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The Association of Gender, Age, and Coping with Internalizing Symptoms in Youth with Sickle Cell Disease

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The Association of Gender, Age, and Coping with Internalizing Symptoms in Youth with
Sickle Cell Disease

by

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ABSTRACT

Youth with sickle cell disease (SCD) are at an elevated risk for having internalizing symptoms. Prior studies have suggested unique age by gender patterns of internalizing symptoms may be present in this population, however this pattern has not been thoroughly examined and the mechanisms underlying this pattern are not known. We examined rates of depression and anxiety symptoms between males and females with SCD across childhood and into adolescence in a cross-sectional design. We also considered the potential role of coping styles and health related locus of control for SCD morbidity that could account for age or gender patterns for internalizing symptoms. Fifty-two children and adolescents with SCD and their caregivers reported on background information, measures of coping with sickle cell pain, and depression and anxiety symptoms. There was a statistically significant interaction of age and gender in predicting anxiety symptoms, with anxiety symptoms decreasing with older age among females and increasing with older age among males. However, there was no significant coping or locus of control moderation evident for age and gender effects. Further investigation of these moderation effects are needed however, due to the cross-sectional nature of this study.

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CHAPTER 1: BACKGROUND AND LITERATURE REVIEW

Sickle cell disease (SCD) is a genetic blood disorder that can adversely affect both the physical and psychosocial functioning of those with the condition. The disease predominately affects African Americans and it is estimated that it occurs at a rate of approximately one in every 340 African American births in the United States (Hassell, 2010). Sickle cell disease affects the globin in red blood cells which carry oxygen throughout the body. S-type red blood cells produced by people with SCD polymerize as they travel through the body and the cells become rigid and take on a sickle shape. These sickled cells carry less oxygen and are more likely to cause vaso-occlusion (Discoll, 2007; Wills, 2013). Vaso-occlusion can then cause pain episodes without warning as the damaged red blood cells attach to blood vessel walls or form clots (Discoll, 2007; Wills, 2013). The most common forms of SCD are the homozygous variant HbSS (referred to as sickle cell anemia) and the heterozygous types of HbS with C-type (HbSC), HbS-Beta-Thalassemia-Plus (HbS β Thal⁺) and HbS-Beta-Thalassemia-Zero(HbS β Thal⁰). HbSS and HbS β ⁰ are the subtypes that tend to experience the most severe disease complications (Gold, Johnson, Treadwell, Hans, & Vichinsky, 2008; Kirkhan, 2007).

Although these medical complications are the hallmark of the disease, those with SCD often face additional psychosocial stressors. These additional challenges include reduced quality of life and psychological stress stemming from both the acute symptoms

and the chronic nature of the disease (Anie & Green, 2013). The challenges that SCD present make it important to evaluate the psychosocial adaptation of those living with the disease. However, understanding children and adolescents' psychosocial adaptation to SCD is still not well understood and little is known about important moderators influencing psychological adaptation. This study will examine depression and anxiety symptoms experienced by children and adolescents with SCD, and the potential role of exposure of disease related stressors and health related coping in the rates of these internalizing symptoms among boys and girls with the disease to better understand psychological adaptation and potential moderators in adaptation among youth with SCD. It is important to know if there are unique risk factors adolescent males in particular may face, in order to improve clinical understanding and practice. Internalizing symptoms can be characterized by examining symptoms of depression and anxiety separately or by combining symptoms of depression and anxiety into a single construct of internalizing symptoms. Unless symptoms are specifically labeled as depression or anxiety, internalizing symptoms indicates that a study looked at symptoms of depression and anxiety together as a single construct of internalizing.

1.1 Challenges to Adaptation among Youth with SCD

Biomedical Factors and Symptoms of Depression. It is important to examine the role of internalizing symptoms among those with SCD because of a suggested relationship between the disease processes themselves and depressive symptoms among those with SCD (Alao & Cooley, 2001). Pro-inflammatory cytokines and nitric oxide (NO), which are overproduced in youth with SCD, may influence stress and resulting depressive symptoms (Katz, 2014). Pro-inflammatory cytokines help mediate the body's

immune response to infection, and those with SCD often have infections related to tissue ischemia and spleen dysfunction (Rees, Williams, & Galdwin, 2010). These pro-inflammatory cytokines have also been associated with depression in a number of medical disorders. Due to the complications associated with SCD, pro-inflammatory cytokines could also put youth with SCD at risk for their related negative effects, including symptoms of depression. However, findings are mixed with some evidence they are not the cause but help sustain depression, and others proposing the opposite directional effect where depression affects pro-inflammatory cytokines.

Nitric oxide is an additional disease factor that may influence symptoms of depression and stress among youth with SCD. Nitric oxide is important for the dilation of blood vessels and due to the effects of SCD it is less available, and this results in less blood flow (Abboud & Musallam, 2009). Additional important roles NO may play is in stress-reducing activities and in helping to partially mediate the action of antidepressants such as SSRIs (Dhir & Kulkarni, 2011; Esch & Stefano, 2010). The elevated NO in SCD may then contribute to a reduced ability to regulate stress and an increase in depressive symptoms. Both issues relating to blood vessel dilation and stress management relate to living with a chronic illness such as SCD, and the disease processes themselves can put youth with SCD at an increased risk for developing symptoms of depression. This suggests that it is important to consider the potential for depressive symptoms among those with SCD.

Psychosocial Factors and Internalizing Symptoms. It is well established that complications from SCD can cause psychosocial stress, which increases the risk for internalizing symptoms (Barakat, Lash, Lutz, & Nicolaou, 2006; Edwards et al., 2005;

Fuggle, Shand, Gill, & Davies, 1996). Symptoms of depression and anxiety are the most common psychological problems identified by children and adolescents with SCD, with a point estimate rate of around 30% (Barbarin, Whitten, & Bonds, 1998; Thompson et al, 2003; Thompson et al., 1998). There is some evidence that children and adolescents with SCD in fact have higher levels of depression and anxiety symptoms when compared to their healthy siblings (Brown et al., 1993), and adults with SCD have been shown to have higher levels of depression than matched comparisons within the general population of the United States (Jenerette, Funk, & Murdaugh, 2005). This suggests that depression and anxiety rates may be higher for children and adolescents with SCD compared to a normative sample. Evidence also suggests that children and adolescents with SCD may even be at higher risk for developing internalizing and externalizing symptoms than children with other chronic illnesses, whom themselves have elevated rates compared to a normative sample (Helps, Fuggle, Udwin, & Dick, 2003).

Internalizing symptoms have been shown to be related to a number of disease management issues. Internalizing symptoms in SCD are often associated with the acute pain episodes and these two factors may have mutual causality. It has been shown that depression and anxiety symptoms in those with SCD has been linked to having more pain episodes and higher healthcare costs (Jerrell, Tripathi, & McIntyre, 2011). Painful vasoocclusive crises have also been linked to contributing to higher anxiety rates (Mahdi, Al-Ola, Khalek, & Almawi, 2010; Unal, Toros, Kutuk, & Uyaniker, 2011). In addition to internalizing symptoms being associated with disease related complications, this population may be even further at risk for developing symptoms of internalizing due to both the stigma that comes with having SCD and all the additional stressors that are

associated with discrimination and hardship from being African American (Barakat et al., 2006; Jenerette et al., 2005). It is clear that problems with internalizing symptoms are a real concern in this population and can both stem from a number of variables associated with the disease as well as further contribute to disease related complications.

1.2 Differences across Gender and Age in Internalizing Symptoms

Although internalizing symptoms of depression and anxiety are more common among youth with SCD than their peers, these symptoms are not unusual among the general population of children and adolescents. Anxiety has an estimated lifetime prevalence of approximately 25% (Kessler et al., 2005) and depression estimates are approximately 17% (Kessler et al., 2003). Both depression and anxiety among children occur at a rate of 10-20% by the end of adolescence (Reinecke, Curry, & March, 2009). It has been established that there are genetic factors that contribute to the development of internalizing disorders among youth, including both anxiety (Leahy, Holland, & McGinn, 2012) and depression (Sullivan, Neale, & Kendler, 2000). The genetic risk factors for anxiety disorders are complex and probabilistic, including the interaction of multiple genes and gene-environment interaction (Page, George, Go, Page, & Allison, 2003; Arnold, & Taillefer, 2011). In family studies, odds ratios of 4.0 to 6.0 for first degree relatives for all anxiety disorders have been demonstrated in a meta-analysis (Hettema, Neale, & Kendler, 2001). For depressive disorders, there is also an interaction of genes and environment. However, there is evidence from five family studies included in a meta-analysis that there is strong genetic inheritance, with an odds ratio for probands of 2.84 and a point estimate of heritability of 37% (Sullivan et al., 2000).

