BARRIERS AND FACILITATING FACTORS IN DELAYING SCHOOL START TIMES

by

Julia Marie Fitzpatrick

A DNP Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2 0 1 6

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Julia Marie Fitzpatrick entitled Barriers and Facilitating Factors in Delaying School Start Times and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

_____ Date: 11/9/2016
Graciela E. Silva Torres, PhD, MPH

_____ Date: 11/9/2016
Donna B. McArthur, PhD, APRN, FNP-BC, FAANP, FNAP

_____ Date: 11/9/2016
Lori Martin-Plank, PhD, APRN, FNP-BC, NP-C, GNP-BC, FNAP

Final approval and acceptance of this DNP Project is contingent upon the candidate's submission of the final copies of the DNP Project to the Graduate College.

I hereby certify that I have read this DNP Project prepared under my direction and recommend that it be accepted as fulfilling the DNP Project requirement.

_____ Date: 11/9/2016
DNP Project Director: Graciela E. Silva Torres, PhD, MPH

STATEMENT BY AUTHOR

This DNP Project has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this DNP Project are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the copyright holder

SIGNED: Julia Marie Fitzpatrick

ACKNOWLEDGMENTS

Thank you to my committee for guiding me through this project. Thank you to my husband and daughters who tolerated seeing me infrequently throughout my schooling. Finally, thank you to my parents as I am indebted to them for their help throughout my DNP journey.

TABLE OF CONTENTS

TABLE OF CONTENTS - *Continued*

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

The majority of adolescents in the United States do not obtain the recommended amount of sleep each night. While the reasons for this are multi-factorial, early school start times effect the amount of sleep an adolescent is able to achieve each night. Biological rhythms influence adolescents to stay up later and wake up later in the morning. School districts across the country are taking notice of adolescent sleep research and delaying their start times to better match adolescents' biological rhythms. However, the majority of the schools in the United States continue to start earlier than the recommended 8:30am start time, including the school district targeted in this project. The purpose of this project was to collect data from administrators whose schools had undergone a delay in school start time on the barriers and facilitating factors they found during the implementation. This information was then shared with the local school district.

INTRODUCTION

Local Problem Description

The Great Falls school district is comprised of two traditional high schools, both of which start classes prior to 8am. Both schools offer 7am classes as an option for upperclassmen, including core classes (English) and non-core classes (stagecraft). Some students enroll in early classes so they can be released earlier for after-school jobs.

The most recent Youth Behavior Risk Survey revealed that in the county, the majority of students only obtain 7 hours of sleep on school nights (Montana Office of Public Instruction (MTOPI), 2015). Delaying school start time has been informally discussed by community members and school district employees; however, no actions have been taken by any of the schools' administrators to begin to implement such a change.

The school district uses a tiered bus system. The schools have staggered start times to allow for the buses to pick and drop off the high school and middle school students before shifting to transport elementary students. A change in high school start time would therefore impact not only the transportation of the older adolescents, but it would also affect the transportation schedule of the elementary and middle school students.

Participation in sports is very important for high school students. Both high schools in this district have achieved state championships in various sports. The prowess of the schools' athletic success is a source of pride in the community. The majority of the sports are practiced after school, with the notable exception of the cheerleading and drill teams which have traditionally held practice before school. Shifting school start times may affect practice times, as

well as have the potential to require students to miss more afternoon classes to travel for competition.

Faith is an important part of the community in Great Falls. Wednesday nights have been unofficially reserved as 'church nights' where the various denominations across town will hold youth group activities. If school activities are held on Wednesday evenings, they will often cease prior to 6pm to allow for the teens to attend their faith-based youth group activities. A later school star time may put more time constraints on extracurricular activities on Wednesday nights.

Montana has a high rate of suicide; in 2012 it had the distinction of having the third highest suicide rate in the nation (Center for Disease Control and Prevention, 2014). In the region that these high schools are located, 26% of students reported depression symptoms and 20% seriously contemplated suicide (MTOPI, 2015). Suicide and motor vehicle accidents are the most common causes of preventable death in teens in Montana (MTOPI, 2015). As described below, sleep is an important part not only of overall health, but also in mental health, good decision-making, and safety.

Available Knowledge

The National Sleep Foundation recommends that adolescents obtain eight to ten hours of sleep each night (Hirshkowitz et al., 2015), however many adolescents do not consistently achieve this (National Sleep Foundation, 2006). Middle school students average 8.4 hours of sleep on school nights, but by the time students are seniors in high school, the average sleep time drops to 6.9 hours (National Sleep Foundation, 2006). The Youth Behavior Surveillance System, a biennial survey administered to students across the United States in grades 9-12, found that

only 31.7% of students attain at least eight hours or more of sleep per night (Centers for Disease Control and Prevention, 2013). Increasing the number of students who obtain eight hours of sleep each night has been identified as a goal of Healthy People 2020 (Healthy People 2020, 2014).

As children enter adolescence, they have increased autonomy in choosing their bedtime. In addition, their circadian rhythm naturally influences them to prefer to stay up later at night and sleep later in the morning (Carskadon & Acebo, 2002). Early school start times, homework, parental involvement, extra-curricular activities and the use of electronics also play a role in how much sleep an adolescent obtains each night (Dahl & Lewin, 2002).

Studies have shown that poor sleep patterns in adolescence have been linked to social and mental health problems such as increased risk of suicide and depression (Fredrickson, Rhodes, Reddy, & Way, 2004; Goldstein, Bridge, & Brent, 2008; Roberts & Duong, 2012), as well as increase in risk-taking activities such as the use of nicotine, alcohol, and marijuana (Catrett & Gaultney, 2009; McKnight-Eily, Easton, Lowry, Croft, Presley-Cantrell, & Perry, 2011; Pasch, Latimer, Cance, Mode, & Lytle, 2012). Less than optimal sleep has also been linked to poorer academic performance and increased behavioral problems in school (Gregory & O'Connor, 2002; Merikanto, Lahti, Puusniekka, & Partonen, 2013). Chronic sleep deprivation has been linked to a decreased resistance to common infections (Orzech, Acebo, Seifer, Barker, & Carskadon, 2014), an increase in body mass index in early adolescence (Lumeng et al., 2007; Nielsen, Danielson, & Sorensen, 2011; Snell, Adam, & Duncan, 2007), and an increase in cardiometabolic risk (Iglayreger et al., 2014). In contrast, healthy sleep patterns in adolescents are associated with a balanced healthy diet, an increased amount of overall physical activity, and

an awareness of personal responsibility towards one's health (Chen, Wang, & Jeng, 2006; Foti, Eaton, Lowry & McKnight-Ely, 2011).

Interventions designed to influence healthier sleep habits in adolescents have succeeded in improving sleep knowledge, but have fallen short in imparting a behavioral change (Cain, Gradishar, & Moseley, 2011; Mosley & Gradishar, 2009). Research has shown that adolescents may have little internal motivation to change their sleep behaviors, which is difficult to overcome when trying to influence a behavioral change (Mosley & Gradishar, 2009).

The reasons why adolescents fail to obtain the suggested amount of sleep each night is multifactorial. Among these are changes in their physiological and biological rhythms. Changes in adolescents' brains signal them to stay up later and wake up later as they enter and move through puberty (Crowley, et al., 2014; Sadeh, Dahl, Shahar, & Rosenblat-Stein, 2009).

It is anticipated that school start times can be more easily manipulated than biological rhythms. The adjustment of school start times in some school districts has been found to be successful in assisting adolescents to obtain sufficient sleep on school nights (Boergers, Gable, & Owens 2014; Owens, Belon, & Moss, 2010). The American Academy of Pediatrics recommends that middle school and high school classes should optimally start no earlier than 8:30am (Adolescent Sleep Working Group, 2014). However, across the United States, less than 18% of High Schools begin classes after 8:30am (Wheaton, Ferro, & Croft, 2015).

Delays in school start times have been associated with improved emotional stability and increased optimism (Perkinson-Gloor, Lemola, & Grob, 2013). Other studies have also found an improvement in mood, as well as a decrease in caffeine use (Boergers, Gable, and Owens, 2014). Academic advancement has been mixed. Some studies have demonstrated no significant effect

(Wahlstrom, 2002; Hinrichs, 2011) but further studies have shown a positive effect on academics as well as a decrease in absences and tardiness (Asarnow, McGlinchey, & Harvey, 2014; Lufi, Tzischinsky, & Hadar, 2013). Owens and Belon (2010) found that the percentage of students obtaining less than 7 hours of sleep per night decreased by 79% after a 30 minute delay in start time. In addition, studies have revealed an additional community safety benefit: a decrease in adolescent motor vehicle crashes (Danner & Phillips, 2008; Vorona, Szklo-Coxe, Lamichhane, Ware, McNallen, & Leszczyszyn, 2014).

Although information regarding the benefits of delayed school start times has been published, there is a lack of disseminated knowledge regarding the barriers and facilitating factors to implement a delayed school start time. A systematic review on delayed school start times prepared by Minges and Redeker (2015) found that there is a lack of information regarding barriers, as well as facilitating factors, in placing the delay of school start times into practice. Theorized barriers include: increased transportation costs, extra-curricular scheduling pressures, traffic congestion, and lack of community education regarding adolescent sleep needs (Wheaton et al., 2015). This project seeks to add to the literature by identifying and describing barriers that administrators found during implementation of a delayed school start time in their district as well as identifying facilitating factors in the process.

Framework

The social ecological model of health provides the framework for this project. This model describes the health behavior of an individual as being influenced by multiple factors including: individual decisions, interpersonal relationships, organizational influences, community influences, the physical environment, and public policy (Sallis, Owen, & Fisher, 2008). It is not

sufficient to have knowledge regarding a health behavior change and an intention to change if extrinsic factors do not align with the desired behavior change. The use of the social ecological model attempts to provide support by the way of providing opportunities to guide adolescents towards obtaining good sleep.

Interpersonal influences include the adolescent's social network, family, teachers, and healthcare providers. Development of a peer group that prioritizes sleep can serve as a positive role model for the adolescent, taking advantage of the adolescent's need to fit in with peers (Sanders, 2013). The role of parents as role models remains important in adolescence, especially in the areas of attitudes towards health choices, behavioral norms, and social expectations (Williams, Burton, & Warzinski, 2014). Teens that have parents who set a school-night bedtime sleep better (Short, Gradisar, Wright, Lack, Dohnt, & Carskadon, 2011). Some researchers suggest that peer and school influences may be more important in the development of healthy sleep patterns than the internal biological drive to stay up later (Maume, 2013).

