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School Start Times: Is Later Better for High School Students?

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SCHOOL START TIMES: IS LATER BETTER FOR HIGH SCHOOL STUDENTS?

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Abstract

This thesis seeks to answer the question: School start times: Is later better for high school students? Research for this study focuses primarily on high school start times in the United States from 1988 to 2017. Factors include changes at puberty including melanin production, circadian rhythms and homeostatic systems. High school start times of 7:30 a.m. or earlier make it difficult for students to acquire 8.5 to 9 hours of sleep on school nights. Beyond teen biology, there are community factors to consider such as part-time jobs, athletic practices, child care, and school bus schedules. In summary, there is no one clear answer to the question of a later start time being better for high school students.

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CHAPTER I: INTRODUCTION

Bethel University's Master of Arts in Education program provides an opportunity for educators, and those aspiring to become educators, to enhance their teaching skills through an advanced degree. Candidates are required to conduct thoughtful inquiry, undertake meaningful reflection and research questions relevant to their own experiences and aspirations. Based on the direction of many schools across the country, including the school district where I currently work, I decided to address the following as my thesis topic: School start times: Is later better for high school students? The following chapter provides the reader details as to why this topic is relevant to me. Definitions for terms appear throughout the paper. I believe the research conducted and the information presented in this paper will provide valuable insight for not only myself, but other teachers, parents of high school students, school board members, business professionals, administrators and adolescents.

Background

With every year of teaching experience, I see new trends and ask how I can make my classroom experience better for my students. For many years, the educational community has been researching when students begin their school day to see if there is an optimal start time. I asked myself what information might be beneficial for my own knowledge and might also benefit others. Having come from a very disciplined and strict family upbringing, attending a private Christian college and working in the business world for 11 years, changing careers to become a teacher led me into a different world.

My college and previous work experiences taught me that disobedience to rules leads to enforced consequences. One of the rules I struggled with when I first started in the business world was work start times. At the first company I worked for, the day started at 8:00 am sharp and ended at 5:00 pm (no earlier). While I had no problem with the actual start time, there were times when making it to work before 8:00 am was difficult. During the 11 months that I worked for that company, two people were fired for poor attendance. Being new to the business world, this made me a little nervous. I made sure to get to work on time every day. Of course there were days that I barely made it on time. One such day I had stopped for some hot chocolate at a gas station on the way to work and during the drive from the gas station to work, I proceeded to spill hot chocolate down the front of my white dress shirt. The company I worked for at the time had a very strict dress code policy consisting of dress pants, a white shirt and a tie. Having a large brown stain on the front of my white dress shirt was not going to go over well. Knowing that I did not have enough time to return home and change, I quickly stopped at a fast food restaurant and tried to clean the shirt the best I could. Since it was winter, I thought I could just leave my coat on as long as possible and only take it off when I knew I would be working in my cubby for extended periods of time so no one would see.

After all that work, I arrived to work at 8:01am. Since no one said anything to me I thought I was off the hook. A few months later I over slept and arrived to work at 8:04 am. Again, the incident was not addressed and I thought it had gone unnoticed. After working for that company for 11 months, I accepted a job with another company.

During my exit interview with the company, I asked the Human Resource Manager if there was anything he felt I could work on as an employee. I will never forget his exact words. He said, "No Paul we really enjoyed having you work here. You just might want to make sure you make it to work on time." According to my file, my direct supervisor had recorded the two days I had arrived late. I was not informed, at the time, I had a write-up in my permanent file, but the Human Resource Manager informed me that one more late arrival would have placed me on the company's discipline referral program. Not only would that have had implications on my future employment with the company, but also affected future promotional opportunities and pay incentives.

My intent in sharing this story is not to scare today's students about future employers, but to give some background as to why I struggle with the concept of pushing school start times to 8:30 am or even 9:15 am. If the goal of schools across the country is to prepare students for post-secondary success and the average job in the United States starts at 7:55 am (Silver, 2015), how does letting a senior in high school sleep in until 8:00 am prepare him/her to get up, get to a job, and be on time? When only 69.7% of high school graduates attend college the year after their high school graduation (College enrollment and work activity, 2017), does it make sense to start high school 35 minutes to an hour and a half after the typical work day begins? I personally have always found it much more difficult to try to get up earlier after I have set my body to a certain wake time than it is for me to sleep in a little later when I do not have to be somewhere. Isn't teaching students discipline when it comes to time management and routine a good thing? What are the substantiated benefits of starting

school later in the morning? These questions entered my mind and made me wonder, when it comes to high school start times, is later always better for students?

While my brain struggled with the concept, the school district where I work decided to look into the possibility of changing our high school start time from 7:30 am to 8:20 am. After much discussion, heated school board meetings and extensive research, the changes were approved. During this process, I started to receive many questions from students, parents in and out of the school district, other teachers, and friends and family wondering why we would consider making this change and what results we were hoping to see. It was at this point that I realized I had a great idea for a thesis project and decided to begin researching this topic.

Definition of Terms

Adolescence

Adolescence typically starts as a young person enters puberty and ends when they reach their early 20's (Kelly & Lee, 2014). According to Amy Wolfson and Mary Carskadon (1998), "Adolescence is a time of important physical, cognitive, emotional, and social change when the behaviors in one developmental stage are constantly challenged by new abilities, insights, and expectations of the next stage" (p.875). During a student's late teens and early 20's, many biological changes are taking place in his or her body. Besides the many biological changes that come along with puberty, changes to an adolescent's natural sleep time preferences are also taking place (Crowley, Acebo, & Carskadon, 2007). Additionally, this is a time when teenagers begin to make independent decisions, which have a direct influence on their thoughts and behaviors (Wahlstrom, Dretzke, Gordon, Peterson, Edwards, & Gdula, 2014).

Better

For the purpose of this paper, better means providing maximum opportunity for high school students in grades 9-12 to function at optimal levels and become more prepared for post-secondary success.

High School

For the purpose of this research paper, high school will be referred to as grades 9-12. While grades in around the country vary, my experiences as a student and teacher, along with the majority of the research presented in this project, include a 9-12 high school setting.

Sleep Deprivation

Throughout this paper, the term *sleep deprivation* will appear many times. According to Julie Boergers (2015), sleep deprivation is becoming an epidemic in American adolescents and a problem with many Americans in general. According to the American Sleep Association (n.d.), sleep deprivation is defined as not obtaining adequate total sleep. Anytime students do not get the clinically recommended amount of sleep they need to function during their wake time, they are considered sleep deprived. The lack of adequate sleep can lead to many issues. This thesis will look into some of those issues discovered by previous research studies and investigations.

Sleep Duration

Sleep duration is another term used throughout this paper. Since the word duration means the time during which something continues, sleep duration refers to the amount of time adolescents spent sleeping.

Sleep Hygiene

Sleep hygiene are the habits that help a person achieve a good night's sleep. According to the National Sleep Foundation (n.d.), sleep hygiene is "a variety of different practices and habits that are necessary to have good nighttime sleep quality and full daytime alertness (para. 1)." These habits are based on decisions that people make on a daily basis and can have a positive or negative affect on their quality of sleep.

Start Time

Start time for the purposes of this paper is the beginning of the first official period of the school day signified by the ringing of a bell or buzzer. Research shows that high school start times vary around the country from 7:00 am to 9:30 am (Wheaton, Ferro, & Croft, 2015).

