

**OTHER ASPECTS OF ADOLESCENT OBESITY:
UNHEALTHY BEHAVIORS, DEPRESSION, AND ACADEMIC ACHIEVEMENT**

By:

Renee Danielle Singh, M.ED.
University of California, Santa Barbara

Contributor:

Matthew Quirk, Ph.D.
University of California, Santa Barbara

INTRODUCTION

According to the Centers for Disease Control and Prevention (CDC), an adolescent is “obese” when his or her Body Mass Index (BMI)-for-age percentile falls at or above the 95th percentile for children of the same age and sex (CDC, 2009). As rates of adolescent obesity continue to rise, so does our understanding of the physiological effects of the condition. For example, a plethora of studies from the medical field have established that adolescent obesity is associated with deleterious outcomes such as hypertension, dyslipidemia, diabetes mellitus, coronary heart disease, stroke, and increased mortality (Faith, Matz & Jorge, 2002, p. 935). But should the physiological effects of adolescent obesity be our only concern as researchers? The purpose of this paper is to highlight the importance of understanding the “other” aspects of adolescent obesity—namely how adolescent obesity relates to unhealthy behaviors, depression, and academic achievement.

Why Study Other Aspects of Adolescent Obesity?

Although there is a plethora of literature available on the relationship between obesity and depression and the relationships between depression and engagement in unhealthy behaviors (e.g., alcohol abuse, substance abuse, cigarette smoking, and unhealthy eating), little time has been devoted to exploring these variables altogether. That is, there is evidence to suggest that obesity and depression are related and that depression, engagement in unhealthy behaviors, and academic achievement are also related... But, as researchers, we are missing important details such as *how* and *why* these variables are related. Additionally, little time has been devoted to exploring the relationships between obesity, unhealthy behaviors, and depression in school-aged children. The above may be a travesty because studies have found that obesity, unhealthy behaviors, and depression are all associated with poor academic outcomes.

The Conceptual Model

Figure 1 represents the conceptual model for the present study from a developmental-systems perspective (DST). According to Oyama, Griffiths, and Gray (2001), developmental-systems theory represents “a general theoretical perspective on development, heredity, and evolution” that encompasses the following themes: 1. Joint determination by multiple causes; 2. Context sensitivity and contingency; 3. Extended inheritance; 4. Development as construction; 5. Distributed control; and 6. Evolution as construction (p. 2). The primary assumption of the model is that BMI, unhealthy/healthy behaviors, depression, and academic achievement are all connected to each other. Thus, each variable’s influence depends on what is happening in the rest of the system. For example, BMI’s influence on academic achievement is contingent upon interactions between psychological influences and behavioral influences; behavioral influences and educational influences; child-environment interactions; and so forth. A secondary assumption of the model is no single influence (e.g., biological, psychological, etc.) controls development. Therefore, we must focus on within-systems interactions because they provide the resources developmental forces use to construct outcomes.

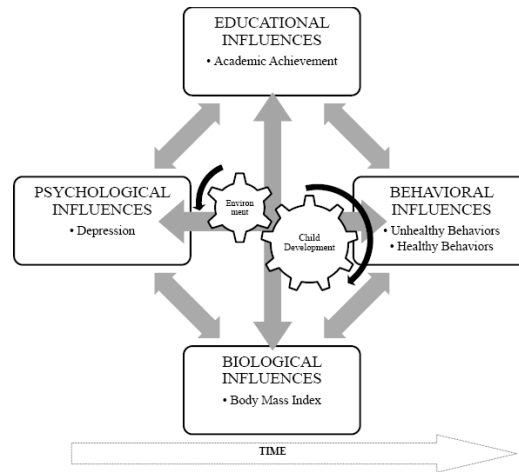


Figure 1. The conceptual model for the current study.

