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I, Jessica J Black, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Psychology.

It is entitled:
Motivation for Change and Depression: An Examination of Factors Related to Weight Loss Outcomes for Overweight Adolescent Girls with Polycystic Ovary Syndrome

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Committee member: Dana Rofey, PhD
Committee member: Steven Howe, PhD

UNIVERSITY OF CINCINNATI

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Motivation for Change and Depression: An Examination of Factors Related to Weight Loss Outcomes for Overweight Adolescent Girls with Polycystic Ovary Syndrome

A dissertation proposal submitted to the
Division of Graduate Education and Research
at the University of Cincinnati
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY
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2013
by
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Abstract

To enhance the understanding of the role adolescent depression plays between motivation for positive health behavior changes and successful implementation of changes, the current study examined both parent and child self-report of the severity of adolescent depressive symptoms and clinician diagnosed major depressive disorder (MDD) as potential moderators between parent and adolescent readiness to change weight related behaviors at baseline and implemented adolescent behavior change at treatment completion and follow-up. Participants were overweight adolescent girls with an endocrine disorder participating in a psychosocial treatment study (n = 115). Results indicated that parent and child baseline readiness to change positively predicts adolescent change in weight related behaviors from baseline to both treatment completion and follow-up. Moderation analyses revealed that adolescent depression did not affect the relationship between parent and adolescent baseline self-reported stage of change and adolescent change in weight related behaviors from pre- to post-treatment. Findings suggest that among overweight adolescents, parent and child readiness to change at the beginning of treatment is central to positive health behavior changes even withstanding depressive symptoms.
Acknowledgements

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Chapter 1

Introduction

Over the past four decades, childhood obesity rates have quadrupled for children ages 6-11 and have tripled for adolescents ages 12-to-19 (Institute of Medicine, 2007). Approximately 17% of U.S. children 2-19-years-old are classified as obese (Center for Disease Control (CDC), 2011), and within some ethnic groups the rate is as high as 25% (Ogden, Lamb, Carroll & Flegal, 2010). This epidemic persists despite over half of U.S. states receiving CDC funding to address childhood obesity (CDC, 2011) and mandates such as the requirement to display nutritional facts at restaurants (Institute of Medicine, 2007). A possible reason that state and federal actions have not substantially impacted the childhood obesity epidemic may be that these efforts fail to target variables associated with childhood obesity and with weight management intervention outcomes. Identification of associated factors is critical to improving preventative and treatment practices among this young, high-risk population.

Within the field of health behaviors, motivation for change has been a variable found to be related to optimizing intervention success. Rooted in the alcohol field, readiness for change was originally conceptualized as a black-or-white event precipitated by a person hitting rock bottom. In contrast, DiClemente and colleagues (1990; 2009) proposed that readiness to initiate treatment is a more fluid process than hitting one’s lowest point and is influenced by various factors such as attitudes, intentions, and expectancies (Bandura, 2004; Fishbein, 2008). These factors converge to result in a person’s readiness to change, or stage of change: a concept of the Transtheoretical or Stages of Change model used for research and treatment purposes (Connors, Donovan, & DiClemente, 2001). While the number of stages within the model varies, there are five commonly accepted stages of the model: pre-contemplation, contemplation, preparation
(sometimes combined with contemplation), action and maintenance. See Figure 1 for a more detailed description. A person may skip a stage, repeat a stage, overlap with a stage or regress back to a previous stage. These stages are meant to be used as a conceptual basis to understand where a person currently is in their readiness to change in order to incorporate appropriate strategies for treatment.

A person’s stage of change or motivation for change has been found to be an important indicator of behavior modification across the health psychology literature (Castro-Fornieles et al., 2007; Hofkamp & Burns, 2008), with a recent emphasis on weight management (Hickson, Macqueen & Frost, 2009). In support of motivation for change in a pediatric population, Lawman and colleagues (2011) reported results from a trial on a school-based physical activity program for underprivileged sixth graders. Lawman et al. (2001) found that there was an effect of motivation for change and self-efficacy on moderate physical activity for girls and a trend for boys. Due to the nature of the study, these youths were not necessarily overweight or seeking weight management services (Lawman, Wilson, Van Horn, Resnicow & Kitzman-Ulrich, 2011). Among overweight youth with depressive symptoms presenting to a clinical outpatient center, our group (Jakubowski et al., 2011) found preliminary results that indicate parents’ reported stage of change at baseline predicted youth’s reduction in body mass index (BMI). On the other hand adolescents’ stage of change at baseline was not predictive of positive change (Jakubowski et al., 2011) indicating that parents’ motivation is essential to youth’s weight management outcomes.

