT strategies including goal-setting, time management, determination of exercise preferences and enjoyment level, problem solving, exercise adherence, and planning for long-term exercise.

Entering college is a significant transition and a time during which self-care behaviors change. Despite physical and mental health benefits, many students do not engage in a sufficient amount of exercise, as defined by the CDC (2008). Recent research shows internet and email interventions may be an effective way to increase physical activity on college campuses (Glanz et al., 2002; Parrott et al., 2008; Suminski & Petosa, 2006). Increasing physical activity may assist students in maintaining a stable mood, during an unstable time. The researcher hypothesized that at the end of their first semester of college, students who received an email intervention would report
significantly higher levels of physical activity and fewer symptoms of depression than students who did not receive the email intervention. In addition, it was hypothesized that an increase in physical activity would be related to a decrease in symptoms of depression at the end of the semester.

Method

Participants

All first-year undergraduate students from a small, urban, Midwestern university were eligible to participate. Undergraduate transfer and Center for Adult and Part-Time students were not eligible to participate. During the Time 1 data collection, 1,181 students received the invitation email; 256 participants completed the survey representing a response rate of 21.7%, which was lower than expected. Of those participants, 58 (46.0%) in the intervention condition completed the Time 2 survey, for a drop-out rate of 54.0%. Seventy-seven participants (60.2%) in the control condition completed the Time 2 survey, for a drop-out rate of 39.8%. A Chi-square test for independence indicated a significant association between condition (i.e., control and intervention) and participation status (i.e., dropped out and continued participation), \( \chi^2(1, n = 254) = 5.09, p = .02, \phi = -.14 \), indicating a small effect size (Cohen, 1988). There were no statistically significant differences in LTEQ scores at Time 1 between participants who dropped out (\( M = 71.97, SD = 28.80 \)) and those who completed the Time 2 survey (\( M = 70.92, SD = 24.08 \)), \( t(248) = 1.02, p = .31 \). There were also no statistically significant differences in CES-D scores at Time 1 between participants who dropped out (\( M = 15.03, SD = 9.38 \)) and those who completed the Time 2 survey (\( M = 13.99, SD = 9.28 \)), \( t(254) = .02, p = .89 \).
The drop-out rate for female participants was 43.2%, whereas the drop-out rate for males was 53.5%. A Chi-square test for independence indicated no significant association between gender and participation status (i.e., dropped out and continued participation), $\chi^2(1, n = 255) = .24, p = .12$. The drop-out rate for minority students was 62.5%, whereas the drop-out rate for Caucasian/White participants was 45.0%. A Chi-square test for independence indicated no significant association between ethnicity and participation status (i.e., dropped out and continued participation), $\chi^2(1, n = 255) = 2.67, p = .10$. Finally, 72.7% of commuter participants dropped out, whereas 44.2% of resident students dropped out. A Chi-square test for independence indicated a significant association between residential status (i.e., commuter and resident) and participation status (i.e., dropped out and continued participation), $\chi^2(1, n = 255) = 6.57, p = .01$, phi = .16, indicating a small effect size (Cohen, 1988).

The mean age of participants was 18.14 years ($SD = 0.37$); 71.1% of participants were female ($n = 96$) and 28.9% were male ($n = 39$). The majority (93.3%) were Caucasian ($n = 126$), 1.5% were African American ($n = 2$), 2.2% were Asian or Pacific Islander ($n = 3$), and 3.0% were Hispanic ($n = 4$). In addition, the majority of participants lived in a dorm or residence hall ($n = 129$), whereas the remaining participants were commuter students ($n = 6$). In this sample, the percentage of females is higher and of minority students is lower compared to this University’s typical first-year class. In addition, the percentage of commuter students in this sample is lower than the typical first year class (Xavier University, 2011).
Measures

The Leisure-Time Exercise Questionnaire (Godin, Jobin, & Bouillon, 1986).

The Leisure-Time Exercise Questionnaire (LTEQ) is a physical activity questionnaire that is reliable, valid, and easy to complete quickly (Godin & Shephard, 1985). Respondents are instructed to record, on average, the number of times per week that they engage in at least 15 minutes of strenuous (heart beats rapidly, e.g., running, soccer), moderate (not exhausting, e.g., fast walking, baseball), and mild (minimal effort, e.g., yoga, golf) exercise. A total leisure activity score was calculated using the following formula: (9 x strenuous) + (5 x moderate) + (3 x mild) = total exercise metabolic equivalents (METS) per week (Godin & Shephard). Then, respondents report how often they engage in any regular activity long enough to work up a sweat (i.e., often, sometimes, or never/rarely) and a frequency score is calculated for each category (i.e., strenuous, moderate, and mild exercise). In a large normative study of the LTEQ using a sample of 2,714 participants ages 18 to 24, the mean LTEQ score was 55.06 (SD = 24.66) for males and 51.21 (SD = 23.42) for females (Wilson et al., 2010). Cumming (2008) found a similar mean LTEQ score of 51.35 (SD = 38.26) in a sample of adults ages 18 to 66. Wilson and Muon (2008) reported somewhat higher mean LTEQ scores for males ($M = 68.36$, $SD = 30.06$) and females ($M = 60.19$, $SD = 26.48$).

Godin and Shephard (1985) reported two-week test-retest reliability coefficients for the LTEQ as .48, .46, and .94 for mild, moderate, and strenuous exercise respectively, and .80 for self-report of sweat-inducing exercise. Concurrent validity of the LTEQ was demonstrated by statistically significant correlations with other activity measures ranging from .45 to .61 (Godin & Shephard). The LTEQ has previously been used with the
depressed and non-depressed college student population (Giacobbi, Hausenblas & Frye, 2005; Thome & Espelage, 2004).

Directions for the LTEQ indicate, “Considering a 7-day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number)?” The directions for the LTEQ were modified for this study to indicate, “The last 7-day period.” These directions instructed the students to consider a specified time period, rather than a non-specific time, which could have been in the more distant past, prior to their arrival on campus. In addition, some examples of activities in each category were changed to be more consistent with activities of college students today. For example, in the “strenuous exercise” category, racquetball replaced squash, and in the “moderate exercise” category, softball was included, in addition to baseball.