The purpose of the current study is to examine the relationships between obesity (as defined by BMI), unhealthy behaviors (e.g., smoking, alcohol use, substance abuse, unhealthy eating, and physical inactivity), and academic achievement in adolescents. Specific research questions include:

- (1) Do adolescents of different weight statuses (e.g., underweight, normal-weight, at-risk for overweight, and overweight) differ in terms of their engagement in unhealthy behaviors (e.g., alcohol use, substance abuse, cigarette smoking, and unhealthy eating)?
- (2) Do adolescents of different weight statuses differ in terms of their engagement in healthy behaviors (e.g., participating in extra-curricular activities, healthy eating, and exercise)?
- (3) Do adolescents of different weight statuses differ in terms of their academic achievement?
- (4) Does depression mediate the relationship between adolescent weight status and healthy/unhealthy behaviors?
- (5) Does depression mediate the relationship between adolescent weight status and academic achievement?

METHOD

Participants

Participants included approximately 15,686 students in grades 6 through 11 who contributed data to the 1997-1998 *Health Behavior in School-Aged Children* (HBSC) survey overseen by the World Health Organization (WHO) (WHO, 1998). With regard to gender, approximately 46.6% (7,315 of 15,868) of the participants were male and 53.4% (8,370 of 15,868) were female. With regard to ethnicity, approximately 57.4% (9,007 of 15,868) of the participants were Caucasian, 16.6% (2,602 of 15,868) were African American, 19.8% (3,101 of 15,868) were Hispanic, 4.8% (754 of 15,868) were Asian, and 1.4% (222 of 15,868) were Native American. With regard to socioeconomic status, 56.1% (8,801 of 15,868) of participants indicated that their family was either quite well off or very well off, 30.3% (4,747 of 15,868) indicated that their family was average, and 8.7% (1,364 of 15,686) indicated that their family was either not very well off or not at all well off.

Measures

The HBSC is a 54-item questionnaire, self-report survey instrument used by the World Health Organization (WHO) to assess health-relevant behavior and perceived health status in students aged 11-16 (Yu, Lee, Wirrell, Sherman, & Hamiwka, 2008). It measures students' health behaviors, lifestyles and their context, and how students perceive health itself. The core questions in the survey gather information on eating and dieting, physical activity, risk behaviors, violence and injuries, peer culture, positive health, and school setting. For the purposes of this study, individual and groups of questions from the HBSC were used to infer student weight status, engagement in unhealthy behaviors, engagement in healthy behaviors, academic achievement, and symptoms of depression (please see Table 1 below).

Table 1
Variables from the Health Behavior in School-Aged Children Survey

Variable	HBSC Item(s)	Description
BMI	21, 30	Weight in kg / height in m ²
Weight Status		BMI-for-age percentile
Underweight		< 5 th
Normal Weight		5 th < 8 th
At-Risk for Overweight		85 th > 95 th
Overweight		> 95 th
Unhealthy Behaviors		
Alcohol Use	91	Asked students to indicate how often they consumed 5 or more drinks of alcohol in a row during the past 30 days
Substance Abuse	96, 97	Asked students how often they used marijuana and how often they used over-the-counter medications for the purpose of getting high
Smoking	83	Asked students how often they smoked at the present
Unhealthy Eating	26e through 36i	Asked students how often they ate or drank coke or other soft drinks that contain sugar, sweets (candy or chocolate), cakes or pastries, potato chips, French fries or fried potatoes, hamburgers, hot dogs, sausages, and coffee
Healthy Behaviors		
Extracurricular Activities	19a through 19d	Asked students how often they participated in the following during the last 12 months: Organized or supervised sports (e.g., volleyball, basketball, soccer, etc.); unorganized sports (e.g., rollerblading, bicycling, recreational swimming, etc.); classes (e.g., gymnastics, dance, karate, etc.); and activities (e.g., clubs, religious organizations, etc.)
Healthy Eating	26a through 26c; 26j through 26l	Asked students how often they ate or drank fruit, raw or cooked vegetables, whole wheat or rye bread, and low fat or whole milk
Exercise	24	Asked students how many hours a week they exercised
Academic Achievement	57	Asked students to indicate what their class teacher(s) thought about their school performance compared to their peers
Symptoms of Depression	33d, 33g, and 69b	Asked students to rate how often during the last six months they felt low, had sleeping difficulties or felt helpless