In addition to examining motivation as a predictor, there may be other important variables related to the strength or direction of the relationship between motivation for change and intervention outcomes. For example, research indicates that increased weight is correlated
with depressive symptoms especially during early adolescence (Franko, Striegel-Moore, Thompson, Schreiber & Daniels, 2005; Goodman & Whitaker, 2002). The relationship between depression and obesity appears to be particularly strong among youth seeking treatment (Britz et al., 2000; Erermis, Cetis, Tamar, Bukusoglu, Akdeniz & Goksen, 2004; Vlierberghe, Braet, Goossens & Mels, 2009). Evidence is mixed on whether obesity predicts depression (Merten, Wickrama & Williams, 2008; Pott, Albayrak, Hebebrand & Pauli-Pott, 2010), or depression leads to obesity (Rofey et al., 2009). The current method of diagnosing depression is categorical (American Psychiatric Association, 2000); however, it is important to note there is more recent evidence that depression among children and adolescents may be better viewed on a continuum (Hankin, Fraley, Lahey & Waldman, 2005). Consequently, varying methods of assessing depression may contribute to the entanglement of extant directional findings. Another contributor to mixed research findings may be discrepancies between information sources; parent and child reports of depressive symptoms often differ (Grills & Ollendick, 2003; Lewis et al., 2012). Regardless of the direction or assessment method, depression appears to be an important variable related to childhood weight; and, while current research trials often exclude youth with current comorbid psychiatric disorders, it may be more beneficial to examine these disorders concurrently. In fact, evidence is beginning to accumulate that interventions that target weight loss among depressed youth are efficacious (Rofey, Szigethy, Noll, Dahl, Iobst & Arslanian, 2009).

**Current Study**

Exploration of factors that predict these intervention outcomes can facilitate development of more efficacious treatments. There is preliminary evidence to suggest that parental motivation is one such predictor of adolescent weight loss (Jakubowski et al., 2012). This study first aims to
further examine whether reported stage of change at baseline predicts not only change in BMI but change in weight related behaviors from pre- to post-treatment (e.g. increase in fruits and vegetables) with a larger sample of overweight adolescents with depressive symptoms participating in a structured treatment research study. Exploring underlying processes that affect the relationship between predictor and outcome variables may optimize treatment success.

Understanding these processes can help answer important clinical questions such as “When do psychiatric symptoms affect the relationship between reported stage of change and implemented change, e.g. change in diet?” There is empirical support for examining depression as an underlying process among overweight treatment seeking youth. This is logical not only because of the high rate of comorbidity (Britz et al., 2000), but also because of the evidence that depression negatively affects weight loss outcomes (Pagoto, Bodenlos, Kantor, Gitkind, Curtin & Ma, 2007) and motivation for other types of behavior change (Blume, Schmaling & Marlatt, 2003). Therefore, given all adolescents in our sample report some depressive symptoms, a second aim is to investigate whether adolescent depression serves as a potential moderator (a variable affecting the strength or direction) between parent and adolescent self-reported stage of change and adolescent change in weight related behaviors from pre- to post-treatment.

Based on our lab’s previous preliminary findings (Jakubowski et al., 2012) that motivation is predictive of positive behavior change and on evidence that severity of depression may be a particularly salient factor (Hankin et al., 2005), the following five hypotheses will be tested:

*Hypothesis 1.* Adolescents’ self-reported stage of change at post-treatment (3 months) and follow-up (6 months) will increase from self-reported stage of change at baseline.
Hypothesis 2. Parents’ self-reported stage of change at baseline will predict adolescent change in weight-related behaviors from baseline to post-treatment (3 months) and follow-up (6 months).

Hypothesis 3. Adolescent diagnosis of major depressive disorder (MDD) will not moderate the relationship between parental stage of change at baseline or adolescent stage of change at baseline and adolescent change in weight related behaviors from pre- to post-treatment (3 months) and follow-up (6 months).

Hypothesis 4. Adolescent’s report of higher severity of adolescent depression will moderate the relationship between baseline adolescent stage of change and change in adolescent weight related behaviors from pre- to post-treatment (3 months) and follow-up (6 months).

