Adolescent Perceptions of Competence, School Belonging, and Autonomy in Healthy Students and Those with a Chronic Medical Condition: Relations and Implications for Academic Attainment

Dissertation

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By

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Abstract

The purpose of this study was to explore how the consequences of diagnosis and treatment of chronic illness as a child are related to motivational processes in adolescence and academic outcomes in young adulthood. Self-determination theory (Connell, 1990; Connell & Wellborn, 1991; Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002; Skinner & Edge, 2002; Skinner, Wellborn, & Connell, 1990) suggests that every individual has basic needs for autonomy, relatedness/belonging, and competence. These needs are universal, despite health or psychosocial status, but may be harder to meet for some individuals than others. The needs must be met to promote motivated behavior.

Data for this study was drawn from the restricted data set of the National Longitudinal Study of Adolescent Health (Add Health; Harris, et al, 2009). Measures of autonomy, belonging, and competence were developed from items in the Add Health data. Levels of perceived autonomy, school belonging, and competence during adolescence were compared for students with chronic health conditions and healthy peers. Further, health status was examined as a possible moderator of perceived autonomy, school belonging, and competence in relation to academic
outcomes. Diagnosis status alone was also considered as a predictor of long-term outcomes of on-time high school completion (by age 19) and educational attainment in young adulthood.

A structural measurement model was established, and then used to assess mean differences in the constructs between healthy and chronically ill participants. Logistic regression modeling was used to examine the hypothesis about differences in rates of on-time high school completion. A continuation ratio ordinal regression model was used to assess differences in levels of young adult academic attainment.

Health variables were significant predictors for levels of perceived autonomy, school belonging, and competence. Students with health concerns reported lower levels of autonomy, belonging, and competence. Diagnosis status served as a significant moderator for belonging when assessing on-time completion of high school. Students with chronic illness experienced an increase of 63% in the odds of completing high school on time with a one-unit increase in belonging. Health status served as a significant moderator of belonging when assessing long term academic attainment. Students with low health scores benefited most from increased perceptions of belonging.

Diagnosis status served as a moderator for autonomy in relation to on-time high school completion. An increase in autonomy was related to higher odds of on-time high school completion for healthy students but that was not the case for students with chronic illness.
An important contribution of this study is the added understanding it provides about the universal need for a perception of school belonging, a need that may be even more critical for students with health issues. Teachers, administrators, and other adults in the lives of adolescents can support positive academic outcomes for students with chronic health conditions by promoting opportunities for enhanced perceptions of belonging.

Acknowledgement of data source:

This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

Citation for contractual data:

Dedication

Dedicated to my “village”—family, friends, professional colleagues, and academic peers—who have been instrumental in helping me reach this milestone.
Acknowledgments

I have had the support of many people in my life to reach this milestone. Until about five years ago I don’t think I could say I ever had an aspiration to complete a doctoral degree. I have always loved to learn new things and like taking classes but the thought of earning a Ph.D. didn’t come into my mind. In 2008, I was busy working full time as an educational liaison and advocate for children with cancer, enjoying my family, and learning the nuances of a job that required a lot of interaction with the educational system. I decided I should pursue a master’s degree in something like educational policy to improve my credibility with the educational administrators I encountered and to become a better advocate for my patients. Several of my mentors encouraged me to consider doctoral work rather than a second master’s degree but I felt hesitant about adding such an endeavor to my plate of responsibility.

Then...I took a class with Dr. Eric Anderman as a way to become acquainted with the Department of Educational Policy and Leadership at The Ohio State University. I found the class energizing and applied for the master’s program in educational psychology. Eric was assigned as my advisor. At our first official
meeting after my admission to the program, as we discussed my interests and opportunities that the program could offer, Eric said “are you sure you don’t want to work on a doctoral degree instead of another master’s degree?” After sharing some of my hesitation about the time involved and Eric’s reassurance that there “are ways to make it work”, I moved my application to the Ph.D. pile. I have not had reason to look back.

Eric, thank you for your consistent availability and strong guidance, even as your own responsibilities have grown and changed over our time of working together. I did not have opportunity to take more classes with you, but you have been a wonderful teacher non-the-less. I am also thankful for the ways you have encouraged me to focus on my own interests and passions even when they were a bit outside the typical mold of an educational psychology doctoral student.

Other members of my dissertation committee have provided support in a variety of ways. Thank you to Dr. Lynley Anderman, Dr. Ann O'Connell, and Dr. Kathy Vannatta for your guidance and collegiality.

Lynley, even though Eric has been my official advisor, you are the Anderman with whom I have spent the most time. I appreciate your honest conversation and transparent sharing about the academe and the state of the field of educational psychology. I have learned so much from you about the education side of educational psychology and have gained much confidence in my writing as a result of your guidance and feedback. You have pushed me into defining clearer concepts
out of mushy, anecdotal thoughts at times. Your willingness to challenge unclear thinking and writing has been invaluable.

Ann, your enthusiasm for quantitative methods reignited my strong interest in mathematical endeavors from years gone by. I found your passion for statistical methods contagious and your teaching made the field understandable to me. I remember one conversation when I told you I felt like a fish out of water with the statistics and you said, “It’s okay, come on in...the water is warm”. You made the water inviting and I thank you for that.

Kathy, thank you for your willingness to add the job of committee member to your list of duties. I have appreciated your encouragement and mentorship from the time I took the education coordinator position on the oncology unit at Nationwide Children's Hospital. It is exciting to me to add this new layer to our relationship and I look forward to working together in ways that inform us about the academic needs of children with chronic illness.

Another mentor who deserves mention in this space is Dr. Bryan Warnick. I have never considered myself much of a philosopher. Bryan, I found your classes engaging and an entrance into the world of educational philosophy that I could not have imagined on my own. Thank you for making the world of philosophy so accessible. Thanks to you, there are a few books on a pile waiting to be read when I am finished with this dissertation!
A special thank-you goes to Dr. Claire Kamp Dush. I appreciate your willingness to add my work to your IRB proposal for the Add Health data. Thanks too for the tips about working with Stata and the push to do so.

As a non-traditional student in a different life space, I found my interactions with my academic peers refreshing and an experience unlike any I had in other arenas of my life. I have been energized and encouraged to work with such capable and accomplished young people. Those who were ahead of me in the program and taught me some of the ropes of academia are Dr. Mike Yough, Dr. Heather Dawson, and Dr. DeLeon Gray. Thank you each for the insight you so generously provided about this road we have traveled.

Dr. Monica Kowalski deserves a special mention. Just a step ahead of me in the program, she was a quiet support. Monica, you were always willing to share practical tips and a positive influence. I am utterly impressed that you could complete a Ph.D. with such a positive frame while also having three babies! Your investment in your family and your career inspire me.

Now to the members of my academic cohort—I am thankful for the experiences I have shared with Yujin Chang, Charles Okonkwo, Andy Zircher, (and even though they came a year later) Lauren Hensley and Stephanie Levitt Shaulskiy. I have learned from each of you and am wiser from our times spent together in classes, research group, and writing projects. Yujin, Lauren, Stephanie, and You Joung Lee have been good writing partners as we have learned the ropes of submitting papers to conferences and journals.
Two other peers who have provided intangible support during this long and winding path to completion of the dissertation are Dr. Dawn Pascoe-Wallace and Rashea Hamilton. Dawn, I treasure our chats over breakfast or lunch and the friendship that has emerged as we made our way through this adventure. Rashea, you are a great conference roomie and have been a wonderful support as we tried to stay on track with our work. I have so enjoyed our chances to get to know one another and develop a friendship that I value. Your honesty, warmth, and openness are treasures to me.

During my time in this doctoral program, much of my attention focused on the academic side of my world. However, the other side of my professional self remains firmly attached and indebted to my coworkers, mentors, and the families whose children receive care at Nationwide Children's Hospital. Work at Nationwide Children's Hospital has been the core of my professional career; I have had opportunities to learn from many different experiences there. I am thankful for the administrative support I have received during this academic adventure and the moral support I have felt from my peers (even when they thought I was crazy for undertaking such an endeavor at this time in my career!)

The last group of people I would like to acknowledge, and certainly the most important group, is my family. Throughout this process I often thought of Grandpa McAfoose, a teacher in a one-room school, and his interest in my academics from the time I was a little girl. I always felt special when we talked about school. My parents also cultivated an eagerness to learn from the time I was a little girl. They let me
believe I could do anything I wanted if I worked at it. My father was not a part of this accomplishment in the flesh but he certainly was there in spirit and he was in my mind often. He shared with me his curiosity about things around him, persistence, and a desire to make this world a better place. I know he would be proud—even if he did think all that education could make a person uppity! While my mother has never considered herself an academic, she is a wise and generous woman and has been a wonderful support in this process, consistently reminding me to take care of myself and not get overwhelmed. She is patiently waiting my completion of this process so she can have more frequent visits and shopping trips. My children Lindsey and Brady, and grandchildren Levi and Lydia have been good distractions from the constant demands of work and school. Lindsey has become an adult friend and my workout buddy. Brady reminds me about the value of seeing things through a different set of eyes and that we don’t all travel the same road in life. Levi and Lydia are just fun playdates!

To Ron—I am thankful for your never-ending encouragement, patience with my non-stop busy-ness, willingness to invest in this endeavor financially, and your generosity of time and energy to keep the household running when I was consumed with work and studies. I never felt anything but total support from you throughout the journey and I know I am a lucky girl! I am looking forward to some time at a slower pace, with opportunities for just being and going on some adventures with you.
Vita

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enrollment, and grades to distinct forms of academic dishonesty. *Teaching in
Association of Pediatric Hematology Oncology Educational Specialists. (2011). *APHOES practice recommendations for managing the educational needs of pediatric hematology and oncology patients*. Stony Brook, NY: Searles Graphics. Also at [www.aphoes.org](http://www.aphoes.org) (K. Kirkpatrick served as member of writing team and chapter lead writer).


**Fields of Study**

**Major Field:** Education: Policy & Leadership

  Educational Psychology

**Cognate:** Quantitative Methods
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Chapter 1: Introduction

The roots of this project have been cultivated over years of experience with students struggling to fit the mold of traditional school expectations. As a clinical social worker, I spent many years serving students with a variety of chronic medical conditions. Those young people taught me a lot about how their medical status interfered with a typical school experience. Of course, many students had the supports and resources in place to make up for the difficulties. Others struggled both academically and socially.

Jaci was a 15-year-old high school freshman with type 1 diabetes diagnosed when she was 8 years old. To control her medical condition she was required to perform routine blood tests and manage her insulin as prescribed, including during the school day. She also had to make sure she had plenty of fluid and an emergency snack with her at all times. With the transition to high school she had decided that she did not want her peers or teachers to know anything about her health needs. There were times when she had to leave class during a low blood sugar event to tend to her self-care. That blood sugar issue made her thought processes move more slowly and made her irritable and shaky. These events usually happened in
math class, the last class of the morning before lunch. The math teacher did not understand the medical need and thought Jaci was trying to get out of class when she didn't want to do work. The slowed processing speed was misinterpreted as defiance, and the irritability was misunderstood as disrespect. The slowed thinking and shakiness made it hard for Jaci to compete her math work adequately. These issues made it difficult for Jaci to feel competent in her math class and made her feel as though she could not have a supportive relationship with her teacher. The episodes often made her late for lunch and she felt awkward with peers when she got to the cafeteria.

Alex was a 12-year-old seventh grade student who had been treated for acute leukemia when he was in preschool. Despite having undergone three years of very intense chemotherapy as a young boy, Alex looked healthy, had no current medical needs, and no visible sequelae from his previous illness. However, the chemotherapy that defeated Alex’s cancer also caused damage to the part of his brain that is responsible for executive functioning—memory, planning, initiating, and self-monitoring of tasks. He often forgot to finish assignments, turn in what he did complete, and had a locker that looked like a trash bin. Alex would study for spelling tests and history tests but when it came time to take the test it was difficult for him to pull the information from his memory. In school he often sat and just looked forward when the teacher gave the class time to begin a project or homework. Alex’s teacher explained to his parents that he was just an irresponsible middle school boy that needed firmer limits and higher expectations to succeed. In
reality, Alex needed accommodations to his school day that could help him keep track of assignments, cuing for tasks, and assistance with dividing large projects into bite-size pieces. When his parents and teachers labeled him as lazy and disorganized, Alex lost confidence and motivation for his academic work.

The field of educational psychology has helped me find ways to explore some of the issues that might be in play for these young people. Adolescents with chronic medical conditions have an additional issue to manage as they negotiate academic accomplishment and grow into young adulthood. While I often identify more as a psychologist (really, as a systems-based social worker in my soul!) than an educator, I have come to appreciate the melding of these two areas of study as a way of understanding the needs of young people who have taught me so much over the years.

**Context**

This study is situated in a theory of motivated behavior that can provide a framework for understanding the dilemma chronically ill students may be facing. Self-determination theory (Connell, 1990; Connell & Wellborn, 1991; Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002; Skinner & Edge, 2002; Skinner, Wellborn, & Connell, 1990) suggests that every individual has basic needs for autonomy, relatedness/belonging, and competence that must be met to promote development of volitional motivation. These needs are universal, despite health or psychosocial status, but may be harder to meet for some individuals than others. The theory and
its implications for students with chronic illness are outlined in the literature review chapter of this document.

**Statement of Problem**

By some estimates, as many as 20% of school aged children in the United States live with a chronic illness of some form (Fowler, Johnson, & Atkinson, 1985; Sexson & Madan-Swain, 1995; Shaw, Glaser, Stern, Sferdenschi, & McCabe, 2010). As medical advances have occurred over the years, many conditions that were once considered terminal or life shortening for children are now managed as a chronic illness well into adulthood. Young people with chronic illness must manage the needs of their condition while also negotiating the typical developmental milestones of growing into young adulthood and fulfillment of their basic needs of autonomy, belonging, and competence. Much of the negotiation required of these adolescents happens in the context of school.

Effects of health on academic performance may be directly related to cognitive impact of disease and treatment or a result of indirect factors (Haas, 2006; Madan-Swain, Fredrick, & Wallander, 1999). Factors that can directly affect academic outcomes include fatigue, pain, and cognitive changes that result from the disease and treatment. Indirect effects arise via school attendance patterns and related missed instructional time, alterations of teacher and parental expectations for academic achievement, or other psychosocial adjustment issues such as the development of school phobia or separation anxiety (Clay, 2004; Haas, 2006;
A complicating factor for students with chronic illness can be a lack of understanding or awareness on the part of the teachers and administrators in the schools about the existence of a condition or needs related to management of the condition. Teachers receive little training about medical conditions or the implications they might have for the classroom and student learning (Barraclough & Machek, 2010; Fowler et al., 1985; Thies, 1999). Educators often acknowledge a feeling of being overwhelmed by the responsibility for the students with chronic medical conditions in their care (Madan-Swain, Katz, & LaGory, 2004; Olson, Seidler, Goodman, Gaelic, & Nordgren, 2004; Sexson & Madan-Swain, 1995).

**Study Hypotheses**

This study was designed to examine relations between a student's medical status, level of perceived basic need fulfillment, and academic outcomes. Some researchers have found students with chronic medical conditions have lower high school completion rates and lower levels of academic attainment (Berg & Linton, 2009; Case, Fertig, & Paxson, 2005; Haas & Fosse, 2008; Joe, Joe, & Rowley, 2009; Maslow et al., 2011). I hypothesized that students who struggled with a chronic health condition would have more difficulty addressing their basic human needs for autonomy, relatedness/belonging, and competence compared to healthy peers. If students with chronic medical concerns do indeed have lower perceptions of autonomy, belonging, and competence, then I wanted to explore whether those
differences might be related to the lower levels of academic attainment. I hypothesized that chronic health issues would serve as a moderator for the relation between the psychological needs and academic outcomes.

The hypotheses used to guide this study considered differences between students with chronic health conditions and those who have been healthy throughout childhood, adolescence, and young adulthood.

1. My first hypothesis was that there would be mean differences in the levels of perceived autonomy, school belonging, and competence between chronically ill students and their healthy peers. I expected chronically ill students to report lower levels of need satisfaction.

2. I hypothesized that there would be differences in the likelihood of on-time high school completion between students with a chronic health condition and their healthy peers and that: a) chronic illness status would be a useful predictor of high school completion by the age of 19 years, and b) health status would moderate the relation between autonomy, belonging, and competence and on-time high school completion.

3. My third guiding hypothesis was that differences in long-term academic attainment would exist between students with chronic health conditions and their healthy peers. I hypothesized that: a) health status in adolescence would be a significant predictor of long-term academic attainment, and b) health status would moderate the relation between autonomy, belonging, and competence and long-term academic outcomes.
The numbers of adolescents and young adults with a history of any specific chronic illness are relatively small so this study was designed to use a large national database with a pool of students who identified a variety of chronic medical conditions. A non-categorical approach was taken for exploration of the educational outcomes of the students. A non-categorical approach to the study of students with chronic health conditions suggests that all students have many common life experiences, despite the actual diagnosis involved. Different disease processes may have different mechanisms of impact but the resulting symptoms look similar across populations. The academic community can address slowed cognitive processing, fatigue, pain, or inattention with appropriate intervention strategies despite the origin of the difficulty.