Adjusting school start times is an intervention that can be used at the organizational level to promote adequate sleep time. Organizational influences include both school and extra-curricular groups. They consist of peers and role models, therefore playing an important role in the expectations and organization of the adolescent's day. Involvement in extra-curricular activities is associated with good health choices (Modecki, Barber, & Eccles, 2014); nonetheless they may be a source of stress due to time constraints (Suldo, Shaunessy, Thalji, Michalowski, & Shaffer, 2009). Sleep time may be reduced as a priority if the demands of extra-curricular activities are unmanageable. Extra-curricular involvement must allow the teen enough time to fulfill school and sleep needs. Moving the school start time to a later time may provide the

largest and most efficient amount of time available for the student to sleep. An open dialogue with the coordinators of extra-curricular activities is necessary to ensure that the later school start time does not result in a later bedtime due to time constraints.

Specific Aims

The study question is: Among school district administrators who have employed a delay in school start time, what barriers and facilitating factors did they identify during implementation planning?

The purpose of this project is to survey administrators in schools that have completed a change to delay in school start times in order to identify barriers and facilitating factors that made the adjustment possible. Identification of these barriers and facilitating factors can be used in addition to the biological science of delayed school start times to enable school district administrators to evaluate the benefits of adopting this policy.

Aggregated de-identified information regarding the results of this project, as well as the science behind delaying school start times, will be shared with the Great Falls Public School District administrators, school board, and local principals (Appendix A). This author's intention is to secure an audience at a school board meeting to impart a ten minute presentation on adolescent sleep, school start times, and the findings of this project. By providing information on the barriers and facilitating factors of implementing a delayed school start time, it is hoped to increase the likelihood of the school board and administrators to seriously consider implementing a delayed school start time in their district. The author has also proposed a public service announcement in conjunction with the local hospital, which is interested in filming next spring. To reach parents of future high-school students, the author will contact the Parent Teacher

Association (PTA) of both middle schools to give a short presentation and post a link to the opinion article on their Facebook pages. The intention with the additional exposure is to not only educate, but to also identify additional champions of the cause.

METHODS

Context

Respondents will be administrators: superintendents, assistant superintendents, principals, vice-principals, school board members, and counselors who currently work in a school that has been identified as having undergone a delayed school start time as identified by the American Sleep Foundation (startschoollater.net/success-stories). There are 128 districts or schools in the United States listed on this site that have implemented a delayed school start time as of November 14, 2015. Respondents are limited to those who have an email address publically available on the internet. A total of 1,601 emails were distributed to potential respondents using the Qualtrics survey platform. A copy of the email, which contained a link to the survey and informed consent, is found in Appendix B.

Intervention

A copy of the barriers and facilitating factors survey (henceforth referred to as BFFS) is included in Appendix C. Each participant received an email with a link to the BFSS and consent. Data collection was open for one month, with a goal of at least a 10**%** response from the 1,601 administrators contacted. A reminder with a link to complete the BFFS was emailed at 7 days, 14 days, and 21 days.

Study of Intervention

Personalization of the invitation to complete web-based surveys and follow-up reminders sent once a week has been found to increase the response rate (Sanchez-Fernandez, Munoz-Leiva, & Montoro-Rios, 2012). Therefore both were utilized in this project.

The advantages to internet survey administration include low cost, the ability to reach a large number of persons, and the potential for a quick return rate (Fowler, 2013). The disadvantages to administering an internet survey may include: poor response rate, inability of respondents to ask clarifying questions, and difficulty obtaining a comprehensive address list. It is assumed that school district administrators and counselors have universal access to email and the internet. This project is dependent on the validity of the information provided by startschoollater.net, which provides information to identify the target population. Startschoollater.net is a non-profit organization whose interest lies in collecting and disseminating information regarding later school start times (schoolstartlater.net). The accuracy of information provided by each school district's websites regarding email addresses and the supposition that the administrators listed were present during the change in school start time is also a key assumption in the identification of the target population.

Measures

Qualtrics, an online, email based survey software (qualtrics.com) was utilized to format and distribute the survey. The BFFS contains fifteen questions that are a mix of Likert scales and multiple choice questions, with three areas available for free text if the respondent wishes to elaborate. The questions were selected based on previous publications (Minges & Redeker, 2015), as well as input from sleep scientists at the University of Arizona.

Question one listed 31 items considered to be barriers for implementation of a delayed school start time by previous schools that have implemented the change. Respondents were asked to rate if the item was considered a 'significant', 'moderate', or 'minor' barrier or 'not a barrier' or 'not applicable' in implementing a delayed start time for their school. Question three listed 36 items considered to be facilitating factors for the implementation of a delayed school start time. Respondents were asked to rate each facilitating factor as 'significant', 'moderate', 'minor', 'not a facilitating factor', or 'not applicable'. Question ten listed 13 items considered to be improvements since the implementation of a delayed school star time (e.g. less sleeping in class, or improved student satisfaction). Respondents were asked to consider each statement and score each if they agreed, disagreed, or were neutral regarding each statement. The survey was anticipated to take no longer than 15 minutes to complete.

Face validity of the BFFS was obtained through a review of the tool by four experts in the field of sleep medicine at the University of Arizona. Face validity is a measure of whether an instrument appears to measure what is intended to measure (Polit & Beck, 2012). In this case, it was necessary to validate whether the results from the survey appeared to sufficiently identify barriers and facilitating factors concerning the implementation of a school start time. The recommendations of the aforementioned experts were incorporated into the final tool. In addition the BFFS was found to be appropriate and applicable by the University of Arizona Institutional Review Board to be used by human subject participants.

Analysis

Data analysis was completed using descriptive statistics. The frequency of each barrier and facilitator is described, as are answers to the other questions. In addition, the free text

questions were analyzed for frequency of common themes of barriers or facilitating factors that were not previously identified in the BFFS. Chi square tests were performed to evaluate differences in distributions between categorical variables.

Ethical Considerations

The respondents were not required to identify themselves or submit any identifying information such as race, age, or sex. This allowed respondents to take the survey using total anonymity. The survey was completely voluntary and no compensation was associated with completion. A disclosure statement was integrated into the survey. If the participant at any time wished to stop the survey, they were able to do so without repercussion. The school administrators surveyed were from varying parts of the country, with the hope that the final results of the survey encompassed differing ethnic and socioeconomic backgrounds. However to keep the survey results anonymous, this type of data was not collected. Human subjects IRB approval was obtained from University of Arizona.

RESULTS

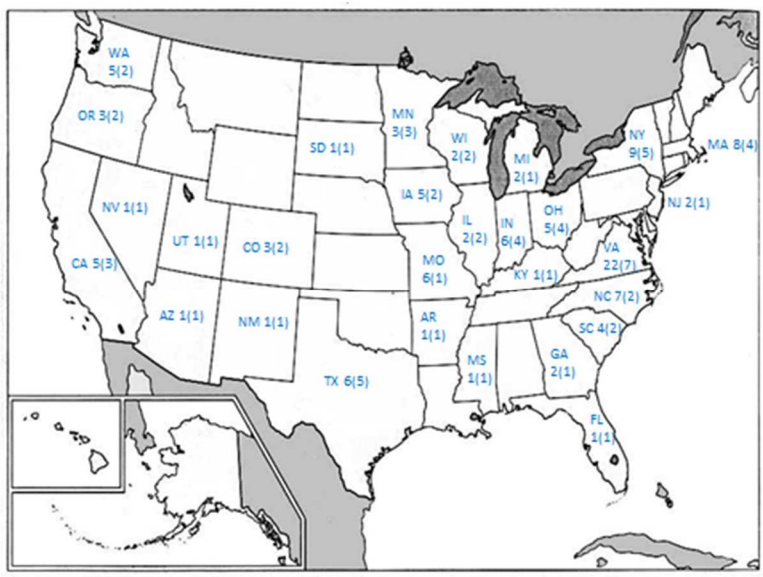
Data Analysis and Outcomes

The BFFS was completed by 116 respondents. Participants were not required to answer each question contained in the BFFS. Therefore, the total number of respondents who answered each question varied. Completion was defined by clicking on the red completion button at the end of the BFFS. Socioeconomic and racial information regarding the school or the respondent were not collected, however, job title of the respondent and the school district from which they worked were collected. Table 1 summarizes the percent distribution of the job titles of the respondents, while Figure 1 illustrates the regions from which the respondents submitted their

answers. Respondents to the BFFS were from diverse parts of the United States, with no particular clustering. It was possible for multiple respondents to be from the same school district as we surveyed multiple levels of administration from each district.

Table 1. *Percent of Respondents by Job Title*

Title	Percent % (N)
Superintendent	7.8 (9)
Assistant Superintendent	16.4 (19)
Principal	20.7 (24)
Assistant Principal	42.2 (49)
Counselor	11.2 (13)
School Board Member	1.7 (2)
TOTAL	**100 (116)**



Key: Number of Participants per State (Number of Different School Districts Represented per State)

Figure 1. Distribution of Respondents across the United States and Number of Different School Districts Represented

Table 2 summarizes the number of years that the delayed school start time had been implemented by the respondents. Figure 2 illustrates the percentage of respondents whose district or school had 'flipped' elementary and high school start times. In the BFFS, 'flipping' an

elementary and high school start time was understood to mean that the elementary start time was adjusted to the previous high school start time, and the new high school start time was now when the elementary school had previously started.