Hypothesis 5. Parent’s report of higher severity of adolescent depression will moderate the relationship between parental stage of change at baseline and change in adolescent weight related behaviors from pre- to post-treatment (3 months) and follow-up (6 months).
Chapter 2

Method

Participants

Participants were 115 overweight, English speaking adolescent girls ages 12-21 (mean age = 15.52, mean BMI > 85 percentile, 75% white, 19.1% black or African American, 5.9% other) who were primarily recruited to participate in a psychosocial treatment study while seeking services through the Polycystic Ovary Syndrome Center at an urban Mid-Atlantic Children’s hospital. Occasionally, adolescents or their parents contacted the research study directly after seeing a flyer posted at the affiliated University or a local fitness center, or after learning about the intervention program through word of mouth. All participants had a confirmed diagnosis of polycystic ovary syndrome (PCOS) by a board-certified endocrinologist based on clinical and laboratory evidence of hyperandrogenism. Participants received the interventions free of charge and were financially compensated at each assessment time point for completing research forms. If participants were under age 18 then they provided verbal assent and their parental guardian provided written informed consent, if participants were ≥ age 18 then they provided written informed consent. This study was approved by the local Institutional Review Board and participants were treated in accordance with APA ethical guidelines (American Psychological Association, 2002).

All participants endorsed ≥ 10 on the Children’s Depression Inventory (CDI; Kovacs, 1992) and frequently met Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) criteria for minor or major depressive disorder (American Psychiatric Association, 2000). Adolescents were excluded on the basis of a bipolar or psychotic disorder diagnosis, having taken antidepressant medication within the past three weeks, having suicidal or homicidal plan
which necessitated immediate psychiatric hospitalization, and currently receiving empirically validated psychotherapy from another provider. If they were willing to discontinue treatment with their current therapists then they were included in the study.

Procedure

Screening. Researchers administered a two-step screening process. First, adolescents whose CDI score ≥ 10 were invited to participate in the second step of the screening process, a semi-structured interview (see Measures). This CDI cut-off score was chosen to be consistent with the usual cut-off scores for depressive symptoms in other physically ill populations (Szigethy et al., 2004, 2005, 2006). Any participants that chose not to participate or to drop-out of the treatment study were referred for a psychiatric evaluation through the affiliated University’s psychiatric hospital.

Study intervention. The one-on-one intervention primarily consisted of cognitive behavioral therapy and consisted of 4 weekly sessions, 4 bi-weekly sessions and 3 monthly booster sessions. During adolescent sessions 1, 4, and 8, parents were invited to also participate in separate, parent one-on-one sessions. Study interventionists were trained Master and Ph.D. level clinicians with backgrounds in nutrition and exercise physiology. Endocrinologists, nutritionists, and exercise physiologists also served on study staff and had input into session content.

Measures

Participants completed a battery of self-report measures at pre-treatment and post-treatment (3 months) and follow-up (6 months). This self-report assessment also included an investigator-designed demographics questionnaire used in prior published studies (Rofey et al., 2009). These measures included those used for outcome and moderator assessment.
Self-report of depression. Pertinent to the current study, participants completed the Children’s Depression Inventory (CDI; Kovacs, 1992) which is a commonly used measure across various settings to assess childhood depressive symptomatology. This 27-item scale is designed to assess depressive symptoms over the past 2 weeks with participants endorsing one of three sentence choices per item (ranging from 0-2 points). The CDI displays good psychometric properties including sufficient reliability and validity (Ialongo, Edelsohn & Kellam, 2001).

Research supports that psychometric properties of the CDI remain adequate with updated iterations of the DSM and, in clinical settings a cutoff score of 13 is predictive of a depressive disorder (Timbremont, Braet & Dreessen, 2004). In the current study, the investigators utilized a cut-off of 10 that warrants a subsequent step, using a semi-structured clinical interview to attain a DSM diagnosis (Li et al., 2007; Goossens, Braet, Vlierberghe & Mels, 2009). Additionally, this procedure has been used to reliably diagnose depression in other medically ill patients (Engstrom, 1992; Pavuluri & Birmaher, 2004). Participants were not excluded on the basis of a prior history of depression or endorsement of items consistent with high levels of current depression.

Semi-structured interview for depression. In order to better confirm depressive symptoms and to rule out bipolar disorder or a psychotic disorder, adolescents that meet initial criteria for the study (≥ 10 score on CDI; diagnosis of PCOS) were interviewed pre-treatment using the The Kiddie Schedule for Affective Disorders and Schizophrenia for -Present and Lifetime version (KSADS), a widely used semi-structured interview for assessing psychiatric disorders in youth according to the DSM-IV criteria (Kaufman, Birmaher, Brent, & Rao, 1997; Puig-Antich, Orvalschel, Tabrizi, & Chambers, 1980). The KSADS demonstrates good inter-rater and test, re-
test reliability as well as convergent and discriminant validity (Chambers et al., 1985; Gammon et al., 1983; Kaslow et al., 1997).