The primary aim of this study was to find some understanding about the needs of students with chronic illness that can be shared with teachers and administrators and that could support the needs of these students to promote the best possible academic outcomes.
Chapter 2: Review of Literature

Children with chronic or severe medical conditions have been the focus of pediatric specialists for many decades. Physicians and scientists have worked, with many successes, to discover causes and treatments for diseases that affect children and adolescents. Many diagnoses that once meant a child would not likely survive into adulthood are now treated as chronic illnesses and must be managed in adolescence, young adulthood, and beyond (Pless & Nolan, 1991; Pless & Pinkerton, 1975; Stein, Bauman, Westbrook, Coupey, & Ireys, 1993; Thies, 1999; Thompson & Gustafson, 1996). Today these children must manage chronic medical conditions while also functioning in school and other psychosocial settings. Allied professionals, including those in fields of pediatric, educational, and neurocognitive psychology, have worked to identify some of the barriers and stressors that prevent optimal functioning for these young people and to target protective factors that can promote well-being in the face of the stress (Armstrong, 2006; Burke & Elliott, 1999; Madan-Swain et al., 2004; Maslow et al., 2011; Ross, 1984; Sexson & Madan-Swain, 1995; Thies, 1999; Thompson & Gustafson, 1996; Vitulano, 2003).
Entrance into the world of school opens the doors for development of academic and social competence and “serious illness threatens the child's self confidence, interrupts school attendance, interferes with developing social and academic skills and disrupts important relationships with other children and adults” (Ross, 1984, p. 84). School administrators and teachers receive limited training related to the needs of children with chronic illness (Barraclough & Machek, 2010; Fowler et al., 1985; Phelps, 2006; Power & Blom-Hoffman, 2004; Ross, 1984; Thies, 1999) and often acknowledge discomfort or an overwhelming sense of responsibility around meeting the needs of these children (Clay, Cortina, Harper, Cocco, & Drotar, 2004; Madan-Swain, et al., 2004; Olson et al., 2004; Sexson & Madan-Swain, 1995). To facilitate student success in academic and social domains, it is important for educators to understand the needs of all students, including those with chronic illness.

**Students with Chronic Illness**

Estimates of children who live with chronic illness range from 6% to 20% of the school aged population (Fowler et al., 1985; Sexson & Madan-Swain, 1995; Shaw et al., 2010; Theis, 1999; Vitulano, 2003). A chronic illness is generally defined as a “medical condition, lasting for more than 3 months, which requires medical attention and interferes with a person's daily living” (Barraclough & Machek, 2010, p. 132). Chronic illness impacts both physical and psychological functioning for a child in domains that include family, school, and peer relationships (Brown & Anderson, 1999; Power, 2006; Shaw et al., 2010). Even with the conservative
estimates, any given classroom in the United States would include at least one or two students who must manage chronic disease while also managing the challenges of academic performance and social development in the school setting.

Federal and state education laws have developed since the Education for All Handicapped Children Act of 1975 first required every state and local school district to educate all children in their jurisdiction, including those with handicaps (Wright & Wright, 2011). The current law governing the education of all children, regardless of (dis)ability, is the Individuals with Disabilities Education Act of 2004 (IDEA), requiring state and local authorities to find any child that might have a special education need as well as provide individually appropriate educational services to that child (Wright & Wright, 2011). IDEA provides a definition for a health impairment category that allows students with chronic illness to be provided special education services if they meet very specific requirements. Identification of “health impairment” involves a child

“having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that—

(i) Is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and
(ii) Adversely affects a child’s educational performance” (Wright & Wright, 2011, p.194).

When children with chronic illness are not eligible for special education services they can be served by a 504 Plan, a legal provision of the Rehabilitation Act of 1973, which protects access to, and participation in, educational programs and services for all children (Wright & Wright, 2006). The Americans with Disabilities Act, a civil rights law, also protects a 504 Plan (Wright & Wright, 2006). Most children with chronic illness do not need special education placement, but many do need coordination, intervention, and support to promote academic and social success in school (Madan-Swain et al., 1999; Sexson & Madan-Swain, 1993, 1995).

No matter the level of educational support needed by children with chronic medical conditions, the goal is “to produce competent individuals who can cope effectively with their chronic health condition and be productive members of society. For adults, steady employment and job performance are markers of overall functioning. For children, school attendance and achievement reflect general adjustment” (Fowler et al., 1985, p. 686).

**Noncategorical Model of Childhood Chronic Illness**

Identification of children with chronic medical conditions must begin with some clarification of terminology. There are a number of terms in the literature that are used interchangeably—disease, illness, disability, and condition are among them (Northam, 1997; Perrin et al., 1993; Stein et al., 1993; Stein & Jessop, 1989). Two of the more broad labels for children living with chronic illness are “children with
special health care needs” (Bethell et al., 2002; Davis & Brosco, 2007; McPherson et al., 1998; Stein et al., 1993) and “children with chronic conditions” (Davis & Brosco, 2007; Perrin et al., 1993; Stein et al., 1993). Definition is important because it impacts the prevalence estimates used to interpret any research effort. Davis and Brosco (2007) advise against interchangeable use of children with chronic conditions and children with special health care needs because they are two different populations—not all chronic conditions require special health care.

The traditional medical model is very problem-specific and tends to focus on biological and physical issues of specific diagnoses so the problem can be fixed (Mosby’s Medical Dictionary, 8th Ed., 2009; Stein & Jessop, 1989). While this problem-solving model has been successful in finding treatment and cure options for disease, and is critical to that pursuit, it may be less helpful to researchers in the social sciences and education (Stein et al., 1993). There are some concerns with using a diagnosis-specific approach to address chronic health conditions if the focus in on issues other than specific medical planning and intervention.

A primary difficulty in using a discrete diagnosis approach in the study of children with chronic conditions is the complexity and sheer vastness of the list of potential diagnoses (McPherson et al., 1998; Stein et al., 1993). And, within each diagnosis there is a wide spectrum of symptoms and functional limitations affecting daily life. Labels may be unreliable for indicating the specific strengths and needs of any particular child and may cause confusion, or more seriously, misinterpretation of strengths and needs (Perrin et al., 1983; Stein et al., 1993).
Consequences of chronic health conditions can be measured with symptoms, level of impairment, level of services necessary for remediation or amelioration, or necessity for ongoing medical monitoring (McPherson et al., 1998; Perrin et al., 1993; Pless & Nolan, 1991; Stein et al., 1993). It is even more difficult to label or consider elements of a disease or its management when the characteristics are not readily visible. Sometimes a child has compensated for the disadvantage, or sometimes, adequate medical management erases the functional deficits caused by the condition. Labels do not necessarily provide an accurate picture of the potential consequences.

Discussion about moving toward a generic approach for studying the youngster with chronic illness as a “whole child” (Pless & Pinkerton, 1975; Stein & Jessop, 1982) escalated in the late 1980’s and 1990’s with multiple calls for a clear and consistent definition of “childhood chronic conditions” (Perrin et al., 1993; Stein et al., 1993; Stein & Jessop, 1982,1989). The generic or non-categorical approach focuses on the consequences of the health condition for the child, regardless of the actual diagnosis (Davis & Brosco, 2007). Stein and colleagues (1993), provide a comprehensive definition of chronic health conditions as any disorders that:

1. Have a biologic, psychologic, or cognitive basis, and
2. Have lasted or are virtually certain to last for at least 1 year, and
3. Produce one or more of the following sequelae
a. Limitation of function, activities, or social role in comparison with healthy age peers in the general areas of physical, cognitive, emotional, and social growth and development

b. Dependency on one of the following to compensate for or minimize limitation of function, activities, or social role

1) Medications

2) Special diet

3) Medical technology

4) Assistive devices

5) Personal assistance

c. Need for medical care or related services, psychologic services or educational services over and above the usual for child’s age, or for special ongoing treatments, interventions, or accommodations at home or in school (p. 345).

There has been some disagreement about the required duration of a condition that constitutes a chronic health condition (Stein et al., 1993). The range used for purposes of service eligibility or inclusion in research is generally between 3 and 12 months, depending on the purpose of the definition and how inclusive or selective the population needs to be for a given research study. A chronic health condition is one that is assumed to be ongoing or permanent. The term does not include a series of acute illnesses or a condition that is time-limited.
The general definition of children with chronic health conditions was developed for use by health policy and program developers as well as a mechanism for managing costs of insurance providers and government agencies. It may also be a useful way to consider the educational needs of children. Schools must consider the educational needs presented by any of a variety of medical conditions and provide services accordingly, to promote academic success.

Differences are consistently found between groups of children who experience neurological or cognitive impairment as a part of their condition and those who do not (Howe, Feinstein, Reiss, Molock, & Berger, 1993; Northam, 1997). Howe and colleagues (1993) suggest that formal comparisons of a heterogeneous group of children is necessary to decide whether general classes of children can be considered for study. They used a sample divided by neurocognitive status plus a control group of healthy, typical children, and measured functioning across multiple domains. They generally concluded that children with brain-based limits present different risks and needs than do children with other consequences of chronic illness, although there was evidence that children with more general limitations also fare more poorly overall than their healthy peers.

Other researchers (e.g., Northam, 1997; Perrin et al., 1993; Pless & Nolan, 1991; Pless & Pinkerton, 1975; Stein et al., 1993; Stein & Jessop, 1982) also have identified characteristics or dimensions, separate from a diagnostic label, which might create appropriate categories of children with chronic conditions for study:
severity of illness; duration; prognosis; visibility of symptoms or side effects of
treatment; age; strengths and weaknesses of the child; family dynamics; and the
availability of an advocate in the medical environment. So, while the fine separation
of specific disease labels may not be useful, separation of children into groups by the
impact of their disease may indeed provide some insight that would be useful to
social scientists and educators.

Health Effects on Academic Achievement and Psychosocial Adjustment

When a disease process affects any body system, it is likely there will be
some impact on other parts of the body, including the brain (Berg & Linton, 2009).
The disease process itself, the necessary treatment, or psychosocial and coping
capacity may all impact the total outcome. When any part of the body is disturbed
through a chronic medical condition, there can be disruption to the nutrient supply
to the brain, with consequences of one sort or another for brain functioning.
Children with a variety of chronic illness diagnoses have consistently demonstrated
lower levels of academic achievement, even when global IQ scores are similar to
those of healthy peers (Berg & Linton, 2009; Case et al., 2005; Haas & Fosse, 2008;
Maslow et al., 2011). These children also experience lower educational trajectories
and lower socioeconomic status in adulthood (Joe et al., 2009). There is some
evidence that children with chronic medical conditions reach developmental
milestones later than their healthy peers (Barraclough & Machek, 2010) and are less
likely to complete high school on time (Haas & Fosse, 2008). Children with chronic
medical conditions have also been noted to have higher levels of behavioral and
emotional problems than their healthy peers, with decreased peer interactions and increased dependence on adults (Barraclough & Machek, 2010; Burke & Elliott, 1999; Martinez & Ercikan, 2008; Pless & Pinkerton, 1975).

**Academic achievement**

Children with chronic illness experience lower levels of academic and vocational achievement than do their healthy peers (Armstrong, 2006; Case et al., 2005; Clay et al., 2004; Jackson, 2009; Joe et al., 2009; Martinez & Ercikan, 2008; Maslow, Hayden, McRee, & Halpern, 2012). Effects of health on academic performance may be directly related to cognitive impact of disease and treatment or a result of indirect factors (Haas, 2006; Madan-Swain et al., 1999). Factors that can directly affect academic outcomes include fatigue, pain, and cognitive changes that result from the disease and treatment. Indirect effects arise via school attendance patterns and related missed instructional time, alterations of teacher and parental expectations for academic achievement, or other psychosocial adjustment issues such as the development of school phobia or separation anxiety (Clay, 2004; Haas, 2006; Jackson, 2009; Maslow et al., 2011; Sexson & Madan-Swain, 1995).

Academic struggles can occur acutely as a result of disease symptoms and treatment side effects or they can emerge later, when the child reaches an age at which affected skills would be expected to emerge developmentally (Armstrong, 2006; Armstrong & Briery, 2004). Acute interference with academic progress is often a result of pain, fatigue, lethargy, general malaise, or medication side effects (Madan-Swain et al., 1999; Meijer, Sinnema, Bijstra, Mellenbergh, & Wolters, 2000;
Thies, 1999). When cognitive effects appear over time, they do not represent deterioration of previously accomplished milestones, but rather are a result of impact on the rate of brain growth and development of complex structures within the brain (Armstrong & Briery, 2004; Daly, Kral, & Brown, 2008; Moore, 2005, Oeffinger, Nathan, & Dremer, 2008). Neurocognitive sequelae can include impact on cognitive ability, attention, processing speed, memory, visual-motor integration, school performance, social interactions, and adaptive behaviors (Armstrong & Briery, 2004; Brown & Anderson, 1999; Burke & Elliott, 1999; Martinez & Ercikan, 2008; Meijer et al., 2000; Power, 2006). These neurocognitive deficits can interfere not only with academic progress, but also with development of competence and social skills (Power, 2006). They can be observed by parents and teachers in the classroom as failure to complete work, slowness with approaching and accomplishing work, periods of inattention, fine motor deficits, or difficulty with development and maintenance of peer relationships (Armstrong & Briery, 2004; Madan-Swain et al., 2004).

**Psychological adjustment**

Maladjustment in the psychosocial arena has been identified as a “second handicap” of pediatric chronic illness (Pless & Nolan, 1999). Whereas it is important to remember that most children with chronic illness do not have mental health or psychosocial adjustment concerns, the incidence of distress is higher for that group of youngsters (Cadman, Boyle, Szaltmari, & Offord, 1987; Madan-Swain et al., 2004). The risks of psychological distress may be exacerbated by feelings of self-doubt, lack
of control, or isolation from typical experiences (Brown & Anderson, 1999; Burke & Elliott, 1999; Madan-Swain et al., 2004). Students with chronic illness experience higher levels of depression and anxiety that could be related to changes in appearance, decreased activity, or the losses experienced as a part of the diagnosis and treatment process (Burke & Elliott, 1999; Cadman et al., 1987; Madan-Swain et al., 2004; Martinez & Ercikan, 2008). Some researchers have reported that psychosocial distress was a higher risk when a chronically ill child also had disabilities related to the condition (Burke & Elliott, 1999; Cadman et al., 1987; Martinez & Ercikan, 2008; Meijer et al., 2000). Premorbid functioning or factors such as perceived locus of control, attachment, social competence, and family history of distress may also play a role in the psychosocial impact of chronic illness for any given child (Brown & Anderson, 1999; Burke & Elliott, 1999).

**Example diagnoses**

Even though there is a vast array of diagnoses that are considered chronic pediatric conditions, it is helpful to review a few of the most often studied groups to draw attention to the similar struggles across chronic conditions. There are a variety of resources that speak to the neurocognitive or educational issues for children with specific diseases (Brown, 2004; Berg & Linton, 2009; Clay, 2004; Phelps, 2006). There are also multiple studies that use a similar list of diagnoses with the noncategorical approach for research (Cadman et al., 1987; Fowler et al., 1985; Maslow et al., 2011; Meijer et al., 2000; Thies, 1999).
Cancer

Some childhood cancer diagnoses and treatment regimens create a higher risk of cognitive difficulties than others (Armstrong & Mulhern, 1999; Daly et al., 2008; Moore, 2005; Mulhern & Butler, 2004). The diagnoses found to have the highest risk of cognitive effects after completion of treatment (cognitive late effects), and consequently, interference with academic progress and psychosocial skills, are those that involve the brain or central nervous system. This group includes children diagnosed with brain and spinal tumors and those diagnosed and treated for acute lymphoblastic leukemia (ALL) and lymphoma.

Treatment for brain tumors can include a combination of surgery to the brain, chemotherapy, and radiation to the brain and spine (Robinson et al., 2010). Acute leukemia and lymphoma treatment regimens involve intrathecal chemotherapy (medication delivered directly into the spinal fluid) and high dose chemotherapies that can cause cognitive late effects (Berg & Linton, 2009; Brown et al., 1998; Mulhern & Butler, 2004). Children with high risk leukemia or disease that has spread to the central nervous system are also likely to receive craniospinal radiation therapy at a part of their treatment regimen (Armstrong & Mulhern, 1999; Mulhern & Butler, 2004). Other, more rare, diagnoses also involve treatment regimens that include high doses of chemotherapy or radiation to the neck and head (Oeffinger et al., 2008).

Childhood ALL survivors have been found to have poorer educational outcomes than their typical peers, including more frequent failure and retention,
and higher levels of behavior difficulties (Barrera, Shaw, Speechley, Maunsell, & Pogany, 2005; Haupt et al., 1994; Katz & Madan-Swain, 2006; Madan-Swain et al., 2004). Mulhern and Butler (2004) have suggested that as many as 20-30% of children with ALL who are treated with intrathecal chemotherapy will develop cognitive dysfunction. Some of the critical academic skills that can be affected for brain tumor and ALL survivors include attention, memory, processing speed, planning and organizational skills, fine motor skills (that can affect writing or copying speed and accuracy), visual learning, mathematics skills, and reading comprehension (Berg & Linton, 2009; Katz & Madan-Swain, 2006). Some children also experience declines in general intellectual functioning as a result of their disease and treatment (Berg & Linton, 2009).

The school absence, pain, and fatigue that accompany the intense treatment of any pediatric cancer can impact both academic and social outcomes (Barrera et al., 2005; Madan-Swain et al., 1999). Additional risk factors that have been identified include young age at diagnosis, gender, and length of time since treatment (Armstrong, 2006; Daly et al., 2008).

**Diabetes**

Type I diabetes is most commonly diagnosed in childhood (Clay, 2004). It involves a failure of the beta cells in the pancreas that are responsible for insulin production and requires insulin injections for management. Insulin is the hormone that regulates blood sugar levels for optimal energy and bodily functioning (Clay, 2004; Rovet & Fernandes, 2004; Sandberg & Zurenda, 2006). Type II diabetes is a
condition that is acquired when the body is unable to use the insulin that it does produce. Type II diabetes is becoming more common in children as a result of increased prevalence of obesity in childhood (Clay, 2004; Sandberg & Zurenda, 2006). Both types of diabetes have implications for functioning but type I is not as amenable to lifestyle changes as is Type II and may have more impact on learning over time (Sandberg & Zurenda, 2006).

Blood glucose levels that are too high (hyperglycemia) or too low (hypoglycemia) both impair brain functioning. The conditions can have both acute and long-term effects for the individual. High blood sugar levels can lead to fatigue, malaise, confusion, and potential for brain swelling and coma (Clay, 2004). Chronic hyperglycemia can lead to microvascular changes in multiple body systems, including eyes, kidneys, and the nervous system (Clay, 2004; Rovet & Fernandes, 2004). Low blood sugar levels can lead to acute episodes of confusion, weakness, lack of concentration, or seizure (Clay, 2004; Rovet & Fernandes, 2004).