There are also established gender and age differences for both depression and anxiety as children move into adolescence. Rates of clinical depression are relatively low in pre-adolescent children and begin to rise in adolescence, and with this rise in incidence girls begin to have higher rates of depression starting around the age of 13 years (Hankin & Abramson, 2001). This gender difference continues with women having a higher risk for experiencing a major depressive episode throughout the rest of the lifespan (Kessler, 2006). This difference has also been demonstrated in anxiety. Girls begin to report higher rates of anxiety (especially Social Phobia) than boys starting at around age six, and they continue to report more anxiety into adolescence (Hankin & Abramson, 2001; Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998).

There are a few suggested reasons for why these gender differences in depression and anxiety may exist, including genetic and environmental influences such as gender specific socialization (Christophersen & VanScoyoc, 2013). For example, it has been suggested that girls may be parented in a way that predisposes them to develop more internalizing symptoms (Peng, Lam, & Jin, 2011). Girls may be especially at risk for developing comorbid depression and anxiety symptoms. For example, girls with depression have been shown to report more fear, worry, and social anxiety compared to males with depression (Nilzon & Palmerus, 1998). Additionally, it has been found that adolescent girls may use less effective coping strategies and be more affected by interpersonal stress. In one study, using rumination as a coping response partially mediated gender differences for depressive and other internalizing symptoms with girls showing more symptomology (Hankin, 2010). Adolescent girls have also been shown to report more depressive symptoms in interpersonal contexts, with peer related stress

partially explaining their increased rates of depressive symptoms compared to adolescent boys (Hankin, Mermelstein, & Roesch, 2007). In the general population being female seems to be a risk factor for developing internalizing symptoms; and the use of ineffective coping strategies in adolescence may result in adolescent girls having higher rates of internalizing symptoms.

1.3 Differences across Age and Gender in Internalizing Symptoms in SCD

Age Differences. The same age effect has been observed amongst children and adolescents with SCD as in the general population. Adolescents with SCD report more internalizing symptoms than younger children, however there may be additional age-related factors that amplify this effect in SCD (Barakat et al., 2006; Brown, Eckman, Baldwin, Buchanan, & Dingle, 1995; Hurtig et al., 1989; Scott & Scott, 1999).

Adolescence is a critical developmental period marked by many physical, emotional, and psychological challenges as new identity is formed and greater independence is achieved (Hankin et al., 2007). Adolescence can produce unique challenges to those with SCD. Children with SCD can experience disease complications that include delayed puberty, short stature, and fatigue (Barakat et al., 2006; Lemanek et al., 1998). These complications can cause additional stress for adolescents with SCD because of their influence on identity formation, social role participation (such as dating), and the ability to be independent. In fact, adolescents with SCD have reported less satisfaction with peer relationships and poorer self-esteem than their healthy peers (Scott & Scott, 1999). With reduced social functioning there is an increase in reports of distress and internalizing symptomology (Morgan & Jackson, 1986, Telfair, 1994). So, in addition to the normal stressors that all adolescents face, those with SCD experience additional disease related

difficulties that can lead to internalizing symptomology during this crucial developmental time period.

Gender Specific Differences in Internalizing Symptoms in SCD. There is some evidence to suggest that, amongst those with SCD, adolescent boys have higher rates of internalizing symptoms than adolescent girls (Hurtig & White, 1986; Kell, Kliwer, Erickson, & Ohene-Frempong, 1998). This is a potentially important departure from the gender-related patterns in the general population, in which adolescent girls report more internalizing symptoms than their adolescent male counterparts. Adolescent boys with SCD have been shown to have lower social competence than both younger boys with SCD and girls of all ages with SCD (Hurtig & Park, 2006). Boys with SCD may be especially prone to reduced social competence due to disease related decreases in physical stature and ability, which may be especially important for males during adolescence (Barakat et al., 2006). This reduced social competence is thought to contribute to an increase in internalizing symptoms, as building successful peer relationships may be especially challenging for adaptive psychosocial development in adolescent boys with SCD. In addition, adolescent boys with SCD have been shown to have more behavior problems and deficits on a range of adjustment variables when compared to younger boys and to girls of all ages with SCD (Hurtig & White, 1986). In this same study, adolescent boys with SCD also reported more problems in behavior and social adjustment than adolescent girls with SCD, while older girls showed an increase in depressive symptoms and a decrease in externalizing symptoms compared to younger girls in the study (Hurtig & White, 1986).

Age- and gender-related risks for internalizing problems in SCD deserve further study. To-date, very little research on the psychological effect of SCD has considered age and gender patterns with the few studies reviewed above not replicated. Thus, potential moderators of internalizing symptoms should be clarified or examined to help determine if there are unique risk factors (particularly for adolescent males) that may not be factored into current clinical research and practice. Although a unique gender pattern of internalizing symptoms deserves further investigation and could certainly prove important for intervention, it must also be considered that only two studies have reported gender-specific data (Hurtig & White, 1986; Kell et al., 1998), and that these studies are more than 15 years old, raising concerns about the reliability of this finding and whether other studies may have failed to report null effects for gender differences. One purpose of this study is to examine internalizing symptoms among male and female youth with SCD in a more recent sample.

1.4 The Role of Coping in Childhood

Coping is important to consider in the relationship between stressors and internalizing symptoms and can therefore be an important moderator at play in the relation of SCD and internalizing symptoms. Lazarus and Folkman (1984) have provided a widely accepted definition of coping which states that coping is an ever changing behavioral and cognitive effort to manage internal and external demands that are seen as exceeding the resources of an individual. Coping strategies are known to follow a predictable developmental course, and they continue to increase and diversify as children enter into adolescence. In infancy, coping skills are limited to using objects for self-soothing, withdrawal from threat, and seeking support from others (Compas et al., 2001;

Guunar, 1994). Very young children have limited coping skills, but as children age new skills begin to develop. By middle childhood, increased language and meta-cognition skills allow for self-talk, the ability to generate alternative solutions, and other problem solving techniques (Compas et al., 2001, Zimmer-Gembeck & Skinner, 2011). As children move from middle childhood into adolescence, their coping skills continue to grow and develop. Increased cognitive skills allow for adolescents to more accurately match a coping skill to a stressor (Compas et al., 2001). Adolescents have an increased capacity for coping, but also must balance their emerging autonomy with parental support. Experience is constructed through cognitive capacity and the environment, and development clearly influences ability to utilize different coping strategies.

Understanding the role of development in coping is an important foundation for understanding how internalizing symptoms are impacted by coping among children and adolescents. This can help frame the differences in rates of depression and anxiety among children versus adolescents. In addition to examining coping within a developmental framework, it may also be useful to consider how different coping methods may have different utility for depressive versus anxiety symptoms. This is related to the tripartite model of depression and anxiety which proposes that although both depression and anxiety share a common negative affect, depression is uniquely associated with a low positive affect, while anxiety is uniquely associated with physiological hyperarousal (Clark & Watson, 1991). It has been suggested that youth with symptoms of anxiety are more likely to use proactive and problem focused coping responses, including seeking out social support (Wright, Banerjee, Hoek, Rieffe, & Novin, 2010). This is likely a response aimed at reducing the hyperarousal associated with anxiety. On the other hand,

depression is associated with a reduction of perceived social support during adolescence (Stice et al., 2004). This may be related to lower arousal from the lack of positive affect associated with depressive symptoms.