Stage of change. Both parents and adolescents completed the *Weight Loss Behavior Stage of Change Scale* (WLB-SOC; Sutton, Logue, Jarjoura, Baughman, Smuker & Capers, 2003) which aims to assess dietary and exercise stage of change in order to better individually tailor weight loss programs. For the majority of the 39-items, participants endorse whether or not they currently engage in a behavior and for how long they have engaged in that behavior (within the last 6 months or longer); or, if they plan to initiate the behavior within the next month, within the next six months or if they have no plans to initiate behavior change. The last item of the measure clearly defines exercise and evaluates exercise practices or plans to initiate exercise. The WLB-SOC displays good psychometric properties (Sutton et al., 2003). In the current study, the total baseline WLB-SOC score was used as the predictor variable (proxy of stage of change/readiness for change); and, the total change score from baseline to post-treatment (3-months and 6-months) was used as the outcome variable to assess change in weight-related behaviors over the course of the intervention.

Data Analysis

The analyses to test the hypothesized effects are *a priori* secondary analyses of data from a psychosocial weight management intervention study (Rofey et al., 2009). The models to be presented were first run with interaction terms included. However, because there were no expectations that these models would have been moderated, the analytic strategy was to present in detail the unmoderated models unless there was significant evidence of moderation. To address the effect of missing data, multiple imputation (five iterations) was used, with the missing data estimated using expectation maximization on each imputation. Each study
hypothesis was evaluated using SAS PROC MIXED. Analyses were run twice, once on the non-imputed data set and then again multiple times on the imputed data set. For the latter results, SAS PROC MIANALYZE was used to combine the results from the multiple imputations into one set of results.
Chapter 3

Results

It is not surprising that there is missing data among this clinical sample as it’s comprised adolescents with comorbid physical and psychiatric disorders participating in an 8-session (11 sessions with boosters) behavioral intervention. To gain a better understanding of the patterns of missing data, frequencies were run on the main study variables, see Table 1. Examination of missing data patterns indicate the data was missing at random (MAR), a term coined in a series of publications by Rubin (1976) meaning that the reason for missing data is not dependent on the missing data itself (see also Meng, 2006), see Figure 2.

Table 1

<table>
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<th>Variable</th>
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<td>1. adolescent baseline stage of change</td>
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<tr>
<td>2. parent baseline stage of change</td>
<td>48</td>
</tr>
<tr>
<td>3. adolescent major depressive disorder</td>
<td>40</td>
</tr>
<tr>
<td>4. adolescent reported CDI</td>
<td>7</td>
</tr>
<tr>
<td>5. parent report of adolescent CDI</td>
<td>12</td>
</tr>
<tr>
<td>6. treatment completion stage of change</td>
<td>51</td>
</tr>
<tr>
<td>7. follow-up stage of change</td>
<td>57</td>
</tr>
</tbody>
</table>
Figure 2. Flow of participants through each stage of intervention.
Given that 40% of the total data was missing, it was necessary to run analyses with and without data imputation. A series of 5 multiple imputations were run. Then, expectation maximization (EM) was employed for each imputation, using only variables needed in any of the planned analyses (i.e., no covariates were used for the EM imputation). EM takes into consideration the predicted value and random error term to account for potential variability among regression results with varying imputations. It also adjusts the imputed data so it maintains the same covariance structure as the original dataset. Imputation did not alter the results. Therefore, all results presented are based on analyses conducted on the data without imputation. To facilitate a basic understanding of the variable interrelationships, Pearson bivariate correlations were computed among the hypothesized predictor and dependent variables for the total sample, see Table 2. Study hypotheses were then examined through a series of randomized regression analyses using the SAS PROC MIXED procedure, a form of generalized linear mixed modeling.