Over time, abnormal blood sugar levels can lead to cognitive compromise in the areas of verbal skills, attention, memory, psychomotor efficiency, executive functioning, declines in overall intellectual ability and ultimately, school achievement (Clay, 2004; Rovet & Fernandes, 2004; Sandberg & Zurenda, 2006). School absences, time away from instruction for trips to the health office at school, or fluctuations in attention can also affect academic performance and can have social implications for the student (Rovet & Fernandes, 2004). Cadman and colleagues (1987) included children with diabetes in their study and overall, found
that children with chronic illness were at higher risk of emotional and psychosocial difficulties than healthy peers. Maslow and colleagues (2011) also included children with diabetes in their sample of chronically ill students and found lower levels of educational attainment, despite similar levels of cognitive ability.

Levels of disease control over time, age of the child at diagnosis, and gender have all been identified as risk factors for academic and social disruptions (Rovet & Fernandes, 2004; Sandberg & Zurenda, 2006; Taras & Potts-Datema, 2005). There may also be a dynamic relationship between the control necessary for management of the disease and the development of autonomy and competence for the student (Maslow et al., 2011; Rovet & Fernandes, 2004).

**Epilepsy**

Seizures are episodes of abnormal brain wave activity or neuron firing that can lead to disturbances in awareness or movement (Barrett & Sachs, 2006; Clay, 2004). Diagnosed if a child has two or more unprovoked seizures, epilepsy is the most prevalent chronic neurological impairment in children and is often diagnosed when the child is young (Hiemenz, Hynd, & Jimenez, 2004). Some children have a seizure related to fever or head trauma and are not diagnosed with epilepsy (Barrett & Sachs, 2006; Clay, 2004). Epilepsy is diagnosed when the cause of seizures is an underlying chronic pathology of the brain (Barrett & Sachs, 2006). Children with epilepsy are a very heterogeneous group, with differences in presentation, progression and impact of disease from one child to another (Barrett & Sachs, 2006; Clay, 2004; Hiemenz et al., 2004; Taras & Potts-Datema, 2005).
Children with epilepsy may experience difficulties in both academic and psychosocial domains. Neurocognitive impact in the form of attention difficulties, mood changes, or memory difficulties can be a result of the seizure activity and related changes to the brain or a result of the treatment (Clay, 2004; Hiemenz et al., 2004). Medications used to treat seizures can cause fatigue and cognitive dullness or slowing in some children (Barrett & Sachs, 2006).

Students with epilepsy often fall behind academically, even though difficulties may not be related to differences in general intellectual ability and they do not exhibit differences in creative abilities (Clay, 2004; Hiemenz et al., 2004). Students with epilepsy do receive higher levels of special education services than the typical student population (Barrett & Sachs, 2006). Social adjustments may be complicated indirectly by stigma and fear of others about the potential for a seizure event, or by parental anxiety and lowered expectations for academic performance (Barrett & Sachs, 2006; Hiemenz et al., 2004).

Heart conditions

Pediatric heart conditions can be congenital or acquired after birth (Clay, 2004; Delamater, Brady, & Blumberg, 2004). Many congenital heart conditions occur in tandem, or as a part of, other genetic syndromes (Clay, 2004). The conditions generally involve the interruption of oxygen delivered to the brain and consequences are related to both the anoxia and any consequences of the treatment interventions (Delamater et al., 2004). The severity of impact on school will depend
a great deal on the accompanying difficulties and the severity of the disease (Cadman et al., 1987; Clay, 2004; Delamater et al., 2004).

Children with cardiac conditions do experience lower levels of academic functioning than their healthy peers, especially related to perceptual-motor skills and attention (Delamater et al., 2004). Overall general intellectual functioning seems to fall within the normal range but still lower than healthy peers (Delamater et al., 2004). Students with heart conditions may experience higher number of absent days than their peers and may present with symptoms such as fatigue or labored breathing. They are also prone to greater difficulties in relationships (Clay, 2004; Delamater et al., 2004). Delamater and colleagues (2004) suggest that temperament and behavior differences in children with cardiac disorders may be responsible in some way for relationship difficulties and they suggest further exploration of social competence, social anxiety and autonomy in this population.

**Migraine headaches**

Headaches that are caused by dilation and constriction of blood vessels in the brain can be chronic and debilitating for children as well as adults (Clay, 2004). Migraine headaches often have specific triggers and can affect different parts of the brain. They can involve visual disturbances, weakness, and abdominal pain or nausea (Clay, 2004).

Chronic headaches can lead to more frequent school absence than is typical for healthy students, reduced academic performance, and decreased socialization with peers (Clay, 2004; Powers, Patton, Hommel, & Hershey, 2003). Migraines can
also affect memory, processing speed, attention, concentration, and can impact psychomotor abilities (Clay, 2004; Riva et al., 2006). Children with migraine headaches do not display deficiencies in general IQ scores but they do experience higher levels of withdrawal, somatic complaints, and anxiety or depression (Clay, 2004; Riva et al., 2006). They also report quality of life patterns similar to those of children with other chronic conditions; lower than the quality of life reported by healthy peers (Powers et al., 2003; Riva et al., 2006). Powers and colleagues (2003) report similar or worse patterns of disability for children with headaches, compared to children with arthritis or cancer.

Given the common struggles these groups of children face, using a non-categorical approach to explore educational needs and strengths is feasible. A student that struggles with slowed processing speed, whether a result of treatment for cancer, frequent seizure activity, or chronic low blood sugar events, will need similar supports and accommodations to achieve optimal outcomes socially and academically. The list of examples in this study is used to showcase some of the issues experienced by the population of adolescents available in the proposed sample for the current study. Of course, there are many other diseases (i.e. sickle cell disease, Crohn’s disease and inflammatory bowel syndrome, cystic fibrosis, juvenile arthritis) that impact children in the academic and social realms of their worlds but they are not reviewed in detail here, as they are not identified in the sample available for this study.
I will now review the constructs of perceived competence, belonging and autonomy. According to self-determination theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2000, 2002), these components facilitate motivated behavior and well-being. A primary intention of the current study is exploration of ways these elements might matter for adolescents with chronic health issues.

**Motivation**

Self-determination theory (Connell, 1990; Connell & Wellborn, 1991; Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002; Skinner & Edge, 2002; Skinner et al., 1990) implicates basic human needs as the impetus for motivated behaviors. The basic psychological needs of competence, relatedness, and autonomy, and the level at which those needs are satisfied or frustrated for an individual, drive motivated behaviors and are related to a state of well-being (Connell & Wellborn, 1991; Deci & Ryan, 2000; Ryan & Deci, 2000, 2002). The needs are innate and are important as individuals move through childhood, on to adolescence and then to young adulthood and beyond (Connell, 1990; Ryan & Deci, 2002). *Competence* has been defined as “feeling effective in one’s ongoing interactions with the social environment and experiencing opportunities to exercise and express one’s capacities . . . not an attained skill or capability, but rather a felt sense of confidence and effectance in action” (Ryan & Deci, 2002, p. 7). *Relatedness* is “feeling connected to others, to caring for and being cared for by those others, to having a sense of belongingness both with other individuals and with one’s community . . . tendency to connect with and be integral to and accepted by others”
(Ryan & Deci, 2002, p. 7). In the context of academic outcomes, relatedness will be reviewed here as school belonging. Autonomy is defined as “being the perceived origin or source of one’s own behavior . . . acting from interest and integrated values” (Ryan & Deci, 2002, p. 8). Basic needs are addressed and served in the social context and are met in relationships with others (Connell & Wellborn, 1991; Deci, Eghrari, Patrick, & Leone, 1994; Deci & Ryan, 2000; Ryan & Deci, 2002; Skinner & Edge, 2002).

As students, children and adolescents need experiences with competence, relatedness, and autonomy in order to nurture a self-directed level of motivation for social development and academic achievement (Deci & Ryan, 1985, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991; Ryan & Deci, 2000, 2002). It is also helpful to keep in mind that needs can sometimes compete with one another and compromise an individual's well being in doing so (Elliott, McGregor & Thrash, 2002). An example might be that a person’s need for competence could lead to such driven behavior that relationships are ignored and the need for relatedness would suffer.

The self-determination theory of motivation assumes humans actively seek to define their sense of self and to meet basic psychological needs through challenging, interesting, and accomplished experiences (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002). The theory is presented as a dynamic interaction between individual and environment with the primary force of motivation being the push to meet basic human psychological needs of competence, relatedness, and autonomy. Satisfaction of the basic needs comes from interpretation of contextual
or environmental factors by the individual and level of need satisfaction can lead to support for or interference with an individual’s motivation, performance, and well-being. One’s environment offers opportunities for personal growth or thwarting of development, and the person’s level of self-regulation and interaction contributes to the benefit or deficit garnered from the environmental context.

**Competence**

Competence involves feelings of effectiveness, self-efficacy, or confidence in one’s efforts to intentionally impact the environment (Bandura, 1993; Elliott et al., 2002; White, 1959). The need is innate and the feelings develop over time, within a variety of contexts and relationships, and they contribute to both social and cognitive development (Bandura, 1993; Elliott et al., 2002; Harter, 1978). Erikson’s (1950/1963, 1968) psychosocial stage of industry vs. inferiority, the work of middle childhood, provides an example of the ways competence influences relationships and outcomes. When an individual does not develop a strong sense of competence, there is a higher risk of experiencing anxiety, depression, or withdrawal from the environment (Bandura 1993; Patrick et al., 1993) and less likelihood of self-determined motivation being in play (Bandura, 1993; Elliott et al., 2002).

Competence can also be conceived as the sense of “perceived control”, the ability of the individual to impact the environment and achieve a desired outcome (Skinner, 1991; Skinner et al., 1990; Patrick, et al., 1993). Perceived control involves three different sets of beliefs (Patrick et al., 1993; Skinner et al., 1990). Control beliefs are those about whether one can influence successes rather than failures.
Strategy beliefs are those about whether there are effective strategies to create desired outcomes. Capacity beliefs are those about whether or not the individual has the capacity to implement the strategies that might be successful in the given situation. Perceived control is influenced by social relationships and by environmental contexts, and can facilitate goal achievement.

An individual’s beliefs about controllability may influence the degree of effort expended to master a skill or change an environment versus a decision to tolerate an adverse situation (Compas, Banez, Malcarne, & Worsham, 1991). Perceptions about controllability change with development; children develop the ability to differentiate chance or luck from skill and ability by the age of 11 to 13 years (Compas et al., 1991). By then, children have a greater ability to use problem-focused coping with efforts to manage or master an element of the environment seen as stressful.

High levels of competence have been linked to internalized levels of motivation and academic achievement (Bandura, 1993; Deci et al., 1991; Patrick et al., 1993; Skinner et al., 1990).

**Relatedness/School Belonging**

Belonging has been defined as a basic human need, important for optimal functioning (Baumeister & Leary, 1995; Goodenow, 1993; Libbey, 2004). People need to have an integrated and reciprocal relationship with others in the community. School is the primary community outside the family for children and adolescents. School environments with characteristics such as high academic
standards, high levels of teacher support, a community where relationships between students and adults are caring and respectful, and school safety have been identified as promoting school connectedness for students (Blum, 2005; Libbey, 2004; Wingspread Conference, 2004) and is important for students of all ages (Anderman, 2003; Anderman & Freeman, 2004; Birch & Ladd, 1997). Many benefits of school belonging for student success have been noted, including social, behavioral, and academic (Anderman & Anderman, 1999; Blum, 2005; Goodenow, 1993; Libbey, 2004; Wingspread Conference, 2004).

School connectedness has been identified as a protective factor for adolescents (McNeely, Nonnemaker, & Blum, 2002; Resnick et al., 1997) and it may be especially related to academic attainment for students with chronic illness (Maslow et al., 2011). Social isolation can be a greater concern for students with medical conditions and it may be that lack of connectedness is related to lost opportunities for development of competence and social relationships. Peer interaction and teacher-student relationships may be especially important for students with chronic illness, as they can foster a sense of school belonging just as they do for healthy, typical students (LaGreca, Bearman, & Moore, 2004; McMahon, Parnes, Keys, & Viola, 2008; Shiu, 2001).

Meijer and colleagues (2000) found that children with chronic illness reported lower levels of assertive behaviors. They suggest that students with chronic illness may work hard to meet social expectations and find ways to fit in,
thus responding in ways they perceive to be socially desirable. This finding could add support for the strong need to belong in the school community.

When children feel as though they belong, they may be able to pull from a stronger set of inner resources. They may also suffer when they anticipate isolation by experiencing decrements in reasoning and thought processing (Baumeister, Twenge, and Nuss, 2002).

Teacher-student relationships have been shown to have a clear positive impact on school belonging for students (Goodenow, 1993; Klem & Connell, 2004; Libbey, 2004; McNeely & Falci, 2004; Murray & Greenberg, 2000; Patrick, Anderman, & Ryan, 2002; Rosenfeld, Richman, & Bowen, 2000; Wentzel, 1998). Teachers can impact their students through caring, treating the students fairly, and actively engaging them in learning. Libbey (2004) noted “student relationships with their school often were operationalized as their relationship with their teachers” (p.281). Goodenow noted that teacher support explained over one-third of students' assessment of value and interest related to their academic work.

Pedagogical caring (Klem & Connell, 2004; Noddings, 1992; Wentzel, 1997) is a concept that involves the ways that students perceive care from their teachers. Behaviors of teachers that suggest pedagogical caring include modeling caring behaviors, democratic communication style, treating students as individuals, structure and expectations, and a nurturing manner. When students feel cared for by their teachers, they are more likely to be academically motivated, experience
autonomy and competence, and pursue prosocial goals (Klem & Connell, 2004; Wentzel, 1997).

Wentzel (1998) looked at the impact of support from peers, parents/family, and teachers. She found that, while each component of the adolescent’s environment provides some support for academic success, it was perceived teacher support that provided the most impact for classroom functioning and interest in class. Others have also come to the conclusion that supportive relationships between teachers and students influence children’s social, emotional, and academic adjustment and achievement (Murray & Greenberg, 2000; Rosenfeld et al, 2000). However, Rosenfeld and colleagues (2000) found that, although perceived teacher support was a necessary condition for success, it was not sufficient on its own—partnerships with parents, other teachers, peers, and other members of the students’ environment were also important.

It seems that teacher caring and teacher-student relationships are integral elements of belonging and relatedness and have consequent positive impact toward the development of competence. Patrick and her colleagues (2002) note that “perceptions of support arguably foster feelings of confidence and self-worth, allay anxiety, encourage persistence in times of difficulty, and sustain the necessary motivation to use effortful, adaptive learning and metacognitive strategies” (p.95).

A sense of school belonging may have long-term implications for adolescents (Eccles et al., 1993; Finn, 1989; Patrick et al., 2002). When students experience a sense of belonging or connectedness to their school and its values they are likely to
have positive school functioning and are less likely to leave school before graduation. Young adolescents need an opportunity to interact with peers, teachers, and a mastery oriented environment so they can become invested and motivated for academic tasks. High risk students may need to be offered specific avenues for belonging and positive teacher relationships, as they can be at risk for withdrawal at even younger ages (Murdock, 1999).

**Autonomy**

Autonomy is a term that has been used to represent different constructs, depending on the theoretical framework being used for definition (Hill & Holmbeck, 1986; Ryan & Deci, 2006; Soenens & Beyers, 2012; VanPetegem, Byers, Vansteenkiste & Sorens, 2012). Researchers in the developmental psychology or psychoanalytic frames have tended to describe autonomy as a result of the separation-individuation process, the point at which an adolescent becomes independent of others in terms of decision-making and planning behaviors (Blos, 1979; Freud, 1958; Silk, Morris, Kanaya & Steinberg, 2003; Steinberg & Silverberg, 1986). In these theoretical frames autonomy is equated with independence and self-reliance. Autonomy from the self-determination point of view involves choice or volition, whether the decision is to behave in a dependent manner or an independent manner (Ryan & Deci, 2000, 2006).

Self-determination theory purports that autonomy involves a perception of being responsible for one’s own actions and choices and the perceived ability to act from one’s own interests or values. Autonomy is not the opposite of dependence,
but rather, it is the opposite of coercion and its development requires support in the social environment (Ryan & Deci, 2000, 2006; Skinner & Edge, 2002). Individuals seek to be the origin of their own behavior rather than a pawn to external forces that cannot be controlled (de Charms, 1968; Skinner & Edge, 2002). Autonomy is related to the concept of “locus of causality”, with self-regulation more related to an internal locus of causality—when the reasons for acting come from within the individual (Connell, 1990; Ryan & Connell, 1989). When the impetus for behavior is autonomous, the behavior is likely to be more self-determined and engaged (Connell & Wellborn, 1991; Ryan & Deci, 2000; Skinner & Edge, 2002).

Autonomous behaviors have been discussed in a framework of automatic vs. automatized (Ryan & Deci, 2006). Automatic behaviors are not preceded by active thought and choice but automatized behaviors are a result of reflection and choices that fit with personal values and needs. “... peoples’ autonomy lies not in being independent causes but in exercising their capacity to reflectively endorse or reject prompted actions” (Ryan & Deci, 2006, p. 1574).

Parent support for autonomy through the use of an authoritative parenting style, including qualities of firm control and psychological autonomy, has been found to promote self-reliance and independence in children (Grolnick & Ryan, 1989). Grolnick and Ryan (1989) define parental autonomy support as the “degree to which parents value and use techniques which encourage independent problem solving, choice, and participation in decisions versus externally dictating outcomes and motivating achievement through punitive disciplinary techniques, press, or
controlling rewards” (p. 144). Parental autonomy support also seems to promote self-determined motivation and better school performance (Ryan & Deci, 2000; Deci et al., 1991).

Autonomous motivation (internal regulation) and controlled motivation (external regulation) both generate energy for action (Deci & Ryan, 2008; Deci et al., 1991; Ryan & Deci, 2000). Satisfaction of the basic needs of competence and belonging will promote motivated behaviors but the behavior is not likely to become self-determined without support for autonomy (Deci et al., 1991). Since many of the demands of schooling are not intrinsically motivating, it is especially important for children to develop the self-determination and self-regulation necessary to promote school success (Deci et al., 1991; Grolnick & Ryan, 1989).