Primary Analyses

Data processing and analyses were performed using SPSS Statistics GradPack version 17.0. Once it was established that the data were missing at random, the author followed Pallant's (2007) recommendation of using the exclude cases pairwise option to handle the missing data. Because descriptive statistics, histograms, and normality plots with tests revealed that the data were not normal, non-parametric techniques were used for all subsequent analyses. For example, to determine whether adolescents of different weight statuses differed in terms of their engagement in unhealthy behaviors, healthy behaviors, and academic achievement; three separate Kruskal-Wallis Tests were performed. As stated by Pallant (2007), the Kruskal-Wallis Test is "the non-parametric alternative to a one-way between-groups analysis of variance" which allows the researcher "to compare scores on some continuous variable for three or more groups" (p. 226). Whenever a statistically significant result was obtained for the Kruskal-Wallis Test, a series of Mann-Whitney *U* tests were performed to determine which of the weight status groups were significantly different from one another. The Mann-Whitney *U* test is the non-parametric alternative to the *t*-test for

independent samples (p. 220). Unlike the t -test, the Mann-Whitney U test converts scores on the continuous variable to ranks across two or more groups and the mean rank (i.e., a statistic that indicates which group had the highest overall score on the continuous variable) for each group is compared. For all Mann-Whitney U tests, mean rank scores were used to determine which weight-status groups to compare. Lastly, for all follow-up Mann-Whitney U comparisons, a Bonferroni adjustment was made to the alpha level used to judge statistical significance in order to control for Type 1 error (p. 207).

Mediation Analyses

To assess whether depression mediates the relationships between weight status and unhealthy behaviors, and weight status and academic achievement, the following three regression equations were estimated (Baron & Kenny, 1986). First, the mediator (i.e. depression) was regressed on the independent variable (i.e. BMI). Second, the dependent variable (i.e. engagement in unhealthy behaviors/academic achievement) was regressed on the independent variable (i.e. BMI). Third, the dependent variable (i.e. unhealthy behaviors/academic achievement) was regressed on the mediator (i.e. depression).

RESULTS

(1) Do adolescents of different weight statuses (e.g., underweight, normal-weight, at-risk for overweight, and overweight) differ in terms of their engagement in unhealthy behaviors (e.g., alcohol use, substance abuse, cigarette smoking, and unhealthy eating)?

The first Kruskal-Wallis Test found that adolescents of different weight statuses differ significantly in terms of their engagement in alcohol use, $X^2(3, n = 13,383) = 38.87, p \leq 0.05$, and substance abuse, $X^2(3, n = 13,218) = 24.63, p \leq 0.05$. However, there were no significant differences between groups with regard to cigarette smoking or unhealthy eating. With regard to alcohol use, the at-risk for overweight group had the highest mean rank score (which corresponded to most frequent alcohol use). Thus, follow-up Mann-Whitney U tests were performed between the at-risk for overweight group and all other weight status groups. The Mann-Whitney U tests for alcohol use revealed a significant difference between the at-risk for overweight ($n = 1,986$) and underweight ($n = 496$) group, $U = 414,800, z = -5.85, p \leq 0.017$. With regard to substance abuse, the overweight group had the highest mean rank score (which corresponded to most substance abuse). Thus, Mann-Whitney U tests were performed between the overweight group and all other weight status groups. The Mann-Whitney U tests for substance abuse revealed a significant difference between the underweight ($n = 496$) and overweight ($n = 1,255$) group, $U = 278,475, z = -4.59, p \leq 0.017$.

(2) Do adolescents of different weight statuses differ in terms of their engagement in healthy behaviors (e.g., participating in extra-curricular activities, healthy eating, and exercise)?