Table 2

<table>
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<tr>
<th>Variable</th>
<th>1</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>M</th>
<th>SD</th>
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<td></td>
<td></td>
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<td></td>
<td>10.45</td>
<td>3.13</td>
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<td>2. parent baseline stage of change</td>
<td>.19</td>
<td>---</td>
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<td></td>
<td></td>
<td></td>
<td>11.45</td>
<td>3.35</td>
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<td>3. adolescent major depressive disorder</td>
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<td>4. adolescent reported CDI</td>
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<td>-.15</td>
<td>.34</td>
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<td>13.55</td>
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<td>5. parent report of adolescent CDI</td>
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<td>-.09</td>
<td>.19</td>
<td>.39</td>
<td>---</td>
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<td>18.11</td>
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<td>6. treatment completion stage of change</td>
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<td>.36</td>
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<td>-.10</td>
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<td>7. follow-up stage of change</td>
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<td>.66</td>
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<td>12.29</td>
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Note: treatment completion = session 8; follow-up = booster session 3

**Hypothesis 1.** The first hypothesis is that adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC) will increase from adolescent baseline stage of change (BSOC). Results confirm this hypothesis as the mean SOC increased from 10.45 at baseline to 12.23 at completion and 12.29 at follow-up. As shown in Table 1, the correlation
between BSOC and TCSOC was .54 and between BSOC and FSOC it was .70. A randomized regression model with up to two (TC and F) observations per subject, depending on whether any data were missing, was first used to test the effects of BSOC, Time (TC versus F), and a BSOC-Time interaction on SOC scores. This first model revealed that the interaction term was not significant, F(1,33) = 0.66, p = .42, meaning that there is no evidence that the correlation between BSOC and TC is different from the correlation between BSOC and FU. This model had an AICC value of 460.9. Dropping the interaction term reduced the AICC value to 459.2, suggesting that the reduced model is to be preferred. The final model showed that there is a significant correlation between BSOC and later SOC measurements, b = .69, SE = .11, t(34) = 6.48, p < .01, again supporting the first hypothesis. Mean SOC did not change from treatment completion to follow-up, b = -.68, df = 34, t = -1.71, p = .10. Based on the multiple imputations, none of these conclusions changed.

Hypothesis 2. The second hypothesis is that parent baseline stage of change (PBSOC) will predict adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC). The correlation between PBSOC and TCSOC was .36 and between PBSOC and FSOC was .49, see Table 1. A randomized regression model with up to two (TC and F) observations per subject, depending on whether any data were missing, was first used to test the effects of PBSOC, Time (TC versus F), and a PBSOC-Time interaction on SOC scores. The interaction term was not significant, F(1,31) = 0.34, p = .56. Therefore, evidence does not support the correlation between PBSOC and TC is different from the correlation between PBSOC and FU. Removing the interaction term from the model reduced the AICC from 443.7 to 441.7. Therefore, the second model has the advantage of better fit. This unmoderated model revealed a significant correlation between PBSOC and later SOC measurements, b = .37, SE = .11, t(32) =
3.27, p < .01. Mean SOC did not change from treatment completion to follow-up, b = -.68, SE = .43, t(32) = -1.56, p = .13. Based on the multiple imputations, none of these conclusions changed. Therefore, the second hypothesis was confirmed.

The knowledge that neither child nor parental state of change at baseline interactions with child state of change ratings at treatment conclusion or at follow-up led to the decision to not include a Time x Baseline state of change interaction term in testing hypotheses 3 and 4.

**Hypothesis 3.** The third hypothesis is that adolescent diagnosis of major depressive disorder (MDD) will not moderate the relationship between adolescent baseline stage of change at baseline (BSOC) and adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC). Additionally, it was hypothesized that adolescent MDD will not moderate the relationship between parent baseline stage of change (PBSOC) and adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC). As shown in Table 1, the correlation between BSOC and MDD was .01 and between PBSOC and MDD it was -.03. The correlation between MDD and TSOC was -.35 and between MDD and FU it was -.22. A randomized regression model was used to test the effects of childhood state of change, MDD and a BSOC-MDD interaction on SOC scores. The correlation between MDD and later SOC measurements was not significant, b = 3.02, SE = 2.54, t(34) = 1.19, p = .24. Results revealed that the interaction between BSOC and MDD was not significant, F (1, 34) = 0.23, p = .63. MDD was not shown to moderate the relationship between BSOC and post-treatment stage of change.

Next, a randomized regression model was used to test the effects of PBSOC, MDD and the PBSOC-MDD interaction on SOC scores. The correlation between MDD and later SOC scores was not significant, b = -1.09, SE = 2.87, t(32) = -1.35, p = .71. The interaction term was also not significant, F (1,32) = 1.17, p = .29, meaning MDD did not moderate the relationship
between PBSOC and later adolescent stage of change. These conclusions did not change as a result of multiple imputations. Therefore, the third hypothesis was supported.