Feelings of autonomy may function as a protective source of energy during times of stress or distress, as the sense of autonomy may counteract the inherent feelings of helplessness that can accompany difficult life events (Skinner & Edge, 2002). The social context can provide feedback to frame a stressful event as a challenge or a threat. Autonomy support may help the individual cope with both the chaos (loss of control) and coercion (loss of choice) in ways that lead to better adjustments (Skinner & Edge, 2002).

**Impact of Chronic Illness**

The importance of competence, belonging, and autonomy in stressful conditions (i.e. serious or chronic illness) may be especially important. A motivational model of stress and coping (Skinner & Edge, 2002) suggests that
stressful situations or contexts can threaten an individual’s ability to meet psychological needs. The appraisal of any given stressful situation will elicit certain ways of acting in an effort to meet basic needs. Whether the context is perceived as a challenge or threat will cause the individual to act accordingly and show either resilience or degeneration of the ability to self-regulate and function in a motivated way. Chronic or serious illness is certainly a time of stress for children and adolescents and thus, may set up a need for more deliberate activities that promote competence, relatedness, and autonomy.

When young people must balance the demands of managing a chronic health condition with the school demands all adolescents experience, a new dimension is added to the quest for academic and social success. There is no reason to believe that adolescents with chronic medical conditions would have any less desire than their healthy peers to meet their basic needs of competence, relatedness, and autonomy (Schwartz & Drotar, 2009; Shaw & McCabe, 2008; Svavarsdottir, 2008). However, depending on the level of impact the condition has on physical, emotional, or cognitive aspects of life, the student may experience interruptions to typical developmental and academic progress (Fowler et al., 1985; Northam, 1997).

Chronic health conditions are often accompanied by fatigue, pain, nausea, lethargy, and cognitive sequelae such as attention, memory, and processing speed deficits (Sexson & Madan-Swain, 1993; 1995; Shaw & McCabe, 2008). Adolescents with chronic illness are often absent from school or have low levels of energy, and these issues are likely to create a sense of isolation and academic struggle (Fowler et
The daily demands of managing a chronic health condition, especially the social and emotional elements, can contribute to declines in academic performance (Fowler et al., 1985; Needham et al., 2004; Thies, 1999). Frequent absence and chronic physical concerns can interfere with both academic progress and social integration (Fowler et al., 1985; Hogan, McLellan, & Bauman, 2000; Olsen et al., 2004; Shaw & McCabe, 2008).

Adolescents who have been out of school frequently, or for a long period of time, also have higher rates of school phobic behaviors and higher levels of anxiety, depression, and psychosomatic complaints (Hogan et al., 2000; Sexson & Madan-Swain, 1993, 1995; Shiu, 2001; Thies, 1999). Thies (1999) explains the dilemma associated with frequent absence and chronicity of illness clearly: “Falling behind academically leads to catching up, and catching up takes time away from keeping up. Self-confidence and achievement motivation are undermined” (p.395).

Students who are managing a chronic health condition have more academic difficulties than healthy peers even when they appear to have typical cognitive functioning and no diagnosed learning disability (Fowler et al., 1985; Sexson & Madan-Swain, 1993, 1995; Thies, 1999). Although frequent absence is an issue for adolescents with chronic conditions, it seems that the relation between absence and lower academic achievement is different for these students than it is for the general student population (Fowler et al., 1985; Sexson & Madan-Swain, 1993, 1995). Absence is not as highly correlated with lower achievement for students with
chronic health conditions as it is with healthy students. Socioeconomic status, which is also related to school absence and achievement, may function as a moderator in the relation for typical students (Fowler et al., 1985; Sexson & Madan-Swain, 1993). It may be that absence is more related to lower academic achievement for chronically ill students through factors like anxiety, or subtle effects of medication and disease process, rather than through the features of socioeconomic status.

Given the challenges faced by young people who are trying to progress academically and also maintain their level of health and well-being, it is not difficult to see how the elements necessary for academic motivation can be compromised. Frequent absence, pain, and fatigue can limit social interactions or cause awkwardness on behalf of both the adolescent with a health condition and others in the school environment. Symptoms of disease and side effects of treatment may also make focusing on academic work difficult at times.

Students with chronic health conditions have consistently described lower levels of motivation, engagement, school satisfaction, feelings of safety, and academic achievement along with higher levels of loneliness and isolation compared to healthy peers (Forrest Bevans, Riley, Crespo, & Louis, 2011; Hogan et al., 2000; McDougall, DeWit, King, Miller, & Killup, 2004; Svavarsdottir, 2007). Boys with chronic health conditions have been found to report or display more distress than girls (Svavarsdottir, 2007).
Another issue that can impact relatedness for adolescents with chronic health conditions is the perception the adults and peers at school have about the medical condition (Forrest et al., 2011; Olson et al., 2004; Sexson & Madan-Swain, 1993, 1995). Teachers may have an inaccurate understanding of the true risks and barriers to academic achievement, are often worried about whether there will be an emergency in their classroom, and wonder whether the student with a medical condition will require a lot of extra time and attention (Olson et al., 2004). Teachers may also worry about managing the needs of the healthy children in their classroom while adequately addressing any special needs of the child with a chronic health condition.

Teachers can promote an environment of normalcy in the classroom when they have an accurate understanding of the needs of a student with a chronic medical condition but also recognize that the special student has needs similar to peers (Shiu, 2001). McDougall and colleagues (2004) report that a school-wide task orientation and positive teacher student relationships at the school level can encourage individual teachers to provide direct support for individual students. It is reasonable to believe that the modeling of teachers providing support and respect to all students would help the students develop relationships with one another as well. The resulting sense of community may be especially important for students with chronic conditions who have frequent absences (Shaw & McCabe, 2008).

Competence and autonomy are important needs for the development of adolescents with chronic health conditions, just as they are for healthy young
people. When children face limitations in activities or choices due to their medical condition, they may experience challenges in finding opportunities to direct their own learning or social encounters (Forrest et al., 2011). It may also be difficult for students to develop a sense of mastery or competence when their practice and exposure to learning is interrupted by frequent absence, fatigue, or pain. If a teacher or parent has altered (lower) expectations for the adolescent with a medical condition or tolerates any sign of impaired learning without intervention, the interactions could lead to disaffection or underachievement in the student (Forrest et al., 2011; Northam, 1997; Sexson & Madan-Swain, 1995). It is important for teachers, peers, and parents to all understand the need for helping an adolescent with a chronic medical condition find ways to meet needs for competence, belonging, and autonomy.

Health status in childhood is an established risk factor for academic and vocational outcomes (Haas, 2006; Haas & Fosse, 2008; Jackson, 2009), but there are other factors that must be taken into account. Variables such as socioeconomic status of the family, parental education level, gender, age, and family valuing of education have all been suggested as impact factors for academic and other young adult outcomes (Berg & Linton, 2009; Case et al., 2005; Fowler et al., 1985; Haas, 2006; Madan-Swain et al., 2004). There may be some confounding effects of the various risk factors because health not only affects academic and vocational outcomes but health and academic achievement have some reciprocal risk factors.
(Jackson, 2009; Needham et al., 2004; Pless & Nolan, 1991). There may also be some unexpected interactions between health and other risk factors.

Understanding the dynamics and issues involved for children with chronic health concerns in school should help educators and other community adults provide some of the resources needed for these young people to achieve successful outcomes in academics and young adulthood.

**Developmental Context**

Adolescent development is an important dynamic of the context in which students, with or without chronic health conditions, are navigating the academic arena and managing the satisfaction or frustration of the basic psychological needs of autonomy, belonging, and competence. As bodies change, brains mature, and social relationships become more complex, adolescents are outgrowing childhood and preparing for the independence and responsibility of young adulthood (Eccles, 1999; Susman & Rogol, 2004; Wigfield, Byrnes, & Eccles, 2006).

Erikson’s theory of psychosocial development (1950/1963; 1959/1980; 1968) provides a framework for understanding some of the social and emotional changes experienced by adolescents as they move away from the world of childhood and into the world of a developing adolescent. Young adolescents are generally moving from a stage of developing a sense of industry and competence on to a stage where they must spend energy working toward development of an identity. Social interactions are necessary for that process to move forward (Erikson, 1956/2008; 1968). Adolescents in this stage of psychosocial development may be preoccupied
with the perceptions they believe others have of them and how those perceptions fit with the beliefs they hold about themselves. As the young person works to integrate the different ideas of who they seem to be, they develop an ego identity—an understanding of needs, beliefs, abilities, interests, and resources—and how all of those things add up to the self. Much of this work involves opportunities for experimentation, choice and decision that Erikson says allows the adolescent to find a niche in some section of his society, a niche which is firmly defined and yet seems to be uniquely made for him. In finding it the young adult gains an assured sense of inner continuity and social sameness which will bridge what he was as a child and what he is about to become, and will reconcile his conception of himself and his community’s recognition of him (Erikson, 1956/2008, p. 225, italics in original).

Piaget’s theory of cognitive development (Piaget, 1970, 1972; Wadsworth, 2004) also provides some insight about the journey through adolescence. He outlined stages through which an individual must progress to have an adult understanding of the world. Progression through the sequential phases is a product of individual qualities interacting with the world outside the self (Piaget, 1970). It is in this interaction that knowledge is constructed and the individual develops cognitive capacity. In the theory, Piaget identifies four specific factors that contribute to the construction of knowledge or intelligence and allow the individual to interiorize (internalize) the information provided by the world in new ways: maturation of the individual, experience with the physical environment, action
within the social environment, and equilibrium or self-regulation (Piaget, 1970). The factors play a collaborative role in the development of the individual.

Piaget’s stage of formal operations involves the ability to use formal and hypothetical reasoning (Wadsworth, 2004). It is characterized by the ability to use mental operations to solve hypothetical or verbal problems. The formal reasoning that is accessible to the adolescent at this stage allows planning and deduction of potential consequences. The adolescent can use information from the past, present and future to solve hypothetical or abstract problems (Piaget, 1970, 1972; Wadsworth, 2004). A formal operational thinker also has the ability to identify opinions of the self and others, understand concepts such as justice and morality, and use propositional logic (Piaget, 1970, 1972).

Elkind (1967; 1978; 1985) introduced the construct of adolescent egocentrism and its components of imaginary audience and personal fable, describing the concepts as a part of an adolescent’s growth in accordance with the Piagetian theory of cognitive development and the emergence of formal operational thought. The imaginary audience encompasses the sense that others are carefully watching and evaluating the young person’s looks, behaviors, and abilities. The personal fable involves a sense of personal uniqueness and invincibility; no one else can truly understand the experiences of the adolescent. Both concepts are the product of an immaturesly differentiated sense of self and others. The imaginary audience and personal fable may interfere with fulfillment of psychological needs of autonomy or relatedness because the teens would be very cautious about
expressing themselves openly and honestly, possibly inhibiting autonomous behaviors and supportive relationships (Ryan & Kuczkowski, 1994). Egocentrism is reduced over time with experiences in the social milieu, learning that others are often focused on their own thoughts and, at the same time, have life experiences that are similar to the adolescent.

There is some disagreement in the literature as to whether adolescent egocentrism and the related elements of imaginary audience and personal fable are fully explained by the Piagetian theory of cognitive development and formal operations. Some more recent work has pointed toward an underlying explanation that includes elements of psychoanalytic theory of ego development, including the process of separation-individuation adolescents experience in the development of an identity (Lapsley, 1993; Lapsley & Murphy, 1985; Ryan & Kuczkowski, 1994; Vartanian, 2000). Lapsley (1993) suggested “imaginary audience and personal fable may serve as integrative constructs that bridge social cognitive accounts of the adolescent self with psychodynamic accounts of the adolescent ego” (p. 570). Even though there is some disagreement about the theoretical underpinnings of adolescent egocentrism, the general sense of the ability of the constructs to explain adolescent thinking and behavior is widely accepted by developmental psychologists.

Social, cognitive, and ego development are all large tasks for an adolescent to master in the context of increasing independence, more complex social relationships, and academic demands. Keeping the developmental context in mind
will be helpful when exploring the health and motivation issues at the center of the current study.

**Present Study**

The current study is designed to evaluate relations between an adolescent’s status as an individual with a chronic illness since childhood, perceptions of autonomy, school belonging, and competence and long-term academic outcomes. Those relations were evaluated using outcomes of high school graduation by the age of 19 years and the level of academic attainment in young adulthood.

The first hypothesis guiding this study was that mean differences would exist in reported perceptions of autonomy, school belonging, and competence for students who have entered adolescence with a diagnosis of chronic illness compared to healthy peers. I expected students with health concerns to have lower perceptions of autonomy, school belonging, and competence. Secondly, I hypothesized that health status would help predict the likelihood of graduating from high school on time and that there would be an interaction between health status and levels of perceived autonomy, school belonging, and competence in relation to the high school completion outcomes. My third hypothesis was that health status could be used to predict long-term academic attainment and that health status would moderate the relation between autonomy, belonging, and competence and long-term academic attainment. I expected the relations between the motivation variables and the academic outcomes to be different for healthy students and those with a chronic health condition.
The literature supports the importance of perceived autonomy, school belonging, and competence for positive outcomes. A primary aim for this study was to explore whether the need for these motivational supports is more or less important for students with chronic illness. Methods of investigation are addressed in the next chapter of this document and findings are outlined in Chapter 4.
Chapter 3: Methods

The purpose of this study was to explore how the consequences of diagnosis and treatment of chronic illness as a child are related to motivational processes in adolescence and long-term academic outcomes. Levels of perceived autonomy, school belonging, and competence during adolescence were compared for students with chronic illness and healthy peers. Further, health status was explored as a possible moderator of perceived autonomy, school belonging, and competence in relation to academic outcomes. Long-term outcomes of on-time high school completion (by age 19) and educational attainment in young adulthood were considered.

Data for this study was drawn from the restricted data set of the National Longitudinal Study of Adolescent Health (Add Health; Harris, et al., 2009). The Institutional Review Board of The Ohio State University approved use of the data for the current study (protocol #2008B0310; Claire Kamp Dush, PhD., PI). Data access was also approved by the Carolina Population Center.

National Longitudinal Study of Adolescent Health

The National Longitudinal Study of Adolescent Health (Add Health; Harris, et al., 2009) is a long-term study using a nationally representative sample of U.S.
adolescents who were in grades 7-12 during the 1994-95 school year. The study was undertaken for the exploration of relations between adolescent behaviors, attitudes, health risks, family, peer and intimate relationships, educational outcomes, school climates, and neighborhood and community contexts. Topics assessed by the investigators include health status, health behaviors, sexual behaviors and attitudes, substance use and abuse, mental health status, relationships, educational/vocational experiences, school and community contexts, and biological specimens. Information was collected via in-home interviews with the students, parent questionnaires, and surveys of school personnel. Biospecimens were collected from the participants at the final wave of data collection.

A stratified, complex sample was used for the Add Health study. Four waves of data have been collected to date. Wave 1 of the data was collected in 1994-1995, Wave 2 in 1996, Wave 3 in 2001-2002, and Wave 4 was gathered in 2007-2008. A total of 80 high schools and 52 feeder schools functioned as the primary sampling units (PSUs) for the core sample included in the study. The schools represent 80 clusters/communities that are representative of the U.S. population of students in grades 7-12 during the 1994-95 school year, with respect to size of the school attended, type of school attended, census region of residence, level of urbanicity in the community/school, and percent of student population who were white.

The aims of the Add Health study at Wave 1 and Wave 2 were to create national estimates of behaviors, attitudes, experiences, and outcomes that describe U.S. adolescents in areas of life related to health and mental health status, health
risks, education, problem-solving skills, attitudes, and relationships (Carolina Population Center, n.d.).

Aims identified for Wave 3 of the study included locating and collecting longitudinal data from the Wave 1 in-home interview participants, adding data for subsamples of romantic couples, collection of biospecimens to assess for sexually transmitted disease status and establish prevalence estimates, and documenting geocodes for participant home addresses. There were more questions related to relationships, childbearing status, and educational or vocational history at Wave 3 to account for the movement of the sample toward young adulthood (Carolina Population Center, n.d.). These additional data allow for extended analyses of social, economic, and health-related behaviors and attitudes among the then 18 to 26 year old young adults. The length of time between Wave 1 and Wave 3 provides an opportunity to explore longitudinal changes in life situations, choices, and behaviors during a time of transition to young adulthood.

Wave 4 of the Add Health study was collected in 2007-08, when the Wave 1 participants were 24 to 32 years of age. The primary aim of this phase of the study was to collect information from Wave 1 respondents that would allow for analyses of developmental and health trajectories for the participants as they moved from adolescence to young adulthood. More objective data collection methods were incorporated into the study at Wave 4, including collection of physical measurements and multiple biomedical specimens (Carolina Population Center, n.d.).
Table 3.1 provides a summary of information from Wave 1, Wave 3, and Wave 4 of the Add Health study. I have also included areas of focus from each wave that was included in the current study.
Table 3.1

*Information Regarding Participants in Add Health Waves 1, 3, and 4*

<table>
<thead>
<tr>
<th>Wave</th>
<th>Students Core Sample</th>
<th>Oversamples</th>
<th>Parents</th>
<th>Information Used in Current Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wave 1</strong>&lt;br&gt;In-Home Interview 1995</td>
<td>Random selection from stratum of students in grades 7-12 ($N=12,105$)</td>
<td>Purposeful selection for oversamples plus saturation samples of 16 schools ($N=8,640$)</td>
<td>Parents of participating students ($N=17,670$)</td>
<td>*Demographic variables&lt;br&gt;*Health report&lt;br&gt;*Items for measurement of perceived autonomy, belonging, and competence&lt;br&gt;*Grades&lt;br&gt;*Report of symptoms</td>
</tr>
<tr>
<td><strong>Wave 3</strong>&lt;br&gt;In-Home Interview 2001-02</td>
<td>All Wave 1 respondents (now aged 18-26 years) who could be located and re-interviewed ($N=15,197$)</td>
<td></td>
<td></td>
<td>*Information about on-time high school completion</td>
</tr>
<tr>
<td><strong>Wave 4</strong>&lt;br&gt;In-Home Interview 2007-08</td>
<td>All Wave 1 respondents (now aged 24-32 years) who could be located and re-interviewed ($N=15,701$)</td>
<td></td>
<td></td>
<td>*Information about young adult academic attainment&lt;br&gt;*Information related to diagnosis of chronic illness in childhood&lt;br&gt;*Student level weights</td>
</tr>
</tbody>
</table>
Current Study

Information from Wave 1, Wave 3, and Wave 4 was used for these analyses. These three waves include the same group of participants. Wave 2 information is not included in this study, as Wave 1 students who were disabled or no longer in school were excluded in the second wave of data collection.