Summary

Having spent 11 years in the business world and eight years as a high school teacher, I have experienced the discipline, organization and work ethic necessary to be a successful business professional, a high school teacher and a high school student in today's world. I have seen how deadlines and timeliness are important, how along with age comes biological changes and how the decisions we make influence our level of functioning on a daily basis. Parenting my own adolescent children and working at a high school in the midst of start time changes has driven me to find an answer to the question, School start times: Is later better for high school students?

In the following chapter I present research from many studies, journals and articles to summarize what researchers and scholars in various fields have discovered regarding start times for high schools. Chapter II also presents a brief history of schools

and school start times, sleep statistics of today's adolescents, positive implications of starting high school late in the morning, and the rationale behind keeping high school start times early.

CHAPTER II: LITERATURE REVIEW

Introduction

To acquire the necessary articles for this thesis project, searches were performed, interviews were conducted and many discussions were held. Searches were performed using Academic Search Premier, Business Source Premier, CLICsearch, EBSCO MegaFILE, ERIC, Gales Virtual Reference Library, Google Scholar, high school websites and various other online tools. An informal interview was conducted with the superintendent of the author's school district and a school board member. Discussions were held with many business professionals, fellow teachers, students and parents, all with a vested interest in the topic. Research articles from 1995 to 2017 are included to ensure a wide range of data. The information that follows in this chapter represents a variety of sources and experience, and reviews all the relevant research collected on this topic.

Brief History of School and School Start Times

The author feels it is important to take a brief look at the history of schools and school start times in order to have a context for today. The first American school opened during the 17th century. The Bostin Latin School was founded in 1635 and is the first and oldest existing school in the United States (Sawe, 2016). The first free tax-payer school was opened in 1639 in Massachusetts (Sawe). School attendance rates were low but nonetheless, options were available. It was not until the late 1700's that the number of children attending school increased.

Still, during this time many families could not afford to pay for school for their children or could not spare their time away from farm work (Glavin, 2014). By the end

of the 18th century, dame schools were attended by most colonial American school age boys (Monaghan, 1988). Dame schools were intended to prepare boys for public schools (Monaghan). Dame schools were held in the homes of older women in the community (Monaghan).

Outside of dame schools, due to the large number of people living in rural areas and limited number of students, public schools consisting of one-room schoolhouses with non-standard starting times were the norm (Wahlstrom, 2016b; Brown, Boser & Baffour, 2016). All age levels and abilities were taught in one classroom. Start times were typically early each day but students had the freedom to arrive as schedules permitted. At this time private schools were only for the wealthy, and were segregated by sex (Monaghan, 1988).

While the New England states were experiencing the beginnings of education during this time, the South was having a different experience. Due to a lack of educated leaders to promote education, families, and neighborhood group or congregations, developing an educational system was more of a struggle for the South (Jernegan, 1919). Most of the settlers in this area of the United States were adult males, unknown to each other, or servants of business. These settlers could be broken down into three different classes; planters, white servants, and negro slaves. While public education was not supported early on, many children of the planter class received private tutoring and some were eventually sent away for further education. With the exception of a couple of states, anti-literacy laws even made it illegal to educate slaves (Jernegan).

The years 1890 to 1930 saw a dramatic expansion in the number of schools and students served. One room schoolhouses were being replaced by grade level schools

and start times started to stagger (Wahlstrom, 2016b). By 1900, 34 states had compulsory schooling laws and 31 of those required schooling from ages 8-14. By 1918, every state required students to complete elementary school (Glavin, 2014). In 1921, the first public high school in the United States was opened in Boston (Glavin). By 1940, 50% of young adults earned a high school diploma (Glavin). During the 1960's high school start times started moving before those of elementary schools due to lack of sleep research and community needs (Owens, Drobnich, Baylor, & Lewin, 2014; Jacob & Rockoff, 2011). By the 1970's, many high schools were starting between 7:00 am and 8:00 am, earlier than ever before (Boergers, 2015). High schools now had sports drawing large crowds and were more community oriented.

By the mid 1970's, detailed research was conducted to try to identify the ideal start times for students (Owens et al., 2014). In 1996, the Edina, Minnesota school district became the nation's first district to move start times for high school students based on sleep research. Many schools would follow. As of 2012, only 9.5% of public high schools started before 7:30 am, 33% were starting between 7:30 am and 7:59 am, 43.1% were starting between 8:00 am and 8:29 am, 10.6% were starting between 8:30 am and 8:59 am, and 3.8% were starting after 9:00 am (Wheaton, Ferro, & Croft, 2015). As of 2014, at least 70 public school districts consisting of over 1,000 individual schools had successfully pushed back their high school start times (Owens et al.).

Sleep and Today's Adolescents

Getting the right amount of sleep each night is an important part of being a functioning member of society. The right amount of sleep needed varies during different stages of life (Boergers, Gable, & Owens, 2014). According to the National

Sleep Foundation, the optimal sleep duration for adolescents is 8.5 to 9.5 hours per night (*Summary of findings*, 2006). Based on sleep lab studies conducted in the late 1970's, the recommended amount of sleep for adolescents ranges from 9 to 9.5 hours (Carskadon, 1999). With that said, the following is a literature review about sleep and today's adolescents. Whether it is biological or decision (sleep hygiene) based, research has much to say about what influences the sleep patterns of today's adolescent.

Circadian Rhythms

One of the biggest factors in sleep habits in the 21st century is based on circadian rhythms, briefly defined in chapter I. The following information expands on that information.

According to the National Sleep Foundation (n.d.), circadian rhythms are "a 24-hour internal clock that is running in the background of your brain and cycles between sleepiness and alertness at regular intervals. It's also known as the sleep/wake cycle" (para. 1). These rhythms help our bodies decide when to be awake and when to sleep. The circadian system is associated with the hormone melatonin and is influenced by light and darkness. This system is part of the reason people start to feel sleepy when daylight goes away and night time comes.

Due to biological changes in adolescents, melatonin isn't produced until around 11:00 pm and stops around 8:00 am with a peak time of around 7:00 am (McKeever & Clark, 2017). It is during this time that adolescents can achieve optimal sleep (McKeever & Clark). According to a sleep study performed by Carskadon, Vieira, and Acebo (1993), there is some evidence that as adolescents begin puberty (especially females), they undergo a shift in their circadian system toward later bedtimes and wake

times. This shift, which can be attributed to melatonin, helps explain why teenagers tend to say they are not tired and have a tendency to stay up later and can easily sleep in longer. Adults, on the other hand, have melatonin levels that peak at 4:00 am (Carrell, Maghakian & West, 2011)

According to Groen and Pabalonia (2015), humans also have a homeostatic system that provides sleep pressure. This means the longer a person stays awake, the more pressure there is for the body to sleep. The pressure goes away the more sleep a person gets. These two systems working together help maintain a regular sleep/wake pattern. Studies have also found that sleep/wake timing shifts later for 10-20 year olds (Crowley, Acebo, & Carskadon, 2007). These biological shifts create different sleep needs for different people. The timing of these shifts vary by age and gender from person to person.

Environmental Factors and Sleep Hygiene

As noted above, research creates a case for biological maturation causing shifts in sleep patterns. There is, however, a second related piece to this puzzle, environmental factors and sleep hygiene. This section of the thesis describes some of these factors and their influence on sleep patterns of today's adolescent.