_Hypothesis 4._ The fourth hypothesis is that higher severity of depression based on adolescent self-report (CCDI) will moderate the relationship between adolescent baseline stage of change (BSOC) and adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC). As displayed in Table 1, the correlation between CCDI and BSOC was -.21 and the between. The correlation between CCDI and TSOC was -.19 and between CCDI and FSOC it was .10, see Table 1. A randomized regression model was employed to examine the effects of CBSOC, CCDI and a BSOC-CCDI interaction on later SOC scores. The model revealed that the interaction between BSOC and CCDI was not significant $F(1,33) = 0.02, p = .88$ suggesting the interaction between BSOC and CCDI does not affect later SOC. The AICC for this model was 451.6. Dropping the interaction term reduced the AICC value to 445.5, a better penalized-fit. The final model did not show a main effect for CCDI, $b = -0.03, SE = .05, t(33) = -0.67, p = .50$. Results do not support the hypothesis.

_Hypothesis 5._ The fifth hypothesis is that parent’s report of higher severity of adolescent depression (PCDI) will moderate the relationship between parent baseline stage of change (PBSOC) and adolescent’s stage of change at treatment completion (TCSOC) and follow-up (FSOC). The correlation between PCDI and PBSOC was -.09; between PCDI and TSOC it was -.10; and, between PCDI and FSOC it was -.01, see Table 1. The effects of PBSOC, PCDI and a PBSOC-PCDI interaction on later SOC was examined through a randomized regression model. Results indicate no significant interaction $F (1, 32) = 1.46, p = .24$ with an AICC value of 442.5. This model suggests that PCDI does not moderate the relationship between PBSOC and later adolescent SOC. After dropping the interaction term from the model the AICC value decreased.
to 437.3. However, there was no main effect for PCDI on later SOC scores, $b = 0.003$, $SE = .05$, $t(32) = 0.05$, $p = .96$. These results do not support our hypothesis that the interaction between PBSOC and PCDI affect later adolescent stage of change scores.
Chapter 4

Discussion

Childhood obesity is recognized as a serious health concern and has been the focus of national prevention and intervention efforts. Investigating specific variables associated with childhood obesity and weight management intervention outcomes may shed light on the persistence of pediatric obesity despite widespread efforts. One such relevant variable may be motivation for lifestyle change as motivation has extensive empirical support as a predictor of change within the general health psychology literature. Recent evidence demonstrates that readiness to change is also an important predictor of treatment outcomes in an overweight youth population. Second, depression may also be vital to examine as depression is prevalent among overweight youth and known to negatively affect general motivation. There is some evidence that shows positive treatment outcomes in interventions that target youth with comorbid obesity and depression (Rofey, Szigethy, Noll, Dahl, Iobst & Arslanian, 2009). Therefore this study had two primary aims: 1) examine the association between readiness for change at baseline and realized change at treatment completion and follow-up and, 2) examine whether adolescent depression affects this relationship among overweight treatment seeking youth. Both parent and adolescent self-report of adolescent’s depression symptoms and clinician diagnosed major depressive disorder (MDD) were examined as potential conditions under which the relationship may be affected (MacKinnon & Luecken, 2008).

Study Findings

Adolescent stage of change increased from baseline to post-treatment (treatment completion and follow-up). As would be statistically expected, there was a significant correlation between adolescent baseline stage of change and adolescent’s later stage of change.
There was no difference between mean readiness to change at treatment completion (session 8) and follow-up (booster session 3). The correlation between stage of change at baseline and session 8 and, between baseline and booster session 3 was also not significantly different. In other words, there was not a meaningful difference between the two post-treatment time points.

As far as parent’s role in adolescent’s realized behavior change post-treatment, parent’s self-reported readiness to change at baseline positively predicted adolescents’ reported change in weight related behaviors from baseline to post-treatment.

The second primary aim of the study was to examine the role of adolescent depression as a potential moderator or a variable that affects the strength or direction between baseline stage of change (parent and child) and adolescent’s change in weight related behaviors from baseline to post-treatment. First, self-report of depressive symptoms was examined as a proxy of severity of depressive symptoms. This was done as recent research suggests that youth depression is more accurately represented on a continuum (Hankin et al., 2005; see also Richey et al., 2009). Both parent and adolescent self-report of adolescent depressive symptoms were explored as potential moderators as evidence supports a discrepancy between parent and child report of psychiatric symptoms with parents typically endorsing higher levels of externalizing depressive symptoms in youth (Grills & Ollendick, 2003; Lewis et al., 2012). Neither parent nor adolescent self-report of adolescent’s depressive symptoms affected the relationship between baseline readiness to change and change from baseline to post-treatment in weight related behaviors. Therefore, baseline motivation persisted as a predictor despite the severity of depression endorsed.

