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The Relationship between Self-Regulation and Stress, Sleep, and Behavioral Health

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Abstract

The goal of this research was to investigate multiple aspects of self-regulation and their relationship to stress, sleep, and behavioral health. Participants (N=89, 55 females, 29 males, and 5 did not list their sex) were recruited from a high-risk Midwest high school. Participants reported their own self-regulatory ability, sleep, stress, and behavioral problems. Nail samples were also collected from a subset of the participants to assay for cortisol and DHEA. Several measures of self-regulation were found to correlate with sleep quality, behavioral problems, and perceived stress. The natural log of the ratio of cortisol to DHEA was positively correlated with multiple measures of self-regulation. These findings demonstrate a relationship a positive relationship among self-regulation, sleep quality, and improved behavioral functioning as indexed by lower levels of externalizing and internalizing behaviors. Better self-regulation also correlated with lower perceived stress, but higher physiological biomarkers of stress. These findings are discussed in the context of theoretical proposals of self-regulation and stress adaption.

Keywords: self-regulation, stress, sleep, externalizing behaviors, internalizing behaviors, cortisol, DHEA

Introduction

Self-regulation (SR), is essential to success and human health. Self-regulatory ability has been shown to predict better health, more wealth, lower levels of criminal behavior (Moffitt, et al., 2011). Self-regulation is the general process of managing feelings, thoughts, and behaviors so that general personal goals and standards are met (Fujita, 2011). Components of self-control include delay of gratification, persistence, and emotion regulation. These abilities are important to every aspect of our lives including personal relationships, financial decisions, academic and professional achievements, and health behaviors.

Empirical research has consistently demonstrated the importance of self-regulatory abilities. People who score poorly on self-control tests are found to have significantly more debt than those who do not (Achtziger, Hubert, Kenning, Raab, & Reisch, 2015). In people with equal sexual desires, those with low self-control are more likely to be unfaithful to their partner (McIntyre, Barlow, & Hayward, 2014). Self-control can also be changed and depleted through experiences and behaviors (Baumeister, Bratslavsky, Muraven, & Tice, 1998) leading to the possibility that when their self-control is depleted people may do things they usually would not. For example, researchers found that when people's self-control is depleted their sexual desires translate into more bold romantic intentions and infidelity (McIntyre, et al., 2014).

The primary purpose of this review and empirical analysis is to cover the general topic of self-regulation and how it relates to the health behaviors and outcomes of sleep, stress, and behavioral and emotional functionality. These behavioral health variables are looked at in relation with self-regulation to gain a perspective on how self-regulation

impacts both heath behaviors and objective and subjective experiences of stress. In the following paper, I will first review theoretical models of self-regulation. The relationship between self-regulation, health outcomes, stress, sleep, and behavioral and emotional functioning will then be examined. Finally I will conclude with an empirical investigation of the relationship between multiple aspects of self-regulation and the aforementioned measures of health and functioning.

Literature Review

Theoretical Models of Self-Regulation and Delay of Gratification

The idea of self-control may seem simple and intuitive at first since we have all experienced in one way or another. It's been repeatedly shown that people often prefer smaller short-term benefits to larger long-term rewards. One way to think about this process is to break it into a conflict between two motives. The first motive is the impulse for the more proximal and concrete reward (for example $10 today). The other motive is the more abstract and distant reward ($100 sometime in the future). Successfully navigating this conflict involves choosing a more abstract and distant reward which is difficult to do. An essential factor in these decisions is that they are mutually exclusive; by choosing one an individual sacrifices the opportunity for the other. If someone has to make a decision between two equally beneficial things at the present moment, this is not an act of self-control as there is no difference in the impact this decision has on their overall goals. Situations like this fall under the wider realm of self-regulation (Fujita, K., 2011).

Walter Mischel, the father of delay of gratification research, proposed a 2-system "hot/cool" framework. The "cool" system is cognitive, thoughtful and characterized by

"know" whereas the "hot" system is emotional, immediate action focused and characterized by "go". This model serves to explain the classic delay of gratification paradigm established in the early 1970s in which children could get a treat now, or wait 15 minutes and get twice the treat. These two systems interact, the "cool" system inputting knowledge about various contextual factors in a goal sensitive and strategic way, and the "hot" system inputs feelings based on things generally under stimulus control. Within the two systems, there are "nodes" with different qualities. These nodes link to each other and trigger different responses. An activation of one of these nodes corresponds to an activation of its corresponding node although the level of activation depends on a number of environmental factors. It's important to note that while cool nodes have a complicated web of connections within the cool system, hot nodes do not connect to each other. In order to activate a hot node from thinking about an object in a cool context someone has to think about the right aspects of that object in a "hot framing" that has a corresponding hot node. Essentially, one must focus on the facts about a stimulus that they have strong feelings about. Thus, one can trigger the hot system to trigger a behavior by thinking about parts of a stimulus in a cool way. Once a response, or decision, has been triggered from the hot or cold system its participation in the act is over. Actually walking to the refrigerator for a piece of cake is handled by other systems. Certain nodes, such as ones that are related to the self, various environmental factors, goals, or values, can also be chronically activated. The dominance of one system or the other is largely developmental. Early in life the hot system is more dominant and as someone ages the cool system takes over. This explains children's struggles with self-control.

There are three different ways that this framework can be used to describe willpower strategies. In a default scenario where there is no willpower strategy implemented, a hot stimulus will directly activate a hot node and trigger a go response. The first strategy is to obscure the stimulus. This is as simple as hiding the cookie jar out of sight. However, something as routine as naturally thinking about the stimulus can trigger a hot node and a go response. Obscuring the stimulus can also be done internally by not paying attention to it. The second strategy is to focus on other stimuli, either externally by focusing attention on other things, or internally by activating other parts of the hot/cool system. The effectiveness of this strategy depends on the quality of the distractor. The third strategy is to reconfigure the meaning of a stimulus to just activate the corresponding cool nodes. Physically this is achieved by presenting a picture of the stimulus. This activates all of the cool aspects, while limiting activation of the hot aspects. It triggers everything we know about that object. However we don't have the same emotional response because it's "just a picture". For example, thinking about something objectively, as if it were just a picture. However, it's important to note that all of the research Mischel conducted on these strategies was with children who's hot/cool systems are not fully developed (Metcalfe, & Mischel, 1999).

These models give us some idea as to how these processes work, but it's also important to see them applied in reality.