Table 2. *Number of Years Since the Delay of School Start Time*

Length of Delay in place	Percent% (N)
1 year	9.3 (10)
2 years	24.3 (26)
3 years	16.8 (18)
4 years	14.0 (15)
5 years	11.2 (12)
more than 5 years	24.3 (26)
Total	**100 (107)**

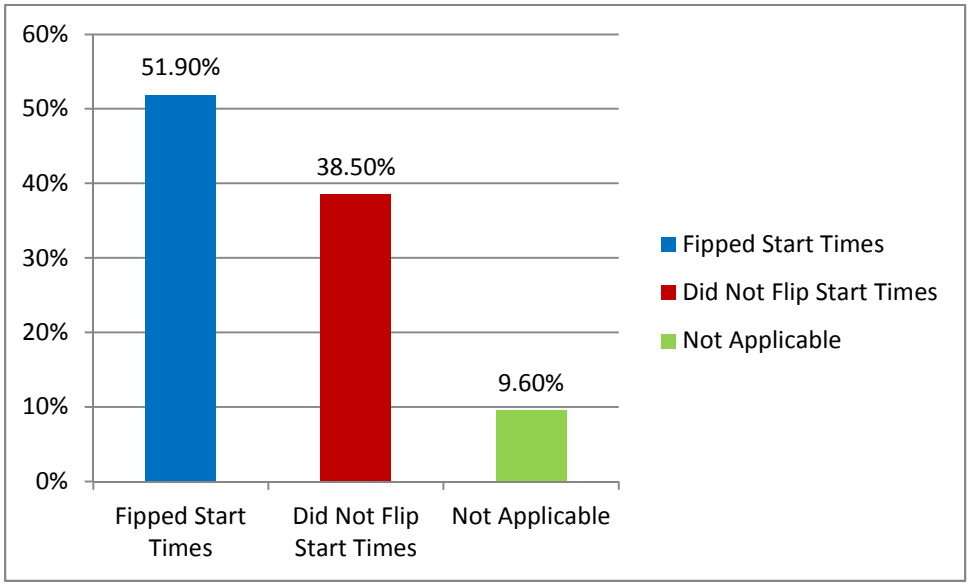


Figure 2. Percentage of Respondents who 'Flipped' Elementary and High School Start Times

The BFFS was organized and analyzed into five major groupings: 1) barriers to implementing a delayed school start time, 2) facilitating factors in implementing a delayed school start time, 3) improvements recognized by the administrators after implementation of the change, 4) if the respondent would recommend a delay in start time, and 5) total amount of time delayed. These five categories are detailed below. The data was analyzed utilizing SPSS for

frequencies as well as chi square analysis to determine associations between categorical variables.

Barriers in the Implementation of a Delayed School Start Time

As respondents read through each proposed barrier on the BFFS, they could choose if they felt the barrier was 'significant', 'moderate', 'minor', 'not a barrier', or 'not applicable.' The 'not a barrier' and 'not applicable' data were combined during post-survey analysis and categorized as 'not a barrier'.

First, we analyzed the barriers that were most likely to be marked 'significant'. The most commonly cited 'significant' barrier was *school-based athletes missing more afternoon classes to attend to or travel to games*. This was followed by *use of a tiered school bus transportation system*, *less after school time for athletic activities*, *club-based athletes missing more afternoon classes to attend to or travel to games*, *family members resistant to change schedule*, and *elementary students would be waiting for bus pick-up in the early morning*, *in the dark*. See the complete list of the top ten barriers rated as 'significant' in Figure 3.

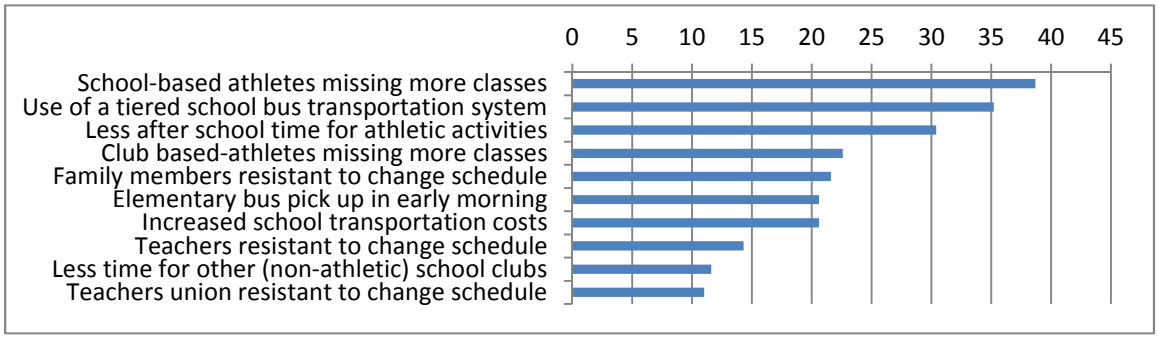


Figure 3. Top Ten Barriers Marked as 'Significant' by Respondents (Percent)

Next we were interested in which categories were most likely agreed to be a barrier among respondents. We did this as personal definitions of 'significant', 'moderate', and 'minor',

may vary between respondents. To analyze this, we combined the frequencies of the 'significant', 'moderate', and 'minor' responses into one category. We felt that by adding together barrier frequencies, we were able to best capture what scenarios were most commonly seen as a barrier in general. Table 3 shows barriers organized by overall barrier frequency, followed by the breakdown of 'significant' 'moderate' and 'minor' and 'not a barrier'.

Table 3. ***Distribution of Top 10 Barriers for School Start Time Delay as 'Significant', 'Moderate', or 'Minor'***

Barrier	Combined Barrier %(N)	Significant Barrier %(N)	Moderate Barrier %(N)	Minor Barrier %(N)	Not a Barrier %(N)
School-based athletes missing more afternoon classes to attend or travel to games	84.2 (96)	37.7 (43)	26.3 (30)	20.2 (23)	15.8 (18)
Less after school time for athletic activities	80.7 (92)	29.8 (34)	26.3 (30)	24.6 (28)	19.3 (22)
Family members resistant to change schedule	78.9 (90)	21.1 (24)	32.5 (37)	25.4 (29)	21.1 (24)
Unavailability of adolescents to provide after school care for siblings	75.6 (87)	10.4 (12)	33.9 (39)	31.3 (36)	24.4 (28)
Use of a tiered school bus transportation system	71.1 (81)	32.5 (37)	23.7 (27)	14.9 (17)	28.9 (33)
Teachers resistant to change schedule	74.8 (86)	13.9 (16)	26.1 (30)	34.8 (40)	25.4 (29)
Elementary students would be waiting for bus pick up in the early morning	69.6 (78)	18.8 (21)	33.0 (37)	17.9 (20)	30.4 (34)
Students resistant to change their schedule	63.5 (73)	7.0 (8)	20.9 (24)	35.7 (41)	37.4 (42)
Less time for adolescents to work	65.8 (75)	10.5 (12)	26.3 (30)	29.0 (33)	34.2 (39)
Increased school transportation costs	58.4 (66)	18.6 (21)	18.6 (21)	21.2 (24)	41.6 (47)

There is a small difference between the barriers marked as 'significant' and the combined frequency of the barriers. The following barriers were among the top ten barriers marked as 'significant' but their combined barrier frequencies were not in the top ten: *club athletes missing more classes*, *less time for other (non-athletic) school clubs*, and *teacher's union resistance to change*. This may imply that if these barriers were present, they were likely to be a significant barrier to overcome, but that these barriers were not present in all districts. Likewise, *student*

resistance to change their schedule, *less time for students to work after school*, *and inability to provide childcare* were found to be among the top ten in the combined barrier frequencies; however, they were not among the top ten barriers that were rated as 'significant'. These barriers may be commonly found across districts, but are uncommonly found to be a significant barrier to overcome.

In addition, 20 respondents provided additional comments under the free text comment for 'barriers' concerning "any other perceived barriers or any other comments on barriers in general". One survey respondent commented that their athletes missed even more afternoon classes than before as now the team bus was driving to events during rush-hour traffic, and had to leave school earlier to accommodate for this. Another survey respondent noted that their athletic conference delayed the start of games to coincide better with the school's delayed release time, which other schools in the conference found disruptive. Yet other respondents noted that the delay in start time and the subsequent delay in athletic practices resulted in some outdoor sports, like golf, tennis or junior varsity field hockey, were finishing their games or practices in the dark during certain times of the year.

Comments that could be perceived as new or undescribed barriers listed in the free text section included: "*surrounding communities not on the same schedule"* and *"educating the community about the pros of a late start time"*. The later comment may be describing the difficulty in conducting and organizing community-wide education regarding delayed school start times. The logistics of how education was conducted was not asked in this survey, but should be considered for future research.

One section of the BFFS assessed barriers associated with resistance to change among varied groups. Family resistance to change was cited as both the most 'significant' as well as the most 'moderate' barrier to overcome (See Table 4 and Figure 3).

Table 4. ***Groups and their Resistance to Change School Start Times, Analyzed by the Barrier being 'Significant', 'Moderate', or 'Minor'***

	Significant Barrier % (N)	Moderate Barrier % (N)	Minor Barrier % (N)
Family resistant to change	21.6 (24)	33.3 (37)	26.1 (29)
Teachers resistant to change	13.8 (16)	26.8 (30)	35.7 (40)
Teacher's Union resistant to change	11.0 (10)	20.9 (19)	31.9 (29)
Students resistant to change	7.1 (8)	21.4 (24)	36.6 (41)
Support staff resistant to change	7.1 (8)	8.0 (9)	39.3 (44)
Childcare providers resistant to change	6.75 (7)	14.3 (15)	36.2 (38)
Community resistant to change	4.7 (5)	12.3 (13)	22.6 (24)
Bus drivers resistant to change	3.9 (4)	9.8 (10)	24.5 (25)
Administration resistant to change	3.6 (4)	10.7 (12)	27.7 (31)
Spiritual community resistant to change	1.0 (1)	4.1 (4)	17.3 (17)