Next, clinician diagnosis of major depressive disorder (MDD) was examined. Meeting DSM-IV criteria for depression is standard for receiving clinical treatment in many settings and there is also some research to support a taxonic presentation among youth (Richey et al., 2009).
Additionally, clinician-ratings may be more objective than patient and parent self-report. Therefore, MDD was examined as a potential moderator and as a main effect. In the same vein as self-report of depressive symptoms, MDD diagnosis did not moderate the relationship or show a main effect. Again, providing support that readiness to change at baseline predicts adolescent’s successful implementation of weight related behavior changes at post-treatment and follow-up and depression does not change this relationship.

It is important to keep in mind that this study was not designed to directly examine differences between self-report of depressive symptoms versus clinician diagnosed MDD. Therefore, no conclusions can be made on viewing depression along a continuum vs. categorically among this sample. All that can be concluded is that neither method of surveying depression affected the relationship between baseline readiness to change and stage of change at treatment completion and follow-up.

*Clinical Implications*

Results have several important clinical implications. First, the current study supports that motivation is key to successful implementation of positive health behaviors among overweight girls seeking treatment. Fortunately, motivational interviewing (MI) is an empirically supported therapeutic style to facilitate motivation for change and compliments myriad evidence based treatments such as cognitive behavioral therapy (CBT). Parent self-readiness to change at baseline also predicted adolescent’s implementation of positive weight related behaviors at post-treatment and follow-up. Our results are in line with earlier findings that parent’s baseline motivation is important to adolescent treatment outcomes (Jakubowski *et al.*, 2012). These earlier findings found parent’s motivation for change is actually more predictive of adolescent reduction in BMI than adolescent’s motivation. And while the design of the current study
statistically does not allow for such an examination it does examine behavior change outcomes, a potential proxy of longer-term health. In sum, findings support the existing literature that involving families in weight management interventions is ideal.

Parent’s motivation for change may affect adolescent change in multiple ways. Research indicates parents can have positive or negative effects on adolescents. For example, parents may contribute to an “obesogenic” environment (Golan & Crow, 2004). On the other hand, parents can positively affect health behaviors such as physical activity and fruit and vegetable intake (Moore, Lombardi, White, Campbell, Oliveria, & Ellison, 1991; Fisher, Mitchell, Smiciklas-Wright & Birch, 2002). Modeling parent’s behaviors may play a role in this strong association (Rhee, De Lago, Arscott-Mills, Mehta, & Krysko, 2005). Regardless of why parents have such a strong influence on adolescent’s weight related outcomes, it is important to involve them. For this reason, our study results indicate that a good assessment of both parent and adolescent self-readiness to change is important as it may be key to intervention success by allowing individual tailoring of interventions (Prochaska, DiClemente, & Norcross, 1992). MI is a great fit for this as it aims to meet persons where they are regarding readiness to change and has been shown to be an effective therapeutic style in family-based obesity programs (Berg-Smith et al., 1999; Irby, Kaplan, Garner-Edwards, Kolbash, & Skelton, 2010; Resnicow, McCarty, & Baranowski, 2005).

Finally, our results help inform the issue of how adolescent depression may play a role in weight management intervention outcomes. The current study sheds an optimistic light on the potential for youth to change and supports earlier findings that adolescent youth with comorbid depression can not only participate in weight management interventions but be successful (Rofey et al., 2009). These results may be particularly informative for prevention efforts as evidence indicates that obesity predicts depression (Merten, Wickrama & Williams, 2008; Pott, Albayrak,
Hebebrand & Pauli-Pott, 2010). Consequently, being able to implement positive weight management behaviors may in turn mitigate current depressive symptoms and/or prevent episodes of depression at later stages of life. Conversely, there is also support for adolescent depression predicting increased BMI (Rofey et al., 2009; Pine et al., 1997; Franko et al., 2005; Goodman & Whitaker, 2002). Mixed literature on the direction of the relationship between weight and mood indicates it may be bidirectional hence simultaneous treatment of both conditions may have a cumulative effect. And while future studies should examine the change in depression symptoms over the course of the intervention, our findings that adolescents can still make positive health changes despite depression at baseline indicates that presentation of depressive symptoms should not preclude weight management initiation.