*The Center for Epidemiologic Studies Depression Scale (Radloff, 1977).*

The Center for Epidemiologic Studies Depression Scale (CES-D) is a screening measure for current level of depressive symptoms designed for use with the general adult population and for research purposes (Radloff, 1977). The CES-D has 20 items from previously validated longer scales, is self-administered, and measures features of depression such as depressed mood, feelings of guilt and worthlessness, psychomotor retardation, and loss of appetite and sleep disturbance, with an emphasis on the affective component of depressed mood (Radloff, 1977). The CES-D was also designed to detect depressive reactions to events in a person’s life. Respondents report positive and negative experiences in the past week on a 4-point Likert-type scale: 0 = “Rarely or None of the Time (Less than 1 day),” 1 = “Some or little of the time (1-2 days),” 2 =
“Occasionally or a Moderate Amount of the Time (3-4 days),” and 3 = “Most or All of the Time (5-7 days).” The scale takes less than 10 minutes to complete. Items 4, 8, 12, and 16 assess positive affect and also control for response bias. These items are reversed scored; then, all items are summed to develop a total score. Scores can range from 0 to 60. A score of 16 or above may be interpreted as “at risk” of depression or in need of treatment (Radloff, 1977; Wells, Klerman, & Deykin, 1987).

Other studies have used the CES-D with college students. Daughtry and Kunkel (1993) reported a mean CES-D score of 16.70 in a sample of 78 undergraduate introductory psychology students. In a Canadian college student sample (N = 151), Santor, Zuroff, Cervantes, and Palacios (1995) found a mean CES-D score of 16.0 (SD = 12) for males and 18.0 (SD = 12.3) for females. In a study of 424 college students ages 16 to 19, the average score on the CES-D was 13.8, and 33% of students scored at 16 or above (Wells et al., 1987). The distribution of CES-D total scores was a skewed normal distribution with the long tail to the right (Wells et al.). Total CES-D scores in the college population were compared to adult community samples; mean scores ranged from 8 to 10, and prevalence rates of scores at 16 or above ranged from 14% to 22% in the adult samples. Because prevalence rates tend to be higher in the college population than in adult community samples, a cut-off score of 19 or above may be considered for use with college students (Wells et al.).

The CES-D has high internal consistency reliability of .85 in the general population and .90 in an inpatient sample (Radloff, 1977). Test-retest correlations are in the moderate range, between .45 and .70, and are generally larger for shorter intervals (Radloff, 1977). The CES-D correlated moderately with interviewer ratings of
depression, had good discriminant validity ratings between psychiatric inpatient and
general population sample, and discriminated moderately among levels of severity within
inpatient groups (Radloff, 1977). Good concurrent validity is demonstrated by
statistically significant correlations with the SCL-90 (.83) and the Hamilton rating scale
(.50 to .80). A factor analysis of the 20 items of the CES-D revealed four factors:
depressed affect, positive affect, somatic and retarded activity, and interpersonal
(Radloff, 1977). Shean and Baldwin (2008) found the CES-D produced satisfactory
levels of specificity and positive predictive value for current depressive symptoms in
college students.

_Additional Survey Questions_

Two questions were included at Time 1 and Time 2 of the data collection to
assess the nature of participant exercise, “Please select one response to the following
question: I get most of my exercise from…” and “Select all responses that apply to the
following question: I also get exercise from…” The response choices included physical
activity options available to students on campus (e.g., varsity team sports, club sports,
intramural sports, weight lifting/strength training, jogging, exercise classes, etc.). An
additional question, “Did you receive mental health treatment (e.g., psychological
counseling or psychotherapy) this semester?” was included at Time 2 to account for a
potential confound (i.e., a reduction in depressive symptoms due to the mental health
treatment rather than the increase in exercise). Finally, at Time 2, intervention
participants were asked if they read the email messages, how many email messages they
read (from 0 to 7), and how carefully they read the email messages (on a Likert-type
scale from 1 to 7).
Procedure

The University's Institutional Review Board (IRB) approved this study (see Appendix A). Thereafter, the University's Office of Decision Support sent an invitation to the University email account of all incoming first year students aged 18 years and older during the second week of the Fall 2009 semester. The email requested student participation and indicated that by participating, students were giving informed consent. Participants completed the LTEQ (Godin et al., 1986) and CES-D (Radloff, 1977) online. All collected data was stored on the University's server. A reminder follow-up email was sent the following week to students who did not complete the LTEQ and CES-D. This is considered the Time 1 data collection.

The Office of Decision Support collected demographic data (i.e., age, gender, race/ethnicity, major, if the student lived on campus or was a commuter, and if the student was from Greater Cincinnati) from the University Server. Participant groups were stratified by gender, ethnicity, and commuter status and then randomly assigned to the intervention or control condition. Participants in the intervention condition received seven weekly emails encouraging them to engage in physical activity. Participants in the control condition did not receive the emails.

The University's Office of Decision Support sent all students who completed the measures at the beginning of the semester an additional invitation email to complete the same measures two weeks before Thanksgiving break (i.e., the twelfth week of the semester). A reminder email was sent the following week to encourage students to participate. This is considered the Time 2 data collection.
Participation was voluntary and incentivized. Participants completing the first set of questionnaires were entered in a drawing for a chance to win one of two gift cards valued at $75 and $50. Intervention and control group participants who completed the measures at both data collection points were entered in another drawing for a chance to win one of two gift cards per group (i.e., two gift cards, valued at $85 and $65, per group). The winners of the drawing were sent an email and then received the gift card in the mail. The Office of Decision Support emailed all data to the researcher. Once the researcher received all the data (i.e., CES-D and LTEQ scores from Time 1 and Time 2), it was deleted from the University Server.