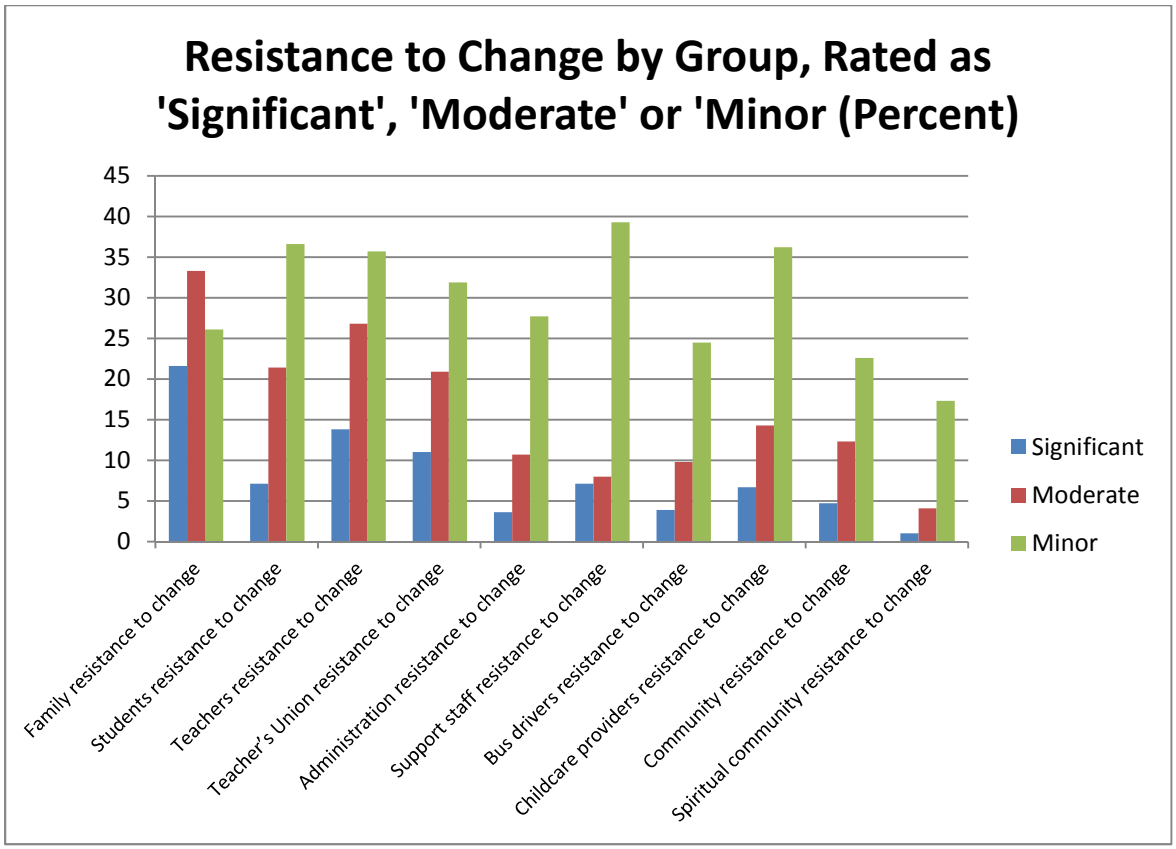


Figure 4. Groups Described as Resistant to Change, Analyzed by the Barrier being 'Significant', 'Moderate', or 'Minor' (Percent)

The following were not considered to be barriers by over 60% of the respondents: *spiritual organizations resistant to change schedules*(77.6%), *no organized transportation (school or city buses) to transport athletes home after practice*(63.2%), *bus drivers resistant to change their schedule* (61.8%), and *community (non-spiritual) resistant to change in schedule* (60.4%).

Facilitating Factors in the Implementation of a Delayed School Start Time

The facilitating factors were examined in a similar fashion as the barrier factors. We first ranked the facilitating factors by how many times they were rated as 'significant' (Figure 5). We then combined the frequencies of the 'significant', 'moderate', and 'minor' ranks to create a combined facilitating factor frequency (Table 5). The most commonly cited facilitating factor was *involvement of school administrators in the decision-making process*, followed by *sleep education for family*, and *sleep education for school administrators*.

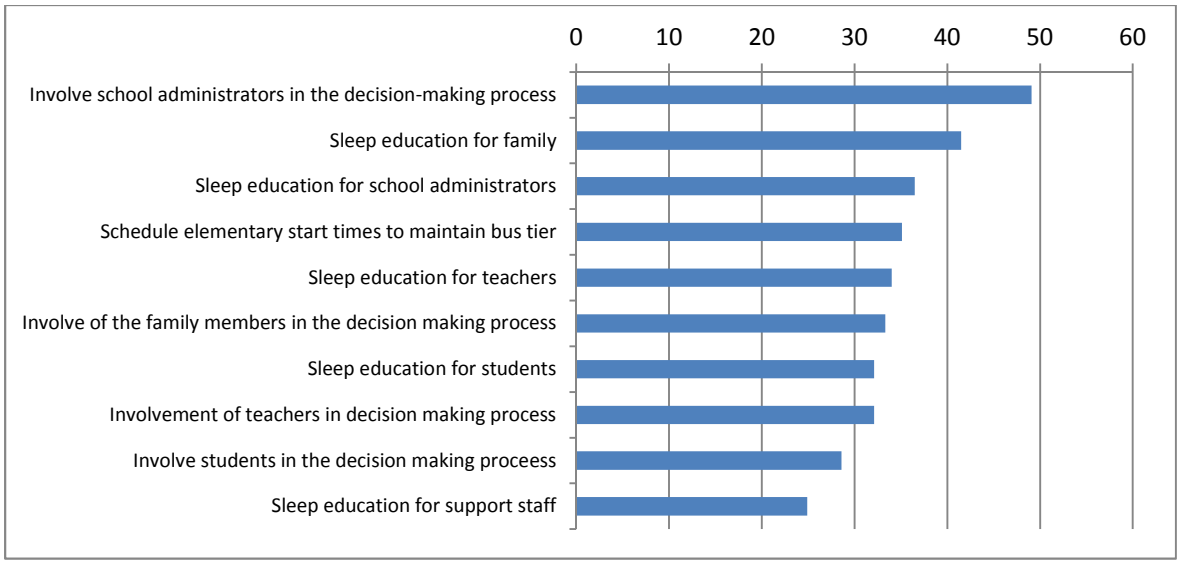


Figure 5. Top Ten Facilitating Factors Marked as 'Significant' by Respondents (Percent)

Table 5. ***Distribution of the Top 10 Facilitating Factors for School Start Time Change marked as 'Significant', 'Moderate', or 'Minor'***

Facilitating Factor	Combined Facilitating Factor %(N)	Significant Facilitating Factor %(N)	Moderate Facilitating Factor %(N)	Minor Facilitating Factor %(N)	Not a Barrier %(N)
Involvement of the teachers in the decision-making process	84.5 (93)	31.0 (34)	34.6 (38)	19.1 (21)	19.1 (21)
Involvement of school administrators in the decision-making process	84.4 (92)	47.7 (52)	23.9 (26)	12.8 (14)	15.6 (17)
Providing education on adolescent sleep patterns for students	83.5 (91)	31.2 (34)	32.1 (35)	21.2 (22)	16.5 (18)
Providing education on adolescent sleep patterns for family members	82.5 (90)	40.1 (44)	27.5 (30)	14.7 (16)	17.4 (19)
Providing education on adolescent sleep patterns for teachers	81.5 (88)	32.4 (35)	31.5 (34)	17.6 (19)	18.5 (20)
Involvement of the family members in the decision making process	80.9 (89)	31.8 (35)	30.0 (33)	19.1 (21)	19.1 (21)
Involvement of students in the decision making process	79.1 (87)	27.3 (30)	31.0 (34)	21.0 (23)	21.0 (23)
Providing education on adolescent sleep patterns for school administrators	77.1 (84)	34.9 (38)	31.5 (34)	17.6 (19)	22.9 (25)
Ability to schedule elementary start times to maintain bus tier system	74.5 (82)	30.0 (33)	26.9 (29)	18.5 (20)	23.6 (26)
Involvement of support staff in the decision-making process	70.4 (76)	16.7 (18)	23.2 (25)	30.6 (33)	29.6 (32)

The top ten facilitating factors marked as 'significant' and the top ten combined frequency factors contained the same facilitating factors, but in a different order. In addition, *providing sleep education for support staff* was found in the top ten of 'significant' facilitating factors, but absent from the combined frequencies of facilitating factors as *involvement of support staff* was instead present at number 10. The similarity between the top ten facilitating

factors marked as ‘significant’ and the top ten frequencies suggests that these are consistently found to aid the change to delay school start time.

Involving teachers, administrators, parents, and students in the decision-making process, as well as providing them with education regarding adolescent sleep were regularly found to be the most common overall facilitating factors. Education and involvement of those parties in the decision-making process were also found most likely to be rated as a ‘significant’ facilitating factor.

Moving activities to earlier in the day, be it athletic, school-sponsored, or other were not commonly found to be facilitating factors. Moving activities to before school undermines the effort to allow adolescents to utilize the extra time in the morning to sleep. Approximately 55% of respondents indicated that they did not move athletic practices to before school to make up time. Additionally, 50% of respondents indicated that they did not move school sponsored extracurricular/club (non-athletic) activities to before school. In addition, the majority of respondents did not feel that moving philanthropic-sponsored events (78.9%), spiritual sponsored events (76.8%), or community –sponsored events (78.7%) to before school were facilitating factors.

However, 46.4% of respondents replied that their schools provided an option for students to enroll in classes that started earlier than the delayed start. Offering early classes were found to be linked to a higher rate of improved teacher satisfaction, less sleeping in class, less tardiness, less absences, improved attention during early morning classes, and improved student and family satisfaction (Table 6).

Table 6. *Associations of Improvements Found with "Offering of Early Classes"*

Improvements Seen		Offers Optional Early Classes %(N)	Does not Offer Optional Early Classes %(N)	p value*
Improved Teacher Satisfaction	Agree	93.3 (28)	69.0 (29)	.012
	Disagree	6.7 (2)	31.0 (13)	
Less sleeping in class	Agree	87.5 (28)	65.8 (25)	.035
	Disagree	12.5 (4)	34.2 (13)	
Less Tardiness	Agree	73.5 (25)	50.0 (19)	.041
	Disagree	26.5 (9)	50.0 (19)	
Less Absences	Agree	70.8 (17)	44.1 (15)	.044
	Disagree	29.2 (7)	55.9 (19)	
Improved Student Satisfaction	Agree	87.1 (27)	70.0 (28)	.087[a]
	Disagree	12.9 (4)	30.0 (12)	
Improved Attention in Early Morning Classes	Agree	90.9 (30)	70.3 (26)	.031
	Disagree	9.1 (3)	29.7 (11)	
Improved Family Satisfaction	Agree	80.8 (21)	60.0 (21)	.083[a]
	Disagree	19.2 (5)	40.0 (14)	

*p-value for Chi-square test

[a]may be statistically significant if the sample size were larger

Allowing students to choose to take a class prior to the start of the school day may allow natural 'larks', that is persons who prefer to rise earlier and go to bed earlier, to take advantage of their individual biology while allowing the majority of adolescents to follow the 'owl' schedule where they are allowed to wake at a more biologically natural time. The improved teacher satisfaction could suggest that teachers who also are 'larks' may appreciate the ability to

still start their day early, while teachers who are not larks enjoyed the later start time and the ability to start their day later. We postulate that schools which offered early morning classes may have delayed their start time by at least a class period, which then would allow the 'owls' to obtain at least 30min more of sleep each morning, and which then translated into the decrease in tardiness and absences.