Sub-Categories of Self-Regulation

Self-regulation is clearly a concept that is involved in an incredible variety of situations and is a part of many human behaviors. Consequently, it is important to break down self-regulation slightly to clearly understand different ways in which it manifests

itself in human life and behavior. The Adult Temperament Questionnaire (ATQ), which is used in this study, investigates effortful control, or willpower, within the concept of self-regulation. Effortful control is defined as “the ability to inhibit a dominant response to perform a subdominant response” (Eisenberg, n.d.). The ATQ then breaks effortful control into three sub-categories to differentiate within the overarching idea of willpower. These three sub-categories are: attentional control, inhibitory control (also known as response inhibition), and activation control (Evans, & Rothbart, 2007).

Attentional control is well understood by anyone who has interacted with a young child. It is the ability of an individual to focus attention, shift attention when necessary, and generally control their focus. Posner and Peterson (1990) have proposed a system that further breaks down human attention into three systems: alerting, orienting, and executive control. Alerting is the brain's ability to achieve and maintain an alert state and has been found to be associated with the frontal and parietal regions of the right hemisphere of the brain. Orienting is the process of sifting through all of the information gathered through sensory input. This process includes quickly shifting attention from target to target when new stimuli are presented. Parts of the frontal and parietal lobes have also been found to be involved in this process. Executive control of attention is the process through which the brain assesses and resolves conflicts of attention, deciding what to focus on. The midline frontal areas and the lateral prefrontal cortex of the brain have been demonstrated to be involved in this process of evaluating conflicts (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Parents of children between the ages of six and twelve with ADHD reported additional sleep problems than children without

attentional problems. This demonstrates the connection between attentional problems and sleep (Marcotte, A., et al., 1998).

Inhibitory control is the ability or capacity of an individual to suppress a dominant, routine, or inappropriate behavior. Hasher, Zacks, and May (1999) have researched inhibition control under a model that breaks inhibition into three functions as they relate to working memory: access, deletion, and restraint. Inhibitory control, to be effective, controls access to working memory for anything that may arise that is not goal-relevant. This comes into play when a familiar stimuli in the environment attempts to draw the attention of the individual, however inhibitory control prevents access to working memory thus not allowing these irrelevant stimuli to interrupt the goal being focused on. Deletion is the process of clearing working memory of irrelevant information to make as much of the information in working memory relevant information. Restraint keeps items in working memory that seem to be exceptionally important from seizing control of attention in order to allow less probable options to still be considered. These aspects of inhibitory control prevent thoughts from distracting an individual from their goal or from being impulsive and not fully assessing all options. Children with ADHD demonstrate deficits in their ability to successfully perform inhibition control and response inhibition. In a study performed by Joel Nigg (1999) children with ADHD were compared to children without ADHD on a stop signal task. They were instructed to press one of two buttons when the corresponding signal appeared on the screen, but when they heard a tone to not press any button. The study found that the children with ADHD performed worse on the stop signal task than their non-ADHD counterparts. This demonstrates that

children with ADHD have a harder time inhibiting their initial inclination to press the button when they heard the tone.

The third category used in the Adult Temperament Questionnaire is activation control. Activation control is the opposite of inhibitory control. It is the ability to perform an action when an individual's tendency is to avoid it. These two constructs are similar in process as they are simply the inverse of one another. They are both the ability to inhibit a dominant behavior, whether it be to perform an action or not, and do the opposite, or at least not act on immediate impulse (Hasher, et al, 1999).

The Effects of Self-Regulation on Life-Outcomes

Self-regulation and self-control have incredible importance in life and are vital in a number of areas from a very early age. There's strong evidence that children's self-regulation abilities are influenced by their parents (Bridgett, Burt, Edwards, & Deater-Deckhard, 2015). This research demonstrates that improving self-regulation for one person or a group may have a generational impact over time. Improvements in a child's task-attentiveness, a vital SR skill, from ages 2-3 to 6-7 correlates with greater teacher-rated literacy and math achievement. Improvements in emotional regulation, another vital SR skill, over the same age range correlate with greater teacher-rated literacy, although not as strongly as task-attentiveness (Sawyer, et al., 2014). Differences in self-control and delay of gratification skills can be distinguished as young as four years old. Children that demonstrate the ability to delay gratification at age four go on to be more cognitively and socially competent adolescents, be more successful academically, and cope better with frustration and stress (Mischel, Shoda, & Rodriguez, 1989). Moffitt and colleagues (2011) performed a longitudinal study of 1,000 people from birth to age 32 collected self-

control data until age eleven. Self-control was found to predict physical health, substance dependence, personal finances, and criminal offending outcomes. Just looking at the data collected from ages 3-5 could predict health, wealth, and convictions at age 32, although not as strongly as the full set of data from ages 3-11. Self-control also predicts the behavior of more than just children. College students with low self-control were found to be more likely to pirate music (Higgins, & Makin, 2004). However, there is evidence to suggest that poor early life self-control may not always be permanent. Young people aged 14-22 who engaged in risky, low self-control, behaviors like drinking, and smoking cigarettes and marijuana see a higher increase in the ability to delay gratification later in life. This is perhaps because these risky behaviors provide experience that eventually leads to greater patience for long-term rewards (Romer, Duckworth, Sznitman, & Park, 2010).

Self-Regulation and Self-Control Models in Practice

The system of self-regulation is not a stand-alone system and given certain circumstances a person's self-regulation ability can change over time, change in the short term as a result of experiences, or can be exhausted. An example of this is that people who were forced to eat radishes instead of chocolates gave up quicker on an unsolvable anagram puzzle. This shows that one self-regulation task can take away from some internal "ego", fortitude, or strength (Baumeister, et al., 1998). There are three theories of how self-regulation operates. That it is a skill, meaning that its level never changes. That is a schema, meaning performing one self-control skill preps for another and thus after doing one a person would do better on a second. The third is that self-control is like a muscle that can be trained to perform better, and if it is not used it will get weaker. The

first two theories have been shown to be false and more evidence exists in support of the third. The idea of self-control as a muscle that can be strengthened has been further investigated. Trying to suppress forbidden thoughts led to people giving up quicker on an anagram task as though engaging in another task wore out self-regulatory abilities. A similar thought suppression task made it more difficult for people to hide their emotions when watching a video clip. This demonstrates that self-regulation can be fatigued and overworked. However, it can also be strengthened. In one study, researchers had three groups each practice a self-regulation task for two weeks, sitting up straight whenever possible, improving their mood at all times, and keeping a food diary. They squeezed a handgrip for as long as possible before the two weeks and after the two weeks. The self-regulation groups all outperformed the control. This shows that just practicing a general self-regulation task can improve more self-regulation skills than just that task (Muraven, Baumeister, & Tice, 1999). Further supporting this theory of self-regulation as a muscle, people that successfully quit drinking are generally more successful at quitting smoking. This indicates their self-regulation skills may have improved by completing one difficult self-regulation task, quitting drinking (Zimmerman, Warheit, Ulbrich, & Auth, 1990).

