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SCHOOL STRUCTURE DIFFERENCES AND PHYSICAL ACTIVITY OF YOUTH: A CASE STUDY OF FOUR RURAL COMMUNITIES

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SCHOOL STRUCTURE DIFFERENCES AND PHYSICAL ACTIVITY OF YOUTH:
A CASE STUDY OF FOUR RURAL COMMUNITIES

A thesis

Presented to the

School of Health and Kinesiology

and the

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by

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May 2023

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SCHOOL STRUCTURE DIFFERENCES AND PHYSICAL ACTIVITY OF YOUTH:
A CASE STUDY OF FOUR RURAL COMMUNITIES

Jillian L. Kilty, MS

University of Nebraska, 2023

Advisor: Dr. Michaela A. Schenkelberg

Purpose: To describe youth physical activity (PA) and participation in organized activities within school systems adopting different organizational structures.

Design: Cross-sectional case-study of the Wellscapes Project with baseline data from Wave 1 (Fall 2018) and Wave 2 (Fall 2021).

Setting: Four rural Midwestern communities.

Sample: A total of 507 fourth, fifth, and sixth graders participated and were used in analyses ($n = 156$ fourth graders; $n = 189$ fifth graders; $n = 162$ sixth graders). Two communities followed an elementary school model. The other two communities followed a middle school model.

Measures: Students completed the Youth Activity Profile (YAP), an online 15-item self-report PA questionnaire. Organized activity participation was determined using supplemental National Survey of Children's Health (NSCH) survey questions. School administrators provided session amount and duration of physical education (PE) and recess per week for each grade.

Analysis: In-school YAP items were aggregated to estimate in-school moderate-to-vigorous physical activity (MVPA) using calibrated algorithms. Administrator-reported PE and recess sessions and duration were summarized. Community and grade, and the interaction between the two on in-school MVPA outcomes and participation (“yes”, “no”) in each organized activity was analyzed using the GLIMMIX procedure. Gender and race/ethnicity were included as covariates.

Results: Session and duration of PE and recess was the same regardless of grade in an elementary model but differed across grade in a middle school model. Sixth graders had a lower frequency of reporting participation in classroom breaks compared to 5th grade across all communities. Regardless of grade, Community 1 reported the highest in-school MVPA ($p<0.0001$), and Community 3 reported the lowest levels of in-school MVPA ($p<0.0001$). After-school program, sport, club, and other organized activity participation varied within and between communities.

Conclusion: Among youth attending different school models, differences in organizational structures were present, in-school MVPA was higher for students in an elementary model, and organized activity participation varied by community and grade. Researching these differences with a larger sample size may aid in better understanding the influence of school structure on PA during childhood and adolescence.

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CHAPTER I

Introduction

Regular physical activity (PA) during school-aged years is associated with numerous health benefits for youth (U.S. Department of Health and Human Services, 2018), with evidence showing that PA patterns follow young people into adulthood (Hayes et al., 2019; Telama, 2009; Telama et al., 2005). The 2018 Physical Activity Guidelines recommend daily participation in 60 minutes or more of moderate to vigorous physical activity (MVPA) for children ages 6 to 17 (U.S. Department of Health and Human Services, 2018). Additionally, the National Association for Sport and Physical Education (NASPE) (2012) suggests that elementary students receive 150 minutes of physical education (PE) every week for the entire school year while middle school and high school students receive 225 minutes every week for the full length of the school year. NASPE (2006) also recommends a minimum of 20 minutes of recess per day in conjunction with PE. In addition to PE and recess, regular breaks from sedentary time in the classroom are considered a necessity (Centers for Disease Control and Prevention, 2018; Institute of Medicine et al., 2013). Despite the recommendations and benefits of PA presented in research, only around 24% of children participate in the recommended guidelines of at least 60 minutes of MVPA per day (National Physical Activity Plan Alliance, 2018).

Research has suggested that one barrier to obtaining the recommended guidelines of physical activity are differences in living areas (i.e., rural vs. urban) (Wilcox et al., 2000). Living areas can impact an individual's eating habits, opportunities for physical

activity, and access to recreational facilities (Chillón et al., 2011). Despite their importance, geographical factors have received less attention throughout research (Joens-Matre et al., 2008). Furthermore, issues affecting rural populations have not been examined extensively (Patterson et al., 2004). Research lacks sufficient details and information pertaining to rural communities' and rural minorities' physical activity (Flegal et al., 2010; Ludwig et al., 1999; Mokdad et al., 1999, 2001; Schoenborn et al., 2002). Obtaining precise population-level data on physical activity is crucial, particularly for minorities and individuals residing in rural areas, as they may be at a higher risk of chronic disease (Patterson et al., 2004). This is especially vital for rural youth since PA behaviors present in adulthood tend to stem from those exhibited in adolescence (Hayes et al., 2019; Telama, 2009; Telama et al., 2005). Moreover, existing research on PA levels of youth in rural locations is inconsistent (Davy et al., 2004; Felton et al., 2002; Hedley et al., 2004; Joens-Matre et al., 2008; McMurray et al., 1999, 2000; Paxton et al., 2004).

One way to address this inconsistency is through implementation of PA initiatives (Institute of Medicine et al., 2013; World Health Organization, 2008). The years between 6 and 14 mark a time of important developmental milestones (Centers for Disease Control and Prevention, 2021b; J. S. Eccles, 1999). Not only are youth working toward self-awareness, competency, and independence during this time, they are going through major cognitive and biological changes that impact their minds and bodies (J. S. Eccles, 1999). Encouraging and increasing participation in PA during this time period is advantageous since PA provides significant health benefits (U.S. Department of Health and Human Services, 2018), including: physiological (e.g., improved fitness and reduced

obesity, type II diabetes, blood pressure, and cardiovascular disease) (Janssen & LeBlanc, 2010), and psychological (e.g., increased self-confidence and self-esteem, and reduced stress, anxiety, and depression) (Lubans et al., 2016). Research has also shown improved cognition, meta-cognition, attentiveness, and scholastic achievement due to participation in PA (Álvarez-Bueno et al., 2017). Since enrollment in school systems is nearly universal (Nathan et al., 2018) and young people spend more than 40% of their awake time at school (Fox, 2004; Institute of Medicine et al., 2013), schools are recommended settings to increase youth PA (Institute of Medicine et al., 2013; World Health Organization, 2008). Furthermore, schools tend to be a “central hub” in many communities due to the considerable amount of time young people spend there during the day and the availability of facilities, recreational activities, and events for families and peer groups both before and after school (Webster, 2022), making them prime locations to promote PA.

Specifically examining the transition from childhood into adolescence is critical since research also reveals a decrease in PA levels as grade level increases (Allison et al., 2007; Corder et al., 2019; Nader et al., 2008; Wickel et al., 2009). The school environment and the way it is structured can have a significant impact on what a student can accomplish during the school day (Cleveland, 2016). Understanding variations in the structural differences between elementary school and middle school, and the impact they have on the PA of young people as they transition between the two types of schools is important in order to inform interventions and ensure youth receive the recommended amount of PA as they grow older (Barnett et al., 2006). The way in which a school is structured can be described in terms of “organizational structures” (Ellerbrock et

al., 2018). These structures include the structure of place (i.e., types of school), the structure of people (i.e., students, teachers), and the structure of time (i.e., organization of school day) (Ellerbrock et al., 2018). PA opportunities resulting from these structures can standardize PA within school systems (Ellerbrock et al., 2018; Webster, 2022).

According to the Comprehensive School Physical Activity Program (CSPAP), these PA opportunities emerge through the implementation of five components: physical education, PA during school (i.e., recess, lunch, PA in the classroom, and special events like field day), PA before and after school (i.e., before and after school PA programs through the school or community organizations, active transportation programs to and from school), staff involvement (i.e., activity levels of teachers and staff, promotion of PA, and participation in PA with students), and family and community engagement (i.e., encouragement and participation from family members, access to neighborhood recreational spaces and equipment, availability of public transportation and safety of communities) (Webster, 2022). These structures which promote and increase PA are crucial because they support child development, facilitate opportunities for risk-taking, allow time to practice social skills, and have been shown to improve young people's attention, boost social and emotional outcomes, and positively impact academic performance (Webster, 2022). Despite the evidence suggesting the importance of PA within schools, there is a gap in our understanding of the organizational structures in elementary school compared to middle school, and the role these differences play on young peoples' PA levels (Barnett et al., 2006; Harding et al., 2015; Lau et al., 2017; Pate, Schenkelberg, et al., 2019; Webster, 2022).

The purpose of this case study is to describe population children and youth PA levels and participation in organized activities within four rural community's school systems which adopt two different organizational structures. Two communities follow a middle school model while the other two communities follow an elementary school model.

We hypothesize that:

- 1) Young people attending a school in a community following a middle school model will have lower levels of PA and participate in fewer organized activities compared to young people attending a school in a community following an elementary school model.

Definitions and Key Abbreviations

The following definitions and abbreviations were used for the purposes of this study:

Youth: A person between the ages of 12 and 18 years old (*Who Are Youth?*, 2022).

Young People: A person under the age of 18 (*Who Are Youth?*, 2022).

Child/Children: A person 6 to 12 years of age (National Library of Medicine, n.d.-b).

Adolescent(s): A person 13 to 18 years of age (National Library of Medicine, n.d.-a).

5th Grade: Typically children ages 10 – 11 years old.

6th Grade: Typically children and youth ages 11 – 12 years old.

Physical Activity (PA): PA is defined as any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen et al., 1985).

Physical Inactivity: Physical inactivity is defined as a state in which bodily movement is minimal and energy expenditure approximates the resting metabolic rate (Miles, 2007).

Organizational Structures: The way in which schools are structured. This includes the structures of place (i.e., types of school), the structures of people (i.e., students, teachers), and the structures of time (i.e., organization of school day) (Ellerbrock et al., 2018)

Elementary School Model: A school that follows a self-contained classroom structure.

Middle School Model: A school that follows a departmentalized classroom structure.

Self-Contained: A school structure where children are taught all subjects by one teacher during the school day with the exception of going to specialists teachers (i.e., PE, music, library, art, etc.) (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963).

Departmentalized: A school structure where youth travel from classroom to classroom, being taught different subjects by different teachers throughout the school day (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963).

In-School Activity: Moderate to vigorous physical activity that occurs during transportation to school, transportation from school, physical education, lunch, and recess (Saint-Maurice & Welk, 2015).

Activity Breaks: Activity breaks, also known as brain breaks or energizers are short bouts of PA meant to interrupt the prolonged sedentary behaviors common to the school day (Dinkel et al., 2017; McMullen et al., 2014).

Organized Activities: Any extracurricular activities that occur outside of school time both before and after school, in the evening, and on weekends (i.e., afterschool programs, youth clubs and sports, 4-H, Girl Scouts, and Boy Scouts) (Vandell et al., 2015).

Adolescence: Adolescence is defined as the maturation of cognitive and social behaviors related to the changes of puberty (Sisk & Foster, 2004).

Maturation: Maturation is defined as the timing and tempo of progress toward the mature biological state; often described as the process of becoming mature (Malina et al., 2004).

Puberty: Puberty is defined as the activation of the reproductive system, resulting in reproductive capabilities (Sisk & Foster, 2004).

Other key abbreviations

MVPA: Moderate to vigorous physical activity

TPA: Total physical activity

LPA: Light physical activity

YAP: Youth Activity Profile

PE: Physical Education

CHAPTER II

Review of Literature

PHYSICAL ACTIVITY

Physical activity (PA) has a significant impact on health. Regular PA impacts body composition and energy balance while also protecting against chronic diseases such as obesity, cardiovascular disease, stroke, type 2 diabetes, and various types of cancers (Miles, 2007; Warburton et al., 2006). Research has also shown an association between PA, improved mental health, and reduced risk of falls and injuries (Miles, 2007). Studies have also found PA to benefit children and youth ages 6 to 17 physiologically (e.g., improved fitness and reduced obesity, type II diabetes, blood pressure, and cardiovascular disease) (Janssen & LeBlanc, 2010), and psychologically (e.g., increased self-confidence and self-esteem, and reduced stress, anxiety, and depression) (Lubans et al., 2016), as well as through improved cognition, meta-cognition, attentiveness, and scholastic achievement (Álvarez-Bueno et al., 2017).

According to Caspersen et al. (1985), physical activity can be defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (p126) and is commonly categorized by duration, frequency, intensity, and modality (Blair et al., 1992; Miles, 2007). Duration and frequency refer to how long and how often an activity is engaged in, while intensity and modality refer to the energy expenditure level demanded by an activity and the type of activity being performed (Miles, 2007). Despite these known benefits, physical inactivity continues to remain a substantial public health problem (Gichu et al., 2018; Kohl et al., 2012; Miles, 2007; Warburton et al., 2006). In

order to combat this population issue, promoting PA from a young age and instilling positive PA patterns is crucial since evidence shows PA patterns established in youth follow individuals into adulthood (Hayes et al., 2019; Telama, 2009; Telama et al., 2005).