The role of social support seeking as a coping mechanism is especially important to consider during adolescence, as this is a developmental time period in which peer relationships are increasingly important (Telfair, 1994). It has been found that adolescent females may be more likely to effectively use social support as a coping mechanism compared to adolescent males among those with chronic pain. Lynch, Kashikar-Zuck, Goldschneider, & Jones (2007) found that girls with chronic pain used more social support as a coping mechanism while boys used more behavioral distraction techniques. It has been suggested that the differences in coping preferences seen among males and females with chronic pain, especially during adolescence, may be attributed to different socialization experiences (Lynch et al., 2010). Additionally, girls with chronic pain have reported expecting more positive outcomes as a result from seeking social support to cope with their pain, while their male counterparts are more likely to be told to work through their pain (Palermo, 2000). Social support in adolescence seems to be an important coping mechanism, especially in response to anxiety symptoms, and it appears female adolescents may be more effective in utilizing this coping strategy.

1.5 The Role of Coping in Internalizing Symptoms in SCD

Health Related Coping. When examining coping among children with SCD, it is thought that the use of coping strategies may mediate the relationship between SCD related stressors and depression and anxiety, just as coping can mediate stressors and internalizing symptoms among children with other chronic health conditions and children

in the general population. When examining coping among those with SCD, an extension of the Lazarus & Folkman (1984) model can be used. With this model, coping is a behavioral and cognitive effort that is ever changing in order to deal with vaso-occlusive pain that is appraised as stressful and exceeding the resources of the individual. In the SCD literature there have been three primary types of coping evaluated, which have been labeled coping attempts, negative thinking, and passive adherence (Gil, Williams, Thompson, & Kinney, 1991). The construct of coping attempts is similar to the active coping construct that is common in the broader coping literature. This includes using active thinking or behaviors to reduce pain, such as using distraction or maintaining one's activity level (Gil, et al., 1991). On the other hand, negative thinking is a coping style that relies on rumination of the pain being experienced, seeing the pain as never ending, and having a negative impact on the individual's life. Passive adherence is a coping method that includes non-psychological strategies that may be recommended by a health professional, such as massage, warm baths, or ice (Gil, et al., 1991; Rosenstiel & Keef, 1983).

Differences among these coping styles have been shown to alter outcomes, both in pain and in handling more general stressors, including internalizing symptomology. In relation to pain, active coping (i.e. coping attempts) has shown to produce better psychological and functional outcomes in comparison to negative thinking or passive adherence. The use of coping attempts has been shown to be related to lower pain sensitivity, lower health care utilization, and increased activity in relation to others who reported using more of the other two coping strategies in response to sickle cell related pain (Anie, 2002; Gil et al., 1989; Gil et al., 1991; Thompson, Gil, Burbach, Keith, &

Kinney, 1993). Additionally, those who have reported more negative thinking in response to sickle cell pain have also reported more distress and worse psychological adjustment (Anie, 2002). There is also evidence that as children move into adolescence there may be a shift in coping, where adolescents utilize more negative thinking and passive adherence as coping strategies in response to sickle cell related pain (Gil, Thompson, Keith, Tota-Faucetter, Noll, & Kinney, 1992).

In addition, adolescents (as opposed to younger children) with SCD have been shown to utilize ineffective coping strategies that may lead to depression and anxiety symptoms. More specifically, Barakat, Schwartz, Simon, & Radcliffe (2007) found that negative thinking as a coping strategy mediated the relationship between pain intensity and depression, as well as the relationship between sickle cell pain's interference with activities and anxiety among adolescents with SCD. In the same study, a direct path was established between using negative thinking as a coping strategy and the presence of depression and anxiety among adolescents with SCD. This demonstrates the potential link between ineffective coping (negative thinking in particular) and internalizing symptoms among adolescents with SCD (Barakat et al., 2007). These findings add to the explanation of why more internalizing symptoms are seen in adolescence in those with SCD. This study will attempt to understand if indeed a unique age by gender pattern of internalizing exists, if utilization of different types of coping strategies might be an explanation for that pattern of internalizing symptoms among youth with SCD.

Health Related Locus of Control. Another construct of interest in the study of coping in youth with chronic health conditions is how health related locus of control, and associated functional independence can impact adjustment. A presumed factor in age-

related changes in pain coping in SCD is that youth with recurrent pain often begin in adolescence to believe the pain is less controllable. Perceived control over health outcomes also has important implications for functional independence. Functional independence (i.e. the level of disability) can be evaluated by understanding how much control over their disease a child or adolescent with SCD believes they have. The idea of locus of control was first suggested by Rotter (1966), who grounded the concept in social learning theory and defined it as the interpretation of reinforcement as either being due to luck or chance (external locus of control) or due to an individual's relatively permanent characteristics (internal locus of control). Locus of control is related to whether a response is instrumental in attaining a goal, no matter the specific nature of the goal or reinforcer (Furnham & Steele, 1993).

Health related locus of control has been examined to understand how much children and adolescents believe their health related behaviors influence their health. This allows for the investigation of locus of control in the specific domain of health. Evaluating health related locus of control assumes that if a child can gain an understanding and positive attitude about a health related behavior, then their behavior can change (Parcel & Meyer, 1978). Within the Health Belief Model, which is a framework used to predict health behavior, Maiman & Becker (1974) suggest that the prediction of behavior depends on both the value a child or adolescent places on a particular goal as well as their estimate of the likelihood that a given action will result in their goal. Health related locus of control is thought to tap into the individual's estimation that their action will get them to their goal (Parcel & Meyer, 1978).

When examining what may impact health related locus of control beliefs, there are some important factors to consider. Variables such as ethnicity, gender, and age may impact whether an internal or external health related locus of control is held by a child. There is some evidence that children who are ethnic minorities may hold more external health related locus of control beliefs than Caucasians (Malcarne, Drahota, & Hamilton, 2005; Parcel & Meyer, 1978). However, in a study comparing African American children with SCD and Caucasian children with cystic fibrosis there were no significant differences found in health related locus of control (Thompson et al., 1998). It has been suggested that the lack of differences in health related locus of control beliefs in this study could be due to the fact that both of these populations of children have extensive exposure to health care due to the chronic nature of their illness. In addition to ethnicity potentially impacting children holding an internal or external health related locus of control, age and gender may also be important to consider. There is some evidence that girls have a more internal health related locus of control than boys (Olvera et al., 2001; O'Brien et al., 1990). O'Brien (1990) found that among African American schoolchildren there was not a difference in internal health related locus of control beliefs between boys and girls at ages 9-11 years, but when measured again two years later girls reported more internal health related locus of control beliefs. This finding may point to health related locus of control shifting across age.

Health related locus of control has been found to relate to certain health outcomes and behaviors, but findings have differed across studies. For example, it has been found that an internal locus of control was associated with better physiological health outcomes for children with asthma (Griffin & Chin, 2006) and children with rheumatoid arthritis

(Smith, Dobbins, & Wallston, 1991). On the other hand a more external health related locus of control has been connected to poor psychological adjustment (Affleck, Tennen, Pfeiffer, & Fifield, 1987; Benassi, Sweeney, & Dufour, 1988). However, health related locus of control has also been found to not relate to psychological adjustment. Among children with cancer, locus of control was not found to be predictive of self-reported anxiety; rather, hopefulness was found to better predict this psychological outcome (Goertzel & Goetzel, 1991).

Although it is not definitive if locus of control can predict health behavior, it is generally believed that an internal locus of control is associated with positive outcomes in adaptation. If a child with SCD has an internal locus of control and therefore believes that they have more control of their illness, they might engage in more problem-solving coping strategies (Brown et al., 2000). The further binds the link between coping and adaptation, as it has been shown that children with a higher functional independence report better adaptation (Casey, Brown, & Bakeman, 2000). Understanding health related locus of control and functional independence among children and adolescents with SCD may help better understand adaptation to stressors.

1.6 The Present Study

The present study is a preliminary study conducting secondary data analyses to lend empirical support and guidance to the examination of age and gender and moderating effects of internalizing symptoms in SCD. This study will examine if there are cross-sectional differences in rates of depression and anxiety symptoms between males and females with SCD across childhood and into adolescence. We will also examine if different coping strategies or an internal versus a more external health related

locus of control as two potential moderators, may help explain any differential patterns of depression and anxiety among males and females and across age.