The second Kruskal-Wallis Test found that adolescents of different weight statuses differ significantly in terms of their participation in extra-curricular activities, $X^2(3, n = 13,286) = 38.221, p \leq 0.05$, and exercise, $X^2(3, n = 13,814) = 33.488, p \leq 0.05$. However, there were no significant differences between groups with regard to healthy eating. With regard to participation in extra-curricular activities, the underweight group had the highest mean rank score (which corresponded to most participation in extra-curricular activities). Thus, Mann-Whitney U tests were performed between the underweight group and all other weight status groups. The Mann-Whitney U tests for extra-curricular activities revealed a significant difference between the underweight ($n = 489$) and at-risk for overweight ($n = 1,967$) group, $U = 442,462, z = -2.75, p \leq 0.017$; and between the underweight ($n = 489$) and overweight ($n = 1,262$) group, $U = 271,079, z = -3.96, p \leq 0.017$. With regard to exercise, the overweight group had the highest mean rank score (which corresponded to most hours of exercise per week). Thus, Mann-Whitney U tests were performed between the overweight group and all other weight status groups. The Mann-Whitney U tests for exercise revealed a significant difference between the overweight ($n = 1,311$) and at-risk for overweight ($n = 2,059$) group, $U = 1,279,063, z = -2.61, p \leq 0.017$; and between the overweight ($n = 1,311$) and normal weight ($n = 9,927$) group, $U = 5,945,673, z = -5.17, p \leq 0.017$.

(3) Do adolescents of different weight statuses differ in terms of their academic achievement?

The third Kruskal-Wallis Test found that adolescents of different weight statuses differ significantly in terms of academic achievement, $X^2(3, n = 13,754) = 21.21, p \leq 0.05$. Because the overweight group had the highest mean rank score (which corresponded to the lowest grades), Mann-Whitney U tests were performed between the overweight group and all other weight status groups. The Mann-Whitney U tests revealed a significant difference

between the overweight ($n = 1,308$) and underweight ($n = 512$) group, $U = 301,599$, $z = -3.45$, $p \leq 0.017$; and between the overweight ($n = 1,308$) and normal weight ($n = 9,885$) group, $U = 6,057,994$, $z = -3.90$, $p \leq 0.017$.

(4) Does depression mediate the relationship between adolescent weight status and healthy/unhealthy behaviors?

To determine whether depression mediates the relationship between adolescent weight status and unhealthy behaviors, three regression equations were estimated (Baron & Kenny, 1986). With regard to evaluating the first model (depression regressed on weight status), the R Square value from the Model Summary table, which “tests the null hypothesis that multiple R in the population equals 0,” suggested that the first model reached statistical significance, $F(1, 12.42)$, $p \leq .0005$ (Pallant, 2007, p. 158). With regard to evaluating the independent variable (weight status), an examination of the Part correlation coefficient, which indicates “how much of the total variance in the dependent variable is uniquely explained by that variable,” revealed that BMI explained 0.0001% of the total variance in depression.

With regard to evaluating the second model (engagement in unhealthy behaviors regressed on weight status), the R Square value suggested that the second model reached statistical significance as well, $F(1, 1.31)$, $p \leq .0005$. With regard to evaluating the independent variable (weight status), the Part correlation coefficient revealed that BMI explained 0.0001% of the total variance in engagement in unhealthy behaviors.

Finally, with regard to evaluating the third model (unhealthy behaviors regressed on depression), the R Square value suggested that the third model also reached statistical significance, $F(1, 165.45)$, $p \leq .0005$. With regard to evaluating the mediator variable (depression), an examination of the Part correlation coefficient revealed that depression explained 0.01% of the total variance in engagement in unhealthy behaviors.

Although weight status affected depression in the first equation and unhealthy behaviors in the second equation, and depression affected unhealthy behaviors in the third equation, the effects were minimal. Additionally, the effect of the independent variable on the dependent variable was greater in the third equation than in the second equation (which is counter to Barron and Kenny’s (1986) criteria). As a result of the above findings, the author could not conclude that depression was a mediator of the relationship between weight status and engagement in unhealthy behaviors.