Sleep, Health Outcomes, and Self-Regulation

Sleep has a clear connection to self-regulation as most people experience the decision every night whether to go to bed early or stay up. Sleep's importance to health is also crucial as anyone who is behind on their sleep can tell you. However, sleep may sometimes be taken for granted as it's something that everybody does every day. However, it is vital for a number of factors related to human health and even though we may think we can get away with sacrificing sleep if it becomes a habit it will have

significant negative effects on your health. Sleep allows the body and nervous system to recover and is when protein synthesis is most active (Chen, Wang, & Jeng, 2006). We routinely hear that we need 8 hours of sleep, and that is true between the ages of nineteen and fifty-five, but according to the National Sleep Foundation before the age of nineteen we need at least eight hours of sleep and ideally ten hours. Additionally, during adolescence it is unnatural for the human body to go to bed before 11:00 PM. Combined with school start times that are commonly around 8:00 AM and as early as 7:00 AM, extracurricular activities that push into the evenings, and homework, getting the ideal ten hours of sleep is a near impossibility for most adolescents. The data backs this up as only 15% of teens report getting eight and a half hours of sleep a night. These factors combine to lead to a huge number of sleep deprived children at a time in their life when sleep is incredible vital. Not getting enough sleep can negatively impact adolescents' ability to learn, listen, concentrate, and solve problems, all of which are clearly important for getting the most out of and excelling in school. ("Teens and Sleep", n.d.).

However, these are not the only issues that sleep deprivation causes in adolescents. A study that investigated the sleep habits and health outcomes of 656 Taiwanese adolescents found a negative relationship between low sleep and life appreciation, taking responsibility for health, adopting a healthy diet, effective stress management, regular exercise, and total score on the Adolescent Health Promotion scale. Routinely getting adequate sleep also was associated with low frequencies of obesity and in general junior high school students that were studied got adequate sleep more often than high school students (Chen, et al., 2006).

Not only does a lack of sleep have negative effects on human health, but it also negatively impacts adolescent's success in school and overall daytime functioning. A study of 3,120 high school students in Rhode Island found that students who got better grades self-reported getting more sleep. Students who got A's and B's in school got an average of 442 minutes of sleep (7.37 hours) on school nights and went to bed on average at 10:27 PM on school nights. Students who got C's and D's got 424 minutes of sleep (7.07 hours) on school nights and went to bed at 10:52 PM on school nights. In a limited sample, students who got D's and F's showed another sharp decline reporting 408 minutes of sleep (6.80 hours) on school nights and an average school night bedtime of 11:22 PM. The study also found that inadequate sleep habits were related with increased behavioral difficulties. Students who didn't get enough sleep on school nights and had irregular weekend sleep habits had more sleep related behavior problems such as arriving to school late, feeling tired or dragged out throughout the day, and needing multiple reminders to wake up in the mornings. These students also had higher levels of depressive mood and greater sleepiness (Wolfson & Carskadon, 1998).

There is also significant evidence connecting self-regulation to sleep for a variety of populations. A longitudinal study of 2,880 Australian youths discovered a connection between poor self-regulation, sleep problems, and behavioral and emotional issues. Children whose parents reported them developing normal self-regulation abilities over time also had a normal pattern of declining sleep problems from birth to five years old. However, the 31% of children who did not fit in this profile demonstrated below average self-regulation skills and increased sleep problems through childhood. These children then demonstrated more adjustment problems in school than their peers with better self-

regulatory capabilities (Williams, Nicholson, Walker, & Berthelsen, 2016). Another study of 137 college-aged students found a link between self-regulation and sleep hygiene, which is defined as engaging in healthy sleep habits. Two facets of self-regulation, cognitive flexibility and behavioral inhibition, were found to be correlated with sleep hygiene with cognitive flexibility being found to be a stronger predictor of sleep hygiene (Todd, & Mullan, 2013). This connection between poor self-regulation and poor sleep hygiene has been demonstrated among adult members of the workplace as well. A study of 328 adult workers found that self-regulation was positively correlated with sleep hygiene. The same study also found that poor sleep hygiene appears to diminish self-regulatory capabilities leading to decreases in work engagement (Barber, Grawitch, & Munz, 2013). The same researchers investigated this connection between sleep and self-regulatory capacity in another study. They found that people who started engaging in improved sleep habits for five days performed better on self-regulation tasks and their self-regulation strength improved. A decrease in psychological strain was also observed among these people practicing improved sleep (Barber, & Munz, 2011).

There also appears to be some connection between stress and sleep although the exact relationship has yet to be determined. There is some research supporting the claim that people with disturbed sleep show similar physiological markers as people under stress including increased cortisol, body temperature, heart rate, and oxygen consumption. However, this has not been established as fact (Everly, & Lating, 2012). Kim and Dimsdale (2007) performed a systematic review of studies investigating the effect of stress on sleep quality. Several studies have found that emotional stressors as simple as worrying about or having work the next day causes changes in sleep in the form

of less slow-wave sleep, less total sleep time, and more REM sleep. Further studies found that major stressful life events cause increased REM sleep, decreased REML sleep, and decreased slow-wave sleep. Other studies instigated stressors to investigate their effect. Watching an aversive film before sleeping, or receiving impersonal treatment was found to increase the length of REM sleep, increase the number of awakenings through the night, and increase how long it took individuals to fall asleep. Negative thoughts or a feeling of inferiority brought on by having to take an intellectually challenging test before sleeping increased how long it took participants to fall asleep and rearranged their normal sleep schedule. Traumatic experiences have also been widely studied in regards to sleep quality. Numerous studies have established that individuals with post-traumatic stress disorder experience increased awakenings during sleep and less total sleep time. Several studies have also observed reduced body movement during sleep among individuals with PTSD terming it “freezing body”.