(1) The first research question of interest is if there is an interaction between gender and age among youth with SCD in rates of reported depression and anxiety symptoms. It is hypothesized that as age increases males with SCD will report more internalizing symptoms (both depression and anxiety) than females with SCD; while there will be no reported difference of internalizing symptoms among younger males and females with SCD. (2) The second research question of interest is if there is an interaction between gender and age among youth with SCD in rates of coping attempts, passive adherence coping, and negative thinking coping in response to sickle cell pain. It is hypothesized that there may be gender differences in coping styles with more ineffective coping styles utilized among males as age increases in comparison to females with SCD across age. Such a difference in coping styles may help explain the age by gender interaction of depression and anxiety, if indeed present. (3) Finally, the third research question of interest is if internal versus external health related locus of control helps explain any differences in reported rates of depression and anxiety symptoms among males and females with SCD across age.

CHAPTER 2: METHOD

2.1 Participants and Recruitment

Participants in this study were drawn from a study which was designed to examine a combination of biological (i.e., disease-related) and psychosocial risk factors in relation to multiple pain outcomes in pediatric SCD, with the goal of developing a biopsychosocial model of pain for this condition. The larger study included 76 children and youth with SCD, ages 8 to 21, and 70 caregivers. The current study includes 52 of the original 76 children and youth with SCD who participated. Children and adolescents were given supplemental measures of anxiety and depression as part of the study, though these measures were a lower priority as they were not related to the hypotheses of the main study. No families refused the measures, but several families were unable to complete the measures due to time constraints. The 52 children and adolescents who did not have time constraints and were able to stay to complete the additional mood measures are included in the current study. Children in the current study had a mean age of 14.64 years ($SD = 3.06$) and ranged in age from 8.25 years to 19.34 years. See Table 2.1 for further demographic information. The age range for children was chosen to maximize participation in the research while also considering the lowest age range that would allow for valid self-report data (our measures had been validated with children as young as age 8). Families were recruited during routine health visits at the Center for Cancer and Blood Disorders (CCBD) at Palmetto Richland Children's Hospital in Columbia, SC.

Eligibility for the study was determined by examining the child's medical chart. After the chart review the attending hematologist was consulted to determine if there were any reasons to postpone approaching the family (e.g., acute medical or psychosocial concerns). The attending hematologist asked the families about their interest in the study and an investigator followed up with the family after the visit or via phone to set up a time to complete the procedures. Interested families met with an investigator in a private room at the clinic to obtain consent/assent and complete study procedures. Youth between the ages of 18 and 21 were given the choice of participating with or without a caregiver. This decision was made to maximize participation of this particular group of youth, who were more likely to attend hematological visits without a caregiver. Five youth chose to participate without a caregiver.

Inclusion and Exclusion Criteria. Eligible children must have received their primary hematological care through the CCBD. Children with major developmental disorders or overt neurologic disease resulting in severe cognitive limitations were excluded, as these conditions would limit the validity of the self-report data. Participants could not be experiencing pain requiring the use of opioid-based drugs on the day of participation as this may have influenced their ability to complete self-report data on pain. If opioid drugs were used, children and their families were approached during their next routine visit for participation. Children undergoing transfusion therapy were excluded because transfusion therapy can alter the natural course of pain in SCD and these children represented a small minority of the overall population of children with SCD at the clinic (Miller, et al., 2001). In contrast, children receiving hydroxyurea, a treatment that can also alter the natural course of pain in SCD, were not excluded as this

treatment was much more prevalent in the clinic population and typically has a lesser impact on pain than transfusion therapy. Families of children treated with hydroxyurea were asked to provide additional detail about the child's pain history and the researcher also documented details about the treatment and pain history during the medical record review. In addition, the hematologist was consulted to provide ratings of therapeutic response and adherence to complement the medical record review.

2.2 Measures

Background Information. Caregivers completed a brief demographic questionnaire that included information on child gender, age, race, and ethnicity, and caregiver gender, race, ethnicity, socioeconomic status, education, and relationship to the child.

Disease Information.

Medical Record Review. Medical record review was conducted using a structured coding method to identify risk factors for pain episodes and descriptive information. Information was collected on the following: presence or absence of alpha thalassemia trait, history of medical complications, current medications, and the most recent laboratory blood results for hemoglobin, hematocrit, white blood cells, platelets, and fetal hemoglobin levels. At the CCBD, hemoglobin, hematocrit, white blood cells, and platelets were routinely measured at each clinic visit. Fetal hemoglobin levels were measured every two years for children ages 8 to 21 until levels reached less than 10%. Documented hospitalizations, emergency room visits, and outpatient health care contacts (e.g., calls or visits to the clinic) for pain episodes over the previous 24 months were also recorded. For children taking hydroxyurea, laboratory values closest to the start date of

treatment were recorded. In addition, documented hospitalizations, emergency room visits, and outpatient health care contacts for pain episodes in the 24 months preceding the start of treatment were recorded. Although the time captured for medical record review differed from caregiver- and child-reported health care utilization (i.e., 24 months versus 12 months), these measures were strongly related ($r = .67$).

Psychological Variables: Child-Completed.

Coping Strategies Questionnaire for Sickle Cell Disease (CSQ-SCD). The CSQ-SCD is an 80-item questionnaire that assesses the frequency of coping behaviors children used to deal with pain. The CSQ-SCD is an adapted version of the original Coping Strategies Questionnaire and has been validated by Gil, et al. (1991) for children and adolescents with SCD ages 7 to 17. The CSQ-SCD includes 13 subscales with six items each, with each item rated on a 7-point Likert scale from 0 (never) to 6 (always) to indicate how often a strategy is used. Two additional items assess subjective feelings of how effective the coping strategies are at controlling and decreasing pain. Factor analysis also has supported three broad subscales: Coping Attempts, Negative Thinking, and Passive-Adherence. Coping Attempts, which measures adaptive coping (e.g., distraction), Negative Thinking, which measures maladaptive coping (e.g., catastrophic thinking), and Passive Adherence (e.g. following medical advice) were used. Scores on the Coping Attempts scale range from 0 to 180, with higher scores representing higher coping attempts. Scores on the Negative Thinking Scale range from 0 to 144, with higher scores representing higher ratings of negative thinking. The Passive Adherence scale scores ranged from 0-144, with higher scores representing more frequent use of medical coping such as applying heat to a painful area. In the current study, internal consistency was

good to excellent for the Coping Attempts ($\alpha = .91$) and Negative Thinking ($\alpha = .89$) scales.

Children's Health Locus of Control-Revised (CHLC). The CHLC is a measure that assesses health locus of control. This measure was originally developed for elementary school children ages 9-12 years. The revised measure includes 12 items on a yes-no answer format. The measure contains one internal locus of control scale. The items relating to the internal locus of control include beliefs that an individual has control over their health behaviors. It also contains two external locus of control scales (chance and powerful others). The chance related items include statements that refer to their health being due to chance or luck and the powerful other related items refer to an individual's health being controlled by powerful people in their lives (i.e. nurse, doctors, parents). Items were scored as either relating to an internal locus of control or external locus of control, and then were summed, with higher summed scores indicating a more external locus of control. There are acceptable levels of reliability, internal consistency, and construct validity (Parcel & Meyer, 1978).

Behavior Assessment System for Children, Second Edition (BASC-2). The BASC-2 is a measure of adaptive and clinical functioning of children and adolescents. The self-report for children 8-11 years of age version was used in this study for all participants in order to equate the number of items and item content across participants. The raw scores were used for all analyses because the *t* scores were only normed for the children 8-11 years, and therefore were not applicable to all participants in the study. There are 36 items on the BASC-2 version utilized, with 13 items on the Depression scale and 13 items on the Anxiety scale. The range of possible scores for the Depression scale

were 0 – 22 and the range of possible scores for the Anxiety scale were 0 - 29. The only prior studies using the BASC-2 in children with SCD focused only on adolescents, so it was unclear how the measure would perform in a larger age range (Barakat, Patterson, Daniel, & Dampier, 2008). The internal consistency was adequate in this sample, Depression Scale ($\alpha = .84$) and Anxiety Scale ($\alpha = .80$).