PHYSICAL ACTIVITY IN RURAL AREAS

Research has suggested that one barrier to obtaining the recommended guidelines of physical activity are differences in living areas (e.g., rural and urban) (Wilcox et al., 2000). Living areas can impact an individual's eating habits, opportunities for physical activity, and access to recreational facilities (Chillón et al., 2011). Despite their importance, geographical factors have received less attention throughout research (Joens-Matre et al., 2008). Furthermore, issues affecting rural populations have not been examined extensively (Patterson et al., 2004). Research lacks sufficient details and information pertaining to rural communities' and rural minorities' physical activity (Flegal et al., 2010; Ludwig et al., 1999; Mokdad et al., 1999, 2001; Schoenborn et al., 2002). Obtaining precise population-level data on physical activity is crucial, particularly for minorities and individuals residing in rural areas, as they may be at a higher risk of chronic disease (Patterson et al., 2004). This is especially vital for rural youth, given the inconsistent results reported in literature on their physical activity levels (Davy et al., 2004; Felton et al., 2002; Hedley et al., 2004; Joens-Matre et al., 2008; Lutfiyya et al., 2007; Paxton et al., 2004; Springer et al., 2006).

One study conducted on young individuals from rural areas in Mississippi found that 54% of the sample were either at risk for being overweight or overweight (Davy et al., 2004). This percentage was quite a bit higher than the national youth percentage (30%) of at-risk and overweight youth (Hedley et al., 2004). Youth in this study also

reported lower levels of PA compared to a national sample, however, the geographic locations in the national sample were not specified (Davy et al., 2004). Similarly, rural youth in a Midwest study were less physically active than urban youth, as compared to a national sample (Paxton et al., 2004). Overweight children aged 5 to 18 years old in rural locations were also less likely to meet the recommended PA guidelines compared to overweight urban children (Lutfiyya et al., 2007). However, another study examining activity levels of middle school girls in South Carolina in both rural and urban areas found differences in activity levels by geographical location depending upon race (Felton et al., 2002). White girls in urban areas were more vigorously active compared to those in rural areas, while Black girls in rural areas were more vigorously active than those in urban areas (Felton et al., 2002). In contrast, Springer et al. (2006) analyzed a nationally representative sample of urban and rural young people's activity levels. Rural males were more likely to participate in strength training and MVPA compared to urban males while rural females were more likely than urban females to participate in at least one sport (Springer et al., 2006). A study by Liu et al. (2008) also found that among rural and urban children aged 10 to 17 years, urban children had higher levels of physical inactivity (29.1%) compared to rural children (25.5%). Younger, rural males (aged 10 to 14 years) were actually less likely to be physically inactive comparatively (J. Liu et al., 2008), potentially highlighting not only the impact of geographical region, but also age.

PHYSICAL ACTIVITY DECLINE FROM CHILDHOOD TO ADOLESCENCE

The 2018 Physical Activity Guidelines recommend daily participation in 60 minutes or more of moderate to vigorous physical activity (MVPA) for children ages 6 to 17 (U.S. Department of Health and Human Services, 2018). Additionally, the National

Association for Sport and Physical Education (NASPE) (2012) suggests that elementary students receive 150 minutes of physical education (PE) every week for the full length of the school year while middle school and high school students receive 225 minutes every week for the entire school year. NASPE (2006) also recommends a minimum of 20 minutes of recess per day in conjunction with PE. In addition to PE and recess, regular activity breaks from sedentary time in the classroom are considered a necessity (Centers for Disease Control and Prevention, 2018; Institute of Medicine et al., 2013). Despite the recommendations, a majority of U.S. children and adolescents aged 6 to 17 years old are not meeting the guidelines (Institute of Medicine et al., 2013; Janssen & LeBlanc, 2010; National Physical Activity Plan Alliance, 2018). In fact, recent data revealed that only around 24% of children participate in the recommended guidelines of at least 60 minutes of MVPA per day (National Physical Activity Plan Alliance, 2018).

This is a compounding issue since PA levels and intensity often decrease as grade level increases (Allison et al., 2007; Corder et al., 2019; Institute of Medicine et al., 2013; Nader et al., 2008; Wickel et al., 2009). Emerging research from Pate, Saunders, et al. (2022) observed an overall decrease in PA levels between the ages 10 and 17 years at a rate of 1.76 minutes per hour per year of observation. However, in another study conducted by Pate, Schenkelberg, et al. (2019) one group of youth (Group 1) being followed from 5th to 11th grade did not show any change in PA from ages 10 to 14 years and increased in PA from ages 14 to 16 years. This was not observed in the other two groups though, where both groups decreased in PA levels at approximately two minutes per hour or 20 to 24 minutes per day over the observational period (Pate, Schenkelberg, et al., 2019). The discrepancy observed in Group 1 should be interpreted cautiously,

given the subset of participants (4% of the entire sample) were predominately male, less physically mature, and had the lowest mean BMI compared to the other two groups (Pate, Schenkelberg, et al., 2019). Lau et al. (2017) found similar patterns of total physical activity (TPA) and MVPA decline in youth transitioning from elementary school (5th grade) to middle school (6th grade) and then into 7th grade, with the steepest decline occurring from 5th to 6th grade. Another study examining students' PA from ages 10 to 14 years at varying time-segments (e.g., weekdays vs weekends, in-school vs out-of-school, out-of-school vs weekends, and lesson-time vs lunch time) found MVPA and TPA to decrease over time for all time-segments, except during lesson times (Brooke et al., 2016). This lack of change during lesson time however was attributed to students being required to remain seated (Brooke et al., 2016).

Similarly, a study by Rutten et al. (2014) tracking 6th graders in elementary school as they moved into middle school and progressed to 8th grade using pedometers found an overall increase in sedentary behavior (SB), but no change in step count. Even though step count remained the same during the transition from elementary to middle school, self-reported MVPA decreased over the years, indicating that the type, amount, and intensity of PA available in middle school may be different from elementary school (Rutten et al., 2014). Additionally, Harding et al. (2015) observed the PA of adolescents ages 12 to 15 years as they transitioned through middle school and high school. During this time, there were significant increases in the proportion of time spent sedentary during school, after-school, and on weekends as well as a significant decline in light physical activity (LPA) across all areas and in MVPA during school hours (Harding et al., 2015). Another study that observed upper elementary students and secondary students' PA with

accelerometers resulted in overall lower in-school PA compared to out-of-school PA for secondary students, with a significantly lower level of PA at the primary to secondary school transition period (Gidlow et al., 2008). Gidlow et al. (2008) mentions homework pressures, instances of embarrassment, self-consciousness, and the onset of puberty being potential reasons behind this drop in activity during the transition from elementary to middle school. However, the data from the study did suggest that adolescence may be compensating for the lack of in-school physical activity with out-of-school activities (Gidlow et al., 2008). Not only do these results point to the importance of participation in organized activities outside of school, but it also provides evidence that the changes children experience when moving into adolescence may play a role in their PA levels (Gidlow et al., 2008).

MATURATION

For many students, the transition from elementary school to middle school elicits a host of concerns, emotions, and behaviors (Arowosafe & Irvin, 1992) and typically occurs during the start of their developmental period or puberty and maturation (Anzilotti, 2022; Goldstein et al., 2015). The years between 6 and 14 mark a time of important developmental milestones (Centers for Disease Control and Prevention, 2021b; J. S. Eccles, 1999). Not only are youth working toward self-awareness, competency, and independence during this time, they are going through major cognitive and biological changes that impact their minds and bodies (J. S. Eccles, 1999). This time of adolescence is characterized by social, behavioral, psychological, and physiological changes (Holder & Blaustein, 2014; Sherar et al., 2010) and is defined as the maturation of cognitive and social behaviors related to the changes of puberty (Sisk & Foster, 2004). According Sisk

& Foster (2004), puberty is the activation of the reproductive system, resulting in reproductive capabilities, while the timing and tempo of progress toward the mature biological state, often described as the process of becoming mature, is referred to as maturation (Malina et al., 2004).

Different timing of puberty and maturation in youth may be related to the decline in PA (Sherar et al., 2010). A study following the PA patterns and psychological well-being of U.S. girls at ages 11 and 13 found early maturation at age 11 led to lower psychological health at age 13, which in turn resulted in lower levels of MVPA and decreased enjoyment of PA (Davison et al., 2007). Similarly, a study conducted by Pate, Dowda, et al. (2022) observing maturation and PA of girls as they transition from 5th to 7th grade, found that girls who matured earlier had lower levels of PA compared to girls who matured later at each grade level. However, this study also found lower levels of self-efficacy, enjoyment motivation, and competence motivation in girls who matured later (Pate, Dowda, et al., 2022). Both findings suggest the importance of providing different PA opportunities that are fun, social, and increase self-confidence during this time frame (Pate, Dowda, et al., 2022). In addition, a study conducted by Murdey et al. (2004) stated that boys and girls ages 10 to 17 years old progressing through puberty reported greater amounts of SB as puberty status increased. A study observing female British students from 7th to 9th grade found peer acceptance of maturation to impact PA levels (Pindus et al., 2014). Girls who matured early and on time reported greater participation in PA when they had higher perceptions of acceptance from peers compared to those who perceived less peer acceptance (Pindus et al., 2014). Another study examining British youth aged 13 and 14 found that chronological age was less associated

with PA levels compared to biological maturity, which may explain why boys are more likely to participate in PA than girls of the same age at certain time periods in adolescence (Cumming et al., 2009).

Contrary to these findings, Sherar et al. (2007) examined the PA and biological maturity of Canadian girls and boys 8 to 13 years of age and found that levels of PA among both sexes decreased as age and maturity increased. Similarly, another study assessing the PA levels and barriers to PA among adolescent girls 8 to 15 years old by grade level and maturity, observed a decrease in PA as grade level increased and found barriers to PA more closely related to grade level (Sherar et al., 2009), suggesting that grade level environment may also play a role in PA patterns. Biological maturity was discovered to have no impact on PA in this study (Pindus et al., 2014). Another study provides evidence that the transition period from elementary school to middle school could have an impact on students' PA through the findings of declined grade point average, class preparation, and self-esteem (Seidman et al., 1994) since research has shown that early maturing girls and late maturing boys with low self-esteem tend to participate in lower amounts of PA (Sherar et al., 2010). This idea is supported by the claim that participation in PA is closely related to improved anxiety/stress, self-concept, depressive symptoms, and self-esteem (Calfas & Taylor, 1994).

As previously mentioned, a noticeable decline in PA during adolescence is prominent (Allison et al., 2007; Cumming et al., 2009; Janssen & LeBlanc, 2010; Nader et al., 2008; National Physical Activity Plan Alliance, 2018; Wickel et al., 2009). Disengagement from PA during adolescence is likely associated with the interaction of maturation, puberty, and a variety of social, behavioral, environmental, and biological

factors (Sherar et al., 2010). Since youth PA patterns established in adolescence tend to continue into adulthood (Hayes et al., 2019; Telama, 2009; Telama et al., 2005) and provide the highest likelihood of decreased mortality and increased longevity (Hills et al., 2007), it is imperative that interventions tailored to youths' specific needs are implemented to foster strong PA patterns during adolescence.