Materials

Informational and Motivational Email Intervention

Seven weekly intervention email messages were sent to participants in the intervention condition to encourage them to participate in physical activity. The intervention was based on previous research that focused on increasing physical activity (CDC, 2008; Cholewa & Irwin, 2008; Dishman et al., 2009; Ebben & Brudzynski, 2008; Green et al., 2007; Gyurcsik, Bray & Brittain, 2004; Petruzzello & Motl, 2006; Suminski & Petosa, 2006). The first email message informed participants that there would be six additional weekly emails and they could discontinue participation at any time by deleting the emails. Each email message began with a motivational introduction followed by a few tips to begin and maintain an exercise routine. Then, there was an “FYI,” including exercise related activities at the University’s Sports Center or on campus. At the end of each email, there was a summary of the exercise tips from previous weeks. The final
email provided tips on setting long-term fitness goals and long-term benefits of exercise (CDC; Suminski & Petosa). The intervention emails can be found in Appendix B.

Results

A 2 x 2, mixed between-within subjects analysis of variance (ANOVA) was conducted to test for differences in the total leisure activity score between the intervention and control groups (i.e., between factor), at Time 1 and Time 2 (i.e., within factor), as measured by the LTEQ. Three participants were excluded, due to missing data. There was no statistically significant difference in physical activity between the intervention and control groups, Wilks’ Lambda = .98, F(1, 130) = 2.60, p = .11. The group means and standard deviations are presented in Table 1.

Of participants in the intervention condition, 36% (n= 21) reported they read 0 to 2 of the emails, 41% (n= 24) reported they read 3 to 5 of the emails, and 22% (n= 13) reported they read 6 to 7 of the emails. In addition, when participants were asked how carefully they read the email messages on a Likert-type scale from 1, not at all, to 7, very carefully, 50% (n= 29) reported scores from 1 to 3, and 50% (n= 29) reported scores from 4 to 7. Two correlations were calculated to test for a relationship between the number of emails read and how carefully the participants read the emails, and participants’ score on the LTEQ. The correlation between the number of emails read and the LTEQ score at Time 2 was not statistically significant, r(58) = .05, p = .69. The correlation between how carefully the participants read the emails and the LTEQ score at Time 2 was also not statistically significant, r(58) = .04, p = .78.

A series of three mixed between-within subjects ANOVA’s were conducted to test for differences in depressive symptoms between the intervention and control groups
(i.e., between factor), at Time 1 and Time 2 (i.e., within factor), as measured by the CES-D. Participants with a CES-D score of three or below were excluded from this analysis because their initial scores were low enough that there would be little possibility of a reduction in their symptoms of depression. This cut-off score was based on the distribution of scores in the intervention and control groups (the bottom 5.2% and 7.8%, respectively). If a CES-D cut-off score of four had been established, then 10.3% of the intervention and 13.0% of the control condition participants would have been excluded. Three participants from the intervention condition and six participants from the control condition were excluded, resulting in 55 participants in the intervention and 71 in the control condition. The first 2 x 2, mixed between-within subjects ANOVA included participants who scored above the CES-D cut-off score and indicated they received mental health treatment during the semester. There was no statistically significant difference in symptoms of depression between the intervention and control groups, Wilks’ Lambda = 1.00, F (1, 124) = .10, p = .75. The group means and standard deviations are presented in Table 2.

In a meta-analysis, Conn (2010) found smaller effect sizes in studies in which participants were not clinically depressed as compared to studies in which participants were initially clinically depressed. Wells et al. (1987) found prevalence rates of depression to be higher in the college population than in adult community samples and therefore recommended using a cut-off score of 19 on the CES-D for the presence of clinically significant depression. Therefore, a follow-up, 2 x 2, mixed between-within subjects ANOVA, including only those participants who scored 19 or more on the CES-D at Time 1, was conducted to determine if the intervention was effective for participants
who were more depressed. There was no statistically significant difference in level of depression between the intervention and control groups (i.e., between factor) at Time 1 and Time 2 (i.e., within factor), Wilks’ Lambda = .98, $F(1, 33) = .61, p = .44$. The group means and standard deviations are presented in Table 3.

In a third mixed between-within subjects ANOVA, participants who reportedly received mental health treatment were removed from the sample, because their involvement in mental health treatment might have influenced their level of depression, representing a potential confound. Five participants in the intervention condition and four in the control condition reported involvement in mental health treatment. Additionally, one participant in the control condition did not answer this question and therefore was excluded. Hence, the intervention group included 50 participants and the control group included 66 participants. A 2 x 2, mixed between-within subjects ANOVA revealed no statistically significant difference in symptoms of depression between the intervention and control groups (i.e., between factor) at Time 1 and Time 2 (i.e., within factor), Wilks’ Lambda = 1.00, $F(1, 114) = .02, p = .89$. The group means and standard deviations are presented in Table 4.

Finally, those participants in the intervention condition who reported they did not read the intervention emails ($n = 13$) were separated from those who indicated that they did ($n = 37$). A secondary analysis compared the post-test mean CES-D score of the group who reportedly read the email messages and the group who did not, using an independent samples t-test. There was no statistically significant difference between the means for participants who reported they read the email messages ($M = 14.97$, $SD = 10.93$) and those who reported they did not ($M = 13.08$, $SD = 9.12$), $t(48) = .56, p = .25$. 


Correlations were calculated to assess the relationship between exercise frequency and intensity as measured by the LTEQ and depression symptoms as measured by the CES-D Scale, at the beginning and the end of the semester. There was not a statistically significant correlation between participant scores on the LTEQ and the CES-D at Time 1, $r(133) = .07, p = .44$, or Time 2, $r(134) = .01, p = .88$.