Self-Regulation and Biomarkers of Stress

Stress is something everybody has experienced and deals with to some degree on a daily basis. It can be the result of any kind of problem in an individual's life whether it is school, family, work, social, or nearly anything else. Stressors can be both physical, like getting attacked, or psychological, as both a lack of control and a lack of predictability have been shown to produce a stress response in rodents (Sapolsky, 1994). The body produces a stress response when a stressor overloads the body’s ability to handle it. This response is produced by the Hypothalamic-Pituitary-Adrenal (HPA) Axis, a group of glands located in brain and on the kidneys. When a stressor presents itself the hypothalamus secretes hormones that reach the pituitary causing the release of another

hormone, the adrenocorticotropic hormone (ACTH) into circulation. This hormone reaches the adrenal glands, binds, and causes the release of cortisol, the stress hormone, into the bloodstream (Hostinar, Sullivan, & Gunnar, 2014). The vast majority of cortisol binds to large proteins, but enough free cortisol remains to diffuse through the body into all body fluids. This makes it possible to determine cortisol levels in the body through testing the saliva of people (Kirschbaum, n.d.). However, stress and cortisol do not have a perfectly positive relationship. A study comparing high-social anxiety college aged males to low-social anxiety college aged males found a difference in stress reactivity between the two groups. Stress was induced in the two groups through the use of the Trier Social Stress Test, a test used to investigate psychobiological stress responses. The high-social anxiety group showed a lower cortisol response to the TSST, but no difference in DHEA response. This difference drove a significant difference between the two groups' cortisol/DHEA ratio. The high-social stress group had a significantly lower ratio likely driven by their blunted cortisol reactivity. These results point to a generally blunted stress response among individuals who are inundated with stressors throughout the day (Shirotsuki, et al., 2009). Other studies have found evidence to support the idea that high amounts of consistent stress lead to a dampening of the HPA's stress response. One study investigated adults with atopic dermatitis (AD), a skin disease that can become chronic. Adult AD patients underwent the TSST and blood and salivary cortisol levels and ATCH levels were significantly dampened. The same study investigated the stress response of children with allergic asthma (AA), a chronic disorder of the airways that causes constant inflammation. Children with AA also showed a significantly blunted cortisol response. Together these results suggest that conditions that place the body in a common and

consistent state of stress lead to a dampening of the HPA axis' reactivity (Buske-Kirschbaum, & Hellhammer, 2007). Research on a high-risk low-income population of women in Mexico unearthed another similar relationship with depression. The researchers showed up unannounced to the women's place of residence and administered a depression scale, intensive interview, and a physical assessment. This process was used as a naturalistic stress induction and cortisol levels were taken upon arrival and after these assessments. Women that scored high on the depression assessment failed to show a cortisol response, whereas women who scored low on the depression assessment demonstrated a cortisol response to the stressor. This once again demonstrates the capability of the HPA axis to be buffered in high-stress individuals (Burke, Fernald, Gertler, & Adler, 2005). A number of other studies have supported the finding that chronic stress buffers the HPA axis' response. Individuals with chronic PTSD, holocaust survivors, victims of domestic abuse, and caregivers of ill family members have all been demonstrated to have blunted cortisol responses. This is likely due to the HPA buffering effect of chronic stress (Miller, Chen, & Zhou, 2007).

While testing biomarkers of stress through saliva samples is common, cortisol and DHEA can also be collected through fingernail trimmings. Cortisol builds up in the fingernails over time and provides a picture of cortisol levels over time. Izawa and colleagues conducted two studies investigating the validity of testing cortisol through the fingernails compared to through the hair and through the saliva. They found that nail cortisol levels were moderately associated with hair cortisol levels ($r = 0.29$) and slightly more associated with salivary cortisol ($r = 0.45$). This demonstrates that using fingernails to test cortisol level is a fair measure of stress (Izawa et al., 2015).

Another way to assess the presence or level of stress in a person is through the assessment of their dehydroepiandrosterone (DHEA). DHEA is another hormone produced, like cortisol, in the adrenal glands, but DHEA has a counteracting effect to cortisol. Research has found that state anxiety and trait anxiety have a negative relationship with DHEA suggesting that DHEA has a stress mitigating effect (Boudarene, Legros, & Timsit-Berthier, 2002). DHEA has also been linked to individuals with PTSD. In a study of 40 veterans with PTSD, DHEA levels were found to be higher in individuals with PTSD. Additionally DHEA was found to be positively correlated to symptom improvement and measures of coping. The cortisol/DHEA ratio was also collected and was found to be negatively correlated with the severity of current symptoms and with risk factors for PTSD. These results imply that DHEA assists in symptom improvement for PTSD and also demonstrates DHEA levels may be higher in those who experience higher stress (Yehuda, Brand, Golier, & Yang, 2006). Looking at the ratio between DHEA and cortisol is a useful measure because of the seemingly contradictory nature of the two. Understanding how this ratio responds to stressors is an important step in understanding how the body responds to stress. If DHEA truly works as a cortisol buffer then it is necessary to understand when the body produces it in concert with cortisol in order to fully understand their relationship. An experimental study conducted by Lennartsson & colleagues (2012) tested the impact of induced stress through the Trier Social Stress Test on DHEA and cortisol levels. The results showed that, in men and women, DHEA levels as measured through a blood draw significantly rose 30 minutes after the stress test. However, the secretion of DHEA following stress was found to be decreased with increased age of the participant. DHEA was also found to be positively correlated with

cortisol and heart rate following the stress test. DHEA can be assessed through fingernail samples that allows to test levels over a period of time because the DHEA accumulates in the nails over time. Warnock and colleagues conducted a study testing the validity of testing DHEA through nail clippings and found it was a reliable method with which to gather DHEA data over time. During a known time of stress they observed a significant decrease in the cortisol: DHEA ratio driven by a decrease in DHEA (Warnock, et al., 2010).

Self-Regulation and Perceived Stress

The research exploring the connection between self-regulation and stress is very limited, although connections between the two have been explored. A study of students entering college investigated the effect of a self-regulation task on illness-related clinic visits. Students were divided by optimistic and pessimistic tendencies and placed into a self-regulations task group, a disclosure task group, or a control group. Among optimists the self-regulation and disclosure tasks reduced clinic visits and among the pessimists only the self-regulation task reduced clinic visits. This implies that the self-regulation task helped all of the participants reduce the stress they were experiencing (Cameron, & Nicholls, 1998). A study of 241 young adults, half of whom lived at or below the poverty line and the other half of whom who grew up at the income level of the majority of American families, was conducted to investigate the effect of self-regulation on mitigating the effects of chronic stress. Measures of overall stress, allostatic load, and self-regulation through a delayed gratification task were collected. The children who grew up in poverty had elevated chronic stress and worse working memory as was expected. However, self-regulatory ability was found to have a protecting effect on this

relationship. Children who grew up in poverty, but demonstrated good self-regulation skills, showed better working memory than the children without good self-regulation skills. This demonstrates that self-regulation lessens the effects of chronic stress in high poverty populations. This is due to self-regulatory skills allowing children to develop better coping strategies as well divert their attention away from stressors (Evans, & Fuller-Rowell, 2013).