Another interpretation of the findings is that these treatment seeking adolescents in the current sample may be experiencing symptoms that are not actually indicative of depression. Rather, they may be experiencing a secondary reaction to being an overweight/obese adolescent in our society. Many depressive symptoms overlap with other disorders. The empirically supported tripartite model suggests that negative affect is a shared symptom between anxiety and depression; whereas, anhedonia is more specific to depression and physiological hyperarousal is more specific to anxiety (Clark & Watson, 1991). Jonier and colleagues (1996; 2000) reported findings supporting the tripartite model among 116 psychiatric inpatients (ages 8-to-16). This model also has been shown to hold up among a community sample of African American youth in grades 6 and 9; however, negative affect, anhedonia, and physiological hyperarousal did not diverge as much over time as in other samples (Lambert, Joiner, Schmidt, McCreary & Ialongo, 2004). Overall, anhedonia has support as one of the most sensitive markers of depression among both adults and youth. It is important to note that recent research suggests that anhedonia is
capturing reduced anticipation and motivation rather than the traditional view of deficit in the experience of pleasure, as patients are overestimating the cost and underestimating the rewards of behavioral activation (Treadway et al., 2012). Specific to an overweight treatment seeking youth sample, Rofey, Black, Olson, & Szigethy (2010) found Anhedonia, a subscale of the CDI, did not emerge as a factor among this population. In fact, the only factors this sample shared with the instruments’ published sample were Negative Self-Esteem and Negative Mood, symptoms which commonly overlap with other disorders aside from depression.

**Strengths, Limitations, and Future Directions.**

Both limitations and strengths of the current study should be considered in looking to future directions. On the one hand, a treatment seeking sample is reflective of adolescents more commonly struggling with a mood disorder; however, it also reduces generalizability to the other, non-depressed overweight youth. In a similar vein, the sample is limited to adolescent girls and results may differ among adolescent boys. As the current study chose to examine a sample that closely mirrors the population of youth struggling with obesity and depression, all participants had a comorbid diagnosis of polycystic ovary syndrome (PCOS). PCOS is the most common endocrine disorder among women of reproductive age, affecting 7-to-10 million women and is one of the most common obesity associated syndromes (Yildiz, Knochenauer, & Azziz, 2007). At the same time, it is unknown how results may differ among obese adolescents without a co-occurring physical illness.

A major strength of this study is its novelty in examining mood as a moderator of treatment outcomes among overweight youth. To the best of our knowledge, this is the first study to date to examine whether depression affects the relationship between pre-treatment readiness for change and realized change post-treatment among this high risk population. Findings support
researchers and clinicians tailoring interventions to focus on both adolescent’s and parent’s readiness for behavior change even in the face of adolescents’ baseline depressive symptoms.

The present findings inform future research in this area. In order to increase confidence in the current findings, replication of the intervention with a larger, more gender and medically (non-PCOS) diverse sample would be beneficial. It may also be worth investigating whether depression would moderate the relationship between baseline stage of change and reduction in BMI post-intervention to further examine earlier findings by Jakubowski et al. (2012) that parent’s readiness for change is key to child’s successful weight loss. Examining the change in depression temporally, over the course of the intervention, and how that change is associated with treatment outcomes could elucidate the relationship between depression and behavior change. One avenue to do this is to explore mediators of treatment outcomes or mechanisms through which change occurs. While beyond the scope of the current study, it would likely be important to examine potential mediators such as change in depression and therapist’s adherence to features of motivational interviewing to better understand the treatment outcomes.

Additionally, only adolescent’s scores at post-treatment and follow-up were examined. It may be beneficial to examine parents’ scores at these time points and the association with adolescent’s outcomes.

Taking into account the current study’s strengths and limitations, results provide a better understanding of the role depression plays in treatment outcomes which may in turn improve weight management intervention and prevention efficacy and effectiveness among overweight youth, a population that has the increased potential for serious, chronic depression and obesity.
References


Figure 1. Stage of change model.

- **Pre-Contemplation**
  - Person displays little to no interest in change
  - Therapist works to reduce resistance and increase interest in change

- **Contemplation**
  - Person is considering the pros and cons of making a behavior change

- **Preparation**
  - Person begins to prepare to make a change

- **Action**
  - Person is beginning to take steps towards formulating and implementing a change plan

- **Maintenance**
  - Person is consistently implementing positive behavior changes