Environmental factors such as increased academic obligations and extracurricular commitments, decreased parental involvement in behavioral decisions, and increased social activities also play an integral part in when and how adolescents sleep (Crowley et al., 2007). Adolescents today are pressured to turn their most valuable resource, time, in many different directions. They must decide how much to study, how many extra-curricular activities to participate in, when to volunteer, who to hang out

with, whether or not to have a part time job, how much time to spend communicating electronically with friends and family, and when to simply relax on a daily basis.

An article written by Short, Gradisar, Lack, Wright, Dewald, Wolfson, and Carskadon (2013) analyzed differences between U.S. and Australian adolescents. They found that U.S. students obtain 47 less sleep minutes per school night, were less likely to have parent-set bed times (6.8% to 17.5%), and spend an average of two hours and 41 minutes a day on extracurricular activities which is one hour and four minutes more than Australian adolescents. Wahlstrom et al. (2014) found a similar number for time spent on extracurricular activities in their multi-state study. This time gets tacked on to the average three and a half hours of homework that is estimated to be assigned to high school students every night (Stainburn, 2014). When added together, that is six hours and eleven minutes of academic and extracurricular commitments to be fulfilled each night. If a typical school dismisses at 3:00 pm, the student's day will not be complete until 9:20 at night; that does not include transportation time, meal time, and social time. Once these academic and extracurricular considerations are taken into account, parental involvement and family behavior decisions should also be discussed. Throughout the authors research these components have been referred to as sleep hygiene.

Sleep hygiene practices and habits come down to decisions people make on a daily basis. Barnes, Davis, Mancini, Ruffin, Simpson, and Casazza (2016) make the statement that effective methods to create enough sleep for adolescents that do not disrupt the entire community include; "reducing all night lighting, avoiding caffeine stimulants, exercise, eating, screen time before bed, napping" (p.552). Sleep hygiene decisions have a significant effect on the sleep patterns of adolescents. Making the right

decisions about using electronic devices, when to stop eating or drinking, and what time is a good bedtime, can lead to a more productive adolescent. Early research in this area found that access to telephones, televisions, computer, and other electronics in bedrooms contributes to a reduction in sleep for adolescents (Carskadon, 1999). More recent research conducted by Vernon, Modecki, and Barber (2017) also found a significant correlation between increased nighttime phone use of adolescents and poor sleep behavior, depressed moods and poor coping ability.

When researching the impact of later school start times on today's adolescents, it is good to start with the biggest study, *Examining the Impact of Later High School Start Times on the Health and Academic Performance of High School Students: A Multi-Site Study* (2014) conducted by the Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota. This landmark, multi-site, three year study by CAREI in 2014 led by Kyla Wahlstrom from the University of Minnesota, gathered information from over 9,000 students in three states, five school districts, and eight public schools. The purpose of this study was to examine if the delay in start time for high school students had any impact on the health and academic performance of those students. This three year study found that 45.8% of high school students polled had a television in their bedroom, 41% had a computer in their bedroom and 88.1% had telephone/cell phone in their bedroom at night (Wahlstrom et al., 2014). The data collected in this survey showed that the presence of a potential distraction like a computer or cell phone significantly related to the amount of sleep that the students reported getting (Wahlstrom et al.).

The report also referenced Carskadon's 2013 article *Optimal Sleep Habits in Adolescents* where she discussed the negative effect that electronic devices that emit blue lights has on adolescent sleep by artificially altering their bodies natural sleep rhythm. These blue lights suppress the production of melatonin which make it harder to fall asleep (Ware, 2014). On average, the National Sleep Foundation recommends shutting down all electronics at least 30 minutes before going to bed (Ware). The 2006 Sleep in America Poll conducted by the National Sleep Foundation found that 97% of the adolescents they surveyed had at least one of the following devices in their bedroom at night; electronic music device, television, video games, cell phone, telephone or computer. In fact, the median number for these devices in their bedroom was three (National Sleep Foundation, 2006). The decision to leave a cell phone, computer, or television in a high school student's bedroom could lead to reduced sleep and sleep disruption from the sounds of text messages, phone calls or even emails.

Another factor to consider when discussing sleep hygiene is caffeine intake. The 2006 Sleep in America Poll conducted by the National Sleep Foundation found that 31% of the 1,602 adolescents surveyed drank two or more cups or cans of caffeinated beverages a day. Other, more recent studies on adolescent caffeine consumption have found that 83.2% of teenagers consume caffeinated beverages on a regular basis and that 96% consume them from time to time (Turton, Pich, & Battram, 2016). Wahlstrom et al. (2014) reported in their findings that students who consume energy drinks or other caffeinated beverages have a tendency to report lower grades. Caffeine has a half-life of about three to five hours. These numbers could be more or less depending on the individual (Turton et al., 2016). Caffeine has also been found to have a negative effect

on the homeostatic system, discussed in the previous section, causing a reduction in sleep pressure when adolescents attempt to sleep (Wahlstrom et al., 2014).

In a study by the National Sleep Foundation (2006), 1,602 telephone interviews were conducted with caregivers and their adolescent children. Participants had to be either primary caregivers or someone with equal responsibility for the care of adolescents in grades 6-12 (ages 11-17). When it comes to bedtimes, the National Sleep Foundation found adolescents with a set bedtime have a better sleep profile than those without. The survey also found that while 95% of 6th graders have a parent set bedtime, only 39% of 12th graders do. Adolescents with set bedtimes were less likely to have sleep problems throughout the day (National Sleep Foundation). According to Crowley, Acebo, and Carskadon (2007), adolescents go to bed later the older they get. While part of this is due to biological factors, the data also shows a reduction in parental influence over bedtimes as adolescent get older (Crowley et al., 2007).

Rationale for Later Start Times

Basic Sleep Needs

As stated in a previous section, according to the National Sleep Foundation the optimal sleep duration for adolescents is 8.5 to 9.5 hours per night (*Summary of findings,* 2006). This section of the paper provides research and information as to how much sleep today's adolescent is getting and the implications of not meeting basic sleep needs.

According to Wahlstrom et al. (2014), when high schools push back start times to 8:30 am or later, more than 60% of students who attend those schools obtain at least eight hours of sleep. While that number is not between 8.5 and 9.5 hours, adolescents would get much less sleep if the start time was 7:30 am. Over the course of a school

week that could be up to five much needed hours. These are five extra hours of sleep that students in the Minneapolis School District are getting because of the delay in high school start time from 7:15 am to 8:40 am (Wahlstrom, 2002).

Because of the adolescent circadian rhythms and homeostatic system discussed previously, the sleep-wake cycles of today's adolescents causes them to need more sleep, feel sleepy at later times, and desire to sleep in longer in the mornings (Wahlstrom et al., 2014). Because of these needs, starting high school after 8:30 am would better meet the basic sleep needs of today's adolescents. The National Sleep Foundation found that adolescents only get about 7.6 hours of sleep on school nights (*Summary of findings*, 2006). Also presented in their findings was the fact that 12th grade students, on average, only sleep 6.9 hours per school night, 9% of 9th – 12th grade students get at least nine hours of sleep, and only 20% of adolescents in general are getting at least nine hours of sleep (*Summary of findings*). These are not ideal statistics for the leaders of tomorrow.