Sample

All Add Health participants with complete data for the items used in the study were included for variable development and for many of the analyses used to address the research questions. Designed-based features including stratum, cluster, and weights were included in analyses as appropriate. Wave 1 weights were used for the analyses that included only Wave 1 data and Wave 4 weights were used for the analyses to address academic outcomes (Chantala, 2006).

A subsample was drawn from the total data set and included two groups of participants. The subsample was used to address the group differences questions. The first group in the subsample includes students who were diagnosed with a chronic medical condition at the age of 12 years or younger (N=629). Participants self-identified their diagnosis and age of diagnosis on the Wave 4 survey. The list of diagnoses identified by the survey, and included in this study, are cancer, diabetes, epilepsy, heart condition, and migraine headaches. When children are diagnosed at a young age, they experience the transition to the secondary school setting with some identification as a person with chronic illness. These students’ entire high school careers include managing the health condition in concert with the tasks of
academic and adolescent development. A random portion (10%) of participants who identified no history of health concerns at Wave 4 was selected to serve as a healthy group for comparison analyses. The study employed a non-categorical approach to assess relations between chronic illness and other variables of interest; all those with a diagnosis were considered together. The non-categorical approach holds that adolescents with chronic illness experience similar stresses and life challenges, regardless of the specifics of the disease (Perrin, et al., 1993; Pless & Pinkerton, 1975; Stein & Jessop, 1989).

**Variable Development**

Within the limitations that accompany secondary data analysis, items from Add Health were identified and combined to create the variables of interest for the current study. The demographic variables and scales to represent perceived autonomy, belonging, and competence were created using survey responses from the Wave 1 dataset (N= 20,745). Wave 1 variables included in the study had missing observations ranging from 0.2% to 6.6%. Parent education was the only variable with missing observations greater than 4%. Correlations were reviewed using pairwise deletion and list wise deletion was employed by the Stata software to address missing data in other analyses. The academic outcome dependent variables are drawn from information provided at Wave 3 and Wave 4. The Wave 4 sample providing information for the current study included 15,700 participants (76% of the Wave 1 population). Student weights are available and were used to account for
non-response at Wave 4. Design-based information (stratum, clusters, and weights) was included in the data files and was used for weighted analyses.

All variables are presented here with an explanation of the items and procedures used for creation. Specific survey items used for development of the variables, definition of categories, and descriptive statistics for the dependent and independent variables are included in Table 3.2.

**Dependent variables.** The two primary outcome variables for the current study were the level of academic attainment reached by the participant at Wave 4 and a binary outcome of high school completion by the age of 19 years.

**Academic attainment.** Academic attainment was measured using the highest level of academic progress reached by the participant, measured at Wave 4, and grouped into five categories (did not complete high school; high school graduate or obtained GED; some college or post secondary training; baccalaureate degree; and participation in some educational endeavor beyond a baccalaureate degree). The categories are used as an ordinal measure of the outcome.

**On-time high school completion.** Student age at high school completion was calculated using participant date of birth and Wave 3 responses about high school graduation or GED completion dates. This outcome variable is a binary measure. Completion by the age of 19 years was considered “on-time” completion for the purposes of this study.

**Independent variables.** Independent variables include some that are used as controls and others that are used as predictors of the outcomes. Individual items
were used to create scaled variables. Some of the individual survey items were used in the confirmatory factor analysis and group mean differences structural equation models.

**Age.** Participant age to the level of years was calculated based on the date of interview and date of birth provided at the Wave 1 time point. Students who were between the ages of 12 and 19 years at the Wave 1 interview are included in the current study.

**Autonomy.** Perceived autonomy was measured using four Wave1 survey items about the participants’ cognitive processes in making choices ("...get as many facts as possible about a problem"; "...try to think of as many different ways to approach the problem as possible"; "...use a systematic method for judging and comparing alternatives"; "...after carrying out a solution...try to analyze what went right and what went wrong"). There are no explicit items available in the Add Health data to measure purely *intrinsic* motivation (and thus, the purest of autonomous behavior), so the behavior involved in thoughtful decision-making is used here to assess the participants’ autonomy perceptions by measuring the extent to which they “organize their behavioral regulation by taking reflective interest in possibilities and choices” (Ryan & Deci, 2006, p. 1563). The individual items, measured with a Likert-type scale (1=strongly disagree, 5=strongly agree), were included in the structural equation measurement model. The composite score was used as a continuous variable in the regression models.
**Belonging.** Five items from the Wave 1 survey were used to measure student perception of school belonging. The five items were used individually as observed indicators of the latent variable in the structural equation measurement model. The composite scale score was entered as a continuous variable in other models. The individual items are measured with a Likert-type scale (1=strongly disagree, 5=strongly agree). The five items chosen ("You feel close to people at your school"; “You feel like you are part of your school”; You are happy to be at your school”; The teachers at your school treat students fairly”; You feel safe in your school”) have been shown to reliably measure school belonging in previous research (Anderman, 2002; McNeely, Nonnemaker, & Blum, 2002; Resnick et al., 1997).

**Competence.** Four Wave 1 survey items were used to measure participants’ perceptions of competence. A 5-level Likert-type scale was also used for this item. The items include some general perceptions (“You have a lot of good qualities”; “You have a lot to be proud of”; “You like yourself just the way you are”) and one more specific perception (“You are physically fit”). The individual items served as observed variables in the structural equation measurement model, and the scaled score was used as a continuous variable in the regression models.

**Diagnosis status.** Diagnosis status is used as a grouping variable to address research questions about group differences. A subsample was drawn from the larger Add Health data to create the comparison sample. The groups in the subsample were determined based on responses to the Wave 4 questions about health/diagnosis history. The chronic illness group (N=629) includes participants
who were diagnosed with cancer, diabetes, epilepsy, heart disease, or migraine headaches at the age of 12 years or younger. The age parameter was chosen to allow for the participants to experience their entire secondary school career with the demands of illness management and adjustment. The healthy group was created by randomly selecting 10% of those who reported no history of health concerns during the Wave 4 data collection, yielding \( N=897 \).

**Gender.** Participants reported their biological sex at the Wave 1 interview. This information is included as one of the control variables throughout the analyses.

**Grade average.** A grade average was computed by using the mean of the most recent grades for English, math, science, and history, reported by the participant at Wave 1. Grade average is used as a proxy for prior academic performance and is included as a control variable.

**Health report at Wave 1.** Students and their parents were each asked to assess the student’s general health at Wave 1 (“In general, how is your/student’s health?”; scale of 1=poor to 5=excellent). The health report value was created using the mean of the two scores reporting health status. There are many chronic medical conditions that are not identified in the Add Health data, so the health report at Wave 1 was added as a more general health variable for the assessment of outcomes.

**Parent education.** At Wave 1, participants reported the highest level of education attained by each parent. The parent education variable was created using the mean of mother education level and father education level, when both are
reported. The completion level of one parent was used when only one was identified. Five education levels had a range from ‘no high school diploma’ (1) to ‘completion of education beyond the baccalaureate level’ (5). Parent education was used as a control variable.

**Race.** Race was self-reported by participants at Wave 1 and grouped into white and minority status. The minority group includes those identified as African American, Asian, Hispanic, Native American, and Other. Race was included as a control variable.

**Symptom score.** Students reported on the frequency of a variety of physical symptoms for the previous 12 months. The responses ranged from 0 (never) to 4 (almost every day) for each symptom. A mean score indicating the self-reported frequency of 11 symptoms was developed from Wave1 responses. The items describe a variety of student complaints, some that would be considered more physical (i.e. headaches, feeling weak) and some that might be categorized as more emotional (i.e. moodiness, unable to relax). Physical and emotional symptoms were both included as a way of addressing the fuzziness that exists between the two, and because the symptoms, per se, were not the focus of this study. Principal components analysis with an oblique rotation was used to assess the items and determine if they represented one or two factors. Details of the factor analysis procedure are presented in chapter 4, but the items are included as a single scale variable in the analyses.
Other considerations. An underlying question of the current study is whether unmet needs for autonomy, belonging, and competence have a particular impact for students who are living with chronic illness, compared to those who are healthy. To further address that question, interaction terms between health status and autonomy, belonging, and competence were created and examined in terms of the relations with academic outcomes.

SPSS 20 (IBM Corp, 2011) software was used for initial data cleaning and recoding. Stata 12 (StataCorp, 2011a) software was used to compute results of all further analyses. The Stata12 survey set commands address the stratified, clustered and weighted nature of the data (StataCorp, 2011b) and allow for accurate parameter and variance estimates. The survey set commands employ a noniterative, linearized method (Taylor series linearization) of computing the standard errors rather than a maximum likelihood method (Heeringa, West, & Berglund, 2010). The linearized method uses confidence intervals based on the complex sample to determine the significance of results.

All of the predictor variables were created from Wave 1 data, so Wave 1 weights were used with the stratum and cluster identifiers for the initial computation of design-based variable means and standard errors (Chantala, 2006). The regression models used to address academic outcomes are considered using Wave 4 student level weights to account for non-response and sample design (Chantala, 2006). Because level two (school) variables are not of interest in the current study, survey set commands are used rather than multi-level modeling to
account for the clustered data when generating design-based parameter and variance estimates (Chantala & Tabor, 2010; Heeringa et al., 2010; personal communication with C. Kamp Dush, July, 2013). Design elements and weights were not used when the two groups of students in the subsample (chronically ill and healthy) were compared directly.

Several of the variables were included consistently as controls due to their potential as covariates of the outcomes, but they are not the key variables of interest in the current study. The control variables were all gathered from Wave 1 data and include age, gender, previous grade average, parent education level, and minority racial status.
Table 3.2

Descriptive Characteristics and Statistics of Variables From the Full Dataset

<table>
<thead>
<tr>
<th>Variable</th>
<th>Survey Items Used</th>
<th>Values(^a)</th>
<th>Range</th>
<th>Unweighted M (SD)</th>
<th>Skew (SE)</th>
<th>Design-based M (linearized se)</th>
<th>% Miss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Academic Attainment</td>
<td>Wave 4 Highest level of</td>
<td>1=less than HS 2=HS grad 3=Some college/post HS train 4=Bachelor degree</td>
<td>1 - 5</td>
<td>3.11 (1.07)</td>
<td>-.024 (.02)</td>
<td>3.05 (.04)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>education achieved to</td>
<td>date</td>
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<tr>
<td>High School Completion</td>
<td>Wave 3 GED/HS grad</td>
<td>Computed from Wave 1 age 0 = No 1 = Yes</td>
<td>0/1</td>
<td>0 = 7.7%</td>
<td>1 = 92.3%</td>
<td>0 = 7.3% 1 = 92.7%</td>
<td></td>
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<tr>
<td>by 19yo</td>
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<tr>
<td><strong>Independent</strong></td>
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<tr>
<td>Age</td>
<td>Wave 1</td>
<td>Calculated and restricted to ≤ 19yo for this study</td>
<td>12-19</td>
<td>16.11 (1.70)</td>
<td>-.220 (.02)</td>
<td>15.85 (.12)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

\(^a\) Values range from 1 to 5.

Continued
### Table 3.2 continued

<table>
<thead>
<tr>
<th>Autonomy</th>
<th>Wave 1</th>
<th>Ordinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get as many facts as possible to solve problem</td>
<td>1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree</td>
<td></td>
</tr>
<tr>
<td>Think of different approaches to problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic method to make choices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.83 (.86)</td>
<td>-.785 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.97 (.77)</td>
<td>-.913 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.62 (.88)</td>
<td>-.520 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.82 (.83)</td>
<td>-.836 (.02)</td>
</tr>
<tr>
<td>Composite</td>
<td>Scale ($\alpha = .74$) 4 items</td>
<td>3.81 (.63)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belonging</th>
<th>Wave 1</th>
<th>Ordinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>You feel close to people at your school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You feel like you are part of your school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You are happy to be at your school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The teachers at your school treat students fairly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You feel safe in your school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = strongly disagree 2 = disagree 3 = neither 4 = agree 5 = strongly agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.69 (1.01)</td>
<td>-.756 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.81 (1.03)</td>
<td>-.914 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.70 (1.11)</td>
<td>-.782 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.49 (1.07)</td>
<td>-.514 (.02)</td>
</tr>
<tr>
<td>1 - 5</td>
<td>3.73 (1.05)</td>
<td>-.781 (.02)</td>
</tr>
<tr>
<td>Composite</td>
<td>Scale ($\alpha = .76$) 5 items</td>
<td>3.68 (.75)</td>
</tr>
</tbody>
</table>

Continued
<table>
<thead>
<tr>
<th>Competence</th>
<th>Wave 1</th>
<th>Ordinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have a lot of good qualities</td>
<td>1=strongly disagree 2=disagree 3=neither 4=agree 5=strongly agree</td>
<td>1 - 5</td>
</tr>
<tr>
<td>You are physically fit</td>
<td></td>
<td>4.25 (.67)</td>
</tr>
<tr>
<td>You have a lot to be proud of</td>
<td></td>
<td>-.720 (.02)</td>
</tr>
<tr>
<td>You like yourself just as are</td>
<td></td>
<td>4.27 (.01)</td>
</tr>
<tr>
<td>Composite</td>
<td></td>
<td>4.11 (.64)</td>
</tr>
<tr>
<td></td>
<td>Scale ( $\alpha = .77$)</td>
<td>-.573 (...)</td>
</tr>
<tr>
<td></td>
<td>4 items</td>
<td>4.12 (.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>Gender</td>
<td>Wave 1</td>
<td>Categorical</td>
</tr>
<tr>
<td>Participant self-report</td>
<td>0 = Male 1 = Female</td>
<td>0 = 49.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>49.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>49.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Grade Average</td>
<td>Wave 1</td>
<td>Average</td>
</tr>
<tr>
<td>Most recent grade in:</td>
<td>1=D or less 2=C 3=B 4=A</td>
<td>1.00 - 4.00</td>
</tr>
<tr>
<td>English or language arts</td>
<td></td>
<td>2.75 (.77)</td>
</tr>
<tr>
<td>Math</td>
<td></td>
<td>-.227 (...)</td>
</tr>
<tr>
<td>History or social studies</td>
<td></td>
<td>2.85 (.020)</td>
</tr>
<tr>
<td>Science</td>
<td></td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continued</td>
</tr>
</tbody>
</table>
Table 3.2 continued

<table>
<thead>
<tr>
<th>Health Status</th>
<th>Wave 4 diagnosis</th>
<th>No identified Condition at Wave 4</th>
<th>Random 10% selection</th>
<th>N = 897</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Illness Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>Cancer = 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Diabetes = 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td>Epilepsy = 107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart conditions</td>
<td>Heart = 44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migraine headaches</td>
<td>Migraine = 436</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave 4 Age at diagnosis</td>
<td>≤ 12yo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave 4 diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In general, how is your health? Parent report of student's health</td>
<td>1 = Poor 2 = Fair 3 = Good 4 = Very Good 5 = Excellent</td>
<td>1 - 5</td>
<td>3.967 (.76)</td>
<td>.563 (---)</td>
</tr>
<tr>
<td>Parent Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of mother/father highest education</td>
<td>1 = less than HS 2 = HS grad or GED 3 = Some college 4 = Bachelor 5 = Beyond bachelor</td>
<td>1 - 5</td>
<td>2.68 (1.14)</td>
<td>.313 (---)</td>
</tr>
</tbody>
</table>

Continued
Table 3.2 continued

<table>
<thead>
<tr>
<th>Race</th>
<th>Wave 1</th>
<th>Binary</th>
<th></th>
</tr>
</thead>
</table>
| Participant self-report | 0=White 1=Minority | 0/1             | White= 57.7%    | 72.1%  
|               |                         |                 | Minority= 42.3% | 27.9%  |

<table>
<thead>
<tr>
<th>Symptoms Score</th>
<th>Wave 1</th>
<th>How often you have had in the last 12 months:</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Headache 0 = never 1 = just a few times</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hot all over 1 = just a few times</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stomach ache or upset stomach 2 = about once/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>stomach 3 = almost every day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physically weak for no reason 4 = every day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feeling really sick</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dizziness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chest pains</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor appetite</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insomnia</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unable to relax</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moodiness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean of 11 items</td>
<td>α = .79 (11 items)</td>
<td>0 – 3.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean Score</td>
<td>758 (.45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.031 (.02)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.776 (.01)</td>
</tr>
</tbody>
</table>

*Values were recoded as necessary to allow for the highest value to indicate the most of the given construct.*
Hypotheses and Analyses

This study examined the previously identified hypotheses with multiple procedures. Preliminary data review was done to determine whether a measurement model to assess group differences and regression models to assess academic outcomes were viable. The value of health variables (diagnosis status, symptom score, or health report at Wave 1) in the prediction of levels of perceived autonomy, school belonging, and competence was examined with linear regression models. Group mean differences in levels of perceived autonomy, belonging, and competence were assessed using structural equation modeling methods. Logistic and ordinal regression models were used to assess prediction of academic outcomes. The data review procedures and results are described in Chapter 4 of this document.

Three hypotheses guided this study to examine differences between students with chronic illness and those who have been healthy throughout childhood, adolescence, and young adulthood.

1. My first hypothesis was that there would be mean differences in the levels of perceived autonomy, school belonging, and competence between chronically ill students and their healthy peers, with chronically ill students reporting lower levels of need satisfaction. A structured mean differences model was then used to examine differences between chronically ill and healthy participants.
2. I hypothesized that there would be differences in the likelihood of on-time high school completion between students with a chronic health condition and their healthy peers and that: a) chronic illness status would be a useful predictor of high school completion by the age of 19 years and b) health status would moderate the relation between autonomy, belonging, and competence and on-time high school completion. A logistic regression model was used to address the relation between health status, motivation variables and on-time graduation.