Self-Regulation and Emotional and Behavioral Functioning

To quantify general social and emotional health and functioning, behaviors can be broken down into two primary categories, internalizing behaviors, and externalizing behaviors. These categories are simply defined by who the behavior targets. Externalizing behaviors are behaviors whose target is external to the individual performing it and can be seen as a lashing out type of behavior. The categories of externalizing behaviors used in this study are aggressive behavior and rule-breaking behavior. Internalizing behaviors are behaviors that do not lash out towards others and are instead held within the individual and often manifest in the form of being withdrawn, lonely depressed, or anxious. It's important to identify individuals with disorders relating to these behaviors because they can have dangerous health outcomes for the individual with the disorder and those around them. Internalizing behaviors can manifest in dangerous physical conditions such as anorexia or bulimia as well as serious problems like depression. Externalizing behaviors like aggression when exhibited early in life are correlated with long term issues including dropping out of school, delinquency, and violence. These behaviors generally begin on a smaller scale among young children in the form of annoying and bullying and then grow throughout life (Smith, D., 2014). In the

current study the internalizing behaviors are broken down into three categories: being withdrawn, somatic complaints, and anxiety and depression. Research has shown a connection between self-regulation and externalizing and internalizing behaviors. Twelve and thirteen year-old boys showed a correlation between low self-control and aggressive and delinquent externalizing behaviors. The ability to delay gratification also appeared to mitigate the risk of these externalizing behaviors (Krueger, Caspi, Moffit, White, & Stouthamer-Loeber, 1996). On the contrary it has been argued that children that struggle with internalizing behaviors have self-regulation abilities that are too high and lead to these children being "over controlled" (Eisenberg, et al., 2001).

Purpose

The purpose of this study is to investigate the effect of self-regulation on the variables sleep, subjective and objective markers of stress, and emotional and behavioral functioning. Within self-regulation five sub-categories were investigated, delay of gratification, effortful control and it's three sub-categories: attentional control, activation control, and inhibitory control. This allows the study to specifically investigate what aspects of human self-regulation as determined by the chosen surveys affect these crucial health outcomes. Additionally the magnitude of data collected in this study allows for the further analysis of these variables as they interact with each other. This allows for a clearer and fuller picture of human health and how it is achieved and maintained in regards to these variables. This study also allows for further research into the area of the collection of cortisol and DHEA through the fingernails as this is a fairly new and under researched area. The pairing of this technique with subjective measures of stress gives us

further information regarding how we perceive stress and how our body reacts to stress.

Methods

Participants

A total of 89 participants were recruited at a high school in the mid-west region of the United States. The participants were primarily African-American (83 of 89) and the majority were female (55 females and 29 males with five participants not recording their sex). The participants ranged from age 14 to 18 (mean age=16.18$\pm$1.26).

Procedure

Participants were recruited through the use of flyers and announcements at their high school. The surveys were distributed to fill out and then be brought back upon completion for the collection of the DHEA and cortisol.

The Adult Temperament Questionnaire (ATQ)

The ATQ is a survey comprised of five constructs: effortful control, negative affect, extraversion/ surgency, and orienting sensitivity. Each construct is then broken down into three or four scales. The only construct used in this study was effortful control which is comprised of three scales: attentional control, inhibitory control, and activation control. There are two versions of the questionnaire, a short form that is made up of 77 items and a standard form made of 177 items. All of the questions were formatted as seven point likert scales (“The Adult Temperament Questionnaire”, 2006). The short form of the ATQ was used in this study. A mistake was made in the administration of the survey and all the questions above 70 were left off (N=7). This only affected two questions used in this study and the scores were still computed as averages.

Perceived Stress Scale (PSS)

The PSS is a ten item questionnaire used to measure the level of perceived stress of participants with at least a junior high school education based on their thoughts and feelings in the last month. The questions are designed to be general and simple to allow for the scale to be used with a wide variety of populations. The ten questions are all on a five point likert scale between Never and Very Often referring to how often the participant felt the way of the question. The scale produces a score that generalizes the participants' perceived stress between zero (low) and five (high) (Cohen, 1994).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a survey designed to measure sleep quality and patterns. It breaks sleep down into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month. These seven components are combined to formulate an overall score that assesses general sleep quality. The higher the score, the poorer the overall quality of the participant's sleep is determined to be. A score of five or higher is defined as having poor sleep quality (Buysse, et al., 1989).

Delay of Gratification Measure

The Monetary Choice Questionnaire (MCQ) was used as a metric of an individual's ability to delay gratification. The MCQ is a 21 or 27 questionnaire survey designed to estimate an individual's tendency to delay gratification and what their personal discount rate, how much they value having money now compared to later, is. The questionnaire asks questions framed as the choice between two amounts of money, a smaller sum now, or a larger sum some amount of time in the future. Using how long in the future the

money would be received and the difference in the two amounts gives a picture of how much the participant weights the value of something now compared to more in the future. For this study the 27 item questionnaire was administered. However, because it was observed that some of the participants may have not completed the entire survey with complete accuracy due to length only the first two questions were used to get an accurate measure of how the participants delayed gratification.

Youth Self-Report (YSR)

The YSR is a survey designed to measure the emotional and behavioral problems of adolescents. It asks general questions about hobbies and recreational activities as well as the participants interactions with their peers. The questionnaire also contains 112 statements to which the participant responds True, Somewhat or Sometimes True, or Not True which were scored as 0, 1, or 2. These questions covered eight subscale symptoms three of which fall under the category of internalizing: Withdrawn, Somatic Complaints, and Anxiety and Depression. Three that cover general behavioral issues: Social Problems, Thought Problems, and Attention Problems. Lastly it covers two externalizing behaviors: Aggressive Behavior, and Rule Breaking Behaviors. An individual score for each of these subscales is calculated with lower numbers correlating to less problems and high numbers correlating to more problems. For this study only the symptoms that fall under the categories of externalizing or internalizing were used (Achenbach, & Rescorla, n.d.).