(5) Does depression mediate the relationship between adolescent weight status and academic achievement?

To determine whether depression mediates the relationship between adolescent weight status and unhealthy behaviors, three more regression equations were estimated. With regard to evaluating the first model (depression regressed on weight status), the R Square value from the Model Summary table, suggested that the first model reached statistical significance, $F(1, 12.42)$, $p \leq .0005$. With regard to evaluating the independent variable (weight status), an examination of the Part correlation coefficient, revealed that BMI explained 0.0001% of the total variance in depression.

With regard to evaluating the second model (academic achievement regressed on weight status), the R Square value suggested that the second model reached statistical significance as well, $F(1, 20.973)$, $p \leq .0005$. With regard to evaluating the independent variable (weight status), an examination of the Part correlation coefficient revealed that BMI explained 0.0004% of the total variance in academic achievement.

Finally, with regard to evaluating the third model (academic achievement regressed on depression), the R Square value suggested that the third model also reached statistical significance, $F(1, 311.66)$, $p \leq .0005$. With regard to evaluating the mediator variable (depression), an examination of the Part correlation coefficient revealed that depression explained 0.04% of the total variance in academic achievement.

Although weight status affected depression in the first equation and academic achievement in the second equation, and depression affected academic achievement in the third equation, the effects were minimal. Additionally, the effect of the independent variable on the dependent variable was greater in the third equation than in the second equation. As a result of the above findings, the author could not conclude that depression was a mediator of the relationship between weight status and academic achievement.

DISCUSSION

The current study examined the relationships between weight status, engagement in unhealthy behaviors, engagement in healthy behaviors, and academic achievement. Additionally, an attempt was made to determine whether depression mediates the relationships between weight status and engagement in unhealthy behaviors, and weight status and academic achievement. The results suggest that adolescents of different weight statuses differ in terms of their engagement in alcohol use and substance abuse. Specifically, at-risk for overweight students engage in significantly more alcohol use than their underweight peers; and overweight students engage in significantly more

substance abuse than their underweight peers. From a DST perspective, we cannot assume that weight-status alone is the cause of more frequent alcohol and substance abuse among at-risk for overweight and overweight students. However, we can hypothesize that interactions elsewhere in the system are having an effect on the outcome. For example, future studies may wish to explore how interactions between family influences (e.g., parents are unsupportive) and educational influences (e.g., teachers are mean) might influence alcohol/drug use.

In addition to the above, results of the current study suggest that adolescents of different weight statuses differ in terms of their engagement in healthy behaviors. For example, with regard to participation in extra-curricular activities, it would appear that underweight students participate in more extra-curricular activities than both their at-risk for overweight and overweight peers. Borrowing again from DST, I hypothesize that the above outcome is the result of psychological and behavioral influences interacting with each other. For example, perhaps the underweight students suffer from body-issues and, thus, are engaging in more after-school sports to maintain their current weight? To address the issue raised above, future studies may wish to examine psychological and behavioral attributes of students who participate in extra-curricular activities.

In contrast, with regard to exercise, it would appear that overweight students exercise more than their at-risk for overweight and normal weight peers. From a DST perspective, this is an interesting finding because it suggests that weight status (i.e. a biological influence) is interacting with some other variable or variables to produce a positive outcome (e.g., routine exercise). Given the above, what could this variable be? To address this question, future studies may wish to explore both potential mediators and moderators of the obesity-exercise relationship. Perhaps the missing link relates to motivation?

Thirdly, the results of the current study suggest that adolescents of different weight statuses differ in terms of academic achievement. Specifically, it would appear that overweight students obtain poorer grades than their underweight and normal weight peers. From a DST perspective, I suspect that the above is the result of interactions between school-environment and psychological variables. For example, perhaps overweight students feel less connected to school and, thus, lose motivation easily? To address the above, future studies may wish to examine feelings of school connectedness and within group differences amongst obese youth.