In order to discover why today's adolescents basic sleep needs are not being met, it is important to analyze the process of going to sleep. When it comes to actual sleep times and the length of time it takes an adolescent to fall asleep at night, the National Sleep Foundation (2006) found that 74% of the 1,602 adolescents they interviewed took 30 minutes or more on school nights to fall asleep once they were in bed (*Summary of findings*, 2006). These findings were consistent for both males and females as 50% of those interviewed male and 50% were female. After conducting their own research on various studies, the American Academy of Pediatrics found that today's adolescents have "difficulty falling asleep before 11:00 pm and are best suited to wake at 8:00 am or

later" (Owens et al., 2016, p. 643). Based on their research, they also believe high school classes should not start prior to 8:30 am.

Hanover Research, a public research firm that conducted research for Lake Washington School District, WA in 2015 also found that adolescents typically struggle falling asleep before 11:00 pm and need to sleep until about 8:00 am to be fully rested and ready for the school day. This is difficult to accomplish with 60% of high schools around the United States starting at or before 8:00 am (Benchmarking High School Start Times, 2015).

When it comes to how much sleep today's adolescents are getting, Kelley and Lee (2015) found in their research that many adolescents lose two hours or more of sleep a night if school start times are prior to 8:00 am. In writing their paper on sleep and later school start times, Kelley and Lee also found that due to the biological changes discussed earlier in this chapter, adolescents lose 2-3 hours of sleep time every school night. These authors found failure by high schools to adjust start times to meet the basic sleep needs of adolescents can lead to unrecoverable sleep loss.

Many parents worry that pushing back high school start times means students will use the later morning start times to stay up later thus eliminating the possibility of extra sleep. Wahlstrom's 2002 findings from the changes the Minneapolis Public School District made in 1997 show that students continued to go bed at the same time both pre and post start time change, 10:45 pm.

Another study conducted by Boergers et al. (2014) at a coeducational residential school for grades 9-12 and postgraduate students also sheds light on this topic. This study compared student grades and sleep patterns over 3 trimesters at the school.

During the fall and spring terms, school start time was 8:00 am. For the winter term, school start time was changed to 8:25 am. At the end of each term, data were collected and analyzed for all students involved in the study. The finding from this study showed that a 25 minute delay in start time from 8:00 am to 8:25 am resulted in a 29 minute increase in sleep duration of those surveyed. The results also confirmed that the later start time did not alter the students' bedtimes. In presenting the results of a pilot survey analyzed by Wolfson and Carskadon (2005), they found high schools with early morning start times require adolescents to have bedtimes that are impractical or just not possible.

"Teens require more sleep than adults and are hardwired to want to sleep in" (Lewis, 2016, para. 3). Because research has shown that adolescents need 8.5 to 9.5 hours of sleep a night, both the American Academy of Pediatrics and the Center for Disease Control and Prevention have urged the education community to push back start times for middle and high schools to 8:30 am or later (Lewis) to meet the basic sleep needs of today's adolescents. Wahlstrom et al. (2014) summarized it best, "sleep plays an important role in all aspects of an adolescent's life" (p. 7). Studies consistently report sleep, health, behavioral, and learning benefits to adolescents who attend high schools with later start times (Kelley, Lockley, Foster & Kelley, 2015).

Academic Rationale

Are later high school start times better for students and do they lead to more academic success? The following section addresses the academic results recorded for various school districts that have implemented later school start times and how that information could be used to push for later start times for high school students.

Based on research conducted by Wahlstrom, Dretzke, Gordon, Peterson, Edwards and Gdula (2014) it was concluded that in Minnesota (5 high schools) and in Colorado (2 high schools), there was a "weak, but statistically significant correlation between the total number of hours of sleep students get on school nights and their self-reported grades in school" (p. 29). This study also found a small positive relationship between a student's sleep *quality* and grades. The report states that "students who consider themselves good sleepers had better grades" (Wahlstrom et al., 2014, p.31).

When looking at GPAs and standardized test scores, the report presented the following findings. Based on core course results (math, science, social studies, English) where some class results were combined, all high schools, with the exception of St. Louis Park, MN, showed statistical significant increases in GPA for their core courses. While the data cannot be broken down in micro-level details, it does show that moving high school start times to later in the morning has a positive effect on student GPAs. From a standardized test score perspective, two of the five school districts (Boulder, CO and Mahtomedi, MN) showed a significant increase in their performance on the ACT and preliminary ACT (PLAN) tests, and South Washington County, MN showed an increase in their standardized Math test scores but not in other core classes (Wahlstrom et al., 2014).

In 1997, the Minneapolis Public School District delayed their high school start times from 7:15 am to 8:40 am (Wahlstrom, 2002). Based on letter grades from the three years prior to the delay in start time and the three years following the delay in start time, Wahlstrom found slight improvements in grades earned by students.

Although this section of the paper focuses on high school student academic achievement, Carrell, Maghakien, and West (2011) also conducted some related research at the US Air Force Academy. Research for this study was performed on 6,165 first year students from years 2004-2008. The academic day for these students changed twice from academic year 2006 to 2007. In 2006, the academic day was moved from 7:30 am to 7:00 am and in 2007 the academic day was moved from 7:00 am to 7:50 am (Carrell et al.). Because these were first year academy students with a rigorous eight class daily schedule similar to that of a high school, the findings of this study contain valuable information. Also making this study relevant and reliable was the grading structure for core courses at the academy. Content and exams were identical and standardized. Making the data even more relevant, students with a first period class were compared to students without a first period class (Carrell et al.). These changes provided an opportunity to easily assess academic success based on start times.

The results of this study show a clear relationship between school start times and academic success. First, not only did students with a first period (7:00 am) course earn lower grades in their first period class when compared to later starting students, they also earned lower overall grades in courses taken over the entire academic day compared to those students that did not have a first period class (Carrell et al., 2011). Second, the deviation of grades significantly lowers when the academic day started at 7:50 am. The data clearly shows how students who start their academic day before 7:50 am are at a disadvantage when it comes to grades. Later start times for adolescents lead to a higher GPA (Carrell et al.).

Finally, in 2012, Finlay Edwards analyzed research on middle school students in Wake County, NC collected from 1999-2006. Although his study was in grades 6-8, Edwards (2012a, 2012b) found that a one hour delay in start times led to a three percentile gain in math and reading test scores.

While the survey and research results listed above do not reflect major improvements in adolescent grades or standardized test scores, they do provide evidence of a direct link between later school start times and academic performance. Beth Tudan, mother of 18 year old Alexander at James Madison High School in Virginia, has seen firsthand how delayed start times does influence academic performance (Pannoni, 2017). Due to a school start time change at her son's school, "His grades are higher, his concentration has been better. He's just been happier" (Pannoni, para. 13).

Behavior Rationale

Although academic success and preparedness are mainly based on grades and standardized tests, there are many behavioral components that factor into an adolescent's ability to obtain good grades and prepare for post-secondary success. This section of the paper presents information about behavioral improvements that can be attributed to late start times for high school students.

In order for high school students to reach their maximum potential when it comes to grades, they must be at school, be on time and be prepared to engage in classroom learning. Can delaying the start times for high school students lead to behavioral improvements at school? According to research conducted by Wahlstrom, Dretzke, Gordon, Peterson, Edwards, & Gdula, (2014) it can.