3. My third guiding hypothesis was that differences in long-term academic attainment would exist between students with chronic health conditions and their health peers. I hypothesized that a) health status in adolescence would significantly predict long-term academic attainment and b) health status would moderate the relation between autonomy, belonging, and competence and long-term academic outcomes. An ordinal regression model was used to examine the relations between health status, motivation variables, and academic attainment question.

Descriptions and results from each of the analyses are included in chapter 4 of this document.
Chapter 4: Results

Secondary analysis of data requires an initial assessment to determine the data’s ability to address the research questions at hand (Kiecolt & Nathan, 1985; Heering et al., 2010). It is also critical to address the design elements of a stratified, complex sample during analysis (Heering et al., 2010; Hosmer & Lemeshow, 2000; Lee & Forthofer, 2006). The Add Health data appears well suited to address the questions of the current study. Items necessary to measure all variables of interest were available. Preliminary analyses were conducted to identify the strengths and limitations of the items chosen for the current study. Initial data cleaning and recoding was completed using SPSS 20 software (IBM Corp, 2011). All further analyses for the study were completed using Stata 12 software (StataCorp, 2011a).

The sample for this study included all Add Health participants with complete data on the variables used to address the research questions. The Wave 1 sample with complete data (N=20,180) was used to establish the scaled variables and to develop a structural equation measurement model for the latent variables of perceived autonomy, school belonging, and competence. The first research question (differences in perceptions of autonomy, school belonging, and competence) was assessed using Wave 1 data. The questions about academic outcomes were
addressed using data from Wave 3 and Wave 4 of the Add Health study. The complete sample with the academic outcome variables of interest included 10,810 participants.

**Scale Development**

Composite scores were created for the measurement of perceived autonomy, belonging, and competence. I chose items available in the Add Health survey that seemed to most clearly represent the constructs of autonomy and competence as described by self-determination theory (Connell, 1990; Connell & Wellborn, 1991; Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002; Skinner & Edge, 2002; Skinner, Wellborn, & Connell, 1990). Prior researchers have used the items in the belonging scale (Anderman, 2002; McNeely, Nonnemaker, & Blum, 2002; Resnick et al., 1997) with good reliability so they were reviewed as a scale for this study. To assess the feasibility of the scales for the study, factor analyses to assess the covariance of items was conducted (Tabachnick & Fidell, 2007). Factor loadings and eigenvalues for each of the scales are listed in Table 4.1.

The scales used to measure perceived autonomy, belonging, and competence were created using the mean score from individual survey items (listed in Table 3.2). Preliminary analysis suggested that the items for each scale fit together with adequate reliability; alpha values ranged from .74 to .77. Autonomy was measured using four individual survey items. Belonging was measured using five survey items. Four survey items were included in the competence score.
Table 4.1

**Factor loadings and eigenvalues for composite scales**

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Autonomy</th>
<th>Belonging</th>
<th>Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>.6644</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>.7057</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rational</td>
<td>.6359</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate</td>
<td>.5862</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close</td>
<td></td>
<td>.6907</td>
<td></td>
</tr>
<tr>
<td>Part</td>
<td></td>
<td>.8028</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td></td>
<td>.7044</td>
<td></td>
</tr>
<tr>
<td>Teach Fair</td>
<td></td>
<td>.4604</td>
<td></td>
</tr>
<tr>
<td>Safe</td>
<td></td>
<td>.4993</td>
<td></td>
</tr>
<tr>
<td>Qualities</td>
<td></td>
<td>.7169</td>
<td></td>
</tr>
<tr>
<td>Physical Fit</td>
<td></td>
<td>.5772</td>
<td></td>
</tr>
<tr>
<td>Proud</td>
<td></td>
<td>.8081</td>
<td></td>
</tr>
<tr>
<td>Like Self</td>
<td></td>
<td>.6618</td>
<td></td>
</tr>
<tr>
<td>Scale α</td>
<td>.74</td>
<td>.76</td>
<td>.77</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>1.687</td>
<td>2.079</td>
<td>1.938</td>
</tr>
</tbody>
</table>

A principal components analysis was conducted for the reported physical symptoms listed in the Wave 1 survey to derive an appropriate number of items to include in the scale. I chose the symptoms that I thought would most clearly represent (and serve as a proxy for) chronic medical conditions. Sixteen items were initially reviewed with 11 of them included in the final factor model. The 11 symptoms included and their summary statistics are listed in Table 3.2. The items excluded from the analysis were “cold sweats”, “sore throat or cough”, “feel very tired for no reason”, “painful or frequent urination”, and “muscle/joint pain or soreness”. The excluded items did not fit into the factor model in any meaningful way. The included items all loaded onto one factor with an eigenvalue of 3.59. The 11 items had an alpha coefficient of .79. No other factors had eigenvalues of at least
so the items were all used together to create a composite symptoms mean score.

The loadings for components of the final scale are included in Table 4.2.

Table 4.2

Loadings for Components of Symptoms Scale

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>.520</td>
<td></td>
</tr>
<tr>
<td>Hot All Over</td>
<td>.568</td>
<td></td>
</tr>
<tr>
<td>Stomach Ache</td>
<td>.549</td>
<td></td>
</tr>
<tr>
<td>Weak</td>
<td>.622</td>
<td></td>
</tr>
<tr>
<td>Feel Sick</td>
<td>.578</td>
<td></td>
</tr>
<tr>
<td>Dizzy</td>
<td>.660</td>
<td></td>
</tr>
<tr>
<td>Chest Pain</td>
<td>.567</td>
<td></td>
</tr>
<tr>
<td>Poor Appetite</td>
<td>.531</td>
<td></td>
</tr>
<tr>
<td>Insomnia</td>
<td>.533</td>
<td>.445</td>
</tr>
<tr>
<td>Unable to Relax</td>
<td>.584</td>
<td>.451</td>
</tr>
<tr>
<td>Moodiness</td>
<td>.554</td>
<td></td>
</tr>
<tr>
<td>Scale α</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>3.59</td>
<td>0.51</td>
</tr>
<tr>
<td>PVAF</td>
<td>1.03</td>
<td>.137</td>
</tr>
</tbody>
</table>

Note: PVAF=proportion of variance accounted for by component; all blanks represent loadings less than .250

Preliminary Data Review

All variables were examined and recoded as necessary so a higher value indicated more of a construct. The initial review of the full Add Health Wave 1 data was completed using unweighted data. Many of the correlations among the independent variables are statistically significant but small. Correlations between variables included in the current study are provided in Table 4.3. Health report at Wave 1 was significantly and negatively related to age, gender, race, and number of reported symptoms. Girls, minority status students, older students, and those with
more reported symptoms all reported lower health scores. Health report was positively and significantly correlated to prior grades, parent education level, and perceptions of autonomy, belonging, and competence. Perceived autonomy has a statistically significant and positive relationship with age, prior grades, minority racial status, and health report. Autonomy decreased when a student reported a higher number of symptoms. Belonging was positively and significantly related to prior grades, parent education level, and health report. Older students, girls, students of minority status, and those with higher numbers of reported symptoms all experienced declines in belonging. Competence was positively related to prior grades, parent education level, racial minority status, and higher health reports. Older students, girls, and students with higher levels of reported symptoms perceived lower levels of competence.
Table 4.3

Correlation Matrix for Independent Variables Using Full Add Health Wave1 Sample (N=20,745)

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Gender</th>
<th>Race</th>
<th>ParEduc</th>
<th>Grades</th>
<th>HealthRep</th>
<th>Symp</th>
<th>Aut</th>
<th>Bel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td>-0.041</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td>0.024</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Educ</td>
<td></td>
<td>-0.055</td>
<td>-0.020</td>
<td>-0.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade Avg</td>
<td></td>
<td>-0.078</td>
<td>0.144</td>
<td>-0.097</td>
<td>0.237</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Report</td>
<td></td>
<td>-0.055</td>
<td>-0.106</td>
<td>-0.073</td>
<td>0.180</td>
<td>0.205</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td>0.022</td>
<td>0.204</td>
<td>-0.058</td>
<td>-0.024</td>
<td>-0.058</td>
<td>0.277</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autonomy</td>
<td></td>
<td>0.080</td>
<td>-0.009</td>
<td>0.081</td>
<td>0.002</td>
<td>0.083</td>
<td>0.093</td>
<td>-0.095</td>
<td></td>
</tr>
<tr>
<td>Belong</td>
<td></td>
<td>-0.090</td>
<td>-0.022</td>
<td>-0.042</td>
<td>0.057</td>
<td>0.231</td>
<td>0.211</td>
<td>-0.253</td>
<td>0.171</td>
</tr>
<tr>
<td>Competence</td>
<td></td>
<td>-0.074</td>
<td>-0.201</td>
<td>0.035</td>
<td>0.094</td>
<td>0.133</td>
<td>0.366</td>
<td>-0.305</td>
<td>0.274</td>
</tr>
</tbody>
</table>

Note: **Bold** = significance at $p < .01$; *Italic* = n.s.; unweighted data used for correlations
All of the individual items used to create the scales for perceived autonomy, belonging, and competence, as well as the composite scores themselves, had slight negative skews (<1). The mean score for symptoms had a slight positive skew (1.03). Cronbach’s alpha values for each of the created scales (autonomy, belonging, competence, symptoms) indicate acceptable reliability, with values of .74 or higher for the current sample. Survey items used to measure age and prior grade average had a slight negative skew (<1). The measure of parent education had a slight positive skew (.313). Skew (and standard error) values, alpha values, and percent missing are shown for each variable in Table 3.2.

The amount of missing data in Wave 1 ranged from 0.2% to 3.6% for all but one of the independent variables included in the analyses (age, gender, race, prior grades, health report, symptom mean, autonomy scale, belonging scale, and competence scale). Parent education level had 6.6% observations missing. Students reported their parents’ level of education at Wave 1 and some may not have known that information.

The research questions in this study were designed to explore differences in the level of perceived autonomy, belonging, and competence between students with chronic illness and their healthy peers. The questions also addressed differences in academic outcomes and potential relations between academic outcomes and level of psychological need satisfaction (autonomy, belonging, competence).
Hypothesis 1: Levels of Autonomy, Belonging, and Competence

With the first hypothesis I expected to find differences in levels of perceived autonomy, belonging, and competence for students with chronic health conditions and their healthy peers. I hypothesized that students with health concerns would report lower levels of autonomy, belonging, and competence.

Canonical correlation was conducted as a preliminary review of the association between a health status variate (health report, symptoms score) and a psychological needs variate (autonomy, belonging, competence; Stata Consulting Group, 2013; Tabachnick & Fidell, 2007). The complete Wave 1 data set was used for this analysis (N=20,180). Results of the Wilks’ lambda tests indicate that the two groups of variables are linearly related on two dimensions (\(\lambda=.7883, F_{(6, 40432)} = 849.023, p<.001; \lambda=.9951, F_{(2, 20172)} = 49.695, p<.001\)). The first dimension represents a variance overlap of 20.8% \(r_{c1}=.456\). The second dimension accounts for only 0.5% of the remaining variance \(r_{c2}=.070\). Overall, the health variables accounted for 8.3% of the variance in the psychological needs set of variables \(\text{redundancy1}=.080, \text{redundancy2}=.003\).

Graphic representation of the canonical model, including coefficients for the two significant variate pairs, is provided in Figure 4.1. The measure of autonomy in this analysis had a very weak relationship with the psychological needs variate. The other variables all had moderate to strong correlations with their respective variates (Tabachnick & Fidell, 2007).
The relations between health issues (Wave 1 Health report and symptoms mean score) and perceived levels of autonomy, school belonging, and competence were examined independently using linear regression analyses. Independent variables for each regression analysis included age, gender, minority racial status, prior grades, and parent education level as control variables. Wave 1 health report and the symptoms mean scores were also used as independent variables and were the predictors of interest for this set of analyses. The dependent variables for the regression analyses were perceived autonomy, belonging, and competence.
Coefficients and levels of significance for variables retained in the final models are provided in Table 4.4.

The correlations between the health report at Wave 1 and reported symptoms mean at Wave 1 was -.277, suggesting that collinearity should not be a large concern. Confounding effects of multicollinearity were further discounted by tolerance values of >.72 and variance inflation factors between 1.01 and 1.39 for all variables included in the models (Cohen, Cohen, West, & Aiken, 2003). The three regression models were produced using the full Wave 1 data with design-based parameters (Stata survey set commands). Wave 1 cross-sectional weights were used for these analyses because all information was gathered from the Wave 1 data (Chantala, 2006).

The health report score and mean symptoms score both provided significant predictive utility for perceived autonomy, belonging and competence. After controlling for demographic variables in the model, the health items provided additional explanation of variance of 1.5% for perceived autonomy, 7.0% for perceived school belonging, and 14.5% for perceived competence. The report of health status at Wave 1 had a positive relationship with autonomy, belonging and competence, while the number of reported symptoms had an inverse relationship with the outcomes.
Table 4.4

*Final Regression Models for Perceived Autonomy, School Belonging, and Competence, using Design-based Wave 1 Data*

<table>
<thead>
<tr>
<th></th>
<th>Autonomy</th>
<th>Belong</th>
<th>Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.033***</td>
<td>-.031***</td>
<td>-.020***</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>-.206***</td>
</tr>
<tr>
<td>Race</td>
<td>.110***</td>
<td></td>
<td>.094***</td>
</tr>
<tr>
<td>Parent Educ</td>
<td>-.021**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade Average</td>
<td>.070***</td>
<td>.195***</td>
<td>.075***</td>
</tr>
<tr>
<td>Initial model $R^2$</td>
<td>.022</td>
<td>.067</td>
<td>.084</td>
</tr>
<tr>
<td>Wave 1 Health Report</td>
<td>.063***</td>
<td>.122***</td>
<td>.258***</td>
</tr>
<tr>
<td>Symptoms Mean Score</td>
<td>-.121***</td>
<td>-.376***</td>
<td>-.268***</td>
</tr>
<tr>
<td>Model $R^2 \Delta$</td>
<td>.015</td>
<td>.075</td>
<td>.145</td>
</tr>
<tr>
<td>Total Model $R^2$</td>
<td>.037</td>
<td>.142</td>
<td>.231</td>
</tr>
</tbody>
</table>

Notes: standardized coefficients; gender coded male=0, female=1; race coded white=0, minority=1; ***$p<.001$; **$p<.01$; blank indicates variable not included in final model due to non significance; **bold**=variance explained by control variables, additional variance explained by health variables, and total variance explained.

With relations between health variables and perceived autonomy, belonging, and competence identified, attention was turned to potential differences in levels of need satisfaction based on health characteristics. Structural equation modeling methods were used to explore the group differences.

**Group Differences**

Two subsets of participants were identified from the larger Add Health sample for purposes of comparison based on health history. The groups were
chosen based on self-reported information about diagnosis of chronic illness, collected at the Wave 4 data time point. The two groups were combined to create a convenience sample and used for comparison analyses. The first group included participants who reported diagnosis of one of five chronic illnesses at the age of 12 years or younger (n= 629). Diagnoses included for the chronic illness group were cancer, diabetes, epilepsy, heart conditions, and migraines. The second group included participants who identified no history of health concerns at the Wave 4 data collection point. The subsample was chosen for evaluation because there are other diagnoses included in the information collected at Wave 4 but those diagnoses were not pediatric onset. The healthy group consisted of a 10% random selection from all participants who reported no history of health concerns at the Wave 4 data collection time point (n= 897). The healthy group was randomly reduced in size to allow for the comparison groups to be more similar in size. The smaller convenience sample will be identified as the *comparison subset* throughout this document.

T-tests and Chi-square tests were used to examine mean differences for the demographic variables between the two groups in the comparison subset (total $N=1058$). Based on diagnosis status (yes vs. no), no differences were found for age, prior grades, or report of parent level of education. The two groups differ in composition for gender ($\chi^2 (1) = 36.07, p<.001$) and racial minority status ($\chi^2 (1) = 7.65, p.006$). The chronic illness group includes more females and more students with minority status. There has been previous research to indicate gender and racial
classification might lead to differing levels of chronic illness incidence and consequences of the disease and treatment (Berg & Linton, 2009; Case, Fertig, & Paxson, 2005; Fowler, Johnson, & Atkinson, 1985; Madan-Swain, Katz, & LaGory, 2004). Accordingly, it is not surprising that these differences are found between the groups. The demographic variables were entered into models as controls so any differences were accounted for prior to examining effects for the variables of interest.

Using the comparison subset sample, initial comparison of group means was completed using t-tests (healthy vs. chronically ill). Mean levels of perceived autonomy, school belonging, and competence were examined. Results of the mean comparisons are provided in Table 4.5. All differences were significantly greater than zero with the means for the chronic illness sample being lower than those of the healthy comparisons. Effect sizes were all in the small range (Cohen, 1988). A structured mean differences model was developed to further explore the relations and is explained later.

Table 4.5

*Healthy (n=642) and Chronically Ill (n=416) Group Mean Comparison with t-tests*

<table>
<thead>
<tr>
<th></th>
<th>Healthy Sample</th>
<th>Chronic Illness Sample</th>
<th>Cohen's $d$</th>
<th>Diff &gt;0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Autonomy</td>
<td>3.831</td>
<td>.589</td>
<td>3.747</td>
<td>.640</td>
</tr>
<tr>
<td>School Belonging</td>
<td>3.783</td>
<td>.678</td>
<td>3.614</td>
<td>.799</td>
</tr>
<tr>
<td>Competence</td>
<td>4.167</td>
<td>.625</td>
<td>4.038</td>
<td>.666</td>
</tr>
</tbody>
</table>
**Structural Measurement Model**

A structural equation measurement model was developed, using polychoric correlation matrices because the item responses are all ordinal in nature. Polychoric correlation coefficients are not created using the observed scores; rather, a weighting procedure that estimates the latent structure underlying the identified variables is used. Polychoric correlations are recommended when using ordinal response variables (Likert-type scales), to obtain accurate parameter estimates and standard errors (DiStefano, C., 2002; Giley & Uhlig, 1993; Holgado-Tello, Chacon-Moscoso, Barbero-Garcia, & Vila-Abad, 2010; Joreskog & Sorbom, 1993). “The polychoric correlation is used when the variables are continuous and linearly related but, contrary to the requirements of Pearson correlations, are divided into a series of categories” (Holgado-Tello et al., p.155). Pearson correlations are likely to produce underestimates of the parameter estimates and the standard errors with ordinal data (Giley & Uhlig, 1993; Holgado-Tello et al., 2010).