Finally, the author could not conclude that depression mediates the relationships between weight status and engagement in unhealthy behaviors, and weight status and academic achievement. The above findings suggest that other mechanisms may underlie the above relationships. Borrowing again from DST, I hypothesize that family influences are involved. For example, perhaps child-parent or child-sibling interactions mediate the relationships between weight status, engagement in unhealthy behaviors, and academic achievement? Thus, to address the above questions, future studies may wish to examine other potential mediators and moderators (e.g., anxiety), especially those that are related to the family system.

Limitations of the Current Study

The findings discussed in “Other Aspects of Adolescent Obesity,” should be interpreted with caution due to several limitations. Firstly, constructs could only be represented by items available on the HBSC survey. This resulted in constructs being defined by a limited number of questions (e.g., “depression” was measured via only three questions on the HBSC survey). Additionally, it should be noted that the HBSC was a self-report survey. According to Heppner, Wampold, and Kivlighan (2008), self-report measures are “vulnerable to distortions (intentional or unintentional) by the participant” (p. 334). That is, participants may respond “in a manner that makes them look good” or that they feel is socially desirable (p. 334). The above may have affected participants’ responses to questions such as height, weight, alcohol use, substance abuse, etc. Finally, because the data were not normal, non-parametric techniques were used to address all of the study’s research questions. According to Pallant (2007), non-parametric techniques tend to be less sensitive than their parametric counterparts and “may fail to detect differences between groups that actually exist” (p. 210).

CONCLUSION

The purpose of this paper was to highlight the importance of understanding the “other” aspects of adolescent obesity—namely how adolescent obesity relates to unhealthy behaviors, depression, and academic achievement. The study’s findings suggest that there are many different outcomes associated with adolescent obesity. Of particular concern are the negative outcomes (e.g. alcohol use, substance abuse, and poor grades) which have implications for both students’ academic and social-emotional well being. Given the above, it is imperative that school professionals consider the impact the obese condition can have on multiple aspects of an adolescent’s life. For example, future researchers may want to focus on identifying the mechanisms (i.e. mediators) that underlie the relationships between obesity, unhealthy behaviors, and academic achievement. Finally, once we gain a greater

understanding how these variables fit together, perhaps we will be more equipped to develop interventions that reduce not only students' physiological weight problems, but the negative psychological, behavioral, and academic symptoms that accompany the condition as well.