Based on the information gathered in their study, Wahlstrom et al. (2014) found that when the eight high schools in their study delayed start times, Boulder High School, Fairview High School, South Washington County School District as a whole (Woodbury, Park, East Ridge high schools), and Jackson Hole High School all saw a reduction in the number of tardies. The biggest decrease came at Jackson Hole High where the mean number of tardies to class per day dropped from 6.74 before the delay to 3.25 after resulting in a 51.8% reduction. At Mahtomedi High School there was no significant difference in results and St. Louis Park High School had a grade scale change making it too difficult for analysis to be carried out. Other findings from the study included the fact that South Washington County School District as a whole saw its percentage of students with an attendance rate of 90% or greater increase from 85.5% to 87.4% for all grade levels and its mean total days absent per year drop from 9.67 to 9.17.

Another study that found a positive connection between later school start times and student behavior was conducted by Boergers, Gable, and Owens (2014). This study of 197 boarding students with a mean age of 15.6 found that by delaying the start time of high school from 8:00 am to 8:25 am; the percentage of students who arrived late to class dropped from 25% to 16%, and the percentage of students who struggled to stay awake and/or fall asleep in class dropped from 72% to 55% for the school year. This research shows that even a small delay in start times of high schools can lead to higher functioning adolescents in the classroom.

Hanover Research, while conducting interviews with personnel of school districts that have transitioned to later school times, found that these schools saw behavioral advantages to these changes (Benchmarking High School Start Times, 2015).

Academy School District in Colorado saw tardy rates decrease and students become more engaged especially in morning classes. Albany Unified School District in California found the later start time led to a better school culture and a reduced stress level for students. Glens Fall City School District in New York reported a 2.9% decrease in students arriving late to school, a .3% decrease in absenteeism, and fewer students being referred to the counselling office for depression screening. North Andover Public Schools in Massachusetts noticed positive changes in student engagement mainly in their first period classes (Benchmarking High School Start Times). All of these behavioral advantages led to better learning opportunities at these schools.

According to a survey by Wolfson and Carskadon given in the fall of 1994 to four public high schools from Rhode Island school districts, the earlier schools start, the more behavioral issues arise (Wolfson & Carskadon, 1998). Based on their study of 3,120 students from four high schools with start times ranging from 7:10 am to 7:30 am, students that reported getting more sleep found themselves better equipped to meet the daily demands of high school. On the other hand, students who reported getting less than eight hours of sleep found themselves more likely to arrive late to school, had higher levels of depressive mood, had more daytime sleepiness, and more difficulty focusing throughout the day (Wolfson & Carskadon).

In another study conducted by Wolfson and Carskadon (2005), surveys were sent to 4,116 schools from the National Center for Education Statistics website. These surveys were sent to school administrators requesting information about school schedules, current views on schedules, perceived barriers to altering school schedules

and other logistical information. After returned surveys were analyzed, 345 were found to be relevant and reliable for the purpose of the study. Of these 345 surveys, 73% were completed by school administrators while 27% were completed by administrative support staff or school counselors. Based on the feedback, 50% of the respondents identified the following positive outcomes of delayed start times: improved attendance, lower tardiness rates, and happier students (Wolfson & Carskadon).

As mentioned in the previous section, Wahlstrom (2002), conducted a longitudinal study of the Minneapolis Public School District and although she found only a slight non-statistically significant improvement in letter grades, behavioral improvements were significant. The study researched attendance rates for students who were continuously enrolled in the same high school for two or more years (continuous) and students who moved from high school to high school over a four year period (non-continuous). The results showed improvements for both groups. Continuous students' grades 9-11 showed an increase from 93% to 95% pre and post start time change while non-continuous student's grades 9-11 showed an increase from 72% to 77.5%. Both of these changes reflect a statistically significant increase. When surveyed following the delayed start time, high school teachers in the Minneapolis Public School District reported students being more alert during period one and period two classes. They also reported fewer students falling asleep at desks during the school day.

Thacher and Onyper (2016), conducted another longitudinal study of data from students at Glen Falls High School in New York. A total of 372 students completed all surveys required for this study. In the end, based on a 45 minute delay in high school

start time, lasting improvements were found in the areas of disciplinary violations and tardiness.

Based on sleep/wake diaries kept by 60 incoming seniors at Evanston Township High School in Illinois, Hansen, Janssen, Schiff, Zee and Dubocovich (2005) found that students with early morning classes reported being less alert, wearier, and needing to expend more energy to focus on a daily basis. Other authors like Jacob and Rockoff (2011) concluded that early high school start times can be linked to increased absences and fatigue in adolescents. In a literature review performed by Morgenthaler, Hashmi, Croft, Dort, Heald, & Mullington (2016) evidence was found to support increased engagement by students and a decrease in tardiness or truancy in high schools with delayed start times. McKeever and Clark (2017) found data to support a conclusion that high schools with a start time later than 8:30 am have better attendance rates than high schools that start prior to 8:30 am. In their study of 2,716 8th and 9th graders in Switzerland, Perkinson-Gloor, Lemola, and Grob (2012) found that in schools with a start time of 8:00 am, students reported significantly less daytime tiredness than at schools with a 7:40 am or earlier start time.

Driving Rationale

More than fifty percent of all car crashes caused by a driver falling asleep at the wheel involve drivers 25 years old or younger (Hamiduzzaman & Phillips, 2014). To take these numbers one step further, Hamiduzzaman and Phillips also found that adolescent drivers between the ages of 16 and 19 are three times more likely to be involved in a fatal crash than drivers 20 and older. One of the benefits of a later school start time often missed is the effect the additional sleep has on adolescent driving.

Wahlstrom (2016a) informs us that "car accidents are the greatest cause of accidental deaths in teens; more than 2,700 teens are killed in car crashes each year" (p.12). According to her research, sleep deprivation is a major problem for inexperienced teenage drivers. Reaction time, attentiveness and the ability to stay in a lane are lacking in a driver who is tired. What many people do not realize is that "a person with fewer than four hours of sleep has the same driving characteristics as someone who is legally drunk with a blood alcohol content of .08%" (Wahlstrom, 2016a, p.13). The following section of this paper will attempt to present various findings about impaired driving.

According to research conducted by Fred Danner and Barbara Phillips (2008), "Later school start times may both increase sleep of adolescents and decrease their risk of motor vehicle crashes" (p. 533). Research was gathered for the two years (1996-1997) preceding the high school delayed start time change and the two years (1999-2000) following the change on car crashes in Fayette County, a school district in Lexington, Kentucky. Due to the fact that the state of Kentucky put in place legislation that severely restricted 16 year old driving privileges in 1996, the data presented by Fred Danner and Barbara Phillips focuses mainly on 17-18 year old drivers. For the 1997-1998 school year, start times for the high school and middle schools involved were 7:30 am and 8:00 am respectively. For the 1998-1999 school year, start times were 8:30 am and 9:00 am respectively. The objective of the study was to determine if there was a cause and effect relationship between starting school later in the morning, sleep duration and motor vehicle crashes.

The study found due to increased sleep duration the average crash rate following the high school start time change decreased 16.5% for 1999 and 2000 (Danner &

Phillips, 2008). This represents a drop from about 260 crashes to 220 crashes per 1000 teen drivers in the Fayetteville district. At the same time, Danner and Phillips found statewide crash rates increased by 7.8%. This represents an increase from about 180 crashes to 207 crashes per 1000 teen drivers. The data gathered by Danner and Phillips shows a positive correlation between later school start times and the reduction of adolescent car crashes.