ORGANIZATIONAL STRUCTURES

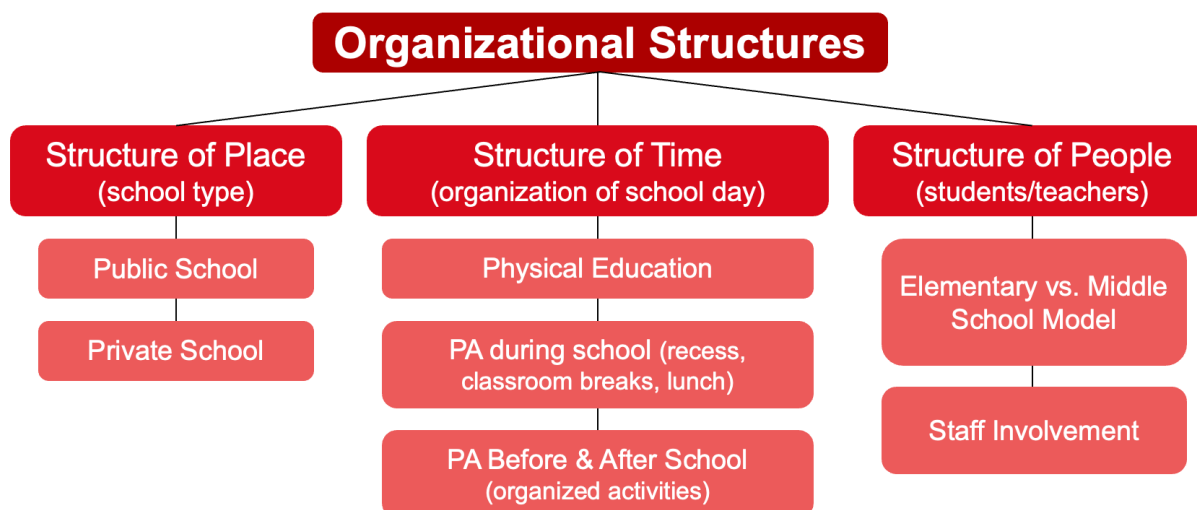
Given that attendance to school is nearly universal (Nathan et al., 2018) and young people spend roughly half of their daytime hours at school (Fox, 2004; Institute of Medicine et al., 2013), schools are recommended settings to increase youth PA through the implementation of PA initiatives (Institute of Medicine et al., 2013; World Health Organization, 2008). In addition, schools are considered "central hubs" for families and peer groups in many communities (Webster, 2022), making them an ideal location for physical activity promotion both before and after school. Research notes that school and/or grade structure can influence adolescents' behaviors (Sherar et al., 2010), and environments that are not adapted to adolescents' needs can eventually cause them to lose self-confidence and spiral into poor behavior patterns (J. S. Eccles, 1999). Similarly, Cleveland (2016) claimed that one's abilities (i.e., engagement, learning, and movement) within a school environment are hugely impacted by the school's structures which includes the built environment. Research has also shown student's PA to be linked to the social environment (Button et al., 2013). This study conducted by Button et al. (2013) found that a higher social capital score which refers to the social connections between people was associated with higher levels of MVPA in students. The way in which a school's environment is built and its social dynamics can impact students' academics,

social abilities, psychological well-being, engagement and willingness to participate, sense of belonging and ownership of learning, and ability to move during the school day (Cleveland, 2016; Kirby et al., 2013). Understanding the structural differences between primary and secondary school, and the impact these differences have on youth PA is important since a school's built and social environment can impact the access to PA opportunities (Institute of Medicine et al., 2013; Kirby et al., 2013).

According to Ellerbrock et al. (2018), the way in which a school is structured can be referred to as "organizational structures". These structures include the structures of place (i.e., types of school), the structures of people (i.e., students, teachers), and the structures of time (i.e., organization of school day) (Ellerbrock et al., 2018). Within these organizational structures, PA opportunities emerge through the implementation of five components: physical education, PA during school (i.e., recess, lunch, PA in the classroom, and special events like field day), PA before and after school (i.e., before and after school PA programs through the school or community organizations, active transportation programs to and from school), staff involvement (i.e., activity levels of teachers and staff, promotion of PA, and participation in PA with students), and family and community engagement (i.e., encouragement and participation from family members, access to neighborhood recreational spaces and equipment, availability of public transportation and safety of communities) (Webster, 2022). A breakdown of the three organizational structures can be seen in figure 1. For the sake of this paper, the structure of people and the structure of time will be analyzed, focusing specifically on the differences in PE, PA during school, and PA before and after school in schools following elementary and middle school models.

Figure 1

Types of Organizational Structures and the Components Within Each One



Structure of People: Students and Teachers

Schools in the United States are organized into elementary school (primary), middle school (intermediate), and high school (secondary) (*Organization of U.S. Education: The School Level*, 2008). Depending upon state and district policy, elementary education typically ranges from kindergarten to fifth grade while middle school ranges from sixth to eighth grade (*A Guide to the US Education Levels*, 2022). In both elementary school and middle school, age-based grade levels are used to group children and adolescents (*Why Do We Separate School Kids by Age Groups?*, 2018). Students are sometimes split up by their learning level in middle school (*A Guide to the US Education Levels*, 2022). During primary education, children tend to attend schools following an elementary school model of teaching (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963). This model involves organizing students into self-

contained classrooms where they learn all subjects from one teacher throughout the school day (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963). Schools following an elementary school model with self-contained classrooms typically have specialist teachers who teach subjects such as music, art, and physical education in their own classrooms as well (Lobdell & van Ness, 1963). Conversely, the majority of middle schools follow a middle school model in which subjects are departmentalized (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963). A departmentalized structure means youth travel from classroom to classroom, being taught different subjects by different teachers throughout the school day (*A Guide to the US Education Levels*, 2022; Lobdell & van Ness, 1963).

According to a systematic review by Rickwood (2013), there is a positive correlation between the presence of positive adult and peer role models at school and increased PA of young people during the school day. Even though there are an increased number of adult interactions from changing classrooms within a middle school model of teaching, young people transitioning into middle school tend to report more positive associations with peers and report fewer positive associations with adults compared to elementary children (Lynch & Cicchetti, 1997). According to the book *Yardsticks: Children in the Classroom, Ages 4 – 14* (2015), children in 5th grade need adult empathy and humor. The book states they also enjoy adult recognition while youth in 6th grade care more about peer opinions than teacher opinions, and are more willing to accept help from adults other than their teachers and parents (Wood, 2015). Additionally, compared to students in a departmentalized school setting (i.e., middle school model), students in a self-contained setting (i.e., elementary school model) have a longer length of time to form

positive relationships with peers and adults (Hamalainen, 1958). These positive relationships can lead to effective role modeling and peer support which is associated with participation in PA (Efrat, 2009). Another study analyzing PA promoting practices between elementary and middle school teachers found that teachers who participated in higher levels of MVPA without obesity were more likely to promote PA (Pulling Kuhn et al., 2021). Pulling Kuhn et al. (2021) also observed these practices to be more regularly implemented in elementary schools compared to middle schools. Overall, this suggests that the organizational structure of people may play a role in young peoples' PA levels as they transition into middle school.

Structure of Time: Organization of the School Day

Not only can peer and adult relationships play a role in young peoples' PA, the organization of the school day can also provide the opportunity for participation in PA such as recess, physical education, classroom PA, access to fixed and portable equipment during lunch (e.g., playgrounds, basketball hoops, balls, hula hoops), and extracurricular sports (Wechsler et al., 2000). Ample research has shown a decline in PA as young people transition from elementary to middle school (Allison & Adlaf, 2000; Barnett et al., 2006; Brooke et al., 2016; Gidlow et al., 2008; Harding et al., 2015; Institute of Medicine et al., 2013; Lau et al., 2017; Pate, Dowda, et al., 2019; Pate, Saunders, et al., 2022; Pate, Schenkelberg, et al., 2019; Rutten et al., 2014). However, research provides limited findings on how the difference in structures of time (e.g., number of sessions and length of both PE and recess, classroom structure and activity breaks, PA opportunities during lunch, and availability of organized activities) between elementary school models of teaching and middle school models of teaching impact the decline in PA levels (Allison

& Adlaf, 2000; Barnett et al., 2006; Brooke et al., 2016; Gidlow et al., 2008; Harding et al., 2015; Institute of Medicine et al., 2013; Lau et al., 2017; Pate, Saunders, et al., 2022; Rutten et al., 2014).

Physical education.

PE structured within the school day promotes and provides students with the opportunity to participate in PA (Tompkins et al., 2004). Daily PE is recommended for students kindergarten through 12th grade by the National Association for Sports and Physical Education (*National Association for Sport and Physical Education, 2023*). However, research shows a drop in student participation and a drop in the amount of PE offered from elementary school to middle school (Kolbe et al., 2001; Tompkins et al., 2004). According to the 2000 School Health Policies and Programs Study (SHPPS) about half of schools required PE in 1st through 5th grade while only 25% required PE in 8th grade, with a majority of schools not providing PE for the entire school year for all grade levels (Kolbe et al., 2001). Kolbe et al. (2001) also notes that schools with reduced amounts of PE observed a decrease in PA levels across grade levels. According to the most recent SHPPS, the percentage of schools requiring PE to be taught decreased from elementary (92.6%) to middle (89.7%) as well as the percentage of schools having specified time requirements for PE (i.e., elementary, 73.5%; middle, 70.5%) (*SHPPS: Results from the School Health Policies and Practices Study, 2016*).

According to one study observing opportunities and participation in PE and intramurals in Ontario elementary and secondary schools, grades 1-8 received on average just below three sessions of PE a week with duration of PE class and intensity of PA increasing with grade level (Allison & Adlaf, 2000). While duration and intensity did

increase, the study noted that the levels of PA students received were still either just at or approaching the recommended guidelines (Allison & Adlaf, 2000). Additionally, Allison and Adlaf (2000) found that even though PE was offered at 98% of secondary schools, enrollment in PE decreased substantially as grade level increased, potentially being due to the fact that PE is no longer a requirement at higher school levels. Similarly, another study examining student engagement in PA during PE in 24 middle schools observed daily PE providing only around 83 minutes of MVPA per week and 25 minutes of vigorous activity per week which is less than the national guidelines (McKenzie et al., 2000).

Comparatively, Fairclough and Stratton (2006) reviewed existing literature on PE within elementary schools and found that students at the elementary level are also not meeting the recommended amount of engagement time during PE. Unlike middle school though, elementary PE sessions tended to last around 33 minutes with students participating in only around 13 minutes of MVPA per lesson (Fairclough & Stratton, 2006). Fairclough and Stratton (2006) also noticed a trend of increased activity during PE as grade level went up. However, reasoning as to why students were more active as they got older was unclear (Fairclough & Stratton, 2006). Another study looking at PA opportunities before, during, and after school at 227 elementary schools in Montreal found PE classes to range from 30 to 120 minutes a week with only about 20% to 90% of that time spent in motor activity (Barnett et al., 2006). In addition, Barnett et al. (2006) observed that even though the majority of schools offered PE more than once a week, availability decreased as grade level increased. Whether this trend continues into middle

school is unknown since this study was only conducted within elementary schools (Barnett et al., 2006).

Recess.

Another avenue for schools to provide PA to students is recess. Recess allows children unstructured opportunities for PA and play (Wechsler et al., 2000), which is recommended by the CDC's Guidelines for School and Community Programs to Promote Lifelong Physical Activity among Young People (Centers for Disease Control and Prevention, 1997). However, PA requirements outside of PE decrease considerably in middle school and high school with many secondary schools not even providing recess (Institute of Medicine et al., 2013). Other research has mentioned the difficulty in reviewing play behaviors and PA of middle school students since recess is an "extreme rarity" at the middle school level (Jarrett & Duckett-Hedgebeth, 2003). This is unlike elementary school where the need for movement, play, and socialization is deemed impactful and thus scheduled into the day as recess (Barnett et al., 2006). While data on recess at the intermediate level was not noted, the 2016 SHPPS did find that 31.3% of districts recommended that elementary schools provide regular recess while 64.8% of districts required it (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). Even though recess tends to be implemented at the elementary level, the number of recess sessions and length of recess period vary by school and by grade level within school (Pellegrini & Smith, 1993). Among the districts that required or recommended recess in the 2016 SHPPS data, there was variation in the number of minutes per day required or recommended among those districts (i.e., 30 or more minutes, 30.2%; 20 to 29 minutes, 35.1%; 10 to 19 minutes, 18.7%; less than 10 minutes,

0.6%; no specified requirement, 15.5%) (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). Additionally, an article in *Childhood Education* that interviewed teachers about recess opportunities for students in their district revealed on average elementary students received 15 to 25 minutes a day while middle school students received none (Blackwell, 2004). Another study found that elementary students attended an average of 1.5 recess periods a day, averaging around 18.3 minutes (Ross et al., 1987). Similarly, a study assessing school-based opportunities for physical activity in elementary, middle, and high schools discovered that 94% of elementary schools reported providing recess daily for roughly 24 minutes per day (Tompkins et al., 2004). Data on this school structure was not available for the intermediate level because the recess questions were omitted from the middle and high school version of the questionnaire in this study (Tompkins et al., 2004).

Organized activities.

Even though kids spend a majority of their day at school, a large portion of PA among young people occurs outside of school (Simons-Morton et al., 1990), making promotion of organized activities such as before-school and after-school programs, youth clubs and sports, Girl Scouts and Boy Scouts, and 4-H essential to increasing children and adolescents PA (Pate et al., 1995). Additionally, organized activities appear to benefit young people in a variety of other ways (e.g., academic performance, social behaviors and relationships, mental health and physical health, and school engagement) (Beighle & Moore, 2012; Y. Liu et al., 2021; Mahoney et al., 2005). These benefits provide youth with the necessary skills to be successful and help to prepare them for the transition into adulthood (Mahoney et al., 2005). A longitudinal study conducted by Liu et al. (2021),

collected data on adolescents' activity and academic skills in 6th grade, 9th grade, and 12th grade. The study found a link between activity intensity and activity quality in 6th and 9th grade and academic performance in 12th grade, suggesting that participation in organized activities at a young age may prepare young people for academic success in middle school and high school (Y. Liu et al., 2021). Another study conducted by Trost et al. (2008) analyzed the PA levels of students in grades 3 – 6 at after-school programs. Overall, after-school programs were found to be a positive contributor to the PA levels of children and youth, with students accumulating an average of 20.3 minutes of MVPA when participating in an after-school program (Trost et al., 2008).