Discussion

The primary goal of the present study was to examine the effect of an email intervention on participant level of physical activity and symptoms of depression as compared to participants who did not receive the intervention, in a college student sample in which students did not initially meet criteria for MDD. There was no statistically significant difference in reported exercise frequency and intensity between the intervention and control groups, at the beginning and end of the semester. Although the intervention and control groups reported a numerical increase in exercise frequency and intensity over the course of the study, this increase was likely due to normal fluctuations of participant physical activity behaviors over the course of the semester. Mean scores on the LTEQ at Time 1 in this study are significantly greater than reported in a large normative sample of Canadian college students (Wilson et al., 2010), $t(2844) = 8.39, p < .001, \eta^2 = .02$. Therefore, it is possible that with a higher initial LTEQ score, participants in this study were already engaging in a sufficient amount of exercise and thus had little room to increase their exercise. On the other hand, mean scores on the LTEQ in this study are comparable to mean scores on the LTEQ with some college student samples (Giacobbi et al., 2005; Wilson & Muon, 2008).
The first finding in this study, that there was no significant increase in exercise in either control or intervention condition, is in contrast to previous research on exercise interventions. For example, Dishman et al. (2009) and Green et al. (2007) found significant increases in physical activity in their studies; however, the interventions in these studies were designed for use in the workplace. Also, the interventions were implemented in person rather than via the internet, and participants experienced encouragement from managers and co-workers (Dishman et al.; Green et al.). On the other hand, in a systematic review of the literature on using the internet as a tool to boost physical activity, van den Berg, Schoones and Vliet Vlieland (2007) found mixed results. Some studies showed increases in exercise among participants in an intervention condition as compared to those in a control condition, whereas others did not (van den Berg et al.). One of the researchers’ explanations for this discrepancy was differing levels of contact with the researcher. In the current study, it is possible that more frequent contact and/or more personal contact with the participants (i.e., face-to-face contact) could have resulted in an increase in exercise behavior. With more personal contact, the researcher may have a better opportunity to increase participants’ affective attitude (i.e., enjoyment of exercise) and instrumental attitude (i.e., benefits of exercise) in order to increase their intention to engage in physical activity (Theory of Planned Behavior; Glanz et al., 2002).

The second hypothesis of this study was also not supported. There was no difference in the level of depressive symptoms reported by the intervention and control groups, at the beginning (CES-D $M=13.78$, and $M=15.63$, respectively) and end of the semester (CES-D $M=15.47$, and $M=14.73$, respectively). The mean CES-D scores at
Time 1 are comparable to mean scores from previous research with a college student population (Rottinghaus, Jenkins & Jantzer, 2009), but lower than reported in a study by Baldwin and Shean (2006) who reported a mean score of 19.3 in 392 college students. A possible explanation for this result is that most participants were not initially clinically depressed. The mean level of depression in the current study was not statistically significantly different than that reported by Wells et al. (1987; \( M = 13.8, SD = 8.2 \), \( t(548) = 1.21, p = .23 \), who recommended using a cut-off score of 19 on the CES-D for the presence of clinically significant depression. Therefore, current participants had little room to reduce their depressive symptoms. This finding is consistent with a meta-analysis of physical activity interventions with depressive symptom outcomes by Conn (2010). The researcher found smaller effect sizes in studies in which participants were not clinically depressed as compared to studies in which participants were initially clinically depressed.

In addition, the third hypothesis of the current study was not supported. There was not a negative correlation between participant scores on the LTEQ and the CES-D at the beginning or end of the semester, as was predicted. This suggests that participants who reported higher levels of exercise, did not report fewer symptoms of depression. Moreover, because there was not a statistically significant increase in exercise in either condition, a statistically significant decrease in depressive symptoms would not be expected.

There are several possible explanations for why the hypotheses in the current study were not supported. For example, there were a large number of participants in the intervention condition who did not read the intervention emails, therefore limiting their
exposure to the intervention. Moreover, a large number who reported reading the emails, only read a few of them. In addition, it is possible that the study’s duration was too short for noticeable changes in exercise or depression to occur. Another explanation could be that the students in the intervention condition were bothered by the weekly emails and subsequently stopped reading them. Therefore, it is possible that they ignored the invitation emails to complete the second round of surveys, which may explain why a significantly larger number of participants from the intervention condition did not complete the Time 2 data collection as compared to the control condition.

Although most research indicates a positive relationship between exercise and mood, there are some exceptions. Brown and Blanton (2002) reported that women who participated in frequent moderate to vigorous physical activity were more likely to report suicidal behavior than inactive women; however, sports participation, which included intramural or extramural participation, was a protective factor for suicidal behavior. On the other hand, inactive men had a greater chance of reporting suicidal behavior than active men (Brown & Blanton, 2002). Thome and Espelage (2004) examined the possible moderating effect of disordered eating on the relationship between exercise and psychological health in college students. Results indicated that females who exercised and reported more pathological eating behaviors, showed higher levels of depression and anxiety; females who exercised and reported healthier eating behaviors, showed more positive affect. According to this study, females who exercise, but have disordered attitudes about eating, do not experience the same psychological benefits from exercise. It is possible that disordered eating could have had a moderating effect in the current study; hence, researchers might consider including this variable in the future. Ryan
(2008) found that physical activity is associated with decreases in depressive symptoms in undergraduates. However, when controlling for self-esteem and self-efficacy, the results indicated that the direct effect of physical activity on depressive symptoms was negligible. Levels of self-esteem and self-efficacy were not measured in the current study, but it is possible that these variables could have had a mediating effect. Future research could include measures of self-esteem and self-efficacy to further examine the effects that they have on the relationship between physical activity and depression.

Although the hypotheses of the current study were not supported, the results provide valuable information for the university in this study. According to the current sample, first year students at this university are already engaging in a greater amount of exercise as compared to previous college student samples, as measured by the LTEQ. Therefore, interventions could be tailored more toward a population that is already exercising, to increase and/or maintain current physical activity behaviors, in addition to interventions for those who may not already have an exercise routine established, which is in line with the Stages of Change model. In addition, increasing physical activity can be presented to students as a means to cope with depression and stress (i.e., a benefit of exercise, consistent with the Health Belief Model). Among participants in the current sample, first year students at this university reported average levels of depressive symptoms as compared to previous college student samples, as measured by the CES-D.