Other studies have also been conducted on this topic. Pack, Pack, Rodgman, Cucchiara, Dinges, and Schwab (1995) conducted a study based on information from the Highway Safety Research Center at the University of North Carolina to better understand the characteristics of crashes. The study looked into 4,333 crashes where the drivers were asleep or sleepy but had not been drinking. While the study was not specifically focused on school start times and car crashes, the authors did find the following; crashes were occurring primarily between 12:00 am and 7:00 am and around 3:00 pm (times of increased sleepiness), 55% of the crashes involved young adults 25 year old or younger, and 20 year olds were the peak age of occurrence (Pack et al., 1995).

Data collected by Wahlstrom et al. (2014) in a large multi-state study also provides much insight into adolescent driving and car crashes. The study analyzed high school data in three states (Colorado, Minnesota, Wyoming), from five school districts and eight different high schools. According to the study, after start times for high schools were moved to later in the morning, the number of car crashes for 16-18 year olds in the following locations decreased by the following percentages; the cities of Cottage Grove and Woodbury MN (part of the Washington Country School District)

saw a 6% reduction, the city of St. Louis Park (contiguous with the St. Louis Park School District) saw a 9% reduction, the city of Mahtomedi (contiguous with the Mahtomedi School District) saw a 65% reduction, and Teton County (contiguous with the Teton County School District) saw a 70% reduction (Wahlstrom et al., 2014)

Along with these studies, the American Academy of Pediatrics in 2014 found adolescents who do not get enough sleep are at greater risk of sleep related crashes (Owens, Au, Carskadon, Millman, and Wolfson, 2014). Boergers et al. (2014) found that earlier high school start times have negative consequences when it comes to motor vehicle crashes. The National Sleep Foundation (2006) reported that 5% of all driving adolescents who took part in their survey reported having nodded off or fallen asleep at the wheel and 51% have driven drowsy at least once in the past year. The latter percentage increased for juniors to 62% and for seniors to 68% (National Sleep Foundation, 2006).

As evidence mounts, finding methods of getting today's adolescent more sleep grows in importance. Not only are fully rested adolescents more aware of how they are driving, they are more aware of their surroundings which is better for other drivers on the road as well. With all of the electronic distractions drivers deal with in today's society and in automobiles, adolescent sleepiness need not be one.

Health Rationale

Along with the rationale discussed above, research shows there are many health benefits to delaying high school start times. The following section describes some of these benefits.

Research conducted identified lack of sleep in today's adolescents as becoming an epidemic (Boergers, Gale, & Owens, 2014). One of objectives of a study conducted by Boergers et al. was to examine the impact of delaying school start time on health-related outcomes. In this study, 849 students, grades 9-12, participated in an independent and anonymous survey. Forty-nine percent of the participants were male and fifty-one percent were female. These surveys were taken before and after a delayed start time from 8:00 am to 8:25 am. Based on the self-reported surveys it could be concluded that students with nightly sleep times of greater than eight hours reported being less depressed (as reflected in scores on the Depression Scale calculated by the survey), reduced the amount of caffeine consumed on a weekly basis and reported a slight decrease in visits to the school clinic for fatigue-related issues (Boergers et al.)

As a validation to these findings, Wahlstrom, Dretzke, Gordon, Peterson, Edwards and Gdula (2014), after analyzing their own research, found that adolescents with at least eight hour of sleep at night claimed to be in better overall health, were less likely to use caffeine, alcohol, tobacco and other drugs, and were less likely to report being depressed. Reduced daytime caffeine consumption and a lower risk of depressive behavior were also reported by Hanover Research (Benchmarking High School Start Times, 2015) after conducting research on high schools that delayed their start times.

When challenged, by their school board, with the task of reducing transportation costs and identifying methods to improve the sleep health of their students, the Minneapolis School District decided to delay high school start times from 7:15 am to 8:40 am (Wahlstrom, 2002). This change was made with hope of a positive experience for the over 12,000 secondary students in the district. At the start of the 2000-2001

school year, the Center for Applied Research and Educational Improvement (CAREI) was asked to perform a longitudinal study of grades, attendance and sleep habits. The point of this study was to determine if the positive outcomes identified in year one of the change were still evident in year four.

Along with the academic and behavioral benefits discovered during this study, health benefits were also researched. When sleep habits were surveyed for students with a delayed start time (8:40 am) and compared to surveys of students in a high school with a 7:30 am start time, some of the mean values were significantly different. Students with the delayed start time were found to report fewer depressive feelings, be less likely to oversleep and were less likely to stay home sick.

In an attempt to summarize experiences by high schools that delayed start times across the United States, Owens, Drobnich, Baylor and Lewin (2014) conducted in-depth research using multiple research tools. Through literature reviews, telephone interviews, online surveys, and case studies, their research produced multiple findings on improvements to students' health. Beyond the school districts discussed in the paragraphs above, Owens et al. also found the following. The West Hartford School District in Connecticut reported positive impacts on emotional health and stress levels. Private boarding schools in Rhode Island and other New England schools identified self-reported decreases in depression and health center visits. Almost all of the schools in the study reported increases in sleep health of their students after delaying the start times of their high schools 20 minutes or more (Owens et al.).

When students are deprived of sleep, they are more likely to use cigarettes, drugs, and alcohol, have increased incidents of depression, and increased feeling of

sadness and hopelessness (Wahlstrom, 2016b). These are all issues that can be decreased.

Obstacles to Later Start Times

As seen in the sections above, much research has been conducted and presented on the benefits of delaying high school start times. Despite all this evidence, the Centers for Disease Control and Prevention (CDC) found that during the 2011-2012 school year only 14.4% of the 18,360 high schools analyzed started at 8:30 am or later (Wheaton, Ferro, & Croft, 2015). Additional research found that in 42 states, 75% to 100% of high schools start prior to 8:30 am. The American Academy of Pediatrics (AAP) recently found that 85% of high schools in the United States have a starting time before 8:30 am (Barnes, Davis, Mancini, Ruffin, Simpson, & Casazza, 2016). The following sections will discuss some of the reasons why more high schools have not taken the advice of the AAP and CDC to delay start times.

Transportation Concerns

One of the most discussed deterrents to later start times for high schools is busing schedules and their effect on small children and traffic congestion. For smaller school districts these logistics present fewer obstacles. For large school districts with elementary, middle and high schools, and multiple bussing tiers, scheduling is much more difficult. In a school start time study conducted by Wahlstrom and Freeman (1997) in the state of Minnesota, 17 metropolitan area school districts were asked to provide data and answer questions as to start times and potential benefits and drawbacks to later start times for high schools. When the 17 transportation directors were asked

about tiered busing schedules, 15 of them mentioned or stressed the importance of staggered times to keep costs down and match the supply of drivers with route demands.

A study by Wolfson and Carskadon (2005) found that start times for high schools in districts with two to three bussing tiers were earlier than start times of those with one or no busing tiers. Many of these districts have different start times for elementary, middle, and high school students with high school starting first followed by middle school then elementary school (Wolfson & Carskadon). These staggered start times are a necessity due to the need for busses to run multiple routes and drop off at various schools at different times in the morning.

Because high schools that have delayed start times need buses later in the morning, studies conducted by Wahlstrom (2016a) and Wahlstrom and Freeman (1997) found one of the biggest concerns of many parents with younger children is waiting in the dark for the bus. In larger districts or districts with limited access to busing, when the high school start time is 8:30 am, other schools in the district need to start up to one and a half hours earlier to accommodate this schedule. From various starting dates in September through mid to late February daylight does not start until 7:00 am in northern states (Sunrise and sunset calculator, n.d.). This would lead to young children between the ages of five and ten waiting in the dark for the bus (Dexter, Bijwadia, Schilling & Applebaugh, 2003; Wahlstrom, Dretzke, Gordon, Peterson, Edwards & Gdula, 2014).