In the free text area of the BFFS, a number of novel facilitating factors were identified. One respondent noted that they involved doctors and experts from a local university in providing education to the community. Another respondent stated that they redesigned the high school day to provide a block of time in the middle of the day for the purpose of club meetings or for students to obtain extra help. Yet another respondent stated that with the buses running more often, they were able to attract more high quality drivers as the drivers' salaries, were increased. Flipping the elementary and high school start time was found to be beneficial to parents of the elementary students. As one respondent noted, as many elementary students no longer had to attend daycare prior to starting their school day as the new elementary start time coincided with most parents' work schedules. Sharing data collected after the implementation with the stakeholders was also noted to be a facilitating factor, as was education of the school board.

Improvements Seen

Sixty percent of respondents agreed that adolescent sleep either *improved* or *somewhat improved* after the delay in start time. A list of thirteen options were provided in the BFFS to assess if the respondent had observed any changes since they had implemented the start time. These included items as, *improved teacher satisfaction* or *improved student satisfaction* as well as hypothesized improvements or improvements found in the literature as described above such

as *less sleeping in class*, *decreased tardiness*, or *improved schoolwork*. The respondents were able to choose 'agree', 'neutral', or 'disagree' in regards to each statement. The statements that were most frequently marked as 'agree' are summarized in table 7.

Table 7. ***Most Frequently Marked as Improvements Seen After a Delay in Start Time***

Improvement	Percent % (N)
Improved administrator satisfaction	57.1 (60)
Improved teacher satisfaction	54.3 (57)
Improved attention during early classes	53.3 (56)
Improved student satisfaction	52.4 (55)
Less sleeping in class	50.0 (53)
Less tardiness	41.9 (44)
Improved support staff satisfaction	41.4 (43)
Improved family satisfaction	40.0 (42)

Prior School Start Time

Most school districts began school classes between 7:01 - 8:00am (74.7%) prior to the delay. Only two respondents reported that they started prior to 7:01am. In our study, schools that had an initial start time prior to 8:01am saw the most benefits of a delayed start time (table 8).

Table 8. ***Significant Improvements Seen Among Schools Whose Initial Start Time was Prior to 8:01am***

Improvement		Initial Start Time Prior to 8:01am % (N)	Initial Start Time After 8:01am %(N)	p value*
Less Sleeping In Class	Agree	83.6 (46)	38.5(5)	.003
	Disagree	16.4 (9)	61.5 (8)	
Improvement in Schoolwork and Grades	Agree	76.5 (26)	33.3 (3)	.014
	Disagree	23.5 (8)	66.7 (6)	
Less Tardiness	Agree	69.0 (40)	16.7 (2)	.001
	Disagree	31.0 (18)	83.3 (10)	
Improved Attention During Early Morning Classes	Agree	84.2 (48)	58.3 (7)	.043
	Disagree	15.8 (9)	41.7 (5)	
Less Absences	Agree	61.4 (27)	30.8 (4)	.052[a]
	Disagree	38.6 (17)	69.2 (9)	

p value for Chi-squared test

[a]Not statistically significant, but may be if sample size were large

Time Delayed to New School Start Time

Most respondents (45.8%) reported that they delayed their school start time anywhere from 30-49 minutes. A comparison between the number of minutes delayed and the school's prior start time is found in Table 9. Twenty-eight (26.7%) respondents reported that their start time was delayed 60 minutes or more.

Table 9. ***Comparison of Minutes Delayed and Start Time Prior to Delay***

		Start Time Prior to Delay						
		Before 6:30am	6:31-7am	7:01 – 7:30am	7:31 – 8am	8:01 – 8:30 am	After 8:30am	**Total**
Minutes delayed	<20min	0	0	1	1	0	3	**5**
	20-29min	0	0	3	5	2	1	**11**
	30-39min	0	0	9	5	10	0	**24**
	40-49min	0	0	16	7	1	1	**25**
	50-59min	0	0	3	5	4	0	**12**
	60min or more	1	1	15	10	0	1	**28**
Total		**1**	**1**	**47**	**33**	**17**	**6**	**105**

As the number of minutes of the delay increased, the respondent was significantly more likely to mark 'agree' with the following statements: *improved attention during early morning classes* (p-value .035), *improved school work and grades* (p-value .170), and *less sleeping in class* (p-value .221). While the last two were not statistically significant in our small study, with a larger sample size, they could be found to be significant.

Recommendations for a Delayed Start Time

Eighty-five respondents (79.1%) would recommend that other districts pursue a delayed start time while 23 respondents (20.9%) stated they would not recommend it. The majority of the persons who would not recommend were in either the first or second year of the delay (47.6%).

This could suggest that some of the persons who did not recommend other schools to delay school start times would be part of the 'late majority' or 'laggard' groups when we consider Roger's Diffusion of Innovation theory (Rogers, 2010). Persons belonging to the 'late majority' approach change with skepticism, even after the majority of the group has accepted the change, while persons belonging to the 'laggard' group are the last to adopt change and usually feel that 'traditions' are important. If this group was re-surveyed in a couple of years, we may find that more of them feel that the delaying of school start times was a positive and influential change.

A chi-squared analysis was completed comparing *would you recommend a delayed start time* and the *improvements seen* and *did adolescent sleep improve* sections of the BFFS. Persons who would recommend a delayed start time were more likely than persons who would not recommend to experience positive changes associated with a delay in school start time. We found that persons who marked that they would not recommend a delayed start time were more likely to disagree that any positive changes had occurred since the delay in start time took place (Table 10). Of the respondents who would not recommend a delay in start time, none of them (0.0%) agreed with the statement that the delay resulted in an improvement in adolescent sleep, but 21 persons (91.3%) of persons who would not recommend a delay in start times did agree that adolescent sleep improved 'somewhat'. Of persons that would recommend a delayed start time, 33 persons (38.8%) of persons agreed that adolescent sleep improved, while another 11 persons (12.9%) marked that adolescent sleep improved 'somewhat'.

Table 10. ***Comparison of "Who Would Not Recommend a Delay" by Improvements***

Improvement		Would recommend delay %(N)		p value*
		Yes	No	
Less sleeping in class				
	Agree	60.2 (50)	13.6 (3)	<.0001
	Neutral	33.7 (28)	31.8 (7)	
	Disagree	6.0 (5)	54.5(12)	
Less tardiness				
	Agree	51.2 (42)	4.5 (1)	<.0001
	Neutral	32.9 (27)	27.3 (6)	
	Disagree	15.9 (13)	68.2 (15)	
Less absences				
	Agree	37.8 (31)	4.8 (1)	<.0001
	Neutral	46.3 (38)	33.3 (7)	
	Disagree	15.9 (13)	61.9 (13)	
Improved schoolwork/grades				
	Agree	36.6 (30)	0.0 (0)	<.0001
	Neutral	58.5 (48)	54.5 (12)	
	Disagree	4.9 (4)	45.5 (10)	
Improved attention in early morning classes				
	Agree	65.9 (54)	9.1 (2)	<.0001
	Neutral	29.3 (24)	45.5 (10)	
	Disagree	4.9 (4)	45.5 (10)	
Improvement in family satisfaction				<.0001
	Agree	49.4 (41)	4.8 (1)	
	Neutral	42.2 (35)	38.1 (8)	
	Disagree	8.4 (7)	57.1 (12)	
Improvement in student satisfaction				<.0001
	Agree	62.2 (51)	13.6 (3)	
	Neutral	31.7 (26)	36.4 (8)	
	Disagree	6.1 (5)	50.0 (11)	
Improvement in teacher satisfaction				
	Agree	65.1 (54)	14.3 (3)	<.0001
	Neutral	32.5 (27)	23.8 (5)	
	Disagree	2.4 (2)	61.9 (13)	
Improvement in support staff satisfaction				<.0001
	Agree	50.6 (41)	9.1 (2)	
	Neutral	46.9 (38)	36.4 (8)	
	Disagree	2.5 (2)	54.5 (12)	
Improvement in administrator satisfaction				<.0001
	Agree	68.3 (56)	13.6 (3)	
	Neutral	26.8 (22)	31.8 (7)	
	Disagree	4.9 (4)	54.5 (12)	
Improvement of bus driver satisfaction				
	Agree	16.0 (13)	4.5 (1)	<..0001
	Neutral	74.1 (60)	50.0 (11)	
	Disagree	9.9 (8)	45.5 (10)	
Improvement of community satisfaction				
	Agree	16.0 (13)	0.0 (0)	<.0001
	Neutral	75.3 (61)	59.1 (13)	
	Disagree	8.6 (7)	40.9 (9)	
Improvement of spiritual community satisfaction				
	Agree	8.5 (7)	0.0 (0)	.001
	Neutral	81.7 (67)	59.1 (13)	
	Disagree	9.8 (8)	40.9 (9)	

*p value for Chi-squared test

DISCUSSION

Relationship of Results to the Framework

Delaying school start times is a solution that affects the adolescent on the community level of the social ecological model. This study adds to the evidence that making changes at the community level can impact the health of the individual. The social ecological model can also be used to categorize the various barriers that have been identified in making a delay in school start times. There are individual barriers (less time for adolescents to work), interpersonal barriers (family resistance to change), organizational barriers (athletic practices and games) and community barriers (childcare providers who are resistant to change their schedules). While our study showed that there were common barriers, it also demonstrated that the significance of each barrier varies. Some districts may find that barriers on the community level may be the most difficult to overcome, such as asking the community for support to increase the school district budget for more transportation funding, while other districts may find that barriers on the organizational level may be the most significant barrier to overcome, such finding time for extra-curricular activities. The facilitating factors are also found among the different levels of the socioecological model. Education and shared-decision making were found to be significant facilitating factors in this study. Successful school districts indicated that they employed these at varying degrees at the individual, interpersonal, organizational, and community level.

Relationship of Results to Other Evidence

It is believed that this is the first study which has attempted to systematically examine the barriers and facilitating factors that exist among schools that have transitioned to a delayed school start time. The literature suggested that transportation budget, traffic congestion, time

constraints on extra-curricular scheduling, and a lack of community education (Wheaton et al., 2015) are primary barriers in undergoing a delay in school start time. Our study suggested that the transportation budget and time constraints on extra-curricular activities are commonly cited barriers. We did not find that concerns regarding traffic were considered barriers to overcome (table 11).