The results of the current study also provide valuable information for other colleges and universities. It is clear from previous research that exercise provides many physical and mental health benefits. Most prior research shows that exercise consistent with CDC recommendations is associated with lower levels of depression, and exercise
can be used as an intervention to decrease symptoms of depression. The discrepancy between prior research and the results of this study may be explained by the limitations of the study. The first limitation is a shorter length of the intervention (i.e., seven weeks). The weeks leading up to and during semester exams can be particularly stressful and can potentially cause a decrease in mood. Therefore, the researcher avoided collecting data during final examinations, which led to a shorter intervention period. According to a meta-analysis by Craft and Landers (1998), participants who were involved in an exercise program for 9 to 12 weeks showed significantly greater reductions in depression than those involved in an exercise intervention for eight weeks or less. Furthermore, according to a meta-analysis by North, McCullagh, and Tran (1990), studies that utilized exercise interventions lasting for 21 to 24 weeks reported larger effect sizes than interventions lasting less than 21 weeks or greater than 24 weeks. Hence, future research should focus on intervention programs that allow students more time to establish an exercise routine.

An additional limitation of the study is that many participants did not read the email intervention and the majority of participants who did, read five or fewer. Therefore, it is difficult to draw conclusions about the effectiveness of the content of the emails. In addition, it is apparent that the delivery of the intervention was not effective. There are several possible explanations about why the delivery was not effective; for example, participants did not check their email regularly or were annoyed by the frequency of the emails. Additionally, it is possible that the participants, experiencing independence for the first time, did not like the idea of being told what to do by a researcher with whom they had no personal contact. Also, there was an unexpectedly
high drop-out rate of participants from Time 1 to Time 2. A significantly greater number of participants in the intervention condition did not complete the survey at Time 2 compared to those in the control condition. Moreover, a significantly greater number of commuter students did not complete the survey at Time 2 compared to students who live on-campus. Future research could develop exercise interventions that are specifically tailored to commuter students.

According to a meta-analysis by Conn (2010), physical activity studies without supervision of the intervention and with random assignment of participants to intervention and control conditions, reported significantly smaller effect sizes (0.20) than studies without supervision and without random assignment (0.93). If participants self-selected to participate in an exercise intervention, greater increases in exercise might occur because they would be participating by choice rather than being randomly selected. Future research could study the effects of having some participants chose to participate in an intervention, whereas others are randomly assigned to participate in the intervention or control groups.

A final limitation of this study is that most participants were not initially clinically depressed. When using a general college student population that includes participants who may or may not be clinically depressed, it is possible that another measure of mood states or general mental health rather than a measure of specific clinical symptoms of depression would be more appropriate. Another measure may more easily detect an overall improvement in the participants’ mental health or well-being. In other words, rather than focusing on measuring a decrease in depressive or negative symptoms, the
focus could be more on increasing positive feelings, emotions, attitudes, self-esteem and self-confidence.

In conclusion, the current sample reported engaging in a healthy level of exercise on the LTEQ and an average level of depressive symptoms on the CES-D at the beginning of this study as compared to other college student samples (Rottinghaus et al, 2009; Wells et al, 1987). Future research could examine the effects of tailoring the intervention to individual participant needs based on his/ her initial report of exercise behavior and symptoms of depression, which is consistent with the Stages of Change approach to increasing motivation and commitment to behavior change. In addition, future research could examine the effects of more personal contact with the researcher which may increase the effectiveness of identifying the participants’ personal beliefs of the benefits and barriers to exercise, which is similar to the Health Behavior Model of behavior change. Future research could also focus on increasing affective and instrumental attitude toward exercise in line with the Theory of Planned Behavior. Finally, future research could encourage participants to establish personal exercise goals, identify exercise preferences, problem-solve barriers to exercise, increase exercise adherence, and plan for long-term exercise behavior which is consistent with the Social Cognitive Theory of behavior change. The combination of a more individualized intervention with more personal contact with the researcher could result in a successful intervention.
Table 1

LTEQ Means and Standard Deviations

<table>
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<tr>
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<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>57</td>
<td>72.56 (23.82)</td>
</tr>
<tr>
<td>Control Group</td>
<td>75</td>
<td>70.03 (24.33)</td>
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<tr>
<td>All participants</td>
<td>132</td>
<td>71.12 (24.05)</td>
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</table>
Table 2

*CES-D Means and Standard Deviations*

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>$M$ (SD)</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>55</td>
<td>13.78 (8.47)</td>
</tr>
<tr>
<td>Control Group</td>
<td>71</td>
<td>15.63 (9.45)</td>
</tr>
<tr>
<td>All participants</td>
<td>126</td>
<td>14.83 (9.05)</td>
</tr>
</tbody>
</table>
Table 3

*CES-D Means and Standard Deviations, using a cut-off CES-D score of 19 or above*

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>14</td>
<td>25.93 (5.81)</td>
</tr>
<tr>
<td>Control Group</td>
<td>21</td>
<td>27.90 (7.24)</td>
</tr>
<tr>
<td>All participants</td>
<td>35</td>
<td>27.11 (6.69)</td>
</tr>
</tbody>
</table>
Table 4

**CES-D Means and Standard Deviations, Excluding Participants Who Received Mental Health Treatment**

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>50</td>
<td>13.76 (8.72)</td>
</tr>
<tr>
<td>Control Group</td>
<td>66</td>
<td>15.70 (9.62)</td>
</tr>
<tr>
<td>All participants</td>
<td>116</td>
<td>14.86 (9.26)</td>
</tr>
</tbody>
</table>
References


Appendix A

IRB Approval Letter

August 21, 2009

Ms. Kristen Wilson
4361 Matson Avenue
Cincinnati, OH 45236

RE: IRB Protocol #0602: The Impact of an Informational and Motivational Email Intervention on Physical Activity and Depression in College Freshmen

Dear Ms. Wilson:

The IRB has received the requested modifications to the above referenced study, and appreciates your prompt and appropriate changes to the protocol. The Board finds that your response fully addresses the IRB’s request for clarification. Upon review, they have determined that your study as revised is approved under the Expedited category.

As you know, should you wish to further modify your study, it will be necessary to obtain IRB approval prior to implementing that modification. If any adverse events occur, please notify the IRB immediately. Approval expires August 21, 2010. A progress report, available at http://www.xavier.edu/irb/forms.cfm, is due by that date.

We wish you success with your study!