2.3 Procedures

All study procedures, including the consent and assent process, were conducted by the study P.I.s (Alyssa Schlenz, Ph.D. or Jeff Schatz, Ph.D.). Institutional Review Board approval was obtained from Palmetto Richland Hospital, with concurrent approval from the University of South Carolina. Informed consent was obtained from all caregivers and assent was obtained from all children. Families were told that their choice to participate in the study would not impact their relationship with health care staff or their treatment at the CCBD.

Procedures for Questionnaires. Children and caregivers completed the demographic and psychosocial questionnaires in a private clinic room. Questions were read aloud to all children, with the exception of adolescents who indicated a preference for completing measures independently. Medical record reviews were conducted after the families' visits using a structured coding method and both electronic and paper records were used.

2.4 Data Analysis

In order to address the research questions, separate multiple regression models were used. The first two models looked differences in rates of depression and anxiety symptoms reported among males and females with SCD across age using the statistical

model: Depression/Anxiety = $B_0 + B_1 \text{ Gender} + B_2 \text{ Age} + B_3 \text{ Gender X Age}$. The next three models evaluated differences in reported coping among males and females with SCD across age, Coping Attempts/Passive Adherence/Negative Coping = $B_0 + B_1 \text{ Gender} + B_2 \text{ Age} + B_3 \text{ Gender X Age}$. The summed scale scores of the coping measure was used as the primary outcomes in these three models. A final model evaluated differences in health related locus of control among males and females with SCD across age, Health Locus of Control = $B_0 + B_1 \text{ Gender} + B_2 \text{ Age} + B_3 \text{ Gender X Age}$. A summed score of the health locus of control measure was used as the outcome measure in this model. To test all of these models, first a model testing age and gender was conducted, followed by a model including age, gender, and their interaction. All significant results were interpreted from the models containing the interaction of gender and age. The alpha level was set at .05 for each analysis due to the preliminary nature of the research.

Table 2.1 *Demographic and Medical Characteristics of Children*

Characteristics	<i>N</i> = 52
Age (<i>M, SD</i>)	14.64, 3.06
Gender (<i>n</i>)	
Male	31
Female	21
Race* (<i>n</i>)	
African American	52
Ethnicity (<i>n</i>)	
Hispanic, Latino, or Spanish Origin	0
Insurance Status	
Medicaid only	30
Medicaid and private insurance	9
Private insurance only	13
Sickle Cell Subtype (<i>n</i>)	
HbSS	36
HbSC	8
HbSβ ⁰	3
HbSβ ⁺	5
Currently taking hydroxyurea (<i>n</i>)	32

Note. *Participants were able to mark multiple selections.

CHAPTER 3: RESULTS

3.1 Preliminary Analyses

The associations between the age and gender of participants at intake, the depression and anxiety summed scale score from the BASC-2, the coping summed scale scores for coping attempts, passive adherence, and negative thinking, and the locus of control summed score were examined using Pearson correlations. This was done to assess initial relationships between predictors and outcomes and to screen for multicollinearity. The summed scores on the anxiety scale was significantly correlated with negative thinking ($r = .51, p < .05$), and the summed depression scale from the BASC-2 ($r = .55, p < .05$). The summed scores on the depression scale was also significantly correlated with negative thinking ($r = .62, p < .05$) as well as significantly correlated with health related locus of control ($r = .32, p < .05$). Age was significantly correlated with coping attempts ($r = -.46, p < .05$). In addition, point-biserial correlations showed gender significantly correlated with anxiety ($r = -.43, p < .05$) and negative thinking ($r = -.20, p < .05$). See Table 3.1 for all tested correlations.

All model assumptions of normality, linearity and homoscedasticity were tested by plotting the model residuals. All model assumptions were reasonably met, except for the test of the relationship between the predictors gender and age and the outcome depression. A log transformation of the summed depression scale score was run to better meet the assumptions of normality, linearity, and homoscedasticity. See Figure 3.1 for

model assumptions before and after log transformation. However, there was no substantial difference found in effects before and after log transformation. In light of this result and in order to maintain interpretability, the depression scale score was simply transformed into a z score for analyses but was not log transformed. The anxiety scale score was also transformed into a z score for analyses for ease of interpretability. Age and gender were centered for all analyses to reduce multicollinearity among predictors.

3.2 Relationships between Gender, Age, and Anxiety

We hypothesized that as age increased males with SCD would report more anxiety symptoms than females with SCD, and that there would not be a difference in reported anxiety symptoms among younger males and females with SCD. The overall model containing the main effects and interaction produced the best prediction of reported anxiety symptoms ($F(3, 48) = 5.66, p < .05, R^2 = .26$). In the model including the interaction of gender and age, there was a significant main effect of gender on anxiety ($B = -2.67, p < .05, SE = .78$) with a large Cohen's effect ($d = .94$). This means that females reported significantly more anxiety than males and the large effect size indicates that this is potentially an important difference clinically. Further, there was a significant interaction of age and gender in predicting anxiety ($B = .58, p < .05, SE = .26$). This result is also bolstered by a large effect size ($r^2 = .30$). This indicates that there is significant moderation occurring in predicting anxiety symptoms, and that anxiety symptoms vary across the slope of age for males and females. Specifically, it was found that young females had high levels of anxiety that decreased with older age, while young males reported low levels of anxiety that that increased with age (see Figure 3.2). See Table 3.2 for full regression results of the interaction model.

3.3 Relationships between Gender, Age, and Depression

We hypothesized that as age increased males with SCD would report more depression symptoms than females with SCD, and that there would not be a difference in reported depression symptoms among younger males and females with SCD. No model was significant and there was no significant interaction effect of gender and age predicting reported depression, indicating that there was no moderation. However, there was a trend towards significance found for the main effect of gender on depression ($B = -1.24, p = .10, SE = .75$), with a small to moderate Cohen's effect size ($d = .49$). See Table 3.3 for full regression results. This result suggests that female participants reported more depression than males, however because the effect size for this result is small to moderate (and much smaller than the effect seen in predicting anxiety) the difference between males and females in reported depression is likely not clinically meaningful within this sample. See Figure 3.3

3.4 Testing the Role of Coping

Relationships between gender, age, and coping attempts. We hypothesized that as age increased males with SCD would report fewer coping attempts than females with SCD, and that younger males would report more coping attempts than younger females with SCD. The model containing both the main effects and their interaction was significant in predicting reported coping attempts $F(3, 48) = 4.54, p < .05, R^2 = .22$. There was no significant interaction effect of gender and age, indicating that there was no significant moderation. However, there was a significant main effect of age on coping attempts with a large effect size in the interaction model ($B = -3.74, p < .05, SE = 1.15, r^2 = .41$). This means that older youth made significantly fewer coping attempts than their

younger counterparts, with coping attempts decreasing by 3.74 with every one unit increase in age (See Figure 3.4). See Table 3.4 for full regression results.

Relationships between gender, age, and passive adherence. We hypothesized that as age increased males with SCD would report less passive adherence than females with SCD, and that younger males would report more passive adherence than younger females with SCD. The model was not significant, there was no significant interaction effect of gender and age, and there was only a small to moderate effect size for the interaction ($r^2 = .05$). These results indicate that there was no significant moderation in predicting passive adherence. See Table 3.5 for full regression results.

Relationships between gender, age, and negative thinking. We hypothesized that as age increased males with SCD would report more negative thinking than females with SCD,, and that in particular, adolescent males with SCD may report more negative thinking. The model containing the main effects of gender and age and their interaction was significant in predicting reported negative thinking, $F(3, 48) = 2.70, p < .05$. However, there was no significant interaction effect of gender and age, indicating that there was no significant moderation. There was a significant main effect of gender in predicting negative thinking in the interaction model ($B = -8.46, p < .05, SE = 3.70$) with a small Cohen's effect of $d = .21$. See Table 3.6 for full regression results. This result means that gender significantly predicted negative thinking, with females reporting 8.46 more negative thinking symptoms than the grand mean of negative thinking for males and females. See Figure 3.5 for mean differences in reported negative thinking for males and females.

3.5 Relationships between Gender, Age, and Health Related Locus of Control

We were interested in the role that health related locus of control has in relation to the reported number of depression and anxiety symptoms of males and females across childhood and into adolescence. However, no model was significant and there was no significant interaction effect of gender and age. See Table 3.7 for full regression results.