Results

A series of correlations were run unearthing a number of correlations between self-regulation, sleep, stress, and emotion and behavioral function. The sleep variables

showed a number of significant relationships with behavioral and emotional functioning. Overall sleep score on the PSQI was positively correlated with the sub-scales of being withdrawn (r=.281, p=.030), and somatic complaints (r=.321, p=.012). The frequency of sleep disturbances was significantly positively correlated with anxiety and depression (r=.320, p=.013), being withdrawn (r=.418, p=.001), and somatic complaints (r=.437, p=.000).

A number of significant relationships between stress and sleep also emerged. The score on the PSS was significantly positively correlated with the overall score on the PSQI (r=.293, p=.023). The amount of stress reported in the last six months on the YSR was significantly positively correlated with the frequency of sleep disturbances (r=.377, p=.012), and reported sleep duration for a higher score is less hours of sleep (r=.361, p=.017).

The various self-regulation variables, effortful control, attention control, inhibitory control, activation control, and the results from the MCQ delay of gratification measure showed effects with the three other categories. There were several correlations between self-regulation and sleep, summarized here, and shown in Table 1. Overall sleep quality, where a higher score was indicative of worse sleep quality, was significantly correlated with attentional control (r=-.307, p=.017). Daytime dysfunction was significantly correlated with effortful control; (r=-.296, p=.024) and inhibitory control (r=-.332, p=.011). The measure of delay of gratification, the sum of the first two responses to the MCQ, trended towards significance with daytime dysfunction (r=-.270, p=.076). Self-regulation also had significance with stress as shown in Table 2. The score of the perceived stress scale was negatively correlated with attentional control (r= -.356,

p=.006), and effortful control (r= -.401, p=.002). Activation control showed a correlation with sex so to control for that effect a partial correlation controlling for sex was run as shown in Table 4 and activation control was significantly correlated with the perceived stress scale (r= -.371, p=.004). Inhibitory control also trended towards significance on this measure of perceived stress (r= -.234, p=.077). The natural log of the ratio of Cortisol to DHEA was significantly positively correlated with attentional control (r= .529, p=.003, N=30), inhibitory control (r= .416, p=.022, N=30), and effortful control (r= .504, p=.005, N=30). Effortful control was significantly positively correlated with cortisol levels (r= .397, p=.010, N=41) and negatively correlated with DHEA levels (r= .-.419, p=.019, N=31). Self-regulation variables were also significantly correlated with behavioral and emotional functioning as measured by the YSR and these results can be seen in Table 3. The sub-scales of anxiety and depression (r= -.291, p=.027), and being withdrawn (r= -.328, p=.012) were significantly negatively correlated with effortful control. The sub-scale of aggressive behavior was significantly negatively correlated with effortful control (r= -.303, p=.021), and inhibitory control (r= -.329, p=.012).

Discussion

This study aimed to investigate the relationship among multiple aspects of self-regulation and multiple markers of health and functioning. Identifying what aspects of self-regulation contributed to each of these variables also allows this study to hone in on how people make the decisions they do and what parts of that process are important for what behaviors and outcomes. This theoretically could allow us to pinpoint why certain people fail to do important behaviors or why they struggle with stress or behavioral problems and therefore help them change their behavior more effectively to overcome

these problems. The results demonstrated that self-regulation is significantly related to sleep quality, self-reported stress, and behavioral and emotional functionality. While the connection between self-control and biomarkers of stress may seem at first glance to run contradictory to the results of the connection between self-regulation and the subjective measure of stress research on chronic stress dampening the HPA axis likely explains this.

The results generally show that increased attentional control, effortful control, and inhibitory control is negatively correlated with increased sleep problems. This makes sense logically and within the context of the literature. Self-regulation is often framed within the context of making a decision now that may involve sacrificing a tangible reward for a larger reward in the future (Fujita, K., 2011). This fits clearly with many of the decisions that go into consistently getting a quality night's sleep. Simply not getting enough sleep is the primary cause of sleep problems for adolescents which is understandable given the amount of other options they have rather than sleeping. They might have to make the decision near bedtime to watch another episode of a TV show or go to bed. In that moment the TV show is a very tangible reward that takes only the push of a button to receive. The value of that extra half-hour or hour of sleep, on the other hand, is much harder to quantify at the time. The child may not that they're going to be tired in the morning, or the whole next day, but they're tired all day anyways so in that moment it may seem as though that extra sleep won't really do anything. For adolescents who struggle with inhibitory control the reward of better sleep may be so intangible it isn't even fully understood and the TV show, as the tangible dominant behavior, easily wins out, sleep barely putting up a fight. This is perfectly encapsulated within the

definition for effortful control which is “the ability to inhibit a dominant response to perform a subdominant response”. In the moment, the option of watching a TV show is clearly a dominant response and therefore it makes clear sense as to why effortful control was negatively correlated with daytime dysfunction. Respondents with better effortful control are able to better rationalize that decision and go to bed leading to fewer problems staying awake during the day. Inhibitory control was similarly related to daytime dysfunction and the reasoning follows the same lines. Attentional control in particular was negatively correlated with overall sleep problems. This is supported in the literature by the finding that parents of children with ADHD report more sleep problems among their children than children without ADHD (Marcotte, A., et al., 1998). This effect could exist for a few possible reasons. One possibility is that children that lack in attentional control may have trouble completing everything they need to throughout the day because they cannot focus on the task at hand. As a result their work and responsibilities may push later and later into the night and they have to stay up late to complete their work. As they approach a normal bedtime they also may find themselves being distracted repeatedly and pushing aside sleep for other distractions. They may also have trouble falling asleep as they cannot calm their mind down. The data showed some support, although not significantly so, for this theory. Attentional control trended toward a significantly negative relationship with sleep efficiency, calculated as hours slept divided by the number of hours spent in bed ($r= -.251$, $p=.078$). The last measure of self-regulation that was significantly correlated with sleep was the measure of an individual's ability to delay gratification which was negatively correlated with daytime dysfunction. This measure asked participants to choose between a smaller monetary reward now or a

larger one later. The same logic already laid out in regards to effortful control explains this relationship. People that would choose the smaller reward now, thus getting a lower score on delaying gratification, would be expected to choose the current reward of doing something instead of going to bed.