Sincerely,

[Signature]

Diane Miszczak
Secretary
On behalf of Assistant Chair, Institutional Review Board
Charles Grosman, Ph.D.

cc: Renee Zucchero, Ph.D.
Appendix B

Intervention Emails

Subject: Exercise Tips from Kristen Wilson

Email #1

Dear Xavier Student,

Thank you for participating in my research study! As you will recall, you completed a survey within the last few weeks. You were selected to receive weekly emails to encourage you to be physically active. This is the first email in a series of seven weekly emails that you will receive. We hope you find them beneficial! You have the option of opting out of this study at any time. If you decide that you do not want to participate, please delete emails you receive from us.

Oftentimes, people have a difficult time developing a regular exercise routine. Studies have shown that many people who exercised in high school, do not exercise in college. As a first-year college student in a time of transition, you may face some challenges in developing your own exercise habits. We hope to help you decrease these challenges and discover the benefits you personally experience from exercise.

Here are Kristen’s exercise tips of the week:

- Before beginning an exercise routine, you may consider setting some personal fitness goals. Think about your recent exercise habits. Are you happy with your exercise routine? We encourage you to set realistic goals based on what you are already doing or not doing. For example, if you are currently exercising once a week, you may want to set a goal to exercise two or three times a week. If you enjoyed a particular sport in high school, you might consider joining a related intramural activity here at Xavier.

- Studies have shown that people who log their physical activity are more likely to follow a consistent work-out routine. We strongly encourage you to use the attached goal and tracking sheet to write down your personal goals and log your weekly physical activity.

FYI: To find out what’s going on at O’Connor Sports Center, visit www.xavier.edu/recsports. There is a fitness link that lists all of the group exercise classes, schedules for the personal trainers (free to students!), contacts for the Club Sports programs, and dates for all of the intramural programming. Facility hours and monthly pool and gym calendars are posted there as well.
Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

Sources: (Cholewa & Irwin, 2008; Dishman et al., 2009; Petruzzello & Motl, 2006)

Email #2

Dear Xavier Student,

We hope you’ve started or enhanced your exercise routine! If not, we encourage you to start this week.
Here are Kristen’s exercise tips of the week:

- Try using a pedometer to track your daily steps and then increase the number of steps you take each day. A pedometer is a device that tracks the number of steps you take. The recommended number of steps each day is 10,000 or more. You can purchase a pedometer at a sporting goods store, such as Dick’s Sporting Goods, or Target for $25 or less.
- Find a work-out buddy to encourage you to stick to your exercise routine.
- The CDC (Centers for Disease Control and Prevention) recommends 2 hours and 30 minutes of moderate aerobic activity each week (i.e., brisk walking, biking on level ground, softball, volleyball) or 1 hour and 15 minutes of vigorous aerobic activity each week (i.e., jogging, soccer, basketball, swimming laps, biking faster than 10 mph). In addition, the CDC recommends that you strength train 2 days per week.
- If you’re not achieving the amount or intensity of exercise provided in these recommendations on a regular basis, we encourage you to set smaller weekly goals to work toward reaching the CDC recommendations.

FYI: Did you know that the facilities at O’Connor Sports Center include an indoor pool, a gymnasium, Hammer Strength room, Nautilus cardiovascular room, and racquetball/handball courts? Access to the facilities is free to students with your All Card. To find out what’s going on at O’Connor this week, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P. S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the last email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.

Sources: (Cholewa & Irwin, 2008; Dishman et al., 2009; Green et al., 2007; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #3

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some goals you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!
Here are Kristen’s exercise tips of the week:

- Incentives are a good way to keep you motivated to exercise. When you reach your goals, you may want to reward yourself. Some examples are spending time with friends, going to a movie, reading a book or magazine for pleasure, attending a fun activity on campus, or going on an off-campus outing.
- Some common benefits of exercise are stress relief, improved physical and mental health, enjoyment/pleasure, and increased fitness.
- Think about how exercise helps you and what motivates you to stay active.

FYI: Did you know that a variety of fitness classes are offered at the Sports Center, including ZUMBA, Turbo-Kick, spinning, and yoga? To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
P.S.
Tip 1: Remember to use the goal and tracking sheet that we sent with the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned last week? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps, and find a work-out buddy.

Sources: (Dishman et al., 2009; Ebben & Brudzynski, 2008)

Email #4

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some goals you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!
Here are Kristen’s exercise tips of the week:

- You may have discovered that there are barriers to exercise. Some commonly cited barriers among college students are: school workload being too great, stress due to exams, job demands, other campus activities/involvement, friends who are not physically active, lack of motivation, and lack of sleep.
- Here are some tips to overcoming common barriers.
- If you do not have a 30 minute block of time to exercise, try exercising for 10 minutes, 3 times during the day.
- Take a 10 minute, brisk walk as a study break to wake you up and clear your head.
- Use stairs rather than an elevator or walkway.
- Remember, exercise is good for your overall health and well-being! Make exercise part of your routine and build it into your schedule so that you feel the benefits of increased energy, reduced stress, and improved physical and mental health.

FYI: Did you know fitness trainers are available at the O’Connor Sports Center and are free to students with their All Card? Each person must complete a FREE assessment
which includes all mandatory paperwork, goal setting, and screening. Working with a
trainer is a great way to increase your motivation to exercise on a regular basis! To find
out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zuccher, Ph.D

P.S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the first email to stay
on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we
encourage you to set reasonable goals. Also, you may want to try using a pedometer to
track your daily steps, and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you
experience from exercise.

Sources: (Ebben & Brudzynski, 2008; Gyrcksik, Bray & Brittain, 2004;
http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #5

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some new
goals that you can achieve. Remember that some physical activity is better than none! If
you are meeting your goals, keep up the good work and keep pushing yourself!
Here are Kristen’s exercise tips of the week:

• Are you sleeping well? One benefit of physical activity is that it can
  enhance your quality sleep. In return, getting enough sleep is important to
  maintain and improve your physical fitness and performance. Try to get 7-9
  hours of sleep each night (as recommended by the CDC).
• If you’re having trouble falling asleep or getting enough sleep, try going to
  bed and waking up at the same time each day, only using your bed for
  sleeping (not reading or studying), avoid physical activity within a few
  hours before bed, and avoid large meals before bed.
- Getting enough sleep and developing an exercise routine require good time management skills. For tips on time management, visit Xavier’s Learning Assistance Center website at http://www.xavier.edu/lac/Time-Management.cfm.