Table 3.1 *Correlations of Age, Gender, BASC-2 Anxiety and Depression Summed Scales, CSQ-SCD Summed Coping Scales, and CHLC Summed Locus of Control Score*

	Age	Gender	Anxiety	Depression	Coping Attempts	Passive Adherence	Negative Thinking
Age	1.00						
Gender	.01	1.00					
Anxiety	-.06	-.43*	1.00				
Depression	.07	-.23	.55*	1.00			
Coping Attempts	-.46*	-.09	.15	.11	1.00		
Passive Adherence	-.06	-.22	.20	.01	.44*	1.00	
Negative Thinking	.21	-.20*	.51*	.62*	.14	.40*	1.00
Locus of Control	-.22	-.02	.03	.32*	.12	-.18	.10

Note. * $p < .05$.

Table 3.2 Summary of Predicted Anxiety

	B	SE	t	R ²	ΔR ²	F
Step 1				.19		5.56*
Intercept	11.94	.81	14.74*			
Age	-.11	.26	-.40			
Gender	-2.68	.81	-3.30*			
Step 2				.26	.07	5.66*
Intercept	11.94	.78	15.29*			
Age	-.28	.26	-1.05			
Gender	-2.67	.78	-3.42*			
Age X Gender	.58	.26	2.23*			

Note. * indicates $p < .05$. Overall model, $F(3, 48) = 5.66$, $p < .05$, $R^2 = .26$.

Table 3.3 Summary of Predicted Depression

	B	SE	t	R ²	ΔR ²	F
Step 1				.06		1.50
Intercept	5.14	.75	6.90*			
Age	.12	.24	.49			
Gender	-1.24	.75	-1.67•			
Step 2				.06	0	1.04
Intercept	5.14	.75	6.83*			
Age	.09	.26	.35			
Gender	-1.24	.75	-1.65•			
Age X Gender	.10	.26	.40			

Note. * indicates $p < .05$, • indicates $p = .10$. Overall model, $F(3, 48) = 1.04$, *ns*, $R^2 = .06$.

Table 3.4 Summary of Predicted Coping Attempts

	B	SE	t	R ²	ΔR ²	F
Step 1				.21		6.73*
Intercept	84.37	3.37	25.03*			
Age	-3.94	1.09	-3.60*			
Gender	-2.16	3.37	-.64			
Step 2				.22	.01	4.54*
Intercept	84.39	3.39	24.87*			
Age	-3.74	1.15	-3.25*			
Gender	-2.17	3.39	-.64			
Age X Gender	-.68	1.15	-.59			

Note. * indicates $p < .05$. Overall model, $F(3, 48) = 4.54, p < .05, R^2 = .22$.

Table 3.5 Summary of Predicted Passive Adherence

	B	SE	t	R ²	ΔR ²	F
Step 1				.05		1.31
Intercept	105.56	2.95	35.84*			
Age	-.36	.96	-.38			
Gender	-4.61	2.95	-1.57			
Step 2				.08	.03	1.31
Intercept	105.52	2.94	35.93*			
Age	-.69	.99	-.70			
Gender	-4.59	2.94	-1.56			
Age X Gender	1.13	1.0	1.14			

Note. * indicates $p < .05$. Overall model, $F(3, 48) = 1.31$, ns , $R^2 = .08$.

Table 3.6 Summary of Predicted Negative Thinking

	B	SE	t	R ²	ΔR ²	F
Step 1				.14		3.90*
Intercept	57.99	3.68	15.77*			
Age	1.91	1.19	1.61			
Gender	-8.48	3.68	-2.31*			
Step 2				.15	.01	2.70*
Intercept	57.96	3.70	15.66*			
Age	1.68	1.25	1.34			
Gender	-8.46	3.70	-2.29*			
Age X Gender	.80	1.25	.64			

Note. * indicates $p < .05$. Overall model, $F(3, 48) = 2.70, p < .05, R^2 = .15$.

Table 3.7 Summary of Predicted Health Locus of Control

	B	SE	t	R ²	ΔR ²	F
Step 1				.05		1.14
Intercept	26.68	.91	29.33*			
Age	-.44	.29	-1.51			
Gender	-.10	.91	-.11			
Step 2				.05	0	.75
Intercept	26.68	.92	29.00*			
Age	-.44	.31	-1.42			
Gender	-.10	.31	-.10			
Age X Gender	-.01	.31	-.03			

Note. * indicates $p < .05$. Overall model, $F(3, 48) = .75, ns, R^2 = .05$.

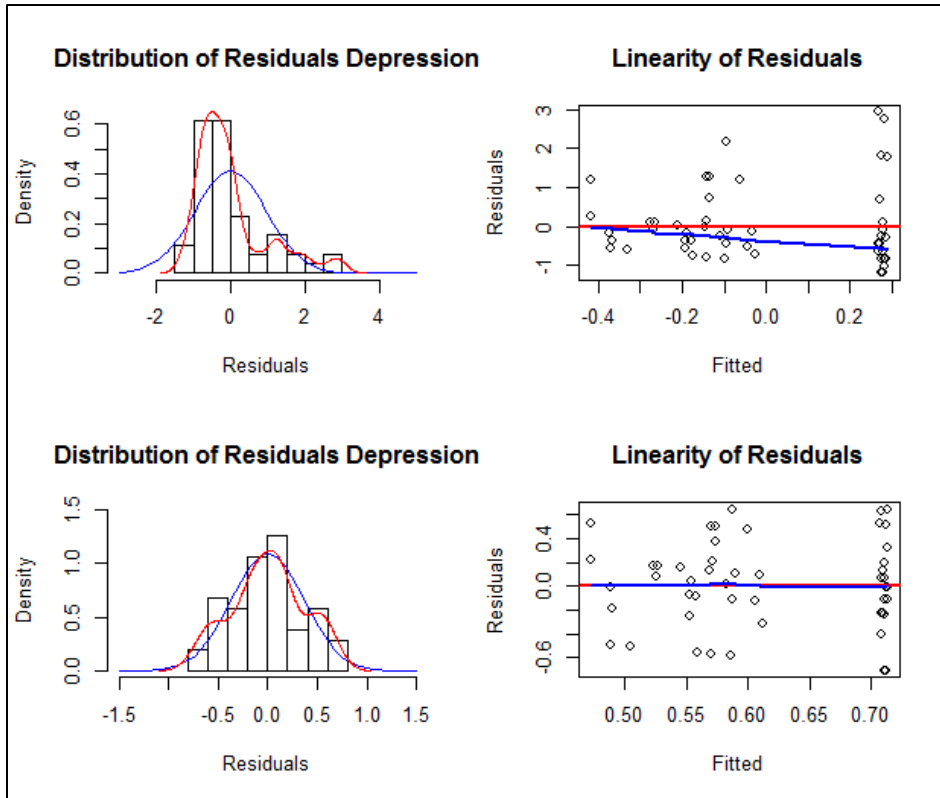


Figure 3.1 Model assumptions for depression. Top row shows the positively skewed distribution, heteroscedasticity, and non-linear residuals of the BASC-2 Depression Scale. Bottom row shows the distribution of BASC-2 Depression Scale residuals and tests of linearity and homoscedasticity of residuals after log transformation