Self-regulation also showed a number of significant results with both subjective and objective markers of stress. Effortful, attentional, and activation control were all significantly negatively correlated with the result of the self-reported measure of stress, and inhibitory control trended towards significance. This demonstrates that people who are successful in many areas of self-regulation report experiencing less stress. There are two likely explanations for this. Individuals with better self-regulation skills likely are able to avoid putting themselves in situations that would result in them experiencing stress. These situations could vary from financial, making the decision to not spend money that would put you in a financial bind down the road, academic, completing homework and studying in or ahead of time, or other potentially stressful family or social situations. Improved self-regulation skills could also help individuals implement better coping strategies as theorized by Evans and Fuller-Rowell (2013). Whichever mechanism is actually the driving force behind this relationship the overall theme is that self-regulation generally allows people to better control their thoughts, actions, and feelings. This then allows them to control and better understand the situations they find themselves in thus mitigating potential stressors. Self-regulation was also significantly correlated with objective biomarkers of stress, however the relationship may not be what someone would first guess. The negative relationship between attentional, inhibitory, and effortful control with the natural log of the ratio between cortisol and DHEA implies that as self-

regulatory skills go up, so does the amount of cortisol in relation to DHEA. This implies that people who have better self-regulation skills have a more stimulated HPA axis than those who do not and their bodies are under more stress. This is a direct contradiction to the results of the perceived stress scale. The individual cortisol and DHEA results also contradicted this as effortful control was positively correlated with cortisol and negatively correlated with DHEA. However, some of the literature on the stress response demonstrates that the HPA axis response is not as straight forward as we may always hope it to be. The literature demonstrates that in individuals and populations that experience high levels of chronic the stress response can be muted or abnormal. Given that this is a high-risk population, as determined by the fact that this was a high school in which a high percentage of students receive free lunch, that it is likely what happened in this case as these results add to that research. Shirotsuki and colleagues (2009) demonstrated that college students under high levels of social stress had a blunted cortisol response to a stressor. A number of other studies repeated this finding with people who have PTSD, holocaust survivors, victims of domestic abuse, and caregivers of ill family members (Miller, et al., 2007). In the context of this information and the results of the perceived stress scale these results make more sense. Self-regulation separates within the sample individuals who experience higher levels of chronic stress (those with low self-regulation) from those with lower levels of chronic stress (those with high self-regulation). It would then make sense that those who experience high levels of chronic stress, the low-self regulation group, would have a blunted cortisol response as the literature predicts. Those with high self-regulation do not experience as much chronic

stress due to their improved coping strategies and as a result their HPA axis response is not blunted like their peers.

Self-regulation was also found to be correlated with a number of the emotional and behavioral wellbeing variables from the YSR. Across the board the self-regulation variables were negatively correlated with the YSR variables. This makes sense in the context of research that found self-control to be negatively correlated with externalizing behaviors as effortful control was negatively correlated with aggressive behavior (Krueger, et al., 1996). However these results did not support the theory that self-regulation would be positively correlated with internalizing behaviors as effortful control was negatively correlated with being withdrawn, and being anxious and depressed (Eisenberg, et al., 2001). This is likely due to this theory only being true in cases of extreme self-control. In a population not selected for its self-regulation abilities it is not surprising to not see an effect related to this theory as the strength of self-regulation is not great enough in general.

In general these results support the importance of self-regulation in mitigating a number of negative health benefits in high-risk adolescent populations. These results demonstrated that improved self-regulation improved people's perception of their amount of stress, however those with poor self-regulation actually saw a lower physiological stress response due to the dampening of their bodies' stress response due to increased general stressors that may result from their poor self-regulation capabilities. These findings combined with the previous literature demonstrates that even though people in these populations with worse self-regulation appear to be responding physically less to stress it is in fact likely a result of their poorly functioning stress response. Improving

these individuals self-regulation capabilities would likely lower the stressful situations they put themselves in thus lowering their perceived stress. Over time this should allow their HPA axis to return to normal functioning. This will also allow them to improve their sleep health and behavioral health as demonstrated through the correlations with the sleep scale and the internalizing and externalizing behaviors. Therefore targeting self-regulation with programs has the long term possibility of improving these students' health and happiness.

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Appendix

Table 1. Correlations between Self-Regulation and Sleep

This table contains the results of the correlations between self-regulation and sleep.

		ActCon	AtnCon	InhCon	EffCon	Sum of the responses to the first two MCQ questions	Daytime Dysfunction	PSQI score (higher is more problems)	Sleep disturbances (Higher is more)
ActCon	Pearson Correlation	1	.193	.184	.626**	-.043	-.116	-.058	.095
	Sig. (2-tailed)		.140	.160	.000	.783	.387	.657	.469
	N	60	60	60	60	43	58	60	60
AtnCon	Pearson Correlation	.193	1	.330*	.731**	-.139	-.180	-.307*	-.199
	Sig. (2-tailed)	.140		.010	.000	.375	.176	.017	.127
	N	60	60	60	60	43	58	60	60
InhCon	Pearson Correlation	.184	.330*	1	.737**	-.067	-.332*	-.114	-.158
	Sig. (2-tailed)	.160	.010		.000	.670	.011	.384	.227
	N	60	60	60	60	43	58	60	60
EffCon	Pearson Correlation	.626**	.731**	.737**	1	-.114	-.296*	-.227	-.124
	Sig. (2-tailed)	.000	.000	.000		.466	.024	.081	.347
	N	60	60	60	60	43	58	60	60
Sum of the responses to the first two MCQ questions	Pearson Correlation	-.043	-.139	-.067	-.114	1	-.270	-.038	.004
	Sig. (2-tailed)	.783	.375	.670	.466		.076	.805	.981
	N	43	43	43	43	64	44	45	45
Daytime Dysfunction	Pearson Correlation	-.116	-.180	-.332*	-.296*	-.270	1	.525**	.208
	Sig. (2-tailed)	.387	.176	.011	.024	.076		.000	.111
	N	58	58	58	58	44	60	60	60
PSQI score (higher is more problems)	Pearson Correlation	-.058	-.307*	-.114	-.227	-.038	.525**	1	.586**
	Sig. (2-tailed)	.657	.017	.384	.081	.805	.000		.000
	N	60	60	60	60	45	60	62	62
Sleep disturbances (Higher is more)	Pearson Correlation	.095	-.199	-.158	-.124	.004	.208	.586**	1
	Sig. (2-tailed)	.469	.127	.227	.347	.981	.111	.000	
	N	60	60	60	60	45	60	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Correlations between self-regulation and stress

This table contains the correlations between the five self-regualtion variables and the five stress variables.