FYI: Did you know that the registration deadline for the intramural basketball and volleyball tournament, floor hockey, and racquetball ladder is October 27th? If you don’t have a team but still want to play, you can fill out a free agent form. What a great way to meet new people and increase your level of activity! To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P. S.
Tip 1: Remember to use your goal and tracking sheet that I sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.
Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!

Sources: (http://www.cdc.gov/Features/Sleep/; http://www.xavier.edu/lac/Time-Management.cfm; Suminski & Petosa, 2006)

Email #6

Dear Xavier Student,
We hope you’re reaching your exercise goals! If not, you may want to set some new goals that you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!

Here are Kristen’s exercise tips of the week:

- If you’re having trouble sticking to an exercise routine, maybe you haven’t found something you enjoy. Try switching up the physical activities you engage in until you find something that motivates you to keep exercising. Try something new. Maybe you could join an intramural or club team or take exercise classes at the O’Connor Sports Center. Get some friends together for a pick-up basketball, ultimate Frisbee, soccer, or another game. You can do strength training in your dorm room by doing push-ups, sit-ups, wall-sits, free weights, etc. The important thing is to find your personal exercise preferences to increase your enjoyment level and motivation to keep exercising!
- If you haven’t been active in awhile, or can’t find something you enjoy, try walking around campus. There are plenty of hills and stairs to give you plenty of exercise! If you are experiencing barriers to exercise, figure out what is getting in the way and problem solve to get around those barriers.

FYI: Did you know that Xavier has a variety of club sports teams, from boxing to lacrosse, from rugby to ultimate frisbee? Joining a club sport is a great way to increase your commitment to exercising regularly and meet people who have a similar interest as you. To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Keep up the good work! Thanks again for your participation!
Look for another exercise tip this time next week.

Kristen Wilson, M.A.
Renee’ Zucchero, Ph.D

P.S.
Tip 1: Remember to use the goal and tracking sheet that we sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.
Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!
Tip 5: Remember to get 7-9 hours of sleep each night and use good time management skills!

Sources: (Suminski & Petosa, 2006; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)

Email #7

Dear Xavier Student,

We hope you’re reaching your exercise goals! If not, you may want to set some new goals that you can achieve. Remember, some physical activity is better than none! If you are meeting your goals, keep up the good work and keep pushing yourself!

This is the last week of Kristen’s exercise tips! We hope that you continue with your physical activity goals and set some long-term goals so your exercise routine will become part of your lifestyle. Studies show that physical activity behaviors developed in college are likely to be maintained after college, which makes the development of your fitness routine now that much more important!

- Set some long-term fitness goals to plan for long-term exercise, follow your progress, and reward yourself for reaching goals!
- When you reach your goals, try being active longer each time or being active more often. If you get bored, try new things.
- We’ve discussed a lot of the immediate benefits of exercise, but there are long-term benefits, too. When you are not physically active, you are more likely to get heart disease, type 2 diabetes, have high blood pressure and high blood cholesterol, and to have a stroke. What you do (or don’t do) today, tomorrow, or next week really can have a positive impact on your physical and overall health and well-being!

FYI: Did you know that the O’Connor Sports Center pool is a recreational pool geared toward lap swimmers and is available daily for usage? During the fall and winter, a dip in the pool can feel great and it is great exercise, too! To find out what’s going on at O’Connor, visit www.xavier.edu/recsports.

Thanks Again for Your Participation!
You will receive another email next week about completing the second survey for our study. Remember if you complete the survey, you will be entered into another drawing and winners will be randomly chosen to win an $85 and a $65 gift card.

Kristen Wilson, M.A.
Renee' Zucchero, Ph.D

P.S.
Tip 1: Remember to use your goal and tracking sheet that I sent in the first email to stay on top of your exercise routine. Attached is another tracking sheet for your convenience.
Tip 2: Are you meeting the CDC recommendations mentioned before? If not, we encourage you to set reasonable goals. Also, you may want to try using a pedometer to track your daily steps and find a work-out buddy.
Tip 3: Keep rewarding yourself when you reach your goals! Remember the benefits you experience from exercise.
Tip 4: To overcome barriers, try exercising in 10 minute blocks of time such as taking a study break to take a 10 minute brisk walk, and use stairs. Try and make exercise part of your routine to help improve your overall health and well-being!
Tip 5: Remember to get 7-9 hours of sleep each night and use good time management skills!
Tip 6: Find activities you enjoy. Identify your barriers to exercise. Problem solve to reduce the barriers.

Sources: (Suminski & Petosa 2006; http://www.cdc.gov/physicalactivity/everyone/getactive/index.html)
Email Attachment

Goal and Tracking Sheet

My fitness goal for the week of ____________________________

My long-term fitness goal: ________________________________

<table>
<thead>
<tr>
<th>What I did</th>
<th>Effort (vigorous, moderate, mild)</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>Total hours or minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. jogging</td>
<td>vigorous</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td>90</td>
</tr>
</tbody>
</table>

Total number of hours or minutes this week:

Adapted from CDC: Physical activity for everyone

http://www.cdc.gov/physicalactivity/everyone/getactive/index.html
Summary

Title: The Impact of an Informational and Motivational Email Intervention on Physical Activity and Depression in First Year College Students

Problem. Entering college is a significant transition and a time during which self-care behaviors change. Despite the physical and mental health benefits, many students do not engage in a sufficient amount of exercise (Bray & Born, 2004; Petruzzello & Motl, 2006). Whereas 66 percent of first year college students reported adequate amounts of physical activity in high school, only 44 percent reported adequate amounts of physical activity in the first two months of college (Petruzzello & Motl). Hence, students could benefit from developing and maintaining an exercise routine when beginning college. This routine might promote wellness and good self-care, reduce or prevent depressive symptoms, and increase energy and decrease levels of tension and stress. Recent research shows internet and email interventions may be an effective way to increase physical activity on college campuses by reaching a large number of students (Parrott et al., 2008; Suminski & Petosa, 2006). This study examined the effectiveness of an informational and motivational email intervention on first year college students’ level of physical activity and depression, as compared to a control group. In addition, this study examined the relationship between students’ physical activity behaviors and symptoms of depression.