REFERENCES

- American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed. revised). American Psychiatric Association, Washington, DC: Author.
- Andrews, B., & Wilding, J. M. (2004). The relation of depression and anxiety to life-stress and achievement in students. *British Journal of Psychology*, *95*, 509-521.
- Bamia, C., Trichopoulou, A., Lenas, D., and Trichopoulos, D. (2004). Tobacco smoking in relation to body fat mass and distribution in a general population sample. *International Journal of Obesity*, *28*, 1091-1096. doi:10.1038/sj.ijo.0802697.
- Baron, R. M., & Kenny, D. A. (1986). Moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.
- Beck, A. T., Ward, C. H., Mendelssohn, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561-571.
- Binder, E. B., Salyakina, D., Lichtner, P., Wochnik, G. M., Ising, M. & Pütz, B. (2004). Polymorphisms in FKBP5 are associated with increased recurrence of depressive episodes and rapid response to antidepressant treatment. *Nat Genet*, *36*, 1319-1325.
- Block, G., Hartman, A., Dresser, C., Carroll, M., Gannon, J., & Gardner, L. (1986). A data-based approach to diet questionnaire design and testing. *American Journal of Epidemiology*, *124*, 453-469.
- Brook, J. S., Stimmel, M. A., Zhang, C., & Brook, D. W. (2008). The association between earlier marijuana use and subsequent academic achievement and health problems: A longitudinal study. *The American Journal on Addictions*, *17*(2), 155-160.
- Brugha, T., Bebbington, P., Tennant, C., & Hurry, J. (1985). The List of Threatening Experiences: A subset of 12 life event categories with considerable long-term contextual threat. *Psychological Medicine*, *15*, 189-194.
- Centers for Disease Control (CDC). (2009, August 19). *Defining childhood overweight and obesity*. Retrieved September 1, 2009, from <http://www.cdc.gov/obesity/childhood/defining.html>.
- Coelho, R., Rangel, R., Ramos, E., Martins, A., Prata, J., & Barros, H. (2000). Depression and the severity of substance abuse. *Psychopathology*, *33*(3), 103-109.
- Datar, A., & Sturm, R. (2006). Childhood overweight and elementary outcomes. *International Journal of Obesity*, *30*, 1449-1460.
- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H. & Covi, L. (1974). The Hopkins Symptom Checklist 90-R (HSCL): A self-report symptom inventory. *Behavioral Science*, *19*, 1-15.
- Drewnowski, A., Kurth, C., Holden-Wiltse, J., & Saari, J. (1992). Food preference in human obesity: Carbohydrates versus fats. *Appetite*, *18*, 207-221. doi:10.1016/0195-6663(92)90198-F.
- Elliott, A. C., & Woodward, W. A. (2007). *Statistical analysis quick reference guidebook with SPSS examples*. Thousand Oaks, CA: Sage Publications.
- Faith, M. S., Matz, P. E., & Jorge, M. A. (2002). Obesity-depression associations in the population. *Journal of Psychosomatic Research*, *51*, 1-8.
- Fernstrom, M. H., Krowinski, R. L., & Kupfer, D. J. (1987). Appetite and food preference in depression: Effects of imipramine treatment. *Biological Psychiatry*, *22*(5), 529-539.
- Försterling, F., & Binser, M. J. (2002). Depression, school performance and the veridicality of perceived grades and causal attributions. *Personality and Social Psychology Bulletin*, *28*(10), 1441-1449.
- Fröjd, S. A., Nissinen, E. S., Pelkonen, M. U. I., Marttunen, M. J., Koivisto, A., & Kaltiala-Heino, R. (2008). Depression and school performance in middle adolescent boys and girls. *Journal of Adolescence*, *31*(4), 485-498. doi:10.1016/j.adolescence.2007.08.006.
- Grant, B. F., & Harford, T. C. (1995). Comorbidity between DSM-IV alcohol use disorders and major depression: results of a national survey. *Drug and Alcohol Dependence*, *39*, 197-206.
- Grant, B. F., Moore, T. C., Kaplan, K. *Source and accuracy statement: wave 1 national epidemiologic survey on alcohol and related conditions (NESARC)*. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.
- Hamilton, M. (1960). A rating scale for depression. *Journal of Neurology, Neurosurgery & Psychiatry*, *23*, 56-61. doi:10.1136/jnnp.23.1.56.