Despite the positive impact organized activities can have on youth, participation in these out-of-school opportunities seem to decline as children move into adolescence (J. Eccles & Gootman, 2002; Mahoney et al., 2005; Shann, 2001). One study that surveyed 1,583 students on how they spend their time on the weekends and after school found that 77.2% did not participate in an after-school program and 86.5% did not participate in lessons of any kind (Shann, 2001). Somewhat similarly, the SHPPS 2016 data showed that 1.2% of districts required PA before school and 25.2% recommended it at the middle school level compared to an increased percentage for both required (2.6%) and recommended (28.6%) PA before school at the elementary level (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). However, the percentage of districts requiring and recommending PA after school was greater at the middle school level compared to the elementary level (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). The type of physical activity districts required or recommended students to participate in is not specified in the SHPPS (*SHPPS: Results*

from the *School Health Policies and Practices Study*, 2016). Another study by Leek et al. (2011), reported that a player can reach up to 75 percent of their 60 minutes of recommended PA per day through youth sports practice. However, roughly 80 percent of young people tend to drop out of youth sports by the age of 12 (Leek et al., 2011). Additionally, a study examining extracurricular activity programs at 24 public middle schools found that while all schools offered multiple extracurricular activity programs, participation was incredibly low (Powers et al., 2002). The decline in organized activity participation as children get older may be due to the following: an increase in skill level that children do not have, a decline in programs for older youth, an increase in membership cost or decrease in membership availability, lower school budgets for before- and after-school programs, programs that are not tailored to adolescents' interests, and an increase in adolescence employment (Mahoney et al., 2005).

Additional opportunities.

Additional opportunities for PA within the school day other than PE and recess should be provided in order for youth to reach the recommended guidelines of PA (Centers for Disease Control and Prevention, 2018; Institute of Medicine et al., 2013). According to the Institute of Medicine et al. (2013), activity breaks tend to be regularly implemented in elementary classrooms, but very few, if any, are incorporated into middle school classrooms, which is attributed to the increase in academic demand, time restraints, and lack of age-appropriate activities. Recent SHPPS data reveals that districts require or recommend regular classroom PA breaks in elementary school at a higher percentage than in middle schools (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). Another characteristic that may influence PA is the type of

classroom students are in (i.e., self-contained vs departmentalized) (Rutten et al., 2014). In one study, the transition from elementary to middle school resulted in students switching from staying in the same classroom during the school day (i.e., self-contained) to regularly moving from one classroom to the next (i.e., departmentalized), which may have accounted for the similar step count observed between grade levels (Rutten et al., 2014). There is however limited research on the effect the self-contained and departmentalized classroom structures have on youth PA levels. Additionally, Brooke et al. (2016) followed 10-year olds' TPA and MVPA in-school and out-of-school over 5 years witnessing an overall decrease in PA during lunch as grade level increased. Lunch time MVPA and TPA was greater than PA during lesson-time though, which was attributed to students being required to remain seated during lessons even as grade level increased (Brooke et al., 2016). Elementary schools in Montreal also used lunchtime as another opportunity for students to participate in PA with 21% of schools making these extracurricular PA opportunities available during lunch only and 28% offering these activities both during lunch and after school (Barnett et al., 2006). The specific types of extracurricular PA offered were not mentioned (Barnett et al., 2006). Whether these opportunities were also provided in middle schools is unknown (Barnett et al., 2006). The SHPPS 2016 highlights the requirement or recommendation that recess be provided in conjunction with lunch either right before or directly after (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). Similar to other studies, there was no mention of lunch recess at the middle school level (*SHPPS: Results from the School Health Policies and Practices Study*, 2016). A study by Tompkins et al. (2004), did find that 64% of middle and junior highs offered free time at lunch which provided the

opportunity for students to be physically active. However, the number of minutes students spent being physically active during that time was not analyzed and thus, further research should examine the amount of PA students are participating in during lunch (Tompkins et al., 2004).

Gap in organizational structures research.

While research notes the decline of PA levels as children transition into adolescence (Allison et al., 2007; Corder et al., 2019; Institute of Medicine et al., 2013; Nader et al., 2008; Wickel et al., 2009), there seems to be a gap in the understanding of the impact that organizational structures have on this decline (Gidlow et al., 2008; Lau et al., 2017; Pate, Schenkelberg, et al., 2019). A study by Lau et al. (2017) found patterns of total PA and MVPA to decline in youth transitioning from elementary school (5th grade) to middle school (6th grade) and then into 7th grade. The steepest decline observed occurred from 5th to 6th grade, suggesting that an overall decrease in PA within the middle school setting may be a contributing factor (Lau et al., 2017). While specific reasons as to why youth PA decreased are not mentioned in the study, Lau et al. (2017) does suggest future research examines what factors contribute to this decrease during the transition from elementary to middle school. Likewise, 91.6% of the sample (100% preschool, 100% elementary, 79.8% secondary) in a study conducted by Gidlow et al. (2008) met the guidelines of 60 minutes of MVPA each day. The study itself did not investigate what organizational structures differed between elementary school and middle school, but it did state that PE and recess opportunities during the school day can make an impactful contribution and need to be promoted within secondary schools, specifically during the transition from elementary to middle school (Gidlow et al., 2008). Conversely,

Pate, Schenkelberg, et al. (2019) observed one out of the three groups of youth (Group 1) transitioning from elementary to middle school to have plateaued in PA levels from the ages 10 to 14 years old and then to have increased their PA level from ages 14 to 16. The difference in results among the three groups may be attributed to Group 1s small sample size ($n = 27$), and consisting of predominately males with lower mean BMI and maturity levels (Pate, Schenkelberg, et al., 2019). However, the data still suggests a deeper investigation into the effect of organizational structures should occur. Further investigation can in turn improve interventions and ensure youth receive the recommended amount of PA as they progress into adulthood (Barnett et al., 2006).

SUMMARY

In summary, regular participation in PA is a modifiable health behavior for the management and prevention of numerous chronic diseases and other health related issues in adulthood (Miles, 2007; Warburton et al., 2006). PA has also been shown to positively benefit youth physiologically, psychologically, cognitively, and academically (Álvarez-Bueno et al., 2017; Janssen & LeBlanc, 2010; Lubans et al., 2016). However, children and adolescents are insufficiently active (Institute of Medicine et al., 2013; Janssen & LeBlanc, 2010; National Physical Activity Plan Alliance, 2018). PA levels in youth tend to decrease as grade level increases which is a rising concern since research has shown PA patterns established in adolescence tend to follow youth into adulthood (Allison et al., 2007; Institute of Medicine et al., 2013; Nader et al., 2008; Telama, 2009; Telama et al., 2005; Wickel et al., 2009). It is important to keep in mind that the years between 6 and 14 mark a time of important developmental milestones (Centers for Disease Control and Prevention, 2021b; J. S. Eccles, 1999) where youth are progressing through maturation

and puberty (J. S. Eccles, 1999; Sisk & Foster, 2004). This is a time characterized by social, behavioral, psychological, and physiological changes (Holder & Blaustein, 2014; Sherar et al., 2010) that have been shown to be related to the decline in youth PA depending upon the individual's timing of maturation and puberty (Sherar et al., 2010). Since the transition into adolescence typically begins when youth are moving from elementary school to middle school (Anzilotti, 2022; Goldstein et al., 2015), focusing on ways to implement PA initiatives and increase PA opportunities within schools are imperative (World Health Organization, 2008).

The decline in PA as youth get older is consistent across research (Allison & Adlaf, 2000; Barnett et al., 2006; Brooke et al., 2016; Corder et al., 2019; Gidlow et al., 2008; Harding et al., 2015; Institute of Medicine et al., 2013; Lau et al., 2017; Pate, Dowda, et al., 2019; Pate, Saunders, et al., 2022; Pate, Schenkelberg, et al., 2019; Rutten et al., 2014), but data on the impact of differences in organizational structures between elementary and middle school models of education on youth PA levels remains inconsistent (Allison & Adlaf, 2000; Barnett et al., 2006; Brooke et al., 2016; Gidlow et al., 2008; Harding et al., 2015; Institute of Medicine et al., 2013; Lau et al., 2017; Pate, Schenkelberg, et al., 2019; Rutten et al., 2014). Providing this gap in literature and the need for adolescence to create positive PA patterns before progressing into adulthood, we aim to (1) describe the differences in organizational structures pertaining to PA between elementary and middle school models of education across four rural, Midwestern communities, and (2) describe the differences in 5th and 6th grade students' PA and organized activity participation by the organizational structures of the two school models.

CHAPTER III

Methods

This cross-sectional case study was a sub-study of the Wellscapes Project, a staggered-start community randomized trial that was implemented in two waves (ClinicalTrials.gov Identifier: NCT03380143). The Wellscapes Project is an ongoing social epidemiology study of four Midwestern, rural communities designed to assess the impact of a multi-level community system intervention on youth physical activity and community change (ClinicalTrials.gov Identifier: NCT03380143). Some participating schools in the communities followed an elementary school model (i.e., 5th and 6th grade in elementary school) whereas others followed a middle school model (i.e., 5th grade in elementary school and 6th grade in middle school). The specific aims for this cross-sectional case study are to (1) describe the differences in organizational structures pertaining to PA between elementary and middle school models of education across four rural, Midwestern communities, and (2) describe the differences in 5th and 6th grade students' PA and organized activity participation by the organizational structures of the two school models. The protocol for all study activities (IRB #439-18-EX and #446-18-EP) were approved by the Institutional Review Board at the University of Nebraska Medical Center.

SETTING

The present case study was derived from Wave 1 and Wave 2 baseline data (2018 and 2021, respectively) of the Wellscapes Project in which two rural communities represented by predominantly white children (Wave 1) and two rural communities represented by predominantly Hispanic/Latino children (Wave 2) were targeted for

recruitment. Rurality was defined as an area which meets the National Center for Education Statistics' definition for rural setting based on population size and distance from the nearest urban area (Geverdt, 2015). The objective was to characterize a rural community based on its social structure that encompassed both in-school and out-of-school locations where young people live, engage in leisure activities, and learn.

Therefore, it was imperative that the remote location of each community was far enough away from major urban areas so that children and youth did not travel outside of town for activities (Kellstedt et al., 2021). Inclusion criteria of communities included the following: located in a rural micropolitan area (> 10 miles from an urbanized area), population size large enough to have a public school district containing one high school (> 10 miles from an urbanized area), provided after school programs and youth club and sport opportunities, adult leaders were present in-school, after-school, and at clubs, and 3rd through 6th grade students were available to participate. For information on the classifications of population and distance, reference Kellstedt et al. (2021).

PARTICIPANTS

This case study focused on the 5th and 6th grade baseline population PA and corresponding questionnaire data of Wave 1 (2018) and Wave 2 (2021). There were 198 fifth graders and 170 sixth graders ($n = 368$ total) enrolled in public school within the four communities at the time of the study. Data from 59 fifth graders and 49 sixth graders from community one, 63 fifth graders and 51 sixth graders from community two, 28 fifth graders and 34 sixth graders from community three, and 39 fifth graders and 28 sixth graders from community 4 will be used in analyses ($n = 189$ fifth graders; $n = 162$ sixth graders; $n = 351$ total). Students self-reported grade, gender, participation in organized

activities, sedentary behavior, and physical activity data via the YAP questionnaire (Kellstedt et al., 2021; Schenkelberg et al., 2021; Von Seggern et al., 2022). Under a Data Sharing Agreement with the research team, PA data was linked with demographic characteristics without needing active consent (Schenkelberg et al., 2021). Schools provided population enrollment data including grade, gender, free-and-reduced lunch status, and race/ethnicity (Schenkelberg et al., 2021). Active consent was needed to link the free and reduced lunch status (FRLS) variable to physical activity data.

Additionally, differences in organizational structures between the school systems were analyzed using baseline questionnaire data of Wave 1 (2018) and Wave 2 (2021) and administrator self-reported data on number of sessions and length of PE and recess. Two of the four communities followed an “elementary school model” where 5th and 6th grade students ($n = 175$; Community 1, $n = 108$; Community 4, $n = 67$) attended school at the same building and spent the majority of the day in a self-contained classroom learning all core subjects from the same teacher. In the other two communities, students ($n = 176$; Community 2, $n = 114$; Community 3, $n = 62$) followed a “middle school model”. In this model, 5th graders attended a primary school and followed the “elementary school model” previously mentioned while 6th graders attended a middle school where they transitioned from classroom to classroom learning different subjects from different teachers. Sample sizes of 5th and 6th graders that complete the YAP by school model, community, and Wave can be seen in Table 1.