The initial structured measurement model for the latent variables labeled perceived autonomy, school belonging, and competence and was fully identified with 13 degrees of freedom. Fit indices produced by Stata and used to evaluate the model (and the target values; Acock, 2013; Schumacker & Lomax, 2010) were: chi-square likelihood ratio test ($\chi^2_{LR}$ not significant); the root mean square error of approximation (RMSEA <.05); comparative fit index (CFI>.95); standardized root mean squared residual (SRMR<.05); and coefficient of determination (CD>.95).
Initial model fit indices were less than optimal so adjustments were made to the model with the guidance of modification indices. The modification indices suggested loading some of the observed variables onto more than one latent variable, but the decision was made to keep the latent variables separate to fit the theory being tested with a more parsimonious model. Several of the error variances for each of the factors were allowed to correlate, based on the recommendations of the modification indices and the logical assumption that there could be some covariance between the observed variables loading on each latent factor. Fit information for the initial model and the final model can be found in Table 4.6. The final model provides a good fit for the polychoric correlation form of the data and the design-based data. The likelihood ratio chi-square results are significant for each of the samples, but that is likely related to the large sample sizes (Schumacker & Lomax, 2010).
Table 4.6

*Fit Indices for the Structural Measurement Model Including Autonomy, Belonging, and Competence*

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Initial Model Polychoric correlation</th>
<th>Final Model Polychoric correlation</th>
<th>Final Model Design-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR Test</td>
<td>$\chi^2_{(62)}; p&lt;.001$</td>
<td>$721.85_{(48)}; p&lt;.001$</td>
<td>na</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.058</td>
<td>.026</td>
<td>na</td>
</tr>
<tr>
<td>CFI</td>
<td>.958</td>
<td>.993</td>
<td>na</td>
</tr>
<tr>
<td>SRMR</td>
<td>.028</td>
<td>.014</td>
<td>.012</td>
</tr>
<tr>
<td>CD</td>
<td>.995</td>
<td>.998</td>
<td>.994</td>
</tr>
</tbody>
</table>

Note: Labels (and target ranges) for fit indices: LR=likelihood ratio (not significant); RMSEA=root mean square error of approximation (<.05); CFI=comparative fit index (>95); SRMR=standardized root mean squared residual (<.05); CD=coefficient of determination (>95); na=not available with *survey set* command.

The measures of autonomy, belonging, and competence were used as representatives of the dimensions of self-determination theory of motivated behavior (Connell, 1990; Connell & Wellborn, 1991; Deci & Ryan, 1985, 2000; Ryan & Deci, 2000, 2002; Skinner & Edge, 2002) for the purposes of this study. Once the measurement model was established, it was used to assess mean differences in the constructs between healthy and chronically ill participants. A graphic representation of the model with factor loadings and correlations is provided in Figure 4.2. Factor loading values derived from the Wave 1 full data polychoric matrix are included in the diagram.
Structured mean differences model

A structured mean differences model was used with the comparison subset of data to further explore the first research question about mean differences in
autonomy, belonging, and competence between chronically ill students and their healthy peers. The hypothesis tested by the model was that the group mean differences for perceived autonomy, school belonging, and competence would be significantly different than zero. I anticipated that group means for the chronic illness group would be significantly lower than those of the healthy students.

The two groups in the subsample were assessed for invariance across the structure of the measurement model. Invariance between the groups for model form and loadings would indicate that the two groups of students perceived the concepts in a similar fashion and the comparison of means is reasonable (Acock, 2013; Schumacker & Lomax, 2010). The data from each group fits the theoretical measurement model similarly. The two groups had similar factor loadings on the latent variables. The error variances and intercepts were different for each group. Model fit statistics are provided in Table 4.7. Group goodness-of-fit statistics are provided in Table 4.8.
Table 4.7

Model Comparisons for Healthy and Chronically Ill Student Groups

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>$\chi^2$ difference</th>
<th>df difference</th>
<th>Significance (difference)</th>
<th>RMSEA</th>
<th>CFI</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Same Form</td>
<td>301.71</td>
<td>98</td>
<td>&lt;.001</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>.052</td>
<td>.974</td>
<td>.028</td>
</tr>
<tr>
<td>2. Same Loadings</td>
<td>302.07</td>
<td>106</td>
<td>&lt;.001</td>
<td>.36$_{(1v2)}$</td>
<td>8</td>
<td>ns</td>
<td>.049</td>
<td>.975</td>
<td>.032</td>
</tr>
<tr>
<td>3. Same Loadings and Err Variances</td>
<td>407.17</td>
<td>133</td>
<td>&lt;.001</td>
<td>105.10$_{(2v3)}$</td>
<td>27</td>
<td>Sig.</td>
<td>.052</td>
<td>.965</td>
<td>.051</td>
</tr>
<tr>
<td>4. Same Loadings and Intercepts</td>
<td>341.29</td>
<td>119</td>
<td>&lt;.001</td>
<td>39.22$_{(2v4)}$</td>
<td>13</td>
<td>Sig.</td>
<td>.049</td>
<td>.972</td>
<td>.039</td>
</tr>
</tbody>
</table>

Note: parameters for good model fit are RMSEA<.05, CFI>.95, and SRMR<.05

Table 4.8

Group Goodness of Fit Parameters (SRMR) for Comparison Models

<table>
<thead>
<tr>
<th>Observations</th>
<th>1. Same Form</th>
<th>2. Same Loadings and Error Variances</th>
<th>3. Same Loadings and Error Variances</th>
<th>4. Same Loadings and Intercepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>924</td>
<td>.024</td>
<td>.046</td>
<td>.034</td>
</tr>
<tr>
<td>Chronically Ill</td>
<td>627</td>
<td>.032</td>
<td>.037</td>
<td>.055</td>
</tr>
</tbody>
</table>

Note: SRMR=standardized root mean-squared residual, target <.05
Mean differences between the chronic illness and the healthy group were significantly different than zero for perceived school belonging and perceived competence. The difference for autonomy did not reach significance at the $p = .05$ criteria used. The results for the structured mean differences model are found in Table 4.9.

Table 4.9

*Structured Means Model Results for Perceived Autonomy, School Belonging, and Competence for Chronically Ill and Healthy Groups*

<table>
<thead>
<tr>
<th>Latent Variable</th>
<th>Healthy (reference)</th>
<th>Chronically Ill (difference, se)</th>
<th>z score ($p$)</th>
<th>95% CI for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Autonomy</td>
<td>0</td>
<td>-.0616 (.033)</td>
<td>-1.85 (.064)</td>
<td>-.1268, .0036</td>
</tr>
<tr>
<td>Perceived School Belonging</td>
<td>0</td>
<td>-.0896 (.036)</td>
<td>-2.52 (.012)</td>
<td>-.1593, -.0199</td>
</tr>
<tr>
<td>Perceived Competence</td>
<td>0</td>
<td>-.0818 (.029)</td>
<td>-2.81 (.005)</td>
<td>-.1388, -.0247</td>
</tr>
</tbody>
</table>

**Hypothesis 2: Chronic Illness Status and High School Completion**

The second hypothesis was evaluated using the likelihood of graduating from high school by the age of 19 years (considered on-time) as the outcome variable. I hypothesized that students with health conditions would have a lower likelihood of on-time graduation. I also hypothesized that health status would serve as a moderator of the motivation variables (autonomy, belonging, and competence) in relation to the likelihood of on-time high school completion.
T-tests to compare graduation rates by disease status (healthy vs. chronically ill) were performed as a preliminary review of the data to answer the research question about on-time high school completion. Completion of high school by the age of 19 years was considered on-time for the purposes of this study. In the full sample of participants 93.3% of the healthy students (M=.9327, SD=.251) completed high school on time, whereas 92% of the chronically ill students (M=.9197, SD=.272) completed high school by the age of 19 years. The difference in completion rates was significantly greater than zero ($t=2.67, p=.004$) but the effect size was minimal at .05. In the comparison subset, 94.4% of the healthy students (M=.9439, SD=.230) completed high school on time compared to 90.1% of the students with chronic illness (M=.9014, SD=.298). The difference was significantly greater than zero for the smaller sample as well ($t=2.60, p=.005$) but the effect size was still small at .16. An effect-size calculator was used to determine the Cohen d values (Becker, 2013).

Logistic regression was used to assess the relation between chronic illness status and high school completion by the age of 19 years. The model was calculated using Stata 12 survey set commands with the full data set. Wave 4 weights were applied (Chantala, 2006). Proposed predictor variables were added to the model in blocks: 1) demographic (control) variables, 2) health variables, and 3) autonomy, belonging, and competence variables. Interaction variables were created for diagnosis status (healthy vs. chronically ill) and the motivation variables of interest (perceived autonomy, school belonging, and competence) and were added in a final
block. At each step, the coefficients were reviewed for significance and a decision was made to retain or remove the non-significant items. Non-significance was confirmed with all of the items in the model before the variables were removed from the final logistic regression model. Non-significant variables were retained in the model when their interaction with another variable was significant. The design-based coefficients and odds ratios for the final variables are included in Table 4.10.
Table 4.10

*Design-based Coefficients and Odds Ratios for Final Logistic Regression Model to Predict High School Completion by the Age of 19 Years (N=10,253)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>b</th>
<th>p</th>
<th>OR</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Linearized se)</td>
<td></td>
<td>(Linearized se)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.3252 (.034)</td>
<td>&lt;.001</td>
<td>.7223 (.024)</td>
<td>.6759,.7719</td>
</tr>
<tr>
<td>Gender</td>
<td>.3185 (.123)</td>
<td>.011</td>
<td>1.3751 (.169)</td>
<td>1.0786,1.7530</td>
</tr>
<tr>
<td>Race</td>
<td>-.4326 (.146)</td>
<td>.004</td>
<td>.6488 (.095)</td>
<td>.4861,.8659</td>
</tr>
<tr>
<td>Parent Education</td>
<td>.5008(.071)</td>
<td>&lt;.001</td>
<td>1.6500 (.117)</td>
<td>1.4342,1.8983</td>
</tr>
<tr>
<td>Grade Average</td>
<td>.9250(.076)</td>
<td>&lt;.001</td>
<td>2.5219 (.192)</td>
<td>2.1697,2.9313</td>
</tr>
<tr>
<td>W1 health report</td>
<td>.1703 (.078)</td>
<td>.031</td>
<td>1.1857 (.093)</td>
<td>1.0158,1.3840</td>
</tr>
<tr>
<td>Diagnosis status</td>
<td>-.5055 (.751)</td>
<td>.502</td>
<td>.6032 (.453)</td>
<td>.1365,2.6651</td>
</tr>
<tr>
<td>Autonomy</td>
<td>.0589 (.150)</td>
<td>.694</td>
<td>1.0607 (.159)</td>
<td>.7889,1.4261</td>
</tr>
<tr>
<td>School Belonging</td>
<td>-.3373 (.130)</td>
<td>.010</td>
<td>.7137 (.092)</td>
<td>.5523,.9222</td>
</tr>
<tr>
<td>Diag X Autonomy</td>
<td>-.3935 (.195)</td>
<td>.045</td>
<td>.6747 (.131)</td>
<td>.4589,9.9919</td>
</tr>
<tr>
<td>Diag X Belonging</td>
<td>.4882 (.158)</td>
<td>.003</td>
<td>1.6293 (.258)</td>
<td>1.1911,2.2287</td>
</tr>
</tbody>
</table>

Note: High school completion coded = 1; no completion = 0; Gender coded 0=male, 1=female; Race coded 0=white, 1=minority; diagnosis coded 0=no, 1=yes

In the design-based analysis using the full data, age, gender, race, parent education, and prior grades were all significant predictors of high school completion by the age of 19 years. Diagnosis status was not a significant predictor on its own but it did serve as a significant moderator for both autonomy and belonging. Competence did not provide significant prediction value for the outcome of on-time high school completion for either group of students. Graphic representation of the interaction between diagnosis status and belonging in relation to high school
completion status is provided in Figure 4.3. Information about the diagnosis status and autonomy interaction is provided in Figure 4.4.

Holding all demographic variables constant, perceived belonging has a different relation with likelihood of on-time high school completion for a student with a chronic health condition than for a healthy peer. Students with medical concerns experience more benefit from increased levels of perceived belonging than do their healthy peers. The odds ratio for the interaction term between diagnosis status and belonging is 1.629 \( (p=0.003) \), indicating that an increase of one unit in
perceived belonging leads to a 63% increase in the odds of completing high school on time for a student with a chronic illness.

The relation between perceived autonomy and high school completion was also moderated by diagnosis status. However, the pattern of influence was the opposite of the pattern for perceived belonging. For healthy students, higher levels of autonomy were related to higher likelihood of on-time high school completion. For their chronically ill peers, higher levels of perceived autonomy were related to lower odds of on-time high school completion. A one unit of increase in perceived autonomy predicted a 32.5% decrease ($OR = .6747, p = .045$) in the likelihood of on-time high school completion for students with chronic illness.
Hypothesis 3: Health Status and Long-term Academic Attainment

The third hypothesis was evaluated using self-reported long-term academic attainment as the outcome variable. I hypothesized those students with health conditions would have a lower likelihood of moving on to a higher level of education and that health status would serve as a moderator of the motivation variables (autonomy, belonging, and competence) in relation to the likelihood of moving on to a higher level of education.
Differences in levels of academic attainment, as predicted by diagnosis status and motivation variables of perceived autonomy, belonging, and competence, was explored using ordinal regression methods. The levels of academic attainment were measured using a sequential categorical rating of 1-5. The categories included are: less than high school, high school graduation, some college or post high school training, bachelor degree, and some school beyond a bachelor degree.

A proportional odds ordinal regression model was first developed using the full data sample. A proportional odds model estimates the probability that a dependent variable will be at or beyond a particular category, given a value of the independent variable(s) (Long & Freese, 2006; O'Connell, 2006). The assumption that the effects of the independent variables are constant across categories of the dependent variable (proportional odds assumption) must be satisfied for the proportional odds model. Stata survey set capabilities do not allow for testing the proportional odds assumption with the complex data. Hosmer & Lemeshow (2000) suggest using the unweighted data to assess assumptions in this situation. Therefore, the proportional odds model was run on the full sample without design-based parameters in place. The model using the unweighted data was tested for the proportionality assumption using a Brant test (Brant, 1990; Long & Freese, 2006). A significant result on the Brant test indicates that the slopes are not equal at all values of the ordinal outcome variable. The Brant results were significant for all variables except Wave 1 health report and belonging so a continuation ratio model was used for further analysis. A continuation ratio ordinal model is designed to
predict the likelihood that a person will move on to a higher category on the
dependent variable, given that they have already achieved the current category
(Agresti, 2010; Liu, 2010; Long & Freese, 2006; O’Connell, 2006). Stata is unable to
run a continuation ratio model on complex data so the model was computed using
the full sample unweighted data.

The independent variables were entered into the regression in blocks. A
logit link was used for the analysis because the ordinal values for the dependent
variable represent a pattern of progression through the stages of academic
attainment and one stage must be accomplished prior to movement to the next
stage (Agresti, 2010). The first block entered into the model included the
demographic (control) variables. All of the control variables were significant in the
prediction of continuing on to a higher level of academic attainment so they were all
retained in the model. The second block included the health variables of diagnosis
status, health report and symptoms score. Symptoms score was not significant and
was removed from the model. Diagnosis status and Wave 1 health report were both
significant predictors and had negative relations with the odds of moving onward in
education. The next block entered into the model included the motivation variables
of perceived autonomy, belonging, and competence. Perceived belonging was the
only motivation variable with significant prediction utility in the model.
Interactions were explored between diagnosis status and the motivation variables
but none were significant. Wave 1 health report was evaluated as a moderator of
autonomy, belonging, and competence. There was no interaction with autonomy or
competence but health report and belonging did interact to provide a significant predictor of continuation to a higher level of academic attainment. Table 4.11 provides the coefficients and odds ratios for the final CR regression model.