		ActCon	AtnCon	InhCon	EffCon	Sum of the responses to the first two MCQ questions	Amount of stress reported in past 6 months	LNCortToDhea	HCORT (pg/mg)	DHEA (pg/mg)	Perceived Stress Scale (higher is more stress)
ActCon	Pearson Correlation	1	.193	.184	.626**	-.043	-.075	.150	.254	-.307	-.281*
	Sig. (2-tailed)		.140	.160	.000	.783	.638	.430	.109	.093	.033
	N	60	60	60	60	43	42	30	41	31	58
AtnCon	Pearson Correlation	.193	1	.330*	.731**	-.139	-.502**	.529**	.246	-.325	-.356**
	Sig. (2-tailed)	.140		.010	.000	.375	.001	.003	.121	.074	.006
	N	60	60	60	60	43	42	30	41	31	58
InhCon	Pearson Correlation	.184	.330*	1	.737**	-.067	-.429**	.416*	.339*	-.273	-.234
	Sig. (2-tailed)	.160	.010		.000	.670	.005	.022	.030	.137	.077
	N	60	60	60	60	43	42	30	41	31	58
EffCon	Pearson Correlation	.626**	.731**	.737**	1	-.114	-.509**	.504**	.397*	-.419*	-.401**
	Sig. (2-tailed)	.000	.000	.000		.466	.001	.005	.010	.019	.002
	N	60	60	60	60	43	42	30	41	31	58
Sum of the responses to the first two MCQ questions	Pearson Correlation	-.043	-.139	-.067	-.114	1	.309	-.016	-.107	-.183	-.031
	Sig. (2-tailed)	.783	.375	.670	.466		.091	.947	.567	.428	.811
	N	43	43	43	43	64	31	20	31	21	62
Amount of stress reported in past 6 months	Pearson Correlation	-.075	-.502**	-.429**	-.509**	.309	1	-.380*	-.195	.211	.448**
	Sig. (2-tailed)	.638	.001	.005	.001	.091		.035	.215	.246	.003
	N	42	42	42	42	31	44	31	42	32	42
LNCortToDhea	Pearson Correlation	.150	.529**	.416*	.504**	-.016	-.380*	1	.552**	-.520**	-.315
	Sig. (2-tailed)	.430	.003	.022	.005	.947	.035		.001	.002	.090
	N	30	30	30	30	20	31	32	32	32	30
HCORT (pg/mg)	Pearson Correlation	.254	.246	.339*	.397*	-.107	-.195	.552**	1	.029	-.122
	Sig. (2-tailed)	.109	.121	.030	.010	.567	.215	.001		.874	.440
	N	41	41	41	41	31	42	32	44	32	42
DHEA (pg/mg)	Pearson Correlation	-.307	-.325	-.273	-.419*	-.183	.211	-.520**	.029	1	.384*
	Sig. (2-tailed)	.093	.074	.137	.019	.428	.246	.002	.874		.033
	N	31	31	31	31	21	32	32	32	33	31
Perceived Stress Scale (higher is more stress)	Pearson Correlation	-.281*	-.356**	-.234	-.401**	-.031	.448**	-.315	-.122	.384*	1
	Sig. (2-tailed)	.033	.006	.077	.002	.811	.003	.090	.440	.033	
	N	58	58	58	58	62	42	30	42	31	86

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Correlations between self-regulation and externalizing/internalizing behaviors
This table contains the correlations between the five self-regulation variables and the five externalizing and internalizing variables.

		ActCon	AtnCon	InhCon	EffCon	Sum of the responses to the first two MCQ questions	Anxious/Depressed (Internalizing)	Withdrawn/Depressed (Internalizing)	Somatic Complaints (Internalizing)	Rule Breaking Behavior (Externalizing)	Agressive Behavior (Externalizing)
ActCon	Pearson Correlation	1	.193	.184	.626**	-.043	-.199	-.108	.030	-.154	-.070
	Sig. (2-tailed)		.140	.160	.000	.783	.135	.422	.823	.248	.602
	N	60	60	60	60	43	58	58	58	58	58
AtnCon	Pearson Correlation	.193	1	.330*	.731**	-.139	-.162	-.297*	-.258	.003	-.208
	Sig. (2-tailed)	.140		.010	.000	.375	.224	.024	.051	.981	.117
	N	60	60	60	60	43	58	58	58	58	58
InhCon	Pearson Correlation	.184	.330*	1	.737**	-.067	-.227	-.253	-.187	-.124	-.329*
	Sig. (2-tailed)	.160	.010		.000	.670	.086	.055	.161	.355	.012
	N	60	60	60	60	43	58	58	58	58	58
EffCon	Pearson Correlation	.626**	.731**	.737**	1	-.114	-.291*	-.328*	-.223	-.138	-.303*
	Sig. (2-tailed)	.000	.000	.000		.466	.027	.012	.092	.302	.021
	N	60	60	60	60	43	58	58	58	58	58
Sum of the responses to the first two MCQ questions	Pearson Correlation	-.043	-.139	-.067	-.114	1	-.154	-.158	-.154	-.145	.001
	Sig. (2-tailed)	.783	.375	.670	.466		.244	.233	.243	.272	.993
	N	43	43	43	43	64	59	59	59	59	59
Anxious/Depressed (Internalizing)	Pearson Correlation	-.199	-.162	-.227	-.291*	-.154	1	.692**	.510**	.439**	.339**
	Sig. (2-tailed)	.135	.224	.086	.027	.244		.000	.000	.000	.002
	N	58	58	58	58	59	82	82	82	82	82
Withdrawn/Depressed (Internalizing)	Pearson Correlation	-.108	-.297*	-.253	-.328*	-.158	.692**	1	.409**	.284**	.293**
	Sig. (2-tailed)	.422	.024	.055	.012	.233	.000		.000	.010	.007
	N	58	58	58	58	59	82	82	82	82	82
Somatic Complaints (Internalizing)	Pearson Correlation	.030	-.258	-.187	-.223	-.154	.510**	.409**	1	.322**	.344**
	Sig. (2-tailed)	.823	.051	.161	.092	.243	.000	.000		.003	.002
	N	58	58	58	58	59	82	82	82	82	82
Rule Breaking Behavior (Externalizing)	Pearson Correlation	-.154	.003	-.124	-.138	-.145	.439**	.284**	.322**	1	.590**
	Sig. (2-tailed)	.248	.981	.355	.302	.272	.000	.010	.003		.000
	N	58	58	58	58	59	82	82	82	82	82
Agressive Behavior (Externalizing)	Pearson Correlation	-.070	-.208	-.329*	-.303*	.001	.339**	.293**	.344**	.590**	1
	Sig. (2-tailed)	.602	.117	.012	.021	.993	.002	.007	.002	.000	
	N	58	58	58	58	59	82	82	82	82	82

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).