Table 1*5th and 6th Graders Who Complete the YAP by School Model, Community, and Wave*

Total Number of 5th & 6th Graders Who Completed the YAP					
	Elementary School Model		Middle School Model		
	Community 1 (Wave 1, 2018)*	Community 4 (Wave 2, 2022)*	Community 2 (Wave 1, 2018)*	Community 3 (Wave 2, 2022)*	Total by grade level
5 th Grade	59	39	63	28	189
6 th Grade	49	28	51	34	162
Total by community	108	67	114	62	351
Total by school model	175		176		

* Wave 1 (2018) was predominately White children & youth and Wave 2 (2022) was predominately Hispanic/Latino children & youth

PROCEDURES

Physical Activity Surveillance System

The Youth Activity Profile (YAP) was utilized to collect data on and estimate physical activity. The YAP is an online, self-administered physical activity assessment tool designed to estimate in-school and at-home physical activity and sedentary behavior of children and adolescents over the last seven days (Saint-Maurice & Welk, 2015). This questionnaire consists of 15 items broken up into three sections (in-school, out-of-school, and sedentary behavior) (Saint-Maurice & Welk, 2015). Each section contains five questions all structured on a 5-point Likert scale and is designed to be scored independently, with a higher score representing a higher activity level or sedentary time (Saint-Maurice & Welk, 2015). Questions in the in-school section examine MVPA during six parts of the school day: transportation to school, transportation from school, physical education, lunch (Fall 2018), classroom activity breaks, and recess). Questions in the out-of-school section focus on activity before school, after school, during the

evening, and on the weekends. Sedentary questions relate to time spent watching TV, using a cell phone, playing video games, using the computer, and overall sedentary time (Saint-Maurice & Welk, 2015). The instrument has demonstrated acceptable levels of test-retest reliability (Segura-Díaz et al., 2021) and validity (Fairclough et al., 2019; Saint-Maurice & Welk, 2015).

Children and youth in the Wellscapes study completed the online version of the YAP within the classroom setting using media carts or in the school's media center while supervised by a teacher. Students' self-reported behaviors and raw scores were used in calibration equations to estimate time spent (minutes per day) in MVPA and SB (Saint-Maurice & Welk, 2015). In this study, a set of supplemental questions from the National Survey of Children's Health (NSCH) were added to the YAP in order to obtain organized activities participation in the last month and 12 months (U.S. Census Bureau, 2017). For the purposes of this study, baseline YAP data from participating 5th and 6th grade students from all communities were examined.

MEASURES

Demographics

Children and youth self-reported gender and grade level when completing the YAP. Demographic data (i.e., race/ethnicity, gender, grade, and free and reduced lunch status) was collected from participating schools under a Data Sharing Agreement established between the communities and the research team (Schenkelberg et al., 2021). Active consent was needed for the FRLS variable. Grade was classified as 5th or 6th grade, but only baseline data from Wave 1 and Wave 2 will be used in this study.

Moderate to Vigorous Physical Activity

The primary outcome variable of 5th and 6th grade students' MVPA during school was obtained from the YAP instrument. In this questionnaire, youth were asked to report the number of days (0, 1, 2, 3, or 4 to 5 days) they participated in at least 10 minutes of PA (www.youthactivityprofile.org). The questionnaire consists of five questions related to in-school PA participation, five questions related to out-of-school PA participation, and five questions related to sedentary behavior. This present study utilized the following questions pertaining to in-school PA participation (i.e., physical education, lunch, classroom activity breaks and recess) for data analysis of MVPA at school: (1) How many days each week do you have PE?, (2) How many recess periods do you have per day?, (3) During lunch break, how often were you moving around, walking, or playing?, (4) During physical education, how often were you running and moving as part of the planned games or activities?, (5) During recess, how often were you playing sports, walking, running, or playing active games? (6) During school, how often did you engage in classroom "activity breaks" that involve standing or moving around for 5 minutes or more as part of the normal class activities? (other than PE and recess). Then an algorithm that converts raw YAP scores into minutes of PA per day is used to estimate the accumulation of average PA per weekday (Iowa State University Department of Kinesiology, 2020; Saint-Maurice & Welk, 2015).

Organizational Structure

In this study, the organizational structures of people (i.e., elementary school model, self-contained – learning all subjects from one teacher in the same classroom; middle school model, departmentalization – learning different subjects from different teachers by moving between classrooms) and of time (i.e., organization of school day:

amount and length of PE and recess, and classroom activity breaks) will be analyzed. YAP questions from the in-school section will be utilized for this analysis. These questions are: (1) How many days each week do you have PE?, (2) How many recess periods do you have per day?, (3) During lunch break, how often were you moving around, walking or playing?, (4) During physical education, how often were you running and moving as part of the planned games or activities?, (5) During recess, how often were you playing sports, walking, running, or playing active games?, (6) During school, how often did you engage in classroom “activity breaks” that involve standing or moving around for 5 minutes or more as part of normal class activities? (other than PE and recess). Additional information on the number and length of recess sessions per day, and number and length of PE lessons per week provided via email from school administrators for each grade level will be used for analysis.

Organized Activities

Organized activity participation was determined using the NSCH survey questions added to the YAP which assessed students’ participation in out-of-school activities (e.g., clubs, sports teams and lessons, daily after school programs, and other organized activities). This analysis included the following questions: (1) Did you participate in a daily after school program? (12 months), (2) Did you participate in a daily after school program? (1 month), (3) Did you participate in a sports team or take a sports lesson after school or on weekends? (12 months), (4) Did you participate in a sports team or take sports lessons after school or on weekends? (1 month), (5) Did you participate in any clubs or organizations (4-H, scouting) after school or on weekends? (12 months), (6) Did you participate in any club organizations (4-H, Scouting) after school or on weekends? (1

month), (7) Did you participate in any other organized activities or lessons, such as music, dance, language, or other arts? (12 months), (8) Did you participate in any other organized activities or lessons, such as music, dance, language, or other arts? (1 month), (9) How often do you normally go to organized activities (after school programs, clubs, sport teams), after school and on weekends? For the purposes of this case study, only the NSCH organized activities questions assessing participation in the previous month will be used for analysis.

DATA ANALYSES

Descriptive statistics will be used to summarize demographic characteristics of study participants ($n = 351$) by grade and sex. Data will be summarized by race/ethnicity and FRLS for the subsample who provided consent to link school and physical activity data. Minutes of MPVA per day will be calculated using calibration equations for the YAP. These daily estimates of MVPA at the community level will be derived by aggregating individual-level YAP data. For all analyses SAS (version 9.4) will be used. Descriptives of in-school YAP data questions between communities, administration reported data, and field notes will be compared in order to describe the differences in organizational structures (Aim 1) between the elementary and middle schools. T-tests will then be used to evaluate the difference between 5th and 6th grade PA levels when at the elementary school compared to middle school for each organizational structure analyzed (i.e., number of sessions and length of PE and recess, classroom activity breaks, and opportunities for PA before school, during the lunch period, and after school) (Aim 2). Additionally, chi-square will be run to evaluate questions pertaining to participation in organized activities (1 month) for each wave (Aim 2).

CHAPTER IV

Manuscript

Regular physical activity (PA) during school-aged years is important for children's health (Álvarez-Bueno et al., 2017; Janssen & LeBlanc, 2010; Lubans et al., 2016; U.S. Department of Health and Human Services, 2018). Recommended guidelines include daily participation in 60 minutes or more moderate to vigorous physical activity (MVPA) (U.S. Department of Health and Human Services, 2018), as well as regular participation in recess, physical education (PE), and breaks from sedentary time in the classroom (Centers for Disease Control and Prevention, 2018; Institute of Medicine et al., 2013; National Association for Sport and Physical Education, 2006, 2012). However, recent surveillance estimates less than a quarter of children and youth are meeting these guidelines (National Physical Activity Plan Alliance, 2018; U.S. Department of Health and Human Services, 2018). The inadequate number of young people meeting these guidelines is concerning since PA behaviors established in adolescence tend to track into adulthood which can therefore impact the health of the general population (Hayes et al., 2019; Telama, 2009; Telama et al., 2005).

The inadequate amount of PA among children and youth have been characterized by factors such as age, race/ethnicity, sex, and socioeconomic status (SES) (Braveman et al., 2011; Corder et al., 2019; Gordon-Larsen et al., 2006; Gortmaker et al., 2012; Stalsberg & Pedersen, 2010; Trost et al., 2002). Research has also noted disparities in PA based on geographical area (e.g., rural and urban) (Chillón et al., 2011; Flegal et al., 2010; Joens-Matre et al., 2008; Ludwig et al., 1999; Mokdad et al., 1999, 2001; Patterson et al., 2004; Schoenborn et al., 2002). However, existing research on PA levels of young

people by geographical location is inconsistent (Davy et al., 2004; Felton et al., 2002; Hedley et al., 2004; Joens-Matre et al., 2008; McMurray et al., 1999, 2000; Paxton et al., 2004). In one Midwest study, rural youth aged 9 to 14 were less physically active than urban youth, as compared to a national sample (Paxton et al., 2004). Similarly, rural middle school youth (mean age in years, 12.20) were significantly less active (15.9 minutes/day) compared to urban middle school youth (19.2 minutes/day) (Moore et al., 2013). However, these results are contrary to the results of other studies (Felton et al., 2002; J. Liu et al., 2008; Springer et al., 2006).

One way to address these inconsistencies is through PA promotion (Institute of Medicine et al., 2013; World Health Organization, 2008). Schools tend to be recommended sites for PA promotion (Institute of Medicine et al., 2013; World Health Organization, 2008) because attendance is nearly universal (Nathan et al., 2018), young people spend a significant amount of time there (Fox, 2004; Institute of Medicine et al., 2013), and many communities view them as “central hubs” (Webster, 2022). PA tends to decline as grade level increases with a notable drop occurring during the transition from elementary to middle school (Allison & Adlaf, 2000; Corder et al., 2019; Nader et al., 2008; Wickel et al., 2009). According to Gordon-Larsen et al. (2006), environmental factors play a critical role in PA. Additionally, Cleveland (2016) argues that the way in which the school environment is structured can significantly impact what a student can accomplish during the day in terms of engagement, learning, and movement.

Bronfenbrenner’s Ecological Systems Theory also highlights the importance of observing children and youth in various environments to examine the interaction of the environment on human behavior (Bronfenbrenner, 1979, 2000). Additionally, Barker’s notion of

behavior settings, which emphasizes the effect interconnected ecological units (e.g., schools, homes, and neighborhoods) limited by space and time can have on behavior patterns (Barker, 1963b, 1963a). Thus, it is important to understand the structural differences in environments between elementary school and middle school and how they impact the PA of young people (Barnett et al., 2006).

The way in which a school is structured can be described in terms of “organizational structures” which consist of the structure of place (i.e., types of school), the structure of people (i.e., students, teachers), and the structure of time (i.e., organization of school day) (Ellerbrock et al., 2018). PA opportunities resulting from these structures can standardize PA within school systems (Ellerbrock et al., 2018; Webster, 2022). According to the Comprehensive School Physical Activity Program (CSPAP) implementation of the following five components can increase PA opportunities: physical education (PE), PA during school, PA before and after school, staff involvement, and family and community engagement (Webster, 2022). These structures are crucial for child development, risk-taking opportunities, social skills development, academic performance, and overall health (Álvarez-Bueno et al., 2017; Janssen & LeBlanc, 2010; Lubans et al., 2016; Webster, 2022). PE, classroom breaks, recess, and opportunities for PA before and after school (e.g., active transport, clubs, intramural and interscholastic sports) are present within elementary schools and middle schools (Institute of Medicine et al., 2013; McKenzie & Kahan, 2008). However, the level at which each are present varies (Burgeson et al., 2001; Institute of Medicine et al., 2013; McKenzie & Kahan, 2008). Recess tends to be minimal or non-existent at the middle school level, while intramural and interscholastic sports tend to be more common

(Burgeson et al., 2001; Institute of Medicine et al., 2013). Recent trends also reveal a decrease in active transportation to and from school from elementary to middle school (Institute of Medicine et al., 2013).

Despite the evidence suggesting the importance of PA within schools, there is a gap in our understanding of the impact the differences in organizational structures pertaining to PA in elementary schools and middle schools have on young peoples' PA levels (Barnett et al., 2006; Harding et al., 2015; Lau et al., 2017; Pate, Schenkelberg, et al., 2019; Webster, 2022). Providing this gap in literature and the need for adolescence to create positive PA patterns before progressing into adulthood, we aim to (1) describe the differences in organizational structures pertaining to PA between elementary and middle school models of education across four rural, Midwestern communities, and (2) describe the differences in 4th, 5th, and 6th grade students' PA and organized activity participation by the organizational structures of the two school models.