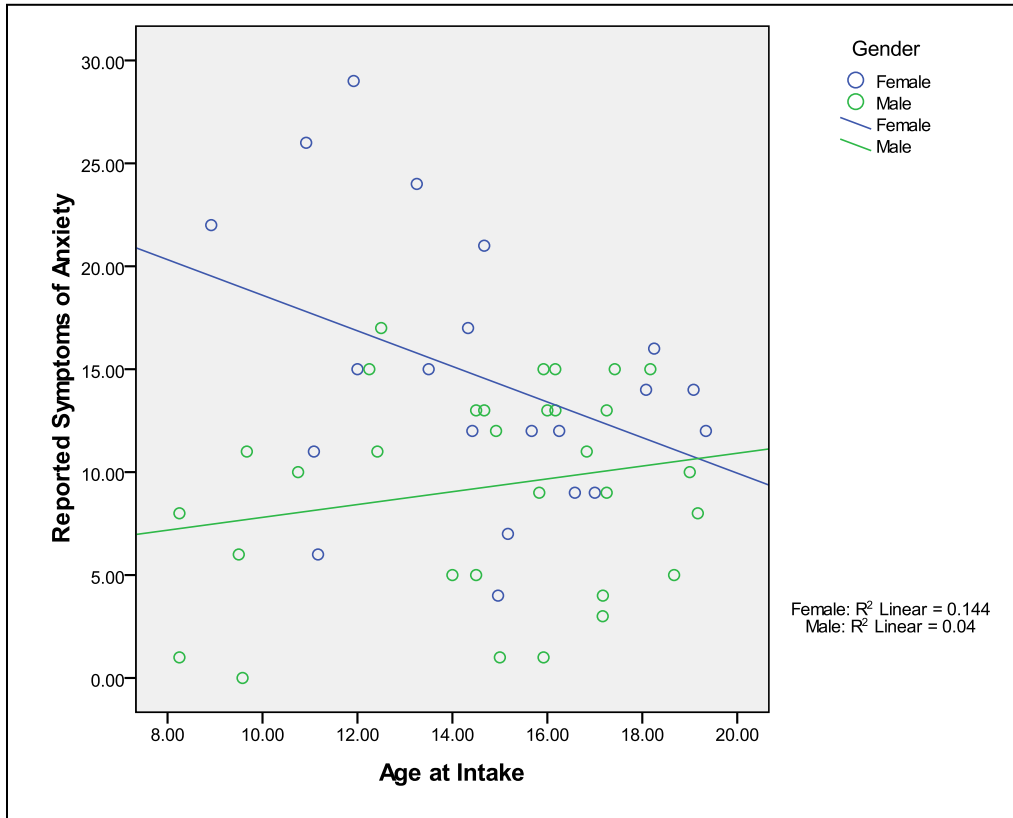


Figure 3.2 Age and gender interaction predicting symptoms of anxiety. Age is in years and anxiety is presented in the raw number of anxiety symptoms reported.

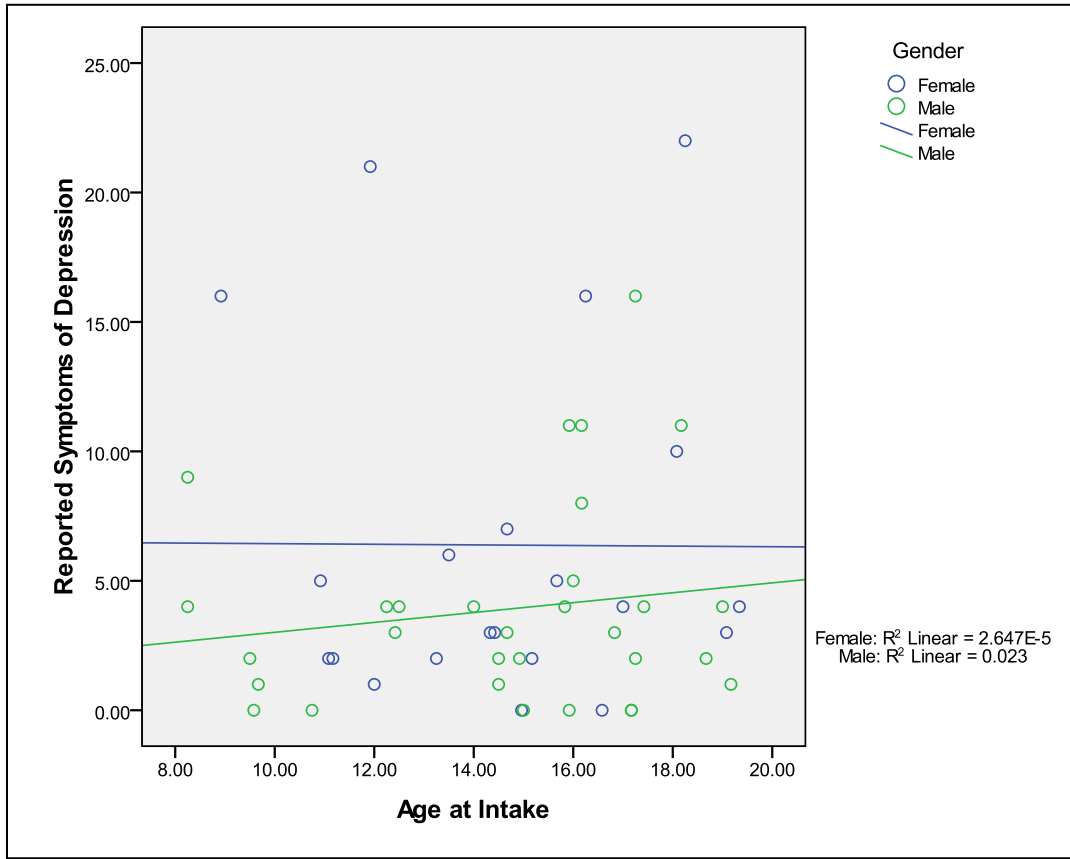


Figure 3.3 Age and gender interaction predicting symptoms of depression. Age is in years and depression is presented in the raw number of depression symptoms reported.

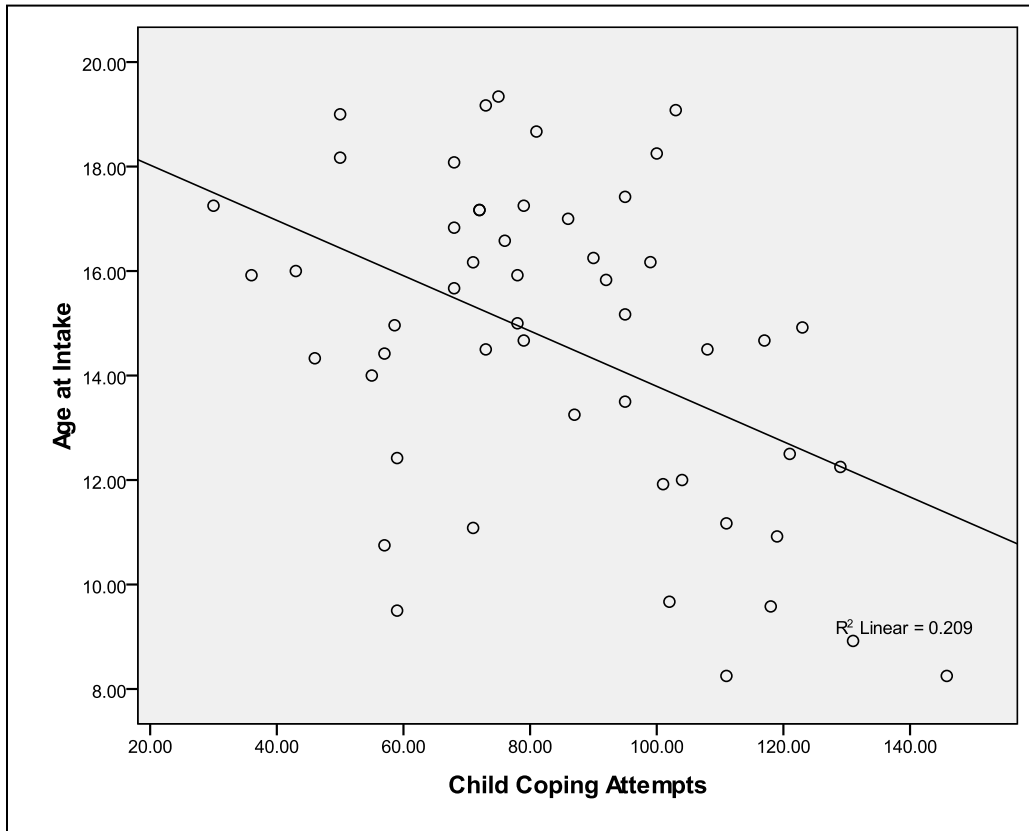


Figure 3.4 Age related to reported number of coping attempts. Age is in years.