Another transportation concern that surfaced as part of school districts working to delay the start times of high schools is traffic congestion. According to an article by Barnes, Davis, Mancini, Ruffin, Simpson, and Casazza (2016), one of the barriers to delayed high school start times in many communities is traffic congestion for both

students and teachers. In the research conducted by Owens, Drobnich, Baylor, and Lewin (2014), traffic flow was the highest ranked concern by schools in Arkansas, Florida, Massachusetts, and Virginia.

The average job in the business world starts at 7:55 am (Silver, 2015), and the heaviest part of morning rush hour traffic is from 7:00 am to 8:00 am (Yau, 2016). When high schools start at 7:30 am, the majority of adolescent drivers are off the roads by 7:15 am, thus eliminating these vehicles from congestion. With a start time of 8:30 am, many adolescent drivers are on the road from 7:30 am to 8:15 am adding to the congestion of the morning commute.

According to the Minnesota Department of Transportation (MnDOT), the afternoon rush hour in Minneapolis runs from 3:00 pm to 7:00 pm (Brown, 2013). Since high schools with delayed start times typically are released between 3:00 pm and 4:00 pm (Owens et al., 2014), adolescent drivers would be hitting the roads during rush hour instead of before.

After School Activities

As high schools across the country contemplate delaying start times, they have to take into consideration after school activities. These activities include school sponsored athletics, after school jobs, and access to public and private support resources.

In the study conducted by Wolfson and Carskadon (2005), mentioned in the behavior rationale section above, 55% of the schools that responded to the survey identified athletic practices as a major barrier to delaying school start times. Another 26% identified other after school activities as a deterrent (Wolfson & Carskadon). Because a large percentage of students participate in after school activities, the start and

end time of high schools is the main determining factor as to when activities start and the number of activities in which students can participate.

The American Academy of Pediatrics, through their research into school start times for adolescents, found that high school start times determine athletic start times (Owens, Au, Carskadon, Millman & Wolfson, 2014). Until all schools in a conference have the same or similar start times it will be difficult for students to make it to games on time without contemplating solutions like pulling them from class early (Owens et al., 2014).

In a recent report published by the New Jersey Department of Education (2017), it was found a delay in high school start times "will almost certainly impact scheduling of interscholastic sports games, matches, and meets" (p. 16). Delays to start times could reduce the amount of time that athletics, clubs, and other extra-curricular activities have available due to daylight and venue availability. Some schools could even face funding issues if lighting needs to be installed (New Jersey Department of Education). These time crunch and lighting issues could also cause more students to miss class as buses will need to leave during school hours for games (Owens et al, 2014). While this may not be a big issue when the school day ends between 2:00 pm and 2:30 pm, it could become a bigger issue if the school day does not end until 3:00 pm or later.

One of the solutions to after school athletic start times identified by Owens et al. (2014) is to create early dismissal times for game days. This removes the student from the classroom on a regular basis for some sports. Based on focus group feedback from 9-12 grade students in the Minneapolis school district following a change in start time from 7:15 am to 8:40 am, these concerns exist (Wahlstrom, 2002). One student was

quoted as saying, “I play softball in the spring. Every time we have a game, I end up getting out early” (Wahlstrom, p.15). Another student stated, “I had a really hard time keeping up with my sixth hour grade because I would keep getting out of class almost every day” (Wahlstrom, p.15). According to Wahlstrom’s research, a few coaches in the district even struggled with the later start and dismissal times, especially when they had long practices or had to travel long distances for games. These concerns also appeared in the study conducted by Wahlstrom and Freeman (1997).

The delay in start times could also cut into work time of students. According the U.S. Census Bureau (2012) in 2011, 28.8% of the 11.1 million high school students in the United States had part or full time jobs year round. High school student use this money for spending cash, to save for college, pay bills, or even help with family expenses (Wolfson & Carskadon, 2005). For students with after school jobs, delaying the start time of school means they will be released from school later in the day also. A later release time mean fewer hours worked and less take home money on their paychecks due to adolescent work restrictions. For families that rely on adolescent income to supplement family resources this is problematic (Wolfson & Carskadon, 2005; Wahlstrom et al., 2014; New Jersey Department of Education, 2017). Delayed start times could have an adverse effect on family incomes especially in low income families.

Students who are reliant on public resources after school will also feel the crunch with later release times (New Jersey Department of Education, 2017). When researching the closing times of businesses like public libraries, Kumon Math and Reading Center, Mathnasium, and Tutor Time it was discovered that closing time for

these academic support centers ranged from 6:00 pm to 8:00 pm. For students released from 3:30 pm to 4:15pm in the afternoon there is the potential for a reduction in the amount of time that can be spent taking advantage of these resources.

Child Care Costs

Research conducted by the Center for American Progress found that throughout the school year, schools are closed an average of 29 days excluding weekends (Brown, Boser, & Baffour, 2016). Based on study findings, the average worker with paid leave receives 16 days of holiday and vacation time off each year. This means that parents of young children need to find money to cover 13 days of the school year when children are at home (Brown et al.). Brown et al. also found that fewer than half of the elementary schools researched provide before and after school care. When researching low-income schools, less than one-third offer these services (Brown et al.).

The concept of supply and demand is another factor that Brown et al. discovered in their research. According to their findings, "Parents of nearly 20 million children report that they would enroll their child in an after-school program if one were available" (Brown et al., p.12). Further finding from their research claim that around 45% of public elementary schools in all states have before and after school care. In several states that number decreases to 15% and in Utah it is around 3% (Brown et al.). According to Brown et al. if high school students remain in school longer than elementary school students, many families must find the means and methods to provide care for their children while siblings are not present and parents are still at work. The possibility of young children having to spend time in an empty house because older siblings are released from school after them, is a potential problem of delayed start times

for high schools (Dexter, Bijwadia, Schilling, Applebaugh, 2003). If high school were to start before elementary school, siblings would be home to care for younger children before parents get home from work.

The cost to provide child care in the United States in not cheap. When nine percent of full-time workers have no paid vacation and 21% of workers have limited access to paid leave due to being a contract or temp worker, it can be difficult to find the funds to not only cover the days where there is no school but also the hours before or after school when children are home without sibling to watch them. For lower income families, this means a higher burden of cost (Brown, Boser, & Baffour, 2016).

CHAPTER III: DISCUSSION AND CONCLUSSION

Summary

After careful examination of studies, papers, briefs and other research conducted by individuals in the world of business, government, and academia, it is apparent that much information is available to address the question: School start times: Is later better for high school students? The research presented in this chapter clearly illustrates the fact that when determining the optimal start time for adolescents, both biological and social/environmental factors need to be discussed to arrive at an acceptable conclusion. Because communities around the United States are different, there is no singular optimal approach to addressing this issue. Sleep needs, along with sleep hygiene, transportation needs, commute times, economic status of students, involvement in after school activities and facility resources all need to be addressed before changes are made.