METHODS

Participants

The cross-sectional case study was derived from Wave 1 and Wave 2 baseline data (2018 and 2021, respectively) of the Wellscapes Project, a staggered-start community randomized trial across four rural, Midwestern communities (ClinicalTrials.gov Identifier: NCT03380143), in which two communities represented by predominantly white children (Wave 1) and two rural communities represented by predominantly Hispanic/Latino children (Wave 2) were targeted for recruitment. Rurality was defined as an area which meets the National Center for Education Statistics' definition for rural setting based on population size and distance from the nearest urban

area (Geverdt, 2015). Inclusion criteria of communities included the following: located in a rural micropolitan area (> 10 miles from an urbanized area), population size large enough to have a public school district containing one high school (> 10 miles from an urbanized area), provided after school programs and youth club and sport opportunities, adult leaders were present in-school, after-school, and at clubs, and 3rd through 6th grade students were available to participate. For information on the classifications of population and distance, reference Kellstedt et al. (2021). Students self-reported grade and gender (Kellstedt et al., 2021; Schenkelberg et al., 2021; Von Seggern et al., 2022).

Demographic data (i.e., race/ethnicity, gender, grade, and free and reduced lunch status, “FRLS”) was collected from participating schools under a Data Sharing Agreement established between the communities and the research team (Schenkelberg et al., 2021). Active consent was needed to link the FRLS variable with physical activity data. Grade was classified as 3rd, 4th, 5th, or 6th grade, but only baseline data from Wave 1 (2018) and Wave 2 (2021) for 4th through 6th graders were used in the present case study.

In total, there were 173 fourth graders, 198 fifth graders, and 170 sixth graders ($n = 541$ total) enrolled in public school within the four communities at baseline. Out of the 541 fourth, fifth, and sixth graders enrolled, 507 completed the study activities and were used in the analyses ($n = 156$ fourth graders; $n = 189$ fifth graders; $n = 162$ sixth graders) (see Table 1). Two of the four communities followed an “elementary school model” where 4th, 5th, and 6th grade students ($n = 259$; Community 1, $n = 165$; Community 4, $n = 94$) attended school at the same building and spent the majority of the day in a self-contained classroom learning all core subjects from the same teacher. In the other two communities, students ($n = 248$; Community 2, $n = 160$; Community 3, $n = 88$) followed a “middle school model”. In this model, 4th and 5th graders attended a primary school and

followed the “elementary school model” previously mentioned while 6th graders attended a middle school where they transitioned from classroom to classroom learning different subjects from different teachers. The protocol for all study activities (IRB #439-18-EX and #446-18-EP) was approved by the Institutional Review Board at the University of Nebraska Medical Center.

Instrumentation

Physical activity.

The Youth Activity Profile (YAP) was utilized to estimate PA. The YAP is an online, self-administered PA assessment tool designed to estimate in-school and at-home PA and sedentary behavior of children and adolescents over the last seven days (Saint-Maurice & Welk, 2015). This questionnaire consists of 15 items broken up into three sections (in-school, out-of-school, and sedentary behavior) (Saint-Maurice & Welk, 2015). Each section contains five questions all structured on a 5-point Likert scale and is designed to be scored independently (Saint-Maurice & Welk, 2015). Questions in the in-school section examine MVPA during six parts of the school day: transportation to school, transportation from school, PE, classroom activity breaks, and recess. Questions in the out-of-school section focus on PA before school, after school, during the evening, and on the weekends. Sedentary questions relate to time spent watching TV, using a cell phone, playing video games, using the computer, and overall sedentary time (Saint-Maurice & Welk, 2015). The instrument has demonstrated acceptable levels of test-retest reliability (Segura-Díaz et al., 2021) and validity (Fairclough et al., 2019; Saint-Maurice & Welk, 2015). For the purposes of this study, the following YAP questions from the in-school section were analyzed for in-school PA outcomes: (Y1) How many days did you

walk or bike to school? (Y2) During physical education, how often were you running and moving as part of the planned games or activities?, (Y3) During recess, how often were you playing sports, walking, running, or playing active games?, (Y4) During school, how often did you engage in classroom “activity breaks” that involve standing or moving around for 5 minutes or more as part of normal class activities? (other than PE and recess), and (Y5) How many days did you walk or bike from school? The YAP questions pertaining to PE and recess followed the same Likert scale format (i.e., 0 = I didn’t have PE (or recess), 1 = Almost none of the time, 2 = A little bit, 3 = A moderate amount, 4 = A lot, 5 = Almost all of the time) while the Likert scale pertaining to active transportation (walking or biking) to and from school (i.e., 1 = 0 days, never, 2 = 1 day, 3 = 2 days, 4 = 3 days, 5 = 4-5 days, almost every day) and classroom activity breaks (i.e., 1 = Less than once per week, 2 = 1-2 times per week, 3 = 3-4 times per week, 4 = 5 times per week (every day), 5 = More than once per day) was different.

School organizational structure.

In this study, the organizational structure of time (i.e., organization of the school day: session amount and duration of PE and recess, and classroom activity breaks) was analyzed in relation to school model (i.e., elementary school model, self-contained – learning all subjects from one teacher in the same classroom; middle school model, departmentalization – learning different subjects from different teachers by moving between classrooms). Data were obtained through school administrators who provided the number of sessions and duration of PE and recess per week for each grade level. Raw scores from the YAP item related to classroom activity breaks were also included. Students self-reported engagement in 5-minutes or more of activity break movement

during class using a 5-point Likert scale (i.e., 1 = Less than once per week, 2 = 1-2 times per week, 3 = 3-4 times per week, 4 = 5 times per week (every day), 5 = More than once per day).

Organized Activity Participation.

A set of supplemental questions from the National Survey of Children's Health (NSCH) were added to the YAP in order to obtain self-reported organized activities participation (e.g., clubs, sports teams and lessons, daily after school programs, and other organized activities) in the last month and 12 months (U.S. Census Bureau, 2017). For the purposes of this study, only the NSCH organized activities questions assessing organized activity participation in the previous month were used for analyses. These questions were: (PreY4) Did you participate in a daily after school program? (1 month), (PreY6) Did you participate in a sports team or take sports lessons after school or on weekends? (1 month), (PreY8) Did you participate in any clubs or organizations (4-H, Scouting) after school or on weekends? (1 month), and (PreY10) Did you participate in any other organized activities or lessons, such as music, dance, language, or other arts? (1 month). Answer options for these questions were either yes or no.

Procedure

The primary outcome variable of 4th, 5th, and 6th grade students' self-reported in-school MVPA was obtained from the online version of the YAP instrument. Youth reported how often they participated in PA during PE, recess, and classroom activity breaks in the last week using a Likert scale. The YAP was completed within the classroom setting using media carts or in the school's media center while supervised by a teacher. Raw scores from students' self-reported behaviors were used in calibration

equations to estimate time spent (minutes per day) in MVPA in school (Saint-Maurice & Welk, 2015). Additionally, students self-reported participation in organized activities after school or on the weekends including after-school programs, sports, clubs or organizations (i.e., 4-H, Scouting), and other activities or lessons (i.e., music, dance, language, or other arts) in the last month.

Organizational structure of PE and recess was collected from school administrators. School administrators reported the number of sessions and duration of PE and recess per week for each grade level to the research team. Additionally, participating children self-reported the frequency of classroom activity breaks outside of PE and recess. This item was attained from the YAP.

Data Analyses

Data were analyzed using SAS version 9.4. Demographic characteristics (i.e., grade, gender, race/ethnicity) across the four communities were summarized using descriptive analyses (i.e., counts, frequencies). In-school YAP items were aggregated to estimate in-school physical activity (mean minutes/day during school) using calibrated algorithms (Welk et al., 2021). Administrator-reported PE and recess sessions and session duration for each community and grade were summarized by community and grade.

The main effect of community (1, 2, 3, 4) and grade (4th, 5th, 6th) and the interaction between community and grade on the PA outcome (i.e., in-school minutes of MVPA) was analyzed using the GLIMMIX procedure. Gender and race/ethnicity were included as covariates in the model. The same analysis was used to analyze the dichotomous participation outcome (i.e., “yes”, “no”) for each organized activity variable

(i.e., after-school programs, sports, clubs and organizations, other activities or lessons).

Alpha level was set as $p \leq 0.05$ for all of the planned hypotheses tests.

RESULTS

Demographic Characteristics and School Structure

Among the 4th, 5th, and 6th graders, 51.08% ($n = 259$) attended a school that followed an elementary school model of education (Community 1 and 4) whereas 48.92% ($n = 248$) attended a school that followed a middle school model of education (Community 2 and 3). Communities 1 and 2 had a higher percentage of non-Hispanic white participants (Community 1, 93.3%; Community 2, 95.6%) while communities 3 and 4 had a higher percentage of participants classified as ‘other’ (Community 3, 82.9%; Community 4, 54.3%) due to planned recruitment of communities with higher concentrations of Hispanic/Latino children during Wave 2. Communities 3 and 4 had a higher percentage of students with FRLS compared to Communities 1 and 2. Reference Table 1 for complete community demographic characteristics.

According to administrator-reported data, students attending an elementary school model of education received the same number of sessions and length of recess each week, regardless of grade level (Community 1: 10 sessions, 20 min each; Community 4: 5 sessions, 20 min each). Students attending a middle school model of education received the same number of sessions and length of recess each week in 4th and 5th grade (Community 2: 5 sessions, 25 min each; Community 3: 5 sessions, 15 min each), but zero sessions in 6th grade. Variations in PE were observed in both communities following a middle school model of education. Community 2 reported 3, 30-minute sessions and 2, 35-minute sessions of PE for 4th and 5th graders each week, respectively, whereas 6th

graders received 5, 47-minute sessions each week. In community 3, both 4th and 5th grade students received 2.5, 30-minute PE sessions each week, whereas 6th graders received 3, 47-minute sessions each week. The elementary model schools both provided the same number of sessions and duration of session each week, regardless of grade (Community 1: 2.5 sessions, 25 min each; Community 4: 2.5 sessions, 30 min each).

In addition to PE and recess, raw scores for the YAP item pertaining to classroom activity breaks revealed 5th grade students in communities 2, 3, and 4 had a higher frequency of self-reporting participation in classroom activity breaks compared to 4th graders on the Likert scale (Community 2: 4th = 2.83, 5th = 3.29; Community 3: 4th = 2.50, 5th = 2.79; Community 4: 4th = 1.85, 5th = 2.41), whereas 6th graders had a lower frequency of reporting participation in activity breaks compared to 5th grade on the Likert scale across all communities (Community 1: 5th = 3.07, 6th = 2.55; Community 2: 5th = 3.29, 6th = 2.98; Community 3: 5th = 2.79, 6th = 2.53; Community 4: 5th = 2.41, 6th = 2.39). Significance was not tested.

Physical Activity

There was a significant fixed effect of community on in-school MVPA [$F(3,493)=124.59, p<0.0001$]. There was not a statistically significant interaction effect of community*grade on in-school MVPA [$F(6,493)=1.04, p<0.3977$]. However, planned comparisons of MVPA by community and grade were established a priori. Thus, post hoc analyses comparing MVPA by community and grade were performed.

Elementary school model communities: communities 1 and 4.

Communities 1 and 4 followed the elementary school model in which 4th through 6th graders attend the same elementary school, and each student receives academic

instruction from the same teacher, in the same classroom throughout the school day. Children in Community 1 reported higher levels of in-school MVPA compared to children across the other three communities, regardless of grade ($p < 0.0001$). There were no statistical differences in in-school MVPA among 4th, 5th, and 6th graders within Community 1. Children in Community 4 were statistically less active ($p < 0.0001$) compared with children in Community 1. Children in Community 4 demonstrated significantly more in-school MVPA compared with children in Community 3, regardless of grade ($p < 0.0001$). There were no statistical differences between children in Community 4 compared with Community 2, nor were there statistical differences in in-school MVPA within grade levels in Community 4. Refer to Figure 1 for mean estimates of in-school MVPA by community and grade level.

Middle school model communities: communities 2 and 3.

Communities 2 and 3 followed the middle school model in which 4th and 5th graders adhered to the elementary school model mentioned above, while 6th graders received specialized instruction on different subjects by different teachers through rotating from classroom to classroom at a middle school. There were no statistical differences in in-school MVPA participation among 4th, 5th, and 6th graders within Community 2 and 3. Children in Community 2 were statistically more active ($p < 0.0001$) compared with children in Community 3. Children in Community 3 reported lower levels of in-school MVPA compared to children across the other three communities, regardless of grade ($p < 0.0001$). Refer to Figure 1 for mean estimates of in-school MVPA by community and grade level.