Method. Volunteer participants for this study were first-year undergraduate students from a small, urban, Midwestern university. During the Time 1 data collection, of the
1,181 students who received the invitation email to participate, 256 participants completed the Leisure-Time Exercise Questionnaire (LTEQ) and Center for Epidemiologic Studies Depression Scale (CES-D), and answered a few additional questions that addressed the nature of participant physical activity (e.g., team sports, exercise classes, individual exercise, etc.) in the second week of the fall 2009 semester. This response rate of 21.7% was lower than expected.

Participant groups were stratified based on gender, ethnicity, campus residency status (i.e., resident or commuter), and geographical area of their home (i.e., Greater Cincinnati or not) and randomly assigned to the email intervention or control condition. Participants in the intervention condition received seven weekly emails encouraging them to engage in physical activity (based on research by Centers for Disease Control and Prevention [CDC], 2008; Cholewa & Irwin, 2008; Dishman et al., 2009; Ebben & Brudzynski, 2008; Green et al., 2007; Gyracsik, Bray & Brittain, 2004; Petruzzello & Motl, 2006; Suminski & Petosa, 2006), whereas those in the control condition did not receive the emails. In the twelfth week of the semester, all students who completed the Time 1 assessment were invited to complete the Time 2 assessment. This assessment included the same measures and questions as the Time 1 assessment, plus an additional question that addressed whether or not the participants received mental health treatment (e.g., psychological counseling or psychotherapy) during the semester. Intervention participants were also asked at Time 2 if they read the email messages, how many email messages they read (from 0 to 7), and how carefully they read the email messages (on a Likert-type scale from 1 to 7).
The final sample at Time 2 included 135 participants; 58 participants in the intervention condition (i.e., a drop-out rate of 54.0%) and 77 in the control condition (i.e., a drop-out rate 39.8%). A Chi-square test for independence indicated a significant association between condition (i.e., control and intervention) and participation status (i.e., dropped out and continued participation), $\chi^2(1, n = 254) = 5.09, p = .02, \phi = -.14$, indicating a small effect size (Cohen, 1988). The mean age of participants was 18.14 years ($SD = 0.37$); 71.1% of participants were female ($n = 96$) and 28.9% of participants were male ($n = 39$). The majority (93.3%) of participants were Caucasian ($n = 126$), 1.5% were African American ($n = 2$), 2.2% were Asian or Pacific Islander ($n = 3$), and 3.0% were Hispanic ($n = 4$). In addition, the majority of participants lived in on-campus ($n = 129$); the remaining participants were commuter students ($n = 6$).

*Findings.* A $2 \times 2$, mixed between-within subjects ANOVA did not yield a significant difference in exercise frequency and intensity between the intervention and control groups (i.e., between factor), at Time 1 and Time 2 (i.e., within factor), as measured by the LTEQ. An independent-samples $t$-test compared the frequency and intensity of exercise of the group of participants in the intervention condition who reported they read the email messages ($n = 40$) to the group who did not read the email messages ($n = 17$) at Time 2; this analysis did not yield a significant difference. Two, $2 \times 2$ mixed between-within subjects ANOVA's were conducted to test for differences in depressive symptoms between the intervention and control groups (i.e., between factor) at Time 1 and Time 2 (i.e., within factor), as measured by the CES-D; neither yielded a statistically significant
difference. An additional 2 x 2 mixed between-within subjects ANOVA was conducted including only those participants who scored 19 or more on the CES-D at Time 1 to determine if the intervention was effective for participants who were more depressed. This analysis also did not yield a statistically significant difference in the level of depression between the intervention and control groups (i.e., between factor) at Time 1 and Time 2 (i.e., within factor). Correlations were calculated to assess the relationship between exercise frequency and intensity as measured by the LTEQ and depression symptoms as measured by the CES-D Scale, at the beginning and the end of the semester; neither yielded a statistically significant correlation between participant scores.

*Implications.* It is clear from previous research that exercise provides many physical and mental health benefits. In this study, there was no significant difference in the reported exercise frequency and intensity or symptoms of depression between the intervention and control groups, from the beginning to the end of the semester. Mean scores on the LTEQ in this study were statistically significantly greater than reported in a study with a large normative sample of Canadian college students (Wilson et al., 2010), \( t(2844) = 8.39, p < .001, \eta^2 = .02 \), and comparable to mean scores on the LTEQ with other college student samples (Giacobbi et al., 2005; Wilson & Muon, 2008). In addition, mean CES-D scores in this study are comparable to mean scores from previous research with a college student population (Rottinghaus, Jenkins & Jantzer, 2009; Wells et al., 1987), but lower than reported in a study by Baldwin and Shean (2006). Hence, at the beginning of the study, participants reported engaging in a healthy amount of exercise and experiencing an average level of depression, compared to other college student samples.
Future research could examine the effects of tailoring the intervention to individual participant needs which is consistent with the Stages of Change approach to increasing motivation and commitment to behavior change. In addition, future research could examine the effects of more personal contact with the researcher which may increase the effectiveness of identifying the participants’ personal beliefs of the benefits and barriers to exercise, similar to the Health Behavior Model of behavior change. Future research could also focus on increasing affective and instrumental attitude toward exercise, as indicated by the Theory of Planned Behavior. Finally, future research could encourage participants to establish personal exercise goals, identify exercise preferences, problem-solve barriers to exercise, increase exercise adherence, and plan for long-term exercise behavior which is congruent with the Social Cognitive Theory of behavior change. The combination of a more individualized intervention with more personal contact with the researcher could result in a successful intervention.