Research shows that adolescents need 8.5 to 9.5 hours of sleep a night. After conducting the research noted above, I still believe sleep hygiene decisions and environmental factors play a major role in meeting these needs, and could even be more important than start times. Knowing that we are all made different in the Creator's eye, I struggle with the concept of every adolescent having the same exact sleep demands of 11:00 pm to 8:00 am. I do believe, as a society, we have placed many unnecessary demands on today's adolescents, which cause them to miss out on much needed sleep. Our high schools expect adolescents to not only get good grades in school and on the ACT/SAT, but also spend hours each week in clubs and volunteering to build their resumes for post-secondary acceptance. Our parents place demands on their teenagers to be involved in school sponsored sports and other extra-curricular clubs so they can get

scholarships to attend expensive schools and reduce costs. While these students are participating in school sponsored athletics, they are missing school.

In my school district, with a delay in start time from 7:30 am to 8:20 am, for example, I have students missing entire blocks multiple days a week in the spring to compete. Along with these competition demands come hours of studying, practices, and hours of socializing on electronics. When all is said and done, there are not enough hours in the day to keep up with the expectations placed on teenagers. With more and more parents leaving sleep hygiene decisions up to over demanded adolescents (National Sleep Foundation, 2006), it is no wonder students make poor decisions when it comes to sleep hygiene. Wahlstrom (2016a) said it best when she stated, "given what we now know, creating a balance between students' sleep needs and their interests outside of school is important" (p. 12). Helping adolescents make the right decisions when it comes to eating patterns, caffeine consumption, bedtimes, organization and electronics in the bedroom is just as important, in my opinion as high school start times. These decisions are transferable over into the real world once they graduate and move on.

I agree with Barnes et al. (2016) when they say "One could argue that less disruptive interventions may be just as effective for preventing sleep deprivation (e.g., reducing all night lighting, avoiding caffeine stimulants, exercise, eating, screen time before bed, napping)" (p. 552). Research shows that after a delay in start time for high schools from 8:00 am to 8:25 am, students who sleep for eight or more hours a night increases from 18% to 44% (Boergers et al., 2014). The research also shows that these students still feel the need to sleep in longer on the weekends to compensate for missed

sleep. We need to do a better job as a society parenting and educating our adolescents on how to get the proper amount of sleep each night.

While Barnes et al. (2016) do recognize the importance of sleep hygiene decision making when it comes to adolescent sleep needs, they also contend that "sleep hygiene does not address the physiological shift in melatonin secretion" (p. 552). One of the major findings uncovered by this research is the fact that adolescent's circadian rhythms do change with puberty and along with the homeostatic system, their sleep-wake cycles are altered. While the education community needs to do a better job at reducing time demands on adolescents, it also needs to make sure that start times are as closely aligned to sleep needs as possible.

Does that mean that later start times for high school students are better? I think the research in this paper shows that it does. What it doesn't identify is what the ideal time is.

Limitation of Research

While the data uncovered in this paper is timely and valuable, it does have its limitations. The number of published studies detailing the impact of delayed high school start times is still somewhat limited. The primary argument against delaying school start times is a lack of causal relationship between start times and student achievement (Carrell et al., 2011).

There is some research showing early start times lead to sleep deprivation for adolescents and that the number of hours of sleep is positively correlated with a measure of academic achievement, but, these studies are either not gathering information about high school students grades 9-12 (Carrell et al., 2011; Edwards, 2012a; Edwards,

2012b), or they show minimal improvements at best. Also, due to the heterogeneity of assessments and the subjectivity of grading, grades are not a consistent measure of academic achievement (Carrell et al., 2011; Wahlstrom, 2002). Added to this is the fact that many of the studies discussed in this paper are derived from a small sample size. Boergers et al. (2014) conducted a study of 197 boarding students. Wolfson and Carskadon (2005) surveyed 345 high schools in the United States which represents less than 1% (.83%) of schools that serve high school students according to the National Center for Education Statistics. Hansen et al. (2005) analyzed sleep/wake diaries of 60 incoming high school seniors and performed early morning light treatments on 19 additional students.

Another limitation to the data researched is that most of the findings rely on surveys and self-reporting. Because of the complexity and privacy issues associated with gathering and comparing actual student grades, most research must rely on self-reporting and surveys. Both of these analysis tools are highly subjective.

Implications for Future Research

While research around the topic of sleep needs and sleep/wake schedules for adolescents is abundant, there is still a huge demand for long-term research into the effects of delaying high school start times and its effect on grades and the sleep patterns of teens following these changes. Because the results on two longitudinal studies Wahlstrom (2002) and Thacher & Onyper (2016) differed in their conclusions, when it came to sleep patterns the year after a delay in high school start times, I agree with Morgenthaler et al. (2016) when they say more research in this area should be conducted. Also, since research shows that the later the start time the greater the

academic benefits to adolescents (Wahlstrom, 2016a), more research should be conducted as to what the optimal start time is.

Professional Application

When the school district where I teach began discussing the possibility of changing schedules to accommodate a delayed start time for high school students, I was extremely pessimistic. Coming from the business world and having a work schedule that demanded I be ready to go by 8:00 am on a daily basis, this concept seemed counter-productive. Since national statistics revealed only 69.7% of 2016 graduating high school students attended two or four year colleges or universities in the fall of 2016 (College enrollment and work activity, 2017), I kept asking myself, are we not missing one third of the student population and failing them when it comes to being prepared for life after high school.

As discussions heated up and more questions were hurled my way, I realized that I truly was not prepared to have meaningful discussions on this topic. From the start, the skeptic in me assumed that this decision was being made based on grades. Since school districts are always looking for methods of increasing the academic results of the student body, increasing the percentage of students passing Advanced Placement (AP) exams, and increasing federal and state standard test scores, I assumed this was another means to accomplish those results. What I found is that I needed to be better educated on the concepts of adolescent sleep, biological shifts, and sleep hygiene decisions.

Taking the results of the research analyzed into account, the decision of whether or not to delay the start time of high schools is based on more than grades. While I may not completely agree with delaying start times of high schools past 8:00 am, and still

believe that the decisions we make as parents and adolescents play a major role in the amount of sleep adolescents get at night, I will use the researched information in my classroom. As an educator, I understand the value of Madeline Hunter's model of mastery learning and try to follow this model on a daily basis. I try to start every class with an anticipatory set to make sure that students have time to change gears and begin to engage with the topic of the day.

The process of researching this topic has been a rewarding process and much useful information has been discovered. I have been approached by multiple sources to share information and discuss this topic. Not only will I be presenting my findings at department meetings in my own school, I will also be conducting an informational class for teacher professional development within the school district. With many school district in Minnesota still considering start time changes and searching for information to use in presentations, it is my desire to be a resource for these schools and participate in discussions as requested.

As a teacher of electives working in a school district where 87% of students participate in at least one after school extra-curricular activity, 47% are involved in at least one sport, and many have part times jobs, understanding the demands on student time before and after school is paramount to being the best teacher I can. I need to continually search for the best methods of maximizing student engagement while minimizing demands on time. As educators, if we are effective and efficient with our lesson planning and students are trained to make appropriate sleep hygiene decisions they can have a positive educational experience.

Conclusion

Although implementing a high school start time that aligns with adolescent biological needs has a clear scientific rationale and lack of sleep can be damaging to an adolescent's learning and health, change is difficult. As school districts begin discussions as to the possibility of aligning adolescent sleep patterns with education schedules, there are many logistical and societal obstacles that need to be addressed. Along with these obstacles, stakeholders in general, need to be better educated about this topic.

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