Participation in Organized Activities

Among all participating students, 20.91% participated in an after-school program, 52.27% participated in a sport, 22.88% participated in a club or organization (e.g., 4-H, Scouting), and 40.83% participated in another organized activities such as dance, music, language, or art. However, participation rates varied by community and grade. The highest proportion of after-school program participation was among 5th graders in Community 1 (50.85%) whereas the lowest proportion of participation was among 5th graders in Community 2 (3.17%). The proportion of students participating in sports within Communities 2, 3, and 4 was not consistent (Community 2: 4th = 65.22%, 5th = 61.90%, 6th = 58.82%; Community 3: 4th = 42.31%, 5th = 25.00%, 6th = 20.59%; Community 4: 4th = 48.15%, 5th = 41.03%, 6th = 53.57%). There was lack of consistency between communities as well. Fourth grade students in Community 2 had the highest proportion of sports participation (65.22%) whereas 6th graders in Community 3 had the lowest proportion (20.59%). Additionally, a higher proportion of students within Communities 2, 3, and 4 reported participating in a club in 6th grade compared to 5th grade (Community 2: 5th = 19.05%, 6th = 23.53%; Community 3: 5th = 7.14%, 6th = 11.76%; Community 4: 5th = 10.26%, 6th = 21.43%). However, between all communities, 5th and 6th grade students in Community 1 had the highest proportion of club or organized activity participation (44.07% and 40.82%). Furthermore, the proportion of other organized activities participation varied within Communities 2, 3, and 4. Participation ranged from 47.05% - 61.90% in Community 2, 19.23% - 25.00% in Community 3, and 18.52% - 35.71% in Community 4. Within Communities 2 and 3, a smaller proportion of students reported participating in other organized activities in 6th grade compared to 5th grade as well (Community 2: 5th = 61.90%, 6th = 47.05%; Community 3: 5th = 25.00%,

6th = 23.53%). Detailed descriptives regarding participation in organized activities in the past month are reported in Table 2 by education model, community, and grade.

There were significant fixed effects of community on participation in after school programs [F(3,493)=5.99, $p<0.0005$], sports [F(3,493)=2.77, $p<0.0409$], clubs [F(3,493)=2.57, $p<0.0537$], and other activities [F(3,493)=6.45, $p<0.0003$]. There was a significant interaction effect of community*grade on participation in after school programs [F(6,493)=4.77, $p<0.0001$]. For all other organized activities there was no significant interaction effect: sports [F(6,493)=0.71, $p<0.6391$], clubs [F(6,493)=1.81, $p<0.0956$], other organized activities [F(6,493)=0.84, $p<0.5394$].

Elementary school model communities: communities 1 and 4.

Within Community 1, compared to 4th graders, 5th and 6th graders were each significantly more likely to participate in an after-school program (5th: Odds ratio [OR] = 4.99, 95% CI = 2.12–11.74; 6th: OR = 2.82, 95% CI = 1.15–6.95). Within Community 4, there were no statistical differences in participation in an after-school program for 4th, 5th, and 6th graders. Similarly, within Community 1 and 4, there were no statistical differences in participation in a sport for all grade levels. Within Community 1, when compared to 4th graders, 5th and 6th graders were each significantly more likely to participate in a club or organization (5th: OR = 3.39, 95% CI = 1.46–7.88; 6th: OR = 3.11, 95% CI = 1.29–7.50). However, within Community 4, there were no statistical differences in participation in a sport for 4th, 5th, and 6th graders. Similarly, within Community 1 and 4, there were no statistical differences in participation in other organized activities (i.e., music, dance, language, art) for all grade levels.

Students in Community 1, grade 5 were significantly more likely to participate in an after-school program compared to 5th graders in Communities 2, 3, and 4 whereas students in grade 4 and 6 had no statistical differences in after-school program participation compared to 4th and 6th graders in Communities 2, 3, and 4 (Table 3). However, 6th grade participation in after-school programs in Community 1 compared to 6th grade participation in Community 3 was approaching statistical significance (Table 3). Sixth grade students in Community 1 were significantly more likely to participate in a sport compared to 6th grade students in Community 3 while 4th and 5th grade students' participation in sports was not statistically different from 4th and 5th grade students in Communities 2, 3, and 4 (Table 3). Students in Community 1, grade 5 were significantly more likely to participate in a club or organization compared to 5th graders in Communities 2, 3, and 4 whereas students in grade 4 and 6 had no statistical differences in club or organization participation compared to 4th and 6th graders in Communities 2, 3, and 4 (Table 3). Fifth grade students in Community 1 were significantly more likely to participate in other organized activities compared to 5th grade students in Community 2 and 4 while 4th and 6th grade students' participation in other organized activities was not statistically different from 4th and 6th grade students in Communities 2, 3, and 4 (Table 3).

Middle school model communities: communities 2 and 3.

Within Community 2, compared to 5th graders, 4th and 6th graders were significantly more likely to participate in an after-school program (4th: Odds ratio [OR] = 0.09, 95% CI = 0.02–0.44; 6th: OR = 0.11, 95% CI = 0.02–0.50). Within Community 3, there were no statistical differences in participation in an after-school program for 4th, 5th, and 6th graders. Similarly, within Community 2 and 3, there were no statistical

differences among grade levels for participation in a sport, club or organization, and other organized activities.

Fifth grade students in Community 2 and 3 were significantly less likely to participate in an after-school program than 5th grade students in Community 1 (Table 3). There was no statistical difference in after-school program participation for both 4th and 6th grade students compared to 4th and 6th grade students in all communities. Additionally, there was no statistical difference between 5th grade students' participation in after-school programs compared to 5th grade students in Community 3 and 4 (Table 3). Students in 5th and 6th grade in Community 2 were significantly more likely to participate in a sport compared to 5th and 6th grade students in Community 3 while no significant difference in sports participation was found between 4th grade students in Community 2 and all other communities. Sixth grade students in Community 3 were significantly less likely to participate in a sport compared to 6th grade students in Community 1, but significantly more likely than 6th graders in Community 4. Similarly, 5th grade students in Community 3 were significantly less likely to participate in a sport compared to 5th graders in Community 1 and 2. Participation in sports for 4th graders in Community 3 was not statistically different from 4th grade students in Communities 1, 2, 3, and 4 (Table 3). Students in 4th and 6th grade in Community 2 and 3 had no statistical difference in club or organization participation between 4th and 6th grader students in community 1, 2, 3, and 4 whereas 5th grade students only had no statistical difference in club or organization participation between 5th graders in Community 2, 3, and 4 (Table 3). Fourth and 5th grade students in Community 2 were significantly more likely to participate in other organized activities compared to 4th and 5th grade students in Community 3 and 4 while

6th grade students' participation in other organized activities was not statistically different from 6th grade students in Communities 1, 3, and 4. However, 6th grade participation in other organized activities in Community 2 compared to 6th grade participation in Community 3 was approaching significantly different (Table 3).

DISCUSSION

There is a lack of research on the influence of organizational structures (i.e., recess, PE, classroom breaks, and lunch period) and organized activities (i.e., after-school programs, sports, clubs, and other out-of-school activities) on children and youth PA depending upon school model attended (elementary school model vs. middle school model). In the present study, differences in organizational structures were observed between communities and within communities. In-school PA outcomes and participation in organized activities outside of school varied by community as well.

Sixth grade students attending a school following a middle school model did not receive any recess whereas all grade levels in schools following an elementary school model received the same number of sessions and length of recess, which is similar to findings in other studies (Barnett et al., 2006; Institute of Medicine et al., 2013; *SHPPS: Results from the School Health Policies and Practices Study*, 2016). The Institute of Medicine et al. (2013) notes that requirements for PA outside of PE decrease outside of elementary school with middle schools and high schools typically not providing recess, while recess is deemed necessary at the elementary level and thus scheduled into the day (Barnett et al., 2006; *SHPPS: Results from the School Health Policies and Practices Study*, 2016). Since 6th graders attending an elementary school model received recess

while 6th graders in a middle school model did not, recess can be considered an organizational structure that differs between the two school models.

On the other hand, duration of PE sessions increased from 5th to 6th grade for students in a middle school model while the duration of PE sessions stayed the same for students in an elementary model. A consistent session amount and length of PE seems to differ between grade levels in other studies (Allison & Adlaf, 2000; Barnett et al., 2006; Fairclough & Stratton, 2006; Kolbe et al., 2001; McKenzie et al., 2000; Tompkins et al., 2004). Not only does this organizational structure seem to differ between school models, but between grade levels as well.

Additionally, across grade level regardless of school model, 6th graders reported participating in fewer classroom breaks involving PA which is consistent with current research (Institute of Medicine et al., 2013; *SHPPS: Results from the School Health Policies and Practices Study*, 2016). The recent SHPPS (2016) and the Institute of Medicine et al., (2013) found a higher percentage of lower grade levels implement classroom breaks compared to upper grade levels. The lower percentage of participation in 6th grade may be due to higher academic demands and greater emphasis placed on testing and academics as students get older (Howie et al., 2014; Institute of Medicine et al., 2013). One study examining barriers to implementing classroom breaks found that teachers reported difficulty facilitating breaks at an upper level due to academic pressures (Campbell & Lassiter, 2020).

According to PA outcomes, students attending schools in an elementary school model participated in more in-school MVPA each day compared to students attending a school in a middle school model. This is consistent with current research which notes the

decrease in amount and intensity of PA as young people transition from elementary to middle school (Lau et al., 2017; Pate, Saunders, et al., 2022; Pate, Schenkelberg, et al., 2019). However, in contrast to current research which reveals a decrease in PA as grade level increases (Allison et al., 2007; Corder et al., 2019; Institute of Medicine et al., 2013; Nader et al., 2008; Wickel et al., 2009), each consecutive grade level in an elementary model school had higher levels of PA. On the contrary, each consecutive grade level in a middle school model either had lower levels of PA than the previous grade or students had higher levels of PA in 5th grade compared to 4th grade, but lower levels of PA in 6th grade compared to 5th grade. This suggests that the addition of daily recess, and implementation of classroom PA breaks may have a greater impact on in-school PA outcomes than PE alone. These patterns emphasize the potential impact the differing organizational structures (i.e., recess, PE, and classroom breaks) may have on PA outcomes and should be examined further. Additionally, since PA outcomes during PE within each community were variable between grade level, other factors such as policies, teaching style, and student engagement and behavioral challenges may impact PA as well (Hills et al., 2015; Jenkinson & Benson, 2010; Kolbe et al., 2001; Morgan & Hansen, 2008). Further investigation into these factors should be conducted.

Another way for students to obtain PA during the day is through out-of-school organized activities (i.e., after-school programs, sports, clubs, and other activities). Despite research suggesting access to and availability of organized activities may be limited in rural communities (Ferris et al., 2013; Findlay et al., 2009), our study shows participation in all organized activities within each community. However, organized activity participation by community and grade varied. In Community 1, an elementary

model school, 5th and 6th graders were more likely to participate in both after-school programs and clubs compared to 4th graders. This contradicts current studies which have found participation in out-of-school opportunities to decline as children increase in age (Eccles & Gootman, 2002; Mahoney et al., 2005; Shann, 2001). However, the likelihood of participation in after-school programs in Community 2, a middle school model, was less likely for 5th graders compared to 4th and 6th graders. In all other communities, participation in after-school programs and clubs was not significantly different by grade. Further investigation should examine structures, policies, and activities in place at the different school models that would cause participation differences. Similarly, participation in both sports and other activities was not significantly different by grade in each community. This differs from current findings as well (Leek et al., 2011; Powersm et al., 2002). Leek et al. (2011) found a significant drop of 80 percent participation in youth sports as children reached the age of 12. Additionally, Powersm et al. (2002) observed that even though 24% of middle schools offered extra-curricular activities outside of school hours, participation was incredibly low. However, Communities 3 and 4 which consisted of predominately Hispanic children and youth had lower proportions of student participation in all organized activities. This is consistent with research which highlights reduced PA both in-school and out-of-school for Hispanic youth compared to non-Hispanic youth (Gordon-Larsen et al., 2002; Hasson, 2018; Rodriguez et al., 2011; Stovitz et al., 2007). Among the organized activities offered, participation in after-school programs and clubs seemed to differ the most between grade levels in several communities. Examination of these activities at each school model should be investigated

more in depth to determine why participation at certain grade levels is significantly different.

While we believe this study highlights patterns present between grade levels in communities following different school models, it is not without limitations. First, the sample size consisted of only four communities, with only one school district within each community. In addition, there were only two school districts total following each school model (elementary vs. middle). Therefore, future research should be conducted with larger sample sizes to see if organizational structures described between school models, and PA and organized activity patterns are consistent. There are also limitations to the self-report measure of PA and organized activity participation. While objective measures provide more precise estimates of PA, the YAP yields group-level estimates of in-school and out-of-school values within 23% and 21% of the SenseWear Armband Pro 3 PA monitor values (Welk et al., 2021). Future research should however consider tracking PA outcomes in-school and out-of-school using accelerometers in conjunction with the YAP to gain more objective data on which organizational structures students are participating in more PA.