Table 11. ***Assessment of Traffic Concerns as a Barrier***

Barrier	Responding 'Not a barrier' or 'Not applicable' %(N)
Buses commuting **from** school during peak traffic times	59.8 (58)
Bus drivers commuting **to** school during peak traffic times	59.8 (58)
Staff commuting **from** school during peak traffic times	58.8 (57)
Adolescents commuting **from** school during peak traffic times	56.7 (55)
Staff commuting **to** school during peak traffic times	54.6 (53)
Adolescents commuting **to** school during peak traffic times	53.1 (51)

While one respondent commented on the difficulty to provide community education, most respondents cited that they provided education to administrators, teachers, support staff, students, and family members and they considered this a strong facilitating factor in the implementation of the delayed school start time. We did find that a resistance to change was a common barrier to overcome with the different groups in the school community: teachers, support staff, students, and parents. Parent resistance to change was the most concerning among respondents. Family is an important, and in many cases may be the most important, influencer of the adolescent at the interpersonal level. Providing education to the family on the science behind delaying school start times may make the difference in families accepting a radical change to

their schedule. Involving parents in the decision making as well as providing education was found to be a strong facilitating factor to help them feel comfortable with making a change to their schedules. The school community, consisting of administrators, teachers, support staff, students, and the teacher's union were also found to be resistant to change in our study, but perceived to be less so than families. Providing education and allowing the school community, outside of just the administrators, be a part of the decision-making process was found to be a facilitating factor by many respondents.

The American Academy of Pediatrics recommends that schools serving adolescents should not start prior to 8:30am. Our study found that while many schools are implementing a delayed start time, there is still variability in start times. While we did not specifically ask the final start time of each school, looking at the data comparing minutes delayed to start time prior to delay, suggests that most schools are getting close to the 8:30am mark with their delay, but a handful of schools still appear to start prior to 8:30am. We did find that schools that had a prior start time to 8am saw the greatest benefits after implementing a delayed start time.

Our study also affirms work done by Owens & Belon (2010) who found that a modest 30 minute delay was enough to show improvement. We found that a 30 minute delay was associated with improved attention during early morning classes, and may be associated with improvement in schoolwork and less sleeping in class.

Relationship of Results to Project Aims

The BFFS achieved the primary aim of this project: to survey administrators who have completed a delay in school start time to identify common barriers and facilitating factors. The secondary aim, to share the information with the local community, has provided more difficult.

This author attended a school board meeting to share the results of the study with the administration present and the school board during a public comment period. The information was well received but the school board did not want to discuss the project at that point in time. The author was asked to share the information with the local principals via email, which was completed. This author has been in contact with the associate superintendent for inclusion in the local principal meeting which is held once a month, but has not been invited to a meeting. The author has met individually with select principals and vice principals who are interested in delaying a school start time, who cite the barriers in implementing such a project.

This author also contacted the local PTA to request if they would be interested in having the author speak at a meeting or post a short video on delayed school start times on their Facebook page. The PTA politely declined, stating that they did not want to be part of any 'controversial' issues. The local hospital is interested in pursuing a public health announcement regarding adolescent sleep with the author, but does not want the focus to be on delayed school start times. This author has agreed, as general education regarding the sleep needs of adolescents is important.

This author's experience of administrators who are resistant to change, coupled with the results of the study may suggest that administrators are the gatekeepers in making a change to delay school start times. Our study found that administrators rated themselves as not significantly resistant to change; this may be due to the fact that their districts were moving forward with a delayed school start time and either they were a champion of the cause or perhaps they did not see it to be beneficial to be resistant as the district had made the decision to move forward. While the secondary aim of this project may not have been completed to this author's liking, the author

will continue to advocate for delayed school start times and to increase the awareness of the sleep needs of adolescents.

Impact of Results on Practice

This project's intent was to find common barriers and facilitating factors in implementing a delayed school start time so that these can be shared with school districts that have yet to undergo a delay. It is hoped that administrators can recognize that the barriers they perceive in implementing such a change can be overcome with thought and planning. It also hopes to help districts recognize that the adolescent's family may be the ones who need the most education and involvement in the decision-making process. This study, while small, also re-affirms that delayed a school start time can make a difference in adolescent sleep which can also be transformed into an improvement of adolescent performance.

Nurse Practitioners and other health professionals can use this information to help partner with school districts to provide health education to adolescents, families, and staff, while the administrators work on the logistics of making a change. One should not expect school districts to become experts on adolescent sleep and health and to disseminate that information, when there are a number of trained professionals in the community who are well versed in preventative health. School districts and health professionals need to seek each other out as they both have the adolescents' best interests at heart.

Strengths and Limitations

The BFFS was a nation-wide survey with the attempt to reach all schools that were known to have a delay in school start times. Respondents were at various levels of administration: superintendents, associate superintendents, school board members, principals,

vice principals, and counselors. Our goal was to reach a variety of administrators, as some levels may have been more knowledgeable regarding budgetary issues, while other respondents may see the family or student effects of a delayed start time more directly. We believe that this enhances the generalizability of our study to have these varied points of view.

Approximately 7.2% of persons responded to the invitation to the survey. This is similar with response cited by other studies that have solicited participation using online surveys (Scott et al., 2011). The survey was distributed over a period of a month during the summer, which may have decreased return of the survey due to time off. However, most administrators work year-round (Bureau of Labor Statistics, 2016) and it was hoped that between the school years, the administrators would find themselves with more time to complete the survey. School counselors may not necessarily work year-round and so this group may have been more likely to be under-represented.

The survey cannot be generalized to all schools. Factors such as socioeconomic status of each school were not discussed in the survey and may be important to study when considering the barriers and facilitating factors in implementing a delayed school start time. For example, needing to find alternate childcare if start times are delayed may be more significant in a district where both parents tend to work rather than in a district that may be comprised of primarily families where one parent stays at home. In addition, even the geographic location of the school may affect the importance of some factors. For example, the difference in daylight hours between Montana and Arizona can be up to an hour and a half in the winter. States that have less daylight hours may find that flipping elementary and high school start times is less desirable as

their elementary students would be waiting for the bus often in the dark, while states with more daylight hours may not find this to equally concerning.

Dissemination and Future Implications for Practice

A respondent in the BFFS astutely noted that "…it is important to distinguish between real and perceived barriers…it takes [a] little thought, imagination, or effort to make changes". Working with stakeholders in each district to identify barriers and how they can be overcome is important. Sharing the experiences of other districts that had similar barriers is important to encourage problem solving and not labeling barriers as 'impossible' to overcome.

One of the overall greatest facilitating factors was providing sleep education to students, parents, administrators, teachers, and support staff. Nurse Practitioners and other health professionals are in a prime position to conduct this education. Those working in pediatrics and adolescent health can directly talk with parents and patients regarding teen sleep health. Other practitioners can be community advocates and assist in community education via newspaper editorials, social media, and by commenting at school board meetings.

Schools should be encouraged to collect and analyze data before and after a delayed school start time. Participants who would not recommend a delay in school start times were more likely to not perceive that there was a benefit to the delay. Nurse Practitioners and health researchers can collect data formally using quantitative research, or collect stories regarding the changes that teachers, families, and the adolescents themselves have seen, using qualitative research. Collecting and disseminating data regarding the positive improvements seen in the community after a delay in school start time has been put into place may assist in convincing detractors that the delay does indeed bring positive benefits.

The importance of sleep in adolescent health is often overlooked. Delaying school start times does help adolescents obtain the sleep that their growing bodies need. Their sleep needs are often overlooked in favor of keeping the 'status quo' – an early high school start time. The administrators surveyed demonstrate that we can adjust school start times to improve adolescent sleep and still have a functional transportation budget as well as have time for athletics and other after-school activities. We as members of the health community need to ask why aren't we challenging the status quo of early school start times and help the administrators and families understand that the benefits may reach farther than just allowing teens to sleep in a couple of more minutes. We can see improvements in school work, functionality, and as other research has shown, even improve students' mental health and cut down on traffic accidents. Health professionals can act as an outside voice to challenge the perceived barriers and assist in the creation of solutions.

APPENDIX A

PRELIMINARY LETTER TO LOCAL ADMINISTRATORS

PRELIMINARY LETTER TO LOCAL ADMINISTRATORS

Dear _,

My name is Julia Fitzpatrick. I am a family nurse practitioner student here in Great Falls currently finishing my doctoral project through the University of Arizona. My study focus is adolescent sleep and the role that school start times play in the ability of teens to achieve enough sleep each night.

The American Sleep Foundation recommends that teens obtain 9 hours of sleep each night. In reality, teens average about 7 hours of sleep on school nights, and even closer to 6 by the time they are seniors. The reasons for this are multifactorial, however a large part of this is that teens have a biological drive to stay awake later and wake up later.

School is a large part of an adolescent's day. By starting school early, we are creating an environment that does not allow for optimal sleep for our teens. Teens who are sleep deprived have more mood and behavior problems, tend to be overweight, and have a decreased resistance to illness. Good sleeping habits are linked to an increase in academic performance, healthier food choices, and a general better sense of well-being.

I encourage you to consider moving start times back at the high school and middle school levels. The science exists that it will make a positive difference in the students. A delay of even 30 minutes has been found to be significant.

As part of my doctoral project, I surveyed administrators and counselors whose schools had undergone a delay in school start time to improve teen health and performance. My interest is in the barriers and facilitating factors that administrators they found in doing so. I would like to share my results with you and your staff and have an opportunity for discussion. If you are

interested in seeing my results to use in implementing a delayed school start time, I would be happy to share them with you.

Sincerely,

Julia Fitzpatrick

jmfitzpatrick@email.arizona.edu

406-727-0826

APPENDIX B

BARRIERS AND FACILITATING FACTORS SURVEY CONSENT

BARRIERS AND FACILITATING FACTORS SURVEY CONSENT

Dear __,

The purpose of this study is to identify barriers and facilitating factors in implementing a delayed school start time. You have been identified as an administrator in a school district which has previously implemented a delayed school start time. Studies have shown that this improves student's health, well-being, and academic attention. However, many districts and communities struggle with implementing this change.

If you choose to take this survey, it will take approximately 15 minutes to complete. There are no foreseeable risks associated with participating and you will receive no immediate benefit from your participation. Survey responses are anonymous.