Students with a chronic illness were 7% less likely to move to a higher level of academic attainment ($OR= .9292$, $p= .008$). Holding all other variables constant, the interaction between Wave 1 health report and perceived belonging increased the overall odds of moving to a higher level of academic attainment by 9% ($OR= 1.09$, $p< .001$). A graph of the interaction is presented in Figure 4.5. Belonging has a positive relation with the odds of moving to a higher level of academic attainment for all health status groups. However, it is interesting to note that the primary area of difference in slopes lies in the group of students who have lower reports of health and low levels of perceived belonging. The groups at the mean level of health report and one standard deviation above the mean for health report exhibit increases in odds of further academic attainment as belonging increases with a rather consistent slope. However, the students with a health report score at one standard deviation below the mean exhibited a steeper slope for increased odds of moving to a higher level of academic attainment as they moved from low levels of perceived belonging to the mean. Increased perceptions of belonging seem most important for students with the lowest health report scores. The slope for students with lower health report was similar to the other two groups when perceived belonging was at or above the mean.
Table 4.11

Coefficients, Odds Ratios, and Intercepts for the Final Continuation Ratio Ordinal Regression Model Using Unweighted Full Data (N=43,551)

<table>
<thead>
<tr>
<th>Variable</th>
<th>b (se)</th>
<th>(p)</th>
<th>OR (se)</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.0846 (.008)</td>
<td>&lt;.001</td>
<td>1.0883 (.009)</td>
<td>1.0713, 1.1055</td>
</tr>
<tr>
<td>Gender</td>
<td>.3783 (.028)</td>
<td>&lt;.001</td>
<td>1.4600 (.041)</td>
<td>1.3825, 1.5414</td>
</tr>
<tr>
<td>Race</td>
<td>.0883 (.028)</td>
<td>.001</td>
<td>1.0923 (.030)</td>
<td>1.0345, 1.1533</td>
</tr>
<tr>
<td>Parent Educ</td>
<td>.5139 (.013)</td>
<td>&lt;.001</td>
<td>1.6717 (.022)</td>
<td>1.6293, 1.7153</td>
</tr>
<tr>
<td>Grade Avg</td>
<td>.9143 (.021)</td>
<td>&lt;.001</td>
<td>2.4949 (.051)</td>
<td>2.3963, 2.5975</td>
</tr>
<tr>
<td>Wave 1 Health Report</td>
<td>-.0983 (.086)</td>
<td>.254</td>
<td>.9064 (.078)</td>
<td>.7655, 1.0732</td>
</tr>
<tr>
<td>Diagnosis Status</td>
<td>-.0734 (.028)</td>
<td>.008</td>
<td>.9292 (.026)</td>
<td>.8800, .9812</td>
</tr>
<tr>
<td>School Belonging</td>
<td>-.2720 (.094)</td>
<td>.004</td>
<td>.7618 (.071)</td>
<td>.6340, .9154</td>
</tr>
<tr>
<td>HealthXBelong</td>
<td>.0862 (.023)</td>
<td>&lt;.001</td>
<td>1.0900 (.025)</td>
<td>1.0415, 1.1408</td>
</tr>
<tr>
<td>( \alpha_1 )</td>
<td>2.3089 (.375)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \alpha_2 )</td>
<td>3.5319 (.379)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \alpha_3 )</td>
<td>5.9907 (.461)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \alpha_4 )</td>
<td>6.7614 (.381)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR ( \chi^2 )</td>
<td>5490.00 (9df)</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo R(^2)</td>
<td>.1348</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Gender coded 0=male, 1=female; Race coded 0=white, 1=minority; diagnosis coded 0=no, 1=yes; \( \alpha_i \)=intercept for each category; LR \( \chi^2 \)=model likelihood ratio chi-square value
Each of the hypotheses guiding this study received some support from the results of the analyses. With the first hypothesis I predicted lower levels of perceived autonomy, belonging, and competence for students with chronic health conditions compared to healthy students. Students with health concerns reported
lower levels of all three constructs but only belonging and competence differences consistently reached a level of statistical significance. In the second hypothesis I anticipated a relation between health difficulties and on-time completion of high school, as well as an interaction between health status and motivation variables. Students with chronic medical conditions do have lower likelihood of completing high school by the age of 19yo. Diagnosis status moderates the effects of both autonomy and belonging in predicting on-time high school completion. The last hypothesis guiding the study involved the relation between health status and long-term academic attainment. I expected to find lower levels of academic attainment for the students with chronic health conditions and an interaction between health status and the motivation variables. There was support for this hypothesis in that diagnosis status was a significant predictor of moving to a higher level of academic attainment. Health report at Wave 1 offered some ability to predict continuation of academic attainment as a moderator of belonging. In the following chapter I will discuss possible implications of the patterns identified with these analyses.
Chapter 5: Discussion

The purpose of this study was to examine how the consequences of diagnosis and treatment of chronic illness as a child are related to motivational processes in adolescence and academic outcomes in young adulthood. Levels of perceived autonomy, school belonging, and competence during adolescence were compared for students with chronic illness and healthy peers. Health status was considered as a predictor of long-term academic outcomes—high school completion by age 19 and educational attainment in young adulthood—both as a covariate with the motivation variables and as a moderator of those variables. Students with five different medical diagnoses were considered together in exploring outcomes, as suggested by researchers supporting a non-categorical approach to the study of these adolescents (Howe et al., 1993; Northam, 1997; Perrin et al., 1993; Pless & Nolan, 1991; Stein et al., 1993; Stein & Jessop, 1982). A non-categorical approach to the study of individuals with chronic illness suggests that life experiences are similar despite the specific diagnosis involved.

The primary sample for this study came from Add Health, a large national sample of adolescents with longitudinal data. A comparison subsample, comprised of students who identified as having been diagnosed with a chronic medical
condition at age 12 or younger and a control group of healthy peers, was used for supplemental analyses regarding group differences. Three waves of Add Health data were used to answer the research questions identified for this study. Wave 1 data was collected when the students were in grades 7 through 12, Wave 3 data was collected when participants were aged 18 to 26 years, and Wave 4 data was collected when the participants were young adults aged 24 to 32 years.

Summary of Findings and Implications

Results of the analyses provided mixed support for each of the hypotheses suggested at the outset of the study. Some of the significant findings were as expected, and others were not. Each hypothesis will be reviewed in turn after a brief discussion of some overarching observations.

The three health related variables—health report at Wave 1, number of reported symptoms at Wave 1, and diagnosis status reported at Wave 4—were moderately correlated with one another. Each had some predictive value for the outcomes but there were differences across outcomes. Health report and symptoms scores were both significant predictors of the motivation variables—autonomy, belonging, and competence. Overall, the Wave 1 health variables explained 8.3% of the variance in the psychological needs variables. Diagnosis status and Wave 1 health report were significant factors in the prediction of academic outcomes but symptoms score did not add to the explanation of variance for academic outcomes. I had expected that the health variables would have similar relations to perceived autonomy, belonging, competence, and the academic outcomes across models. It
may be that health reports, symptoms scores, and diagnosis status are confounded by the fact that only a small number of chronic illness diagnoses are specifically identified in the Add Health data. Many other participants may have chronic medical conditions diagnosed in childhood that were not on the list at the Wave 4 time point but caused lower general health scores or higher levels of symptoms at Wave 1. Significant findings for the health report/symptoms variables at Wave 1 do support prior research suggesting that students with a disability related to a medical diagnosis have more difficulty than their healthy peers in the academic setting (Burke & Elliott, 1999; Cadman et al., 1987; Fowler et al., 1985). These findings also support the idea that students under stress (poor physical health) may have difficulty meeting their psychological needs for autonomy, belonging, and competence (Skinner & Edge, 2006). The symptoms score and health report may be more accurate assessment of disability or stress than diagnosis status, since not all young people with chronic illness experience high levels of distress (when their condition is under good control).

Factor analyses and a structural equation measurement model support the items used to measure perceived autonomy, belonging, and competence. However, there could be some debate about whether the operationalization of the constructs with the items available in the Add Health data is congruent with self-determination theory. The use of a pre-existing data set creates some constraint around the items available to measure the constructs. The items used to measure autonomy reflect decision-making behaviors, but there were no items available to address the
choice/volition component of the decision-making process. The items used to measure competence are very generic in nature and are statements closer to a report of self-esteem. They are used here to reflect the student’s feelings about themselves as a proxy for their perceptions of effectance. The items used to measure belonging are specific to the school environment, not an overall sense of relatedness.

Despite the operational shortcomings, the results of the current study do provide insight into the questions that drove the study. The results from the evaluation of school belonging and health status are likely the most reliable, given the measurement limits.

**Hypothesis 1: Levels of Autonomy, School Belonging, and Competence**

Findings in the current study provide general support for the first hypothesis—that students with health concerns would report lower levels of perceived autonomy, school belonging, and competence. Using the full Add Health sample with design-based parameters applied, health report at Wave 1 and symptoms score at Wave 1 both added explanation of variance in the levels of perceived autonomy, school belonging, and competence reported by participants at Wave 1. The health variables explained an additional 1.5% of the variance in perceived autonomy, an extra 7.0% of the variance in perceived school belonging, and 14.5% more variance in perceived competence after controlling for the demographic variables.
The two groups of students in the comparison subsample reported levels of perceived school belonging and competence that had mean differences significantly different than zero. The reported lower levels of perceived school belonging and competence were lower for the students with health concerns than for their healthy peers. The students with chronic illness also reported lower levels of perceived autonomy but the difference did not reach the significance threshold of $p=.05$.

Given that the overall model, and the health variables specifically, provided a relatively small contribution to the explanation of variance for autonomy, and that the comparison group differences did not meet the $p=.05$ level of statistical significance, it will be important to further examine whether health status plays a different role in the need for autonomy or whether the construct was measured in a way that did not capture the intended meaning. The items used to measure autonomy in this study were geared toward choice-making behaviors but may not be measuring the volition component of the construct in the way intended. Participants may have interpreted the items more as independence than volition. Autonomy may also need to be interpreted cautiously in this study because of the impact adolescent egocentrism can play in the responses provided. Adolescent belief that others are watching and evaluating, or that no one could really understand their perspective, may lead to responses that are considered desirable rather than a report of true behaviors/beliefs (Ryan & Kuczkowski, 1994).

Health status did help predict perceptions of school belonging in the current study. Whereas a causal relation cannot be determined with this study, the
phenomenon of lower levels of perceived belonging for students with chronic health conditions warrants attention. It could be that students experience less support for belonging due to the consequences of their medical status (absences, slow cognitive processing, physical abnormalities) or a lack of belonging could be a precipitant of lower reports of general health or higher levels of somatic symptoms.

Health status provided the largest explanation of variance for perceptions of competence in the current study, compared to autonomy and belonging. Again, no causal relation can be assumed as students with chronic health conditions may have fewer opportunities to develop feelings of effectance or competence due to the medical condition or they may report more poor health status when they do not perceive themselves as competent. The measurement and operational concerns mentioned earlier need further investigation before this strong relationship between health status and competence (as defined by self-determination theory) can be confirmed.

**Hypothesis 2: Chronic Illness Status and High School Completion**

This study provides support for the hypothesis that students with chronic illness would experience lower likelihood of on-time high school completion. The differences in completion rate were significantly different than zero for both the full data sample and the comparison subsample. Effect sizes were very small but chronically ill students had lower levels of on-time school completion in both samples.
There is also partial support for the hypothesis that health status would moderate the relation of the psychological needs variables and likelihood of high school completion by the age of 19 years. Using the full data set with design-based parameters incorporated, the final logistic regression model indicates that diagnosis status interacts with both autonomy and belonging in predicting the outcome. Holding all demographic variables constant, a student with a chronic illness diagnosis has a significant benefit for each unit increase in perceived belonging. A unit of increase in perceived belonging is related to a 63% increase in the odds of completing high school on time for a student with a chronic illness. Belonging is also important for healthy students did not experience the same rate of benefit from increased levels of belonging. For each unit increase in Wave 1 health report, all students experienced an increase of 18% in the odds of on-time high school completion.

Although autonomy did not prove to be consistently predicted by health status, findings show that autonomy is indeed an important element in predicting on-time high school completion. Perceived autonomy was modified by diagnosis status with the current data. The interaction term was negatively related to the outcome. For each unit increase in perceived autonomy, students with chronic illness had a 32.5% drop in the odds of completing high school by the age of 19 years. Healthy students experienced increased odds of on-time high school completion with increased values of autonomy.
I had expected the direction of the relation with on-time high school completion to be similar across the motivation variables so the differences were a surprise. Further investigation is warranted to examine the role of autonomy for students with chronic illness. It may be that those students benefit from imposed structure because it helps maintain health and the more stable health status actually leads to more successful academic outcomes. This finding may also support the previously reported finding that students with chronic illness tend to meet development milestones of adolescence later than do their healthy peers and have prolonged reliance on adults (Barraclough & Machek, 2010; Burke & Elliott, 1999; Martinez & Ercikan, 2008; Pless & Pinkerton, 1975).

**Hypothesis 3: Health Status and Long-term Academic Attainment**

Findings of this study provide support for the third hypothesis—that students with chronic illness would have lower levels of long-term academic attainment than healthy peers. Students with a diagnosis of chronic illness experienced a 7% decrease in the likelihood that they would move on to a higher level of academic attainment, given their current level of attainment. The hypothesis that the relation between motivation variables and academic attainment would be moderated by health status was also partially supported. Wave 1 health report was a significant moderator of perceived school belonging, adding significant predictive value for the odds that a student at a certain level of academic attainment would move on to a higher level of achievement. Overall, students with lower Wave 1 health report scores had lower levels of perceived belonging but all students
experienced increased odds of moving on to a higher level of academic attainment with increases in perceived belonging scores. Students with low health report scores experienced the most profound increase in odds of continuing forward in academic attainment as they moved from low levels of belonging to a mean level of belonging. No causal relation can be interpreted from these findings. However, whether student perception of belonging is the impetus for poorer reports of health status or whether health status is at the core of low perceptions of belonging, this finding suggests that students with health concerns should receive some concentrated energy focused on creating and maintaining higher levels of perceived school belonging.

Autonomy and competence, as measured in the current study, did not provide any prediction value and were not moderated by health status in the regression model examining long-term academic attainment. Again, further investigation with questions that are more targeted at the volition/choice aspect of autonomy and the effectance component of competence will need to be done before conclusions can be drawn.

The findings of this study support previous research that has reported differences in academic attainment levels for chronically ill students and their healthy peers (Armstrong, 2006; Case et al., 2005; Clay et al., 2004; Jackson, 2009; Joe et al., 2009; Martinez & Ercikan, 2008; Maslow et al., 2012).
Limitations of the Study

Studies undertaken with pre-existing data are generally limited by the availability of previously determined survey items. Such is the case with this study. Items used to measure autonomy and competence were limited and may not be measuring the constructs in a way congruent with self-determination theory. The structural measurement model did provide good fit to the data using the variables chosen to represent autonomy, belonging, and competence but there is low specificity in the autonomy and competence items. More direct measurement of volition or choice needs to be included in the autonomy measure. Items that ask about the ability to effectively impact the environment need to be included to measure competence.

Another limitation of the current study is the abbreviated list of diagnoses identified among the participants. Many of the more common pediatric chronic conditions were excluded from the list and those exclusions may have made the division between healthy and chronically ill students more blurry and difficult to account. For example, students with Sickle Cell Disease or Inflammatory Bowel Disease are not identified in the Add Health sample but are among some of the students with significant care needs that can interfere with school (Brown, 2004; Clay, 2004; Daly et al., 2008; Phelps, 2006). The non-categorical approach using the collective group of students with illness likely helped make the broader picture visible but further investigation with a larger heterogeneous group with more clear
information about specified diagnoses or symptoms that affect function may help expand and clarify some of the findings of the current work.

**Contributions to the Field**

The findings of this study contribute to the fields of education and psychology in practical ways. Helping school staff (teachers, administrators, coaches, etc.) understand the importance of perceived belonging for all students under their charge may be a way to promote academic attainment. The first level of academic attainment—high school completion—needs to be a reality for students before they can move on to higher levels of attainment. It is important to help school personnel understand that the need for belonging is similar, or maybe even more important, for students with chronic illness or identified health concerns. Understanding that the needs are not so different may help resolve some of the anxiety teachers experience about how to meet the needs of students with health issues (Olson, et al., 2004; Shiu, 2001). If health status and belonging interact to provide some explanation of variance for long-term academic attainment, it seems prudent for academic leaders to find ways to promote perceived belonging for students with chronic medical conditions/health concerns to create a supportive environment for high school completion and then increased odds of moving on to a higher level of achievement.

There is research available to provide guidance to school administrators and teachers about how to provide belonging support for students. The Wingspread Declaration (Wingspread, 2004) describes school connection as “the belief by
students that adults in the school care about their learning as well as about them as individuals” (p. 233). Three critical school-level components of belonging are identified as predictors of positive academic outcomes for students—high academic expectations coupled with support for learning, positive and respectful student-adult relationships, and physical and emotional safety of the school environment (Blum, 2005; Klem & Connell, 2004; Wingspread, 2004).

Multiple researchers have reported school or classroom level antecedents to student perception of school belonging. Some of those qualities are classroom and school structure and safety (Crosnoe, Johnson, & Elder, 2004; Solomon, et al., 1997), classroom achievement goal orientation (Anderman, 2003; Roeser, Midgley, & Urdan, 1996), teacher warmth and promotion of respect (Anderman, 2003; Anderman & Freeman, 2004; Blum, 2005), peer collaboration (Anderman & Freeman, 2004), teacher support (Anderman, 2003; Klem & Connell, 2004; Libbey, 2004; Wentzel, 1997), opportunities to develop competence and self-esteem (Finn, 1989; Newmann, et al., 1992) and an environment that fits with the needs of the students (Eccles, et al., 1993; Patrick, et al., 2002).

Another contribution of the current study is the unexpected finding of the relation between perceived autonomy and the likelihood of on-time high school completion. It is important for parents, teachers, and other adults invested in the education of chronically ill children to understand the need for both support and structure those children may be experiencing. The importance of autonomy for
chronically ill students may need to be minimized with increased attention to support and opportunities for development of perceived belonging.

Conclusions

Overall, the current study provides support for the hypothesis that students with chronic illness have lower levels of perceived autonomy, school belonging, and competence. The relations between autonomy and belonging and on-time high school completion are moderated by diagnosis status. Health report and levels of perceived school belonging interact to predict a student's likelihood of moving on to a higher level of academic attainment, given accomplishment of the current level.

The biggest take-away message provided by this current study is that students with chronic health conditions do have a need for and receive benefit from high levels of school belonging. When students miss many days of school or are impaired by fatigue, pain, or thought processing issues, it may be more difficult for them to find opportunities to develop perceived belonging. Teachers and administrators in the school setting should be aware of this finding so they can facilitate opportunities for the student with health concerns to feel that sense of belonging in the school environment.

The finding for the role of autonomy in on-time high school completion is also important. It may be important for adults to minimize the push for autonomy with students who are managing a chronic medical condition. Those students must do things they may not want to do in an effort to maintain good health and the good health is important for academic success.
This work does provide a baseline to support further research around the perceptions of autonomy and belonging for students with chronic illness. A more controlled study with refined measures of autonomy could help define the relation between perceived autonomy and on-time high school completion or further academic attainment. More directed work to identify specific supports or situations that help students with chronic illness feel a sense of school belonging is also warranted.

It may be that perceived competence has a different kind of relation with chronic illness and academic outcomes. Competence as it was defined by the measures available for this study was lower for students with health concerns but there was not a significant predictive relation between competence as measured here and academic outcomes. Further refinement of specific competence measures and a review of other potentially related variables is needed before broader conclusions can be drawn about the role of competence for students with health concerns.
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