CONCLUSIONS

Currently, research notes a decline in PA both in-school and out-of-school as children increase in age, specifically during the transition from elementary school to middle school (Allison et al., 2007; Corder et al., 2019; J. Eccles & Gootman, 2002; Harding et al., 2015; Institute of Medicine et al., 2013; Lau et al., 2017; Mahoney et al., 2005; Nader et al., 2008; Shann, 2001; Wickel et al., 2009). However, research on the specific organizational structures present in elementary school models of education and

middle school models of education that are impacting PA outcomes of children and youth is limited (Gidlow et al., 2008; Lau et al., 2017; Pate, Schenkelberg, et al., 2019). This study not only contributes to the existing literature on PA participation and outcomes as children age into adolescence, but it also highlights patterns between communities and grade levels. It also describes differences in organizational structures (i.e., PE, recess, classroom activity breaks, and out-of-school organized activities) between elementary schools and middle schools that may be impacting PA outcomes. Gaining a better understanding of which organizational structures have the greatest impact on young people's PA, can drive future PA initiatives and policies within schools and school districts.

Figures/Tables

Table 1. Demographic Characteristics for Community YAP Responses

	Elementary School Model ^a		Middle School Model ^b		Total (N, %)
	W1 C1 (N, %)	W2 C4 (N, %)	W1 C2 (N, %)	W2 C3 (N, %)	
Community Total (N)	165	94	160	88	507
Grade					
4	57, 34.55	27, 28.72	46, 28.75	26, 29.55	156, 30.77
5	59, 35.76	39, 41.49	63, 39.38	28, 31.82	189, 37.28
6	49, 29.69	28, 29.79	51, 31.87	34, 38.63	162, 31.95
Gender					
Male	83, 50.30	49, 52.13	86, 53.75	35, 39.77	253, 49.90
Female	82, 49.70	45, 47.87	74, 46.25	53, 60.23	254, 50.10
Race/Ethnicity					
Non-Hispanic White	154, 93.33	43, 45.74	153, 95.63	15, 17.05	365, 71.99
Other	11, 6.67	51, 54.26	7, 4.37	73, 82.95	142, 28.01
FRLS					
Free/Reduced	19, 11.52	40, 42.55	42, 26.25	41, 46.59	142, 28.01
Full Pay	88, 53.33	33, 35.11	76, 47.50	35, 39.77	232, 45.76
Missing/Unknown ^c	58, 35.15	21, 22.34	42, 26.25	12, 13.64	133, 26.23

Abbreviations: YAP, Youth Activity Profile; FRLS, Free and Reduced Lunch Status; W1 C1, Wave 1 (2018) Community 1; W1 C2, Wave 1 (2018) Community 2; W2 C3, Wave 2 (2022) Community 3; W2 C4, Wave 2 (2022) Community 4

^a 4th, 5th, and 6th attend school at an elementary school, receiving all subjects from one teacher

^b 4th, and 5th attend school at an elementary school, receiving all subjects from one teacher; 6th grade attends a middle school, receiving different subjects from different teacher by moving between classrooms

^c FRLS missing or unknown due to lack of consent for lunch status to be linked to data, or not provided

Table 2. Participation in Organized Activities Out-of-School in the Last Month by Education Model, Community, and Grade

NSCH Question	Elementary School Model ^a						Middle School Model ^b					
	W1 C1			W2 C4			W1 C2			W2 C3		
	Grade in School			Grade in School			Grade in School			Grade in School		
	4	5	6	4	5	6	4	5	6	4	5	6
(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)	(N, %)
Daily ASP Participation	10, 17.54	30, 50.85	18, 36.73	2, 7.41	2, 5.13	7, 25.00	12, 26.09	2, 3.17	12, 23.53	5, 19.23	3, 10.71	3, 8.82
Sport Participation	33, 57.89	35, 59.32	29, 59.18	13, 48.15	16, 41.03	15, 53.57	30, 65.22	39, 61.90	30, 58.82	11, 42.31	7, 25.00	7, 20.59
Club or Organization Participation	11, 19.30	26, 44.07	20, 40.82	5, 18.52	4, 10.26	6, 21.43	13, 28.26	12, 19.05	12, 23.53	1, 3.85	2, 7.14	4, 11.76
Other Organized Activity Participation^c	25, 43.86	26, 44.07	22, 44.90	5, 18.52	8, 20.51	10, 35.71	28, 60.87	39, 61.90	24, 47.06	5, 19.23	7, 25.00	8, 23.53

Abbreviations: W1 C1, Wave 1 (2018) Community 1; W1 C2, Wave 1 (2018) Community 2; W2 C3, Wave 2 (2022) Community 3; W2 C4, Wave 2 (2022) Community 4; NSCH, National Survey of Children's Health; ASP, After-School Program

^a 4th, 5th, and 6th attend school at an elementary school, receiving all subjects from one teacher

^b 4th, and 5th attend school at an elementary school, receiving all subjects from one teacher; 6th grade attends a middle school, receiving different subjects from different teacher by moving between classrooms

^c Other organized activities include dance, music, language, and art activities

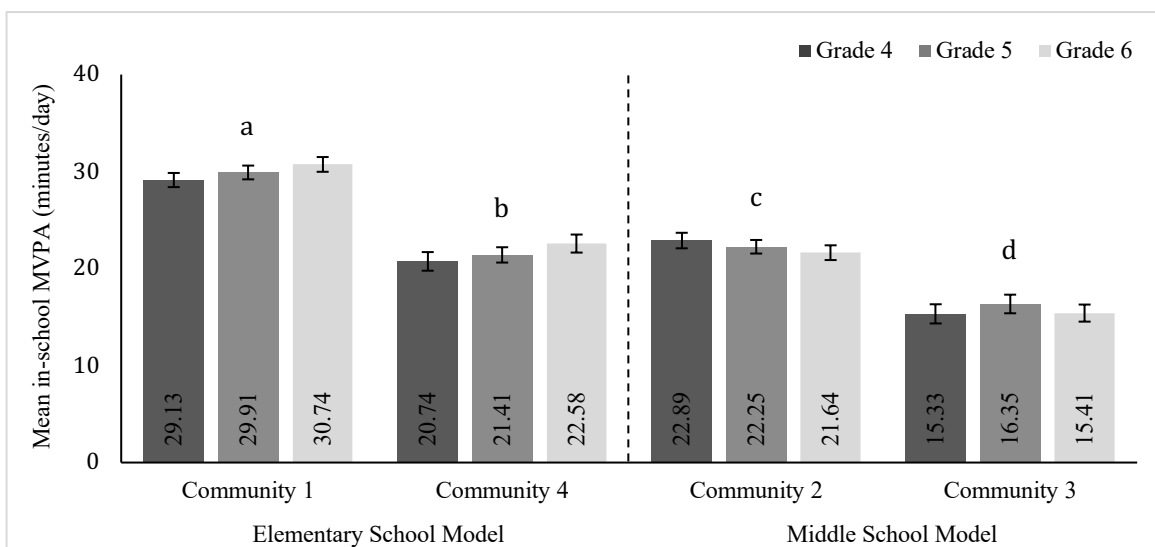


Figure 1. Mean daily minutes of in-school moderate to vigorous physical activity (MVPA) by grade level, community, and education model.

- ^a Community 1 had significantly higher in-school minutes of MVPA per day compared to Communities 2, 3, and 4, regardless of grade ($p < 0.0001$). There were no significant differences in in-school MVPA within Community 1.
- ^b Community 4 had significantly higher in-school minutes of MVPA per day compared to Community 3, regardless of grade ($p < 0.0001$). There were no significant difference in in-school MVPA between Community 2 and within Community 4.
- ^c Community 2 had significantly higher in-school minutes of MVPA per day compared to Community 3, regardless of grade ($p < 0.0001$). There were no significant difference in in-school MVPA within Community 2.
- ^d Community 3 had significantly lower in-school minutes of MVPA per day compared to Communities 1, 2, and 4, regardless of grade ($p < 0.0001$). There were no significant differences in in-school MVPA within Community 3.

Table 3. Likelihood of Participating in Organized Activity by Community and Grade

	After-School Program			Sports			Clubs or Organizations			Other Activities ^a		
	Odds Ratio	95% Confidence Interval	<i>P</i> -Value	Odds Ratio	95% Confidence Interval	<i>P</i> -Value	Odds Ratio	95% Confidence Interval	<i>P</i> -Value	Odds Ratio	95% Confidence Interval	<i>P</i> -Value
4th Grade												
C1 vs. C2*	0.60	(0.23,1.55)	0.2876	0.72	(0.32,1.60)	0.4147	0.64	(0.25,1.62)	0.3441	0.55	(0.25,1.24)	0.1488
C1 vs. C3*	0.59	(0.16,2.21)	0.4304	1.30	(0.46,3.68)	0.6205	2.95	(0.34,25.99)	0.3290	2.90	(0.85,9.84)	0.0880
C1 vs. C4*	1.93	(0.37,10.11)	0.4344	1.12	(0.41,3.01)	0.8292	0.58	(0.17,2.06)	0.4015	2.97	(0.91,9.67)	0.0709
C2 vs. C3*	0.98	(0.26, 3.67)	0.9814	1.81	(0.61,5.39)	0.2798	4.61	(0.53,40.49)	0.1674	5.26	(1.50,18.46)	0.0097
C2 vs. C4*	3.24	(0.62,16.83)	0.1615	1.56	(0.55,4.42)	0.4020	0.91	(0.26,3.20)	0.8853	5.39	(1.60,18.17)	0.0068
C3 vs. C4*	3.29	(0.57,19.06)	0.1833	0.86	(0.29,2.57)	0.7841	0.20	(0.02,1.87)	0.1574	1.03	(0.25,4.17)	0.9729
5th Grade												
C1 vs. C2*	32.54	(7.23,146.4)	<0.0001	0.93	(0.45,1.93)	0.8415	3.33	(1.46,7.56)	0.0042	0.43	(0.20,0.90)	0.0261
C1 vs. C3*	5.77	(1.40,23.71)	0.0153	3.09	(1.04,9.13)	0.0419	5.17	(1.02,26.21)	0.0471	2.08	(0.68,6.36)	0.1996
C1 vs. C4*	16.29	(3.52,75.36)	0.0004	1.81	(0.77,4.25)	0.1710	5.08	(1.56,16.57)	0.0071	2.71	(1.02,7.16)	0.0451
C2 vs. C3*	0.18	(0.03, 1.24)	0.0805	3.33	(1.12,9.84)	0.0301	1.56	(0.29,8.25)	0.6031	4.83	(1.57,14.87)	0.0061
C2 vs. C4*	0.50	(0.07,3.78)	0.5018	1.95	(0.83,4.56)	0.1215	1.53	(0.44,5.27)	0.5014	6.29	(2.38,16.67)	0.0002
C3 vs. C4*	2.83	(0.42,18.90)	0.2831	0.59	(0.20,1.76)	0.3411	0.98	(0.16,6.09)	0.9845	1.30	(0.39,4.34)	0.6665
6th Grade												
C1 vs. C2*	1.96	(0.82,4.70)	0.1328	1.06	(0.47,2.36)	0.8902	2.27	(0.95,5.44)	0.0652	0.85	(0.38,1.91)	0.6942
C1 vs. C3*	3.97	(0.95,16.68)	0.0594	3.90	(1.31,11.6)	0.0145	2.58	(0.69,9.66)	0.1605	2.46	(0.82,7.38)	0.1081
C1 vs. C4*	1.36	(0.46,4.07)	0.5764	1.01	(0.38,2.69)	0.9885	1.66	(0.54,5.13)	0.3800	1.33	(0.48,3.68)	0.5889
C2 vs. C3*	2.03	(0.46, 8.91)	0.3469	3.69	(1.23,11.0)	0.0196	1.13	(0.29,4.46)	0.8579	2.89	(0.96,8.73)	0.0594
C2 vs. C4*	0.70	(0.22,2.18)	0.5349	0.95	(0.36,2.54)	0.9217	0.73	(0.26,2.37)	0.5983	1.56	(0.56,4.32)	0.3944
C3 vs. C4*	0.343	(0.08,1.52)	0.1588	0.26	(0.08,0.80)	0.0192	0.64	(0.15,2.69)	0.5446	0.54	(0.17,1.69)	0.2878

Abbreviations: C1, Community 1; C2, Community 2; C3, Community 3; C4, Community 4

^a Other activities include music, dance, language, and art

* The reference group for each paired comparison

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