- Henry, K. L., Smith, E. A., & Caldwell, L. L. (2007). Deterioration of academic achievement and marijuana use onset among rural adolescents. *Health Education Research, 22*(3), 372-384.
- Heppner, P. P., Wampold, B. E., & Kivlighan, D. M. (2008). *Research design in counseling* (3rd ed.). Belmont, CA: Thomas Brooks/Cole.
- Jacobs, D., Hahn, L., Haskell, W., Pirie, P. & Sidney, S. (1989). Validity and reliability of short physical activity history: Cardia and the Minnesota heart health program. *Journal of Cardiopulmonary Rehabilitation, 9*, 448-459.
- Jeynes, W. H. (2002). The relationship between the consumption of various drugs by adolescents and their academic achievement. *American Journal of Drug and Alcohol Abuse, 28*(1), 15-35.
- Kloiber, S., Ising, M., Reppermund, S., Horstmann, S., Dose, T., Majer, M., Zihl, J., Pfister, H., Unschuld, P. G., Holsboer, F., & Lucae, S. (2007). Overweight and obesity affect treatment response in major depression. *Biological Psychiatry, 62*(4), 321-326. doi:10.1016/j.biopsych.2006.10.001.
- Little, K. Y., Ramssen, E., Welchko, R., Volberg, V., Roland, C. J., & Cassin, B. (2009). Decreased brain dopamine cell numbers in human cocaine users. *Psychiatric Research, 168*, 173-180. doi:10.1016/j.psychres.2008.10.034.
- Oyama, S., Griffiths, P. E., & Gray, R. D. (2001). Introduction: What is developmental systems theory? In S. Oyama, P. E. Griffiths, & R. D. Gray (Eds.), *Cycles of contingency*. Cambridge, MA: The MIT Press.
- Pallant, J. (2007). *SPSS survival manual: A step-by-step guide to data analysis using SPSS version 15* (3rd ed.). New York: McGraw Hill.
- Peterson, C., Semmel, A., von Baeyer, C., Abramson, L. Y., Metalski, G. I., & Seligman, M. E. P. (1982). The attributional style questionnaire. *Cognitive Therapy and Research, 6*, 287-299.
- Petry, N. M., Barry, D., Pietrzak, R. H., Wagner, J. A. (2008). Overweight and obesity are associated with psychiatric disorders: results from the national epidemiologic survey on alcohol and related conditions. *Psychosomatic Medicine, 70*, 288-297. doi: 10.1097/PSY.0b013e3181651651.
- Raitasalo, R. (1995). Coping as the target of social policy. The social insurance institution, Helsinki, Finland. *Studies in Social Security and Health, 1*, 1995.
- Riboli, E., & Kaaks, R. (1997). The EPIC project: rationale and study design. *International Journal of Epidemiology, 26*, S6-S14.
- Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. American Psychiatric Association. New York: Psychology Press.
- Shore, S. M., Sachs, M. L., Lidicker, J. R., Brett, S. N., Wright, A. R., Libonati, J. R. (2008). Decreased scholastic achievement in overweight middle school students. *Obesity, 16*, 1535-1538.
- Simon, G. E., Ludman, E. J., Linde, J. A., Operskalski, B. H., Ichikawa, L., Rohde, P., Finch, E. A., & Jeffery, R. W. (2008). Association between obesity and depression in middle-aged women. *General Hospital Psychiatry, 30*(1), 32-39. doi:10.1016/j.genhosppsych.2007.09.001.
- Skinner, H. A. (1982). The drug abuse screening test. *Addictive Behavior, 7*, 363-371.
- Spitzer, R. L., Endicott, J., and Robins, E. (1978). Research diagnostic criteria: rationale and reliability. *Archives of General Psychiatry, 35*, 773-782.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education, Inc.
- Wadden, T. A., Stunkard, A. J. & Liebschutz, J. (1988). Three-year follow-up of the treatment of obesity by very low calorie diet, behavior therapy, and their combination. *Journal of Consulting & Clinical Psychology, 56*, 6, 925-928.
- Wang G-J., Volkow, N. D., Logan, J., Pappas, N. R., Wong, C. T., Zhu, W., Netusil, N., & Fowler, J. S. (2001). Brain dopamine and obesity. *Lancet, 357*, 254-257.
- Wiesbeck, G. A., Kuhl, H., Yaldizli, Ö., Wurst, F. M., & WHO/ISBRA Study on Biological State and Trait Markers of Alcohol Use and Dependence. (2008). Tobacco smoking and depression--results from the WHO/ISBRA study. *Neuropsychobiology, 57*(1-2), 26-31. doi: 10.1159/000123119.
- World Health Organization. (1997-1998). *Health behavior in school-aged children, 1997-1998: [United States]*. Ann Arbor: Inter-university Consortium for Political and Social Research.
- Yu, C. G., Lee, A., Wirrell, E., Sherman, E. M. S., & Hamiwka, L. (2008). Health behavior in teens with epilepsy: How do they compare with controls? *Epilepsy & Behavior, 13*, 90-95.
- Zung, W. W. K. A self-rating depression scale. *Archives of General Psychiatry, 12*, 63-70.