You may discontinue participation at any time without penalty. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant. An institutional Review Board found this project to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research. For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at http://rgw.arizona.edu/compliance/human-subjects-protection-program

For questions, concerns, or complaints about the study, you may contact Julia Fitzpatrick RN, MSN, principal investigator, at jmfitzpatrick@email.arizona.edu.

By taking this survey, you agree to have your responses used for research purposes.

Sincerely, Julia Fitzpatrick

APPENDIX C

BARRIERS AND FACILITATING FACTORS SURVEY

BARRIERS AND FACILITATING FACTORS SURVEY

1. The following is a list of **barriers** that have been identified by some school district administrators when implementing a delayed school start time in high school or middle school. Click on the circle that best rates how significant you felt each barrier was for your district.

	Significant Barrier	**Moderate** Barrier	**Minor** Barrier	**Not** a Barrier	N/A
Use of a tiered school bus transportation system (using same buses to transport elementary, middle-school and high school student					
Increased School Transportation cost					
Less time for after-school athletic activities					
No organized transportation (school or city buses) to transport athletes home after athletic activities					
School-based Athletes missing more afternoon classes to attend or travel to games					
Club/Community team athletes missing more afternoon classes to attend or travel to games					
Less time for other school sponsored extracurricular activities/clubs (non-athletic)					
Less time for after-school school-sponsored tutoring					
Less time for community sponsored extracurricular activities					
Less time for spiritual-sponsored extracurricular activities					
Less time for philanthropic-sponsored extracurricular activities					
Less time for adolescents to work					
Unavailability of adolescents to provide after school care for siblings					
Less time for homework					
Family members resistance to change their schedules					
Students resistant to change their schedules					
Teachers resistant to change their schedule					
Teacher's Union/Professional teacher association resistant to change their schedule					
Administrators resistant to change their schedule					

Support staff resistant to change their schedule					
Bus drivers resistant to change their schedule					
Childcare providers resistant to change their schedules					
Community (non-spiritual) resistant to change in schedule					
Spiritual organizations resistant to change in schedule					
Adolescents would be commuting to school at peak traffic times					
Adolescents would be commuting from school at peak traffic times					
Staff would be commuting to school at peak traffic times					
Staff would be commuting from school at peak traffic times					
Bus drivers would be driving to school during peak traffic times					
Bus drivers would be driving from school at peak traffic times					
Elementary students would be waiting for bus pick-up in the early morning, in the dark					

2. Please note any other barriers that your district has encountered. Feel free to comment on the barriers you listed.
3. The following is a list of possible facilitating factors - i.e. **factors that made it easier** - that other districts have found when implementing a delayed school start time in high schools or middle schools. Please click the circle that best rates how significant you felt each facilitating factor was for your district.

	Significant Facilitating Factor	**Moderate** facilitating factor	**Minor** Facilitating Factor	**Not** a facilitating factor	N/A
Involvement of family members in the decision-making process					
Involvement of students in the decision-making process					
Involvement of teachers in the decision-making process					
Involvement of teacher's union/professional teachers associations in the decision-making process					
Involvement of school administrators in the decision-making process					

Involvement of support staff in the decision-making process					
Involvement of bus drivers in the decision-making process					
Involvement of childcare providers in the decision making process					
Involvement of community (non-spiritual) in the decision-making process					
Involvement of spiritual organizations in the decision-making process					
Providing education on adolescent sleep patterns for family members					
Providing education on adolescent sleep patterns for students					
Providing education on adolescent sleep patterns for teachers					
Providing education on adolescent sleep patterns for school administrators					
Providing education on adolescent sleep patterns for support staff					
Providing education on adolescent sleep patterns for bus drivers					
Providing education for sleep patterns for childcare providers					
Moving school-sponsored athletic practices to before school					
Moving school sponsored extracurricular/club (non-athletic) act ivies to before school					
Moving school-sponsored tutoring to before school					
Moving student meetings with teachers to before school					
Asking community-sponsored events to be moved before school					
Asking spiritual-sponsored events to be moved before school					
Asking philanthropic-sponsored events to be moved before school					
Providing a hotline or dedicated person to answer questions about the delayed school start time					
Teacher's Union/Professional teacher associations agreeing to delayed school start times					

Ability to schedule elementary start times to be compatible with delayed start time to maintain a tiered school bus transportation system					
More before-school time for teacher meetings or preparation time					
Less unsupervised time for students at home in the afternoon/evening					
Adolescents commuting to school at off-peak traffic times					
Adolescents commuting from school at off-peak traffic times					
Staff commuting to school at off-peak traffic times					
Staff commuting from school at off-peak traffic times					
Bus drivers driving to school at off-peak traffic times					
Bus drivers driving from school at peak traffic times					
Adolescents no longer waiting to be picked up by the bus in the early morning, in the dark					

4. Please note any other facilitating factors that your district encountered. Feel free to comment on any facilitating factors listed. [free text]
5. How many months would you suggest between the announcement of a delayed school start time and the actual implementation of the delayed start time?
    a. Less than 3 months
    b. 3-6 months
    c. 7-9 months
    d. 10-12 months
    e. More than 12 months
6. Would you recommend that other districts pursue delaying school start times?
    a. Yes
    b. No
7. Do you offer classes that students can elect to take that start prior to the delayed school start time?
    a. Yes
    b. No
8. If you have any other comments regarding implementing delayed school start times, please share below. [free text]
9. Do you think that the sleep of the adolescents in your school has improved as a result of your district delaying your school start time?
    a. Yes

b. Somewhat
c. No

10. What changes have you seen or have been reported to you since the implementation of a delayed school start time?

	Agree	Neutral	Disagree
Less sleeping in class			
Less tardies			
Less absences			
Improved schoolwork/grades			
Improved attention during early classes			
Improved family satisfaction			
Improved student satisfaction			
Improved teacher satisfaction			
Improved administrator satisfaction			
Improved support staff satisfaction			
Improved bus driver satisfaction			
Improved community (non-spiritual) satisfaction			
Improved spiritual community satisfaction			

11. Did you district 'flip' or 'exchange' elementary and middle school and/or secondary start times to maintain a tiered bus transportation system?

a. Yes
b. No
c. N/A

12. At what time did your school classes start before the delay?

a. 6:30am or earlier
b. Between 6:31 and 7am
c. Between 7:01 and 7:30 am
d. Between 7:31 and 8am
e. Between 8:01 and 8:30am
f. After 8:31am

13. How may minutes did your school district or school delay the school start time?

a. Less than 20 minutes
b. 20-29 minutes
c. 30-39 minutes
d. 40-49 minutes
e. 50-59 minutes
f. 60 minutes or more

14. How long has your district/school had a delayed school start time?

a. Less than one school year
b. 1 school year
c. 2 school years

d. 3 school years
e. 4 school years
f. 5 school years or more

15. If you have any other comments regarding delayed school start times, please share below [free text]

REFERENCES

Adolescent Sleep Working Group; Committee on Adolescence; Council on School Health (2014). School start times for adolescents. *Pediatrics*, 134(3), 642-649

Asarnow, L.D., McGlinchey, E., & Harvey, A.G. (2014). The effects of betimes and sleep duration on academic and emotional outcomes in a nationally representative sample of adolescents. *Journal of Adolescent Health, 54*(3), 350-356. doi: 10.1016/ j.jadolhealth.2013.09.004

Baldwin Tigges, B. (2004). Parental consent and adolescent risk behavior research. *Journal of Nursing Scholarship*, *35*(3), 283-289

Blunden, S.L., Chapman, J., & Rigney, G. (2011). Are sleep education programs successful? The case for improved and consistent research efforts. *Sleep Medicine Reviews*. *16*(4), 355-370. doi: 10.1016/j.smrv.2011.08.002.

Boergers, J., Gable, C.J., Owens, J.A. (2014). Later school start time is associated with improved sleep and daytime functioning in adolescents. *Journal of Developmental & Behavioral Pediatrics. 35*(1), 11-17. doi: 10.1097/DBP.0000000000000018.

Bureau of Labor Statistics (2016). Elementary, middle, and high school principals. *Occupational Outlook Handbook, 2016-2017.* Retrieved on August 4, 2016 from http://www.bls.gov/ ooh/management/elementary-middle-and-high-school-principals.htm

Cain, N., Gradishar, M., & Moseley, L. (2011). A motivational school-based intervention for adolescent sleep problems. *Sleep Medicine*, *12*(3), 246-251. doi: 10.1016/jsleep. 210.06.008.

Carskadon, M. A., Seifer, R., Davis, S. and Acebo, C. (1991). Sleep, sleepiness in college-bound high school seniors. *Sleep Research, 20,* 175

Carskadon, M.A., & Acebo, C. (2002). Regulation of sleepiness in adolescents: Updates, insights, and speculation. *Sleep*, *25*(6), 606-614.

Catrett, C. D., & Gaultney, J. F. (2009). Possible insomnia predicts some risky behaviors among adolescents when controlling for depressive symptoms. *The Journal of Genetic Psychology*, *170*(4), 287-309.

Chen, M.Y., Wang, E.K., Jeng, Y.J. (2006). Adequate sleep among adolescents is positively associated with health status and health related behaviors. *BMC Public Health*, *8*(6), 59.

Crowley, S.J., VanReen, E., LeBourgeois, M.K., Acebo, C., Tarokh, L., Seifer, R., Barker, D.H., Carskadon, M.A. (2014). A longitudinal assessment of sleep timing, circadian phase, and phase angle of entrainment across human adolescence. *PLOS One, 9*(11): e112199. doi: 10.1371/journalpone.0112199.

Center for Disease Control and Prevention (2012). QuickStats: Age-adjusted suicide rates, by state – United States, 2012. Retrieved on March 11,2016 from http://www.cdc.gov/ mmwr/preview/mmwrhtml/mm6345a10.htm

Center for Disease Control and Prevention (2013). Youth Risk Behavior Survey. Retrieved on March 31, 2016 from www.cdc.gov/yrbss.

Danner, F., & Phillips, B. (2008). Adolescent sleep, school start times, and teen motor vehicle crashes. *Journal of Clinical Sleep Medicine, 4*(6), 533-535.

Dahl, R.E., & Lewin, D.S. (2002). Pathways to adolescent health: sleep regulation and behavior. *Journal of Adolescent Health, 31*(6), 175-184.