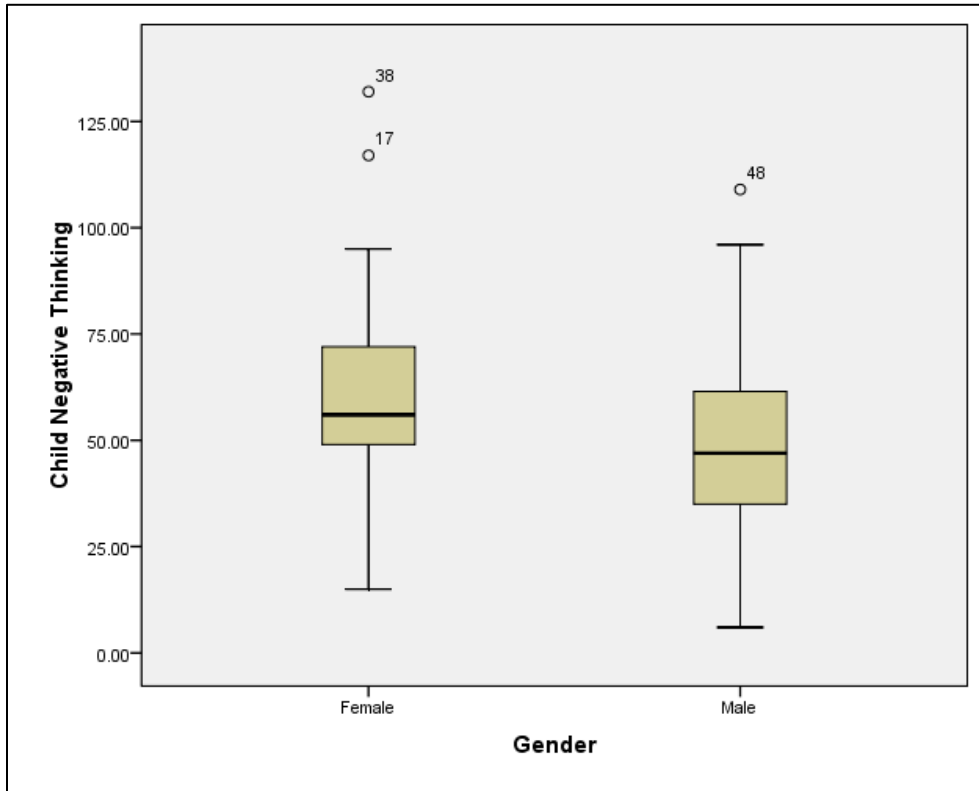


Figure 3.5 Negative thinking coping reported by males and females.

CHAPTER 4: DISCUSSION

The present study evaluated the self-reported depression and anxiety symptoms of youth with SCD across childhood and adolescence, and whether age and gender differences were apparent in these symptoms and related coping constructs that could help in explaining any differences found among males and females across age. A significant interaction of gender and age was found in predicting reported anxiety, as well as main effects of gender in predicting anxiety and negative thinking, and a main effect of age in predicting coping attempts. These findings provide some support for previous studies of an age and gender interaction in predicting internalizing symptoms that is unique to those with SCD. However, it does not appear that the coping methods examined in this study can fully explain why this pattern of reported anxiety symptoms exists among this population.

Our first hypothesis was partially supported, as an interaction of age and gender in predicting anxiety symptoms was found. The interaction was found to be significant with anxiety (but not for depression), with older males reporting more anxiety symptoms than older females. However, females still had a higher base rate of anxiety and showed a steep decline of anxiety symptoms with older age, whereas males showed only a gradual increase in anxiety symptoms with older age. Although the interaction partially supports our hypothesis, the pattern of older females having a steep decline in anxiety symptoms compared to their younger counterparts is different than previous cross sectional studies where younger males reported less internalizing symptoms and then there was a steady

increase in internalizing symptoms as age increased among males (Hurtig & White, 1986; Kell et al., 1998). This finding may be important in that it provides some evidence of possible developmental differences that vary by gender among youth with SCD. However, caution should be used when interpreting the results of the significant interaction of age and gender in predicting anxiety. The pattern of the interaction does not completely match the previous studies and considerable care should be used in interpreting developmental differences based on cross-sectional data. This finding needs further study and replication is needed in order to fully understand its potential impact and role in intervention planning for youth with SCD.

When examining the role of coping in the relationship between age and gender, we hypothesized that males would use less effective coping methods than females (including using more negative thinking and passive adherence). We did not find an interaction of gender and age in predicting negative thinking, but rather a main effect of gender in which females reported more negative thinking than males. Although this was contradictory to our hypothesis, it fits with the participant characteristics of this sample, where females had higher base rates of both depression and anxiety. This result is also consistent with adolescent girls in the general population (Hankin & Abramson, 2001). In light of these findings, additional research into the role of negative thinking in anxiety symptoms for youth with SCD (and gender-related differences) may be fruitful. For example, there are a range of specific cognitive risk factors for depression which are subsumed under the general term negative thinking (e.g. Beck's negative cognitive triad, pessimistic attributional style, rumination, and self-evaluation). Future studies could better characterize which risk factors are particularly important for anxiety in this

population. Such work could better tailor future interventions to promote more effective coping strategies.

In addition to finding gender differences in negative thinking, a main effect of age was also found in which coping attempts decreased with older aged youth within the sample. Although this was not initially hypothesized, a previous study by Gil et al. (1993) also found that coping attempts were stable during childhood but decreased as children entered into adolescence. Because making more frequent coping attempts has been associated with better physical and psychological health outcomes, it is important to understand why this decrease may be occurring and how to help adolescents continue to make successful coping attempts in dealing with symptoms of SCD. Longitudinal studies would be particularly helpful as there are potential concerns with cohort effects that confound the present findings. It has been suggested that adolescents with more severe disease complications may learn over time that their coping attempts are not successful, so they turn toward using passive adherence and negative thinking strategies, which leads to worse psychological adjustment (Gil et al., 1993). However, pain frequency and disease severity do not explain all the variability in which coping strategy is used or all of the variability in psychosocial adjustment. Due to this uncertainty, future studies should continue to explore the change in coping attempts and why they appear to decrease during adolescence.

Although the findings for coping did not mirror the age by gender interaction in anxiety as originally hypothesized, the observed main effects for age and gender patterns in coping may be helpful in planning for future studies. Findings related to the coping constructs assessed are limited by the fact that the coping scales used were related

specifically to the pain associated with SCD. Pain is the most frequent complication in SCD. Even though there are strong associations between pain and psychological distress, a more direct assessment of coping related to psychosocial stressors more broadly (not just to pain) may provide a more relevant assessment of the role of coping in depression and anxiety. Future studies should look at coping strategies more generally and specifically related to medical stressors to provide a more comprehensive view of the role coping plays in internalizing symptoms in this population.

Another limitation of this study was the use of the 8-11 year old version of the BASC-2 for all participants. Although this allowed for the consistent use of one measure for all participants, it limited our ability to assess age norms and if children were in the clinically significant range for depression and anxiety. Alternative measures had other limitations, including requiring significant additional time, which likely would have resulted in even greater participant attrition for these data. In addition, the available internal consistency data did not suggest a difference in reliability of measurement across older and younger participants.

Further, this study included a small sample size for examining interaction effects and was cross-sectional in nature. Future studies examining the age by gender interaction of depression and anxiety among those with SCD and the role of coping may want to focus on longitudinal designs that allow for multiple data points over time. Given SCD is a relatively rare medical condition, it may be difficult to follow a large cohort of children but cross sequential designs would provide a stronger method. For example, diary methods collected via the internet might allow one to track stress exposure, coping and internalizing symptoms over time without the need for in-person visits. The need for

long in-person data collection sessions and multiple in-person visits can pose a significant problem for recruitment in this population (Schatz et al., 2015).

In conclusion, the current study found the hypothesized age by gender interaction in predicting anxiety and notable main effects of gender and age in predicting negative thinking and coping attempts. The result related to anxiety replicated previous studies done by Hurtig & White (1986) and Kell et al. (1998) that suggest adolescent males with SCD may have increased internalizing symptoms in comparison to adolescent females. More work is needed, however, to fully understand why this pattern of internalizing symptoms is occurring, as the coping strategies and health related locus of control examined did not adequately explain these findings.

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