Eaton, D.K., McKnight-Eily, L.R., Lowry, R., Perry, G.S., Presley-Cantrell, L., & Croft, J.B. (2010). Prevalence of insufficient, borderline, and optimal hours of sleep among high school students – United States, 2007. *Journal of Adolescent Health*, *46*(4), 399-401. doi: 10.1016/j.jadohealth.2009.10.011.

Fredriksen, K., Rhodes, J., Reddy, R., & Way, N. (2004). Sleepless in Chicago: tracking the effects of adolescent sleep loss during the middle school years. *Child Development*, *75*(1), 84-95.

Foti, K.E., Eaton, D.K., Lowry, R., McKnight-Ely, L.R. (2011). Sufficient sleep, physical activity, and sedentary behaviors. *American Journal of Preventative Medicine, 41*(6), 596-602.

Fowler, F.J. (2013). *Survey Research Methods*. Los Angeles, CA: Sage Publications

Goldstein, T. R., Bridge, J. A., & Brent, D. A. (2008). Sleep disturbance preceding completed suicide in adolescents. *Journal of Consulting and Clinical Psychology*, *76*(1), 84.

Great Falls Public Schools (2015). Schools. Retrieved on February 3, 2015 from http:// www.gfps.k12.mt.us/schools.

Gregory, A. M., & O'Connor, T. G. (2002). Sleep problems in childhood: a longitudinal study of developmental change and association with behavioral problems. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(8), 964-971.

Healthy People 2020 (2014). *Sleep Health*. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Retrieved on March 31, 2016 from www.healthypeople.gov/2020/topics-objectives/topic/sleep-health/objectives

Hirshkowitz, M., Whiton, K., Albert, S.M., Alessi, C., Bruni, O., DonCarlos, L.,…Adams Hillard, P.J. (2015). National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health, 1*(1), 40-53

Hinrichs, P. (2011). When the bell tolls: the effects of school starting times on academic achievement. *Education Finance and Policy, 6*(4), 486-507. doi: 10.1162/EDFP_a_00045

Hunter, R.H., Anderson, L.A., Belza, B., Bodiford, K., Hooker, S., Kochtitzhy, C.S.,…Satariano, W.A. (2013). Environments for healthy aging: Linking prevention research and public health practice. *Preventing Chronic Disease*. Online publication. doi: 10.5888 /pcd10.120244.

Iglayreger, H.B., Peterson, M.D., Liu, D., Parker, C.A., Woolford, S.J., Sallinen-Gafka, B.J., Hassan, F., & Gordon, P.M. (2014). Sleep duration predicts cardiometabolic risk in obese adolescents. *Journal of Pediatrics*, *164(*5), 1085-1090.e.1. doi: 10.1016/j.jpeds. 2014.01.034.

Johns, M. W. (1991). A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*, *14*(6), 540-545.

Lufi, D., Tzischinsky, O., & Hadar, S. (2011). Delaying school starting time by one hour: Some effects on attention levels in adolescents. *Journal of Clinical Sleep Medicine, 7*(2), 137-143.

Lumeng, J.C., Somashekar, D., Appugliese, D., Kaciroti, N., Corwyn, R.F., & Bradley, R.H. (2007). Shorter sleep duration is associated with increased risk for being overweight at ages 9 to 12 years. *Pediatrics*. 120(5), 1020-1029.

Maume, D.J. (2013). Social ties and adolescent sleep disruption. *Journal of Health and Social Behavior, 54(*4), 498-515. doi: 10.1177/0022146513498512

McKnight-Eily, L.R., Eaton, D.K., Lowry, R., Croft, J.B., Presley-Cantrell, L., & Perry, G.S. (2011). Relationships between hours of sleep and health-risk behaviors in US adolescent students. *Preventative Medicine, 53*(4-5), 271-273. doi: 10.1016/j.ypmed.2011.06.020

Merikanto, I., Lahti, T., Puusniekka, R., & Partonen, T. (2013). Late bedtimes weaken school performance and predispose adolescents to health hazards. *Sleep Medicine, 14*(11), 1105-1111. doi: 10.1016/j.sleep.2013.06.009

Minges, K.E., & Redeker, N.S. (2015). Delayed school start times and adolescent sleep: A systematic review of the experimental evidence. *Sleep Medicine Reviews*, *28*, 82-91 doi: 10.1016/j.smrv.2015.06.002.

Montana Office of Public Instruction (2015). 2015 North Central region youth risk behavior survey. Retrieved on May 11, 2016 from http://www.opi.mt.gov/pdf/YRBS/15/RD /15NorthCentral_HS.pdf

Moseley, L., & Gradisar, M. (2009). Evaluation of a school-based intervention for adolescent sleep problems. *Sleep*, *32*(3), 334.

Modecki, K.L., Barber, B.L., & Eccles, J.S. (2013). Binge drinking trajectories across adolescence: For maturing youth, extra-curricular activities ae protective. *Journal of Adolescent Health, 54*(1), 61-66. doi: 10.1016.jadohealth.2013.07.032

National Sleep Foundation (2006). *Sleep in America poll: Teens and Sleep Summary Findings*. Washington, D.C.: National Sleep Foundation.

Nielsen, L.S., Danielson, K.V., & Sorensen, T.I.A. (2011). Short sleep duration as a possible cause of obesity: Critical analysis of the epidemiological evidence. *Obesity Reviews, 12*(2), 78-92.

Orzech, K. M., Acebo, C., Seifer, R., Barker, D., & Carskadon, M. A. (2014). Sleep patterns are associated with common illness in adolescents. *Journal of Sleep Research*, *23*(2), 133-142.

Owens, J.A., Belon, K., Moss, P. (2010). Impact of delaying school start time on adolescent sleep, mood, and behavior. *Archives of Pediatrics & Adolescent Medicine, 164*(7), 608-614. doi: 10.1001/archpediatrics.2010.96

Pasch, K. E., Latimer, L. A., Cance, J. D., Moe, S. G., & Lytle, L. A. (2012). Longitudinal bi-directional relationships between sleep and youth substance use. *Journal of Youth and Adolescence*, *41*(9), 1184-1196.

Perkinson-Gloor, N., Lemola, S., & Grob, A. (2013). Sleep duration, positive attitude toward life, and academic achievement: The role of daytime tiredness, behavioral persistence, and school start times. *Journal of Adolescence, 36*(2), 311-318. doi:10.1016/ j.adolescence.2012.11.008

Polit, D.F. & Beck, C.T. (2012). *Nursing Research* (9th ed.). Philadelphia, PA: Wolters Kluwer Lippincott, Williams, & Wilkins

Roberts, R. E., & Duong, H. T. (2013). Depression and insomnia among adolescents: A prospective perspective. *Journal of Affective Disorders*, *148*(1), 66-71.

Rogers, E.M. (2010). *Diffusion of Innovations* (4th ed.). New York: Simon and Schuster

Sadeh, A., Dahl, R.E., Shahar, G., & Rosenblat-Stein, S., (2009). Sleep and the transition to adolescence: a longitudinal study. *Sleep*. *32*(12), 1602-1609.

Sallis, J.F., Owen, N., & Fisher, E.B. (2008). Ecological models of health behavior (Chapter 20). In K. Glanz, B.K. Rimer, & K.V. Viswanath (Eds.). *Health Behavior and Health Education: Theory, Research, and Practice* (Chapter 15) (4th ed.). Hoboken, NJ: John Wiley & Sons

Sanchez-Fernandez, J., Munoz-Leiva, F., & Montoro-Rios, F. (2012). Improving retention rate and response quality in Web-based surveys. *Computers in Human Behavior 28*(2), 507-514

Sanders, R.A. (2013). Adolescent psychosocial, social, and cognitive development. *Pediatrics in Review, 34*(8), 354-358. doi: 10.1542/pir.34-8-354

Scott, A., Jeon, S.H., Joyce, C.M., Humphreys, J.S., Kalb, G., Witt, J., & Leahy, A. (2011). A randomized trial and economic evaluation of the effect of response mode on response rate, response, bias, and item non-response in a survey of doctors. *BMC Medical Research Methodology, 5(11), 126.* doi: 10.1186/1471-2288-11-126.

Short, M.A., Gradisar, M., Wright, H., Lack, L.C., Dohnt, H., & Carskadon, M.A. (2011). Time for bed: parent set bedtimes associated with improved sleep and daytime functioning in adolescents. *Sleep*, *34*(6), 797-800. doi: 10.5665/SLEEP.1052

Snell, E.K., Adam, E.K., Duncan, G.J. (2007). Sleep and body mass index and overweight status of children and adolescents. *Child Development 78*(1), 309-323

Suldo, S.M., Shaunessy, E., Thalji, A., Michalowski, J., & Shaffer, E. (2009). Sources of stress for students in high school college prepatory and general education programs: group differences and associations with adjustment. *Adolescence, 44*(176), 925-948

Sweet, S.N., Latimer-Cheung, A.E., Bourne, C., & Martin Ginis, K.A. (2014). Assessing the research use and needs of organizations promoting healthy living for adults with disabilities. *Translational Behavioral Medicine*, *4*(1), 86-94. doi: 10.1007/s13142-013-0231-2

Unger, J.B., Gallaher, P., Palmer, P.H., Baezconde-Garbanati, L., Trinidad, D.R., Cen, S., & Johnson, C.A., (2004). No news is bad news: Characteristics of adolescents who provide neither parental consent nor refusal for participation in school-based survey research. *Evaluation Review, 28*(1), 52-63

Vorona, R.D., Szklo-Coxe, M., Lamichhane, R., Ware, J.C., McNallen, A., & Leszczyszyn, D. (2014). Adolescent crash rates and school start times in two central Virginia counties, 2009-2011: a follow-up study to a southeastern Virginia study, 2007-2008. *Journal of Clinical Sleep Medicine, 10*(11), 1169

Wahlstrom, K. (2002). Changing times: Findings from the first longitudinal study of later high school start times *NASSP Bulletin, 286*(633), 3-21.

Williams, J.F., Burton, R.S., & Warzinski, S.S. (2014). The role of the parent in adolescent substance abuse. *Pediatric Annals*, *43*(10), 410. doi: 10.3928/00904481-20140924-07

Wheaton, A.G., Ferro, G.A., & Croft, J.B. (2015). School start times for middle school and high school students – 2011-2012 school year. *Morbidity and Mortality Weekly, 64*(30), 809-813.